Sampling and Analysis Plan for the Continuation of Carver County's Evaluation of Contact Water Collected at the SET Organics Demonstration Site

1.0 Introduction

As in other regions of the U.S, the number of source-separated organics composting facilities being proposed in Minnesota has increased in the past few years. Currently there are four sites that accept source-separated organic materials from the Twin Cities Metropolitan Area. The continued interest in siting new facilities has been driven in most part by the Minnesota Pollution Control Agency's (MPCA) organics diversion goal of 15% by 2020 set in the 2010-2030 Metropolitan Solid Waste Management Plan.

To increase the capacity for managing organics, the MPCA initiated a rules change process in 2011. By changing the siting requirements, MPCA hopes to reduce unnecessary regulatory barriers to opening these types of facilities. There is a limited amount of information on potential environmental impacts from organics composting facilities. Carver County has been actively involved in composting organics since 2007 when it received its first of three MPCA grants. Since the opening of the initial demonstration site, the County has collected contact water data to evaluate potential environmental.

The purpose of this study is to add to existing data on contact water from organics composting sites and evaluate whether these compounds are causing impacts on storm and ground water quality. Work on the current study began in the fall of 2012 and the second round of testing is scheduled to begin in the summer of 2013. The following plan summarizes laboratory and field work procedures which will be utilized during the second phase of research.

1.1 Goals and Objectives

Organic waste that has the potential to be composted accounts for between 27% to 37% of mixed municipal solid waste. Thus expanding access to composting in Minnesota has the potential of diverting over 1.4 million tons of waste in Minnesota annually. As the industry expands within the state more material will be diverted from landfills and incinerators which will reduce greenhouse gas emissions and air and water pollution.

The evolution of compost technology and the composting of materials such as food, yard waste and non-recyclable paper resulted in the MPCA initiating a compost site rules revision process which will result in the expansion of the composting industry in the State of Minnesota. As the process moved forward, it was clear there is a lack of a comprehensive understanding of the environmental impacts of source-separated organics composting operations. MPCA regulators requested additional research on the following questions to allow for rules change process to move forward:

1. Is there a need for a pad in the curing area or will a drivable surface over certain soil types and depth to water table be enough to protect the water table below a facility?
2. What is the chemical composition of the contact water from various areas (i.e. the mixing, active composting (both under the windrows and between the windrow, and curing area) of the compost facility?
3. Is there infiltration into the soils in the areas that have a pad vs. don't have a pad? Is there a difference in the infiltration rates?

To scientifically answer these questions the MPCA identified three areas to focus research. First, determine chemical composition of feedstocks through the use of SPLP testing. Second, the analysis of contact water and storm water generated at a compost facility during different stages of the compost process. Third, determine if there is infiltration of contact water into the ground-water.

1.2 Project Goals

The purpose of this research is to assess environmental effects of contact water and storm water generated at a site-specific composting operation (at the University of Minnesota Landscape Arboretum). The specific question to be answered by this study is: "What is the chemistry and volume of contact water associated with typical source-separated food waste and yard waste composting operations, and what potential effects might this contact water have on the environment?"

2.0 Background

Carver County promotes the concept that food residuals and non-recyclable paper are resources and should not be viewed as a waste in need of disposal. Carver was one of the first counties in Minnesota to implement a co-collection organics program in 2007 which utilized a yard waste site located on University of Minnesota Landscape Arboretum property for processing source-separated organics. The best management practices developed at the initial Carver organics compost site was designed to guide the site operator through the process of expanding an existing yard waste site to incorporate additional organic materials. Data from this site contributed to a change in the statutory definition of organics, which now allows for the co-collection of food waste and non-recyclable paper with yard waste throughout Minnesota. That site also illustrated the increase in demand for additional capacity to process organic materials. The site experienced odor issues which resulted in the MPCA not renewing the Demonstration Agreement when it expired at the end of September 2009. With the assistance from the MPCA, the organics composting demonstration site was relocated to a better suited location on the Minnesota Landscape Arboretum property.

In September 2011, the new site opened in partnership with Specialized Environmental Technologies (SET). The new site incorporated management practices including: reduced capacity, forced aerated piles and reduced volumes of commercial organics accepted.

There is much still to be learned from the organics composting demonstration site. With knowledge gained from continued research at the Arboretum site, the MPCA will have additional data to evaluate as it completes the rules process. In response to the MPCA Request for Proposal for the 2012-13 Environmental Assistance Grant program, Carver County submitted an application entitled "Scientific Evaluation of Contact & Storm Water from the Organics Demonstration Site." In the grant application, Carver County proposed testing materials at different stages of the composting process as well as evaluating contact water through sheet flow sampling and the use of lysimeters. The application also includes the use of a rainfall simulator to provide adequate sample volumes to analyze parameters that have not been tested and a literature review to summarize existing data.

