South Dakota
Department of Transportation
Office of Research

U.S. Department
of Transportation
Federal Highway
Administration

SD04-05-F

SDDOT Water Quality Enhancement Program for Construction

Study SD04-05
Final Report

Prepared by
Texas Transportation Institute
Environmental Management Program
3578 TAMU
College Station, Texas 77843-3578

March 2005

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ACKNOWLEDGEMENTS

This work was performed under the supervision of the SD04-05 Technical Panel:

Tim Bjorneberg.....Planning & Engineering
Joan Bortnem .....Project Development
Mike Carlson..... Belle Fourche Area
Noel Clocksin..... Local Government Assistance
Dave Drake .....Watertown Area
Hadly Eisenbeisz..... Bridge Design
Natalie Gates.....US Fish & Wildlife
Curt Cady.....Project Development
Kevin Heiman .....Yankton Area
Marc Hoelscher.....FHWA
Jason Humphrey..... Operations Support
AliceAnn Krantz.....Buskerud Construction
Ron Koth..... SD Game, Fish & Parks
Tanya Lieberman.....Road Design
Nathan Morey.....Project Development
Daris Ormesher..... Office of Research
Mark Peppel..... Pierre Area
Eric Prunty..... Mitchell Area
Albert Spangler.....DENR
Hal Rumpca ..... Office of Research
Steve Ryan.....Road Design
Scott Schweitzer .....Brosz Engineering

The research team wishes to express their sincere appreciation to all of the SDDOT technical panel and individuals who have helped us complete this project. We appreciate the advice and consideration of Joan Bortnem and Curt Cady for helping us with the project's environmental context and in understanding their responsibilities in the SWPPP process. We are appreciative of Dean VanDeWiele and his staff, Steve Ryan and Tanya Lieberman for their help in getting base materials for illustrations and for their assistance and council regarding the plan preparation phase of the SWPPP. Special thanks to the Area engineers and project engineers, Mark Peppel, Dave Drake, Kevin Heiman, Eric Prunty, Mike Carlson, for their help in arranging field visits and their honest and forthright view of construction site reality. We appreciate Jason Humphrey's help and council in crafting language consistent with the policies and specifications of SDDOT and Tim Bjorneberg for asking the hard questions and helping us understand department policy. We also want to express our thanks to Stacy Read and Al Spangler with SD DENR for their help with the regulatory frame work and with state regulations. Alice Ann Krantz was most helpful in helping us maintain a view of the contractor's world. Finally, the research team expresses our most sincere thanks to Daris Ormesher for his guidance, easy manner, hospitality, and assistance in getting to the places and in contacting the people we needed to accomplish the project.

The work was performed in cooperation with the United States Department of Transportation Federal Highway Administration.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. SD04-05-F	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle SDDOT Water Quality Enhancement Program for Construction		5. Report Date April 27, 2005	
		6. Performing Organization Code	
7. Author(s) Harlow Landphair, Jett McFalls, Beverly Storey, Ming-Han Li		8. Performing Organization Report No.	
9. Performing Organization Name and Address Texas Transportation Institute Environmental Management Program, 3578 TAMU College Station, Texas 77843-3578		10. Work Unit No.	
		11. Contract or Grant No. 310893	
12. Sponsoring Agency Name and Address South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586		13. Type of Report and Period Covered Final Report August 2004 to April 2005	
		14. Sponsoring Agency Code	
15. Supplementary Notes An executive summary is published separately as SD04-05-X.			

16. Abstract

This study examined the current practices used by the South Dakota Department of Transportation (SDDOT) to control storm water discharges from activities associated with construction. The study reviewed and summarized current regulations as implemented by the South Dakota Department of Environment and Natural Resources, surveyed current practice, knowledge and skills related to preparation, execution and maintenance of erosion and sediment controls of SDDOT Staff, their contractors and consultants and reviewed construction site state-wide. These findings were utilized to develop two new manuals for design and construction activities associated with erosion and sediment control and to develop a training program. The report made several recommendations to facilitate the preparation of the SWPPP, facilitate materials selection, and institutionalize the knowledge needed to comply with water quality mandates. The educational materials prepared consisted of a series of 10 annotated presentations, an instructor's manual and a student guide. It was recommended that these training materials be used as the basis for a sediment and erosion control certification program for SDDOT personnel, contractors and consultants that work for SDDOT.

17. Keywords Drainage, Erosion control, Sediment control, Storm water quality,	18. Distribution Statement No restrictions. This document is available to the public from the sponsoring agency.		
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages 73	22. Price

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EXECUTIVE SUMMARY

INTRODUCTION

The goal of the South Dakota Department of Transportation (SDDOT) Water Quality Enhancement Project was to institutionalize tools and procedures that would help ensure SDDOT was meeting its water quality protection obligations in an efficient and cost effective manner. The project had two primary objectives:

- Determine ways to improve compliance with environmental regulations pertaining to water quality for SDDOT construction projects.
- Develop erosion and sediment control manuals and training materials reflecting the Department's erosion and sediment control design policies.

RESEARCH FINDINGS

This project's research activities included a literature review, a formal survey of SDDOT personnel, contractors, and consultants, and a review of the current SDDOT design and project delivery process which impact the Department's storm water quality activities. The research findings are as follows.

Literature

1. The literature suggests that the problems and issues that SDDOT is experiencing in implementing federal and state storm water quality programs are common to many other transportation agencies across the country. Practically every state has either developed or is in the process of developing manuals and training programs to help personnel meet storm water requirements for their construction activities.
2. Nationally, a majority of the storm water quality training programs have been developed by each state's environmental regulatory agency or as cooperative programs between the agency and the transportation department.
3. SDDOT currently has a scattered assortment of specifications, technical documents, presentations, and manuals that for the most part contain good, if somewhat limited information related to sediment and erosion control.
4. In some instances the design practices recommended for selecting erosion control materials are not consistent with current engineering practice, while SDDOT's Drainage Manual recommendations are in line with current literature. See Federal Highway Administration Hydraulics Engineering Circular No. 15 (HEC-15).

The Survey

1. The survey showed that a majority of the SDDOT personnel and their contractors confirmed a need for training to help them understand the requirements and policies for administration of the requirements on project sites. On the other hand, most all SDDOT personnel felt they had a good understanding of sediment and erosion control methods and technology.
2. There was a general and overwhelming consensus among SDDOT personnel that a certification program would be beneficial.

3. Most personnel responded that their weakest knowledge was in the area of Best Management Practice (BMP) maintenance and the regulatory requirements.

The Training Audience

In addition, the research intended to identify the personnel that should receive training in erosion and sediment control. Based on the survey results, discussions with the technical panel, and follow up interviews with selected SDDOT staff, the research team recommends:

1. Training should be provided for all SDDOT engineering design personnel as well as project engineers and field technicians.
2. SDDOT should require training for general contractors that do grading and paving work, as well as those subcontractors that provide erosion and sediment control services and products.
3. Consultants that prepare project documents should also be required to take the training in order that they understand SDDOT's operational requirements.

The Design Process

The research required a review of the project development process to ensure that the proper information was being conveyed to prospective bidders and to those personnel in charge of field administration. This investigation led to several specific recommendations.

1. The research team noted differences in strategies for implementing the Storm Water Pollution Prevention Plan (SWPPP) requirements for construction projects. Efforts to have the general contractors implement erosion and sediment controls as a routine part of the construction process resulted in bidding inconsistencies and some unsatisfactory performance in meeting regulatory requirements.

   Given the lack of uniform understanding on the part of the contractors and the confusion that can result in preparing bids when there is not sufficient plan information to note what will or may be required, the research team recommended that SDDOT prepare detailed erosion and sediment control plans and the SWPPP documentation. SDDOT showed to be moving in this direction already.

2. To facilitate the process of preparing the SWPPP, the research team recommended that it be incorporated into the project document set. SDDOT already had a Section D plan notes section for erosion and sediment control. The recommendation was that this section be renamed the SWPPP and that additional boiler plate be added to the section to comply with the South Dakota Department of Environment and Natural Resources (SD DENR) requirements for the SWPPP. The research team developed these materials and submitted them for approval by SDDOT.

3. The research team noted in the review that SDDOT used a limited Approved Products List (APL) for many of the erosion and sediment control materials.

Therefore, researchers recommended this list be expanded and reordered to be more consistent with more detailed performance criteria and recognized industry terminology. SDDOT is currently reviewing its methods for developing the APL and the research team's suggestions for expanding the list, as well as how it might be organized.

4. The research team recommended SDDOT adopt a new inspection form. The intent of this form, which requires less narration, is to improve the consistency in reporting and simplify data extraction for preparing annual environmental compliance reports.

Manuals

Two manuals were developed for this project. It should be pointed out that the approach to the manuals is somewhat different than some of the other manuals SDDOT staff use. The Water Quality Enhancement Program Design Manual is a reference document focusing on materials used in the selection, design, application, and maintenance of erosion and sediment controls. This manual is not designed to be used as a training guide; separate materials meet that need.

The Construction Field Manual for Construction Site Management and Erosion/Sediment Control focuses on activities and tools needed to administer a construction project. It does not include the theory materials or detailed plan preparation process described in the Design Manual. The Construction Manual is intended to be of immediate use in day to day activities of the project engineer and/or other technicians that may be charged with inspection duties.

The Training Materials

The research team developed a twelve hour training course divided into 9 units with a certification examination. The course content reflects results of the research survey of Department needs as well as consultation with the project technical panel. The final products consist of three documents: a set of Microsoft PowerPoint presentations, an Instructor's Manual and a Student Guide.

The presentations are the heart of the training program. Each slide of each unit has a detailed script, and as appropriate, emphasis points to focus on the key materials in that slide. The Instructor's Manual is a Microsoft Word document produced from the slide presentations. Each unit is prefaced with the learning objectives, statement of purpose, presentation requirements and the estimated time to complete the presentation.

The student guide is a compendium of the handout pages from each presentation used in the course. Detailed reference materials are not used in the training in order to focus the attention of the students on the instructor. The two manuals provide the backup and detailed reference materials to support the training.

SUMMARY

The training materials and the design and construction manuals are tools for implementing SDDOT's erosion and sediment control policies. The training program focuses on the theory and the tasks needed to comply with the regulatory requirements. The manuals are complementary to the training program and provide a reference source after the training has been completed.

RECOMMENDATIONS

1. Integrate the SWPPP into the construction document preparation process.

2. Utilize checklists as compliance tools.

3. Utilize the required inspection process as the primary compliance tool.

4. Implement a training and certification program for erosion and sediment control contactors, consultants and SDDOT personnel.

5. Revise the current erosion control product terminology

6. Adopt the use of shear stress design for selecting channel and outlet erosion protection.

LITERATURE REVIEW

INTRODUCTION

The literature review focused on the current hydraulics and hydrology literature related to sediment and erosion control, selection and design of erosion control practices, and training and certification programs being used by other transportation agencies. The research literature in this area tends to be highly focused. That is, the reports focus on single technologies or practices in terms of performance and application. For the most part, recent literature focuses on proprietary materials such as blankets or mats, wattles, rolls or logs, silt fence; etc. The literature dealing with more generic materials and methods dates back to the 1930s.

The richest source of published papers and documented research on erosion and sediment controls for construction activities can be found in the proceedings of the annual meetings of the International Erosion Control Association. These annual publications provide a wealth of information about research, application, and evaluation of sediment and erosion control technology around the world. The articles cited here are those dealing with the performance of surface and channel protection management practices and technologies, articles discussing the state of the practice in transportation, and those dealing with education and certification programs.

The other source of information came from the manuals and guidance publications produced by local, state, and federal agencies dealing with implementation, management, or regulation of construction erosion and sediment controls. Because of the recent changes in the requirements to implement erosion and sediment controls during construction there is a large body of information in this area. Numerous publications were reviewed to determine content, audience, organization, and format.

TECHNICAL LITERATURE

There are three books with application to sediment and erosion control for construction sites, they are:

- Dodson, Roy. *Storm Water Pollution Control, 2nd Edition*
- Fifield, Jerald. *Design for Effective Sediment and Erosion Control on Construction Sites,* and
- Gray, Donald. *Biotechnical and Soil Bioengineering Slope Stabilization: A practical Guide for Erosion Control.*

These three sources overview the current regulatory framework and the materials and technologies available to meet the legal mandates. Dodson's book covers the full range of storm water quality issues, including regulations and technologies. The material provides a good mix of older technologies as well as newer technology. Fifield's book is an effort to provide a technical underpinning to the design of erosion and sediment controls for construction sites. The information he provides reflects his long standing experience in the field and his desire to bring good engineering practice to the design of erosion and sediment controls. Gray's book is a complement to the first two books because it deals with using plants as an engineering material for erosion control. While some of the solutions covered by Gray are more for permanent

stabilization, he does cover some very important tools that are often overlooked when selecting erosion and sediment control technologies.

Numerous technical papers are also available dealing with the subject matter pertinent to developing the South Dakota Department of Transportation Water Quality Enhancement Program. Since the changes in the Clean Water Act in 1987 requiring the permitting of construction sites, there has been a great deal of interest in determining the performance of the materials and methods available for controlling erosion.

Some of the first research activity for sediment and erosion control began in 1980 for the National Cooperative Highway Research Program (NCHRP), when the Transportation Research Board published two reports by C.E. Israelson and other researchers at Utah State University. The first report NCHRP 220 "Erosion Control during Highway Construction," describes the research that was conducted as background for the preparation of a manual for control of erosion during highway construction. This study was essentially a synthesis of existing information. The report suggested an adaptation of the USDA, Universal Soil Loss Equation (USLE), as a means of estimating surface erosion potential and the effectiveness of erosion control measures on highway construction sites. It also included one of the first laboratory efforts to verify the results of the USLE.

The second report NCHRP Report 221, "Erosion Control during Highway Construction: Manual on Principles and Practices" also published in 1980, suggests detailed procedures for estimating erosion loss from specific sites under various conditions. The manual describes many measures to control erosion and includes information that will aid in the selection of measures to meet specific site requirements. It also included a limited erosion control product evaluation study.

At about this same period, with the publication of the Federal Highway Administration (FHWA) Hydraulic Engineering Circular 15 (HEC-15), the "Design of Roadside Channels with Flexible Linings" was published. This project examined the design of roadside channels and the materials and methods to ensure their stability. The research work for this project was conducted at the USGS Hydraulics Laboratory in Bay St. Louis, Mississippi.

During the period of the late 1980s in response to Clean Water Act federal mandates, there was an amazing proliferation of materials and products being marketed for sediment and erosion control. However, there were no means of determining how well any of them performed. There was no general industry standard or any recognized protocol for performance testing. In 1989, the Texas Department of Transportation (TxDOT) initiated a field testing program for surface erosion control materials and flexible channel lining materials. This was the first program of its type in the country.

Since the institution of the TxDOT program other programs have been developed by manufacturers and other transportation agencies. The design and results of these other programs have been well documented in the literature. Several papers that discuss the issues involved in testing are included in the references. Sutherland, Cebalka, Fifield and Clopper have raised important issues with respect to scale, use of artificial rainfall devices, scale and repeatability in

testing. Harding, Forest and Landphair have recently contributed refinements in the performance criteria and to the precision of performance measurements.

There is also considerable interest in developing even smaller scale tests that will predict material performance. One of the major efforts is being pioneered by the Erosion Control Technology Council (ECTC), which is primarily an industry council. This is an important effort, but as yet there has been no strong evidence of correlation between small scale tests and field data.

AGENCY MANUALS AND PUBLICATIONS

In order to get usable information about the requirements for erosion and sediment control during construction to the appropriate agency personnel, there has been a flurry of manual development activity. Most of the erosion and sediment control publications, whether for design, field use, or for training date from around 1999. There were manuals prior to that in most states, but they generally dealt with installation of permanent erosion and sediment controls upon completion of construction. There was little attention given to temporary controls accept for the Middle Atlantic States. These states had water pollution requirements that predated the Clean Water Act requirements of 1987.

The research team reviewed several manuals and training programs to determine what content would be most appropriate to South Dakota and its unique context. The organizational approach of manuals varies considerably from state to state. Some states have elected to develop single, detailed manuals that include not only temporary erosion and sediment controls for construction but also hydrology theory and permanent storm water quality control measures as well. These are lengthy publications and in most cases have already been supplemented with field manuals of some type. The notable examples of this are Georgia and Florida, which have some of the most comprehensive erosion and sediment control manuals reviewed for this project.

Other states have taken a separate manual approach. That is, the responsible agency produces a reference manual and a field manual. These materials may also be supplemented with other training materials. What is significantly different among the states is who produces the manual materials. In a majority of the states reviewed, the research team found that the primary manual for erosion and sediment control was produced by the state agency charged with environmental enforcement. These manuals might then be supplemented by other specialized publications by the state's transportation agency to meet its special needs. Examples of these situations include Maryland, Florida, Michigan, Mississippi, Oregon, and New York. This would be analogous to the South Dakota Department Environment and Natural Resources producing the erosion and sediment control manual for South Dakota.

