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

Permit Application for Construction and Operation

Solid Waste Permit Program

Doc Type: Permit Application

MPCA Public Notice number: _____

Print or type application: Before submitting, make a photocopy for your records. The Minnesota Pollution Control Agency (MPCA) will review the application for completeness and provide an official response to the permittees within 30 business days of receipt of the application.

Permit application assembly: To expedite the processing and review of your application, **put this form at the beginning** of your submittal package. Please place all checklists directly behind this application form in order by the number found on the bottom left hand corner of each checklist. **Do not place forms and checklist in an appendix** as this makes it difficult and time consuming for staff to locate them.

Completeness instructions: Without properly completed forms, an application cannot be processed and will be determined to be incomplete. All sections of this form must be completed. If portions do not apply to this facility, please indicate so with "n/a".

The completed form is to be returned to: **Solid Waste Permit Document Coordinator**
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Submittal: You must submit one (1) paper copy ***and*** one (1) electric copy (i.e., disc or thumb drive) of your application.

Facility name: MFS Farms - Good Thunder Compost Facility Permit No.: SW-662

Application is for (check appropriately): ☐ New permit ☒ Permit reissuance
☒ Major modification ☐ Minor modification
☐ Resubmittal of 'Incomplete' application originally submitted on: _____ *(mm/dd/yyyy)*

Variance request(s) included (check appropriately): ☐ Yes ☒ No

If yes, please describe:

Is construction planned during the proposed permit term (check appropriate)? ☒ Yes ☐ No

If yes, please specify the proposed construction start date (mm/dd/yyyy) 6/1/2019

If yes, please provide a brief description of the construction project:

Actual date of construction is dependent upon results of the DRP. Prior to proposed construction activities, Facility Operator or Owner will provide MPCA with Construction Plans and Specifications.

Checklists required (Please check all that are included with this application.)

All applicable checklists must be completed and submitted with this application. The MPCA will not process an application that does not include all of the required checklists. All checklists can be found on the MPCA website at: http://www.pca.state.mn.us/enzq8a9.

All Solid Waste Facilities
☒ Solid Waste Facility Application Checklist

Mixed Municipal Solid Waste (MSW) Landfill
☐ MSW Landfill Application Checklist

MSW Combustor Ash Landfill
☐ MSW Combustor Ash Landfill Application Checklist

Demolition Debris Landfill
☐ Demolition Debris Landfill Application Checklist

Industrial Solid Waste Landfill
☐ Industrial Solid Waste Landfill Application Checklist

Transfer Station
☐ Solid Waste Transfer Station Application Checklist

Solid Waste Compost Facility
☐ Solid Waste Compost Facility Application Checklist

Source-Separated Organic Material (SSOM) Compost Facility
☒ SSOM Compost Facility Application Checklist
☒ Checklist for a Site Suitability Workplan for a Source-Separated Compost Facility

Refuse-Derived Fuel Processing Facility
☐ Refuse-Derived Fuel Processing Facilities Application Checklist

I. Local acknowledgment/permission for

Other Solid Waste Facilities

This section is primarily meant to notify the county and local authorities of the applicant's intent so that all county and local ordinances and plans can be met. It is intended to validate that counties and local authorities were properly notified of this permit application for construction and operation. Signature by the county or local authority is not meant to imply approval.

A. County acknowledgment/permission (to be completed by County Solid Waste Administrator or County Zoning Administrator)

Signature: _____ Date: 2/14/2018
Print name: Dave Kronlokken Phone: 507-304-4381
Title: Waste and Recycling Supervisor Fax: 507-304-4431
Email: dave.kronlokken@blueearthcountymn.gov
Organization: Blue Earth County Environmental Services
Address: 410 South 5th Street, P.O. Box 3566
City: Mankato State: MN Zip: 56002

B. Local acknowledgment/permission (to be completed by local building or zoning office)

Signature: _____ Date: 2-14-2018
Print name: George Leary Phone: 507-304-4495
Title: Zoning Administrator Fax: 507-304-4431
Email: george.leary@blueearthcountymn.gov
Organization: Blue Earth County Environmental Services
Address: 410 South 5th Street, P.O. Box 3566
City: Mankato State: MN Zip: 56002

In lieu of completion of this part of the application, the applicant may submit documentation that the applicant has sent appropriate notification to the county and local authorities. Documentation must consist of copies of letters sent to the county and local authorities via certified mail, return receipt requested and copies of the signed return receipt.

Solid Waste Transfer Facilities and SSOM Compost Facilities

The applicant for a transfer facility or SSOM compost facility must attach copies of all required municipal licenses/approvals, unless the applicant is a municipality. The MPCA will not process an application without these approvals. See Minn. R. 7001.3400, item C, or 7001.3375 item L for more details. If no municipal approvals are required the owner or operator must sign the statement below stating that no municipal approvals are required.

Have all local licenses/approvals been acquired? ☒ Yes ☐ No

If yes, please list all approvals, include issuances and expiration dates (include a copy of each approval)

Modifications to the conditional use permit (CUP) are being purused concurrent to this permit modificcation.

If no, please sign the following line confirming no municipal approvals are required:

Signature: _____ Date: _____
Print name: _____ Title: _____

II. Facility information

A. General information

Facility name: MFS Farms - Good Thunder Compost Facility

Permit number (for modification/ reissuances only): SW-662

Address: 16225 563rd Avenue

City: Good Thunder State: MN Zip: 56037

MPCA Region (check one): ☐ Brainerd ☐ Detroit Lakes ☐ Duluth ☐ Marshall/Willmar ☐ Metro ☒ Rochester

B. Legal description of property (acreage includes the entire area of the facility)

10 Acres ____ ¼ ____ ¼ ____ ¼ NW ¼ Section 01 T 106 N R 27 W

Township name: Lyra MN Legislative District: 24B

County: Blue Earth

Latitude: ____ Deg ____ Min ____ Sec North

Longitude: ____ Deg ____ Min ____ Sec West

1. Directions to the facility (physical location):
   16225 563rd Avenue, Good Thunder, MN 56037

2. Current land use:
   Compost Facility

3. Current zoning designation of the site and the surrounding areas within a quarter mile radius:
   Agricultural

4. Describe the key topographic features at and around the facility:
   Generally open fields sloping gently to the southeast.

5. Environmental Assessment Worksheet (EAW) or Environmental Impact Statement (EIS) required? ☐ Yes ☒ No
   Explain:
   The Facility is currently apermitted operating Compost Facility and will continue compost operations.

C. Identify the following features within a one mile radius of the site

Feature	Name of feature	Distance
Current and former water supply or monitoring wells	MFS Farms	0.5 Miles
Airports	Permit Modification Figure 1	
Lakes or ponds	Permit Modification Figure 1	
Rivers, streams or springs	Permit Modification Figure 1	
Wetlands	Permit Modification Figure 1	
Floodplains	Permit Modification Figure 1	
Karst features (sinkholes, caves)	Permit Modification Figure 1	
Parks or wildlife refuges	Permit Modification Figure 1	
Present or proposed access and major haul roads, and their weight restrictions	563rd Avenue (7 tons in spring)	0.05 Miles
Easements or right-of-way	563rd Avenue	0.05 Miles
Recreational areas	Permit Modification Figure 1	
Historical or archeological areas	None Known	

III. Waste activity information

A. Type(s) of waste activity(s) to occur at the facility (check all boxes that apply)

Disposal activity

- ☐ Mixed Municipal Solid Waste
- ☐ Industrial Solid Waste
- ☐ Demolition Debris
- ☐ Municipal Solid Waste Combustor Ash
- ☐ Other: _____

Processing activity

- ☐ Solid Waste Composting
- ☐ Solid Waste Transfer Station
- ☐ Solid Waste Recycling
- ☐ Solid Waste Processing (prior to mass burn)
- ☐ Solid Waste Storage
- ☐ Refuse-Derived-Fuel (RDF)
- ☒ Other: SSOM Composting
  Land Application of contact water

B. Describe the capacity of each waste activity area and the total facility capacity in the tables below. Provide information for each type of activity selected above.

Disposal activity areas

Disposal area	Capacity (yd^3)				
	Ultimate design capacity	Proposed additional capacity	Current in-place volume	Remaining permitted capacity	Certificate of Need (MSW only)
Mixed Municipal Solid Waste (MSW)					
Industrial Waste					
Demolition Debris					
Municipal Solid Waste Combustor Ash					
Other:					
Total	NA	NA	NA	NA	NA

Processing activity areas

Processing area	Proposed capacity		Permitted capacity		Design capacity	
	tons/year	tons/day	tons/year	tons/day	tons/year	tons/day
Solid Waste Composting						
SSOM Composting		220		220		220
Solid Waste Transfer Station						
Solid Waste Recycling						
Solid Waste Processing (prior to mass burn)						
Solid Waste Storage						
Refuse-Derived-Fuel (RDF)						
Other:						
Total		220		220		220

IV. Operational information

A. List the solid waste and waste by-products to be managed at the facility according to the waste type, quantity, and management method (collect, transfer, store, process, convert, compost, treat, or disposal).

Waste Type	Quantity	Unit (tons, tons/day, tons/year, cubic yards, PTE's, items)	Management Method
Municipal Solid Waste			
MSW Combustor Ash			
Demolition Debris			
Industrial Waste			
Asbestos			
Appliances			
Electronics			
Yard Waste	As Needed	tons/day	Compost
SSOM	220	tons/day	Compost
Tires			
Household Hazardous Waste			
Recyclables (list)			
Other:			
Other:			

B. The facility will have capacity to receive 25 vehicles per day and expects to receive an average of 15 vehicles per day. List the vehicle types (i.e., packer trucks, roll-off boxes, private citizen vehicles) using the facility including those that transport special wastes, such as tires or white goods.

Vehicle Type	Vehicle Capacity	Waste Type Transported
End-dump trucks	40 yards/ 20 tons	SSOM
Roll-off boxes	30 yards/ 10 tons	SSOM
Packer Trucks	25 yards/ 8 tons	SSOM
Tanker	6,000 gallons	SSO Liquids

C. Describe the equipment to be located and used on site at the facility, or the availability and arrangement for use of equipment kept off-site, managing the waste:

Water truck

Excavator

Front-end loader

Skid Loader

Grinder

Screener

Turner

V. Signature and Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Engineer (Consultant)

Signature: _____ Date (mm/dd/yyyy): _____

Print name: Bruce Rehwaldt License Number: 19042

Title: Client Team Leader State licensed: MN

Email: bruce.rehwaldt@foth.com

Address: 8550 Hudson Blvd N Suite 105
City: Lake Elmo State: MN Zip: 55042
Phone: 651-288-8598 Fax: 651-288-8551

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I further certify that the construction and operation of the above described facility will be in accordance with the plans, specifications, reports and related communications accepted by the Minnesota Pollution Control Agency (MPCA) and on file in its office; and in accordance with conditions imposed in the permit issued by the MPCA.

I certify that the facility is consistent with local solid waste management plans. I am aware an MPCA permit must be obtained before construction or operation of the facility may begin and all local permits, licenses or other government approval must be obtained before an MPCA permit can be issued.

I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

Landowner

Signature: Kevin Fitzsimmons Date: 2/14/18
Print name: Kevin Fitzsimmons Phone: 507-317-0746
Title: Property Owner Fax: 507-278-3795
Email: mfs@mwrecyclingsolutions.com
Organization: MFS Farms
Address: 56437 164th Street
City: Good Thunder State: MN Zip: 56037
Phone: 507-317-0746 Fax: 507-278-3795

Owner (Applicant)

Signature: Kevin Fitzsimmons Date: 2/14/18
Print name: Kevin Fitzsimmons Phone: 507-317-0746
Title: Property Owner Fax: 507-278-3795
Email: mfs@mwrecyclingsolutions.com
Organization: MFS Farms
Address: 56437 164th Street
City: Good Thunder State: MN Zip: 56037

Operator*

Signature: Date: 2/15/18
Print name: Mike Higgins Certification No:
Title: CEO Midwest Recycling Solutions Expiration date:
Email: mike@mwrecyclingsolutions.com Phone: 989-429-2006
Organization: Midwest Recycling Solutions Fax:
Address: 1801 Mill Avenue
City: Brainerd State: MN Zip: 56401

**Provide the same information for other certified operators.*

VI. Solid Waste Annual Report Contact

Print name: Mike Higgins Phone: 989-429-2006
Title: CEO Midwest Recycling Solutions Fax:
Email: mike@mwrecyclingsolutions.com

Organization: Midwest Recycling Solutions

Address: 1801 Mill Avenue

City: Brainerd State: MN Zip: 56401

Minnesota Pollution Control Agency
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Checklist for a Site Suitability Workplan for a Source-Separated Compost Facility

Solid Waste Permit Program

Doc Type: Permitting Checklist

Instructions: The owner or operator of a Source-Separated Organic Material Compost Facility shall submit to the Minnesota Pollution Control Agency (MPCA) a Site Suitability Workplan and Report prepared and certified by a professional soil scientist, geologist or engineer licensed in the state of Minnesota. Pursuant to Minn. R. 7001.3075 the Site Suitability Report needs to completely and accurately characterize the proposed site, to record site conditions. The following checklist summarizes what must be included in the Site Suitability Workplan.

I. General Information

Document and page number	Included in the Workplan	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Modification Report- Appendix C	1. Date and title of the submittal *[Example: Site Suitability Workplan for the Acme Source Separated Compost Facility, SW-001]*.			
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	2. Name, signature and credentials of the person preparing the workplan.			
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	3. Name, address and signature of the owner and/or operator, listing of other contact persons.			
Permit Modification Report- Appendix C	4. Location of the proposed site (county, nearest town, coordinates: Universal Transverse Mercator (UTM) or latitude/longitude).			
Permit Modification Report- Appendix B	5. List of all approved engineering, construction, soils/hydrogeologic plans and the date the MPCA approved the plans.			
Permit Modification Report- Section 2	6. Description and volumes of feed stock types proposed to be accepted.			
Permit Modification Report- Section 2	7. Proposed number of acres, preliminary pad design			

II. Location Standards

Document and page number	Included in the Workplan	MPCA use only	
		Completeness review	Comments

		Admin	Technical	
Permit Modification Report- Figure 1	1. Proposed method to verify that the site is not within a floodplain.			

Document and page number	Included in the Workplan	MPCA use only		
		Completeness review		
		Admin	Technical	Comments
Permit Modification Report- Figure 1	2. Proposed method to verify that the site is not within a shoreland or wild and scenic river land use district governed by chapters 6105 and 6120.			
Permit Modification Report- Figure 1	3. Proposed method to verify that the site is not within a wetland.			
Permit Modification Report- Figure 1	4. Proposed method to verify that the site is not on a site with karst features, including sinkholes, disappearing streams, and caves.			
Permit Modification Report- Figure 1	5. Proposed method to verify that the site is not within 500 feet of the nearest residence, place of business, or public areas, such as parks, wildlife areas, and public buildings.			

III. Geotechnical and Soil Standards

Document and page number	Included in the Workplan	MPCA use only		
		Completeness review		
		Admin	Technical	Comments
Permit Modification Report- Appendix E	1. Topographic map with the proposed site location drawn on the map.			
Permit Modification Report- Appendix E	2. Soil survey map with the proposed site location drawn on the map, and the associated soil unit descriptions.			
Permit Modification Report- Figure 1	3. Proposed method and locations to determine depth in feet to the seasonal high water table (e.g., soil borings, piezometers, and/or test pits).			
Permit Modification Report- Appendix E	4. Proposed method and locations to characterize the top five feet of site soils to include texture, structure, and colors/mottling.			
NA	5. If groundwater monitoring is being proposed, the monitoring well installation workplan.			

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SSOM Compost Facility Application Checklist

Solid Waste Permit Program

Doc Type: Permit Application

Purpose: This checklist has been developed as a guide for permit application preparers and reviewers in order to assist with the submittal of a substantially complete permit application. Thoroughly review all applicable rules, statutes and guidance documents for further details and requirements. Minnesota Rules can be found at: https://www.revisor.mn.gov/rules/. All guidance documents can be found on the Minnesota Pollution Control Agency (MPCA) Solid Waste Publications webpage at: http://www.pca.state.mn.us/lupg880.

Many items listed below must be discussed in depth within the permit application submittal package. Be sure to include the most recently updated information, drawings and plans. Previously submitted documents **cannot** be referenced; all necessary documents must be included in this package. The permit application submittals should discuss all applicable MPCA Guidance Documents; include justification if the facility does not follow the guidance provided.

Instructions for permit application preparers: The following checklist must be completed and included with a permit application for all source-separated organic material (SSOM) compost facilities. In the table below, indicate in the far left column the name and page number(s) of the document where the specified rule requirement is addressed. If the rule requirement does not apply, please indicate with "n/a" for not applicable. **The permit application will be determined to be incomplete if there are any blank spaces in this column**.

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Modification Report- Section 2	7001.3375, item A Description of area for each stage of the composting process			
Permit Modification Report- Section 2	7001.3375, item B Description of design and features of the facility, including run-off, run-on, and contact water control systems			
Permit Modification Report- Section 2	7001.3375, item C Description of material(s) to be composted			
Permit Modification Report- Section 2	7001.3375, item D Description of the composition of residuals and rejects			
Permit Modification Report- Section 2	7001.3375, item E Description of disposal method for residuals and rejects			
Permit Modification Report- Section 2, 6	7001.3375, item F Design of odor control system			
Permit Modification Report- Section 2, 4	7001.3375, item G Design and performance specifications of the composting facility			
Permit Modification Report- Section 2	7001.3375, item H Description of composting method, including retention time, temperature, number of turns and air flow design			

Permit Modification Report- Section 2, 4	7001.3375, item I Operating plan and waste analysis plan including provisions of 7035.2836 subp. 11			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Modification Report- Section 2	7001.3375, item J Description of the proposed uses for the compost			
Permit Modification Report- Appendix C	7001.3375, item K Workplan for site suitability (Complete *Checklist for a Site Suitability Workplan for a Source Separated Compost Facility*, form w-sw3-52)			
Permit Modification Report- Section 1	7001.3375, item L Evidence that municipal approvals have been obtained, if applicable			
Permit Modification Report- Appendix C	7035.2836, subp. 8 Location Requirements (Complete *Checklist for a Site Suitability Workplan for a Source Separated Compost Facility*, form w-sw3-52)			
Permit Modification Report-Section 3, Appendix B	7035.2836, subp. 9A Design Requirement Engineering Design			
Permit Modification Report-Section 3, Appendix B	7035.2836, subp. 9 (B)(1) Site preparations including facility layout, stormwater control features, contact water collection system, access roads, screening, fencing, and other special design features			
Permit Modification Report- Section 2	7035.2836, subp. 9(B)(2) Access control features			
Permit Modification Report- Section 3, Appendix B	7035.2836, subp. 9(B)(3) Compost Storage and Operating Area Stormwater control system for curing and finished compost storage areas that complies with 7035.2855, subp. 3, items C to E.			
Permit Modification Report-Section 2, Appendix B	7035.2836, subp. 9(B)(4) Contact water collection and treatment system for immature compost that complies with applicable portions of 7035.2815, subp. 9.			
Permit Modification Report- Section 2	7035.2836, subp. 9(B)(5) Collection, storage, transport and disposal plan for compost rejects and management plan for compost residuals			
Permit Modification Report-Section 2, Appendix B	7035.2836, subp. 9(B)(6) Design plans for hard packed, all weather surfacing for tipping, mixing, active composting, curing and storage areas			
Permit	7035.2836, subp. 9(B)(7)			

Modification Report- Figure 1, Appendix C, E	Five foot minimum separation to the water table			
Modification Report- Figure 1, Appendix C, E	7035.2836, subp. 9(B)(8) Soil profile (Complete *Checklist for a Site Suitability Workplan for a Source Separated Compost Facility*, form w-sw3-52)			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
NA	7035.2836, subp. 9(B)(9)(a) If applicable geomembrane pad design that complies with 7035.2815 subp. 7 and 7035.2855, subp. 3, item A.			
Permit Modification Report- Appendix B	7035.2836, subp. 9(B)(9)(b) If applicable concrete or asphalt pad design that complies with Minnesota Department of Transportation, Road Design Manual			
NA	7035.2836, subp. 9(B)(9)(c) If applicable an alternative pad design			
Permit Modification Report- Section 2, 6	7035.2836, subp. 9(B)(10) Design plans for the control of liquids, odors, vectors, litter, noise, ponding water and erosion.			
Permit Modification Report- Section 2, Appendix B	7035.2836, subp. 10 Construction specifications in compliance with applicable portions of (A) to (G)			
Permit Modification Report- Section 2, 6	7035.2836, subp. 11(B)(1) Access security			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(2) SSOM processed within 24 hours			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(3) Salvageable and recyclable material management			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(4) Management of residuals and rejects			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(5) Contact liquid collection and treatment system operations			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(6) Contact water and storm water management plan/re-use plan			
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(7) Storm water drainage system plans			
Permit	7035.2836, subp. 11(B)(8)			

Modification Report- Section 6	Operations requirements that meet requirements Operations to control wind dispersion of particulate matter			
Permit Modification Report- Section 4	7035.2836, subp. 11(B)(9)(a) Analysis plan to characterize SSOM prior to acceptance			
Permit Modification Report- Section 3	7035.2836, subp. 11(B)(9)(b) Identify SSOM delivery area			
Permit Modification Report- Section 2, 6	7035.2836, subp. 11(B)(9)(c) SSOM management methods to control odors, vectors and nuisance conditions including litter, noise, ponding water, and erosion when SSOM is delivered to the facility. Mixing plans for proper moisture content, carbon:nitrogen, porosity, and pH. Identify acceptable SSOM and bulking materials.			
Document and page number	**Minn. R. citation**	**MPCA use only**		
		Completeness review		**Comments**
		Admin	**Technical**	
Permit Modification Report- Section 2	7035.2836, subp. 11(B)(10) Identify which PFRP process that will be used from the list in (a) to (c). Provide details on how time and temperature data will be monitored and recorded.			
Permit Modification Report- Section 4	7035.2836, subp. 11(B)(11) Compost sampling and testing plan that complies with 7035.2836 subp. 5(J) [See below]:			
Permit Modification Report- Section 2, 6	7035.2836 subp. 11(B)(12) Odor management plan that includes BMP's for oxygen and porosity, handling odor complaints, BMP's specific to each area of the compost process, contact water and storm water ponding areas.			
Permit Modification Report- Section 2	7035.2836 subp. 11(B)(13) Personnel training program that addresses requirements of 7035.2545 subp. 3 and 4, 7035.2836 subp 6 to 10 and includes 24 contact hours within 12 months and 5 contact hours annually.			
Permit Modification Report- Section 1	7035.2836 subp. 11(B)(14) Contents of annual report that complies with 7035.2585, 7035.2836 subp. 5(k) and the county of origin for all SSOM received			
Permit Modification Report- Section 6	7035.2836 subp. 11(B)(15) Contingency Action Plan in accordance with 7035.2615 and notification of Agency within 48 hours if facility becomes inoperable			
NA	7035.2836 subp. 11(B)(16) Weekly inspection of geomembrane, if applicable, in accordance with 7035.2855, subp. 4			
Permit Modification	7035.2836, subp. (5)(J)(1) Testing plan for compost maturity. Note			

Report-Section 4	that the maturity may be determined using the Solvita index results in 7035.2836 subp, (9)(B)(3).			
Permit Modification Report-Section 4	7035.2836, subp. (5)(J)(2) Metals analysis of each batch according to list in subp. 6, item A, subitem (1)			
Permit Modification Report-Section 4	7035.2836, subp. (5)(J)(3) Percent inert materials analysis			
Permit Modification Report-Section 4	7035.2836, subp. (5)(J)(4) Testing plan for pH, moisture content, particle size, NPK ratio, and soluble salt content			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(a) Training and experience of person collecting samples			
NA	7035.2836 subp. (5)(J)(5)(b) Equipment used to collect, process and store samples			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
NA	7035.2836 subp. (5)(J)(5)(c) Equipment cleaning procedures			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(d) Sample collection locations			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(e) Grab sample procedures			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(f) Composite sample procedures			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(g) Chain-of-custody and sample storage procedures			
Permit Modification Report-Section 4	7035.2836 subp. (5)(J)(5)(h) Sampling QA/QC			
Permit Modification Report-Section 4	7035.2836, subp. 6 Description of a compost batch. Compost classification and description of how results will determine distribution			
NA	7035.2836, subp. 7(A) Registration with MN Department of Agriculture			
Permit Modification Report-Section 2	7035.2836, subp. 7(B) Allowable end uses			
Permit Modification	7035.2836, subp. 7(C) Compost distribution			

Report- Section 2				

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Solid Waste Facility Application Checklist

Solid Waste Permit Program

Doc Type: Permit Application

Purpose: This checklist has been developed as a guide for permit application preparers and reviewers in order to assist with the submittal of a substantially complete permit application. Thoroughly review all applicable rules, statutes and guidance documents for further details and requirements. Minnesota Rules can be found at: https://www.revisor.mn.gov/rules/. All guidance documents can be found on the Minnesota Pollution Control Agency (MPCA) Solid Waste Publications webpage at: http://www.pca.state.mn.us/lupg880.

Many items listed below must be discussed in depth within the permit application submittal package. Be sure to include the most recently updated information, drawings and plans. Previously submitted documents **cannot** be referenced; all necessary documents must be included in this package. The permit application submittals should discuss all applicable MPCA Guidance Documents; include justification if the facility does not follow the guidance provided.

Instructions for permit application preparers: The following checklist must be completed and included with a permit application for all solid waste facilities. In the table below, indicate in the far left column the name and page number(s) of the document where the specified rule requirement is addressed. If the rule requirement does not apply, please indicate with "n/a" for not applicable. **The permit application will be determined to be incomplete if there are any blank spaces in this column**.

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	7001.0050, item A Name, address, and telephone number of the owner of the facility for which the application is submitted and identification of the status of the owner as a federal, state, public, private, or other entity			
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	7001.0050, item B If the operator of the facility for which the application is submitted is different from the owner, the name, address, and telephone number of the operator and identification of the status of the operator as a federal, state, public, private, or other entity			
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	7001.0050, item C Name, address, and telephone number of the person who prepared the application			
Permit Modification Report- MPCA Form Permit Application for Construction and Operation	7001.0050, item D Description including the location of the business, plant, system, facility, or activity for which the permit is sought			
Permit Modification Report-	7001.0050, item E General description of the materials			

MPCA Form Permit Application for Construction and Operation	handled, processed, stored, or disposed of by the applicant; and a statement of the nature and quantity of the materials proposed to be stored, processed, discharged, emitted, or disposed of during the period of the required permit, and proposed methods for control of these materials			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
NA	7001.0060, item A For a corporation, the permit application must be signed by a principal executive officer of at least the level of vice-president or the duly authorized representative or agent of the executive officer if the representative or agent is responsible for the overall operation of the facility that is the subject of the permit application			
MPCA Form Permit Application for Construction and Operation	7001.0060, item B For a partnership or sole proprietorship, the permit application must be signed by a general partner or the proprietor, respectively			
NA	7001.0060, item C For a municipality, state, federal, or other public agency, the permit application must be signed by either a principal executive officer or ranking elected official			
MPCA Form Permit Application for Construction and Operation	7001.0060, item D If the operator of the facility for which the application is submitted is different from the owner, the permit application must be signed by both the owner according to items A through C above			
MPCA Form Permit Application for Construction and Operation	7001.0060, item E For solid waste management facilities, the permit application must be signed by the facility owner and landowner under items A to C if the landowner is different from the owner of the facility for which the application is submitted			
MPCA Form Permit Application for Construction and Operation	7001.0060, item F For a firm preparing the necessary reports and plans for a solid waste management facility permit application, the permit application must be signed by an engineer registered in Minnesota			
MPCA Form Permit Application for Construction and Operation	7001.0070 A person who signs a permit application shall make the following certification: “I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that			

	qualified personnel properly gather and evaluate the information submitted based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information. The information is, to the best of my knowledge and belief, true, accurate, and complete."			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
MPCA Form Permit Application for Construction and Operation	7001.3150 A person who signs a permit application or any portion of it, or any report required by a permit to be submitted to the commissioner or agency must make the certification required by part 7001.0070 and shall make the following additional certification: "I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment." An engineer registered in Minnesota must certify all technical documents, such as design drawings and specifications, engineering reports, and hydrogeologic studies, required to be submitted as part of a permit application or by a permit condition. The hydrogeologic report and all related groundwater and surface water monitoring reports must be signed by a person knowledgeable in the field of hydrogeology. This person must certify the quality of work performed and must have been responsible for the gathering and interpretation of the hydrogeologic data and the preparation of the reports.			
Permit Modification Report-Section 1	7001.3300, item A General description of the facility			
Permit Modification Report-Section 2	7001.3300, item B Industrial solid waste management plan in accordance with 7035.2535			
Permit Modification Report-Section 2, 6	7001.3300, item C Description of security procedures and equipment			
Permit Modification Report-Section 2	7001.3300, item D Inspection schedule			
Permit Modification Report-Section	7001.3300, item E Contingency action plan			

6				
Permit Modification Report- Section 2,6	7001.3300, item F(1) Description of procedures, structures or equipment to prevent operational hazards			
Permit Modification Report- Section 2, Appendix B	7001.3300, item F(2) Description of procedures, structures or equipment to prevent run-off, run-on			
Permit Modification Report- Section 2,5, Appendix B	7001.3300, item F(3) Description of procedures, structures or equipment to prevent ground and surface water contamination			
Permit Modification Report- Section 2	7001.3300, item F(4) Description of procedures, structures or equipment to mitigate effects of equipment failure			
Permit Modification Report- Section 2,6	7001.3300, item G Description of precautions to prevent ignition or explosions and emergency response plan			

Document and page number	**Minn. R. citation**	**MPCA use only**		
		Completeness review		**Comments**
		Admin	**Technical**	
Permit Modification Report- Section 2	7001.3300, item H Traffic patterns and control			
Permit Modification Report- Section 2	7001.3300, item I Storage descriptions			
Permit Modification Report- Section 5	7001.3300, item J Closure and Postclosure Plan			
Permit Modification Report- Section 5	7001.3300, item K Closure cost estimates and evidence of financial assurance			
Permit Modification Report- Section 5	7001.3300, item L Postclosure cost estimates and evidence of financial assurance			
Permit Modification Report- Section 5	7001.3300, item M Corrective action cost estimates and evidence of financial assurance			

Permit Modification Report- Appendix A, B, E	7001.3300, item N(1 to 18) Topographic and development map			
Permit Modification Report- Appendix E	7001.3300, item O Geologic and location information			
Permit Modification Report- Section 2	7001.3300, item P(1 to 9) Operations and maintenance manual			
Permit Modification Report- Section 3	7001.3300, item Q Construction QA/QC plan			
Permit Modification Report- Section 2, 6	7001.3300, item R Household hazardous waste management plan			
NA	7001.3300, item S Full size copies of all engineering plan sheets			
Permit Modification Report- Appendix A,B	7001.3300, item S Reduced copies of all engineering plan sheets (11” x 17”)			
Permit Modification Report- Figure 2	7001.3300, item S Address labels for all adjacent properties owners and interested parties			
Permit Modification Report- Figure 2	7001.3300, item S Plan sheet with adjacent land owner information			
Permit Modification Report- Section 1	7001.3300, item S Discussion of all previously granted variances			
Permit Modification Report- Section 1	7001.3300, item S Variance application according to Minn. R. 7000.7000 for all new requests			
Permit Modification Report- Section 1	7001.3300, item S Description of how and why the facility does or does not operate according to all applicable MPCA Guidance Documents			
Permit Modification Report- Appendix F	7001.3300, item S Inspection Form			

Report

Application for Permit Modification and Renewal for MFS Farms - Good Thunder, MN

Source Separated Organic Materials Compost Facility

SW-662

Project I.D.: 16M185

Prepared For
MFS Farms, LLC, and
Midwest Recycling Solutions, LLC

February 2018

Foth

Eagle Point II • 8550 Hudson Blvd. North, Suite 105
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www.foth.com

February 15, 2018

Ms. Sherri Nachtigal, P.E.
Minnesota Pollution Control Agency
18 Wood Lake Drive SE
Rochester, MN 55904

Dear Ms. Nachtigal:

RE: Application for Permit Modification and Renewal for
MFS Farms - Good Thunder, MN
Source Separated Organic Materials Compost Facility (SW-662)

On behalf of MFS Farms, LLC (MFS Farms) and Midwest Recycling Solutions, LLC (Midwest Recycling Solutions), Foth Infrastructure & Environment, LLC (Foth) is submitting one copy paper and one electronic copy of the Application for Permit Modification and Renewal for MFS Farms - Good Thunder, MN Source Separated Organic Materials Compost Facility (SW-662). With this application, MFS Farms will be assuming the roles of Property Owner and Facility Owner and Midwest Recycling Solutions will assume the role of Operator.

MFS Farms and Midwest Recycling Solutions are requesting the Facility to be permitted at 220 tons of source separated organics materials (SSOM) per day, an increase from the current permitted capacity. The practice of composting is continuously changing and this request, and the operational changes proposed in this permit application, reflect that. Some level of flexibility is key to being able to respond to the changing conditions and methods.

The most significant Facility changes proposed with this application are the conversion of the permit from its current status as an MSW compost operation to an SSOM compost operation, and the addition of a new liquid organics mixing/aeration building. The mixing/aeration building is conceptually equipped with two concrete pits for mixing of SSOM liquids and carbon and initiation, if not achievement, of PFRP conditions under roof (i.e., new hoop building) using in-place aeration. Final design of the proposed liquid organics mixing/aeration building will be developed upon completion of the recently approved demonstration research project (DRP) evaluating appropriate mix designs. Construction documents (Engineering plans and specifications) will be provided to the MPCA for review and approval prior to construction.

This application also proposes the option for MFS Farms/Midwest Recycling Solutions to use either or both of the aerated or static windrow compost methods to achieve PFRP on the composting pad, and the option for aeration of the contact water pond to maintain aerobic conditions.

Please contact Bruce Rehwaldt at 651-288-8598 or bruce.rehwaldt@foth.com if you have any questions concerning this permit application package.

Sincerely,

Foth Infrastructure & Environment, LLC

Bruce Rehwaldt, P.E. LEED AP
Client Team Leader

Nate Klett, P.E.
Project Manager

cc: Solid Waste Permit Document Coordinator
MFS Farms, LLC
Midwest Recycling Solutions, LLC

Application for Permit Modification and Renewal for MFS Farms - Good Thunder, MN

Distribution

No. of Copies	Sent To
1	Sherri Nachtigal, MPCA – Rochester, Minnesota
1	MCPA Solid Waste Permit Document Coordinator, St. Paul, Minnesota
1	Kevin Fitzsimmons, MFS Farms, LLC, Good Thunder, Minnesota
1	Mike Higgins, Midwest Recycling Solutions, LLC, Brainerd, Minnesota
1	George Leary, Zoning Administrator, Blue Earth County
1	Dave Kronlokken, Waste and Recycling Supervisor, Blue Earth County

Application for Permit Modification and Renewal for MFS Farms - Good Thunder, MN

Source Separated Organic Material Compost Facility

Project ID: 16M185

Prepared for

MFS Farms, LLC and

Midwest Recycling Solutions, LLC

56437 164th Street CCC
Good Thunder, MN 56037

Prepared by

Foth Infrastructure & Environment, LLC

February 15, 2018

Eagle Point II • 8550 Hudson Blvd. North, Suite 105 • Lake Elmo, MN 55042 • (651) 288-8550 • Fax: (651) 288-8551 • www.foth.com

Application for Permit Modification and Renewal for MFS Farms - Good Thunder, MN (SW-662)

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1 Introduction

1.1 Objective

The MFS Farms, LLC - Good Thunder Facility ("Facility") provides an alternative for the management of organics that would otherwise be disposed in municipal solid waste landfills in Blue Earth County and the surrounding area. MFS Farms contracts with haulers, food waste suppliers, and industry for source separated organic materials (SSOM) that are processed into Class I compost material for use in landscaping, non-food chain agricultural, and other acceptable uses. By composting food waste from food suppliers, restaurants, hospitals, schools, universities, and industries, the Facility anticipates being able to reduce the loading on area landfills by an estimated 4,400 to 4,750 tons per month at full production. The Facility will use yard waste and wood chips from Blue Earth County and surrounding areas as a carbon source for the composting process, in addition to alternative agricultural and industrial sources of carbon. This Facility will serve the 65,787 residents of Blue Earth County and more from the surrounding area by reducing the amount of organic and yard waste materials going to an MPCA permitted landfill, thereby extending the usable life of landfills in the region.

1.2 General Site Information

Facility:	MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Facility Owner:	MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Operator:	Midwest Recycling Solutions, LLC 1801 Mill Avenue Brainerd, MN 56401
Primary Contacts:	Kevin Fitzsimmons MFS Farms, LLC Phone: (507) 3l7-0746 Mike Higgins Midwest Recycling Solutions, LLC Phone: (218) 822-6600 (989) 429-2006
Property Owner:	MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Engineering Consultant:	Foth Infrastructure & Environment, LLC Bruce Rehwaldt, P.E. 8550 Hudson Boulevard North, Suite 105 Lake Elmo, Minnesota 55042 Phone: (651) 288-8598

1.3 Project History

The Facility was originally permitted on August 27, 2012 to construct and operate the Full Circle Organics – Good Thunder Composting Facility, with MFS Farms as the Property Owner and Full Circle Organics, LLC as the Facility Owner and Operator. In 2017, the Facility ownership transferred to MFS Farms and Midwest Recycling Solutions assumed the role of Facility Operator.

On January 2, 2018, MFS Farms and Midwest Recycling Solutions were issued a Demonstration Research Project Agreement (DRP) to evaluate different material blends using liquid organics. The DRP operations have not yet been fully initiated. The primary goal of the DRP is to establish appropriate combinations of SSO liquids and carbon/bulking agent materials so that the mixtures can be stacked into windrows for composting by conventional methods. The study will also establish how long the materials need to "soak" in order to achieve the optimum moisture content so that the mixtures will hold their shape when piled up. The DRP will provide scientific information pertaining to alternative methods for managing these materials and a final report will be provided 30 calendar days after the Demonstration Completion Date, evaluating the Project results.

1.4 Existing Conditions

Prior to development as a compost Facility, the site was used for agricultural crop production. The site generally drains from the northwest to the southeast. Drain tile lines had been installed throughout the field and were removed from below the site during initial construction of the project. A topographical survey was completed by McCombs Frank Roos Associates (MFRA), Inc. on October 27, 2011 and soil borings were completed by American Engineering Testing. Inc. on November 7, 2011. The site has approximately six feet of relief and the soils consist primarily of clay.

Record Drawings for the original constructed Facility were prepared for the Owner by MFRA in February 2012 and are provided in Appendix B. The record drawings include the October 27, 2011 pre-existing conditions map. Additional approved modifications to the Facility since construction have included installation of a trommel screen used for depackaging and installation of the "Phase 2" asphalt curing pad, which is shown on the "Existing Conditions" drawing of the permit drawings provided in Appendix A.

The site in Good Thunder, MN is in close proximity to a number of educational and commercial facilities with cafeterias suitable for separation of solid SSOM such as food waste. Additional commercial, industrial, and agricultural establishments generating other SSOM as liquid by-products are also located in proximity to the Facility. Lastly, the Facility is also located close to reliable carbon and nitrogen sources for composting, including the straw and hay used for farming operations at MFS Farms, plus yard waste and other organic materials collected within nearby communities.

1.5 Surrounding Land Uses

Farm fields and homes surround the property. The closest home is approximately one quarter mile to the north and is owned by MFS Farms. The closest home to the south is approximately one quarter mile away. The property surrounding the Facility is currently in crop production. A location map is provided in the Permit Drawings in Appendix A and in Figure 1.

In 2016 and 2017, the adjacent farm fields were used for a one-time land application event, approved by the MPCA and Blue Earth County, to dispose of contact water from the Facility. With this permit modification and renewal application, MFS Farms is proposing to continue land application on an on-going basis as one option for disposal of contact water. Water will be injected into the fields, and all crops produced on land application acres will be diverted to non-food chain uses, including potentially for ethanol production.

1.6 Zoning

The property is currently zoned Agricultural on the Lyra Township Zoning Map with the effective date of March 17, 2005. The Agricultural zoning districted is intended to preserve the land tier agricultural purposes. A composting facility is a similar use to a solid waste landfill which is a permitted conditional use in the agricultural zoning district. The facility has a conditional use permit with Blue Earth County that will potentially need to be updated concurrent with the issuance of the facility MPCA solid waste permit.

2 Operations and Maintenance Manual

2.1 General

2.1.1 General Operations Description

The Facility is currently permitted at a capacity of 110 tons per day of organic material plus an unlimited amount of carbon materials such as yard waste, wood chips and/or crop residue. Based on the current and proposed operations, building and equipment at the Facility, a permitted capacity of 220 tons per day of organic material is being requested. The Facility again requests that there be no limit on the amount of carbon material included in the operating permit.

This permit application proposes to add a new liquid organics mixing/aeration building and to modify the processing building to install an upgraded depackaging system. The facility is already permitted for depackaging. Future expansion of the processing building footprint is under consideration, but would be constructed for operational convenience rather than production capacity necessity.

Final design of the proposed liquid organics mixing/aeration building will be developed after providing MPCA with a final report evaluating the project results from a Demonstration Research Project (DRP) approved in January 2018 to evaluate different material blends using liquid organics. Design documents (Engineering plans and specifications) will be provided to the MPCA for review and approval prior to construction. The existing site plan and building layouts for the existing Facility are as illustrated in the Permit Drawings in Appendix A.

2.1.2 Summary of Facility Operations

Trucks will enter the site from County Road 165/563rd Avenue, proceed to the truck scale, and check in with the Facility personnel at the scale house. After weighing, trucks will proceed to the appropriate unloading area. If the loads are solid organics, the material will generally be tipped inside the processing building. If the loads are carbon/bulking materials (e.g., yard waste, wood chips, etc.), they will be tipped on the outdoor carbon storage pad. If the loads are liquid organics, the materials will be unloaded into the existing processing building (current operation), one of two pits inside the proposed liquids mixing/aeration building (future operation) or, if non-odorous, may be processed directly into windrows on the curing pad (proposed with this permit). All loads will be inspected after dumping to the extent possible. The operator will inspect each load for compliance prior to the hauler being allowed to leave the site.

Solid organics will be mixed in the processing building with an appropriate amount of carbon material before being moved outside to the composting pad and formed into windrows for processing by either the static or aerated windrow methods.

Liquid organics will generally be mixed in the existing building or in the proposed liquids mixing/aeration building with appropriate amounts and types of carbon materials. In general, carbon materials will be placed in the pit (s) of the proposed liquid mixing/aeration building in preparation for receiving the liquid organics. Once the liquid is unloaded into the pit of the proposed building, additional carbon materials will be added to the organic liquids until the

mixture has sufficient minimum bulk density and maximum moisture content (currently estimated to be 45% to 65% water by weight). The mixture may be aerated in the pits of the proposed building using aeration pipes on the floor of the pit or in-floor aeration channels. In addition, solid organics may be added to the liquid/carbon mixture depending on the types of materials and moisture content.

Inside the proposed liquids mixing/aeration building, the Facility anticipates that there will be two pits that may be equipped with a piping system to allow forced aeration. The mixture may either be retained in the aerated pit or may be moved to the composting pad until the material has achieved the required PFRP and Solvita maturity status. Once PFRP and Solvita maturity requirements have been met, the material will be moved to the compost curing area north and west of the processing building for additional curing and eventual screening. Screened materials will be staged to the west of the composting pad.

Some non-odorous liquid organic materials may be mixed directly on the compost curing pad and formed into windows (not exceeding 12 ft in height). Aeration may be provided either by mechanical aeration using the Facility's windrow turner (static) or with blowers (aerated). The windrows (static and aerated) will remain on the curing pad for the minimum PFRP times specified by rule. The windrows will be turned in accordance with MN Rule 7035.2836 supb 11 and moisture will be added as needed. If water from the contact water pond or other industrial sources are used for moisture conditioning on the curing pad, the PFRP process will be re-started. When the required PFRP and Solvita maturity requirements are achieved, the material can be moved from the compost curing pad for screening and additional curing.

The operator's staff will inspect and log the temperatures of the materials in the new liquid mixing/aeration building and in the composting windrows on a daily basis until the PFRP and Solvita maturity conditions are met. Compost has reached the curing stage after PFRP standards and the Solvita maturity index standards have been achieved. Once these standards have been met, the compost can be moved to the compost curing area north and west of the processing building for additional curing and eventual screening. Screened materials will be staged to the west of the composting pad. Upon achieving the desired characteristics of mature compost, the materials will be screened and moved to the finished compost stockpile area south of the scale between the existing composting pads and western fenceline.

The Facility will utilize a variety of finished compost distribution and sales outlets. Some suppliers will come to the Facility to obtain the finished, screened compost end product. Other compost product will be land applied to farm fields under contract with MFS Farms.

2.1.3 Population/Area Served

The Facility will serve a multi-county region in south central Minnesota, including Blue Earth County. Blue Earth County alone consists of a population of 65,787 residents. The residents of Mankato and the local college campuses are a potential source of organic material. The Facility will be open to commercial haulers that have contracts with the MFS Farms. Other targeted source businesses will include restaurants, grocery stores, gas stations, catering companies, and large food producers.

Additionally, institutions with cafeterias such as local hospitals, schools, college campuses, or nursing homes will also be potential SSOM suppliers to the Facility. Finally, the Facility anticipates receiving liquid by-product source separated organic waste from food processors and other manufacturers and industrial suppliers.

2.1.4 Authorized Suppliers

The Facility will only accept material from authorized suppliers. Authorized suppliers will consist of clients who have a contract in place with MFS Farms prior to tipping. To be an authorized customer, a representative from Midwest Recycling Solutions will meet with the potential supplier and help characterize their waste to determine if the material is acceptable to the Facility. Midwest Recycling Solutions will train the supplier on how to separate the waste in order to meet the supply quality criteria set by the contract.

2.2 Hours of Operation

The Facility will be open on Monday thru Friday from 7 a.m. to 6 p.m. and Saturday from 7 a.m. to 2 p.m. The site will be closed Sunday and major holidays. Equipment will operate within the scheduled hours of operation. Delivery trucks are anticipated to arrive between the hours of 8 a.m. and 2 p.m. Monday through Friday and 8 a.m. arid 10 a.m. on Saturday.

2.3 Tipping Fees

Tipping fees are required as a principal source of revenue to operate the Facility. Tipping fees will be set to be competitive with the current cost to landfill the waste. MFS Farms and Midwest Recycling Solutions will calculate a fair tipping fee for each of its authorized suppliers based on their location and the amount, quantity and quality of the product they will be delivering to the Facility.

2.4 Access to the Facility

2.4.1 Traffic Routes

The following are driving directions from Mankato: From the intersection of Stadium Road and Warren Street, travel east a distance of 1.8 miles to South Victory Drive. Turn south onto South Victory Drive and travel a distant of 0.5 miles to Street/County Road 10 and travel west for a distance of 2.5 miles. Turn south on County Road 10/County Road 39 and stay on County Road 10 around the curve to the west for a distance of 1.5 miles to County Road 165/563rd Ave. Turn north on County Road 165/563rd Ave., travel a distance of 1.2 miles to the site. The Facility is on the east side of County Road 165/563rd Ave.

2.4.2 Access Control and Regulation

The entire Facility is fenced with access to the Facility only from County Road 165/563rd Ave. to prevent non- contracted or otherwise unsupervised deliveries to the site. The gate will be opened during business hours while Facility staff are on site. Contract haulers will be required to weigh their vehicle at the scale and log into the computer to make sure they are an authorized supplier

for the Facility. All commercial haulers using the Facility will be required to be licensed by Blue Earth County and/or surrounding counties as appropriate.

2.4.3 Inspection of Waste Deliveries

All incoming waste deliveries will be inspected by trained Facility personnel to verify that the wastes delivered meet Facility specifications. All incoming vehicles are required to report at the scale area. Haulers with incoming waste loads will identify the source and type of load prior to tipping. The Operator will direct the hauler to the appropriate tipping area depending on the type of waste.

Before reporting to the tipping floor, the following information will be recorded at the scale:

1. Date and time of delivery
2. Origin of the material (location, city, county)
3. Weight/volume of material
4. Type of material
5. Hauling company
6. Driver name and signature.

Only hauling companies with contracts with the Facility will be allowed to tip at the Facility. If the hauler and/or location is not in the computer system, the operator will confirm with the Facility Operator that an account can be entered into the computer. Upon approval, the Operator will allow the hauler to tip their load at this Facility.

After logging in at the scale:

1. Loads will be directed to the appropriate tipping area.
2. Tipped loads will be visually inspected by the operator to confirm the materials meet Facility specifications. Hauling vehicles will be required to stay in the tipping area until load inspection is completed.
3. Loads containing unacceptable material will be rejected and may be re-loaded onto the delivery truck for removal.
4. The Operator will complete a load inspection report and allow the vehicle to leave the tipping area.

2.4.4 Potential Vehicle Types and Waste Quantities

Supply vehicles entering the Facility will vary from day to day. MFS Farms expects to receive waste trucks and semi-trailers of waste material daily.

A truck scale is located at the entrance of the Facility to weigh all incoming loads. The scale will be capable of handling vehicles as large as semi tractors with trailer units.

Truck payloads are expected to average approximately fourteen tons of organic material per load. Liquid payloads may be heavier. The Facility will receive materials via end-dump trucks, roll-off boxes, refuse packer trucks, and tanker trucks.

During the first years of operation, the Facility averaged four to eight truckloads of material per day. At full production, the Facility should increase to about fifteen to twenty truckloads of material per day.

2.5 Acceptable Wastes and Materials

Two types of materials will be processed and composted at the Facility: (1) organic materials, both in solid and liquid form; and (2) carbon to include yard debris, crop residue and other bulking materials. Additional information on each of these categories of material follows.

Source separated organic materials are compostable materials segregated, accumulated, and presorted by the generator. Likely sources of feedstock materials include institutional generators with significant food preparation components, industrial sources from paper or food processing sectors, or commercial enterprises such as groceries, restaurants and other industrial processing facilities.

MFS Farms and Midwest Recycling Solutions will establish clear specifications for wastes acceptable at the Facility and will work with waste haulers to help ensure compliance. Any hauler tipping an unacceptable waste load may be required to immediately reload the material or will be surcharged for the cost of its removal and disposal at an appropriate facility. This strong economic incentive, together with supplier education and training, is expected to be the most direct means of assuring receipt of acceptable source separated organic wastes.

Typical acceptable organic materials may include:

- All food waste (including meat and bones)
- Compostable industrial food waste
- Paper towels, napkins and other non-recyclable paper items
- Paper bags
- Coffee filters
- Waxed cardboard
- Floral trimmings
- Liquid food waste
- Straw
- Agricultural-based waste
- Paper milk, juice and other beverage containers
- Paper cups and plates
- Delivery pizza boxes (other non-coated paper food containers)
- Food soiled paper products
- Teabags
- Paper vacuum bags
- Plants
- Garden waste
- Certified compostable plastic
- Compostable diapers

2.5.1 Organic Wastes

2.5.1.1 Food Waste

Food waste includes food processing and food preparation wastes such as hulls, coffee grounds, egg shells, scrapings, peelings, rejects, and by-products.

2.5.1.2 Paper Waste

Paper waste includes wet, soiled, or otherwise non-recyclable fiber products, including cardboard, paper towels, paper food liners, coffee filters, fast-food wrappings, or other compostable materials.

2.5.1.3 Garden Waste

Garden waste can be classified as a part of yard waste. Garden waste includes plants, floral waste, trimmings, overripe vegetables, and other compostable discards from gardening and horticultural activities, or from florists or garden markets.

2.5.1.4 Animal Bedding

Animal bedding (e.g., which is essentially free of manure).

2.5.1.5 Liquid Wastes

Liquid food waste and other compostable industrial liquids may be accepted and stored on site for use in the mixing area and on the windrows to provide moisture.

2.5.1.6 Yard Waste

Yard waste is defined as garden waste, leaves, lawn cuttings, weeds, tree waste and pruning as generated by residential and commercial properties.

2.5.1.7 Agricultural Waste

Agricultural waste includes vegetative byproducts from farming such as unusable straw, hay, silage, or other crop residues.

2.5.1.8 Compostable Diapers

Minnesota Rules specifically excludes compostable diapers from the definition of SSOM. The Facility is requesting a variance to allow it to accept compostable diapers under its revised permit.

2.6 Prohibited Wastes

The MFS Farms will not accept hazardous waste, mixed Municipal Solid Waste (MSW), non-compostable plastics, or any waste deemed unacceptable by management. On-site personnel will be responsible for visually inspecting all loads to ensure that prohibited materials are not delivered and unloaded at the Facility.

The Contingency Plan, Included in Section 6, addresses actions in the event that prohibited materials are inadvertently received.

2.7 Material Receiving, Mixing, and Composting

2.7.1 Qualifying Suppliers

All suppliers and haulers will be carefully vetted to help assure materials delivered meet Facility specifications. The raw product will be delivered to the site via trucks by authorized suppliers (e.g., licensed commercial haulers).

2.7.2 Feedstock Unloading, Inspection, and Storage

All deliveries by authorized suppliers will first scale their truck loads and then log in at the scale house.

Carbon materials (e.g., straw, leaves, etc.) will unload at the carbon stockpile area near the northeast corner of the Facility. Maintaining an adequate supply of dry carbon materials is critical to the entire mixing/composting process. For example, a supply of leaves from each fall will be saved for use as a carbon source to the extent possible.

Solid organics (e.g., food waste) will be visually scanned to confirm the acceptability and type of material delivered before unloading. Most solid organics will be unloaded inside the processing building on the concrete tip floor. Acceptable material will remain where unloaded, most often inside the processing building on the tipping floor. Rejected waste will be reloaded into the hauler's truck and immediately removed. Or, rejected solid organics will be placed in a covered MSW refuse container located near the unloading area and then removed from the site weekly. The origin of non-acceptable items will be identified for further education of the generator and supplier.

Liquid organics will generally be delivered in tanker trucks. These liquid materials will be visually inspected during unloading. Liquid organics will be unloaded into one of two aerated pits in the new liquids mixing/aeration building. Non-odorous, typically corn-based, liquids, may be mixed directly into windrows on the compost curing pad. Once a truck supplying liquid organics is finished unloading, additional carbon materials will be immediately added until sufficient bulk density and moisture content is reached.

The original underground, liquid organics storage tank is located outside just southwest of the processing building between the building and the truck scale. Delivery trucks can also discharge their liquid byproduct through a hose connection, gravity flow to the tank for mixing within the processing building. The tank holds 20,000 gallons of liquid material at any moment.

2.7.3 Processing Building

Organic materials will be mixed with the proper amount and type of carbon / bulking agents. Moisture content will be adjusted when needed either by adding moisture if too dry or adding carbon / bulking agents if too wet. Also, mixtures will be adjusted to achieve an approximate ratio of three (3) parts carbon to one (1) part organics by weight and a moisture content of approximately 45-65% depending on the final results of the DRP. Moisture will be added if a squeeze test indicates the material is too dry.

Front-end loaders and excavators will be used to move and mix the organic material with carbon and bulking agents. The carbon to nitrogen (C:N) ratio of the initial mixture will typically range from 5:1 to 20:1 depending on the material.

2.7.3.1 Depackaging/Size Reduction Operation

A turbo separator will be installed in the processing building. Acceptable loads requiring size reduction or depackaging will be dumped on the tipping floor and visually scanned before loading into the feed hopper. Output of solid and liquid organic material from the turbo separator will be discharged back to the mixing area within the processing building.

Non-compostable material will be recycled (e.g., recyclable steel) or disposed of in an approved landfill (e.g., packaging too contaminated to recycle). Any excess liquids will be soaked up with carbon / bulking material spread out at the liquid discharge point of the separator. This liquid/carbon mixture will then be moved either to the new liquids building or piled into windrows on the active composting pad.

2.7.4 Potential Liquids Mixing/Aeration Building

Prior to design of the liquids mixing/aeration building, the findings of the demonstration research project (DRP) will be evaluated and a report will be provided to the MPCA as required in the DRP Agreement. The final design of a liquids mixing/aeration building will be based on the results of the DRP and appropriate MN Rules for compost facility design. Construction plans and specifications for the building will be submitted to the Agency for review prior to construction. Conceptually, the building would be located in the northeast quarter of the Facility near the eastern pad and will likely consist of a hoop style structure.

The intent of the building will be to provide a cost-effective means to compost liquid organics through the required active PFRP composting process as required by the MPCA Compost Rule prior to moving the compost material to the curing pad.

As a general concept for operation, loads of organic liquids and carbon/bulking materials (e.g., wood chips, etc.) will be loaded on top of each other (i.e., in “layers”) and then mixed. Once the entire pit is full, PFRP will officially begin and continue for at least seven days. The materials will then be moved to the composting pad. Once both PFRP and the Solvita maturity index standards have been attained, the compostable materials will be able to be transferred off of the curing pad.

2.7.5 Composting Pad

The composting pad was constructed in two phases; the original "Phase 1" pad was constructed on the east side of the Facility in 2012 and the "Phase 2" pad on the west side of the Facility was constructed in 2017. The curing pads were constructed as shown in the Permit Drawings in Appendix A, which includes a total of 6 inches of asphalt (MNDOT Spec 2360), under lain by 8 inches of class 5 aggregate (MNDOT Spec 3138), 12 inches of select granular, Type V MNDOT geosynthetic fabric, and approved subgrade.

The pads are sloped to drain to the pond along the south side of the Facility Property. The pond is aerated as necessary to maintain aerobic conditions. The total compost pad area is approximately three and three quarters (3.75) acres. A site map showing the layout of the Facility is provided in the Permit Drawings in Appendix A.

The entire Facility (both pads) is designed to have up to 18 windrows in varying stages of composting at any one time, each having an estimated volume of 1,000 cubic yards.

To manage the material pursuant to the PFRP standards in the MPCA Compost Rule (7035.2836, Subp. 11, Sub-item B), compostable material on the active composting pad will be turned using the Facility's compost turning machine.

Active composting material will be monitored to maintain an internal temperature of 55 degrees Celsius for a minimum of 15 days, and will be turned at least once every three to five days during the non-winter months (with allowances for less frequent turning during extreme cold temperatures). Contact water from the pad drains to the contact water retention pond at the south end of the Facility.

Once the material on the active composting pad has attained PFRP and the required Solvita maturity standards, the material will be moved off of the composting pad for additional curing in the compost curing area north and west of the processing building. Finished compost will be determined by the standard tests pursuant to MPCA Compost Rule.

2.7.6 Screening

Upon achieving the desired characteristics of mature compost, the materials will be screened and moved to the finished (screened) compost stockpile.

2.7.7 Finished Product Storage

Finished compost is proposed to be stored to the south of the scale just east of the fence or in the adjacent farm field owned by MFS Farms. Additional storage locations for finished compost may include nearby gravel quarries.

2.8 Rejects and Residuals Management

As materials are received, unacceptable materials will be rejected during inspections to the extent identifiable. The hauler is responsible for removal of such unaccepted wastes (or for the cost of removal and disposal).

Rejects from pre-composting operations (e.g., depackaging in the existing processing building) and any residuals from finished compost product screening will be loaded into enclosed dumpsters. A trash compactor will be installed at the northwest corner of the processing building.

The loading hopper and compactor will be inside the building and the enclosed dumpster will be stationed outside of the building. The compactor box will be serviced at least weekly for transport to a licensed landfill.

The types of materials that could be found among the rejects include rock and concrete chunks, plastics, glass and other inserts.

Wind-blown litter will be collected from throughout the Facility grounds on a weekly basis. This could include fugitive paper and plastic. Such litter will be prevented to the extent possible at the source of generation (e.g., processing building, windrow turning, finished compost screening).

2.8.1 Other Recyclables and Waste Materials

If non-compostable, recyclable materials are present, they will be removed and recycled. The Facility may install a bailer to prepare steel, aluminum and cardboard for recycling (i.e. the depackaging process may result in recyclable materials depending on packaging type).

There will be a small hazardous material container onsite for batteries and other potential containers that may be mixed in the waste delivered to the site. All non-recyclable material will be removed on a weekly basis.

2.9 Finished Compost Distribution Plan

All finished compost product from the Facility will meet Class 1 standards according to the MPCA Compost Rule (7035.2836, Subp. 6). End markets applications include: commercial use for nurseries and other bulk sales (e.g., landspreading on nearby farm fields). Midwest Recycling Solutions is planning on selling finished compost to the general public, state/county/local governmental entities, nurseries or landscapers.

2.10 Maintenance

Routine daily start-up steps will include completion of an initial visual security check, preparation of the tipping floor and spreading of an absorbent carbon layer to absorb free liquids. Gates will be locked until start-up tasks are completed and the Facility is staffed and ready to receive incoming materials. Equipment maintenance records will be kept at the site office.

2.11 Storage Capacity

The Facility has adequate capacity to provide:

- Stockpiling of limited carbon material to be used as feedstock (the Operator has access to additional carbon material for delivery on an "as needed" basis).
- The asphalt pads have capacity for 18 windrows at a time, each with 1,000 cubic yards of capacity.
- 15,000 cubic yards of unscreened compost and 15,000 cubic yards of screened compost for a total of 30,000 cubic yards of finished product.
- Additional storage capacity for finished/screened compost is available at off-site locations. Much of the finished product is expected to be land applied to farm fields.

2.12 Equipment

Equipment that will routinely be available and utilized for Facility operations will include:

- **Front End Loader(s)***:* Conventional front-end and skid steer type loaders will be used to move tipped waste loads, charge the grinder, load the mixer truck, and move finished compost.
- **Water Truck***:* Water needed to control dust on interior and exterior haul routes will be applied with a rubber tired sprayer. The water truck can also be used to add moisture to stockpiled wastes that need increased moisture content.
- **Compost Turner:** The turner will be used to turn the windrows until material is at the acceptable stage.
- **Excavator:** The excavator will be used as needed for windrow management and materials handling within the pits in the liquids mixing/aeration building.
- **Grinder:** To size reduce materials as needed.
- **Screen:** To remove contaminants (e.g., plastic) from finished compost.

To the extent possible, equipment will be washed in the processing building. Waste water from inside the building drains to the underground contact/waste water tank monitored on a set schedule for BOD, chloride, hardness (calcium & magnesium), total magnesium, nitrites, nitrates, nitrogen, phosphorus, sodium, total dissolved solids, total suspended solids, specific conductance, total inflates, and oil /grease. If the contact water is unacceptable for use as moisture recycled back into the compostable materials, or if the tank is full, a pumper will be contracted and the effluent will be hauled to a waste water treatment plant to be properly disposed.

2.12.1 Contact Water from the Composting Pad

The south pond receives the storm water drainage from the asphalt composting pad. The pond system has been designed to have capacity for back-to-back 24 hour-100-year storm events without discharging off site.

The contact water in the south pond will be routinely tested pursuant to the MPCA'S SSOM Composting Rule (7035.2836, Subp. 9, item B, subitem 4) as detailed in Appendix D – Sampling and Analysis Plan and Section 4.

Several means of treating the contact water may be used. As a primary means of treatment, the retention pond will be aerated to treat and evaporate the water. If additional moisture is needed for the compostable material batches, the contact water could be recycled back to the liquids mixing/aeration building to be used as an additional source of liquid organics prior to starting the PRFP process.

In the event the contact water pond is full, the water may be land applied on nearby farm fields owned by MFS Farms using standard farm equipment to inject the liquid into the topsoil (see Appendix E – Plan for Land Application of Contact Water). A final option is to haul the water to a licensed waste water treatment plant as approved by MPCA.

2.13 Safety

The Facility's safety policy delineates personnel responsibilities, orientation procedures, scheduling and responsibilities for regular safety meetings, and requirements for regular training and inspections. It contains accident investigation procedures, reporting procedures, first aid information, general safety rules, and rules for specific situations. The MPCA's *Safety in Recycling Facilities* manual is utilized as an additional reference, as appropriate.

When initially hired, all personnel are required to participate in the operators' training and safety program. The initial orientation includes Facility-wide rules and procedures and job-specific operations and safety procedures.

Hard hats, safety glasses, and steel-toed boots are all examples of the safety equipment that all employees on site are required to use. A personal flotation device and rope ladder are also available for use when working in the vicinity of the pond. All employees have ready access to phones or radios at all times on site. Other safety precautions and on-site equipment are described in the contingency plan (Section 6).