After reviewing the full proposal, the project respondents and the MPCA staff met to finalize various aspect of the project. Issues of concern for MPCA staff included the desire to analyze feedstocks, yard waste and

source-separated compostable materials (SSCM), using the Synthetic Precipitation Leaching Procedure (SPLP) test prior to the rain simulation component of the project. In addition, MPCA staff wanted the literature review completed prior to the commencement of testing. The hope was that by conducting these two investigative measures prior to conducting rainfall simulations; the list of constituents that needed to be tested could be narrowed to reduce the testing costs.

A literature review was completed and was used to minimally reduce the pesticide and herbicide testing. However, the rainfall simulator was available for a very narrow time period in the month of October, 2012, and there was no guarantee it would be available again during the period of the grant. Since the work plan and grant agreement was not fully executed until September 20, 2012, it was not possible to collect feedstock samples and conduct SPLP tests prior to running rainfall simulations.

The County's sampling proposal was reviewed at an October 3, 2012 meeting by MPCA staff including: Tim Farnan, Project Manager; Lisa Mojsiej, Engineer and John Elks, Hydrologist. During that meeting the analytes and parameters were agreed upon. MPCA staff specified that surface sampling was a higher priority over lysimeter samples given available funding and lack of surface data collected. MPCA directed the County to alter the initial proposal of adding lysimeters and directed the grantee to collect contact water from existing lysimeters. The focus moving forward was to collect run-off of contact water from the pad.

After considerable discussion, it was decided that the grantee should go forward with the rainfall simulation testing and test for all components. This information, plus the SPLP tests and the literature review could be used to narrow the test needed in the next phase of testing.

Carver County began collecting data in October of 2012 in collaboration with the MPCA, Specialized Environmental Technology, University of Minnesota Extension, and the Minnesota Department of Agriculture. The information gathered during the first round of sampling is summarized in Appendix A.
A meeting was held on December 18, 2012 at the MPCA offices to discuss initial results. MPCA staff requested that non-detect analytes be listed as less than the detection limit in the data summary. The need for SLPL testing of feedstock and actively compost material was reiterated and added to the testing protocol. The need for mass balance accounting of water volumes was introduced during the meeting and the directive that lysimeters sampling will be discontinued and replaced with new sampling method.

After a February 11, 2013 meeting the MPCA requested that the County submit a written proposal describing the testing protocol the next series of contact water sampling utilizing the new MPCA designed sampling method. This is that proposal.

2.1 Site Name

Carver County/Specialized Environmental Technology Organics Composting Demonstration Site

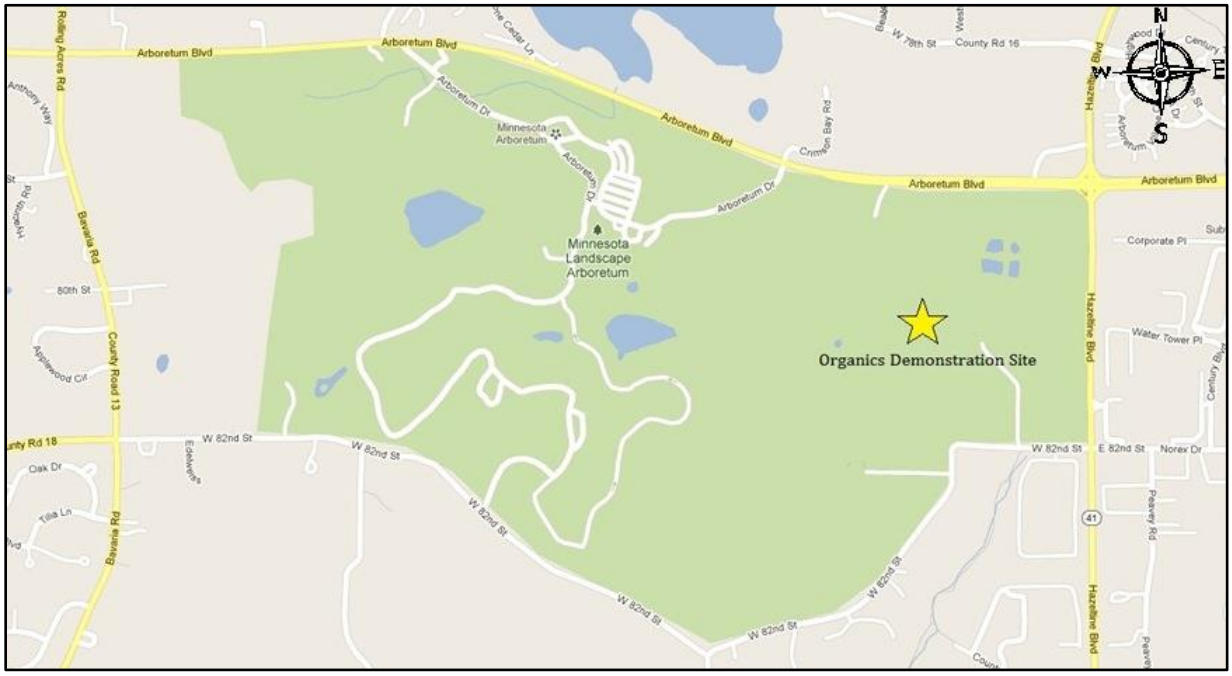
2.2 Site Location and Description

The organics composting demonstration site is located at the University of Minnesota Landscape Arboretum at 3675 Arboretum Drive in Chanhassen. The Minnesota Landscape Arboretum is part of the College of Food, Agricultural and Natural Resource Sciences at the University of Minnesota. Their mission is to be a growing resource for horticultural and environmental information, plant conservation, research and education; to

inspire and delight a growing visitor ship with quality plants in well-designed and maintained displays, collections, model landscapes and natural areas.