While the organization and format of the manuals vary widely from state to state, the content of the manuals is very much the same. In general, the manuals will include the following information in their combined manuals:

- Authorities and regulations
- Erosion processes
- Purpose and functions of erosion controls
- Structural best management practices (BMPs) for erosion and sediment control

- Hydrology and hydraulics related to erosion processes
- Modeling erosion processes
- Inspection and construction site management
- Terms and definitions
- Preparation of the Storm Water Pollution Prevention Plan (SWPPP)
- Permit documents, Notice of Intent (NOI), Notice of Acceptance (NOA), Notice of Termination (NOT)

Interestingly, a majority of the manuals focus on active structural controls for erosion control with little attention given to passive, management type controls, like spill prevention, storage of materials, phasing of work, spill clean up, etc. While the most visible activities of erosion and sediment control are the BMPs, the management activities are an important part of the SWPPP and the management of a construction site.

STATE OF PRACTICE

INTRODUCTION

The research team looked at the state-of-the-practice of erosion and sediment control in the South Dakota Department of Transportation, allied state agencies, their consultants and contractors. This activity was accomplished with a formal survey and through field visits with SDDOT staff, contractors, and SD Department of Environment and Natural Resources representatives. A copy of the survey instrument is included at the end of this section and survey results are graphically displayed in Appendix A.

THE SURVEY

The survey was divided into five parts:

- Demographics
- Rules, Regulations and Training
- Erosion Control
- Sediment Control
- General Questions

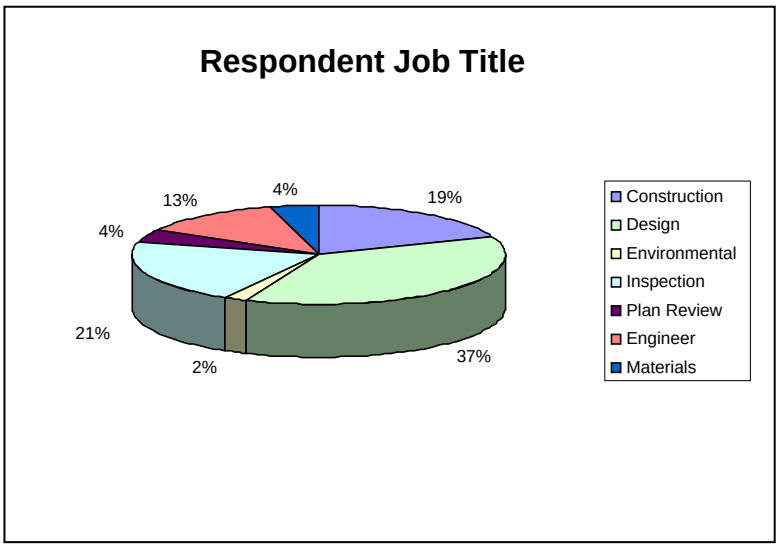


Figure 1. Respondent Job Title

The survey was administered through an internet site. Potential survey respondents were sent an e-mail with an option to fill out a paper response by mail if e-mail was not available. All of the responses were submitted via the survey internet site. There was some trouble in transmitting the data and the responses from the SD DENR and one or two SDDOT staff were lost. That is why the demographic data indicates there were no responses from regulators. This deficiency was later corrected by personal contact and interviews.

Design Personnel

The majority of the survey participants were SDDOT personnel (84%) followed by consultants (10%) and contractors (6%). There were no surveys included from regulatory personnel. Design personnel (including designers, engineers, and plan reviewers) accounted for 54% of the participants while field personnel (inspectors and

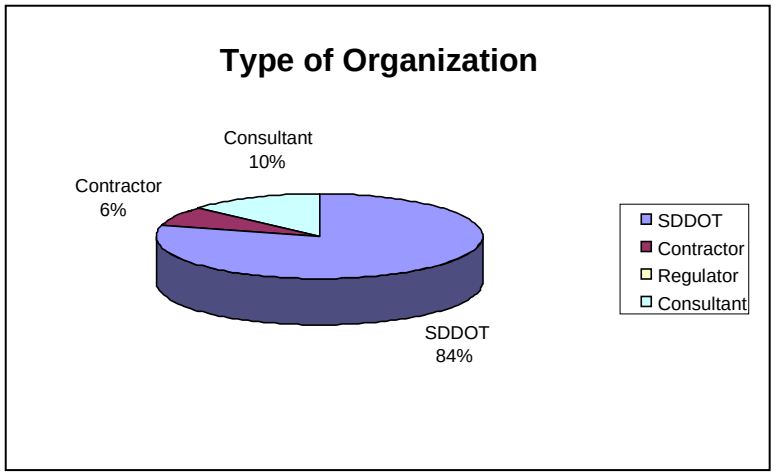


Figure 2. Type of Organization

construction personnel) made up 40%. There were an equal number of participants from Sioux Falls and Rapid City, as well as an equal number of participants from Pierre and Aberdeen. The largest group of participants was from areas other than these four cities.

Rules, Regulations, and Training

This section determined respondents' understanding of regulatory requirements and what training may be needed in these areas. When asked if they have a thorough understanding of the NPDES/state requirements as they apply to construction site storm water management, 63% of the SDDOT personnel participating in the survey said they disagreed or strongly disagreed, while 37% indicated they agreed they had a thorough understanding of the NPDES/state requirements. Of the consultants, 100% agreed or strongly agreed that they have a thorough understanding of NPDES. Contractor results indicated that 66.6% said they do not have a thorough understanding, while 33.3% agreed they did.

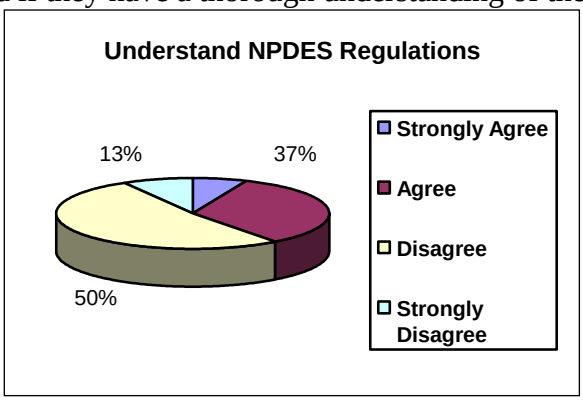


Figure 3. Understand NPDES

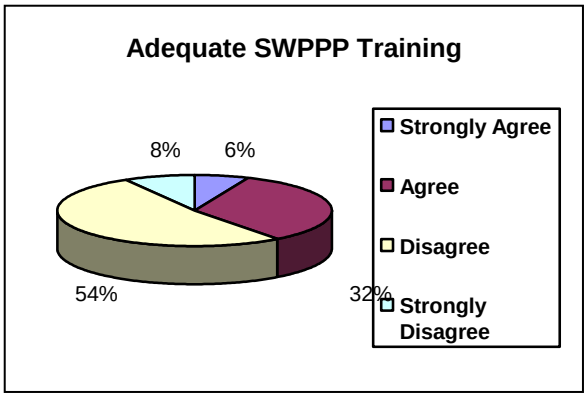


Figure 4. Adequate SWPPP Training

When asked if they had adequate training to prepare a SWPPP, 62% of SDDOT personnel felt they did not have adequate training, while 38% said they felt they did have adequate training. The consultants indicated they had adequate training, with 100% responding this way. Of the contractors, 66% felt they did not have adequate SWPPP training, while 33% said they did.

Erosion Control

The majority of the participants indicated that they knew how to install erosion control Best Management Practices (BMPs). However, BMP maintenance showed to be the area they knew the least about.

The survey indicated that most participants felt they had adequate training in the areas of channel and slope protection. Protecting channel crossings and waterways were the areas with the largest training deficit.

This survey section was intended to gauge the understanding of erosion control options in a variety of situations. For steep slopes (2:1 or steeper) participants indicated that they had the least success with crimped straw while erosion control blankets (ECB) had the highest degree of success. Crimped straw had a much higher level of success on the flatter slopes (3:1 or flatter). Again, ECBs had the highest level of success on the flat slopes as well.

Riprap and gabions were by far the most successful BMPs for channel protection (creeks, streams) while silt curtains had the lowest degree of success in channels. An extremely high percentage of participants indicated that they did not know anything about biotechnical engineering or turf reinforcing mats (TRM) for channel protection. ECBs indicated the highest level of success for protecting roadside ditches (shoulders, borrow ditches). Erosion bales were shown to have provided the least amount of success in these ditches. A high percentage of participants indicated they knew the least about triangular silt barrier and TRMs for ditch protection.

For inlet protection (culverts and grates) participants responded that erosion bales provided the least degree of success, while stilling basins provided the greatest degree of protection. Interestingly, while stilling basins offered a high degree of protection, there was a large percentage of the participants that indicated that they did not know anything about them. A large percentage responded that they did not know about filter socks as well.

Riprap and gabions showed to be by far the most successful forms of outlet protection**.** Triangular silt barrier was shown to be the least successful, as well as the least known application.

Sediment Control

This survey section determined respondents understanding of the difference between erosion control and sediment control, as well as what options exist. Participants indicated that silt fence and erosion bales were the least successful for sediment control on steep slopes (2:1 or steeper), while berms, dikes, and swales proved to be the most effective in this application. As expected, five techniques were listed as effective for flat slopes (3:1 or flatter). These were: silt fence, wattles/fiber rolls, rock dams, berms/swales/dikes, and detention basins. Notice that silt fence proved to be effective on these flat slopes compared to the steep slopes. Again, triangular silt barrier was listed as the least known BMP.

For channel protection (creeks, streams), hanging silt curtains were shown to be the least effective at controlling sediment, while riprap and gabions proved to be the most effective in this application. Again, hanging silt curtains were the least effective for wetlands, lakes, and waterways. Vegetated buffer strips were shown to be the most effective.

Based on participant experience erosion bales proved to have the least success in controlling sediment in roadside ditches (shoulders, borrow ditches). Several techniques showed a high success rate including detention basins, rock dams, and wattles/fiber rolls. TRMs and triangular silt barrier were again the most unknown BMP for this application.

Erosion bales and inlet filter devices were identified by participants as being the least successful BMP used to protect inlets (culverts, grates, side inlets), while excavated drops (stilling basins) proved to be the most effective in controlling sediment at inlets. Riprap and gabions were shown to be the most effective at controlling sediment at outlets.

General Questions

This section was included to gain additional information about common problems, the perceived need for training, respondents' job responsibilities, and the perceived need for a certification program.

Improper installation, poor sequencing/timing of work, and lack of maintenance were the most common problems noticed with both erosion and sediment control BMPs. Training was shown to be the most effective method used by SDDOT to improve communication of the importance of erosion and sediment control on construction sites. Participants indicated that the Project Engineer was the one most responsible for the successful selection, installation, and maintenance of erosion and sediment control BMPs. An overwhelming 93% of the participants supported the idea of SDDOT adopting an erosion and sediment control certification program. Two-thirds of the participants suggested that SDDOT offer extensive contractor training to improve erosion and sediment control activities. Other suggestions included more information on website, improved communication, creating erosion specialists, and addressing seed mixtures and materials used.

DISCUSSION

Overall, the survey indicates there is a good general understanding of the erosion and sediment control requirements for construction sites on the part of SDDOT personnel. However, this appears not to be the case on the part of the contractors. In further exploration with SDDOT field personnel and contractors, it was clear that while most of those we spoke to after the survey thought they had a good understanding of requirements; there was some significant variation in the uniformity of understanding.

Where training was concerned, there was a perceived need for additional training. Most of the field personnel felt they understood how to install BMPs but were less confident about timing, maintenance, and inspections. Authorities also seem to be a question. There did not appear to be a good general understanding of site management requirements, plan maintenance, and associated responsibilities.

The contractors in general expressed concerns that erosion and sediment controls represent a substantial cost that is difficult to predict. Too, the contractors felt that this cost could lead to the loss of work if underbid by less competent contractors. There were also concerns about the need for multiple mobilizations during the course of the contract period, which have not been necessary when permanent controls were only installed after final grades were reached. For this reason there appeared to be a need for contractor training to reach a uniform understanding of requirement. There appeared to be a good overall understanding of erosion control BMPs. The perceptions and experiences cited regarding what worked and the reasons for failure were consistent with the literature and the experience of the research team.

However, when the research team followed up on some of the responses, we learned there was a general misunderstanding of the difference between erosion control and sediment controls. For example, inlet protection was often cited as an erosion control while it is a primary sediment control function. Likewise, there was a great deal of discussion about stream diversions which

are neither erosion nor sediment control. These types of issues were addressed in the manuals and training materials.

The survey revealed concerns and questions about working around streams and the requirements for diversions and in-stream erosion controls. There appeared to be some misconceptions about the use of hanging silt curtains and their application. Some appeared to believe that it was a primary sediment control rather than a limited control only for in-stream disturbances.

The understanding of inlet protection function was usually cited as erosion control as mentioned earlier. This is a matter of some concern, since it should be secondary to good upstream erosion control.

The problems most frequently cited in this survey were the issues of improper installation and maintenance. These are universal to the research team's experience in the field and speak to the need for training of contractors who perform the erosion and sediment control installations. Likewise, inspectors need appropriate training to recognize problems and improper installation.

Interestingly, there was a perception that SDDOT needed to provide specific guidance in the plans about what erosion and sediment controls would be required. Earlier efforts to have the contractor responsible for compliance had apparently not been successful. Therefore, the inclusion of more details in the contract documents was recognized as a desirable method of operation.

Finally, the notion of a certification program for SDDOT employees, consultants and contractors met with almost unanimous approval. Suggestions ranged from classroom training to more web based information. While there seemed to be some recognition of the additional administrative burden that a certification program would require, it was perceived as the most viable way to achieve uniform compliance.

SDDOT Water Quality Enhancement Program for Construction
Research Project SD2004-05
SDDOT Erosion and Sediment Control Survey

Type of Organization: SDDOT Contractor Regulator
Job Title: Design Construction Inspection Maintenance Environmental Other
Region/Area: Pierre Aberdeen Sioux Falls Rapid City
Name (Optional):

I am not involved in erosion and sediment control design or construction. (End Survey)

Section: 1: Rules/Regulations and Training

1. I have thorough understanding of the rules and regulations of the National Pollutant Discharge Elimination System (NPDES) requirements as they apply to construction site storm water management.

   Strongly Agree Agree Disagree Strongly Disagree

2. I have adequate training to prepare a Storm Water Pollution Prevention Plan (SWPPP).

   Strongly Agree Agree Disagree Strongly Disagree

3. I have adequate training and knowledge of erosion & sediment control best management practices (BMPs) in terms of:

   How they work Strongly Agree Agree Disagree Strongly Disagree
   Where to place them Strongly Agree Agree Disagree Strongly Disagree
   How to install them Strongly Agree Agree Disagree Strongly Disagree
   How to maintain them Strongly Agree Agree Disagree Strongly Disagree
   When to inspect them Strongly Agree Agree Disagree Strongly Disagree
   When to remove them Strongly Agree Agree Disagree Strongly Disagree

4. I have adequate training in the following areas.

   a. Protecting Slopes Strongly Agree Agree Disagree Strongly Disagree

   b. Protecting Channels Strongly Agree Agree Disagree Strongly Disagree

   c. Protecting inlet/outlet Strongly Agree Agree Disagree Strongly

Agree Disagree

d. Establishing vegetation on projects

Strongly Agree Disagree Strongly
Agree Disagree

e. Management of channel crossings

Strongly Agree Disagree Strongly
Agree Disagree

Section 2: Erosion control – Differs from sediment control in that the BMP is designed to minimize erosion by protecting the soil surface and therefore keeping the soil in place.

