STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
GRAND RAPIDS DISTRICT OFFICE

RICK SNYDER
GOVERNOR

C. HEIDI GRETHER
DIRECTOR

December 14, 2016

Mr. Jerry Olman, Environmental Coordinator
Ottawa County Road Commission
14110 Lakeshore Drive
Grand Haven, Michigan 49417

Dear Mr. Olman:

SUBJECT: Pollution Prevention and Good Housekeeping (PP/GH) Plan
National Pollutant Discharge Elimination System (NPDES)
Certificate of Coverage (COC) No. MIG610117
Municipal Separate Storm Sewer System (MS4)

On October 10, 2016, the Department of Environmental Quality (DEQ), Water Resources Division (WRD), received the final version of the PP/GH Plan for the Ottawa County Road Commission. The revised PP/GH Plan was submitted on your behalf by the Macatawa Area Coordinating Council (MACC). The PP/GH Plan was reviewed in accordance with the requirements of NPDES General Permit No. MIG619000. NPDES General Permit No. MIG619000, authorizes discharges of storm water from municipal separate storm sewer systems (MS4s) to the surface waters of the state, and thus you are subject to the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq; the "Federal Act"), Michigan Act 451, Public Acts of 1994, as amended (the "Michigan Act"), Parts 31 and 41, and Michigan Executive Orders 1991-31, 1995-4 and 1995-18.

The PP/GH Plan has been reviewed and is approved. At the request of the MACC, this document was also reviewed in accordance with the requirements of the 2016 MS4 permit application. The 2016 PP/GH Plan appears to meet the new MS4 permit requirements as well as those of the current permit.

Please begin implementing the October 10, 2016, version of the PP/GH Plan immediately to maintain compliance with your current permit.

Should you require further information, please contact me at 616-356-0215; stamoura@michigan.gov; or at the address below.

Sincerely,

Amanda St. Amour
Senior Environmental Quality Analyst

as/lr

cc: Ms. Kelly Goward, MACC

POLLUTION PREVENTION & GOOD HOUSEKEEPING PROGRAM HANDBOOK

OTTAWA COUNTY ROAD COMMISSION

2016

Prepared by

Macatawa Area Coordinating Council

301 Douglas Ave, Holland MI 49424

www.the-macc.org

616-395-2688

Cover Photos

Top: Winter plowing (OCRC)

Middle: Detention pond at North Holland Garage (MACC)

Bottom: Lake Macatawa, © Marge Beaver - Photography Plus, 1571 Goody Rd., Muskegon Michigan 49441, 231-798-2395

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SECTION 1: The Importance of Pollution Prevention and Good Housekeeping

1.1 Introduction

Storm water runoff occurs when rain and snowmelt flows over land and does not soak into the ground. Runoff is part of the natural water cycle. However, human activity in urban areas impacts the natural water cycle by increasing runoff and reducing infiltration. Runoff in urban areas tends to pick up trash, chemicals, sediment, and other pollutants and deliver them directly to local drains, rivers and lakes untreated. This can lead to poor water quality and impair uses, such as recreation and fish habitat.

Many municipal activities have the potential to impact surface water. Some activities, such as construction site management, vehicle washing and street maintenance can negatively impact water quality. Other activities, such as street sweeping, storm drain cleaning and employee training, can help improve water quality. Negative impacts can be reduced through the use of best management practices to protect water quality. A municipal pollution prevention and good housekeeping program can help control and reduce storm water pollution while addressing local land and water restoration goals and objectives.

1.2 Purpose and Scope

This guidebook was developed by the Macatawa Area Coordinating Council in coordination with the Ottawa County Road Commission (OCRC) and other members of the Macatawa Watershed Storm water Committee to document the pollution prevention and good housekeeping (PPGH) program in order to maintain compliance with the State of Michigan's NPDES permit for discharge of storm water to surface waters of the state from a municipal separate storm sewer system (Part 31 of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended). The guidebook provides detailed information about the OCRC's facilities, storm water controls, operation and maintenance procedures, best management practices, and other required program components that must be followed in order to maintain compliance with the MS4 permit.

1.3 Users of the Guidebook

This guidebook is intended to be used and maintained at all facilities owned and operated by the OCRC that fall within the jurisdiction of the MS4 permit. Users will include facility managers and employees that are engaged in pollution prevention and good housekeeping activities that are described in the guidebook.

1.4 Organization of the Guidebook

The guidebook is divided into the following sections:

Section 1: The Importance of Pollution Prevention and Good Housekeeping

> This section provides a general overview of the purpose and use of the guidebook. Included is information about the Lower Grand River and Macatawa Watersheds, regulatory program requirements and a list of definitions and acronyms.

Section 2: Municipal Facility and Structural Storm Water Control Inventory

This section contains detailed information about facilities owned by the OCRC. Included is a list of property locations and contact information, information about activities that occur at each property that have the potential to pollute rain water, and the types and quantities of storm water controls that are located on OCRC property and right of ways. Much of this information is summarized in tables with maps as appropriate

Section 3: Facility-specific Storm Water Management

Section 3 provides detailed information about how storm water is being managed at individual properties. Included is a procedure for prioritizing facilities according to their potential to discharge pollutants to storm water. Best management practices are described for activities that are occurring at high priority facilities. This section also outlines procedures for completing regular inspections of storm water control devices implemented at high priority facilities and comprehensive inspections of high priority facilities.

Section 4: Structural Storm Water Control Operation and Maintenance Activities

Section 4 provides procedures for inspecting and maintaining catch basins owned by the OCRC that are located in the urbanized areas of Ottawa County as well as a procedure for inspecting and maintaining all other storm water control devices that are not otherwise addressed at high priority facilities.

Section 5: Municipal Operations and Maintenance Activities

This section provides an assessment of operation and maintenance activities that are performed by the OCRC and the potential pollutants associated with those activities. Also included is a procedure for conducting street sweeping.

Section 6: Additional Program Components

The final section of the handbook provides information on other program components that are required by the MS4 permit. Included is information related to vegetation management, contractor oversight and an employee training program.

1.5 Watershed Information

Ottawa County contains portions of two major watersheds that fall within the regulated MS4 area: the Lower Grand River Watershed and the Macatawa Watershed (Fig. 1), both of which contain water bodies that are subject to Total Maximum Daily Loads (TMDLs) for various pollutants.

The Lower Grand River Watershed covers 2,909 square miles, 18% of which is in Ottawa County, and the landuse (2006) is 51% agriculture, 24% forest/open land, 13% wetland/open water, and 12% urban, (LGROW 2011). The Lower Grand River, which flows through Ottawa County, is the largest major subwatershed, encompassing 42% of the watershed. Overall, the Lower Grand River Watershed has lost 42% of its historic wetlands.

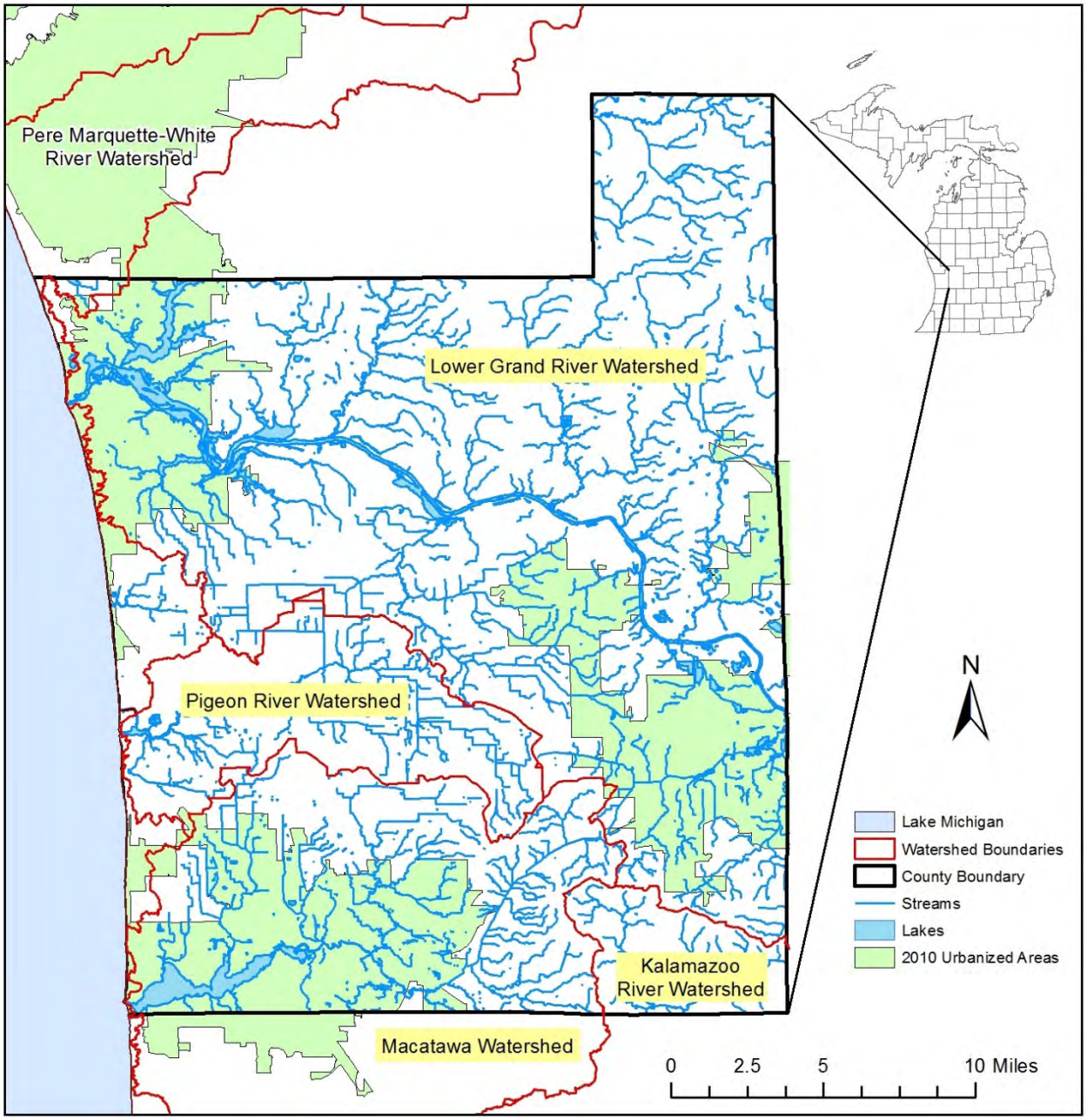

Figure 1. Ottawa County Watershed Map

Numerous tributaries in the watershed are listed on the state of Michigan integrated report for not attaining water quality standards for various uses. In Ottawa County, Bass River is listed as impaired for the designated uses of warm water fishery and other indigenous aquatic life due to erosion/sedimentation. A TMDL for sediment was approved for Bass River in 2005 (Wuycheck 2005a). Increased urbanization and residential development in the Bass River Watershed resulted in an altered hydrology (rapid runoff rates to streams) and increase in nonpoint source pollution runoff. Additionally, riparian vegetation losses have further contributed to stream instability and erosion/sedimentation. The NPDES storm water point source waste load allocation is 65% of the total suspended solid (TSS) annual load estimated target. The TSS goal for storm water point sources is 80 mg/L during wet-weather runoff

events. Also in Ottawa County, Sand Creek is a trout stream and is listed as impaired for the designated use of cold water fishery due to excessive sedimentation and flashy stream flows. This is attributed to increased development and the associated increased runoff that is realized with impervious surfaces. A TMDL for sediment was approved for Sand Creek in 2005 (Wuycheck 2005b). The NPDES storm water point source waste load allocation is 68% of the TSS annual load estimated target. The TSS goal for storm water point sources is 80 mg/L during wet-weather runoff events. Overall, only a very small portion of the MS4 regulated area falls within these two TMDL watersheds (Fig. 2).

The Macatawa Watershed covers 175 square miles, 63% of which is in Ottawa County, and the landuse (2009) is 46% agriculture, 33% urban and 21% natural/forested and water/wetland (MACC 2012). The watershed has lost over 85% of its wetlands and 75% of its forestland to agriculture and urbanization. From 1978 to 2009, urban land increased from 15% of the watershed area to 33% (MACC 2012). With this increase in urbanization came an increase in impervious surfaces, with most of the urbanized subwatersheds having more than 20% impervious surface cover (Fongers 2009). An increase in impervious surfaces resulted in dramatic increases in the volume of storm water runoff (89% on average from 1978 to 2005), which has resulted in a flashy stream system that is plagued by erosion and sediment laden flows during many rain or snowmelt events. Most peak flows have increased by more than 100% and runoff volumes in most subwatersheds have increased by over 75% since 1978 (Fongers 2009).

This history of landuse changes in the Macatawa Watershed has led to most of the tributaries being listed as impaired and not supporting water quality for a variety of uses, most commonly warm water fishery and other aquatic wildlife due to sedimentation and phosphorus. A phosphorus total maximum daily load (TMDL) was approved for Lake Macatawa in 2000 (Walterhouse 1999). The majority of the phosphorus load in Lake Macatawa, 90%, was determined to be from nonpoint sources. Since the TMDL was developed prior to the issuance of the Phase II program, discharges from MS4s are part of the nonpoint source load allocation. The *Nonpoint Source Phosphorus Reduction Plan for the Macatawa Watershed* was developed and approved in 2000. Numerous efforts were made to reduce nonpoint sources of phosphorus throughout the watershed, but by 2008, water quality monitoring showed little improvement. The TMDL was renewed at that time and a process was started to update the plan. The *Macatawa Watershed Management Plan* was updated in 2012 and provides best management practice recommendations for reducing sediment and phosphorus loads from priority areas in the watershed, including recommendations for urban areas.

1.6 Regulatory Requirements

The federal Clean Water Act (CWA), as amended in 1987, is the principal legislation for establishing requirements for the control of storm water pollutants. Enforcement of the CWA and other federal laws has generated numerous federal, state and local requirements and programs that deal directly or indirectly in controlling storm water discharges. In the following sections, various programs are discussed in relation to the control of pollutants from municipal storm water systems.

Federal NPDES Program

In 1972, provisions of the federal Water Pollution control Act, also known as the Clean Water Act (CWA) was amended so that discharge of pollutants to waters of the United States from any point source is effectively prohibited unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 amendments to the CWA added Section 402(p) that established a framework for regulating municipal, industrial and construction storm water discharges

under the NPDES program. In 1990, the EPA published final Phase I regulations that established application requirements for storm water permits for municipal separate storm sewer systems (MS4s) serving populations over 100,000 and certain industrial facilities, including construction sites greater than 5 acres. In 1999, the EPA published final Phase II regulations for communities with an MS4 serving populations less than 100,000 and operators of construction sites 1 to 5 acres in size.

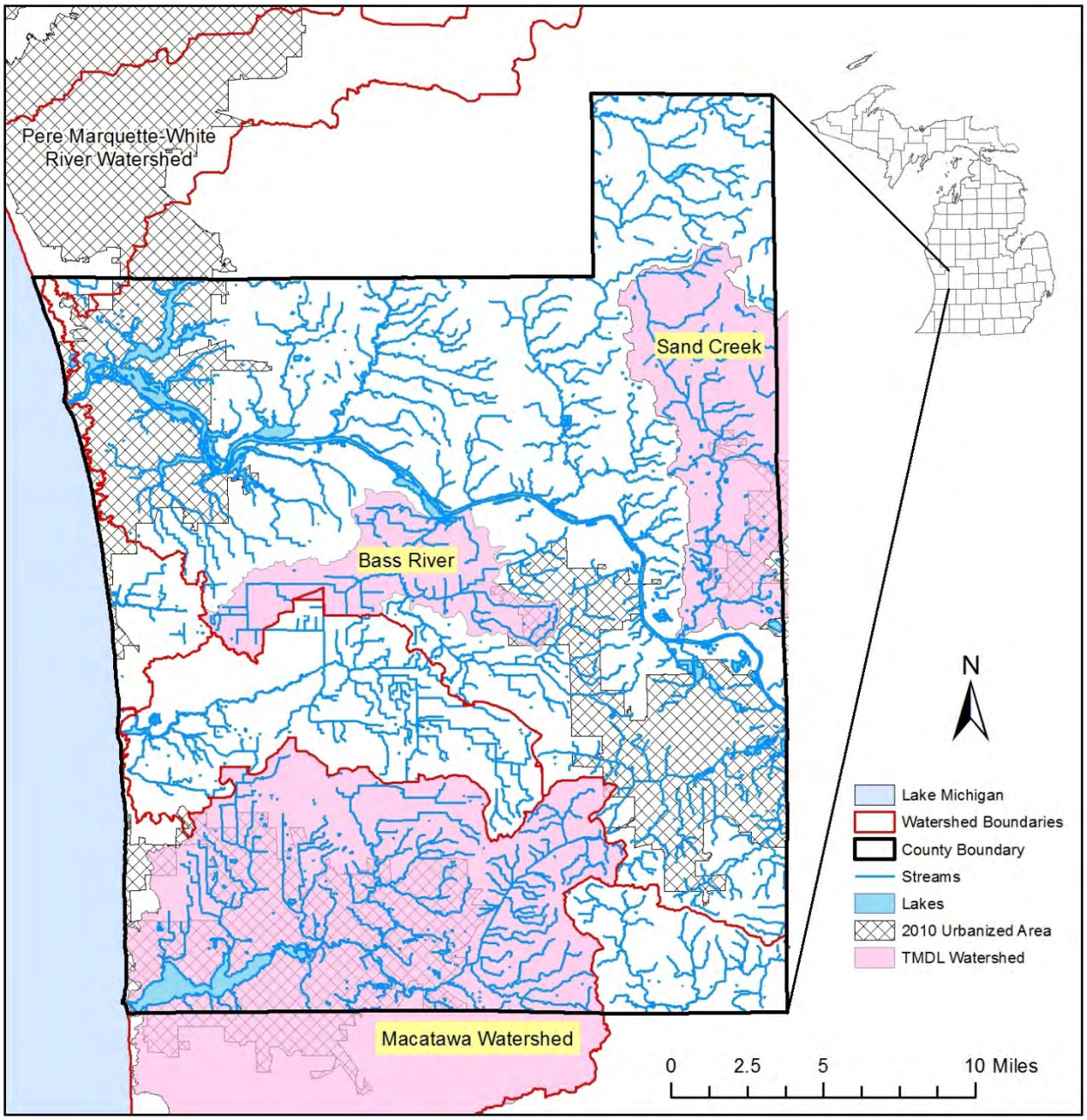

Figure 2. Ottawa County Watersheds with TMDLs

Municipal NPDES Storm Water Programs

In Michigan, municipalities were given the option to apply for a jurisdictional permit or a watershed permit and work together with other MS4s within a watershed to meet Phase II requirements. The watershed approach uses the local watershed management plan as a basis for guiding water quality protection activities. MS4 communities whose jurisdictions spanned multiple watersheds were allowed to select which watershed to work with. The six communities that have jurisdictional boundaries within the Macatawa Watershed all elected to work collectively under a watershed permit with the assistance of the Macatawa Area Coordinating Council. Ottawa County entities, including the Road Commission, have still participated in some aspects of the Phase II program in the Lower Grand Watershed, most notably public education.

On April 2, 2016, all Macatawa Watershed permittees reapplied for MS4 permit coverage under the new individual permit required by the State of Michigan as of 2013. As part of the new permit, phase II communities are required to develop and implement a Storm Water Management Plan with the following six minimum control measures:

Public Participation/Involvement Program – Provide opportunities for citizens within the jurisdiction to review the Storm Water Management Plan and participate in the implementation and periodic review of the plan.

Public Education Program – Distribute education materials and perform outreach to inform citizens about storm water issues and actions they can take to help prevent storm water pollution.

Illicit Discharge Elimination Program – Develop and implement a plan to detect and eliminate illicit discharges and connections to the storm drain system, including illegal dumping.

Construction Storm Water Runoff Control Program – Develop, implement and enforce an erosion and sediment control program for construction activities that disturb one or more acres of land.

Post-Construction Storm Water Runoff Program – Develop, implement and enforce a program to address discharge of storm water runoff from new and redeveloped areas to minimize water quality impacts and maintain or restore stable stream hydrology.

Pollution Prevention and Good Housekeeping Program – Develop and implement a program to prevent or reduce pollutant runoff from municipal facilities and operations. This is the purpose of this guidebook.

In addition to the six measures listed above, the Storm Water Management Plan must identify measureable goals for each for each control measure. The goals will be used by the MS4 and the MDEQ to gauge compliance and evaluate effectiveness of individual best management practices or of the storm water management program as a whole. Phase II communities must also monitor their efforts and prepare periodic progress reports demonstrating that they are implementing their minimum control measures and are in compliance with the permit requirements.

1.7 Definitions and Acronyms

The following is a list of terms and acronyms that are commonly used throughout the guidebook.

BMP – best management practice. Methods or techniques that are used to achieve an objective. In the context of this guidebook, a BMP is any physical structure or behavioral activity that prevents or minimizes the potential for pollution to enter storm water.

CWA – Clean Water Act. Passed in 1972, it is the primary federal law in the United States governing water pollution. The act specifically addresses point and nonpoint source pollution, wastewater treatment and wetland protection.

EPA – Environmental Protection Agency. A federal agency that was established to consolidate federal research, monitoring, standard-setting and enforcement activities to ensure environmental protection. The EPA is in charge of enforcing the Clean Water Act including authorizing states to implement the Stormwater NPDES permitting program.

NPDES – National Pollutant Discharge Elimination System. NPDES is the national program for administering and regulating Sections 307, 318, 402, and 405 of the Clean Water Act. In Michigan, the Michigan Department of Environmental Quality issues permits for storm water discharges associated with Phase II and Phase I communities.

MACC – Macatawa Area Coordinating Council. The MACC is a designated inter-municipality study committee, also known as a metropolitan planning organization, which is the local decision-making body responsible for carrying out the metropolitan transportation planning process. The mission of the MACC is "to encourage cooperation among neighboring units of government on area wide issues."

MDEQ – Michigan Department of Environmental Quality. The Michigan Department of Environmental Quality promotes wise management of Michigan's air, land, and water resources to support a sustainable environment, healthy communities, and vibrant economy. MDEQ is the regulatory agency that, among other things, administers the NPDES program in Michigan and oversees MS4 permitting.

MS4 – Municipal Separate Storm Sewer System. An MS4 is a conveyance or system of conveyances that is owned by a public entity that discharges to waters of the state and is designed to collect and convey storm water. It is not a combines sewer nor part of a publically owned sewage treatment facility.

OCRC – Ottawa County Road Commission

Phase I Community – Medium to large cities or counties that own or operate a MS4 with a population of 100,000 or more. Phase I of the NPDES permit program was initiated in 1990.

Phase II Community – Small communities who own or operate a MS4 in an urbanized area with a population less than 100,000. Phase II of the NPDES permit program was initiated in 1999.

TMDL – Total Maximum Daily Load. A TMDL is a document that describes the process used to determine how much pollutant a lake or stream can assimilate and meet water quality standards. TMDLs are developed by the MDEQ and must be approved by the EPA.

1.8 References and Resources

Fongers, D. 2009. Macatawa Watershed Hydrologic Study. Hydrologic Studies Unit. Land and Water Management Division. Michigan Department of Environmental Quality.

Lower Grand River Organizations of Watersheds (LGROW). 2011. Lower Grand River Watershed Management Plan.

Macatawa Area Coordinating Council (MACC). 2012. Macatawa Watershed Management Plan.

Walterhouse, M. 1999. Total Maximum Daily Load (TMDL) for Phosphorus in Lake Macatawa. Great Lakes and Environmental Assessment Section, Surface Water Quality Division, Michigan Department of Environmental Quality.

Wuycheck, J. 2005a. Total Maximum Daily Load for Biota for the Bass River, Ottawa County. Surface Water Assessment Section, Water Bureau, Michigan Department of Environmental Quality.

Wuycheck, J. 2005b. Total Maximum Daily Load for Biota for the Sand Creek Watershed, Ottawa County/Kent County. Surface Water Assessment Section, Water Bureau, Michigan Department of Environmental Quality.

SECTION 2: Municipal Facility and Structural Storm Water Control Inventory

2.1 Introduction

One key component of the PPGH Program is a comprehensive inventory of the facilities and storm water controls that are owned or operated by the MS4. Digital and hard copy maps of the facilities and the storm water controls are located at the main Road Commission office in Grand Haven (14110 Lakeshore Dr, Grand Haven, MI 49416). The MACC will maintain a master database of facilities and storm water controls that are found in the following sections. The inventory, both the OCRC digital maps and the MACC's master database, will be updated within 30 days of the addition, removal or transfer of ownership of any facility or storm water control. The OCRC will make updates to their digital maps and notify the MACC to update their database.

2.2 Facility Inventory and Descriptions

Table 1 contains a complete list of all facilities and properties owned and operated by the Ottawa County Road Commission. Maps of facilities located within the regulated MS4 area are shown in Figures 3-5. Table 2 provides a list of the activities that are occurring at each facility that have the potential to generate pollution. The process to assess facilities that generated Table 2 is described in Section 3.1.

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Table 1. Ottawa County Road Commission Facility Inventory

Facility Name	Facility Type	Legal Description	Address	City	Zip	Contact Person	Phone Number	Sub Watershed (12 digit)	Latitude	Longitude
Macatawa Watershed										
North Holland Garage[2]	Vehicle Storage and Maintenance Yard	SE ¼, Sec 4, T5N, R15W Holland	12150 Ransom St	Holland	49424	Doug Ymker, Supervisor	(616) 399-6591	Lower Mac, Drain 15 & 17	42.846827	-86.082995
104th & Chicago Dr: Greenspace[1]	Open Space	NW ¼, Sec 24, T5N, R 15W, Holland	NE corner of 104th Ave and Chicago Dr	Zeeland	49464	Jerry Olman	(616) 842-5400	Noordeloos Creek	42.812239	-86.037245
104th & Adams: Wetland Mitigation, Greenspace[1]	Open Space	SW ¼, Sec 25, T5N, R15W, Holland	NW corner of 104th Ave and Adams St	Holland	49424	Jerry Olman	(616) 842-5400	Lower Mac, Macatawa River	42.784364	-86.037083
Kok Pit[1]	Materials Storage Yard	NW ¼, Sec 29, T5N, R14W, Zeeland	Frontage/84th	Zeeland	49464	Jerry Olman	(616) 842-5400	Upper Macatawa River	42.792536	-85.995133
Lower Grand River Watershed										
Kirkbride Pit[2]	Materials Storage Yard	NE ¼, Sec 16, T7N, R14 W, Allendale	76th Ave	Allendale	49401	Jerry Olman	(616) 842-5400	Grand River	42.999338	-85.971561
Bradish Pit[2]	Materials Storage Yard	Sec 5, T9N, R13 W, Chester	36th St	Ravenna	49451	Jerry Olman	(616) 842-5400	North Branch Crockery Creek	43.203918	-85.881543
Cheyne Pit[1]	Materials Storage Yard	Sec 2 & 3, T6N, R13W, Georgetown	Taylor St	Georgetown	49428	Jerry Olman	(616) 842-5400	Grand River	42.933130	-85.821032
Hudsonville Garage[1]	Vehicle Storage and Maintenance Yard	Sec 27, T6N, R13W, Georgetown	2232 Chicago Dr	Hudsonville	49426	Mike TerHorst, Supervisor	(616) 669-9075	Rush Creek	42.882358	-85.838711
Grand Haven Administrative Office and Garage[1]	Administration Building, Vehicle Storage and Maintenance Yard	Sec 4, T7N, 15W, Grand Haven	14110 Lakeshore Dr	Grand Haven	49417	Scott Powell, Supervisor	(616) 850-7250	Pottawatomie Bayou	43.025095	-86.217776
Van Noord Pit[2]	Materials Storage Yard	E ½, Sec 15, T5N, R13W, Jamestown	Riley St	Jamestown	49426	Jerry Olman	(616) 842-5400	East Branch Rush Creek	42.820077	-85.830264
Coopersville Garage[2]	Vehicle Storage and Maintenance Yard	Sec 23, T8N, R14W, Polkton	526 Cleveland St	Coopersville	49404	Roger Langeland, Supervisor	(616) 837-8000	Deer Creek	43.074303	-85.939879
Jac Jungle Pit[2]	Materials Storage Yard	Sec 1, T7N, R15W, Robinson	Sleeper/Cedar	Grand Haven	49417	Jerry Olman	(616) 842-5400	Grand River	43.024626	-86.039613
County 80[1]	Materials Storage Yard	Sec 1, T8N, R16W, Spring Lake	Apple/144th	Fruitport	49415	Jerry Olman	(616) 842-5400	Spring Lake	43.114111	-86.148280
Bronkema/Scharl's Pit[2]	Materials Storage Yard	Sec 29, T7N, R13W, Tallmadge	Linden Dr	Grand Rapids	49534	Jerry Olman	(616) 842-5400	Grand River	42.959364	-85.866346

County Roads throughout Ottawa County	1600 miles + or -

[1] Facility is located *inside* the MS4 regulated area

[2] Facility is located *outside* of the MS4 regulated area

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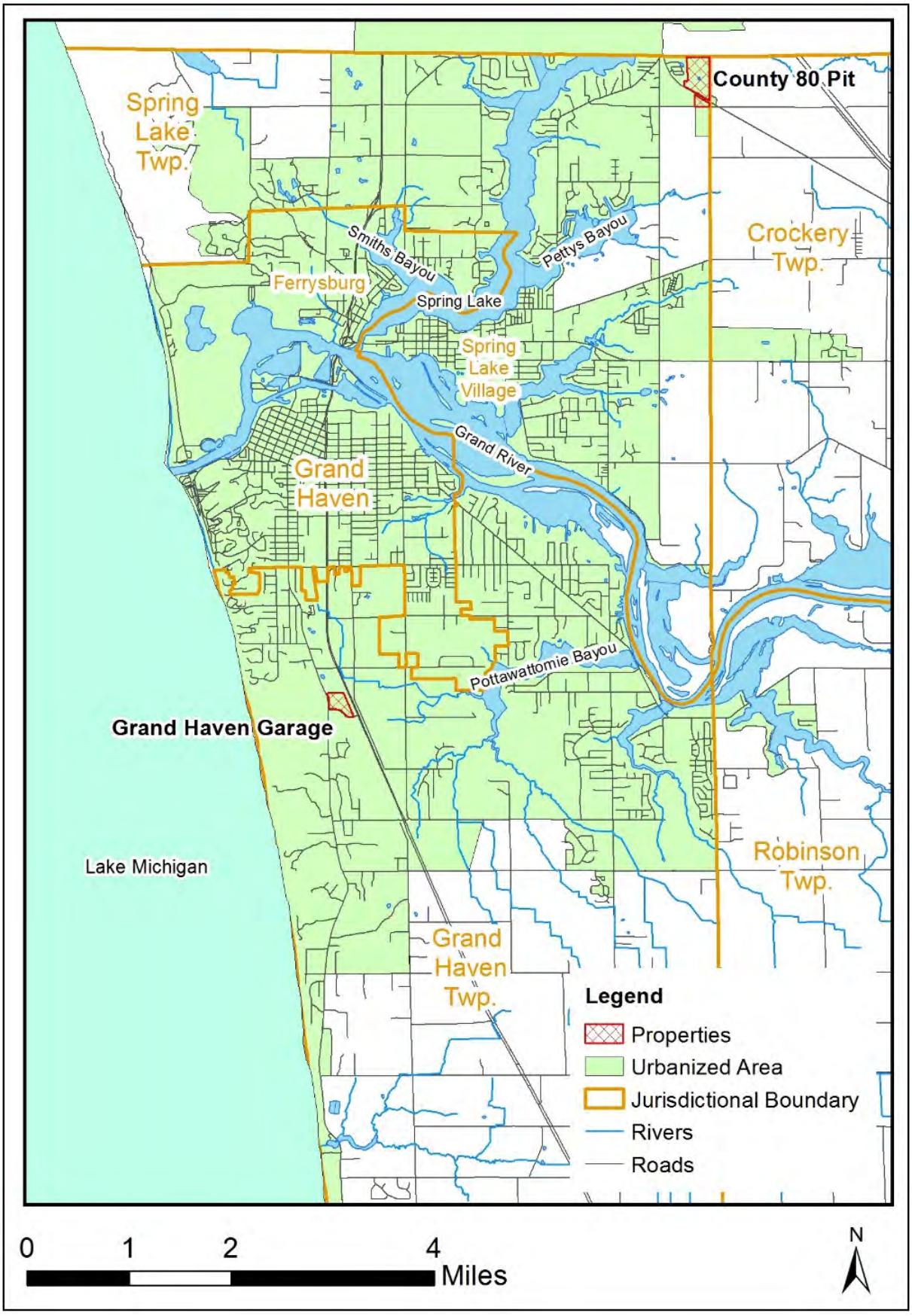

Figure 3. OCRC Properties in the Muskegon Urbanized Area

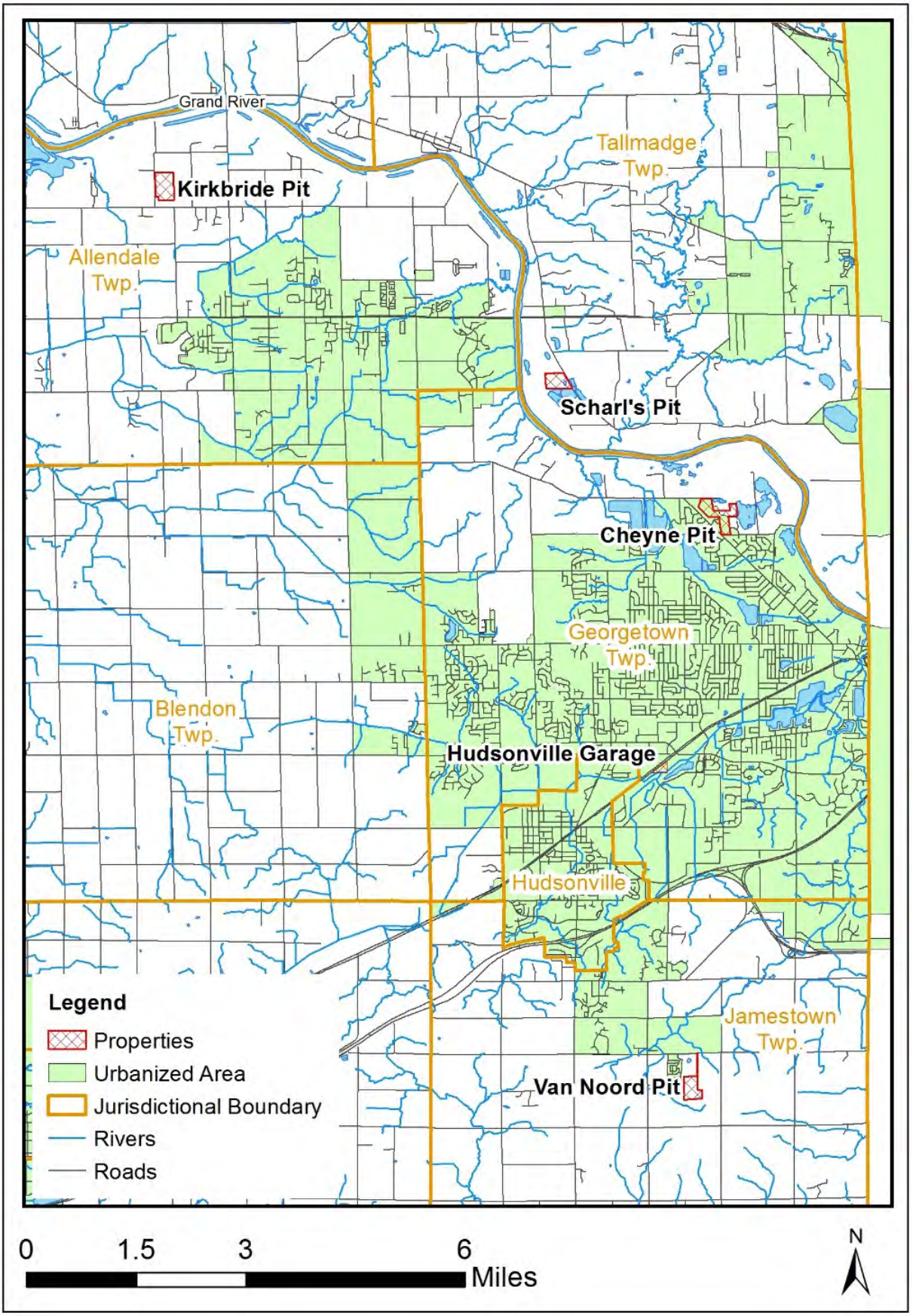

Figure 4. OCRC Properties in the Grand Rapids Urbanized Area

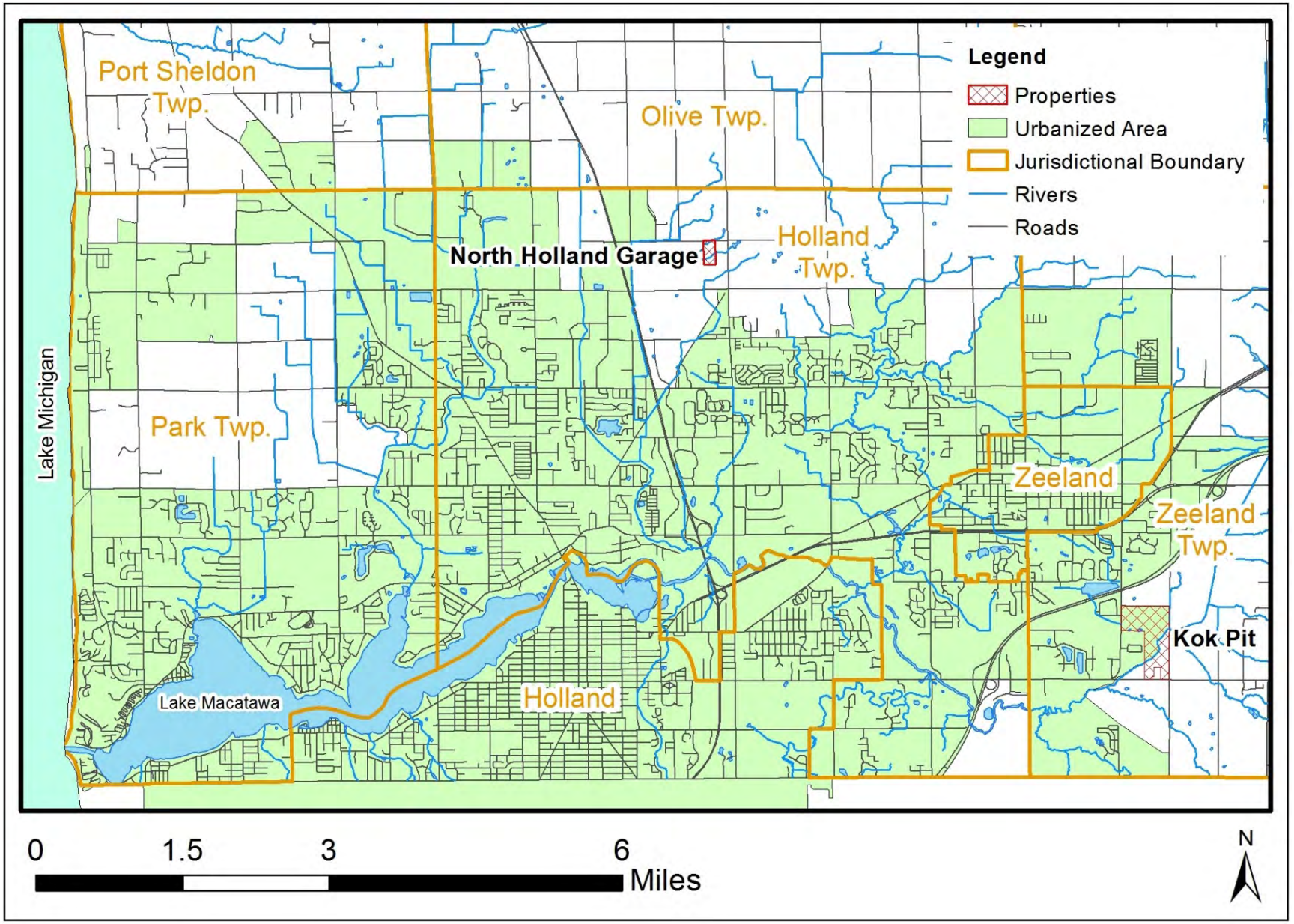

Figure 5. OCRC Properties in the Holland Urbanized Area

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Table 2: Potential pollutant generating activities at OCRC properties

Facility Name	Stormwater Control Inspection and Maintenance	Culvert and Discharge Point Inspection and Maintenance	Building Washing	Vehicle and Equipment Storage	Vehicle Maintenance	Vehicle Washing	Vehicle Fueling/ Fuel Storage	Hazardous Materials Storage	Materials Storage	Salt Storage	Parking Lot/ Sidewalk Salting	Salt Vehicle Washing	Onsite Snow Storage	Outside Dumpster	Lawn Maintenance
North Holland Garage	✓	✓		✓	✓ **Inside**	✓	✓	✓	✓	✓	✓		✓		✓
104th & Chicago Dr. Greenspace	✓	✓											✓		
104th & Adams Greenspace	✓	✓											✓		
Kok Pit*		✓							✓				✓		
Kirkbride Pit		✓							✓				✓		
Bradish Pit									✓				✓		
Cheyne Pit*		✓							✓				✓		
Hudsonville Garage*	✓	✓		✓	✓ **Inside**	✓ **Outside**		✓	✓	✓	✓		✓	✓	✓
Grand Haven Administrative Office and Garage*	✓	✓	✓	✓	✓ **Inside**	✓ **Inside**	✓	✓	✓	✓	✓		✓	✓	✓
Van Noord Pit		✓							✓				✓		
Coopersville Garage	✓	✓	✓	✓	✓ **Inside**	✓ **Outside**		✓	✓	✓	✓	✓	✓	✓	✓
Jac Jungle Pit		✓							✓				✓		
County 80*									✓				✓		
Bronkema/Scharl's Pit	✓			✓					✓	✓			✓		

* Located in urbanized area

Activities on County Roads and right of ways throughout the county include right of way mowing, unpaved road maintenance, paved road maintenance, bridge and culvert maintenance, catch basin inspection and maintenance, and street sweeping.

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2.3 Structural Storm Water Control Inventory

Table 3 contains a list and quantity of all storm water structural controls owned and operated by the OCRC. The first number is the total number of that control and the number in parentheses is the amount located within the regulated urbanized area. Table 4 is a list of locations of structural controls that are located in the OCRC right of way and not associated with an OCRC property.

Table 3. OCRC storm water controls

Type	Quantity	Notes
Catch Basins	1,773 (1,304)	
Detention	3 (1)	2 at Holland Garage, 1 at Bronkema Pit
Vegetated Swale	2 (2)	Open space (Table 1)
Check Dam	1 (1)	Grand Haven Garage
Isolated Sump	2 (1)	Grand Haven and Coopersville Garages
Infiltration Facility	4 (2)	Listed in Table 4
Buffer Strips	2 (1)	Hudsonville and Coopersville Garages (natural)
Bioretention	2 (2)	Open space (Table 1)
Oil/Water Separator	4 (2)	One at each garage
Mitigated Wetland	2 (1)	104th & Adams (Table 1) and Holland Garage

Table 4. Locations of storm water controls in OCRC right of ways

Structural Control	Location	Latitude, Longitude	Township
Infiltration system* (at outlet of 3 drains – 4 catch basins)	18th Ave N of Rosewood St (Rosewood Park)	42.897204, -85.830624	Georgetown
Infiltration system (6 catch basins)	22nd Ave N of Fillmore St (3, each located 150' east of catch basin on 22nd Ave)	42.937467, -85.836886	Georgetown
Infiltration ditch* (12 catch basins)	NW corner of Bauer Rd and 24th Ave	42.921860, -85.842617	Georgetown
Water quality snout units on 3 storm drains* (17 catch basins)	Mercury Drive Phase 3, Groesbeck St to 144th Ave	43.023195, -86.153834	Grand Haven
Wetland detention* (14 catch basins)	NW corner of 104th Ave and Adams St (north side of river)	42.784500, -86.037088	Holland
Bioswale* (4 catch basins)	NE corner of 104th Ave and Chicago Dr	42.812034, -86.038174	Holland
Infiltration system (3 catch basins)	7168 Lakeshore Ave	42.897767, -86.201730	Port Sheldon

* Located in the regulated urbanized area

SECTION 3: Facility-Specific Storm Water Management

3.1 Facility Assessment

Staff at the MACC completed facility assessments for all OCRC properties during the summer of 2014. The assessment included interviews with OCRC staff and site inspections of high priority facilities. The MACC used a checklist of activities as the basis for the OCRC staff interviews and site inspections (Appendix A). As appropriate, MACC staff viewed maps, site plans and as-builts in order to develop an accurate inventory of storm water controls at each facility. MACC staff also reviewed existing related OCRC documents, such as Pollution Incident Prevention Plans, to evaluate existing pollution prevention and good housekeeping practices. The assessment results were input into a database created and maintained by the MACC. The OCRC will notify the MACC of any changes to their facilities that impact storm water, including the construction of new facilities, addition or removal of storm water controls, demolition of old facilities, and transfer of ownership, so that MACC staff can complete a new assessment and update the database. The new assessment and/or database update will be completed within 30 days of the completion of any major facility changes as listed above.

3.2 Prioritized Facility List

MACC staff used information gathered during the assessment procedure to assign priority levels to each facility based on having high, medium or low potential to discharge pollutants to surface waters of the state (Table 5). The list of prioritized facilities is provided in Table 6. The pages following Table 6 provide site plans and a summary of the four garage locations, two of which are in the urbanized area and are ranked as high priority. Due to the nature of the facilities, all garages will be inspected and maintained according to MS4 permit pollution prevention and good housekeeping requirements. Information about additional properties located in the urbanized area that ranked low are provided in Appendix B.