The organics composting demonstration site occupies 2 acre of the Minnesota Landscape Arboretum which was previously undeveloped. The site is accessed from the north by Highway 5 utilizing an improved gravel road and surrounded by walking trails used by Arboretum visitors.

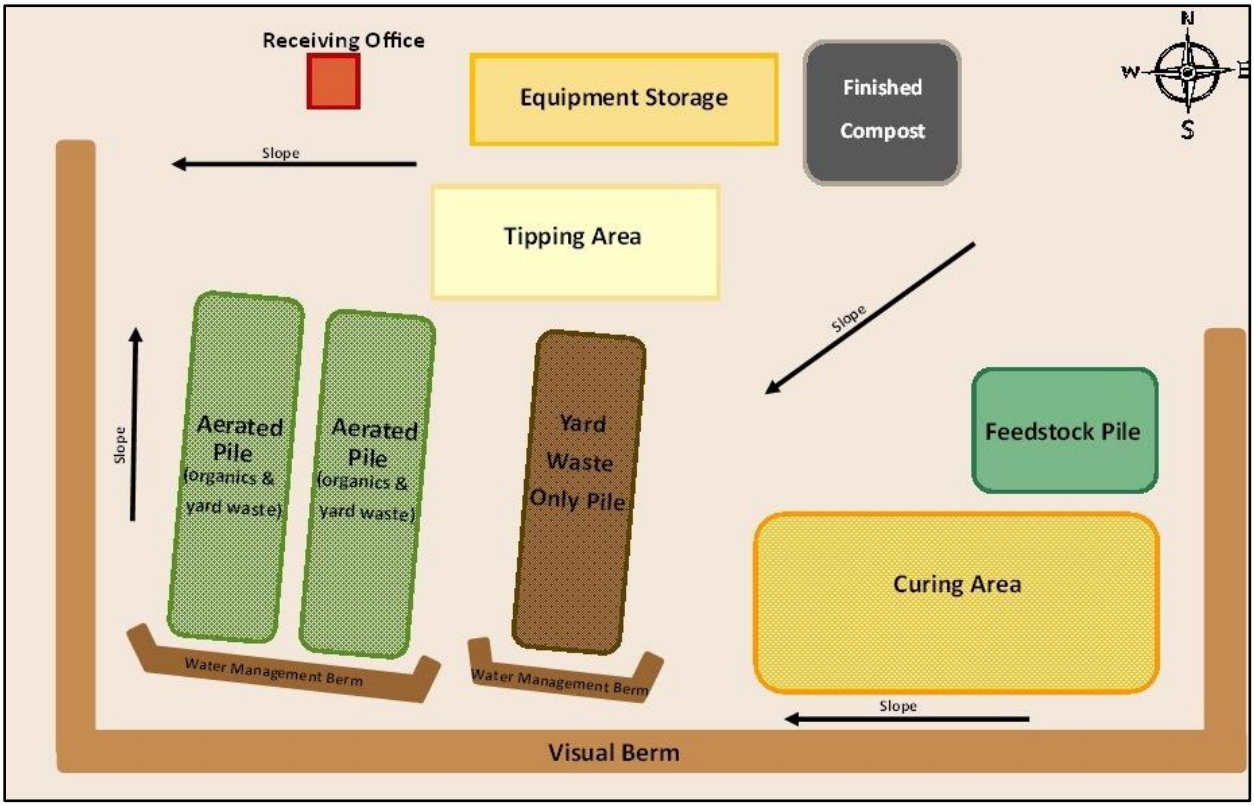
Fig 2.2a – Organics Composting Demonstration Site Location



The site is constructed on Lester-Kilkenny Loam soil with a 12% - 18% slope and a 25% - 40% slope respectively. Lester soil has been selected as the Minnesota State Soil. USDA notes that Lester soils are well drained and form in loamy, calcareous glacial till on ground moraines. The mean annual precipitation is about 28 inches, and the mean annual soil temperature is about 49 degrees Fahrenheit.

The USDA Web Soil Survey lists the depth to the water table and the depth to any soil restrictive layer at the demonstration compost site as >200 centimeters (>78.7 inches). The USDA's Web Soil Survey refers to the water table as the saturated zone in the soil that occurs during specified months. It also notes that the saturated zone that lasts for less than a month is not considered the water table.