Visitors to the site will be required to use personal protective equipment (PPE) and follow the instructions of site personnel. Truck drivers entering the site will be given specific unloading instructions, including how to safely unload and Facility speed limits

2.14 Personnel Training

The Facility will be staffed by an on-site manager and at least one assistant. Operators will have training updates on a quarterly basis. Initial training session with consist of 24 contact hours within the first 12 months of employment and a minimum of 5 contact hours of training on an annual basis.

Personnel training will include, but is not limited to the following:

- Using, inspecting. repairing and replacing Facility emergency and monitoring equipment;
- Activating communication and alarm systems;
- Activating automatic waste feed cutoff systems;
- Responding to fires;
- Responding to Facility failures, including monitoring devices;
- Responding to ground water or surface pollution incidents;
- Accepting and managing waste other than acceptable and approved SSOM or yard waste;
- Rejecting waste not permitted at the Facility; and
- Sampling and testing procedures and protocols (e.g., storm water, contact water, feedstocks, organic materials still under active PFRP composting phase. organic materials after PFRP ready for curing, finished compost product, etc.).

On a yearly basis, the training program will review the current training standards and update the program to enhance the worker's expertise. Any relevant updates to MPCA Rules (especially the facility Personnel Training rule, 7035.2545) shall be adopted into the training program.

2.15 Inspections

Facility operators conduct regular inspections to monitor operations, safety equipment and procedures, emergency equipment, security devices, fencing, odor integrity, litter, and other conditions. Inspection records will be kept at the site office.

3 Construction Documentation

As-built Facility construction documentation was submitted to the MPCA and Blue Earth County in February 2013 and in December 2017. A construction NPDES permit was obtained for the construction project. The ponds and subgrade were sequenced to allow the Facility to capture and control site run-off throughout construction. Additional erosion control practices, including silt fence, were installed as needed to ensure minimal impact to the environment. The natural drainage of the site is such that all runoff can be readily contained.

3.1 Compost Pad Lines/Windrow Area Construction

The eastern portion (Phase 1) of the composting pad was constructed in 2012 with the roadways, existing processing building, tanks and other primary infrastructure. In 2017, Foth submitted construction document for Agency review and as-built documentation for about 75% of the originally planned western portion (Phase 2) of the composting pad (remaining 25% of this pad will not be paved and will be used for storage of finished and screened compost. The composting pads are constructed as shown in the Permit Drawings in Appendix A, which includes a total of 6 inches of asphalt (MNDOT Spec 2360), under lain by class 5 aggregate (MNDOT Spec 3138), 12 inches of select granular, Type V MNDOT geosynthetic fabric, and approved clay subgrade. The pads are sloped to drain to the pond along the south side of the Facility Property.

3.2 Contact Water Storage Pond Construction

The contact water storage pond liner system was constructed by stripping top soil, excavating and recompacting native clay soils as documented in the Construction Certification Report prepared by MFRA February 2013. A water level measuring tool was added to the storage pond as requested by the MPCA to monitor contact water volume in the pond.

3.3 Existing Process Building Construction

The existing processing building was constructed with a concrete floor and partial walls and a fabric hoop style roof and walls. The building has a concrete floor with a floor drain to contain any contact water and liquids not absorbed by the composting mixing process. The building has a sliding door for ventilation and to allow trucks into the Facility. Air louvers are provided in the building end walls to allow proper air flow and contain odors. Provisions are included for operation of a biofilter to filter air discharged from the building as needed.

3.4 Potential Liquids Mixing/Aeration Building

Prior to design of the liquids mixing/aeration building, result of the demonstration research project (DRP) will be evaluated and a report will be provided to the MPCA as required in the DRP Agreement. The final design of a liquids mixing/aeration building will be based on the results of the DRP and appropriate MN Rules for compost facility design. Construction plans and specifications for the building will be submitted to the Agency for review prior to construction. Provisions will be included for operation of a biofilter to filter air discharged from the building as needed for odor control.

4 Environmental Monitoring Plan

4.1 Introduction

Monitoring activities will include, but not be limited to those needed to meet Facility permit requirements as specified by state and local regulatory agencies. A sampling and analysis plan is provided in Appendix D.

4.2 Compost Sampling and Testing Plan

The plan includes identifying the characteristics of incoming waste by source (feedstock) and evaluating its compatibility with existing composting recipes.

Facility staff will perform daily temperature monitoring of active composting materials (i.e., in the pits within the potential liquids mixing/aeration building, the existing processing building, and on the active composting pad) until PRFP is achieved and weekly thereafter. The monitoring will establish that the process to further reduce pathogens (PFRP) has been met pursuant to the MPCA Compost Rule (7035.2836, Subp 11). Current Facility plans call for using one or both methods of aeration on the active composting pad: (1) the windrow method with active turning using the Facility's compost turning machine; and/or (2) the static aerated pile method.

As allowed by Minnesota Rule (7035.2836 Subp. 11, Item B, Subitem (10a), MFS Farms anticipates it may need to vary the windrow turning frequency during winter months when the temperature drops below 20^{o} F. During these periods of cold temperatures, the Operator anticipates turning as needed in order to achieve PFRP. Testing requirements for the finished product will be as follows to determine the maturity of the compost; In accordance with Minn. R. 7035.2836 subp. 5 item J, subp. 6 & 7.

1. Ignition Loss analysis to determine more than 60% decomposition has been achieved.
2. Carbon/nitrogen ratio US EPA Method 9060A, Total Carbon and Dumas. In the range of 10:1 to 20:1.
3. Solvita Test
4. Each batch of compost will be analyzed for metal contaminants, using EPA test methods outlined in EPA SW-846, and 8080 for PCB's, as outlined in Table 2 below.
5. Inert content greater than four millimeters shall be determined by passing four replicates of 250 cc oven-dried (70 degrees Celsius) samples of compost through a four millimeter sieve. Material retained on the sieve shall be visually inspected and inerts, including glass, metal, and plastic shall be separated and weighed. The weight of the separated material divided by weight of the total sample, multiplied by 100, shall be the percent dry weight of inert material. The percent of dry weight inert material may not exceed three (3) percent.
6. The mature compost will be analyzed for the following parameters:
    a) pH
    b) moisture content
    c) particle size
    d) NPK ratio

e) Soluble Salt content

Each of the testing results will be recorded and retained as part of the chain of custody for each batch of compost produced. The results will be reported to the County on a quarterly basis and to the State on an annual basis.

Sampling of the compost material will be completed by the Operator using trained Facility staff following the procedures outlined in the Compost Councils *Sample Collection and Laboratory Preparation 02.01 Field Sampling of Compost Materials* Guidance document. Each batch of compost will be sampled for maturity and to assure Class I compost standards. Each sample will be composed of individual samples throughout the batch. All equipment and containers shall be thoroughly cleaned, washed, rinsed, and free from any debris or contamination prior to sampling and after sampling. The Operator and/or trained person in charge of the sampling procedure must document the chain of custody for each batch of compost tested. Each batch is core sampled from numerous locations and shall be combined by mixing in a clean container to obtain a combined sample for the lab to analyze.

The contaminants and associated concentration limits shown in Table 1 will not be exceeded by for Class I composted produced at the Facility.

Table 1
Metals and Concentration Limits for Compost

Contaminant	Concentration (mg/L)
Arsenic (As)	41
Cadmium (Cd)	39
Copper (Cu)	1,500
Lead (Pb)	300
Mercury (Hg)	5
Molybdenum (Mo)	18
Nickel (Ni)	420
Selenium (Se)	100
PCB	6
Zinc (Zn)	2,800

The results of each batch is retained on-site by Facility staff. Also, upon request, a copy of the test results is provided to the buyer of compost. Each batch shall be piled separately to clearly identify different batches.

The monitoring and analyses required by regulatory agencies will be necessary, but may not be sufficient to satisfy some potential end-market-derived requirements. Therefore, additional analyses may also be conducted. If MFS can historically demonstrate that some of the testing requirements by the MPCA are not applicable to source separated composting, it may suggest that the testing requirements be modified.

4.3 Pond Sampling Plan

The contact water pond located on the south side of the property is designed with a capacity for a back-to-back 100 year-24-hour storm event. The pond water can be used to keep the moisture content of the windrows within acceptable limits by pumping the water onto the active composting windrows. Biannual tests will be conducted in the pond to ensure water quality standards are being met. Water from the contact water pond is sampled for the following contaminates:

Table 2
Contaminant Sampling Items

TSS	BOD (5-Day)	Magnesium
Chloride	Ammonia	Antimony
Total Alkalinity (as CaCO3)	Nitrate (as Nitrogen)	TDS
Total Kjeldahl Nitrogen	Phosphorous	Sulfate
Sodium	Coliform, total	Boron
pH, Field	Escherichia coli	Cadmium (Cd)
pH	Barium (Ba)	Copper (Cu)
Arsenic (As)	Chromium, total (as Cr)	Molybdenum (Mo)
Calcium (Ca)	Mercury (Hg)	Iron (Fe)
Lead (Pb)	Selenium (Se)	Manganese
Nickel (Ni)	PCB	Potassium
Zinc (Zn)	Aluminum (Al)	Carbon, Total Organic (TOC)
Cobalt	PFC	

Test results are submitted annually to the MPCA and Blue Earth County.

4.4 Land Application of Contact Water

Land application has been permitted twice as a one-time application. Approximately 2.8 million gallons of contact water were land applied by Midwest Pumping to adjacent agricultural fields in 2016. Approximately 1.5 million gallons were land applied in 2017. With this permit application and conversion from an MSW to a SSOM compost facility, MFS Farms / Midwest Recycling Solutions is requesting a permit modification to land apply excess contact water annually. Detailed information on the permit modification for land application can also be found in Appendix E.

5 Closure and Post Closure Plan

5.1 Introduction

This portion of the document constitutes a closure and post-closure plan for the MFS Farms, LLC - Good Thunder Facility. In the sections which follow, the plan identifies proposed closure and post-closure activities appropriate to this Facility, addresses end use, and describes information about Facility development and operations that will be regularly added to the Plan record.

5.2 Dates of Operation

Acceptance of organic materials and operation of the processing and composting Facility began in the spring of 2012. A closure date of the Facility is not specified.

5.3 Site Contacts/Important Persons

Facility Owner:	MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Operator:	MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Primary Contacts:	Mike Higgins Midwest Recycling 1801 Mill Avenue Brainerd, MN 56401 Phone: 989-429-2006
	Kevin Fitzsimmons MFS Farms 56437 164th Street Good Thunder, Minnesota 56037 Phone: 507-3l7-0746
Property Owner:	MFS Farms, Inc. 56437 164th Street Good Thunder, Minnesota 56037
Engineering Consultant:	Foth Infrastructure & Environment, LLC Bruce Rehwaldt, P.E. 8550 Hudson Boulevard North, Suite 105 Lake Elmo, Minnesota 55042 Phone: (651) 288-8598

5.4 Notification of Final Closure

MFS Farms will provide at least a five-month written notice to Blue Earth County and MPCA regarding the decision to close the Facility. The notice would specify the date on which materials would cease to be accepted, and specify a date, several months later by which time all on-site composting will have been completed. Subsequent closure activities could include removal of finished product, removal of site equipment and other site improvements and any required site restoration to the satisfaction of the landowner.

A minimum of four-and-a-half months prior to the selected closure date for composting operations, MFS Farms will provide a two-week (14-day) notice to Blue Earth County, MPCA and all regular suppliers of the effective date on which it will cease to accept wastes. Public notice of intent to cease acceptance of wastes at the Facility will also be published. A notice will be posted at the entrance of the Facility indicating the date of closure and provide a listing of other facilities accepting similar materials. Effective the published date, the Facility will cease to accept waste.

All acceptable wastes delivered during this two-week period will be processed and composted, or transferred from the Facility.

5.5 Closure Activities

5.5.1 Termination of Composting Activity

Facility personnel will continue to complete daily monitoring and composting of material in process until all materials have attained a finished product status. As other elements of the Facility are decommissioned, the composting aeration system will remain intact and operational until all materials are fully composted.

5.5.2 Removal of Stockpiled Materials

Finished product will be marketed from the site until no stockpile remains or land application of remaining quantities can be completed. Removal of finished product and all other Facility closure activities is expected to be completed within six months of the termination of composting activity, weather permitting.

5.5.3 Access Control

The entrance and exit gates to the Facility will remain in place at least until all other planned and required closure activities have been completed.

5.5.4 Drainage Plan

In the event of closure, all infrastructure will be removed and the site will be returned to agricultural production.

5.5.5 End Use

The contact water pond will be tested and pumped out. The contact water will be land applied in accordance with the operating permit or disposed of at a wastewater treatment facility. If the asphalt from the composting windrow pads is removed it will be recycled or disposed of in accordance with MN Rules. Clay from the pond may be sampled as appropriate and if necessary will be managed as required by MN Rules.

The site will be re-graded to allow natural drainage to occur through the site. The contact water tank will be pumped dry. The contact water from the tank will be disposed of at a wastewater treatment Facility, or if it meets discharge standards, will be land applied. The tank will be filled with sand and capped or removed from the site per the existing standards at the time of closure.

It is anticipated that Blue Earth County will not require MFS Farms to perform long-term post-closure activities because the Facility is not intended to be a site of permanent waste disposal. Accordingly, there should not be any restrictions on potential end uses, other than those established by local zoning controls.

The site is located within an area zoned for agricultural uses, with other uses allowed through conditional approval by Blue Earth County. If the composting pads, processing building, and new liquids mixing/aeration building are left on site, they could be converted to a variety of other purposes, with necessary approvals.

5.5.6 Closure Provisions Not Applicable to Facility

A significant number of the provisions typically governing closure of waste disposal facilities are not applicable to this SSOM composting Facility. The following are examples of requirements which are applicable only to disposal sites (i.e., not applicable for the composting Facility): final cover, landscape maintenance, establishment of vegetation, slopes, cover maintenance, post-closure maintenance, cross-sections of disposal areas, and leachate and gas evaluation, control, and monitoring requirements, and closure/post-closure cost estimating.

5.5.7 Closure Plan Record

This closure plan will be supplemented at least annually to ensure that it provides an up-to-date compilation of significant records and information about the Facility, its development, and its operational history.

The information records that will be maintained are identified in Table 4. Comments are provided either regarding the approach that will be followed to maintain records or the status of specific decisions.

Table 3
Information Records to be Maintained

Record	Comments/Status
Dates of Operation	With MPCA and Blue Earth County approvals, the earliest date by which the Facility is to be ready to receive waste deliveries.
Chronological Record of Waste Acceptance	Quarterly reports of waste receipts, types, and disposition are required by the MPCA. Copies of these reports will be appended to the Closure Plan.
Notarized Affidavits	Notarized affidavits from persons knowledgeable about the Facility will be provided at the end of the two-year start-up period arid at least every three years thereafter that lists types and quantities of wastes received, haulers and known generators, and which identifies all persons with such knowledge, including knowledge about siting, design, construction, operation, maintenance and closure of the site. Supporting records will be provided, and the location of operating records will be specified.
Important Regulatory Documents	The closure plan will be appended to include copies of all permits and approvals obtained for development and operation of the Facility, including lease agreement, conditional use permit, county license, MPCA compost facility permit, construction storm water management permit application, and copies of all known covenants or easements. Any modifications to these documents made during the operating life of the site will be incorporated into the plan record.
Deviations from Specifications	A record will be maintained that describes, documents, and illustrates deviations from the planned site layout, design, and/or operations. As design elements for the Facility are refined, these detailed additions will be added to the plan.

5.5.8 Financial Assurance Estimates

The Operations Plan identifies that MFS Farms / Midwest Recycling Solutions will provide notification to the MPCA, Blue Earth County, and its regular suppliers four and one-half (4.5) months prior to closure, providing a minimum of four months for completion of processing and composting of on-site materials prior to final closure. Finished materials produced during that time would be marketed or used on site for erosion control or top soil with no associated external costs.

The Facility is not required to maintain financial assurance under Minnesota solid waste rules, but is required to outline projected costs for closure and post-closure activities. There are no post-closure costs anticipated, as no waste materials will remain on site post-closure. With respect to closure, the only real costs for closure will be removal of any raw, incompletely processed, or finished materials remaining on site. The costs for management of those materials are minimal, estimated at less than $50,000. The facility maintains the required reclamation performance bond as part of its Solid Waste Facility License with Blue Earth County.

6 Contingency Plan

6.1 Unauthorized Deposits of Acceptable Materials

Daily, a designated Facility employee will check the boundaries of the property for deposits of material that, although acceptable, have been delivered to the wrong spot or at a time other than normal working hours. Any unacceptable materials found will be collected by the employee, using equipment as needed and transported to an appropriate location.

6.2 Delivery of Hazardous or Otherwise Prohibited Wastes

Facility employees will act according to the following policies and procedures in the event that prohibited wastes are delivered. Any prohibited material, despite the quantity, remains the property and responsibility of the hauler attempting delivery and the original property owner. Prohibited waste will be rejected and turned away at the gate. If Facility personnel determine the prohibited material to be hazardous to the health or the environment of the Facility, or if the hazards associated with the material cannot be identified, County and State authorities will immediately be notified and an appropriate handling plan negotiated among those agencies, the hauler, the actual material owner, and MFS Farms/Midwest Recycling Solutions.

If prohibited material is identified after the vehicle has left the Facility and the material can be readily identified as not hazardous to the health of personnel or the environment of the Facility, Facility personnel will remove the prohibited material and any adjacent material that may have become intermixed with the prohibited material from the Facility. Any materials removed in such a manner will be disposed of at an appropriate facility.

If Facility personnel determine the prohibited material left behind to be hazardous to the health or the environment of the Facility, or if the hazards associated with the material cannot be identified, County and State authorities will be notified and an appropriate handling and disposal plan negotiated among those agencies, the hauler and original material owner (if identified), and MFS Farms.

6.3 Fires on Site

Minor fires such as equipment fires or within roll-off boxes or dumpsters will be handled by on-site fire extinguishers located in the office and on operating equipment. Fires, other than those discussed in the previous paragraph, will be handled by the local fire department.

Within 24 hours of discovery of a fire, the Facility will provide notice to the MPCA that a fire has occurred and that the contingency action plan has been implemented. If the Facility is unable to extinguish the fire within two weeks of notifying the MPCA, the Facility will again notify the MPCA and provide the name of the professional engineer they have hired to develop a revised plan for further fire-fighting efforts. The revised plan will identify the actions to be taken to extinguish the fire, including sources for materials and equipment, and a timeline for implementation. The Facility will submit the revised plan to the MPCA for review and approval within 15 days of notifying the MPCA that a revised plan is being prepared. The Facility will implement the revised plan upon receiving approval from the MPCA.

6.4 Nuisance Management Plan

6.4.1 Dust

The access road to the facility (164th Street) is not paved. The Facility is equipped with a water truck and will water the access road and unpaved interior traffic routes with well water, or clean stormwater, as needed to control dust. As noted in its Conditional Use Permit with Blue Earth County, the Facility has also worked with the Blue Earth County Highway Department to determine acceptable dust control methods for the County Road. In addition to using the water truck as needed, the Facility will at a minimum, also apply calcium chloride (CaCl) to the access road twice per year.

Prior to processing, yard waste may be stockpiled without cover at the facility. The compost material will be kept at moisture content to prevent dusty conditions. If dusty conditions are created by the compost process, sufficient clean water will be applied to control the dust.

6.4.2 Noise

On-site noise is reduced by the enclosure of the noisiest operations within the process and proposed liquid mixing buildings. The facility is also intentionally set back from the road and bermed to minimize noise. Outdoor noise from delivery, shipment traffic and heavy machinery should not adversely affect the public, as the equipment will only operate during the designated hours of operation and the site is located in an agricultural area frequented by truck traffic and large farm equipment.

Delivery of organic loads and most compost processing steps other than windrow management will be completed within enclosed structures, minimizing the potential for external noise impacts. All engine-powered equipment used external to the building (e.g., front-end loaders, snowthrower, lawnmower) will be equipped with backup beepers, as required by law. The distance between the facility and residential or other development, and limiting equipment operation to the designated hours of operation, will ensure that facility noise is not a nuisance.

6.4.3 Vector Control

Rapid processing of incoming organic matter and maintaining good housekeeping practices will provide effective control of insects, rodents, or other vectors. Steps taken to establish vector control include:

- Total enclosure of tipping floors within a hoop-style fabric buildings with concrete floor and foundation walls;
- Doors to hoop buildings closed at night;
- Source separated organic materials spilled out of doors cleaned up promptly;
- Landscaping adjacent to the building and compost pad regularly mowed to reduce nearby safe habitat; and
- Trapping as needed.

6.4.4 Odor

There are a number of areas from which odors might originate at the facility, including: (1) the tipping floor and processing areas (located within an enclosed structure); (2) the active compost windrow area; and (3) the contact storage water pond. If odor is detected, staff will walk the Facility to identify the source and will take appropriate actions to mitigate the source of the odor. Operator will also record weather and other conditions that may contribute to odor.

Odor control within the processing and liquid mixing buildings will be achieved through a combination of techniques. The doors along all sides of the buildings provide flexibility to both enhance as well as restrict airflow through the structure. Additionally, provisions have been made for both buildings to optionally install and operate biofilters to control air discharged from the building.

Operational practices within the processing building are also key to maintaining effective odor control. Thorough inspections of incoming loads and prompt blending of odorous SSOM materials with carbon and bulking agents, and rapid movement of feedstocks from the tipping floor to the active compost pad processing area and into the composting windrows, are all essential operating steps. Under routine operations, organics received in the process building will be processed into the windrows on the day received. Wood chips, yard waste or finished compost will be placed over the composting windrows as needed to minimize odors.

Non-odorous liquid SSOM will be processed directly into windrows or blended with odorous liquids in the proposed liquid mixing building. All odorous liquid SSOM materials will be received indoors within the proposed liquid mixing building. The odorous materials will be immediately mixed with carbon and bulking agents and the mixture aerated to expedite development of PFRP conditions to minimize odor. As noted above, provisions will be made for the new building to be configured with a biofilter to treat air being discharged from the building.

Windrow or aerated static pile composting will be used for final finishing, curing, and maturing. Attention to temperature and moisture content, recipe adjustments to optimize carbon/nitrogen ratios, and proper turning of the windrows/static piles will assist in the maintenance of aerobic conditions and minimization of odor potential.

The contact water pond has the potential to become anaerobic, particularly in dry years. With this permit application, the Facility is proposing to be allowed to aerate the pond as needed to maintain aerobic conditions to minimize the potential for odor generation. The MPCA aerated stabilization pond design criteria recommend that aeration equipment be capable of delivering a minimum of 2 pounds of oxygen per pound of BOD in the pond.

A minimum oxygen concentration of 3 mg/L is also recommended. The Facility will use these guidelines as the basis for aerating the pond as needed to reduce the potential for odors.

6.4.5 Waste Products and Rejects

All by-products, including rejects and recyclables, will be stored in a manner that prevents vector problems and aesthetic degradation. Rejects and recyclable material will be kept under cover in separate, labeled containers. As noticed, material will be collected and placed in the respective container.

Litter, waste products, and rejects will be collected from mixing station, contact water pond, and any on site location where present on a weekly basis. The contact water pond will not be pumped for use or disposal until reject material has been removed and disposed of properly.

6.5 Runoff Controls & Contact Water Management Plan

The site is relatively level, although the compost pads drain to the south into a clay-lined holding pond sized to capture two back to back 24-hour, 100-year storm events. Until compost materials have satisfied the specified PFRP and Solvita maturity requirements of Minn. Rules 7035.2836, water contacting the compost must be collected. This water will be land applied or disposed at an area wastewater treatment facility.

Runoff from other non-contact areas of the site are directed to the existing sedimentation pond on the north end of the facility for management as stormwater.

6.6 Unauthorized Access to the Facility

Only authorized individuals will be allowed to access to the Facility. These individuals are anticipated to include:

- Facility personnel.
- Qualified drivers of commercial vehicles delivering materials.
- Inspectors, as may be required by permit or regulation from Blue Earth County, or the MPCA.

Unauthorized individuals who gain access to the Facility will be escorted off site by Facility personnel to the extent that is deemed safe to interact with the unauthorized individuals. If Facility staff considers the unauthorized individuals to be a threat to their safety or to the safety of authorized users of the Facility, they will call 911 and contact the local sheriff's department for assistance.

6.7 Unscheduled Shutdown

If shutdown is due to an emergency, the Facility personnel will follow all applicable emergency response steps and procedures before starting the unscheduled shutdown cycle. The unscheduled shutdown cycle procedures will include the following:

- Call MFS Farms
  - Notify MFS Farms of the shutdown, its reasons, and expected duration.
  - If appropriate, Facility staff will notify regular suppliers.

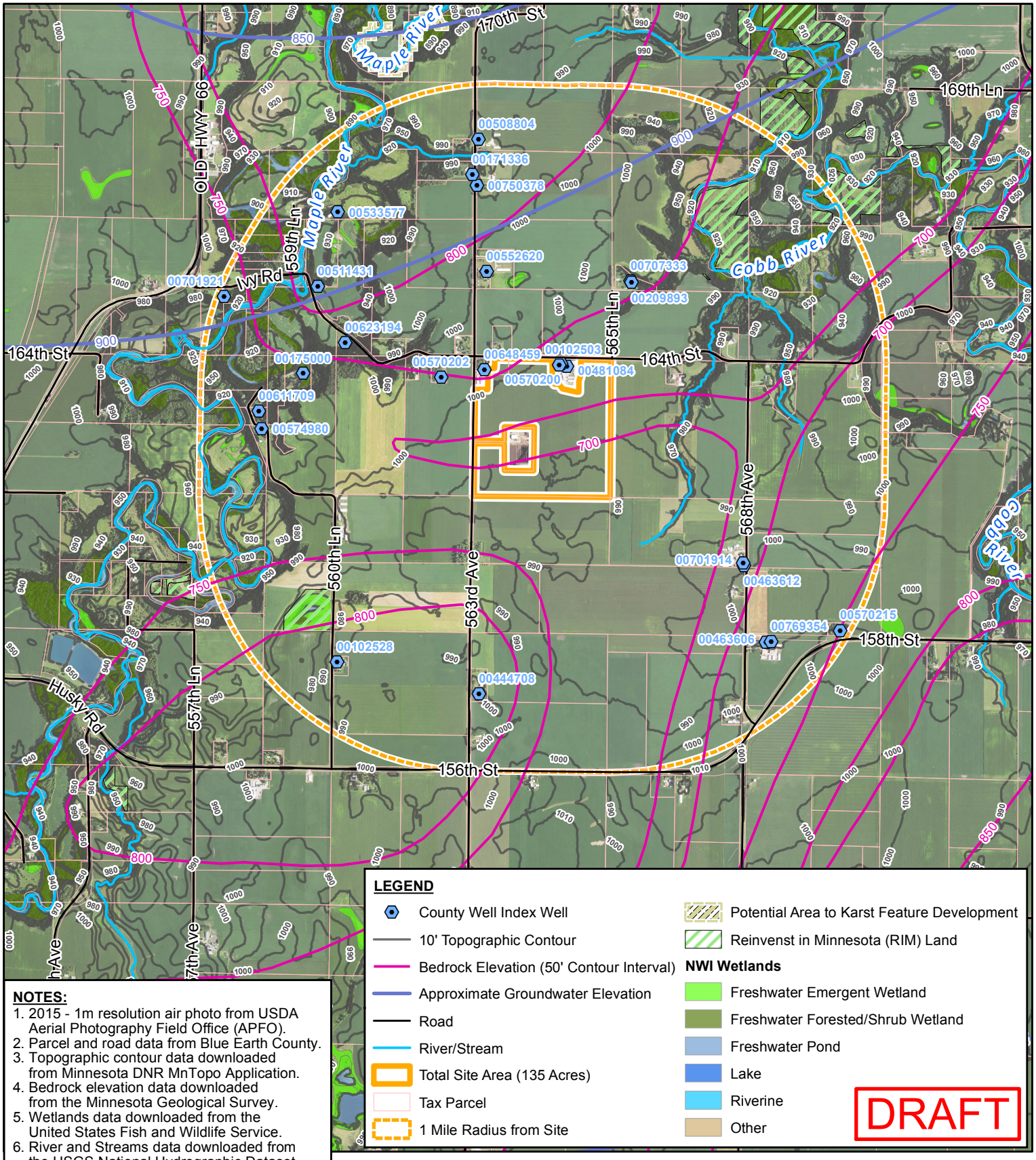
- If shutdown will be extended due to heavy weather damage or other unusual event, Facility staff will notify Blue Earth County and the MPCA.

- Close and lock entrance roadway gates:
  - Obtain "Unscheduled Shutdown" signs from office.
  - The sign says: "Temporarily Closed" - for information call MFS Farms at 989-429-2006.
  - Close and lock entrance roadway gate. Hang "Unscheduled Shutdown" sign on the gate.

- Complete routine on-site operational and closure activities:
  - Short-term shutdown: complete as many remaining activities as possible under conditions.
  - Extended shutdown: complete routine daily operational activities, if possible. Complete all other routine on-site closure activities.

- Close exit gates
  - Close and lock exit roadway gates at Facility.
  - Drive past entrance gate and confirm gate is closed and padlocked.

Figures



LEGEND

- County Well Index Well
- 10' Topographic Contour
- Bedrock Elevation (50' Contour Interval)
- Approximate Groundwater Elevation
- Road
- River/Stream
- Total Site Area (135 Acres)
- Tax Parcel
- 1 Mile Radius from Site
- Potential Area to Karst Feature Development
- Reinvenst in Minnesota (RIM) Land

NWI Wetlands

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

DRAFT

NOTES:

1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).
2. Parcel and road data from Blue Earth County.
3. Topographic contour data downloaded from Minnesota DNR MnTopo Application.
4. Bedrock elevation data downloaded from the Minnesota Geological Survey.
5. Wetlands data downloaded from the United States Fish and Wildlife Service.
6. River and Streams data downloaded from the USGS National Hydrographic Dataset.
7. Karst feature and Reinvest in Minnesota data downloaded from the Minnesota Geospatial Commons.
8. County Well Index (CWI) data downloaded from the Minnesota Department of Health.
9. Groundwater contours digitized from USGS Atlas HA-525, Sheet 2.

Foth

N

0 1,250 2,500 Feet

MIDWEST RECYCLING SOLUTIONS

FIGURE 1

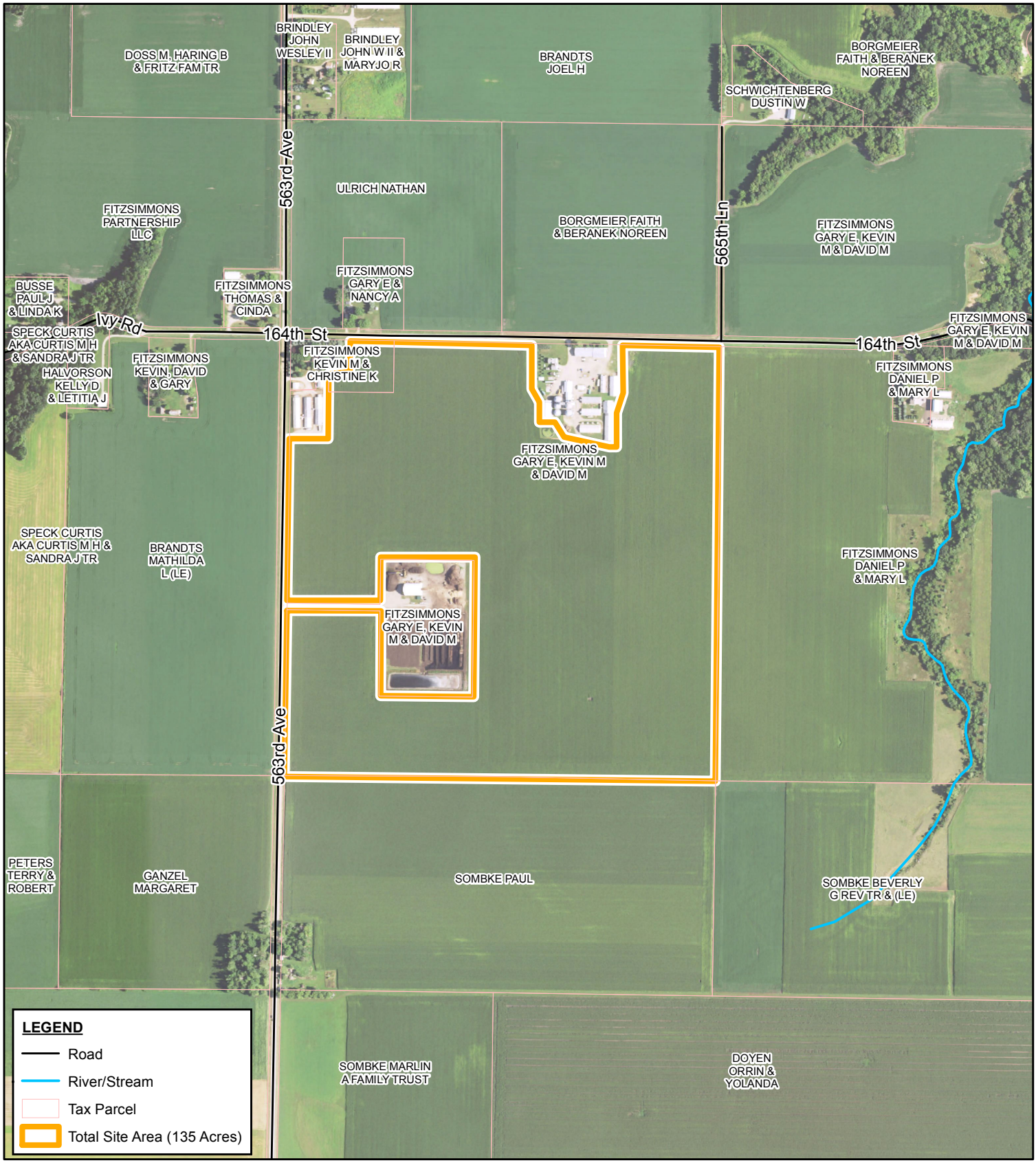
SITE LOCATION MAP
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: FEBRUARY 2018 | Revision Date:

Drawn By: BJW1 | Checked By: BMS2 | Scope: 16M185

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 1 - Site Location Map.mxd Date: 2/15/2018



NOTES:

1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).
2. Parcel and road data from Blue Earth County.

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

Foth

N

0 400 800 Feet

MIDWEST RECYCLING SOLUTIONS

FIGURE 2

PROPERTY OWNERSHIP MAP
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: FEBRUARY 2018	Revision Date:	
Drawn By: BJW1	Checked By: BMS2	Scope: 16M185

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 2 - Ownership Map.mxd Date: 2/15/2018

Appendix A
Permit Drawings for the Proposed Modifications to the MFS Farms Good Thunder Composting Facility

PERMIT MODIFICATION DRAWINGS FOR

MFS FARMS / MIDWEST RECYCLING SOLUTIONS
GOOD THUNDER COMPOSTING FACILITY

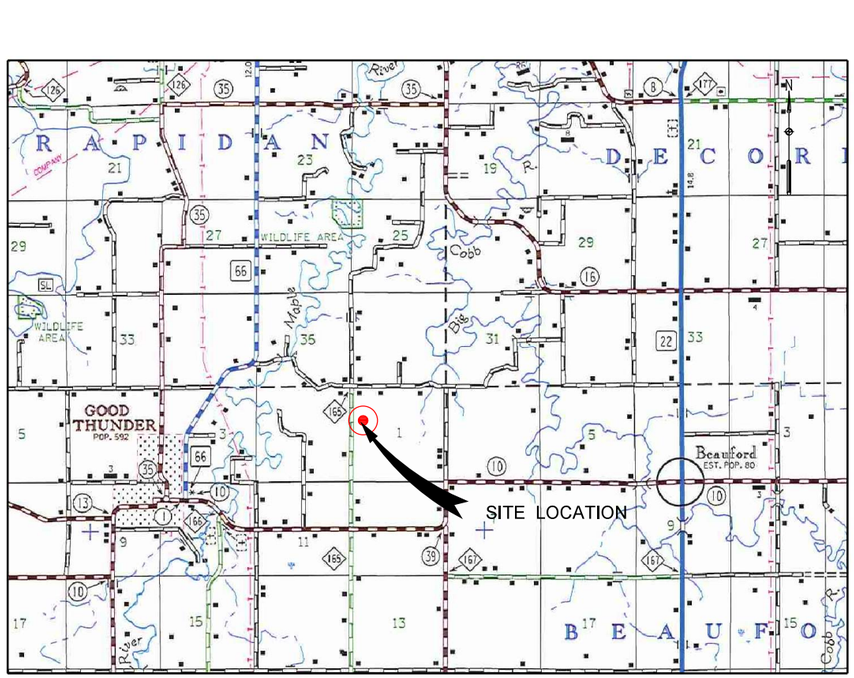
BLUE EARTH COUNTY, MINNESOTA

FEBRUARY 2018

Prepared By

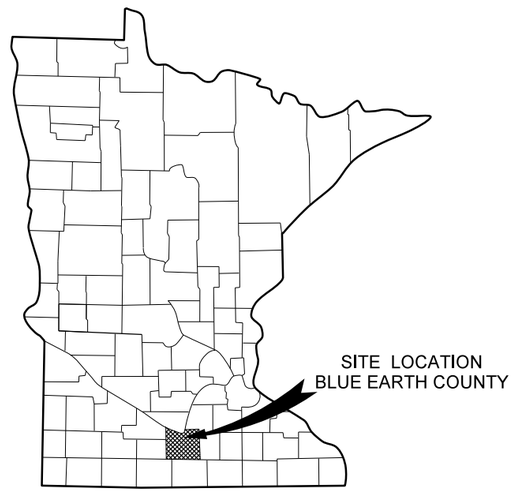
Foth

16M185.00



SITE LOCATION MAP

T. N. , R. E.



COUNTY LOCATION MAP

NOT TO SCALE

INDEX

TITLE SHEET	1

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GRAVEL SURFACE

30' x 60'
DRP BUNKER

PAVEMENT LIMITS

FINAL PRODUCT STORAGE

EXISTING WINDROW AREA

EXISTING
POND

EXISTING 4' WIDE
PAVED GUTTER

POND-1
TOP-988.50
HWL-986.16
NWL-982.0
BOT-980.0

71'

95'

BUILDING
6,745 S.F.
FFE=993.6

3Φ UE

SCALE

PUMP MANHOLE

2" WATER
LINE

EXISTING WINDROW AREA

EXISTING
POND

PAVEMENT LIMITS

GATE

EXISTING FENCE

N

Foth Infrastructure & Environment, LLC
Eden Prairie Office
8550 Hudson Boulevard North, Suite 105
Lake Elmo, MN 55042
Phone: 651-288-8550 Fax: 651-288-8551

PERMIT MODIFICATION
DRAWINGS FOR
MFS FARMS / MIDWEST
RECYCLING SOLUTIONS
GOOD THUNDER
COMPOSTING FACILITY

BLUE EARTH COUNTY MINNESOTA

NO.	BY	DATE	REVISIONS DESCRIPTION
1			RECORD DRAWING OF COMPLETED CONSTRUCTION BY:
2			RECORD DRAWINGS OF COMPLETED CONSTRUCTION CONFORMING TO CONTRACTOR AND/OR OWNERS RECORDS.
3			DATE _____
4			BY _____

DATE OF PREPARATION

	BY	DATE
SURVEYED		
DRAWN	CKV	FEB 2018
DESIGNED		
CHECKED	BDR	FEB 2018

EXISTING
CONDITIONS

HORIZONTAL SCALE:
0 25' 50'

PROJECT ID: 16M185.00

2

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PROPOSED LIQUID SSO HOOP BUILDING

PAVEMENT LIMITS

8' DEEP PIT

30' x 60'
DRP BUNKER

CONCRETE PAD AT EXISTING GRADE
0.5% SLOPE TO SOUTH

8' DEEP PIT

FINAL PRODUCT STC

CARBON STORAGE AREA
(10,000 CY)

EXISTING WINDROW AREA

EXISTING 4' WIDE
PAVED GUTTER

EXISTING
POND

POND-1
TOP-988.50
HWL-986.16
NWL-982.0
BOT-980.0

BUILDING
6,745 S.F.
FFE=993.6

71'

95'

3Φ UE

SCALE

PUMP MANHOLE

COMPOST CURING AREA
(15,000 CY)

2" WATER
LINE

PAVEMENT LIMITS

FINISHED (SCREENED) COMPOST
STORAGE AREA
(15,000 CY)

GATE

EXISTING FENCE

EXISTING
POND

N

Foth Infrastructure & Environment, LLC
Eden Prairie Office
8550 Hudson Boulevard North, Suite 105
Lake Elmo, MN 55042
Phone: 651-288-8550 Fax: 651-288-8551

PERMIT MODIFICATION
DRAWINGS FOR
MFS FARMS / MIDWEST
RECYCLING SOLUTIONS
GOOD THUNDER
COMPOSTING FACILITY

BLUE EARTH COUNTY MINNESOTA

NO.	BY	DATE	DESCRIPTION
1			
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3			
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RECORD DRAWING OF COMPLETED CONSTRUCTION BY:

RECORD DRAWINGS OF COMPLETED CONSTRUCTION CONFORMING TO CONTRACTOR AND/OR OWNERS RECORDS.

BY _____ DATE _____

DATE OF PREPARATION

	BY	DATE
SURVEYED		
DRAWN	CKV	FEB 2018
DESIGNED		
CHECKED	BDR	FEB 2018

SITE PLAN

HORIZONTAL SCALE:
0 25' 50'

PROJECT ID: 16M185.00

3

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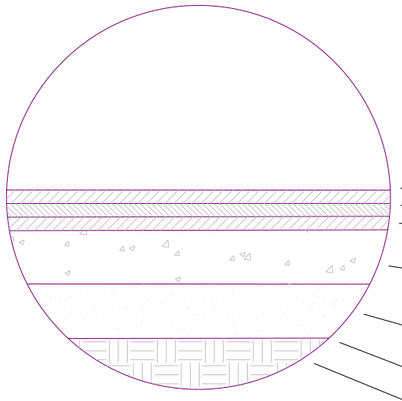


2.0" BIT NON-WEARING COURSE
MN/DOT SPEC 2360, TYPE SPNW 33030B

2.0" BIT NON-WEARING COURSE
MN/DOT SPEC 2360, TYPE SPNW 23030B

2.0" BIT NON-WEARING BASE COURSE
MN/DOT SPEC 2360, TYPE SPNW 23030B

8.0" CLASS 5 AGGREGATE BASE
MN/DOT SPEC 3138

12.0" SELECT GRANULAR BORROW
MN/DOT SPEC 3149.2B2

GEOFABRIC, MN/DOT TYPE V, MIRAFI 500X

APPROVED SUBGRADE

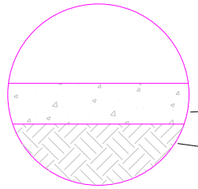
WINDROW PAVEMENT SECTION

NOTES:

1. LIFTS SHALL BE PLACED 90° RELATIVE TO PREVIOUS LIFT.
2. THE PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MNDOT "STANDARD SPECIFICATION FOR CONSTRUCTION", AND ALSO THE REQUIREMENTS OF THE OWNER'S SOIL ENGINEER.
3. ALL THICKNESSES, AS SPECIFIED, ARE TO BE CONSIDERED MINIMUM DEPTHS, AFTER COMPACTION.
4. MN/DOT SPEC 2357 BITUMINOUS TACK COAT SHALL BE PLACED BETWEEN SUCCESSIVE BITUMINOUS LIFTS AND AGAINST ABUTTING CONCRETE CURB EDGES.

STRT-04
11/08
NO SCALE

2/4 PAVEMENT SECTIONS
N.T.S.



12" CRUSHED AGGREGATE BASE COURSE *

APPROVED SUBGRADE

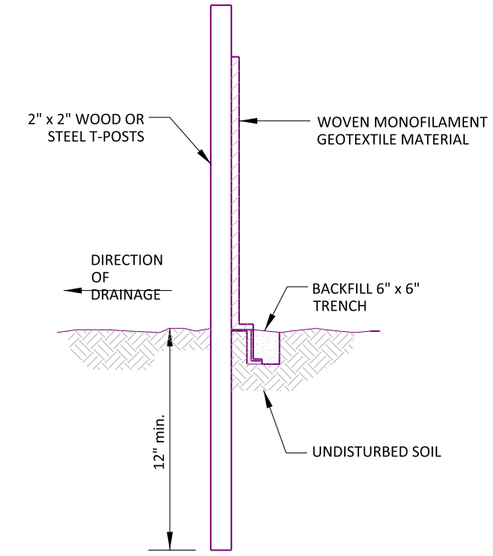
GRAVEL DRIVEWAY

*REFER TO MN/DOT SPECIFICATIONS

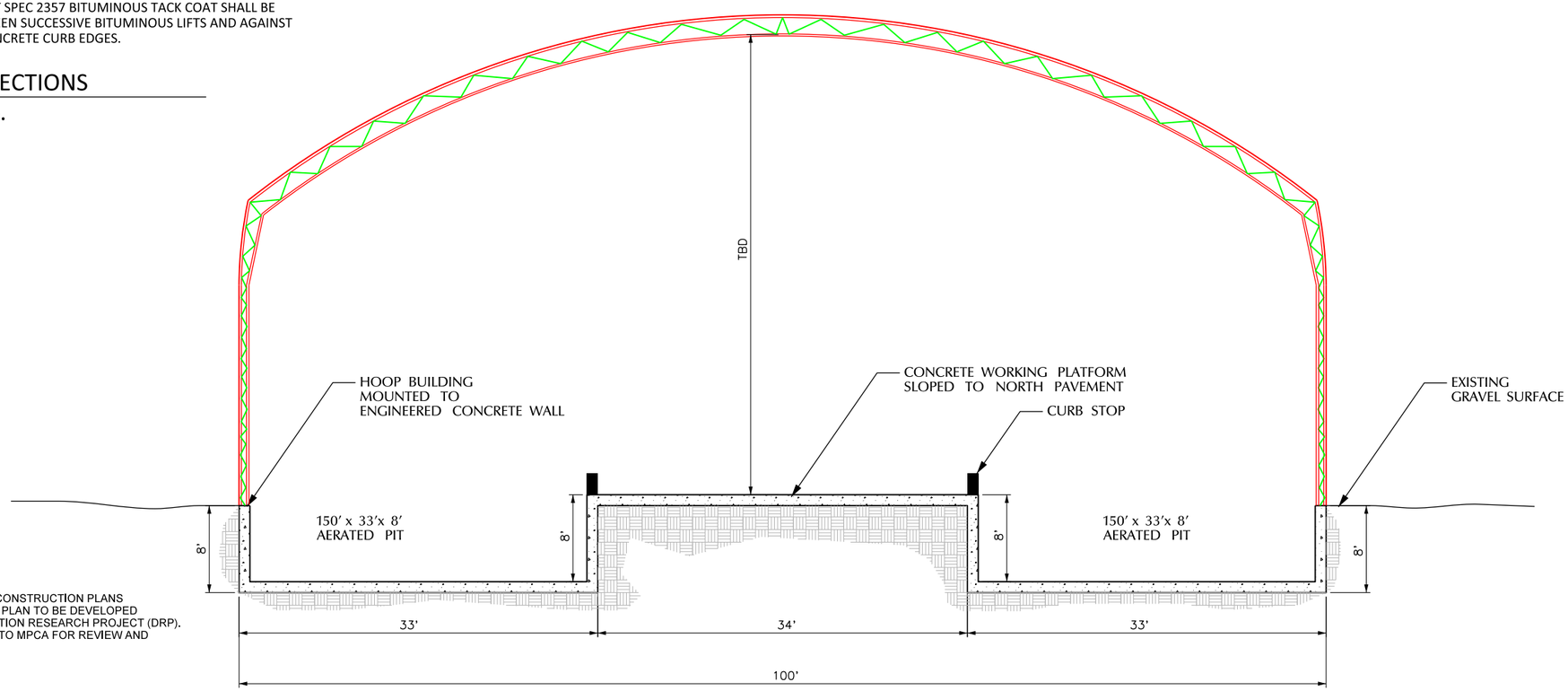
NOTES:

1. THE PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MNDOT "STANDARD SPECIFICATION FOR CONSTRUCTION", AND ALSO THE REQUIREMENTS OF THE OWNER'S SOIL ENGINEER.
2. ALL THICKNESSES, AS SPECIFIED, ARE TO BE CONSIDERED MINIMUM DEPTHS, AFTER COMPACTION.

4/4 GRAVEL DRIVEWAY SECTION
N.T.S.



3/4 TYPICAL SILT FENCE DETAIL
N.T.S.



NOTE:

1. BUILDING ISSUSTRATED IS CONCEPTUAL. CONSTRUCTION PLANS AND SPECIFICATIONS FOR FINAL BUILDING PLAN TO BE DEVELOPED FOLLOWING COMPLETION OF DEMONSTRATION RESEARCH PROJECT (DRP). CONSTRUCTION PLANS TO BE SUBMITTED TO MPCA FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

1/4 CONCEPTUAL LIQUID SSO BUILDING SECTION
N.T.S.

Foth Infrastructure & Environment, LLC
Eden Prairie Office
8550 Hudson Boulevard North, Suite 105
Lake Elmo, MN 55042
Phone: 651-288-8550 Fax: 651-288-8551

PERMIT MODIFICATION
DRAWINGS FOR
MFS FARMS / MIDWEST
RECYCLING SOLUTIONS
GOOD THUNDER
COMPOSTING FACILITY
BLUE EARTH COUNTY MINNESOTA

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			

RECORD DRAWING OF COMPLETED CONSTRUCTION BY:
RECORD DRAWINGS OF COMPLETED CONSTRUCTION CONFORMING TO CONTRACTOR AND / OR OWNERS RECORDS.
DATE _____
BY _____

DATE OF PREPARATION

	BY	DATE
SURVEYED		
DRAWN	CKV	FEB 2018
DESIGNED		
CHECKED	BDR	FEB 2018

DETAILS

NOT TO SCALE

PROJECT ID: 16M185.00

4

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Appendix B
Record Drawings for the Original Full Circle Organics Good Thunder Composting Facility Solid Waste Permit

Record Drawings
for

Full Circle Organics -
Good Thunder Composting Facility

Blue Earth County, Minnesota

Presented by:

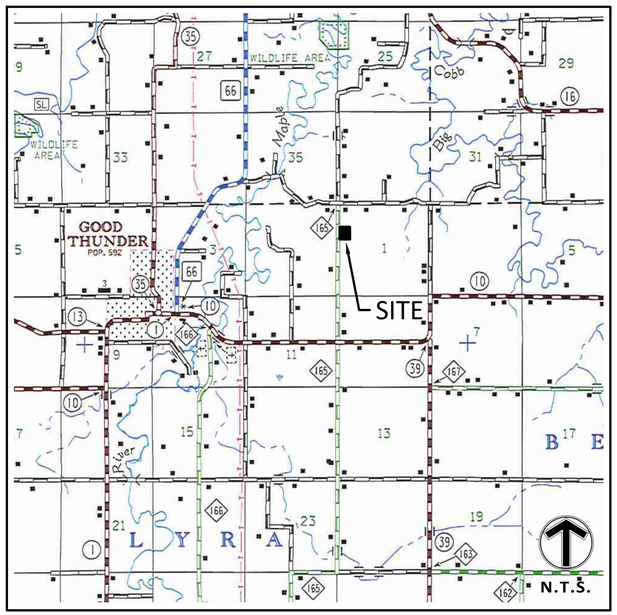
MFS Farms, LLC
&
Full Circle Organics

CONSULTANT CONTACT LIST:

DEVELOPER/OWNER
FULL CIRCLE ORGANICS
5029 13th AVE. S.
MINNEAPOLIS, MN. 55417
TEL 612-282-9382
FAX
CONTACT: Max Milinkovich

CIVIL ENGINEER
MFRA
14800 28TH AVENUE, SUITE 140
PLYMOUTH, MN 55447
TEL 763-476-6010
FAX 763-476-8532
CONTACT: Mike Brandt PE

SURVEYOR
MFRA
14800 28TH AVENUE, SUITE 140
PLYMOUTH, MN 55447
TEL 763-476-6010
FAX 763-476-8532
CONTACT: Marcus Hampton RLS



VICINITY MAP
NO SCALE

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013

GENERAL CONTRACTOR: KELLAS ENVIRONMENTAL SERVICES
JOHN KELLAS
4899 PAGE AVE NE
ST MICHAEL, MN 55376
PHONE: 612-751-8221

EARTHWORK CONTRACTOR: SAUTER & SONS, INC
TOM SAUTER
6651 141ST AVE NW
RAMSEY, MN, 55303
PHONE: 763-421-7919

UTILITY CONTRACTOR: DAVE PERKINS CONTRACTING, INC
DAVE PERKINS
7060 143RD AVE NW
RAMSEY, MN, 55303
PHONE: 763-427-0109

DRAINTILE CONTRACTOR: KRENGEL BROS. TILING INC.
TIM KRENGEL
PO BOX 385
MAPLETON, MN 56065
PHONE: 507-524-3635

ASPHALT CONTRACTOR: WW BLACKTOPPING INC
700 INDUSTRIAL ROAD
MANKATO, MN 56001
PHONE: 507-384-1518

1. DISTANCES, ELEVATIONS AND TIES ARE BASED ON FIELD MEASUREMENTS TAKEN AFTER CONSTRUCTION. WYE LOCATIONS SUPPLIED BY CONTRACTORS.
2. ALL TIES AND DISTANCES ARE TO THE CENTER OF SURFACE STRUCTURES.

SHEET INDEX

mfra
engineering surveying planning energy
14800 28th Ave. N, Ste 140
Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
www.mfra.com

Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary

Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

Revision History

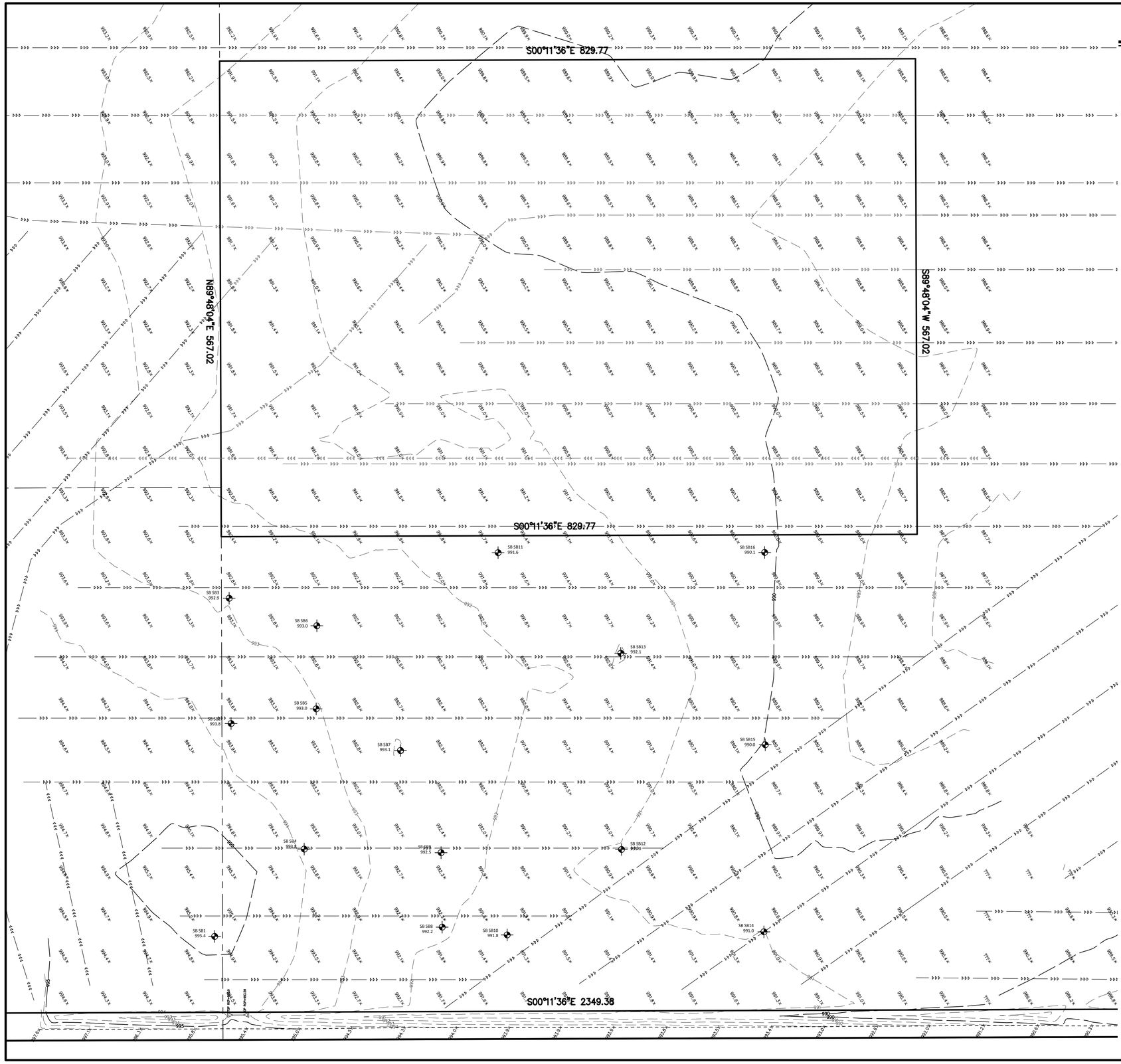
No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION
D	08/21/12	BSO	POND 2 VALVE ADDITION
E	08/28/12	ERW	MPCA COMMENTS
F	09/19/12	SEG	CLIENT COMMENTS
G	10/09/12	BSO	BIOFILTER ADDITION
H	01/11/13	BSO	RECORD PLANS
I	02/08/13	JRE	RECORD PLANS
J	02/12/12	ERW	RECORD PLAN COORDINATION

Sheet Title
COVER SHEET

Sheet No. Revision
C1.01 J

Project No. MFS19051

Feb 14, 2013 - 10:30am - User:528 L:\PROJECTS\MFS19051\dwg\Record\19051-01-RP-TITLE.dwg



LEGEND

- FOUND MONUMENT
- SET MONUMENT
- ELECTRIC METER
- LIGHT
- AIR CONDITIONER
- GUY ANCHOR
- HANDICAP STALL
- UTILITY POLE
- GUARD POST
- BOLLARD
- SIGN
- WATERMAIN
- SANITARY SEWER
- STORM SEWER
- FLARED END SECTION
- ELECTRIC TRANSFORMER
- TELEPHONE PEDESTAL
- GAS METER
- OVERHEAD WIRE
- CHAIN LINK FENCE
- IRON FENCE
- WIRE FENCE
- WOOD FENCE
- EASEMENT LINE
- SETBACK LINE
- RIGHT OF ACCESS
- CONCRETE CURB
- BUILDING LINE
- BUILDING CANOPY
- BITUMINOUS SURFACE
- CONCRETE SURFACE
- LANDSCAPE SURFACE
- DECIDUOUS TREE
- CONIFEROUS TREE

GENERAL NOTES

1. SITE IS LOCATED AT LATITUDE N45.3213
   LONGITUDE W95.8052

DESCRIPTION

THE NORTHWEST QUARTER OF SECTION 1, TOWNSHIP 106N, RANGE 27W, EXCEPT THE NORTH 5 ACRES OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER THEREOF.

PROPERTY SUMMARY

TOTAL SITE AREA:	6,818,506 S.F.	OR	156.531 AC. (GROSS)
COMPOST SITE AREA	435,600 S.F.	OR	10.0 AC.
REMAINING SITE AREA	6,240,097 S.F.	OR	143.253 AC.
EXISTING LESS 563RD AVE. RIGHT-OF-WAY:	77,534 S.F.	OR	1.780 AC.
EXISTING LESS 164TH ST. RIGHT-OF-WAY:	65,275 S.F	OR	1.498 AC.
	6,675,697 S.F.	OR	153.253 AC. (NET)

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013

1. DISTANCES, ELEVATIONS AND TIES ARE BASED ON FIELD MEASUREMENTS TAKEN AFTER CONSTRUCTION. WYE LOCATIONS SUPPLIED BY CONTRACTORS.
2. ALL TIES AND DISTANCES ARE TO THE CENTER OF SURFACE STRUCTURES.

NORTH

0 60 120
SCALE IN FEET

mfra
engineering surveying planning energy
14800 28th Ave. N, Ste 140
Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
www.mfra.com

Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

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H	01/11/13	BSO	RECORD PLANS
I	02/08/13	JRE	RECORD PLANS
J	02/12/12	ERW	RECORD PLAN COORDINATION

Sheet Title
EXISTING CONDITIONS

Sheet No. Revision
C2.01 J

Project No. MFS19051

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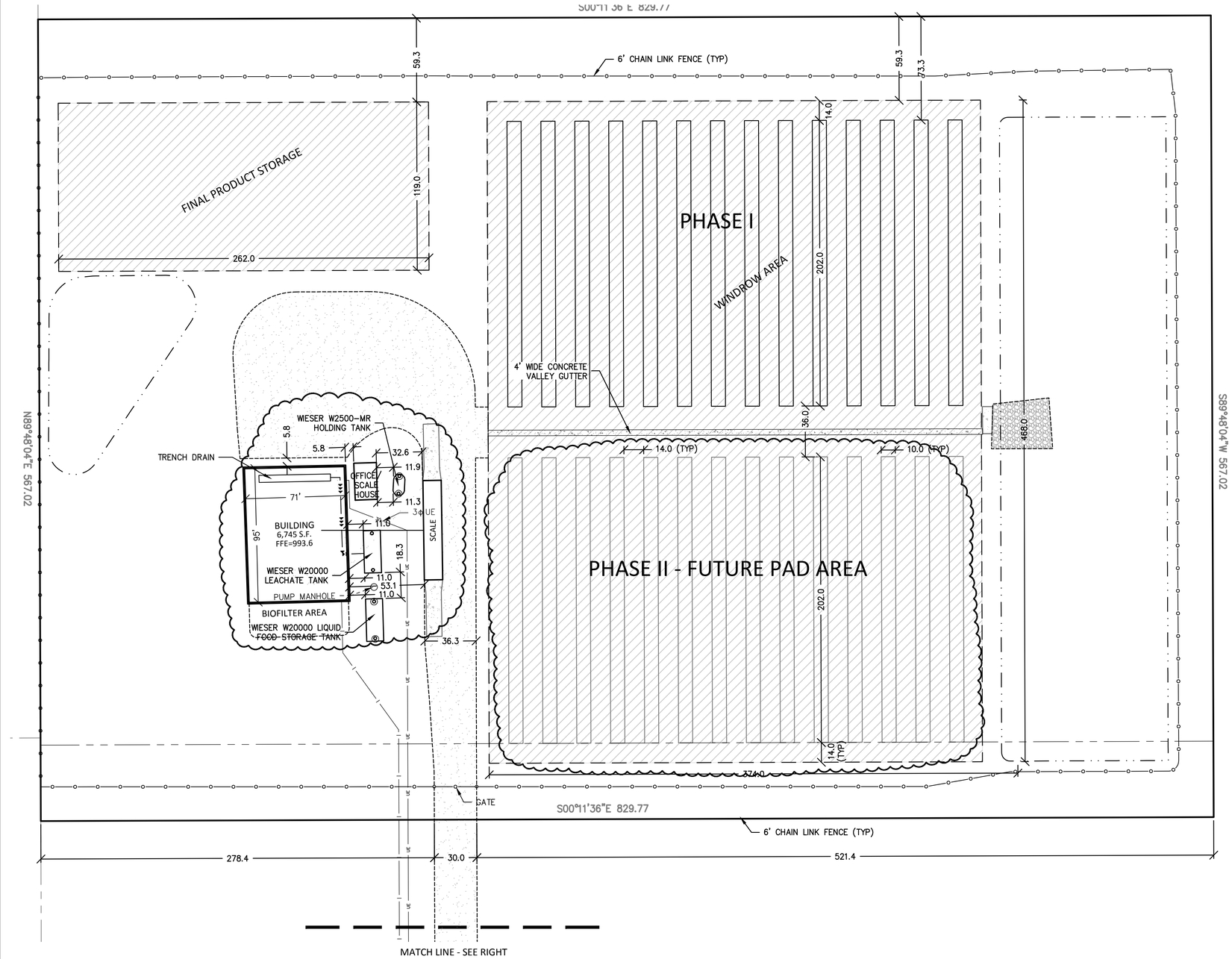


LEGEND

- PROPERTY LIMIT
- CURB & GUTTER
- EDGE OF GRAVEL
- BUILDING
- GRAVEL (SEE C7.01 FOR SECTION)
- WINDROW AREAS (SEE C7.01 FOR SECTION)
- CONCRETE PAVING (SEE C7.01 FOR SECTION)

DEVELOPMENT NOTES

A. ALL DIMENSIONS ARE ROUNDED TO THE NEAREST TENTH FOOT.

B. ALL AREAS ARE ROUNDED TO THE NEAREST SQUARE FOOT.

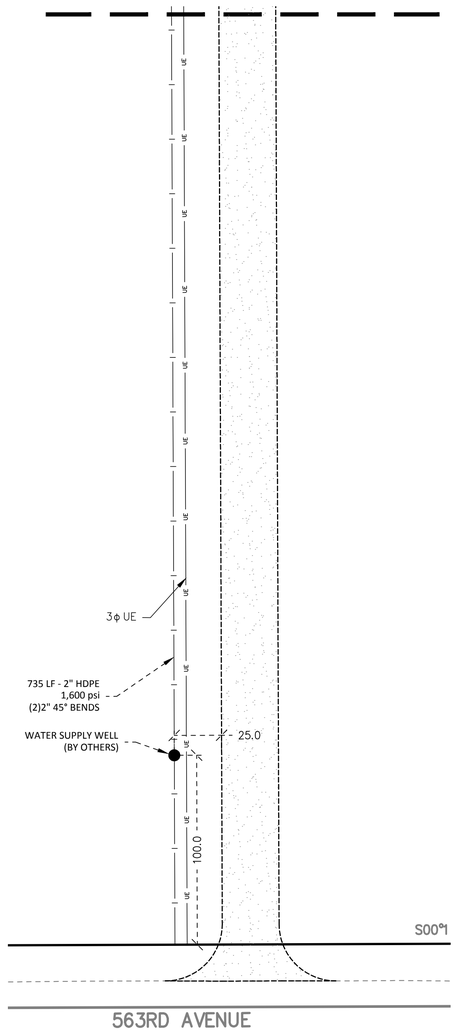
C. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS AND DIMENSIONS OF EXIT PORCHES, RAMPS, PRECISE BUILDING DIMENSIONS AND EXACT BUILDING UTILITY ENTRANCE LOCATIONS.