Table 5. Criteria used to assign pollutant discharge potential priorities to OCRC facilities

Priority Level	Location	Storm water management	Facility type	Material storage
High*	In an urbanized area	Connect to waters of the state	Fleet Maintenance and Storage Yard	Bulk chemical on site
Medium	In an urbanized area	Connect to waters of the state	Any other except open space	Small quantities of chemicals on site
Low	In an urbanized area	Infiltration or maintained on site	Any other including open space	No chemicals of any quantity on site

* A site is considered high priority if it meets the facility type *or* the material storage criteria

Table 6. OCRC prioritized facility list

Facility Name	Location	Storm Water Management	Facility Type	Material Storage	Priority
Hudsonville Garage	Urbanized	Connected to waters of the state	Vehicle Storage and Maintenance Yard	Yes – bulk quantities	**HIGH**
Grand Haven Administrative Office and Garage	Urbanized	Connected to waters of the state	Administration Building, Vehicle Storage and Maintenance Yard	Yes – bulk quantities	**HIGH**
Kok Pit	Urbanized	Maintained on site	Materials Storage Yard	Solid, no liquid	**LOW**
County 80	Urbanized	Maintained on-site	Materials Storage Yard	Solid, no liquid	**LOW**
Cheyne Pit	Urbanized	Maintained on-site	Materials Storage Yard	Solid, no liquid	**LOW**
104th & Chicago Dr: Greenspace, Storm water Outfall	Urbanized	Connected to waters of the state	Open Space	None	**LOW**
104th & Adams: Wetland Mitigation, Greenspace	Urbanized	Connected to waters of the state	Open Space	None	**LOW**
North Holland Garage	Non-urbanized	Connected to waters of the state	Vehicle Storage and Maintenance Yard	Yes – bulk quantities	**N/A**
Coopersville Garage	Non-urbanized	Connected to waters of the state	Vehicle Storage and Maintenance Yard	Yes – bulk quantities	**N/A**
Kirkbride Pit	Non-urbanized	Maintained on site	Materials Storage Yard	Solid, no liquid	**N/A**
Bradish Pit	Non-urbanized	Maintained on-site	Materials Storage Yard	Solid, no liquid	**N/A**
Van Noord Pit	Non-urbanized	Maintained on-site	Materials Storage Yard	Solid, no liquid	**N/A**
Jac Jungle Pit	Non-urbanized	Maintained on-site	Materials Storage Yard	Solid, no liquid	**N/A**
Bronkema/Scharl's Pit	Non-urbanized	Connected to waters of the state	Materials Storage Yard	Solid, no liquid	**N/A**

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Figure 6: Hudsonville Garage site plan

**** HIGH PRIORITY FACILITY LOCATED IN REGULATED URBANIZED AREA ****

Property Type: Vehicle storage and maintenance, salt storage

Structural Stormwater Controls: Catch basins, oil-water separator connected to sanitary sewer (pumped annually or as needed)

Roof Drains: Sheet flow, no roof drains

Lawn Care: Mowing done by staff

Winter Maintenance: Snow stored on site, some salting done for foot traffic

Salt storage/mixing pad: 4,500 square foot bituminous pad that is above grade with outside areas sloping away. Runoff from direct precipitation is captured by catch basin with 2-foot sump to allow for settling of sand. The catch basin empties into 2,000 gallon underground concrete tank. The tank has 2 outlets: 1 to sanitary and 1 to storm. The storm outlet is plugged when salt/sand is present.

Vehicle Maintenance: Inside, floor drains connected to sanitary, self-contained trench drains pumped out as needed

Miscellaneous Storage: materials storage (gravel, salt, culvert pipes, oil)

Other Information:

- Vehicle storage inside and outside, vehicle washing performed outside
- Recycling of oil and antifreeze, garage has a Spill Prevention and Response Plan and spill kit
- Parking lot sweeping preformed
- Dumpsters have secondary containment (sit on impervious surface)
- Berm at edge of paved parking lot prevents sheet flow runoff from directly entering Rush Creek
- Repairs to most imperious surfaces performed by staff
- 250 gallon tank for waste oil, pumped out by waste oil hauling company as needed

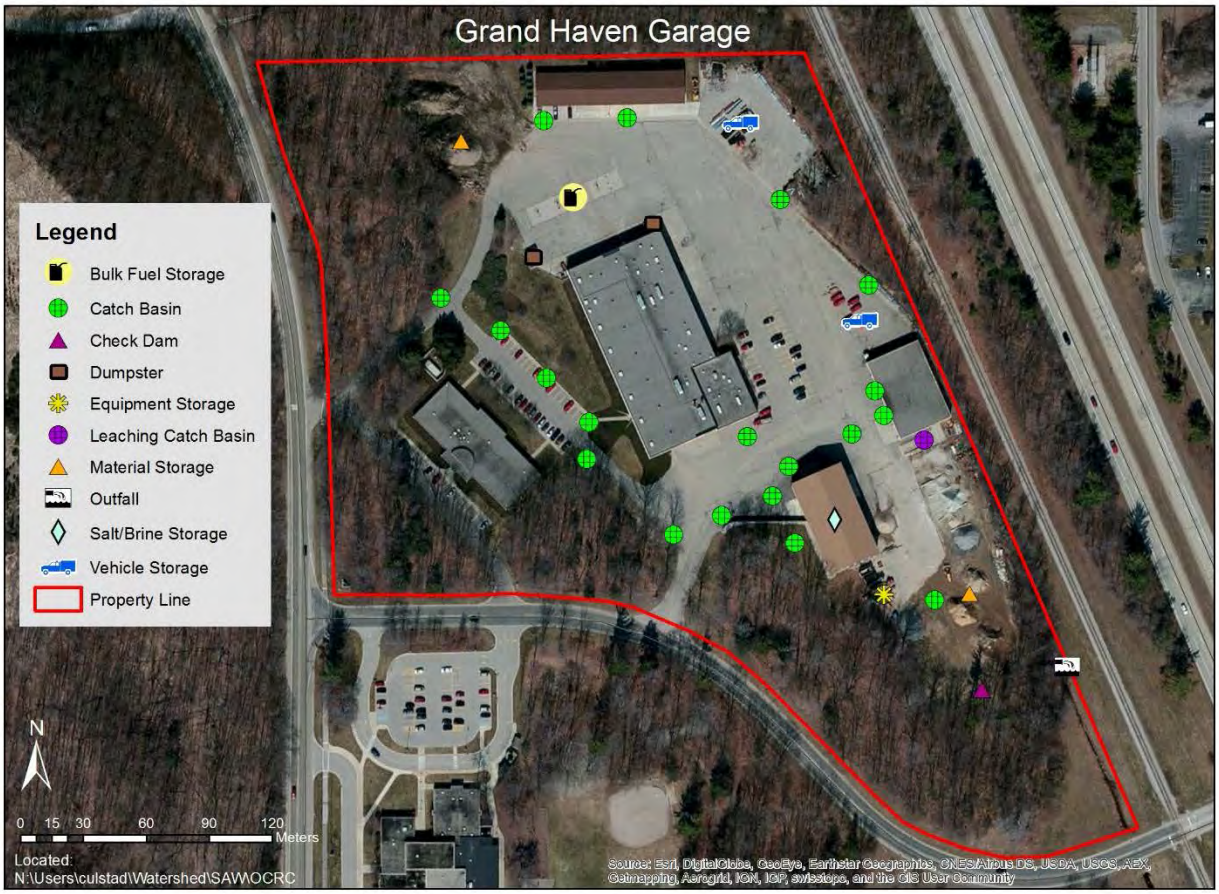

Figure 7. Grand Haven Administrative Office and Garage site plan

**** HIGH PRIORITY FACILITY LOCATED IN REGULATED URBANIZED AREA ****

Property Type: Administration building, vehicle storage and maintenance, materials storage yard

Structural Stormwater Controls: Natural infiltration, check dam, catch basins

Roof Drains: Connected to storm sewer

Lawn Care: Mowing done by staff; contractor hired for other landscaping needs

Winter Maintenance: Snow stored on site, some salting performed

Salt/brine storage: indoor, all mixing occurs inside, secondary containment for brine tanks, self-contained sump in building

Vehicle Maintenance: Inside where drains are connected to oil separator and sanitary sewer

Oil water separator: 2-1,000 gallon holding tanks in the maintenance building, pumped at least once a year by a licensed waste hauler, connected to sanitary sewer

Miscellaneous Storage: Bulk underground fuel storage, oil, soap, lawn equipment

Other Information:

- Metal, paper, oil, and antifreeze recycling
- Garage has a Spill Prevention and Response Plan, spill kit; fuel station has oil dry
- Preform parking lot sweeping twice a year on average
- OCRC does maintenance on Ottawa County Sheriff vehicles, floor drains in garage connected to sanitary
- Repairs to most impervious surfaces performed by staff
- Office houses PIPP's (4 total, developed by Prein & Newhof)

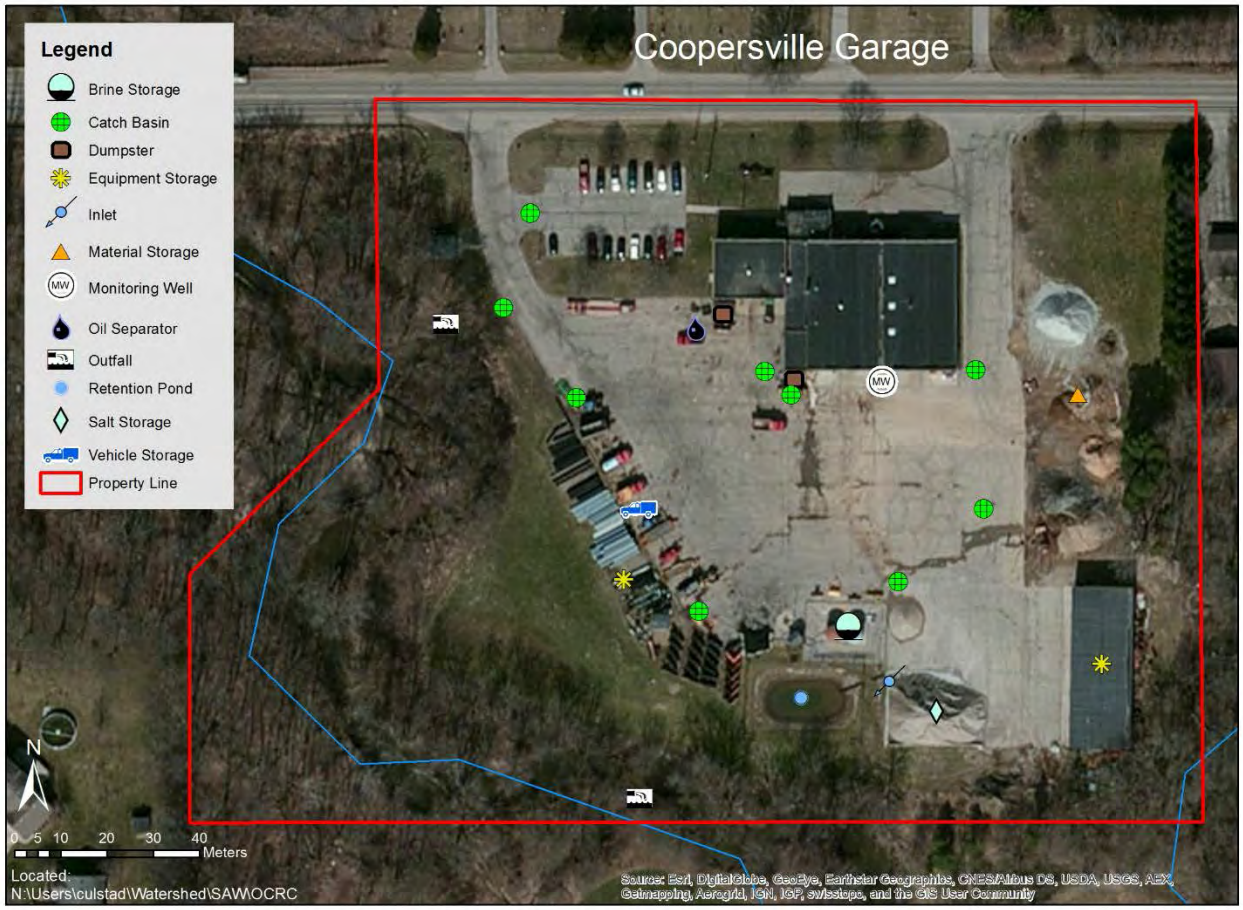

Figure 8. Coopersville Garage site plan

Property Type: Vehicle storage and maintenance, equipment storage, salt storage

Structural Stormwater Controls: Retention pond, catch basins

Roof Drains: Water is piped through building

Lawn Care: 30' riparian buffer along Deer Creek, lawn care done by OCRC staff

Winter Maintenance: Snow stored on site, parking lot salting for foot traffic

Salt/brine storage: Tanks north of retention pond. Temporary salt storage outside adjacent to pond – has tarp

Vehicle Maintenance:

Oil water separator (connected to sanitary sewer): Floor drain in maintenance garage goes to oil separator, storage bay drains to oil separator, no outlet in cold storage building (sump only)

Miscellaneous Storage: Vehicles inside and outside.

Other Information:

- Spill kits in storage building
- Storm water from this property enters Deer Creek
- Retention pond has pump for water reuse
- Garage will likely be closing/relocating

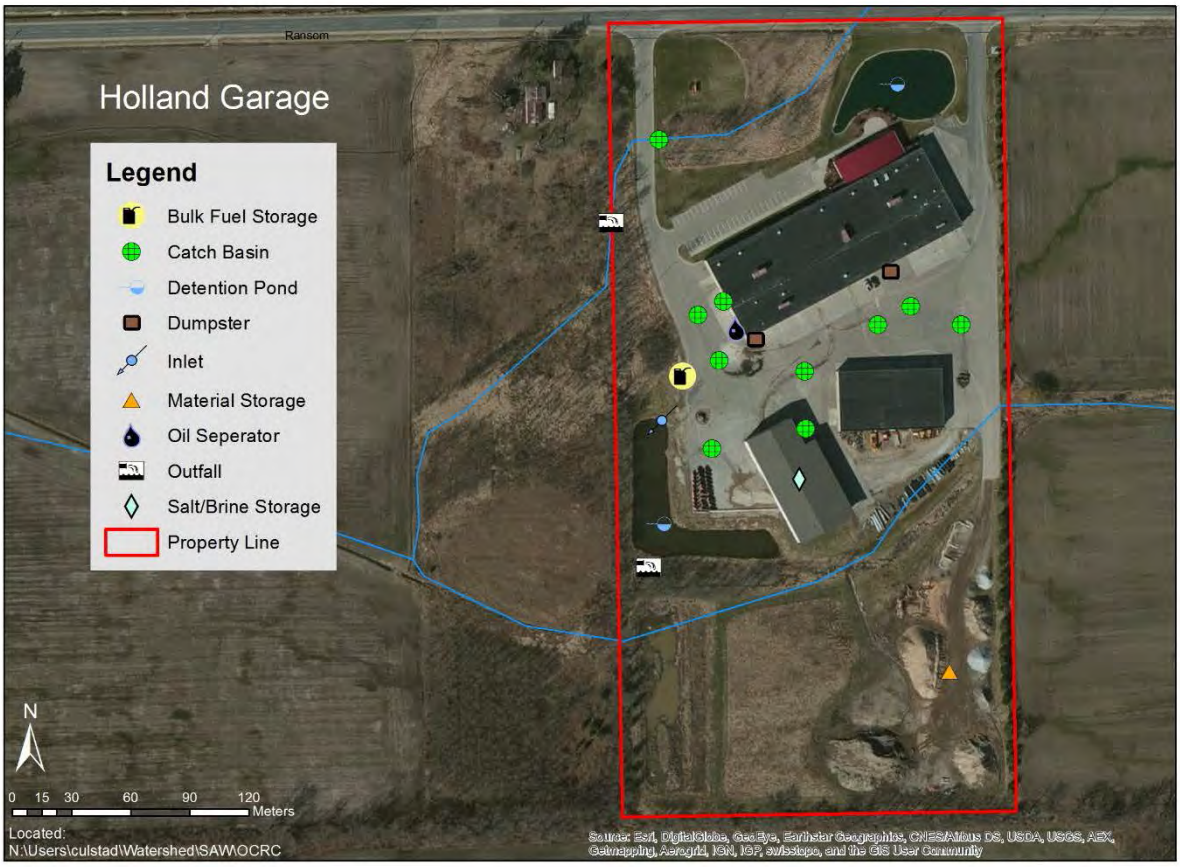

Figure 9. Holland Garage site plan

Property Type: Vehicle storage and maintenance, equipment storage, salt storage

Structural Stormwater Controls: Detention ponds, catch basins, vegetated swale, mitigated wetland

Roof Drains: Drains through building and then out to detention pond

Lawn Care: done by OCRC staff

Winter Maintenance: Snow stored on site, parking lot salting

Salt/brine storage: Salt stored inside

Vehicle Maintenance: Preformed inside

Oil water separator: Vehicle storage garage drain has oil separator connected to sanitary sewer

Miscellaneous Storage: Fuel tanks are double walled and have secondary containment

Other Information:

- Retention pond collects parking lot runoff
- All catch basins drain to detention pond
- Detention pond outlets into wetland
- Spill kit in garage

3.3 Best Management Practices

Best management practices (BMPs) are physical structures that are installed or actions that are taken to prevent or reduce the potential for storm water pollution when undertaking certain activities. The next section of the guidebook provides BMPs that are being and will be followed for activities that are occurring at high priority OCRC facilities. These same BMPs will be implemented at low priority facilities at facilities located outside of the urbanized area for the applicable activities.

Table 7. Activities that could generate storm water pollution at high priority OCRC facilities

	FACILITY		
ACTIVITY	Hudsonville Garage	Grand Haven Garage	BMP Summary Sheet (page #)
Vehicle storage inside	X	X	29
Vehicle storage outside	X	X	29
Equipment storage	X	X	29
Vehicle and equipment maintenance inside	X	X	30
Vehicle and equipment washing	outside	inside	31
Vehicle fueling station/fuel storage		X	32
Outdoor Materials storage	X	X	33
Bulk chemical/hazardous materials storage (see Table 7)	X	X	34
Salt storage	X	X	35
Parking lot/sidewalk salting		X	36
Parking lot/sidewalk cleaning	X	X	37
Building washing		X	38
Snow management	X	X	39
Outside dumpster storage	X	X	40
Lawn maintenance	X	X	41

Table 8. List of significant materials stored at high priority OCRC facilities

MATERIAL	HUDSONVILLE GARAGE QUANTITY	GRAND HAVEN GARAGE QUANTITY
Motor oil	605 gallons	500 gallons
Hydraulic fluid	275 gallons	175 gallons
Axle grease	120 pounds	120 pounds
Antifreeze	55 gallons	55 gallons
Cleaning solvent	NONE	55 gallons
Windshield solvent	20 gallons	24 gallons
Mineral spirits	55 gallons	55 gallons
Salt	1100 tons	700 tons
Brine	8,000 gallons	25,000 gallons
Diesel exhaust fluid	55 gallons	55 gallons
Diesel fuel	NONE	2-8,000 gallon tanks (capacity)
Unleaded gasoline	NONE	1-8,000 gallon tank (capacity)

Detailed information about the use, loading/unloading, storage, pollution prevention, and spill procedures for these materials is found in the Pollution Incident Prevention Plan for each garage (Appendix C).

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Vehicle and Equipment Storage

BMP Description:

- All floor drains that discharge to storm sewers should be sealed/plugged. New floor drains should discharge to a sanitary sewer.
- All floors should be constructed of cement or other impervious materials to prevent contaminants from leaching into the soils or groundwater.
- Equipment wash areas should discharge into a sanitary sewer line. Depending on the amount of oil, grease and other pollutants, pre-treatment of wastewater may be needed before it enters the sanitary sewer.
- Spill kits should be available and clearly marked to respond quickly to any automotive fluid leaks for both inside and outside vehicle storage.
- Vehicles parked outside for extended periods of time or overnight should be parked away from storm drains.
- If equipment is to be stored outside, all fluids should be drained first. Store idle equipment containing fluids under cover.

Measurable Goals:

A minimum of one well-marked spill kit available in every garage

100% of vehicles and equipment stored outside kept a minimum of 100 feet from any storm drain

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Comprehensive inspection once every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Vehicle and Equipment Maintenance

BMP Description:

- Whenever feasible, move maintenance and repair activities indoors.
- Avoid hosing down work areas, but if work areas are washed, collect the water and direct to sanitary sewer.
- Post signs to indicate storm drains and sinks are not to receive hazardous wastes.
- Designate a special area, with no connections to the storm drain, to drain motor fluids.
- Collect leaking or dripping fluids in drip pans or containers, and drain all fluids immediately.
- Promptly transfer used fluids to proper waste or recycling drums.
- Keep equipment clean, don't allow excess grease and oil buildup.
- If temporary work is being done outside, use a tarp, ground cloth, or drip pans to capture all spills and drips, and dispose of properly.
- Regularly inspect vehicles and equipment for leaks and repair immediately.
- Spill kits should be available and clearly marked to respond quickly to any fluid leaks for both inside and outside maintenance activities.

Measurable Goals:

100% of all maintenance activities conducted inside and use of tarp for any maintenance that must be conducted outside

A minimum of one well-marked spill kit available in every garage

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Comprehensive facility inspections every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Vehicle and Fleet Maintenance*, Stormwater Coalition of Monroe County, NY*

Vehicle and Equipment Washing

BMP Description:

- Wash waste water must not be allowed to enter storm drains.
- Consider washing vehicles and equipment inside the building if washing must occur on-site.
- If washing must be done outside, it should be done over a gravel or grassed area with cold water and no soap. Alternatively, wash outside on a covered, paved surface that collects wash waste water and directs it to the sanitary sewer.
- Design wash areas to properly collect and dispose of wash waste water when engine cleaning is conducted and when chemical additives, solvents or degreasers are used.
- Use biodegradable, phosphate-free detergents for washing vehicles if needed.
- Discharge all wash waste water to a sanitary sewer, holding tank or a process treatment system after consulting with the local sewer authority to find out if pretreatment is required.

Measurable Goals:

100% of vehicles washed inside or at a commercial facility

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Vehicle Fueling Station

BMP Description:

- Inspect tank foundations, connections, coatings, tank walls, and piping systems. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Visually inspect new tank or container installations for loose fittings, poor welds and improper or poorly fitted gaskets.
- Check for leaks or spills when transferring fuel from tanker truck into storage system and when fueling vehicles.
- Above-ground tanks should be tested periodically for integrity by a qualified professional.
- Dry cleanup methods should be employed when cleaning up fuel-dispensing areas. Spill kits should be readily available and clearly labeled.
- Fuel dispensing areas should be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area.
- Barriers should be in place to prevent vehicles from damaging pumps and other fuel station structures.
- Fueling stations should be located away from storm drains.

Measurable Goals:

A minimum of one well-marked spill kit available at fueling station

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Comprehensive facility inspection once every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Outdoor Materials Storage

BMP Description:

- Consider building a covered area with a paved floor for storing materials to prevent contact with storm water runoff. This practice can be used for significant materials that could contaminate storm water runoff.
- If small quantities of materials are stored outdoors, consider placing a temporary plastic film or sheeting over the material to protect it from storm water runoff.
- New storage areas should be paved and include a drainage system to collect the storm water runoff. The paved area should be sloped to avoid pooling and curbed to contain any contaminated runoff. Avoid the use of catch basins in the interior of the paved area since catch basins could fill with material and clog. The drain from the paved area can be connected to the sanitary sewer if allowed by the local public works department. If this is not possible, then the runoff may need treatment to remove pollutants.
- For unpaved storage areas, determine whether or not rainfall infiltrates into the soil through visual observations during rainfall events. If storm water passes into the soil, no further work is needed provided there is no concern for groundwater contamination. If runoff is observed, construct a berm around the storage area to collect and divert the excess runoff either to the sanitary sewer or for treatment.
- On paved surfaces, sweep any spilled or escaped materials back into the storage area. Do not hose down an area with water.
- Maintain an Emergency Spill Response and Cleanup Plan

Measurable Goals:

Monthly inspection of storage area

100% of spills or trackout are cleaned up and kept out of storm drains and other structural controls

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Comprehensive facility inspection once every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Reference: State of Oregon Department of Environmental Quality. 1997. *Recommended Best Management Practices for Storm Water Discharges.*

Hazardous Materials Storage

BMP Description:

- Ensure sufficient aisle space to provide access for inspections and to improve the ease of material transport.
- Store materials away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags or containers.
- Stack containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself.
- Store containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests (insects, rodents, etc.).
- Liquid materials should be stored with secondary containment to contain any leaks or spills.
- Delegate the responsibility for management of hazardous materials to personnel trained and experienced in hazardous substance management.
- Have a spill response and prevention plan including readily available and well-marked spill kits.

Measurable Goals:

A minimum of one well-marked spill kit available near hazardous material storage area100% of liquid materials stored with secondary containment
Monthly inspections of storage areas at high priority facilities

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Comprehensive facility inspection once every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on EPA Hazardous Materials Storage website:
http://water.epa.gov/polwaste/npdes/swbmp/Hazardous-Materials-Storage.cfm

Salt[1] Storage

BMP Description[2]:

- Salt should be stored inside and in dry conditions or covered with waterproof tarps.
- Salt should be stored on impervious surfaces to reduce seepage into groundwater.
- Salt piles should be located at least 50 feet from any open water body or wetland and located outside the 100-year floodplain.
- For indoor storage, minimize trackout of vehicles and sweep up any materials deposited outside of building and exposed to storm water as soon as possible.

Measurable Goals:

A minimum of one well-marked spill kit available near salt storage areas100% of spills and trackout are cleaned up and kept out of storm drains

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Comprehensive facility inspection once every 6 months at high priority facilities

Specific Components and Notes:

See MDEQ *Salt and Brine Storage Guidance* in Appendix D for more information.

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

[1] Includes salt, salt-sand mixtures and other alternative deicers in solid form

[2] Some of these recommended practices, as well as additional requirements, may need to be met in order to comply with Part 5 rules if the salt storage facility meets certain criteria.

Parking Lot and Sidewalk Salt[1] Application

BMP Description:

- Calibrate spreaders to ensure proper application rates.
- Consider environmental impacts and practical melting temperature when determining which material and how much to apply.
- Consider alternative products to spread on sidewalks and parking lots that have less environmental impact.
- Only apply the amount of deicer needed to get the job done.
- As much as possible, remove snow prior to applying deicers. The less snow, the less deicer needed.
- Remember that sand provides traction and does not melt ice. If sand must be used, then institute regular sweeping to prevent sand from entering storm drains.
- Consider anti-icing products in key areas that receive high-foot traffic to avoid slip and fall injuries.

Measurable Goals:

Track amount of salt used with a goal of reducing salt use or incorporating alternative deicers or anti-icing products

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

See *Winter Parking Lot and Sidewalk Maintenance Manual* in Appendix E for more information.

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

[1] Salt includes sand-salt mixtures and other alternative deicers.

Parking Lot Sweeping and Sidewalk Cleaning

BMP Description:

- A regular sweeping schedule should be maintained.
- Parking lot sweeping is only to be performed during dry weather if possible.
- Wet cleaning or flushing of the lot is to be avoided where possible. If wet cleaning is necessary, collect debris and direct wash waste water to the sanitary sewer.
- Sweepers are to be operated at manufacturer directed optimal speed level to increase effectiveness.
- Vacuum or regenerative air sweepers should be used in high sediment and trash areas.
- Accurate logs of the sweeping frequency and the amount of waste collected are to be kept.
- Dispose of sweeping debris and dirt at a landfill.
- Do not store swept material near a storm drain inlet.
- Debris storage is to be kept to a minimum during the wet season. Piles will be contained by a berm or covered.

Measurable Goals:

Annual sweeping of parking lots/sidewalks at high priority facilities

Track number of acres of parking lots cleaned and volume of material collected with a goal of reducing the volume over time

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Street Sweeping and Cleaning*, Stormwater Coalition of Monroe County, NY*

Building Washing (Powerwashing)

BMP Description:

- Use dry spot cleaning methods when possible and properly dispose of any pre-cleaning debris
- Block or protect storm drains from waste water runoff
- Minimize water usage with regulating nozzles or high pressure delivery systems
- If necessary, use only non-toxic cleaning solutions
- Contain and collect waste water and dispose of in the sanitary sewer (with permission) or allow to infiltrate into vegetated areas. If necessary, use an absorbent pad to reduce/remove any oil or other hydrocarbons
- Clean up any residue or solids left after disposal to keep materials out of storm water runoff

Measurable Goals:

100% of waste water is kept out of storm drains

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Plaza and Sidewalk Cleaning*, Stormwater Coalition of Monroe County, NY*

Snow Storage and Removal

BMP Description:

- Snow disposal sites must be located at least 50 feet from private water supply wells, 75 feet from non-community water supply wells, 200 feet from municipal water supply wells, and not be located in a wellhead protection area.
- Do not dispose of snow within a drinking water source water protection area.
- Avoid snow storage and disposal on erodible sites or where there are steep slopes.
- Avoid disposal sites with high risk for human exposure (parks, playgrounds, etc.).
- Avoid disposal sites near areas of fractured bedrock. Choose sites with adequate soil depth between the surface and groundwater to act as a filter. Fine-grained loamy soils with high organic matter will filter and retain contaminants better than sandy soils.
- Avoid disposal in a landfill.
- Avoid disposal in wetland and floodplains.
- The best disposal sites are those that drain to a detention pond or infiltration area that capture pollutants and keep them from entering surface water.

Measurable Goals:

Amount (volume or percent of total managed) of snow stored in detention/infiltration areas

100% of snow stored in areas that allow infiltration or treatment of meltwater

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on MDEQ Snow Disposal Guidance: https://www.michigan.gov/documents/deq/wrd-waterwords-20140208_446950_7.pdf

Dumpster Storage and Maintenance

BMP Description:

- All outdoor dumpsters will be stored on an impervious surface.
- All outdoor dumpsters will have a cover that is closed when they are not being loaded or unloaded.
- All outdoor dumpsters will be inspected during the six-month comprehensive site inspection to check for structural damage. Leaky dumpsters will be repaired or replaced.
- Dumpster areas will be inspected regularly as part of a facility litter control program to ensure that debris is disposed of properly and not allowed to enter surface water.
- Minimize the disposal of liquids in dumpsters.

Measurable Goals:

Monthly inspections of dumpsters at high priority facilities

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Comprehensive facility inspection once every 6 months at high priority facilities

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Lawn Care and Landscape Maintenance

BMP Description:

- Use phosphorus-free fertilizer in all cases except when starting a new lawn from seed, patching/repairing a lawn with seed or when a soil test has shown there is a need
- The area of lawn will be measured prior to applying fertilizer to ensure that the proper amount is applied
- Maintain at least a 3-foot buffer of no fertilizer application when applying adjacent to surface water or storm water controls
- Grass should be cut no shorter than three inches to encourage root growth
- All grass clippings and fertilizer will be swept or blown off impervious surfaces back onto lawns to prevent runoff into storm drains
- When irrigating, follow a schedule to maximize efficiency and prevent excess water from running off
- When selecting landscape plants, choose species that are appropriate for the site conditions. Use of native species is encouraged to minimize the need for fertilizing and irrigation.
- Any pesticide application will be completed by an employee or contractor that is certified by the State of Michigan as a pesticide applicator in the applicable category

Measurable Goals:

100% of fertilizer used is phosphorus free unless necessary for the above listed reasons Maintain a 3-foot buffer of no fertilize application adjacent to surface water and storm water controls
100% of pesticide applications completed by certified individuals

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on Macatawa Watershed Project's Lawn Care Seal of Approval criteria

3.4 Inspection and Maintenance of Storm Water Control Devices

Routine monthly inspections of storm water control devices will occur at the high priority facilities as well as the other two garages located outside of the urbanized areas. This inspection procedure will also include storm water control devices that are not associated with other properties as listed in Table 3. Inspections will be completed by the OCRC Environmental Coordinator or other qualified, trained OCRC staff using the **Monthly Facility Storm Water Control Inspection Form** (Appendix F). During these inspections, the inspector shall review all storm water controls located on the property including points of discharge. Controls will be inspected for proper function and any maintenance needs will be recorded and scheduled.

Specific observations will be recorded on the inspection form and upon completion, the form will be reviewed with the Facilities Manager for any areas that need attention. Areas that need immediate attention will be addressed within 24-48 hours. All other concerns will be addressed within 90 days. The Facilities Manager shall notify the Environmental Coordinator when items needing attention have been addressed and it will be recorded on the inspection form. A copy of the completed inspection form will be kept in the Environmental Coordinator's office at the Grand Haven Administration Building.

Any new storm water structural controls that fall under the OCRC's responsibility will be incorporated into the inspection and maintenance schedule within 30 days of construction or addition.

3.5 Comprehensive Site Inspection

Comprehensive site inspections will be performed at the Grand Haven, Hudsonville, North Holland, and Coopersville garages every April and October of each year. The inspections will be conducted by the Environmental Coordinator or other qualified, trained OCRC staff using the **Storm Water Comprehensive Site Inspection Form** (Appendix G). During these inspections, the following areas will be reviewed:

- Facility operation
- Fluids management
- Leak and spill prevention and control
- Battery storage
- Tire storage
- Fueling areas (North Holland and Hudsonville only)
- Absorbent materials storage and disposal
- Salt storage
- Miscellaneous material storage
- Facility storm water runoff

After the inspection is complete, the form will be reviewed with the Facilities Manager for any areas that need attention and they will be addressed within 30 days. The Facilities Manager shall notify the Environmental Coordinator when items needing attention have been addressed. When there are areas of concern, the Environmental Coordinator, the Operations Superintendent and the Facilities Manager shall together review current processes and procedures to address the areas of concern with a goal of having a safe, clean and efficient operation. A copy of the inspection form will be kept in the Environmental Coordinator's office at the Grand Haven Administration Building.

SECTION 4: Structural Storm water Control Operation and Maintenance Activities

4.1 Catch Basin Inspection and Maintenance

OCRC owned catch basins were assigned high, medium and low priority designations for inspection and maintenance based on the criteria in Table 9. The criteria were applied to the OCRC's catch basins located in urbanized areas and the results by township are shown in Table 10. The OCRC developed a 12-year plan for inspecting catch basins starting in 2017 (Table 11). Catch basins will be inspected by the Environmental Coordinator or another trained employee and documented on the **Catch Basin Inspection Form** (Appendix H). Inspections will be completed in the spring of each inspection year. Catch basins that are 50% of more full of sediment will be scheduled for cleaning within the same calendar year. Other maintenance needs will be assessed. High priority maintenance, such as blocked inlets, will be addressed immediately. Medium priority maintenance needs, such as a sink hole with infiltration into the structure, will be addressed within two weeks of inspection. Low priority maintenance needs such as cracks inside the structure will be addressed within 90 days.

Table 9. Criteria used to prioritize catch basin inspections

Criteria	High Priority	Medium Priority	Low Priority
Road type	Primary road (high volume)	Local road (moderate volume)	Subdivision street (low volume)
Salt/sand usage	Used regularly	Used moderately	Used minimally
Proximity to intersection	<300'	300-1,000'	>1,000'
Curb and gutter	Yes, with steep grade	Yes, with low grade	No
Adjacent surface	Road/paved surface	N/A	Grass or vegetated area

Table 10. Catch basin prioritization

Township	# High Priority	# Medium Priority	# Low Priority	Total
Allendale	5	14	0	19
Blendon	8	1	0	9
Georgetown	63	202	29	294
Grand Haven	24	194	42	260
Holland	59	311	72	442
Jamestown	5	12	10	27
Park	12	26	28	66
Robinson	0	0	2	2
Spring Lake	0	2	32	34
Tallmadge	0	12	16	28
Wright	4	19	49	72
Zeeland	9	11	6	26
TOTALS	**189**	**804**	**286**	**1,279**

Does not include catch basins at garages as they will all be inspected monthly as part of the Monthly Facility Storm Water Control Inspection

On an annual basis, all completed inspections will be evaluated to determine if the priority levels of any catch basins need to be changed. Catch basins that are 50% or more full of sediment at the time of inspection may be moved to a higher priority level. If high priority catch basins are found with more than 50% sediment at the time of inspection, then the inspection frequency may be increased. The Environmental Coordinator will also investigate these catch basins further to identify the source of sediment or other material to determine if the source can be reduced or eliminated. Any catch basins, regardless of priority, found with more than 50% sediment at the time of inspection may be moved to a higher priority level. Any catch basins that are 20% or less full of sediment at the time of sediment may be moved to a lower priority level. If low priority catch basins are found with less than 20% sediment, then the inspection frequency may be decreased. Catch basins that are 20-50% full of sediment will remain in the existing priority class. This evaluation and reclassification of priority and/or frequency of inspection will occur on an annual basis once all inspections are completed for that year. The evaluation will also take into account any reports or complaints received from citizens. Any newly constructed catch basins will be incorporated into the schedule within 30 days of construction.

Table 11. Catch basin inspection schedule

Township	**Inspection schedule for high priority**	**Inspection schedule for medium priority**	**Inspection schedule for low priority**
Allendale	Every 2 years starting in 2018	Every 4 years starting in 2018	N/A
Blendon	Every 2 years starting in 2018	Every 4 years starting in 2018	N/A
Georgetown	Every 2 years starting in 2018	Every 4 years starting in 2018	Every 8 years starting in 2018
Grand Haven	Every 2 years starting in 2018	Every 4 years starting in 2018 except Sec. 4 which will start in 2024	Every 8 years starting in 2020
Holland	Every 2 years starting in 2017	Every 4 years, Sec. 10-20 starting in 2017, Sec. 21-28 starting in 2019	Every 8 years, Sec 13-25 starting in 2017, Sec. 10-12 starting in 2021
Jamestown	Every 2 years starting in 2018	Every 4 years starting in 2020	Every 8 years starting in 2022
Park	Every 2 years starting in 2017	Every 4 years starting in 2019	Every 8 years starting in 2021
Robinson	N/A	N/A	Every 8 years starting in 2022
Spring Lake	N/A	Every 4 years starting in 2019	Every 8 years starting in 2019
Tallmadge	N/A	Every 4 years starting in 2019	Every 8 years starting in 2019
Wright	Every 2 years starting in 2017	Every 4 years starting in 2019	Every 8 years starting in 2023
Zeeland	Every 2 years starting in 2018	Every 4 years starting in 2020	Every 8 years starting in 2022

Additional inspections of catch basins will be completed as necessitated by dry weather screening conducted as part of the Illicit Discharge Elimination Program (IDEP). Points of discharge are inspected a minimum of once per permit cycle. If an illicit discharge of excessive sediment or other material is observed during dry weather screenings, upstream catch basins will be examined to determine the source of the discharge. This investigation will be completed by the Environmental Coordinator or another trained employee and will be done at the same time as the dry weather screening. Once the source is determined, corrective action will be taken following procedures outlined in the IDEP Plan. A copy of the Dry Weather Screening and **Catch Basin Inspection Form** will be kept on file at the office of the Environmental Coordinator.

Routine catch basin cleaning is currently completed by the OCRC annually according to the following schedule:

- Primary and local roads – even years: Crockery, Grand Haven, Holland, Olive, Park, Polkton, Port Sheldon, Robinson, and Spring Lake Townships
- Primary and local roads – odd years: Allendale, Blendon, Chester, Georgetown, Jamestown, Tallmadge, Wright, Zeeland

This current schedule will be adjusted as determined by inspections. This regular cleaning schedule will continue until all catch basins have been inspected once as part of the new prioritized inspection schedule. After initial round of inspections have been completed for all catch basins, then cleaning will take place as determined by inspections.

Once the catch basins have been inspected and marked for cleaning, this information will be given to the Operation Superintendent (OS). The OS will schedule cleaning with the contractor. The contractor will be accompanied by OCRC staff to sample the water in the sump and conduct a visual inspection. If there is a sheen, discoloration or odor, then the water shall be collected in the vactor truck with the sediment from the sump. If the water is clear, OCRC staff will insert a sump pump and will pump the sump water to the curb line prior to the vactor truck removal of sediment. Contractors are required to show proof of delivery of catch basin waste to the landfill for disposal. The landfill performs testing of the material and submits the test results to the OCRC. The test results are kept in the office of the Operations Superintendent. All catch basin cleaning and material disposal will be conducted following the MDEQ Catch Basin Cleaning Activities Guidance Document (Appendix I).

Citizens are invited to call the main OCRC office or submit requests or questions via an online form on the OCRC's website (www.ottawacorc.com) related to catch basin and street sweeping issues. When a complaint is received, a **Service Request Form** (Appendix J) is generated and forwarded to the appropriate department for response the same day or next business day if received after hours. If the complaint is regarding an OCRC-related activity, the District Forman is notified and he/she will investigate the complaint within 24 hours. If the District Forman determines further action is warranted by OCRC staff, corrective action will then be taken within 24 hours. If the complaint is related to a private development activity, the enforcement action will be taken by the OCRC Special Services Department. The Special Services Department will contact the owner of the private development within 24 hours. The contractor and/or developer to take immediate action to clean the street and catch basins of all debris they are responsible for within 24 hours of being notified. If immediate action is not taken by the contactor or developer, the Special Services Department may revoke their right-of-way permit and notify the Ottawa

County Water Resource Commissioner's office and the Township Supervisor for assistance in resolving the matter. Continued follow up by the Special Services Department will take place throughout the construction of the development until the right of way is stabilized.

4.2 Other Storm Water Controls

Table 3 on page 15 provides a list of non-catch basin storm water structural controls that are not associated with facilities. These controls are inspected every April and October for each year by the Environmental Coordinator of other trained, qualified OCRC staff using the **Storm Water Structural Control Inspection Form** (Appendix K) assessing the overall function, condition and need for maintenance. Copies of the inspection forms will be kept at the office of the Environmental Coordinator. Storm water structural controls will be scheduled for maintenance when they reach 50% capacity. Most maintenance needs will be contracted out, but some simpler maintenance may be performed by OCRC staff. A filter bag will be used on the pump outlet to filter small sized particles when dewatering detention basins. Water will be discharged to a location downstream of the basin utilizing appropriate soil erosion measures. The material removed from the detention basins will be will be transported by truck and disposed of at an approved landfill. This inspection and maintenance procedure for storm water controls will be reviewed on an annual basis for the need to update frequency of inspections or maintenance activities. Any new storm water controls that are constructed or come under ownership of the OCRC will be added to the inspection and maintenance schedule within 30 days of construction or acquisition.

The OCRC requires that all construction of new OCRC-owned facilities or new storm water controls designed for water volume control will be designed, installed and maintained in accordance with the county's post construction runoff control performance standards and long-term operation and maintenance requirements.

SECTION 5: Municipal Operations and Maintenance Activities

5.1 Assessment

All OCRC owned facilities, including public roads, were assessed by the Environmental Coordinator to determine which operation and maintenance activities are occurring at facilities and within right of ways. The following activities were assessed:

- Road, parking lot and sidewalk maintenance
- Bridge maintenance
- Right-of-way maintenance
- Unpaved road maintenance
- Cold weather operations
- Drainage system maintenance
- Landscape maintenance

A summary of the operation and maintenance activities and associated potential pollutants is found is Table 12. The assessment will be revised within 30 days of any significant changes to operation and maintenance activities or to the best management practices that are implemented.

5.2 Street Sweeping

The OCRC schedules street sweeping annually every spring and it is completed by a contractor. The contractor delivers the swept material to the OCRC Grand Haven garage for testing and proper disposal. The OCRC tests for BETX, TCLP Lead, Cadmium, and Chromium and then disposes of material at an approved landfill. Copies of test results are kept in the Grand Haven Administrative Office

The following roads are swept annually (urbanized areas shown in bold):

<u>Allendale Township</u>

- **48th Ave intersection at Pierce St**
- **48th Ave intersection at West Campus Dr**
- **48th Ave M-45 to Rich St ****
- **68th Ave intersection at Fillmore St**
- **68th Ave intersection at Pierce St**
- **68th Ave ½ mile North and South of M-45**
- 68th Ave intersection at Warner St
- 68th Ave Bridge over the Grand River
- 92nd Ave intersection at Warner St
- 96th Ave intersection at Fillmore St

<u>Blendon Township</u> (all outside of urbanized area)

- 96th Ave ½ mile North and South of Port Sheldon St
- Port Sheldon St ½ mile East of 96th Ave
- 96th Ave intersection at Taylor St

Chester Township (all outside of urbanized area)

- 36th Ave Bridge over Crockery Creek North of Truman St
- 40th Ave intersection at Wilson St

Crockery Township (all outside of urbanized area)

- Cleveland St intersection at 112th Ave
- Cleveland St from 112th Ave 1 mile East

Georgetown Township

- **8th Ave from 44th St to Port Sheldon St**
- **10th Ave from Cottonwood Dr North ½ mile ****
- **12th Ave from Rosewood St to Baldwin St**
- **18th Ave from Port Sheldon St to Chicago Dr**
- **18th Ave from Chicago Dr to Rosewood St**
- **20th Ave from Rosewoood to Bauer Rd**
- **24th Ave from Bauer Rd to Fillmore St**
- **42nd Ave from Baldwin North ½ mile ****
- **Port Sheldon St from 48th Ave East to County line**
- **Rosewood St from 12th Ave West to end ****
- **Tyler St from Port Sheldon Rd to County Line**
- **School St from Port Sheldon Rd to Baldwin St**
- **Baldwin St from 48th Ave East to County line**
- **Cottonwood Dr from Baldwin St to Bauer Rd**
- **Bauer Rd intersection at 48th Ave**
- **Bauer Rd from 24th Ave to 20th Ave**
- **Bauer Rd from Cottonwood Dr West ½ mile**
- **Fillmore St intersection at 48th Ave**

Grand Haven Township

- **168th Ave intersection at Hayes St**
- **168th Ave intersection at Comstock St**
- **172nd Ave from Comstock St to Robbins Rd ****
- **Lakeshore Ave intersection at Lake Michigan Dr**
- **Lakeshore Ave intersection at Lincoln St**
- **Lakeshore Ave intersection at Ferris St**
- **Lakeshore Ave from Hayes St to Robbins Rd**
- **Rosy Mound Dr from Lakeshore Ave to US31 ****
- **Comstock St from US31 to 172nd Ave**
- **Hayes St from US31 to 168th Ave**
- **Mercury Dr from Grand Haven City Limits to 144th Ave**

Holland Township

- **100th Ave ½ mile North, ¼ mile South of Riley St ****
- **120th Ave from Chicago Dr to Riley St**
- **120th Ave intersection at Quincy St**
- **Westshore Dr from Felch St to Greenly St ****
- **Beeline Rd from Felch St to Riley St**
- **128th Ave from Riley St North to end ****
- **John F Donnelly from Riley St to Quincy St ****
- **Windquest Dr from Riley St to Greenly St ****
- **136th Ave from Butternut Dr to Riley St**
- **136th Ave intersection at Quincy St**
- **Adams St from Holland City limits to 96th Ave**
- **Woodbridge St from Chicago Dr to US31**
- **Chicago Dr from Woodbridge St to US31**
- **Chicago Dr ¼ mile East and West of 104th Ave**
- **Van Hill Dr from BL196 to Chicago Dr**
- **Douglas Ave from 144th Ave to Lakewood Blvd**
- **Lakewood Blvd intersection at 144th Ave**
- **Lakewood Blvd from Aniline to 112th Ave**
- **River Ave from 136th Ave to Holland City limits**
- **Butternut Dr from 136th Ave to 144th Ave**
- **James St from Butternut Dr to 112th Ave**
- **Felch St from 128th Ave to 120th Ave**
- **Riley St from 136th Ave to 96th Ave**
- **Greenly St from Windquest St to Bill Baker Dr ****
- **Greenly St from US31 West to end ****
- **Greenly St from US31 East to end ****
- **Reflections Dr from John F Donnelly West to end ****
- **Corporate Circle from John F Donnelly East to end ****

Jamestown Township

- Adams St intersection at 24th Ave
- Byron Rd from 40th Ave West ½ mile
- Byron Rd intersection at 32nd Ave
- Byron Rd intersection at 24th Ave
- **Riley St intersection at 24th Ave**
- Quincy St from 32nd Ave ¾ mile West **
- **Quincy St from 32nd Ave ¼ mile East ****

Olive Township (all outside of urbanized area)

- 136th Ave intersection at Port Sheldon St
- Port Sheldon St intersection at 120th Ave

Park Township

- **Ottawa Beach Rd from 160th Ave to 144th Ave**
- **Lakewood Blvd intersection at Lakeshore Ave**
- **Lakewood Blvd intersection at 152nd Ave**
- **Riley St intersection at 152nd Ave ****
- **Butternut Dr intersection at 148th Ave**
- **Lakeshore Ave from Quincy St North ¼ mile**

Polkton Township (all outside of urbanized area)

- 56th Ave from Cleveland North ¾ mile
- 68th Ave from Leonard Rd North ¾ mile
- 68th Ave from Arthur North to ¼ mile North of Randall St
- 68th Ave intersection at Cleveland St
- Leonard Rd from 54th Ave East ½ mile
- Garfield St Bridge over Deer Creek **
- State Rd from Cleveland St to 80th Ave

Port Sheldon Township (all outside of urbanized area)

- West Olive Rd Bridge over Pigeon River **
- Wildwood Dr from Butternut Dr West ¼ mile **
- State Rd from Inland Dr SW to end **
- Lakeshore Ave from Butternut Dr to North side of Bridge over Pigeon River
- Lakeshore Ave Bridge at Croswell St
- Croswell St from Lakeshore Ave East ¼ mile

Robinson Township (all outside of urbanized area)

- 104th Ave intersection at M-45
- 104th Ave intersection at Osborn St
- 104th Ave intersection at North Cedar Dr
- 120th Ave intersection at Fillmore St
- 120th Ave intersection at M-45
- 144th Ave intersection at M-45
- 144th Ave intersection at Lincoln St
- Green St Bridge over Stearns Bayou

Spring Lake Township

- **Fruitport Rd intersection at State Rd**
- **Fruitport Rd Bridge over Petty's Bayou**
- **West Spring Lake Rd Bridge over Jerusalem Bayou ****
- **174th Ave intersection at Taft St**
- **174th Ave intersection at Hickory St**
- **Taft St from 168th West ½ mile**

Tallmadge Township (all outside of urbanized area)

- 24th Ave from M-45 to Leonard Rd **
- Buchanan St from 24th Ave West to end **
- Leonard Rd intersection at 48th Ave
- Leonard Rd intersection at Linden Dr
- Leonard Rd intersection at 24th Ave
- Leonard Rd Bridge over Sand Creek

Wright Township

- 8th Ave intersection at Hickory St
- **16th Ave from Hayes St to Comstock St**
- 48th Ave intersection at Garfield St
- 48th Ave intersection at Ironwood Dr

Zeeland Township

- 64th Ave from Adams St North ½ mile
- 64th Ave from Byron Rd North ½ mile
- 72nd Ave intersection at Ransom St
- **96th Ave intersection at Perry St**
- **96th Ave from Roosevelt St to Riley St**
- **96th Ave intersection at Quincy St**
- **Adams St Bridge over Black River**
- Adams St from 64th Ave to 60th Ave
- Byron Rd at 64th Ave East and West ¼ mile

** denotes local roads all other roads are primary.

Listed above are all county roads. Not listed are the MDOT highways. The priority for sweeping are all MDOT highways are swept first, primary roads are second, local roads are third. The schedule will be reviewed annually and adjustments will be made as appropriate based on the amount of material collected. Any additions of road segments for street sweeping will be incorporated into the schedule within 30 days of discovery.