Fig 2.2b – Organics Demonstration Composting Site



2.3 Grantee

Carver County is located at the south western edge of the Twin Cities Metropolitan Area and is comprised of 11 cities and 10 townships of varying population density and size. Carver County has a history of developing and managing composting programs dating back to the mid 80's when it was award a series of grants from the MPCA to investigate the economics of operating a small compost site as well as investigating the uses of various feedstocks.

Carver County has worked closely with the MPCA staff on the development of three organics composting demonstration sites. The initial site opened in 2007 at the University of Minnesota Landscape Arboretum. This site was permitted to have 40,000 yards of material on site at any one time. The material consisted of both residential co-collected material as well as commercial organics. A second site opened in 2008 in the City of Mayer that had an annual capacity of 100,000 yards and accepted both residential and commercial organics. After the closure of the first two organics composting demonstration sites, a third site was approved by the MPCA and opened in 2011 at new location at the University of Minnesota Landscape Arboretum. This site is permitted to accept 13,000 yards of material annually.

Carver County assisted the State legislators and the ~~Soils~~ Solid Waste Management Coordinating Board (SWMCB) with making positive changes to organics composting regulation. These changes included removing organics from the MSW definition in 2008 which allowed for the co-collection of organics with yard waste and the elimination of conventional plastic bags from yard waste collection pick up service in 2009.

For their efforts Carver County received the 2009 Governor's Award for Excellence in Waste and Pollution Prevention and the 2009 Local Government Innovation Award.

2.4 Site Operator

SET offers innovative recycling and processing solutions for organics including yard waste, brush and SSCM such as food waste mixed with non-recyclable paper and Emerald Ash Borer contaminated materials. SET's processing strategies promote a closed loop system of waste management by recycling organic materials into valuable soil amendments (compost) and mulch. With multiple locations around the Twin Cities Metropolitan Area, SET processes over 60,000 tons of products each year. Their environmentally conscientious customer base ranges from commercial waste haulers, governmental units, schools, and corporations to residents and community gardeners.

2.5 Project Organization

The Minnesota Pollution Control Agency (MPCA) entered into an agreement with Carver County in June of 2011 to study the environmental effects of composting operations.

Carver County will provide coordination and oversight of on-going composting operations, and coordinate with the MPCA regarding sampling and analysis.

Specialized Environmental Technologies will provide the study site at the University of Minnesota Arboretum site, compost admixtures, site safety (securing the site and ensuring basic safety precautions are taken),

University of Minnesota Extension Service will provide: technical expertise for the project, access to University of Minnesota labs to run moisture analysis testing and assistance in preparing material grab samples for shipment to the respective analytical lab.

The MPCA is the sponsoring organization and will provide technical and administrative expertise.

A report and/or a paper at the end of the study will be undertaken by Carver County in collaboration with the University of Minnesota and the MPCA.

Project Team Members:

Grant Manager/Authorized Rep.	Tim Farnan	MPCA	651-757-2348
Engineer	Lisa Mojsiej	MPCA	651-757-2373
Hydrogeologist Sr.	Neal Wilson	MPCA	651-296-8595
Project Manager	Marcus Zbinden	Carver County	952-361-1806
Project Staff	Sarah Braman	Carver County	651-231-3799
Technical Advisor	Tom Halbach	UofM Solis & Climate	612-625-3135
	Carl Rosen	UofM Soils & Climate	612-625-8114

Site Manager	Anne Ludvik	SET	952-946-6999
Site Operator	Loren Cook	SET	952-946-6999
Sustainable Ag. Specialist	Mark Zumwinkle	MDA	651-201-6240

2.6 Operational History

The organics composting demonstration site began accepting materials on September 1st, 2011. The majority of the material came from co-collected residential loads from the following haulers: Organics Disposal, Vierkant Disposal, and Vintage Waste. Randy's Environmental Services and the University of Minnesota Landscape Arboretum both contributed a small portion of organics only material to the site.

Figure 2.6a: Materials Delivered to the SET Site Sept. 2011 – Sept. 2012

Material Type:	Volume (yd^3)	Percent of Total Yd^3
Organics	673	25%
Yard Waste	1,397	52%
Yard Waste Feedstock	616	23%
TOTAL	**2,686**	**100%**

The Operations Plan for the organics composting demonstration site can be found in Appendix A it mirrors SET's standard operating procedures utilized at their Empire site located in Dakota County. These sites are similar in that they both utilize forced aeration systems. The standard operating procedures outlined in the Operations Plan include the following information:

a. Day to day operations
b. Housekeeping and nuisance management
c. Contingency action and emergency response
d. Personnel training
e. Closure plan

2.7 Previous Investigation

In fall 2012, the grantee ran a total of 8 rainfall simulations in a two week time period. Surface samples from the rainfall simulator were collected over:

a. The empty pad itself,
b. Arboretum cafeteria feedstock
c. Grass heavy co-collected organics pile
d. Grass heavy yard waste only pile
e. Native soil as a control
f. Leaf heavy co-collected organics pile
g. Leaf feedstock pile

The analyses agreed to by MPCA staff and the grantee were completed from surface samples. No subsurface samples were collected in lysimeters directly below compost piles. The water for the rainfall simulator was

delivered by the City of Chanhassen's water truck and was obtained through the city water supply. The water was also tested for all analytical parameters

In addition, grab samples were taken of the incoming feedstock and sent in for testing of pesticide and herbicide concentration by Columbia Food Laboratories in Oregon.