1. From your experience, what are the most **successful** techniques for controlling **<u>erosion</u>** in the following applications:
    a. Steeper slopes (2H:1V or steeper)
    ECB (Erosion Control Blanket)
    TRM (Turf Reinforcement Mat)
    Crimped/Poked Straw
    Hydraulically applied mulch
    BFM (Bonded Fiber Matrix)
    Other

    b. Flatter slopes (3H:1V or flatter)
    ECB (Erosion Control Blanket)
    TRM (Turf Reinforcement Mat)
    Crimped/Poked Straw
    Hydraulically applied mulch
    BFM (Bonded Fiber Matrix)
    Other

    c. Channels (creeks, streams)
    Bio-technical Engineering
    Hanging Silt Curtains
    TRM (Turf Reinforcement Mat)
    Riprap
    Gabions
    Other

    d. Roadside ditches (shoulders, borrow ditches)
    ECB (Erosion Control Blanket)
    TRM (Turf Reinforcement Mat)
    Erosion Bales
    Rock Dam
    Wattles/Fiber Rolls
    Triangular Silt Dike
    Other

    e. Inlets (culverts, grates, side inlets)
    Slotted Pipe with Filter Fabric
    Excavated Drop (stilling basin)
    Erosion Bales

Sand/Gravel Bag
Filter Sock
Other

f. Outlet
TRM (Turf Reinforcement mat)
Gabions
Riprap
Triangular Silt Dike
Rock Dam
Other

2. From your experience, what are the most **unsuccessful** techniques for controlling erosion in the following applications

a. Steeper slopes (2H:1V or steeper)
ECB (Erosion Control Blanket)
TRM (Turf Reinforcement Mat)
Crimped/Poked Straw
Hydraulically applied mulch
BFM (Bonded Fiber Matrix)
Other

b. Flatter slopes (3H:1V or flatter)
ECB (Erosion Control Blanket)
TRM (Turf Reinforcement Mat)
Crimped/Poked Straw
Hydraulically applied mulch
BFM (Bonded Fiber Matrix)
Other

c. Channels (creeks, streams)
Bio-technical Engineering
Hanging Silt Curtains
TRM (Turf Reinforcement Mat)
Riprap
Gabions
Other

d. Roadside ditches (shoulders, borrow ditches)
ECB (Erosion Control Blanket)
TRM (Turf Reinforcement Mat)
Erosion Bales
Rock Dam
Wattles/Fiber Rolls
Triangular Silt Dike
Other

e. Outlet
TRM (Turf Reinforcement mat)
Gabions
Riprap
Triangular Silt Dike
Rock Dam
Other

Section 3: Sediment Control – Differs from erosion control in that the BMP is designed to capture/remove sediment (eroded soil that has been transported) from stormwater runoff and prevent off site discharge of sediment laden stormwater.

1. From your experience, what are the most **successful** techniques for controlling **sediment** in the following applications?
    a. Steeper slopes (2H:1V or steeper)
        Silt Fence
        Wattle/Fiber Roll
        Triangular Silt Dike
        Rock Dam
        Berm/Dike/Swale
        Erosion Bales
        Other

    b. Flatter slopes (3H:1V or flatter)
        Silt Fence
        Wattle/Fiber Roll
        Triangular Silt Dike
        Rock Dam
        Berm/Dike/Swale
        Erosion Bales
        Other

    c. Channels (creeks, streams)
        Bio-technical Engineering
        Hanging Silt Curtains
        TRM (Turf Reinforcement Mat)
        Riprap
        Gabions
        Other

    d. Roadside ditches (shoulders, borrow ditches)
        ECB (Erosion Control Blanket)
        TRM (Turf Reinforcement Mat)
        Erosion Bales
        Rock Dam
        Wattles/Fiber Rolls
        Triangular Silt Dike
        Other

    e. Inlets (culverts, grates, side inlets)
        Slotted Pipe with Filter Fabric
        Excavated Drop (stilling basin)
        Erosion Bales
        Sand/Gravel Bag
        Filter Sock
        Other

    f. Outlet
        TRM (Turf Reinforcement mat)
        Gabions
        Riprap

Triangular Silt Dike
Rock Dam
Other

2. From your experience, what are the most **unsuccessful** techniques for controlling **sediment** in the following applications?
    a. Steeper slopes (2H:1V or steeper)
    Silt Fence
    Wattle/Fiber Roll
    Triangular Silt Dike
    Rock Dam
    Berm/Dike/Swale
    Erosion Bales
    Other

    b. Flatter slopes (3H:1V or flatter)
    Silt Fence
    Wattle/Fiber Roll
    Triangular Silt Dike
    Rock Dam
    Berm/Dike/Swale
    Erosion Bales
    Other

    c. Channels (creeks, streams)
    Bio-technical Engineering
    Hanging Silt Curtains
    TRM (Turf Reinforcement Mat)
    Riprap
    Gabions
    Other

    d. Roadside ditches (shoulders, borrow ditches)
    ECB (Erosion Control Blanket)
    TRM (Turf Reinforcement Mat)
    Erosion Bales
    Rock Dam
    Wattles/Fiber Rolls
    Triangular Silt Dike
    Other

    e. Inlets (culverts, grates, side inlets)
    Slotted Pipe with Filter Fabric
    Excavated Drop (stilling basin)
    Erosion Bales
    Sand/Gravel Bag
    Filter Sock
    Other

    g. Outlet
    TRM (Turf Reinforcement mat)
    Gabions
    Riprap

Triangular Silt Dike
Rock Dam
Other

Section 4: General questions

1. Please rank the following common problems you've noticed with **<u>erosion</u>** control BMPs. 1 no problem to 5 greatest problem
    a. Improper installation
    b. Lack of maintenance
    c. Poor access for maintenance
    d. Wrong location (place in clear zone, hinders work etc.)
    e. Poor sequencing or timing of work
    f. Other (please list)

2. Please rank the following common problems you've noticed with **<u>sediment</u>** control BMPs.
    a. Improper installation
    b. Lack of maintenance
    c. Poor access for maintenance
    d. Wrong location (place in clear zone, hinders work etc.)
    e. Poor sequencing or timing of work
    f. Other (please list)

3. Please provide any comments you feel would help improve SDDOT's erosion and sediment control activities:

KNOWLEDGE AND SKILLS NEEDED TO MEETING EROSION AND SEDIMENT CONTROL REQUIREMENTS

INTRODUCTION

A specific requirement of this project was to identify the roles, knowledge and skills, authority, levels of responsibility, and training needs of individuals involved with erosion and sediment control projects. The research team interviewed a wide range of SDDOT employees, particularly those on the technical panel for the project. We also looked at the formal project delivery process as described in the PCEMS materials posted on the SDDOT website.

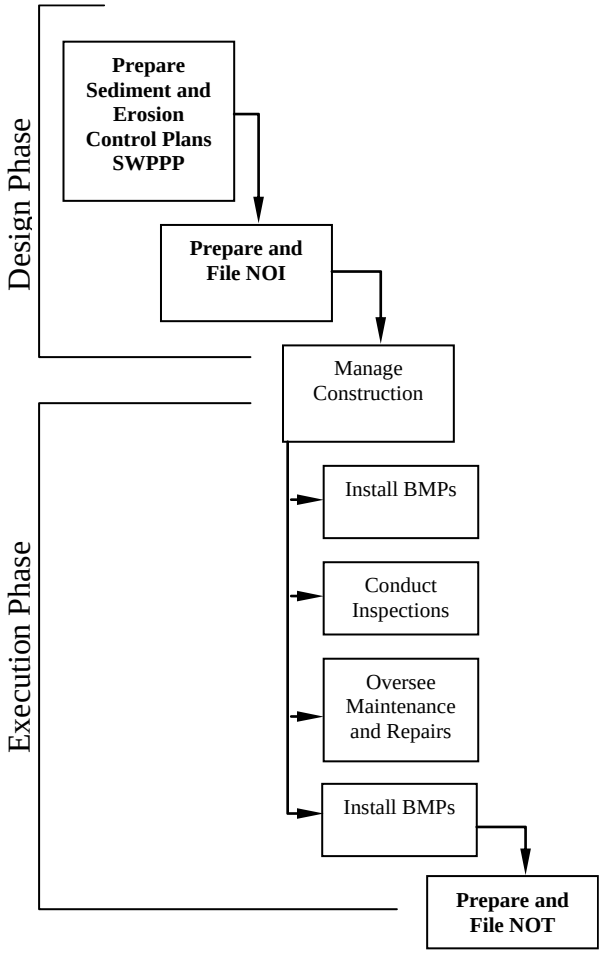


Figure 5: Process for Meeting Erosion and Sediment Control Rules for Construction

The project delivery organization of SDDOT is similar to most transportation agencies in the country. That is, the process is divided into task groups that correspond to the various areas of specialization within a project: planning, roadway design, bridge design, hydraulics and hydrology, environment, construction, operations, maintenance, and so forth. This model allows for greater efficiency in project delivery and operations by compartmentalization of specialized design and administrative tasks.

Comparing this organizational model to the demands of meeting the regulatory mandates required by the implementation of the NPDES, and the associated temporary sediment and erosion controls for construction sites, there are two distinct phases in the work flow. The first phase includes the work that takes place during the period from programming and design through letting. This part of the process is where the design information is developed that is the basis for preparation of the required Notice of Intent (NOI) and the SWPPP. This is characterized as the design phase. The second period is the execution phase, which is the time between the beginning of construction and the issuance of the final Notice of Termination (NOT). Activities during this period require implementation and maintenance of the SWPPP (Figure 5).

The personnel involved in the first design phase of the work include personnel in: roadway design, bridge design, hydraulics and hydrology, and environment. The individuals involved in the second phase of the work are the project engineers and field technicians involved in supervision and quality control of construction projects. Each of these groups needs to have a basic understanding of the rules and regulations and knowledge of the tools and methods

available for meeting the requirements. The difference in training needs between the two groups is one of level of detail (Table 1).

Table 1: Training Level

Job Responsibility	Phase I Training Level	Phase II Training Level
Design Personnel	**Application**	**Awareness**
Field Personnel	**Awareness**	**Application**

In table 1, the term awareness means that the individual would have knowledge of the information and a general familiarity with the processes and requirements but would not be expected to be able to perform the work or function without direct supervision. Application implies that an individual has direct knowledge of the technology, materials, and process and is qualified to perform the required functions without supervision.

It is possible when designing a training program to develop courses for each audience that focus on the appropriate level of detail for each group. However, the research team's experience in developing and delivering applied training in erosion and sediment control suggests that separating the two audiences is not desirable. It seems that if training is compartmentalized the individual groups do not develop an appreciation for the other groups' responsibilities. Therefore designers do not produce the most usable plans and the field personnel do not have the tools necessary to affect the desired solution. By keeping the groups together meaningful dialog can be generated that leads to more effective means of addressing problems unique to each situation.

The research team identified specific areas of knowledge and skill in the review of the literature on erosion and sediment control, they are:

- Authorities and regulations
- Erosion processes
- Purpose and functions of erosion controls
- Structural Best Management Practices (BMPs) for Erosion and Sediment Control
- Hydrology and hydraulics related to erosion processes
- Modeling erosion processes
- Inspection and construction site management
- Terms and definitions
- Preparation of the Storm Water Pollution Prevention Plan (SWPPP)
- Permit documents and requirements

SDDOT EMPLOYEES

The groups of SDDOT employees that should be trained in erosion and sediment control for construction activities are from the following divisions:

- Environmental – Office of Project Development
- Hydraulics – Office of Bridge Design
- Office of Road Design
- Consultant Plan reviewers
- Regional Offices
    - Regional Engineers
    - Area Engineers
    - Project Engineers
    - Field Technicians (appropriate assignments)

It is important that all engineering personnel involved in project delivery have a working knowledge of regulations and the regulatory obligations related to erosion and sediment control on construction projects. Knowledge of the processes and requirements will help ensure the most cost-effective project delivery.

OTHER AUDIENCES

Other audiences that should be invited or required to participate in the training program include:

- Consultants
- Contractors
- Regulators

Consultants

All consultants that prepare construction documents for SDDOT should be required to have the prescribed erosion and sediment control training. It is essential with the changing regulatory environment that project documents related to SDDOT projects or those administered by SDDOT be uniform with respect to the storm water permit requirements. Therefore, it is vital that consultants prepare the SWPPP and other documents in the SDDOT required format. The overall consultant response was that they did not need additional training because they knew the requirements. In this regard, consultants responded to the question in the context that they prepare NOIs, NOTs, SWPPPs, spill prevention plans, etc., for counties and cities all of the time so they therefore feel that they are well versed on what is required. No one in the DOT handles all of these items completely, with the exception of the personnel in Environmental, Office of Project Development.

Contractors

Contractors need the training to understand what is going to be required of them and what will be in the plan documents to generate a level playing field with respect to preparation of bids. They are ultimately responsible for implementing and maintaining the construction site erosion and sediment controls. The contractors also need to know what project engineers will expect of the contractors during construction, as well as what their responsibilities are, and what the project engineer's responsibilities will be.

Regulators

When possible it is desirable to have the regulators participate in the training for instructional value as well as helping the regulators see that SDDOT is earnestly working to meet regulatory mandates and has the technical expertise and resources to meet those requirements.

TRAINING NEEDS IDENTIFIED

INTRODUCTION

In order to fulfill the regulatory mandates imposed by the Clean Water Act and subsequent rules promulgated by the U. S. Environmental Protection Agency and administered by the South Dakota Department of Environment and Natural Resources (SD DENR), specific knowledge is required of those charged with design and execution of transportation projects. The information gathered in the survey and subsequent field interviews suggests that there is a good base of practical knowledge about basic erosion and sediment control methods. However, the regulatory context, application, contactor-SDDOT division of responsibility and administrative context is not uniformly understood. This has resulted in inconsistencies, disagreements and some problems in meeting regulatory expectations.

In order to ensure the most cost-effective solution to erosion and sediment control management on SDDOT projects and to minimize misunderstandings and institutionalize a state-wide uniformity of practice, basic training is needed. Specific training needs identified in interviews, review of existing SDDOT documents, specifications and manuals are outlined in this section.

REGULATORY FRAMEWORK

While there was a general awareness of the regulatory requirements at almost all levels of the department, there was no consistency in the interpretation or depth of understanding. There seemed to be no general consensus as to the division of responsibility between SDDOT and the contractors. Therefore, training is needed to clarify areas of responsibility, what is actually required, and how regulations will be administered by the SD DENR.

TYPES AND CAUSES OF EROSION

It was interesting to note that most field personnel had a general understanding of the results of water erosion processes. On the other hand, many of the field personnel and contractors did not seem to understand the difference between managing erosion and collecting sediment that results from erosion. This suggests that some training is needed to point out the root causes of water erosion and how these processes need to be managed during construction.

EROSION CONTROLS

There appeared to be wide gaps in understanding the basic tools (BMPs) that are effective in controlling erosion on construction sites. The more experienced engineering staff and project engineers seemed to have a good grasp of the traditional practices used by the department; however, newer SDDOT personnel are not particularly confident about managing and or maintaining appropriate erosion control on construction sites. Further examination of SDDOT standard plates, erosion control publications and specifications also suggested that some additional training in selecting, installing, and maintaining erosion control BMPs would be warranted.

SEDIMENT CONTROLS

There seems to be a great deal of confusion about the difference between erosion control and sediment control. In interviews almost everyone referred to silt fence as an erosion control when

in fact, it is a primary tool in sediment control. In field visits we observed numerous cases where sediment controls had been neglected or not provided at all. This suggests that there needs to be some time spent differentiating between erosion controls and sediment controls.

SWPPP AND OTHER DOCUMENTS

The format and responsibilities for preparation of the project SWPPP for SDDOT projects was an evolving process. This was a source of continuing discussions within the department and with SD DENR. Over the course of this project the procedures and documents have been refined and are in the process of being adopted by the department. The training program needs to introduce this procedure and the accompanying documents.

CONSTRUCTION SITE MANAGEMENT

Because there has been no uniform policy or procedure for the preparation of the regulatory documents, there was a corresponding lack of uniformity in construction site management. Much of what is required by the regulatory program involves field administration, and because the progress of a construction project and the impacts of weather are not predictable, project engineers and field technical personnel need to have the knowledge and skills to make onsite sediment and erosion control decisions. What is often overlooked in this regard is the responsibility for managing materials and storage areas to prevent spills, being alert for potential violations, conducting regular inspections, and keeping the SWPPP documents up to date.

PERMANENT CONTROLS AND EROSION MODELING

Storm water mandates transcend the actual construction period in that there are additional requirements for permanent storm water controls. Design personnel and those charged with obtaining the necessary environmental permits for construction should have some training in these requirements and how they will relate to the construction period. Clearly, permanent facilities can be used as an integral part of the construction SWPPP.

At this time there is no requirement in the regulatory program of U.S. EPA or SD DENR to base temporary erosion and sediment controls on any quantitative method or model. However, there are some basic public domain tools for predicting erosion potential. Design staff in particular should be familiar with these tools in the event that situations arise requiring the use of some defensible design method for selecting and applying erosion controls.

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

The project scope required a review of SDDOT's design process to address several areas of the project delivery process. Recommendations cover two specific areas:

- Actions to improve the uniformity in bidding and construction practices related to erosion and sediment control.
- Procedures that would ensure compliance with the specifications related to erosion and sediment control

The following section discusses each of these areas and makes specific recommendations for improvements.

IMPROVING UNIFORMITY IN BIDDING AND CONSTRUCTION PRACTICES

Context

There are several existing documents, templates, and plates that form the foundation for SDDOT's current sediment and erosion control efforts. Most of these materials have been part of the standard specifications and library of standard plates for sometime. What has really changed is the timing of the application and the requirement for interim erosion and sediment control measures. The results of the survey suggest that this is the root cause of confusion and inconsistencies. In the past, permanent stabilization was accomplished at the end of construction. Erosion and the resulting sediment loss that occurred during the construction period was generally considered incidental. Research has demonstrated that this is not the case, and therefore, erosion controls are being required during construction.

SDDOT design and environmental staff have a good understanding of what is required to control erosion during the construction period. The research team reviewed several plan sets and projects as part of this work, and while there were some deficiencies here and there, there were no observed incidences of unacceptable practices. The most problematic situations observed were cases where the contractors had been charged with implementing erosion and sediment controls without SDDOT guidance. In discussions with contractors, two important issues were raised.