5.3 Best Management Practices

Best management practice (BMP) summary sheets for operations and maintenance activities are found in the pages following Table 12. Some BMPs discussed in section 3.3 apply to some activities and are noted where applicable in Table 12.

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Table 12. Potential pollutants typically associated with municipal operation and maintenance activities

		Potential Pollutants									
Field Programs	**Activities**	**Sediment**	**Nutrients**	**Trash**	**Metals**	**Bacteria**	**Oil & Grease**	**Organics**	**Pesticide**	**Oxygen demanding substances**	**BMP Summary Sheet (page #)**
Roads, Streets and Highways Operation and Maintenance	Sweeping and Cleaning	X	X	X	X	X	X	X	X	X	54
	Street Repair, Maintenance and Striping/Painting	X		X	X		X	X			55, 56
	Bridge and Structure Maintenance	X		X	X		X	X			57
	Unpaved Road Maintenance	X	X	X			X	X		X	58
Plaza, Sidewalk and Parking Lot Maintenance and Cleaning	Surface Cleaning	X	X			X	X			X	38
	Graffiti Cleaning	X	X		X			X			59
	Sidewalk Repair	X		X							See Bridge, 57
	Controlling Litter	X		X		X	X			X	60
Landscape Maintenance	Mowing, Trimming, Planting	X	X	X		X			X	X	41
	Fertilizer & Pesticide Management	X	X						X		41
	Managing Landscape Wastes	X	X	X					X	X	41
	Erosion Control	X	X								61
Drainage System Operation and Maintenance	Inspection and Cleaning of Stormwater Conveyance Structures	X	X	X		X		X		X	See Sec. 3.4
	Controlling Illicit Connections and Discharges	X	X	X	X	X	X	X	X	X	Refer to Illicit Discharge Elimination Program Plan
	Controlling Illegal Dumping	X	X	X	X	X	X	X	X	X	62
	Maintenance of Inlet and Outlet Structures	X		X	X		X			X	See Sec. 3.4
Cold Weather Operations	Plowing	X	X	X	X		X	X		X	63
	Sand application	X	X								64
	Salt application		X								65
	Use of deicing agents		X								36
	Snow removal and storage	X	X	X	X		X	X		X	39

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Street Sweeping and Cleaning

Category of Municipal Operation: Roads, Streets, and Highways Operation and Maintenance

BMP Description:

- Maintain a consistent sweeping schedule.
- Street cleaning is only to be performed during dry weather if possible.
- Wet cleaning or flushing of the street is to be avoided where possible.
- When possible, sweeping frequency will be increased based on factors such as traffic volume, land use field observations of sediment and trash accumulation, proximity to water course.
- Sweepers are to be operated at manufacturer requested optimal speed level to increase effectiveness.
- Vacuum or regenerative air sweepers will be used in the high sediment and trash areas.
- Accurate logs of the number of curb-miles swept and the amount of waste collected are to be kept.
- Dispose of sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Debris storage is to be kept to a minimum during the wet season. Piles will be contained by a berm or covered.

Measurable Goals:

Reduction in the quantity (tons or cubic yards) of debris cleaned from streets, sidewalks and parking lots.

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Street sweeping schedule (see previous section)

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Street Sweeping and Cleaning*, Stormwater Coalition of Monroe County, NY*

Roadway Patching, Resurfacing and Surface Sealing

Category of Municipal Operation: Roads, Streets, and Highways Operation and Maintenance

BMP Description:

- Patching, resurfacing and sealing are to be scheduled for dry weather.
- Material stockpiles are to be kept away from streets, gutter areas, storm drain inlets or waterways. Piles are to be bermed or covered during wet weather to prevent runoff.
- Preheating, transfer or loading of hot bituminous material is to be done away from drainage systems or waterways.
- Where applicable, nearby storm drains are to be covered before applying seal coat, slurry seal etc.
- Covers are to be left in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from storm drain inlets when the job is complete.
- Excess material is to be prevented from entering streets or storm inlets.
- There shall be a designated area for cleanup and proper disposal of excess material.
- To avoid runoff, only as much water as is necessary will be used for dust control.

Measurable Goals:

Number of projects that utilize storm drain covers (goal = 100% of all completed within the urbanized area)

Timeline/Implementation Schedule:

Employee training once every 5 years of within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Roadway Patching, Resurfacing and Surface Sealing*, Stormwater Coalition of Monroe County, NY*

Painting and Paint Removal

Category of Municipal Operation: Roads, Streets, and Highways Operation and Maintenance

BMP Description:

- Paint and materials are to be transported to and from job sites in containers with secure lids and tied down to the vehicle.
- Do not transfer or load paint near storm drain inlets or waterways.
- Spray equipment is to be tested and inspected prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Nearby storm drain inlets are to be plugged prior to starting painting in areas where there is a significant risk of a spill reaching the drain. Remove plugs when the job is complete.
- Storm drain inlets are to be covered prior to sand blasting.
- If a bridge crosses a waterway, work should be performed on a maintenance traveler, platform or over suspended netting or tarps to capture paint, rust, paint removing agents, or other materials to prevent discharge of materials to surface waters. If sanding, use a sander with a vacuum filter bag.
- Capture all cleanup water and dispose of properly.
- Properly disposed of unused paint at a County Resource Recovery Center.

Measurable Goals:

Number of projects that utilize storm drain covers (goal = 100% of all completed within the urbanized area)

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Painting and Paint Removal*, Stormwater Coalition of Monroe County, NY*

Bridge Repair and Maintenance

Category of Municipal Operation: Roads, Streets, and Highways Operation and Maintenance

BMP Description:

- Prevent concrete, steel, wood, metal parts, tools and other work materials from entering storm drains or waterbodies.
- Thoroughly clean up the job site when repair work is completed.
- If surface cleaning, painting and paint removal, and graffiti removal are performed, implement the appropriate procedures as outlined in those BMPs.

Measurable Goals:

Keep 100% of all maintenance wastes out of surface water and storm drains

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Bridge Repair and Maintenance*, Stormwater Coalition of Monroe County, NY*

Unpaved Roads and Trails

Category of Municipal Operation: Roads, Streets, and Highways Operation and Maintenance

BMP Description:

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- Roadside areas with exposed soils should be vegetated with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets, straw or gravel as appropriate.
- In roadside areas where sediment is already eroded and mobilized temporary controls should be installed. These may include: silt fences, fabric dikes, hay bales staked in place, or any other appropriate measure.

Measurable Goals:

Erosion control measures in place on all unpaved roads within the urbanized area with a goal of keeping 100% of sediment out of storm drains and surface waters

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Unpaved Roads and Trails*, Stormwater Coalition of Monroe County, NY*

Graffiti Removal

Category of Municipal Operation: Plaza, Sidewalk and Parking Lot Maintenance and Cleaning

BMP Description:

- Graffiti removal activities are to be scheduled during dry weather.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal.
- Nearby storm inlets are to be protected prior to removing graffiti. Runoff from sand blasting and high pressure washing should be directed into a landscaped or dirt area. If such an area is not available filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles and debris out of storm sewers.
- When power washing using cleaning compounds, nearby storm inlets are to be plugged and water is to be vacuumed/pumped to the sanitary sewer.
- Waterless and nontoxic chemical cleaning methods (e.g. gels or spray compounds) should be used when possible.

Measurable Goals:

Number of projects that utilize storm drain covers (goal = 100% of all completed within the urbanized area)

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on P2 BMP Summary Sheet – Graffiti Removal*, Stormwater Coalition of Monroe County, NY*

Litter Control

Category of Municipal Operations: Plaza, Sidewalk and Parking Lot Maintenance and Cleaning

BMP Description:

- Source reduction
  - Place outdoor litter containers in visible areas and empty frequently to prevent overflow. Containers should have lids.
  - Promote recycling programs
  - Develop an educational message to garner employee support
- Litter removal
  - Includes regular street and parking lot sweeping, catch basin cleaning and general property cleanup
  - Leaf collection program

Measurable Goals:

Annual sweeping of parking lots and sidewalks
Monthly property inspections to pick up general trash
Reduction in the amount of litter collected

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on BMP: Litter Control*, Springville City Corporation Public Works Department, Springville UT*

Erosion Control

Category of Municipal Operations: Landscape Maintenance

BMP Description:

- Preserve and protect existing vegetation on site
- Implement vegetative and soil protection practices in areas where soil is exposed
    - Establish permanent vegetative cover as soon as possible by seeding, seeding and mulching or sodding. Establish temporary vegetative cover until permanent cover can be established.
    - Secure mulch, erosion control blankets or other physical measures to protect exposed soil until permanent measures can be established.
- Use structural storm water controls to reduce the amount or velocity of water flowing across erosive surfaces or divert water away from these areas.
- Inspect and maintain all erosion control measures to ensure proper function

Measurable Goals:

Severe erosion issues will be eliminated or stabilized within 5 business days of discovery; all other erosion issues will be addressed within 90 days

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires
Annual inspection and maintenance as needed

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on BMP: Erosion Control*, Springville City Corporation Public Works Department, Springville UT*

Controlling Illegal Dumping

Category of Municipal Operations: Drainage System Operation and Maintenance

BMP Description:

- Develop and implement public awareness program to prevent illegal dumping and encourage reporting
- Train staff to recognize and report incidents
- Establish system to track incidents that will identify:
  - Dumping hot spots
  - Types and quantities of waste
  - Patterns of occurrence (time of day, season, etc.)
  - Method of dumping
  - Responsible parties

Measurable Goals:

Decrease number of illegal dumping reports
Develop public awareness program by September 2017
Develop tracking system by September 2017

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Based on BMP: Illegal Dumping Controls*, Springville City Corporation Public Works Department, Springville UT*

Plowing

Category of Municipal Operations: Cold Weather Operations

BMP Description:

- Plow prior to an application of chemical in order to minimize product dilution.
- Coordinate plowing activities to eliminate windrows at intersections and prevent removal of another operator's deicing material.
- Remove snow from roads as quickly as possible to reduce compaction.
- Avoid pushing snow over the bridge rails and onto roads or water beneath.
- Pay attention to wind conditions. If shoulder blading isn't critical, then delay until wind speeds are lower.
- Reduced speed minimizes the risk of a snow cloud. Lift the blade and wing if a snow cloud forms; do not slow down or brake.

Measurable Goals:

Develop annual winter maintenance plan
Conduct annual route preparation and planning

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

See *Michigan Winter Maintenance Manual* (Appendix L) for more information

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Reference: *Michigan Winter Maintenance Manual: Promoting Safe Roads and Clean Water*. 2013. See Appendix K.

Sand Application

Category of Municipal Operations: Cold Weather Operations

BMP Description:

- Sweep up excess sand after each event.
- Apply sand in extreme cold weather, when salt is ineffective.
- Avoid salt/sand mixes because they reduce each other's effectiveness. Determine if you need melting or temporary traction and choose the proper tool.
- Employ sand only for short-term traction needs. It has no melting capability.
- In limited situations such as a freezing rain event, a 25 to 50% sand/salt mix can be effective in increasing friction.[1]

Measurable Goals:

Track and reduce the amount of sand used

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

See *Michigan Winter Maintenance Manual* (Appendix L) for more information

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Reference: *Michigan Winter Maintenance Manual: Promoting Safe Roads and Clean Water*. 2013. See Appendix K.

[1] *Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators*, Second Revision, published by the Minnesota Local Road Research Board, 2012. http://www.mnltap.umn.edu/publications/handbooks/documents/snowice.pdf

Road Salt Application

Category of Municipal Operations: Cold Weather Operations

BMP Description:

- Calibrate salt spreaders to ensure proper application.
- Only apply the amount of salt needed to get the job done.
- Follow the proper application guidelines.
- Consider temperature when determining volume of salt to apply.
- Cleanup 'trackout' after a storm event around the storage area.
- Contain wash water from trucks used for salting and sanding in a holding tank for disposal or discharge into sanitary sewers.
- Explore alternative compounds to spread on the roads that have the same effect but are better for surrounding area.
- Store salt properly under cover to make sure salt is not leaving the storage area and draining to a storm drain or water body.
- Place salt piles in areas not subject to flooding.
- Use diversion berms to minimize water runoff from storage areas.

Measurable Goals:

- Salt storage structures are inspected annuallyand necessary repairs have been scheduled or completed within 90 days
- All deicing materials are stored under cover.
- Application components are tested, calibrated and maintained at regular intervals.

Timeline/Implementation Schedule:

Employee training once every 5 years or within 1 year for new hires

Specific Components and Notes:

See *Michigan Winter Maintenance Manual* (Appendix L) for more information

Responsible Party for this BMP

Indicate who specifically is responsible for the implementation and monitoring of this BMP. This should be the individual who is actively involved with the BMP.

Name:

Department:

Phone:

E-mail:

Reference: *Michigan Winter Maintenance Manual: Promoting Safe Roads and Clean Water*. 2013. See Appendix K.

SECTION 6: Additional Program Components

6.1 Managing Vegetated Properties

Most of the vegetation management carried out on OCRC property pertaining to lawn care and landscape maintenance is done by OCRC staff. Lawn mowing is performed by OCRC employees and as part of employee participation/good housekeeping training they are made aware of the importance of keeping clippings and other debris away from storm drains. The amount of work performed by private contractors for landscaping is minimal and only done at the Grand Haven location. The Finance Director receives a quote for the work specified and approves as needed.

If pesticide application is determined to be necessary, the OCRC will require proof that the contractor or its employees are certified by the State of Michigan as a pesticide applicator in the appropriate category. As much as possible, contractors will use integrated pest management techniques to minimize the use of pesticides to protect the environment and avoid potential surface or groundwater contamination.

Any OCRC staff that may apply pesticides during vegetation management on properties or in right of ways will be certified by the State of Michigan as a pesticide applicator in the applicable category. OCRC staff will be trained in the use of integrated pest management in order to consider all potential solutions before applying pesticides.

6.2 Contractor Requirements and Oversight

The OCRC may occasionally hire contractors to complete routine operation and maintenance (O&M) procedures that are described in this handbook, such as catch basin cleaning and street sweeping. Any contractors that are hired to perform O&M activities are required to follow all pollution prevention and good housekeeping practices described in this handbook. Language will be included in any bid packets and contracts to this effect. Contracts will also include language that allows designated OCRC staff to perform inspections to ensure that all PPGH practices are being followed. A copy of the handbook will be made available to all contractors performing O&M at OCRC properties or right of ways.

6.3 Employee Training

The MACC provides training opportunities to the OCRC and other MS4 communities within the Macatawa Watershed. In class training will be scheduled for staff responsible for PPGH activities within 1 year of adopting this manual. Online training modules are being developed to cover PPGH required activities and staff responsible for PPGH activities will be required to complete the modules once during each permit cycle. Any new staff will be required to complete the online training modules within one year of their date of hire. In-class training sessions will be available and scheduled as needed. Additional online modules will be created for special interest topics, such as lawn care or rain garden maintenance Employees will be encouraged to participate in these as applicable.

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APPENDIX A

MUNICIPAL FACILITY ACTIVITY CHECKLIST

Ottawa County Road Commission

INVENTORY OF MUNICIPAL PROPERTIES

Common Name of Property: _____

Property Location: _____

Person(s) completing this form: _____ **Date:** _____

Property type (check one)

☐Administration building	☐Animal control building	☐Airport	☐Bus station/terminal
☐Cemetery	☐Composting facility	☐Equipment storage/maintenance	
☐Fire station	☐fuel farm	☐Hazardous waste disposal	
☐Landfill	☐Library	☐Material storage yard	
☐Park/open space	☐Pesticide Storage	☐Police station	☐Public parking lot
☐Public School	☐Public works yard	☐ Recycling facility	☐Salt storage
☐Solid waste handling facility	☐Vehicle storage/maintenance	☐Other: _____	

Does storm water from this property enter the MS4 owned conveyance or Waters of the State?

☐ YES ☐ NO, stormwater goes to the sanitary sewer
☐ NO, there is no runoff ☐ DON'T KNOW

If NO, then go to next Municipal Property. If YES or DON'T KNOW, then continue with this form.

Structural Stormwater Controls at this Facility

Control Measure or BMP	**Qty.**	**Inspection Frequency**	**Maintenance Schedule**	**BMP operation & maintenance program**
☐ vegetated swales				
☐ infiltration facility (e.g. seepage pond, drywell)				
☐ detention pond or sedimentation facility				
☐ bioretention facility (e.g. raingarden)				
☐ storm water devices (swirl separation or other proprietary device)				
☐ curb, gutter, catch basins, storm sewers				
☐ filter				
☐ grit separator				
☐ oil/water separators				
☐ isolated sump				
☐ vegetated buffer strips				
☐ porous pavement				
☐ underground storage tanks				
☐ any other controls _____				

Is there a map available of the stormwater structural controls? ☐**YES** ☐**NO**

Municipal Operations at the Property: complete attached

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Municipal Facility Activity Checklist

FACILITY/BUILDING NAME

Activity																					
Stormwater Drainage and Conveyance System																					
Not applicable																					
Dredging																					
Inspections of system components (how often)																					
Record keeping and frequency tracking																					
Maintenance, repair, cleanout of system components																					
Maintenance of open drain ditches																					
Dumping of vactor spoils																					
Winter Maintenance																					
Snow stored on site																					
Snow removed off site - where?																					
Snow is stored away from wells																					
Snow is stored out of wetlands/floodplains																					
Snowmelt is directed to structual control																					
Parking Lot/Sidewalk Salting Performed																					
Salt Storage On-site																					
Alternative Materials Used (ie.sand)																					
Salt Vehicle Washing																					
Sensitive or Priority Waterbody Considerations																					
Spreaders Calibrated and Maintained																					

APPENDIX A

Municipal Facility Activity Checklist

FACILITY/BUILDING NAME

Activity																					
Municipal Building Maintenance																					
Contractor Used for Maintenance																					
Bulk Fuel Storage																					
Other bulk fluid storage (list)																					
Hazardous Materials Storage																					
Spill Prevention and Response																					
Flourescent Light Recycling																					
Paper/Plastic Recycling																					
Roof Drainage Systems																					
Building Washing Performed																					
Sidewalk Cleaning (powerwashing)																					
On Site Septic System systems																					
Septic Inspections and Record Keeping																					
Dumpsters covered																					
Dumpsters have secondary containment																					
Contractor used for lawn care/landscaping																					
Lawn mowing																					
Lawn/landscape watering																					
Lawn/landscape fertilizing																					
Pesticide application																					
Lawn equipment and chemical stoarge onsite																					
Staff have been trained re. Stormwater mgmt Principles																					
Sump pumps connected to storm sewer																					

APPENDIX A

Municipal Facility Activity Checklist

FACILITY/BUILDING NAME

Activity																					
Vehicle Equipment Maintenance																					
Not applicable																					
Vehicle storage (indoor or outdoor)																					
Vehicle washing done outside																					
Vehicle washing done at commercial facility																					
Maintenance done outside																					
Maintenance done inside																					
Maintenance done at commercial garage																					
Vechicle fluid bluk storage (list)																					
Recycling oil and antifreeze																					
Spill prevention and response plan																					
Wastewater disposal and treatment from wash water																					
Oil water separator on site																					
Staff have been trained re. stormwater mgmt principles																					
Impervious Surfaces Maintenance																					
Not applicable																					
Sidewalks and parking lots cleaned (sweeping)																					
Dumping of Sweeper Waste																					
Repairs done by staff																					
Repairs done by contractors																					

APPENDIX A

Municipal Facility Activity Checklist

FACILITY/BUILDING NAME

Activity																					
Streambank and Hydrologic Habitat Maint.																					
Not applicable																					
Stream bed dredging																					
Creek bottom sediment removal																					
Removal of woody debris																					
Bank reshaping																					
Cleaning culverts and outfalls																					
Priority setting for streambank stabilization projects																					
Use of alternative "soft" engineering approaches																					
Inventory of ponds																					
Pond maintenance program																					
Buffer strips																					
Parks & Open Space Maintenance																					
Not applicable																					
Maintenance Contractor Used																					
Fertilizer Application																					
Pesticide Application																					
Fertilizer and Pesticide Usage Records																					
Integrated Pest Management Use																					
Lawn mowing																					
Lawn equipment and chemical storage onsite																					
Lawn/landscape watering																					
Erosion Control Practices																					
Pet Waste Present																					
Pet Waste Education																					
Recycling																					
Litter Control																					
Dumpsters covered																					
Dumpsters secondary containment																					
Hazardous Materials Storage																					
Staff have been trained re. Stormwater mgmt Principles																					

APPENDIX A

APPENDIX B

LOW PRIORITY PROPERTIES IN URBANIZED AREAS

OCRC Kok Pit, Zeeland Township section 29, 88.02 acres, inspected July 6, 2012.

West (main) entrance to the Kok Pit, gated and locked. Note off road traffic bypassing at right side of the gate.

North entrance, gated, locked and posted no trespassing.

Shallow lake created by OCRC excavations at Kok Pit.

Overview of Kok Pit based on photo looking south from Frontage Road.

Pipe storage at Kok Pit.

Pipe storage at Kok Pit.

Unauthorized ORV course at Kok Pit.

Soil storage at Kok Pit.

OCRC Cheyne Pit, Georgetown Township section 2 & 3, 69.34 acres, inspected August 1, 2012.

Main entrance to Cheyne Pit off Taylor Street (east of Cottonwood Drive).


Grand Rapids Gravel Company and Cheyne Pit access from Fillmore Street. The main access route to Cheyne Pit and GR Gravel is located off Taylor Street just east of Cottonwood Drive.

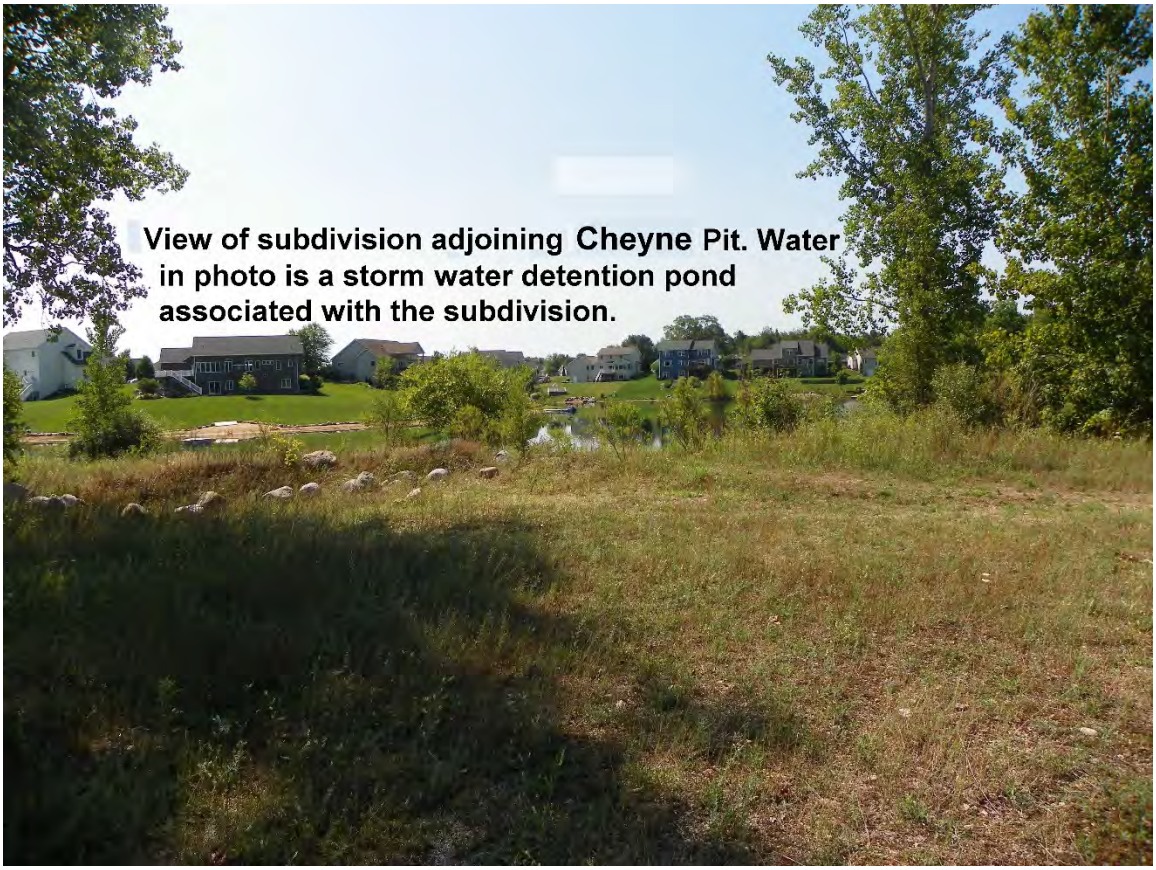

One of the access roads thru Cheyne Pit.


Typical view at Cheyne Pit. Note uneven stoney terrain,
infertile mined soils with partial wildflower cover.
Note Grand Rapids Gravel operations in background.
Cheyne Pit is not actively mined by the OCRC.
No OCRC equipment is located at this site.


Miscellaneous debris at Cheyne Pit
such as concrete pieces and timber,
(not typical).


Rocks typical at site.


Grand Rapids Gravel Company
operations adjacent to Cheyne Pit.



End of Cheyne Pit info.

OCRC County 80 Pit, Spring Lake Township section 1, 80 acres, last inspection January 18, 2013.

Entrance to County 80 on west side of 144th Avenue north of Apple Drive.

Wetland/shallow pond with outlet to stream. Topsoil storage in distance. Pipe was removed.

Close up of shallow pond.

Grading at County 80 in 2002.

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Open Space at 104th Ave & Adams St
Section 25, Holland Township, Ottawa County

N

No Scale

Open Space at 104th Ave & Chicago Dr
Section 24, Holland Township, Ottawa County

N

No Scale

APPENDIX C

STORAGE AND HANDLING OF SIGNIFICANT MATERIALS

II. FACILITY IDENTIFICATION INFORMATION

Facility Name: Ottawa County Road Commission
Grand Haven District Garage

Address: 17400 Rosy Mound Drive
Grand Haven, Michigan 49417
Telephone: (616) 842-5400

24-hour Emergency Telephone: Ottawa County Sheriff 911

Contact Person for Spill Prevention and Control

Jerry Diekema (616) 842-5400
Operations Director

Don Karle (616) 850-7251
Equipment Supervisor

Main Facility

Ottawa County Road Commission
P.O. Box 739
Rosy Mound Drive at US-31
Grand Haven, Michigan 49417
(616) 842-5400

III. FACILITY DESCRIPTION

The Ottawa County Road Commission's Grand Haven District Garage is the Road Commission's main facility and serves the northwest portion of Ottawa County. A map indicating its location is provided in Figure 1. The facility operates and maintains vehicles and equipment in both summer and winter months. The Road Commission is primarily involved in maintenance and repair of road surfaces, shoulders, roadsides, drainage structures, signs, signals and pavement markings. During the spring through fall season, there is additional involvement in rebuilding roadways and providing dust control on gravel roads. During the winter months, the primary activity is snow removal and ice control.

A site plan for the Grand Haven facility is illustrated in Figure 2. The major features of the site and locations of materials stored and used at the facility are shown.

The facility is served by Grand Haven Township municipal water supply and sanitary sewer systems. Site drainage is directed to catch basins and storm sewers which discharge directly to an open County drain near the southeast corner of the site.

IV. MATERIALS USED AND STORED

The materials used and stored on site include liquid chloride, salt, fuel, and oil. Small quantities of antifreeze, hydraulic oil, transmission and brake fluids, gear lubes, truck wash soap, windshield washer fluid, and degreasing cleaners are also used. Each material's use and storage is discussed below along with the pollution prevention measures taken and spill clean up procedures. The storage tank data for the major materials used are provided in Table 2. Appendices A and B provide a Spill Occurrence Procedure and a Notification List, respectively.

A. Liquid Chloride

Liquid chloride is stored at the Grand Haven garage in one above ground 10,000 -gallon tank for use in deicing during winter months on County roads and State trunklines maintained by the Ottawa County Road Commission as well as for dust control. The Grand Haven site stores and uses approximately 45,000 gallons annually. Usage varies with annual weather conditions.

Winter calcium chlorides are 26% solution. The material is commercially produced to specifications, as opposed to oil field brines, therefore, priority pollutant petroleum hydrocarbons are not of concern. The material is non-toxic, non-reactive, and non-flammable.

1. Tank Data

The liquid chloride is stored in one above ground 10,000 -gallon tank, which is approximately 1 year old at the location shown in the site plan. The tank is constructed of fiberglass and is approximately 12 feet in diameter and 15 foot high. The tank is equipped with a level gauge, which is readily visible from the outside of the tank. The storage tank sits within an approximately 1,800 square foot triangular shaped, bermed area with a plastic liner underneath to provide an estimated 20,000 gallons of storage. The liner is covered with a 2-3" sized gravel for protection from sunlight degradation and puncture hazards. The Road Commission designed and constructed the containment area. A pipeline and valve is located within the gravel to drain off precipitation accumulating in the containment area for discharge to the storm sewer system.

2. Inventory Control

The district supervisor is responsible for maintaining adequate liquid chloride supplies. The Supervisor checks the level indicator periodically to gage the supply available. These checks are made more frequently during high use periods such as winter storms. When the supply is low, an order is made and is typically delivered within 24 hours.

A daily inventory is kept at the garage which tracks the daily usage and delivery. In addition, the inventory includes the road systems which received liquid chloride applications. The daily usage totals are recorded by individual employees responsible for the application of their daily time sheet submitted to the Supervisor.

3. Loading/Unloading Procedures

Liquid chlorides are delivered in 10,000 -gallon tank trucks by private suppliers. The truck pulls up next to the tank. A hose from the truck is connected to the bottom of the tank; a valve is opened and the liquid is pumped into the storage tank through a pump on the truck. A 10,000 -gallon load takes approximately 20 – 30 minutes to unload. The

delivery driver is present at the truck during the entire filling process. At completion, the valve is closed and the hose is unhooked.

Unloading of liquid from the storage tank to a distribution truck is conducted through a separate valve and piping system. This piping runs through the pump house located on the other side of a concrete filling pad from the tank. A flexible hose is permanently attached to this piping. The hose is placed into the top of the tank distributor truck through an opening by the driver. The driver then starts the pump in the pump house. All trucks are equipped with level gages. The loading process takes approximately 15 minutes and the level is visually observed by the driver through the level gage or by watching through the opening on top of the truck. When nearly full, the pump is shut off. Trucks are loaded on a concrete pad with a catch basin that discharges directly to a below grade 1,500-gallon concrete holding tank. Liquid accumulated in the tank is pumped out into either a truck or the storage tank.

4. Pollution Prevention and Spill Procedures

The Grand Haven Garage has no history of liquid chloride spills. In the event of a spill, however, the employee noting such a condition will immediately notify the equipment supervisor, shift supervisor or designated representative. These personnel all have two-way radios in their vehicles and can therefore be readily contacted. The Supervisor will immediately mobilize the appropriate personnel and equipment to begin containment of a spill. The Spill Occurrence Procedure and Notification List are contained in Appendices A and B respectively.

In the event of a spill from the tank, liquid chloride should be contained within the lined 20,000-gallon containment area. Three-inch diameter discharge pumps are available to pump solution from the containment. Two liquid chloride trucks are available at each Commission garage, and pumped solution can be hauled to other facilities.

The truck filling pad located between the pump house and storage tank discharges directly to a 1,500 -gallon concrete holding tank via a catch basin. A pump is available to recycle spilled chloride from the tank back into the trucks.

The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the liquid chloride spill meets the definition of a release. Current State definitions for a release do not include the following:

> *Spilling, leaking, or discharging less than 1000 gallons of a polluting material into a secondary containment structure that complies with State rules, if recovery of the material spilled, leaked, or discharged is initiated within 24 hours of detection, is completed as soon as practicable, but not more than 72 hours after detection, and if no polluting materials are released directly or indirectly to any public sewer system or to the surface waters or groundwaters of the State.*

The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident if a release to the surface of the ground, waters of the state, or public sewer system equals or exceeds the threshold reporting quantity of 50 gallons established by the State for liquid salt. A spill or release report form and address to send completed form to is contained in Appendix C.

B. Salt/Sand

Solid salt is mixed with sand and stored at the Grand Haven garage facility on a bituminous pad located on the southern portion of the facility during the winter months (usually November through March). The salt/sand mixture is used for snow and ice control during winter months on County roads and State trunklines maintained by the Ottawa County Road Commission. Up to 550 tons of salt is stored at the Grand Haven facility. Usage varies with winter weather conditions. No salt is stored on site during summer months.

1. Storage and Mixing Pad

The bituminous salt/sand pad is approximately 5,600 square feet in size, and is sloped such that only water falling in the pad area will enter the storage pad catch basin located at the northeast corner of the pad. A three-foot high concrete barrier constructed of highway dividers bounds the downgradient south and west sides of the pad to help retain the pile.

2. Inventory Control

The initial season pile of salt/sand mixed is 600-700 cubic yards. Throughout the winter season, additional salt is ordered as necessary.

A daily inventory is kept at the garage which tracks daily usage and delivery of salt. In addition, the inventory includes the road systems which received salt/sand applications. The daily usage totals are recorded by individual employees responsible for salt/sand application on their daily time sheets submitted to the Supervisor.

3. Loading/Unloading Procedures

Salt is delivered in truckload bulk quantities by private suppliers. Salt is dumped directly onto the pad. Sand is delivered by County Road Commission trucks and dumped next to the pad. Front end loaders are then used to mix the sand in with the salt in the appropriate proportions. Generally the salt content is 50% or less in the mixture.

Salt trucks are then filled by a front end loader directly from the storage pad.

4. Pollution Prevention and Spill Procedures

Because the material being handled in this instance is a solid material, accidental spills are not an immediate threat to waters of the State. If the material is accidentally spilled or unloaded onto an area other than the storage pad, the Supervisor or designated representative will be contacted immediately by the person noting the spill. The

Supervisor will make the necessary arrangements to have an operator pick up the material and place it on the pad.

Pollution from salt is prevented by collecting runoff generated by precipitation falling on the pad. The pad is sloped such that all runoff is directed toward a catch basin at the northeast corner of the pad. The catch basin structure has outlets to both the sanitary and storm sewer collection systems. During winter salt storage months, a plug is placed in the storm water opening to direct all runoff into the sanitary sewer system. After the winter period, the pad is cleaned and not used for salt/sand storage until the next winter season. In the summer when no salt is present, the plug is removed and placed in the sanitary opening to direct all flow into the storm water collection system.

The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the spill results in the release of 50 pounds or more of salt, directly or indirectly, to the surface of the ground, waters of the State, or to a public sewer system during a 24-hour period. The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident. A spill or release report form and address to send completed form to is contained in Appendix C.

C. Motor Fuels

Motor fuels for use by Ottawa County Road Commission vehicles are stored in three underground storage tanks located on the north side of the maintenance building. The tank locations are shown on the Site Plan. The Grand Haven garage has an average annual fuel usage of 92,000 gallons.

1. Tank Data

Fuels are stored in three 8,000 -gallon capacity underground tanks. Two tanks store diesel fuel and one tank stores unleaded gasoline. All tanks are of steel construction. These tanks were installed in 1999 and designed to meet all current State of Michigan and U.S. EPA Underground Storage Tank Regulations. The tanks are located below a concrete pad.

The tanks utilize cathodic protection and a leak detection system connected to an alarm monitoring panel inside the north end of the maintenance building.

2. Inventory Control

The Supervisor is responsible for inventory control of motor fuels. Pump readings are taken and recorded daily. Ottawa County Road Commission drivers fill out a usage slip recording the number of gallons taken and placed into a designated slip box in the office. These are totaled each day and compared with pump readings. Any discrepancies are noted. If reconciliation cannot be made, the discrepancy is reported to the main Ottawa County Road Commission facility. Gage readings are also taken periodically to compare with inventory records.

3. Loading/Unloading Procedures

Motor fuels are delivered in bulk as needed. Bulk trucks pull up to fill areas. A truck hose is hooked directly to the fill pipe and pumped into the tank. A delivery receipt is left in the office upon completion of the delivery. County vehicles load fuel from the storage tanks through one of the fuel pumps. Drivers fill out a usage slip for each fill up and place the slip in the designated box in the office.

4. Pollution Prevention and Spill Procedures

The Grand Haven garage has no history of petroleum spills. In the event of a spill, however, the employee noting such a condition will immediately notify the Supervisor, shift supervisor, or designated representative. These personnel all have two-way radios in their vehicles and can therefore be readily contacted.

The employee will place absorbent booms or socks around nearby catch basins to prevent spillage into storm sewers and surface waters of the State. In addition, absorbent pads or pillows shall be placed around the spill location to contain the spill as best as possible.

The Supervisor, after being contacted, will immediately mobilize appropriate personnel and equipment to begin construction of a temporary earthen berm to contain the spill if necessary. The Ottawa County Road Commission is capable of providing these services. A licensed liquid waste hauler will be contacted to go to the facility and begin removal of spilled or leaking material into tanker trucks, if necessary.

The Supervisor will also notify appropriate parties on the emergency notification list (Appendix B). The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the oil spill meets the definition of a release. Current State definitions of a release do not include the following:

> *1) Spilling, leaking, or discharging less than 55 gallons of oil or fuel to the ground surface, if the spill leak, or discharge is detected and the oil recovered within 24 hours of the spill leak or discharge, and if oil is not released directly or indirectly to any public sewer system or to the surface waters of the State;*
>
> *2) Spilling, leaking, or discharging less than 55 gallons of oil or fuel to the surface waters of the State, if effective recovery measures are implemented in response to the spill, leak, or discharge immediately upon detection.*

The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident if the release meets or exceeds threshold reporting quantities established by the State for oil and fuel products. These quantities are as follows:

1) Release to ground surface = 50 pounds;

2) Release to waters = any quantity that causes unnatural turbidity, color, visible sheens, oil films, foams, solids, or deposits in receiving waterbody.

A spill or release report form and address to send completed form to is contained in Appendix C.

These tanks are regulated by the U.S. EPA and the State of Michigan by regulations other than Part 5 rules. Leak detection for tanks and piping were installed to meet the regulations. Each tank is also equipped with an overflow alarm system. Regular monitoring for leaks, which is also required, will further prevent accidental releases to the environment

D. Small Quantity Materials

Other materials used and stored at the site include motor oil, hydraulic oil, transmission fluid, brake fluid, power steering fluid, antifreeze, degreasing solvent, gear lubes, concrete and citrus based cleaners, and windshield washer solvents. All items are stored within the maintenance building.

1. Material Use and Storage Description

Motor oil is stored in a 550-gallon above ground painted steel tank inside the garage. This oil is used in Road Commission vehicles and equipment operated from the Grand Haven garage. Used oil is drained from vehicles and transferred to a painted 550 -gallon steel aboveground waste oil storage tank located outside along the east side of the

maintenance building. The amount of waste oil in the tank is measured periodically by garage personnel. When nearly full, a waste oil hauling company is contacted to pump the tank contents. Contents can only be removed from an opening on top. This tank was installed in 1999.

Hydraulic oil is stored in a 275 -gallon aboveground painted steel tank inside the garage. The fluid is used in Road Commission vehicles and equipment operated from the Grand Haven garage. Used hydraulic oil is placed in the waste oil tank.

Other fluids such as brake fluid, power steering fluids, automatic transmission fluid, and low-use motor oils are stored in 30 to 55-gallon drums inside the building. Antifreeze is also stored in 55-gallon drums. Generally, one to two drums of each material are present on-site at one time totaling less than ten drums stored. One 220-gallon polyethylene tank is used for storage of used antifreeze. When the tank is nearly full, a licensed waste hauler removes tank contents. Containment is provided for the used antifreeze tank.

Mineral spirits is used as a degreasing solvent to clean mechanical equipment. One to two 55-gallon drums of this material are usually stored on site at a time. The solvent being used is kept in a special wash tank in 15-gallon quantities at a time. The tank is designed so that solids can settle out in the bottom of the tank allowing solvent to be used over and over again. Used solvent is disposed in the waste oil tank.

Citrus based cleaners with petroleum distillates are stored in 5-gallon buckets as well as small quantities of biodegradable concrete cleaner.

Several lead-acid batteries are stored inside. The batteries are a manufactured item and are exempt from classification as a polluting material. The risk of a significant lead or sulfuric acid release is low due to the small quantity and size of the batteries.

Small quantities of miscellaneous combustible products are stored in yellow flammable storage cabinets.

2. Pollution Prevention and Spill Procedures

Accidental spills are not typically threatening to waters of the State because of the small quantity used and the fact that these materials are used inside buildings. Two 1,000 - gallon oil-water separator holding tanks are located at the southwest corner of the maintenance building to collect and hold any oil based wastes spilled into floor drains. At a minimum, these tanks are pumped annually by a licensed waste hauler.

If an accidental spill does occur, the employee noting such a condition will immediately utilize floor dry materials, absorbent pads, pillows, or booms to absorb and contain the spill. The employee will also close off nearby floor drains with absorbent products to prevent material from moving into the waste collection system, although all floor drains are connected to the oil-water separators as described above. Any waste soaked materials are placed in plastic lined 55 -gallon drums and disposed of by a licensed waste hauler.

Upon rectification of the situation, the spill will be reported to the Supervisor. The Supervisor will report to the Ottawa County Road Commission Director if deemed serious enough or if any question remains regarding a release of material to the environment.

Depending on the product and quantity spilled, the Supervisor may need to notify appropriate parties on the emergency notification list. The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the product spill meets the definition of a release. Current State definitions of a release do not include the following:

> *1) Spilling, leaking, or discharging less than 55 gallons of oil to the ground surface, if the spill leak, or discharge is detected and the oil recovered within 24 hours of the spill leak or discharge, and if oil is not released directly or indirectly to any public sewer system or to the surface waters of the State;*

2) Spilling, leaking, or discharging less than 55 gallons of oil to the surface waters of the State, if effective recovery measures are implemented in response to the spill, leak, or discharge immediately upon detection;

3) Spilling, leaking, or discharging less than 1000-gallons of a polluting material into a secondary containment structure that complies with State rules, if recovery of the material spilled, leaked, or discharged is initiated within 24 hours of detection, is completed as soon as practicable, but not more than 72 hours after detection, and if no polluting materials are released directly or indirectly to any public sewer system or to the surface waters or groundwaters of the State.

The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident if the release meets or exceeds threshold reporting quantities established by the State. These quantities are as follows:

1) Oil based products released to ground surface = 50 pounds;

2) Ethylene glycol (main antifreeze component) = 500 pounds;

3.) Any product quantity release to waters that causes unnatural turbidity, color, visible sheens, oil films, foams, solids, or deposits in receiving waterbody.

A spill or release report form and address to send completed form to is contained in Appendix C.

Review of the MSDS for the spilled product is recommended to determine if the product may contain chemicals whose threshold reporting quantity (TRQ) may be exceeded by the spill. MSDSs are located in the lunchroom. A list of Rule 9 TRQ's are in Appendix D.