3.0 Project Design

Due to concerns regarding limitations of lysimeters the MPCA terminated sampling used in the fall 2012 –As an alternative, the MPCA developed a new sampling method utilizing three test cells constructed of compacted gravel pad over drainage layer of sand and 40-mill high-density polyethylene (HDPE)liner. The design drawings can be found in Figure 4.2. Lysimeters will no long be utilized in this round of sampling. In addition, the parameters tested for will be expanded to include SPLP of various feedstocks and compost mixtures and (BPA) testing.

3.1 Synthetic Precipitation Leaching Procedure (SPLP)

The five primary feedstocks being considered are grass clippings, leaf litter, residential co-collected organics wood chips and ~~l~~ commercial organics. For this study a the compost mixture~~s~~ will be chemically characterized by running SPLP analyses to provide data on potential release into the environment. Results from the SPLP analyses may also allow list of parameters for testing in the field to be narrowed.

The following summarizes proposed feedstocks and pad material for testing:

1. Residential co-collected organics, commercial organics (grocery store/restaurant), leaves, grass clippings and wood chips
2. Pad material and sand

To account for sample variability at least three samples from each of the above categories will be analyzed utilizing the SPLP method for a total of 6 SPLP analyses. If funding is available and additional information is needed regarding specific components of the compost mixture or pad material addition SPLP testing will be completed.

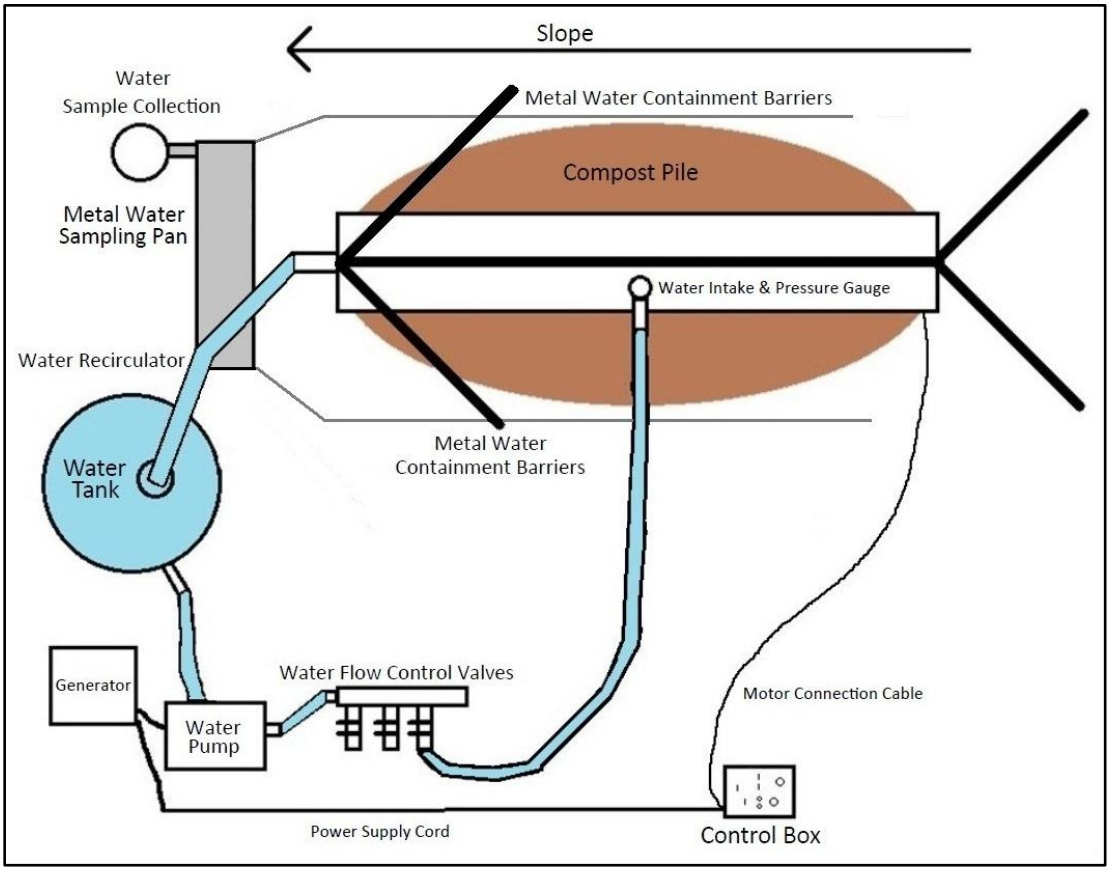
3.2 Surface and Subsurface Contact Water Sampling

For the field study, it is proposed to utilize an eight foot USDA Purdue-style rainfall simulator. A diagram illustrating the proposed set up of the rainfall simulator can be found in Figure 3.2.