First, without SDDOT guidance, contractors are placed in an unfair competitive situation. That is, they feel that they can easily be underbid by irresponsible contractors who may not provide a reasonable amount for the required erosion and sediment controls. Furthermore, several grading contractors noted that they did not feel they had sufficient knowledge of erosion control methods to effectively select appropriate measures. On the other hand, there were subcontractors that did appear to be well versed in erosion control technology. However, they also noted that without SDDOT guidance, the bidding process was not uniform.

Recommendations

To improve uniformity in bidding and construction practices the research team makes three specific recommendations:

1. Integrate The SWPPP Into The Construction Document Preparation Process.

Because the SWPPP is in part a construction document in that it carries spatially explicit information about the extent of grading disturbance, type and location of erosion and sediment controls for the project, it should be included as a drawing in the actual construction document set. Since other parts of the SWPPP are essentially boiler plate, that is repetitive administrative and procedural information about the administration of a project, it can also be incorporated into the drawing set as plan notes. This change will simplify the overall preparation of the SWPPP and further facilitate the updating and administration of the plan during construction. This could be accomplished by revising the current Section D Plan Notes to include the information needed to satisfy the requirements for the SWPPP. This will only apply to work on State of South Dakota rights-of-way. On those projects through Indian lands the SWPPP template used by EPA Region 8 may be required.

A proposed revision to the current Section D has been provided for review.

2. Utilize Checklists as Compliance Tools.

The recommendation for the detailed SWPPP prepared by SDDOT as part of the document set will set the stage for achieving a general level of uniformity and will serve notice to potential bidders about what is expected. This will set the stage for easier administration in the field. Other tools that will also assist in securing compliance include checklists and inspection forms to be used in preparing plans and administering the project during construction.

The research team recommends three checklists and one inspection form be used in related project stages. All forms are included in the appendices.

1. SWPPP Checklist – The SWPPP checklist is to be used during the design stage of project development to ensure that all the SWPPP requirements have been met. It addresses each section of the SD DENR "General Permit for Storm Water Discharges Associated with Construction Activities" (General Permit). The design checklist is included in the Design Manual developed under this project.

2. SWPPP Mobilization Checklist – The mobilization checklist aids in site inspection and addresses the mobilization regarding General Permit Documentation (SWPPP & NOI), deployment of erosion and sediment controls, and waste disposal and spill management.

3. SWPPP Site Inspection Form - The SWPPP site inspection form records required site inspections during a construction project to include project information and inspection findings.

4. Final Inspection Checklist - The final inspection checklist aids in the preparation and filing of the NOT by documenting the removal of structural erosion & sediment controls, waste disposal, and spill management.

3. Utilize the Required Inspection Process as the Primary Compliance Tool.

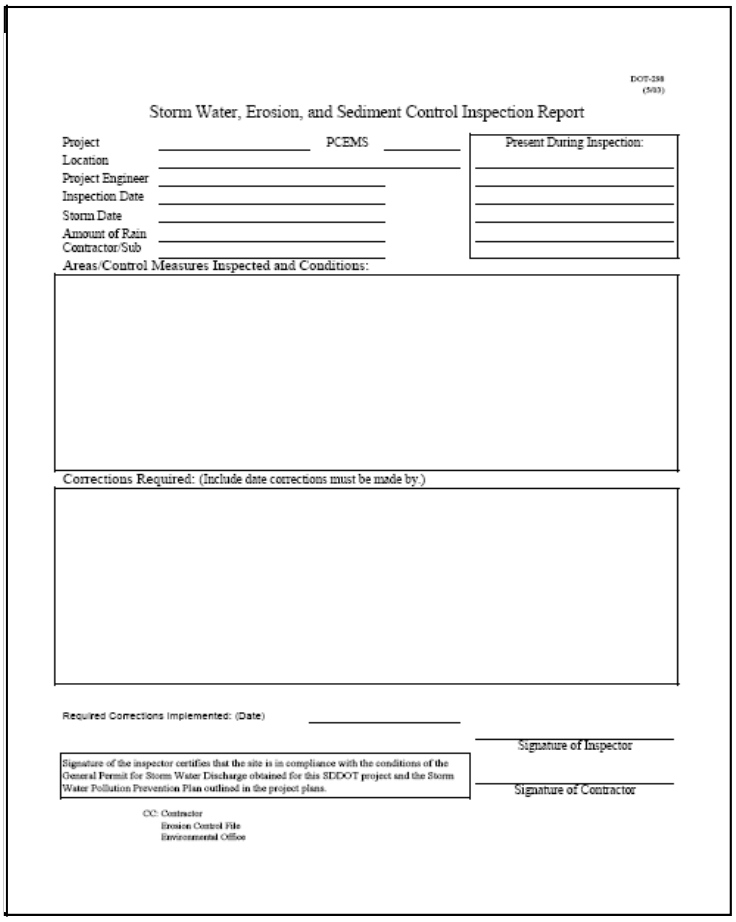
The General Permits of both the U. S. EPA and SD DENR require weekly inspections of erosion and sediment controls for the duration of construction and after any storm event with a rainfall depth of 0.5 inches or greater. The frequency of inspections along with the detailed plan sheets for erosion and sediment control included in the SWPPP become the primary tool for ensuring compliance. Other provisions or penalties such as including a liquidated damages clause will probably not be as effective as the required inspections.

SDDOT has recently adopted a site inspection form that is quite simple (Figure 6), but it requires quite a bit of narrative writing on the part of the inspector.

A slightly more detailed form has been proposed for several reasons, which are:

- minimized narrative writing,
- able to be implemented as a MS Word form on a laptop computer,
- provides more consistent data that can be used to document compliance,
- provides precise location information, and
- data can be more easily extracted for preparation of compliance reports.

A copy of the form is included here as Figure 7.



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Storm Water, Erosion, and Sediment Control Inspection Report

Project _____ PCEMS _____
Location _____
Project Engineer _____
Inspection Date _____
Storm Date _____
Amount of Rain _____
Contractor/Sub _____

Present During Inspection:

Areas/Control Measures Inspected and Conditions:

Corrections Required: (Include date corrections must be made by.)

Required Corrections Implemented: (Date) _____

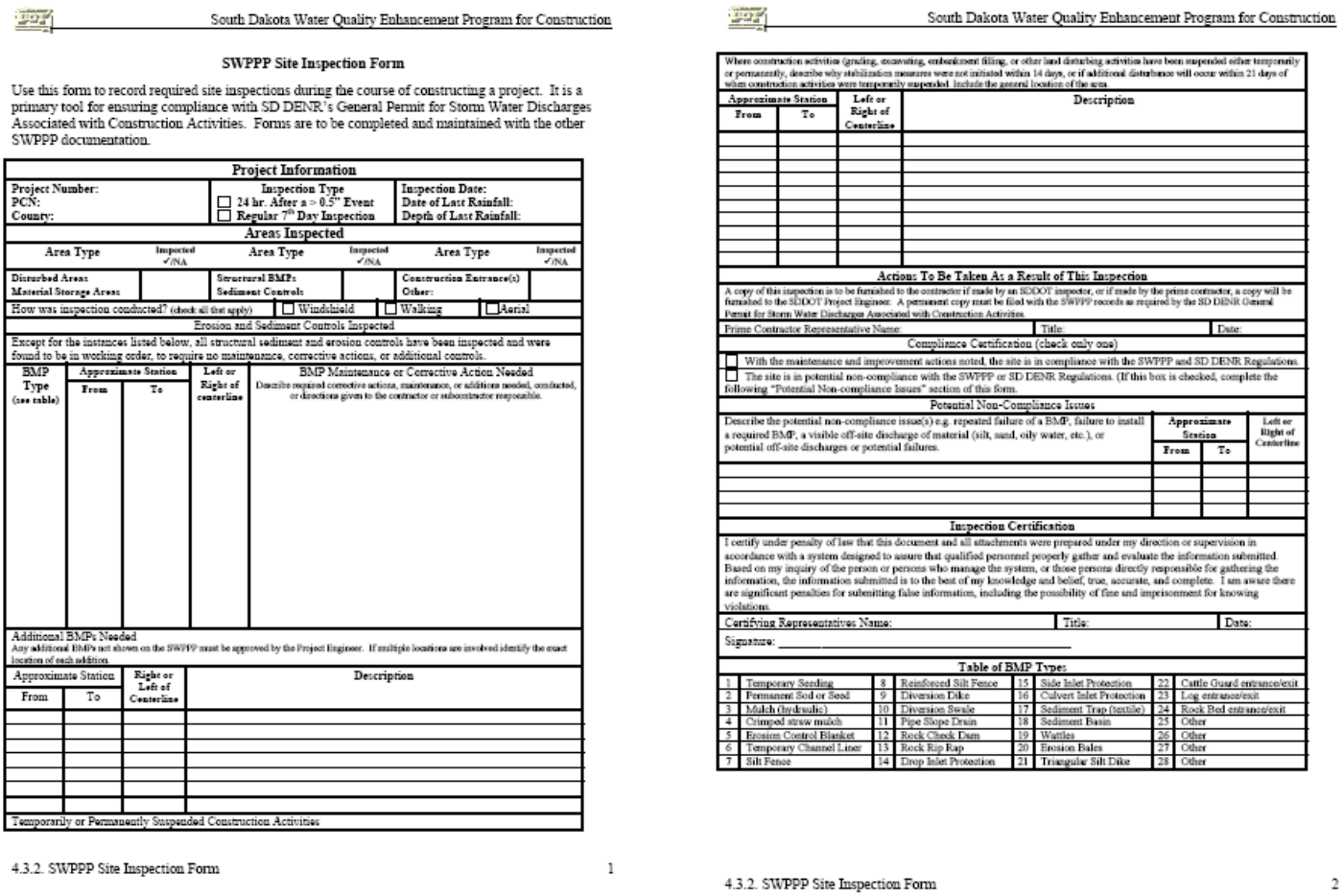
Signature of Inspector

Signature of the inspector certifies that the site is in compliance with the conditions of the General Permit for Storm Water Discharge obtained for this SDDOT project and the Storm Water Pollution Prevention Plan outlined in the project plans.

Signature of Contractor

CC: Contractor
Erosion Control File
Environmental Office

Figure 6: Current SWPPP Site Inspection Form



South Dakota Water Quality Enhancement Program for Construction

SWPPP Site Inspection Form

Use this form to record required site inspections during the course of constructing a project. It is a primary tool for ensuring compliance with SD DENR's General Permit for Storm Water Discharges Associated with Construction Activities. Forms are to be completed and maintained with the other SWPPP documentation.

Project Information

Project Number: PCN: County:	Inspection Type ☐ 24 hr. After a > 0.5" Event ☐ Regular 7th Day Inspection	Inspection Date: Date of Last Rainfall: Depth of Last Rainfall:

Areas Inspected

Area Type	Inspected ✓/NA	Area Type	Inspected ✓/NA	Area Type	Inspected ✓/NA
Disturbed Areas Material Storage Areas		Structural BMPs Sediment Controls		Construction Entrance(s) Other:	

How was inspection conducted? (check all that apply) ☐ Windshield ☐ Walking ☐ Aerial

Erosion and Sediment Controls Inspected

Except for the instances listed below, all structural sediment and erosion controls have been inspected and were found to be in working order, to require no maintenance, corrective actions, or additional controls.

BMP Type (see table)	Approximate Station From	Approximate Station To	Left or Right of centerline	BMP Maintenance or Corrective Action Needed Describe required corrective actions, maintenance, or additions needed, conducted, or directions given to the contractor or subcontractor responsible.

Additional BMPs Needed

Any additional BMPs not shown on the SWPPP must be approved by the Project Engineer. If multiple locations are involved identify the exact location of each addition.

Approximate Station From	Approximate Station To	Right or Left of Centerline	Description

Temporarily or Permanently Suspended Construction Activities

4.3.2. SWPPP Site Inspection Form 1

South Dakota Water Quality Enhancement Program for Construction

Where construction activities (grading, excavating, embankment filling, or other land disturbing activities have been suspended either temporarily or permanently, describe why stabilization measures were not initiated within 14 days, or if additional disturbance will occur within 21 days of when construction activities were temporarily suspended. Include the general location of the area.

Approximate Station From	Approximate Station To	Left or Right of Centerline	Description

Actions To Be Taken As a Result of This Inspection

A copy of this inspection is to be furnished to the contractor if made by an SDDOT inspector, or if made by the prime contractor, a copy will be furnished to the SDDOT Project Engineer. A permanent copy must be filed with the SWPPP records as required by the SD DENR General Permit for Storm Water Discharges Associated with Construction Activities.

Prime Contractor Representative Name: Title: Date:

Compliance Certification (check only one)

☐ With the maintenance and improvement actions noted, the site is in compliance with the SWPPP and SD DENR Regulations.

☐ The site is in potential non-compliance with the SWPPP or SD DENR Regulations. (If this box is checked, complete the following "Potential Non-compliance Issues" section of this form.

Potential Non-Compliance Issues

Describe the potential non-compliance issue(s) e.g. repeated failure of a BMP, failure to install a required BMP, a visible off-site discharge of material (silt, sand, oily water, etc.), or potential off-site discharges or potential failures.	Approximate Station From	Approximate Station To	Left or Right of Centerline

Inspection Certification

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

Certifying Representatives Name: Title: Date:

Signature: _____

Table of BMP Types

1	Temporary Seeding	8	Reinforced Silt Fence	15	Side Inlet Protection	22	Cattle Guard entrance/exit
2	Permanent Sod or Seed	9	Diversion Dike	16	Culvert Inlet Protection	23	Log entrance/exit
3	Mulch (hydraulic)	10	Diversion Swale	17	Sediment Trap (textile)	24	Rock Bed entrance/exit
4	Crimped straw mulch	11	Pipe Slope Drain	18	Sediment Basin	25	Other
5	Erosion Control Blanket	12	Rock Check Dam	19	Wattles	26	Other
6	Temporary Channel Liner	13	Rock Rip Rap	20	Erosion Bales	27	Other
7	Silt Fence	14	Drop Inlet Protection	21	Triangular Silt Dike	28	Other

4.3.2. SWPPP Site Inspection Form 2

Figure 7: Recommended SWPPP Site Inspection Form

While this form looks more complicated, it actually involves less effort to collect more detailed information. The current form does not provide a means to note locations, problems, or BMP type, other than by narrative description. This will lead to differences in terminology and inconsistencies in information reported. Of course, the amount of information on the form depends on the site condition. In many cases, most of either form would be blank because everything is in place and working.

The single best argument for using a more detailed form is that the environmental staff has to prepare compliance reports annually. These reports must be compiled in part from the field inspection forms. These forms would provide greater consistency in the data collection and terminology and can be formatted to allow automated data extraction for report preparation.

4. Implement a Training and Certification Program for Erosion and Sediment Control Contactors, Consultants, and SDDOT Personnel.

The primary purpose of this project was to develop a training program (this will be addressed in the final section of this report). However, the project also required that the audience for the training program be identified along with the basic knowledge and skills for the training program. The target audience for training includes:

- Contractors – on-site superintendent or project manager;
- Consultants – All designers, plan reviewers, and project inspectors; and
- SDDOT – All designers involved with erosion and sediment control, all project inspectors (engineers and technicians).

In conducting the survey and follow up interviews, it became clear that contractors and consultants were key audiences for the training. Further inquiry convinced the research team that contractors and consultants may not fully understand the design and administration requirements as they apply to SDDOT practice.

A training program could be made voluntary and the target audiences invited to the training. However, the goal is for consistency and integration of these new practices into a culture as soon as possible. In order to do this, it would seem that a mandatory certification program is the most expeditious means to achieve this goal. SDDOT is already operating other certification programs, so there is experience and administrative machinery already in place. Clearly it will involve an increase in time and expense to administer the program, but it will probably be the most effective means of gaining uniformity in compliance.

It is interesting to note that many states have developed certification programs for erosion and sediment controls, as well as storm water quality. However, in most every case the programs are administered by the state environmental enforcement agency or conducted jointly by the environmental agency and the department of transportation, such as North Carolina, Michigan, Virginia and Washington. Washington, Delaware and Florida have programs administered wholly by the environmental agency. Minnesota's program is interesting in that it was developed by the Minnesota Department of Transportation (MinnDOT) in cooperation with the Minnesota Erosion Control Association. Since the SD DENR is responsible for administering storm water permitting for construction and industrial sites as well as transportation projects, there may be some merit in discussing a broader based certification program which could reduce the administrative costs to SDDOT in the future.

5. Revise the Current Erosion Control Product Terminology.

Erosion control materials are evolving and there is no clear consensus or recognized authority on terminology. However, the ECTC, an industry council made up of most of the major manufacturers and distributors of sediment and erosion control materials, is attempting to establish some standardized terms that are generally accepted in practice. For the most part, this organization has the best available lexicon and it is strongly recommended that their basic terminology be adapted as it applies to erosion control blankets and what are being called turf reinforcing mats. Turf reinforcing mats are grouped on the basis of resistance to horizontal shear

and longevity. The materials made of pure organic fibers such as straw, excelsior, and coir are generally considered temporary for short term protection, while many of the synthetic products are being considered by many as permanent materials.