D. REFER TO FINAL PLAT FOR LOT BOUNDARIES, LOT NUMBERS, LOT AREAS, AND LOT DIMENSIONS.

E. DRAINAGE AND UTILITY EASEMENTS SHALL BE PROVIDED AS REQUIRED. DRAINAGE AND UTILITY EASEMENTS WILL BE PROVIDED OVER ALL PUBLIC UTILITIES AND UP TO THE HIGH WATER LEVEL OF ALL PONDS.

F. BIOFILTER MECHANICAL DESIGN BY OTHERS.

MATCH LINE - SEE LEFT



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Sheet Title
SITE PLAN

Sheet No. Revision
C3.01 J

Project No. MFS19051

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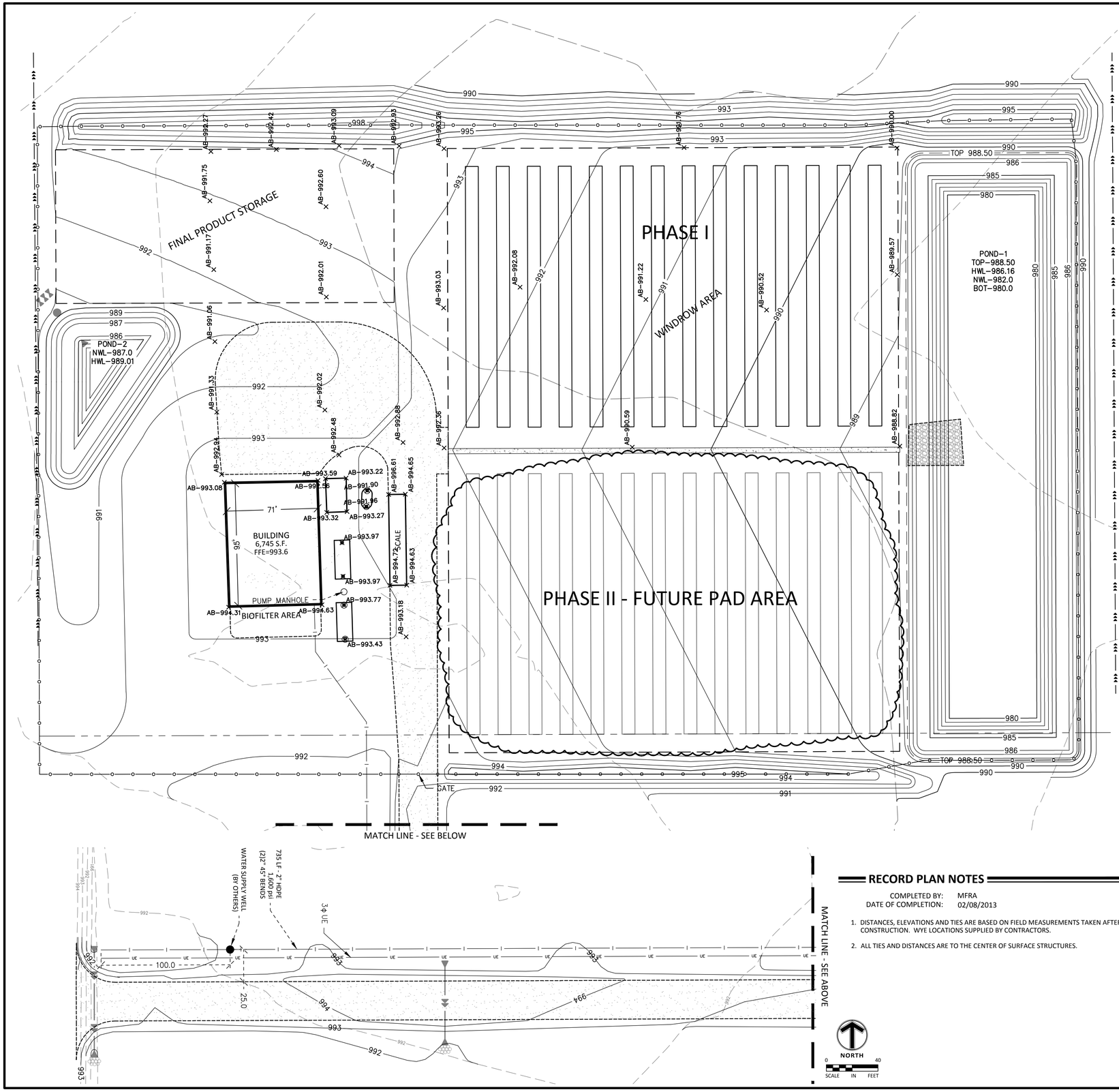

LEGEND

	PROPOSED	EXISTING
PROPERTY LIMIT		
CURB & GUTTER		
STORM SEWER		
DRAINTILE		
BUILDING		
RETAINING WALL		
WETLAND LIMITS		
TREELINE		
SPOT ELEVATION	962.5 X	962.5 X
CONTOUR	902	902
RIP RAP		
OVERFLOW ELEV.	EOF XXX.X	
SOIL BORINGS		ST 5 1042.56

GRADING NOTES

A. PROPOSED CONTOURS ARE TO FINISHED SURFACE ELEVATION. SPOT ELEVATIONS ALONG PROPOSED CURB DENOTE GUTTER GRADE.

B. THE CONTRACTOR IS CAUTIONED THAT "THE SUBSURFACE UTILITY INFORMATION SHOWN ON THESE PLANS IS A UTILITY QUALITY LEVEL D. THIS QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02 TITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". THE CONTRACTOR AND/OR SUBCONTRACTORS SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, BY CONTACTING THE NOTIFICATION CENTER (GOPHER STATE ONE FOR MINNESOTA AT 1-800-252-1166). THE CONTRACTOR AND/OR SUBCONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY HIS OR HER FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES (UNDERGROUND AND OVERHEAD).

IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

C. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES TO THE ADJACENT PROPERTIES OCCURRING DURING THE CONSTRUCTION PHASES OF THIS PROJECT.

D. SAFETY NOTICE TO CONTRACTORS: IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS ON THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER OR THE DEVELOPER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON OR NEAR THE CONSTRUCTION SITE.

E. THE CONTRACTOR SHALL COMPLETE THE SITE GRADING CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF THE OWNER'S SOILS ENGINEER. ALL SOIL TESTING SHALL BE COMPLETED BY THE OWNER'S SOILS ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIRED SOIL TESTS AND INSPECTIONS WITH THE SOILS ENGINEER.

A GEOTECHNICAL ENGINEERING SOILS REPORT HAS BEEN COMPLETED BY:

COMPANY: AMERICAN ENGINEERING TESTING
ADDRESS: 550 CLEVELAND AVE NORTH, SAINT PAUL MN 55114
PHONE: 651-659-9001
DATED:

THE CONTRACTOR SHALL OBTAIN A COPY OF THE SOILS REPORT.

F. THE CONTRACTOR SHALL COMPLETE DEWATERING AS REQUIRED TO COMPLETE THE SITE GRADING CONSTRUCTION.

G. PRIOR TO PLACEMENT OF THE AGGREGATE BASE, A TEST ROLL WILL BE REQUIRED ON THE STREET AND PARKING AREA SUBGRADE. THE CONTRACTOR SHALL PROVIDE A LOADED TANDEM AXLE TRUCK WITH A GROSS WEIGHT OF 25 TONS. THE TEST ROLLING SHALL BE AT THE DIRECTION OF THE SOILS ENGINEER AND SHALL BE COMPLETED IN AREAS AS DIRECTED BY THE SOILS ENGINEER. THE SOILS ENGINEER SHALL DETERMINE WHICH SECTIONS OF THE STREET OR PARKING AREA ARE UNSTABLE. CORRECTION OF THE SUBGRADE SOILS SHALL BE COMPLETED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOILS ENGINEER.

H. REPLACE ALL SUBGRADE SOIL DISTURBED DURING THE CONSTRUCTION THAT HAVE BECOME UNSUITABLE AND WILL NOT PASS A TEST ROLL. REMOVE UNSUITABLE SOIL FROM THE SITE AND IMPORT SUITABLE SOIL AT NO ADDITIONAL COST TO THE OWNER.

I. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING VEHICULAR TRAFFIC CONTROL DEVICES SUCH AS BARRICADES, WARNING SIGNS, DIRECTIONAL SIGNS, FLAGMEN AND LIGHTS TO CONTROL THE MOVEMENT OF TRAFFIC WHERE NECESSARY. TRAFFIC CONTROL DEVICES SHALL CONFORM TO APPROPRIATE MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARDS.

J. THE TREES AND OTHER NATURAL VEGETATION WITHIN THE PROJECT AND/OR ADJACENT TO THE PROJECT ARE OF PRIME CONCERN TO THE CONTRACTOR'S OPERATIONS. HE WILL BE REQUIRED TO PROTECT THE TREES WHICH ARE TO BE SAVED TO BE SURE THAT EQUIPMENT IS NOT NEEDLESSLY OPERATED UNDER NEARBY TREES AND SHALL EXERCISE EXTREME CAUTION IN WORKING ADJACENT TO TREES. SHOULD ANY PORTION OF THE TREE BRANCHES REQUIRE REMOVAL TO PERMIT OPERATION OF THE CONTRACTOR'S EQUIPMENT, HE SHALL OBTAIN THE SERVICES OF A PROFESSIONAL TREE TRIMMING SERVICE TO TRIM THE TREES PRIOR TO THE BEGINNING OF OPERATION. SHOULD THE CONTRACTOR'S OPERATIONS RESULT IN THE BREAKING OF ANY LIMBS, THE BROKEN LIMBS SHOULD BE REMOVED IMMEDIATELY AND CUTS SHALL BE PROPERLY PROTECTED TO MINIMIZE ANY LASTING DAMAGE TO THE TREE. NO TREES SHALL BE REMOVED WITHOUT AUTHORIZATION BY THE ENGINEER. COSTS FOR TRIMMING SERVICES SHALL BE CONSIDERED INCIDENTAL TO THE GRADING CONSTRUCTION AND NO SPECIAL PAYMENT WILL BE MADE.

M. EXCAVATE TOPSOIL FROM AREAS TO BE FURTHER EXCAVATED OR REGRADED AND STOCKPILE IN AREAS DESIGNATED ON THE SITE. THE CONTRACTOR SHALL SALVAGE ENOUGH TOPSOIL FOR RESPREADING ON THE SITE AS SPECIFIED. EXCESS TOPSOIL SHALL BE PLACED IN EMBANKMENT AREAS, OUTSIDE OF BUILDING PADS, ROADWAYS AND PARKING AREAS. THE CONTRACTOR SHALL SUBCUT CUT AREAS, WHERE TURF IS TO BE ESTABLISHED, TO A DEPTH OF 4 INCHES. RESPREAD TOPSOIL IN AREAS WHERE TURF IS TO BE ESTABLISHED TO A MINIMUM DEPTH OF 4 INCHES.

N. FINISHED GRADING SHALL BE COMPLETED, THE CONTRACTOR SHALL UNIFORMLY GRADE AREAS WITHIN LIMITS OF GRADING, INCLUDING ADJACENT TRANSITION AREAS. PROVIDE A SMOOTH FINISHED SURFACE WITHIN SPECIFIED TOLERANCES, WITH UNIFORM LEVELS OR SLOPES BETWEEN POINTS WHERE ELEVATIONS ARE SHOWN, OR BETWEEN SUCH POINTS AND EXISTING GRADES. AREAS THAT HAVE BEEN FINISHED GRADED SHALL BE PROTECTED FROM SUBSEQUENT CONSTRUCTION OPERATIONS, TRAFFIC AND EROSION. REPAIR ALL AREAS THAT HAVE BECOME RUTTED BY TRAFFIC OR ERODED BY WATER OR HAS SETTLED BELOW THE CORRECT GRADE. ALL AREAS DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO EQUAL OR BETTER THAN ORIGINAL CONDITION OR TO THE REQUIREMENTS OF THE NEW WORK.

O. TOLERANCES

1. THE COMMERCIAL BUILDING SUBGRADE FINISHED SURFACE ELEVATION SHALL NOT VARY BY MORE THAN 0.10 FOOT ABOVE, OR 0.10 FOOT BELOW, THE PRESCRIBED ELEVATION AT ANY POINT WHERE MEASUREMENT IS MADE.
2. THE STREET OR PARKING AREA SUBGRADE FINISHED SURFACE ELEVATION SHALL NOT VARY BY MORE THAN 0.05 FOOT ABOVE, OR 0.10 FOOT BELOW, THE PRESCRIBED ELEVATION OF ANY POINT WHERE MEASUREMENT IS MADE.
3. AREAS WHICH ARE TO RECEIVE TOPSOIL SHALL BE GRADED TO WITHIN 0.30 FOOT ABOVE OR BELOW THE REQUIRED ELEVATION, UNLESS DIRECTED OTHERWISE BY THE ENGINEER.
4. TOPSOIL SHALL BE GRADED TO PLUS OR MINUS 1/2 INCH OF THE SPECIFIED THICKNESS.

P. AFTER THE SITE GRADING IS COMPLETED, IF EXCESS OR SHORTAGE OF SOIL MATERIAL EXISTS, THE CONTRACTOR SHALL TRANSPORT ALL EXCESS SOIL MATERIAL OFF THE SITE TO AN AREA SELECTED BY THE CONTRACTOR, OR IMPORT SUITABLE MATERIAL TO THE SITE.

Q. THE CONTRACTOR SHALL DETERMINE THE LOCATION OF ANY HAUL ROADS THAT MAY BE REQUIRED TO COMPLETE THE SITE GRADING CONSTRUCTION AND SHALL INDICATE HAUL ROADS ON EROSION AND SEDIMENT CONTROL "SITE MAP". THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE GOVERNING AUTHORITY OF EACH ROADWAY. THE CONTRACTOR SHALL POST WHATEVER SECURITY, AND COMPLY WITH ALL CONDITIONS WHICH ARE REQUIRED BY EACH GOVERNING AUTHORITY OF EACH ROADWAY.

RECORD PLAN NOTES

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Sheet Title
GRADING PLAN

Sheet No. Revision
C4.01 J

Project No. MFS19051

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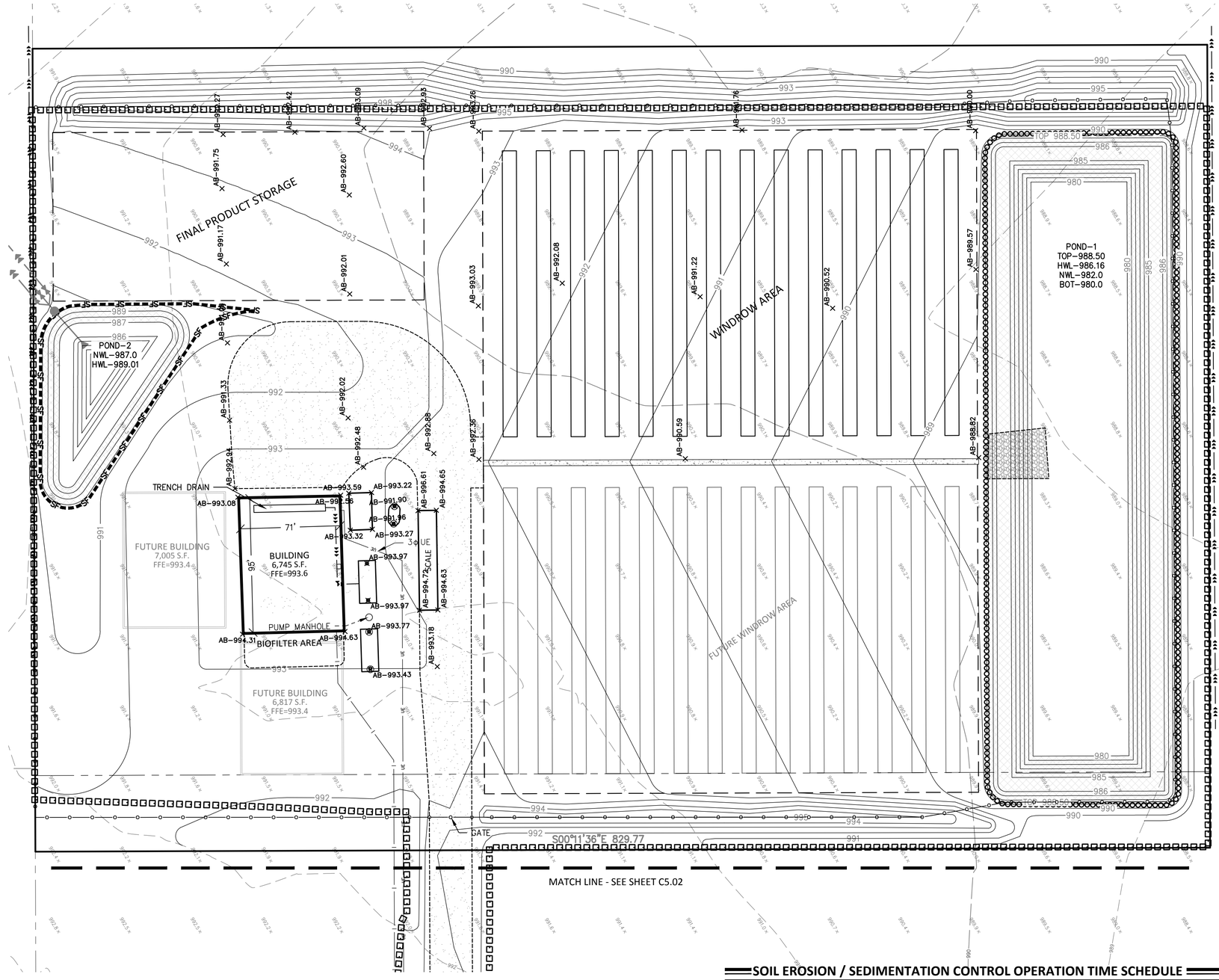

LEGEND

	PROPOSED	EXISTING
CURB & GUTTER		
STORM SEWER		
DRAINTILE		
CONTOUR	902	902
RIP RAP		
OVERFLOW ELEV.	EOF XXX.X	
SILT FENCE - PHASE 1		
SILT FENCE - PHASE 2	–SF–SF–	
BIOROLLS		
SOIL BORINGS	ST-9 PA-10	
DIRECTION OF OVERLAND FLOW		
TEMPORARY DIVERSION DITCH		
EROSION CONTROL BLANKET		
LIMITS OF DRAINAGE SUB-BASIN		
BIO-ROLL		
INLET PROTECTION DEVICE 1	IP1	
INLET PROTECTION DEVICE 2	IP2	
TEMPORARY STONE CONSTRUCTION ENTRANCE		
TEMPORARY SEDIMENT BASIN	SB	
TEMPORARY STORAGE AND PARKING AREA	TS	
TEMPORARY STABILIZATION MEASURES (SEED, MULCH, MATS OR BLANKETS AS OUTLINED IN THE SWPPP)	TSM	

SEQUENCE OF CONSTRUCTION

PHASE I:

1. INSTALL STABILIZED CONSTRUCTION ENTRANCES.
2. PREPARE TEMPORARY PARKING AND STORAGE AREA.
3. CONSTRUCT THE SILT FENCES ON THE SITE.
4. CONSTRUCT THE SEDIMENTATION AND SEDIMENT TRAP BASINS.
5. HALT ALL ACTIVITIES AND CONTACT THE CIVIL ENGINEERING CONSULTANT TO PERFORM INSPECTION OF BMPs. GENERAL CONTRACTOR SHALL SCHEDULE AND CONDUCT STORM WATER PRE-CONSTRUCTION MEETING WITH ENGINEER AND ALL GROUND DISTURBING CONTRACTORS BEFORE PROCEEDING WITH CONSTRUCTION.
6. CONSTRUCT SEDIMENTATION BASINS.
7. CLEAR AND GRUB THE SITE.
8. BEGIN GRADING THE SITE.
9. START CONSTRUCTION OF BUILDING PAD AND STRUCTURES.

PHASE II:

1. TEMPORARILY SEED DENUDED AREAS.
2. INSTALL UTILITIES, UNDERDRAINS, STORM SEWERS.
3. INSTALL RIP RAP AROUND OUTLET STRUCTURES.
4. INSTALL INLET PROTECTION AROUND ALL STORM SEWER STRUCTURES.
5. PREPARE SITE FOR PAVING.
6. PAVE SITE.
7. INSTALL INLET PROTECTION DEVICES.
8. COMPLETE GRADING AND INSTALL PERMANENT SEEDING AND PLANTING.
9. REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES (ONLY IF SITE IS STABILIZED), IF REQUIRED BY THE CONTRACT

NOTE TO CONTRACTOR

THE EROSION CONTROL PLAN SHEETS ALONG WITH THE REST OF THE SWPPP MUST BE KEPT ONSITE UNTIL THE NOTICE OF TERMINATION IS FILED WITH THE MPCA, THE CONTRACTOR MUST UPDATE THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS AS NECESSARY TO INCLUDE ADDITIONAL REQUIREMENTS, SUCH AS ADDITIONAL OR MODIFIED BMPS DESIGNED TO CORRECT PROBLEMS IDENTIFIED. AFTER FILING THE NOTICE OF TERMINATION, THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS, AND ALL REVISIONS TO IT MUST BE SUBMITTED TO THE OWNER, TO BE KEPT ON FILE IN ACCORDANCE WITH THE RECORD RETENTION REQUIREMENTS DESCRIBED IN THE SWPPP NARRATIVE.

AREA SUMMARY IN ACRES

PAVEMENT AREA	5.40 AC±
BUILDING AREA	0.90 AC±
SEEDED AREA	1.60 AC±
TOTAL DISTURBED	10.0 AC±
PRE - CONSTRUCTION IMPERVIOUS	0.00 AC±
POST - CONSTRUCTION IMPERVIOUS	6.30 AC±

* REFER TO SHEET C5.02 FOR GENERAL NOTES, MAINTENANCE NOTES, LOCATION MAPS, AND STANDARD DETAILS

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EROSION CONTROL MATERIALS QUANTITIES

ITEM	UNIT	QUANTITY
SILT FENCE - PHASE 1	LINEAR FEET	2740
SILT FENCE - PHASE 2	LINEAR FEET	1700
EROSION BLANKET	SQUARE FEET	65,000
CONSTRUCTION ENTRANCE	UNIT	1
INLET PROTECTION DEVICE (IP-1)	UNIT	1

SOIL EROSION / SEDIMENTATION CONTROL OPERATION TIME SCHEDULE

CONSTRUCTION SEQUENCE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
TEMPORARY CONTROL MEASURES																		
STRIP & STOCKPILE TOPSOIL																		
ROUGH GRADE / SEDIMENT CONTROL																		
TEMPORARY CONSTRUCTION ROADS																		
FOUNDATION / BUILDING CONSTRUCTION																		
SITE CONSTRUCTION																		
PERMANENT CONTROL STRUCTURES																		
FINISH GRADING																		
LANDSCAPING / SEED / FINAL STABILIZATION																		
STORM FACILITIES																		

NOTE: CONTRACTOR OR GENERAL CONTRACTOR TO COMPLETE TABLE WITH THEIR SPECIFIC PROJECT SCHEDULE

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Sheet Title
EROSION CONTROL PLAN

Sheet No. Revision
C5.01 J

Project No. MFS19051

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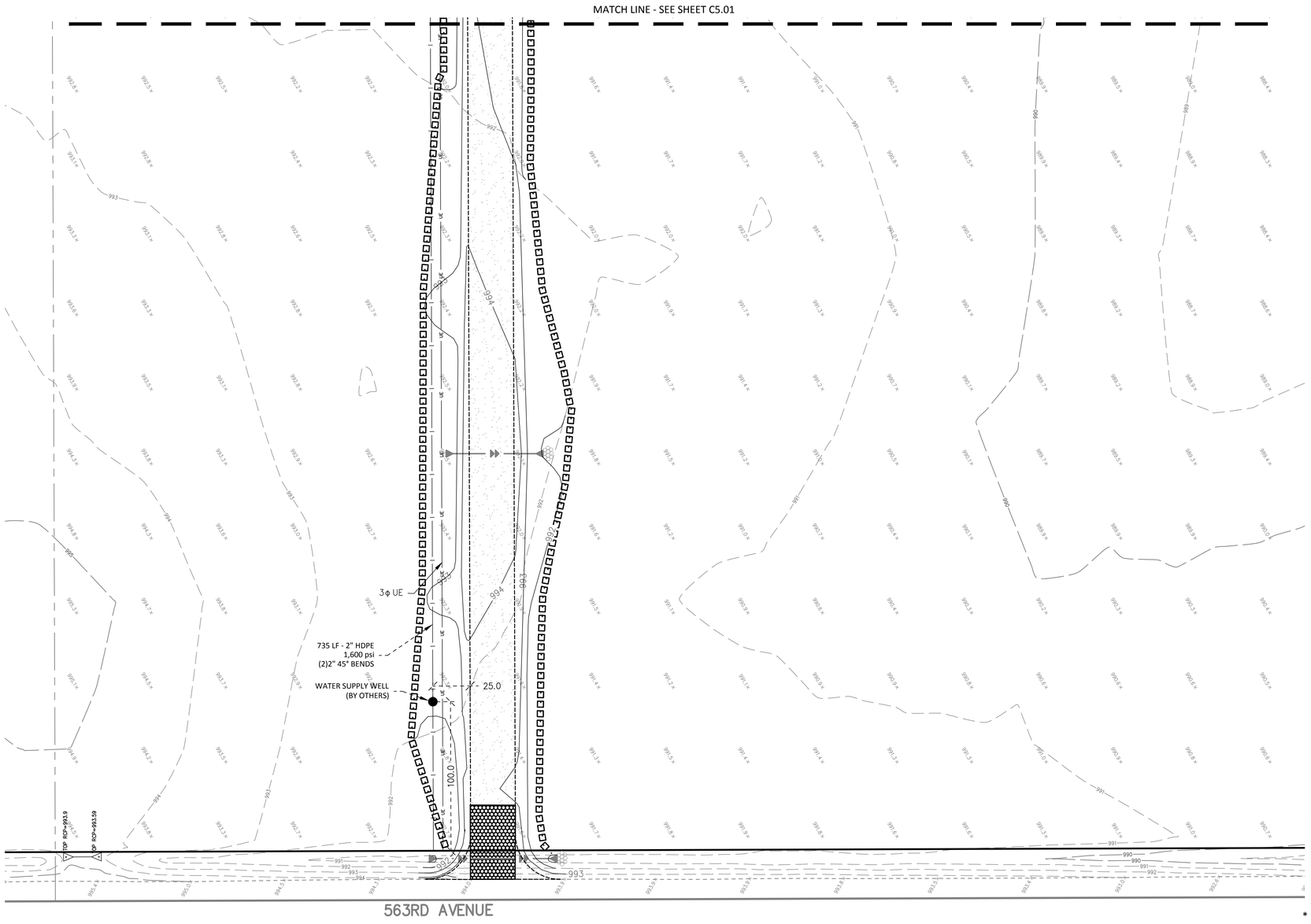

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DRAINTILE		
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RIP RAP		
OVERFLOW ELEV.	EOF XXX.X	
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SILT FENCE - PHASE 2	SF	SF
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LIMITS OF DRAINAGE SUB-BASIN		
BIO-ROLL		
INLET PROTECTION DEVICE 1	IP1	
INLET PROTECTION DEVICE 2	IP2	
TEMPORARY STONE CONSTRUCTION ENTRANCE		
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TEMPORARY STORAGE AND PARKING AREA	TS	
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3. CONSTRUCT THE SILT FENCES ON THE SITE.
4. CONSTRUCT THE SEDIMENTATION AND SEDIMENT TRAP BASINS.
5. HALT ALL ACTIVITIES AND CONTACT THE CIVIL ENGINEERING CONSULTANT TO PERFORM INSPECTION OF BMPs. GENERAL CONTRACTOR SHALL SCHEDULE AND CONDUCT STORM WATER PRE-CONSTRUCTION MEETING WITH ENGINEER AND ALL GROUND DISTURBING CONTRACTORS BEFORE PROCEEDING WITH CONSTRUCTION.
6. CONSTRUCT SEDIMENTATION BASINS.
7. CLEAR AND GRUB THE SITE.
8. BEGIN GRADING THE SITE.
9. START CONSTRUCTION OF BUILDING PAD AND STRUCTURES.

PHASE II:

1. TEMPORARILY SEED DENUDED AREAS.
2. INSTALL UTILITIES, UNDERDRAINS, STORM SEWERS.
3. INSTALL RIP RAP AROUND OUTLET STRUCTURES.
4. INSTALL INLET PROTECTION AROUND ALL STORM SEWER STRUCTURES.
5. PREPARE SITE FOR PAVING.
6. PAVE SITE.
7. INSTALL INLET PROTECTION DEVICES.
8. COMPLETE GRADING AND INSTALL PERMANENT SEEDING AND PLANTING.
9. REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES (ONLY IF SITE IS STABILIZED), IF REQUIRED BY THE CONTRACT

NOTE TO CONTRACTOR

THE EROSION CONTROL PLAN SHEETS ALONG WITH THE REST OF THE SWPPP MUST BE KEPT ONSITE UNTIL THE NOTICE OF TERMINATION IS FILED WITH THE MPCA, THE CONTRACTOR MUST UPDATE THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS AS NECESSARY TO INCLUDE ADDITIONAL REQUIREMENTS, SUCH AS ADDITIONAL OR MODIFIED BMPS DESIGNED TO CORRECT PROBLEMS IDENTIFIED. AFTER FILING THE NOTICE OF TERMINATION, THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS, AND ALL REVISIONS TO IT MUST BE SUBMITTED TO THE OWNER, TO BE KEPT ON FILE IN ACCORDANCE WITH THE RECORD RETENTION REQUIREMENTS DESCRIBED IN THE SWPPP NARRATIVE.

AREA SUMMARY IN ACRES

PAVEMENT AREA	5.40 AC±
BUILDING AREA	0.90 AC±
SEEDED AREA	1.60 AC±
TOTAL DISTURBED	10.0 AC±
PRE - CONSTRUCTION IMPERVIOUS	0.00 AC±
POST - CONSTRUCTION IMPERVIOUS	6.30 AC±

* REFER TO SHEET C5.02 FOR GENERAL NOTES, MAINTENANCE NOTES, LOCATION MAPS, AND STANDARD DETAILS

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013

1. DISTANCES, ELEVATIONS AND TIES ARE BASED ON FIELD MEASUREMENTS TAKEN AFTER CONSTRUCTION. WYE LOCATIONS SUPPLIED BY CONTRACTORS.
2. ALL TIES AND DISTANCES ARE TO THE CENTER OF SURFACE STRUCTURES.

EROSION CONTROL MATERIALS QUANTITIES

ITEM	UNIT	QUANTITY
SILT FENCE - PHASE 1	LINEAR FEET	2740
SILT FENCE - PHASE 2	LINEAR FEET	1700
EROSION BLANKET	SQUARE FEET	65,000
CONSTRUCTION ENTRANCE	UNIT	1
INLET PROTECTION DEVICE (IP-1)	UNIT	1

SOIL EROSION / SEDIMENTATION CONTROL OPERATION TIME SCHEDULE

CONSTRUCTION SEQUENCE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
TEMPORARY CONTROL MEASURES																		
STRIP & STOCKPILE TOPSOIL																		
ROUGH GRADE / SEDIMENT CONTROL																		
TEMPORARY CONSTRUCTION ROADS																		
FOUNDATION / BUILDING CONSTRUCTION																		
SITE CONSTRUCTION																		
PERMANENT CONTROL STRUCTURES																		
FINISH GRADING																		
LANDSCAPING / SEED / FINAL STABILIZATION																		
STORM FACILITIES																		

NOTE: CONTRACTOR OR GENERAL CONTRACTOR TO COMPLETE TABLE WITH THEIR SPECIFIC PROJECT SCHEDULE

NORTH
0 40 80
SCALE IN FEET

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engineering surveying planning energy
14800 28th Ave. N, Ste 140
Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary

Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION
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F	09/19/12	SEG	CLIENT COMMENTS
G	10/09/12	BSO	BIOFILTER ADDITION
H	01/11/13	BSO	RECORD PLANS
I	02/08/13	JRE	RECORD PLANS
J	02/12/12	ERW	RECORD PLAN COORDINATION

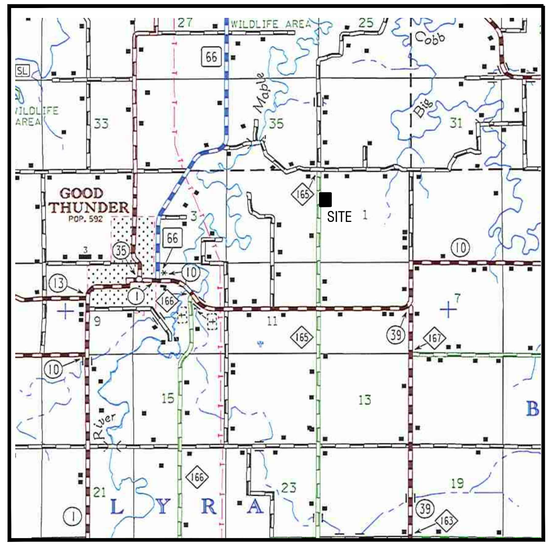
Sheet Title
EROSION CONTROL PLAN

Sheet No. C5.02 **Revision** J

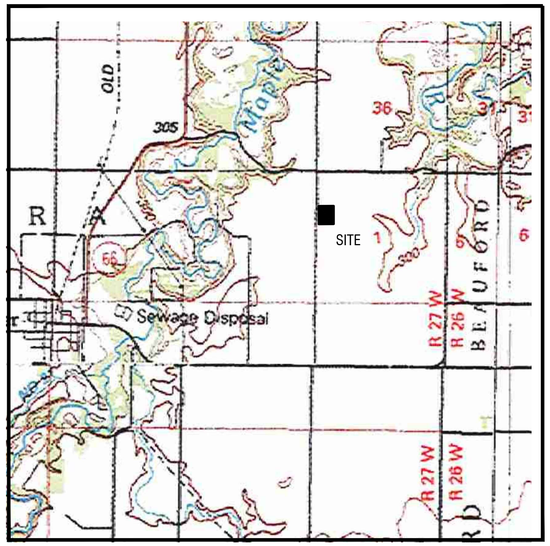
Project No. MFS19051

Feb 14, 2013 - 10:31am - User:528 L:\PROJECTS\MFS\19051\Dwg\Record\19051-05-RP-EROSION.dwg

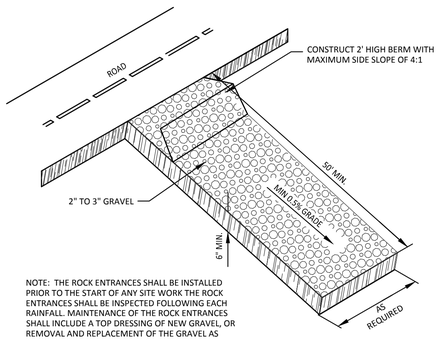
EROSION & SEDIMENTATION CONTROL NOTES & DETAILS / "SITE MAP"



SITE LOCATION MAP
NOT TO SCALE

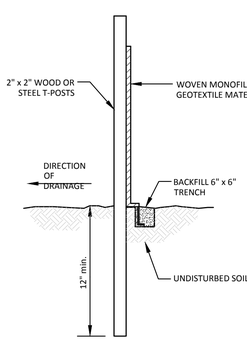


USGS MAP
NOT TO SCALE

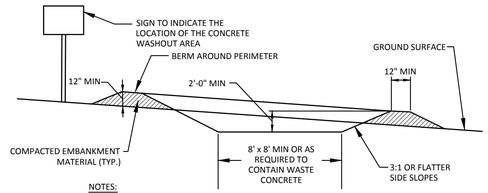


NOTE: THE ROCK ENTRANCES SHALL BE INSTALLED PRIOR TO THE START OF ANY SITE WORK THE ROCK ENTRANCES SHALL BE INSPECTED FOLLOWING EACH RAINFALL. MAINTENANCE OF THE ROCK ENTRANCES SHALL INCLUDE A TOP DRESSING OF NEW GRAVEL, OR REMOVAL AND REPLACEMENT OF THE GRAVEL AS NEEDED, TO KEEP THE ENTRANCE FREE FROM COLLECTED MUD.

ROCK ENTRANCE DRIVE
NOT TO SCALE



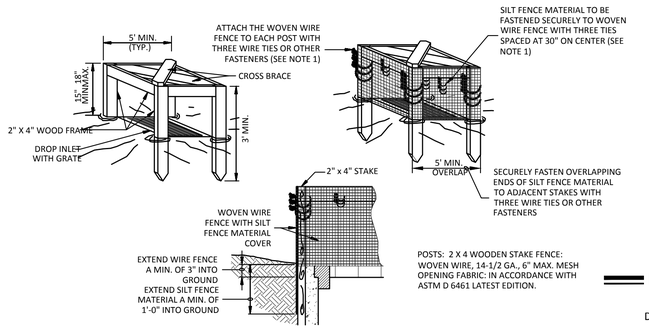
SILT FENCE DETAIL
NOT TO SCALE



NOTES:

1. CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
2. CONCRETE WASHOUT AREA SHALL BE LINED WITH MINIMUM 10 MIL THICK PLASTIC LINER.
3. VEHICLE TRACKING CONTROL IS REQUIRED IF ACCESS TO CONCRETE WASHOUT AREA IS OFF PAVEMENT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
5. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
6. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN ACCEPTED WASTE SITE.
7. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER ACCEPTED BY THE CITY.

CONCRETE WASHOUT AREA
NOT TO SCALE



POSTS: 2 X 4 WOODEN STAKE FENCE: WOVEN WIRE, 14-1/2 GA., 6" MAX. MESH OPENING FABRIC: IN ACCORDANCE WITH ASTM D 6461 LATEST EDITION.

1. ATTACH THE WOVEN WIRE FENCE TO EACH POST AND THE GEOTEXTILE TO THE WOVEN WIRE FENCE (SPACED EVERY 30") WITH THREE WIRE TIES OR OTHER FASTENERS, ALL SPACED WITHIN THE TOP 8" OF THE FABRIC. ATTACH EACH TIE DIAGONALLY 45 DEGREES THROUGH THE FABRIC, WITH EACH PUNCTURE AT LEAST 1" VERTICALLY APART.
2. WHEN TWO SECTIONS OF SILT FENCE MATERIAL ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED ACROSS TWO POSTS.
3. MAINTENANCE SHALL BE PERFORMED AS NOTED IN THE SWPPP. DEPTH OF ACCUMULATED SEDIMENTS MAY NOT EXCEED ONE-HALF THE HEIGHT OF THE FABRIC. MAINTENANCE CLEANOUT MUST BE CONDUCTED REGULARLY TO PREVENT ACCUMULATED SEDIMENTS FROM REACHING ONE-HALF THE HEIGHT OF THE SILT FENCE MATERIAL ABOVE GRADE.
4. ALL SILT FENCE INLETS SHALL INCLUDE WIRE SUPPORT.

SILT FENCE INLET PROTECTION (IP-1)
NOT TO SCALE

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013

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2. ALL TIES AND DISTANCES ARE TO THE CENTER OF SURFACE STRUCTURES.

DEVELOPER/OWNER: MAX MILINKOVICH FULL CIRCLE ORGANICS 5029 13th AVE. S. MINNEAPOLIS, MN. 55417 612-282-9382
SITE OPERATOR / GENERAL CONTRACTOR
SUPERINTENDENT:

GENERAL EROSION NOTES:

1. CONSTRUCTION SHALL COMPLY WITH ALL APPLICABLE GOVERNING CODES AND BE CONSTRUCTED TO SAME. WHERE A CONFLICT EXISTS BETWEEN LOCAL JURISDICTIONAL STANDARD SPECIFICATIONS AND MFRA STANDARD SPECIFICATIONS, THE MORE STRINGENT SPECIFICATION SHALL APPLY.
2. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATIONS AND/OR ELEVATIONS OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE SUBSURFACE UTILITY INFORMATION SHOWN ON THESE PLANS IS A UTILITY QUALITY LEVEL D. THIS QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA." THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CONTACT ALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. THE LOCATIONS OF SMALL UTILITIES SHALL BE OBTAINED BY THE CONTRACTOR BY CALLING MINNESOTA GOPHER STATE ONE CALL AT 800-252-1166 OR 651-454-0002
3. THE DESIGN SHOWN IS BASED UPON THE ENGINEER'S UNDERSTANDING OF THE EXISTING CONDITIONS. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE BASED UPON AN ALTA OR TOPOGRAPHIC SURVEY PREPARED BY MFRA DATED 11-21-2011. IF CONTRACTOR DOES NOT ACCEPT EXISTING TOPOGRAPHY AS SHOWN ON THE PLANS WITHOUT EXCEPTION, THEY SHALL HAVE MADE, AT THEIR EXPENSE, A TOPOGRAPHIC SURVEY BY A REGISTERED LAND SURVEYOR AND SUBMIT IT TO THE OWNER FOR REVIEW. SEE ATTACHED SURVEY SHEETS.
4. THE GENERAL CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES OCCURRING TO THE ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT.
5. THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IS COMPRISED OF THIS DRAWING (EROSION & SEDIMENTATION CONTROL PLAN-ESC PLAN), THE STANDARD DETAILS, THE PLAN NARRATIVE, AND ITS APPENDICES, PLUS THE PERMIT AND ALL SUBSEQUENT REPORTS AND RELATED DOCUMENTS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING & SUBMITTING THE APPLICATION FOR THE MPCA GENERAL STORMWATER PERMIT FOR CONSTRUCTION ACTIVITY. ALL CONTRACTORS AND SUBCONTRACTORS INVOLVED WITH STORM WATER POLLUTION PREVENTION SHALL OBTAIN A COPY OF THE SWPPP AND THE STATE OF MINNESOTA NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM GENERAL PERMIT (NPDES PERMIT) AND BECOME FAMILIAR WITH THEIR CONTENTS. THE SWPPP AND ALL OTHER RELATED DOCUMENTS MUST BE KEPT AT THE SITE DURING CONSTRUCTION.
7. CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES (BMP'S) AS REQUIRED BY THE SWPPP & PERMITS. THE CONTRACTOR SHALL OVERSEE THE INSPECTION & MAINTENANCE OF THE BMP'S AND EROSION PREVENTION FROM BEGINNING OF CONSTRUCTION AND UNTIL CONSTRUCTION IS COMPLETED, IS APPROVED BY ALL AUTHORITIES, THE NOTICE OF TERMINATION (NOT) HAS BEEN FILED WITH THE MPCA BY EITHER THE OWNER OR OPERATOR AS APPROVED ON PERMIT. ADDITIONAL BMP'S SHALL BE IMPLEMENTED AS DICTATED BY CONDITIONS AT NO ADDITIONAL COST TO OWNER THROUGHOUT ALL PHASES OF CONSTRUCTION.
8. CONTRACTOR SHALL COMPLY WITH TRAINING REQUIREMENTS IN PART III.A.2 OF THE GENERAL PERMIT.
9. BMP'S AND CONTROLS SHALL CONFORM TO FEDERAL, STATE, OR LOCAL REQUIREMENTS OR MANUAL OF PRACTICE, AS APPLICABLE. CONTRACTOR SHALL IMPLEMENT ADDITIONAL CONTROLS AS DIRECTED BY PERMITTING AGENCY OR OWNER.
10. ESC PLAN MUST CLEARLY DELINEATE ALL STATE WATERS. PERMITS FOR ANY CONSTRUCTION ACTIVITY IMPACTING STATE WATERS OR REGULATED WETLANDS MUST BE MAINTAINED ON SITE AT ALL TIMES.
11. CONTRACTOR SHALL MINIMIZE CLEARING TO THE MAXIMUM EXTENT PRACTICAL OR AS REQUIRED BY THE GENERAL PERMIT. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THE ESC PLANS SHALL BE CLEARLY DELINEATED (E.G. WITH FLAGS, STAKES, SIGNS, SILT FENCE, ETC.) ON THE DEVELOPMENT SITE BEFORE WORK BEGINS. GROUND DISTURBING ACTIVITIES MUST NOT OCCUR OUTSIDE THE LIMITS OF DISTURBANCE.
12. GENERAL CONTRACTOR SHALL DENOTE ON PLAN THE TEMPORARY PARKING AND STORAGE AREA WHICH SHALL ALSO BE USED AS THE EQUIPMENT MAINTENANCE AND CLEANING AREA, EMPLOYEE PARKING AREA, AND AREA FOR LOCATING PORTABLE FACILITIES, OFFICE TRAILERS, AND TOILET FACILITIES.
13. ALL WASH WATER (CONCRETE TRUCKS, VEHICLE CLEANING, EQUIPMENT CLEANING, ETC.) MUST BE LIMITED TO A DEFINED AREA OF THE SITE AND SHALL BE CONTAINED AND PROPERLY TREATED OR DISPOSED. NO ENGINE DEGREASING IS ALLOWED ON SITE.
14. ALL LIQUID AND SOLID WASTES GENERATED BY CONCRETE WASHOUT OPERATIONS MUST BE CONTAINED IN A LEAK-PROOF CONTAINMENT FACILITY OR IMPERMEABLE LINER. A COMPACTED CLAY LINER THAT DOES NOT ALLOW WASHOUT LIQUIDS TO ENTER GROUND WATER IS CONSIDERED AN IMPERMEABLE LINER. THE LIQUID AND SOLID WASTES MUST NOT CONTACT THE GROUND, AND THERE MUST NOT BE RUNOFF FROM THE CONCRETE WASHOUT OPERATIONS OR AREAS. LIQUID AND SOLID WASTES MUST BE DISPOSED OF PROPERLY AND IN COMPLIANCE WITH MPCA REGULATIONS. A SIGN MUST BE INSTALLED ADJACENT TO EACH WASHOUT FACILITY TO INFORM CONCRETE EQUIPMENT OPERATORS TO UTILIZE THE PROPER FACILITIES.
15. SUFFICIENT OIL AND GREASE ABSORBING MATERIALS AND FLOTATION BOOMS SHALL BE MAINTAINED ON SITE OR READILY AVAILABLE TO CONTAIN AND CLEAN-UP FUEL OR CHEMICAL SPILLS AND LEAKS.
16. DUST ON THE SITE SHALL BE CONTROLLED. THE USE OF MOTOR OILS AND OTHER PETROLEUM BASED OR TOXIC LIQUIDS FOR DUST SUPPRESSION OPERATIONS IS PROHIBITED.
17. SOLID WASTE: COLLECTED SEDIMENT, ASPHALT & CONCRETE MILLINGS, FLOATING DEBRIS, PAPER, PLASTIC, FABRIC, CONSTRUCTION & DEMOLITION DEBRIS & OTHER WASTES MUST BE DISPOSED OF PROPERLY & MUST COMPLY WITH MPCA DISPOSAL REQUIREMENTS.
18. HAZARDOUS MATERIALS: OIL, GASOLINE, PAINT & ANY HAZARDOUS SUBSTANCES MUST BE PROPERLY STORED, INCLUDING SECONDARY CONTAINMENT, TO PREVENT SPILLS, LEAKS OR OTHER DISCHARGE. RESTRICTED ACCESS TO STORAGE AREAS MUST BE PROVIDED TO PREVENT VANDALISM. STORAGE & DISPOSAL OF HAZARDOUS WASTE MUST BE IN COMPLIANCE WITH MPCA REGULATIONS.
19. ALL STORM WATER POLLUTION PREVENTION MEASURES PRESENTED ON THIS PLAN, AND IN THE SWPPP, SHALL BE INITIATED AS SOON AS PRACTICABLE AND PRIOR TO SOIL DISTURBING ACTIVITIES UPSLOPE.
20. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS STOPPED SHALL BE TEMPORARILY SEEDED, WITHIN 14 DAYS OF INACTIVITY. SEEDING SHALL BE IN ACCORDANCE WITH MN/DOT SEED MIXTURE NUMBER 100 OR 110 DEPENDING ON THE SEASON OF PLANTING (SEE MN/DOT SPECIFICATION SECTION 2575.3) SEEDING METHOD AND APPLICATION RATE SHALL CONFORM TO MN/DOT SPECIFICATION SECTION 2575.3. TEMPORARY MULCH SHALL BE APPLIED IN ACCORDANCE WITH MN/DOT SPECIFICATION SECTION 2575.3F1 AND 2575.3G. ALTERNATIVELY, HYDRAULIC SOIL STABILIZER IN ACCORDANCE WITH MN/DOT SPECIFICATION SECTION 2575.3H MAY BE USED IN PLACE OF TEMPORARY MULCH.
21. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS PERMANENTLY STOPPED SHALL BE PERMANENTLY STABILIZED. THESE AREAS SHALL BE STABILIZED IN ACCORDANCE WITH THE TIME TABLE DESCRIBED ABOVE. REFER TO THE GRADING PLAN AND/OR LANDSCAPE PLAN FOR VEGETATIVE COVER.
22. CONTRACTORS OR SUBCONTRACTORS WILL BE RESPONSIBLE FOR REMOVING SEDIMENT FROM CONVEYANCES & FROM TEMPORARY SEDIMENTATION BASINS THAT ARE TO BE USED AS PERMANENT WATER QUALITY MANAGEMENT BASINS. SEDIMENT MUST BE STABILIZED TO PREVENT IT FROM BEING WASHED BACK INTO THE BASIN, CONVEYANCES, OR DRAINAGEWAYS DISCHARGING OFF-SITE OR TO SURFACE WATERS. THE CLEANOUT OF PERMANENT BASINS MUST BE SUFFICIENT TO RETURN THE BASIN TO DESIGN CAPACITY.
23. ON-SITE & OFF-SITE SOIL STOCKPILE AND BORROW AREAS SHALL BE PROTECTED FROM EROSION AND SEDIMENTATION THROUGH IMPLEMENTATION OF BMP'S. STOCKPILE AND BORROW AREA LOCATIONS SHALL BE NOTED ON THE SITE MAP AND PERMITTED IN ACCORDANCE WITH GENERAL PERMIT REQUIREMENTS.
24. TEMPORARY SOIL STOCKPILES MUST HAVE SILT FENCE OR OTHER EFFECTIVE SEDIMENT CONTROLS & CANNOT BE PLACED IN SURFACE WATERS, INCLUDING STORMWATER CONVEYANCES SUCH AS CURB & GUTTER SYSTEMS OR CONDUITS & DITCHES.
25. SLOPES SHALL BE LEFT IN A ROUGHENED CONDITION DURING THE GRADING PHASE TO REDUCE RUNOFF VELOCITIES AND EROSION.
26. DUE TO THE GRADE CHANGES DURING THE DEVELOPMENT OF THE PROJECT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING THE EROSION CONTROL MEASURES (SILT FENCES, CHECK DAMS, INLET PROTECTION DEVICES, ETC.) TO PREVENT EROSION.
27. ALL CONSTRUCTION SHALL BE STABILIZED AT THE END OF EACH WORKING DAY, THIS INCLUDES BACKFILLING OF TRENCHES FOR UTILITY CONSTRUCTION AND PLACEMENT OF GRAVEL OR BITUMINOUS PAVING FOR ROAD CONSTRUCTION.

MAINTENANCE NOTES:

ALL MEASURES STATED ON THIS EROSION AND SEDIMENT CONTROL PLAN, AND IN THE STORM WATER POLLUTION PREVENTION PLAN SHALL BE MAINTAINED IN FULLY FUNCTIONAL CONDITION UNTIL NO LONGER REQUIRED FOR A COMPLETED PHASE OF WORK OR FINAL STABILIZATION OF THE SITE. THE DESIGNATED CONTACT PERSON NOTED ON THIS PLAN MUST ROUTINELY INSPECT THE CONSTRUCTION ON SITE ONCE EVERY SEVEN DAYS DURING ACTIVE CONSTRUCTION AND WITHIN 24 HOURS AFTER A RAINFALL EVENT GREATER THAN 0.5 INCHES IN 24 HOURS. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE CLEANED AND REPAIRED IN ACCORDANCE WITH THE FOLLOWING:

1. ALL SILT FENCES MUST BE REPAIRED, REPLACED, OR SUPPLEMENTED WHEN THEY BECOME NONFUNCTIONAL OR THE SEDIMENT REACHES 1/3 OF THE HEIGHT OF THE FENCE. THESE REPAIRS MUST BE MADE WITHIN 24 HOURS OF DISCOVERY, OR AS SOON AS FIELD CONDITIONS ALLOW ACCESS.
2. TEMPORARY AND PERMANENT SEDIMENTATION BASINS MUST BE DRAINED AND THE SEDIMENT REMOVED WHEN THE DEPTH OF SEDIMENT COLLECTED IN THE BASIN REACHES 1/2 THE STORAGE VOLUME. DRAINAGE AND REMOVAL MUST BE COMPLETED WITHIN 72 HOURS OF DISCOVERY, OR AS SOON AS FIELD CONDITIONS ALLOW ACCESS (SEE PART IV.D. OF THE GENERAL PERMIT).
3. SURFACE WATERS, INCLUDING DRAINAGE DITCHES AND CONVEYANCE SYSTEMS, MUST BE INSPECTED FOR EVIDENCE OF SEDIMENT BEING DEPOSITED BY EROSION. THE CONTRACTOR MUST REMOVE ALL DELTAS AND SEDIMENT DEPOSITED IN SURFACE WATERS, INCLUDING DRAINAGE WAYS, CATCH BASINS, AND OTHER DRAINAGE SYSTEMS, AND RESTABILIZE THE AREAS WHERE SEDIMENT REMOVAL RESULTS IN EXPOSED SOIL. THE REMOVAL AND STABILIZATION MUST TAKE PLACE WITHIN SEVEN (7) DAYS OF DISCOVERY UNLESS PRECLUDED BY LEGAL, REGULATORY, OR PHYSICAL ACCESS CONSTRAINTS. THE CONTRACTOR SHALL USE ALL REASONABLE EFFORTS TO OBTAIN ACCESS. IF PRECLUDED, REMOVAL AND STABILIZATION MUST TAKE PLACE WITHIN SEVEN (7) CALENDAR DAYS OF OBTAINING ACCESS. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING ALL LOCAL, REGIONAL, STATE AND FEDERAL AUTHORITIES AND RECEIVING ANY APPLICABLE PERMITS, PRIOR TO CONDUCTING ANY WORK.
4. CONSTRUCTION SITE VEHICLE EXIT LOCATIONS MUST BE INSPECTED FOR EVIDENCE OF OFF-SITE SEDIMENT TRACKING ONTO PAVED SURFACES. TRACKED SEDIMENT MUST BE REMOVED FROM ALL OFF-SITE PAVED SURFACES, WITHIN 24 HOURS OF DISCOVERY, OR IF APPLICABLE, WITHIN A SHORTER TIME TO COMPLY WITH PART IV.C.6 OF THE GENERAL PERMIT.
5. THE CONTRACTOR IS RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF TEMPORARY AND PERMANENT WATER QUALITY MANAGEMENT BMPS, AS WELL AS ALL EROSION PREVENTION AND SEDIMENT CONTROL BMPS, FOR THE DURATION OF THE CONSTRUCTION WORK AT THE SITE. THE PERMITTEE(S) ARE RESPONSIBLE UNTIL ANOTHER PERMITTEE HAS ASSUMED CONTROL ACCORDING TO PART II.B.5 OVER ALL AREAS OF THE SITE THAT HAVE NOT BEEN FINALLY STABILIZED OR THE SITE HAS UNDERGONE FINAL STABILIZATION, AND A NOT HAS BEEN SUBMITTED TO THE MPCA.
6. IF SEDIMENT ESCAPES THE CONSTRUCTION SITE, OFF-SITE ACCUMULATIONS OF SEDIMENT MUST BE REMOVED IN A MANNER AND AT A FREQUENCY SUFFICIENT TO MINIMIZE OFF-SITE IMPACTS (E.G., FUGITIVE SEDIMENT IN STREETS COULD BE WASHED INTO STORM SEWERS BY THE NEXT RAIN AND/OR POSE A SAFETY HAZARD TO USERS OF PUBLIC STREETS).
7. ALL INFILTRATION AREAS MUST BE INSPECTED TO ENSURE THAT NO SEDIMENT FROM ONGOING CONSTRUCTION ACTIVITIES IS REACHING THE INFILTRATION AREA AND THESE AREAS ARE PROTECTED FROM COMPACTION DUE TO CONSTRUCTION EQUIPMENT DRIVING ACROSS THE INFILTRATION AREA.

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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary

Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

Revision History

No.	Date	By	Submittal / Revision
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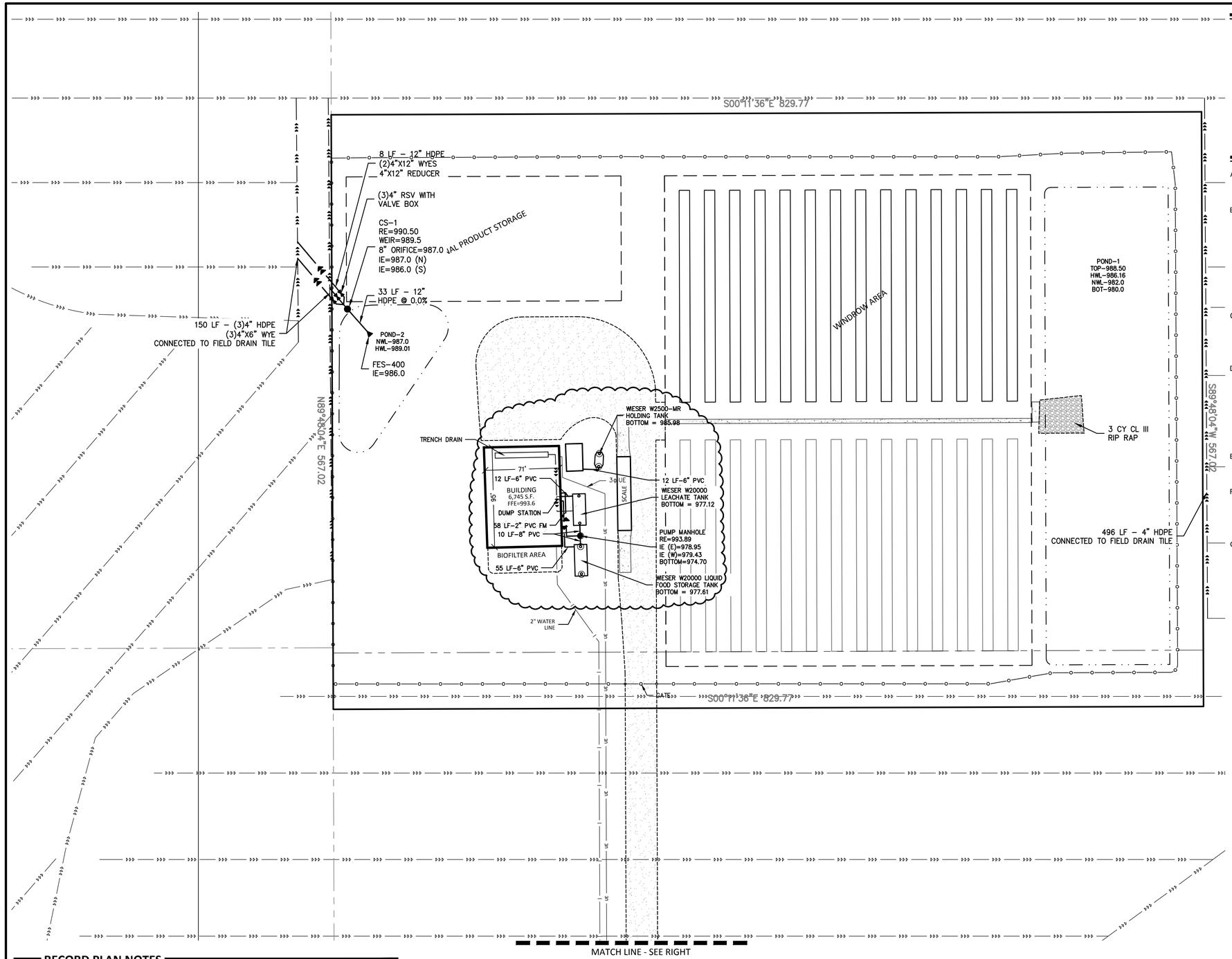
H	01/11/13	BSO	RECORD PLANS
I	02/08/13	JRE	RECORD PLANS
J	02/12/12	ERW	RECORD PLAN COORDINATION

Sheet Title
EROSION CONTROL DETAILS

Sheet No. Revision
C5.03 J

Project No. MFS19051



LEGEND

	PROPOSED	EXISTING
CURB & GUTTER		
STORM SEWER		
SANITARY SEWER		
FORCEMAIN (SAN.)	FM	FM
WATERMAIN	W	W
EASEMENT		
DRAINTILE		
GAS LINE	UG	UG
ELECTRIC	UE	UE
TELEPHONE	UT	UT

UTILITY CONSTRUCTION NOTES

A. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS AND DIMENSIONS OF VESTIBULE, EXIT PORCHES, RAMPS, TRUCK DOCKS, PRECISE BUILDING DIMENSIONS AND EXACT BUILDING UTILITY ENTRANCE LOCATIONS.

B. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. THE LOCATIONS OF SMALL UTILITIES SHALL BE OBTAINED BY THE CONTRACTOR, BY CALLING GOPHER STATE ONE CALL AT 454-0002.

C. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES TO THE ADJACENT PROPERTIES OCCURRING DURING THE CONSTRUCTION PHASES OF THIS PROJECT.

D. SAFETY NOTICE TO CONTRACTORS: IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS ON THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER OR THE DEVELOPER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON OR NEAR THE CONSTRUCTION SITE.

E. ALL AREAS OUTSIDE THE PROPERTY BOUNDARIES THAT ARE DISTURBED BY UTILITY CONSTRUCTION SHALL BE RESTORED IN KIND. SODDED AREAS SHALL BE RESTORED WITH 6 INCHES OF TOPSOIL PLACED BENEATH THE SOD.

F. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING TRAFFIC CONTROL DEVICES SUCH AS BARRICADES, WARNING SIGNS, DIRECTIONAL SIGNS, FLAGMEN AND LIGHTS TO CONTROL THE MOVEMENT OF TRAFFIC WHERE NECESSARY. TRAFFIC CONTROL DEVICES SHALL CONFORM TO APPROPRIATE MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARDS.

G. PRIOR TO PLACEMENT OF AGGREGATE BASE, A TEST ROLL WILL BE REQUIRED ON THE STREET AND PARKING AREA SUBGRADE. THE CONTRACTOR SHALL PROVIDE A LOADED TANDEM AXLE TRUCK WITH A GROSS WEIGHT OF 25 TONS. THE TEST ROLLING SHALL BE AT THE DIRECTION OF THE SOILS ENGINEER AND SHALL BE COMPLETED IN AREAS AS DIRECTED BY THE SOILS ENGINEER. THE SOILS ENGINEER SHALL DETERMINE WHICH SECTIONS OF THE STREET OR PARKING AREA ARE UNSTABLE. CORRECTION OF THE SUBGRADE SOILS SHALL BE COMPLETED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOILS ENGINEER.

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013

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2. ALL TIES AND DISTANCES ARE TO THE CENTER OF SURFACE STRUCTURES.

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Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
www.mfra.com

Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

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Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

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Sheet Title
OVERALL UTILITY PLAN

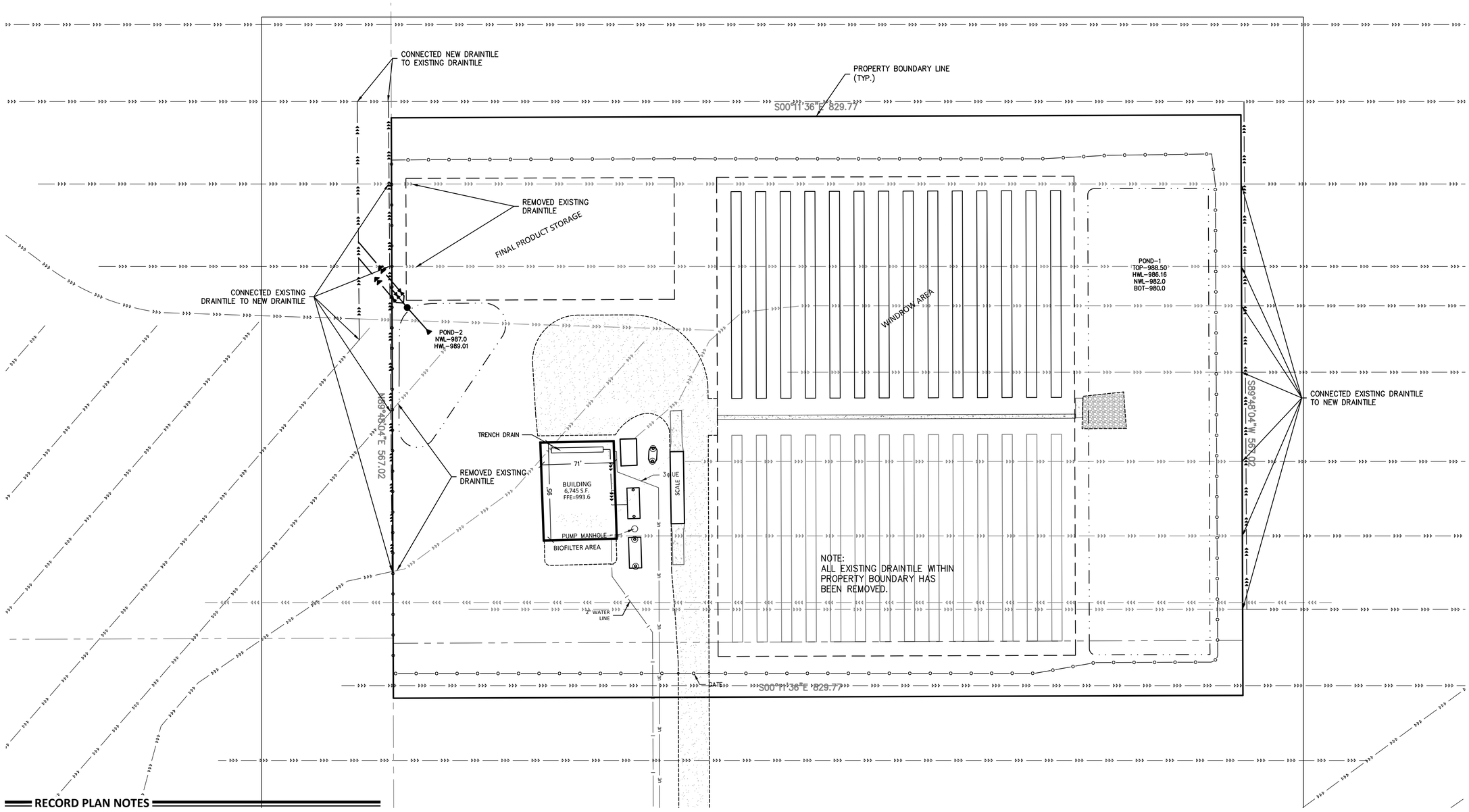
Sheet No. Revision
C6.01 J

Project No. MFS19051

Feb 14, 2013 - 10:31am - User:528 L:\PROJECTS\MFS19051\dwg\Record\19051-06-RP-UTILITY.dwg

LEGEND

	PROPOSED	EXISTING
PROPERTY LIMIT		
CURB & GUTTER		
STORM SEWER		
DRAINTILE		
BUILDING		



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DATE OF COMPLETION: 02/08/2013

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NORTH

0 50 100
SCALE IN FEET

Feb 14, 2013 - 10:31am - User:528 L:\PROJECTS\MFS19051\dwg\Record\19051-06-RP-UTILITY.dwg

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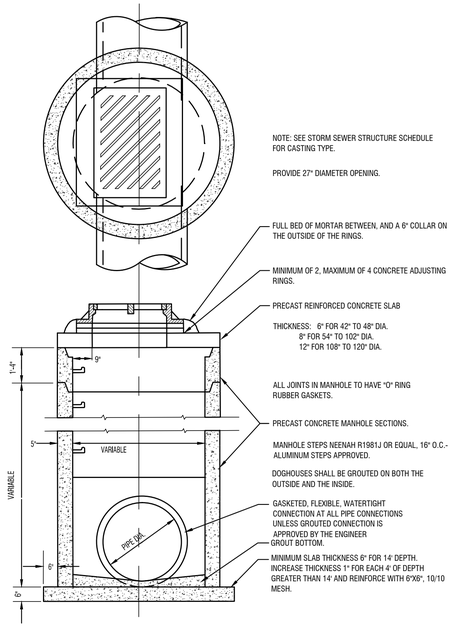
Sheet Title
DRAINTILE REMOVAL PLAN

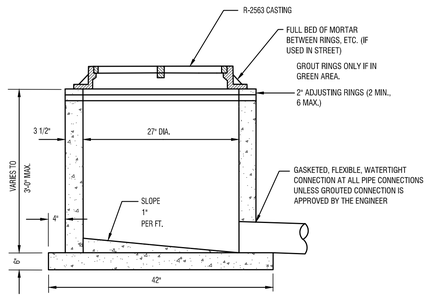
Sheet No. Revision
C6.02 J

Project No. MFS19051



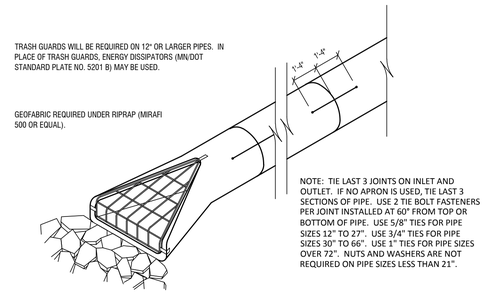
SS-02
05/06
NO SCALE

CATCH BASIN MANHOLE



SS-04
05/06
NO SCALE

27" DIAMETER CATCH BASIN



SS-06
10/08
NO SCALE

FLARED END SECTION

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013
CONTRACTOR: DAVE PERKINS CONTRACTING INC
14230 BASALT ST, RAMSEY, MN 55303
TEL 763-427-0109

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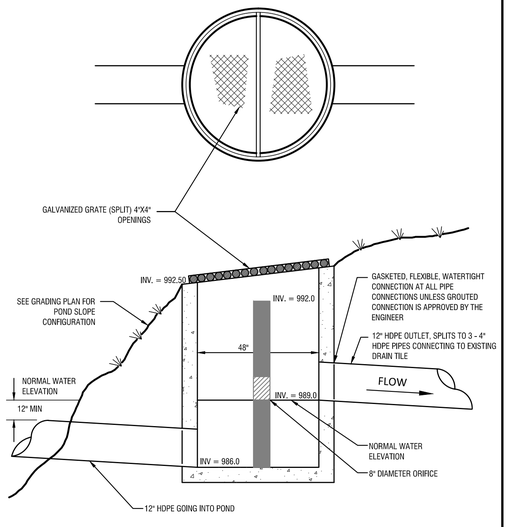
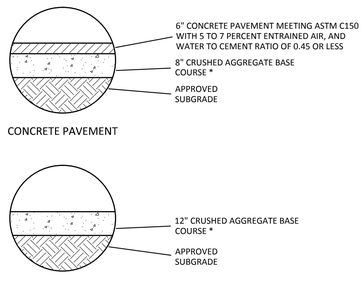


SS-10
05/06
NO SCALE

CONTROL STRUCTURE



*REFER TO MN/DOT SPECIFICATIONS

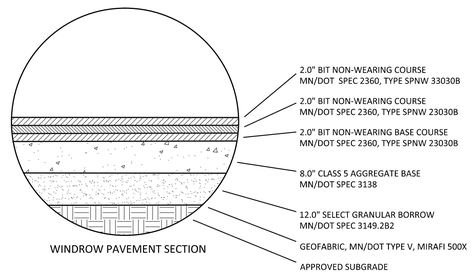
NOTES:

1. THE PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MNDOT "STANDARD SPECIFICATION FOR CONSTRUCTION", AND ALSO THE REQUIREMENTS OF THE OWNER'S SOIL ENGINEER.

2. ALL THICKNESSES, AS SPECIFIED, ARE TO BE CONSIDERED MINIMUM DEPTHS, AFTER COMPACTION.

NO SCALE

PAVEMENT SECTIONS



WINDROW PAVEMENT SECTION

NOTES:
1. LIFTS SHALL BE PLACED 90° RELATIVE TO PREVIOUS LIFT.

2. THE PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MNDOT "STANDARD SPECIFICATION FOR CONSTRUCTION", AND ALSO THE REQUIREMENTS OF THE OWNER'S SOIL ENGINEER.

3. ALL THICKNESSES, AS SPECIFIED, ARE TO BE CONSIDERED MINIMUM DEPTHS, AFTER COMPACTION.

4. MN/DOT SPEC 2357 BITUMINOUS TACK COAT SHALL BE PLACED BETWEEN SUCCESSIVE BITUMINOUS LIFTS AND AGAINST ABUTTING CONCRETE CURB EDGES.

STRT-04
11/08
NO SCALE

PAVEMENT SECTIONS

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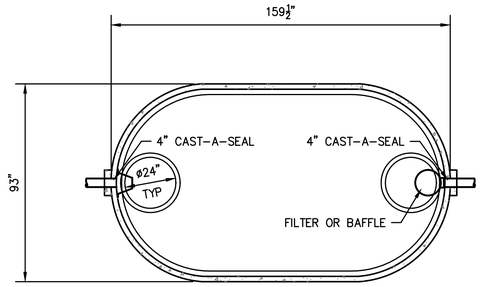
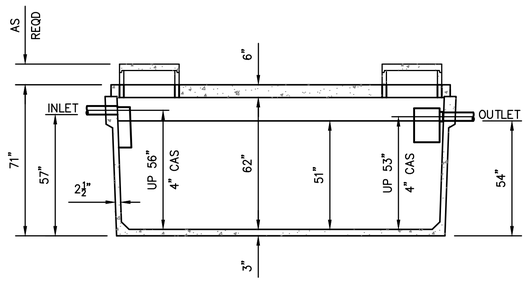
Sheet Title
CONSTRUCTION DETAILS

Sheet No. Revision
C7.01 J

Project No. MFS19051

W2500–MR
TANK SPECIFICATIONS





DIMENSIONS:
WALL: 2 1/2"
BOTTOM: SEPTIC 3"
HEAVY DUTY 5" (ADD 2,300 LBS.)
COVER: 6"
MANHOLE: 24" I.D. PRECAST CONCRETE RISER
HEIGHT: 71" O.D.
LENGTH: 159 1/2" O.D.
WIDTH: 93" O.D.
BELOW INLET: 57" O.D.
LIQUID LEVEL: 51"
WEIGHT: 15,205 LBS. SEPTIC
17,505 LBS. HOLDING

INLET AND OUTLET:
4" CAST–A–SEAL BOOT OR EQUAL
GASKET, CAST–A–SEAL BOOT OR EQUAL

INLET AND OUTLET BAFFLE AND FILTER:
WISCONSIN, SEE DETAIL #10
(OTHER STATES SEE CHART)

LIQUID CAPACITY: 49.46 GAL/IN

LOADING DESIGN: 8' 0" UNSATURATED SOIL

HOLDING TANK:
OUTLET HOLE PLUGGED
ACTUAL CAPACITY: 2,671 GALLONS

MN TANKS:
WILL HAVE ONE VENT OVER OUTLET
AND WILL HAVE TWO VENTS IN COVER OVER INLET

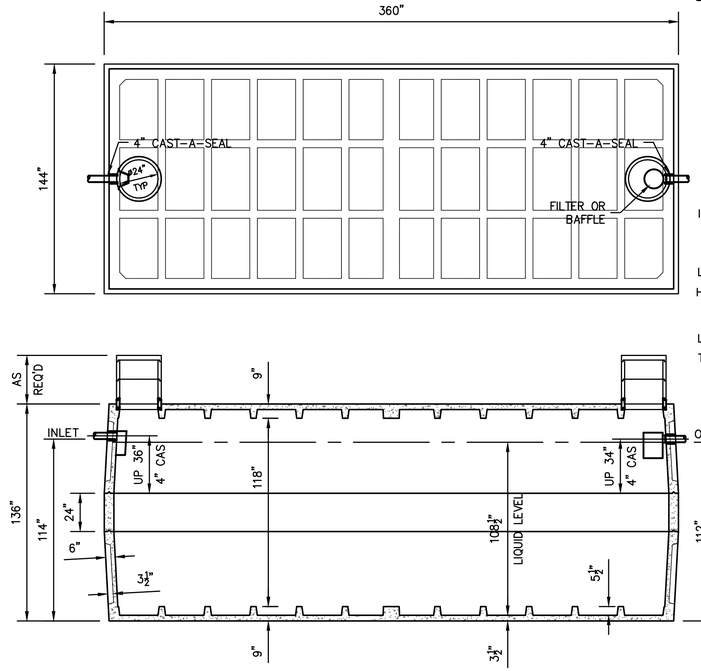
TANK CAN BE USED AS:
SEPTIC/ HOLDING/ PUMP OR SIPHON

COVER: MIX DESIGN #8 (NO FIBER)
TANK: MIX DESIGN #9 (SMALL FIBER)

CUSTOMIZED TANKS:
FOR CUSTOM TANKS CONTACT WIESER CONCRETE

TANKS ARE MANUFACTURED TO MEET OR EXCEED ASTM C–1227 REQUIREMENTS

W20000
TANK SPECIFICATIONS



DIMENSIONS:
WALL: 6" RIBBED
BOTTOM: 9" RIBBED
COVER: 9" RIBBED
MANHOLE: 24" I.D. PRECAST RISER
HEIGHT: 136" O.D.
LENGTH: 360" O.D.
WIDTH: 144" O.D.
BELOW INLET: 114" O.D.
LIQUID LEVEL 108.5"
WEIGHT: 42,000 LBS
PER TOP OR BOTTOM SECTION
12,600 FOR MIDDLE SECTION

INLET AND OUTLET:
4" CAST–A–SEAL BOOT OR EQUAL

INLET AND OUTLET BAFFLE AND FILTER:
WISCONSIN, SEE DETAIL #10
(OTHER STATES SEE CHART)

LIQUID CAPACITY: 194.63 GAL/IN

HOLDING TANK:
OUTLET HOLE PLUGGED
ACTUAL CAPACITY: 21,507 GALLONS

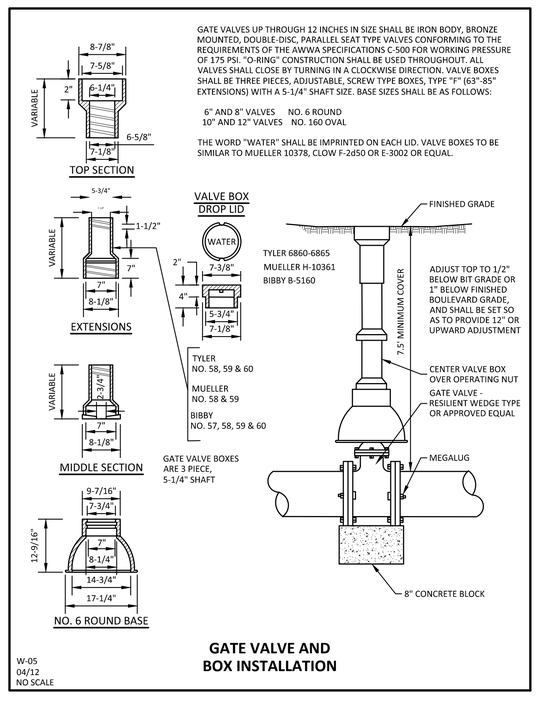
LOADING DESIGN: 8'–0" UNSATURATED SOIL

TANK CAN BE USED AS:
SEPTIC / HOLDING / PUMP OR SIPHON

TANK: MIX DESIGN #9 (SMALL FIBER)

CUSTOMIZED TANKS:
FOR CUSTOM TANKS CONTACT
WIESER CONCRETE

TANKS ARE MANUFACTURED TO MEET OR EXCEED ASTM C–1227 REQUIREMENTS



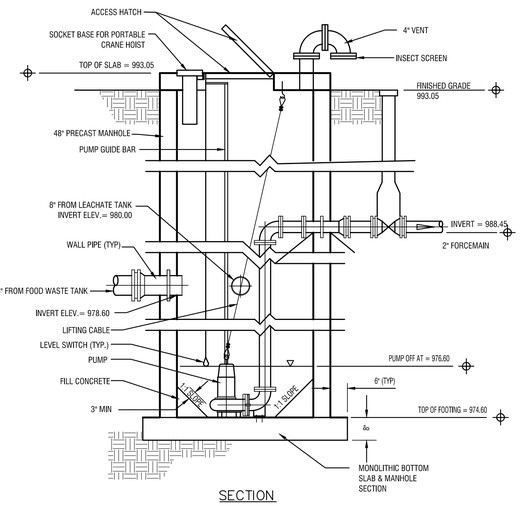
GATE VALVES UP THROUGH 12 INCHES IN SIZE SHALL BE IRON BODY, BRONZE MOUNTED, DOUBLE-DISC, PARALLEL SEAT TYPE VALVES CONFORMING TO THE REQUIREMENTS OF THE AWWA SPECIFICATIONS C-500 FOR WORKING PRESSURE OF 175 PSI. "O-RING" CONSTRUCTION SHALL BE USED THROUGHOUT. ALL VALVES SHALL CLOSE BY TURNING IN A CLOCKWISE DIRECTION. VALVE BOXES SHALL BE THREE PIECES, ADJUSTABLE, SCREW TYPE BOXES, TYPE "F" (63"-85" EXTENSIONS) WITH A 5-1/4" SHAFT SIZE. BASE SIZES SHALL BE AS FOLLOWS:

6" AND 8" VALVES NO. 6 ROUND
10" AND 12" VALVES NO. 160 OVAL

THE WORD "WATER" SHALL BE IMPRINTED ON EACH LID. VALVE BOXES TO BE SIMILAR TO MUELLER 10378, CLOW F-2d50 OR E-3002 OR EQUAL.

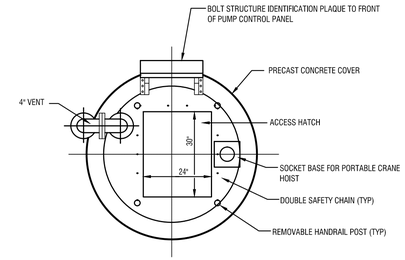
W-05
04/12
NO SCALE

GATE VALVE AND BOX INSTALLATION

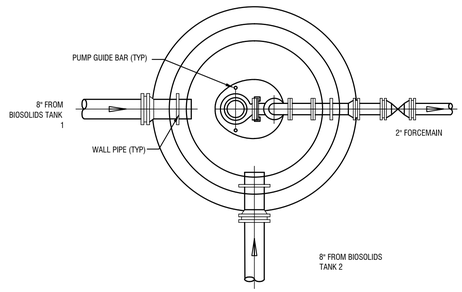


SECTION

1. PUMP SHALL BE MOUNTED ON A SLIDE RAIL SYSTEM.
2. PUMP CONTROLS SHALL BE PROVIDED BY MANUFACTURER, AND BE MOUNTED INSIDE THE BUILDING IN A WEATHER PROOF ENCLOSED CABINET.
3. CONTROLS SHALL HAVE A HAND CONTROLLED ON/OFF WITH AUTO STOP BY A FLOAT.
4. PUMPS SHALL PRODUCE 20 GPM WITH A TDH OF 25 FEET.



TYPICAL PUMP STATION COVER DETAIL



PLAN

RECORD PLAN NOTES

COMPLETED BY: MFRA
DATE OF COMPLETION: 02/08/2013
CONTRACTOR: DAVE PERKINS CONTRACTING INC
14230 BASALT ST, RAMSEY, MN 55303
TEL 763-427-0109

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C7.02 J

Project No. MFS19051

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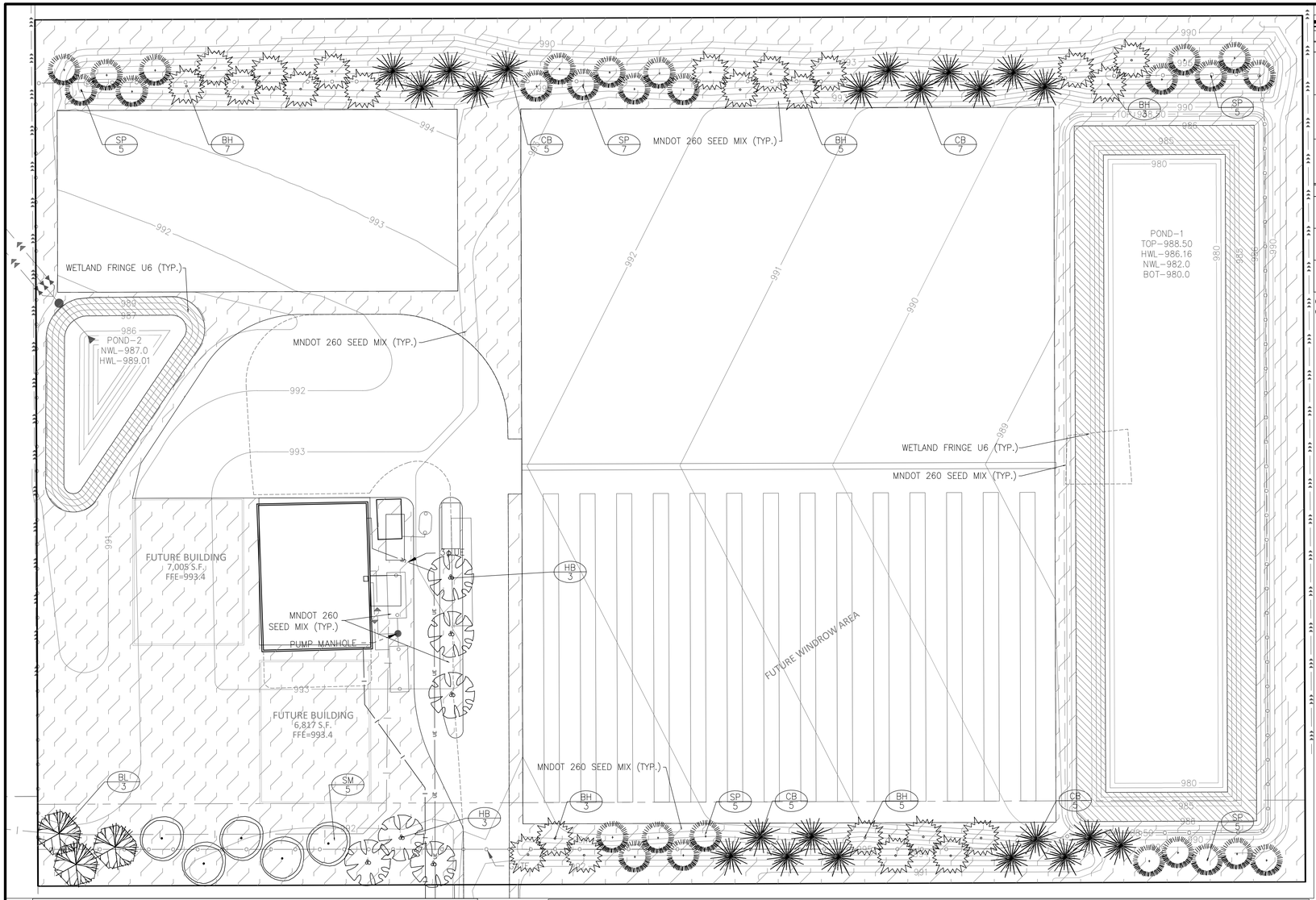


LANDSCAPE LEGEND

KEY		BOTANICAL NAME	COMMON NAME	SIZE	ROOT	QTY.	
		DECIDUOUS TREES					
BL		Tilia americana 'Boulevard'	BOULEVARD LINDEN	3"	BB	3	STRAIT LEADER NO "V" CROTCH
HB		Celtis occidentalis	HACKBERRY	3"	BB	6	
SM		Acer saccharum	SUGAR MAPLE	2.5"	BB	5	
		EVERGREEN TREES					
BH		Picea glauca var. Densata	BLACK HILLS SPRUCE	6'	BB	23	FULL FORM TO GRADE
CB		Picea pungens	COLORADO BLUE SPRUCE	6'	BB	22	
SP		Pinus sylvestris	SCOTCH PINE	6'	BB	27	

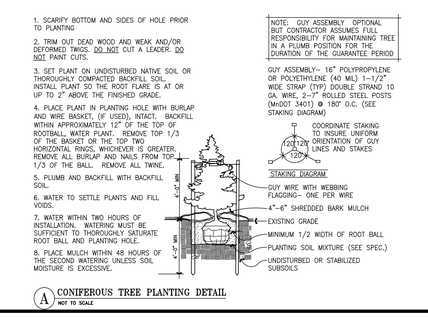
QUANTITIES SHOWN IN THE PLANTING SCHEDULE ARE FOR THE CONTRACTOR'S CONVENIENCE. CONTRACTOR TO VERIFY QUANTITIES SHOWN ON THE PLAN.

NORTH
0 40 80
SCALE IN FEET

SEED MIX LEGEND

SYM.	TYPE	SEED MIX
	WETLAND FRINGE	BWSR U6 WITH 'NO MOW FESCUE'
	HARDWOOD MULCH	MNDOT TYPE 6 HARDWOOD MULCH
	ROADSIDE TURFGRASS MIX ALL AREAS DISTURBED BY CONSTRUCTION NOT INCLUDING FILTRATION BASINS	MNDOT 260

** NO MOW SEED FORMULA FROM SPECIALTY TURF & AG INC, FREEDOM MIX, AT 200LB/ACRE OR APPROVED EQUAL. - WWW.SPECIALTYTURFAG.COM - 188-685-4521



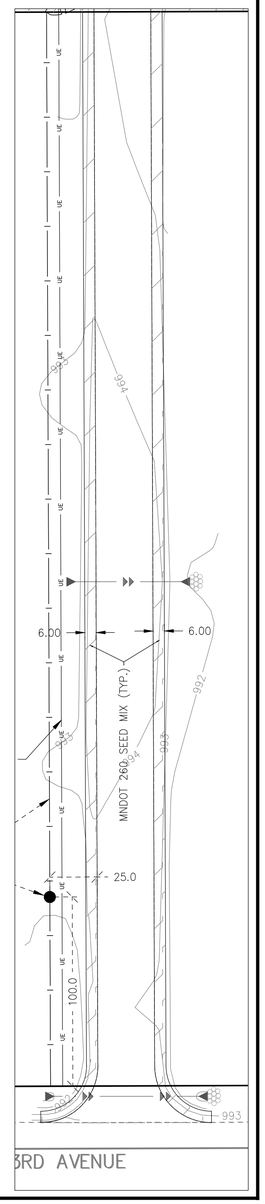
PLANTING NOTES

1. ALL PLANTS MUST BE HEALTHY, VIGOROUS MATERIAL, FREE OF PESTS AND DISEASE AND BE CONTAINER GROWN OR BALLED AND BURLAPPED AS INDICATED IN THE LANDSCAPE LEGEND.
2. ALL TREES MUST BE STRAIGHT TRUNKED AND FULL HEADED AND MEET ALL REQUIREMENTS SPECIFIED.
3. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ANY PLANTS WHICH ARE DEEMED UNSATISFACTORY BEFORE, DURING, OR AFTER INSTALLATION.
4. NO SUBSTITUTIONS OF PLANT MATERIAL SHALL BE ACCEPTED UNLESS APPROVED IN WRITING BY THE LANDSCAPE ARCHITECT.
5. ALL PLANTING STOCK SHALL CONFORM TO THE "AMERICAN STANDARD FOR NURSERY STOCK," ANSI-Z60, LATEST EDITION, OF THE AMERICAN ASSOCIATION OF NURSERYMEN, INC. AND SHALL CONSTITUTE MINIMUM QUALITY REQUIREMENTS FOR PLANT MATERIALS.
6. EXISTING TREES AND SHRUBS TO REMAIN SHALL BE PROTECTED TO THE DRIP LINE FROM ALL CONSTRUCTION TRAFFIC, STORAGE OF MATERIALS ETC. WITH 4' HT. ORANGE PLASTIC SAFETY FENCING ADEQUATELY SUPPORTED BY STEEL FENCE POSTS 6' O.C. MAXIMUM SPACING.
7. ALL PLANT MATERIAL QUANTITIES, SHAPES OF BEDS AND LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETE COVERAGE OF ALL PLANTING BEDS AT SPACING SHOWN AND ADJUSTED TO CONFORM TO THE EXACT CONDITIONS OF THE SITE. THE LANDSCAPE ARCHITECT SHALL APPROVE THE STAKING LOCATION OF ALL PLANT MATERIALS PRIOR TO INSTALLATION.
8. ALL PLANTING AREAS MUST BE COMPLETELY MULCHED AS SPECIFIED.
9. MULCH: SHREDDED HARDWOOD MULCH, CLEAN AND FREE OF NOXIOUS WEEDS OR OTHER DELETERIOUS MATERIAL, IN ALL MASS PLANTING BEDS AND FOR TREES, UNLESS INDICATED AS ROCK MULCH ON THE DRAWINGS. DELIVER MULCH ON DAY OF INSTALLATION.
10. THE PLAN TAKES PRECEDENCE OVER THE LANDSCAPE LEGEND IF DISCREPANCIES EXIST. THE SPECIFICATIONS TAKE PRECEDENCE OVER THE PLANTING NOTES AND GENERAL NOTES.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MULCHES AND PLANTING SOIL QUANTITIES TO COMPLETE THE WORK SHOWN ON THE PLAN. VERIFY ALL QUANTITIES SHOWN ON THE LANDSCAPE LEGEND.
12. LONG-TERM STORAGE OF MATERIALS OR SUPPLIES ON-SITE WILL NOT BE ALLOWED.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE CODES, REGULATIONS, AND PERMITS GOVERNING THE WORK.
14. LOCATE AND VERIFY ALL UTILITIES, INCLUDING IRRIGATION LINES, WITH THE OWNER FOR PROPRIETARY UTILITIES AND GOPHER STATE ONE CALL AT 454-0002 (TWIN CITIES METRO AREA) OR 800-252-1166 (GREATER MINNESOTA) 48 HOURS BEFORE DIGGING. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND REPAIR OF ANY DAMAGES TO SAME. NOTIFY THE LANDSCAPE ARCHITECT OF ANY CONFLICTS TO FACILITATE PLANT RELOCATION.
15. USE ANTI-DESICCANT (WILTPRUF OR APPROVED EQUAL) ON DECIDUOUS PLANTS MOVED IN LEAF AND FOR EVERGREENS MOVED ANYTIME. APPLY AS PER MANUFACTURER'S INSTRUCTION. ALL EVERGREENS SHALL BE SPRAYED IN THE LATE FALL FOR WINTER PROTECTION DURING WARRANTY PERIOD.
16. PLANTING SOIL FOR TREES, SHRUBS AND GROUND COVERS: FERTILE FRIABLE LOAM CONTAINING A LIBERAL AMOUNT OF HUMUS AND CAPABLE OF SUSTAINING VIGOROUS PLANT GROWTH. IT SHALL COMPLY WITH MN/DOT SPECIFICATION 3877 TYPE B SELECT TOPSOIL. MIXTURE SHALL BE FREE FROM HARDPACK SUBSOIL, STONES, CHEMICALS, NOXIOUS WEEDS, ETC. SOIL MIXTURE SHALL HAVE A PH BETWEEN 6.1 AND 7.5 AND 10-0-10 FERTILIZER AT THE RATE OF 3 POUNDS PER CUBIC YARD. IN PLANTING BEDS INCORPORATE THIS MIXTURE THROUGHOUT THE ENTIRE BED BY ROTOTILLING IT INTO THE TOP 12" OF SOIL.
17. ALL PLANTS SHALL BE GUARANTEED FOR TWO COMPLETE GROWING SEASON (APRIL 1 – NOVEMBER 1), UNLESS OTHERWISE SPECIFIED. THE GUARANTEE SHALL COVER THE FULL COST OF REPLACEMENT INCLUDING LABOR AND PLANTS.
18. CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT AT LEAST 3 DAYS PRIOR TO PLANNED DELIVERY. THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT AT LEAST 24 HOURS IN ADVANCE OF BEGINNING PLANT INSTALLATION.
19. SEASONS/TIME OF PLANTING AND SEEDING: NOTE: THE CONTRACTOR MAY ELECT TO PLANT IN OFF-SEASONS ENTIRELY AT HIS/HER RISK.
DECIDUOUS POTTED PLANTS: 4/1 – 6/1; 9/21 – 11/1
DECIDUOUS /B&B: 4/1 – 6/1; 9/21 – 11/1
EVERGREEN POTTED PLANTS: 4/1 – 6/1; 9/21–11/1
EVERGREEN B&B: 4/1 – 5/1; 9/21 – 11/1
TURF/LAWN SEEDING: 4/1 – 6/1; 7/20 – 9/20
NATIVE MIX SEEDING: 4/1 – 7/20; 9/20–10/20
20. MAINTENANCE SHALL BEGIN IMMEDIATELY AFTER EACH PORTION OF THE WORK IS IN PLACE. PLANT MATERIAL SHALL BE PROTECTED AND MAINTAINED UNTIL THE INSTALLATION OF THE PLANTS IS COMPLETE, INSPECTION HAS BEEN MADE, AND PLANTINGS ARE ACCEPTED EXCLUSIVE OF THE GUARANTEE. MAINTENANCE SHALL INCLUDE WATERING, CULTIVATING, MULCHING, REMOVAL OF DEAD MATERIALS, RE-SETTING PLANTS TO PROPER GRADE AND KEEPING PLANTS IN A PLUMB POSITION. AFTER ACCEPTANCE, THE OWNER SHALL ASSUME MAINTENANCE RESPONSIBILITIES. HOWEVER, THE CONTRACTOR SHALL CONTINUE TO BE RESPONSIBLE FOR KEEPING THE TREES PLUMB THOUGHOUT THE GUARANTEE PERIOD.
21. ANY PLANT MATERIAL WHICH DIES, TURNS BROWN, OR DEFOLIATES (PRIOR TO TOTAL ACCEPTANCE OF THE WORK) SHALL BE PROMPTLY REMOVED FROM THE SITE AND REPLACED WITH MATERIAL OF THE SAME SPECIES, QUANTITY, AND SIZE AND MEETING ALL LANDSCAPE LEGEND SPECIFICATIONS.
22. WATERING: MAINTAIN A WATERING SCHEDULE WHICH WILL THOROUGHLY WATER ALL PLANTS ONCE A WEEK. IN EXTREMELY HOT, DRY WEATHER, WATER MORE OFTEN AS REQUIRED BY INDICATIONS OF HEAT STRESS SUCH AS WILTING LEAVES. CHECK MOISTURE UNDER MULCH PRIOR TO WATERING TO DETERMINE NEED. CONTRACTOR SHALL MAKE THE NECESSARY ARRANGEMENTS FOR WATER.
23. CONTRACTOR SHALL REQUEST IN WRITING, A FINAL ACCEPTANCE INSPECTION.
24. ALL DISTURBED AREAS TO BE TURF SEEDED, ARE TO RECEIVE 4" TOP SOIL, SEED, MULCH, AND WATER UNTIL A HEALTHY STAND OF GRASS IS OBTAINED.
25. ALL DISTURBED AREAS TO RECEIVE NATIVE WETLAND SEEDED, ARE TO RECEIVE ENGINEERED SOIL, SEED, MULCH, AND WATER UNTIL A HEALTHY STAND OF GRASS IS OBTAINED.

WET BASIN PLANTINGS

A. Maintaining Native Grass Areas with "No Mow Seed":
1. The native grass areas will require regular management to become established and dominated by native, non-invasive vegetation. This is critical in the first two to three years and should be recognized as a component to the success of native grass areas. Management will include both eliminating non-native and invasive vegetation along with creating ideal conditions for native plants to flourish.
2. Some invasive plants are strong competitors and without management, could hamper establishment the native planting. Invasive wetland species such as purple loosestrife, reed canary grass, and cattail exist in many urban wetlands, and may contribute seed to the created areas.
3. Non-native plant removal/management and careful monitoring is vital during the early stages of development. As native plants slowly grow and spread over the years, and as thatch builds, the site will become less vulnerable to non-native and invasive species. Without non-native and invasive plant removal/management it is highly unlikely that a diverse native plant community will become established.
4. Methods:
   a. Mowing/Weed Whipping
      1) During the first two years of plant establishment mowing/weed whipping at a height of 6 to 10 inches where feasible, during the growing season, will reduce competition from annual weeds. Mowing/weed whipping events should occur twice a year mid-July and again in early September) prior to the seed head development of reed canary grass. Mowing/weed whipping allows light to reach the small native seedlings and reduces competition from weeds for water and soil nutrients.
   b. Spot application of herbicide
      1) Individual invasive plants (including cattail) can be eradicated through wick application or spraying of herbicide. Rodeo or other Minnesota Department of Natural Resources approved herbicides for use near /in water bodies should be applied by a licensed applicator at the appropriate times to control individual plants.
   c. Eradicate large infestations with herbicide
      1) The most effective method of eradicating large colonies of plants is to wick-apply or spray them with herbicide. Use Rodeo when spray may come in contact with water and Roundup in upland situations. Repeated application will probably be necessary. Apply to green, actively growing foliage. Herbicides can effectively control herbaceous non-native vegetation when applied in spring or fall. Take great care not to apply herbicide to surrounding native plants. A very small amount of herbicide can kill a plant.
5. Schedule:
   a. Year 1: After planting, annual weeds should be mowed/weed whipped (before seed set) where feasible, to a height of six to ten inches or removed as needed. The site will likely require one to two mowing/weed whip events (mid-July and again in early September). Spot herbicide application, or hand removal, of aggressive weeds such as, purple loosestrife, reed canary grass, and cattails should also occur when the management crew is at the site to mow/weed whip. Also, at the beginning of the maintenance period any shrubs in the native grass areas should be sprayed with an appropriate herbicide:
      1) **July** (middle) - Mow/weed whip wetland (where feasible) at a height of six to ten inches.
      2) **September** (early)- Mow/weed whip wetland at a height of six to ten inches, spot spray invasive species.
   b. Year 2: Conduct an initial site visit in **May** to evaluate status of restoration and determine management tasks for the year. These will likely include:
      1) **May** - Spot spray invasive species. Mow/weed whip wetland at a height of six to ten inches (mowing may not be needed or possible depending on wetness and condition). Re-seed areas that do not meet the performance standards stated below.
      2) **September** - Spot spray invasive species.
   c. Year 3 (Contract may be fulfilled with this time) Conduct an initial site visit in **May** with to evaluate status of restoration and determine management tasks for the year. These will likely include:
      a) **May** - Spot spray invasive species. Re-seed areas that do not meet the performance standards stated below.
      b) **June/July** - Spot spray invasive species.
      c) **September** - Spot spray invasive species.
   d. Year 4 and beyond: Inspect wetland annually to assess its condition.
      1) **May-September** - Apply herbicide to invasive species. This should be required only once per year.
6. Maintenance Responsibility
   a. The applicant is responsible for completing the items of the Maintenance Plan and Performance Standards. Monitoring of the wetland mitigation areas will be completed by the applicant for a period of three years or until the mitigation basins exhibit wetland characteristics as proposed in the Wetland Permit Application. If the presence of an invasive, non-native plant species is observed during the annual monitoring event, the applicant is responsible for immediate removal of the invasive, non-native plant species following the procedures outlined in this plan.
   b. Mow the "No Mow" grass to a height of 4" twice a year. The first mowing will be in early June, the second shall be in early October.
   c. Fertilize "No Mow" in the fall.

A. Native seed around site shall conform to Minnesota Board of Water and Soil Resource with the use of mix number sft at 20lbs per acre and W3 at 15lbs per acre.
1. Seeded areas shall incorporate a no mow seed mix to aid in the establishment of the BWSR mixes.
2. The no mow mix shall include 30% Sheep Fescue, 30% Gotham Hard Fescue, 20% Chewing Fescue and 20% Miser Creeping Red Fescue spread at 175lbs per acre.



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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

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

James A. Kalkes
Registration No. 45071 Date: 08/28/2012

This certification is not valid unless wet signed in blue ink. If applicable, contact us for a wet signed copy of this survey which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary

Designed: MCB
Drawn: ERW
Approved: MCB
Book / Page:
Phase: FINAL
Initial Issue: 12/13/2011

Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION
D	08/21/12	BSO	POND 2 VALVE ADDITION
E	08/28/12	ERW	MPCA COMMENTS
F	09/19/12	SEG	CLIENT COMMENTS
G	10/09/12	BSO	BIOFILTER ADDITION
H	01/11/13	BSO	RECORD PLANS
I	02/08/13	JRE	RECORD PLANS

Sheet Title
LANDSCAPE PLAN

Sheet No. Revision
L1.01 I

Project No. MFS19051

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Appendix C
SSOM Site Suitability Workplan

Memorandum

Foth Infrastructure & Environment, LLC
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Lake Elmo, MN 55042
(651) 288-8550 • Fax: (651) 288-8551
www.foth.com

February 15, 2018

TO: Sherry Nachtigal, P.E., Minnesota Pollution Control Agency

CC: Mike Higgins, Midwest Recycling Solutions, LLC

FR: Bruce Rehwaldt, P.E., Nathan Klett, P.E., Foth Infrastructure & Environment, LLC

RE: MSF Farms/Midwest Recycling Solutions Facility (SW-662) Checklist for a Site Suitability Workplan for a SSOM Compost Facility

Introduction

MSF Farms, LLC (MFS Farms) currently owns the Good Thunder Compost Facility (Facility) operated by Midwest Recycling Solutions, LLC (Midwest Recycling Solutions) under Minnesota Pollution Control Agency (MPCA) Solid Waste Permit SW-662. Midwest Recycling Solutions is currently in the process of re-permitting the existing solid waste composting facility as a source separated organic material (SSOM) compost facility under Minnesota SSOM rules (Minnesota Rules 7035.2836). Components of the SSOM compost facility application include the Checklist for a Site Suitability Work Plan for a SSOM Compost Facility. Because Midwest Recycling Solutions is re-permitting an existing facility, the site is already suitable for composting operations. Therefore, in lieu of a Site Suitability Checklist, this memorandum has been prepared to discuss the requirements for a site suitability work plan at the Midwest Recycling Solutions Good Thunder Composting Facility.

General Site Information

The SSOM Compost Facility (Site) is located at 56437 164th Street, Good Thunder, Minnesota 56037. This site encompasses approximately 10 acres in the northwest quarter of Section 1, Township 106N Range 27W in Blue Earth County, Minnesota. Additional site information can be found in the *Permit Application for Construction and Operation* prepared by MFRA, dated May 2012. The list of all approved engineering, construction, and soils/hydrogeological plans can be found in a copy of the Site's *Application for Permit Modification* prepared by Foth, dated February 15, 2018. The most recent engineering, construction, and hydrogeological information for the Site has been certified by Brian Sperrazza, a certified Geologist and Engineer in the State of Minnesota.

Information on feedstocks, volumes, and liquid organics materials has been provided in the *Application for Permit Modification* dated February 15, 2018. In summary, feedstocks for the Facility will generally be limited to those items defined as source separated organic material according to Minnesota Rules 7035.0300, subpart 105a with the exception of compostable diapers. The Facility has been designed with a processing building and pad on which all active composting operation take place. Based on the results of the DRP, the Facility may consider an additional liquids/mixing processing building and will provide MPCA with Construction Plans and Specifications. In regards to the design of the Facility, the site is proposing to have the capacity to process 220 tons of source separated organic materials (SSOM) per day. This Facility will serve the 65,787 residents of Blue Earth County and more from the surrounding area by reducing the amount of organic and yard waste materials going to an MPCA permitted landfill, thereby extending the usable life of landfills in the region.

Location Standards

Location standard delineation has already been completed for MFS Farms composting facility. As shown in Figure 1 of Appendix H of the *Application for Permit Modification* February 15, 2018, the facility is not located in an area with karst features, within a shore land, wetland, or wild or scenic river land. Farm fields and homes surround the property. The closest home is approximately one quarter mile to the north and is owned by MFS Farms. The closest home to the south is approximately one quarter mile away. The property surrounding the Facility is currently in crop production. A location map is provided in Figure 1 of the *Application for Permit Modification* dated February 15, 2018.

Geotechnical and Soil Standards

A topographic map showing the site location has been included in Appendix E of the *Application for Permit Modification* dated February 15, 2018. A soil survey map with soils information has been provided in the *Application for Permit Modification* as Figure 3 of Appendix E. Figure 3 shows the subsurface soil conditions at the facility are made up of Minnetonka silty clay loam which meets the Available Water-Holding Capacity (AWC) and hydraulic conductivity requirements. More information on the results from the 2017 USDA NRCS web soil survey can be found in the Appendix E of the *Application for Permit Modification* dated February 15, 2018.

Conclusions

The soils information presented above provides sufficient information on the subsurface materials below the composting operations, and the discussion addresses all requirements of the Site Suitability Work Plan. The soils information illustrate that the native material 5 feet from the ground surface meet requirements according to Minnesota Rules 7035.2836, Subpart 9, item 8. Any contact water will be managed to prevent infiltration into the groundwater in accordance with Minnesota Rules 7035.2836, Subpart 9, item 4. All contact water from composting operations will be drained to a clay lined contact-water pond. Therefore, all contact water will be managed to prevent contact water from infiltrating into the groundwater.

Appendix D
Sampling and Analysis Plan

Memorandum

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February 15, 2018

TO: Sherri Nachtigal, P.E., Minnesota Pollution Control Agency (MPCA)
Eric Porcher, MPCA

CC: Kevin Fitzisimmons, MFS Farms, Inc (MFS)
Mike Higgins, Midwest Recycling Solutions, LLC (Midwest)

FR: Brian Sperrazza, P.E., P.G., Foth Infrastructure & Environment, LLC (Foth)
Bruce Rehwaldt, P.E., Foth

RE: Good Thunder Compost Site, SW-662
Environmental Monitoring System Sampling and Analysis Plan (SAP)

Foth Infrastructure & Environment, LLC (Foth) is submitting this Environmental Monitoring System Sampling and Analysis Plan (SAP) to the Minnesota Pollution Control Agency (MPCA) on behalf of the MFS Farms, Inc. and Midwest Recycling Solutions, LLC (MFS/Midwest) Good Thunder Compost Site (Site) in accordance with solid waste permit SW-662 (Permit).

The Permit Environmental Monitoring System (EMS) schedule is provided on **Table 1**.

1. Environmental Monitoring System Regulatory Basis

The methods and procedures presented in this SAP are in general accordance with those contained in the *MPCA Sampling and Analysis (SAP) Development Guidance* (MPCA, 2005) and *MPCA Quality Assurance Project Plan Guidance* (MPCA, 2012) where applicable. The regulatory basis for this SAP includes sections of Minnesota Rule 7035.2836 Compost Facilities and Minnesota Rule 7035.2815 Mixed Municipal Solid Waste Land Disposal Facilities.

In 2013 the MPCA amended the compost rules to accommodate the handling and disposal of Source Separated Organics Materials (SSOM). However, the sampling and analysis maintains ties to both compost rules and MSW rules.

2. Field Sampling Plan

The field work at the Site is currently conducted by MFS/ Midwest, and laboratory analysis by Minnesota Valley Testing Laboratories (MVTL). Foth will provide schedule coordination and sample plan (i.e. chain of custody documents) for MFS/Midwest to develop their bottle order and appropriate data deliverables. After the sampling event MFS/Midwest stores hard copy field forms, and delivers the samples to the MVTL analytical laboratory in New Ulm, Minnesota.

The monitoring locations are provided on **Figure 1**.

2.1 Event Scheduling

Routine monitoring will be conducted in accordance with the Permit as follows:

- 1st Quarter None
- 2nd Quarter March 14 – April 21
- 3rd Quarter None
- 4th Quarter October 21 - November 21

The sampling schedule for each monitoring location specified in the Permit is provided on **Table 1**. Note, the subject of the SAP only pertain to the monitoring locations listed in **Table 1**.

2.2 Pre-sampling Field Work

Before sampling, the monitoring point should be inspected to verify that:

- it is safely accessible;
- it is in satisfactory condition;
- fluid level measurements are comparable to historic ranges; and
- existing health and safety plan procedures are appropriate for actual site conditions.

Any unusual conditions, including the presence of wind-blown dust or odor in the ambient air, should be recorded in the field book and/or field form.

2.3 Field Documentation

Field documentation includes field forms and COC forms as provided in **Attachment 1**. The field form provides a written record of field conditions, field equipment used for sampling, field parameter/test results, and identification of field quality control samples. The field form also provides a means to verify that the SAP protocol was followed during a number of key steps during sampling.

The COC provides the means to verify that sample handling and preservation was compliant during sampling. The COC also provides key fields for the purposes of electronic database management including task code, sample matrix code, and monitoring point suffix for unique identification within the electronic database.

2.4 Sample Equipment and Procedures

Sample collection at the contact pond, compost, land application soil, and drain tile surface water will be conducted using disposable gloves and clean containers. Only dedicated/ disposable equipment will be used for sample collection. If non-dedicated sampling equipment is reused, an equipment blank will be collected.

Additional guidance for sample collection is provided in **Attachment 2**.

2.5 Sample Collection and Handling

Table 2 summarizes the sample container type, preservation method, and holding time for each analytical parameter set. The filling of sample containers will be completed as follows:

1. Individually prepared bottles will not be opened until they are to be filled with liquid or soil samples.
2. If materials used in the sampling process must be put down, they will be placed on a clean dry sheet of plastic, instead of the ground.
3. A clean pair of latex or other appropriate gloves will be donned at the onset of sampling activities at each sampling location.
4. Sampling personnel will keep their hands as clean as practical and replace gloves if they become soiled while performing sampling activities.

Bottle labels and chain-of-custody forms will be filled out by the field personnel according to procedures described below. To prevent a mix up with sample bottle identification, no sampling point specific information such as *well name* will be filled out on the label in advance of sampling.

Chain-of-custody information will be completed before leaving the sampling point. Laboratory supplied bottles will be used to assure quality control. At a minimum, sampling personnel will use their body to shield the sampling container from wind and airborne dust while filling.

2.6 Field Quality Assurance and Control Procedures

2.6.1 Quality Assurance and Control Samples

Quality Assurance and Quality Control (QA/QC) samples will be analyzed as part of the overall laboratory QA/QC program. The collection schedule for QA/QC samples is provided on **Table 1**. Results from the QA/QC samples will be reviewed prior to approval of the set of results from the sampling event. An overview of the purpose of various QA/QC samples is provided below.

2.6.1.1 Field Blanks

Field blanks are used to detect potential background or method contamination. Field blanks will be analyzed for target parameter(s). Sample containers used for field blanks will be of the same type and preservative as the primary sample container for the target parameter. Field blank samples will be assigned an identification alias (e.g. FB01) on the sample bottle label and on the COC. Laboratory-controlled, target parameter-free water will be used to fill the field blank sample container. Field blanks will be collected at a frequency of one blank per 20 primary samples (approximately 5% of the number of samples).

2.6.1.2 Equipment Blanks

Equipment blanks are used to detect potential cross-contamination resulting from inadequate decontamination procedures. Equipment blanks will be collected when non-dedicated sampling equipment is used at multiple sample locations. Equipment blanks will be collected following method required decontamination procedures. Equipment blank samples will be assigned an identification alias (e.g. EB01) on the sample bottle label and on the COC. A minimum of one equipment blank per analytical batch per method per every 20 primary samples (approximately 5% of the number of samples) will be collected and analyzed.

2.6.1.3 Trip Blanks

Trip blanks are only required for organic chemical analysis. Trip blanks are used to detect potential cross-contamination resulting from chemical diffusion between samples during transport. One trip blank will be included with each cooler containing samples for analysis of organics. The trip blank will consist of a set of two or three pre-filled 40 milliliter (ml) volatile organic analysis (VOA) vials that will be filled with laboratory controlled organic-free water, and sealed by the analytical laboratory. Trip blank samples will be assigned an identification alias (e.g. TB01) on the sample bottle label and on the COC. The vials will travel unopened in the cooler from the laboratory, to the field in the cooler, to the sampling location, and back to the laboratory, so that the blank is exposed to the same conditions as the primary samples. The vials will not be opened until they are analyzed in the laboratory along with the primary samples.

2.6.1.4 Split Samples

If a regulating authority or other group requests split sampling, the details of the event specific process will be agreed in writing, prior to initiating the sampling event. Split samples will be collected by alternatively filling the primary sample bottle and split sample bottle, for each parameter, at approximately the same time or as close in time as practical.

2.6.1.5 Blind Duplicate Samples

Blind duplicate samples are used to test for sampling and analytical reproducibility (i.e. precision). Blind duplicate samples will be collected by alternatively filling a primary set and secondary set of laboratory containers as close in time as practical. The parent sample of the blind duplicate sample will be recorded in the field book. Blind duplicate samples will be assigned an identification alias (e.g. DUP01) on the sample bottle label and on the COC sheet to avoid alerting laboratories of the parent sample. A relative percent difference (RPD) calculation will be performed between the primary (i.e. parent) and duplicate sample.

2.6.1.6 Replicate Samples for Laboratory QA

Replicate samples may be required by the laboratory to implement project matrix spike/matrix spike duplicate (MS/MSD) analyses, which consumes additional sample volume. When collecting replicate samples for laboratory QA, sampling sites with a history of low-level detections and relatively low turbidity will be selected. This will minimize potential TSS interferences during MS/MSD analyses. The number of replicate samples collected during a sampling event will depend on the analytical method, batch size and number of samples submitted and will be specified by the laboratory.

2.6.2 Field Equipment Quality Control

This section addresses the calibration and preventative maintenance of field equipment.

2.6.2.1 Field Equipment Calibration

Field measurements will be collected in the field using direct-reading meters. Instruments must be properly calibrated to produce technically valid data. Documented calibration and calibration check results verify that the instruments used for measurement are in proper working order and the data produced are reliable. Daily calibration is necessary to support the data quality objectives for this project. Documented calibrations are necessary to ensure that the data are technically and legally defensible. Each meter will be calibrated and operated in accordance with the manufacturer's instructions. In general, the following information will be recorded to document the calibration:

- name of device/instrument;
- instrument serial and/or I.D. number;
- frequency of calibration;
- date of calibration;
- results of calibration;
- name of person performing the calibration; and
- identification of calibration gases/solutions (if applicable).

Field calibration records will be maintained by MFS/ Midwest.

2.6.2.2 Preventative Maintenance

MFS/ Midwest is responsible for documenting the maintenance of field equipment prescribed in the manufacturer's specifications. Scheduled maintenance will be performed by trained personnel. The analytical laboratory is responsible for analytical equipment calibration and maintenance as described in the Laboratory Quality Assurance Manual (QAM). Subcontractors are responsible for maintenance of equipment needed to carry out subcontracted duties.

2.7 Corrective Action

Corrective actions are initiated whenever data quality indicators suggest that Data Quality Objectives (DQOs) have not been met. Corrective actions begin with identifying the source of the problem through routine operation or system audits. Potential problem sources include failure to adhere to method procedures, improper data reduction, equipment malfunctions, or systemic contamination. The first level of responsibility for identifying the problems and initiating corrective action lies with the analyst/field personnel. The second level of responsibility lies with any person reviewing the data. Corrective actions may include more intensive staff training, equipment repair followed by a more intensive preventive maintenance program, or removal of the source of systemic contamination. Once resolved, the corrective action procedure is fully documented, and if DQOs are not met, the samples in question must be recollected and/or reanalyzed utilizing a properly functioning system.

Field Corrective Actions
Failures in sampling or field measurement systems may arise from the failure of a process, human error, non-compliance with requirements, inadequate controls, environmental conditions, or sample matrix problems. Out-of-control events may include, but are not limited to, the following:

- field instrument failure;
- improper sample collection, preservation, and shipment procedures;
- incomplete field documentation, including COC records;
- incorrect decontamination procedures; and
- incorrect collection of QA/QC samples.
- sample holding times exceeded;
- pH or sample preservation exceedance;
- DQOs requirements exceeded;
- data recording errors, transcription errors, calculation errors;
- data verification errors; and
- any other situation that might affect the final data quality.

The type and extent of corrective action depends entirely on the type of analysis, type and extent of the problem, and the root cause of the problem. Corrective actions may include, but are not limited to the following:

- recalibration of instruments and/or reanalysis of samples or data;
- replacement of equipment or reagents that yield unacceptable results;
- reassignment or additional training of staff; and/or
- resampling.

All problems and quality issues will be documented in the field logs and checklists, and are reported to management in daily progress reports. The person who performs the corrective action has the responsibility for documenting closure of the issue, and the Project Director/Manager has the responsibility for communicating and documenting policies.

3. Laboratory Analysis Plan

3.1 Laboratory Standard Operating Procedures

The laboratory SOPs are listed on **Table 2**; the laboratory SOPs and Quality Assurance Manual (QAM) are available upon request.

3.2 Laboratory Analytical Parameters

Generally the contact pond, compost, land application soil, and drain tile surface water will be monitored for metals, perfluorochemicals, nutrients, agricultural index parameters, and general chemistry parameters.

The sample parameters for each monitoring event, and each monitoring location, are provided in **Table 1** and on the COCs in **Attachment 1**.

Water samples and soil samples will be analyzed for the parameters listed in **Table 3** and **Table 3**, respectively. Laboratory standard sample containers, preservatives, and hold times are presented in **Table 2**.

3.3 Laboratory Analytical Method Requirements

The analytical methods used for this project are primarily EPA, American Public Health Association (APHA), and American Water Works Association (AWWA) methods and are listed in **Table 3** and **Table 4**, respectively. The analytical methods are described in the Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (U.S. EPA SW-846, Third Edition, and its first, second and third update). Analytical preparation methods and procedures to be performed will be in accordance with the laboratory QAM and SOPs.

The laboratory QAM and SOPs are available for review upon request. Additional guidance on available laboratory methods is provided in **Attachment 2**.

Reporting limit and control limit requirements for water and soil samples are also presented in **Table 3** and **Table 4**, respectively, along with applicable standards. The surface water standards generally conform to the MN Rule 7050.0220 Subp.5a (Class 2C) Maximum Standard (MS).

3.4 Laboratory Quality Assurance and Control Procedures

This section presents QA/QC requirements relevant to analysis of samples that will be followed during project analytical activities. The purpose of the QA/QC program is to produce data of known quality that satisfy the project objectives and meet or exceed the requirements of the standard methods of analysis.

The chemical data to be collected for routine monitoring will be used to evaluate the site conditions. As such, it is critical that the chemical data be of the highest confidence and quality. Consequently, strict QA/QC procedures will be adhered to. These procedures include the following:

- adherence to strict protocols for field sampling and decontamination procedures;
- collection and laboratory analysis of appropriate blanks to monitor for contamination of samples in the field or the laboratory;
- collection and laboratory analysis of matrix spike, matrix spike duplicate, and blind duplicate samples to evaluate analytical precision and accuracy; and
- attainment of completeness goals.

Standard material used in a calibration and to prepare samples will be traceable to National Institute for Standards and Technology (NIST), EPA, or an equivalent source. The standard materials will be current. Supplies will be visually inspected prior to their use in the field or laboratory. A current inventory and appropriate storage system for these materials will ensure their integrity prior to use. Purity of supplies will be monitored through the use of standard materials and blank samples.

Sample preparation and analysis will be completed within the required method holding time. Holding time begins at the time of sample collection. If holding times are exceeded and the analyses performed, the associated results will be qualified as described in the applicable validation procedure. The following definitions of extraction and analysis compliance are used to assess holding times:

- preparation or extraction completion - completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup; and
- analysis completion - completion of all analytical runs, including dilutions, second-column confirmations, and any required re-analyses.

3.4.1 Equipment Quality Control

3.4.1.1 Method Detection Limits (MDLs)

The method detection limit (MDL) is the minimum concentration of a parameter, or compound that can be measured and reported with 99 percent confidence that the reported concentration is neither a false positive nor a false negative. MDLs are established for each method, matrix and parameter, and for each instrument used to analyze project samples. MDLs are derived using the procedures described in 40 CFR 136 Appendix B. MDLs must be established on an annual basis and will be less than applicable reporting limits for each target parameter.

3.4.1.2 Reporting Limits (RLs)

Reporting limits (RLs) for are displayed on **Table 3** and **Table 4**, respectively. Actual sample reporting limits may be higher than the listed reporting limits due to sample dilutions, matrix interference, or correction for percent moisture. In these instances, the reason for the raised reporting limits will be described in the laboratory report case narrative.

3.4.1.3 Instrument Calibration

Analytical instruments will be calibrated in accordance with the procedures specified in the applicable method. Calibrations establish the dynamic range of an instrument, generate response factors used for quantitation, and demonstrate instrument sensitivity. All parameters that are reported will be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in the reference method. Records of standard preparation and instrument calibration will be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results.

Calibration of laboratory instruments is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established detection limits. Each instrument is calibrated with standard solutions appropriate for the type of instrument and the linear range established for the analytical method. Each method contains requirements for the number and concentration of calibration standards, which are described in the laboratory's QAM and SOPs. Quantitation of contaminants will be consistent with the reporting requirements of Minnesota Rule 4740.2010 through 4740.2120. Each calibration is then verified through the use of statistical tests, continuing calibration verification standards and blanks, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and blank spikes prior to the sample results being approved.

3.4.1.4 Preventive Maintenance

Preventive maintenance procedures are essential to ensure reliable operation of laboratory equipment and instruments with minimal downtime. The frequency of routine preventive maintenance procedures should follow instrument manufacturer recommendations or be performed on an "as needed" basis.

3.4.2 Method Quality Control

Laboratory QA/QC samples include method blanks, matrix spikes, laboratory duplicates, and laboratory control samples. For the purposes of this SAP, Foth will incorporate approximately 5% of sampling for laboratory QA/QC matrix spike use.

3.4.2.1 Duplicate Samples

Matrix spike duplicates, sample duplicates, or laboratory control sample duplicates are performed by the analytical laboratory in order to evaluate the reproducibility of the sample extraction and analysis procedures. The matrix spike duplicate is prepared in the same manner as the matrix spike. The relative percent difference (RPD) of the analyses between the matrix spike and matrix spike duplicate is calculated giving an evaluation of the precision of the extraction and analysis procedures. Matrix spike duplicate or sample duplicates will be analyzed by the laboratory at a frequency of at least one per 20, or 5% of the primary samples.