Water that migrates through the compost pile during the rainfall simulations will be captured for analysis from the surface utilizing metal water containment walls, as seen in the rainfall simulator diagram on Figure 3.2a, will be positioned to contain the contact water leaving the tow of the pile and directing it down-slope to the collection sump. Samples will be collected from the 55 gallon drum. Subsurface samples will be collected from contacted water that has infiltrated the gravel pad and drainage layer of sand. The 40 mill DDPE liner directs the water to 55 gallon collection sump.

The average rainfall that falls between May 1st and August 1st in Minnesota is approximately 11” (about 3”/month). However, drought conditions were prevalent the past two years limiting sample collection at the Arboretum organics composting demonstration site. The use of the rainfall simulator will allow for an organized sampling plan which will ensure sufficient volumes to sample from both surface and subsurface for all parameters.

Figure 3.2: Schematic of Rainfall Simulator



The rainfall simulator produces a natural rain drop in size and velocity. Rainfall simulators such as this have been developed to provide carefully controlled conditions that allow studies to be conducted to obtain accurate evaluation of management practices. The rainfall simulator will apply water at known rates in a predetermined 5 foot by 8 foot area over the center of the pile. The measurements use are based on the effective dimensions of the equipment. These dimensions minimize wind distortion, provide drop size distribution similar to that of natural rainfall, provide satisfactory intensity and random drop size distribution over the specific area and provides the ability to reproduce a given storm. ~~During several stages of composting~~. This ~~which~~ will allow a mass balance characterization in terms of chemistry and volume to be calculated. The proposed sampling stages using the rainfall simulator are as follows:

1. Over pile day 1 when it arrives at the site
2. During active composting (approximately day 14)
3. End of active composting prior to moving to curing pile (approximately day 60)

The proposed materials tested will be selected by the MPCA prior to the study. The feedstock and compost will be representative of typical Minnesota source-separated organics composting operations at a low tech facility. The piles will be managed as outlined in the site operations plan to simulate typical composting operations.

3.3 Moisture Content, Water Holding Capacity & Volume Mass Balance

A. Moisture Content Analysis

Compost moisture levels will be established by utilizing an **'oven-dry' method**. Representative samples will be collected and placed in sealable plastic bags, and then brought back to a University of Minnesota lab where it is weighed and placed in a 70-80°C oven for 3 days. The samples are then re-weighed and the moisture content is determined by the weight difference caused by the evaporated water. Samples to determine moisture content of the piles will be taken prior to and after the rainfall simulator.

The equation for calculating percent moisture:

$$\textbf{Moisture Content} = \frac{\textbf{initial wt. – dry wt.}}{\textbf{dry wt.}} \times 100\%$$

B. Water Holding Capacity

A quantitative test method will be used to determine water holding capacity of various stages and types of compost. The compost samples will be conditioned and weighed, saturated and re-weighed to determine water holding capacity. The water holding capacity is expressed as a percentage of increased weight after saturation. There are no known limitations to this test method. This test will be performed at the University of Minnesota laboratory.

4.0 Sampling Protocol

This section covers procedures for collecting the various types of samples outlined in section 3.0. Tables detailing cost associated with each test method are also included.

4.1 Synthetic Precipitation Leaching Procedure (SPLP) Grab Sample Collection

A representative sample of each preselected feedstock will be collected to identify its chemical and physical characteristics. Grab samples will be collected after the material has been delivered to the tipping area. Samples will be taken after routine removal of recyclable and/or reject materials and before adding bulking agents. The date, time, and number of grab samples will be recorded and photographs will be taken.

Three grab samples will be taken to obtain analytical results that are representative of the feedstock. Grab sample points within the feedstock will be selected at random from differing depths within the pile and differing vertical distances. In addition three grab samples will be collected of gravel and sand used for the construction of the test pads.

The sampler will wear new latex gloves (unless otherwise specified by the analytical lab) when collecting each set of samples. Samples will be prepared for shipment as required by the selected analytical lab. Proper quality assurance/quality control procedures for sample preservation, storage, transportation will be followed.

Feedstock samples will be analyzed utilizing the Synthetic Precipitation Leaching Procedure (SPLP) for the following parameters: nitrogen, phosphorous, potassium, pH, metals, pesticides, herbicides, PFCs, BPA, phenols, SVOCs, BOD, COD, and pathogens.

4.2 Contact Water Collection on Surface & Subgrade Liner Sampling

The intensity and duration of water applied by the rainfall simulator will be 7.29 inches over a 212 minute time frame. Rainfall applied will be calibrated with5' by 8" area over the center of the pile.

To ensure the entire width of the pile is included in the spray pattern, a Veeget Nozzles 80100 at a pressure of 6psi will be utilized. This will ensure a an effective spray width of 5 feet parallel, by 8 feet perpendicular to the long dimension of the spray pattern.

The spray drift caused by wind is an issue that will be addressed. Since increased nozzle height could greatly increase the drift, the rainfall simulator will be kept at the recommend height of 10.5 feet. In addition~~,~~ Wind break curtains will be placed around the simulator to minimize drift potential. Rainfall simulations will only be conducted when wind speeds are less than 10 mph.

Figure 4.2 Revised Contact Water Collection System

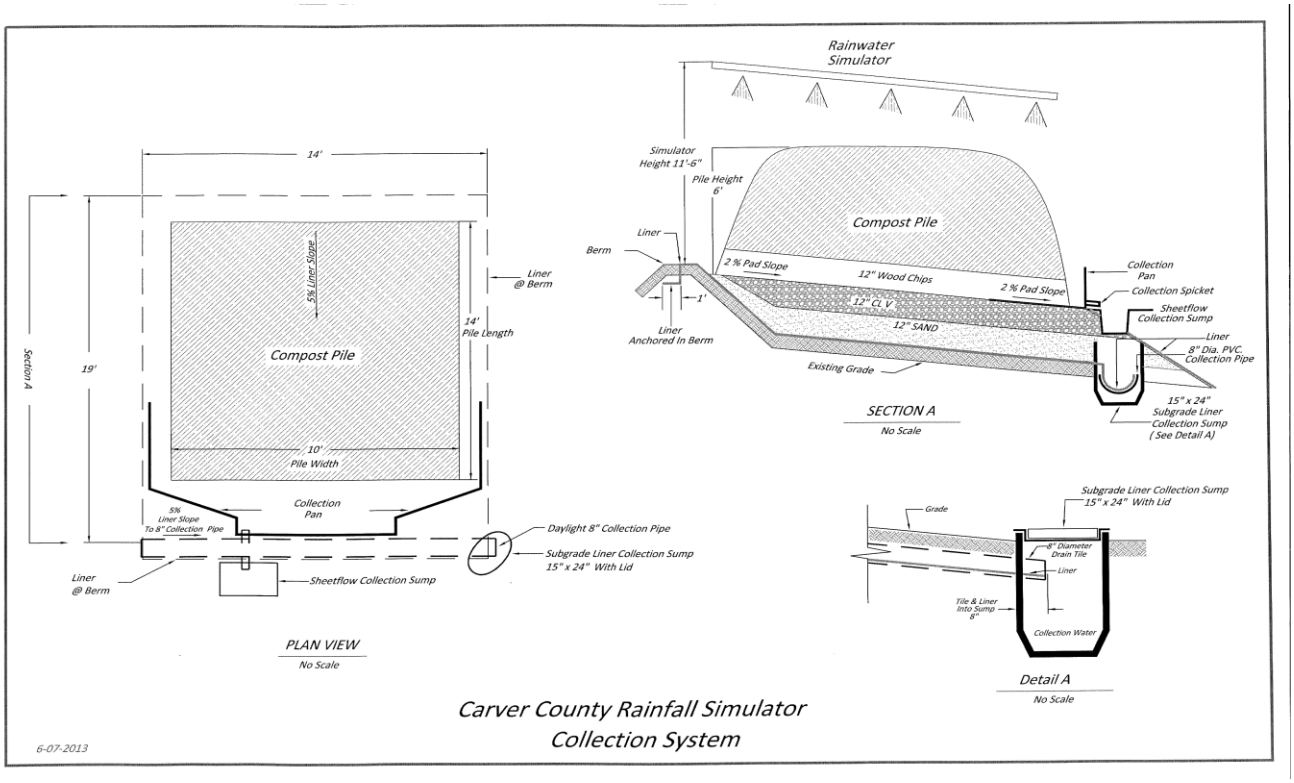


Figure 4.2 illustrates the the revised contact water collection system which will provide data while also taking into account the site limitations, constraints associated with the equipment and staffing.

Surface Samples

Following simulations, water volume will be recorded Samples will be taken of surface contact water samples from the 55 gallon collection sump. If sufficient volumes are not collected to run all analyses, the rainfall simulation will continue until sufficient volumes are collected to test all required parameters.

Sample containment bottles received from analytical lab are free of contaminants when delivered. Sample bottles are only opened to pour a sample in and are immediately re-sealed. Additional sampling equipment needed: metal water containment walls and the metal sampling pan will be triple rinsed with distilled water before collecting contact water/run-off from rainfall simulators. The sampler(s) will wear new latex gloves. The latex gloves will be discarded following each sampling events.

Samples will be run for the same parameter list as they were in fall 2012 that includes: 503 Metals, Nitrates, TKN, phosphorus, TDS, TSS, pH, Total Coliform, E-Coli, BOD, COD, Total Phenolics, and select VOCs, SVOCs, pesticides, herbicides, and PFCs. BPA may also be added to the sampling regimen.