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II. FACILITY IDENTIFICATION INFORMATION

Facility Name: Ottawa County Road Commission
Hudsonville District Garage

Address: 2232 Chicago Drive
Hudsonville, Michigan 49426

Telephone: (616) 669-9075

24-hour Emergency Telephone: Ottawa County Sheriff Department 911

Contact Person for Spill Prevention and Control	Ryan Kemppainen ~~Jerry Diekema~~ (616) 842-5400 Operations Director
	Randy Nagelkirk (616) 638-0384 Equipment Supervisor
Main Facility	Ottawa County Road Commission P.O. Box 739 Rosy Mound Drive at US-31 Grand Haven, Michigan 49417 (616) 842-5400

III. FACILITY DESCRIPTION

The Ottawa County Road Commission's Hudsonville District Garage serves the southeast portion of Ottawa County. A map indicating its location is provided in Figure 1. The facility operates and maintains vehicles and equipment in both summer and winter months. The Road Commission is primarily involved in maintenance and repair of road surfaces, shoulders, roadsides, drainage structures, signs, signals and pavement markings. During the spring through fall season, there is additional involvement in rebuilding roadways and providing dust control on gravel roads. During the winter months, the primary activity is snow removal and ice control.

A site plan for the Hudsonville District Garage is illustrated in Figure 2. The major features of the site and locations of materials stored and used at the facility are shown.

The facility is served by Georgetown Township water supply and sanitary sewer collection systems with wastewater treatment provided by the City of Grandville Wastewater Treatment Plant. Site drainage is directed to catch basins and storm sewers on site discharging to Rush Creek or is directed to Rush Creek which borders the southern boundary of the facility.

IV. MATERIALS USED AND STORED

The materials used and stored on site include salt, motor oil, antifreeze, hydraulic oil, automatic transmission fluid, gear lubes, brake fluids, degreasing cleaners, windshield washer fluid, truck wash soap. Each material's use and storage is discussed below, along with the pollution prevention measures taken and spill clean up procedures. Storage tank data for the major materials used are provided in Table 2. Appendices A and B contain the Spill Occurrence Procedures and Notification List, respectively.

A. Salt/Sand

Rock salt is mixed with sand and stored at the Hudsonville garage facility on a bituminous pad located on the western portion of the facility during the winter months (usually November through March). The salt/sand mixture is used for snow and ice control during winter months on County roads and State trunklines maintained by the Ottawa County Road Commission. Up to 800 tons of salt is used each year at the Hudsonville facility with usage varying with winter weather conditions. No salt is stored on site during summer months.

1. Storage and Mixing Pad

The bituminous salt/sand pad is 4,500 square feet in size, and is elevated such that it is above the surrounding grade with all outside areas sloping away from the pad. This allows only precipitation falling directly on the pad to enter the storage pad collection

system. A three foot high concrete barrier constructed of highway dividers with an inner six inch bituminous curb bounds the northwest and southwest downgradient sides of the pad.

2. *Inventory Control*

The initial season pile of salt/sand mixed is 600-700 cubic yards. Throughout the winter season, additional salt is ordered as necessary.

A daily inventory is kept at the garage which tracks daily usage and delivery of salt. In addition, the inventory includes the road systems which received salt/sand applications. The daily usage totals are recorded by individual employees responsible for salt/sand application on their daily time sheets submitted to the supervisor.

3. *Loading/Unloading Procedures*

Salt is delivered in truckload bulk quantities by private suppliers. Salt is dumped directly onto the pad. Sand is delivered by County Road Commission trucks and dumped next to the pad. Front end loaders are then used to mix the sand in with the salt in the appropriate proportions. Generally the salt content is 50% or less in the mixture. Salt trucks are then filled by a front end loader directly from the storage pad.

4. *Pollution Prevention and Spill Procedures*

Because the material being handled in this instance is a solid material, accidental spills are not an immediate threat to waters of the State. If the material is accidentally spilled or unloaded onto an area other than the storage pad, the Supervisor or designated representative will be contacted immediately by the person noting the spill. The Supervisor will make the necessary arrangements to have an operator pick up the material and place it on the pad.

Pollution from salt is prevented by collecting runoff generated by precipitation falling on

the pad. All runoff is directed toward a catch basin at the south corner of the pad. The catch basin is constructed with a 2-foot sump to allow settling of sand which may get into the system. The catch basin empties into a PVC pipe which flows into a 2,000-gallon below ground precast concrete tank with a 4-foot sump to allow further settling of sand.

The tank has two outlets. One outlet discharges to the Georgetown Township sanitary sewer system and the other is a storm water outlet to Rush Creek. During the months that salt and sand is stored on-site, a plug is placed in the storm sewer outlet so all runoff above storage tank capacity is directed into the sanitary sewer system. The Township's wastewater is treated by the City of Grandville Wastewater Treatment Plant.

After the winter period, the pad, catch basin and tank will be cleaned and not used for salt/sand storage until the next winter season. The tank is pumped off in the spring and the solution used for dust control. Runoff will be diverted from the tank to Rush Creek via the storm sewer outlet by plugging the sanitary sewer outlet. In other words, at the beginning of the winter period the plug will be placed in the storm sewer outlet and the sanitary outlet will remain open. Threaded PVC plugs are used at the outlets. At the end of the winter period following cleanup, the plug will be placed in the sanitary outlet and the storm sewer outlet will remain open. This operational plan has been approved by Georgetown Charter Township.

The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the salt spill results in the release of 50 pounds or more, directly or indirectly, to the surface of the ground, waters of the State, or to a public sewer system during a 24-hour period. The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident. A spill or release report form and address to send completed form to is contained in Appendix C.

B. Small Quantity Materials

Other materials used and stored at the site include motor oil, hydraulic fluid, automatic transmission fluid, brake fluid, gear lubes, power steering fluid, antifreeze, degreasing solvent, windshield washer fluid and soap.

1. Material Use and Storage Description

Motor oil is stored in a 550-gallon above ground painted steel tank inside the garage. This oil is used in Road Commission vehicles and equipment operated from the Hudsonsville garage. Used oil is drained from vehicles and transferred to a 250-gallon polyethylene waste oil storage tank located inside a 1,000-gallon concrete tank for secondary containment. This tank is located outside the garage building and is partially above ground. Waste oil is poured into collection piping located inside the building which drains into the tank. No floor drains are connected to this tank. The amount of waste oil in the tank is measured periodically by garage personnel using a dip stick. Periodically when nearly full, the Supervisor is notified and a waste oil hauling company is contacted to pump the tank contents.

Hydraulic oil is stored in a 275-gallon above ground painted steel tank inside the garage. Oil is also stored in 55-gallon drums. Used hydraulic oil is placed in the waste oil tank.

Other types of liquids such as brake fluid, power steering fluids, gear lubes, automatic transmission fluid, antifreeze and low use motor oils are stored in 30 – 55-gallon drums inside the office and garage building. Generally, one to two drums of these materials are present on site at one time totaling less than ten drums stored. Used antifreeze is stored in a 210-gallon polyethylene tank in the truck storage building. Up to 144 gallons of windshield washer fluid is stored in 1 gallon containers in the new storage building.

Small quantities of flammable items such as gasoline and paint are stored in two yellow flammable storage cabinets.

Mineral spirits is used as a degreasing solvent to clean mechanical equipment. One to two 55-gallon drums of this material are stored on site at a time. The solvent being used is kept in a special parts washing tank in 15-gallon quantities at a time. The tank is designed so that solids can settle out in the bottom of the tank allowing solvent to be used over and over again. Used solvent is disposed in the waste oil tank.

Soap for washing trucks is stored in a 125-gallon polyethylene tank connected to a pressure washer in the truck storage building.

2. Pollution Prevention and Spill Procedures

Accidental spills are not typically immediately threatening to waters of the State because of the small quantity of use and the fact that these materials are used inside buildings. All bulk oils, gear lubes, and fluids excluding used antifreeze, truck washing soaps, and mineral spirits are stored in the office and garage area. Floor drains within the garage area are connected to an oil/water separator located south of the garage. The separator is pumped off annually or as needed by a commercial waste recovery service. Water discharge from the separator goes to the sanitary sewer system. The garage also has two self-contained floor trenches that are pumped out as needed by a waste recovery service.

Items currently stored in the truck storage building include used antifreeze and soap for washing trucks. Floor drains in this building discharge to the sanitary sewer along Chicago Drive. Secondary containment is provided for bulk liquids stored in this building.

If an accidental spill does occur, the employee noting such a condition will immediately utilize floor dry materials, absorbent mats, or absorbent pillows to absorb and contain the spill. The employee will also close off nearby floor drains with drain covers, seals, or plugs to prevent material from moving into the sanitary or storm sewer system.

Contaminated absorbent materials will be stored in plastic lined 55-gallon drums for pickup and disposal by a waste recovery service. The Spill Occurrence Procedure is in Appendix A.

Upon rectification of the situation, the spill will be reported to the Supervisor. The Supervisor will report to the Ottawa County Road Commission Director if deemed serious enough or if any question remains regarding a release of material to the environment.

Depending on the product and quantity spilled, the supervisor may need to notify appropriate parties on the emergency notification list contained in Appendix B. The Supervisor or Director of the Ottawa County Road Commission must immediately contact the State PEAS hotline if the product spill meets the definition of a release. Current State definitions of a release do not include the following:

> *1) Spilling, leaking, or discharging less than 55 gallons of oil to the ground surface, if the spill leak, or discharge is detected and the oil recovered within 24 hours of the spill leak or discharge, and if oil is not released directly or indirectly to any public sewer system or to the surface waters of the State;*
>
> *2) Spilling, leaking, or discharging less than 55 gallons of oil to the surface waters of the State, if effective recovery measures are implemented in response to the spill, leak, or discharge immediately upon detection;*
>
> *3) Spilling, leaking, or discharging less than 1000-gallons of a polluting material into a secondary containment structure that complies with State rules, if recovery of the material spilled, leaked, or discharged is initiated within 24 hours of detection, is completed as soon as practicable, but not more than 72 hours after detection, and if no polluting materials are released directly or indirectly to any public sewer system or to the surface waters or groundwaters of the State.*

The Supervisor or Director must file a report outlining details of the release to the MDEQ – Water Division within 10 days of the incident if the release meets or exceeds threshold reporting quantities established by the State. These quantities are as follows:

1) Oil based products released to ground surface = 50 pounds;

2) Ethylene glycol (main antifreeze component) = 500 pounds;

3) Any product quantity release to waters that causes unnatural turbidity, color, visible sheens, oil films, foams, solids, or deposits in receiving waterbody.

A spill or release report form and address to send completed form to is contained in Appendix C.

Review of the MSDS's for the spilled product is recommended to determine if the product may contain chemicals whose Part 5 Rule 9 threshold reporting quantities (TRQ) may be exceeded by the spill. MSDS's are located in the lunchroom. A list of Rule 9 TRQ's are in Appendix D.

V. PERSONNEL TRAINING

All personnel are required to be familiar with this plan and its provisions. The supervisor is responsible for ensuring that employees are familiar with location of necessary equipment, such as absorbents and the spill procedures outlined herein. The one page Spill Occurrence Procedure and Notification List will be posted at the garage. New employees will be required to read the plan and will be shown proper procedures and locations of emergency equipment, posted procedures and notification list, and locations of product MSDS's.

APPENDIX D

SALT AND BRINE STORAGE GUIDANCE

Michigan Department of Environmental Quality

SALT AND BRINE STORAGE GUIDANCE

FOR ROAD AGENCY MAINTENANCE AND OTHER FACILITIES

Jennifer M. Granholm, Governor ✹ Steven E. Chester, Director
www.michigan.gov/deq

I. INTRODUCTION

There have been documented groundwater quality problems caused by improper salt storage and handling. Most of these problems involve the contamination of drinking water wells.

Salt includes:

- ✓ Sodium chloride (often called rock salt),
- ✓ Potassium chloride,
- ✓ Calcium chloride,
- ✓ Magnesium chloride, and
- ✓ Any solutions or mixtures containing 1% or more of these compounds in either solid or liquid form.

This guidance is to offer the more than 400 Michigan road agency facilities, and other facilities with large amounts of salt or brine, suggested methods for preventing pollution incidents and achieving compliance with the following water protection regulations:

- Effective August 31, 2001, the Part 5 Rules, Spillage of Oil and Polluting Material, promulgated pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) (R 324.2001 through R 324.2009).
- Effective August 26, 1999, Part 22 Rules, Groundwater Quality, promulgated pursuant to Part 31 of Act 451 (R 324.2201 through R 324.2240).
- Part 31, Water Resources Protection, of Act 451 of 1994, as amended
  - Effective June 15, 2004, Section 3111b of Part 31 was amended to include additional release reporting requirements to 911 (or the local primary public safety answering point if 911 service is not available) and also a written follow-up report to the local health department if a facility is subject to Part 5 Rules release reporting. Public Act 142 of 2004
  - Effective June 15, 2004, Section 3115 of Part 31 was amended regarding penalties for not reporting a release if required or having an illegal discharge. Public Act 143 of 2004.

These regulations and additional resources can be obtained from the Internet at www.michigan.gov/deq and select "Water," then select "Emergency Response for Releases to Water" for the Part 5 Rules information and select "Groundwater Discharge" for the Part 22 Rules information. To request printed copies of the rules, call 517-373-2730 or write to the Water Bureau, Michigan Department of Environmental Quality (DEQ), PO Box 30241, Lansing, Michigan, 48909.

The following salt storage facilities are required to meet the Part 5 Rule requirements:

a. **Any location that has 5 tons or more (threshold management quantity – TMQ) of salt in solid form. This includes salt and sand mixtures or other mixtures that contain 1% or more of salt (hereafter referred to as sand-salt).**

b. **Any location that has 1,000 gallons or more (TMQ) of salt in liquid form. This includes brine that has 1% or more concentration of salt (i.e. 10,000 milligrams per liter chloride).**

This guidance does not cover all the requirements for the following:

- ⌦ Brine located at brine storage facilities overseen by DEQ Office of Geological Survey (OGS). These are exempted from the Part 5 Rules by R 324.2001(f) and (g), and by R 324.2003 because they are part of a facility regulated under Part 615, Supervisor of Wells, of Act 451.
- ⌦ Oil, gasoline, and/or other polluting materials such as ethylene glycol used for deicing aircraft which have requirements under the Part 5 Rules and other state or federal regulations. If you have any questions with regard to storage of these materials, please see the "Pollution Incident Prevention Plan (PIPP) and Part 5 Rules Informational Packet" and contact the Water Bureau District Office in your area or see Appendix B. Also see the Waste and Hazardous Materials Division antifreeze guidance.

The purpose of the Part 5 Rules is to prohibit injurious discharges to the waters of the state and the primary requirements include:

- Surveillance requirements in R 324.2004 so the facility inspects the areas for releases or potential problems
- Storage and use area requirements in R 324.2005(4) for solids to contain the salt or precipitation exposed to the salt
- Secondary containment requirements in R 324.2005(2) for brine stored outdoors to contain the salt or precipitation exposed to the salt
- Pollution Incident Prevention Plan (PIPP) requirements in R 324.2006 to identify procedures needed to properly contain the salt and other polluting materials onsite, identify the procedures to address releases, and inventory salt storage, etc. (see Appendix C for checklist of required information)
- Release reporting requirements in R 324.2007, and R 324.2002, and Section 3111b of Part 31 (see Section VIII)

For the purposes of this guidance the following words and their usage are defined as follows:

"impervious" –- incapable of being passed through or penetrated.

"compatible" –- capable of being mixed with, or coming in contact with another substance without reacting chemically or otherwise resulting in deterioration.

"must" –- indicates a particular action is required to meet compliance with the regulations.

"should" –- indicates that the particular action is a recommendation.

"publicly owned sanitary sewer system" –- is a term used to describe a municipal sewer system, which is also called a POTW (publicly operated treatment works) and WWTP (wastewater treatment plant).

II. SOLID SALT AND SAND-SALT STORAGE

Possible ways to eliminate the requirement for sand-salt mixture storage and containment provisions would be:

- Use alternative deicing products and clean sand whenever possible to eliminate salt contaminated runoff.
- Store the sand and salt separately and batch-mixed it on an as needed basis, if the amount of salt on-site is below 5 tons.

If solid salt and sand-salt are on-site and meet threshold management quantities of 5 tons or more, the following provides requirements and guidelines for proper storage at salt loading and unloading sites.

A. All solid salt and sand-salt at the site must be stored in an enclosed building, or covered with waterproof tarps, when the facility's total salt storage exceeds the threshold management quantity. This practice will help prevent the generation of salt contaminated runoff and the need for runoff collection and disposal. Storage on impervious surfaces such as asphalt or coated concrete that provide 1 x 10-7 centimeters per second permeability or less should also be utilized to eliminate salt contaminants from seeping to groundwater. If tarps are used, it will be necessary to ensure they are providing the necessary salt protection.

   The rules do not require a specific type of structure to be built. For more guidance on constructing salt storage units or calculating space needed for storage, see the salt storage publications from the Salt Institute. At the www.saltinstitute.org website, select "About the Salt Institute" "Publications and Audio-visual materials" and scroll down to "Winter Maintenance". The Salt Storage Handbook contains tables showing how much space different height piles will cover and also provides exposure surface areas to use in calculating how many tarps would be needed for covering salt piles. Road agencies may also contact the Michigan Department of Transportation at 517-322-3319 for information.

B. All solid salt and sand-salt must be stored at least 50 feet from the shore or bank of any lake or stream or any designated wetland.

C. Any salt and sand-salt containment structures located within a 100-year floodplain as defined by the federal flood disaster protection act of 1973, 42 U.S.C. 4001 et seq., must be designed and constructed to remain effective during a 100-year flood. Some floodplain information is on the Internet through the Federal Emergency Management Agency at www.fema.gov. Floodplain information may be available through watershed groups, and Soil and Water Conservation District. Or contact the DEQ Land and Water Management Division, Water Management Section at 517-373-1170.

D. Storage and handling of solid salt awaiting transfer at regional distribution sites, and sand-salt not stored within an enclosed structure, must be designed to contain the salt to prevent run-on, runoff, seepage, or leakage to public sewers or to surface water or groundwater. The salt containment should include storage on an impervious pad and a waterproof tarp covering at all times prior to use. The pad must be sloped to direct salt contaminated runoff to an appropriate collection area, and in a manner that prevents the runoff from reaching the soil or surface waters. The curbing must also direct runoff to an appropriate collection area (see sections VI and VII).

III. BRINE STORAGE

Brine storage facilities must meet all of the following conditions.

A. All aboveground brine storage tanks must have secondary containment (e.g. spill containment dikes, double walled tanks, etc). The dike must be lined with or constructed of an impervious material. Soils, other than clay, are not impervious. If a concrete or asphalt liner is used, it must be free of cracks and covered with a compatible waterproof coating. Please refer to Appendix A of this document for liner and lagoon design recommendations.

B. The containment area must have an enclosed storage area so as to be able to contain a volumetric capacity of at least 100% of the largest tank's capacity or at least 10% of the total volume of tanks within the containment area, whichever is larger. The containment area must be constructed so that no volume of brine can escape through drains, sewer systems, or otherwise directly or indirectly into any sewer without prior written approval by the wastewater treatment plant operator or to the surface waters or groundwater of the state.

C. Consider how to provide squirt protection in case aboveground tanks holding liquids are punctured or ruptured. Use engineering calculations to calculate the potential distance a material can squirt, or a general rule of thumb for determining squirt distance for containers is to measure the tallest height of the containers and use that measurement as the minimum distance between the stored containers and the edge of the containment area.

D. Tanks set on ring foundations should be tested each year to insure that there is no leaking inside the ring.

E. All accessory pipes, hoses, valves, and pumps must also be located within the diked area. Top loading and unloading piping is recommended.

F. The containment area should be designed so it is accessible at all times and so there will be easy removal of storm water and spillage by a non-automatic sump, if required.

G. Spilled brine should be pumped and transferred to another tank or tank truck for use or disposal (see Section VI). The PIPP must include provisions for the capture and removal of spilled brine as prescribed by R 324.2006 of Part 5. The PIPP should also include steps to promptly collect and transfer brine from any disabled or damaged tanker on the road.

H. If the brine is from an oil or gas well, then there are additional requirements including annual testing and the facility must obtain a General Permit 2215-00-5 Application of Oil Field Brines for Ice and Dust Control and Soil and Road Stabilization from the Water Bureau. The brine must meet the requirements in R 324.705 of the administrative rules promulgated under Part 615, Supervisor of Wells, of Act 451. Contact Ray Vugrinovich at 517-241-1532 for more information.

   In order to be used for ice or dust control, the brine and well must be approved by the Office of Geological Services (OGS) and meet the following criteria:

   - Calcium: 20,000 milligrams per liter or more;
   - Total Benzene, Ethylbenzene, Toluene, Xylene: 1,000 micrograms per liter or less.

   The PIPP should include the facility's management procedures and maximum brine application rates (1,500 gallons per lane mile of road or 1,250 gallons per acre of land, provided runoff does not occur) contained in General Permit 2215-00-5 Application of Oil Field Brines for Ice and Dust Control and Soil and Road Stabilization.

IV. TRUCK LOADING/UNLOADING AREAS

A responsible observer should be present at all times when salt and brine is being loaded and unloaded. All truck loading and unloading areas must be maintained by one of the following options:

A. Loading areas must be constructed on an impervious pad and should be covered or enclosed within the storage structure to prevent the generation of salt contaminated runoff.

B. Loading areas must be surrounded by curbing or graded to direct salt contaminated runoff to an appropriate collection area (as described under Storm Water Collection and Disposal in section VI), and the drainage ways should be scraped clean of all salt and sand-salt mixture after trucks are loaded and dispatched. The collected salt or sand-salt should be used or returned to the proper storage area.

V. TRUCK WASH AREAS AND GARAGE FLOOR DRAINS

All truck wash areas must be located on an impervious pad. The pad must be sloped or curbed to contain the wastewater and direct it to a collection area for recycling or proper disposal. The wastewater from all garage floor drains and truck wash areas, which is not collected and recycled, must be disposed of by one of the following options.

A. Facility must obtain prior approval from the wastewater treatment facility operator before any discharge of the wastewater to a publicly owned sanitary sewer system. This should be a written approval.

B. The facility can discharge the wastewater into a holding tank which is subsequently pumped and hauled for proper disposal. It is usually taken to a wastewater treatment facility with prior approval from the treatment facility operator, a disposal well, or other disposal company. Recommendations for holding tank design and installation may be obtained from Water Bureau District staff.

1. If a company is hired to haul the liquid waste, then they must be a permitted and registered waste transporter in accordance with Part 121, Liquid Industrial Wastes, of the Natural Resources and Environmental Protection Act, 1994 P.A. 451, as amended, and Act 138 of 1998, Hazardous Material Transportation Act. The facility must have a site identification number before shipping. Check the Waste Data System (WDS) to see if an existing number is assigned for the site and other information on file, and either use the online MiTAPS system at www.michigan.gov/mitaps or submit the form EQP5150 if need to update information or apply for a new number. Waste manifests must accompany the shipment and the facility must meet manifest recordkeeping requirements. Submit manifest copy to DEQ Waste & Hazardous Materials Division by the 10th of month following shipment. Get signed copy back from the disposal company and keep that copy at least 3 years from the date of shipment. If the transporter is using a consolidated manifest, they must provide the facility with a receipt that has the following:
   - Transporter's company name,
   - Driver's signature,
   - Date of pickup,
   - Type and quantity of waste removed,
   - Consolidated manifest number, and the
   - Designated facility information.

2. If a governmental agency owns and operates the hauling vehicle, they are exempt from the permit and registration transporter requirements but must still meet manifesting and other liquid industrial waste generator requirements. See above for site identification number and manifesting requirements. Confirm with the insurance company that there is coverage for environmental cleanup in case of an accident.
   - If the governmental agency is hauling 55 gallons or less themselves, they are not required to use a manifest if the following conditions are met:

     • A record of the source and quantity of waste and where the waste is being transported is kept with the waste shipment.

     • The designated facility acknowledges receipt of the waste by signing the record and they keep a copy of the record.

     • Keep a copy of the shipment records for at least three years.

     • The designated facility and the generator must manage the waste according to the liquid industrial waste regulations.

C. The facility is not allowed to discharge to the environment unless the wastewater discharge to the groundwater or to surface water has the required individual permit, or meets one of the exemptions or conditions for a specifically authorized discharge under Part 22, Groundwater Quality Rules, of Part 31, (see R 323.2210 (v), R 323.2215, or R 323.2218). General permits or exemptions can be considered for wash water or snow melt only when it does not contain additives or other contaminants. Floor drains, in garages where automotive repair and maintenance occurs, are not allowed and are not eligible for an exemption. Discuss the operations with the local Water Bureau district office.

VI. SALT CONTAMINATED STORM WATER MANAGEMENT

Salt contaminated storm water (hereafter referred to as brine) from the loading and unloading areas and salt and sand-salt storage areas can be managed in accordance with one of the following options. Storm water in contact with salt resulting in a chloride concentration of 10,000 mg/l or greater must be collected for use or proper disposal.

A. The preferred option is to collect and use the brine as a road dust control agent or pre-wetting ice control agent. Meet the industry and/or MDOT recommendations regarding usage concentration and application rates for using brine or for pre-wetting sand or roads. It is recommended that if brine is used as a dust control agent, it is used only as make-up water on commercial products. This is the preferred management option.

   1. A groundwater discharge permit may not be required per R 323.2210(b) if application is done according to “normally accepted or regulated practices.” These practices must not cause nuisance conditions or erosion, or becomes injurious, and it does not cause runoff to, ponding on, or flooding of adjacent property.

   2. Storm water in contact with salt resulting in a chloride concentration of 250 mg/l or greater, or sodium concentration of 120 mg/l or greater, is subject to Part 31 groundwater discharge authorization. Discuss requirements with the local Water Bureau district office.

B. Discharge the brine into a holding tank for later disposal off-site. Holding tank guidance is being developed. Contact the Environmental Assistance Center at 800-662-9278 for availability or discuss your holding tank design and installation questions with the Water Bureau district office.

   When being disposed of, the brine must be pumped and hauled by a permitted and registered liquid industrial waste transporter or by using the governmental agency's vehicle. See Section V.B for site identification and shipping requirements. If the brine is not reused, it should be hauled for disposal to an Environmental Protection Agency (EPA) and DEQ approved Class I Underground Injection Control (UIC) disposal well or to a facility capable of treating it. As of August 2005, there are two commercial disposal wells that accept brine from salt piles in Michigan:

   - Liquid Management Inc, Bay City 517-684-3742 (Bay County)
   - Northeastern Exploration, Johannesburg 800-792-8168 or 989-786-4346 (Otsego County)

C. Collect the brine in a lined lagoon for later disposal off-site. When being disposed of, it must be pumped and hauled either by a permitted and registered liquid industrial waste transporter or by using the governmental agency's vehicle (see section V. B.). If not reused, it should be hauled for disposal to an EPA and DEQ approved Class I UIC disposal well (see above) or to a facility capable of treating it.

   1. The lagoon must be lined with an impervious, compatible material which is capable of withstanding changing weather conditions without significant deterioration and/or loss of integrity. Please refer to Appendix A of this document for liner and lagoon design recommendations.
   2. The lagoon must be accessible at all times of the year.
   3. An appropriate test for lagoon leak detection should be performed annually.
   4. The lagoon must have adequate storage capacity. Storage capacity should be determined by considering the frequency that the lagoon will be pumped and the maximum amount of rainfall or snow melt possible during that time. The lagoon must maintain at least one foot of freeboard above the lagoon water level at all times. The lagoon liner must be saturated at all times with at least a one foot water/wastewater level to avoid UV rays degrading installed plastic liners (and stored liners awaiting installation) and desiccation cracking of clay liners.

D. The DEQ does not recommend that brine be discharged directly to a municipal sanitary sewer due to potential impacts to surface water and groundwater quality. However, where options for reuse or approved brine disposal wells are unavailable, it may be an option depending on the amount of brine, the rate of discharge to the wastewater treatment plant, and the discharge location.

   Prior to discharge to a municipal sanitary sewer, approval must be obtained from the wastewater treatment plant (WWTP) personnel and an evaluation must be made by DEQ to determine whether water quality standards will be met. The DEQ evaluation will be made at time of reissuance of the WWTP's discharge permit if the WWTP identifies the potential discharge (including flow and concentration of salt) in their permit application. If the DEQ evaluation shows water quality standards will be met, then the WWTP can approve the discharge into their sanitary sewer.

VII. UNCONTAMINATED STORM WATER MANAGEMENT

The best management option is to eliminate all salt contaminated runoff and thus eliminate the required collection and disposal of salt contaminated wastewater. Enclosed salt storage and a valved piping system is a practical method to eliminate storm water from entering the brine collection system.

The site operator will need to determine if the storm water is contaminated with salt or other pollutants or uncontaminated. To be excluded from the Part 5 rules, the salt concentration must be below 1% concentration. The PIPP must include how you will manage the storm water as discussed below:

Uncontaminated storm water collected in the containment area may be handled by either:

A. Applying the storm water to the soil surface outside the containment area without a groundwater discharge permit per R 323.2210(d) if the water does not contain salt contaminated storm water or other leaks or spills and is inspected to ensure compliance with other discharge standards of the Part 22 Rules. For storm water exposed to salt, the discharge of sodium concentration must be below 120 ppm and chloride concentration below 250 ppm; otherwise the discharge is regulated by R 323.2222. If storm water is directly discharged to surface water, it must also meet Part 4 Rules on Water Quality Standards. Discuss these limits or discharge permit requirements with the Water Bureau District Office.

   The discharge cannot be, or become, injurious, and cannot cause runoff to, ponding on, or flooding of adjacent property. It also cannot cause erosion or cause nuisance conditions. When doing a visual inspection before discharging, consider odor, color of any discharges, turbidity, floatable solids, deposits or stains. See the EPA Storm Water Management Fact Sheet *"Visual Inspection."*

B. Discharging the storm water directly to a municipal sanitary sewer with prior approval of the treatment facility operator. Approval should be in writing. Be aware not all sewer systems accept storm water.

VIII. REPORTING POTENTIAL INCIDENTS OF CONTAMINATION

A. The facility needs to meet the following **reporting requirements if a release occurs and it meets or exceeds the threshold reporting quantities of 50 pounds of salt or 50 gallons of brine**. If salt-sand is spilled, calculate the amount of mixture that would contain 50 pounds of salt. This calculation should be done before a release occurs and included in your PIPP

1. Call to report releases:

- **PEAS at 800-292-4706** or from out of state call 517-373-7660, and
- **911** (or the primary public safety answering point per Section 3111b of Part 31)

2. Submit written report within 10 days after the release to:

- DEQ Water Bureau District Supervisor that oversees the area where the release occurred (Note. See Appendix B for the mailing address which is the same as for the staff contacts. This program was transferred to the Water Bureau, so the report no longer is submitted to the Waste Management Division as noted in the rule.)
- Local health department, environmental health section (per Section 3111b of Part 31)

A facility may use the form EQP 3465 "Spill or Release Report" attached in Appendix D or available on the Internet, or submit a written report containing the information identified in Rule 7(2). Include:

a. Cause of the release
b. Date and time of discovery of the release
c. Response measures that have been done, and the schedule for completion of other measures to be taken, or both
d. Measures taken to prevent recurrence of similar releases

3. Report releases if required under other regulations.

When preparing a PIPP, it is recommended you identify potential scenarios that would require additional release reporting and include those in the plan. For example, a local wastewater treatment plant may require a report if a release went into a drain that goes into their system. Check with the sewer authority for local reporting requirements. Another example where additional release reporting requirements may apply is if there was an accident with a salt truck and in addition to the salt release, there was fuel or other fluids from the vehicles released in reportable amounts or a salt truck hit a fuel storage tank resulting in a release of fuel.

If you are required to submit a written release report to a DEQ Division (for example a permit may require reporting of releases) and are subject to the Part 5 Rule reporting requirements, and if the other required report contains the information listed, it is not necessary to also submit a separate report to the Water Bureau for meeting the Part 5 release reporting requirement. Releases that go into a public wastewater treatment plant (WWTP) and meet Part 5 Rule conditions are reportable to the Water Bureau.

B. The road agency or other responsible party may be required to conduct a hydrogeological investigation if DEQ staff deems that a spill or other discharge to the ground warrants an investigation. The investigation may need to determine one or more of the following factors:

1. Groundwater flow direction.
2. Groundwater flow rate.
3. Horizontal and vertical extent of contamination.
4. Potential adverse effects on the human and natural environment from the discharge.
5. Alternative remedial actions to consider.
6. Other factors deemed necessary by DEQ staff.

APPENDIX A — LAGOON DESIGN RECOMMENDATIONS

Treatment and storage lagoons for wastewater regulated under Part 31 of Act 451 and the Part 22 Groundwater Quality Rules must be designed to prevent, to the maximum extent possible, discharges to the groundwater. The following criteria are acceptable to the Water Bureau, Department of Environmental Quality (DEQ), as guidance for treatment and storage lagoon design along with the Part 22 Guidesheet IV "Wastewater Treatment and Storage Lagoons" which has more information about liners and the quality assurance program. This guide sheet can be found at www.michigan.gov/deq and select "Water" "Groundwater Discharge" and under Permits heading select "Groundwater Permit Application Forms & Technical Information." Note that the quality assurance report is now submitted to the Water Bureau District Office instead of the Waste Management Division as stated on page 5 of the guide sheet.

A composite liner is a system that consists of both of the following components:

1) An upper component that consists of a flexible membrane liner which is installed in direct and uniform contact with the lower compacted soil component. The flexible membrane liner shall have nominal thickness not less than 40 mils (0.040 inch) polyvinyl chloride or 60 mils (0.060 inch) thick high-density polyethylene in accordance with R 323.2237(3).
2) A lower component that consists of any of the following soil layers:
   (a) A compacted soil clay liner that meets the requirements of R 323.2237(2)(b).
   (b) A geocomposite clay liner that meets the requirements of R 323.2237(2)(c).
   (c) A natural soil clay barrier that meets the requirements of R 323.2237(2)(a).
   (d) An alternative soil layer that is approved pursuant to the provisions of the Part 22 Rules.

Alternate composite designs will be considered by the Water Bureau District staff and approved, if the alternative design provides the same or greater environmental protection.

Prior to initiating lagoon construction, the following must be approved in writing by the appropriate DEQ Water Bureau District Office:

- Preliminary soil study verifying that an adequate volume of clay exists on site or can be brought which meets the soil criteria for the clay portion of the composite liner
- Engineering plans for lagoon construction
- Construction Quality Assurance Plan

Recertification of liner construction must be done after sludge removal, or any maintenance or other activity which can potentially jeopardize the liner integrity.

APPENDIX B — DEQ WATER BUREAU DISTRICT OFFICE CONTACTS

DISTRICT OFFICE LOCATION	SERVING THE FOLLOWING COUNTIES		STAFF CONTACT MAILING ADDRESS	PHONE/ Email
Bay City (Saginaw Bay)	Arenac Bay Clare Gladwin Huron Iosco	Isabella Midland Ogemaw Saginaw Sanilac Tuscola	Gene Suuppi DEQ Water Bureau 503 N Euclid Ste 8 Bay City MI 48706-2965	989-686-8025 ext 8262 mailto:suuppig@michigan.gov
Cadillac	Antrim Benzie Grand Traverse Kalkaska Lake Leelanau	Manistee Mason Missaukee Osceola Wexford	Brian Myers DEQ Water Bureau 120 West Chapin St Cadillac MI 49601 OR	231-775-3960 ext 6263 mailto:myersbf@michigan.gov
Gaylord Field Office	Alcona Alpena Charlevoix Cheboygan Crawford Emmet	Montmorency Oscoda Otsego Presque Isle Roscommon	Rick Shoemaker DEQ Water Bureau 2100 West M-32 Gaylord, MI 49735	989-705-3424 mailto:shoemakr@michigan.gov
Grand Rapids	Barry Ionia Kent Mecosta Montcalm	Muskegon Newaygo Oceana Ottawa	Keith Zahn DEQ Water Bureau 350 Ottawa Ave NW Grand Rapids MI 49503	616-356-0244 mailto:zahnk@michigan.gov
Jackson	Hillsdale Jackson Lenawee	Monroe Washtenaw	Greg Merricle DEQ Water Bureau 301 E. Louis Glick Hwy Jackson MI 49201-1556	517-780-7841 mailto:merriclg@michigan.gov
Kalamazoo	Allegan Berrien Branch Calhoun	Cass Kalamazoo St. Joseph Van Buren	Steve Norton Greg Danneffel DEQ Water Bureau 7953 Adobe Rd Kalamazoo MI 49009	269-567-3573 269-567-3575 mailto:nortonsc@michigan.gov mailto:danneffg@michigan.gov
Lansing (previously Shiawassee)	Clinton Eaton Genesee Gratiot	Ingham Lapeer Livingston Shiawassee	Craig Lapham Chris Babcock DEQ Water Bureau PO Box 30242 Lansing MI 48909	517-335-6113 517-373-2230 mailto:laphamc@michigan.gov mailto:babcockch@michigan.gov
Southeast Michigan	Macomb Oakland St. Clair Wayne		Tracy Kecskemeti DEQ Water Bureau 27700 Donald Court Warren MI 48092-2793	586-753-3777 mailto:kecskemt@michigan.gov
Upper Peninsula Gwinn (previously Marquette)	Alger Baraga Chippewa Delta Dickinson Gogebic Houghton Iron	Keweenaw Luce Mackinac Marquette Menominee Ontonagon Schoolcraft	Randy Conroy DEQ Water Bureau 420 Fifth St Gwinn MI 49841	906-346-8527 mailto:conroyr@michigan.gov

You may also contact Bob Babcock, Water Bureau, at 517-373-8566 or email mailto:babcockr@michigan.gov.

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APPENDIX C — PIPP COMPLETENESS REVIEW CHECKLIST

This checklist is provided to help identify that the minimum requirements included in Rule 323.2006 that must be addressed in the PIPP along with a few recommended items to include. Include components that are specific to the facility's pollution prevention methods and emergency response. It is not required to provide the information in the order presented. This checklist does not address all the requirements that may be needed to be included if preparing an Integrated Contingency Plan (ICP) as that will vary with the other planning regulation requirements.

IN THE PLAN?			**I: Facility identification information Rule 6(1)(a)**
Yes	**No**	**N/A**	**Identify the following information about the facility:**
☐	☐		1. Facility name
☐	☐		2. Facility owner
☐	☐		3. Mailing address
☐	☐		4. Street address (if different from mailing address)
☐	☐		5. Facility telephone number
☐	☐		6. 24-Hour emergency telephone number(s)
☐	☐		7. Designated spill prevention and control coordinator. It is recommended to also have an alternate contact.
☐	☐	☐	8. Name of person(s) responsible for on-site spill prevention and control (if different from coordinator). It is recommended to also identify an alternate contact.
☐	☐		9. Procedures that will be used to notify individuals within the facility. It is recommended you include how the following will be alerted of an emergency at the facility:
☐	☐		a. Spill prevention and control coordinator
☐	☐		b. Person(s) responsible for on-site spill prevention and control if different from coordinator, and
☐	☐		c. Other people in the facility about the emergency
☐	☐		10. Map showing facility relative to the surrounding area, include thoroughfares.

			II: Notification Procedures to Entities Outside of Facility Rule 6(1)(b)
Yes	**No**	**N/A**	**Identify the reporting procedures that will be used to notify entities off-site. At a minimum, include notification to the following:**
			1. Michigan Department of Environmental Quality
☐	☐		a. PEAS Hotline 800-292-4706 (or 517-373-7660 if calling from out-of-state)
☐	☐	☐	b. District office during business hours (recommended)
☐	☐		2. U.S. Coast Guard - National Response Center 800-424-8802
☐	☐		3. 911 or if that service not available, then contact your community's primary public safety answering point
☐	☐		4. Local emergency planning committee (may be covered by calling 911)
☐	☐		5. Local fire department (may be covered by calling 911)
☐	☐		6. Local law enforcement agency (e.g. police, sheriff's department, state police) (may be covered by calling 911)
☐	☐	☐	7. Municipal wastewater treatment plant if facility served by that plant
☐	☐	☐	8. Spill clean-up contractor, or consulting firm, or both
☐	☐	☐	9. Other local, state, and/or federal agencies or entities that you may be required to report releases under other regulations (required if preparing an ICP that has additional reporting requirements)

			III: Spill Control and Cleanup Procedures Rule 6(1)(c)
Yes	**No**	**N/A**	**Identify information about how the facility will control spills and conduct cleanups of releases:**
			1. Inventory and location of spill control and clean-up equipment (type and quantity)
☐	☐		a. Equipment available on-site
☐	☐	☐	b. Equipment available off-site
☐	☐		2. Procedures for response and cleanup
☐	☐		3. Procedures for characterization and disposal of recovered materials

			IV: Polluting Material Inventory Rule 6(1)(d)
Yes	**No**	**N/A**	**Include information about polluting materials typically on-site in quantities exceeding TMQs during the preceding 12 months:**
			1. Polluting Material(s) by:
☐	☐		a. Chemical Name(s), and
☐	☐		b. Product Name (e.g. Trade Name(s)), and
☐	☐		c. Chemical Abstracts Service (CAS) number
☐	☐		2. Location where the Material Safety Data Sheets (MSDS) are kept for these polluting materials

IN THE PLAN? **V: Site Plan Rule 6(1)(e)**

Yes	No	N/A	**Include information about polluting materials typically on-site in quantities exceeding TMQs during the preceding 12 months:**
☐	☐	☐	1. Aboveground and underground storage tanks
☐	☐	☐	2. Floor drains (know where these floor drains lead to)
☐	☐	☐	3. Loading and unloading areas, docks
☐	☐	☐	4. Sumps (sump pumps)
☐	☐	☐	5. On-site water supply
☐	☐	☐	6. Containment structures for solid polluting materials
☐	☐	☐	7. Secondary containment structures for liquid polluting materials
☐	☐	☐	7. Other storage and use areas of polluting materials that do not exceed TMQs (recommended)
☐	☐	☐	8. Other relevant site structures

VI: Outdoor Secondary Containment for Liquid Polluting Materials Rule 6(1)(f)

Yes	No	N/A	**Include information about outdoor secondary containment structures on-site used for liquid polluting materials exceeding TMQs:**
☐	☐	☐	1. Location(s)
☐	☐	☐	2. Design and construction data including:
☐	☐	☐	a. Dimensions
☐	☐	☐	b. Construction materials (and types of coatings) used
☐	☐	☐	c. Holding capacity
☐	☐	☐	d. Amount of polluting material stored in that structure
☐	☐	☐	3. How spilled polluting materials will be captured and removed
☐	☐	☐	4. Provisions for physical security of secondary containment structure, such as:
☐	☐	☐	a. Signage
☐	☐	☐	b. Gates & Fences
☐	☐	☐	c. Barriers
☐	☐	☐	d. Other
☐	☐	☐	5. Precipitation management (rain or storm water and snow accumulation) procedures
☐	☐	☐	a. Characterization of collected precipitation
☐	☐	☐	b. Disposal procedures
☐	☐	☐	c. Copies of permits or exemptions authorizing discharge (i.e. from DEQ, local wastewater treatment plant)
☐	☐	☐	6. Inspections and maintenance procedures

VII: Other Control Mechanisms and Facility Security Rule 6(1)(g) & (h)

Yes	No	N/A	**Include the following information if it has not already been addressed in the plan:**
☐	☐	☐	1. Other control mechanisms at facility to prohibit or control releases
☐	☐	☐	2. Provisions for general facility physical security

VIII: Plan Preparation, Submittal, and Update Requirements Rule 6(2)–(5)

Yes	No	N/A	**Complete PIPP or ICP, review and update as necessary, and submit notifications:**
☐	☐		1. PIPP, or update, was completed by August 31, 2003 or when facilities meet threshold management quantities
☐	☐		2. Plan is kept at the facility and available for inspection
☐	☐		3. Notification that PIPP or ICP has been prepared and certification of compliance with Part 5 rules sent to Water Bureau district office within 30 days of completing the PIPP or ICP
☐	☐		4. Notification sent to LEPC that plan is completed and available upon request
☐	☐		5. Notification sent to local health department that the plan is completed and available upon request
☐	☐	☐	6. Copy of plan submitted to a requesting agency within 30 days after receiving the request
☐	☐		7. Plan is evaluated every three years and after any release requiring implementation of the plan
☐	☐	☐	8. Plan is updated if any facility personnel, processes, or procedures that were included in the plan occur, or other changes are necessary to maintain compliance with rules
☐	☐	☐	9. Recertification and re-notification of updates are sent to Water Bureau district office, LEPC, and local health department
☐	☐	☐	10. Plan is modified within 30 days of receipt, or other DEQ provided response timeframe, of the DEQ's request to modify the plan if found to be incomplete or inadequate; submit re-notification and recertification

APPENDIX D — SPILL OR RELEASE REPORT

Report Form EQP3465 begins on the next page. This form is optional to use when reporting releases. It can be used by a facility to organize information they need to report when they call in a release and can also be used to submit the written follow-up report for reportable releases under the Part 5 rules.

Facilities may choose to enter basic information such as facility name etc. onto the form, and then enter the spill/release specific information if the need arises.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

SPILL OR RELEASE REPORT

NOTE: Some regulations require a specific form to use and procedures to follow when reporting a release. Those forms and procedures **MUST** be used and followed if reporting under those regulations. This report form is to aid persons reporting releases under regulations that do not require a specific form. This report form is not required to be used. **To report a release, some regulations require a facility to call the PEAS Hotline at 800-292-4706, or DEQ District Office that oversees the county where it occurred, and other regulating agencies and provide the following information. A follow-up written report may be required. Keep a copy of this report as documentation that the release was reported. If you prefer to submit this report electronically by FAX or e-mail, contact the regulating agency for the correct telephone number or e-mail address.** See the DEQ website on Spill/Release Reporting for more reporting information. Click here for a Microsoft Word version of this report.

Please print or type all information.

NAME AND TITLE OF PERSON SUBMITTING WRITTEN REPORT

TELEPHONE NUMBER (provide area code)

NAME OF BUSINESS

STREET ADDRESS

CITY | **STATE** | **ZIP CODE**

BUSINESS TELEPHONE NUMBER (provide area code)

RELEASE LOCATION (provide address if different than business, if known, and give directions to the spill location. Include nearest highway, town, road intersection, etc.)

SITE IDENTIFICATION NUMBER AND OTHER IDENTIFYING NUMBERS (if applicable)

COUNTY | **TOWNSHIP** | **TIER/RANGE/SECTION (if known)**

RELEASE DATA. Complete all applicable categories. Check all the boxes that apply to the release. Provide the best available information regarding the release and its impacts. Attach additional pages if necessary.