In the event that data does not meet the acceptance criteria for RPD within a preparation batch, the laboratory may take corrective action according to Minnesota Rule 4740.2010 through 4740.2120. This rule discusses the analysis of a laboratory control sample/laboratory control sample duplicate (LCS/LCSD) pair concurrently with the batch of samples, which results in an acceptable measurement of accuracy.

3.4.2.2 Method Blank

A method blank sample consists of laboratory-grade water containing all of the reagents utilized in an analytical procedure. The method blank is prepared in the same manner as a sample and is processed through all of the analytical steps, including sample preparation. Method blanks are used to monitor the laboratory preparation and analysis systems for interferences and contamination from glassware, reagents, sample manipulations, and general laboratory environment.

3.4.2.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Laboratory control samples (LCS/LCSD) measure laboratory performance regarding the accuracy of the preparation process by measuring spiked target parameter recoveries in a controlled matrix. The LCS is taken through the entire sample preparation and analytical process. The LCS samples consist of laboratory reagent water or clean soil matrix (i.e., Ottawa sand) spiked with a known quantity of specific target parameters.

Analysis of the LCS indicates potential sources of contamination from laboratory procedures (e.g., contaminated reagents, improperly cleaned laboratory equipment, or persistent contamination due to presence of certain compounds in the ambient laboratory air).

3.4.2.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) measure matrix-specific method performance. The MS/MSD are prepared by adding a known quantity of target parameters to a single field sample prior to sample digestion or preparation to determine how well the target parameters can be recovered from the sample matrix. Matrix spikes are performed in order to evaluate the efficiency of the sample extraction and analysis procedures. Matrix spike data evaluation is more complex than blank or LCS data evaluation since matrix spikes measure matrix effects in addition to sample preparation and analysis effects.

3.4.2.5 Interference Check Sample (ICS)

An interference check sample (ICS) is a solution containing known concentrations of both interfering and parameter elements. For inductively coupled plasma spectroscopy (ICP) analysis, ICSs can be used to verify backgrounds and correction factors.

3.4.2.6 Surrogates

Surrogates are organic compounds that are similar to the target parameters in chemical composition and behavior in the analytical process, but that are not normally found in nature. Surrogates are spiked into field and QA/QC samples prior to extraction and analysis for specified organic analyses. Percent recoveries for these compounds are used to evaluate accuracy, method performance, and extraction efficiency.

3.4.2.7 Confirmation

Quantitative confirmation of results at or above the reporting limit for samples analyzed by a gas chromatograph (GC) will be completed within the method-required holding times. For GC methods, a second, dissimilar column is used for confirmation. If detections are above the respective GC/mass spectrometer (GC/MS) detection limits, GC/MS methods can be utilized for confirmation of volatile compounds.

3.4.2.8 Internal Standards

Internal standards are measured amounts of method-specified compounds added to field and QA/QC samples after sample preparation, or extraction, for qualitative and quantitative instrument analysis. Internal standards are added to samples, controls, and blanks in accordance with method requirements to identify column injection losses, purging losses, or viscosity effects. These compounds serve to give a standard of retention time and response factor for quantitation. Internal standards can correct for column injection losses, purging losses, or viscosity effects. Acceptance limits for internal standard recoveries are set forth in the applicable method. If the internal standard recovery falls outside of acceptance criteria, the instrument will be checked for malfunction and reanalysis of the sample will be performed after any problems are resolved.

3.4.2.9 Retention Time Windows

Retention time windows will be established as described in SW-846. Retention time windows are used for qualitative identification of parameters and are calculated based on multiple, replicated analyses of a respective standard. Retention times are checked on a daily basis and acceptance criteria. If the retention time falls outside the respective window, corrective actions will be taken. The instrument will be recalibrated after any retention time window failure and the affected samples reanalyzed.

3.4.3 Quality Control Practices

The following subsections discuss the parameters involved with quality control procedures and define the steps necessary for implementation.

3.4.3.1 Holding Time Compliance

Sample preparation and analysis must be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection.

3.4.3.2 Control Charts

Control charts are used to track the performance of laboratory control sample recoveries over time. These charts are useful in identifying trends and problems in an analytical method.

3.4.3.3 Standard Materials

Standard materials used in calibration and to prepare samples will be traceable to National Institute Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent approved source.

3.4.3.4 Supplies and Consumables

The laboratory will inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials.

3.5 Data Review

The project laboratory is responsible for reviewing 100 percent of the analytical data to ensure that it meets the requirements specified in SW-846. The laboratory system for ensuring valid data includes reviews of the instrument printouts, sample preparation information, calibration information, MS/MSD results, LCS results, method/instrument blanks, and laboratory duplicate results. Data review is performed to assess whether there are non-conformances with the analytical method protocols or project-specific requirements, and to correct problems discovered. The laboratory analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by a supervisor. The laboratory QA/QC Manager shall perform a 100 percent review of 10 percent of the completed data packages, and the laboratory project manager shall perform a review check on all the completed data packages.

3.6 Laboratory Analytical Report

The laboratory analytical report is typically a stand-alone report that is provided as an attachment or appendix. The laboratory analytical report typically includes the following data and summary forms:

- Cover letter;
- Detailed case narrative description;
- Cross-reference of field sample identifications (ids) and laboratory ids
- Sample results and method reference;
- Dates sampled and analyzed;
- COC forms, including air-bill numbers or a copy of the bill of lading;
- Documentation of the sample condition upon receipt (as a separate form or on the COC), including cooler temperature;
- A typed report of qa/qc results and acceptance limits that include:
  - Method blanks
  - Surrogate recoveries
  - Precision (laboratory duplicates)
- Accuracy (MS/MSD, LCS, blank spikes, second source standard checks)
- Initial calibration and continuing calibration summary report;
- Detection/reporting limits;
- Approval signature from a responsible officer of the laboratory; and
- Name and identification of the laboratory, including the state license number.

3.7 Data Quality Metrics

The data quality will be measured and evaluated in terms of the following specific data quality metrics:

- precision;
- accuracy;
- representativeness;
- comparability;
- completeness; and
- sensitivity.

Table 5 summarizes the relationship between data quality metrics and QA/QC analyses. Several of these metrics are more qualitative in nature (i.e., representativeness and comparability).

Table 6 provides the calculations used for evaluating the data quality metrics. The following sections describe the data quality indicators and their measurement technique.

3.7.1.1 Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. MS/MSD, LCS/LCSD, and laboratory duplicates are used to determine the precision of the analytical method. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. The precision measurement is determined by calculating the RPD between the duplicate sample results.

The formula for the calculation of precision is provided in **Table 6** as relative percent difference (RPD).

3.7.1.2 Accuracy

Accuracy is a measure of the bias of a method (i.e., the level of agreement of a measurement with a known true value) and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Accuracy is impacted by errors introduced through the sampling and analytical process, handling, analytical procedures, and the sample matrix. Analytical accuracy is measured by comparing the percent recovery of spiked parameters (e.g., MS/MSD or LCS/LCSD) to a control limit. For volatile and semi-volatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of trip blanks will monitor errors associated with sample preservation and handling.

The formula for calculation of accuracy is included in **Table 6** as percent difference (%D).

3.7.1.3 Representativeness

Representativeness is the degree to which sample data accurately and precisely represent selected characteristics of the media sampled. Representativeness of data collection is addressed by careful preparation of sampling and analysis programs. This SAP addresses representativeness by specifying sufficient and proper numbers and locations of samples; incorporating appropriate sampling methodologies; specifying proper sample collection techniques and decontamination procedures; selecting appropriate laboratory methods to prepare and analyze waters and soils; and establishing proper field and laboratory QA/QC procedures. Representativeness will be evaluated using holding time criteria, sample preservation, and method blanks.

3.7.1.4 Completeness

Completeness is the amount of valid data obtained compared to the amount that was expected under ideal conditions. Completeness is evaluated qualitatively and quantitatively. The qualitative evaluation is determined as a function of all events contributing to the sampling event. This includes samples arriving at the laboratory intact, properly preserved, and in sufficient quantity to perform the requested analyses. The quantitative description of completeness is defined as the percentage of QA/QC parameters that are acceptable. QA/QC parameters assessed for quantitative determinations of completeness include surrogate percent recoveries, MS/MSD percent recoveries and RPDs, LCS percent recoveries, field sample and duplicate RPDs, and holding times. Completeness is calculated and reported for each method, matrix and parameter combination. The number of valid results divided by the number of possible results, expressed as a percentage, determines the completeness of the data set. The objective for completeness is to recover at least 90 percent of the planned data to support field efforts.

The formula for calculation of completeness is included in **Table 6** as percent completeness (% complete).

3.7.1.5 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. The objective of comparability is to ensure that data developed during the investigation are comparable to site knowledge and adequately address applicable criteria or standards. Comparability of data is maximized through the use of standard operating procedures in the field and the laboratory, standardized analytical methods, and consistent units of measure.

3.7.1.6 Sensitivity

Sensitivity is a measure of the analytical detection or quantification limits. A detection is the minimum amount of parameter that can be consistently measured and reported with a high degree of confidence that the parameter concentration is above background response. A quantification limit or reporting limit is that amount that can be consistently quantified with acceptable precision and accuracy.

A list of reporting limits and applicable regulatory thresholds for target parameters are shown in **Table 3** and **Table 4**, respectively. Note, according to rule (7035.2815 Subp. 4(I)) if a reporting limit is above an applicable standard, non-detects are assumed below the applicable standard. The reporting limits for the parameters in **Table 3** and **Table 4** are below applicable standards.

3.8 Corrective Action

The internal laboratory corrective action procedures and a description of out-of-control situations requiring corrective action shall be contained in the laboratory QAM. At a minimum, corrective action will be implemented when control chart warning or control limits are exceeded, method QA/QC requirements are not met, or holding times are

exceeded. Out-of-control situations are required to be reported to the contractor Project Manager within two working days of identification. In addition, a corrective action report, signed by the laboratory Director or Project Manager and the laboratory QA/QC Manager, will be provided to the project team. The need for corrective action may be identified by system or performance audits or by standard QA/QC procedures. The essential steps in the laboratory corrective action system will be:

- Checking the predetermined limits for data acceptability beyond which corrective action is required;
- Identifying and defining problems;
- Assigning responsibility for investigating the problem;
- Investigating and determining the cause of the problem;
- Determination of a corrective action to eliminate the problem (this may include reanalysis or re-sampling and analysis);
- Assigning and accepting responsibility for implementing the corrective action;
- Implementing the corrective action and evaluating the effectiveness;
- Verifying that the corrective action has eliminated the problem;
- Documenting the corrective action taken; and
- Reporting the corrective action to management.

For each measurement system, the laboratory QA/QC Manager will be responsible for initiating the corrective action and the laboratory supervisor will be responsible for implementing the corrective action. The corrective action taken will depend on the QA/QC results that did not meet the necessary criteria, and may include re-extraction, re-analysis, qualifying the data, re-sampling, or changing a laboratory procedure.

Tables

Table 1
SW-662 Monitoring Schedule

Sample Location	Daily?	Field Parameters	Target Field Measurement Dates				Laboratory Analytical Parameters	Target Sampling Dates			
			Qtr 1	Qtr 2	Qtr 3	Qtr 4		Qtr 1	Qtr 2	Qtr 3	Qtr 4
1. Curing Pad Compost	Yes	Temp, PFRP	January	April	June	October	NA	NA	NA	NA	NA
2. Land Application Soil (CS-1, CS-2, CS-3)	NO	Sp Con, Moisture Content	NA	April	June	October	organics, metals, anions, cations, wet chemistry	NA	NA	NA	October[a]
3. Finished Compost (FC-1)	NO	Temp, PFRP	NA	April	June	October	organics, metals, anions, cations, wet chemistry	NA	March	NA	October
4. Drain Tile Surface Water (DT-1)	NO	pH	NA	April	June	October	organics, metals, anions, cations, wet chemistry	NA	March	NA	October[b]
5. Contact Pond (CP-1)	NO	pH	NA	April	June	October	organics, metals, anions, cations, wet chemistry	NA	March	NA	October[c]
Field QA/QC Samples										NA	
Trip Blank[1]	NA	NA	NA	NA	NA	NA	organics	NA	March	NA	October
Field Blank[2]	NA	NA	NA	NA	NA	NA	metals, anions, cations, wet chemistry	NA	March	NA	October
Blind Duplicate[3]	NA	NA	NA	NA	NA	NA	metals, anions, cations, wet chemistry	NA	March	NA	October
Equipment Blank[4]	NA	NA	NA	NA	NA	NA	metals, anions, cations, wet chemistry	NA	March	NA	October
Lab QA/QC Samples										NA	
Method Blank[5]	NA	NA	NA	NA	NA	NA	organics (PFCs), metals, anions, cations, wet chemistry	NA	March	NA	October
LCS/LCSD[6]	NA	NA	NA	NA	NA	NA	organics (PFCs), metals, anions, cations, wet chemistry	NA	March	NA	October
MS/MSD[7]	NA	NA	NA	NA	NA	NA	organics (PFCs), metals, anions, cations, wet chemistry	NA	March	NA	October
Surrogate[8]	NA	NA	NA	NA	NA	NA	organics (PFCs)	NA	March	NA	October

Notes:
1- Trip Blanks were collected and analyzed at a frequency of 1/event.
2- Field Blanks were collected and analyzed at a frequency of 1/event.
3- Blind Duplicates were collected and analyzed at a frequency of 1/event.
4- Equipment Blanks were collected and analyzed at a frequency of 1/event, as appropriate when non-dedicated equipment is used for sampling.
5- Method Blanks were analyzed by the laboratory at a frequency of 1 per analytical batch (or every 20 samples whichever is less).
6- LCS/LCSDs were analyzed by the laboratory at a frequency of 1 per analytical batch (or every 20 samples whichever is less).
7- MS/MSDs were analyzed by the laboratory at a frequency of 1 per analytical batch (or every 20 samples whichever is less).
8- Surrogates were analyzed by the laboratory at a frequency of 1 per analytical batch (or every 20 samples whichever is less).
QA/QC- Quality Assurance/ Quality Control
NA- Not Applicable

a = land application composite soil sample will be analyzed for PFCs during fall quarter only.
b = contact pond sample will be analyzed for PFCs during fall quarter only.
c = drain tile surface water sample will be analyzed for PFCs during the fall quatter only.

Prepared by: BMS2
Checked by: NOK

Table 2

Laboratory Analytical Preservation Requirements

Analytical Parameter	Analytical Method	MVTL SOP	Container Type	Preservation	Holding Time
eH, Laboratory	ASTM D1498-76	E49923	100 mL Plastic	None	Immediate
pH, Laboratory	SM 4500-H+ B	40-21007	100 mL Plastic	None	Immediate
Specific Conductance, Laboratory	SM 2510 B	40-23012	1 L Plastic	Cool to ≤6°C	28 days
Biochemical Oxygen Demand (BOD)	SM 5210 B	40-21003	1 L Plastic	Cool to ≤6°C	48 hours
Chemical Oxygen Demand (COD)	EPA 410.4	40-23011	100 mL Plastic	H2SO4 to pH < 2 and cool to ≤6°C	28 days
Total Dissolved Solids (TDS)	SM 2540 C	40-21005	1 L Plastic	Cool to ≤6°C	7 days
Total Suspended Solids (TSS)	USGS I-3765-85	40-21002	1 L Plastic	Cool to ≤6°C	7 days
Nitrogen, Total Kjeldahl	SM 4500-Norg B; SM4500-NH3 C	40-25001	500 mL Plastic	H2SO4 to pH < 2 and cool to ≤6°C	28 days
Alkalinity, Bicarbonate	SM 2320 B	40-23004	100 mL Plastic	Cool to ≤6°C	14 days
Chloride	SM 4500-Cl E	40-22003	100 mL Plastic	None	28 days
Sulfate	ASTM D516-02	40-22002	100 mL Plastic	Cool to ≤6°C	28 days
Sulfide	SM 4500-S2- F	40-23003	500 mL Plastic	NaOH to pH >9 and cool to ≤6°C. Add 2 mL Zn Acetat	7 days
Fluoride	SM 4500-F- C	F45423	500 mL Plastic	None	28 days
Nitrate+Nitrite-N	EPA 353.2	40-22001	100 mL Plastic	H2SO4 to pH < 2 and cool to ≤6°C	28 days
Cyanide	SM 4500-CN E	C95023	500 mL Plastic	NaOH to pH >12 and cool to ≤C°C	14 days
Nitrogen, Ammonia	EPA 350.1/ SM 4500-NH3 B and C	40-22007	500 mL Plastic	H2SO4 to pH < 2 and cool to ≤6°C	28 days
Metals	EPA 200.7/ 200.8/ 6010C/ 6020A	40-24011	1 L Plastic	HNO3 to pH <2	6 months
Mercury	EPA 245.7	40-24004	500 mL Plastic	HNO3 to pH <2	28 days
Phosphorus	EPA 365.1	40-22006	250 mL Plastic	H2SO4 to pH < 2 and cool to ≤6°C	28 days
Perfluoro-compounds (PFC)	DV-LC-0012	Subcontracted	1 L Plastic	Cool to ≤6°C	7 days

Table 5

Data Quality Metric and Evaluation Criteria

Data Quality Metric	Quality Control Analysis	Applicable Methods	Collection Frequency	Evaluation Criteria
Precision	Blind Duplicate	Organics/Inorganics	5% of primary samples	RPD
	Split Sample	Organics/Inorganics	NA	RPD
	MS/MSD	Organics/Inorganics	Per analytical batch	RPD
	LCS/LCSD	Organics/Inorganics	Per analytical batch	RPD
	Laboratory Duplicate	Inorganics	Per analytical batch	RPD
Accuracy	Surrogates	Organics	As required by analytical method	Percent recovery
	MS	Organics/Inorganics	Per analytical batch	Percent recovery
	LCS	Organics/Inorganics	Per analytical batch	Percent recovery
Representativeness	Method Blanks	Organics/Inorganics	Per analytical batch	Qualitative
	Trip Blanks	Organics	One per event	Qualitative
	Field Blanks	Inorganics	Per primary Mercury sample, 5% of primary samples for other analytes	Qualitative
	Equipment Blanks	Organics/Inorganics	5% of primary samples	Qualitative
	Blind Duplicate	Organics/Inorganics	5% of primary samples	Qualitative
	Split Samples	Organics/Inorganics	NA	Qualitative
	Holding Times	Organics/Inorganics	Applicable to all methods	Qualitative
Comparability	Field Procedures	Organics/Inorganics	--	Qualitative
	Analytical Methods	Organics/Inorganics	--	Qualitative
	Units of Measure	Organics/Inorganics	--	Qualitative
Completeness	Valid Data	Organics/Inorganics	--	Percent acceptable data
Sensitivity	Reporting Limits	Organics/Inorganics	--	Qualitative

Notes:
Equipment blanks are not collected if dedicated sampling equipment is used
LCS/LCSD – Laboratory control sample/ laboratory control sample duplicate
MS/MSD – Matrix spike/matrix spike duplicate
NA- not applicable (currently)
RPD – Relative percent difference

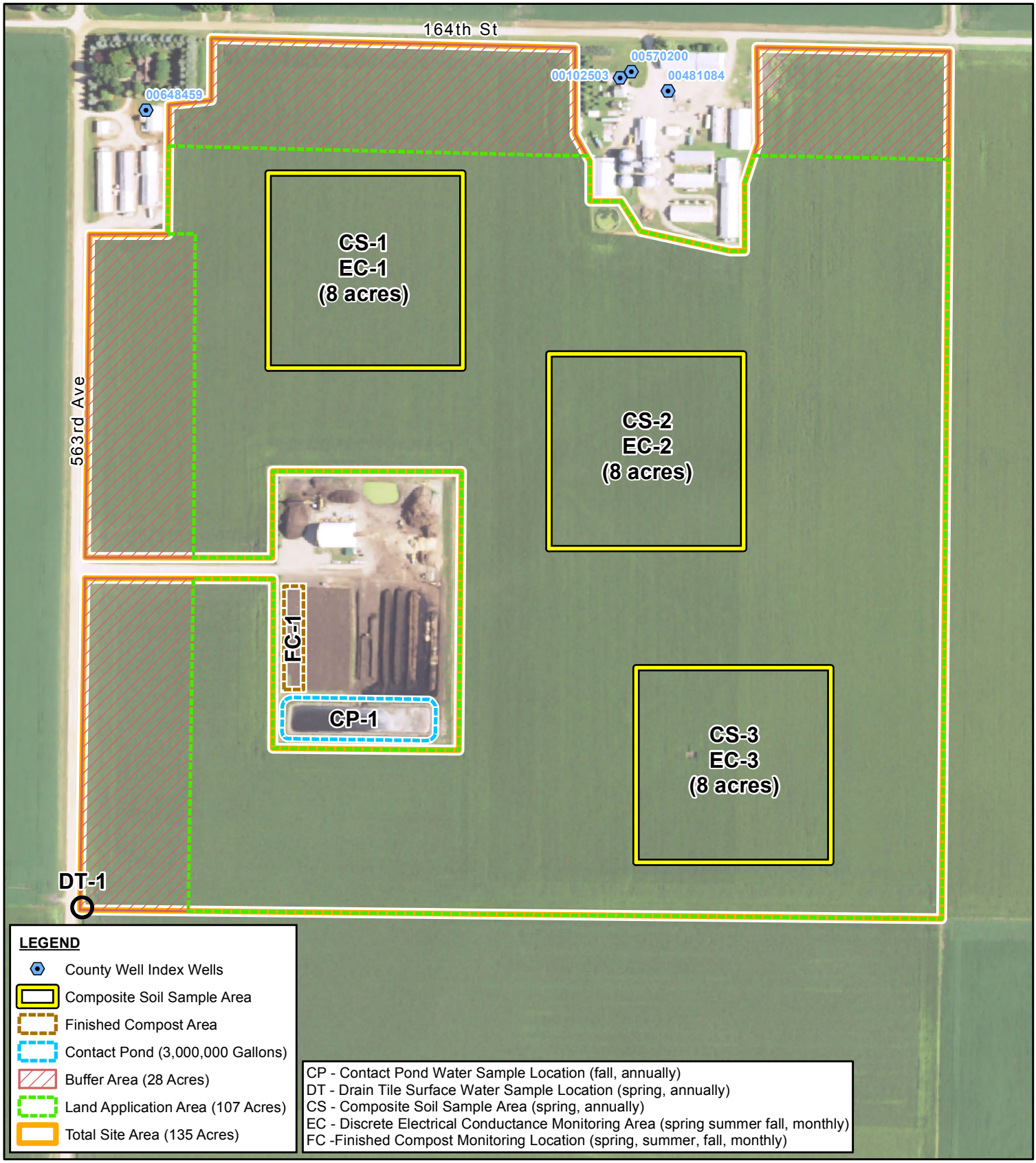
Table 6

Data Quality Calculations

Statistic	Symbol	Formula	Definition	Uses
Relative Standard Deviation	RSD	$\frac{s}{\overline{x}} \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	% D	$\left(\frac{(X_1 - X_2)}{X_1}\right) \times 100$	Measure of the difference of two observations	Used to assess accuracy
Relative Percent Difference	RPD	$\left(\frac{(X_1 - X_2)}{(X_1 + X_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	% R	$\left(\frac{\begin{matrix}value\ of \\ spiked \\ sample\end{matrix} - \begin{matrix}value\ of \\ unspiked \\ sample\end{matrix}}{value\ of\ added\ spike}\right) \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision
Percent Completeness	% Complete	$\left(\frac{number\ of\ usable\ results}{number\ of\ reported\ results}\right) \times 100$	Measure of valid, usable data	Used to assess data completeness

Notes:
s - standard deviation
$\overline{x}$ - average analyte concentration
X - observed analyte concentration

Figures



NOTES:
1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).

Foth

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0 200 400 Feet

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

MIDWEST RECYCLING SOLUTIONS

FIGURE 1

ENVIRONMENTAL MONITORING LOCATIONS
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: FEBRUARY 2018	Revision Date:	
Drawn By: BJW1	Checked By: BMS2	Scope: 16M185

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 1 - Environmental Monitoring Locations.mxd Date: 2/15/2018

Attachment 1

Field Form and Chain-of-Custody

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: of

Cooler # _____ of _____

COC #

Required Ship to Lab:

Lab Name:	MN Valley Testing Laboratory
Address:	1126 North Front Street
New Ulm MN 56073	
Lab PM:	Dave Smahel/ Tim Portner
Phone/Fax:	(800)782-3557/ (507)276-8089
Lab PM email	dsmahel@mvtl.com tportner@mvtl
Applicable Lab Quote #:	

Required Project Information:

***Facility ID #:**	SW-662 MFS/Midwest
***Task Code #**	18Q4_18M046
Site Address	16225 563rd Avenue
City	Good Thunder
State	MN, 56037
Project Contact:	Kevin Fitsimmons/ Brian Sperrazza
Phone/Fax:	(507)317-0746/ (651)288-8584
Email:	

Required Invoice Information:

Send Invoice to:	Kevin Fitzsimmons at mfs@mwrecyclingsolutions.com
Address:	56437 164th Street
City/State	Good Thunder, MN
Ph #:	507-317-0746
Foth Project Number:	18M046
Send EDD to:	Brian Sperrazza at Brian.Sperrazza@foth.com
CC pdf report to	Brian Sperrazza at Brian.Sperrazza@foth.com
CC pdf report to	Kevin Fitzsimmons at mfs@mwrecyclingsolutions.com

TAT: Standard 10 day	X	Rush		Mark One
If Rush, Date due				
QC level Required: Standard	X	Special		Mark one
Lab Project ID (lab use)				

Requested Analyses

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	SURFACE WATER	WS
GROUND WATER	WG	WATER QC	WQ
WASTE WATER	WW	SLUDGE	SL
FREE PRODUCT	LF	LF LEACHATE	WL
SOIL	SO	LF CONDENSATE	LC
OIL	OIL		
WIPE	SW		
AMBIENT AIR	AA		
SVE AIR	AE		
SOIL GAS	GS		

Sample Type Codes

TYPE	
NORMAL	N
FIELD DUPLICATE	FD
FIELD BLANK	FB
TRIB BLANK	TB
LOW-LEVEL HG BLANK	FBLL
COMPOSITE	C
GRAB	G

ITEM #	*SAMPLE ID Samples IDs MUST BE UNIQUE	*MATRIX CODE	Sample Type Code	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Filtered (Y/N) MVTL: As, B, Cd, Cr, Cu, Pb, Hg, Ni, P, Se, Zn, K, Na- by EPA 6010	Midwest Labs Inc.: USDA soil texture, soluble salts, bulk density	SC, %moisture (field)	extrct. Boron	S1ABasic: OM(LOI), extrct.P(Olsn<7.4<Bray), exchng.K, pH, CEC, %Sat, Bl	field capacity, wilting point	TA: PFOS, PFOA, PFBA, PFBS	Comments/ Lab Sample I.D.
1	CS-1_18Q4	SO	C			3	3								X	X	X	X	X	X	Test America PFC ONLY
2	CS-2_18Q4	SO	C			3	3								X	X	X	X	X	X	Midwest Agromoic ONLY
3	CS-3_18Q4	SO	C			3	3								X	X	X	X	X	X	
4	CS_18Q4	SO	C			1	1													X	
5																					PFC TO TEST AMERICA
6																					UNDER ORIGINAL COC
7																					
8																					
9																					
10																					
11																					
12																					

Additional Comments/Special Instructions:

MVTL to submit PFC analysis to Test America (TA)- PM Danielle Harrington (303)736-0176. Pace to request EQuIS EDDs from TA.

MVTL to submit Agronomic analysis to Midwest Laboratories (MLI)- PM John McManis (402)829-9887 MLI requested to report; extractable Phosphorus, Boron and exchangable Potassium as mg/kg AND lb/acre; CEC as meq/L AND meq/100g

MVTL to run total metals analysis only, and submit pdf report, pdf invoice, and EQuIS EDDs to Foth.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

Sample Receipt Conditions

	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD: (mark as appropriate) SAMPLER NAME AND SIGNATURE

UPS COURIER FEDEX

US MAIL

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed Time:

Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?

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Lab PM email	dsmahel@mvtl.com tportner@mvtl
Applicable Lab Quote #:	

Required Project Information:

***Facility ID #:**	SW-662 MFS/Midwest
***Task Code #**	18Q4_18M046
Site Address	16225 563rd Avenue
City	Good Thunder
State	MN, 56037
Project Contact:	Kevin Fitsimmons/ Brian Sperrazza
Phone/Fax:	(507)317-0746/ (651)288-8584
Email:	

Required Invoice Information:

Send Invoice to:	Kevin Fitzsimmons at mfs@mwrecyclingsolutions.com
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TAT: Standard 10 day	X	Rush		Mark One
If Rush, Date due				
QC level Required: Standard	X	Special		Mark one

Lab Project ID (lab use)

Requested Analyses

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	SURFACE WATER	WS
GROUND WATER	WG	WATER QC	WQ
WASTE WATER	WW	SLUDGE	SL
FREE PRODUCT	LF	LF LEACHATE	WL
SOIL	SO	LF CONDENSATE	LC
OIL	OIL		
WIPE	SW		
AMBIENT AIR	AA		
SVE AIR	AE		
SOIL GAS	GS		

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TYPE	
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FIELD DUPLICATE	FD
FIELD BLANK	FB
TRIB BLANK	TB
LOW-LEVEL HG BLANK	FBLL
COMPOSITE	C
GRAB	G

ITEM #	*SAMPLE ID Samples IDs MUST BE UNIQUE	*MATRIX CODE	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Filtered (Y/N) MVTL: As, Cd, Cu, Pb, Hg, Ni, Se, Zn- by EPA 6010	PCBs- by EPA8080	Filtered (Y/N) Midwest Labs Inc.: USDA soil texture, soluble salts, bulk density	Solvita Test	S1ABasic: OM(LOI), extrct.P(Olsn<7.4<Bray), exchng.K, pH, CEC, %Sat, Bl	Carbon/ Nitrogen by EPA 9060	Filtered (Y/N) TA: PFOS, PFOA, PFBA, PFBS	Comments/ Lab Sample I.D.
1	FC-1_18Q4	SO	C			3	3								X	X	X	X	X	X	X	Test America PFC ONLY
2																						Midwest Agromoic ONLY
3																						
4																						
5																						PFC TO TEST AMERICA
6																						UNDER ORIGINAL COC
7																						
8																						
9																						
10																						
11																						
12																						

Additional Comments/Special Instructions:

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MVTL to run total metals analysis only, and submit pdf report, pdf invoice, and EQuIS EDDs to Foth.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

SHIPPING METHOD: (mark as appropriate) UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed Time:

Sample Receipt Conditions

	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Temp in °C | Samples on Ice? | Sample intact? | Trip Blank?

CHAIN-OF-CUSTODY / Analytical Request Document

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Cooler # _____ **of** _____

COC #

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Address:	1126 North Front Street	***Task Code #**	18Q4_18M046	Address:	56437 164th Street			If Rush, Date due			
New Ulm MN 56073		Site Address	16225 563rd Avenue	City/State	Good Thunder, MN	Ph #:	507-317-0746	QC level Required: Standard	X	Special	Mark one
Lab PM:	Dave Smahel/ Tim Portner	City	Good Thunder	State	MN, 56037	Foth Project Number: 18M046		**Lab Project ID (lab use)**			
Phone/Fax:	(800)782-3557/ (507)276-8089	Project Contact:	Kevin Fitsimmons/ Brian Sperrazz	Send EDD to:	Brian Sperrazza at Brian.Sperrazza@foth.com			**Requested Analyses**			
Lab PM email	dsmahel@mvtl.com tportner@mvtl	Phone/Fax:	(507)317-0746/ (651)288-8584	CC pdf report to	Brian Sperrazza at Brian.Sperrazza@foth.com			Filtered (Y/N)			
Applicable Lab Quote #:		Email:		CC pdf report to	Kevin Fitzsimmons at mfs@mwrecyclingsolutions.com			N	N	N	N

Valid Matrix Codes

MATRIX		MATRIX	
DRINKING WATER	WP	SURFACE WATER	WS
GROUND WATER	WG	WATER QC	WQ
WASTE WATER	WW	SLUDGE	SL
FREE PRODUCT	LF	LF LEACHATE	WL
SOIL	SO	LF CONDENSATE	LC
OIL	OIL		
WIPE	SW		
AMBIENT AIR	AA		
SVE AIR	AE		
SOIL GAS	GS		

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FIELD DUPLICATE	FD
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GRAB	G

ITEM #	*SAMPLE ID Samples IDs MUST BE UNIQUE	*MATRIX CODE	Sample Type Codes TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Al, Sb, As, B, Ba, Cd, Co, Cr, Cu, Fe, Pb, Mn, Mo, Hg, Ni, P, Se, Zn, Ca, Mg, K, Na	Cl, SO4, TAlk, BicarbAlk, CarbAlk, TDS, TSS, IonBalance, SAR	NH3, TKN, NO3	E.Coli, T.Coliform	BOD (5-day), TOC	PCB	pH (field and lab)	PFOS, PFOA, PFBA, PFBS	Comments/ Lab Sample I.D.
1	CP-1_18Q4	WL	N			6	X	X	X		X				X	X	X	X	X	X	X	X	
2	DT-1_18Q4	WS	N			6	X	X	X		X				X	X	X						
3	FB01_18Q4	WDI	FB			6	X	X	X		X				X	X	X						
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Additional Comments/Special Instructions:

MVTL to submit pdf report, pdf invoice, and EQuIS EDDs to Foth.

MVTL to submit field data from COC in EQuIS EDD to Foth.

* = Required field for Foth EQuIS EDDS.

MVTL to submit MPCA EDDs to MPCA On-Line Services Open Landfill Program website, and email forward MPCA submittal confirmation to Foth

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME

SHIPPING METHOD: (mark as appropriate) UPS COURIER FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed Time:

Sample Receipt Conditions			
Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Attachment 2

Compost Sampling, Field, and Laboratory Testing Guidance

Attachment 2a

Compost Sampling Guidance

Test Method: Field Sampling of Compost Materials. Five Protocols						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	*Safety Standards*	*Market Attributes*
02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A
02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B
02.01-C	02.01-C							
		02.01-D	02.01-D	02.01-D	02.01-D	02.01-D	02.01-D	02.01-D
02.01-E	02.01-E		02.01-E			02.01-E	02.01-E	02.01-E

02.01 FIELD SAMPLING OF COMPOST MATERIALS

DISCLAIMERS

(1) The methodologies described in TMECC do not purport to address all safety concerns associated with their use. It is the responsibility of the user of these methods to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations prior to their use.

(2) All methods and sampling protocols provided in TMECC are subject to revision and update to correct any errors or omissions, and to accommodate new widely accepted advances in techniques and methods. Please report omissions and errors to the U.S. Composting Council Research and Education Foundation. An on-line submission form and instructions are provided on the TMECC web site, http://www.tmecc.org/addenda.

(3) Process alternatives, trade names, or commercial products as mentioned in TMECC are only examples and are not endorsed or recommended by the U.S. Department of Agriculture or the U.S. Composting Council Research and Education Foundation. Alternatives may exist or may be developed.

1. Source

1.1 This section covers sampling procedures for compost and composting feedstock.

1.1.1 *Method 02.01-A Compost Sampling Principles and Practices* adapted from sampling procedure documents provided by Dr. William F. Brinton, Woods End Research Laboratory, 1996.

1.1.2 *Method 02.01-B Selection of Sampling Locations for Windrows and Piles.*

1.1.3 *Method 02.01-C Sampling Plan for Composted Material*—adapted from the US EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, September, 1986. Consideration and importance was placed on sampling composted solid waste rather than sampling sediments, sludges, or soils for waste analysis. Most information remained unchanged. The majority of the information on sampling was taken from Chapter Nine, Volume II of the U.S. EPA Solid Waste - 846 Manual.

1.1.4 *Method 02.01-D Composting Feedstock Material Sampling Strategies.*

1.1.5 *Method 02.01-E Data Quality Management and Sample Chain of Custody.*

1.2 Values stated in SI units are to be regarded as the standard. Values given in parentheses are provided for information only.

2. Referenced Documents

ASTM D 5231-92, Determination of the Composition of Unprocessed Municipal Waste. *In* Annual Book of ASTM Standards, Vol. 04.08

ASTM D 4547-91, Sampling Waste and Soils for Volatile Organics. *In* Annual Book of ASTM Standards, Vol. 04.08

A Plain English Guide to the EPA Part 503 Biosolids Rule. US EPA Office of Wastewater Management. EPA/832/R-93/003, September 1994.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. US EPA SW-846. 3rd Edition, September, 1986.

Statistical Quality Control Handbook. Western Electric Company, Inc. 2nd Edition. 1958.

3. Terminology

3.1 *aliquot, n*—a sub-sample of a material prepared for, and subjected to laboratory analysis. A sub-sample size smaller than 1 g may be used to represent more than 1000 kg of compost.

3.2 *attribute verification, n*—a laboratory protocol that includes standard reference materials, checks and blanks to validate analytical determinations.

3.3 *confidence interval, n*—a statistical range with a specified probability that a given parameter lies within that range. The magnitude of the range increases as the specified probability is increased.

3.4 *process monitoring, n*—samples collected at predetermined intervals within the composting process to track the targeted changes in biological, chemical and physical characteristics; key process variables in compost piles that should be monitored include porosity, oxygen percent, moisture percent, temperature, retention time or age.

3.5 *process variability, n*—deviations from optimal management procedures of compost production that

may induce deviations in the desired result and sub-optimal finished compost.

3.6 *product variability, n*—heterogeneity of the chemical, biological and physical characteristics of a compost product attributable to both the composting process and the heterogeneity of input feedstocks.

3.7 *representative sample, n*—a sample that accurately reflects the average chemical, biological and physical characteristics of interest from the source of feedstock, bulk material or compost batch in question.

3.8 *sample collection frequency, n*—retrieval of representative samples at intervals that accurately represent the status within the process step of interest for the bulk of compost in question or batch of concern.

3.9 *statistical validity, n*—determinations made from a sample that accurately represent the average characteristics of the compost of interest.

4. Sampling Collection and the Composting Process

4.1 A generalized model developed to represent the aerobic composting process is presented in Fig 02.01-1 Composting Unit Operations Model.

4.1.1 Market attribute analytical values for a finished compost vary according to the type or blend of composting feedstocks and composting process. Value-added compost products are illustrated in Chapter 01.00 Fig 01.02-A2 Composting Products Model. Sampling and testing plans must be designed to suit the feedstock used in composting, the specific approach to feedstock preparation and composting process management in each composting project, and specifically for each finished product.

4.2 *Selection of Sampling Method:*

4.2.1 *Feedstock Sampling Location*—The sampling location for composting feedstock is after feedstock recovery (step 1) has been completed. Feedstock sampling is performed after routine removal of recyclable and/or problem materials. Samples should be taken before feedstock preparation (step 2), i.e., before shredding or size reduction, and before supplemental nutrients, bulking agents or water have been added. The facility operators can provide the best information for the locations to obtain feedstock samples.

NOTE 1—Once the feedstock preparation, (step 2 of the composting process model), is completed, the actual composting process begins with the material placed in piles, windrows or reaction vessels for composting.

4.2.2 *Prepared Feedstock Sampling*—Samples should be taken after feedstock preparation before composting. Facility operators can provide the best information for the locations to obtain feedstock samples.

4.2.3 *Composting and Compost Curing Process Control Sampling Locations*—The sampling location for process monitoring during composting, step 3, and compost curing, step 6, is indicated in Fig 02.01-B1 Hypothetical Sample Collection Pattern from a Compost Pile.

4.2.4 *Finished Compost Sampling Locations*—Finished compost is expected to match the needs of the customers, and may be obtained from step 3, Composting; step 5, Compost Curing; step 6, Compost Screening and Refining; and step 7, Compost Storing and Packaging as indicated in Chapter 01.00 Fig 01.02-A2 Composting Products Model. Finished compost samples are taken from the actual product that is released for distribution to an end-user.

5. Summary of Methods

5.1 *Method 02.01-A Compost Sampling Principles and Practices*—Review of sampling design schemes adapted from sampling procedure documents provided by Dr. William F. Brinton, Woods End Research Laboratory, Inc.

5.2 *Method 02.01-B Selection of Sampling Locations for Windrows and Piles*—Descriptions of sample collection as sets of compost sub-samples collected and combined to represent the average chemical, physical and biological characteristics of the compost material for a batch windrow or pile of cured or curing compost.

5.3 *Method 02.01-C Sampling Plan for Composted Material*—Review of US EPA SW-846 sampling plan guidelines and statistical procedures for estimating required minimum number of samples.

5.4 *Method 02.01-D Composting Feedstock Material Sampling Strategies*—A representative sample of feedstock is collected to identify its chemical and physical characteristics.

5.5 *Method 02.01-E Data Quality Management and Sample Chain of Custody*—Consideration for third-party sample collection and preparation. Also, an example form and description of the parameters needed for a chain of custody report.

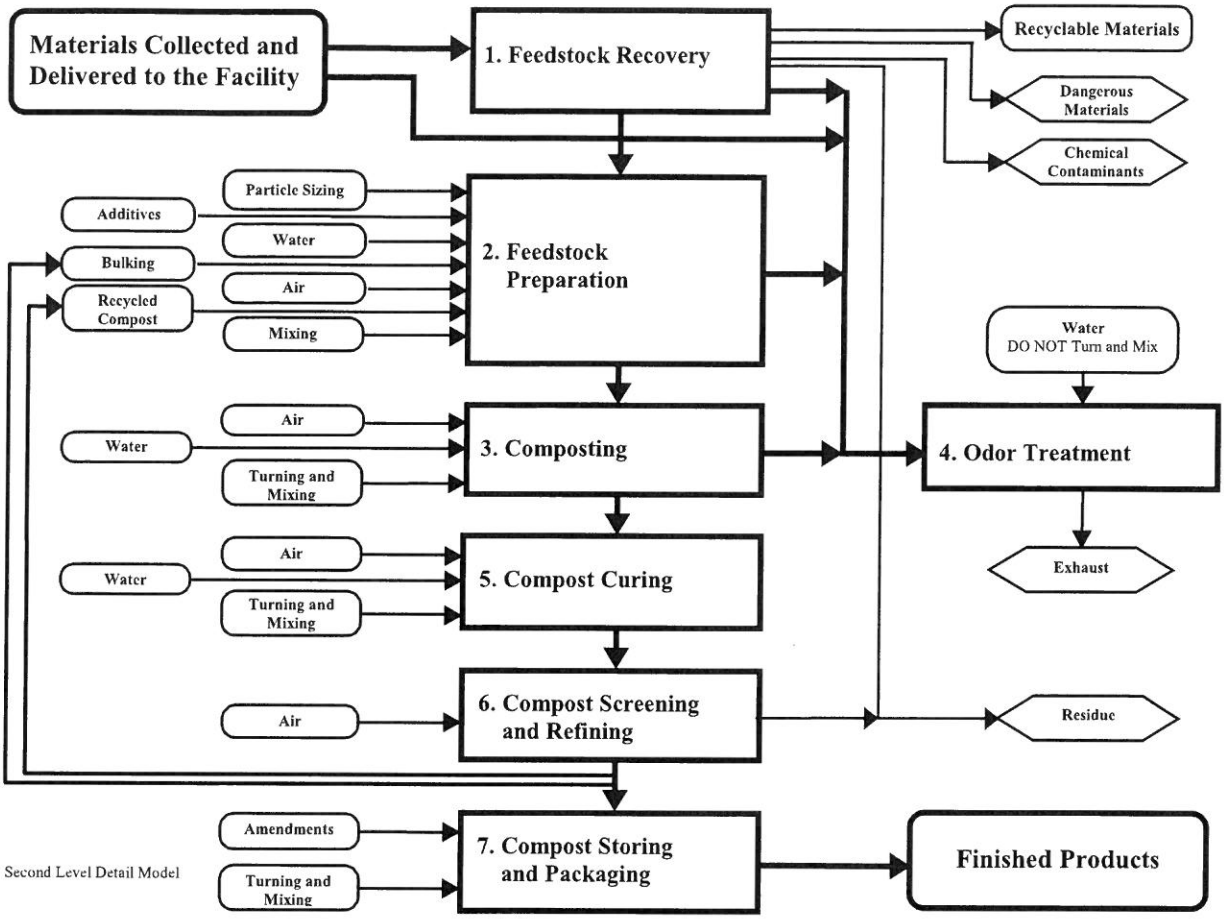


Fig 02.01-1 Composting Unit Operations Model.

6. Significance and Use

6.1 *Method 02.01-A Compost Sampling Principles and Practices*—Source of general guidelines and considerations needed to develop an appropriate compost sampling plan.

6.2 *Method 02.01-B Compost Material Sampling Strategies*—A general guide for compost sample collection and preservation from compost curing piles.

6.3 *Method 02.01-C Sampling Plan for Composted Material (from SW-846 Chapter Nine, part 1)*—The initial, and perhaps most critical element in a program designed to evaluate the physical, chemical and biological properties of a compost is the plan for sampling the material in question. It is understandable that analytical studies, with their sophisticated instrumentation and high cost, are often perceived as the dominant element in a characterization program. Yet, despite that sophistication and high cost, analytical data generated by a scientifically defective sampling plan have limited utility.

6.4 *Method 02.01-D Composting Feedstock Material Sampling Strategies*—A general guide for feedstock sample collection. Specific methods should be modified for differing feedstock materials.

6.5 *Method 02.01-E Data Quality Management and Sample Chain of Custody*—A method of tracking a collected sample from date, time and location of sampling through completion of laboratory analysis.

7. Interference and Limitations

7.1 Analytical error associated with sampling and handling is compounded when multiple properties with conflicting sampling needs are measured from the same sample. For example, it is a good idea to subdivide and remix samples repeatedly if mineral and metal tests are being performed. This improves homogeneity and reduces sample variance. Unfortunately, this same method induces excessive volatilization of some of the compounds, and causes microbial cross-contamination. Therefore, the sampling plan must specify a separate sampling and handling scheme for each test parameter that requires special sampling.

7.2 *Method 02.01-B Compost Material Sampling Strategies*—As compost heterogeneity increases, the number of sub-samples should be increased. If insufficient numbers of samples are collected, analytical results will not represent the compost in question.

7.2.1 Moisture loss or gain during sample handling and splitting may become significant. It is therefore necessary to mix and split a sample under sheltered conditions, such as inside a building where wind, temperature and sunlight or precipitation will not distort the compost moisture.

7.3 *Method 02.01-C Sampling Plan for Composted Material*—Knowledge of or access to statistical procedures is required.

7.4 *Method 02.01-D Composting Feedstock Material Sampling Strategies*—Sample heterogeneity of feedstock may be much higher than that of the finished composted product. It is crucial that all sampling plan collection procedures are followed to maximize the reliability and accuracy of the feedstock sample analytical results.

7.4.1 Moisture loss or gain during sample handling and splitting may become significant. It is therefore necessary to mix and split a sample under sheltered conditions, such as inside a building where wind, temperature and sunlight or precipitation will not distort the feedstock moisture.

8. Sample Handling

8.1 Collect samples from areas of the compost pile that are representative of the general appearance, and avoid collecting atypically moist samples (> 60% moisture, wet basis). If balls form during the process of blending and mixing of point-samples, the compost sample is too wet. Excessively moist compost will cause unreliable physical and biological evaluation.

8.2 For most feedstock or compost samples, use containers made of stainless steel, plastic, glass or Teflon. These materials will not change compost chemical quality. Laboratories provide advice on appropriate sample containers, preservatives and shipping instructions when requested.

8.3 A representative compost sample must be collected from appropriate sampling locations and consist of no less than 15 point-samples. Sampling locations along the perimeter of the compost pile where compost point-samples will be extracted and vertical distances from the ground or composting pad surface shall be determined at random, and shall be representative of the compost on the site.

8.3.1 Determine the number and types of sampling and shipping containers to be used. The composite sample is placed in a sanitized container and thoroughly mixed. Follow proper quality assurance/quality control procedures for sample preservation, storage, transportation and transfer. Sample the cured compost and aliquot 12 L (3 gal) sub-samples from the composite sample and place in a sanitized plastic container and seal.

8.3.2 Utilize the Student's "t"-test with a confidence interval of 80% to statistically analyze the test data. Refer to TMECC 02.01-A, paragraph 9.10 *Sampling Intervals* for guidance in determining sample collection frequency.

8.4 *Test Methods versus Sampling Methods*—The laboratory test method and analytical parameter of interest dictate the method of sample collection, type of container for shipping and storage of samples and sample handling procedures required. Table 02.01-1 provides a partial list of analytical traits that are affected by sample collection and handling. In general, volatile compounds and elements, physical bulk factors and microbiological samples require special considerations when developing the sampling plan.

Table 02.01-1 Partial list of test parameters that require special sampling and handling considerations.

Test Parameter	*Principle Constraint*	*Associated Error*	*Alteration of Sampling for Corrective Action*
Total-N	Volatilization loss of NH_3 during sample handling	Underestimation of total N and volatile N	Place in container quickly with minimal stirring
Volatile fatty acids (VFA)	Volatilization loss of VFA during sample handling	Underestimation of VFA content	Place in container quickly with minimal stirring
Microbiology (pathogens)	Contamination from tools, buckets, air	Over or under estimation of pathogens	Use only clean, sterile containers and implements
Bulk Density	Excess sample moisture	Overestimation of volume/weight	Take large, oversized samples

8.4.1 In each case the determination for a trait of interest can be changed adversely by improper sample collection and handling, and consequently lead to erroneous conclusions. Analytical precision or relative variability may not be affected by inappropriate sampling, but accuracy of the expected determination may be biased and incorrect.

8.5 *Containers, Post-Sample Handling*—For each type of parameter measured after sampling specific containers and holding times should be observed prior

to and during transport to a laboratory (see Tables 02.01-2 through 02.01-6). Use multiple containers to preserve sample integrity as necessary.

8.5.1 Despite the wide variation in sample holding times and condition requirements, all compost samples targeted for general testing should be chilled immediately upon collection and preparation. Refer to Tables 02.01-2 through 02.01-6 to find the most appropriate storage temperature for each test parameter of interest.

8.5.2 When plastic containers are acceptable, use double Ziploc®-type 4-8 L (1-2 gal) bags marked on the exterior with a marking pen with insoluble ink, and placed with several cool-packs in a large polystyrene cooler or similar insulated container.

8.5.3 Ship the samples to the laboratory for delivery within 24 h or less. Request that the laboratory staff store samples at 4°C when delays in lab preparation are anticipated.

8.5.4 Collection and storage of samples for organic compound analysis - polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) or volatile fatty acids (VFAs) - require glass containers with Teflon lids, or exclusively Teflon containers. Sample containers should be filled to overflowing with material to minimize airspace in the container and reduce volatilization of organic compounds during storage.

8.5.5 Include proper *Chain-of-Custody* information: date, time, name of the sampling entity and name individual responsible for sample. Refer to *Method 02.01-E Data Quality Management and Sample Chain of Custody* for an example form and description of parameters needed to complete a chain of custody report.

Table 02.01-2 *Physical Parameters:* Sampling containers and conditions for compost and source ingredient testing.

Test Parameter of Interest	*Container*	*Conditions*	*Maximum Holding Time Allowed in Lab*
Bulk Density, Hydraulic Conductivity, Porosity, Water Holding Capacity	P, G	4°C	7 d
Temperature	*NA*	*NA*	Immediate, no delay
Total Solids	P, G	4°C	24 h

NOTE 2—P=Plastic; G=Glass

Table 02.01-3 *Organic and Biological Properties:* Sampling containers and conditions for compost and source ingredient testing.

Test Parameter of Interest	*Container*	*Conditions*	*Maximum Holding Time Allowed in Lab*
Respirometry	P, G	4°C	24 h
Organic Carbon	P, G	4°C	14 d
Volatile Fatty Acids	G (2 L CWM)	4°C	14 d
Volatile Solids	P, G	4°C	14 d

NOTE 3—P=Plastic; G=Glass

Table 02.01-4 *Chemical Parameters:* Sampling containers and conditions for compost and source ingredient testing.

Test Parameter of Interest	*Container*	*Conditions*	*Maximum Holding Time Allowed in Lab*
Acidity/Alkalinity (pH), Electrical Conductivity, Kjeldahl Nitrogen, Nitrate Nitrogen (NO_3-N), Nitrite Nitrogen (NO_2-N), Ammonia Nitrogen and Ammonium Nitrogen (NH_3-N, NH_4-N), Sulfide	P, G	4°C	48 h
All other Metals	P, G	4°C	6 months
Chloride, Sulfate	P, G	4°C	28 d
Chromium VI	P, G	4°C	24 h
Mercury	P, G	4°C	28 d

NOTE 4—P=Plastic; G=Glass

Table 02.01-5 *Pathogens:* Sampling containers and conditions for compost and source ingredient testing.

Test Parameter of Interest	*Container*	*Conditions*	*Maximum Holding Time Allowed in Lab*
Enteric Virus	G	-70°C	> 8 h
Enteric Virus	SP, G	4°C	8 h
Coliforms and other bacteria	SP, G	4°C	48 h
Helminth Ova	SP, G	4°C	1 month

NOTE 5—SP=Sterilized Polypropylene; G= Sterilized Glass

Table 02.01-6 *Synthetic Organic Compounds:* Sampling containers and conditions for compost and source ingredient testing.

Test Parameter of Interest	*Container*	*Conditions*	*Maximum Holding Time Allowed in Lab*
Chlorinated Herbicides, and Chlorinated Hydrocarbons, PCB	G, Teflon lined cap (2-$^1/_2$ L.A.J.)	4°C	7 d until extraction
Chlorinated Pesticides	16 oz B.R. (2-$^1/_2$ L.A.J.)	4°C	7 d until extraction
Dioxins & Furans, Nitroaromatics and Isophorone, and Polycyclic Aromatic Hydrocarbons, PAH	G, Teflon lined cap (2-$^1/_2$ L.A.J.)	4°C store in dark	7 d until extraction
Phthalate esters	G, Teflon lined cap	4°C	7 d until extraction
Purgeable aromatic hydrocarbons	G, Teflon lined septum (40-mL Glass V)	4°C	14 d prior lab testing
Semi-Volatile Organics	G, Teflon-lined Septum (2.5-L Jug)	4°C	7 d
TCLP Sample	G, Teflon-lined Septum (2.5-L Jug)	4°C	7 d until extraction
Volatile Organic Compounds (VOC)	G, Teflon lined septum (40-mL Glass V)	4°C	14 d preserved in HCl†

NOTE 6—P=Plastic; G=Glass, HDPE=High Density Polyethylene

†—Evaluation data is being sought to confirm this requirement for curing and finished composts.

Test Method: Compost Sampling Principles and Practices						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	*Safety Standards*	*Market Attributes*
02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A	02.01-A

02.01-A COMPOST SAMPLING PRINCIPLES AND PRACTICES

COMMENT—This section was adapted from sampling procedure documents provided by Dr. William F. Brinton, Woods End Research Laboratory, 1996.

9. Justification for Compost Sampling

9.1 Sampling of compost and compost products is an essential aspect of process monitoring, quality control, marketing and labeling, and regulatory compliance. Like other functions of site management, sample collection involves carefully planned and often labor intensive activities. Four common reasons for compost sampling are described:

9.1.1 *Ingredient Analysis*—basic data on source ingredients are needed for the design of a composting process or identification of an optimal composting feedstock recipe.

9.1.2 *Process Design and Monitoring*—composting process evaluation requires information on material characteristics and process benchmarks. Specific sample collection protocol is designed for each parameter of interest.

9.1.3 *Marketing and Labeling*—specification sheets or product labels for compost are needed to compare product with others in the marketplace.

9.1.4 *Regulatory Compliance*—compost process and product requires periodic testing for compliance with specified traits including certain metals, pathogens, stability and maturity.

9.2 *Use of Sampling Data*—Sampling decisions require an understanding of the need for data collection, specifically how to sample and when to collect samples. The sampling decision tree presented in Fig 02.01-A1 illustrates a decision process to assist in the development of proper sample collection methods, to identify sampling interval and sample size, and the end use of sample data. When regulations do not apply, as is the case for recipe formulation, process monitoring for quality assurance (QA) and internal quality control (QC), it is important to clearly understand the intended use of the data and to determine the appropriate sampling procedures. For example, if C:N ratio interpretation is considered very important, then very low variations in sample carbon and nitrogen determinations become a major consideration and a sample collection process must be designed to support to this requirement.

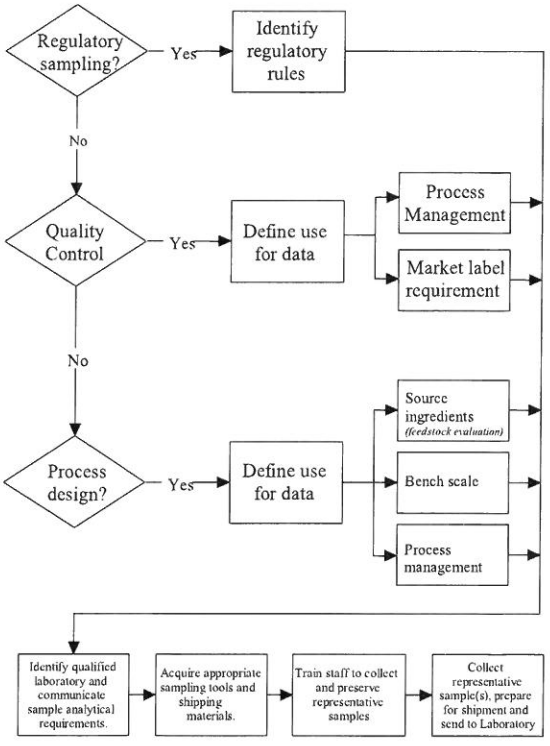


Fig 02.01-A1 Compost sampling decision tree, overview of sampling objectives.

9.3 *Types of Sampling*—Two types of sample collection are used: point-sampling and composite-sampling:

9.3.1 *point sampling*—site-specific sample collection from within the general mass is used to identify and quantify points of extreme variability, hot spots or problem zones. Point-sampling alone should not be used unless special conditions exist.

9.3.2 *composite-sampling*—a single sample for laboratory analysis composed of multiple, well-blended point- or sub-samples uniformly distributed throughout the entire volume that, after mixing, accurately represents an average or median value of the property or trait of interest for a batch or general mass. Properly implemented composite sampling is preferable for most sampling plans because it provides a reliable estimate

of the average or median property or trait of a batch or segment of a continuous stream, rather than a specific spot trait.

9.3.2.1 *stratified sampling*—a modified composite sampling scheme is used to document gradients and define heterogeneity as a function of position within the bulk or general mass of sampled material, where the general mass is subdivided into separate zones and a series of point-samples are collected and composited within each zone. Stratified sampling should be used when heterogeneity of compost is unknown and when regulatory constraints require knowledge of the relative spatial and temporal variability. This is most often based upon the standard deviation and mean; refer to Method 02.01-B for equations applied in calculations for approximating the required number of sub-samples to accurately estimate the average value for the parameter or trait of interest.

9.3.2.2 *interval sampling*—sampling from moving conveyor belts.

9.4 *Sampling Plan*—The constraints of the material and the composting technology must be considered when an optimal sampling plan is designed. Combinations of composite and point sampling are illustrated within the four sampling schemes presented in Fig 02.01-A2. The sampling scheme selected must address limitations of the selected test parameter and should not distort the analytical result.

9.4.1 Stratified sampling (Scenario A, Fig 02.01-A2) is used to determine variability, profile gradients and spatial uniformity characteristics. In most cases, composite sampling (Scenario B, Fig 02.01-A2) is satisfactory when the amount of variability within the mass is known to be insignificant. It involves combining several representative sub-samples into one composite sample that is then thoroughly mixed, then split for shipment to the laboratory. Area or batch sampling (Scenario C, Fig 02.01-A2) and single grab- or point-sampling (Scenario D, Fig 02.01-A2) are for special cases where one sample is collected at one location. Area or batch sampling is typified by a whole mass collected as one sample unit. This method is most appropriate when moving the mass from a vessel to a curing pile. A single point-sample does not provide a representative sample for the bulk mass. Batch sampling and point sampling should be employed to characterize an obvious or potential anomaly at one specific point, time or location within a process. A good example of a single point sample to detect anomalies is shown as X in Fig. 02.01-A2 D, a location referred to as the "toe" of a static aerated pile, and one which is vulnerable to suboptimal temperatures needed to achieve pathogen reduction. For this reason, it is sometimes specifically included to verify pathogen content of compost that has finished the thermophilic phase.

9.5 *Importance of Representative Sampling*—A representative sample defines a material's average characteristic, typical for the entire material being sampled. Under virtually all composting conditions, the mass of compost material is large and heterogeneous. A representative sample of compost is not easily obtained; and sampling must be repeated over time to compensate for naturally high variations. Under proper management and as compost-curing advances, variability within a curing pile or windrow will decrease.

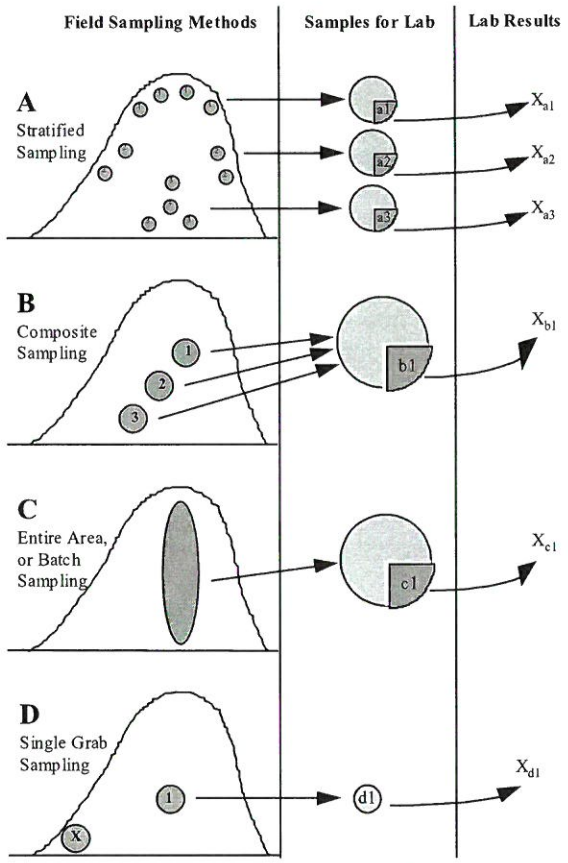


Fig 02.01-A2 The sampling schematic.

9.6 *Variables that Compromise Quality of Sampling*—Sample collection technique and variability of compost and cured compost affect the relative accuracy of sampling and the reliability of laboratory analytical determinations. Failure to adjust sampling protocols according to the nature and source of variations may invalidate test results and lead to inappropriate management or marketing decisions.

9.6.1 *Bias Introduced by the Sampler*—Inaccurate sample collection is often due to systematic or intentionally selective sampling introduced by the sampler. Significant error will result from attempts by the sample collector to counteract perceived variability. Examples include avoiding the collection of sub-

samples from wet pockets or systematically excluding large particles from the composite sample. **Deliberate bias results from an attempt by the sampler to prepare samples that appear superior in a perceived physical trait that does not actually represent the bulk or batch of interest.**

9.6.2 *Sample Heterogeneity*—The following are key sources of non-uniformity that can give rise to significant sampling errors.

9.6.2.1 *Sub-sample size* affects sampling accuracy. In general, a representative composite sample contains large (> 1000 cm^3) and plentiful sub-samples (>15 samples).

9.6.2.2 *Complete and thorough mixing* throughout the composting process improves the quality and ease of sampling. Poor initial mixing effects variability of the parameters throughout the composting process. Repeated use of turning machinery during composting improves homogeneity. However, within days or even hours after turning, mixing or re-piling, the composting mass may develop gradients of stability, moisture, bacteria and ammonia. When pre-mixing, blending or turning are not employed, as in static pile composting or compost curing, the sampling plan should include more sub-samples per composite sample to compensate for inherently high variability within the mass.

9.6.2.3 *Soil and stones* are frequently picked up during routine compost production operations. These pose problems for good sampling. In some cases, the sampler may bias the sample by deliberately excluding gravel and stones present in a compost (soil can not be easily seen). On the other hand, a laboratory that receives a sample containing stones or small gravel may not sub-sample, pre-screen, and grind, resulting in variable results. Staff responsible for sampling must correctly diagnose the situation and advise the analytical laboratory about it. In some cases, laboratories must issue disclaimers about their own sub-sampling technique.