Sub Grade Liner Collection Sampling

Contact water from the subgrade liner will be collected 24 hours after each rainfall simulation to measure, and analyze water that has traveled through the pad.

4.3 Moisture Content, Water Holding Capacity

For the purposes of determining the amount of moisture absorbed by the piles, grab samples will be taken to calculate the percent moisture before and after each applicable rainfall simulation. A series of six samples will be from three locations at varying depths (0 – 12", 12" - 24", and 24"- 48") before and after each rainfall simulation. This sampling scheme will be used to document gradient moisture difference within the pile.

6.0 Schedule

The following is a tentative schedule (to be revised) to complete the study. The field study will begin as soon as the additional lysimeters are installed and the rainfall simulator is made available.

Date	Task
June 10th	Approve testing proposal
June 21	Complete Rain Simulator Calibration
June 28th	Complete installation of testing pads
July 8th	Coordinate feedstock delivery to site and collect SPLP samples
July 13th – 17th	Conduct 1st series of rainfall simulations (Initial)
August 5th-9th	Conduct 2nd series of rainfall simulations (Active Compost)
September 23rd-27th	Conduct 3rd series of rainfall simulations (Curing)
August 19th - 23rd	Conduct 3rd series of Rainfall simulator and collect second set of feedstocks for analysis.
September 3rd	Collect active compost grab samples (if needed)
September 17th	Collect curing grab samples (if needed)
September 30th	Submit first draft of report for review
November 30th	Report completed
Ongoing	Temperature and daily climatic conditions will be recorded

Collect active compost grab samples (if needed)

It should be noted that the opportunity for testing grass heavy feedstocks close quickly and testing using those materials will need to be preformed prior to the middle of June.

7.0 Sample Documentation and Shipment

Multiple tracking sheets have been developed for use during rainfall simulation events. The tracking sheets include:

- Staff Sign In & Out
- Compost Pile Tracking Before Rainfall Simulation
- Rain Gauge Tracking During Rainfall Simulation
- Rainfall Simulator Contact Water Sampling
- Compost Pile Tracking After 100 Year Rainfall Simulation
- Additional Rainfall Simulation Compost Pile Tracking
- 24 Hour After Rainfall Simulation Data Tracking

A complete set of these tracking sheets will be filled out for each rainfall simulation event. Copies of the tracking sheets can be found in Appendix D. All tracking documents will be scanned, saved as PDFs, and will be included as an attachment to the Final Grant Report.

In addition, photographs will be taken before, during, and after each rainfall simulation to verify each part of the rain simulation and sampling process. Photographs will be cataloged in Carver County's master file by sampling date, photographer, and rainfall simulation event. All photos and videos of the process will be given to the MPCA. However, only select photos will be used in the final report.

8.0 Labeling

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Copies of sample labels are included in Appendix E. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: sample ID, date of collection, time of collection analytical parameter(s), and method of preservation (if applicable).

6.2 Sample Chain-of-Custody Forms

All sample shipments for analyses will be accompanied by a chain-of-custody record. A copy of Pace Analytical's Chain of Custody can be found in Appendix F. Form(s) will be completed and sent with the samples for each laboratory and each shipment (i.e., each day).
The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of Carver County. The sampling team leader or designee will sign the chain-of-custody form in the" relinquished by" box and note date, time, and air bill number. A photocopy of the chain-of-custody will be made for the Carver County's master files.

6.3 Packaging and Shipment – Liquid Samples

All sample containers will be placed in a strong-outside shipping container (a steel-belted cooler). The following outlines the packaging procedures that will be followed for liquid samples collected.

1. Ice used to cool samples will be double sealed in two zip-lock plastic bags and placed on top and around the samples to chill them to the correct temperature.
2. The bottom of the cooler should be lined with bubble wrap to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.
4. Wrap all glass sample containers in bubble wrap to prevent breakage.
5. Seal all sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.
6. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.
7. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment.

8. Each ice chest will be securely taped shut and a custody seals will be affixed.

Records will be maintained by Carver County's sample custodian of the following information:

- Sampling contractor's name *(if not the organization itself*
- Name and location of the site or sampling area
- Analytical Lab Project Manager Contact Information
- Total number(s) and matrix of samples shipped to each laboratory
- Carrier, air bill number(s), method of shipment (priority next day)
- Shipment date and when it should be received by lab
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be shipped or if this is the last shipment.

7.0 Quality Assurance/Quality Control

Field contamination will be assessed through the collection of different types of blanks. Equipment blanks will be obtained by passing distilled or deionized water as appropriate over or through the decontaminated equipment used for sampling.

Field blanks will also be taken to help assess contamination from ambient conditions and sampling containers. At least one field blank will be taken for each sampling event.

Because of the questions/concerns raised by the MPCA staff it will be important for them to be present when the rainfall simulator is on site and the work outlined in this report is being conducted.

8.0 Finished Report

Carver County, SET, the University of Minnesota will collaborate with the MPCA on a report that describes the experimental design, observation, and concussions of the study. Carver County will take the lead on completing the study report.