DATE & TIME OF RELEASE (if known)

____/____/____

_____am/pm

DATE & TIME OF DISCOVERY

____/____/____

_____am/pm

DURATION OF RELEASE (if known)

_____ days

_____ hours

_____ minutes

TYPE OF INCIDENT

- ☐ Explosion
- ☐ Fire
- ☐ Leaking container
- ☐ Loading/unloading release
- ☐ Pipe/valve leak or rupture
- ☐ Vehicle accident
- ☐ Other _____

MATERIAL RELEASED (Chemical or trade name)

☐ **CHECK HERE IF ADDITIONAL MATERIALS LISTED ON ATTACHED PAGE.**

CAS NUMBER or HAZARDOUS WASTE CODE

ESTIMATED QUANTITY RELEASED (indicate unit e.g. lbs, gals, cu ft or yds)

PHYSICAL STATE RELEASED (indicate if solid, liquid, or gas)

FACTORS CONTRIBUTING TO RELEASE

- ☐ Equipment failure
- ☐ Operator error
- ☐ Faulty process design
- ☐ Training deficiencies
- ☐ Unusual weather conditions
- ☐ Other _____

SOURCE OF LOSS

- ☐ Container
- ☐ Railroad car
- ☐ Pipeline
- ☐ Ship
- ☐ Tank
- ☐ Tanker
- ☐ Truck
- ☐ Other _____

TYPE OF MATERIAL RELEASED

- ☐ Agricultural: manure, pesticide, fertilizer
- ☐ Chemicals
- ☐ Flammable or combustible liquid
- ☐ Hazardous waste
- ☐ Liquid industrial waste
- ☐ Oil/petroleum products or waste
- ☐ Salt
- ☐ Sewage
- ☐ Other_____
- ☐ Unknown

MATERIAL LISTED ON or DEFINED BY

- ☐ CAA Section 112(r) list (40 CFR Part 68)
- ☐ CERCLA Table 302.4 (40 CFR Part 302)
- ☐ EPCRA Extremely Hazardous Substance (40 CFR Part 355)
- ☐ Michigan Critical Materials Register or permit
- ☐ NREPA Part 31, Part 5 Rules polluting material
- ☐ NREPA Part 111 or RCRA hazardous waste
- ☐ NREPA Part 121 liquid industrial waste
- ☐ Other list _____
- ☐ Unknown

IMMEDIATE ACTIONS TAKEN

- ☐ Containment
- ☐ Dilution
- ☐ Evacuation
- ☐ Hazard removal
- ☐ Neutralization
- ☐ System shut down
- ☐ Diversion of release to treatment
- ☐ Decontamination of persons or equipment
- ☐ Monitoring
- ☐ Other _____

RELEASE REACHED

- ☐ Surface waters (include name of river, lake, drain involved) _____ Distance from spill location to surface water, in feet_____
- ☐ Drain connected to sanitary sewer (include name of wastewater treatment plant and/or street drain, if known) _____
- ☐ Drain connected to storm sewer (include name of drain or water body it discharges into, if known) _____
- ☐ Groundwater (indicate if it is a known or suspected drinking water source and include name of aquifer, if known) _____
- ☐ Soils (include type e.g. clay, sand, loam, etc.) _____
- ☐ Ambient Air
- ☐ Spill contained on impervious surface

THIS IS A MASTER COPY. PLEASE MAKE COPIES AS NEEDED.

EXTENT OF INJURIES, IF ANY	WAS ANYONE HOSPITALIZED?	TOTAL NUMBER OF INJURIES TREATED ON-SITE:
	☐ Yes NUMBER HOSPITALIZED:____ ☐ No	

DESCRIBE THE INCIDENT, THE TYPE OF EQUIPMENT INVOLVED IN THE RELEASE, HOW THE VOLUME OF LOSS WAS DETERMINED, ALONG WITH ANY RESULTING ENVIRONMENTAL DAMAGE CAUSED BY THE RELEASE. IDENTIFY WHO IMMEDIATELY RESPONDED TO THE INCIDENT (own employees or contractor — include cleanup company name, contact person, and telephone number). ALSO IDENTIFY WHO DID FURTHER CLEANUP ACTIVITIES, IF PERFORMED OR KNOWN WHEN REPORT SUBMITTED

☐ **CHECK HERE IF DESCRIPTION OR ADDITIONAL COMMENTS ARE INCLUDED ON ATTACHED PAGE**

ESTIMATED QUANTITY OF ANY RECOVERED MATERIALS AND A DESCRIPTION OF HOW THOSE MATERIALS WERE MANAGED (include disposal method if applicable)

☐ **CHECK HERE IF DESCRIPTION OR ADDITIONAL COMMENTS ARE INCLUDED ON ATTACHED PAGE**

ASSESSMENT OF ACTUAL OR POTENTIAL HAZARDS TO HUMAN HEALTH (include known acute or immediate and chronic or delayed effects, and where appropriate, advice regarding medical attention necessary for exposed individuals.)

☐ **CHECK HERE IF DESCRIPTION OR ADDITIONAL COMMENTS ARE INCLUDED ON ATTACHED PAGE**

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY NOTIFIED:

INITIAL CONTACT BY: ☐ Telephone ☐ Fax ☐ Email ☐ Other

DATE/TIME INITIAL CONTACT:_____

☐ PEAS: 800-292-4706 Log Number Assigned _____

☐ DEQ District or Field Office

- ☐ Baraga
- ☐ Bay City
- ☐ Cadillac
- ☐ Crystal Falls
- ☐ Detroit
- ☐ Gaylord
- ☐ Grand Rapids
- ☐ Gwinn
- ☐ Jackson
- ☐ Kalamazoo
- ☐ Lansing
- ☐ Newberry
- ☐ Warren
- ☐ Wyoming

DEQ Office locations are subject to change

Divisions or Offices Contacted:

- ☐ Air Quality
- ☐ Land & Water Management
- ☐ Office Geological Survey
- ☐ Remediation and Redevelopment
- ☐ Waste and Hazardous Materials
- ☐ Water Bureau

NAME AND TITLE OF PERSON MAKING INITIAL REPORT:

_____

DEQ STAFF CONTACTED & PHONE NUMBER:

_____

_____

OTHER ENTITIES NOTIFIED:

	Date:	Time:
☐ National Response Center (NRC): 800-424-8802	_____	_____
☐ US Coast Guard Office: ☐ Detroit ☐ Grand Haven ☐ Sault Ste. Marie	_____	_____
☐ US Department of Transportation	_____	_____
☐ US Environmental Protection Agency	_____	_____
☐ 911 (or primary public safety answering point)	_____	_____
☐ Local Fire Department	_____	_____
☐ Local Police and/or State Police	_____	_____
☐ Local Emergency Planning Committee	_____	_____
☐ State Emergency Response Commission via MI SARA Title III Program	_____	_____
☐ Wastewater Treatment Plant Authority	_____	_____
☐ Hazmat Team	_____	_____
☐ Local Health Department	_____	_____
☐ Department of Labor & Economic Growth MIOSHA	_____	_____
☐ Department of Labor & Economic Growth Fire Safety	_____	_____
☐ Michigan Department of Agriculture: 800-405-0101		
☐ Other _____		

PERSON CONTACTED & PHONE NUMBER:

_____

_____

DATE WRITTEN REPORT SUBMITTED	SIGNATURE OF PERSON SUBMITTING WRITTEN REPORT

THIS IS A MASTER COPY. PLEASE MAKE COPIES AS NEEDED.

Any questions about salt and brine storage requirements should be directed to the Water Bureau District Office or call the Environmental Assistance Center at 800-662-9278 for referral.

This Salt and Brine Storage Guidance for Road Agency Maintenance and Other Facilities was revised August 2007 by the Water Bureau and Environmental Science and Services Division. Regulations are subject to change. Reliance on information from this document is not usable as a defense in any enforcement action or litigation. Refer to the regulations and discuss questions about requirements with the regulating agency.

APPENDIX E

WINTER PARKING LOT AND SIDEWALK MAINTENANCE MANUAL

Winter Parking Lot and Sidewalk Maintenance Manual

Winter Parking Lot and Sidewalk Maintenance Manual

Reducing Environmental Impacts of Chloride

Written by:

Minnesota Pollution Control Agency

FORTIN CONSULTING, INC. serving the environment

Minnesota Department of Transportation

CTAP Circuit Training and Assistance Program

University of Minnesota

minnetonka

General Growth Properties, Inc.

Envirotech Services, Inc.

LTAP

Scott

Prepare

For winter operations

Take Action

To keep parking lots clear

Winter
Parking Lot and Sidewalk
Maintenance Manual

Evaluate

The effectiveness of your actions

Application Rates

For reduced environmental impacts

08/24/06
Revised:
June 2008

Resources

And biblography

Winter
Parking Lot and Sidewalk Maintenance Manual

June 2006

Revised June 2008

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UNIVERSITY OF MINNESOTA

MINNESOTA DEPARTMENT OF TRANSPORTATION

LTAP MINNESOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

ENVIROTECH SERVICES, INC.

Cadwell Lawn Care & Landscaping Saving Our Customers And The Environment

GGP General Growth Properties, Inc.

Scott Celebrating 150 Years

Acknowledgments

This manual is dedicated to helping Minnesotans protect the environment. Whether you are the plow driver, the building manager or the traveling public, you have an important role to play in protecting our environment.

The *Winter Parking Lot and Sidewalk Maintenance Manual* is based on the *Minnesota Snow and Ice Control Field Handbook for Snowplow Operators* produced by the Minnesota LTAP Center and on the training materials for the MPCA parking lot winter maintenance training class. Thanks to the following sponsors and participants for their valuable input in the production of this document.

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Table of Contents

List of Tables and Figures

Purpose of this Manual

The purpose of this manual is to deliver practical advice to those who manage parking lots and sidewalks. This manual will help you make better, proactive, cost-effective choices in winter parking lot and sidewalk management. It will give you knowledge to become a leader in your industry by operating more efficiently and reducing environmental impacts.

A blanket approach will not work for the range of conditions Minnesota experiences; different strategies are needed for different regions and different conditions. We encourage you to continue to test, document, and refine the practices from this manual.

Throughout the manual you will find environmental tips shown with a fish symbol. These tips will help you reduce environmental impacts from snow and ice control operations.

Throughout the manual you will find cost-saving tips shown with a dollar symbol.

Background Information

Good Business Choices

Customer service is the key to success. You can use Best Management Practices (BMP's) to keep parking lots and sidewalks safe and also reduce environmental impacts. By taking time to educate your customers on the proper methods of snow removal and ice control (and the value to them), you can create a good and long standing-relationship with them.

Your customers want reliable service. Providing a well-planned and executed winter maintenance program will leave a positive impact on your customer. By using the latest technologies, you will be more reliable. By providing a higher level of service, you are likely to reduce slip and fall exposures.

Your customers want someone educated on parking lot maintenance. You are educating yourself on best practices for winter maintenance, with this handbook.

If you use the right amount of material at the right time, you will save time and money.

Certification in snow and ice control is a good reflection on you and your organization.

Your customers and the public want safe parking lots and sidewalks. By understanding the materials, weather and application rates, you will have a head start on controlling icy, slippery parking lots and sidewalks.

Your customers want clean and neat parking lots and sidewalks. By using less material and increased winter sweeping, pedestrians will track less material into buildings, and there will be less damage to flooring. Proper snow storage makes debris removal in the spring easier. Covered storage of deicers looks better, will reduce loss of material and will protect water. By preventing vehicle leaks, cleaning up spills and using lower application rates, you will keep parking lots and sidewalks neat.

Your customers want affordable snow and ice control. By using more sophisticated chemicals, you might need a bigger budget up-front. Initially you may have to charge more for using liquids. However, these costs are likely recovered by reduced sweeping, reduced floor and rug maintenance, reduced parking lot striping and reduced snow and ice maintenance time. Companies are willing to pay to keep the dirt out.

Your customers want to protect our lakes and rivers. Educate your customers on the importance of responsible deicing applications.

The best way to protect our lakes is to use less material. It is difficult to recover salt or sand once applied.

Water and Environmental Impacts

- Only 2.5 percent of all of the water on this planet is freshwater (not saltwater). Of that, less than 1 percent is available to us. The majority of our freshwater is frozen in the glaciers.

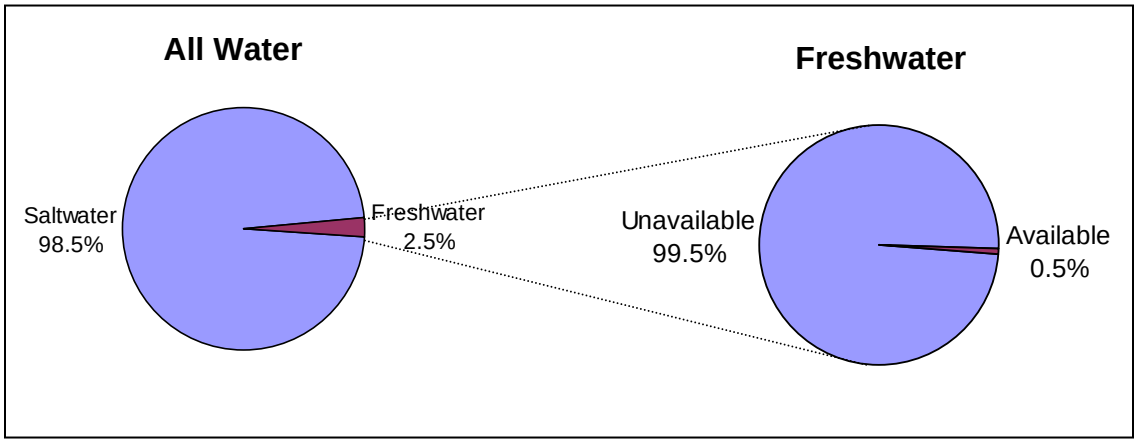

Figure 1. Available Water

- Water is recycled over long periods of time. We have a limited supply of water on this planet. Water is reused, recycled and dispersed as illustrated below from MnDNR "Healthy Rivers a Water Course" CD-Rom.

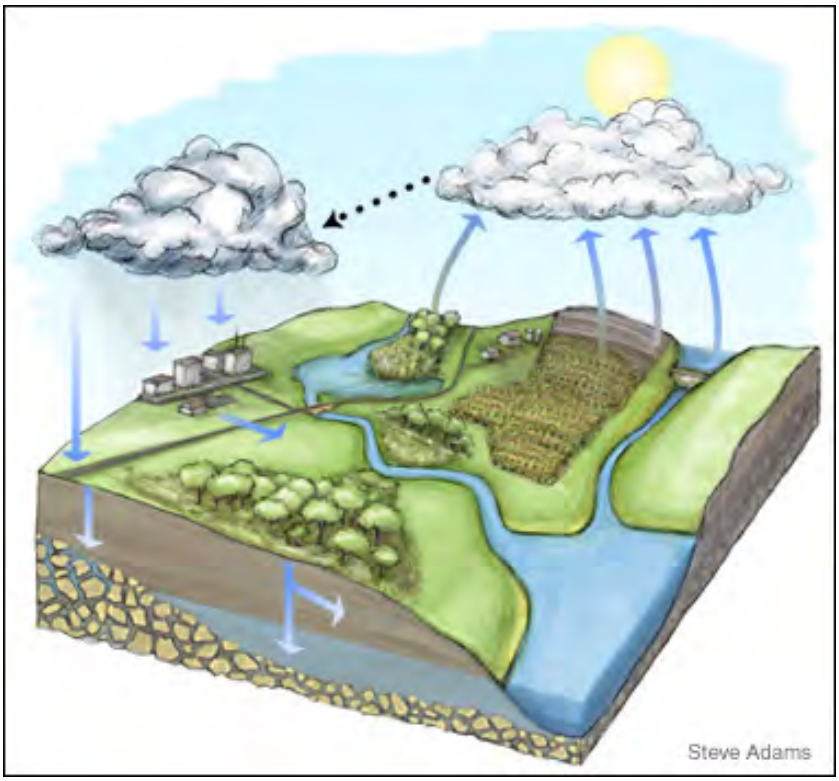

Figure 2. The Water Cycle

- Forty percent of Minnesota's tested lakes and rivers are polluted enough to be put on the federal list of impaired waters. For a list of impaired waters, including those impaired by chlorides, see www.pca.state.mn.us/water/tmdl/index.html
- A lot of salt is used in winter maintenance. The average salt use in the Twin Cities Metropolitan area is 350,000 tons per year (Sander et al. 2007).

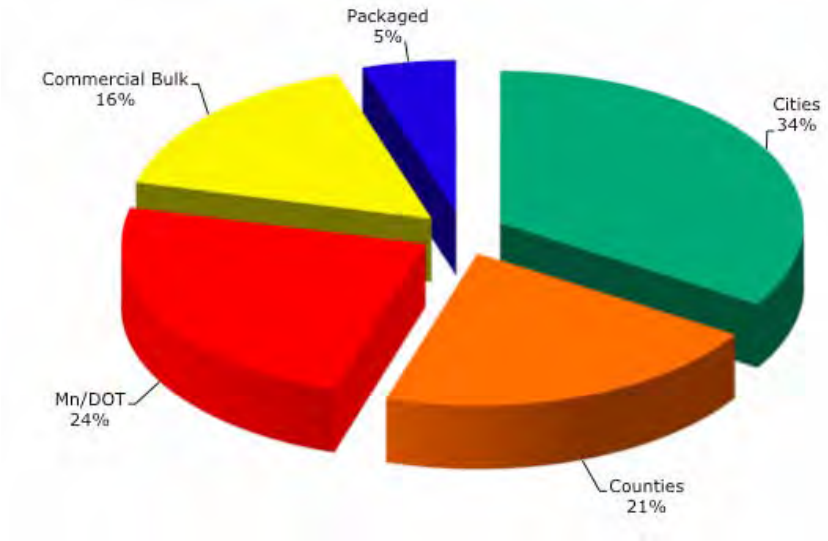

Figure 3. The Distribution of road salt use in the Twin Cities Metropolitan area.

- Our lakes are becoming more saline with increase road salt use.
- Salts dissolve and move downhill with the water to the nearest lake, river or pond. They do not settle out; they stay in our water cycle virtually forever.
- The concentration of chloride is increasing in our surface and groundwater. Salt water is heavier than freshwater and sinks to the bottom of the lakes. Eventually causing chemical stratification of the lake and loss of lake turn over.

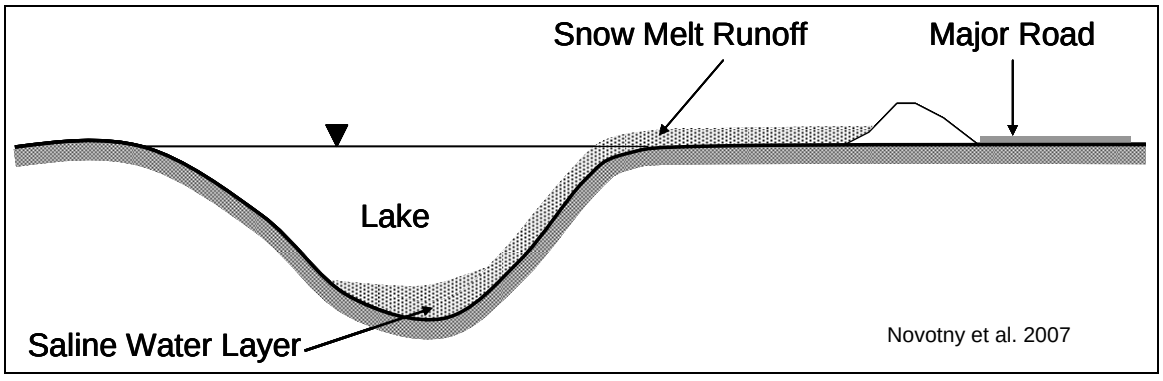

Figure 4. Schematic of a saline water intrusion into a lake

Reduced salt use equals reduced salt in lakes and streams.

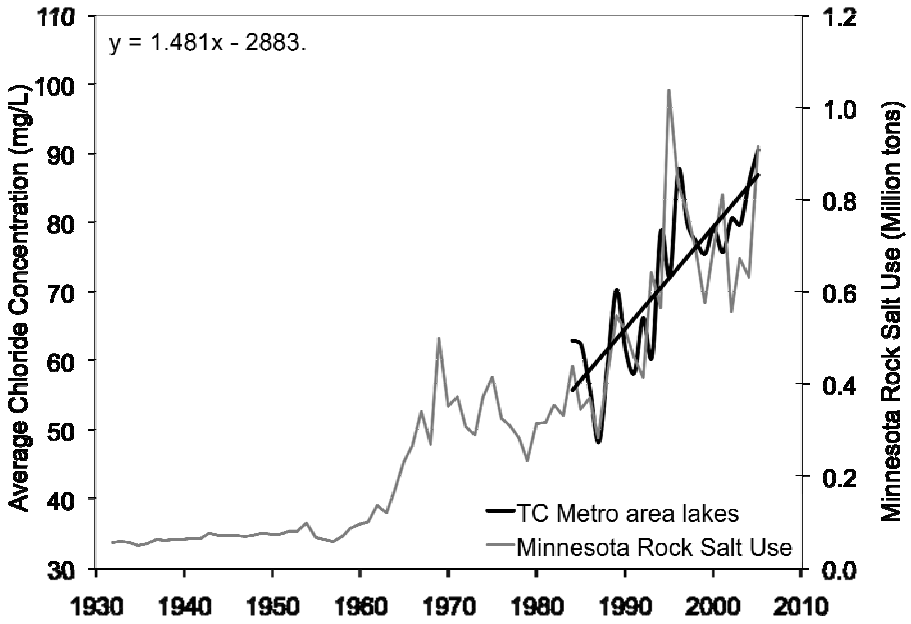

Figure 5. Lake chloride concentrations and rock salt use

Comparison of lake chloride concentrations in 39 Twin Cities lakes and rock salt purchases by the state of Minnesota.
(Novotny et al. 2007).

- Winter sand leaves parking lots and moves downhill with water to the nearest lake, pond or river. They fill in the bottoms of our lakes and rivers, accelerating the aging process of the water body and disrupting the food chain.
- In 2004-2005, the MPCA measured chloride concentrations in Minnesota's ground water. The results show that Minnesota's urban areas have the highest occurrence of chlorides (25-150 mg/L). (MPCA Minnesota's Ground Water Condition: A Statewide View 2007).
- To remove salt from water reverse osmosis is required. This is not practical for our lakes, rivers, groundwater and wetlands. Therefore prevention is important.

1 ton of rock salt ($50) causes greater than $1,450 in corrosion damage to bridges. (Sohanghpurwala 2008)

Fathead Minnows will die if exposed to chloride concentrations of 443 mg/l for more than 30 days
(http://duluthstreams.org/understanding/impact_salt_2.html)

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Prepare for Winter Operations

Policies

Start now! Develop a maintenance policy with your customer. A little planning and communication up-front can help you do a better job.

- To see example policies www.mnltap.umn.edu/ctap.
- Schedule training for you, your crew and customer. Check the MPCA website to find out about upcoming training opportunities: www.pca.state.mn.us/programs/roadsalt.html .
- Discuss the maintenance policy with your crew.
- Address customer expectations, the hours and use of the building, priority access points and environmental concerns in your policy.
- Inform your customers of any changes to your snow and ice maintenance program, and why you are making them.
- Include site monitoring in the policy.
- Plan for year round sweeping.
- Document any closed building entrances during the winter. If this is agreeable, it would reduce the amount of chemicals and maintenance time.
- Reduce your risk by having a solid written winter maintenance policy and training program that utilizes best management practices.

Our waters are threatened by policies which are based on fees for material use. This encourages overuse of materials.

Reduce your liability. Establish a maintenance policy with the customer and follow it.

Storage

Storage areas often cause groundwater or surface water contamination.

Snow Piles

- Store in an area where you can recover the solids after the snow melts.
- Locate snow down-slope from salt and sand storage. Prevent snow melt from flowing through salt or sand storage area.
- Avoid pushing snow into lakes, ponds, wetlands, rivers or other natural areas. This will increase the amount of solids that can be recovered after the melt.
- Windrows of snow can be used to guide motorists in parking when they cannot see the parking lines.

Salt Piles

- Store salt where it is protected from rain, snow and melt water.
- Store on an impervious surface.
- Cover all piles, ideally indoors.

Improper storage of salts can lead to groundwater contamination.

- Sweep loading areas back into the pile to reduce leaching.
- Contoured pads (bowl-like) for pretreated salts, reduces runoff from the pile.
- Store away from lakes, rivers, ditches, storm drains and wetland edges.

A common mistake is storing a snow pile uphill of a salt pile.

Figure 6. Incorrect Salt Storage: uncovered and placed in path of melting snow pile

Salt storage areas are often a source of groundwater contamination. To reduce risk, have a covered storage area on an impervious pad. Take measures to keep salt or salt brine from leaving storage area.

Salt Bags

- Store away from rain or snow.
- Dispose of bags properly.
- Seal open bags.

Liquids

- Understand the freezing point of your liquid. This will determine if it can be stored outdoors or if it must be stored indoors. Salt brine (NaCl) should be stored indoors.
- Storage tanks for liquids are regulated by the MPCA.
- Tanks should be double-walled or have secondary containment.
- Label the tank documenting its contents.
- Before installing tanks, check on local visual screening ordinances.
- Some above-ground storage tanks are exempt from regulations:
    - Those with a capacity of 500 gallons or less.
    - Those with a capacity of 1100 gallons or less and not located within 500 feet of Class 2 surface water (Class 2 surface water includes all

Minnesota waters that are or may be used for fishing, fish culture, bathing, or any other recreational purpose and where it may be necessary to protect water or plant life as well as the public health, safety, or welfare).

- For more information on storage tanks see www.pca.state.mn.us/cleanup/ast.html, Minnesota Rules Chapter 7151

Sand piles

- Winter sand is typically mixed with some deicer to prevent freeze-up of the pile. Therefore, sand pile storage should be the same as salt pile storage.
- Do not use leftover winter sand for other uses. Save it under cover for the next season.

Prevent groundwater contamination. Do not locate storage areas near wells. Limestone regions with fissures and sinkhole are very prone to groundwater contamination as are sandy soils.

Weather

Knowing existing and potential weather conditions is very important for a successful snow and ice control operation. Monitor the weather closely so that you are prepared to act early in storm situations. Check the National Weather Service (website http://www.noaa.gov) local TV station, or website weather. A Road Weather Information System (RWIS) is available on the Internet at www.rwis.dot.state.mn.us. RWIS provides information like pavement temperature from various locations around the state.

Pavement Temperature

You must know the pavement temperature to determine the proper amount and type of material to apply. Most weather stations report air temperature measured at a height of 30 feet above ground, which can differ from pavement temperatures. There is not a direct correlation between air temperature and pavement temperature.

Figure 7. Temperature Sensor

Pavement temperatures differ from sunny to shaded areas and concrete to asphalt surfaces. Similar surfaces constructed over different base materials hold temperatures differently. Seasonal differences also occur. The same air temperature in November and January will often show very different pavement temperatures.

Why guess. You can purchase hand-held temperature sensors from auto part stores for about $100. They are designed to measure engine temperature. Make Sure the one you buy has the appropriate temperature range and accuracy for cold weather work.

Be still and point pavement sensor at the ground to get a reading. Mirror-mounted temperature sensors are also available; they are less likely to be lost or stolen but do cost more and are generally not available at an auto parts store. A small investment in equipment will improve your performance.

Getting prepared for winter

- Calculate the area of your parking lots, service roads and sidewalks.
- Identify snow storage areas.
- Understand the properties of various deicers, and then select the type(s) to use.
- Estimate the amount of material you will need using the application rate charts. Order based on your estimate.
- Understand the environmental problems caused by snow, salt and sand storage. Determine where and how you can best store each item.
- Train your crew on proper application rates.
- Mark islands, fire hydrants and other landmarks obscured by snow.
- Note existing conditions of curbs and other items that might be damaged by winter maintenance.
- Note or mark all catch basins and manholes that may cause a hazard to the plow and the operator.

Knowing the pavement temperature will allow you to apply the proper amount of material for each situation.

Drainage

Take time to inspect drainage ways and, remove obstructions to prepare for the spring melt. Never open frozen storm drains with high doses of salt. This is toxic to aquatic life in the receiving waters. Use other methods such as heat to open drains. Look for ways to capture any solids before they enter the storm drain system. Make sure your parking lot does not drain through your salt storage area.

Storm drains lead to the nearest lake, river, pond or wetland. They do not go to a treatment plant.

Calibration

Calibration is an essential procedure to measure the amount of material applied. No matter how sophisticated or simple your operations, always calibrate each piece of equipment yearly. The trend is to use less material. Purchase equipment that has the capability to deliver low application rates. You can calibrate any type of equipment. Just find a way to determine how many pounds of material per minute is landing on the pavement or sidewalk over a measured area or distance, and for differing speeds.

All good programs are based on calibration of equipment.

If you cannot or choose not to calibrate your equipment, you will need to calculate the size of the parking lot, the surface temperatures and the material you are using. The application rate chart and these three

parameters will tell you how many pounds of deicer to apply. Without calibration, it will be up to you to find a way to evenly distribute the recommended amount across your parking lot.

- Because spreaders vary, calibrate each truck.
- Calibrate separately for every type of material you use.
- If you don't have different settings, you can change your application rate by adjusting the gate opening and truck speed.
- Place the calibration results, for each setting, in your truck.
- For specific calibration directions, contact the manufacturer.

Calibration tells you how much material will be applied at each setting or at each speed.

Calibration will allow you to more accurately use your deicers.

Simple Calibration for Conveyor and Auger Spreaders

If your equipment has different settings, you will need to calibrate for each setting. Make sure the auger plate is in place while calibrating. It generally takes three people to calibrate equipment: one to run the truck, one to catch the material and one to count the auger revolutions. Repeat the calibration for different materials.

Best bet: Contact manufacturer for calibration instructions.

Step 1: Calculate discharge rate

- Mark the auger or conveyor shaft so you can tell when a revolution has been made.
- Determine how many pounds are discharged per auger/conveyor shaft revolution. Capture in a bucket or tarp the amount of material that comes out for one revolution and weigh it. For more reliable results, do this three times and average the results.
- Count the number of revolutions per minute.
- Lbs/revolution X number of revolutions/minute = discharge rate in lbs/minute.

Example: *5 lbs of dry salt was the average amount dropping in 1 revolution. 10 revolutions occurred in one minute. The discharge rate is 50 lbs/minute. We tested setting #1 using dry rock salt (NaCl). We were discharging 50 pounds/minute and at 15 mph the application rate is 200 lbs/mile.*

Step 2: Calculate application rate:

Speed	Time to drive 1 mile	Discharge rate Per setting*	Application rate (discharge x time)	Type of material
5 MPH	12 minutes			
10 MPH	6 minutes			
15 MPH	4 minutes			
20 MPH	3 minutes			
Example: 15 MPH	Example: 4 minutes	Example: 50 lbs from setting #1	Example: 200 lbs/mile	Example: Dry salt (NaCl)

Table 8. Calibration Chart for Auger Spreader

*This number is always the same for each setting

Simple Calibration for Gravity Flow Equipment

Gravity flow equipment is very difficult to calibrate and likewise very difficult to deliver products in a consistent manner. Look for ways to upgrade your equipment. This calibration procedure can also be adapted for use on sidewalk equipment.

Step 1: Calculate discharge rate

- Mark out a 10-foot stretch of road/parking lot.
- Sweep it clean of sand or any other material.
- Drive the truck and start applying material prior to the marked area. When you cross the start point, make sure your speed stays at the desired speed and remains consistent for the 10-foot stretch. Continue spreading material a short distance beyond your marked area.
- Record your vehicle speed.
- Measure the width the material is spread or bounces, in feet.
- Sweep up and weigh the material that is within your marked 10-foot stretch.
- Record the lever position/setting for the gate/chute. If there are no numbers for the positions, make your own permanent marks and numbers on the equipment to identify the positions.
- To improve accuracy, repeat this procedure two more times and calculate the average weight of material applied.

Step 2: Repeat step 1 for different speeds, settings and materials

Step 3: Create an application rate chart to keep in your truck

- Using the information gathered, make an application rate chart to indicate how much material is applied at each setting and speed.
- If you use more than one type of material, repeat the test for each material.
- Place the completed calibration chart in each truck. You can use it to compare to the recommended application rates.

Calculate application rate:

Vehicle: _____ Material:_____ Date:_____

		A	**B**	**C**	**D**	**E**
Speed	Lever position or gate setting	Lbs. Material recovered in 10 feet	Spread width in feet	Coverage area in sq/ft (**B x 10**)	Application rate in lbs/1000 ft^2 (**1000/C x A**)	Application rate in lbs/lane mile (12' width) (**D x 63.4**)
5 MPH						
10 MPH						
15 MPH						
20 MPH						
Example 20 MPH	*Setting 2 Half-closed*	*0.4 lbs*	*13 feet*	*130*	*3.1 lbs/1000 sq. feet*	*196 lbs/mile*

Table 9. Example Calibration Chart for Gravity Flow Equipment

Example:

- *Using sand, driving 20 mph, spreader position half closed.*
- *0.4 lbs of sand was recovered in the 10-foot length, spread out to a 13-foot width (the width the sand bounced to).*
- *Coverage area = 13 feet wide by 10 feet long or 130 square feet.*
- *Since the application rate tables are all in 1000 sq ft units, you can compare this test to the recommended application rate tables.*
- *To determine how much would be spread in 1000 square feet, divide 1000 by the coverage area and multiply by the lbs. of material recovered 1000/130 x 0.4 = 3.1.*
- *The application rate delivered is 3.1 pounds per 1000 square feet. If you want to convert it to lbs. per 12 foot lane mile, multiply by 63.4.*

Desirable Equipment Features

- Ability to calibrate
- Ability to deliver low application rates
- Control switch in cab

Some fish species are affected by concentrations of less than 1000 ppm sodium chloride, about 1 to 1.5 tablespoons of salt in 5 gallons of water.

Apply wisely. We will never have a chance to recover the chemicals applied.

Calibration Chart

Calibration Chart for Gravity Flow Equipment						
Vehicle or spreader number:					Date:	
Material Type:				Calibrated by:		
		A	**B**	**C**	**D**	**E**
Speed	Lever position or gate setting	Lbs. Material recovered in 10 feet	Spread width in feet	Square feet covered with material (**B x 10**)	Application rate in lbs/1000 ft^2 (**1000/C x A**)	Application rate in lbs/lane mile (12' width) (**D x 63.4**)

Table 10. Blank Calibration Chart for Gravity Flow Equipment

How Salt Works

- Salt is a deicer, it will melt snow and ice.
- Sand is an abrasive; it does not melt snow and ice.
- Abrasives provide traction on top of packed snow or ice.
- Abrasives and deicers do not work well mixed together.
- Salt lowers the freezing point of water from 32 ºF to a colder temperature.
- Salt must be in solution (brine) to work, it won't do anything until it begins to dissolve.
- Salt brine (NaCl) is most effective at a 23.3% solution.
- The melting power is reduced as more snow falls or melts and the brine becomes less than 23.3%.
- The melting power is reduced as more salt is applied making a stronger ("hotter") mix and the brine becomes more than 23.3%.
- A deicer (salt) will work until the freeze point of the brine equals the pavement temperature. At this point the salt will stop melting and you may experience refreeze if pavement temperatures are dropping.

One application rate will not fit all storms; how long an application lasts depends on:

- Pavement temperature
- Application rate
- Precipitation
- Beginning concentration of the brine

Speed of Melting

Will the road salt you apply have time to work or is it time to switch to a different deicer? This chart will aid you in making that decision.

Pavement Temp. ºF	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything
5	4.1 lbs of ice	
0	3.7 lbs of ice	
-6	3.2 lbs of ice	

Table 11. Speed of Melting

Don't use road salt below 15º F . You are wasting money and time.

Selection and Use of Materials

Factors to consider

- Environmental impacts
- Practical melting temperature
- Testing
- Cost and availability

Human drinking water cannot exceed 250 mg/l chloride

Environmental Impacts

Deicers are not environmentally safe no matter what the bag says. Do not buy a product based on this claim.

Chlorides:

- Are less effective if applied in concentrations that are too high. The correct concentration is crucial, just like anti-freeze in your car.
- Are corrosive to steel unless they have a corrosion inhibitor added.
- Have corrosion inhibitors and anti-caking agents that are often toxic substances.
- Damage plants through direct toxicity or by interfering with water uptake.
- Change the soil structure.
- Are often the least expensive and most available deicer.
- Are not removed by holding ponds or rain gardens.
- Can be removed by water by reverse osmosis, a very slow and expensive process

About 1 teaspoon of salt can pollute 5 gallons of water forever. This applies to all chlorides.

Acetates:

- Are non-chloride compounds. They have different melting characteristics than chlorides.
- Are an organic substance.
- When added to water, compete with aquatic life for oxygen.
- Contribute nutrients which promote algal blooms in lakes and ponds.
- Cause problems in our waters but tend to be less persistent than the problems introduced by chlorides.
- Are usually safer for vegetation.
- Have less corrosion potential and are often used at airports or in areas with expensive infrastructure such as bridges.
- Have the potential to be treated by holding ponds.

Acetates can have a high biological oxygen demand (BOD), and can contribute to oxygen depletion in soil and water. Use carefully.

Plant-based additives:

- Often corn, beet, molasses or other organic additives are added to salts to improve performance. Increased performance allows for lower application rates.
- These additives do not contribute chlorides to the water but contribute nutrients (fertilizer) to the water. The impact they have is to increase aquatic plant and algae growth. They also use oxygen as they decompose.
- The impacts are serious but not as long-lasting as chlorides.

One lb. of phosphorus encourages growth of up to 500 lbs of algae. Phosphorus is in plant-based products.

Vegetation:

- Deicers can be very damaging to both soil and vegetation.
- Our efforts should be to keep salt off of vegetation: Drive slower when applying deicers, turn down spinner speed to reduce spread pattern, use drop spreaders on sidewalks, store snow piles on hard surfaces, and reduce application rates.
- One source of information about salt-tolerant plants is the MnDOT plant selector tool ***http://plantselector.dot.state.mn.us.***

Figure 12. "Witches Broom" Branching from Salt Spray

Salt spray damages budding and branching of trees.

Salt changes the soil structure. It reduces its permeability and reduces the nutrients in the soil available for the plant uptake.

Practical Melting Temperature

Be careful when reading the melting temperature on bags of deicers. They often list the eutectic temperature, which is the lowest possible melting temperature. At this temperature it would take a very long time to melt ice. Instead, use the lowest practical melting temperatures in the chart below or ask your supplier for the practical melting temperature and the time it takes to melt ice at that temperature. Remember, use pavement temperature, not air temperature.

Chemical	Lowest Practical Melting Temp.	Eutectic Temp.	Optimal Concen-tration
NaCl (Sodium Chloride) —Delivered as solid rock salt, also can be made into a brine. The basis of most deicing materials. Very corrosive. Inexpensive. Very available. Rarely has a corrosion inhibitor added.	15º F	-6º F	23%
$MgCl_2$ (Magnesium Chloride)—Delivered as a liquid. Often used to wet NaCl crystals to increase adherence to surface and reduce melting points. Corrosive. Higher cost. Often has a corrosion inhibitor added.	-10º F	-28º F	27 to 30%
$CaCl_2$ (Calcium Chloride)—Delivered as flakes, pellets, or liquid. Powerful deicer but extremely corrosive. Sometimes used incorrectly to open storm drains. Higher cost. Often has a corrosion inhibitor added.	-20º F	-60º F	30%
CMA (Calcium Magnesium Acetate)—Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive, biodegradable. Sometimes added to sodium chloride as a corrosion inhibiter. Alternative for areas where chloride use must be limited. Often higher cost.	20º F	-18º F	32%
KAc (Potassium Acetate)—Delivered as a liquid. Often used on automated bridge deicing systems and airports. Use for anti-icing, deicing, and prewetting. Non-corrosive, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	-15º F	-76º F	50%
Blends— Both chlorides and acetates exist in blends. Talk to your supplier and determine the lowest practical melting temperature, the optimal concentration and the basic components in the blend. Most blends are centered on rock salt since it is cheap.			
Winter Sand/Abrasives—Winter sand has some salt mixed in it to keep it from freezing. Abrasives should be used for cold temperatures when deicers are not effective. They provide temporary traction but only work when they are on top of the ice.	Never melts—provides traction only		

Table 13. Lowest Practical Melting Temperature

Testing

The best way to reduce impacts, save money and maintain customer satisfaction is to:

- Know what is in your product.
- Know how and when to use it.
- Use the minimum amount needed to get the job done.
- Seek out products that allow for smaller application rates.

Take time to test your materials to ensure that they perform as expected. Do not rely solely on the bag or on the manufacturer's literature. There are no labeling requirements so manufacturers can choose to label products in their own way. Labeling can be confusing; some list the eutectic temperature while others list the lowest practical melting temperature. The list of ingredients may or may not be included. Often the percentage of each ingredient is not included. Research your product, understand the practical melting temperature and get a list of the ingredients.

An area of special concern is the transition to liquids. Anti-icing liquids if over applied can become slimy or slippery. Test your application rates and your spray pattern so you can become confident in preventing the bonding of ice without creating a slimy or slippery situation.

For pre-treating stockpiles, add liquids conservatively. The dry material can only hold so much liquid before leaching occurs. Keep a close eye on your storage area to make sure it can contain the wet salt pile. Test your liquid application rates and your storage facility on a small stockpile before doing this on a large scale.

Cost and Availability

Sodium Chloride (Road Salt) is typically the cheapest and easiest to find of the deicers. Because of this it is widely used and overused. Sodium Chloride is only effective at pavement temperatures above 15 degrees. Because it doesn't work well at colder temperatures it is often over applied in attempts to get it to work better. At temperatures lower than 15 degrees switch to a different deicer.

Non-chloride deicers are more difficult to find and often cost more. If you are concerned about the long term effects of chlorides on our lakes and rivers, take time to find a source for alternate products and give them a try. As the demand for non-chloride deicers increases, the cost will drop and the products will be easier to find. All deicers have environmental impacts but the impacts of chloride based deicers are very long term.

Salt and sand mixes are commonly used to stretch the salt budget. This is an ineffective practice. Salt and sand work against each other. To save money use deicers when you need to melt and sand when you need temporary traction. Mixing them decreases the effectiveness of both products and increases the cost.

If you use a 50/50 salt/sand mix, you're generally either half right or half wrong. Using a salt/sand mix leads to over application of both materials.

Sidewalk Tips

Always remove snow prior to applying deicers. If you plow first, the chances of refreeze diminish and slush build-up is minimized.

- Sidewalks are often the most over-salted of all areas in winter maintenance.
- Sidewalks are the area of highest tracking into the building. Extra salt and sand contribute to slippery entryways inside the building.
- Use drop spreaders, not rotary spreaders, for sidewalks. If you are using a rotary spreader, adjust the opening to limit dispersion of deicers to the sidewalk or install shields to restrict the spread pattern. This minimizes your application rate and protects the vegetation.
- Many slip and fall incidents occur within ten feet of the curb lines. Adjust practices to include proactive measures like anti-icing.
- If you are not responsible for sidewalk maintenance, consider providing this information to the building occupants to educate them on these best practices for winter maintenance.
- Look for opportunities to close extra entrances during the winter to reduce the need to use chemicals on all sidewalks and steps.
- Focus on aggressive mechanical removal of snow. The less snow, the less deicer required. This will lend to a safer walking surface.
- Deicers can harm heated sidewalks.
- Products such as heated or textured mats, placed on sidewalks or steps, may work for small problem areas. Test these, as you would, any new product or deicer.

Salt only needs to melt 1/16 inch to prevent the bond between the pavement and the ice. Save money by applying salt before the ice bonds so you don't need to melt through it.

Parking Lot Tips

- It is hard to walk and push shopping carts through salt and sand accumulations in parking lots. Sand is ineffective once it is on the pavement. Sweep it up to prevent a slippery situation.
- Handicap parking spots are often over salted and over sanded. They should get the same amount of salt or sand as other areas.
- Sand/salt mix isn't advised however it may help in freezing rain situations.
- Always plow before applying chemical.
- You may be able to use a lower rate in high traffic areas. Traffic tends to help mix and melt.
- Store snow downhill from any salt storage areas. Avoid water running through salt storage.

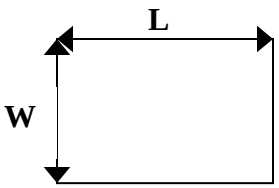
Sand fills in lake bottoms, accelerating the aging process of lakes. Lakes get shallower as they age, some eventually becoming wetlands.

Calculating Parking Lot or Sidewalk Area

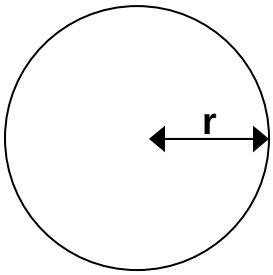
The amount of deicer needed is based on the size of the parking lot. Here are simple ways to calculate the area of your parking lot.

- Ask the property owner for a scaled map of the facility so you can calculate areas.
- Ask the property owner for the size of the area they want you to treat.
- Go out and measure the parking lot.

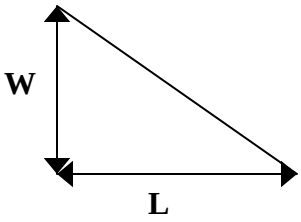
The area or square feet of a square or rectangle is
Length (L) X Width (W)



The area or square feet of a circle is **π r^2**
Or **3.14 x (r x r)** where **r** is half of the distance across the circle.



The area or square feet of a right triangle is
Length (L) X Width (W) divided by 2



Measuring your area along with knowing the pavement temperature will allow you to use the application rate charts. This will help you reduce the amount of chemicals you apply.

Surfaces such as pervious asphalt, pervious concrete and pervious pavers do not experience refreeze. All melted snow and ice travel to the storage layer below the surface. Salt is generally not needed on these surfaces and sand should be avoided.

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Take Action to Keep Parking Lots Clear

Snow Removal Basics

It is best to apply sand or deicers after the storm. Materials applied during the storm are wasted.

All application rates are based on thoroughly plowed surfaces.

- Plow first before applying deicers to avoid dilution of the salt.
- Place deicers in high traffic areas as you plow. Leave other areas until plowing is complete.
- Limit use of salt and sand during the storm; use only to reduce bonding.
- Do not use salt to burn off snow.
- Use application rate chart.
- Understand the melting properties of your deicers. Do not use them unless you understand how they work.
- Plan and look for ways to anti-ice or use wetted materials.
- Check conditions and formulate the best strategy for those conditions.
- Don't apply dry salt (sodium chloride) below 15º F pavement temperature. It will not melt fast enough to help and it will blow off the surface onto nearby vegetation.

About 1 tsp of salt will pollute 5 gallons of water…forever! (Federal Chloride standard is 230 mg/l).

- Below 15º F, use a salt wetted with magnesium or calcium chloride or other low temperature deicers. For extreme cold, skip melting and use sand.
- Turn off auger when stopped, even briefly.
- Clean up spills.
- Track material use and effectiveness with an in-cab deicing data form.
- Use only what is needed based on proper application rates for the conditions. Put extra back in salt pile.
- Never plow or blow snow into bodies of water, wetlands, traffic or into streets.
- Remove snow from surfaces as quickly as possible to reduce compaction. Plow during off-peak hours or prior to the facility opening to increase efficiency and reduce conflicts with vehicles and pedestrians.
- Minimize back-up maneuvers to reduce chance of accidents.

Because it uses less materials, mechanical snow and ice removal is the best strategy for protecting our water.

Loading/hauling

- Don't overfill the vehicle: material will spill out as you drive around corners.
- Fill in side gaps in tailgates or equipment with spill shields where materials can escape and spill out.
- Large snow piles may need to be loaded out and removed to another site. Schedule this work when the mall or facility is closed to minimize conflicts with vehicles and pedestrians.