9.6.2.4 *Foreign and non-compostable matter* almost invariability poses problems to the sampler, and also the laboratory. This is most likely the case with municipal solid waste (MSW) and certain industrial by-products where large and variable amounts of such substances are present. The best approach is to take large sub-samples and blend frequently before removing the final sub-sample for examination or testing. There is presently no generally accepted or standard practice for gauging the minimum sample size required in such situations.

9.6.2.5 *Varying particle size* is one of the most common sources of sample variability. For example, a composting feedstock mix may have exactly 27% wood chips, but inability to sub-sample adequately could result in finding anywhere from 11 to 38% wood chips. The error introduced to C:N values for samples of this range is significant.

9.6.2.6 *Layering, compaction and gradients* of composts arise as a result of inadequate initial mixing, infrequent or excessive turning/mixing during feedstock preparation, or during the composting process because of equipment/ventilation actions such as inappropriate selection and use of bulking materials. Any one or more of these can easily confound sampling attempts.

9.7 *Sampling Practice*—Sampling begins with the decision to evaluate materials and proceeds to determining how and in what time frame the sample is needed. Practical steps include identifying the important parameters to be analyzed and working backwards through the decision tree to identify how to obtain a suitable sample for the specific technology and parameter of interest. Following this process, a sampling protocol and sample log is constructed. Technological constraints sometimes present significant challenges for sampling, however, in most cases, reliable samples can be obtained once a thorough analysis of the process plan is conducted.

9.8 *Composting Technology Systems and Sample Collection*—The physical/mechanical nature of the feedstock preparation and composting operation may impose constraints on sampling. Each composting technology imposes specific limitations on sampling. Representative samples may not be obtainable with some technologies. Therefore, a facility's sampling plan must take into account the realistic strategy for obtaining representative samples. In general, highly engineered compost processes impose more constraints on sampling than a simple composting process. For example, outdoor windrows are more easily sampled than large rotating drums.

9.8.1 Ten basic types of composting systems are presented in Fig 02.01-A3 and their associated sampling constraints are outlined in Table 02.01-A1. Each system introduces particular traits or constraints that impact how (and why) samples are collected. New forms of compost technology under development may expand the list, but the generic form of the prescribed models cover most existing composting technologies.

9.8.2 *Sampling Plan Basics*—The two process-focused modes of compost sampling are: i) In-Process sampling for monitoring during a specific composting technology process; and ii) End-Process sampling. There may be multiple steps or multiple processes involved in an overall system. Sample collection for testing commonly occurs at the end of a specific step of the composting process, mostly for convenience and to be certain that the sample is representative of the batch. Sample collection during a process imposes significant constraints because of the inherent variability of in-process materials. Sampling at these points must be

carefully designed to sample across any existing gradient of non-uniformity.

9.8.3 Discussion in the following section identifies technologies and primary constraints or requirements for representative sampling.

9.8.3.1 *Type A. Home Bins* come in many shapes and sizes, from fixed solid containers, loose wooden structures to rotating solid-tanks. The appropriate framework for sampling is to select the material representing the finished product. Some systems provide doors at the bottom of a bin from which samples may be easily removed; other bins require disassembling or removal from the pile and hand-mixing of the mass. Precaution must be taken to assure a homogenous mixture under any circumstance.

NOTE 7—The inclusion of home composting bins in TMECC is not a suggestion or endorsement for regulatory control, but for information and perspective only. While home composting bins are not a mainstay of commercial composting and not currently or likely to be regulated by state or local jurisdictions when the end product is used by the home generator and producer, the principles described in TMECC for assessing overall quality of compost are suitable for use on such products.

9.8.3.2 *Type B. Turned Windrows* are either batch or continuous piles. In the former common case, the entire windrow is made from similar ingredients at about the same time (e.g., within 3 d). In the latter case, materials are added lengthwise over time. In both cases, non-uniformity is observed down the length of the pile and is greatest with continuous modes of composting. Sampling of windrows requires compositing over a discrete length, either the entire pile, or a sub-section identified to have similar age or other characteristics. Windrow turning machines are useful for preparing uniform mixtures suitable for composite sampling; however, a single pass with a turning machine will not result in an evenly mixed pile, 3-4 passes commonly are required. If turning is performed frequently, the need for multiple turns prior to sampling diminishes.

9.8.3.3 *Type C. Static Piles* are recognized for their non-uniformity. These piles exhibit gradients of temperature, aeration and exposure to elements that reduce homogeneity over time. To obtain a representative sample from a static pile, extreme disruption and mixing is required. Breaking down the pile with a bucket loader and re-mixing after removal of the outer cover may be necessary. If mixing is not complete, sub-samples should be taken from each region during pile breakdown, or from the bucket as material is removed. However, if the purpose of sampling is to characterize non-uniformity, then effort must be made to get to the region of concern where a representative sample can be collected. This could be performed using a core sampler, or by breaking open the pile with heavy equipment.

9.8.3.4 *Type D. Agitated-Bed* systems generally move compost along the length of the system at a fixed rate per day. Should sampling be necessary during the process, care must be taken to understand the variability imposed by nature of daily additions to the system. In some cases, the actual technology physically restricts access for various reasons including worker safety. In such situations, samples can be collected at the discharge end where material comes off the bin. Several sub-samples should be taken each day, cooled immediately; and several days' accumulated samples (except for bacteriological and others parameters limited by a 48 h holding time) can be composited to form a bulk sample.

9.8.3.5 *Type E. Enclosed Vessel* reactors are either circular or oblong containers, bins or towers (these systems may or may not contain internal moving parts) and cannot be easily accessed for sampling. Sample collection is best performed at the vessel's discharge end. In-process sampling for quality control and process monitoring is not always practical with these systems.

9.8.3.6 *Type F. Rotating Vessels* are horizontal tanks, usually positioned on a gradient. They are used for continuous and sometimes for batch composting. Most systems do not have ports to access the material during processing, making in-process sampling impractical. As with the enclosed vessel design, sampling is usually performed at the discharge end of the vessel. Rotating vessels are often used during "Feedstock Preparation" for many technology types, and sampling is performed on the download conveyor.

9.8.3.7 *Type G. Cure Piles* are frequently very large and may contain material composited from several piles. Because of their heterogeneity and size, and the typical lack of turning and mixing, they usually display extreme gradients of moisture, maturity and bulk density. Under these circumstances, one effective way to adequately sample is to use a large tractor loader to break into the pile, moving and mixing the materials in the process. The sampling plan must incorporate a stratified sampling scheme and point sampling to distinguish gradients and map spatial non-uniformity.

9.8.3.8 *Type H. Bagged Product* results from a mixing and screening process that is assumed to produce uniform material prior to bagging. Additional mixing of the bulk mass after bagging and prior to sampling is precluded. Therefore, a statistically representative sample must consist of many sub-samples collected from different bags. Additionally, the physical constraint of extracting small sample cores from separate bags that are palletized compounds the problems of collecting proper samples.

9.8.3.9 *Type I. Source Ingredients* are notorious for non-uniformity. Large sub-samples that accurately

represent the distribution of ingredients must be well mixed, and if possible (when appropriate), shredded to reduce the sample size while retaining sample integrity. Large mechanical equipment may improve the sample collection and preparation process.

9.8.3.10 *Type J. Lab Systems* are a special case of composting and are usually handled as a discrete sampling problem on an individual institutional basis. However, with the increasing popularity of bench scale testing, particularly for bioremediation composting, the value of describing sample units and types becomes more obvious. In general, these units contain highly uniform materials and are sometimes so small that the entire unit becomes the sample from which sub-samples are drawn for separate analyses. Because non-uniformity increases with miniaturization, lab systems are usually designed with small openings into discrete sections of tanks to facilitate extraction of small sub-samples. This allows the operator to monitor the formation of gradients and non-uniformity in miniature lab systems.

Table 02.01-A1 Sampling operations, constraints and required tools for ten types of composting technologies.

Type	*Sampling Action*	*Constraints*	*Preferred Tools*
A. Home Bins	Must open bin, remove cover and sides, and mix by hand	Not homogenous, may be hard or impossible to open	Pail and spading fork
B. Turned Windrows	Sample after turning with machine from surface of pile if well mixed	Pile varies along length, turning machine may not homogenize in one pass	5-gal pail, spading shovel, corer
C. Static Piles	Remove chip cover, and dig into depth, may require bucket loader and multiple depth sampling	Extreme non-uniformity, layering and clumping, inadvertent mixing with cover or surface residues; may be sealed inside tube	5-gal pail, spading shovel, corer or auger, bucket loader
D. Agitated-Bed	Sample after turning or agitation event, or sample discharge	Difficult access except at discharge, piles vary along length with age of source	5-gal pail, spading shovel,
E. Enclosed Vessel	Sample from side doors or top port after agitation	Very difficult or impossible access; potential layering	5-gal pail, spading shovel, corer, auger
F. Rotating Vessels	Sample from discharge/output end or take-away conveyor	Difficult or impossible to sample except at discharge; output varies with time	5-gal pail, shovel or scoop
G. Compost Curing Piles	Remove chip cover, and dig into depth, may require bucket loader and multiple depth sampling	Very large piles, non-uniformity, difficult access, compaction and layering; surface cover mixing	5-gal pail, spading shovel, corer, auger, bucket loader
H. Bagged Product	Sample multiple bags, cores drawn	Bag damage, difficult access	5-gal pail, trowel or soil-corer
I. Source Ingredients	Composite from each pile separately, remove surface	Non-uniformity may be great, poorly mixed, difficult access	Large pail, shovel; bucket loader
J. Lab Systems	Open system and remove with core sampler	Small scale, difficult access	5-gal pail, Spatula, trowel, soil-corer

9.9 *Sampling Interval*—There are no process-specific formulas that dictate sampling intervals for source ingredients and compost, except when biosolids are composted (Table 02.01-A2). Sampling intervals of composting materials for reporting purposes may be fixed by certain regulations. It is advisable to consult local or state sampling guidelines. As a general rule, incoming feedstocks should be sampled every two weeks, or every 3,000 to 5,000 tons of finished product.

9.9.1 *Formula to estimate sampling interval, d:*

$$S = T \div F \times R \qquad \textit{Equation 9.9.1}$$

where:

S = sampling interval in days, d
T = sampling threshold in tons (e.g., 4,000 t), t,
F = tons of incoming feedstock per day, t d^{-1}, and
R = weight reduction factor of incoming feedstock, %.

9.9.2 *Weight Reduction Factor, R:*

$$R = C \div F \qquad \textit{Equation 9.9.2}$$

where:

R = weight reduction factor of incoming feedstock, %,
C = mass of finished compost per week, t dw, and
F = mass of incoming feedstock per week, t dw

NOTE 1A—If the actual weight reduction factor is unknown, use 0.70 until the actual value can be determined. Refer to Method 03.09 Total Solids and Moisture for a description of how to determine dry weight of compost and feedstocks.

Table 02.01-A2 Sampling intervals for composted biosolids.

Amount produced (metric tons of biosolids compost per 365-day period)	*Monitoring Frequency for Pathogens and Trace Elements*
< 290	Once per year (1 yr^{-1})
≥ 290 to < 1,500	One per quarter (4 times yr^{-1})
≥ 1,500 to < 15,000	Once per 60 days (6 times yr^{-1})
≥ 15,000	Once per month (12 times yr^{-1})

Adapted from US EPA 40CFR503

9.9.3 *Sampling raw source ingredients—Example 1.* Samples shall be taken from incoming material that has been shredded, tumbled or otherwise reduced in particle size. From the material exiting the shredder/mixer, one point-sample shall be obtained every 2 h, over an operational period of 6-8 h, for a total of 4 samples. Sample size should be approximately 1000 cm^3 (~ 1 qt) per sample. The four samples shall then be thoroughly mixed together (composite), and a portion of the mixture (composite sub-sample) taken for analysis. If point-sampling directly from the shredder or mixing mill is not possible, the incoming material shall be sampled no more than 24 h after passing through the shredding equipment.

9.9.4 *Example 2—Sampling compost materials.* For each sampling event, a single composite sample shall be made up of multiple sub-samples for each pile or batch, unless otherwise directed.

9.9.5 *Example 3—Sample locations.* Construct and label a diagram of sample locations for your composting system. The example provided in TMECC 02.01-B indicates a minimum of fifteen sub-samples per pile. This procedure establishes a composite or general characterization of the attributes in a compost pile.

9.9.5.1 Refer to section 02.01-B for a strategy to sample generic windrows of compost.

9.9.5.2 Samples collected during the composting process are not composited in the same manner as finished samples because point-specific problems must be identified and monitored. Factors such as anaerobic materials and volatile fatty acids (VFA) may need to be determined from point-samples extracted from multiple locations in the same pile.

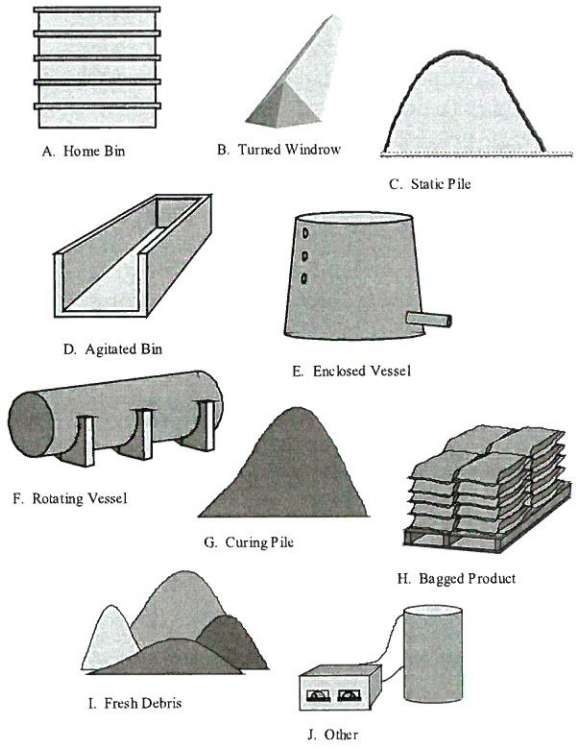


Fig 02.01-A3 Composting technologies.

9.9.6 *Example 4—Sample Variance Exercise.* The coefficient of variation (CV) expresses the relative variability for a parameter of interest across multiple samples. The CV is expressed as a percentage and calculated by dividing the sample standard deviation by the sample mean and multiplied by 100.

9.9.6.1 The ability to distinguish differences between arithmetically similar sample values decreases as the CV increases. It is difficult to draw specific conclusions about analytical results when variability is high. Under circumstances where variability is consistently high either the sampling plan must be redesigned to account for the excessively high variability, or the parameter should be discarded as a standard measure.

9.9.6.2 Consider a hypothetical case where two standard parameters are used to evaluate compost stability, C:N and VFA. Assume that the upper limit of acceptable variability for the parameters are set at 15% for C:N, and 45% for VFA. Low CV thresholds are generally assigned to system and process critical measures, and high CV thresholds are assigned to less critical standard measures.

NOTE 2A—This is a hypothetical case. It may be very difficult to establish meaningful CV limits without a large amount of data from many composts across time for a given test parameter. In addition, depending on the test, an individual test parameter may show a very large CV for repeated analysis of one sample.

9.9.6.3 In the example given in Table 02.01-A2, the CV for VFA testing is greater than the CV for C:N analysis, but the latter is unacceptable, given the use of the data, whereas the former is acceptable. In this hypothetical case, large variations across VFA samples are less significant than smaller variations associated with C:N. This is because variations in VFA's are transient and either readily corrected or do not diminish compost quality relative to its intended use, whereas highly variable C:N ratios indicate potentially serious problems with the composting process and product quality.

Table 02.01-A3 Compost sample data analyzed for variability

Sample	*C:N Ratio*	*VFA mg kg^{-1}*
1	35	12,000
2	19	18,000
3	39	19,000
4	22	25,000
5	42	9,000
Average:	31.4	16,600
Standard Deviation:	10.3	6,268
%CV:	33	38
Acceptable CV:	15%	45%
Suitability of Data:	REJECT	ACCEPT

9.10 *Sampler Devices*—There is no single standardized compost sampling device. Tools and devices for soil and forage sampling are relatively simple and efficient and are useful for compost sampling, but they have severe limitations.

9.10.1 *Slotted Tube Sampler*—Single or double, slotted tube and rod, all slotted ends and a minimum 5-cm (2-in.) diameter. The Pennsylvania State Forage Sampler, or equivalent, is a satisfactory core sampler for composts that do not contain significant foreign objects.

9.10.2 *Shovel*—Standard long, handled, pointed tip; typical horticultural narrow shovel, cleaned well with soapy water, rinsed, and dried between samples.

9.10.3 *Thief Sampler,*

9.10.4 *Trier,*

9.10.5 *Pipe*—PVC or plastic,

9.10.6 *Tarpaulin*—plastic,

9.10.7 *Pail*—16- to 20-L (4- to 5-gal), square pails. Use standard 5-gal plastic pails only when square pails are not available (e.g., square pails are available through Cleveland Bottle & Supply Co.; 850 East 77th Street; Cleveland, OH 44103; telephone: 216 881 3330; FAX: 216 881 7325; URL: http://www.clevelandbottle.com/squrpail.html). Pails must be cleaned well with soapy water, rinsed, and dried between samples.

9.10.8 *Trowel*—Standard garden, high-density polypropylene (HDPP) for sub-sample mixing and bag-filling; trowels must be cleaned well with soapy water, rinsed, and dried between samples.

9.10.9 *Sample Containers*—Use a container that is appropriate for the laboratory analysis to be performed on the collected compost sample. Refer to Tables 02.01-2 through 02.01-6, and Figure 02.01-B3.

9.10.10 Labels and Logbook

9.10.10.1 *Labels*—Name of technician, operator, inspector, facility name, pile identification, date, time, sample number and location in pile using length, width and height coordinates from an identified end and depth from surface measured perpendicular to surface, purpose of sample/test, method of sample preservation.

9.10.10.2 *Logbook*—Name of technician, operator, or inspector; and facility name. Pile data including: pile identification; feedstock-mix; type of pile; date started; weather conditions at time of sampling (for exposed piles only); pile orientation relative to natural drainage. Sample data including: date and time of sample collection; location where samples were collected in pile using length, width and height coordinates from an identified end and depth from surface measured horizontally; description of the sampling point; purpose of sample/test, method of sample preservation, point or composite sample; number and volume of the samples taken; date and time samples were shipped.

Test Method: Selection of Sampling Locations for Windrows and Piles						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	*Safety Standards*	*Market Attributes*
		02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B	02.01-B

02.01-B SELECTION OF SAMPLING LOCATIONS FOR WINDROWS AND PILES

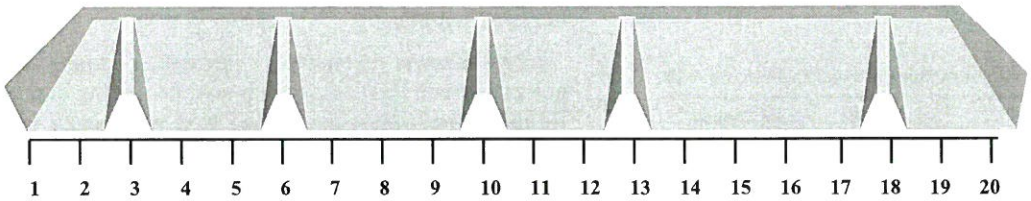


Fig 02.01-B1 Hypothetical sample collection pattern from a compost windrow.

NOTE 1B—In this example, a scale from 1-20 is superimposed on the long dimension of a compost windrow. Five distances (3, 6, 10, 13 and 18 m) are randomly selected to each side of the windrow, (e.g., numbers randomly pulled from a hat), to assign sample collection locations. Point-samples are collected from within three zones at each cutout.

NOTE 2B—The illustrated cut-outs are depicted on one side of the windrow; in a real operation, the cut-outs must be randomly assigned to each side of the windrow. Cone-shaped piles have a circular base. Measure around the base of a cone-shaped pile and randomly assign cutout positions along the pile's meridian, or circumference.

10. Apparatus for Method B

10.1 *Sampling Container*—five 16- to 20-L (4- to 5-gal), plastic (HDPP), glass.

10.1.1 *Organic Contaminant Tests*—For samples to be analyzed for the presence of organic contaminants, please refer to Table 02.01-6 Organic Contaminant Tests: Sampling containers and conditions for compost and source ingredient testing. Modify sample packaging steps presented in this section accordingly.

10.2 *Sampling Device*—silage auger, tilling spade, or other appropriate sampling device.

10.3 *Tractor Loader*—with loader, (e.g., Bobcat, etc.).

10.4 *Trowel*—high-density polypropylene (HDPP), for stirring and mixing composite sample.

10.5 *Pail*—16- to 20-L (4- to 5-gal), square pails, Use standard 5-gal plastic pails for shipping only when square pails are not available (e.g., square pails are available through Cleveland Bottle & Supply Co.; 850 East 77th Street; Cleveland, OH 44103; telephone: 216 881 3330; Fax: 216 881 7325; URL: http://www.clevelandbottle.com/squrpail.html).

11. Reagents and Materials for Method B

11.1 *Plastic Bags*—three 4-L (1 gal) durable bags with seal, (e.g., Ziploc® **Freezer** bags).

11.2 *Plastic Gloves.*

11.3 *Tarp*—clean plastic, canvas, or other type of mixing surface if feedstock is liquid sludge.

11.4 *Cold Packs*—chemical ice packs, or 4-L plastic bags (e.g., heavy duty Ziploc® freezer bags) filled with approximately 0.5 L of water and frozen flat. One ice pack per 4-L sample container of compost to be shipped, (e.g., three ice packs are recommended for three compost 4-L samples).

11.5 *Aluminum Foil*—lining for plastic shipping pail, and

11.6 *Packing Material*—newspaper or other appropriate bulking material to be used as packing or fill to minimize sample movement within the shipping container (square pail) during shipping.

11.7 *Adhesive Tape*—duct tape, 5-cm (2-in.) width.

12. Procedures for Method B

12.1 *Cut into Finished Compost*—Using tractor skid-loader, bobcat or shovel, or sample boring device, cut into the finished compost pile or windrow at five or more randomly selected positions. Collect samples from the full profile and breadth of the compost windrow or pile. Refer to Fig 02.01-B1.

12.2 *Collect Point-Samples*—Samples of equal volume are extracted from the compost pile at three depths or zones measured from the pile's uppermost surface. Collect no less than five point-samples from each of the three depths or zones illustrated in Fig 02.01-B2. The five point samples for each zone must be collected in a manner to accurately represent the horizontal cross-section of the windrow or pile. Use a sanitized sampling tool (a gloved hand, clean shovel or auger) when collecting samples and when transferring samples to the 5-gal sample collection pail.

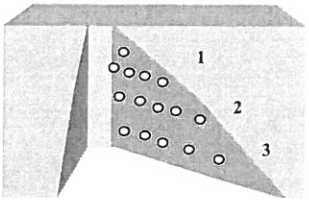


Fig 02.01-B2 Five horizontally dispersed point-samples are collected from each of three depths or zones within each cutout.

NOTE 3B—(1) upper $^1/_3$ of compost profile height; (2) middle $^1/_3$ of compost profile height; and (3) lower $^1/_3$ of compost profile height, where compost pile does not exceed the recommended overall height of 3 m. Create more than three sampling depths or zones within each cutout when the curing pile exceeds a height of 3 m, relative variability is high or the property of interest is found at very low concentrations, near the laboratory detection limit.

12.3 *Composite Point-Samples*—Place all 15 point samples from one cutout together into one sanitized plastic pail. Completely mix the point samples by stirring thoroughly with a sanitized wooden stick or lath, and by covering and shaking the pail to further mix the samples.

12.3.1 Repeat the blending process at least four times until all point samples are thoroughly blended to form one composite sample that accurately represents the compost for the cutout.

12.3.2 Proceed to the next compost sample cutout and repeat this process to collect one thoroughly blended composite sample from each of the five cutouts.

12.3.3 *Composite Sample*—Transfer the five composite samples from the sample collection pails onto a mixing tarp or other appropriately sanitized surface or container, such as into a large pail where all samples can be mixed, blended and then covered to minimize moisture loss. Thoroughly blend the five composite samples to form one large sample that represents the average condition of the entire batch or windrow in question.

12.3.3.1 Quarter the composite sample and thoroughly mix and quarter again. Continue to subdivide and split the sample into quarters and mix as described until sample size reaches approximately 12 L (3 gal).

12.4 *Stratified Sampling*—This sample collection strategy is used to evaluate for the presence of spatial variations or gradients in compost characteristics across and through a windrow or pile.

12.4.1 *Stratified Samples across Cutouts*—Use this sampling strategy to test for differences in compost characteristics between sample cutouts and along the longer dimension of a windrow. Do not composite materials from the five separate cutouts when monitoring for the presence of gradients along the longer dimension of a windrow. Pack and prepare five separate samples (i.e., five separate composite samples, one from each cutout) for shipment as described in step 12.5.

12.4.2 *Stratified Samples within Cutouts*—Use this sampling strategy to evaluate for the presence of spatial variations or gradients that occur with changes in pile depth or distance from the windrow core to its surface.

12.5 Prepare for Shipment and Storage:

12.5.1 Transfer the blended compost to three 4-L (1-gal) sample bags, (e.g., plastic Ziploc® *freezer* bags).

12.5.2 Line the shipment pail with aluminum foil or other reflective material to minimize sample heat-gain. Place the sample bags containing the compost sample into the plastic pail and interleave with ice packs for shipping (refer to Fig 02.01-B3).

12.5.3 Cover the pail with its lid. Seal and secure the lid with a packing tape. Send the sample pail by one-day express delivery service to your selected laboratory for analysis. Include a chain of custody information sheet with environmental regulatory samples (Refer to Method 02.01-E).

NOTE 3B—Maintain cool samples at 4°C (39.2°F) to diminish microbial and chemical activity prior to and during sample shipment.

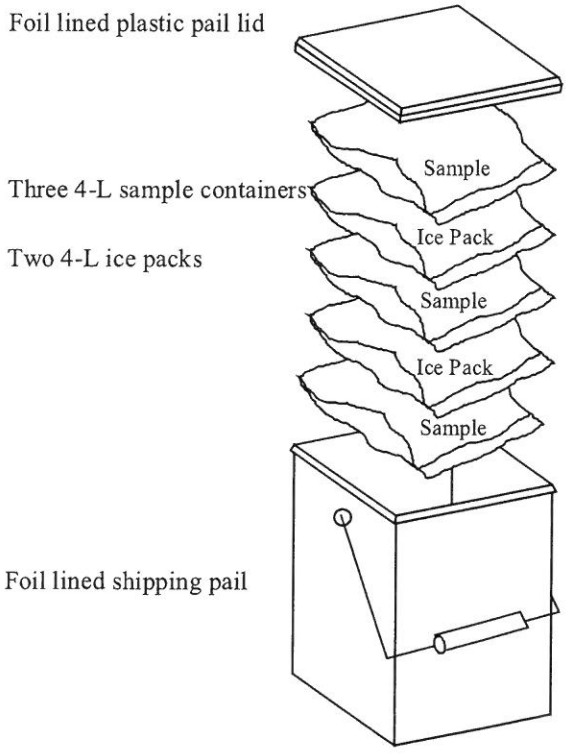


Fig 02.01-B3 Preparation for shipment.

Test Method: Field Sampling Plan for Composted Material						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	*Safety Standards*	*Market Attributes*
02.01-C	02.01-C	02.01-C	02.01-C	02.01-C	02.01-C	02.01-C	02.01-C	02.01-C

02.01-C FIELD SAMPLING PLAN FOR COMPOSTED MATERIAL

13. US EPA SW-846 Guideline Review and Considerations

13.1 With its hazardous waste management system, the US EPA requires that certain solid wastes be analyzed for physical and chemical properties. In its hazardous waste management system, it is mostly chemical properties that are of concern, and in the case of a number of chemical components, the US EPA has promulgated levels (regulatory thresholds) that cannot be equaled or exceeded.

13.1.1 Regulations pertaining to the management of hazardous waste contain three references regarding the sampling of solid wastes for analytical purposes:

13.1.1.1 Collect representative samples of waste, so that they exhibit average properties of the bulk compost or feedstock.

13.1.1.2 Collect enough samples (but no less than four samples) over a period of time sufficient to represent the variability of the compost or feedstock.

13.2 *Sampling Plan Implementation*—The US EPA manual contains a section on implementation of the sampling plan (SW-846 Chapter Nine, part 2). Within that section there is discussion concerning the sampling program's objectives for evaluating a compost. (Refer to Fig 03.01 Sample fate).

13.2.1 The example suggests the following questions be answered:

13.2.1.1 Is the sampling being performed to comply with environmental regulation?

13.2.1.2 Samples are to be analyzed for which parameters?

13.2.1.3 Why not others?

13.2.1.4 Should samples be analyzed for fewer parameters?

13.2.1.5 What is the end-use of the generated data?

13.2.1.6 What are the required degrees of accuracy and precision?

13.2.2 These questions may or may not be as important for sampling composted solid waste.

13.3 *Sampling Plan Considerations*—The implementation section contains a category entitled Sampling Plan Considerations. The sampling plan is usually a written document that describes the objectives, and details the individual tasks and how they will be performed. The more detailed the sampling plan, the less opportunity for oversight or misunderstanding during sampling, analysis, and data management.

13.3.1 The SW-846 document suggests that a sampling plan be designed with input from the various sectors involved in the project, including the following personnel:

13.3.1.1 *regulatory sampling*—in many cases may require state permits and consultations with state officials.

13.3.1.2 *end-user*—to use the data to attain program objectives.

13.3.1.3 *field team member*—an experienced member of the field team who actually collects samples.

13.3.1.4 *analytical chemist*—to review analytical requirements for sampling, preservation, and holding times that will be included in the sampling plan.

13.3.1.5 *process engineer or equivalent*—it explain details and constraints of the production process being sampled.

13.3.1.6 *statistician*—to review the sampling approach and verify that the resulting data will be suitable for any required statistical calculations for decisions.

13.3.2 *quality assurance representative*—to review the applicability of standard operating procedures and determine the number of blanks, duplicates, spike samples, and other steps required to document the accuracy and precision of the resulting data.

13.3.3 If no one is familiar with the site to be sampled, then a pre-sampling site visit should be arranged to acquire site-specific information. Some modifications of the sampling plan may be necessary. It is necessary to have at least one experienced sampler as a member of a sampling team.

14. Statistical Validity of Sampling Plan

14.1 *Objectives*—The primary objective of a sampling plan for a compost is to collect an appropriate

number of representative samples and subsamples for accurate and precise measurement of the chemical, physical and biological properties of the compost. If the chemical measurements are sufficiently accurate and precise, they will be considered reliable estimates of the chemical properties of the compost.

14.1.1 Generally, high degrees of accuracy and precision are required if one or more chemical components of compost are present at a concentration that is close to the applicable regulatory threshold. Alternatively, relatively low accuracy and low precision can be tolerated if the components of concern occur at levels far below or far above their applicable thresholds. Low sampling precision is often associated with considerable savings in analytical costs, as well as expenses associated with sampling; and is clearly recognizable even in the simplest of statistical tests. However, low sampling accuracy may not entail cost savings and is always obscured in statistical tests (i.e., it cannot be evaluated). Although it is often desirable to design sampling plans for compost to achieve only the minimally required precision (at least two samples are required for any estimate of precision), it is prudent to design the plans to attain the greatest possible accuracy.

14.2 *Composite Sampling*—For composite sampling, a number of random subsamples are initially collected and combined into a single sample, which is analyzed for the chemical constituents of concern. The major disadvantage of composite sampling, as compared with non-composite sampling, is loss of information about the spatial variability of chemical constituents because only a single estimate of the parameter is generated. The benefit is that a credible, general representation of the entire compost pile is generated from a large number of subsamples which are composited.

14.3 *Sampling Quality Assurance/Quality Control (QA/QC):*

14.3.1 Make sure all sampling equipment and containers are clean. If equipment is used to collect multiple samples, provisions for cleaning and decontamination are required between samples.

14.3.2 Properly label all samples and keep accurate records. Record as much information on sample labels as possible prior to arriving at the site. Sample labels and field notes should include material type, location, date, approximate age of compost, sampler's name, special sampling procedures used, analytical procedures to be performed, preservatives added (if any), and any special observations or incidents during the sampling event.

14.3.3 Point-samples must be stored in a refrigerator (4°C) before analysis when delays in shipment to laboratory are anticipated. This preservation is especially important for feed stock samples, compost to be evaluated for stabilization or maturity, or microbiological analysis. Chemical quality changes that may take place due to microbiological activity between sample collection and laboratory analysis should be avoided.

14.3.4 Chain of custody forms and procedures should be used with all environmental samples.

14.4 *Other Sampling Considerations*—Compost samples are taken at each facility for a variety of purposes. Varying levels of expertise and quality assurance are required depending on the sampling purpose or objective. A unique sampling protocol should be developed for each specific objective. This information should be detailed in a facility operation and maintenance (O&M) manual and be accessible to all facility staff.

14.4.1 Key process variables including porosity, nutrient balance, oxygen, moisture, temperature and time are monitored and controlled on a continual or daily basis. Measurements of weight and volume of waste arriving and compost leaving the facility are necessary for planning material movements, personnel and transportation requirements, and maintaining facility aesthetics. Although this is the most frequent type of sampling conducted, the sampling quality assurance requirements are the least significant for these activities. Generally, process control and material handling data do not need to be precise to be useful, (e.g., appropriate application of quick-tests). Regulatory compliance and product attribute data must be highly precise and accurate, (e.g., statistically valid sampling program to accurately estimate the average value of interest).

14.5 *Sampling Frequency*—Operating permits for compost sites require that concentrations of certain constituents of environmental concern be evaluated, (e.g., As, Ba, Cd, Cu, Cr, Hg, Mn, Mo, Ni, Pb, Se, Zn, pathogens such as *Salmonella* and fecal coliform, and organic compounds such as PCB's, PCP's, dioxins, furans, organochlorine and organophosphorus pesticides). Regulatory agencies establish compliance using individual sample results. It is, therefore, very important that sample collection and preparation techniques provide representative samples.

NOTE 1C—As much as 20,000 m^3 of compost may be represented by one subsample as small as 1 g. Because of this, it is vital that the sample be representative of the total material. *Quality control and quality assurance for quarterly testing must be greater than that employed for routine daily monitoring.*

14.6 *Statistical Techniques*—Statistical techniques for obtaining accurate and precise samples are relatively simple and easy to implement. Accurate representations of an entire compost pile or batch may be achieved through random sampling. In random sampling, every unit in the population has a theoretically equal chance of being sampled and

measured. Consequently, statistics generated by the sample (e.g. sample mean and to a lesser degree, standard deviation) are unbiased estimators of true population parameters. That is, the sample is representative of the population. A common method of selecting a random sample is to divide the population by an imaginary grid, assign a series of consecutive numbers to the units of the grid, and select the number to be sampled using a random-numbers table.

NOTE 2C—Haphazardly selected samples are not random and therefore not a suitable substitute for a randomly selected sample. That is because there is no assurance that a person performing undisciplined sampling will not consciously or subconsciously favor the selection of certain units of the population.

14.6.1 Sampling precision is achieved by collecting the appropriate number of samples that are uniformly distributed across the entire volume of compost. Precision is improved by increasing the number of samples, while maintaining a sampling pattern to guarantee a spatially uniform distribution.

14.6.2 If a batch of compost is randomly heterogeneous with regard to its chemical characteristics and if that random chemical heterogeneity remains constant from batch to batch, accuracy and appropriate precision can usually be achieved by simple or systematic random sampling. More complex stratified random sampling is appropriate if a batch of compost is known to be non-randomly heterogeneous in terms of its chemical properties and non-random chemical heterogeneity is known to exist from batch to batch. In such cases, the population is stratified to isolate the known sources of non-random chemical heterogeneity. The units in each stratum are numerically identified, and a simple random sample is taken from each stratum. This type of sampling would be advantageous only if the stratification efficiently divides the waste into strata that exhibit maximum between-strata variability and minimum within-strata variability. In composted solid waste that is frequently turned and mixed, little if any stratification is likely to occur. If little or no information is available concerning the distribution of chemical components, simple or systematic random sampling are the most appropriate sampling strategies.

14.7 *Number of Samples*—The appropriate number of samples to collect is the least number required to generate a sufficiently precise estimate of the true mean concentration of a chemical component of a compost. From the compost producer's perspective, this means that the minimum number of samples needed to demonstrate that the upper limit of the confidence interval for the true mean is less than the applicable regulatory threshold value. It is always prudent to collect a greater number of samples than indicated by preliminary estimates of the mean and variance since poor preliminary estimates of those statistics can result in an underestimate of the appropriate number of samples to collect.

14.8 *Simple Random Sampling*—For convenience, the statistical calculations for simple random sampling (wherein within-batch heterogeneity that may be encountered by a compost producer is low) are provided (adapted from SW-846 Chapter Nine, part 2, pages 13-14).

14.8.1 Obtain preliminary estimate of $\bar{x}$ for each chemical component of compost that is of concern. The above-identified statistic is calculated by Equation 14.8.1.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad \textit{Equation 14.8.1}$$

where:

$\bar{x}$ = simple random sample mean,
n = total number of sample measurements,
x = variable in question (e.g., mercury),
i = individual samples ranging from 1 to n, and
$\sum_{i=1}^{n} x_i$ = sum of all x's (analytical results for individual samples), from i = 1 through i = n.

14.8.2 Obtain preliminary estimate of variance, s^2, for each chemical component of concern. The above-identified statistic is calculated by Equation 14.8.2.

$$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2 \Big/ n}{n-1} \qquad \textit{Equation 14.8.2}$$

where:

s^2 = variance of simple random sample,
n = total number of sample measurements,
x = variable in question (e.g., mercury), and
i = individual samples ranging from 1 to n.

14.8.3 Estimate the appropriate number of samples *(n_1)* to be collected from the compost through use of Equation 14.8.3 and Table 02.01-C1. Derive individual values of n_1 for each chemical component of concern *(x)*. The appropriate number of samples to be taken from the compost is the greatest of the individual n_1 values.

$$n = \frac{t_{.20}^2 s^2}{\Delta^2} \qquad \textit{Equation 14.8.3}$$

where:

n = number of samples,
$t_{.20}^2$ = tabulated "t" value for two-tailed confidence interval and a probability of 0.20,
s^2 = sample variance, and

Δ^2 = the square of the regulatory threshold minus sample average, defined by US EPA, (e.g., 100 mg kg^{-1} for barium in elutriate of EP toxicity).

Table 02.01-C1 Tabulated values of Student's "t" for evaluating compost.

Degrees of freedom (n-1)	*Tabulated "t" value*	*Degrees of freedom (n-1)*	*Tabulated "t" value*
1	3.078	16	1.337
2	1.886	17	1.333
3	1.638	18	1.330
4	1.533	19	1.328
5	1.476	20	1.325
6	1.440	21	1.323
7	1.415	22	1.321
8	1.397	23	1.319
9	1.393	24	1.318
10	1.372	25	1.316
11	1.363	26	1.315
12	1.356	27	1.314
13	1.350	28	1.313
14	1.345	29	1.311
15	1.341	30	1.310
		40	1.303
		60	1.296
		120	1.289

14.8.3.1 Randomly collect at least n_1 (or n_2 - n_1, n_3 - n_2, etc., as will be indicated in step 8) samples from the compost. Maximize the physical size (volume) of all samples that are collected from the strata.

NOTE 3C—Collection of a few extra samples will provide protection against poor preliminary estimates of $\bar{x}$ and s^2.

14.8.3.2 Analyze the n_1 (or n_2 - n_1, n_3 - n_2, etc.) samples for each chemical component of concern. Superficially (graphically) examine each set of analytical data from each stratum for obvious departures from normality.

14.8.4 Calculate the standard deviation *(s)* for each set of analytical data by Equations 14.8.1, 14.8.2, 14.8.4 and 14.8.5.

$$s = \sqrt{s^2} \qquad \textit{Equation 14.8.4}$$

14.8.5 Calculate $\bar{x}$, s^2, and standard error (s_x) for each set of analytical data by, Equations 14.8.1, 14.8.2, and 14.8.5.

$$s_x = \frac{s}{\sqrt{n}} \qquad \textit{Equation 14.8.5}$$

14.8.5.1 If $\bar{x}$ for a chemical component is equal to or greater than the applicable regulatory threshold (from Equation 14.8.3) and is believed to be an accurate estimator of μ (population mean), the component is considered to be present in the compost at a hazardous concentration, and the study is completed. Otherwise, continue the study. In the case of a set of analytical data that does not exhibit obvious abnormality and for which $\bar{x}$ is greater than s^2, perform the following calculations with non-transformed data. Otherwise, consider transforming the data by the square root transformation (if $\bar{x}$ is about equal to s^2) or the arcsine transformation (if $\bar{x}$ is less than s^2) and performing all subsequent calculations with transformed data.

14.8.6 Determine the confidence interval (CI) for each chemical component of concern by Equation 14.8.6. If the upper limit of the CI is less than the applicable regulatory threshold (applied in Equation 14.8.3), the chemical component is not considered to be present in the compost at a hazardous concentration, and the study is completed. Otherwise, the opposite conclusion is tentatively reached.

$$CI = \bar{x} \pm t_{0.20} s_x \qquad \textit{Equation 14.8.6}$$

where:

$t_{0.20}$ = referred to in Table 02.01-C1 Tabulated values of Student's "t" for evaluating compost for appropriate degrees of freedom.

14.8.7 If a tentative conclusion of hazard is reached, re-estimate the total number of samples *(n_2)* to be collected from the compost by use of Equation 14.8.3. When deriving n_2, employ the newly calculated (not preliminary) values of $\bar{x}$ and s^2. If additional n_2 - n_1 samples of compost cannot reasonably be collected, the study is completed, and a definitive conclusion of hazard is reached. Otherwise, collect an extra n_2 - n_1 samples of compost.

14.8.8 Repeat the basic operations described in Steps 14.8.3 through 14.8.7 until the compost is judged to be non-hazardous or, if the opposite conclusion continues to be reached, until increased sampling effort is impractical.

14.9 *Stratified Random Sampling*—For convenience, the statistical calculation steps for stratified random sampling that must be performed in situations that may be encountered by a compost producer where within-batch heterogeneity is high are provided below (from SW-846 Chapter Nine, part 2, pages 18-19).

14.9.1 Obtain preliminary estimate of $\bar{x}$ for each chemical component of concern. The identified statistic is calculated by Equation 14.9.1.

$$\bar{x} = \sum_{k=1}^{r} W_k \bar{x}_k \qquad \textit{Equation 14.9.1}$$

where:

$\bar{x}$ = stratified random sample mean,

$\bar{x}_k$ = stratum mean, and

W_k = fraction of population represented by stratum k (number of strata *[k]* range from 1 to r).

14.9.2 Obtain preliminary estimate of s^2 for each chemical component of compost that is of concern. The identified statistic is calculated by Equation 14.9.2.

$$s^2 = \sum_{k=1}^{r} W_k s_k^2 \qquad \textit{Equation 14.9.2}$$

where:

s^2 = stratified random sample variance,

s_k^2 = stratum variance, and

W_k = fraction of population represented by stratum k (number of strata *[k]* range from 1 to r).

14.9.3 Estimate the appropriate number of samples *(n_1)* to be collected from the compost through use of Equation 14.8.3 and Table 02.01-A1 Tabulated values of Student's "t" for evaluating compost. Derive individual values of n_1 for each chemical component of concern. The appropriate number of samples to be taken from the compost is the greatest of the individual n_1 values.

14.9.4 Randomly collect at least n_1 (or n_2 - n_1, n_3 - n_2, etc., as will be indicated in step 8) samples from the compost. If s_k for each stratum (see Equation 14.9.2) is believed to be an accurate estimate, optimally allocate samples among strata (i.e., locate samples among strata so that the number of samples collected from each stratum is directly proportional to the s_k for that stratum). Otherwise, proportionally allocate samples among strata according to size of the strata. Maximize the physical size (volume) of all samples that are collected from the strata.

14.9.5 Analyze the n_1 (or n_2 - n_1, n_3 - n_2, etc.) samples for each chemical component of concern. Superficially (graphically) examine each set of analytical data from each stratum for obvious departures from normality.

14.9.6 Calculate $\bar{x}$, s^2, the standard deviation *(s)*, and $s_{\bar{x}}$ for each set of analytical data by, respectively, Equations 14.9.1, 14.9.2, 14.8.4 and 14.8.5.

14.9.7 If $\bar{x}$ for a chemical component is equal to or greater than the applicable regulatory threshold (from Equation 14.8.3) and is believed to be an accurate estimator of μ (population mean), the component is considered to be present in the compost at a hazardous concentration, and the study is completed. Otherwise, continue the study. In the case of a set of analytical data that does not exhibit obvious abnormality and for which $\bar{x}$ is greater than s^2, perform the following calculations with non-transformed data. Otherwise, consider transforming the data by the square root transformation (if $\bar{x}$ is about equal to s^2) or the arcsine transformation (if $\bar{x}$ is less than s^2) and performing all subsequent calculations with transformed data.

14.9.8 Determine the confidence interval (CI) for each chemical component of concern by Equation 14.8.6. If the upper limit of the CI is less than the applicable regulatory threshold (applied in Equation 14.8.3), the chemical component is not considered to be present in the compost at a hazardous concentration, and the study is completed. Otherwise, the opposite conclusion is tentatively reached.

14.9.9 If a tentative conclusion of hazard is reached, re-estimate the total number of samples *(n_2)* to be collected from the compost by use of Equation 14.8.3. When deriving n_2, employ the newly calculated (not preliminary) values of $\bar{x}$ and s^2. If additional n_2 - n_1 samples of compost cannot reasonably be collected, the study is completed, and a definitive conclusion of hazard is reached. Otherwise, collect an extra n_2 - n_1 samples of compost.

14.9.10 Repeat the basic operations described in Steps 14.9.3 through 14.9.9 of Fig 02.01-1 Composting Unit Operations, until the compost is judged to be non-hazardous or if the opposite conclusion continues to be reached until increased sampling effort is impractical.

Test Method: Composting Feedstock Material Sampling Strategies						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	Safety Standards	Market Attributes
02.01-D	02.01-D							

02.01-D BATCH FEEDSTOCK MATERIAL SAMPLING STRATEGIES

15. Apparatus for Method D

15.1 *Sampling Container*—20-L (5-gal), stainless steel, plastic, glass or Teflon.

15.2 *Sampling Device*—wooden spatula or tiling spade, etc.

15.3 *Trowel*—high-density polypropylene (HDPP).

15.4 *Plastic Storage Pail*—20-L (5-gal), square pails, Use standard 5-gallon plastic pails only when square pails are not available (e.g., Cleveland Bottle & Supply Co.; 850 East 77th Street; Cleveland, OH 44103; telephone: 216 881 3330; Fax: 216 881 7325; URL: www.clevelandbottle.com/squrpail.html.

16. Reagents and Materials for Method D

16.1 *Plastic Gloves.*

16.2 *Tarp*—clean plastic, canvas, or other type of mixing surface if feedstock is liquid sludge.

16.3 *Plastic Bags*—three 4-L (1 gal) Ziploc® *freezer* bags.

16.4 *Cold Packs*—chemical ice packs,

16.5 *Aluminum Foil*—lining for plastic shipping pail, and

16.6 *Adhesive Tape*—duct tape, 5-cm (2-in.) width.

17. Procedure for Method D

17.1 *Sample Collection*—Identify and collect an appropriate number of subsamples needed to ensure a reliable analytical result as described in Methods 02.01-A, B or C.

17.1.1 Place each subsample into a sampling (subsample) container.

17.1.2 Transfer the contents of the subsample container onto (into) mixing surface (container) and proceed to the next randomly selected sample point.

17.1.3 Repeat steps 17.1.1 and 17.1.2 until the predetermined number of subsamples is obtained.

17.2 *Sample Mixing*—Place subsamples on clean tarp or other similar mixing platform, mix sub-samples thoroughly using a wooden spatula or comparable sampling tool.

17.3 *Sample Splitting*—Subdivide sample into quarters, thoroughly mixed composite sample into fourths. Repeat steps 17.2 and 17.3 until sample size is appropriate for intended analysis.

17.4 *Sample Storage and Shipping*—Place composite sample aliquot in clean container, preferably a Teflon pail or similar inert material.

CAUTION—Do not use galvanized sheet metal collection or mixing tools. The galvanized coating will contaminate the sample with zinc.

17.4.1 Transfer blended feedstock or compost to fill three 4-L (1-gal) plastic Ziploc® freezer bags.

17.4.2 Line the shipment pail with aluminum foil to minimize heat exchange. Place the plastic Ziploc® freezer bags containing the feedstock samples in the plastic pail and interleave with cold packs for shipping (refer to Fig 02.01-B3).

17.4.3 Seal the square pail with its lid. Seal and secure lid with duct tape. Send the square plastic pail containing samples by two-day express service to the selected laboratory for analysis. Include completed chain of custody forms when necessary.

NOTE 1D—If any delay is anticipated, cool sample to 4°C (39.2°F) to diminish microbial and chemical activity prior to sample shipment.

Test Method: Data Quality Management and Sample Chain of Custody						**Units:** *NA*		
Test Method Applications								
Process Management							**Product Attributes**	
Step 1: Feedstock Recovery	*Step 2:* Feedstock Preparation	*Step 3:* Composting	*Step 4:* Odor Treatment	*Step 5:* Compost Curing	*Step 6:* Compost Screening and Refining	*Step 7:* Compost Storing and Packaging	Safety Standards	Market Attributes
02.01-E	02.01-E		02.01-E			02.01-E	02.01-E	02.01-E

02.01-E DATA QUALITY MANAGEMENT AND SAMPLE CHAIN OF CUSTODY

18. Aspects of Sampling Quality Assurance for Reported Data

18.1 Three critical steps in the sampling process precede laboratory analysis and often dictate data quality.

18.1.1 sample planning and collection;

18.1.2 sample handling and preservation; and

18.1.3 laboratory sample preparation.

18.2 Each step in the sampling process must be properly executed in a timely manner by well informed, trained individuals to ensure that the collected sample accurately represents a compost batch, windrow or pile.

18.3 *Quality Sample Management*—Regulatory and certification systems may dictate that samples are properly collected, preserved and prepared for analysis. Consider the following hypothetical example of sample management where a certified third party is introduced to manage the sampling plan.

18.3.1 The third party assumes all quality assurance and quality control responsibilities associated with:

18.3.1.1 sample planning and collection;

18.3.1.2 sample handling and preservation; and

18.3.1.3 laboratory sample preparation.

18.3.2 Responsibility for rigorous sample collection is transferred from facility management to the third party. Responsibilities associated with sample storage, preparation and laboratory analysis are also transferred from the analytical laboratory to the third party.

18.3.3 One of the principal benefits of the third party sampling system is to diminish deviations in sampling plan interpretation and implementation across separate facilities and laboratories. Third party control can decrease variability by maintaining consistent field sampling protocols across all participating facilities. Field sample collections would be implemented as described in *TMECC 02.01 Field Sampling of Compost Materials*. Consistent sample preparation protocols would also be followed for laboratory analysis as described in *TMECC 02.02 Laboratory Sample Preparation for Analysis*.

18.4 *Tracking Quality*—A sample must be properly collected and prepared for shipment, and then properly manipulated by laboratory personnel who follow specific preparation protocols designed for each analytical methodology. Previous sections emphasized the importance of properly designed and implemented sampling plans. This section introduces a protocol designed to modify data interpretation to interpret sample variability.

18.4.1 Consider the following hypothetical sampling plan that incorporates an additional step to verify accuracy of reported results using cross-validation techniques. One type of a statistically valid sample management plan requires that samples are properly collected at a very high frequency while the actual number of samples submitted for analysis remains small.

18.4.1.1 *Establish Baseline*—A significant number of samples that represent the composting process of a facility are collected over time and sent to a laboratory for analysis. Results from these samples serve to establish a baseline of information that accurately represents the compost produced by the facility and a given feedstock blend.

18.4.1.2 *Track Deviations from Baseline*—After the baseline is established, samples are collected at specified intervals, over time or per unit of compost produced (refer to *TMECC 02.01-A Equation 9.9.1 Formula to estimate sampling interval*), and held in cold storage. After a specified interval, (e.g., quarterly or monthly) a small but statically representative number of prepared samples are randomly selected from the stored samples and sent to a laboratory for analysis. Because multiple samples would be randomly selected from a larger population of samples, a more reliable statistical inference can be generated than by simply directly submitting monthly or quarterly samples for analysis.

18.4.2 Sampling programs of this nature may require that field samples, or samples prepared for laboratory analysis, are submitted to a secure or bonded cold-storage facility where frequently collected samples are inventoried and properly stored. Samples must be retained in storage for a predetermined time period to

safeguard against cases where a need for re-testing may arise.

18.4.3 *Sampling Costs*—Sampling program maintenance costs should be considered when designing an effective monitoring system. It is difficult to weigh the relative importance of data quality when there is no clear relationship between financial outcome and monitoring protocol. Successful implementation will increase when data quality relates to an increased financial incentive, either artificially through incentives offered by the governing regulatory agency or through quality assurance certification programs designed to indirectly increase market share.

02.01 SUMMARY

19. Report

19.1 Chain of custody forms and procedures should be used with all environmental or regulatory samples. A chain of custody form is used to track sample handling from time of collection through laboratory analysis, and data reporting. Suggested information for the chain-of-custody record includes, at a minimum: Collector's name; Signature of collector; Date and time of collection; Place and address of collection; Requested preprocessing (subsampling, compositing, sieving); Requested analyses; Sample code number for each sample (if used); Signature of the persons involved in the chain of possession. Refer to Fig 02.01-E1 Chain of Custody form for an example.

20. Keywords

20.1 accuracy; aliquot; attribute verification; bias; chain of custody; closed vessel system; composite; compost; coefficient of variation; %CV, confidence interval; feedstock; grab-sample; point-sample; point-sampling; open vessel system; precision; process monitoring; process variability; product variability; quality control; quality assurance; representative sample; sample collection frequency; sampling; sampling plan; statistical validity; stratified sampling; windrow.

CHAIN OF CUSTODY FORM

STA Laboratory: _____ Tel: _____
Address: _____ FAX: _____
_____ Email: _____
City, State Zip code: _____

Client/Reporting Company: _____ Tel: _____
Contact Name: _____ FAX: _____
Billing Address: _____ Email: _____
_____
City, State Zip code: _____

Send Results to: _____
City, State Zip code: _____

Name or Source of sample(s): _____
Name of Sample Collector: _____

LABORATORY USE ONLY *Storage Locations*

Freezer _____ Cold Room _____ Storage Shelf _____

Sample Condition:

Sample Type: O COMPOSITE O POINT O STRATIFIED

P.O. Number: _____
Client STA ID: _____
USCC Member: O YES O NO ID: _____

SELECTION OF ANALYSIS. *Refer to http://tmecc.org/sta for details.*
STA Suite; All 503 Rule Tests; Other – Specify additional tests in fields A through D (below).
NOTE ! *Your selection of* ***STA Suite*** *(below) authorizes laboratory personnel to disclose all analyti results AND submit the STA Compost Technical Data Sheet directly to STA program manageme*

A	B	C	D

Client Sample Identification (and special instructions)	Collection Date/Time	Sample Matrix	Sample Container	Shipping Temp.	Selected Analysis STA	503	A	B	C	D	Lab/Job Number
1	Date:	Compost O	Plastic Bag O	Ambient O							
	Time:	Feedstock O	Pail O	Wet Ice O	O	O	O	O	O	O	1
	Initials:	_____ O	_____ O	Dry Ice O							
2	Date:	Compost O	Plastic Bag O	Ambient O							
	Time:	Feedstock O	Pail O	Wet Ice O	O	O	O	O	O	O	2
	Initials:	_____ O	_____ O	Dry Ice O							
3	Date:	Compost O	Plastic Bag O	Ambient O							
	Time:	Feedstock O	Pail O	Wet Ice O	O	O	O	O	O	O	3
	Initials:	_____ O	_____ O	Dry Ice O							
4	Date:	Compost O	Plastic Bag O	Ambient O							
	Time:	Feedstock O	Pail O	Wet Ice O	O	O	O	O	O	O	4
	Initials:	_____ O	_____ O	Dry Ice O							
5	Date:	Compost O	Plastic Bag O	Ambient O							
	Time:	Feedstock O	Pail O	Wet Ice O	O	O	O	O	O	O	5
	Initials:	_____ O	_____ O	Dry Ice O							

Releasing Signature 1	Date	Time	Receiving Signature 1	Date	Time
Releasing Signature 2	Date	Time	Receiving Signature 2	Date	Time
Releasing Signature 3	Date	Time	Receiving Signature 3	Date	Time
Releasing Signature 4	Date	Time	Receiving Signature 4	Date	Time

Fig 02.01-E1 Chain of Custody. Compost sample chain of custody log

Attachment 2b

Solvita Field Testing Overview and Guidance

SOLVITA™
by WOODS END® RESEARCH

As used WORLDWIDE

GUIDE TO SOLVITA® TESTING FOR COMPOST MATURITY INDEX

The Solvita® procedure is a widely recognized and simple test that gives a Maturity Index for active or aged compost. The kit measures the carbon-dioxide respiration and ammonia volatility simultaneously in the same test. Each of these traits alone provide important clues to compost quality, and used together will accurately estimate the general condition and safety of any composted product.

Compost Maturity is a term that is used in a variety of ways. The Solvita Maturity Test ranks your compost on a 1-to-8 index scale of increasing maturity. Maturity in this sense means *resistant to further decomposition* and *free of compounds such as ammonia and organic acids which can be toxic to plant growth.*

The Solvita test can be used effectively for the following purposes:

1) To comply with state, governmental or trade standards that specify stability/maturity.[1]

2) For evaluating compost conditions in order to make improvements to the process;

3) To determine the best end-use prior to distribution and sales.

3 Steps to Satisfactory Test Results

There are three easy steps involved in using the Solvita test kit to evaluate compost.

A- Carefully obtain and prepare the sample.

B- Perform the test by placing both Solvita gel-paddles in the jar. Use enclosed Color Keys to find the appropriate color numbers. Use the simple computation table to determine your compost's Maturity Index.

C- Interpret the results. Once you know the maturity index, consider the process management and desired end use of your compost. Use the tables in the manual as well as the troubleshooting section to evaluate the process and determine the best use.

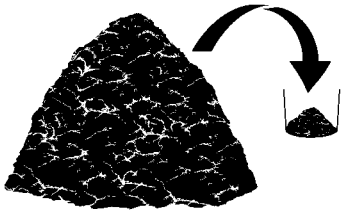
QUALITY CONTROL & STORAGE OF SOLVITA KITS

All Solvita kits are carefully packaged at the factory to insure highest quality prior to shipping. The gel-paddles should be the "Control Color" when the foil pack is opened (see color chart). If the foil packs have been damaged, or the jar cracked, then the test may not work properly. From the date of purchase the kits may be used for up to one year. Shelf-life is significantly extended by refrigerating the foil packs. Do not allow to freeze.

1. Solvita is approved or required in the USA: CA, CT, ID, IL, KS, OH, MA, ME, MN, NJ, NM, TX, WA and in Europe for: DK, S, N, UK, It, and for the EC Eco-Label Program.

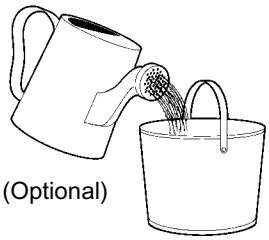
Vers. 3.7 - 4/2002

SAMPLE PREPARATION

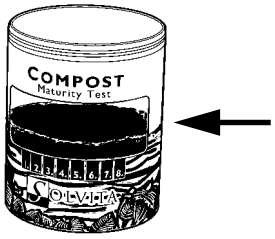


1. COMPOSITE SAMPLE: Make a composite sample by combining at least 10 sub-samples that fairly represent the whole compost pile or batch. Mix thoroughly in a clean pail, then discard all but about 1 quart (1 liter) of product.

2. SCREENING: If you are testing compost that will be screened before sale or use, then screen the sample similarly before running the test. It is advisable to remove stones and very large stems and woods chips that may interfere with the test.



3. CHECK MOISTURE: Samples that are too wet or dry will not give accurate maturity test results. A small handful of compost squeezed tightly should feel wet, but NOT yield any free water. If there is free water, spread the sample out to dry to the proper moisture level- at least overnight. A second handful of compost squeezed tightly in a paper towel should wet the paper towel — if not, it is too dry. If the sample is too dry, then mix in water very gradually. Repeat the squeeze test to confirm that the moisture is in the proper range.



4. LOAD COMPOST INTO THE JAR: Fill the jar to the fill line, while ensuring proper density by sharply tapping the bottom of the jar on a counter. Fluffy or coarse compost should be compacted by pressing firmly into the jar. Let the sample "air out" in the jar without the lid <u>for one hour before starting the test</u>. This will help displace carbon-dioxide that may have accumulated in the sample prior to running the test.

5. EQUILIBRATION STEP: If the compost was sampled from a hot pile, or if it was frozen, or if it needed remoistening or drying, then let the sample equilibrate in the test jar overnight with the lid loose before starting the test. If the compost was very dry it may need 48 hours of equilibration before the Solvita (or any CO_2 or oxygen uptake test) gives accurate results. This can be easily confirmed by doing the Solvita test on the same sample set-up after 1, 2, and 3 days in the test jar, equilibrating with the lid loose between tests.

RUNNING THE SOLVITA TEST

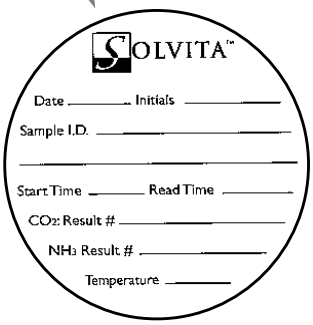
1. OPEN BOTH TYPES OF FOIL PACKS: The Solvita test is actually two tests in one, carried out in the same 4-hour test period. Both the individual paddles marked either "Carbon-Dioxide" or "Ammonia" are opened by tearing along the top and carefully removing the paddle by grasping the handle. The gel-paddles are color-coded: the carbon-dioxide paddle (marked with "C" on the stem) is purple at the start and the ammonia paddle (marked with "A") is yellow. *Do not touch the special gel surface, and don't allow compost to touch it.* Once the gelpack is opened, the test should be started within 30-minutes. The gel is non-toxic but should be kept out of the mouth and eyes.

2. INSERT THE PADDLES: The gel paddles are pushed into the compost sample in the jar so that by looking through the clear side you can see each of the color surfaces, as indicated by the color squares on the jar label. The edges of the paddles can be touching in the middle at about right angles. Push the paddle tips all the way into the compost to the bottom of the jar. Be careful not to jostle or tip the jar.

3. SCREW THE LID TIGHT, and keep the jar at room temperature (68—77°F or 20—25°C) *out of direct sunlight* for 4 hours.

4. READ THE GEL COLOR. At the correct time (4 hours) after the jar has been sealed, read the gel colors by comparing to the two color charts. Mark the results on the lid label. Color matching is best under moderate intensity fluorescent room light, with the paddle left in the jar with the lid on and illuminated from the front. For reading in daylight or incandescent lighting, remove the paddle and lay it face-up on a clean, white surface. It is advisable to judge the colors by darkness as well as hue.

5. USING THE VALIDATION FORM: We have provided a convenient removable lid label to aid in the documentation of the results from Solvita testing. A pre-punched monitoring sheet is provided along with the test kit. The Solvita lid label may be peeled off the jar after the test and affixed to the monitoring sheet and stored in a binder to document the test.



Removable Solvita Label for Quality Control Monitoring

THE COMPOST MATURITY INDEX

The *Maturity Index* is determined using the results from both paddles. The numbers from the color charts are lined up in Table 1 below, to read the intersection which is the Index. This Index number may be used later for the interpretations in Tables 2, 3, 4, and 8.

The Index results simply by using the ammonia to compensate for the apparent CO2-stability. High ammonia levels encountered in some composts can inhibit microbial activity or interfere in the CO_2 test. Also, ammonia by itself is dangerous for compost use on plants. By using both indices, the test more accurately depicts stability/maturity than any other test alone..