At this time, SDDOT uses the term "High Velocity Blanket" and "Standard Erosion Control Blanket." The high velocity blanket is essentially used as a temporary lining for roadside channels that carry concentrated flows, while standard blankets are intended for surface protection of slopes. The problem with using this terminology is that a current engineering practice for the design of roadside channels does not recommend the use of the velocity method of design. The FHWA in HEC-15, recommends that the design of channel linings be based on estimated shear stress on the channel bottom. SDDOT's current drainage manual references HEC-15 and recommends the use of shear stress as the primary channel design method. Shear stress for straight line channels is a very simple calculation and most all of the major suppliers rate their materials for shear strength according to laboratory testing.

For these reasons, the research team recommends the term erosion blanket be used only to describe temporary rolled products used for surface protection. Materials intended for use in channels should be called Turf Reinforcing Mats (TRMs) which is a documented term understood in the industry.

6. Adopt the Use of Shear Stress Design for Selecting Channel and Outlet Erosion Protection.

Based upon the above discussion regarding changes in terminology, it is recommended that the velocity design methodology used in current SDDOT publications be dropped in favor of the more widely used shear stress design method using HEC-15 and similar type calculations.

MANUALS AND TRAINING

INTRODUCTION

The primary products of this research and evaluation effort are two manuals for erosion and sediment control and a training program. The training program as presented here consists of three documents: a series of annotated MS PowerPoint presentations, an instructor's manual and a student guide. The instructor's manual and student guide were produced from the MS PowerPoint Materials. Each of these products will be discussed in this final section.

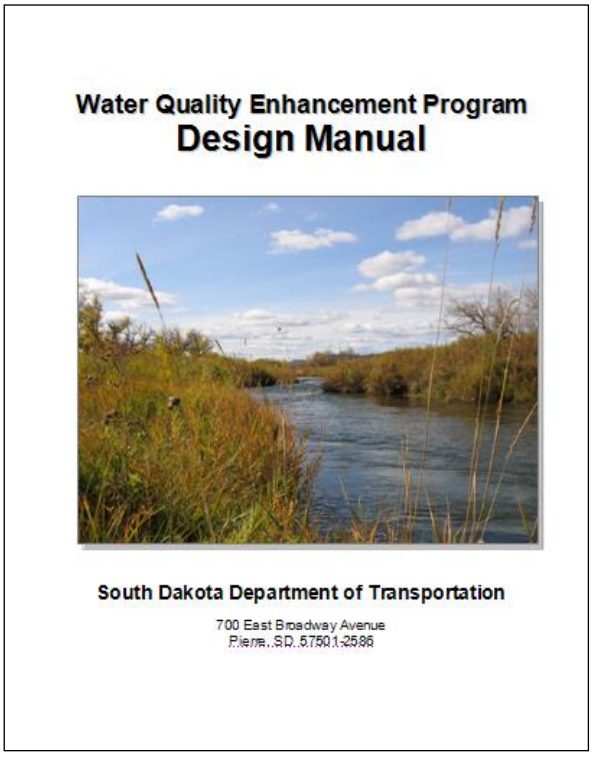
THE MANUALS

Introduction

Two different manuals were developed for this project: a Design Manual and a Construction Field Manual. Each of these manuals serves a somewhat different audience and provides different types of information. The Design Manual is intended as a reference document and carries a wide variety of information covering the primary knowledge base identified in the literature review and survey tasks of the project. The Design Manual's primary audience is the design professionals with some detailed support for field staff. The Construction Manual was seen as a support document directed specifically to the needs of project engineers and field technicians. Its focus is on the day to day tasks required in construction site administration related to erosion and sediment control.

The Design Manual

The design manual has been developed as an on-line reference document. This use is somewhat different than some of the other SDDOT publications that were reviewed. Many existing manuals appear to focus on training for specific tasks and serve a secondary function as a reference. These paper documents become quickly dated and are difficult to update as things change. By designing the Design Manual as an on-line document, the process of updating information and disseminating the changes through out the department is simplified. This is very important for any materials related to the environmental process which is one of the most rapidly evolving areas of regulatory policy.



The contents of the design manual closely reflect the areas identified in the literature review. The design manual consists of five sections:

1. Purpose and Authorities

This section covers the body of legislation and rules established requiring erosion and sediment controls for construction sites. It covers the requirements in plain language, provides a little background for why the controls were instituted and emphasizes the most critical points that impact transportation construction projects. In the body of the text, hyperlinks are provided to the appropriate parts of the South Dakota Code, U.S. EPA rules, and the federal Clean Water Act. Links are also provided to the SD DENR website for the text of the General Permit, and the forms required for filing the NOI and NOT.

2. Principles of Erosion and Sediment Control

The second section covers the mechanics of water erosion processes, the types of erosion that are common on construction sites, and the difference between erosion control and sediment control. These principles are then related to the processes that are essential to effectively controlling erosion, stressing the fact that sediment control is only a secondary tool in preventing the transport of soil borne pollutants to adjacent water bodies. The focus of the text is to generate a good understanding of these processes and the differences between them.

3. Best Management Practices for Erosion and Sediment Control

This third section focuses on erosion and sediment control technology and methods. The material blends modern technology with older proven methods in the form of BMP data sheets. Each data sheet consists of one, to as many as three pages, and covers the material, its application, effectiveness, problems, installation requirements, and any special equipment needs.

Another feature of this section is the BMP selection network. This is a linked network that aids in selecting appropriate BMPs based on purpose and the site conditions, such as slope, soil type and micro climatic conditions. The network is linked so that it carries the user to a list of appropriate tools, and from there to the specific BMP data sheets. Links are also provided to SDDOT's Approved Products Lists for erosion and sediment controls as appropriate.

This section also provides a summary of the relative cost of materials and material longevity. This data is presented in table format and is based on actual field and laboratory testing.

4. Managing the Construction Site

This section deals with the administration of the SWPPP in the field. It is very important because it deals with what might be considered the soft side issues involved in the management of a construction site. The material addresses issues of house keeping, material storage requirements, spill prevention and cleanup, and the paperwork requirements. Most discussion tends to focus on the structural BMPs because they are visible and are perceived as the most costly parts of the requirements. However, experience suggests that a majority of the violation notices issued on construction projects in the past years are for things like failure to store paints, chemicals and petroleum products properly, tracking sediment onto adjacent pavements, and failure to properly post and maintain paperwork. This section covers these requirements along with a detailed discussion of the required inspection process and requirements to maintain records and update the SWPPP when changes are made. Links are provided through out to the appropriate forms and reference materials.

5. Engineering Design for Erosion Control

The final section deals with technical design issues, preparation of the SWPPP documents, and tools for managing storm water quality in general. First, the material describes the documents that have to be prepared to meet the regulatory requirements for storm water management. These requirements are then discussed in the context of the SDDOT projects delivery process, PCEMS. At each milestone in the PCEMS process, suggestions are made regarding data collection, data sources, and potential pitfalls that may impact the storm water management plans and strategy for a project.

Next, section five details the most common models used to predict erosion, the Revised Universal Soil Loss Equation (RUSLE II) and the Water Erosion Prediction Program (WEPP). Links are provided to sites that provide reference manuals, guidance on application and public domain software programs. These materials can be downloaded and used as deemed necessary. As pointed out earlier, there is no current mandate to use a predictive model in the development of sediment and erosion control plans. However, in cases where projects traverse sensitive habitat, and/or have direct connections to sensitive or pristine waters, good documentation and backup for erosion control decisions are often desirable in case there are questions in the permitting process or during the construction period.

In the last part of the section, some specific design criteria are discussed for specific situations and the SWPPP preparation checklist is introduced.

The Construction Field Manual

Introduction

The construction field manual was developed to focus on field issues related to construction site management for erosion and sediment control. It does not carry detailed design information having to do with preparation of the SWPPP document or any detailed information on types and causes of erosion. It is specifically directed to tasks that relate to an active construction site and tools that will help project engineers and technicians perform their jobs in a way that will help ensure compliance with the environmental regulations.

The Construction Manual is divided into four sections with resource materials in the back, as follows:

1. Principles and Practices of Erosion and Sediment Control
2. Inspections and Site Management
3. Checklists and Forms
4. Construction Specifications

This section describes the content of each section.

1. Principles and Practices of Erosion Control

This section is a summary of key points and principles that apply to managing erosion and sediment on construction sites by offering quick reminders of what affects certain types of erosion, and actions that need to be taken to control specific types of erosion or sediment collection. These introductory materials are intended to touch on key points that were detailed in the training and are explained in greater detail in the Design Manual.

2. Site Management and Inspections

This section deals with the key issues of managing the site to prevent spills and or the release of pollutants to any adjacent waters. This is a very important part of the SWPPP and as noted earlier, the areas where many notices of violation occur. The issues of housekeeping, spill prevention, spill cleanup, and other administrative details of managing the site are included. This section also covers the site inspection process, when inspections are required, what has to be reported, what steps need to be taken when deficiencies are found, and what needs to be done to maintain the SWPPP.

3. Checklists and Forms

The third section provides a group of checklists specifically tailored to field applications. The Mobilization checklist deals with the mobilization process and what needs to be in place as construction begins. This helps ensure that every thing that is needed is in place before any disturbance occurs.

In addition there is a form included which addresses the recommended site inspection form. As explained earlier, this is a more detailed form than the one currently adopted by SDDOT. It provides more detailed information and provides for greater consistency in recording rather than

relying on pure narratives as the current form does. This form will also facilitate the preparation of annual environmental compliance reports and provide better backup information in the event of disputes or questions.

The Final Inspection Checklist is recommended as a guide for checking the field conditions just prior to filing the NOT. While there is no requirement for this, it will help ensure that all necessary actions, such as removal of all temporary BMPs have been accomplished. This is considered important because the filing of the NOT is usually done by SDDOT after the contract is closed out. This checklist will help those charged with filing the NOT to be sure everything is done.

4. Construction Specifications

This section provides ready access to the standard specification materials related to establishing permanent seeding and managing the planting, fertilizing, and mulching processes. The material focuses on the tasks that must be followed in order to ensure that greatest possible success.

Resource Materials

At the back of the Construction Manual are several resource material pages. These include:

- A trouble shooting table for erosion and sediment controls
- Examples of calculations
- A table of conversion factors
- All of the check lists
- The inspection form

These materials provide ready reference and handy tools for administering work in the field.

THE TRAINING PROGRAM MATERIALS

Introduction

The recommended training program consists of a 12 hour course which includes an examination certifying that participants have completed the required training. The course is designed to be taken by all of the groups identified in the research section of this document. Those groups include:

- General Contractors and their project superintendents
- Subcontractors that provide sediment and erosion control services to SDDOT
- Consultants that prepare construction project documents for SDDOT
- SDDOT Bridge, and Highway Design Personnel
- SDDOT Region and Area Engineers
- SDDOT Project Engineers and Field Technicians

The research team understands training this large an audience will require some planning and time to fully implement. Therefore, we recommend the initial focus be on training the SDDOT design and project engineering staff. These are the individuals that have the greatest day to day impact on ensuring that the regulatory mandates are met. They in turn will begin disseminating

the requirements and expectations to contractors and consultants until the educational program can be fully implemented.

The training materials consist of three products:

- MS PowerPoint Presentations for the 9 units included in the course
- An Instructor's Manual that details the content to be conveyed with each slide in the presentation package
- A Student Guide produced from the slide presentations.

MS PowerPoint Presentations

Microsoft PowerPoint was used as the primary authoring tool for the training materials. The unit outlines were the basis for the visual materials and each slide has a detailed script. This content can be exported to create other training support documents. This format will allow SDDOT personnel to customize the content as the course evolves over the next few years to meet new or unforeseen situations.

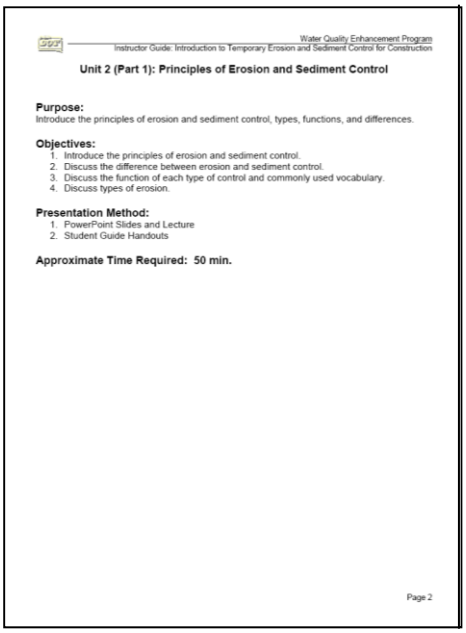
The course is divided into a series of nine units with a written examination as follows:

1. Introduction
2. Regulatory Overview
3. Principles of Erosion and Sediment Control
4. Temporary Erosion and Sediment Control BMPs
5. Preparation of the SWPPP Step-by-Step
6. Construction Site Management and Inspection
7. Examination Review
8. Permanent Water Quality Controls
9. Modeling and Predicting Soil Erosion
10. Examination (Written examination no slides)

Units one through seven with the written examination (10) form the core of the recommended 12 hour course. Units 8 and 9 are recommended to be used for training groups made up of principally of design engineers and consultants. Units 8 and 9 cover tools that can be useful in understanding the full scope of current storm water quality regulations and cover the most widely used tools for predicting water soil erosion. The project technical panel felt that these units could be of some value to this audience, but not to the broader audience concerned with day to day field activities.

The Instructor's Manual

The instructor's manual was produced by exporting the notes pages to an MS Word document. Each unit in the instructor's manual is prefaced with a page that gives the purpose of the unit, the unit learning objectives, the presentation method and the approximate time required to complete the presentation (Figure 8).



Water Quality Enhancement Program
Instructor Guide: Introduction to Temporary Erosion and Sediment Control for Construction

Unit 2 (Part 1): Principles of Erosion and Sediment Control

Purpose:
Introduce the principles of erosion and sediment control, types, functions, and differences.

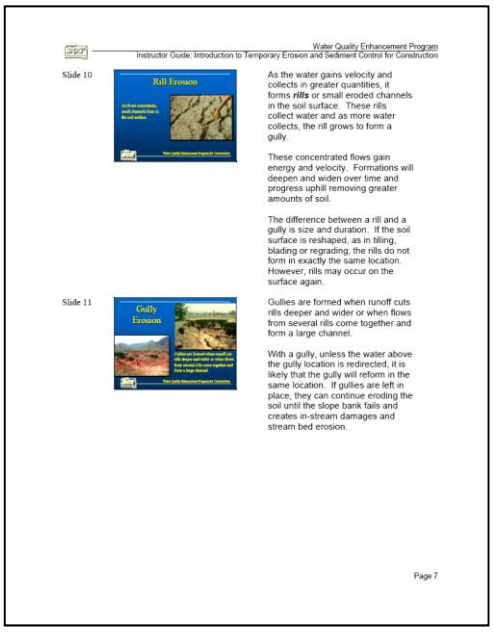
Objectives:
1. Introduce the principles of erosion and sediment control.
2. Discuss the difference between erosion and sediment control.
3. Discuss the function of each type of control and commonly used vocabulary.
4. Discuss types of erosion.

Presentation Method:
1. PowerPoint Slides and Lecture
2. Student Guide Handouts

Approximate Time Required: 50 min.

Page 2

Figure 8: Instructor's Manual Unit Objectives



Water Quality Enhancement Program
Instructor Guide: Introduction to Temporary Erosion and Sediment Control for Construction

Slide 10

As the water gains velocity and collects in greater quantities, it forms ***rills*** or small eroded channels in the soil surface. These rills collect water and as more water collects, the rill grows to form a gully.

These concentrated flows gain energy and velocity. Formations will deepen and widen over time and progress uphill removing greater amounts of soil.

The difference between a rill and a gully is size and duration. If the soil surface is reshaped, as in tilling, blading or regrading, the rills do not form in exactly the same location. However, rills may occur on the surface again.

Slide 11

Gullies are formed when runoff cuts rills deeper and wider or when flows from several rills come together and form a large channel.

With a gully, unless the water above the gully location is redirected, it is likely that the gully will reform in the same location. If gullies are left in place, they can continue eroding the soil until the slope bank fails and creates in-stream damages and stream bed erosion.

Page 7

Figure 9: Typical Instructor's Manual Page

The pages in the Instructor's manual are divided into three columns. The left column has the slide number in the presentation. The middle column has a thumbnail picture of the slide and the right column contains the script text for that slide. Where possible the content of the slide is broken into bullets to help instructors focus on the key points. Other slides simply have a detailed script narrative (Figure 9).