Deicing/Anti-Icing Information

Anti-icing

Anti-icing is the most cost-effective and environmentally safe practice in winter maintenance. You should be heading in this direction.

Anti-icing—a proactive approach—should be first in a series of strategies for each winter storm. By applying a small and strategic amount of liquid or pre-wet deicer before a storm, you can prevent snow and ice from bonding to the pavement.

Anti-icing is like preparing a frying pan. If you add a small amount of a liquid before cooking, the food will not bond to the pan. This reduces the amount of soap needed; scrubbing and time spent trying to clean the pan.

Anti-icing requires about ¼ the material and 1/10 the overall cost of deicing. It can increase safety at the lowest cost, and is effective and cost-efficient when correctly used and approached with realistic expectations.

Anti-icing prevents formation of ice from frost. It can be effective for up to several days depending on the weather conditions.

Anti-icing is quick. You can treat your parking lot in a matter of minutes. It is an excellent strategy for saving time. Charging by the hour is not a desired practice when you move into anti-icing.

Get started in anti-icing

The basic equipment you will need includes: Pavement temperature sensor, storage tank, spray truck system, transfer pump, hoses and fittings.

Guidelines for anti-icing

- Liquids are the more efficient than solids and may be applied days in advance of an event.
- It is better to use less than more. Over-application can cause slippery conditions.
- Anti-icing is often effective for heavy frosts.
- Liquids are dispersed by the traffic. If you spray the traffic lanes, liquid will migrate with the tires to the parking areas.
- Some users advise against spraying the service road in front of buildings and instead spray traffic lanes and back service roads to allow the traffic to spread the liquids near the building where foot traffic is higher. This can reduce tracking into the building and over-application in a high-traffic area.
- For service roads on hills, some users recommend applying to only the top half of the hill, relying on traffic to carry it down the hill, to avoid a slippery situation at the bottom of the hill.

- Anti-icing works best when combined with accurate surface weather information.
- Early application is particularly important for frost or light freezing drizzle.
- Pretreated or prewet materials are not as efficient as liquids for anti-icing; you need more material and they don't track as well. They will work if applied at very low application rates immediately before the snow event.
- See the Anti-Icing Application Rate Chart in this manual.

Stream nozzles prevent slippery conditions better than fan spray.

Anti-icing requires less material, and less material means less water pollution.

What to do

- Apply with stream nozzles to maintain dry areas between sprayed areas to reduce slipperiness. Stream nozzles work the best for anti-icing.
- If using fan nozzles apply extra light to reduce chance of causing a slimy/slippery situation.
- Try anti-icing in a low traffic area until you feel confident about its properties.
- Read some of anti-icing guidelines in the reference section of this manual.

What not to do

- Don't re-apply if there is still residue. The residue can remain many days after application if precipitation or traffic wear-off does not dilute the initial application.
- Don't apply $MgCl_2$ or $CaCl_2$ to a warm surface (above 35º F pavement temp.). It can become slippery.
- Do not apply liquids before predicted rain or significant freezing rain. They will wash away.
- Don't apply too much or the surface may become slippery.
- Less is better. Always follow application recommendations.

Too little $MgCl_2$ is safer than too much.

Using less salt doesn't have to reduce safety, but it does protect our lakes, streams and groundwater.

Equipment

- Anti-icing unit, i.e., transport vehicle with tank.
- Stream nozzles, minimum 8 holes, 8-inch spacing, bar height 12 to 14 inches from surface, 30 to 35 psi at the bar. These can be purchased or constructed.
- Solid stream. Fan spray is more apt to make slippery conditions.
- A hand held pump sprayer or backpack sprayer can be used for sidewalks. Remember to leave a pattern of wet and dry to reduce the chance of creating slippery conditions.

- There are many ways to retrofit your pick-up truck or ATV with a tank and boom and/or hose reel with sprayer.
- A shutoff switch in the cab is recommended.

Prewetting and Pretreating salt and sand

Prewetting and pretreating both mean getting dry material wet. Salt only melts snow and ice when it is in solution (dissolved). Dry salt does nothing until it is dissolved. Liquids applied to dry salt jump-start the melting process and penetrate ice and snow pack faster. Wet materials stick to the pavement and are less likely to end up in the nearby vegetation.

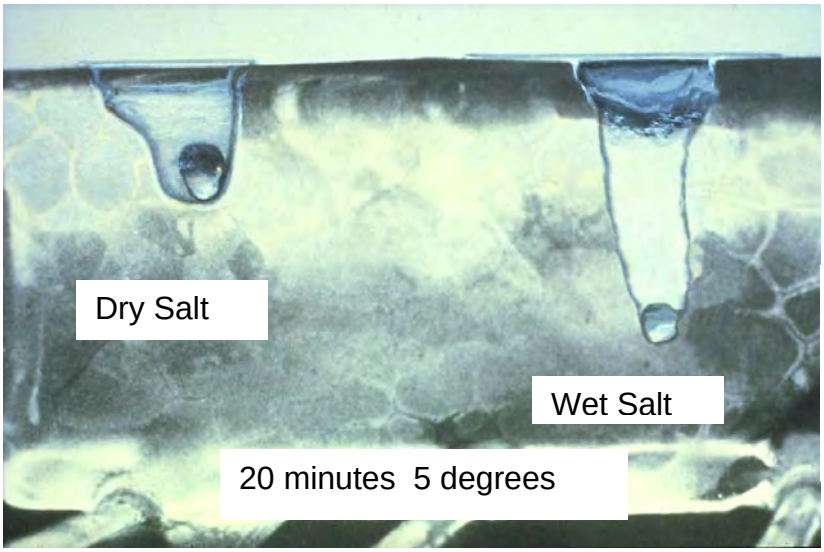

Photo courtesy of Wisconsin DOT transportation bulletin #22

Figure 14. Dry Salt vs. Wet Salt

- There are many types of liquid deicers.
- Brine is a common liquid deicer made from water and rock salt (NaCl).
- Prewetting (truck treatment) is the process of adding liquid to solids as they come off the truck onto the parking lot.
- Pretreating (stockpile treatment) is the process of adding liquid to solids in the stockpile.
- If you add sodium chloride (NaCl) liquid (brine) to dry salt, it will work faster.
- If you use magnesium chloride ($MgCl_2$) or calcium chloride ($CaCl_2$) liquid to dry salt, it will work faster and at lower temperatures.
- Prewetting or pretreating a sand stockpile is an alternative to adding dry salt to keep it flowing.
- Wet material sticks to the surface. Less is wasted by bounce and scatter.

Guidelines for pretreating stockpiles

Pretreating is mixing a liquid deicer into the stockpile of salt or sand. Salt brine, calcium or magnesium chloride or acetates may be used as pretreating agents.

Treated Stockpile Application

- You can apply pretreated salt with a pickup truck, a dump truck, a drop or rotary spreader or almost any type of equipment used for dry salt.
- No equipment changes are required.
- Remember to turn down the application rate; you will need 1/3 less material than dry salt.

Cover salt and salt/sand piles and place them on an impervious pad to limit runoff and infiltration of chlorides.

Treated salt stockpile

- Spray the salt stockpile with a liquid deicing chemical. Salt may be purchased pretreated or mixed on site by you or the vendor.
- When treating the stockpile, apply at 6 to 8 gallons/ton. For $MgCl_2$, rates greater than 6 gallons/ton tend to leach out.
- Because leach risk at a stockpile is increased, proper storage is even more important.
- Be careful not add too much liquid. Follow guidelines.

Covering your stockpile protects the salt from wind, rain and snow and reduces waste.

Treated sand stockpile

- Spray the sand stockpile with a liquid deicing chemical.
- Apply to stockpile at 4 to 6 gallons of salt brine/ton sand.
- Because leach risk at a stockpile is increased, proper storage is even more important.

Generally you can use 1/3 less material if you prewet or pretreat and it works faster than dry salt!

Guidelines for prewetting

Prewetting is adding a liquid to the salt as it comes off of the truck. This can happen either at the spinner or through a soaker pipe in the auger box. While prewetting requires some equipment changes, it provides flexibility to switch the chemical makeup depending on conditions. Salt brine, calcium or magnesium chloride, or acetates may be used as prewetting agents.

Tips

- Remember to turn down the application rate; you will need 1/3 less than dry salt.
- Requires tanks and hoses on your truck.
- Best if you can turn on/off the liquid from inside the cab.
- Best if you can regulate the flow of liquids to be synchronized with the flow of solids so you are getting the proper mix.
- The optimal application rate is 8 to 14 gallons/ton for salt brine, 6-8 gallons/ton for $MgCl_2$.

- Prewetting with a chemical other than salt brine can reduce the application rate even further.
- Below 15º F, salt brine is less effective than other liquids and has the potential of freezing hoses and valves. Verify it is mixed at 23.3% to reduce freezing risk.
- Prewetting is most practical with a dump truck. Use of a pickup truck may be limited due to material weight.
- Think twice before mixing chemicals to form "hotter" brine. This is where problems often occur.

Use cautiously. Many deicers contain trace metals including cyanide, arsenic, lead, and mercury.

Two common overuses of salt are applying to already wet surfaces and not giving the material enough time to work, but adding more on top of existing salt.

Deicing/Traction

Deicing is a reactive operation where a deicer is applied to the top of an accumulation of snow, ice, or frost that has already bonded to the pavement surface and can no longer be physically removed. Deicing costs more than anti-icing in materials, time, equipment, and environmental damage. Deicing is the "traditional" approach to winter maintenance.

The goal is not to melt everything. The goal is to penetrate through the ice and snow and break the bond so the pavement can be plowed.

Deicing

Removing ice that has already bonded to the pavement is difficult. Removing it mechanically can damage equipment and surfaces. Generally, enough ice must be melted chemically to break the bond between the ice and the pavement. This requires larger amounts of chemical, making deicing much less efficient than anti-icing.

Use the application rate table to help you with deicing. Using recommended rates will help you with these common problems:

- Over-salting. Most over-salting can be prevented by using calibrated spreaders and good judgment in selecting application rates based on pavement temperatures.
- Trying to melt everything. Don't try to melt all the snow or ice on the surface with salt. This is an overuse of materials. Apply just enough to loosen the bond between the surface and the ice so it can be plowed off.

Using abrasives

Use winter sand and other abrasives when temperatures are too cold for deicing chemicals to be effective. But be aware that sand does not melt anything. It provides temporary traction, and only when it is on top. As a result, avoid sand use as much as possible. When sand is in contact with the pavement, sweep it up. It is no longer useful to you and can only harm the environment. Sand on dry pavement can cause skidding.

Advantages of sand (abrasives)

- Short-term traction: Abrasives can be helpful in areas of slow moving traffic, such as intersections.
- Useful in very cold temperatures when chemicals will not work.

Disadvantages of sand

- Sand is not cheap when you consider handling, clean-up, and disposal costs.
- Sand will be tracked into your lots or buildings. Sweep this up as often as possible and dispose of it properly.
- Used sand is contaminated with various pollutants such as oil, grease, metal and rubber and should not be used for clean fill unless screened, should not be used for sandboxes or beaches, and should not be dumped in wetlands, fields or any natural area.
- Once sand is driven over many times, the particles are much finer and can cause air quality concerns.
- Cannot be used over pervious asphalt, pervious concrete, or pervious pavers.

Sweeping

Sweep the sand from the parking lot areas midwinter as well as in the spring. Trailer-type power sweepers are available that can be hauled behind a pickup truck. Smaller power brooms or sweepers may be used on sidewalks. Workers should wear a dust mask to avoid inhalation of the fine dust particles.

- Used sand is contaminated with pollutants such as oil, grease, metal and rubber.
- Sweepings often can be brought to a landfill. Inform landfill operator in advance.
- Keep children from playing on the sweeping piles.
- Sweepings may be reused by some industries.
- Before reusing sweepings, trash, leaves and other debris should be removed from them. This is often accomplished by screening. When screening sweepings for reuse, use a small mesh for the final screening to ensure that all of the larger debris has been removed. (A 3/4-inch mesh will screen out much of the debris.) Dispose of trash and debris removed from the sweepings by recycling it (*e.g.,* aluminum cans), composting it (*e.g.,* leaves) or sending it to a sanitary landfill.

For more information on sweeping refer to the MPCA website: www.pca.state.mn.us.

Sweep up sand frequently, after each event if possible. Sand that washes into a stream or lake increases water turbidity, clogs fish gills, inhibits plant growth, and may kill small aquatic organisms due to smothering.

Sand clogs storm sewers, ponds, ditches and is expensive to clean up.

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Evaluate the effectiveness of your actions

After the Storm

When snow and ice control operations have ended after the storm, evaluate what was done, what worked, and what could be changed to improve operations.

- Have an after-the-storm discussion with the maintenance crew.
- Have an after-the-storm discussion with the property manager.
- Consider the environmental impacts caused by your deicer/abrasive use.
- Based on all aspects of the storm fighting experience, look for ways to improve your practices.
- Accurately record your material use at each site.
- Clean and check all equipment.
- At the end of the season, clean and maintain the truck, tanks, brine-making systems, and pumps according to manufacturer specifications.
- Do not use deicers at the end of the season just to use them up. Save them for next year. Place all piles on an impervious pad and cover them. This includes salt and salt/sand mixes.

Save extra salt at the end of the season. Do not apply just to get rid of it.

Winter abrasives are an air pollution concern. They get crushed by tires and the tiny dust can become airborne. Sweep up after the storm.

Documenting and charting

Good documentation leads to reduced use of materials, more effective snow and ice control, reduced environmental impacts, and cost savings.

- Unless you document and chart, you can't measure what you are doing.
- Track your material use. Learn to record what and how much you apply at each site, each time you visit. Be prepared to analyze and make adjustments to your process based on what you learn.
- Use forms like those shown in the appendix of this manual to record and track your work and observations.

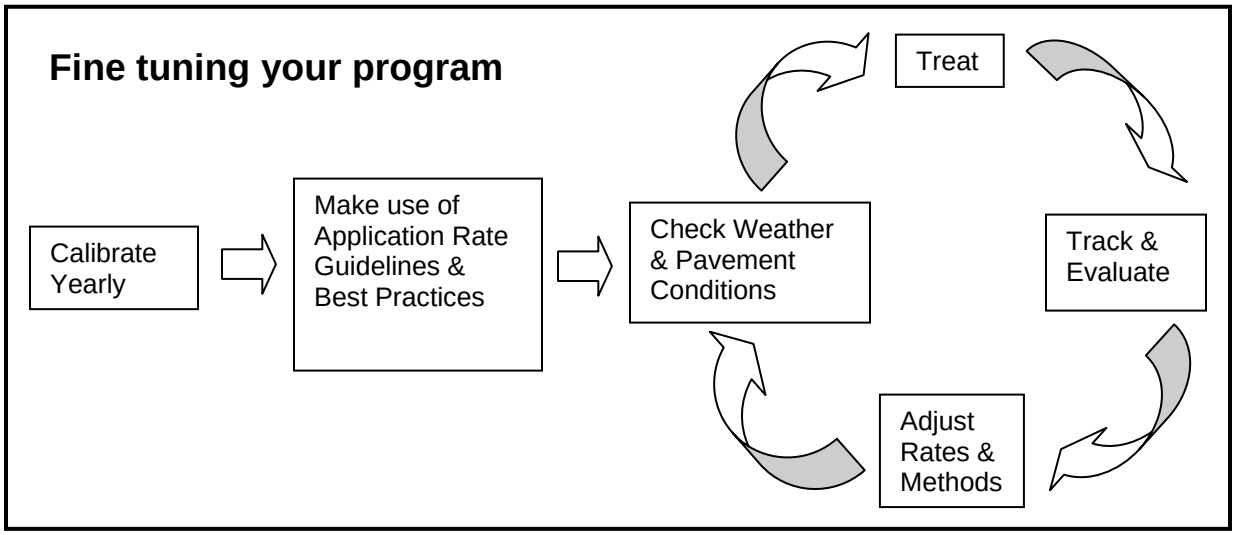

Figure 15. Fine Tuning Your Program

You can't manage what you don't measure.

Following Best Practices and documenting your actions will help prove you are doing the best job possible and may reduce your liability.

Documentation Form For Anti-Icing

Anti-icing Data Form				
Location: Date:				
Air Temp.	Pavement Temp.	RH	Dew	Sky
Reason for applying: Location: Chemical: Application Time: Application Amount: Observation (1st day): Observation (After event): Observation (Before next application): Name:				

Table 16. Documentation Form for Anti-Icing

RH- relative humidity
Dew- dew point
Sky- sunny to cloudy

Documentation Form for Deicing

Deicing Data Form			
Operator:			
Location:			
Event Began:	Date	Time	
Event ended:	Date	Time	
Event type:	snow	rain	both
Total precipitation:			
Pavement temp.:		Air temp.:	
Dew point:			
Temperature Trend:			
Material used:			
Amount used:			
Application rate:			
Observations:			

Table 17. Documentation Form for Deicing

Application Rates for Reduced Environmental Impacts

Effective application rates are based on many factors, including type and rate of precipitation, air and pavement temperature, forecast and temperature trend, humidity, dew point, type of surface and subsurface material and sun exposure. The application rate tables used in this book have been taken from the Mn Snow & Ice Control Field Handbook, Manual 2005-1. These application rates are not perfect but are to be used as a stepping stone to improve your performance. Develop your own application rates using the guidelines included in this handbook as a starting point. Modify your practices incrementally over time to fit your needs. Make it a goal to reduce application rates and keep surfaces safe.

Anti-Icing Application Rate Guidelines **These are a starting point only. Adjust based on your experience.**			
Condition	**Gallons/1000 sq. ft.**		**Other Products**
	$MgCl_2$	**Salt Brine(NaCl)**	
1. Regularly scheduled applications	0.1 - 0.2	0.25 – 0.3	Follow manufacturers' recommendations
2. Prior to frost or black ice event	0.1 - 0.2	0.25 – 0.3	
3. Prior to light or moderate snow	0.1 - 0.2	0.2 – 0.4	
CAUTION: Too high an application rate may result in slippery conditions or tracking.			

Table 18. Anti-Icing Application Rates

***How to use the anti-icing rate table above*:**

1. Determine your parking lot or sidewalk area in square feet.
2. Calculate size factor: Divide that area by 1000 (chart is based on a 1000 square foot area).
3. Find the application rate: Choose your condition in the first column of the table and follow sideways, stopping at the anti-icing chemical you are using.
4. Determine how many gallons you need: Multiply the application rate by your size factor.

Tip: To convert from gallons to ounces: multiply result from #4 by 128.

One 50 lb. bag of salt can contaminate over 10,000 gallons of water.

Deicing Application Rate Guidelines for Parking Lots and Sidewalks

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Pavement Temp. (ºF) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate in lbs/per 1000 square foot area			
			Salt Prewetted/ Pretreated With Salt Brine	Salt Prewetted/ Pretreated With Other Blends	Dry Salt	Winter Sand (abrasives)
>30º↑	Snow	Plow, treat intersections only	0.75	0.5	0.75	not recommended
	Frz. Rain	Apply chemical	1.25	1.0	1.5	not recommended
30º↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75.	not recommended
25 - 30º ↑	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75	not recommended
25 - 30º ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.75	1.5	2.25	3.25
20 - 25º ↑	Snow or Frz. Rain	Plow & apply chemical	1.75	1.5	2.25	3.25 for frz. rain
20 - 25º ↓	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
15º to 20º↑	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
15º to 20º↓	Snow or Frz. Rain	Plow & apply chemical	2.5	2.0	3.0	3.25 for frz. rain
0 to 15º ↑ ↓	Snow	Plow, treat with blends, sand hazardous areas	not recommended	3.0	not recommended	5.0 spot treat as needed
< 0º	Snow	Plow, treat with blends, sand hazardous areas	not recommended	4.5	not recommended	5.0 spot treat as needed

Table 19. Application Rates for Deicing

Instructions for using application rate table if you calibrate your spreaders

1. Using Deicing Application Rate Guidelines for Parking Lots and Sidewalks. Select the row with the appropriate pavement temperature, temperature trend, and weather conditions.➔
2. Select the column that has the type of material you are using.🡻
3. Find the box where the row and columns intersect to find the application rate. ➔🡻
4. Compare those values to the calibration chart for your truck.*
5. Dial the correct setting for the rate calculated.

*If your spreader is calibrated in lbs/lane mile refer to Table 21 for conversion to lbs/1000 square feet.

Example:

1. Temperature: 22ºF and falling. It has finished snowing. Parking Lot: 54,000 sq. ft. ➔
2. Deicer: salt pretreated with salt brine. 🡻
3. Find the 20 – 25º ↓ box. Follow it to the right under the column labeled "Salt Prewetted/pretreated with salt brine." Read the rate in the box.

The box where the column and row intersect shows a rate of 2.0 /1000 square feet. ➔🡻

4. Refer to the calibration chart in your vehicle and set the spreader to the setting that most closely matches the 2.0 lbs/1000 square feet.

How much material will be applied in this example?

a. Calculate parking lot size factor: Divide parking lot size (54,000 sq. ft.) by 1,000 sq. ft. 54,000/1,000 = 54 The size factor is 54.

c. Use the size factor multiplied by the rate from step 3 above to find the amount of material to use for the 54,000 square foot lot.
Multiply 2.0 by 54 = 108.

The application amount for the entire lot is 108 lbs. prewetted/pretreated salt brine.

Instructions for using application rate table if you DO NOT calibrate your spreaders

Follow steps 1 – 3 above and the following instructions:

4. Calculate parking lot size factor: Divide parking lot size by 1,000 square feet.
5. Use the size factor (step 4) multiplied by the application rate (from step 3) to find the amount of material to use. Spread this amount evenly over your parking lot.

 ***Once chlorides enter the ground or surface water, they never go away.***

Results

The first winter maintenance training and certification workshops were held in 2005. After holding several classes, it was determined that a training manual was needed. The Winter Parking Lot and Sidewalk Maintenance Manual was written in 2006 and the training classes using the manual started in the winter of 2006-2007. In order to evaluate the effectiveness of the training, three class exercises were created. These exercises show potential rate reductions, potential change in practices and evaluate the training program. The results from the in class exercises were compiled at the end of the 2007-2008 winter season and are shown below.

Potential Changes

In 2007-2008, 345 people attended 14 Winter Parking Lot and Sidewalk Maintenance Workshops and filled out the forms used to evaluate the course. The summary of all the exercises is given below.

Rate Reduction:

- **95%** of attendees found that they need to either reduce the amount of material that they use, or not use that material at all.
- **96%** of attendees who used rock salt found that they need to reduce their application rates.
- **24%** of all attendees used sand or salt/sand mix. They found that they are using the wrong material.
- **62%** Average potential reduction in salt application rates
- **20% - 89%** Range of potential reduction

Best Management Practices (BMP):

Attendees were given a survey about their BMP practices. Out of 19 recommended practices listed:

- Before training: **31%** of BMPs were already being used
- After training: **76%** BMPs will be used in the future (as stated by participants)

Evaluation:

- Recommend class to colleagues? **93% yes**
- Was this class useful to you? **87% yes**
- Do you think you will be able to reduce the environmental impacts of the winter maintenance activities as a result of attending this class? **79% yes**

Comments from those attending class:

"*It's about time people got concerned about our water. Thanks for your work"*
"Real world examples by people using these methods brings integrity to the presentation"
"Awesome job! I can see the wheels turning in people's heads"
"Spread the word fast. This information is too important"!
"I am very surprised to learn so much about a subject that I thought I knew. "

Actual Changes

Following the winter season, follow up interviews were conducted to learn more about the winter maintenance changes made since training. The individuals interviewed had attended the training and volunteered to be part of our follow up research on the effectiveness of the training class. Several examples of these interviews are included below.

School District of Superior Wisconsin
Michael Soderlund - Maintenance Worker

Michael Soderlund attended the Parking Lot Training in October, 2007. After the training, many new successful changes were implemented. Overall, the District of Superior reduced their total use of deicers. One of the biggest steps forward was the production of their own brine. Michael said that everything is currently working well and there is no marked reduction in quality. Many District of Superior workers were initially hesitant about the new practices, but after a few tries they realized that the new methods work just as well or even better. The material application rates were greatly reduced, especially in the middle school and high school. The actual reduction rates are given below.

Rates:

2006-2007
The district used 294 bags of ice melt (50 lb bags)
The total was $2,320.48.

2007-2008
The district used 196 bags of ice melt.
The total was $1,552.32

Reduction in ice melt use: 33.3%
Reduction in cost: 33.1%

University of Minnesota Twin Cities campus
Jim Weber - U of M Facilities Management

Over the past few years, the U of M recognized the need to become much more environmentally conscious with winter maintenance, storm water management and the campus environment. They made many changes in their snow removal program; two key areas were employee training and calibration of equipment. By increasing awareness of proper application rates, they were able to significantly decrease the amount of de icing chemical we used. They started an aggressive anti-icing program with Liquid Magnesium Chloride for their sidewalks and salt brine for the streets and loading docks. Pre-storm applications were extremely successful in reducing the bond of snow and ice to walks as well as giving them more response time on the front end of snow events. They focused on mechanical removal of snow as their first line of defense and they have changed the main deicer for walks from a blended material to straight Magnesium Chloride. They dramatically reduced the sand in their sidewalk and street program which has saved them time and money in spring clean up and long term savings are expected in storm sewer maintenance. Small amounts of sand are still used as pattern indicators for their sidewalk trucks and for use during extreme cold weather. The numbers speak for themselves:

Material # 1 – Rock Salt
1997 - 2005 average: 775 tons of salt
2006 - 2008 average: 462 tons of salt

Net Average Reduction: 313 tons
% Reduction: 41%
Material Cost: $48.53/ton
Amount Saved: $15,193 average per year (2006 – 2008)

Material #2 – Ice Melt (Magnesium Chloride - MgCl2)
1997 - 2005 average: 131 tons
2006 - 2008 average: 64 tons

Net Average Reduction: 67 tons
% Reduction: 51%
Material Cost: $410/ton
Amount Saved: $27,470 average per year (2006 – 2008)

Material #3 – Sand
1997 - 2005 average: 1965 tons
2006 - 2008 average: 18 tons

Net Average Reduction: 1947 tons
% Reduction: 99%
Material Cost: $8.30/ton
Amount Saved: $16,160 average per year (2006 – 2008)

Net-Work Services Company
Bob Rush – Director of Operations

NSC is a national facility management company that services commercial properties in 22 states. NSC's responsibility is to manage all building services which include hiring and managing winter maintenance contractors. While working in his prior role as Regional Manager for Minnesota and North Dakota, Bob Rush required all of his Minnesota winter maintenance contractors to be trained and certified on the best practices. As Director of Operations he has implemented a regional training program based on the Minnesota program. This allowed NSC to expand the training based on the best practices to all winter maintenance contractors in cold weather states. Bob has taken many steps to reduce the impacts of winter maintenance and to improve the safety of his operations

Bob required all Suppliers in the seven county Metro area to switch to a standardized treated salt for parking areas. He helped calibrate all truck mounted spreading equipment to insure they were not over applying the deicer.

Bob required all Twin City Metro and Duluth area suppliers to switch to a mag/hex for sidewalks. This standardized the deicer which helped the suppliers determine the correct application rates per sq. ft. based on temperature and location of the sidewalk.

He requested that all Twin City Metro suppliers attend the MPCA snow training program. He rewarded the suppliers that were able to show their certifications.

NSC held regional training sessions with all contractors, reviewed best practice for snow removal, and discussed the proper techniques and timing for deicer application.

He expanded the material that was developed by the MPCA and trained his Regional Managers that covered 14 States on best practices, impact on the environment and the need for continual training. They in turn introduced the training material in the larger markets like Salt Lake City, Denver, Omaha, Boise and others.

Bob requires preseason re-training of large suppliers to refresh them on the best practices.

They eliminated sand use in Minneapolis and Denver and continue to educate the maintenance contractors on the impact that sand has on the environment.

Net-Work Services reduced deicer use on parking lots by 15-20% in the first year of the program and on sidewalks by 20-25%. They hope to see additional reductions in the amounts of wasted material by continuing to help the teams understand the use of technology and best practices. Bob developed a working group to continue to research better practices and material with the goal of reducing deicer use and our impact on the environment.

Cadwell Lawn and Landscaping
Charles Cadwell – Owner

After attending the Parking Lot Training in 2005, Charles Cadwell's company examined their procedures for applying salt and deicing chemicals at Ridgedale Center and found some areas that were candidates for improvement. Practices in previous years included using salt rather carelessly and applying it to attempt to keep snow from accumulating during a storm. As such, it was quite common to apply twelve to fourteen tons of salt during a given storm. Since training, they examined their practices and have taken the following measures to reduce usage of salt products:

They reduced the speed setting on our auger to slow the feed rate of salt to the wheel. At the same time, we maintained the speed of the wheel and that made for better dispersion of the salt (more even dispersion of salt and greater coverage in a given load).

They inspected the truck tailgate because in previous years, they had a problem with spillage that resulted in "piles" of salt being dropped at random during turns or when hitting potholes or speed bumps. They found gaps between the tailgate sander and the truck bed that they filled with weather stripping. That forced all salt to be fed through the auger and baffle so that the spillage was eliminated. That further increased the coverage per given load that was achieved.

Based on the lectures provided in training, they no longer apply salt chemical during a storm. Salt is applied after the snow has been mechanically removed. The one exception to this is where some material might be needed to permit traffic safety at stop signs or on slopes and then it is used very sparingly after plowing the areas and then applying the chemical to facilitate traction. (That has occurred twice during this current year, to date.)

Average salt usage for a given snow event is now five to six tons. That is based on the number of loader buckets put in the truck where one bucket is considered to be one ton (Ridgedale does not have a scale). That form of measurement is standard for what we did in previous years and from one contractor to another.

They were able to further reduce salt applications the winter of 2007 -2008 by educating the customer on the mechanical removal being the major step and only when that is complete, applying salt to the pavement. They did use some salt during snowfalls that were extended to maintain traffic traction and safety, however the mall was very receptive to only using salt when absolutely necessary.

They were also able to maintain good performance in terms of the number of slip-and-fall incidents that occurred due to ice or snow. That supported our premises of using mechanical removal - then salt application as a process.

Resources and Bibliography

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Blackburn, R., D. Amsler, and K. Bauer. *Guidelines for Snow and Ice Control.* Presented at 10th AASHTO/TRB Maintenance Management Conference, Duluth, MN, July 2003. www.dot.state.mn.us/aashto/maintenance/files/Blackburn.ppt.

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Cornell Local Surfaces Program. *Calibration Chart. (really an application rate chart but named calibration chart)* www.clrp.cornell.edu/techassistance/calibration chart.pdf.

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Dow Chemical www.dow.com.

Federal Highway Administration. *Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel.* www.fhwa.dot.gov/reports/mopeap/eapcov.htm.

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Field Chemical Testing: Anti-icing and De-icing Liquids.
www.dot.state.mn.us/maint/research/chemical/The Field Book.pdf.

Minnesota Local Research Board, Mn/DOT Research Services Section and Office of Maintenance, August 2005. Minnesota Snow and Ice Control Field Handbook for Snowplow Operators. Manual number 2005-1. www.lrrb.org.

MPCA (Minnesota Pollution Control Agency), 2007. Minnesota's Ground Water Condition: A Statewide View, 11 p. http://www.pca.state.mn.us/publications/wq-gw1-02.pdf.

Nixon, W.A. "Snow-How." *Snow & Ice Manager,* January 2004. Primedia Business Magazines and Media. http://snow.grounds-mag.com/.

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Sohanghpurwala, A. A. "Cost of Winter Maintenance on Infrastructure". PowerPoint Presentation. Seventh Annual Road Salt Symposium. Crowne Plaza, Brooklyn Center, MN. 5 Feb 2008.

University of New Hampshire Technology Transfer Center. *Manual of Practice.* www.t2.unh.edu/pubs/manofpractice_1.pdf.

Additional Resources

Training and technical assistance

- Winter Maintenance Voluntary Certification Program.
- Minnesota Pollution Control Agency www.pca.state.mn.us/programs/roadsalt.html.
- The Circuit Training and Assistance Program (CTAP), a joint program of Mn/DOT and the Minnesota Local Technical Assistance Program (LTAP), brings training to cities, counties and townships 651-282-2160 or www.mnltap.umn.edu/ctap.
- Mn/DOT Winter Maintenance Coordinator: 651-366-3586.
- Winter Parking lot training, Winter road training & Power of winter maintenance professionals to protect our water presentations. Fortin Consulting Inc. 763-478-3606. fci@fortinconsulting.com www.fortinconsulting.com.
- Storage tank regulation questions – MPCA Customer Assistance Center 651-297-2274 or 800-646-6247.

Other Web resources

- Minnesota Snow and Ice Control Field Handbook for Snowplow Operators. August 2005. www.lrrb.org.
- RWIS – Road Weather and Information System. www.rwis.dot.state.mn.us is an Internet weather service provided by Mn/DOT. It gets its information from sensors embedded in the state highways.
- The Minnesota Stormwater Manual. November 2005. http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html.
- Iowa Department of Transportation. *Anti-icing Equipment Manual* (with drawings for shop-made equipment). www.dot.iowa.gov/maintenance/internetpages/chemicals/ManualAntiicingEquipment.pdf.
- Minimizing De-icing Salt Damage to Trees http://www.extension.umn.edu:80/distribution/naturalresources/DD1413.html.
- Minnesota Department of Transportation. *Guide to Field-Testing Deicing and Anti-Icing Chemicals.* www.dot.state.mn.us/maint/research/chemical/chem_evaluation_guide.pdf.
- MPCA fact sheet “Managing Street Sweepings” (Fact Sheet #4.54 September 1997) available at www.pca.state.mn.us.
- Plant selector tool. Allows you to select plants for many conditions including high salt areas. Minnesota Department of Transportation. http://plantselector.dot.state.mn.us.
- Protecting Water Quality in Urban Areas — A Manual, Chapter 7 – Pollution Prevention, http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html. pages 7.27-1 – 7.27-2 street sweeping and the reuse of sweepings
- Assessment of Stormwater Best Management Practices http://wrc.umn.edu/outreach/stormwater/bmpassessment/assessmentmanual/index.html , Chapter 7 – Source Reduction, pages 17 and 21-24 street sweeping and its effectiveness.

- Snow and Ice Management Association (SIMA) www.sima.org.
- Pacific Northwest Snowfighters. www.wsdot.wa.gov/partners/pns/default.htm.
- Salt Institute. *Practical Guide for Storing and Handling Deicing Salt.* www.saltinstitute.org/snowfighting.
- Salt Institute. *Calibration Instructions* (with downloadable Excel worksheet) www.saltinstitute.org/snowfighting/6-calib.html.
- Lake Superior Duluth Streams. "How much salt is a problem" http://duluthstreams.org/understanding/impact_salt_2.html].
- Salt Institute. Snow and Ice List Serve: www.sicop.net.
- Transportation Association of Canada. Syntheses of Best Practices-Road Salt Management:

  www.tac-atc.ca/english/informationservices/readingroom.cfm#syntheses.

Material Conversions

SAND			SALT	
Yards	Tons		Yards	Tons
1	1.4		1	1.1
2	2.8		2	2.2
3	4.2		3	3.2
4	5.6		4	4.3
5	7.0		5	5.4
6	8.4		6	6.5
7	9.8		7	7.6
8	11.2		8	8.6
9	12.6		9	9.7
10	14.0		10	10.8
11	15.4		11	11.9
12	16.8		12	13.0
13	18.2		13	14.0
14	19.6		14	15.1
15	21.0		15	16.2
16	22.4		16	17.3
17	23.8		17	18.4
18	25.2		18	19.4
19	26.6		19	20.5
20	28.0		20	21.6

Table 20. Material Conversions

The following formulas and the above quick reference table will help you convert between tons and cubic yards. Weights will vary depending upon moisture content.

1. To convert tons of clean sand to cubic yards: # tons divided by 1.4 = cubic yards
2. To convert cubic yards of clean sand to tons: # cubic yards multiplied by 1.4 = tons
3. To convert tons of winter sand to cubic yards: # tons divided by 1.37 = cubic yards
4. To convert cubic yards of winter sand to tons: # cubic yards multiplied by 1.37 = tons
5. To convert tons of straight salt to cubic yards: # tons divided by 1.08 = cubic yards
6. To convert cubic yards of straight salt to tons: # cubic yards multiplied by 1.08 = tons

Use these tables to convert application rates between pounds per lane mile and pounds per 1000 square feet.

lbs/ lane mile*	lbs/1000 square feet
25	0.4
50	0.8
75	1.2
100	1.6
125	2.0
150	2.4
175	2.8
200	3.2
225	3.5
250	3.9
275	4.3
300	4.7
350	5.5

lbs/1000 square feet	lbs/ lane mile*
0.5	32
0.75	48
1	63
1.25	79
1.5	95
1.75	111
2	127
2.25	143
2.5	159
2.75	174
3	190
3.25	206
5	317

*12 foot lane width

Table 21. Application Rate Conversion Charts

Common Conversions

- 1 lane mile (12' x5280 ft.) = 63360 square feet
- Average size parking spot: 9 x 20 feet or 10 x 20 feet = 180 – 200 square feet
- Driving isles (2-way) = About 25 feet wide
- 1 acre = 43,560 square feet
- 1 ton = 2000 lbs.
- 1 cup of salt (NaCl) = 0.6 lbs.
- Salt (NaCl) weighs 72 – 84 lbs/ft^3 depending upon moisture and granule size
- 1 gallon = 128 ounces
- 1 cubic yard of salt = 1.1 ton
- 1 cubic yard of sand = 1.4 tons
- 1 cubic yard = 27 cubic feet
- 1 square yard = 9 square feet

Definitions

°C – degrees Celsius
°F – degrees Fahrenheit
brine – liquid deicer made from water and rock salt (NaCl)
lbs. – pounds
LTAP – Local Technical Assistance Program
mg/l – milligrams per liter
Mn/DOT or MnDOT – Minnesota Department of Transportation
MPCA – Minnesota Pollution Control Agency
mph – miles per hour
ppm – parts per million
psi – pounds per square inch
sq. ft. – square feet

APPENDIX F

MONTHLY FACILITY STORM WATER CONTROL INSPECTION FORMS

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Facility Name: **Coopersville Garage** Date: _____

Person completing form (printed name): _____

Control devices present. Select all that were inspected.

___ catch basins (8)

___ curb and gutter

___ retention pond

___ storm water discharge pipes (2)

___ Other (list)

_____

_____

Checklist:

☐ YES ☐ NO Are structural stormwater control devices accessible?

☐ YES ☐ NO Are structural stormwater control devices free of debris, oil and grease, and other pollutants?

☐ YES ☐ NO Are inlet/outlet pipes and/or devices clear and undamaged?

☐ YES ☐ NO Are storm water management devices maintained and functioning properly?

☐ YES ☐ NO Is the storm water discharge pipe dry or without flowing water?

For every NO that is checked above, explain why below:

_____

_____

_____

_____

_____

Is ***any*** maintenance needed? ☐ YES ☐ NO If yes, document on the back of this form.

Provide copy to Facility Supervisor and Environmental Coordinator to schedule any necessary maintenance. Attach facility map with additional notes and/or photos if appropriate.

_____ _____

Inspector's Signature Title

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Stormwater Maintenance Needs for <u>Coopersville Garage</u>

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: _____________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: _____________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: _____________________________________

____

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Facility Name: **Grand Haven Garage/Administration** Date: _____

Person completing form (printed name): _____

Control devices present. Select all that were inspected.

___ catch basins (19)

___ curb and gutter

___ check dam

___ storm water discharge pipe

___ Other (list)

_____

_____

Checklist:

☐ YES ☐ NO Are structural stormwater control devices accessible?

☐ YES ☐ NO Are structural stormwater control devices free of debris, oil and grease, and other pollutants?

☐ YES ☐ NO Are inlet/outlet pipes and/or devices clear and undamaged?

☐ YES ☐ NO Are storm water management devices maintained and functioning properly?

☐ YES ☐ NO Is the storm water discharge pipe dry or without flowing water?

For every NO that is checked above, explain why below:

_____

_____

_____

_____

_____

Is ***any*** maintenance needed? ☐ YES ☐ NO If yes, document on the back of this form.

Provide copy to Facility Supervisor and Environmental Coordinator to schedule any necessary maintenance. Attach facility map with additional notes and/or photos if appropriate.

_____ _____

Inspector's Signature Title

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Stormwater Maintenance Needs for <u>Grand Haven Garage/Administration</u>

Describe maintenance needed: ____

____

____

Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments: _______________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments: _______________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments: _______________________________________

____

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Facility Name: **Holland Garage** Date: _____

Person completing form (printed name): _____

Control devices present. Select all that were inspected.

___ catch basins (9)

___ curb and gutter

___ detention ponds (2)

___ storm water discharge pipes (2)

___ Swale

___ Other (list)

_____

_____

Checklist:

☐ YES ☐ NO Are structural stormwater control devices accessible?

☐ YES ☐ NO Are structural stormwater control devices free of debris, oil and grease, and other pollutants?

☐ YES ☐ NO Are inlet/outlet pipes and/or devices clear and undamaged?

☐ YES ☐ NO Are vegetated controls (detention ponds, swale) free of noxious weeds?

☐ YES ☐ NO Are storm water management devices maintained and functioning properly?

☐ YES ☐ NO Is the storm water discharge pipe dry or without flowing water?

For every NO that is checked above, explain why below:

_____

_____

_____

_____

_____

Is ***any*** maintenance needed? ☐ YES ☐ NO If yes, document on the back of this form.

Provide copy to Facility Supervisor and Environmental Coordinator to schedule any necessary maintenance. Attach facility map with additional notes and/or photos if appropriate.

_____ _____

Inspector's Signature Title

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Stormwater Maintenance Needs for <u>Holland Garage</u>

Describe maintenance needed: ____

____

____

Date resolved: _______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: _________________________ Comments: _______________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: _______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: _________________________ Comments: _______________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: _______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: _________________________ Comments: _______________________________________

____

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Facility Name: **Hudsonville Garage** Date: _____

Person completing form (printed name): _____

Control devices present. Select all that were inspected.

___ catch basins (6)

___ curb and gutter

___ underground storage tank

___ storm water discharge pipes (2)

___ Other (list)

_____

_____

Checklist:

☐ YES ☐ NO Are structural stormwater control devices accessible?

☐ YES ☐ NO Are structural stormwater control devices free of debris, oil and grease, and other pollutants?

☐ YES ☐ NO Are inlet/outlet pipes and/or devices clear and undamaged?

☐ YES ☐ NO Are storm water management devices maintained and functioning properly?

☐ YES ☐ NO Is the storm water discharge pipe dry or without flowing water?

Ensure that storage tank is discharging to sanitary sewer when salt and/or sand is present on storage/mixing pad.

For every NO that is checked above, explain why below:

_____

_____

_____

_____

_____

Is ***any*** maintenance needed? ☐ YES ☐ NO If yes, document on the back of this form.

Provide copy to Facility Supervisor and Environmental Coordinator to schedule any necessary maintenance. Attach facility map with additional notes and/or photos if appropriate.

_____ _____

Inspector's Signature Title

Ottawa County Road Commission

Monthly Facility Storm Water Control Inspection Form

Stormwater Maintenance Needs for Husdonville Garage

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: ____________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: ____________________________________

____

Describe maintenance needed: ____

____

____

Date resolved: ______________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: ________________________ Comments: ____________________________________

____

APPENDIX G

STORM WATER COMPREHENSIVE SITE INSPECTION FORMS

Storm Water Comprehensive Site Inspection

With Fuel Station

This checklist shall be completed at least once every 6 months at facilities that were determined to have a high potential for pollutant runoff.

INSPECTOR'S NAME:	DATE:
NAME & ADDRESS OF FACILITY:	
GENERAL OBSERVATIONS:	
WEATHER:	

Facility Operation				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are vehicles parked indoors or under a roof when not in use?				
Are operations such as vehicle washing, vehicle maintenance, draining of fluids, storage of fluids and waste performed under a roof or inside?				
Are vehicles washed regularly to remove contamination and prevent it from polluting stormwater?				
Is wash water treated in an oil-water separator prior to discharge?				
Is process water diverted to a trench drain system to collect contaminated run-off inside work areas?				
Is process water from the trench drain system treated in an oil-water separator prior to discharge?				
Are solids cleaned out of the oil-water separator and trench drain system regularly?				
When working outdoors, is contaminated process water and sediment collected to prevent it from mingling with and contaminating stormwater?				
Are drains inside the facility connected to a sanitary sewer?				

Storm Water Comprehensive Site Inspection

With Fuel Station

Fluids Management				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are fluids in tanks or drums stored with an appropriate amount of secondary containment?				
Are drum-top pads used for leaks and spills that occur during transfer of fluids?				
Are fluids drained over a drip pan or pad?				
Are funnels or pumps used when transferring fluids?				
Are drip pans placed under leaks?				
Are containers maintained in good condition, closed, covered and away from equipment that can cause them to tip over?				
Are containers stored inside or under a roof?				
Are containers inspected regularly?				
Are all containers labeled in a manner that describes the contents adequately?				
Are absorbent pads used on drum tops to catch spills?				
Is a closed-loop parts washer system used (contains solvent)?				
Is the parts-washer lid kept closed when not in use?				
Is a contract in place with a parts washer service company to change out spent solvent?				
Has the possibility of using an aqueous-based parts washer been explored?				
Are fluids stored in appropriate containers and/or storage cabinets?				
Are storage areas kept clean and well organized?				
Are storage areas labeled clearly?				

Storm Water Comprehensive Site Inspection

With Fuel Station

Leak and Spill Prevention and Control				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are vehicles inspected daily for leaks?				
Is spill control equipment and absorbents readily available? (Spill kits clearly labeled)				
Are emergency phone numbers posted in the area?				
Are material safety data sheets (MSDS's) readily available?				
Are spills cleaned up immediately?				
Are employees trained annually on spill prevention?				
Oil Management				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is oil changed indoors over concrete, sloped to a drain or curbed surface?				
Is oil changed over a drip pan or pad?				
Are funnels or pumps used when transferring oil?				
Are drip pans placed immediately under any oil leak?				
Is waste oil stored indoors when possible and with secondary containment?				
Are waste oil containers in good condition, closed, labeled and inspected regularly?				
Is anything else mixed with waste oil?				
Is waste oil recycled?				

Storm Water Comprehensive Site Inspection

With Fuel Station

Antifreeze				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is antifreeze changed indoors over concrete that is sloped to drain or curbed surface?				
Is antifreeze drained over a drip pan or pad?				
Are funnels or pumps used when transferring antifreeze?				
Are drip pans placed immediately under any leak?				
Is waste antifreeze stored indoors when possible with secondary containment?				
Are containers kept in good condition, closed, labeled and inspected regularly?				
Is antifreeze mixed with any other wastes?				
Is waste antifreeze recycled?				
Lead-Acid Batteries				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are lead-acid batteries stored indoors over a curbed impermeable surface?				
Are intact batteries stored on an acid resistant rack or tub?				
Are cracked or leaking batteries stored in closed leak-proof and labeled containers?				
Is the date each battery was placed into storage recorded?				
Are batteries stacked more than 5 high?				
Are batteries inspected regularly for leaks?				
Are acid neutralizing agents, such as baking soda, available in case of leaks?				
Are batteries recycled?				
Are batteries stored longer than 6 months before recycling?				
Are lead cable ends left on the batteries to be recycled?				