TABLE #1: Compost Maturity Index Table[a]

use the A and C paddle color numbers and read across and down to where the columns meet

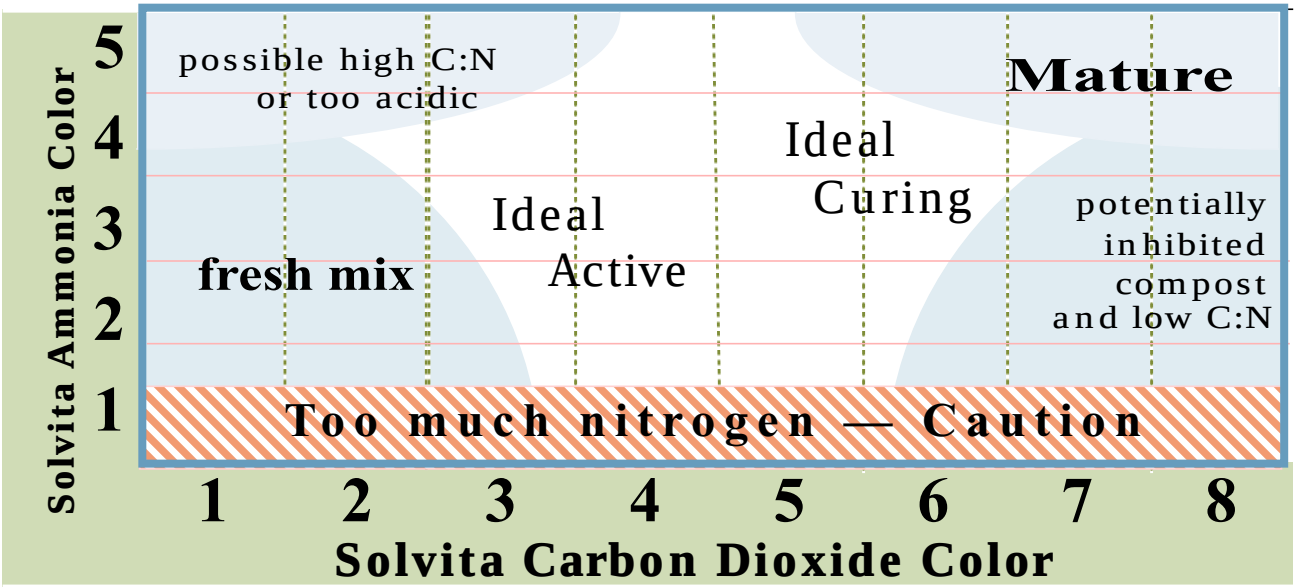
Solvita Ammonia Test Result is:		SOLVITA Carbon Dioxide Test Result is: 1	2	3	4	5	6	7	8
5	Very Low NH_3	1	2	3	4	5	6	7	8
4	Low NH_3	1	2	3	4	5	6	7	8
3	Medium NH_3	1	1	2	3	4	5	6	7
2	High NH_3	1	1	1	2	3	4	5	6
1	Very High NH_3	1	1	1	1	1	2	3	4

a. **Example:** If the NH_3 result is 2, and the CO_2 result is 6, then the Maturity Index is: 4

The following table shows a visual overview of your compost condition based on the two tests.

TABLE #2: Interpreting General Compost Condition with Solvita Ratings

use the A and C paddle color numbers and read across and down to where the columns meet



INTERPRETING THE SOLVITA® MATURITY INDEX-
- Relationship to Other Tests -

As compost ages, it normally goes from a fresh condition (Solvita #1-2) to a mature state (Solvita #7-8). This can take weeks to months, depending on the materials and method of composting. The following table presents an overview of this aging process and shows how other tests that are used to characterize stability can be compared to the Solvita test.

TABLE #3: Solvita® Compost Maturity Index and Other Indexes

IF SOLVITA MATURITY INDEX IS:	THE STAGE OF THE COMPOSTING PROCESS IS:		Approx Equivalency to other indicators[a] DEWAR[b]	CO_2 Rate[c]	O_2-Rate[d]
8.	Inactive, highly matured compost, very well aged, possibly over-aged, like soil; no limitations for usage	"FINISHED" COMPOST	V	1	<3
7.	Well matured, aged compost, cured; few limitations for usage			2	5
6.	Curing; aeration requirement reduced; compost ready for piling; significantly reduced management requirements	Curing		4	11
5.	Compost is moving past the active phase of decomposition and ready for curing; reduced need for intensive handling	"ACTIVE" COMPOST	IV	6	16
4.	Compost in medium or moderately active stage of decomposition; needs on-going management	Very Active	III	8	21
3.	Active compost; fresh ingredients, still needs intensive oversight and management		II	10	27
2.	Very active, putrescible fresh compost; high-respiration rate; needs very intensive aeration and/or turning	"RAW" COMPOST	I	12	32
1.	Fresh, raw compost; typical of new mixes; extremely high rate of decomposition; putrescible or very odorous material			>15	> 40

a. Note: this table gives approximate equivalency based on average organic matter and density.
b. DEWAR = Dewar self-heating test using standardized Dewar Flask
c. CO_2 Rate = total mg CO_2-C evolved per g VS per day @ 34°C
d. O_2 Rate (SOUR) = mg oxygen (O_2) consumed per g VS per day calcuated from column (c)

BEST USE OF COMPOST PRODUCTS BASED ON THE SOLVITA MATURITY INDEX

The Solvita® Maturity Index can be used to identify the best use category of a compost. This method takes into account limitations known to exist with regard to CO_2-evolution rate and ammonia content. The table also shows typical associations with other known soil amendments. All composts should always be checked under actual growing conditions. Many states and some countries that specify Solvita testing require compost to be at or above a certain value in order to be considered a finished product*.

Table 4: Best Use Of Compost

SOLVITA MATURITY INDEX	Raw Feedstock- Mushroom Compost	Landspreading on fallow soil; Mulch	Farm Row Crops, Field Cultivation	Hothouse Beds, Greenhouses	Orchards, Pastures, Hay Crops, Turf	Topsoil Substitute Blends	General Gardening	Bedding Plants, Container Media	Potting Mixes, Seedling Starters	Material in this class will be similar to:
8.					✔	✔	✔	✔	✔	soil & peat-based mixes
7.				✔	✔	✔	✔	✔	✔	soil mixes
6.				✔	✔	✔	✔			compost-soil blends
5.			✔	✔	✔					organic fertilizers
4.		✔	✔	✔						un-treated organic fertilizers
3.	✔	✔	✔							dehydrated manures
2.	✔	✔								raw-waste and most manures
1.	✔									raw-waste & some manures

Increase wait time prior to planting

Control Limit, CA, MA,

Control Limit: ID, WA, TX

Note: There are factors other than maturity index that determine how well a compost will perform with crops. These include, but are not limited to, nutrient content, nitrogen-release, pH, and salinity. You may wish to have a full-service compost laboratory such as Woods End analyze the sample. Please write to Woods End or see www.woodsend.org for a full list of recommended tests and analytical interpretation guidelines. *Note: see the web site for up-to-date information on State or National regulations that specify Solvita testing

Appendix I. INTERPRETING SOLVITA® AMMONIA RESULTS

The Solvita Ammonia Test is used primarily to derive the Maturity Index (Table 1). It is optionally possible to use the test to obtain more information about your compost. This is because presence of ammonia indicates the relative nitrogen content, stability and age of the material. You can use this information in these other two ways:

1. Ammonia in compost may be noxious to workers and can be toxic to some plants. It is often responsible for the "burn" effect after applying to some crops (see Table 4, 5). High ammonia content, however, may also indicate a potential positive crop response when applied correctly to heavy-feeder field crops such as corn, sorghum, etc.
2. You can estimate *total ammoniacal nitrogen* in the sample if you know the compost pH (Table 6). This provides important clues about the C:N balance and maturity (see Table 2 and 7).

TABLE #5: Potential Phytotoxicity Associated with Ammonia Gas

Ammonia Color No:	1	2	3	4	5
Potential Phytotoxicity is:	Very High	High	Medium	Slight	None

Under normal conditions, ammonia increases during the period of rapid decomposition, then declines or disappears as the compost matures. The pH of the compost tends to follow this cycle of ammonia, reaching 8.5-9.0 when the ammonia content is high. This cycle is affected by the balance of available carbon and nitrogen in the compost mix, expressed as the C:N ratio. A surplus of *nitrogen* (C:N < 25) can cause elevated ammonia throughout the composting process, resulting in nitrogen loss and delay of maturity due to elevated pH. Conversely, *nitrogen deficiency* (C:N > 35) results in relatively low ammonia content, and possible delay in maturity due to inadequate supply of nitrogen.

TABLE #6: Estimating Total Ammoniacal-N in Compost (ppm dry basis)

Ammonia Color No:	1	2	3	4	5
Compost pH = 7.0	n/a	n/a	> 10,000	8000	< 4000
7.5	n/a	> 15,000	8000	4000	< 2000
8.0	> 20,000	10,000	4000	2000	< 1000
8.5	> 7000	3000	1500	600	< 400
9.0	> 4000	1500	700	300	< 200

TABLE #7: Interpreting Compost Stability Based on Ammoniacal-N Content

Ammonium level is:	> 10,000	4000-10,000	500-4000	100-500	< 100
Compost Condition	Very Active	Med. Active	Curing	Cured	Mature

Table 7 shows how the total ammoniacal-N content relates to the condition or decomposition state of typical compost having moderate or surplus nitrogen. If the nitrogen is low (i.e. high C:N ratio), then ammonia may be low even if the compost is immature (see Table 2). Ammonia's pH-raising effect is sometimes counteracted by volatile fatty acids in very active compost, especially if oxygen demand is not being met. ❑

Appendix II. INTERPRETING SOLVITA® INDEX RESULTS

TABLE #8: Troubleshooting Compost based on Solvita® Results

Indicated Problem or Result	Possible Explanation	Possible Remedy
Compost is young but test results indicate "mature"	Compost may be very low in organic matter and have low overall respiration	Check organic content; add more organic-rich ingredients; check self-heating
	Compost may be inhibited by low or high pH; very dry or very hot prior conditions; check Solvita ammonia test	Check pH and VOA level; correct moisture; test again 1-2 days later
Compost is old but Solvita results indicate "active" and/or high ammonia levels	Compost may have composted improperly and not advanced significantly, e.g. it is too wet or too dry, too compacted, poor mix of ingredients, not enough air	Turn pile, loosen material, add moisture or "green" materials if needed; if high in ammonia select for field rather than seedling use
Compost has given the same Solvita colors on several tests at 1-2 weeks apart	Compost is not progressing properly— it may be too dry or too compacted, not well mixed; C:N or pH is too high or too low	If pile looks woody add green matter; add moisture if too dry; loosen if too dense
Different parts of the pile give different Solvita colors	Pockets of poorly mixed or poorly aerated material exist	Re-mix entire pile and re-sample and test again
Core is always #1 or #2 on Maturity Scale	Core is anaerobic and/or is not composting properly	Provide coarse structural materials, mix pile or add air; pile may be too large
Solvita colors indicate very "mature" but plants were hurt by compost	Compost contains high levels of salts, VOA or pH is too low	Check pH and conductivity before use; allow to compost more; allow to mature in soil before planting
Color doesn't match the color chart	Package may have leaked air prior to the test or is defective	Discard paddle and request replacement product
Unexpected CO_2 vs. ammonia paddle results	unusual or extreme conditions persist; check paddle quality	See table 2

GUIDE FOR INDEXING COMPOST MATURITY

SOLVITA®

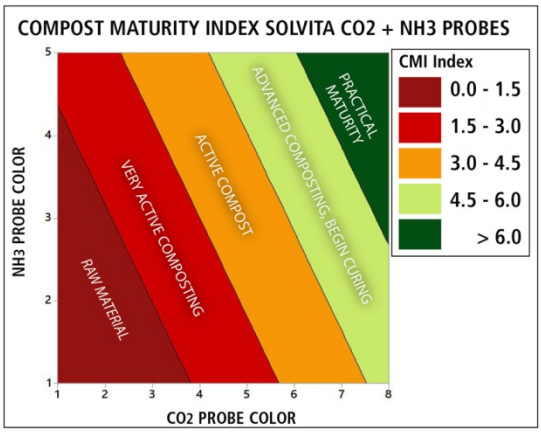
TECH MEMO 0317-6

SOLVITA CO_2 AND NH_3 CO-VARIATES TO DETERMINE MATURITY

Carbon dioxide (CO_2) and ammonia (NH_3) emissions from active composts jointly provide critical clues to the status of the composting process. especially as it goes from "active" to what is commonly called "curing" or "mature". Measuring CO_2 and NH_3 rates together is intended to garner information which either test alone cannot do, since composting is both a carbon and nitrogen stabilization process[1]. CO_2 release represents the raw energy of organic matter decomposition and also indicates probable oxygen demand. Ammonia escape may indicate an initial imbalance of decaying protein and urea in the intermediary amino-N forms, often generating high pH's and free NH_3, and certainly not yet stable. While these factors are normal in early stages of composting, they must both eventually subside before compost may be considered ready-to-use. At this point CO_2 release should be close to a "basal" background level and ammonia sequestered by microbes or converted by "nitrification" to non-volatile, plant-available nitrate (NO_3).

Solvita® provides a unique and reliable approach to gauge maturity by simultaneously indicating the CO_2 rate and the presence of free ammonia. The test employs a Solvita "Hi-CO_2" probe, calibrated for a wide range of 0 – 20% CO_2, since compost can replace all oxygen with CO_2 during composting, presenting an aeration challenge. Additionally, the NH_3 Solvita probe is calibrated for a wide range of ammonia which can climb to high levels in early stages. As a note, Solvita color numbers relate to concentration of CO_2 and NH_3 on an *exponential* scale, each color step doubling the quantity present.

The **Maturity Index** is calculated by reading both probes and determining the interrelation of the two indicators (see figure). This indexing serves two purposes: it factors the interference of high NH_3 in CO_2 determination and the real advancement to maturity[2]. Since compost never fully subsides in release of CO_2, the concept of "practical maturity" is applied whereby a status of satisfactory maturity is attained when compost is unlikely have odor or be phytotoxic to plants [3]. This is an Index (CMI) > 6.



Statistical analysis of the interaction of CO_2 and ammonia has resulted in a highly significant equation (r2=89%) relating maturity level to the ratios of the two Solvita indicators, as shown in the figure. Laboratories performing Solvita maturity tests can have access to a statistical **CMI calculator** which determines the precise location on the grid after reading Solvita probes with the DCR photometer. This should help reporting maturity in regions and states that require Solvita index documentation. tests should always be performed in conjunction with other lab analyses, particularly moisture and bulk density to properly represent the near end-status of compost.

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[1] Changa et al. (2003) Assessment of the Reliability of a Commercial Maturity Test Kit for Composted Manures. Compost Science & Utilization, (2003), Vol. 11, No. 2, 125-143

[2] Wang et al. (2004) Maturity indices for composted dairy and pig manures. Soil Biology & Biochemistry 36 (2004) 767–776

[3] Brinton & Evans (2001) How compost maturity affects container grown plants. Biocycle Vol 1 56:60

Attachment 2c

Agricultural Laboratory Compost and Soil Analysis Guidance

2017
FEE SCHEDULE

AGRICULTURE • ENVIRONMENTAL • ANIMAL FEED
PET FOOD • FOOD • FUEL • HOME/SMALL BUSINESS

Midwest Laboratories®

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General information for

MIDWEST LABORATORIES, INC

13611 B Street, Omaha, NE 68144 • 402-334-7770 • midwestlabs.com

Normal Business Hours of Operation

Monday-Friday, 8:00-5:00pm (Office)
All other analysis and samples received outside of normal business hours are required to be coordinated.

Samples Received at Midwest Laboratories

Monday-Friday, 8:00-5:00pm
Saturday Morning: Mail, UPS and FedEx only
All sample deliveries outside of Monday-Friday Business Hours are required to be coordinated to ensure proper receipt of samples occurs.

Time Sensitive Samples

All time sensitive samples need to be delivered by 4:00pm, Monday-Friday

PROJECT PRICING

Specific projects or packages may be provided as a quote. A Laboratory Representative can provide a tailor-made project with special pricing. Contracts or projects are reviewed each year unless a long term agreement has been made.

CREDIT POLICY

Payment is expected at the time of sample submission unless an account has been established. Payment can be made by check or credit card (VISA, MasterCard and American Express). Applications for an account may be obtained from our client service staff or on the website. All accounts must be paid in full within 30 days of invoicing. Analytical fees for work originating outside of the United States or Canada must be paid in full by credit card before the work will be started in the laboratory. Online payment is available on the website for clients wanting to pay by credit card.

INFORMATION WITH SAMPLE

Accuracy of vitamin, antibiotic and fertilizer assays requires knowledge of approximate analyte levels prior to analysis. Whenever possible, this information should be submitted with the sample. Submittal forms are available on the Midwest website located on the home page under the "Submittal Forms" link. Additional assays on samples with unknown levels may be charged to the submitter. Please note on your submittal form if your sample is submitted for compliance purposes.

INVOICING

All work reported will be invoiced. Please make checks payable to Midwest Laboratories. Payments can also be made online at midwestlabs.com

ACCREDITATIONS

Midwest carries extensive NELAC and ISO 17025 accreditations as demostrations of our commitment to quality. Clients can feel confident the results they are receiving have met stringent quality requirements for precision and accuracy. The scopes of accreditation can be obtained through the following links:

NELAC: http://lams.nelac-institue.org/lab_accreditations/index/502
A2LA - Biological: https://www.a2la.org/scopepdf/2853-01.pdf
A2LA - Chemical: https://www.a2la.org/scopepdf/2853-02.pdf

Contact an account manager at Midwest Laboratories for other state and organizational accreditations and certifications.

LABOR AND CONSULTING FEES

The following fees will be charged for method development work, deposition time, expert witness testimony, record search and compilation, and similar professional and clerical work, in addition to actual travel cost and other normal expenses.

	Hourly	Daily
Clerical	$50.00	$325.00
Technician	$65.00	$500.00
Chemist or other professional	$150.00	$1,200.00
Corporate Officers	$200.00	$1,600.00

QUALITY ASSURANCE/QUALITY CONTROL

If requested, a QA/QC report can be issued to support analytical data. Quality Control paperwork may be charged depending upon the time involved. Please contact QA Director at 402-334-7770 for additional information.

TURNAROUND TIME/RUSH PROGRAM

Turnaround times will vary depending upon the requested analysis, the matrix of the sample, and other factors. We are committed to process the samples from all of our customers as soon as possible. The Rush Program is a fee-based premium service reserved for those customers who need accelerated turnaround time for the requested analysis. A Rush Fee of 100% of the analysis cost (minimum of $100.00) will be applied to each rush request. We will respond to all rush requests on the same day as received, Monday-Friday (8:00am-4:30pm CST). Rush requests received outside of these hours will be addressed immediately on the following business day. Since the Rush Program may not be available for all analyses, please contact Midwest Labs prior to the submission of Rush samples. Microbiology, soil and feeds analyses are not available for the Rush Program.

RE-ASSAY POLICY
Results questioned by the client will be re-tested on request. If the retest confirms the original result, the client will be charged for the retest.

SAMPLE HOLDING
Samples are generally held up to 30 days prior to disposal. Walk-in coolers or freezers are used to store perishable samples. If longer-term storage is required, please contact an account manager as soon as possible after receiving analytical results. A storage fee will be applied to samples held after the 30 day.

SAMPLE SIZE
The amount of sample required can vary considerably depending on the type and number of analyses requested. In many cases, a minimum of 100 grams (four ounces) is required for each analysis. Appropriate containers and preservatives may be ordered from the laboratory at (402) 334-7770. Please check the fee schedule for sample size information.

SAMPLE PREP
An additional sample prep fee may be added to the cost of analysis if the sample is a large volume, is requiring compositing or is a complex matrix.

SHIPPING OPTIONS
Midwest Labs accepts shipment from all major couriers. Be sure to include a submittal form with your sample(s) Please ship your samples directly to:
Midwest Laboratories
13611 B Street
Omaha, NE 68144

Discounted shipping options are available to Midwest Labs clients for UPS, Spee Dee Delivery and FedEx. Contact your account manager for additional information.

SHIPPING AND SAMPLING SUPPLIES
Supplies are available through our website or by contacting account manager.

SPECIAL REPORTING PROCEDURES

MANUAL REPORTING OPTIONS

Special report formats can be compiled and used in place of our typical reports. The client will be charged a set-up fee and for printing of the original manual report. Special certificates of analysis can also be prepared at a cost of $30.00 each.

FACSIMILE REPORTING

Reports or other documents can be sent by FAX at no charge.

EMAIL REPORTING

Reports and/or other documents can be sent via EMAIL at no charge.

OVERNIGHT LETTER

Overnight courier service to any location in the United States is available and will be charged to the client.

SUBMITTAL FORMS

Submittal forms are available online on the home page under the "Sample Paperwork" tab. Forms are provided at no charge. Using provided forms enables us to route your samples properly, analyze them for the correct parameters and send results and invoicing to the proper places without added delay. If Internet access is not available to you, please call us to order submittal forms.

We request that a submittal form accompany each shipment. Please indicate if the sample may be hazardous. Additionally, the submittal form should include the following information: company/person that should be billed for the analysis; company/person to send the report upon completion; list of analytical parameters needed on the samples; and list of how each sample should be identified on the report.

INFORMATION TECHNOLOGY

Client requests regarding reported data, submittal of data and transfer of data must be coordinated with IT Management and approved by the Midwest Laboratories Management Team. These type of requests require assigned programming time and charges for programming may be applied depending on the complexity of the project.

NOTES

AGRICULTURE

SOIL

FEE

SOIL TEST PACKAGES

S1A (Basic): Organic Matter, Available Phosphorus, (P1 Weak Bray and P2 Strong Bray) Exchangeable Potassium, Magnesium, Calcium and Hydrogen, Soil pH, Buffer Index, Cation Exchange Capacity, Percent Base Saturation of Cation Elements
With Recommendations: **$10.50**
Without Recommendations: **$9.30**

S1AN: Same as test S1A with carryover Nitrogen as Nitrate
With Recommendations: **$13.20**
Without Recommendations: **$11.50**

Subsoil Nitrate-N:
With Recommendations: **$6.00**
Without Recommendations: **$5.50**

S1B: Same as test S1A with Olsen Bicarbonate Phosphorus in place of P2 Strong Bray Phosphorus
With Recommendations: **$10.50**
Without Recommendations: **$9.30**

S1C: Same as test S1A plus Olsen Bicarbonate Phosphorus
With Recommendations: **$11.50**
Without Recommendations: **$10.30**

S1AEC: Same as test S1A with Soluble Salts
With Recommendations: **$12.22**
Without Recommendations: **$11.00**

S1ANEC: Same as test S1AN with Soluble Salts
With Recommendations: **$14.92**
Without Recommendations: **$13.22**

S2: Test S1A plus Soluble Salts, Sodium, and Excess Lime
With Recommendations: **$13.40**
Without Recommendations: **$12.30**

S2N: Same as test S2 with Nitrate Nitrogen
With Recommendations: **$15.90**
Without Recommendations: **$14.70**

S3C: A complete analysis including S1A, S2N and S3
With Recommendations: **$26.50**
Without Recommendations: **$25.50**

LAWN & GARDEN: Organic Matter, Available Phosphorus (P1 Weak Bray and P2 Strong Bray), Exchangeable Potassium, Magnesium, Calcium and Hydrogen, Soil pH, Buffer Index, Cation Exchange Capacity, Percent Base Saturation of Cation Elements, Nitrate Nitrogen, Excess Lime, Soluble Salts, Sodium (Recommendations given in pounds per acre, 1000 square feet and 100 square feet) **$25.00**

SOIL HEALTH COMPLETE **$65.00**

is comprised of three components:

1. An in-depth soil analysis that will address the chemical aspects of the soil
2. The Solvita 1-day CO2C (S3C) test.
3. The Haney test with a Soil Health Calculation.

SOIL HEALTH BASIC **$55.00**

is comprised of three components:

1. A basic soil analysis (S1AN) that will address the chemical aspects of the soil.
2. The Solvita 1-day CO2C test.
3. The Haney test with a Soil Health Calculation.

The following packages must be combined with one of the previous packages:

S3: Sulfur, Zinc, Manganese, Iron, Copper, Boron
With Recommendations: **$14.20**
Without Recommendations: **$13.00**

S4: Zinc Manganese, Iron, Copper
With Recommendations: **$9.20**
Without Recommendations: **$8.40**

S5: Sulfur, Zinc
With Recommendations: **$6.80**
Without Recommendations: **$6.00**

S6: Sulfur, Zinc, Manganese, Boron
With Recommendations: **$12.80**
Without Recommendations: **$11.80**

**Recommendations include up to three crops or three yields on request.*

CONTAINER MEDIA EXTRACT pH, Conductivity, Available Nitrogen, Phosphorus, Potassium, Magnesium, Calcium, Sodium **$22.50**

RECOMMENDATIONS ONLY

New recommendations on old reports (per sample) **$3.00**

SAMPLE SIZE

1 soil sample bag filled to the FILL LINE (approximately 2 cups)
Contact Midwest Laboratories shipping department to order soil bags and boxes.

SPECIALIZED SOIL REPORTING

First Form Option (per sample) **$0.50**

FIRST FORM

First Form reports include soil data, graphics, and maintenance + build recommendation format. Many options may be made automatically standard for your account. Contact the laboratory for details.

REPORTING OPTIONS

Standard Recommendations are made for as many as three crops or three yields, or a combination of different crops and yields. You must supply the crop and yield goal information.

TEST PACKAGE SUGGESTIONS

If a field has never been sampled before, we recommend the complete test S3C. For grain crops that will require nitrogen, we recommend tests S1AN or S2N, which include nitrate nitrogen. In low rainfall areas, we also recommend a subsoil nitrate test. For legume crops, we recommend a test including Boron analysis (tests S3, S3C, or S6). In areas of high soil pH (over 7.1), we recommend test S1B (with Bicarbonate Phosphorus) and/or S2. For soil where manure has been applied frequently or heavily, we recommend test S2N. For determining optimum herbicide application rate, we recommend adding a Texture analysis to any of the above.

INDIVIDUAL SOIL ANALYSIS-OTHER CHEMICAL SOIL ANALYSIS

Aluminum (Extractable)		**$18.00**
Ammonacal Nitrogen		**$7.50**
Amino Sugar Nitrate Test		**$28.00**
Chloride		**$6.50**
C:N Ratio		**$24.00**
Electrical Conductivity (Soluble Salts)		**$6.00**
Electrical Conductivity (Soluble Salts) with paste extract		**$16.00**
Humic Matter		**$15.00**
Mehlich Phosphorus (Colorimetric)		**$3.00**
Mehlich Phosphorus (ICP)		**$3.00**
Mehlich Complete		**F.O.R.**
Morgan Extract		**$6.00**
Molybdenum (Extractable)		**$25.00**
Nitrate Nitrogen	With Recommendations:	**$6.00**
	Without Recommendations:	**$5.50**
Olsen Bicarbonate Phosphorus		**$1.00**
Organic Matter (Combustion) (LOI)		**$6.20**
Organic Matter (Walkley Black Titration)		**$35.00**
pH		**$6.00**
pH with paste extract		**$16.00**
PT2		**$22.00**
Quantitative CaCO3		**$27.00**
Resistivity by saturated paste extract		**$20.00**
Saturated Paste Extract		**$10.00**
Silicon		**$25.00**
Sodium Absorption Ratio (SAR) with paste extract		**$20.00**
Total Cation Exchange Capacity (EPA 9081)		**$40.00**
Total Kjeldahl Nitrogen		**$9.00**
Total Nitrogen		**$9.00**
Total Carbon		**$18.00**
Total Phosphorus		**$12.00**
Water Soluble Carbon		**$10.00**
Water Soluble Extraction (P, K, Mg, Ca, Na, S)		**$5.50**

INDIVIDUAL ANALYSIS OF EXTRACTABLE SOIL NUTRIENTS

Sodium	With Recommendations:	**$2.55**
	Without Recommendations:	**$2.15**
Sulfur	With Recommendations:	**$4.35**
	Without Recommendations:	**$3.95**
Zinc, Manganese, Iron, Copper, Boron (each element)		
	With Recommendations:	**$2.95**
	Without Recommendations:	**$2.55**

**Recommendations include up to three crops or three yields on request.*

ADDITIONAL SOIL ANALYSIS — SOIL PHYSICAL MEASUREMENTS

Available Moisture (1/3 plus 15 BAR limits measured with membrane apparatus)	**$21.50**
Individual BAR	**$16.00**
Bulk Density (Disturbed Soil)	**$5.35**
Grain size (ASTM D422)	**$65.00**
Receiving Moisture	**$3.00**
Texture (% Sand, Silt, Clay) by hydrometer	**$11.20**

COMPOSITE SAMPLE PREPARATION

Per sample group	**$5.00**

NEMATODE ASSAYS (Ag Soil)

Plant Parasitic Nematode Analysis (Live Parasite ID)	**$58.00**
Plant Parasitic Nematode Analysis (Compost) (Live Parasite ID)	**$68.00**
Cyst Nematode Identification (Ag Soil) (Egg Count)	**$28.00**
Cyst Nematode (Compost) (Egg Count)	**$38.00**
Root Tissue Examination (Root-Knot Nematode Only)	**$20.00**

PLANT TISSUE

PLANT TEST (COMPLETE)

Nitrogen, Sulfur, Phosphorus, Potassium, Magnesium, Calcium, Sodium, Iron, Manganese, Copper, Boron, Zinc	With Interpretations:	**$24.00**
	Without Interpretations:	**$22.00**

MINERAL PACKAGE

Sulfur, Phosphorus, Potassium, Magnesium, Calcium, Sodium, Iron, Manganese, Copper, Boron, Zinc	**$17.00**
Total Nitrogen	**$9.00**
Nitrate Nitrogen	**$10.00**
Mineral Package + Nitrate Nitrogen	**$22.00**

OTHER ANALYSIS

Ammoniacal Nitrogen	**$10.00**
Carbon	**$10.00**
Chloride	**$10.00**
Cobalt	**$24.00**
Nitrate Nitrogen	**$10.00**
Stalk Nitrate	**$16.00**
Molybdenum	**$24.00**
Molybdenum + Cobalt	**$30.00**
Selenium	**$36.00**

Note: Discounts are available for multiple samples received dried and ground.

SEED GERMINATION

Barley, Wheat, Corn	1lb	**$20.00**
Alfalfa, Clover, Rye, Soybeans	1lb	**$20.00**
Fescue, Oats	1lb	**$20.00**
Cold Stress (Soybeans & Corn only)	1lb	**$20.00**

Please allow a minimum of ten days for germination tests.

GMO DETECTION (ddPCR)

	100g	
	Basic Screen	Event Specific
Corn	**$400.00**	**$100.00**
Alfalfa	**$175.00**	**$100.00**
Soy	**$295.00**	**$100.00**
Flax	**$175.00**	**$100.00**
Canola	**$175.00**	**$100.00**
Rice	**$175.00**	**$100.00**
Sugar Beets	**$175.00**	**$100.00**

FERTILIZER

	SUGGESTED SAMPLE SIZE (MINIMUM)	FEE

FERTILIZER AND LIME

Total Nitrogen	50g	**$25.00**
Total Nitrogen and Total Phosphate (P_2O_5)	100g	**$50.00**
Total Nitrogen, Total Phosphate (P_2O_5), and Total Potash (K_2O)	100g	**$60.00**
10-34-0: Total Nitrogen, Total Phosphate (P_2O_5), Ortho Phosphorus, Specific Gravity, pH	100g	**$60.00**

NITROGEN PROFILE Total Nitrogen, Nitrate, Urea, Ammoniacal **$65.00**

MICRONUTRIENT GENERAL ANALYSIS COMPLETE	100g	**$50.00**
Boron, Calcium, Copper, Iron, Manganese, Magnesium, Sodium, Phosphorus, Potassium, Sulfur, Zinc (includes sample prep)		
Single Element from above	50g	**$22.00**
Single Chelated Mineral	50g	**$25.00**
Zinc, Copper, Iron, Manganese	50g	
FORMULATION LEVEL ASSAY	100g	
Boron, Calcium, Copper, Iron, Manganese, Magnesium, Sodium, Phosphorus, Potassium, Sulfur, Zinc (includes sample prep)		
Single Element from above		**$50.00**
Any two elements from above		**$80.00**
Additional elements from above		**$20.00**
PHOSPHORUS (as Phosphate, P_2O_5)		
Total Phosphorus	100g	**$25.00**
Ortho Phosphorus	100g	**$25.00**
Available Phosphorus (Dry Product Only)	100g	**$25.00**
POTASSIUM (as Potash K_2O)		
Total Potash	100g	**$25.00**
Soluble Potash	100g	**$25.00**
HEAVY METALS SCREEN (NON-REGISTRATION)	50g	**$60.00**
Arsenic, Lead, Cadmium, Chromium		
HEAVY METALS SCREEN (FOR CALIFORNIA REGISTRATIONS)	50g	**$130.00**
Arsenic, Cadmium, Cobalt, Copper, Lead, Molybdenum, Nickel, Selenium.		
HEAVY METALS SCREEN (FOR WASHINGTON REGISTRATIONS) Arsenic, Cadmium, Cobalt, Lead, Mercury, Molybdenum, Nickel, Selenium and Zinc.	50g	**$130.00**
HEAVY METALS SCREEN (FOR CANADIAN REGISTRATIONS)	50g	**$140.00**
Arsenic, Cadmium, Cobalt, Copper, Chromium, Lead, Mercury, Molybdenum, Nickel, Selenium, and Zinc.		

INDIVIDUAL ANALYSIS

Ammoniacal Nitrogen	100g	**$20.00**
Chloride	50g	**$20.00**
C/N Ratio	100g	**$30.00**
Free Ammonia	100g	**$25.00**
Fluoride	100g	**$25.00**
Humic Acid	100g	**$80.00**
Moisture Only	100g	**$10.00**
Nitrogen (N), Total		**$25.00**
pH	100g	**$10.00**
Salt Index	100g	**$15.00**
Salt Out Temperature	100g	**$15.00**
Specific Gravity	100g	**$12.00**
Urea Nitrogen	1 pint	**$25.00**
Water Insoluble Nitrogen	100g	**$25.00**

LIMESTONE MATERIALS

	SUGGESTED SAMPLE SIZE (MINIMUM)	FEE
BASIC LIME PACKAGE	200g	**$60.00**

Calcium, Magnesium, Total Neutralizing Value, Sieve 4, Sieve 8, Sieve 60, ECCE, Moisture

KANSAS LIME PACKAGE	200g	**$60.00**

Calcium, Magnesium, Total Neutralizing Value, Sieve 4, Sieve 8, Sieve 60, Kansas ECC, Moisture

MISSOURI LIME PACKAGE	200g	**$60.00**

Calcium, Magnesium, Total Neutralizing Value, Sieve 4, Sieve 8, Sieve 40, Sieve 60, ECCE, ENM, Moisture

MINNESOTA LIME PACKAGE	200g	**$60.00**

Calcium, Magnesium, Total Neutralizing Value, Sieve 8, Sieve 20, Sieve 60, ENP, Moisture

Total Neutralizing Value (CaCO3 Equivalent)	100g	**$20.00**
Sieve Analysis (specify sizes) each	100g	**$6.00**

GYPSUM PACKAGE	200g	**$60.00**

Calcium, Magnesium, Sulfur, 100 Sieve, pH, Gypsum Purity as CaSO4: $2H_2O$, and Free Moisture

MANURE, BIOSOLIDS AND COMPOST

BASIC MANURE PACKAGE 200g **$40.00**
Moisture/Total Solids, Total Nitrogen, Phosphate, Potash, Sulfur, Calcium, Magnesium, Sodium, Iron, Manganese, Copper, Zinc, pH, Ammoniacal Nitrogen, Organic Nitrogen

LAGOON WATER PACKAGE 200g **$40.00**
Conductance, Kjeldahl Nitrogen, Ammoniacal Nitrogen, Organic Nitrogen, pH, Phosphorus, Potassium, Sulfur, Magnesium, Calcium, Sodium, Iron, Manganese, Copper, Zinc

COMPOST PLUS PACKAGE 200g **$75.00**
Moisture/Total Solids, Total Nitrogen, Organic Nitrogen, Phosphate, Potash, Sulfur, Calcium, Magnesium, Sodium, Iron, Manganese, Copper, Zinc, pH, Total Carbon, Soluble Salts, C/N Ratio, Ammoniacal Nitrogen, Nitrate Nitrogen, Chloride, Organic Matter, Ash

EPA 503 PACKAGE 250g **$215.00**
Total Solids, Ammoniacal Nitrogen, Total Kjeldahl Nitrogen, Phosphorus, Potassium, Sulfur, Calcium, Magnesium, Sodium, Iron, Manganese, Copper, Zinc, pH, Nitrate Nitrogen, Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Calculated Phosphate, Calculated Potash, Organic Nitrogen

SEAL OF TESTING ASSURANCE (STA) COMPOST COUNCIL PACKAGE 250g **$375.00**
man-made materials, Boron, Chloride, Total Carbon, Organic Matter, Zinc, Copper, Manganese, Iron, Sodium, Magnesium, Calcium, Sulfur, Potash, Phosphate, Total Nitrogen, Moisture, Ammoniacal Nitrogen, Organic Nitrogen, pH, Nitrate Nitrogen, Arsenic, Cadmium, Chromium, Lead, Mercury, Molybdenum, Nickel, Selenium, Salmonella, 7 Day Germination, Maturity Index, Conductivity, Fecal Coliform, Sieves, % Passing, 10 Day Vigor.

ORGANIC MATERIALS REVIEW INSTITUTE (OMRI) PACKAGE 250g **$400.00**
E.coli, Fecal Coliform, Salmonella, Total Kjeldahl Nitrogen, Total Phosphate, Potash, Nitrate Nitrogen, Water Soluble Nitrogen, Water Insoluble Nitrogen, Ammoniacal Nitrogen, Humic Acid, pH, Total Organic Carbon, Bulk Density (Packed), Moisture, Sulfur, Calcium, Boron, Cobalt, Copper, Iron, Manganese, Arsenic, Chloride, Lead, Selenium, Cadmium, Chromium, Mercury, Nickel, Sodium, Molybdenum, Zinc

INDIVIDUAL ANALYSIS

Ash	50g	**$15.00**
Chloride	100g	**$20.00**
C/N Ratio	50g	**$30.00**
Cyst Nematode (Compost) (Egg Count)	100g	**$38.00**
Moisture	100g	**$10.00**
Nitrogen, Ammonia	100g	**$20.00**
Nitrate (by IC)	100g	**$20.00**
Nitrogen, Total Kjeldahl	100g	**$25.00**
Organic Matter (Combustion) (LOI)	100g	**$15.00**
pH	100g	**$10.00**
Plant Parasitic Identification (Compost)	100g	**$68.00**
Solids, Total	100g	**$10.00**
Solids, Total Volatile	100g	**$20.00**
SOUR (Specific Oxygen Uptake Rate)	100g	**$65.00**

CAUTION!

Many manures and sludges are biologically active and will produce gases even after being sealed in a container. These gases produce pressure that can burst the container or pop its lid. Precautions should be taken in shipping manure or sludge samples: Never use a glass container and always tape the lid. One pint of sample is adequate.

MICROBIOLOGY

SOIL, SLUDGE AND COMPOST

	SUGGESTED SAMPLE SIZE (MINIMUM)	FEE
Aerobic Plate Count	25g	**$20.00**
Anaerobic Plate Count	25g	**$20.00**
Azotobacter	25g	**$20.00**
E. coli (MPN)	25g	**$25.00**
Fecal Coliform (EPA 1681)	200g	**$30.00**
Fecal Coliform (7 Fecal + % solids)	50g x 7	**$280.00**
Salmonella (EPA 1682)	60g solid, 1 L liquid	**$125.00**
Total Coliforms (MPN)	25g	**$25.00**

LEAFY GREEN PATHOGEN PACKAGE 250g **$270.00**

Fecal Coliform, Salmonella, Total Coliform, E. coli (generic), E. coli O157:H7, Listeria, Solids

Appendix E
Plan for Land Application of Contact Water

Eagle Point II • 8550 Hudson Blvd. North, Suite 105
Lake Elmo, MN 55042
(651) 288-8550 • Fax: (651) 288-8551
www.foth.com

February 15, 2018

Mr. Eric Porcher, P.G.
Minnesota Pollution Control Agency
18 Wood Lake Drive S.E.
Rochester, MN 55904

Dear Mr. Porcher:

RE: MFS Farms, LLC and Midwest Recycling Solutions, LLC- Good Thunder (SW-662) Land Application Phase 1 Site Workplan

Foth Infrastructure & Environment, LLC (Foth) is submitting this workplan to the Minnesota Pollution Control Agency (MPCA) on behalf of MFS Farms, LLC and Midwest Recycling Solutions, LLC (MFS/Midwest). This workplan has been developed in general accordance with Minnesota Rule 7035.2815-subpart 10-item E, the facility permit[1], the Land Treatment of Landfill Leachate guidance document[2] (Guidance), and discussions with MPCA in the fall of 2016.

Background

MFS/ Midwest operates a composting facility and a contact water pond with a capacity of approximately 3,000,000 gallons. To support composting operations MFS/ Midwest is seeking to add provisions to their existing permit for land application of the contact water. MFS/ Midwest began pursuing the installation of a land application site in 2016, by initiating preliminary leachate monitoring and preliminary evaluation of the field soils. In November of 2016 MFS/ Midwest conducted a one (1) time land application event following written approval from MPCA[3].

The land application event was conducted by an independent contractor and included chisel plowing followed by knife injection of the contact water approximately six inches below ground surface. The volume and flow rate of contact water are metered along the drag line which conveys water from the contact pond to the knife injector. MFS/Midwest is providing this workplan to support routine one (1) time land application events using these same procedures in the fall of each year.

[1] Major modification approved 2016
[2] MPCA, 2011
[3] email correspondence dated November 3, 2016

Site Setting

The proposed land application phase 1 site (Site) setting is described on **Figure 1**. MFS/ Midwest intends to operate the Site in substantive compliance with Guidance[4]. The following list has been developed to demonstrate substantive compliance with items 1 through 18 in section five Land Application Site Permit of Guidance[5].

1. A contact water pond with a capacity of approximately 3,000,000 gallons is currently situated in the central portion of the Site. The pond does not use pretreatment such as aerators or chemical additives. The annual land application events will be conducted by an independent contractor and includes chisel plowing of the ground followed by knife injection of the contact water approximately six inches below ground surface. The volume and flow rate of contact water are metered along the drag line which conveys water from the contact pond to the knife injector. The cover crop is soybeans.
2. The Site is comprised of approximately 107 acres for land application, and approximately 28 acres of buffer area, for a total Site area of approximately 135 acres. In accordance with the Blue Earth County Water Management Plan for Feedlots and Manure Management to mitigate priority concerns in surface water quality[6] (County Guidance), the Site has provided a buffer area of 100 feet from public and/or private drainage ditches.
3. The Site is located in Rapidan Township near the city of Good Thunder at cadastral location Township 106 Range 27 Section 1 and spans 40-acre quarter sections A and B, and northern half of 40-acre quarter sections C and D. The land is currently owned by Mike Fitzsimmons & Sons, LLC and occupied by the Fitsimmons family.
4. The Site is comprised of former agricultural lands, and used for growing soybeans. The former application of pesticides, fertilizer, or sewer sludge is unknown at this time.
5. The lands surrounding the Site are existing and former agricultural lands, with approximately 20 homesteads within one mile of the Site. The Site is situated approximately 2 to 10 feet topographically down-gradient from private wells (see **Figure 1**) and approximately 2 miles from the nearest public water supply well.
6. Wind drift receptors are not considered applicable based on the method of application (subsurface injection, not spraying). Note, the Site meets setback distances as identified in the County Guidance[7].
7. The Site is located over 1,000 feet from the nearest flood plain and surface water; wetlands are not present within 1 mile of the site. Note, the Site meets setback

[4] ibid
[5] ibid
[6] Blue Earth County Water Management Plan, 2008- 2013
[7] ibid

distances as identified in the County Guidance[8].

8. A Site map is provided on **Figure 1** indicating the topography, buffer area, and land application area.

9. The United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Soil Surveys[9] excerpts for the Site are provided on **Figure 1** and reports included in **Attachment 1**. While the upper six to twelve inches of the Site have likely been disturbed during agricultural activity, the lower twelve to sixty inches are likely consistent with soil survey publications. The distribution of USDA NRCS soil units, and select soil properties, across the Site are summarized on **Figure 1**.

10. MFS/ Midwest conducted limited preliminary evaluation of the field soils in November 2016. Six grab samples were collected and the results are summarized below and in **Attachment 2**. MFS/Midwest will conduct additional soil evaluations as described in the following section.

    A. The Site soils were not analyzed for textural classification.

    B. The Site soils were measured to contain 5.7% to 6.6% organic matter. The Site soils results for organic matter ranged from 5.7% to 6.6%.

    C. According to near-Site well logs from the Minnesota Well Index[10] and United States Geological Survey (USGS) Hydrologic Atlas 525 (HA-525) Publications[11] USGS Hydrologic Atlas publications, the unconfined quaternary aquifer water table is over 50 feet below ground surface (ft bgs).

    D. According to the USDA NRCS soil surveys[12], the Available Water-Holding Capacity (AWC) and hydraulic conductivity in the upper 5 feet ranged from 7.5 inches to 10.9 inches and 0.06 to 0.57 inches per hour (in/hr). These meet the AWC requirement of greater than or equal to 6 inches, and hydraulic conductivity requirement of greater than 0.004 in/hr and less than 6 in/hr. Note, using the low AWC (7.5 inches) and Site area (130 acres), the Site soils can hold approximately 26,000,000 gallons of water in the upper 5 feet. Using the low hydraulic conductivity (0.06 in/hr), Site area (130 acres) and contact water pond volume (3,000,000 gallons), the Site soils can infiltrate approximately 23,000 gallons per acre, or 0.85 inch of water, in approximately 14 hours. Note, this application rate (0.85 inch) meets the average application rate guidance of 0.5 inch to 1 inch.

    E. The Site soils results for extractable phosphorus ranged from 93 to 133 ppm.

[8] ibid
[9] USDA SCS 1978 and USDA NRCS web soil survey 2017
[10] Minnesota Department of Health map-based on-line search, 2017, https://apps.health.state.mn.us/cwi/
[11] Water resources of the Blue Earth River watershed, south-central Minnesota, HA-525, by H.W. Anderson, D.F. Farrell, and W.L. Broussard, 1974
[12] ibid

F. The Site soils results for exchangeable potassium ranged from 190 to 342 ppm.

G. The Site soils results for pH ranged from 5.8 to 6.8.

H. The Site soils were not analyzed for CEC.

I. The Site soils were not analyzed for specific conductance.

11. According to the USGS topographic map[13], the Site topography ranges from approximately 990 to 1,000 ft amsl, sloping less than 1% to the south-southeast.

12. The life expectancy of the Site soils based on lifetime loading of metals is over 100 years, and annual loading of nutrients is below applicable standards. The results of the chemical loading calculations is provided on **Table 1**.

13. Marginal soils are not present at the Site.

14. Given proposed operations (one-time annual land application event), MFS/ Midwest is not pursuing hydrogeologic investigation. According to USDA NRCS soil surveys[14] the surface soils consist of silt and clay loams. According to USGS HA-525 Publications[15], the quaternary system is primarily comprised of flat-lying thin clay deposits on top of till, with a saturated thickness of approximately 100 to 200 feet. The quaternary system unconfined groundwater level is approximately 50 to 100 ft bgs, and the groundwater flow direction is generally to the east. The quaternary system is underlain by the Praire du Chien group, followed by Jordan Sandstone. According to near-Site well logs from the Minnesota Well Index[16], sandy clay deposits extend 20 to 70 ft bgs, followed by alternating sand and clay deposits to 200 to 250 ft bgs, followed by bedrock.

15. The proposed compliance boundary for the Site will be the existing property boundary.

16. Given proposed operations (one-time annual land application event), MFS/ Midwest proposes semi-annual monitoring of the drain tile system and annual monitoring of surface soils at the locations described on **Figure 3**.

17. MFS/ Midwest currently holds a signed agreement with the City of Good Thunder wastewater treatment plant. A copy of the agreement is provided in **Attachment 3**. Given proposed operations (one-time annual land application event), MFS/Midwest believes this fulfills the contingency action plan.

18. Given proposed operations (one-time annual land application event), MFS/ Midwest is not pursuing methods of controlled access to the Site.

[13] USGS Good Thunder MN 1:24,000 7.5-minute quadrangle, 2016
[14] ibid
[15] ibid
[16] ibid

Site Operations

The proposed Site operations are described on **Figure 2**. MFS/ Midwest intends to operate the Site in substantive compliance with the Guidance document. The following discussion has been developed to demonstrate substantive compliance with sections six, seven, eight, and ten of the Guidance document.

The land applications events will be conducted by an independent contractor. Given proposed operations (one-time annual land application event), MFS/ Midwest is not pursuing a class D wastewater treatment certificate and a type 5 land application of liquid waste certificate.

Given the intended frequency and method of land application (i.e., annual knife injection), the hydraulic loading rate will be approximately 0.85 inches per acre per year, 0.85 inches per acre per irrigation event, and 0.85 inches per hour per irrigation event (i.e., single-pass application). The knife injection of the 0.85 inches of contact water will occur approximately 6 inches below ground surface, promoting lateral infiltration within the root zone perpendicular to the injection line, and minimizing conditions that may result in saturated conditions/ oxygen depletion in the root zone, and run-off.

The soil water deficit will be calculated from precipitation reported at local weather website[17] and crop evapotranspiration values provided in the Irrigation Scheduling Checkbook Method[18] (irrigation checkbook). It is anticipated that the annual land application event will occur in the fall each year before October 30.

As provided on **Figure 2**, the land application event will follow a single pass pattern across the Site. It will take the contractor approximately 16 hours to complete the land application event. The independent contractor knife injection tractor will be equipped with Global Positioning System (GPS) to ensure the land application events are conducted within the bounds of the land application area demarcated on **Figure 2**. In addition the volume and flow rate of contact water will be metered along the drag line which conveys water from the contact pond to the knife injector. Lastly the use of subsurface knife injection, as compared to spray irrigation, are not expected to contribute to potential air quality concerns including wind drift, evaporative loss, and/ or exceedance of air emission limits.

A preliminary contact water sample was collected in the fall of 2016, and the results were evaluated relative to the Site soils life expectancy for parameters with standards stated in the Guidance document. A summary is provided on **Table 1**, and the laboratory report is provided in **Attachment 3**.

The life expectancy of the Site soils based on lifetime loading of metals is over 100 years, and annual loading of nutrients is below applicable standards. The parameters that were not analyzed during the fall of 2016 sampling event included Sodium Absorption Ratio (SAR) and Perfluoro-chemicals (PFC's), and Volatile Organic Chemicals (VOC's). These will be added to future

[17] Weather underground, 2017, https://www.wunderground.com/us/mn/good-thunder
[18] University of Minnesota Extension Services, by Jerry Wright, 2002

annual fall contact water monitoring events. The proposed contact water sample location is shown on **Figure 2**.

Four preliminary soil samples were collected from the land application Site in the fall of 2016 and the results were reported above, and laboratory reports are provided in **Attachment 2**. The parameters that were not analyzed during the fall of 2016 sampling event included USDA textural classification, Cation Exchange Capacity (CEC), and Specific Conductance (EC). These will be added to future annual spring soil sampling events. MFS/ Midwest proposes to collect three (3) composite soil samples, each mixed from 16 subsamples collected at a rate of approximately 2 samples per acre. The proposed soil sample locations are shown on **Figure 2**.

In lieu of a groundwater monitoring points, MFS/Midwest will endeavor to collect an annual spring water sample from the furthest down-gradient discharge point of the Site drain tile system. The proposed drain tile water sample location is shown on **Figure 2**.

The cover crop will be soy beans and will not be used for animal feedstock. The cover crop will be cut at least one time per year, bailed, weighed, and composted on-site and/or sent for off-site landfill disposal. MFS/ Midwest currently holds a signed agreement with the City of Mapleton wastewater treatment plant. A copy of the agreement can be provided upon request. Given proposed operations (one-time annual land application event), MFS/Midwest believes this fulfills the contingency action plan.

MFS/Midwest will prepare and maintain records to support the annual land application event in accordance with the Guidance. This will include the laboratory analytical results of soil samples and drain tile water samples collected annually in the spring, contact water sample collected annually in the fall, and daily soil-water deficit monitoring (i.e., irrigation checkbook) and monthly soil EC monitoring measured during the spring, summer, and fall. The monthly EC monitoring locations will correspond to the 16 subsample locations used to collect the annual composite soil samples, and measured at a rate of approximately 2 EC readings per acre. The sampling and monitoring locations are shown on **Figure 2**.

During the annual land application knife injection event the total injection duration (hours), land application area used (acres), injection rate (gallons per acre), and total volume of contact water applied to the Site (gallons) will be measured and recorded by the independent contractor and provided to MFS/Midwest. In addition MFS/Midwest will perform routine monthly observation inspection of the contact water pond and Site. Observation inspections will include noting areas of concern from previous irrigations or rainfall events, locations of standing water, presence of crop stress conditions, erosion damage, damage by animals and/or improper function/ operation of the facility and/or equipment, contact water pond free-board, and preparations for winterizing the composting operation. If erosion problems or standing water conditions are observed, silt fence and/or hay bales will be used to repair the damaged locations, and these areas will be avoided for land application.

Site Assessment Workplan

MFS/Midwest proposes the following Site assessment workplan to support the evaluation of

approximately 107 acres for an annual subsurface knife injection land application event of contact water associated with their composting facility. The Site assessment will include soil sampling and contact water sampling. The Site assessment sampling locations are provided on **Figure 3**.

The objective of the soil sampling is to collect representative soil samples (aerially and vertically) that will be part of the treatment system used during land application of the contact water. **Table 2** shows a list of the proposed laboratory analysis for this assessment**.**

Table 2
Standard Spray Application Parameters for Laboratory Analysis

Parameter	Unit	Method
USDA soil textural classification and hydrometer	NA	ASA
organic matter (loss of weight on ignition)	percent	NCR
field capacity and wilting point	psi	ASTM D2325
extractable phosphorous*	mg/kg converted to lb/acre	NCR
exchangeable potassium	mg/kg coverted to lb/acre	NCR, RMST
soil pH	s.u.	NCR
cation exchange capacity	meq/L convert to meq/100g	ASA
soluble salts/ electrical conductance	mmhos/cm	USDA
bulk density	g/cm3 converted to pcf	volume
total RCRA metals (As, Cd, Cu, Pb, Hg, Ni, Se, Zn)	mg/kg	EPA 6010B
total boron	mg/kg	EPA 6010B
extractable boron	mg/kg converted to lb/acre	NAPT

Notes:
*Olsen method >pH 7.4>Bray P1 method

The Guidance[19] and landfill regulations[20] have been used as a guide to establish a sufficient number of soil borings to characterize the spray application site soil. The guidance advises the collection of one (1) composite sample comprising of 15-20 sub-samples, in the upper 6-12 inches, for every 40 acres. The guidance is not clear on depth specific subsampling requirements to account for differing soil horizons or lithology within the rooting zone, or evaluating the persistence (i.e. depth, thickness) of the surface soil horizon(s). Interpretation of the landfill regulations[21] suggests that 60 borings (i.e. subsamples) would be required for characterization of 135 acres. Based on these guidance, MFS/Midwest proposes collecting 3 composite surface samples, each mixed from 16 subsamples collected in the upper 6-12 inches, as shown on **Figure 3** (i.e., CS-1, CS-2, CS-3).

In addition to the composite surface sampling, three (3) test pits will be excavated (or hand-augered) to 6 ft bgs in order to assess subsurface soil characteristics of the rooting zone (e.g., available water holding capacity). At each test pit, subsamples will be collected at 1-foot intervals from 1 to 5 ft bgs. MFS/Midwest proposes collecting 3 composite subsurface samples,

[19] ibid
[20] MN Rule 7035.2815 subpart 3- item F3
[21] ibid

each mixed from 5 subsamples collected in the upper 5 feet, as shown on **Figure 3** (i.e., TP-1, TP-2, TP-3).

Schedule

MFS/Midwest anticipates that the Site assessment will occur in early June 2017. Foth will notify the MPCA at least seven days prior to initiating field activities in accordance with Minnesota Rule 7035.2815 Subpart 12A.

Foth will submit a Land Application Phase 1 Site completion report to the MPCA following execution of this work plan. The completion report will include a discussion on sampling activities and deviations, if any, from the work plan. The completion report will be incorporated into the permit modification documents currently being prepared by Foth. It is expected that MPCA will comment on the completion report as part of their response to the permit modification documents in the spring of 2018.

Please contact Brian Sperrazza at (651) 288-8584 or brian.sperrazza@foth.com if you have questions or need additional information.

Sincerely,

Foth Infrastructure & Environment, LLC

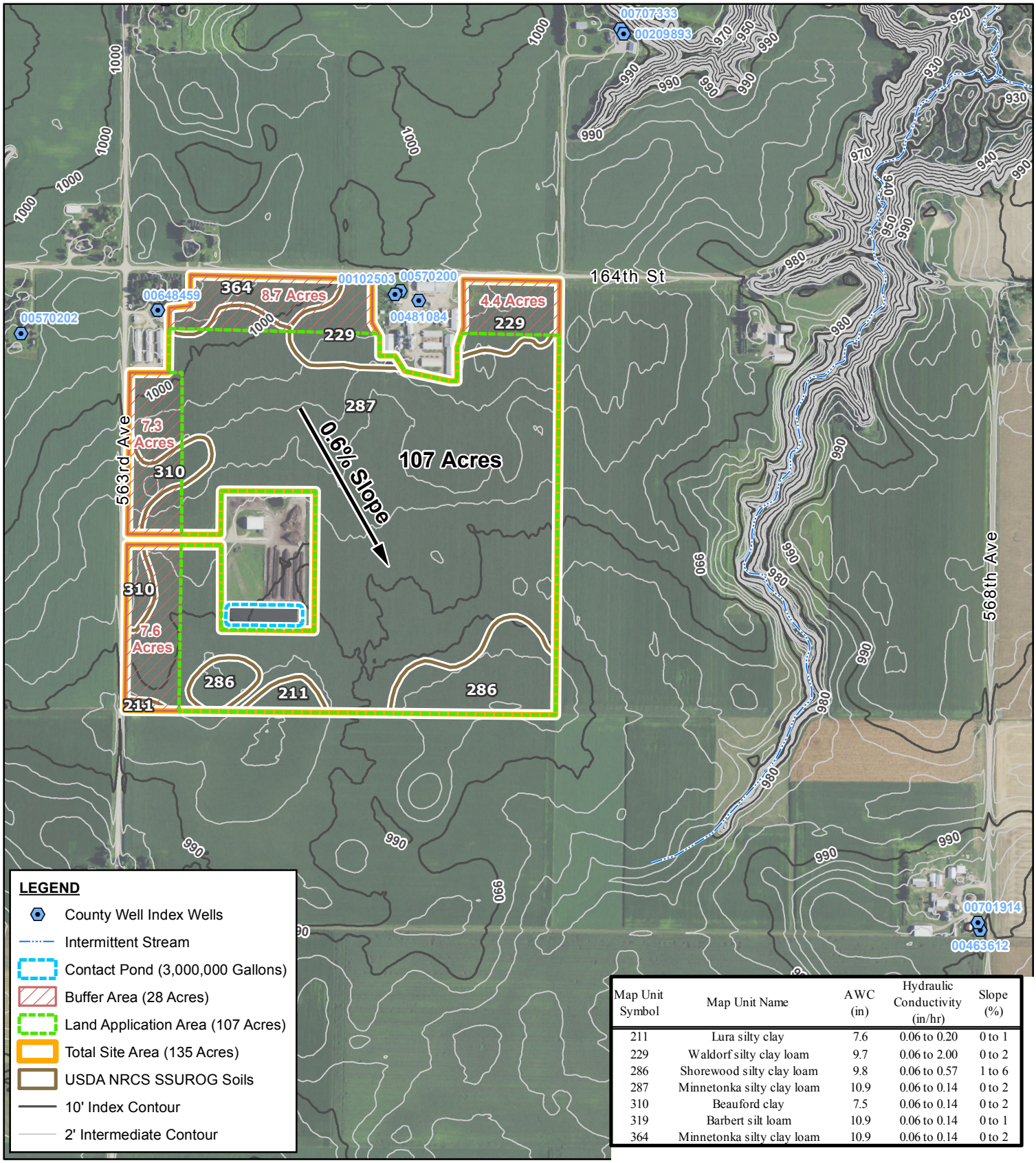
Brian M. Sperrazza, P.E., P.G.
Project Environmental Engineer

Bruce M. Rehwaldt, P.E.
Project Manager

Attachments:
- Figures
- Tables
- Attachment 1 USDA NRCS Soil Surveys Excerpts
- Attachment 2 Analytical Laboratory Reports for Preliminary Soil Samples
- Attachment 3 Analytical Laboratory Reports for Preliminary Contact Water Sample

cc: Ms. Sherri Nachtigal, P.E., MPCA
MFS Farms, LLC
Midwest Recycling Solutions, LLC

Figures



Map Unit Symbol	Map Unit Name	AWC (in)	Hydraulic Conductivity (in/hr)	Slope (%)
211	Lura silty clay	7.6	0.06 to 0.20	0 to 1
229	Waldorf silty clay loam	9.7	0.06 to 2.00	0 to 2
286	Shorewood silty clay loam	9.8	0.06 to 0.57	1 to 6
287	Minnetonka silty clay loam	10.9	0.06 to 0.14	0 to 2
310	Beauford clay	7.5	0.06 to 0.14	0 to 2
319	Barbert silt loam	10.9	0.06 to 0.14	0 to 1
364	Minnetonka silty clay loam	10.9	0.06 to 0.14	0 to 2

NOTES:
1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).

Foth

N

0 400 800 Feet

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

MIDWEST RECYCLING SOLUTIONS

FIGURE 1

SITE SETTING
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: MAY 2017	Revision Date:	
Drawn By: BJW1	Checked By: BMS2	Scope: 16M185

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 1 - Site Setting Map.mxd Date: 5/12/2017

NOTES:
1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).