The Student Guide

The student guide is printed from PowerPoint handouts. This gives the students a thumbnail shot of the slide and a place to take notes. The technical panel had some questions about these materials regarding the legibility of the thumbnail slides. This seemed to have arisen from some confusion about the intent of the student guide.

The student guide is intended as just that, a guide to the course and a place to take notes that may be helpful in passing the certification examination. It is not intended as a text or future reference. That material is included in the manuals. It is preferred that students not have these materials during the course so that they focus their attention on the instruction and not the manual or reference materials.

RECOMMENDED CERTIFICATION PROGRAM

In order to institutionalize the actions needed to comply with regulatory mandates for construction site erosion and sediment control, it will be necessary to generate a common level of understanding among three disparate audiences; contractors, consultants, and SDDOT personnel. If it were only necessary to train SDDOT engineers and field technicians institutionalizing the appropriate practices could be expected through an in-house training effort. However, in this case the research shows that not only SDDOT personnel but contractors and consultants need training as well. Contractors and consultants alike appear to have some knowledge of erosion

and sediment control requirements. However, there is no general understanding in these audiences about SDDOT's requirements. For this reason, the research team strongly recommends SDDOT use the training program developed by this project as the basis of a required certification program for their personnel and all contractors and consultants that build or prepare plans for SDDOT projects.

The research also revealed that a number of state transportation agencies have developed joint certification programs with their state environmental regulatory agencies. Because SD DENR has storm water enforcement responsibility for all types of construction and industrial activities, a joint certification effort may be of benefit to SD DENR as well. For this reason SDDOT may wish to pursue some type of cooperative effort to reach an even broader audience. This would allow the agencies to share cost and administrative activities.

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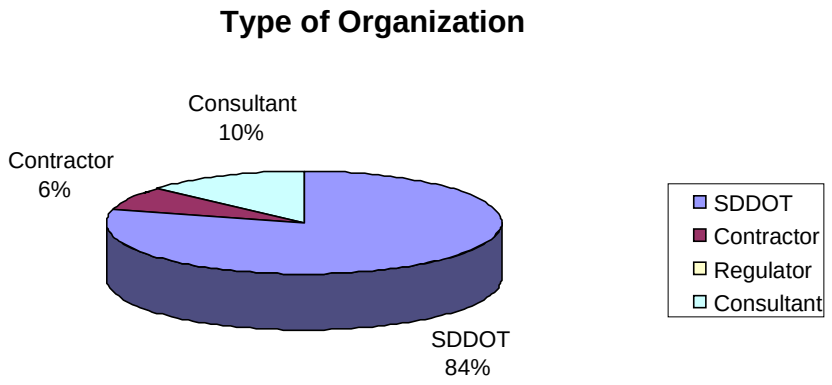
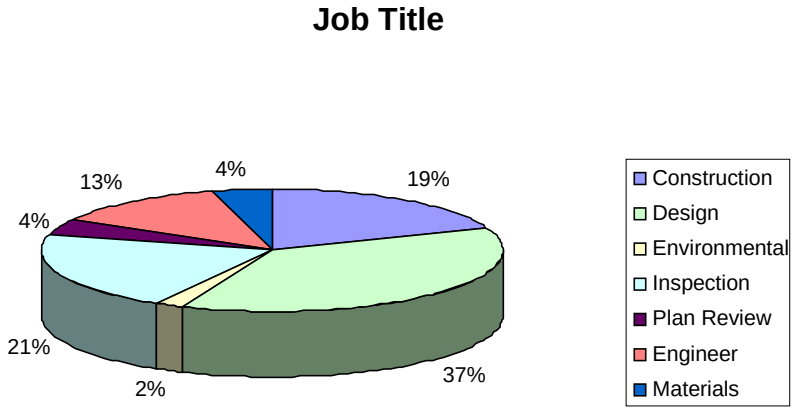
APPENDIX A

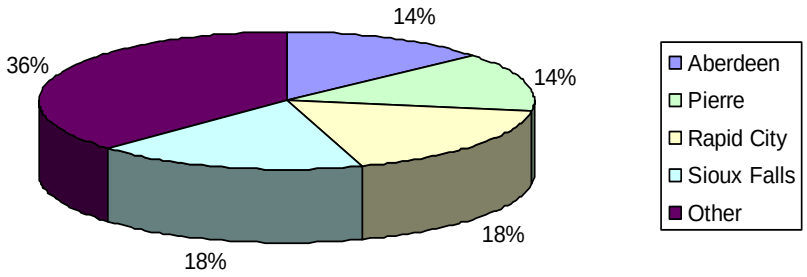
SOUTH DAKOTA DOT WATER QUALITY ENHANCEMENT PROGRAM FOR CONSTRUCTION EROSION AND SEDIMENT CONTROL SURVEY RESULTS

Survey Participant Information



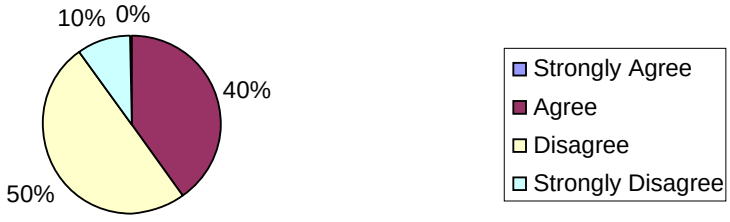


Region/Area

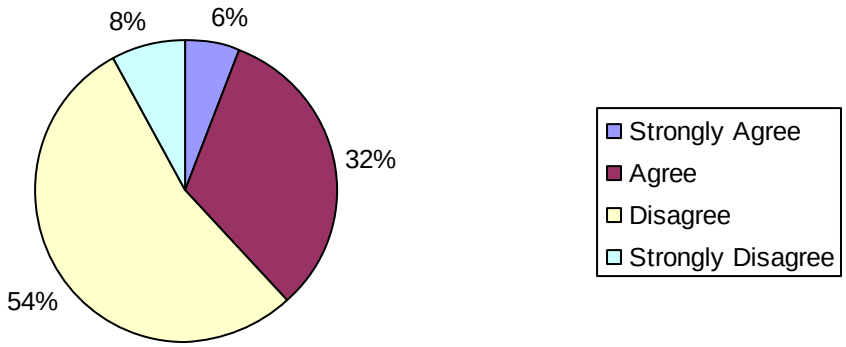


Section 1: Rules/Regulations and Training

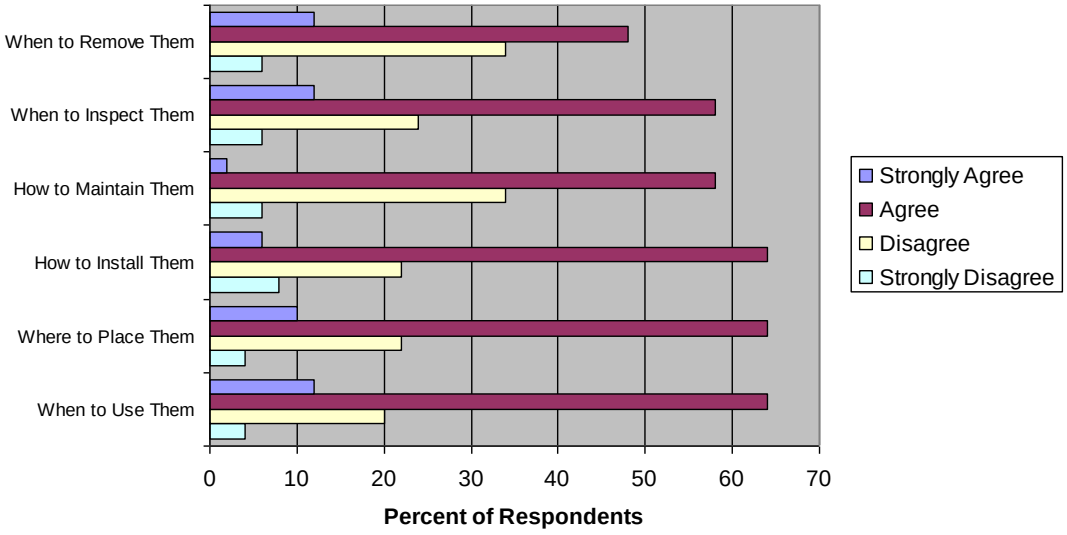
1) I have a thorough understanding of the rules and regulations of the National Pollutant Discharge Elimination System (NPDES) and state requirements as they apply to construction site storm water management.



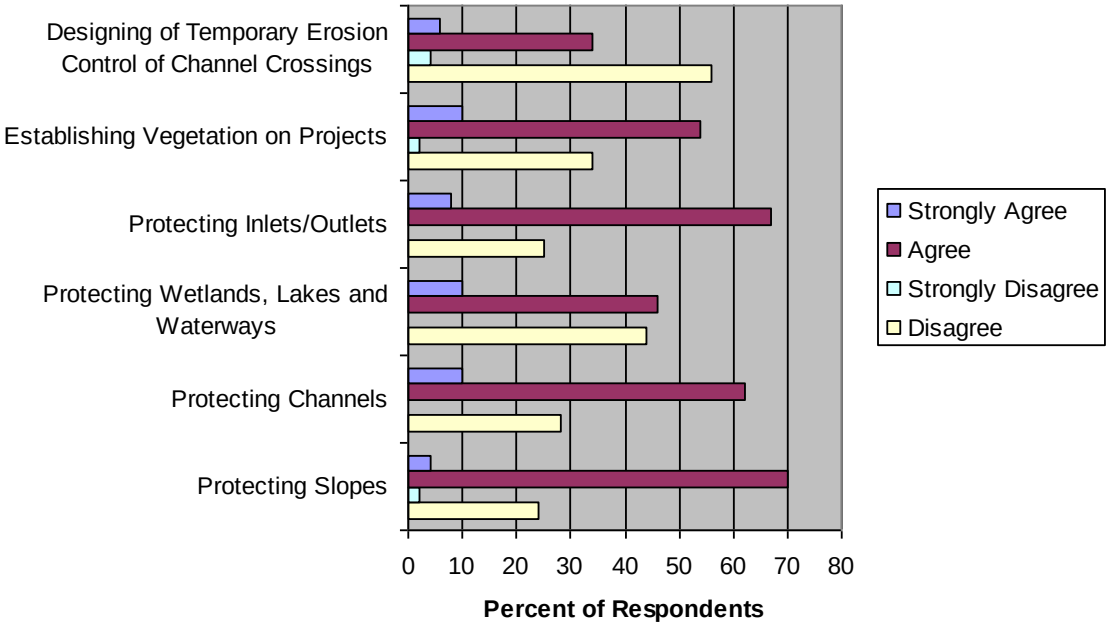
2) I have adequate training to prepare a Storm Water Pollution Prevention Plan (SWPPP).



3) I have adequate training and knowledge of erosion and sediment control best management practices (BMPs) in terms of:



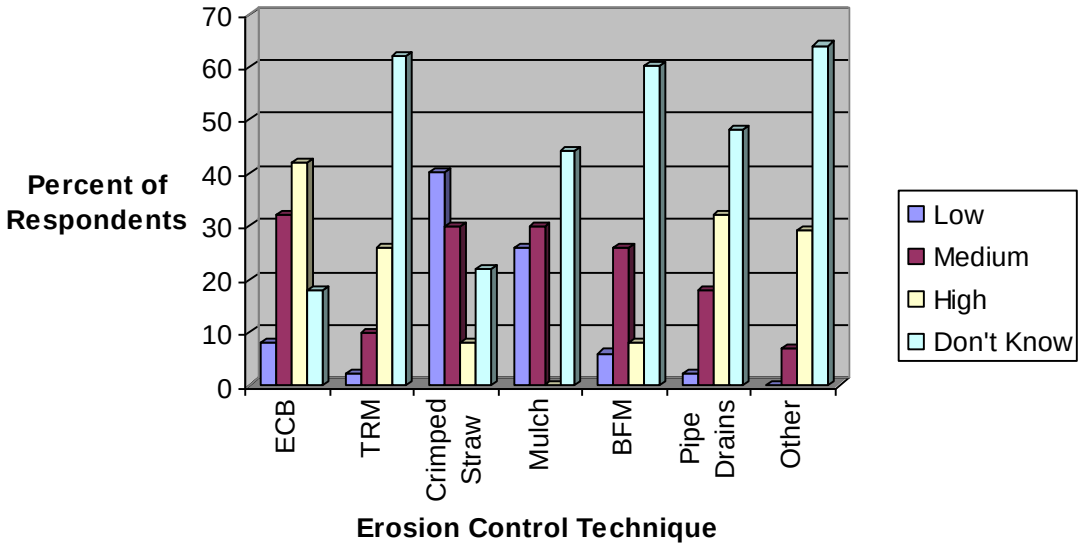
4) I have adequate training in the following area:



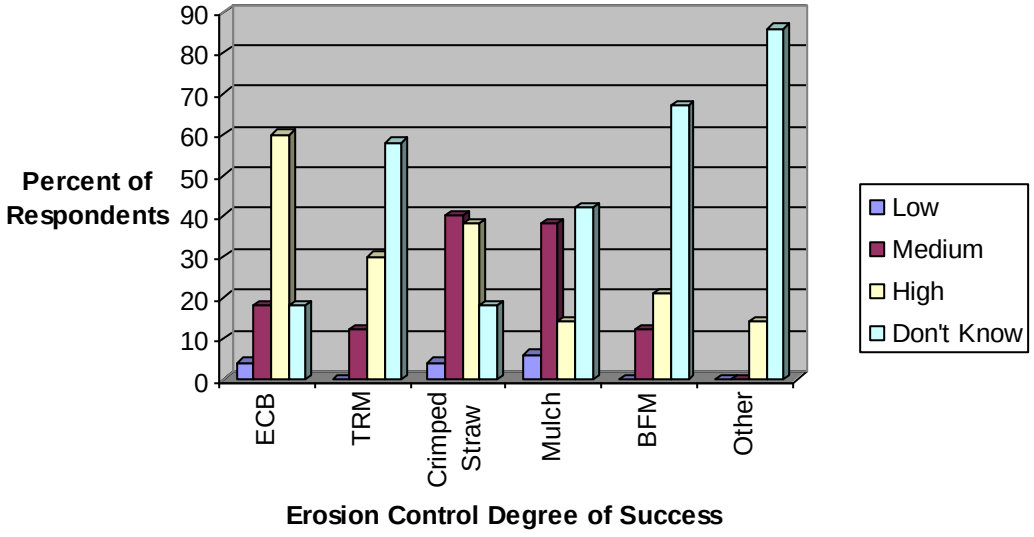
Section 2: Erosion Control

From your experience, rank the following erosion control techniques and applications according to their degree of success.