Storm Water Comprehensive Site Inspection

With Fuel Station

Tires				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are tires stored indoors?				
If tires are stored outdoors, is the tire pile covered?				
Are tires recycled frequently to keep the number of tires stored on site low?				

Fueling Areas				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is fueling performed under a canopy?				
Are spill cleanup materials available at the fueling area?				
Is the fueling handle lock disconnected so the person fueling must attend the fueling process?				
Are breakaway valves used on fueling hoses?				
Is fueling area stormwater runoff treated in an oil-water separator?				
Are all fuel deliveries monitored?				
Is the fueling automatic stop inspected regularly to ensure proper function?				

Rags, Oil-Absorbing Pads, Towels and Clothing				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are oil rags and absorbent pads stored in appropriate containers and disposed of properly?				
Are reusable oily materials such as towels and clothing maintained through a commercial laundering service or an in-house washing machine that discharges to a sanitary system through and oil-water separator?				

Storm Water Comprehensive Site Inspection

With Fuel Station

Salt Storage				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are salt piles stored in a salt storage building or under a roof?				
Are salt spills at a facility cleaned up promptly?				
Does stormwater drain away from the salt pile?				
Miscellaneous Storage Piles				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are piles of spoils, asphalt, street cuts, etc. stored at the facility under a roof or cover?				
Are spills of miscellaneous debris on facility grounds cleaned up promptly?				
Facility Stormwater Runoff				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is uncontaminated stormwater prevented from mixing with process areas?				
Are stormwater controls free of debris, in good condition and functioning properly? *Attach completed Stormwater Control Inspection Checklist.*				

Comments/Action Items:

Submit completed report to Facility Manager or person in charge of storm water program. A copy will be provided to the Environmental Coordiantor.

Inspector's Signature

Date

Storm Water Comprehensive Site Inspection

Without Fuel Station

This checklist shall be completed at least once every 6 months at facilities that were determined to have a high potential for pollutant runoff.

INSPECTOR'S NAME:	DATE:
NAME & ADDRESS OF FACILITY:	
GENERAL OBSERVATIONS:	
WEATHER:	

Facility Operation				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are vehicles parked indoors or under a roof when not in use?				
Are operations such as vehicle washing, vehicle maintenance, draining of fluids, storage of fluids and waste performed under a roof or inside?				
Are vehicles washed regularly to remove contamination and prevent it from polluting stormwater?				
Is wash water treated in an oil-water separator prior to discharge?				
Is process water diverted to a trench drain system to collect contaminated run-off inside work areas?				
Is process water from the trench drain system treated in an oil-water separator prior to discharge?				
Are solids cleaned out of the oil-water separator and trench drain system regularly?				
When working outdoors, is contaminated process water and sediment collected to prevent it from mingling with and contaminating stormwater?				
Are drains inside the facility connected to a sanitary sewer?				

Storm Water Comprehensive Site Inspection

Without Fuel Station

Fluids Management				
	Yes	No	N/A	Notes/Maintanence Needs
Are fluids in tanks or drums stored with an appropriate amount of secondary containment?				
Are drum-top pads used for leaks and spills that occur during transfer of fluids?				
Are fluids drained over a drip pan or pad?				
Are funnels or pumps used when transferring fluids?				
Are drip pans placed under leaks?				
Are containers maintained in good condition, closed, covered and away from equipment that can cause them to tip over?				
Are containers stored inside or under a roof?				
Are containers inspected regularly?				
Are all containers labeled in a manner that describes the contents adequately?				
Are absorbent pads used on drum tops to catch spills?				
Is a closed-loop parts washer system used (contains solvent)?				
Is the parts-washer lid kept closed when not in use?				
Is a contract in place with a parts washer service company to change out spent solvent?				
Has the possibility of using an aqueous-based parts washer been explored?				
Are fluids stored in appropriate containers and/or storage cabinets?				
Are storage areas kept clean and well organized?				
Are storage areas labeled clearly?				

Storm Water Comprehensive Site Inspection

Without Fuel Station

Leak and Spill Prevention and Control				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are vehicles inspected daily for leaks?				
Is spill control equipment and absorbents readily available? (Spill kits clearly labeled)				
Are emergency phone numbers posted in the area?				
Are material safety data sheets (MSDS's) readily available?				
Are spills cleaned up immediately?				
Are employees trained annually on spill prevention?				
Oil Management				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is oil changed indoors over concrete, sloped to a drain or curbed surface?				
Is oil changed over a drip pan or pad?				
Are funnels or pumps used when transferring oil?				
Are drip pans placed immediately under any oil leak?				
Is waste oil stored indoors when possible and with secondary containment?				
Are waste oil containers in good condition, closed, labeled and inspected regularly?				
Is anything else mixed with waste oil?				
Is waste oil recycled?				

Storm Water Comprehensive Site Inspection

Without Fuel Station

Antifreeze				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is antifreeze changed indoors over concrete that is sloped to drain or curbed surface?				
Is antifreeze drained over a drip pan or pad?				
Are funnels or pumps used when transferring antifreeze?				
Are drip pans placed immediately under any leak?				
Is waste antifreeze stored indoors when possible with secondary containment?				
Are containers kept in good condition, closed, labeled and inspected regularly?				
Is antifreeze mixed with any other wastes?				
Is waste antifreeze recycled?				
Lead-Acid Batteries				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are lead-acid batteries stored indoors over a curbed impermeable surface?				
Are intact batteries stored on an acid resistant rack or tub?				
Are cracked or leaking batteries stored in closed leak-proof and labeled containers?				
Is the date each battery was placed into storage recorded?				
Are batteries stacked more than 5 high?				
Are batteries inspected regularly for leaks?				
Are acid neutralizing agents, such as baking soda, available in case of leaks?				
Are batteries recycled?				
Are batteries stored longer than 6 months before recycling?				
Are lead cable ends left on the batteries to be recycled?				

Storm Water Comprehensive Site Inspection

Without Fuel Station

Tires				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are tires stored indoors?				
If tires are stored outdoors, is the tire pile covered?				
Are tires recycled frequently to keep the number of tires stored on site low?				
Rags, Oil-Absorbing Pads, Towels and Clothing				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are oil rags and absorbent pads stored in appropriate containers and disposed of properly?				
Are reusable oily materials such as towels and clothing maintained through a commercial laundering service or an in-house washing machine that discharges to a sanitary system through and oil-water separator?				
Salt Storage				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are salt piles stored in a salt storage building or under a roof?				
Are salt spills at a facility cleaned up promptly?				
Does stormwater drain away from the salt pile?				
Miscellaneous Storage Piles				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Are piles of spoils, asphalt, street cuts, etc. stored at the facility under a roof or cover?				
Are spills of miscellaneous debris on facility grounds cleaned up promptly?				

Storm Water Comprehensive Site Inspection

Without Fuel Station

Facility Stormwater Runoff				
	Yes	**No**	**N/A**	**Notes/Maintanence Needs**
Is uncontaminated stormwater prevented from mixing with process areas?				
Are stormwater controls free of debris, in good condition and functioning properly? *Attach completed Stormwater Control Inspection Checklist.*				

Comments/Action Items:

Submit completed report to Facility Manager or person in charge of storm water program. A copy will be provided to the Environmental Coordiantor.

Inspector's Signature

Date

APPENDIX H

CATCH BASIN INSPECTION FORM

OTTAWA COUNTY ROAD COMMISSION CATCH BASIN INSPECTION FORM

INSPECTOR _____ DATE _____

TOWNSHIP _____ SECTION _____

OF CB IN TWP SEC _____ # INSEPCTED _____

If numbers above do not match, explain below and list which CBs were NOT inspected.

_____

_____

_____

At each CB, look for debris and sediment blocking the inlet and remove if found. Look for sediment and trash in sump. If sump is more than 50% full, note below and schedule for cleaning. Look for damage or cracks to frame, grate, basin walls, etc., note below and schedule for repair.

MAINTENANCE NEEDS

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

OTTAWA COUNTY ROAD COMMISSION CATCH BASIN INSPECTION FORM

MAINTENANCE NEEDS CONTINUED

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

CB Location: _____

Type of maintenance: _____

Date maintenance completed: _____

APPENDIX I

CATCH BASIN CLEANING ACTIVITIES GUIDANCE DOCUMENT

Catch Basin Cleaning

Catch Basin Cleaning Activities Guidance Document

Catch Basin Cleaning Activities

Catch basins are included in storm sewer system designs in order to remove solids such as gravel, sand, oils, and organic material carried by storm water. Catch basins also contain elevated concentrations of metals (attached to the solids) from street runoff or drainage from industrial, commercial and residential properties. In order to maintain the storm sewer systems effectiveness, catch basins must be periodically cleaned out. The Department of Environmental Quality (DEQ) Water Bureau (WB) and Waste and Hazardous Materials Division (WHMD) oversee environmental regulations pertaining to this activity. The Michigan Occupational Safety and Health Administration (MIOSHA) within the Department of Labor and Economic Growth oversee confined space entry and other worker health and safety standards.

In the past, the waste generated from the catch basin cleaning activities was typically discharged back into the storm sewer system. This type of discharge is unauthorized per Part 31, Water Resources Protection (Part 31) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA) and is therefore illegal. The combined solid and liquid waste stream (solid/liquid waste) from cleaning storm sewers systems is legally defined as “liquid industrial waste” pursuant to Part 121, Liquid Industrial Wastes (Part 121) of NREPA.

The following are options recommended to properly deal with the waste stream generated from catch basin cleaning activities:

1. Have the waste transported to drying beds to separate the solid/liquid waste. This is usually performed at a publicly owned treatment plant or at a privately owned permitted facility where the liquid portion of the waste stream is separated from the solids and treated.

2. Request permission from the local wastewater treatment plant operator to discharge the combined solid/liquid waste into the sanitary system. Most treatment plants will require pre-treatment prior to the discharge. All applicable local ordinance provisions must be followed.

3. When conducting catch basin maintenance activities where the above options are not available, the following method can be used as long as there are no discharges to surface waters during dry weather conditions.

- Conduct visual inspection to ensure the water in the sump has not been contaminated. If necessary, collect a grab sample of the water and look for signs of contamination such as visible sheen, discoloration, obvious odor, etc. See the EPA Visual Inspection guidance for more tips. If there is any doubt of the quality of the water, it should be collected into the Vactor truck and treated as waste under Part 121 or Part 115 Solid Waste Management (Part 115) of NREPA.

- Using a sump pump, or any other pumping mechanism, remove the majority of water in the sump of the basin without disturbing the solid material below. Do not use pumps connected to the Vactor truck's holding tank.

- The clear water may then be directly discharged to one of the following:
  - Sanitary system (with prior approval from local sewer authority)
  - Curb and gutter
  - Back into the storm sewer system as long as it is contained within the system during dry weather condition to ensure no discharge into surface water
  - Applied to the ground adjacent to the catch basin (evenly distributed at a maximum rate of 250 gallons/acre/year)

- The remaining liquid/solid in the sump should be collected with a Vactor truck and disposed of off-site in accordance with Parts 115 or 121.

The entity whose catch basin is being cleaned is responsible for meeting the generator requirements under Part 121. See the Liquid Industrial Waste Generator guidance for more information.

The entity transporting the solid/liquid waste must meet the applicable transporter requirements. A local, state, or federal government may use its own vehicle to service catch basins or other parts of the sewer system without being a permitted and registered transporter under the provisions of the Hazardous Materials Transportation Act, 1998 PA 138, as amended (HMTA).

If the local government contracts with a private company to transport the liquids generated from cleaning the catch basins or other parts of the sewer system, that entity must be registered and permitted as a uniform liquid industrial waste transporter under the provisions of HMTA.

The transporter must notify the WHMD about their activity and obtain a site identification number. Follow the instructions and links to the form EQP5150 and online paying option posted at www.deq.state.mi.us/wdspi. There is a fee.

A uniform hazardous waste manifest must accompany the load, or a consolidated manifest may be used per Operational Memo 121-3, when the liquid waste is transported over public roadways by the local government or by a contract transporter. Keep the records at least three years from shipment. The waste transporting portion of the vehicle and/or containers used to

transport the waste must be kept closed except when adding or removing the waste, and the exteriors must be kept free of the liquid waste and residue.

The facility accepting the solid/liquid waste must meet operating requirements:

- They must notify the WHMD that they are operating a liquid industrial waste designated facility, obtain a site identification number, and meet operating requirements under Part 121. This includes practices to prevent unauthorized discharge of the waste, sign manifests, and keep required records. If waste containers are used, they must be kept closed and protected from the weather, fire, physical damage and vandals.

- The discharge of the liquids into the treatment plant that is permitted by the WB must meet the wastewater treatment plant requirements. Any other discharge of the liquids would require a separate DEQ discharge permit.

- The resulting solid waste must be managed under Part 115 requirements. Dispose of the solid waste in a licensed landfill. Contact the landfill authority for their specific disposal requirements, including any tests they require to document the solids are not hazardous or liquid waste. Do not use the solids as fill on local government or private property, or for any other use, unless it meets the conditions of being an inert material according to the solid waste rules R299.4114 through R299.4118. See the Waste Characterization Guidance for information how to determine if the waste is hazardous or not.

Street sweeping activities are also subject to the above solid waste requirements. Street sweeping involves the use of specialized equipment to remove litter, loose gravel, soil, pet waste, vehicle debris and pollutants, dust, de-icing chemicals, and industrial debris from road surfaces. See the BMPs for Street Sweeping and Parking Lot and Street Cleaning.

Follow-up Answers Can be Found as Follows:	
Topic	**Contact:**
Using the solids as fill or other use under Part 115	Duane Roskoskey at 517-335-4712
Part 121 transportation requirements and HMTA	WHMD District Office
Managing waste under Part 31, or general questions regarding this guidance	Mark Fife at 517-241-8993
Confined space entry requirements	MIOSHA Consultation, Education and Training Division at 517-322-1809

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APPENDIX J

SERVICE REQUEST FORM

Print Date
Print Time

OTTAWA COUNTY ROAD COMMISSION
SR - Service Request
Special Services

Request Number
Response Number

Requested By
Address

Received By
Date
Called By
Called To
Priority No

Police
Storm/Calls
Request Status

Phone Number ___-___-____
E-Mail Address
Location
Between
Municipality

And

Problem(s)
Details

Assigned Date **By** **To**
Responded Date **By** **Response Status**
Response(s)
Explanation

Further Action **Last Response Date**

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APPENDIX K

STORM WATER STRUCTURAL CONTROL INSPECTION FORM

Ottawa County Road Commission

Storm Water Structural Control Inspection Form

Date: _____

Storm water control name/location: _____

Person completing form (printed name): _____

Type of storm water structural control: _____

Checklist:

☐ YES ☐ NO Are structural storm water control devices accessible?

☐ YES ☐ NO Are structural storm water control devices free of debris, oil and grease, and other pollutants?

☐ YES ☐ NO Are vegetated controls free of any bare soil, erosion or gullies?

☐ YES ☐ NO Are vegetated controls free of noxious weeds?

☐ YES ☐ NO Are inlet/outlet pipes and/or devices clear and undamaged?

☐ YES ☐ NO Are storm water management devices maintained and functioning properly?

For every NO that is checked above, explain why below:

Is ***any*** maintenance needed? ☐ YES ☐ NO If yes, document on the back of this form.

Provide copy to Facility Supervisor and Environmental Coordinator to schedule any necessary maintenance. Attach facility map with additional notes and/or photos if appropriate.

_____ _____

Inspector's Signature Title

Ottawa County Road Commission

Storm Water Structural Control Inspection Form

Stormwater Maintenance Needs

Describe maintenance needed:

Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments:

Describe maintenance needed:

Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments:

Describe maintenance needed:

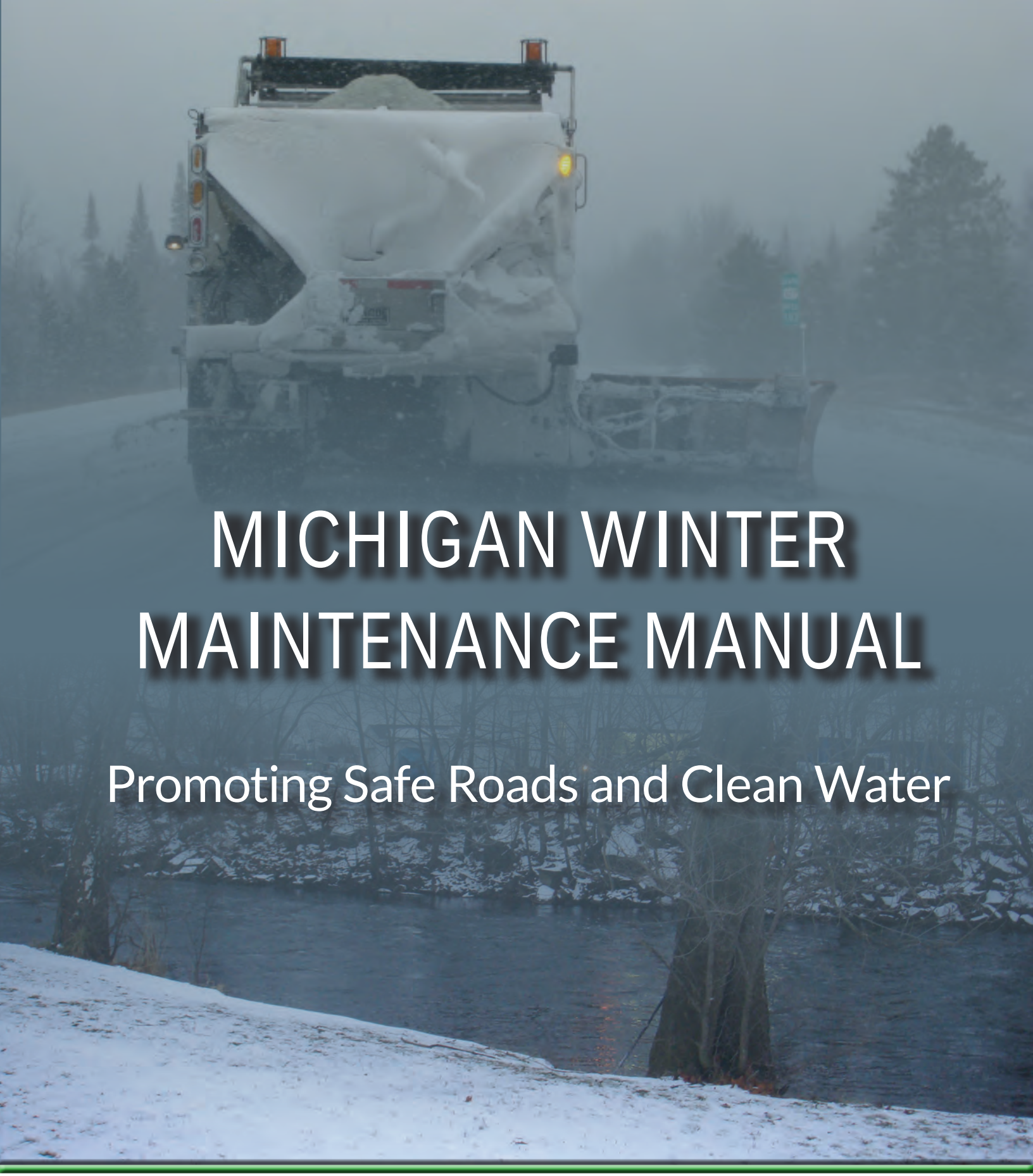
Date resolved: ________________________ By whom: ☐ Facility staff ☐ Environmental Coordinator

Is follow up necessary prior to next monthly inspection? ☐ YES ☐ NO If yes, document below:

Date of follow up: __________________________ Comments:

APPENDIX L

MICHIGAN WINTER MAINTENANCE MANUAL



MICHIGAN WINTER MAINTENANCE MANUAL

Promoting Safe Roads and Clean Water

Applying knowledge to improve water quality
Great Lakes Regional Water Program
A Partnership of USDA NIFA & Land Grant Colleges and Universities

MICHIGAN STATE UNIVERSITY | Extension

Acknowledgments

This manual is dedicated to the protection of Michigan's natural resources and the winter maintenance professionals who have the opportunity to protect them. *Michigan Winter Maintenance Manual – Promoting Safe Roads and Clean Water* is based on the *Minnesota Snow and Ice Control Field Handbook for Snowplow Operators, Second Revision* published by the Minnesota Local Road Research Board in 2012.

Thank you to the following sponsors and participants for their valuable input in the production of this document. Final interpretation is the responsibility of the authors.

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Table of Contents

List of Figures

Purpose of this Manual

The purpose of this manual is to help winter maintenance professionals achieve their goals of providing safe roads through sustainable winter maintenance practices and policies. As a maintenance professional involved in your organization's winter maintenance program, your daily actions are critical components of its success.

Not only are you tasked with providing continued public safety on roads, parking lots and sidewalks during winter storm events, but the choices you make can greatly affect the ability of your organization to provide these services in a cost-effective manner. The actions you take can also make the difference between adding to or reducing the amount of salt, sand and other pollutants presently entering drains, creeks, streams and lakes throughout Michigan.

The over-application of deicing materials can have a detrimental effect on surface water, groundwater and drinking water quality. Studies have also shown that the over-application of deicing materials can contribute to habitat degradation in our local creeks**,** streams, and lakes and in vegetated areas near roadways. This has a negative effect on fish and other wildlife living in these areas. The use of deicing materials is being increasingly regulated, and discharge limits are being applied under federal and state storm water regulations.

This manual is designed to provide you with Best Management Practices (BMPs) and other information that can assist you and your organization in making sound decisions around your winter maintenance duties. The goal of this manual is help you establish procedures that will maintain the desired level of service while reducing the amount of deicing materials that are being applied. It will also help your organization comply with strict federal and state storm water regulations.

We hope that reading this manual will increase your knowledge of the equipment, materials and application processes that are used in winter maintenance operations. Reviewing this manual in your organization can provide an opportunity for further discussion between you, your coworkers, supervisors and managers on how to improve efficiency, while reducing the use of de-icing materials and increasing protection of the environment.

Throughout the manual you will find environmental tips shown with a fish symbol. These tips will help you reduce environmental impacts.

Throughout the manual you will find cost-saving tips shown with a dollar symbol. These tips will allow you to maximize your efficiency and save money.

Michigan Roads: Where Economics and Environment Meet

The business of winter maintenance rests in the very capable hands of people like you.

As the industry evolves, it is important for you to stay current in your knowledge and understanding of the issues that drive winter maintenance. We are beginning to understand the serious corrosion and environmental harm caused by the deicing materials used in winter maintenance. With the advent of better equiment and alternative deicers, we have great opportunity for cost savings as well for a lessening of the environmental impacts of winter maintenance.

By following the BMPs discussed in this manual, you can both meet the needs of your customers and protect the freshwater systems that surround your roads.

The use of more sophisticated deicing materials and equipment with more flexibility may have higher cost assosiated with them up-front. These costs can be recovered, however, by reducing your salt usage and minimizing the need for some of your post-winter maintenace activities such as curb sweeping and catchbasin cleaning. These chemicals and equipment can also help improve your level of service.

By demonstrating a strong return on investment (ROI), you will increase public support for your efforts. By taking time to educate the public on your winter maintenance policy and methods, you can foster a positive and cooperative relationship with them.

In order to help public agencies be careful stewards of taxpayer dollars, the Clear Roads pooled study created an interactive tool kit that helps agencies calculate the cost/benefit ratio of selected winter maintenance technologies. This tool kit can be found on the Clear Roads website at www.clearroads.org.

There are other costs associated with the use of deicing materials that commonly are not included in most organizations' ROI assessment. These uncounted costs include repairing damage to infrastructure. Using less salt on the roadways can save all taxpayers money by reducing the corrosion of maintenance equipment, personal vehicles and bridges, and by limiting the degradation of road surfaces.

Estimates of damage to infrastructure, automobiles, vegetation, human health and the environment from deicing materials range from $803 to $3300 per ton of road salt used, according to several research reports (see figure 1 and citations below).

The True Cost of Road Salt: It Really Adds Up!

Item	Cost
Material (salt) $55/ton[1]	$55/ton
Labor and Equipment to apply salt[2]	$100/ton
Damage from use of salt[3]	$800 - $3300/ton
Total cost:	$955 - $3455/ton

Figure 1: Estimates of Costs for Using Road Salt

Sources: MDOT (2013), Vitaliano (1977) and Murray et. al (1992) as cited in a draft, "The Real Cost of Road Salt Use for Winter Maintenance in the Twin Cities Metropolitan Area of Minnesota," prepared for the Minnesota Pollution Control Agency by Carolyn Dindorf and Connie Fortin, January 21, 2013.

Figure 2: Great Lakes Drainage Area

In addition to having safe roads and reducing the immediate and long-term winter maintenance costs, your customers are also interested in protecting Michigan's lakes and rivers. As "The Great Lakes State," Michigan has an abundance of water bodies, with the Great Lakes and approximately 11,000 inland lakes, as well as streams and wetlands. These should be preserved as the valuable and irreplaceable natural resources that they are.

Lake Michigan and the other Great Lakes represent 20 percent of the world's fresh surface water. The Great Lakes, along with the rivers, channels, and lesser lakes feeding or draining them, constitute the largest surface freshwater system on Earth!

Michigan residents rely on this freshwater for personal, agricultural and business uses. Tourism is important to the state of Michigan as it is one of our leading industries. Our fresh, clean lakes and rivers attract many visitors to the state and contribute to our quality of life in many ways.

Unfortunately, chloride from road salt is entering the environment and threatening the health of Michigan's fresh water ecosystems. Salts, such as those used in winter maintenance activities, dissolve and move downhill with water (snow melt or rain) to the nearest lake, river or pond. Chloride does not settle out or disappear. Chloride stays in our water cycle virtually forever. It only takes about 1 teaspoon of rock salt to contaminate 5 gallons of water to the federal chronic chloride standard of 230mg/l.[1]

There is an overall trend of higher chloride concentrations in water bodies located in the southern region of Michigan. The highest concentrations are around the larger cities and most heavily-traveled roadways.[2] The United States Environmental Protection Agency documented 29 incidences of Michigan groundwater contamination from salt or salt/sand[3] in addition to effects on surface waters.

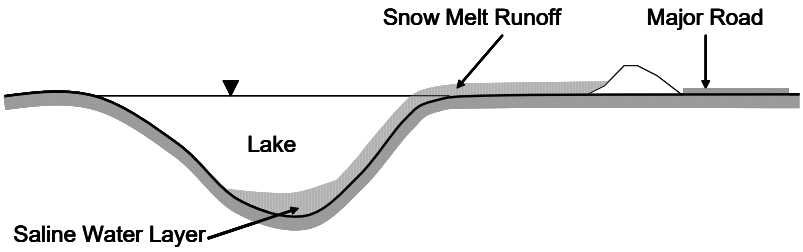

Figure 3: Lake Stratification Due to Saltwater Runoff

In addition to causing aquatic toxicity, salt water is heavier than freshwater and sinks to the bottom of lakes. This can eventually cause stratification of the lake and loss of lake turnover.[4]

A recent study on the negative impacts from road salt runoff concluded that "reduction in usage appears to be the only effective road-salt-runoff management strategy."[5] You, as a winter maintenance professional, are uniquely positioned to safeguard the freshwater resources of Michigan by using less salt. The information in this manual provides many suggestions on how to accomplish this.

Preparing for Winter

All winter maintenance organizations should have a written winter maintenance plan. This plan, if followed, will help protect you legally. It will also help you run a smooth and well-thought-out winter maintenance operation. Each year, in advance of winter, take time to review and update your maintenance procedures. A little planning up-front can help you do an excellent job in keeping the roads safe and decrease the required application of salt throughout the season.

Winter Maintenance Plan

- Develop a winter maintenance plan, and be prepared to follow it.
- Share the plan with all involved staff.
- Define levels of service for all of your snow routes. Your level of service may be based on average daily traffic, environmental concerns, safety, mobility, economics, and other factors.
- Communicate the relevant portions of your winter maintenance plan to your customers so they understand their role and what to expect. See Appendix A for examples of how to reach out to your customers with information on winter maintenance activities.

Route Preparation and Planning

These activities can be done by operators and supervisors, as appropriate, during the fall to lay the groundwork for efficient winter operations.

- Inspect and clear ditches, culverts, and other water channels.
- Remove potential snow traps, such as tall grasses along the road that will catch and deposit snow on the road.
- Assign routes to operators; better performance is achieved when operators have an assigned route throughout the season.
- Drive all routes prior to winter to identify critical or problem areas.
- Understand the target level of service for various areas of a route.
- Inventory all the areas prone to drifting and develop a plan to manage them. Consider installing snow fences.
- Explain the best ways to manage blowing and drifting snow with new operators.

Snow Fences

National research has found that it is 100 times more expensive to plow snow than to trap it with a snow fence.[6] A snow fence can be permanent or seasonal, living or structural. Using vegetation as a snow fence takes long-term vision, as it can take five to ten years before the plantings are of sufficient size to create the desired effect. The economic benefits of using snow fences in winter maintenance operations include savings from: reduced overtime, less need for contract equipment and services, reduced operating expenses, and reduced sand or chemical usage for ice control. See Appendix D for more resources on snow fencing.

Storage and Handling Systems

Proper storage and handling of deicers is a primary way to reduce groundwater contamination from salt. Stored salt needs to be covered, as do sand piles which contains more than 1% of salt. This applies to all piles greater than 5 tons. The DEQ has produced a document to guide the proper storage and handling of road salt. See Appendix D.

The best method to store granular salt and sand/salt mix is in a covered, water-tight building with doors. Having a salt shed with doors greatly improves protection from the elements. The salt and salt/sand mix needs to be stored on an impervious pad such as asphalt. If your impervious pad is constructed out of concrete it should have a sealer applied to it. The surrounding outdoor pad should be sloped and curbed to direct runoff water into a collection area.

Currently, the outdoor storage requirements in Michigan indicate that liquid storage should be in double-walled tanks or that secondary containment should be around single-wall tanks. Secondary containment should be such that if the tank leaks, all of the contents of the tank can be contained and recovered on site. This applies to all liquid deicers over 1000 gallons under the present Part 5 rules. These requirements may change during the Part 5 stakeholder process, so check the DEQ website for the most current information.

The feasibility of outdoor liquid storage is limited based on the eutectic temperature of the liquid product. The eutectic temperature is the freeze point of a liquid at the optimal concentration. Figure 12 lists the eutectic temperature for some of the common liquids.

Key points for salt storage and handling:

- Ensure salt storage is at least 50 feet from the waters of the state (natural wetlands, ponds, lakes, rivers).
- Provide indoor storage for salt and sand that has an impervious floor.
- Use double-wall tanks or secondary containment for liquid deicers.
- Handle salt shipments and loading operations indoors.
- Sweep pad, for outdoor loading, after receiving shipments and after loading.

Storage requirements under Part 5 rules are under review. Check with MDEQ for the most current requirements.

Snow Disposal Sites

Suitable sites for snow disposal should be established prior to the winter season. The optimal sites are those where the debris can be easily recovered in the spring. Snow should not be plowed directly into ponds, rain gardens, lakes, rivers, or wetlands. DEQ draft guidance recommends that snow storage be at least 75 feet from non-community

water supply, 50 feet from private water supply and 200 feet from community water supply wells. This recommendation may change, so keep informed of all local regulations, policies, and guidelines for Michigan water quality protection. See Appendix F for a reference to this draft document.

Calibration

Before the beginning of each snow fighting season, salt trucks must be calibrated to measure the amount of material applied at various settings. The salt discharge should fall within your agency's guidelines. If the automatic controller is not applying the material at the correct application rate per your agency's guidelines, it must be adjusted. The calibration should be rechecked if there are any mechanical adjustments or changes throughout the remainder of the winter season.

By calibrating your equipment, you can be sure your application rates will be accurate and you will know how much product is actually being applied to the roadway. This alone can result in salt cost savings, by avoiding unintentional over-salting. Calibration should be done for all equipment that dispenses liquid or granular material. All granular materials (salt, prewet salt, sand, etc.) flow differently, so calibrate for each material.

With manual-controlled systems, the operator must have a copy of the calibration worksheet in the cab of the truck. This allows the driver to cross-reference the desired material application rate with the speed of travel, and then choose the setting that gives the desired result. A calibration worksheet example is in Appendix C along with other calibration resources.

Key points for calibration

- Calibrate all new equipment prior to use.
- Calibrate all equipment at least once a year or if the truck has had any major service.
- Calibrate for each type or blend of granular material.
- Calibrate liquid application systems, both anti-icing and prewet systems.
- Follow the manufacturer's guidelines for calibration, and contact the manufacturer for training if necessary.
- Put the auger plate in place during calibration for dump trucks. Calibration won't be accurate if the material is gravity-flowing during the calibration process.
- Place a calibration worksheet in each truck and a copy in the shop for those with manual-control spreaders.

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Calibration saves you salt and money.

Investment in Equipment

Investing in equipment that can make your organization's winter maintenance more efficient is money that is repaid quickly. Investment in controllers, liquids and blades are areas that that often give a good return on investment. Top performing organizations integrate new practices and equipment to increase their efficiency. The

Clear Roads online cost benefit analysis toolkit can help provide insight into new practices, equipment and operations. See Appendix D for this resource.

Plow early and often to reduce hard pack.

- Mechanical Removal

  Mechanical removal (blading or plowing) is the most effective strategy to remove snow, from a cost and efficiency standpoint. The Clear Roads Pooled Funds Study has an evaluation of plow prototypes. You can find this in Appendix D, under blades and plows.

  - One trend in the industry is towards segmented blades. These offer more flexibility for blading on uneven surfaces, less vibration for the operator, and will wear more evenly and scrape better. Clear Roads has produced some research on cutting edges. This is in Appendix D, under blades and plows.
  - Underbody blades are very common in Michigan; they allow more down pressure and are helpful at removing compaction. The more snow you remove mechanically, the less salt you will need to keep roads safe.
  - The use of wing-plows for winter operations in Michigan has increased over the past few years. Using wing-plows can make a winter operations program more effective by providing a more effective means of mechanical removal. With a wing-plow, operators can clear an entire lane plus a few feet of the shoulder in one pass, a job that usually takes two passes or two trucks working together.
  - In Michigan and other snow-belt states, the tow plow has been tested and proven to be an effective method of snow removal.
  - Brooms can be very efficient at removing light snow. These are common tools at airports and for sidewalks.

Electronic closed loop controls are easier to operate and are a potential money saver!

- Controllers

  The ability to control the application rate of deicers is vital. By improving the accuracy of your controllers, you will be able to achieve a more efficient operation automatic controllers and manual controllers. All agencies should work toward replacing manual controllers with electronic closed-loop controllers.

  Automatic controllers self-adjust the flow of salt to match the target application rate regardless of the truck speed. When the snowplow speeds up or slows down, the controller automatically speeds up or slows down the salt delivery rate so that desired application rate is maintained.

  Manual controllers are not as accurate as automatic controllers. Manual controllers do not self-adjust to meet a target application rate. Application rates are difficult to hold constant with manual controllers because the speed of the truck is often changing. Although accuracy is low, calibration is essential so your organization can attempt to follow application guidelines. Without calibration, you cannot attempt to deliver a specific amount of salt per lane mile.

With manually-controlled systems the operator must have a calibration worksheet in the truck. An example of a calibration worksheet is located in Appendix C along with other calibration resources.

The calibration of the controllers should be completed annually, at a minimum. Calibration should also be completed anytime major truck repairs are done, or if the operator notices that it is not working properly. It is also important to remember that the gate opening must be set and marked during calibration.

Weather Data

Basic, up-to-date weather information is critical for winter maintenance planning and effective response during an event. The means to acquire this information should be in place prior to the start of winter. Information that should be gathered before an event, and tracked throughout, includes:

- Start of precipitation and expected event length
- Type of precipitation expected
- Total precipitation expected/event intensity
- Wind conditions (speed, gusts, directions)
- Temperature trend (rising or falling during the event)
- Pavement temperature trend (rising or falling during the event)
- Dew point

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Pavement Temperatures should guide your application rates.

Weather information can and should come from a variety of sources, and there are many from which to choose. Many services provide weather forecasts, condition trends but fewer provide pavement temperatures.

The dew point describes the temperature below which water will condense into liquid water at the same rate at which it evaporates. Condensed water is called dew. The dew point is the critical ingredient in predicting the formation of frost on roads. When the pavement temperature falls below the dew point, if that pavement temperature is equal or below freezing, then frost will form. By monitoring the dew point and other weather factors, you can predict frost and be out in front of it. Wind speed and absolute humidity are the other variables which play a role in how quickly the frost forms and how thick the layer will be.

Dew point can be obtained from commercial weather services or the Michigan RWIS system. MDOT's RWIS system started in 2010, and now includes more than 50 stations around the state. The system is made up of a network of sensors, to measure air and road surface temperatures, barometric pressure, wind, salt concentrations on the road surface, frost depth and dew point. You can access MDOT's RWIS system by visiting http://mdotnetpublic.state.mi.us/drive/. Figure 4 is a sample of the information you can get from their RWIS stations.

Pavement Temperatures

Keep in mind that most weather services measure temperature and other conditions in the air, above the ground, which means that the reported conditions can differ substantially from pavement temperatures. It is extremely important to use the pavement temperature, not air temperature, to determine what material(s) to use and the appropriate application rate of your chemicals.

Air Temperature: 61°F
Maximum Daily Temperature: 76°F
Minimum Daily Temperature: 42°F
Relative Humidity: 70.7%
Average Wind Speed: ENE 5 MPH
Maximum Gust Speed: ENE 11 MPH
Barometric Pressure: 29.27"
Precipitation: No Precipitation
Precipitation over the last 24 hours: 0"
Dew Point: 52°F
Visibility: 10 miles

Figure 4: RWIS example (I-75 @ South of M-48 overpass)

Pavement temperature can be measured several different ways. One way is by hand-held temperature sensor guns that can be purchased at any automotive store for under $100. Truck-mounted systems are another alternative. Truck-mounted systems are better than hand-held sensors in that they display in the cab a continuous reading of the air and pavement temperatures. Truck-mounted systems may be incorporated into your spreader controller or can be purchased independently of your controller.

There are many influences on pavement temperature. For example, you will notice changes in pavement temperature first on bridge decks and ramps; pavement temperatures will also be lower in shady areas. The pavement's color and texture, and the type of material in the layer underneath the pavement, all influence its temperature as well. You cannot substitute air temperature for pavement temperature; you must know the pavement temperature before making a decision on application rates. **All of your application rate charts should be based on current and trending pavement temperature.**

Automatic Vehicle Location (AVL) and Maintenance Decision Support Systems (MDSS)

Many organizations are now using computer technology in the form of AVL systems and/or MDSS to further improve the efficiency of their winter maintenance responses.

Use salt carefully! 1 teaspoon of salt pollutes 5 gallons of water.

- Automatic Vehicle Location system

With an AVL system you can see where the snow plow vehicles are deployed in near real time during a winter event. This is typically done through a web portal. Vehicles are depicted on the map via icons indicating the type of actions underway, when and where a vehicle is actively spreading material, or when and where the plow blade is down and pushing snow. Users may hover a cursor over an individual vehicle icon and get a pop-up box describing the vehicle and what it is doing.

Iowa Department of Transportation reported that equipping their trucks with Automatic Vehicle Location (AVL) provided a return on investment of $6.40 for every $1.00 expended.[7]

Both AVL and MDSS have shown good results in reducing salt used.

- Maintenance Decision Support Systems (MDSS)

MDSS combines advanced weather prediction service, advanced road condition prediction and your agency's winter maintenance practices for anti-icing and de-icing to generate road treatment recommendations on a route-by-route basis. The goal of MDSS is to suggest more effective use of maintenance resources and increase safety, reliability and mobility on roadways.

The MDSS system allows crews to input real-time conditions, including road and ambient temperature, type of material being used and the application rate. After compiling the information provided by the crews, along with weather reports, the system will then provide suggested treatments based on the information and models. The system may tell the operator to re-treat the road at a later time, apply different products at different rates, or simply to continue current procedures. The suggested treatment can then be followed or the operator can override the system.

MDSS systems have a scenario selector that can be used as a training tool. For more information on MDSS, see Appendix D. There is a report, "Analysis of Maintenance Decision Support System (MDSS) Benefits & Costs," which summarizes the experiences of several states using MDSS.

Anti-icing before the Event

Anti-icing is the process of putting down a liquid deicer before a winter event. It can be a cost-effective strategy that optimizes, and therefore reduces, chemical usage. It is a proactive approach that should be considered first in a series of strategies for managing most winter events. By applying a liquid deicer before an event, you can prevent snow and ice from bonding to the pavement, or even prevent frost from forming on the roadway altogether.

Anti-icing is not always the answer, but when it is, it can buy you time for physical removal that is easier and more cost-effective. To determine when it is appropriate to anti-ice, see an example of an anti-icing decision chart in Appendix B.

Anti-icing procedures look different from other winter maintenance activities and may cause concern with the general public. Educate your customers about anti-icing techniques and their value ahead of its use.

Selection and Storage of Anti-Icing Products

- Liquids are the most effective anti-icing agents.
- At temperatures below 15°F, it may be more cost effective to use a chemical other than sodium chloride brine (see Appendix B for anti-icing cost model).
- Hygroscopic liquids bring the moisture from the air to the pavement surface (similar to dust control on gravel roads). They give added benefit on cold winter pavement because of this property but they can be troublesome at warm (over 28°F pavement temp) or in humid conditions. The most commonly used hygroscopic products are $CaCl_2$ or $MgCl_2$.
- When using hygroscopic products, it is critical to not over-apply.

Guidelines for Anti-icing Product Application

These are only guidelines and not exact recommendations. Generally it is better to under-apply rather than over-apply anti-icing materials. So start low and increase rates, instead of starting high and decreasing rates. Forms such as those shown in Appendix B of this manual are useful to record and track your work and observations, so you can refine your use and understanding of anti-icing products.

Condition	**Gallons per lane mile**		
	$CaCl_2$ or $MgCl_2$	**Brine**	**Brine Blends**
Regularly scheduled application	15-25	20-40	Ask manufacturer
Prior to frost or black ice	15-25	20-40	Ask manufacturer
Prior to light or moderate snow	15-25	20-50	Ask manufacturer

Figure 5: Anti-icing Application Rates

Key points for Anti-icing

- Apply liquids at half the rate (not half the concentration) for the first application of the season, or after a prolonged dry spell. On dry roads, liquids tend to mix with oil from vehicles and cause slippery conditions if over-applied.
- Consider spot-applications on hills, bridge decks, curves and intersections if predicted conditions warrant and you are just beginning an anti-icing program. Continue to expand anti-icing until you treat most of the areas that you de-ice.
- Utilize anti-icing for light freezing drizzle and light frost events; it can be very effective.

- Apply your anti-icing agent during low traffic times and during regular work hours; this saves product and reduces staff costs.
- Avoid anti-icing under blowing conditions, in areas prone to drifting or anywhere else you would not use salt.
- Avoid applying before a predicted heavy rain.
- Apply liquid anti-icers 24-48 hours in advance of an event. The closer to the event start time the better. Tire action and wind wear away material.
- Remember that re-application isn't always necessary. The residual effect of anti-icing applications can remain for up to five days if precipitation or traffic wear-off does not dilute the material.
- Apply liquids with stream nozzles to maintain bare pavement between application areas.
- Use a spray skirt when anti-icing. This helps significantly in directing product to the roadway where it is needed. Adding a simple spray skirt behind the truck's spray bar significantly increases the amount of product reaching the roadway.[8]

Look at anti-icing's costs and benefits and evaluate how it can best serve you. Anti-icing can provide significant cost, safety, and environmental benefits. Appendix B contains anti-icing resources and a link to a Cost Benefit Analysis Tool that can help you understand how anti-icing can provide a return on your investment in equipment.

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Liquid deicers are faster acting and stay in place better.

During the Event

During a winter precipitation event there is very little extra time. Preparation in advance of an event is the key to success. Integrating best management practices (BMPs) into your operations can help provide safety, appropriate levels of service, and protect Michigan's natural resources. Good documentation is one of the BMP's that helps move your organization ahead. Make sure this is integrated into your winter operations. Appendix E has example charts that you can use for recording your activities.

Effective Use of Plows/Underbody Blades

Plowing or blading is the best approach to snow removal. It can be the most cost-effective approach when all the factors (cost of chemicals, damage to public roadways and infrastructure, etc.) are considered. Physical removal of snow should always be done prior to the application of deicing materials.

Key Points for Plowing/Blading

- Blade prior to an application of chemical in order to minimize product dilution.
- Coordinate blading activities to eliminate windrows at intersections and prevent removal of another operator's deicing material.
- Remove snow from roads as quickly as possible to reduce compaction.
- Avoid pushing snow over the bridge rails and onto roads or water beneath.
- Pay attention to wind conditions. If shoulder blading isn't critical, then delay until wind speeds are lower.
- Reduced speed minimizes the risk of a snow cloud. Lift the blade and wing if a snow cloud forms; do not slow down or brake.

Loading and Hauling Salt

A substantial amount of salt can be spilled, and potentially wasted, during the loading and hauling process. Some easy steps can be taken to ensure that this purchased material ends up only where it is needed, on the roadway.

Key Points for Loading and Hauling

- Load inside the salt shed.
- Sweep outdoor loading areas frequently.
- Fill but do not overfill trucks. One city that uses very little salt inserts a cement base in the truck bed to provide extra weight, thus requiring less material to be loaded.
- Tarp your loads when transporting material.
- Install spill shields to plug up gaps in truck bed.
- Install sander plates to prevent free-fall of salt or sand.

Using Abrasives

Use winter sand and other abrasives when temperatures are too cold for deicing chemicals to be effective, or when immediate traction is needed after a freezing rain event. Be aware that sand does not melt anything. It only provides temporary traction, and only when it is on top of snow or ice. Sand will clog sewers, ditches, and streams. As a result, avoid sand use as much as possible.

Our lakes are turning into wetlands as they fill in and become shallower. Unrecovered winter sand accelerates this process.

A salt/sand mix is generally not recommended as salt reduces the effectiveness of sand, and sand reduces the effectiveness of salt.

Key points for Abrasives

- Sweep up excess sand after each event.
- Apply sand in extreme cold weather, when salt is ineffective.
- Avoid salt/sand mixes. Determine if you need melting or temporary traction and choose the proper tool.
- Employ sand only for short-term traction needs. It has no melting capability.
- Note that, in limited situations such as a freezing rain event, a 25 to 50% sand/salt mix has been documented as effective in increasing friction.[9]

Material Application

Deicing is a reactive operation in which a chemical is applied to the top of snow, ice or frost already on the roadway. Forms such as those shown in the Appendix F of this manual are useful to record and track your deicing work.

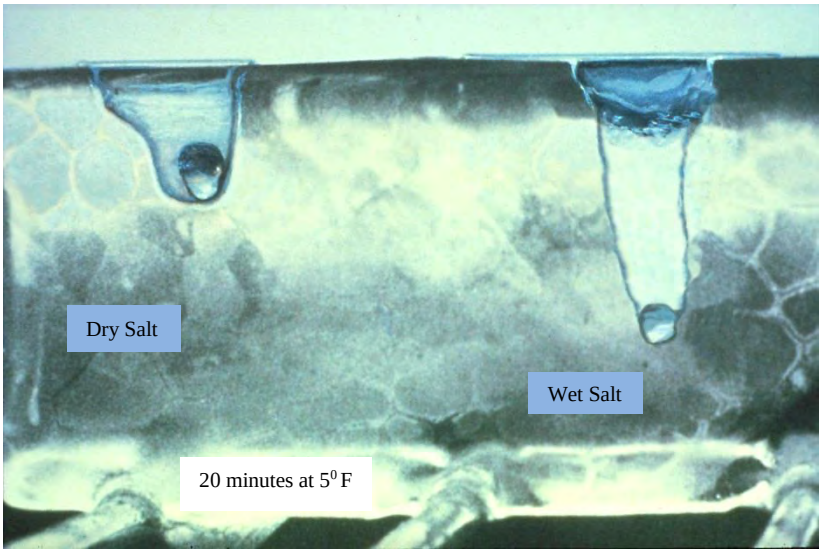
Removing ice that has already bonded to the pavement can be difficult, and removing it mechanically causes wear on equipment and roads. Enough ice must be melted to weaken the bond between the ice and pavement in order to make physical removal

possible. Breaking the bond after it is formed requires more chemical than preventing the bond from forming in the first place.

Integrating science into winter maintenance allows us to use an appropriate amount of product for deicing. Most application rates can be reduced by the best maintenance practices already discussed, such as proper calibration and using closed-loop spreaders. But there are two major handicaps to the effectiveness of a salt application during an event: the precipitation which dilutes it, and the next blade pass which can remove it before it has had a chance to work.

Slower truck speed and prewetting or pretreating salt are best practices for reducing salt waste and lowering the necessary application rates. Applying dry material is a common but ineffective practice. Research and results in the field show that prewetted or pretreated material stays on the road surface better, and is therefore more effective. Another way to reduce salt use is to minimize applications during the storm event. This helps keep blading activities from removing the deicing salt.

Dry salt is slow to dissolve. Adding liquids not only keeps more of the salt on the roadway, it also helps to increase the speed of melting as it jump-starts this process. The greater the liquid to granular ratio, the better control you have over your product during application, and the faster its performance once it is down. The photograph below illustrates the melting speed of prewetted salt versus dry.



Liquids allow you to use less product overall.

Figure 6: Melting Comparison of Dry Salt vs. Prewet Salt
Photo courtesy of the Wisconsin Department of Transportation bulletin #22

How to reduce application rates

1. Speed of application. MDOT recently proved that reducing the speed of application from 35 mph to 25 mph can prevent up to 40% of the salt discharged from being wasted.[10] The speed of trucks during application of granular material should be 25 mph or less, or the lowest safe speed under the conditions.

2. Vary application rates. Use the higher rate listed for the first pass, and reduce on any subsequent passes. Adjust rates as needed if you know you will be able to only make one pass.

3. Spread pattern. The most effective spread pattern is a windrow of salt on the centerline or highpoint in the roadway. Set spreaders lower to the ground or use a chute to reduce bounce and scatter. See Appendix D for instructions on how to build a chute or how to set-up a grid to run a test and get your own bounce and scatter data.

Salt that is bounced off the roadway or is spread outside the travel lanes is money down the drain.

4. Pretreated or prewetted salt. Wet salt remains on the road longer (less bounce and scatter) than dry salt and works faster too. With pretreated salt the liquid to granular ratio is about 4 to 6 gallons per ton. In prewetting operations, the ratio of liquid to granular can vary greatly. It starts at about 8 gallons per ton, upwards to over 100 gallon/ton (slurry). Some organizations have nearly abandoned granular products altogether and are applying straight liquids.

5. Application rate. Make sure your organization has an application rate chart that is based on pavement temperatures. Continually work to refine your chart and lower your application rates.

6. Deicers. Not all deicers perform the same under the same conditions. By choosing the combination of liquid and granular deicers that is least toxic and that works the best at your pavement temperature, you can reduce your application rate and costs, as well as your environmental impact. Figure 7 compares four different applications, using different materials (from salt/sand to a higher ratio of salt/liquid), and all would potentially achieve satisfactory results.

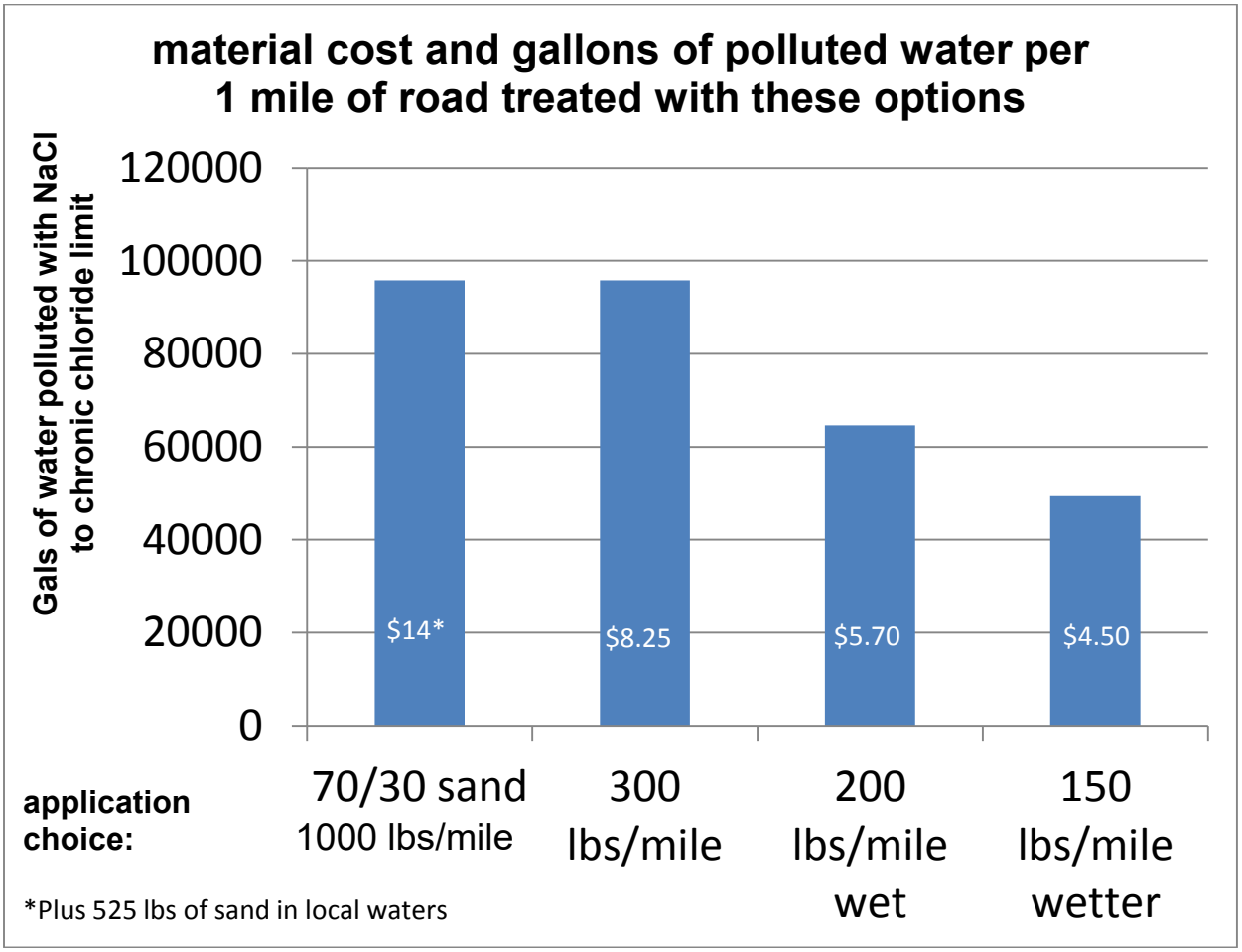


Figure 7: Material Cost and Gallons of Water Polluted

The purchase cost based on $55 ton salt, $16 ton sand and $0.20 gallon brine. Per federal chronic chloride standards of 230 mg/l, 1 pound of salt pollutes 320 gallons of water, 1 gallon of brine pollutes 728 gallons of water. Wet = 10 gal/ton and Wetter = 15 gal/ton

There are many ways to accomplish a safe winter road. We can see from this chart that material selection is a key factor in providing the opportunity to reduce application rates while maintaining effectiveness. By looking at all the factors--performance, cost, and environmental damage--winter maintenance professionals can make the most informed decisions on how to maintain their level of service. See Appendix F for the new Clear Roads Fact Sheet on the Toxicity of Deicers to run your own calculations.

Selecting a Deicer

When selecting a deicer, be careful when looking at the melting temperature on marketing materials. The eutectic temperature is often cited, which is the lowest possible temperature at which a solution remains liquid. At this temperature it would take a very long time for the product or solution to melt ice. Instead, you need to know a product's practical melting temperature range.

Sodium chloride (NaCl, or road salt) is the most widely used of the deicers. It is effective at pavement temperatures above 15°F. Because it doesn't work well at colder temperatures, it is often over-applied in attempts to get it to work better. See the chart below for the melting capacity of NaCl at various temperatures. Ask your vendor for a similar chart for the products you buy or are considering buying.

By adding liquid to granular salt, you can speed up melting and use less salt.

Pounds of Ice Melted Per Pound of Salt

Pavement Temp (F)	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs. of ice	5 min.
25	14.4 lbs. of ice	10 min.
20	8.6 lbs. of ice	20 min.
15	6.3 lbs. of ice	1 hour
10	4.9 lbs. of ice	Dry salt is ineffective and will blow away before it melts any significant amount of ice.
5	4.1 lbs. of ice	
0	3.7 lbs. of ice	
-6	3.2 lbs. of ice	

Avoid using dry rock salt at pavement temperatures below 15° F.

Figure 8: Ice Melting Capacity of Sodium Chloride at Various Pavement Temperatures

- For a chart showing practical temperature ranges for other deicers, see Figure 12.
- For more information on the toxicity of deicers see "Determining the toxicity of deicing materials," a Clear Roads research project, in Appendix F.
- Melting all the snow or ice on the road is not necessary. This is an overuse of materials. Apply just enough to loosen the bond between the road and the ice/compacted snow so it can be effectively bladed off.
- Use pavement temperatures and trends to help you to apply the right product application rate at the right time. Generally use less chemical when temperatures are warm or rising, and more when they are cold or falling.
- Avoid straight salt when temperatures below 15°F; use other deicers such as $CaCl_2$ and $MgCl_2$ to obtain better melting at lower temperatures. If you do not have a good alternative available, use sand for traction until pavement temperatures warm.

Spread Patterns

The spread pattern in Figure 9 is a visual representation of the application method on which the application table is based. That is, you blade only (no chemical application) going out, and blade and apply in a windrow to the centerline on the return trip.

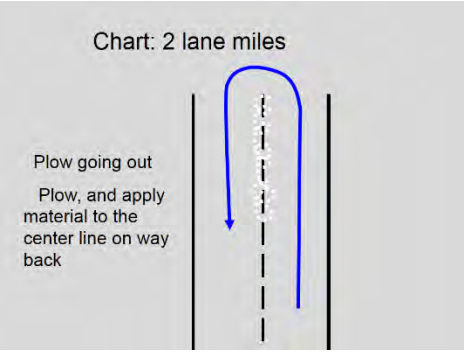


Figure 9: Suggested Plow and Apply Pattern for Deicing

One of the biggest challenges with salt is to keep it on the road long enough for it to work. Narrow your spread pattern to apply salt to the crown of the road. As the salt melts it will migrate across the drive lanes. By driving slowly and applying salt to the center line in a windrow or tight spread pattern you will waste less salt. This applies to all roads, but is essential on high speed roads.

There are various devices and modifications to your spreader that you can make to help you create a tighter spread pattern. Chutes that direct the salt from the spreader to the pavement are one good example. Other examples include skirts below and around the spreader, holes in the spreader, zero velocity spreaders and or simply turning your spreader off.

Strive for an even spread pattern at low application rates. Equipment that was designed to deliver large amounts of sand likely will have trouble delivering a steady spread pattern with a low rate of salt. If this is the case, you will need to retrofit or change your equipment to make it able to deliver an even spread pattern at a low rate. When you purchase new equipment, make sure it can deliver a very low application rate (100 pounds/mile) with an even spread pattern.

Deicing Application Rate Guidelines

Every organization should have an application rate chart that is based on pavement temperatures. This allows you to standardize your operations. The chart below is an example of an application rate chart developed for Minnesota. This chart was developed by a team of city, county and state winter maintenance experts. The rates were chosen with the goal of defining sufficient rates to clear and hold the roads after an event, assuming all of the best practices were done before and during the event.

No chart will be perfect. Make your own chart and keep improving it. See if you can continue to lower the rates as you become more efficient in your winter maintenance practices.

Deicing Application Rate Guidelines

24 feet of pavement (typical two-lane road)

These rates are not fixed values, but rather the low end of a range to be selected and adjusted by an agency, according to its local conditions and experience.

Lbs/two-lane road						
Pavement Temperature (F) and Trend	Weather Conditions	Maintenance Actions	Salt Prewetted/Pretreated with Salt Brine	Salt Prewetted/Pretreated with Other Blends	Dry Salt, least effective*	Winter Sand (Abrasives)
>30 F ↓	Snow	Plow, treat intersections only	**80 (40/lane mile)**	**70**	**100***	Not recommended
	Freezing Rain	Apply product	**80-160**	**70-140**	**100-200***	Not recommended
30 F ↓	Snow	Plow & apply product	**80-160**	**70-140**	**100-200***	Not recommended
	Freezing Rain	Apply product	**150-200**	**130-180**	**180-240***	Not recommended
25-30 F ↑	Snow	Plow & apply product	**120-160**	**100-140**	**150-200***	Not recommended
	Freezing Rain	Apply product	**150-200**	**130-180**	**180-240***	Not recommended
25-30 F ↓	Snow	Plow & apply product	**120-160**	**100-140**	**150-200***	Not recommended
	Freezing rain	Apply product	**160-240**	**140-210**	**200-300***	Not recommended
20-25 F ↑	Snow or freezing rain	Plow & apply product	**160-240**	**140-210**	**200-300***	Not recommended
20-25 F ↓	Snow	Plow & apply product	**200-280**	**175-250**	**250-350***	Not recommended
	Freezing Rain	Apply product	**240-320**	**210-280**	**300-400***	**400**
15-20 F ↑	Snow	Plow & apply product	**200-280**	**175-250**	**250-350***	Not recommended
	Freezing Rain	Apply product	**240-320**	**210-280**	**300-400***	**400**
15-20 F ↓	Snow or freezing rain	Plow & apply product	**240-320**	**210-280**	**300-400***	500 for freezing rain
0-15 F ↓↑	Snow	Plow, treat with blends, sand	Not recommended	**300-400**	Not recommended	500-750 spot treat as needed
<0	Snow	Plow, treat with blends, sand	Not recommended	**300-400**	Not recommended	500-750 spot treat as needed

To calculate for 1 lane, divide application rate numbers in half

Use lower end of application rate range when using super-saturated mixes

Source: Chart: Minnesota Snow and Ice Control Field Handbook for Snowplow Operators (2012).

Figure 10: Application Rate Chart for Deicing

Dilution: the cause of refreeze

An ice control product will work until dilution causes the freeze point of the remaining brine on the roadway to equal the current pavement temperature. At this point, the material will stop melting and you may experience re-freeze if the pavement temperature is dropping. This process is called the dilution of solution.

How long a treatment will last depends on five factors: pavement temperature, application rate, precipitation, beginning concentration, and chemical type. These factors explain why one application rate will not fit all winter events.

Pretreated Stockpiles

Pretreating is mixing a liquid deicer into the stockpile of salt or sand. The liquid used is not brine but a deicer that is hygroscopic and contains a corrosion inhibitor, and may also have stickiness to it. Often a dye is added to help identify the treated pile. You can apply pretreated salt without any equipment changes. Pretreated salt is more effective than dry salt and can allow you to lower your application rate.

- Purchase the pretreated salt from a vendor or mix it on site. If you choose to mix your own be accurate in your measurements.
    - Start out with dry salt. See the salt moisture worksheet in the materials testing section.
    - Treat the stockpile with a liquid deicing chemical (not brine) at 4-6 gallons/ton. Be consistent and check rates.
    - Mix up enough for one storm, not the entire season.
- Store pretreated stockpiles indoors on an impervious pad, consistent with Rule 5 requirements. See Appendix F to locate this information from the DEQ.
- Be aware that pretreated stockpiles have a higher risk of leaching. If you have containment limitations with your storage area, mix up just enough for one event rather than enough for the season. This will limit the leaching risk.

Treated salt piles need proper storage due to a greater risk of leaching

Prewetting Method for Deicing

Prewetting is the addition of a liquid to granular material by means of an on-board truck system. Liquid and granular are combined most often at the spreader, but sometimes in the auger. Wet salt has several advantages; it bounces less and melts ice faster. Prewetting requires some equipment changes, but this practice provides the flexibility to switch chemicals or liquid/granular ratio depending on conditions. Just as with pretreated salt, you can reduce your application rates by using prewetted salt.

- Include salt brine, calcium chloride, magnesium chloride, brine blends, acetates and others among the options you consider for prewetting.
- Check your liquid concentration before using. Figure 12 lists many of the optimal concentrations.
- Start with application ratios of 8-14 gallons/ton; this is the typical starting place for most organizations.[11]
- Super-saturated or slurry mixes activate even more quickly.

- Be sure to properly size the dry volume capacity in the hopper versus liquid holding capacities when purchasing on-board prewetting systems. It is vital that the total truck weight capacity is considered, as liquids add considerable weight to the overall load.

Direct Liquid Application for Deicing

Straight liquids are most commonly used for anti-icing, pretreating salt piles and prewetting on board the truck. However, it is becoming more common, especially in warmer winter conditions, to de-ice with straight liquid product. This is an advanced winter maintenance activity. Called “direct liquid application,” or DLA, this deicing technique is more difficult and should only be attempted by those very familiar with the use of liquid deicers in other areas of winter maintenance. It is possible to create a more slippery surface if straight liquids are used improperly for deicing.

- Attempt liquid-only deicing only after you have mastered the anti-icing and prewetting uses of liquids, and have the proper equipment for the liquid deicing operation.
- Having sufficient pressure on the streamer nozzles, so that the liquid penetrates the snow or ice and spreads out <u>below</u> the snow and ice, is the key to effective deicing with liquids.
- Spraying a liquid deicer on top of compacted snow or ice can increase the slipperiness of the surface.

<u>After the Event</u>

Learn from each storm. Each event provides an opportunity to evaluate what was done, how well it worked and what could be changed to improve operations. Information exchange is the best way to speed up positive changes in winter maintenance. At the end of each event, post or discuss the results of your operation so the entire crew can be informed. When the entire crew is informed and included, change happens faster. Examples of what to track and discuss include: driver statistics such as route length, the type materials used, the amount of material used, and the recovery time. Other things to consider might be the liquid to granular ratio, the type of plow blade, new road surface or other new equipment and/or procedures being tested.

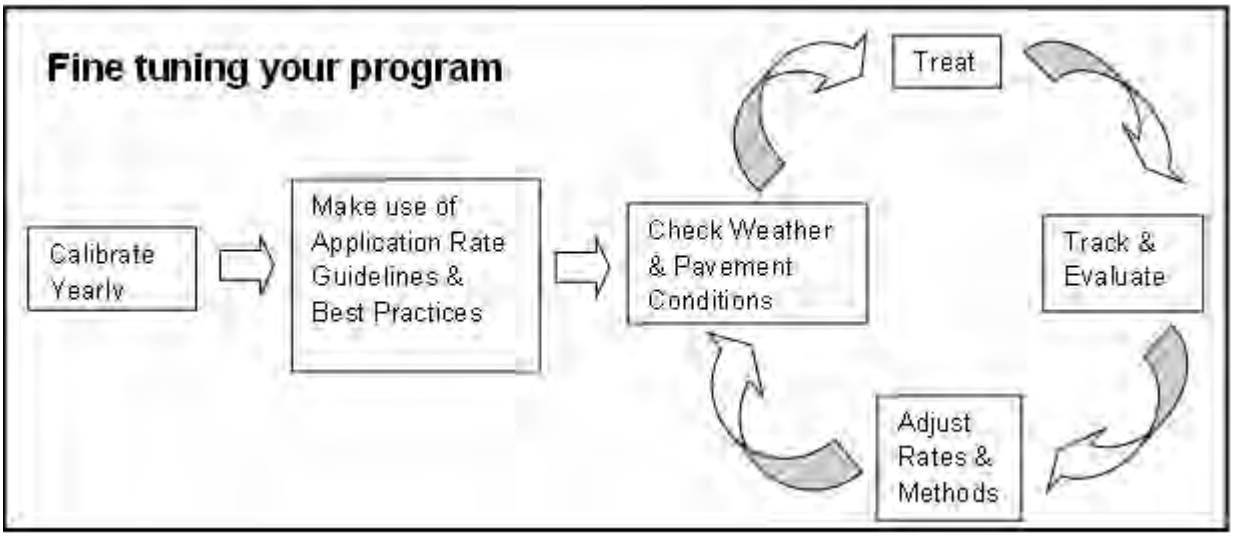


Figure 11: Maintaining a Progressive Winter Maintenance Operation

Key points for after the event

- Use forms such as those shown in the Appendix E of this manual to record and track your material use.
- Report any hazards such as low hanging branches and raised utilities.
- Ensure that all unused granular salt and salt/sand mixtures are stored properly.
- Refine your procedures and material use based on the “end of storm” meeting, and observations from operators.
- Wash vehicles after ensuring they are as empty as possible.
- Direct the wash water to collection/reuse areas or the sanitary sewer system. Do not direct wash water to septic systems or storm drains. Michigan’s DEQ Water Resources Division provides a guidance document on truck washing at municipally owned truck stations. See Appendix D, under salt storage and handling.

Key points for after the season

- Ensure that all unused granular salt and salt/sand mixtures are stored properly and records are kept of the amount of each product remaining.
- Clean and maintain truck tanks, brine making systems and pumps according to manufacturer specifications.

Materials and Quality Control

Practical and Eutectic Temperatures of Deicers

Multiple products can be used in a snow and ice control program. This chart helps you choose the correct product and apply it under the correct conditions. For further guidance on blending chemicals, see the MNDOT Anti-icing Guide, in Appendix B.

Chemical	Lowest Practical Melting Temp.	Eutectic Temp.	Optimal Concen-tration
NaCl (Sodium Chloride) —Delivered as solid rock salt, also can be made into a brine. The basis of most deicing materials. Very corrosive. Inexpensive. Very available. Rarely has a corrosion inhibitor added.	15º F	-6º F	23%
$MgCl_2$ (Magnesium Chloride)—Delivered as a liquid. Often used to wet NaCl crystals to increase adherence to surface and reduce melting points. Corrosive. Higher cost. Often has a corrosion inhibitor added.	-10º F	-28º F	27 to 30%
$CaCl_2$ (Calcium Chloride)—Delivered as flakes, pellets, or liquid. Powerful deicer but extremely corrosive. Sometimes used incorrectly to open storm drains. Higher cost. Often has a corrosion inhibitor added.	-20º F	-60º F	30%
CMA (Calcium Magnesium Acetate)—Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive, biodegradable. Sometimes added to sodium chloride as a corrosion inhibiter. Alternative for areas where chloride use must be limited. Often higher cost.	20º F	-18º F	32%
KAC (Potassium Acetate)—Delivered as a liquid. Often used on automated bridge deicing systems and airports. Use for anti-icing, deicing, and prewetting. Non-corrosive, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	-15º F	-76º F	50%
Blends— Both chlorides and acetates exist in blends. Talk to your supplier and determine the lowest practical melting temperature, the optimal concentration and the basic components in the blend. Most blends are centered on rock salt since it is cheap.			
Winter Sand/Abrasives—Winter sand has salt mixed in it to keep it from freezing. Sand should be used for cold temperatures when deicers are not effective. They provide temporary traction but only work when they are on top of the ice.	Never melts—provides traction only		

Figure 12: Practical and Eutectic Temperatures of Deicers

Material Conversions

The following quick reference table will help you convert between tons and cubic yards. Weight will vary depending on moisture content and density. This chart is based on a density of 80lbs/cubic foot.[12]

Sand		Salt	
Yards	Tons	Yards	Tons
1	1.4	1	1.1
2	2.8	2	2.2
3	4.2	3	3.2
4	5.6	4	4.3
5	7	5	5.4
6	8.4	6	6.5
7	9.8	7	7.6
8	11.2	8	8.6
9	12.6	9	9.7
10	14	10	10.8
11	15.4	11	11.9
12	16.8	12	13
13	18.2	13	14
14	19.6	14	15.1
15	21	15	16.2
16	22.4	16	17.3
17	23.8	17	18.4
18	25.2	18	19.4
19	26.6	19	20.5
20	28	20	21.6

Figure 13: Material Conversions
Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators, Second Revision, published by the Minnesota Local Road Research Board, 2012.

Materials Testing

It is important to understand how deicing chemicals will react on the roadway. Clear Roads developed a guide for testing the effectiveness of chemicals. See Appendix E.

Also test your materials to ensure that they are delivered as ordered and will perform as needed. Refer to your contract or Material Safety Data Sheet (MSDS) for optimal specific gravity and test for that. Michigan's state bid standard for moisture in road salt is 1.5%.

Testing solid salt

Having a standard for the moisture content in your salt prevents having to pay for water weight, and helps reduce the amount of leaching potential should you decide to pretreat the salt. Salt with excessively high moisture content is also more likely to freeze in storage and become difficult to work with.

- Watch the load being dumped and observe if it appears wet.
- Schedule deliveries for days when it is not raining, if delivery will occur outside.
- Test for moisture content. Typically you want a moisture content of less than or equal to 1.5% (check your agency's specification).

How to measure the moisture content of rock salt:

1. Supplies needed:
    - Calibrated scale (triple beam or digital) accurate to 0.1 grams
    - Microwave
    - Sample of the salt (about 1 cup), that is a good representation of the pile
    - Worksheet for recording weight measurements

2. What to do:
    - Place empty container on scale, zero out scale to account for your container.
    - Weigh sample before cooking and record weight on worksheet.
    - Cook sample on low heat (high power may be too hot and make the salt pop, compromising the weight of your sample).
    - Measure cooked/dry weight, record on worksheet.
    - Perform moisture calculations on the worksheet.
    - Save worksheet.

Salt Moisture Worksheet

Date: Company:

P.O. #: Ticket #:

A. Weight of wet salt

B. Weight of dry salt

C. Weight loss (A-B)

Moisture Calculations:

C÷A X 100 = _____ %moisture ***

Tested by:

Remarks:

***Typically you want a moisture content of less than or equal to 1.5% (check your agency's specification).

Testing sand

- Conduct a visual inspection of the material to make sure it is clean.
- Note that each agency has its own specifications based on available materials.

Testing liquids

- Take a 2 cup sample before unloading the tanker truck, use a clean container.
- Make sure you have the correct hydrometer for your material.
- Measure the specific gravity of the liquid using a hydrometer or salimeter.
- Record the results. Salt brine should have a salimeter reading of 85%, or a hydrometer reading of 1.176, which equates to 23.3% salt in the brine.
- Accept the load if the specific gravity is within specifications; if it doesn't meet specifications, don't unload, and notify the responsible supervisor.
- Keep a labeled, dated and sealed sample.

Glossary of Terms

Anti-Icing: The prevention of ice or frost formation upon a surface. Used typically to mean the application of liquid chemicals to prevent the formation of frost or the bonding of snow or ice to pavement.

AVL: Computer-based automatic vehicle location system; a GPS-based system which allows users to view vehicle location and other operational data through a computer portal.

BMPs: best management practices

Black Ice: Popular term for a very thin coating of clear ice which forms on a pavement or bridge deck surface.

Brine: Liquid deicer made of rock salt and water combination, 23% rock salt.

Brine Blends: Any solution for lowering the freezing point of water, with sodium chloride brine as the predominant component.

°C – degrees Celsius

$CaCl_2$: calcium chloride

Calibration: Measurement of the material discharged at each setting of a spreader.

Chloride: The most common ingredient in deicers.

Clear Roads: Clear Roads refers to the pooled funded project for winter maintenance research of which Michigan is a member. www.clearroads.org

De-icing: Defined as removal of existing, snow ice, frost, etc., from a surface. It includes both mechanical (blading or scraping) and chemical (application of salt or other ice melting chemicals) methods. De-icing after snow, ice or frost has already bonded to the pavement surface.

DEQ: Michigan's Department of Environmental Quality. Also referred to as MDEQ.

Dew Point: The atmospheric temperature (varying according to pressure and humidity) below which water droplets begin to condense and dew can form.

DLA: Direct liquid application. The use of straight liquids for deicing purposes.

DOT: Department of Transportation

Eutectic Temperature: Lowest freeze point attainable for a given solution or mixture. At the eutectic temperature, ice and saltwater and solid salt exist in equilibrium. For brine, the eutectic temperature -6°F.

°F – degrees Fahrenheit

Hydrometer: Measures the density of many liquids.

Hygroscopic: Nature of a substance, tending to absorb moisture from the air.

KAC: potassium acetate

DEQ: Michigan Department of Environmental Quality. Tasked with providing guidance and enforcement of the NREPA's Water Resources section, including Part 5 rules. Sometimes referred to as "MDEQ".

Lane mile (LM): An area considered to be 12 foot by 5, 280 feet or an area 63, 360 square feet.

lbs. – pounds

LOS (Level of Service): The LOS describes the desired end-of-storm condition and acceptable interim conditions.

MDSS: Maintenance Decision Support System

Melting capacity: Ice melting capacity is the weight of ice melted per pound of deicer at a given temperature. It can be expressed as the total amount of ice melt that can be achieved or it can be expressed as the amount of ice melt that will occur in a given period of time (e.g. 1 hour, 4 hours, etc.).

mg/l – milligrams per liter

mph – miles per hour

MSDS: Material Safety Data Sheet; content and safety information on chemical products.

$MgCl_2$: magnesium chloride

NaCl: sodium chloride

Non-community Water Supply: A water system that provides water for drinking or potable purposes to 25 or more persons at least 60 days per year or has 15 or more service connections. Michigan is home to nearly 10,000 non community water supply systems, which includes schools, restaurants, motels, campgrounds, and churches.

NREPA: Natural Resources and Environmental Protection Act, 1994 Public Act 451. Regulates facilities of environmental contamination in Michigan. Section 31 deals with Water Resources.

ppm – parts per million

Practical Temperature: Sometimes referred to as the effective temperature; the lowest temperature at which a chemical solution/product is useful for lowering the freezing point of water.

Prewetting: Action by which a solid material is wetted with a liquid via an on-board system either at the spinner or in the auger.

Pretreating: Action by which a solid material is wetted in the stockpile. It can either be delivered already pretreated by the supplier, treated with an overhead showering system, pubmilled, or wetted with a hose and loader, then rolling material to mix.

psi – pounds per square inch

ROI: return on investment

Part 5 Rules: Administrative rules promulgated pursuant to Part 31, Water Resources Portection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) MCL 324.3101 et seq and revised in 2009. The rules address release prevention planning, secondary containment, surveillance and release reporting requirements.

RWIS: Road weather information system; computer-based system of obtaining weather and surface data from remotely-located, permanent sensors.

Salimeter: Instrument that measures the density of salt brine. Also sometimes called a salinometer.

sq. ft. – square feet

Practical Temperature: Range of pavement temperatures within which a chemical will effectively melt ice.

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Findlay, Stuart E.G. and Kelly, Victoria R. "Emerging Indirect and Long-term Effects of Road Salt on Ecosystems." Annals of the New York Academy of Sciences. March 2011 (Vol. 1223), pp. 58-68.

Gallivan, Frank et al. "Greenhouse Gas Mitigation Measures for Transportation, Construction, Maintenance, and Operations Activities." ICF International. August 2010.

"Global positioning system (GPS) technology can assist in tracking and reducing costs." Inside, (online) p 10. http://www.iowadot.gov/inside/inside_december_2011.pdf.

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Minnesota Department of Transportation (Mn/DOT), undated. MnDOT 2010-2011 Annual Winter Maintenance Report- At a Glance. http://www.dot.state.mn.us/maintenance/docs/MnDOT%20Winter%20at%20a%20Glance_1.26.12_WEB.pdf . Accessed on 6/21/12.

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Murray, D M and Brenner, R. "Economic Analysis of the Environmental Impact of Highway Deicing Salts." Transportation Research Board Report. 1977. No. HS-024 782.

"Storm Water Management Fact Sheet: Minimizing Effects from Highway Deicing." US Environmental Protection Agency, Office of Water, Washington, D.C. (EPA 832-F-99-016). September 1999.

US EPA National Water Summary, 1986. Secondary maximum contaminant levels, (subpart B of Part 141, national interim primary drinking water regulations). US Code of Federal Regulations, Title 40, Parts 100-149, revised July 1, 1986.

Vitaliano, Donald F. 1992. “An Economic Assessment of the Social Costs of Highway Salting and the Efficiency of Substituting a New Deicing Material.” Journal of Policy Analysis and Management. 1992 (11-3) pp. 397-418.

Winter Parking Lot and Sidewalk Maintenance Manual: Environmental Impacts of Chloride. 2008 revision. Fortin Consulting Inc. with Minnesota Department of Transportation, Minnesota Pollution Control Agency and CTAP (Circuit Training and Assistance Program).

APPENDIX A: Policy and Education Examples

Level of Service Designations by MDOT.
http://www.michigan.gov/mdot/0,4616,7-151-9620_11057-225137--,00.html

Michigan Winter Maintenance for Michigan Roads Program.
http://miwintermaintenance.weebly.com/

How Salt Works: New Hampshire Best Management Practices.
http://des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/documents/bmp-salt-works.pdf

Minnesota Winter Maintenance Training and Manuals.
www.pca.state.mn.us/programs/roadsalt.html

Colorado DOT webpage for customer outreach.
http://www.coloradodot.info/travel/winter-driving/faqs.html

MDOT customer outreach examples:

See first link of this Appendix to find this document on-line.

APPENDIX B: Anti-icing Information

Anti-icing cost model
www.dot.state.mn.us/maintenance/training.html

Iowa Department of Transportation. *Anti-icing Equipment Manual* (with drawings for shop-made equipment). 1999.
www.dot.iowa.gov/maintenance/internetpages/chemicals/ManualAntiicingEquipment.pdf

Minnesota DOT *Anti-icing Guide*. 2010.
www.dot.state.mn.us/maintenance/docs/training/antiicingguide8Full.pdf

Anti-icing in winter maintenance operations: examination of research and survey of state practice
www.lrrb.org/media/report/TRS0902.pdf

Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel. 1996.
http://www.fhwa.dot.gov/reports/mopeap/mop0296a.htm#I17

Example Documentation Form For Anti-Icing

Anti-icing Route Data Form				
Truck Station: Date:				
Air Temperature	Pavement Temperature	Relative Humidity	Dew Point	Sky

Reason for applying:

Route:

Chemical:

Application Time:

Application Amount:

Observation (1st day):

Observation (After event):

Observation (Before next application):

Name:

Source: Minnesota Snow and Ice Control: Field Handbook for Snowplow, Second Revision. Published by the Minnesota Local Road Research Board, 2012.

Anti-Icing Application Decision Flowchart

This is one example of an anti-icing flow chart. You should review this, change as appropriate to fit your organization, and put into place a customized decision tree for your organization.

Source: Anti-icing Decision Flowchart provided by Mark DeVries, McHenry County, Illinois.

APPENDIX C: Calibration information

Calibration Resources

Link to calibration of salt truck
http://michigan.gov/documents/mdot/mdot_ma_2009-02_calibration_of_salt_trucks_349377_7.pdf

MDOT Dickey John ICS 2000 calibration Manual
http://www.dickey-john.com/_media/pw_mac_ICS2000_calibration_and_programming_manual.pdf

MDOT Control Point Calibration Manual
http://www.dickey-john.com/_media/1-1489_1.pdf

Old MDOT Salt Calibration Instructions
http://inside.michigan.gov/sites/mdot/highways/ops/maintenance/mmm/Documents/Salt_Calibration_Instructions.pdf

Clear Roads has links to manufacturers' calibration instructions and a comprehensive calibration guide. Clear Roads: Research for Winter Highway Maintenance.
http://clearroads.org/researchprojects/05-02calibration.html

For liquid calibrations, see page 30 of the Minnesota DOT Anti-icing Guide (2010) at
http://www.dot.state.mn.us/maintenance/docs/Training/Anti%20Icing%20Guide%208%20Full.pdf

Road Salt Education Program, Minnesota Pollution Control Agency. Four types of calibration links, bottom of the page.
http://www.pca.state.mn.us/index.php/about-mpca/mpca-events-and-training/road-salt-education-program.html

Calibration Worksheet

Agency:	
Location:	
Truck No.:	Spreader No.:
Date:	By:
Gate Opening:	Pounds per Revolution:

Control **Setting**	Auger or Chain Sprocket Revolutions per Minute	Discharge Rate per Revolution	Discharge Rate per Minute	15 MPH X 4.00	20 MPH X 3.00	25 MPH X 2.14	30 MPH X 2.00	35 MPH X 1.71
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Sample Cab Card: courtesy of Michigan DOT

APPENDIX D: Equipment and Weather Resources

- **Blades and Plows**

The Clear Roads Institute has published a study of plow prototypes. 2011.
http://www.clearroads.org/downloads/Multiple-Blade-Snowplow-Project-Final%20Report_1-6-11.pdf

The Clear Roads Institute has published a study of carbide blade durability with comparisons. 2001.
www.clearroads.org/research-projects/07-01 carbideinsert.html

- **Equipment modification for low application rates**

For those unable to deliver an even spread pattern with a 9-inch auger at low application rates, one suggestion is exchanging the 9 inch diameter auger for either a 6 inch auger or a 9 inch "special" auger with larger core and smaller flighting; these "special" augers deliver about 2/3 less material per revolution.

- **Chute**

How to build a chute:

Minnesota Department of Transportation, Office of Maintenance-Training.
www.dot.state.mn.us/maintenance/training.html and

LLRB: Local Operational Research Assistance Program. Maintenance Decision Support System.
http://www.mnltap.umn.edu/about/programs/opera/fact/documents/washingtoncad.pdf

- **MDSS, AVL**

Pooled Fund Study Maintenance Decision Support System Website.
http://www.meridian-enviro.com/mdss/pfs/

Analysis of Maintenance Decision Support System (MDSS) Benefits & Costs, Study SD2006-10, Final Report. Prepared by Western Transportation Institute and Iteris, Inc., May 2009.
http://www.meridian-enviro.com/mdss/pfs/files/WTI-4W1408_Final_Report.pdf

- **Snow fence resources**

Illinois Department of Transportation. Snow fence information.
www.dot.il.gov/blr/1002.pdf

Minnesota Department of Transportation. Living Snow Fences. Snow fence and road design information to prevent blowing snow.

http://www.dot.state.mn.us/environment/livingsnowfence/index.html

Iowa Department of Transportation. Systems Operation Bureau-Office of Maintenance.
http://www.iowadot.gov/maintenance/snowfence.html

- **General Assessment of New Equipment/Resources**

Clear Roads cost benefit analysis toolkit. This provides instruction on how to do return on investment (ROI) calculations for new equipment and new techniques.
http://clearroads.org/research-projects/08-02costbenefitanalysis.html

Western Transporation Institute. Periodic bulletins with information on new equipment and new techniques.
http://www.westerntransportationinstitute.org/publications

Grid for bounce and scatter evaluation
www.sustainablesaltingsolutions.com/material_application_gr.html

- **Salt Storage and Handling**

Michigan Department of Environmental Quality. Salt is considered to be a polluting material under Part 5 Rules—Spillage of Oil and Polluting Materials, of Part 31 of NREPA—Water Resources Protection.
http://www.michigan.gov/documents/deq/deq-ess-p2tas-commercialsaltguidance_267027_7.pdf

Michigan DEQ Water Resources guidance document on vehicle washing.
http://www.michigan.gov/documents/deq/dnre-oppca-faq-vehiclemaintenance_341557_7.pdf

Indiana DOT Invests in Improved Salt Storage, Salt Institute Newsletter, First Quarter 2010.
http://www.bv.transports.gouv.qc.ca/per/0974374/09_2010/01_vol_47_no_1_2010.pdf

- **Weather Information**

Michigan Department of Transportation. Weather and road camera for specific Michigan highway locations. Provides air temperatures only.
http://mdotnetpublic.state.mi.us/drive/

APPENDIX E: De-icing Information

Example Loader Ticket: Daily Salt/Sand Issued

Operator	Shift	Date
Loader No.	Capacity of Bucket	

Stockpile	Truck #	Yards Sand	Yards Salt	Stockpile	Truck #	Yards Sand	Yards Salt
TOTALS							

Example Daily Salt/Sand Use Ticket

Operator	Shift	Date
Truck No.	Capacity	
Weather		

Stockpile	Route	Yards Sand	Yards Salt	Yards Used	Yards Returned	Liquid Gallons
TOTALS						

Clear Roads: Research for Winter Highway Maintenance. Testing the effectiveness of chemicals.
http://clearroads.org/
Click on research projects, completed projects.

MDEQ FAQ Deicers from Agricultural By-Products. Link to report is on the bottom of this page, under Miscellaneous.
http://www.michigan.gov/deq/0,1607,7-135-3307_36106-167850--,00.html

"Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts." The National Cooperative Highway Research Program. This is a comprehensive report.
http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=883

Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators, Second Revision. Minnesota Local Road Research Board. 2012.
http://www.mnltap.umn.edu/publications/handbooks/documents/snowice.pdf

Summary of an evaluation program of de-icing options by the New Hampshire DOT Research Board.
http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/documents/13733q_poster.pdf

Salt Bounce and Scatter Link
http://michigan.gov/documents/mdot/Final_ReportNov2012_404228_7.pdf

APPENDIX F: Environmental Information

MDEQ. Salt and Brine Storage Guidance for Road Agency Maintenance and Other Facilities.
http://www.michigan.gov/documents/deq/deq-ess-p2tas-bulksaltbrineguidance_267024_7.pdf

MDEQ, Rule 5 Guidance Documents.
http://www.michigan.gov/deq/0,4561,7-135-3313_23420-109985--,00.html

MDEQ guidance on how to develop a Pollution Incident Protection Plan (PIPP).
http://www.michigan.gov/documents/deq/deq-ess-p2tas-Part5PIPPchecklist_267025_7.pdf

Michigan's Storm Water Pollution Prevention Initiative (SWPPI). The SWPPI is a subset of the Watershed Management Plan and is typically due 2.5 years after the certificate of coverage is issued to the applicant. The following link details the SWPPI requirements as stated in the permit.
http://rougeriver.com/stormwater/permit.html

Proof's in: salt management protects the environment. Richard L. Hanneman. Salt Institute Newsletter. Third Quarter 2010
http://www.saltinstitute.org/content/download/12660/79607

Determining the toxicity of deicing materials. Research project funded by Clear Roads. (2012-ongoing).
http://www.clearroads.org/research-projects/11-02toxicity-of-deicing-materials.html

To learn more about Part 31 of NREPA, refer to the guidance document found line at
www.michigan.gov/deq
Select the "Get Involved Programs for Citizens" browser button on the left side of the webpage.

Environmental Fact Sheet, New Hampshire Department of Environmental Services, 2011. Includes information on best management practices.
http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf

Information on the water quality of Michigan's inland lakes. Fuller, L.M., and Taricska, C.K., 2012, Water-quality characteristics of Michigan's inland lakes, 2001–10: U.S. Geological Survey Scientific Investigations Report 2011–5233.
http://pubs.usgs.gov/sir/2011/5233/

Water Quality and Pollution Control in Michigan. 2012
2012 Sections 303(d), 305(b), AND 314. MI/DEQ/WRD-12/001
http://www.michigan.gov/documents/deq/wrd-swas-draft-2012IR_370366_7.pdf

End Notes

[1] *Winter Parking Lot and Sidewalk Maintenance Manual: Environmental Impacts of Chloride*. 2008 revision. Fortin Consulting Inc. with Minnesota Department of Transportation, Minnesota Pollution Control Agency and CTAP (Circuit Training and Assistance Program).
[2] Mullaney, J.R., Lorenz, D.L., Arntson, A.D., 2009, Chloride in groundwater and surface water in areas underlain by the glacial aquifer system, northern United States: U.S. Geological Survey Scientific Investigations Report 2009–5086, 41 p.
[3] US EPA National Water Summary, 1986. Secondary maximum contaminant levels, (subpart B of Part 141, national interim primary drinking water regulations). US Code of Federal Regulations, Title 40, Parts 100-149, revised July 1, 1986, pp. 587-590.
[4] Dean, W., Anderson, R., Bradbury, J.P., and Anderson, D., 2002, A 1500-year record of climatic and environmental change in Elk Lake, Minnesota: Journal of Paleolimnology 27, 287-299.
[5] Findlay, Stuart E.G. and Kelly, Victoria R. Emerging Indirect and Long-term Effects of Road Salt on Ecosystems. Annals of the New York Academy of Sciences, Vol. 1223, pp. 58-68, March 2011.
[6] *Snow Fence Guide*. Strategic Highway Research Program (SHRP), 1991. SHRP - National Research Council, Washington, D.C., SHRP-W/FR-91-106.
[7] "Global positioning system (GPS) technology can assist in tracking and reducing costs." Inside, p 10. http://www.iowadot.gov/inside/inside_december_2011.pdf.
[8] Bruce Erickson, Oregon DOT Fleet Services Manager (Nov. 17, 2009) citied in *Greenhouse Gas Mitigation Measures for Transportation, Construction, Maintenance, and Operations Activities*, requested by Gallivan, Frank et al. ICF International. August 2010.
[9] *Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators, Second Revision,* published by the Minnesota Local Road Research Board, 2012. http://www.mnltap.umn.edu/publications/handbooks/documents/snowice.pdf
[10] Salt Bounce and Scatter Study. Final Report, November 2012. MDOT Operations Field Services Division. http://www.michigan.gov/documents/mdot/Final_ReportNov2012_404228_7.pdf
[11] *Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators, Second Revision.*
[12] Salt Institute. The Salt Institute references a dry density of 72 lbs./ft3 for the ASTM D632 Specification; however, there is a variability of density from mid 70s to 84 lbs./ft^3 for natural halite/salt. http://www.saltinstitute.org/About-salt/Physical-properties

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