Foth

N

0 200 400 Feet

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

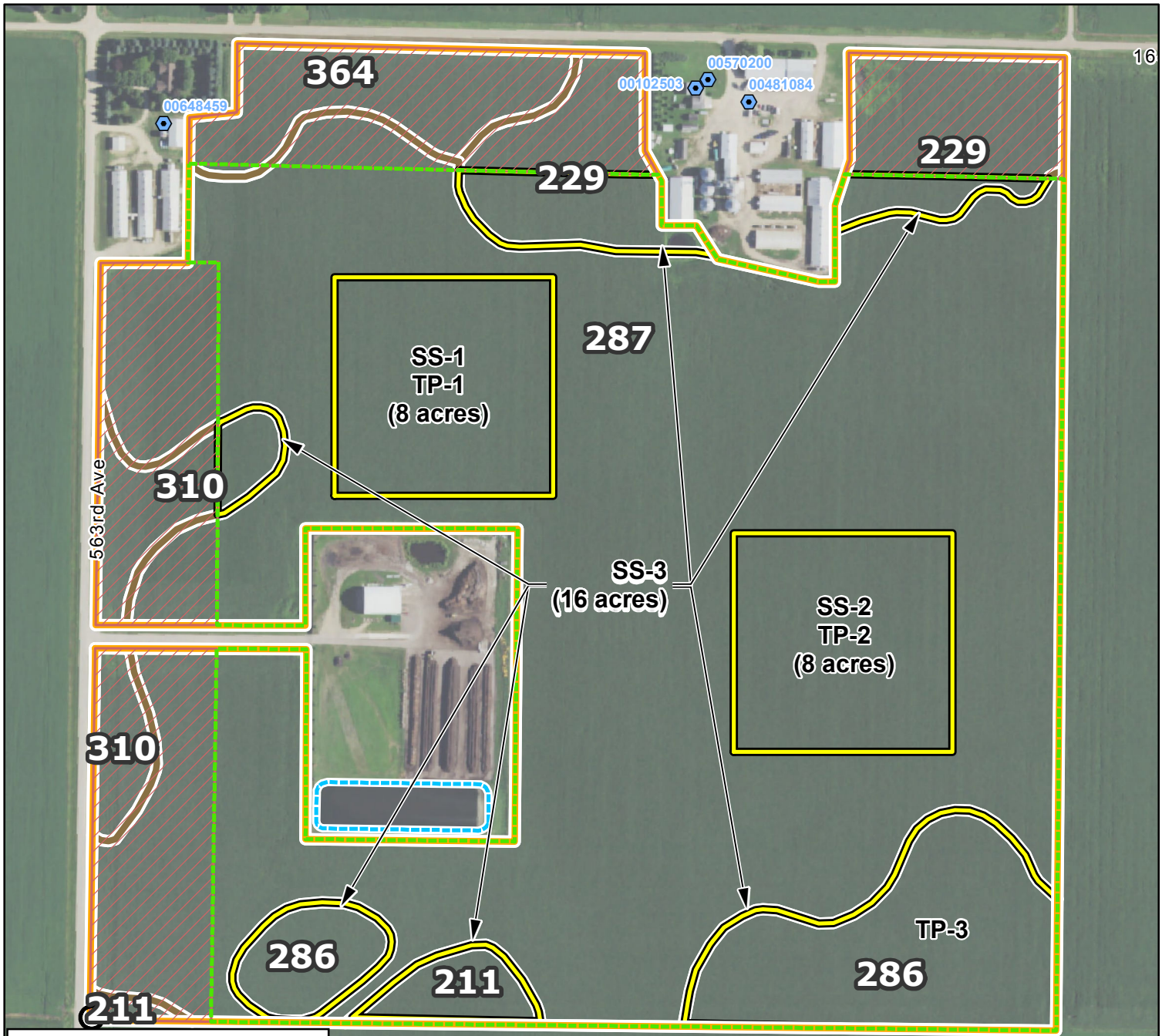
MIDWEST RECYCLING SOLUTIONS

FIGURE 2

SITE OPERATIONS
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: MAY 2017	Revision Date:	
Drawn By: BJW1	Checked By: BMS2	Scope: 16M185

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 2 - Site Operations Map.mxd Date: 5/12/2017



LEGEND

- County Well Index Wells
- Intermittent Stream
- Land Application Area (107 Acres)
- Buffer Area (28 Acres)
- Contact Pond (3,000,000 Gallons)
- Total Site Area (135 Acres)
- Composite Soil Sample Area
- USDA NRCS SSUROG Soils

SS - Surface soil composite sample collected in upper 6-12 inches, subsamples distributed laterally across 16 surface locations
TP - Subsurface test pit soil composite sample collected in upper 5 feet, subsamples distrubuted vertically every foot of test pit depth

Map Unit Symbol	Map Unit Name	AWC (in)	Hydraulic Conductivity (in/hr)	Slope (%)
211	Lura silty clay	7.6	0.06 to 0.20	0 to 1
229	Waldorf silty clay loam	9.7	0.06 to 2.00	0 to 2
286	Shorewood silty clay loam	9.8	0.06 to 0.57	1 to 6
287	Minnetonka silty clay loam	10.9	0.06 to 0.14	0 to 2
310	Beauford clay	7.5	0.06 to 0.14	0 to 2
319	Barbert silt loam	10.9	0.06 to 0.14	0 to 1
364	Minnetonka silty clay loam	10.9	0.06 to 0.14	0 to 2

NOTES:
1. 2015 - 1m resolution air photo from USDA Aerial Photography Field Office (APFO).

Foth

N

0 200 400 Feet

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

MIDWEST RECYCLING SOLUTIONS

FIGURE 3
SITE INVESTIGATION
MFS/MIDWEST
16225 563rd AVE, GOOD THUNDER, MN 56037

Date: MAY 2017	Revision Date:	
Drawn By: BJW1	Checked By: BMS2	Scope: 16M185

Path: Q:\Midwest Recycling Solutions\16M185\GIS\mxd\Figure 3 - Site Investigation Map.mxd Date: 5/16/2017

Tables

Table 1 Site Soils Chemical Loading Summary

Contact Pond Parameters from 11-1-16 Sample	*Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	*Selenium	Zinc	TKN (mg/L)	NO2+NO3 (mg/L)	PAN (mg/L)	Boron	NH3
Concentration	500	5	13	30	0.01	230	500	72	112	0.12	112.12	420	5170

Annual Mass Loading (lb/acre)	Leachate (gal)	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	NA	Boron	NH3
Phase 1 (107) acres)	3,000,000	0.12	0.00	0.00	0.01	0.00	0.05	0.12	0.02	26.22	0.10	1.21
Loading Lifetime (years)	-	316	29915	440172	38177	6410268	6968	761	148386	-	-	-
Maximum Cumulative Lifetime Loading Limit	-	37	35	1339	268	15	375	89	2500	75- 300[a]	12[b]	50- 200[c]

Note:
The Contact Pond Concentration's are in ug/L unless specfied otherwise.
* The values of Arsenic and Selenium were not analyzed on 11-1-16, so the concentrations were assumed from guidance.
The Maximum Cumulative Loading Limits were referenced from the MPCA Land Treatment of Landfill Leachate (April, 2011) publication.
a = The Maximum Annual Loading Limits were referenced from the MPCA Nitrogen Management at Land Application of Landfill Leachate Sites (August, 2012) publication.
b = The Maximum Annual Loading Limits were referenced from the Site Permit SW-17; guidance suggests an annual limit of 4 lb/acre.
c = The Maximum Cumulative Loading Limits were referenced from the MPCA Land Treatment of Landfill Leachate (April, 2011) publication.
PAN = Potentially Available Nitrogen, TKN and NO2+NO3 as N, according to MPCA guidance (August, 2012)
NA = Nitrogen Applied, as TKN and NO2+NO3 as N, according to MPCA guidance (August, 2012)

Chemical Loading Formula

$$M\_load(lbs/acre) = \frac{C\_mean(ug/L) * V(ft^3) * (1lb/453{,}592{,}400ug) * (28.32L/1ft^3)}{A(acre)}$$

Applicable Conversions

1 pound =	4.5E+08	micrograms
Land App Area Phase 1=	107	acres
1 cubic foot =	28.32	liters

Constants

1 acre-inch =	27,154	gallons
One gallon of nitrogen =	8.34	pounds
1 acre =	43, 560	square feet
1 acre-foot =	325,853	gallons
1 cubic foot =	7.48	gallons
1 millon gallons per day =	694.4	gallons per minute

Attachment 1
USDA NRCS Soil Surveys Excerpts

SOIL SURVEY OF

Blue Earth County, Minnesota

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Minnesota Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1959–73. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service and the University of Minnesota Agricultural Experiment Station. It is part of the technical assistance furnished to the Blue Earth Soil and Water Conservation District, and was partially funded by Blue Earth County.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Blue Earth County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Index to Map Units" on page ii lists all of the soils in the county by map symbol and shows the page where each soil is described. The capability unit to which each soil has been assigned is specified at the end of the soil description.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, windbreaks, and crop yields.

Foresters and others can refer to the section "Windbreaks and environmental plantings" where the soils of the county are evaluated according to their suitability for trees and shrubs.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife habitat."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the sections, "Engineering" and "Recreation."

Engineers and builders can find, under "Soil properties," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and classification of soils."

Newcomers in Blue Earth County may be especially interested in the section "General soil map for broad land use planning," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General nature of the county."

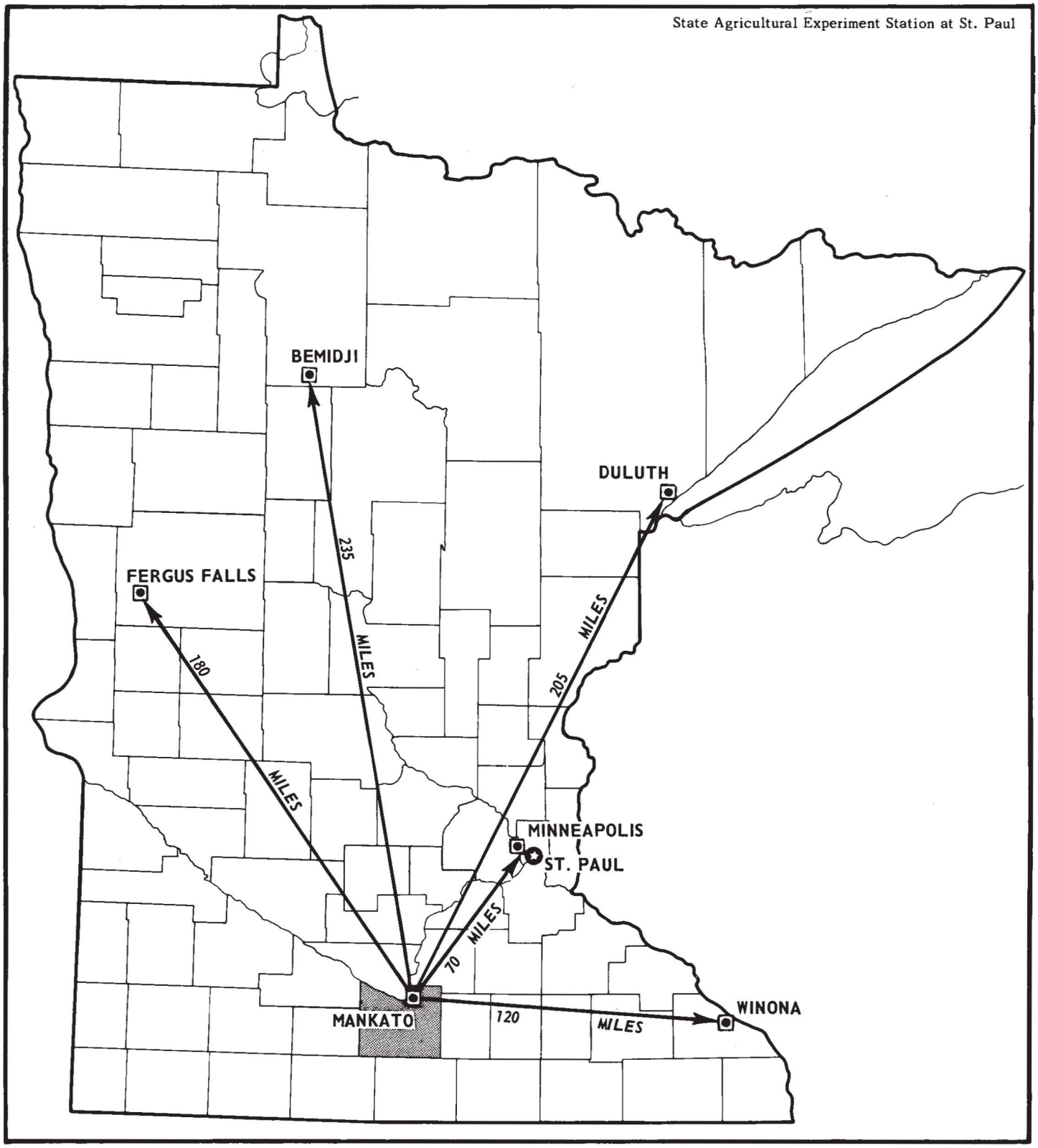
Cover: **Contour stripcropping on smooth, sloping and moderately steep, nearly level-topped circular hills in the Cordova-Lester-Caron map unit. Wita Lake in background.**

Contents

Issued December 1978

Index to Map Units

Summary of Tables



Location of Blue Earth County in Minnesota.

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
183 Dassel	0–24	Loam	OL, ML	A–4
	24–38	Stratified loamy fine sand to fine sandy loam	SM	A–4, A–2
	38–60	Stratified loamy sand to fine sand	SM, SP–SM	A–2
196 Joliet	0–17	Silty clay loam	CL, OL	A–7, A–6
	17	Unweathered bedrock.		
197 Kingston	0–17	Silty clay loam	ML, OL, CL–ML, CL	A–4, A–6, A–7
	17–31	Silty clay loam	CL, ML	A–6, A–7
	31–60	Silt loam, silty clay loam	CL–ML, CL	A–4, A–6, A–7
211 Lura	0–58	Silty clay, clay	OH, MH, CH	A–7
	58–60	Silty clay	CL, CH	A–7
219 Rolfe	0–14	Silt loam	OL, CL, ML, CL–ML	A–6, A–4
	14–30	Clay, silty clay, clay loam	CH, MH	A–7
	30–60	Clay loam, loam	CL	A–7, A–6
222B Lasa	0–15	Fine sand	SM, SP–SM	A–2
	15–45	Fine sand, loamy fine sand	SM	A–2
	45–60	Fine sand	SP	A–3
229 Waldorf	0–20	Silty clay loam	ML, MH	A–7
	20–45	Silty clay, silty clay loam	MH	A–7
	45–60	Silty clay loam, silty clay	MH, CL, ML	A–7, A–6
230 Guckeen	0–22	Silty clay loam	MH, ML	A–7
	22–31	Silty clay	MH, ML	A–7
	31–60	Clay loam	CL	A–6, A–7
238B, 238C Kilkenny	0–7	Clay loam	ML, MH	A–7
	7–34	Clay loam	MH, CH	A–7
	34–60	Clay loam	CL	A–7
238D Kilkenny	0–7	Clay loam	ML, MH	A–7
	7–31	Clay loam	MH, CH	A–7
	31–60	Clay loam	CL	A–7
239 Le Sueur	0–13	Clay loam	CL	A–6
	13–41	Clay loam	CL, CH	A–6, A–7
	41–60	Loam	CL–ML, CL	A–6, A–4
248 Lomax	0–19	Loam	CL, CL–ML	A–4, A–6
	19–26	Sandy loam, loam	SM, SC, CL–ML, ML	A–4, A–6, A–2
	26–60	Stratified sandy loam to sand	SP–SM, SP, SM	A–3, A–2
259B Grays	0–14	Silt loam	CL	A–4, A–6
	14–40	Silty clay loam	CL	A–6, A–7
	40–60	Stratified silt loam to very fine sand	ML, CL, SM, SC	A–4, A–2, A–6
275B Ocheyedan	0–15	Loam	CL, CL–ML	A–4, A–6
	15–34	Sandy clay loam, fine sandy loam, loam	SC, CL, SM–SC, CL–ML	A–4, A–6
	34–60	Silt loam, sandy loam, sandy clay loam	CL–ML, CL	A–4, A–6
281 Darfur	0–19	Loam	OL, ML	A–4
	19–31	Fine sandy loam	SM, SM–SC	A–4
	31–60	Stratified fine sand to fine sandy loam	SM	A–2, A–4
286 Shorewood	0–17	Silty clay loam	CL, ML	A–6, A–7
	17–39	Silty clay, clay	MH	A–7
	39–60	Clay loam, silty clay loam, silty clay	CL, ML	A–6, A–7

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	70–85	50–65	<30	NP–5
0	100	100	60–75	30–40	<30	NP–5
0	100	90–100	50–80	10–35		NP
0–15	90–100	90–100	80–100	60–90	35–50	10–22
0	100	100	95–100	85–98	25–45	5–15
0	100	100	95–100	85–98	35–45	12–20
0	100	100	95–100	85–98	25–45	5–15
0	100	100	95–100	90–98	50–75	15–40
0	100	100	95–100	90–98	40–55	20–30
0	100	95–100	90–100	80–95	30–40	5–15
0	100	95–100	90–100	75–95	50–70	15–35
0–5	95–100	90–100	80–90	55–75	30–50	10–25
0	100	100	80–95	10–20		NP
0	100	100	80–95	15–30		NP
0	100	100	75–90	0–5		NP
0	100	100	95–100	90–100	44–55	14–25
0	100	100	95–100	95–100	50–70	20–30
0	100	100	95–100	95–100	35–65	11–30
0	100	95–100	95–100	80–95	40–60	15–25
0	100	95–100	95–100	80–95	40–65	15–30
0–5	90–100	90–98	85–95	60–75	30–50	10–25
0	95–100	95–100	80–95	70–85	40–60	10–25
0	95–100	90–98	80–95	65–80	50–70	25–35
0–5	95–100	90–98	75–90	60–75	40–50	18–25
0	95–100	95–100	80–95	70–85	40–60	10–25
0	95–100	90–98	80–95	65–80	50–70	25–35
0–5	95–100	90–98	75–90	60–75	40–50	18–25
0	95–100	95–100	90–98	70–85	25–40	10–20
0	95–100	95–100	85–98	60–80	35–60	12–30
0	95–100	90–100	80–95	55–75	20–40	5–20
0	100	80–95	80–95	50–75	25–35	5–15
0	100	80–95	80–95	30–60	20–30	3–13
0–5	100	70–90	70–90	3–20	<20	NP
0	100	95–100	90–100	80–95	25–40	8–20
0	100	95–100	90–100	60–90	30–45	15–25
0	90–100	80–100	70–100	30–70	15–40	NP–20
0	100	95–100	75–90	65–80	25–40	5–15
0	100	95–100	60–80	35–55	25–40	5–15
0	100	95–100	85–95	75–90	25–40	5–15
0	100	100	100	60–80	25–40	NP–10
0	100	100	40–100	35–50	20–30	NP–5
0	100	100	40–100	15–40		
0	100	100	90–98	85–98	35–50	12–20
0	100	100	90–100	85–98	55–75	20–40
0–5	98–100	95–100	85–100	80–95	35–50	10–20

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
287 Minnetonka	0–19	Silty clay loam	MH, ML	A–5, A–7
	19–40	Silty clay, silty clay loam	MH, CH, CL, ML	A–7
	40–60	Clay loam, loam	CL, ML	A–7, A–4, A–6
310 Beauford	0–20	Clay	CH	A–7
	20–46	Clay	CH	A–7
	46–60	Clay	CH	A–7
311 Shorewood	0–17	Silty clay	MH	A–7
	17–45	Silty clay, clay	MH	A–7
	45–60	Clay loam, silty clay loam, silty clay	CL, ML	A–6, A–7
316 Baroda	0–14	Silty clay loam	OL, ML, CL	A–6, A–7
	14–46	Clay	MH, CH	A–7
	46–60	Clay loam	CL	A–6, A–7
317 Oshawa	0–21	Silt loam	OL, ML, CL	A–4, A–6
	21–60	Loam	CL	A–6
319 Barbert	0–17	Silt loam	ML, OL	A–4, A–7
	17–43	Clay	CH, MH	A–7
	43–60	Silty clay loam	CH, CL, ML, MH	A–7
321 Tilfer	0–11	Silty clay loam	MH, OL, ML	A–7
	11–31	Loam, clay loam, silty clay loam	SC, CL, SM, ML	A–6, A–7
	31	Unweathered bedrock.		
329 Chaska	0–8	Loam	OL, CL, ML	A–4, A–6
	8–38	Stratified silt loam to loamy fine sand	CL, CL–ML, ML	A–4, A–6
	38–60	Stratified silt loam to fine sand	SM, ML	A–4, A–2
349 Calco	0–48	Silty clay loam	ML, MH, CH, CL	A–7
	48–60	Silty clay loam	CH, CL	A–7
353 Comfrey	0–34	Clay loam	OL, OH, MH, ML	A–7
	34–60	Clay loam, loam	CL	A–7, A–6
354 Dorchester	0–36	Silt loam	ML, CL–ML, CL	A–4
	36–61	Silt loam	OL, ML, CL	A–6, A–7
360B, 360E Lasa	0–22	Loamy fine sand	SM	A–2
	22–48	Loamy fine sand, fine sand, fine sandy loam	SM, SP–SM	A–2
	48	Unweathered bedrock.		
363 Minneopa	0–15	Sandy loam	SM	A–2, A–4
	15–20	Sandy loam	SM	A–2
	20–60	Loamy sand, sand	SM, SP–SM	A–2, A–3
364 Minnetonka	0–16	Silty clay loam	MH, ML	A–5, A–7
	16–35	Silty clay, silty clay loam	MH, CH, CL, ML	A–7
	35–60	Silty clay loam, silt loam	MH, ML	A–7, A–4, A–6
414 Hamel	0–28	Clay loam	MH, ML, OL, CL	A–6, A–7
	28–34	Clay loam, loam	CH, CL	A–7
	34–60	Loam	CL	A–6
440 Copaston	0–8	Loam	SM, ML	A–4
	8–12	Sandy loam	SM	A–2
	12	Unweathered bedrock.		
448 Shorewood	0–15	Silty clay loam	CL, ML	A–6, A–7
	15–33	Silty clay	MH, CH	A–7
	33–60	Silt loam	ML	A–4
451 Dorchester	0–36	Silt loam	ML, CL–ML, CL	A–4
	36–61	Silt loam	OL, ML, CL	A–6, A–7

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	95–100	95–100	90–98	85–95	40–55	6–20
0	95–100	95–100	90–98	85–95	40–65	12–35
0–5	90–100	85–100	75–90	60–85	30–50	5–25
0	100	100	98–100	90–100	50–70	30–45
0	100	100	98–100	90–100	65–80	35–50
0	100	100	98–100	90–100	60–75	35–50
0	100	100	90–100	85–98	50–70	15–25
0	100	100	90–100	85–98	55–75	20–40
0–5	98–100	95–100	85–100	80–95	35–50	10–20
0	100	100	95–100	85–95	30–50	11–20
0	100	100	95–100	85–95	50–70	20–40
0–5	100	100	90–100	70–80	30–50	11–30
0	100	100	90–100	85–95	30–40	5–15
0	95–100	95–100	90–100	85–95	30–40	10–13
0	100	100	90–100	90–100	35–50	5–20
0	100	100	90–100	90–100	50–80	20–50
0	100	100	95–100	65–100	40–60	15–35
0	95–100	95–100	80–90	70–85	45–55	15–25
2–5	90–95	85–90	60–70	45–70	35–45	11–20
0	100	100	90–100	70–80	30–40	5–15
0	100	100	85–95	60–75	20–40	5–15
0	100	100	85–95	35–75	15–35	NP–10
0	100	100	95–100	85–100	41–60	15–30
0	100	100	90–100	80–100	40–55	15–30
0	100	100	85–98	65–85	45–60	12–20
0	100	100	80–98	60–85	35–50	12–25
0	100	100	95–100	90–95	25–35	5–10
0	100	100	95–100	90–95	35–45	10–20
0	100	100	80–95	15–30	----------	NP
0	100	100	80–95	10–30	----------	NP
0	100	90–100	60–70	30–40	----------	NP
0	100	90–100	60–70	15–30	----------	NP
0	100	90–100	50–75	5–15	----------	NP
0	95–100	95–100	90–98	85–95	40–55	6–20
0	95–100	95–100	90–98	85–95	40–65	12–35
0	95–100	90–100	80–100	75–95	30–55	5–25
0	100	97–100	85–98	70–85	30–60	10–25
0	98–100	95–100	85–95	65–80	40–55	25–35
0–5	98–100	95–100	80–95	60–80	30–40	15–25
0	95–100	90–100	65–80	45–60	30–40	NP–10
0–5	90–100	85–100	50–70	20–35	----------	NP
0	100	100	100	85–95	35–50	12–20
0	100	100	100	85–95	50–75	20–45
0	100	100	100	90–95	30–35	5–10
0	100	100	95–100	90–95	25–35	5–10
0	100	100	95–100	90–95	35–45	10–20

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
109 Cordova	0–13	0.2–0.6	0.18–0.22	6.1–7.3
	13–32	0.2–0.6	0.15–0.19	5.1–6.5
	32–60	0.6–2.0	0.14–0.16	7.4–8.4
110 Marna	0–20	0.06–0.2	0.18–0.22	6.1–7.3
	20–32	0.06–0.2	0.13–0.16	6.1–7.3
	32–60	0.2–2.0	0.14–0.19	6.6–7.8
113 Webster	0–15	0.6–2.0	0.19–0.21	6.6–7.3
	15–30	0.2–2.0	0.16–0.18	6.6–7.8
	30–60	0.6–2.0	0.17–0.19	7.9–8.4
114 Glencoe	0–26	0.2–2.0	0.18–0.22	6.6–7.3
	26–38	0.2–2.0	0.15–0.19	6.6–7.8
	38–60	0.2–2.0	0.15–0.19	7.4–7.8
128, 128B Grogan	0–13	2.0–6.0	0.22–0.24	5.6–7.3
	13–31	2.0–6.0	0.17–0.19	6.1–7.8
	31–60	2.0–6.0	0.17–0.19	7.4–8.4
130 Nicollet	0–21	0.6–2.0	0.17–0.22	6.1–7.3
	21–44	0.6–2.0	0.15–0.19	5.6–7.8
	44–60	0.6–2.0	0.14–0.19	7.4–7.8
134 Okoboji	0–32	0.2–0.6	0.21–0.23	7.4–7.8
	32–60	0.2–0.6	0.18–0.20	7.4–8.4
136 Madelia	0–19	0.6–2.0	0.18–0.24	6.1–7.3
	19–37	0.6–2.0	0.16–0.22	6.6–7.8
	37–60	0.6–2.0	0.16–0.22	7.4–7.8
138B2, 138C2 Lerdal	0–12	0.6–2.0	0.18–0.22	5.1–6.0
	12–34	0.06–0.2	0.13–0.19	4.5–6.0
	34–60	0.2–0.6	0.14–0.19	6.6–7.8
140 Spicer	0–16	0.6–2.0	0.18–0.24	7.4–7.8
	16–40	0.6–2.0	0.16–0.22	7.4–7.8
	40–60	0.6–2.0	0.16–0.22	7.4–7.8
160 Fieldon	0–19	0.6–2.0	0.18–0.20	7.4–7.8
	19–37	0.6–2.0	0.15–0.17	7.4–7.8
	37–60	6.0–20	0.05–0.07	7.4–7.8
178 Granby	0–18	6.0–20	0.16–0.18	5.6–7.3
	18–60	6.0–20	0.05–0.09	5.6–8.4
181 Litchfield	0–16	2.0–6.0	0.10–0.12	6.1–7.3
	16–48	2.0–6.0	0.07–0.16	5.6–6.5
	48–60	2.0–6.0	0.08–0.10	6.1–7.3
183 Dassel	0–24	2.0–6.0	0.18–0.20	6.1–6.5
	24–38	2.0–6.0	0.12–0.17	6.1–6.5
	38–60	6.0–20	0.08–0.10	6.6–7.8
196 Joliet	0–17	0.6–2.0	0.17–0.24	6.1–8.4
	17	---	---	---
197 Kingston	0–17	0.6–2.0	0.18–0.24	6.1–7.3
	17–31	0.6–2.0	0.16–0.20	6.1–7.3
	31–60	0.6–2.0	0.16–0.20	7.4–7.8
211 Lura	0–58	0.06–0.2	0.14–0.17	6.1–7.3
	58–60	0.06–0.2	0.11–0.19	7.4–7.8
219 Rolfe	0–14	0.6–2.0	0.22–0.24	5.1–6.5
	14–30	0.06–0.2	0.11–0.13	6.1–7.3
	30–60	0.2–2.0	0.14–0.16	6.1–8.4

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Moderate	High	Low	0.24	5	6
Moderate	High	Low	0.24		
Moderate	High	Low	0.37		
High	High	Low	0.37	5	4
High	High	Low	0.37		
Moderate	High	Low	0.37		
High	High	Low	0.24	5	6
High	High	Low	0.24		
Moderate	High	Low	0.37		
Moderate	High	Low	0.24	5	6
Moderate	High	Low	0.32		
Moderate	High	Low	0.32		
Low	Low	Low	0.32	5	5
Low	Low	Low	0.43		
Low	Low	Low	0.43		
Moderate	High	Low	0.24	5–4	6
Moderate	High	Low	0.24		
Low	High	Low	0.32		
High	High	Low	0.37	5	4
High	High	Low	0.37		
Moderate	High	Low	0.28	5	6
Moderate	High	Low	0.37		
Low	High	Low	0.37		
Moderate	High	High	0.37	3	6
High	High	High	0.37		
Moderate	High	High	0.37		
Moderate	High	Low	0.28	5	4L
Moderate	High	Low	0.37		
Low	High	Low	0.37		
Low	High	Low	0.20	5	4L
Low	High	Low	0.20		
Low	High	Low	0.15		
Low	High	Low	0.17	5	3
Low	High	Low	0.17		
Low	Low	Low	0.15	5	2
Low	Low	Low	0.15		
Low	Low	Low	0.15		
Low	High	Low	0.20	5	5
Low	High	Low	0.20		
Low	High	Low	0.20		
Moderate	High	Low	0.37	2	6
Low	High	Low	0.28	5	7
Moderate	High	Low	0.37		
Low	High	Low	0.37		
High	High	Low	0.32	5	8
High	High	Low	0.32		
Moderate	High	Moderate	0.37	5	6
High	High	Moderate	0.37		
Moderate	High	Low	0.37		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
222B Lasa	0–15	2.0–6.0	0.08–0.10	5.6–6.5
	15–45	2.0–6.0	0.07–0.09	6.1–7.3
	45–60	6.0–20	0.06–0.08	6.1–7.3
229 Waldorf	0–20	0.2–2.0	0.18–0.25	6.6–7.8
	20–45	0.2–0.6	0.13–0.16	6.6–7.8
	45–60	0.2–2.0	0.20–0.22	7.4–8.4
230 Guckeen	0–22	0.2–0.6	0.16–0.19	5.6–6.5
	22–31	0.06–0.6	0.13–0.16	6.1–7.3
	31–60	0.2–0.6	0.15–0.17	7.4–7.8
238B, 238C Kilkenny	0–7	0.2–0.6	0.17–0.19	5.6–6.5
	7–34	0.2–0.6	0.15–0.19	4.5–6.5
	34–60	0.2–2.0	0.14–0.16	7.4–7.8
238D Kilkenny	0–7	0.2–0.6	0.17–0.19	5.6–6.5
	7–31	0.2–0.6	0.15–0.19	4.5–6.5
	31–60	0.2–2.0	0.14–0.16	7.4–7.8
239 Le Sueur	0–13	0.6–2.0	0.17–0.19	5.6–7.3
	13–41	0.6–2.0	0.15–0.19	5.6–7.3
	41–60	0.6–2.0	0.14–0.16	7.4–8.4
248 Lomax	0–19	2.0–6.0	0.13–0.22	5.1–6.5
	19–26	2.0–6.0	0.12–0.19	5.1–6.5
	26–60	2.0–6.0	0.05–0.11	5.1–7.3
259B Grays	0–14	0.6–2.0	0.22–0.24	5.6–6.5
	14–40	0.6–2.0	0.18–0.20	5.6–6.5
	40–60	0.6–6.0	0.14–0.22	7.4–8.4
275B Ocheyedan	0–15	0.6–2.0	0.20–0.22	5.1–7.3
	15–34	0.6–6.0	0.16–0.18	6.1–7.3
	34–60	0.6–2.0	0.19–0.21	7.9–8.4
281 Darfur	0–19	0.6–2.0	0.20–0.22	6.1–7.3
	19–31	2.0–6.0	0.15–0.17	6.6–7.8
	31–60	2.0–6.0	0.08–0.10	6.6–8.4
286 Shorewood	0–17	0.2–0.6	0.18–0.22	5.6–7.3
	17–39	0.06–0.6	0.13–0.16	5.1–6.5
	39–60	0.2–2.0	0.14–0.16	6.6–7.8
287 Minnetonka	0–19	0.2–0.6	0.18–0.22	5.6–7.3
	19–40	0.06–0.2	0.13–0.19	5.6–7.3
	40–60	0.2–2.0	0.16–0.21	6.6–7.8
310 Beauford	0–20	0.06–0.2	0.13–0.16	6.6–7.3
	20–46	0.06–0.2	0.10–0.14	6.6–7.3
	46–60	0.06–0.2	0.09–0.13	7.4–7.8
311 Shorewood	0–17	0.2–0.6	0.14–0.17	5.6–7.3
	17–45	0.06–0.6	0.13–0.16	5.1–6.5
	45–60	0.2–2.0	0.14–0.16	6.6–7.8
316 Baroda	0–14	0.6–2.0	0.18–0.22	5.1–7.3
	14–46	<0.06	0.13–0.16	4.5–6.0
	46–60	0.6–2.0	0.14–0.16	7.9–8.4
317 Oshawa	0–21	0.6–2.0	0.20–0.22	7.4–7.8
	21–60	0.2–0.6	0.17–0.19	7.4–7.8
319 Barbert	0–17	0.6–2.0	0.22–0.24	5.1–6.5
	17–43	0.06–0.2	0.10–0.14	5.1–7.3
	43–60	0.2–0.6	0.16–0.19	7.4–7.8
321 Tilfer	0–11	0.6–2.0	0.20–0.22	7.4–8.4
	11–31	0.6–2.0	0.17–0.19	6.6–8.4
	31	---	---	---

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	Low	Moderate	0.15	5	1
Low	Low	Moderate	0.15		
Low	Low	Moderate	0.15		
Moderate	High	Low	0.28	5	4
High	High	Low	0.28		
Moderate	High	Low	0.28		
Moderate	High	Low	0.28	3	7
Moderate	High	Low	0.28		
Moderate	High	Low	0.37		
Moderate	Moderate	Moderate	0.28	5–4	6
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low	0.37		
Moderate	Moderate	Moderate	0.28	5–4	6
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low	0.37		
Moderate	High	Low	0.24	5–4	6
Moderate	High	Low	0.32		
Moderate	High	Low	0.32		
Low	Low	Moderate	0.28	5	5
Low	Low	Moderate	0.28		
Very low	Low	High	0.15		
Low	Moderate	Moderate	0.32	5–4	6
Moderate	Moderate	Moderate	0.43		
Low	Moderate	Low	0.43		
Low	Low	Low	0.24	5–4	6
Low	Low	Low	0.32		
Low	Low	Low	0.32		
Low	High	Low	0.20	5	5
Low	High	Low	0.20		
Low	High	Low	0.20		
Moderate	High	Moderate	0.37	3	7
High	High	Moderate	0.37		
Moderate	High	Low	0.37		
Moderate	High	Moderate	0.37	5	7
High	High	Moderate	0.37		
Moderate	High	Low	0.37		
High	High	Low	0.32	5	4
High	High	Low	0.32		
High	High	Low	0.32		
High	High	Moderate	0.37	3	4
High	High	Moderate	0.37		
Moderate	High	Low	0.37		
Moderate	High	Moderate	0.32	5	4
High	High	Moderate	0.32		
High	High	Low	0.32		
Low	High	Low	0.24	5	8
Low	High	Low	0.24		
Moderate	High	Moderate	0.32	3	6
High	High	Low	0.32		
High	High	Low	0.32		
Moderate	High	Low	0.24	4	6
Moderate	High	Low	0.32		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
329 Chaska	0–8	0.6–2.0	0.20–0.22	6.6–7.8
	8–38	0.6–2.0	0.17–0.19	7.4–7.8
	38–60	2.0–6.0	0.07–0.16	7.4–8.4
349 Calco	0–48	0.2–0.6	0.21–0.23	7.4–8.4
	48–60	0.2–0.6	0.18–0.20	7.4–8.4
353 Comfrey	0–34	0.6–2.0	0.18–0.22	6.6–7.8
	34–60	0.6–2.0	0.15–0.19	7.4–8.4
354 Dorchester	0–36	0.6–2.0	0.20–0.22	7.9–8.4
	36–61	0.6–2.0	0.22–0.24	6.6–7.3
360B, 360E Lasa	0–22	2.0–6.0	0.10–0.12	5.6–6.5
	22–48	2.0–6.0	0.07–0.09	6.1–7.3
	48	----------	----------	----------
363 Minneopa	0–15	2.0–6.0	0.13–0.15	6.1–7.3
	15–20	2.0–6.0	0.09–0.14	6.1–7.3
	20–60	6.0–20	0.08–0.10	6.1–7.3
364 Minnetonka	0–16	0.2–0.6	0.18–0.22	5.6–7.3
	16–35	0.06–0.2	0.13–0.19	5.6–7.3
	35–60	0.2–2.0	0.16–0.21	6.6–7.8
414 Hamel	0–28	0.2–2.0	0.18–0.22	5.1–6.5
	28–34	0.2–0.6	0.16–0.19	5.6–7.3
	34–60	0.6–2.0	0.14–0.18	7.4–7.8
440 Copaston	0–8	0.6–2.0	0.20–0.22	6.1–7.3
	8–12	0.6–6.0	0.12–0.14	5.6–7.3
	12	----------	----------	----------
448 Shorewood	0–15	0.2–0.6	0.18–0.21	5.6–7.3
	15–33	0.06–0.2	0.13–0.19	5.6–7.3
	33–60	0.6–2.0	0.18–0.21	6.6–7.8
451 Dorchester	0–36	0.6–2.0	0.20–0.22	7.9–8.4
	36–61	0.6–2.0	0.22–0.24	6.6–7.3
524 Caron	0–8	2.0–6.0	0.30–0.40	5.6–7.8
	8–35	2.0–20	0.40–0.50	5.6–7.8
	35–60	0.2–0.6	0.20–0.22	6.1–7.8
525 Muskego	0–32	0.2–6.0	0.35–0.45	6.1–7.3
	32–84	0.06–0.2	----------	6.6–7.8
539 Palms	0–50	0.2–6.0	0.35–0.45	5.1–8.4
	50–60	0.2–2.0	0.05–0.19	6.1–8.4
548 Palms	0–30	0.2–6.0	0.35–0.45	5.1–6.5
	30–45	0.6–2.0	0.16–0.20	6.1–7.8
	45–60	2.0–6.0	0.08–0.10	7.4–7.8
851* Chaska	0–8	0.6–2.0	0.20–0.22	6.6–7.8
	8–38	0.6–2.0	0.17–0.19	7.4–7.8
	38–60	2.0–6.0	0.07–0.16	7.4–8.4
852* Copaston	0–8	0.6–2.0	0.20–0.22	6.1–7.3
	8–12	0.6–6.0	0.12–0.14	5.6–7.3
	12	----------	----------	----------
853* Copaston	0–10	0.6–2.0	0.20–0.22	6.1–7.3
	10–19	0.6–6.0	0.12–0.14	5.6–7.3
	19	----------	----------	----------
854* Cordova	0–13	0.2–0.6	0.18–0.22	6.1–7.3
	13–32	0.2–0.6	0.15–0.19	5.1–6.5
	32–60	0.6–2.0	0.14–0.16	7.4–8.4

properties of soils—Continued

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
	Uncoated steel	Concrete	K	T	
Low	High	Low	0.24	5	4L
Low	High	Low	0.32		
Low	High	Low	0.32		
High	High	Low	0.37	5	7
High	High	Low	0.37		
Moderate	High	Low	0.24	5	6
Moderate	High	Low	0.37		
Low	High	Low	0.37	5	6
Moderate	High	Low	0.37		
Low	Low	Moderate	0.15	5	2
Low	Low	Moderate	0.15		
Low	Low	Low	0.20	5	3
Low	Low	Low	0.20		
Low	Low	Low	0.20		
Moderate	High	Moderate	0.37	5	7
High	High	Moderate	0.37		
Moderate	High	Low	0.37		
Moderate	High	Low	0.24	5	6
Moderate	High	Low	0.32		
Moderate	High	Low	0.32		
Low	Low	Low	0.28	2	5
Low	Low	Low	0.28		
Moderate	High	Moderate	0.37	3	7
High	High	Moderate	0.37		
Low	Moderate	Low	0.37		
Low	High	Low	0.37	5	6
Moderate	High	Low	0.37		
	High	Moderate	0.10	5	3
High	High	Moderate	0.10		
High	High	Moderate	0.10		
	Moderate	Moderate	0.10	5	3
	Moderate	Moderate	0.10		
	High	Moderate	0.10	5	3
Low	High	Low	0.10		
	High	High	0.10	5	3
Moderate	High	Low	0.32		
Low	High	Low	0.15		
Low	High	Low	0.24	5	4L
Low	High	Low	0.32		
Low	High	Low	0.32		
Low	Low	Low	0.28	2	5
Low	Low	Low	0.28		
Low	Low	Low	0.20	2	8
Low	Low	Low	0.28		
Moderate	High	Low	0.24	5	6
Moderate	High	Low	0.24		
Moderate	High	Low	0.37		

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Blue Earth County, Minnesota

MFS

May 3, 2017

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

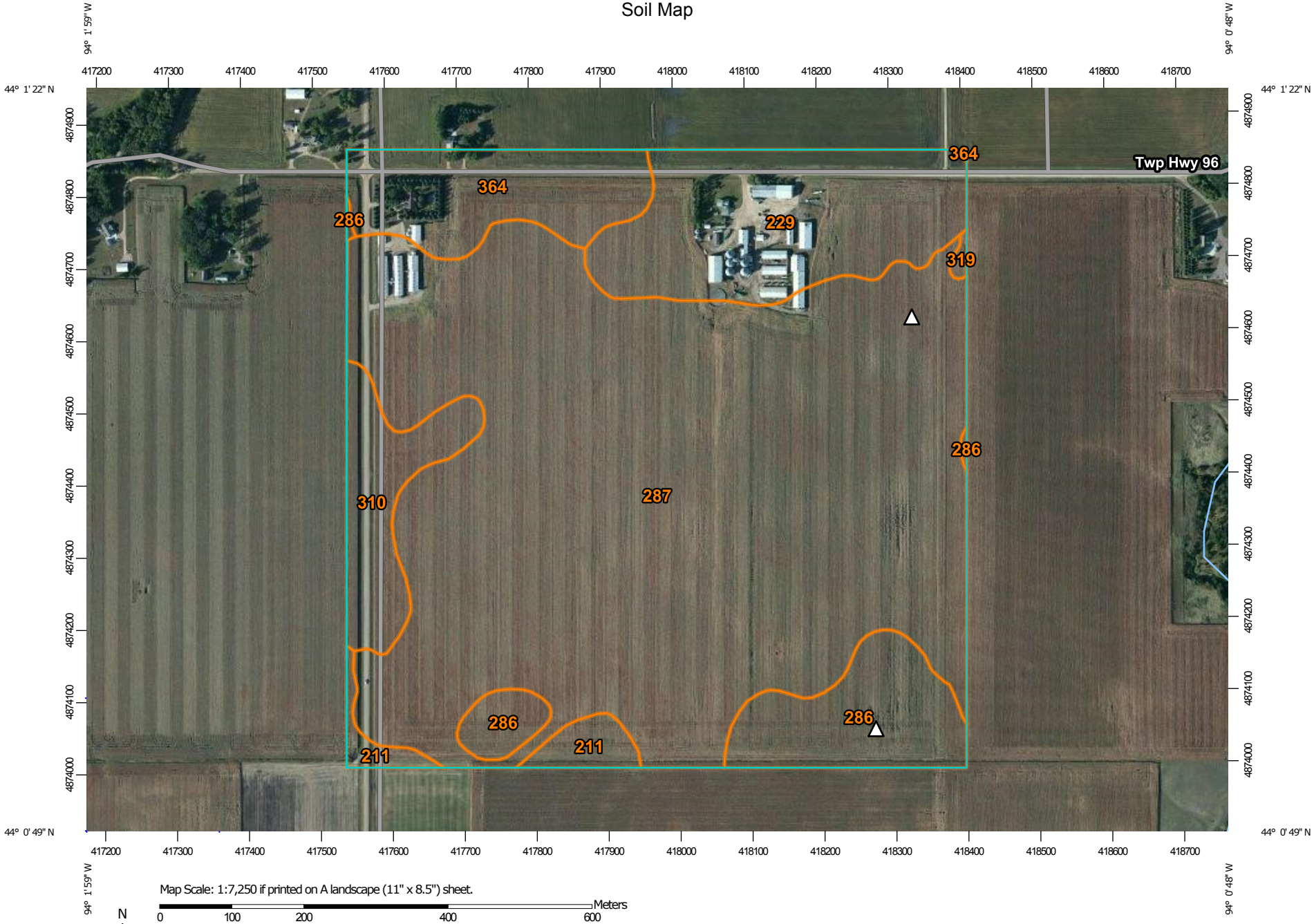
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

Soil Survey Area: Blue Earth County, Minnesota
Survey Area Data: Version 14, Sep 19, 2016

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

Date(s) aerial images were photographed: Sep 6, 2011—Sep 19, 2011

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

Map Unit Legend

Blue Earth County, Minnesota (MN013)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
211	Lura silty clay, 0 to 1 percent slopes	3.4	1.8%
229	Waldorf silty clay loam, 0 to 2 percent slopes	22.3	12.2%
286	Shorewood silty clay loam, 1 to 6 percent slopes	12.9	7.1%
287	Minnetonka silty clay loam	123.3	67.3%
310	Beauford clay	8.5	4.7%
319	Barbert silt loam	0.3	0.1%
364	Minnetonka silty clay loam, silty substratum	12.4	6.8%
Totals for Area of Interest		**183.2**	**100.0%**

Map Unit Descriptions

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

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

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

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Blue Earth County, Minnesota

211—Lura silty clay, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2vwk1
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Lura and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lura

Setting

Landform: Depressions, lake plains on ground moraines
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silty clay
A - 9 to 38 inches: silty clay
Bg - 38 to 43 inches: silty clay
Cg - 43 to 79 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: Depressional Marsh (R103XY015MN)
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Minor Components

Knoke

Percent of map unit: 10 percent
Landform: Depressions, lake plains on ground moraines
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Depressional Marsh (R103XY015MN)
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

Waldorf

Percent of map unit: 5 percent
Landform: Ground moraines, flats, lake plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Wet Prairies (R103XY008MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

229—Waldorf silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t3nl
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Waldorf and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waldorf

Setting

Landform: Ground moraines, flats, lake plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silty clay loam
A - 9 to 20 inches: silty clay loam
Bg1 - 20 to 37 inches: silty clay

Bg2 - 37 to 53 inches: silty clay
Cg - 53 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: Clayey Wet Prairies (R103XY008MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Minor Components

Okoboji

Percent of map unit: 6 percent
Landform: Depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Depressional Marsh (R103XY015MN)
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Collinwood

Percent of map unit: 5 percent
Landform: Ground moraines, flats, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Clayey Upland Prairies (R103XY005MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: No

Brownton

Percent of map unit: 4 percent
Landform: Ground moraines, flats, lake plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Wet Prairies (R103XY008MN)
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

286—Shorewood silty clay loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: f97m
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Shorewood and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shorewood

Setting

Landform: Rises on lake plains
Landform position (two-dimensional): Summit
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey lacustrine deposits over fine-loamy till

Typical profile

Ap,A - 0 to 17 inches: silty clay loam
Bt - 17 to 39 inches: silty clay
C - 39 to 60 inches: loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: Clayey Upland Savannas (R103XY021MN)
Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)
Hydric soil rating: No

Minor Components

Guckeen

Percent of map unit: 5 percent
Landform: Lake plains
Hydric soil rating: No

Minnetonka

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

287—Minnetonka silty clay loam

Map Unit Setting

National map unit symbol: f97n
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Minnetonka and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Minnetonka

Setting

Landform: Flats on lake plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey lacustrine deposits over fine-loamy till

Typical profile

Ap,A - 0 to 19 inches: silty clay loam
Btg - 19 to 40 inches: silty clay
Cg - 40 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 10 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: Clayey Wet Savannas (R103XY023MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Minor Components

Shorewood

Percent of map unit: 4 percent
Landform: Lake plains
Hydric soil rating: No

Lura

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Barbert

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

310—Beauford clay

Map Unit Setting

National map unit symbol: f97p
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Beauford and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beauford

Setting

Landform: Flats on lake plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey lacustrine deposits

Typical profile

Ap,A - 0 to 18 inches: clay

Bg - 18 to 40 inches: clay
Cg - 40 to 60 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: Clayey Wet Prairies (R103XY008MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Minor Components

Lura

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

Guckeen

Percent of map unit: 3 percent
Landform: Lake plains
Hydric soil rating: No

Barbert

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

319—Barbert silt loam

Map Unit Setting

National map unit symbol: f97t
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Barbert and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barbert

Setting

Landform: Depressions on lake plains
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey lacustrine deposits

Typical profile

Ap - 0 to 4 inches: silt loam
E - 4 to 17 inches: silt loam
Btg - 17 to 43 inches: clay
Cg - 43 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: Recharge Depressions (R103XY014MN)
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Minor Components

Lura

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: Yes

Minnetonka

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

364—Minnetonka silty clay loam, silty substratum

Map Unit Setting

National map unit symbol: f984
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Minnetonka, silty substratum, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Minnetonka, Silty Substratum

Setting

Landform: Flats on lake plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty lacustrine deposits and/or clayey lacustrine deposits

Typical profile

Ap,A - 0 to 19 inches: silty clay loam
Bt - 19 to 40 inches: silty clay
C - 40 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 10 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: Clayey Wet Savannas (R103XY023MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Minor Components

Shorewood

Percent of map unit: 4 percent
Landform: Rises
Hydric soil rating: No

Lura

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Barbert

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

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Attachment 2
Analytical Laboratory Reports for Preliminary Soil Samples

MINNESOTA VALLEY TESTING LABORATORIES, INC.

MVTL

1126 N. Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 E. Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885

MEMBER ACIL

SUBMITTED BY: 001351	DATE RECEIVED: Nov 16 2015	SUBMITTED FOR:
KEVIN FITZSIMMONS	DATE REPORTED: Nov 18 2015	
MIKE FITZSIMMONS & SONS	WORK ORDER NO: 201511-03190	FITZSIMMONS
56437 164TH ST		LY1NW
GOOD THUNDER MN 56037		

	SAMPLE ID PREV CROP LAB NUMBER	1 15-A144982	SAMPLE ID PREV CROP LAB NUMBER	2 15-A144983
		V-LOW LOW MED HIGH V-HIGH		V-LOW LOW MED HIGH V-HIGH
ORGANIC MATTER	5.7		6.1	
NITROGEN NO3-N lbs/A (0-6") / (0-6")				
PHOSPHORUS BRAY I P ppm	118		114	
POTASSIUM (K) ppm	276.		190.	
ZINC (ppm)	7.9		5.7	
SULFUR ppm SO4-S (0-6") / (0-6")	5.		5.	
ACIDITY pH	5.9	B ppm Fe ppm Mn ppm Cu ppm Na ppm	5.8	B ppm Fe ppm Mn ppm Cu ppm Na ppm
BUFFER INDEX	6.4		6.2	
CCE %		SALTS mmhos/cm 0.3 Cl lbs/A		SALTS mmhos/cm 0.4 Cl lbs/A
		CEC % BASE SATURATION		CEC % BASE SATURATION
CALCIUM ppm		Ca Mg K Na H		Ca Mg K Na H
MAGNESIUM ppm				
		SAND % SILT % CLAY %		SAND % SILT % CLAY %
		TEXTURE Med/Fine		TEXTURE Med/Fine

ALL GUIDELINES ARE ON A BROADCAST BASIS	**CROP FERTILIZER GUIDELINES**	**CROP FERTILIZER GUIDELINES**
CROP AND YIELD GOAL		
NITROGEN (lbs/A)		
P2O5 (lbs/A) UMN/UMN		
K2O (lbs/A) UMN/UMN		
ZINC (lbs/A)		
SULFUR (lbs/A)		
LIME NEEDS AS	to pH 6.0 2000 lbs of lime for 6" plow depth.	to pH 6.0 2000 lbs of lime for 6" plow depth.
100% ENP (lbs/A)	to pH 6.5 2500 lbs of lime for 6" plow depth.	to pH 6.5 3000 lbs of lime for 6" plow depth.

MVTL is a certified laboratory through North American Proficiency and Ag LabCertification Programs following approved NCR-13 Standards. Phosphorus results are determined colorimetrically.

MINNESOTA VALLEY TESTING LABORATORIES, INC.

MVTL

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1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885

MEMBER ACIL

SUBMITTED BY: 001351 KEVIN FITZSIMMONS MIKE FITZSIMMONS & SONS 56437 164TH ST GOOD THUNDER MN 56037	DATE RECEIVED: Nov 16 2015 DATE REPORTED: Nov 18 2015 WORK ORDER NO: 201511-03190	SUBMITTED FOR: FITZSIMMONS LY1NW

	SAMPLE ID / PREV CROP / LAB NUMBER	V-LOW	LOW	MED	HIGH	V-HIGH	SAMPLE ID / PREV CROP / LAB NUMBER	V-LOW	LOW	MED	HIGH	V-HIGH
	3 15-A144984						4 15-A144985					
ORGANIC MATTER	5.7						6.0					
NITROGEN NO3-N lbs/A (0-6") / (0-6")												
PHOSPHORUS BRAY I P ppm	118						93					
POTASSIUM (K) ppm	215.						248.					
ZINC (ppm)	10.5						5.7					
SULFUR ppm SO4-S (0-6") / (0-6")	13.						8.					
ACIDITY pH	5.8	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm	6.8	B ppm	Fe ppm	Mn ppm	Cu ppm	Na ppm
BUFFER INDEX	6.3											
CCE %		SALTS mmhos/cm 0.5		Cl lbs/A				SALTS mmhos/cm 0.7		Cl lbs/A		
		CEC	% BASE SATURATION					CEC	% BASE SATURATION			
CALCIUM ppm			Ca	Mg	K	Na	H		Ca	Mg	K	Na
MAGNESIUM ppm												
		SAND %	SILT %	CLAY %				SAND %	SILT %	CLAY %		
		TEXTURE Med/Fine						TEXTURE Med/Fine				
ALL GUIDELINES ARE ON A BROADCAST BASIS		**CROP FERTILIZER GUIDELINES**						**CROP FERTILIZER GUIDELINES**				
CROP AND YIELD GOAL												
NITROGEN (lbs/A)												
P2O5 (lbs/A) UMN/UMN												
K2O (lbs/A) UMN/UMN												
ZINC (lbs/A)												
SULFUR (lbs/A)												
LIME NEEDS AS		to pH 6.0	2000 lbs of lime for 6" plow depth.					to pH 6.0	No lime required.			
100% ENP (lbs/A)		to pH 6.5	2500 lbs of lime for 6" plow depth.					to pH 6.5	No lime required.			

MVTL is a certified laboratory through North American Proficiency and Ag LabCertification Programs following approved NCR-13 Standards. Phosphorus results are determined colorimetrically.

MINNESOTA VALLEY TESTING LABORATORIES, INC.

MVTL

1126 N. Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
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1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885

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SUBMITTED BY: 001351	DATE RECEIVED: Nov 16 2015	SUBMITTED FOR:
KEVIN FITZSIMMONS	DATE REPORTED: Nov 18 2015	
MIKE FITZSIMMONS & SONS	WORK ORDER NO: 201511-03190	FITZSIMMONS
56437 164TH ST		LY1NW
GOOD THUNDER MN 56037		

	SAMPLE ID PREV CROP LAB NUMBER	5 15-A144986	SAMPLE ID PREV CROP LAB NUMBER	6 15-A144987
		V-LOW LOW MED HIGH V-HIGH		V-LOW LOW MED HIGH V-HIGH
ORGANIC MATTER	6.6		6.6	
NITROGEN NO3-N lbs/A (0-6") / (0-6")				
PHOSPHORUS BRAY I P ppm	127		133	
POTASSIUM (K) ppm	250.		342.	
ZINC (ppm)	5.8		9.8	
SULFUR ppm SO4-S (0-6") / (0-6")	16.		6.	
ACIDITY pH	5.8	B ppm Fe ppm Mn ppm Cu ppm Na ppm	6.0	B ppm Fe ppm Mn ppm Cu ppm Na ppm
BUFFER INDEX	6.4			
CCE %		SALTS mmhos/cm 0.7 Cl lbs/A		SALTS mmhos/cm 0.5 Cl lbs/A
		CEC % BASE SATURATION		CEC % BASE SATURATION
CALCIUM ppm		Ca Mg K Na H		Ca Mg K Na H
MAGNESIUM ppm				
		SAND % SILT % CLAY %		SAND % SILT % CLAY %
		TEXTURE Med/Fine		TEXTURE Med/Fine
ALL GUIDELINES ARE ON A BROADCAST BASIS	**CROP FERTILIZER GUIDELINES**		**CROP FERTILIZER GUIDELINES**	
CROP AND YIELD GOAL				
NITROGEN (lbs/A)				
P2O5 (lbs/A) UMN/UMN				
K2O (lbs/A) UMN/UMN				
ZINC (lbs/A)				
SULFUR (lbs/A)				
LIME NEEDS AS	to pH 6.0	2000 lbs of lime for 6" plow depth.	to pH 6.0	No lime required.
100% ENP (lbs/A)	to pH 6.5	2500 lbs of lime for 6" plow depth.	to pH 6.5	2000 lbs of lime for 6" plow depth.

MVTL is a certified laboratory through North American Proficiency and Ag LabCertification Programs following approved NCR-13 Standards. Phosphorus results are determined colorimetrically.

Attachment 3
Analytical Laboratory Reports for
Preliminary Contact Water Sample

MINNESOTA VALLEY TESTING LABORATORIES, INC.

MVTL

1126 N. Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 E. Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885

MEMBER ACIL

PRELIMINARY REPORT

KEVIN FITZSIMMONS
MIKE FITZSIMMONS & SONS
16225 563RD AVE
GOOD THUNDER MN 56037

Project Name: COMPOST SITE
Sample Description: CONTACT POND

Report Date: 16 Nov 2016
Lab Number: 16-A59398
Work Order #:12-16591
Account #: 001351
Sample Matrix: WASTEWATER
Date Sampled: 1 Nov 2016 11:00
Date Received: 1 Nov 2016 12:25

Temp at Receipt: 4.2C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
MS Water Digestions					2 Nov 16	TWB
Phosphorus Water Digest					5 Nov 16	MRW
Water Digestions					2 Nov 16	TWB
Solids, Total Suspended	347	mg/L	2	USGS I-3765-85	1 Nov 16 13:15	JFG
pH	* 7.5	units	1.0	SM 4500 H+B-96	1 Nov 16 13:25	JFG
Alkalinity, Total	780	mg/L CaCO3	20	SM 2320B 18th Ed	4 Nov 16 4:39	RBK
Carbon, Total Organic	304.00	mg/L	0.50	SM 5310C	10 Nov 16 8:00	EJV
Chromium, Hexavalent	< 40 @^: Report as <Tot Cr	ug/L	4.0	SM3500CR-B-2009	2 Nov 16 6:50	TWB
Coliform Bacteria	800	CFU/100 mL	1.	SM 9222B 21st Ed	1 Nov 16 14:40	RJN
E. coli	> 4839.2	MPN/100 mL	1.0	SM9223B-97	1 Nov 16 15:15	SRS
Hardness, Total	483	mg/L CaCO3	NA	SM 2340 B-97	4 Nov 16 16:08	RMV
Nitrate	0.00	mg/L as N	NA	353.2	2 Nov 16 11:48	MRW
Nitrogen Total, Calculat	112	mg/L	NA	Calc	7 Nov 16 11:00	TAM
Chromium, Trivalent	< 10	ug/L	NA	CR_III_CALC	4 Nov 16 16:08	RMV
Sulfate	345 ~	mg/L	4.0	ASTM D516-02	3 Nov 16 12:04	MRW
Chloride	299 @	mg/L	3.0	SM 4500 Cl E	3 Nov 16 12:35	MRW
Nitrate+Nitrite	0.12	mg/L as N	0.05	353.2	2 Nov 16 11:48	MRW
Nitrite	0.451 ~	mg/L as N	0.005	EPA 353.2	2 Nov 16 9:38	AKF
Nitrogen, Ammonia	51.7	mg/L	0.16	SM 4500 NH3 C-97	9 Nov 16 7:56	TAM
Phosphorus, Total	19.4 ~	mg/L	0.10	EPA 365.1	8 Nov 16 7:30	MRW
Nitrogen, Total Kjeldahl	112	mg/L	0.2	SM 4500 NH3 C-97	7 Nov 16 11:00	TAM
Mercury	0.010	ug/L	0.005	EPA 245.7	8 Nov 16 9:29	TWB
Solids, Total Dissolved	1690	mg/L	10	SM 2540 C-97	1 Nov 16 15:20	RC
Calcium	109.0	mg/L	0.500	200.7	4 Nov 16 16:08	RMV
Magnesium	51.30	mg/L	0.500	200.7	4 Nov 16 16:08	RMV
Potassium	328.0 ^~	mg/L	0.500	200.7	8 Nov 16 12:31	RMV
Aluminum	0.387	mg/L	0.010	200.7	4 Nov 16 16:08	RMV
Cadmium	< 0.005	mg/L	0.005	200.7	4 Nov 16 16:08	RMV
Chromium	< 0.01	mg/L	0.01	200.7	4 Nov 16 16:08	RMV
Cobalt	< 0.01 ^	mg/L	0.005	200.7	4 Nov 16 16:08	RMV
Copper	0.013	mg/L	0.005	200.7	4 Nov 16 16:08	RMV
Iron	4.550	mg/L	0.015	200.7	4 Nov 16 16:08	RMV
Lead	< 0.03	mg/L	0.03	200.7	4 Nov 16 16:08	RMV
Manganese	0.840	mg/L	0.005	200.7	4 Nov 16 16:08	RMV

RL = Reporting Limit
Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 WI LAB # 999447680 ND MICRO # 1013-M ND WW/DW # R-040

MINNESOTA VALLEY TESTING LABORATORIES, INC.

MVTL

1126 N. Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
2616 E. Broadway Ave. ~ Bismarck, ND 58501 ~ 800-279-6885 ~ Fax 701-258-9724
1201 Lincoln Highway ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885

MEMBER ACIL

PRELIMINARY REPORT

KEVIN FITZSIMMONS
MIKE FITZSIMMONS & SONS
16225 563RD AVE
GOOD THUNDER MN 56037

Project Name: COMPOST SITE
Sample Description: CONTACT POND

Report Date: 16 Nov 2016
Lab Number: 16-A59398
Work Order #:12-16591
Account #: 001351
Sample Matrix: WASTEWATER
Date Sampled: 1 Nov 2016 11:00
Date Received: 1 Nov 2016 12:25

Temp at Receipt: 4.2C

	As Received Result		Method RL	Method Reference	Date Analyzed	Analyst
Molybdenum	< 0.015	mg/L	0.015	200.7	4 Nov 16 16:08	RMV
Nickel	0.023	mg/L	0.010	200.7	4 Nov 16 16:08	RMV
Zinc	0.072	mg/L	0.010	200.7	4 Nov 16 16:08	RMV
Boron	0.420	mg/L	0.100	200.7	4 Nov 16 16:08	RMV
Antimony	Not Entered	ug/L	0.50	200.8		
Arsenic	Not Entered	ug/L	0.50	200.8		
Selenium	Not Entered	ug/L	0.50	200.8		

CFU = Colony Forming Units

* Holding Time Exceeded

Organic Carbon subcontracted to:
Minnesota Valley Testing Labs Inc.
2616 East Broadway Ave
Bismarck, ND 58501
701-258-9720
MDH State Lab ID: 038-999-267

~ Sample diluted due to result above calibration of linear range.

^ The reporting limit (RL) was elevated due to instrument performance at the lower limit of quantitation (LLOQ). This will only impact results that are found to be below the elevated RL. Results above the elevated RL are unaffected.

The sample for Hexavalent Chromium was filtered in the laboratory prior to analysis.

Iron was detected in the blank at 0.043 mg/L. Data that exceeded the blank concentration by a factor of ten was reported.

RL = Reporting Limit
Analyses performed under our Minnesota Department of Health Accreditation conform to the current TNI standards.
The reporting limit was elevated for any analyte requiring a dilution as coded below:
@ = Due to sample matrix # = Due to concentration of other analytes
! = Due to sample quantity + = Due to internal standard response

CERTIFICATION: MN LAB # 027-015-125 WI LAB # 999447680 ND MICRO # 1013-M ND WW/DW # R-040

Appendix F
Inspection Form

MFS Farms/Midwest Recycling Solutions Good Thunder (SW-662)
SOURCE SEPARATED ORGANICS COMPOST FACILITY
FIELD INSPECTION FORM

Date of Inspection: _____ **Time of Inspection:** _____

Name of Inspector: _____

Others Present: _____

Weather Conditions: _____

_____

Operational Requirements:

A. Site Security (Fencing and gates in working order)

_____**Y**____**N** **Comments:**_____

_____

B. Delivery Areas (Deliveries confined to designated areas)

_____**Y**____**N** **Comments:**_____

_____

C. Processing (SSO processed or removed on weekly basis)

_____**Y**____**N** **Comments:**_____

_____

D. Residuals (Residuals managed weekly)

_____**Y**____**N** **Comments:**_____

_____

E. Nuisance Conditions Prevented (Odor, vector, dust control)

_____**Y**____**N** **Comments:**_____

_____

F. Surface Water Management (Capacity available in Contact Pond)

_____Y____N Comments:_____

_____

G. Operational Recordkeeping (Daily Temperature, PFRP documentation, compost maturity verifications)

_____Y____N Comments:_____

_____

H. Laboratory Testing (metals, inert material, pH, moisture, total N, available phosphate, soluble potash, soluble salts)

_____Y____N Comments:_____

_____

I. Additional Observations: