

**EXHIBIT A
SCOPE OF SERVICES**

**EXPANDING THE SUCCESS OF SALT-TOLERANT ROADSIDE TURFGRASSES THROUGH INNOVATION
AND EDUCATION**

BACKGROUND

The University has been working with several partners for over four years developing and implementing salt-tolerant grasses on roadside settings. The result of this effort has been the introduction and use of salt-tolerant sod and seed mixtures that are made up primarily of fine fescue species. Through on-site assessments, the University has determined that even with the use of these improved mixtures, there are an unacceptably high number of installation failures. The University has concluded that these failures are due to many factors including improper pre- and post-installation watering, poor soil preparation, seasonal weather influence, poor rooting of fine fescue grasses cut for sod, and lack of nutrients. Of these, the primary problem appears to be improper watering during establishment. Current watering practices are insufficient for fine fescue sod and new options need to be identified and implemented in a way that makes economic sense for MnDOT and sod/seed installers. The first objective of this project is to investigate alternative means of irrigating new installations of salt-tolerant sod mixtures. The second objective is to evaluate these new irrigation methods in comparison to current practices. In objective 3, the University will develop an online certification training and education program for contractors, maintenance operators, and engineers. Finally, in objective 4, the University will develop online maintenance education for private owners that receive new salt-tolerant grass installations. This project expands on a current Local Road Research Board (LRRB)-funded project that is determining the most important factors associated with roadside salt-tolerant grass establishment (best time of year to sod; how to amend the soil; how much water is needed; etc.). This project will use information from the previously-funded project to (1) develop systems that can be used in the field by installers and (2) educate and train stakeholders involved in this important component of road construction.

SCOPE

This project will benefit MnDOT and the contractors that establish roadside turf grasses by identifying a more economical and effective means of irrigating salt-tolerant seed and sod. The main goals of this project are to reduce the cost of watering and to increase the number of successful establishments. The University will measure this by testing new irrigation strategies in comparison to current watering programs by quantifying both the monetary cost and the improvement in establishment successes using newly developed watering techniques. The end-users of this information will be contractors, maintenance operators, engineers, private owners, and anyone involved in the establishment of salt-tolerant seed and sod in the upper Midwest. Users of salt-tolerant grasses will be provided with online training information in a series of educational modules that address basic turfgrass management and roadside-specific issues. This education and training is important because it will result in more highly educated turfgrass installers and managers which will increase the chance for successful installations that do not need to be redone. Effectiveness of the online training will be assessed through pre and post-class quizzes designed to measure how much the user has learned. End-users for online educational content include anyone involved in roadside grass installations (sod growers, installers, water truck operators, private owners maintaining newly installed salt-tolerant turf grasses).

OBJECTIVES

Objective 1: The University will design and demonstrate several (at least five) options for irrigating new seed and sod installations on roadsides, including establishing new watering techniques through the use of onsite water sources and modifications to current water truck systems. This will involve connecting to fire hydrants or other water sources, installing a pressure reducing system, and then testing both drip and sprinkler irrigation. The University will also evaluate different watering techniques and methods with current water trucks, including nozzle configurations and water delivery methods, in an effort to reduce costs while increasing watering efficiency and uniformity. The most promising methods will be further tested in Objective 2. Specific systems evaluated will include:

1. Identifying water truck nozzles that "fan" out the water coming from the truck better than current soaker type nozzles. Determine efficiency and cost of irrigating in this manner.
2. Determine the efficiency and cost of drip tape style irrigation.
3. Determine the efficiency and cost of above ground drip line style irrigation.
4. Determine the efficiency and cost of below ground drip line style irrigation.
5. Determine the efficiency and cost of above ground sprinkler style irrigation.

Objective 2: Following the design and preliminary evaluation of alternative watering systems, the University will evaluate the efficiency of watering new sod installations using these new watering methods on roadside research sites. At least two new watering methods (from Objective 1) will be tested and a total of at least three roadside sites will be identified and used for this study; sites will be chosen by the University and MnDOT. These sites will be controlled research areas receiving no additional maintenance from contractors. Following site selection, the University will control the existing vegetation at each site and prepare the sodbed. Irrigation systems will be constructed and put in place before or after new sod installation, depending on the type of irrigation system. Each site will be evaluated for 60 days after sodding or seeding and we will be collecting data at 30, 45, and 60 days following planting. These evaluations will take place from May 2016 – October 2016. Effectiveness of these new systems will be quantified by collecting data on total amount of water applied, irrigation efficiency, irrigation uniformity (using time-domain reflectometry to determine soil moisture throughout the site), turf establishment, turfgrass quality, and rooting characteristics. The University will also estimate costs associated with installation, setup and operation of each system for comparison to commonly-used methods. Each site will be further evaluated periodically for at least 1-year. The University anticipate that an outcome of this objective will be knowledge about the most cost effective options for irrigating sites with and without available water sources on various soil types and topographies.

Objective 3: By using information from Objectives 1 and 2 of this project, in addition to knowledge developed from both of our other LRRB-funded projects (*Developing Salt-Tolerant Sod Mixtures for Use as Roadside Turf in Minnesota* and *Best Management Practices for Establishment of Salt-Tolerant Grasses on Roadsides*), the University will develop an online training program detailing successful practices for installation and management of roadside turf grasses. The University's Extension and experienced project team will develop the content. The training program will address basic turfgrass management and roadside-specific issues. This program will be mandatory for contractors involved with installation and establishment of salt-tolerant grasses on roadsides. Additionally, the University will create factsheets and videos with step-by-step information on successful establishment of both seed and sod. This will serve as an excellent continuing education opportunity for roadside turfgrass installers, maintenance operators, and engineers.

Objective 4: The University's Extension will develop online maintenance education for private owners that receive new salt-tolerant grass installations. This education will be free of charge to the public and will be incorporated into the University's Turfgrass Science website. The education will address specific practices related to proper management of salt-tolerant grasses, including watering, fertilizing, mowing, and general culture. The webpages will also feature videos and informational sheets related the establishment and management of these salt-tolerant species. In addition to the online education, the University will develop a brochure that can be given to private owners residing along newly installed salt-tolerant seed or sod areas. This training will provide basic information about care for these mixtures and how their current practices may need to change in order to manage the lower-input fine fescue species.

WORK PLAN

Task Descriptions

Task 1: Alternative Strategies for Watering New Seed and Sod Installations on Roadsides

The University will design and demonstrate at least five alternative irrigation strategies for successful establishment of both seed and sod installations on roadsides. This will include utilization of on-site fire hydrants or other sources, as well as modification to basic water truck delivery systems. Specific systems evaluated will include: 1) identifying more efficient water truck nozzles, 2) drip tape style irrigation, 3) above ground drip line style irrigation, 4) below ground drip line style irrigation, 5) above ground sprinkler style irrigation.

Task 2: Assessment of New Irrigation Strategies vs Current Strategies

The University will install and implement the best alternative irrigation strategies from Objective 1. These systems will be compared with current water truck irrigation practices across three controlled sites receiving new sod establishments. The University will assess at least two new methods at each site.

Task 3: Development of Online Education and Training for Installation and Management of Salt-Tolerant Roadside Turfgrasses

The University's Extension will develop an online training program on salt-tolerant roadside turfgrass installation and maintenance.

Task 4: Development of Education and Website Content for Private Owners

The University's Extension will develop an online education program on proper establishment and maintenance of salt-tolerant grasses for private owners. Additional content will be developed detailing specific maintenance practices through videos and information sheets.

Task 5: Compile Report, Technical Advisory Panel Review and Revisions

The University will prepare a draft report, following MnDOT's publication guidelines, to document project activities, findings and recommendations. This report will need to be reviewed by the Technical Advisory Panel (TAP), updated by the University's Principal Investigator to incorporate technical comments, and then approved by Technical Liaison before this task is considered complete.

Task 6: Editorial Review and Publication of Final Report

During this task the Approved Report will be processed by MnDOT's Contract Editors. The editors will review the document to ensure it meets the publication standard.

Task Deliverables

Task:	Deliverable(s):
1A:	Interim Report, on progress and findings
1B:	A Summary Report, submitted to MnDOT, of findings related to new irrigation strategies, moisture distribution and water usage, and costs, including pictures of the newly designed systems, operating specifications, initial cost associated with purchasing and setup, and maintenance issues observed; Full Drawings, of the design and construction of the recommended irrigation systems will be presented to MnDOT
2A:	An Interim Report, on progress and findings
2B:	A Summary Report, submitted to MnDOT, regarding recommendations for implementation of the most cost effective, efficient, and uniform irrigation strategies for sites with and without water sources (information provided will include drawings for construction of these systems, as well as a parts list and a detailed cost associated with each part)
3A:	An Interim Report, on the development of educational training
3B:	Online Training Modules, providing a series of lessons on salt-tolerant turf grasses and low-input turfgrass management for contractors, maintenance operators, and engineers seeking knowledge about roadside turfgrass establishment. This training program will be mandatory for contractors looking to establish salt-tolerant roadside grasses. The modules will be created as separate stand-alone educational pieces that can be delivered and/or viewed individually or as an entire program. PowerPoint Presentations, to be used by MnDOT for educating stakeholders on salt-tolerant grasses. TAP members will conduct beta testing of the training prior to dissemination.
4:	Online Education and Website Content, for private owners that have had salt-tolerant roadside turf grasses installed at their property. This content will be displayed on the University's Turfgrass Science webpage, www.turf.umn.edu . This content will be maintained and updated by the University for a period of 5 years, after which a fee structure will be determined to maintain the content. PowerPoint Presentations, to be used by private owners. TAP members will conduct beta testing of the training prior to dissemination.
5:	A Draft Report; A PowerPoint Presentation; A Final Report, approved for publication
6:	A Final Published Report; Final Published PowerPoint Presentations

PROJECT SCHEDULE**Task Completion Dates**

Task:	Draft Deliverable Due Date:	Final Task Approval Date:
1A		September 30, 2015
1B	February 28, 2016	April 30, 2016
2A		July 31, 2016
2B	February 28, 2017	April 30, 2017
3A		July 31, 2017

3B	February 28, 2018	April 30, 2018
4	October 31, 2018	December 31, 2018
5	February 28, 2019	April 30, 2019
6		June 30, 2019

Task Durations

Months:	2015									2016								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task 1A	X	X	X															
Task 1B				X	X	X	X	X	X									
Task 2A											X	X	X					
Task 2B														X	X	X	X	X
Task 3A																		
Task 3B																		
Task 4																		
Task 5																		
Task 6																		

Months:	2017												2018											
	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	
Task 1A																								
Task 1B																								
Task 2A																								
Task 2B	X	X	X	X																				
Task 3A					X	X	X																	
Task 3B								X	X	X	X	X	X	X	X	X								
Task 4																	X	X	X	X	X	X	X	
Task 5																								
Task 6																								

Months:	2019					
	43	44	45	46	47	48
Task 1A						
Task 1B						
Task 2A						
Task 2B						
Task 3A						
Task 3B						
Task 4						
Task 5	X	X	X	X		
Task 6					X	X

Key Milestones

Key Milestones	Target Date	Description
New Irrigation Options	December 1, 2015	Identify new irrigation options for roadsides
Field Evaluation	December 1, 2016	Complete field testing and comparison of new irrigation methods
Online Education	February 1, 2017	Fully functional online course available for stakeholders
Homeowner Education	October 1, 2018	Brochure and website complete and ready for use by private owners