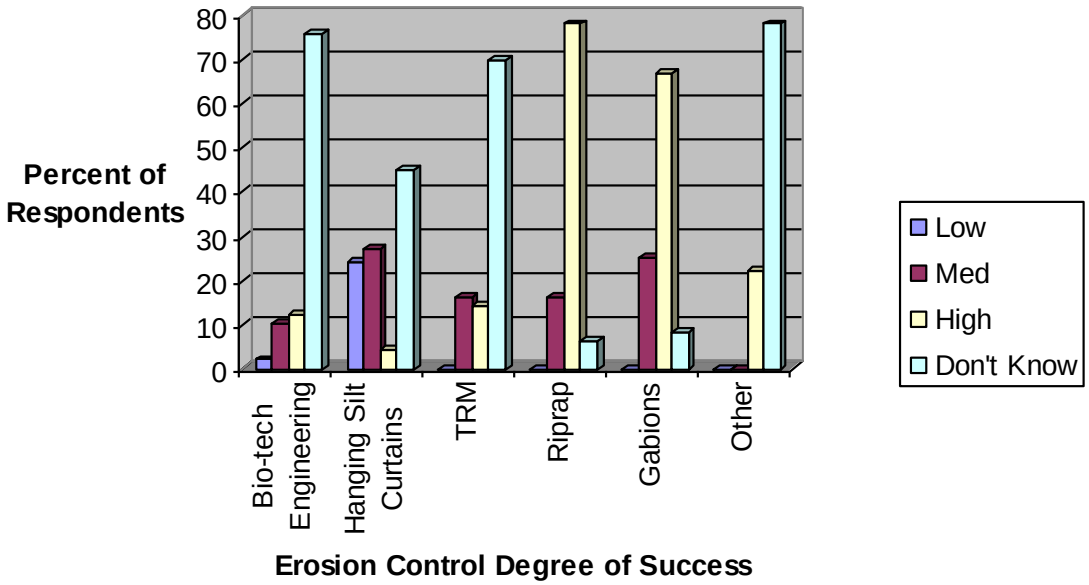
5a) Steeper Slopes (2h:1V or steeper)



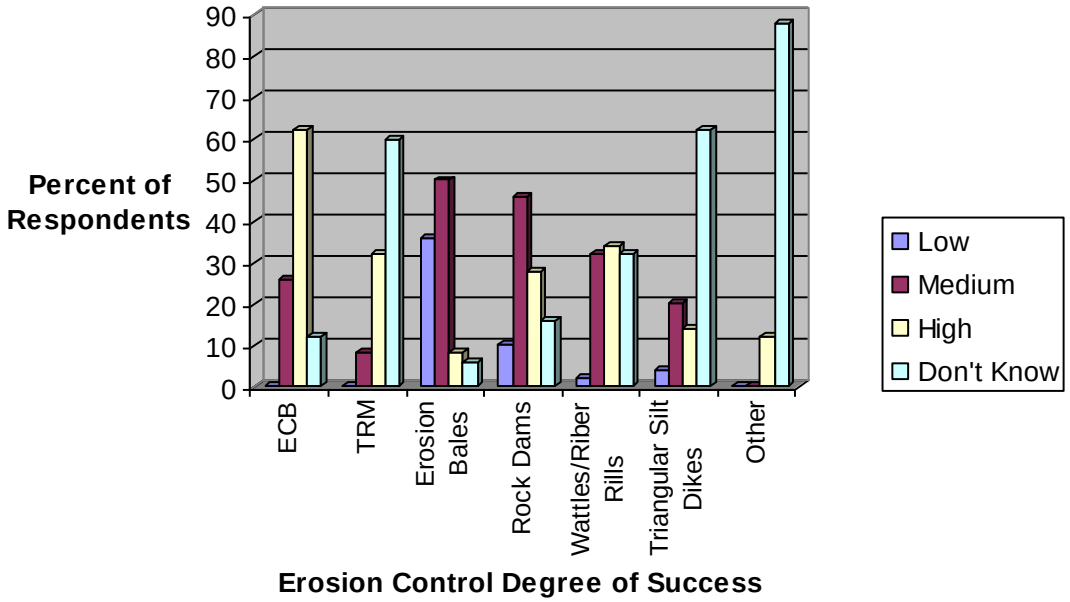
5b) Flatter Slopes (3H:1V or flatter)



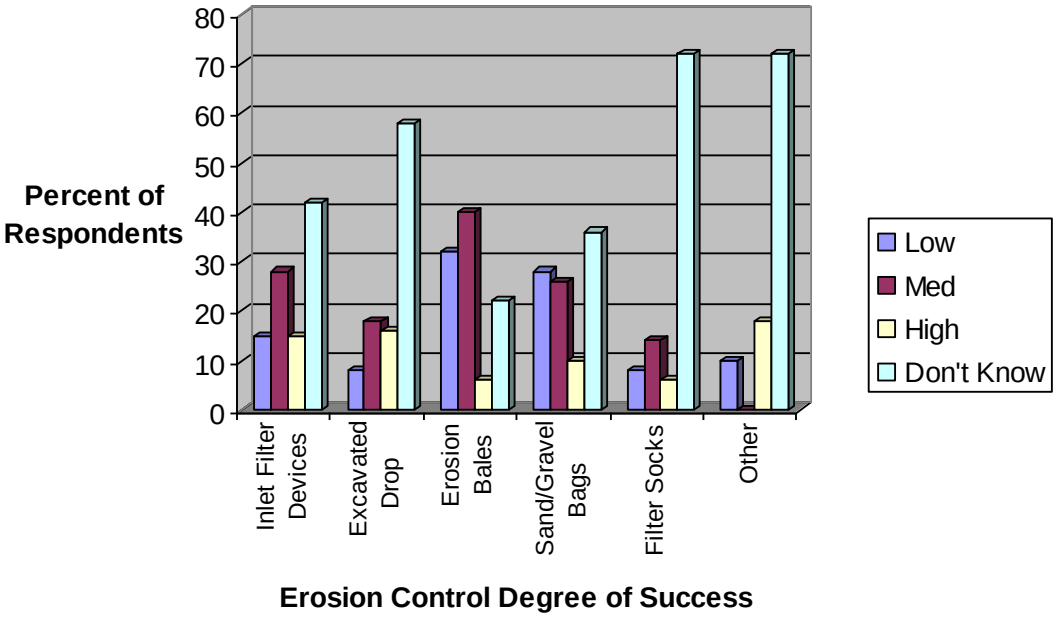
5c) Channels (creeks, streams)



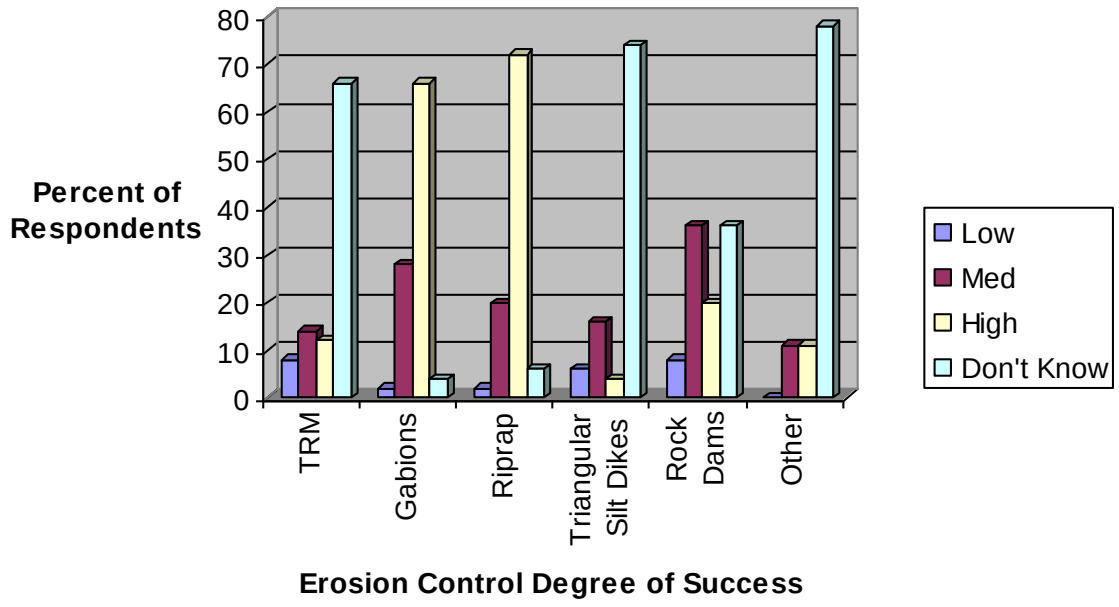
5d) Roadside Ditches (shoulders, borrow ditches)



5e) Inlets (culverts, grates, side inlets)

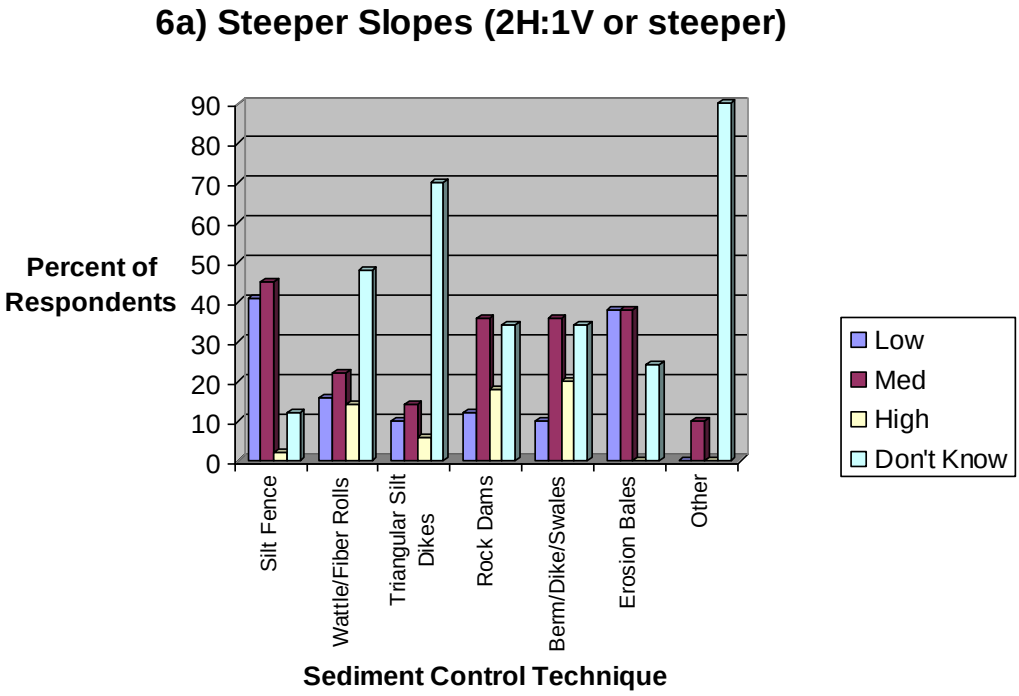


5f) Outlets

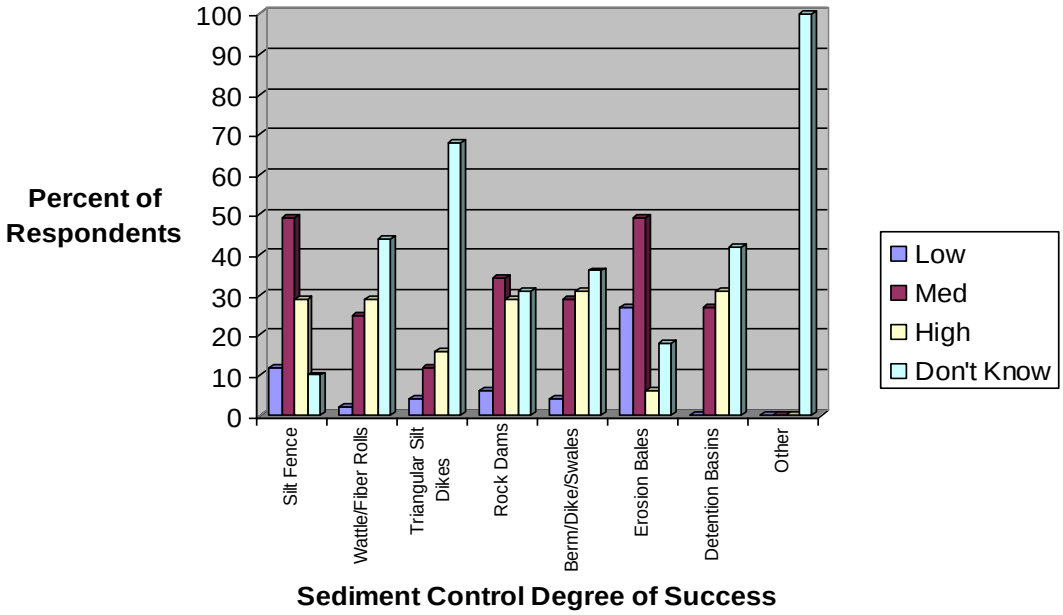


Section 3: Sediment Control

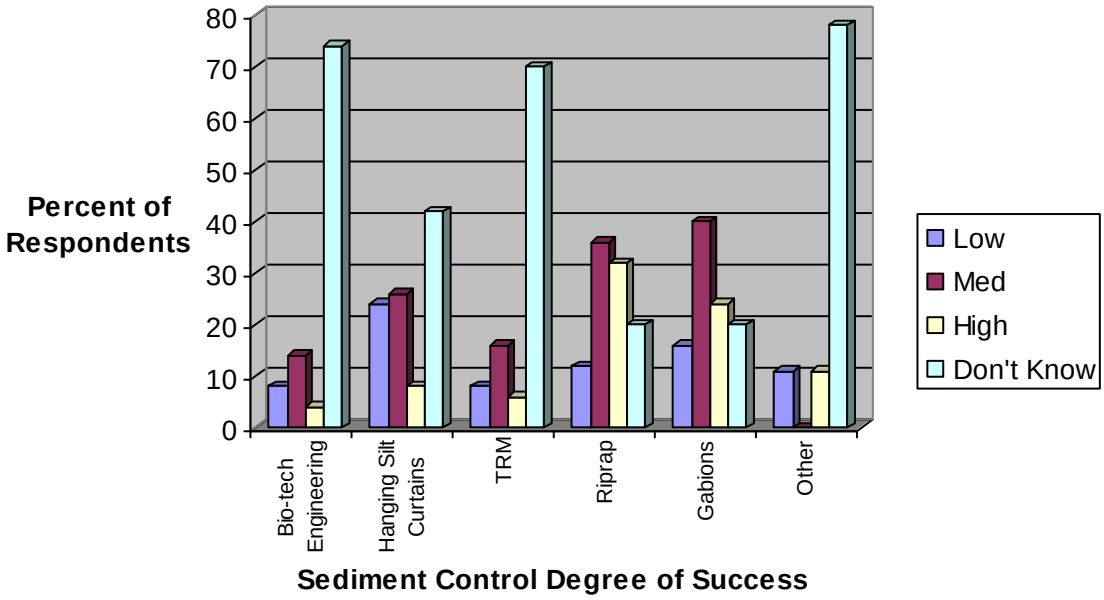
From your experience, rank the following sediment control techniques and applications according to their degree of success.



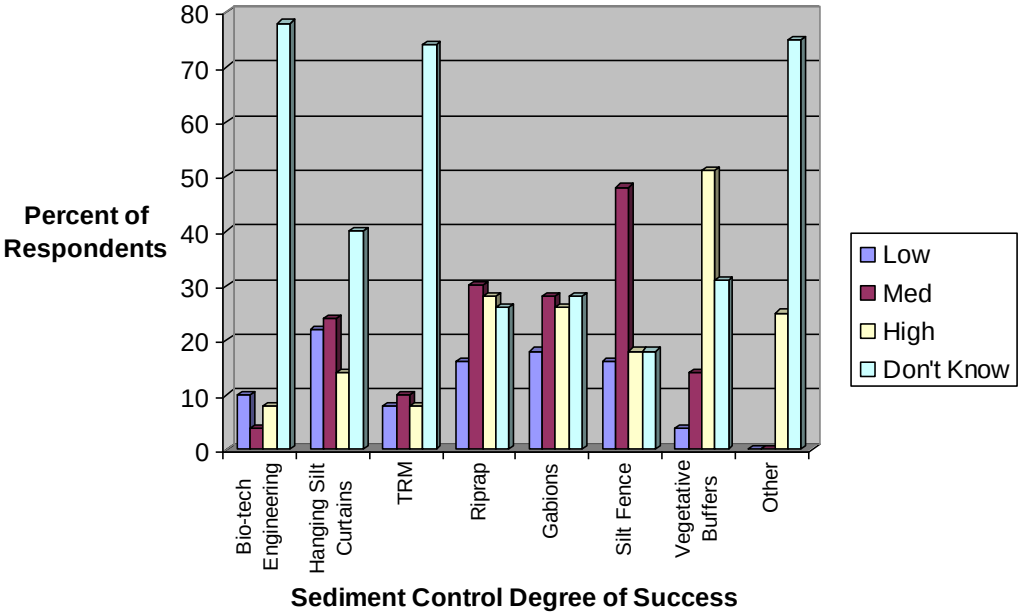
6b) Flatter Slopes (3H:1V or flatter)



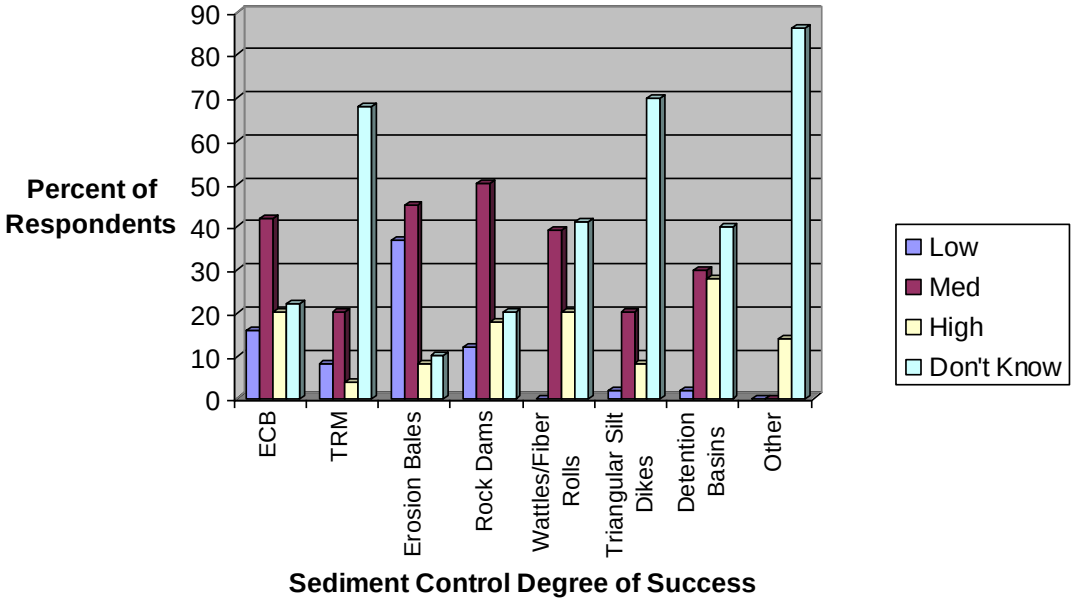
6c) Channels (creek, streams)



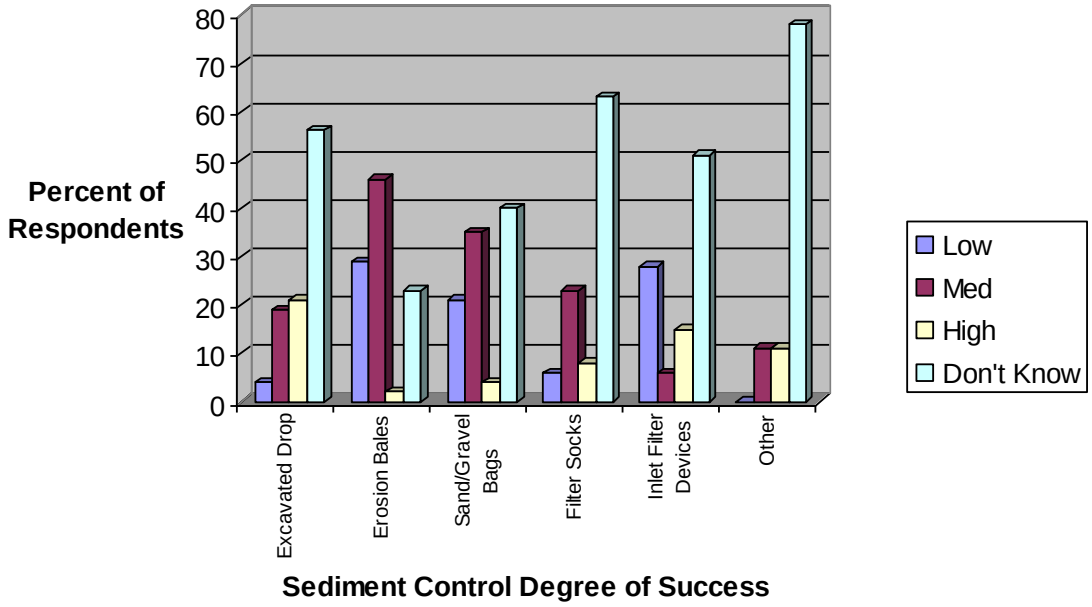
6d) Wetlands, Lakes and Waterways



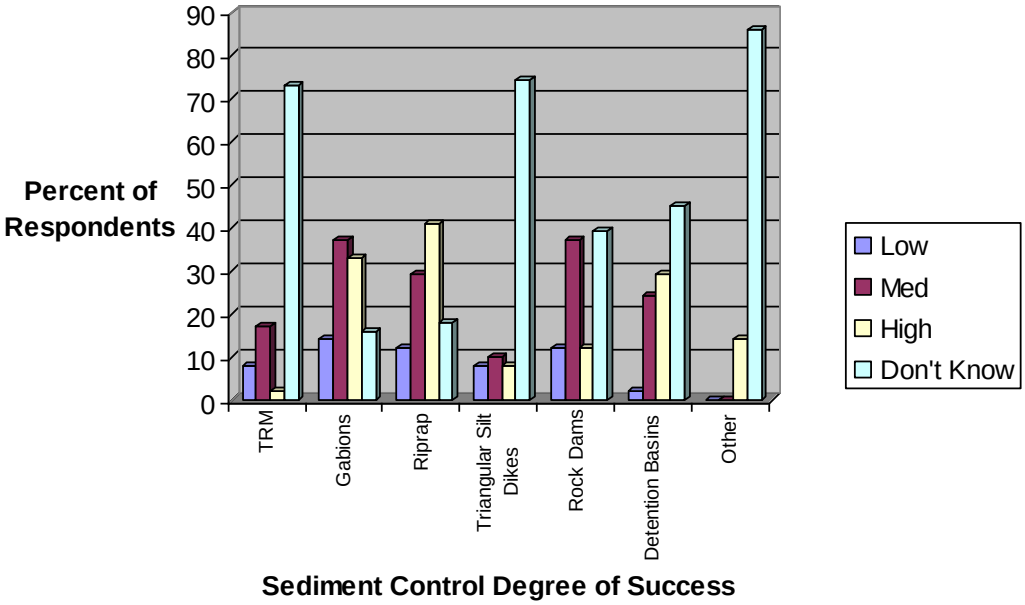
6e) Roadside Ditches (shoulders, borrow ditches)



6f) Inlets (culverts, grates, side inlets)

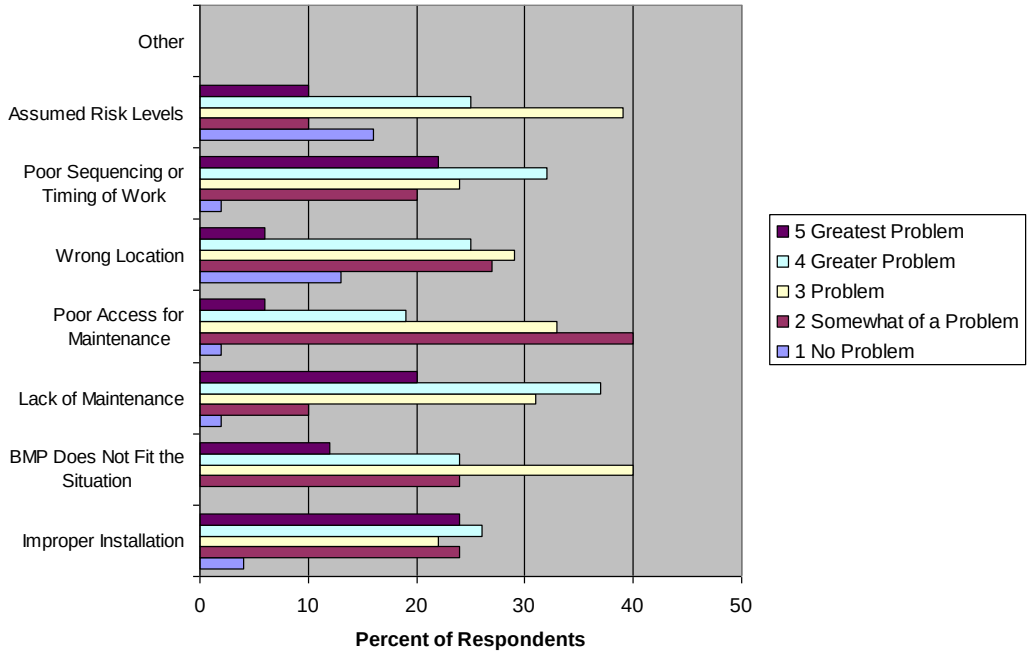


6g) Outlets

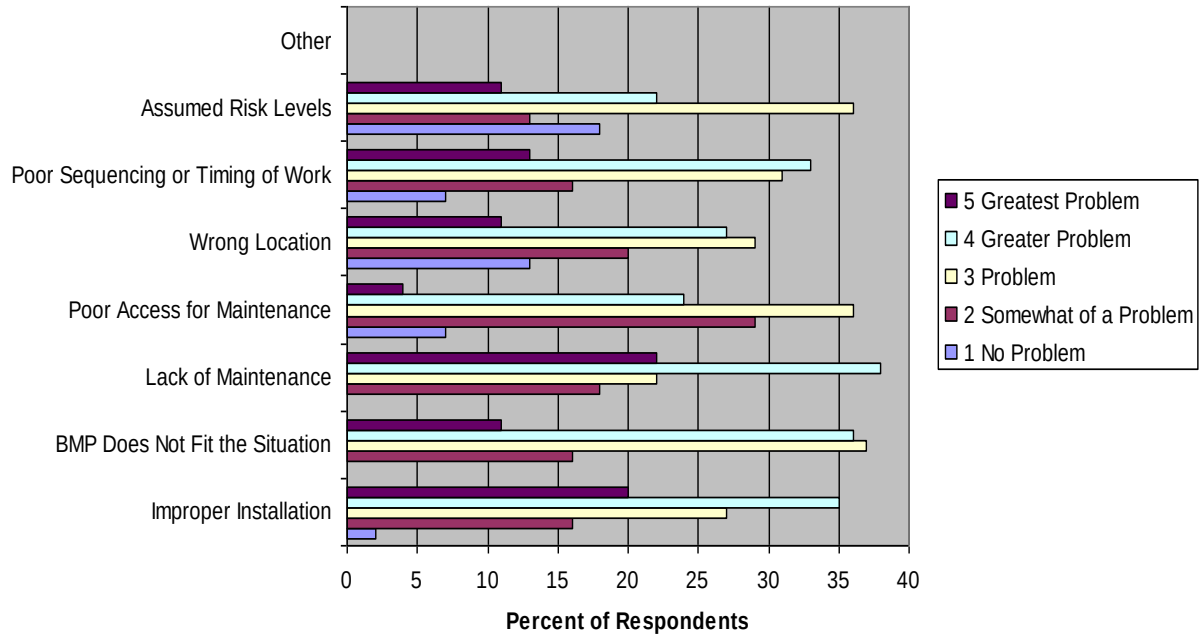


Section 4: General Questions

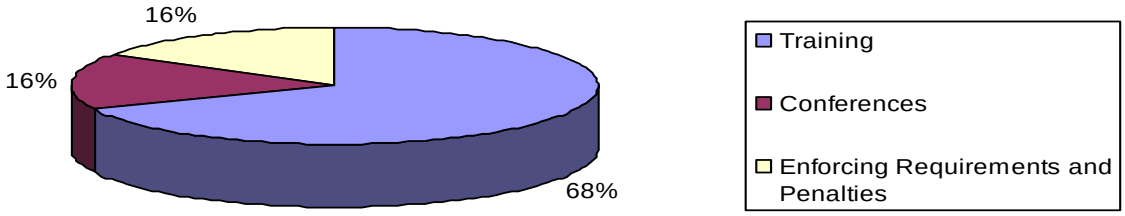
7) Common Problems with Erosion Control BMPs



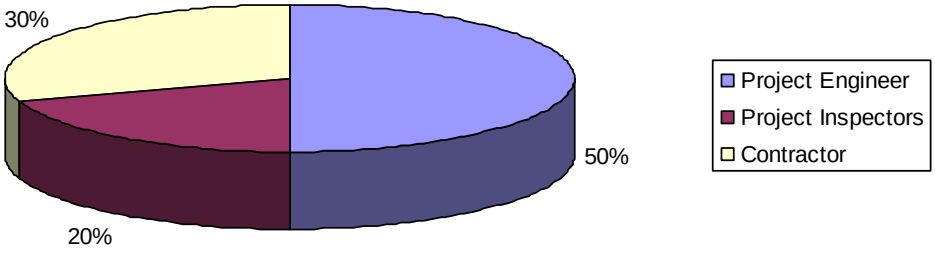
8) Common Problems with Sediment Control BMPs



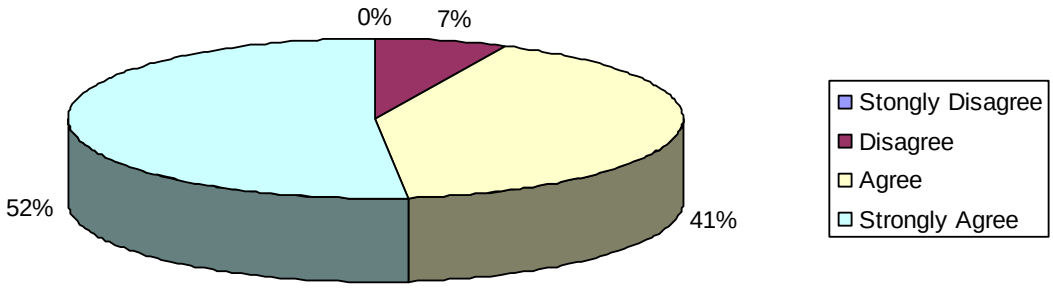
9) Over the last two years, SDDOT has made a concerted effort to improve communication on the importance of appropriate erosion and sediment controls at construction sites. In your opinion, what has been the most effective method used to relay this SDDOT priority?



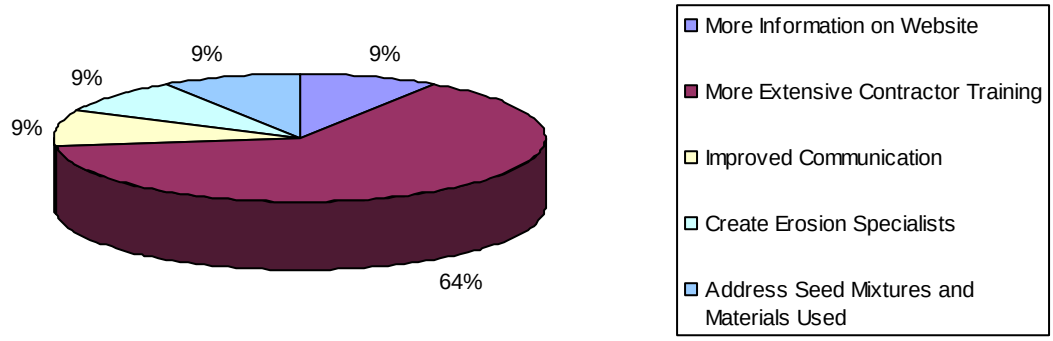
10) Who (job foreman, project manager, etc.) in your organization is responsible for the successful installation and maintenance of erosion and sediment control BMP's?



11) I support SDDOT adopting an erosion and sediment control certification program.



12) Please provide any comments you feel would help improve SDDOT's erosion and sediment control activities.



APPENDIX B

SWPPP CHECKLIST

Chk	Permit Citation	Action/SWPPP Requirement	SWPPP Page
Site Description (4.2.1)			
☐	4.2.1.a	Plan Notes Sheet D-1 cites the appropriate cover sheet for the project.	
☐	4.2.1.b	The total area of the site is recorded and correct.	
☐	4.2.1.c	All soil disturbing activities to be performed are noted.	
☐	4.2.1.d	Soil characteristics are noted in the space provided (D-1).	
☐	4.2.1.e	All surface bodies are noted that may receive runoff from the site.	
Site Maps (4.2.1.f)			
☐	4.2.1.f.(1)	Cover sheet and attached plan sheets show sufficient detail of drainage patterns and approximate slopes after major grading has taken place.	
☐	4.2.1.f.(2)	Plan sheets show areas of soil disturbance.	
☐	4.2.1.f.(3)	Plan sheets show the location of major structural and nonstructural erosion and sediment controls (temporary and permanent)	
☐	4.2.1.f.(4)	Areas where stabilization activities will occur are shown on the plan sheets.	
☐	4.2.1.f.(5)	The area map of the cover sheet shows surface waters including the extent of wetland acreage (if no an additional area map should be included with the Section D Plan notes).	
☐	4.2.1.f.(6)	Map and/or plan sheets show points where storm water is discharged into surface waters, or conveyances that will discharge into an adjacent water body.	
Erosion and Sediment Controls (4.2.2) [1]			
☐	4.2.2.a (1)	For each disturbed area and construction activity of the site approved erosion and sediment controls have been shown. *NOTE: In the event that these controls impact on flood plains or wetlands, Section 404 may apply.*	
☐		Slopes and all exposed surfaces show appropriate temporary controls and the permanent controls to be used.	
☐		Long, steep slopes have diversions or some means of preventing run-on and reducing velocity.	
☐		Suitable perimeter protection is provided in all areas where sheet flow leaves the site and will impact adjacent land or a waterway(s).	
☐		Culverts (inlets and outlets) and drain inlets have appropriate temporary controls to prevent sediment from entering or leaving the site.	
☐		Ditches have proper velocity controls where concentrated flows enter and appropriate surface protection.	
☐		Channels and creek banks have appropriate temporary cover and permanent controls specified.	
☐		Appropriate in-channel protection has been provided in and around perennial streams.	
☐	4.2.2.c(1)	Appropriate construction entrances/exits have been at all points of access to the project site to prevent tracking of sediment onto adjacent roads.	
☐	4.2.2.d	The design capacity of all sediment traps and silt basins is shown on the plan sheets.	

[1] In so far as possible the terms used to describe the stabilization, structural, storm water management, and housekeeping BMPs should use the terms as defined in the SD DENR "General Permit for Storm Water Discharges Associated with Construction Activities.

Chk	Permit Citation	Action/SWPPP Requirement	SWPPP Page
☐	4.2.2.f	Notes are provided on the plan sheets to indicate the contractor's responsibility for locating and providing appropriate erosion and sediment controls for material storage and staging areas.	
☐	4.3.3.(3)(a)	In common drainage locations, provisions have been made to store at least 3,600cf of sediment per acre drained by some approved means. *Note: Small traps are only used where the right-of-way will not accommodate larger, single structures.*	
		Storm Water Management (4.2.2.b)	
☐	4.22.(3)b(1)	Plan sheets describe permanent structures for storm water management after construction. Provisions may include the following:	
☐		Grassed medians or improved vegetated ditches and swales	
☐		Storm water ponds and basins	
☐		Velocity dissipation devices at discharge points	
☐		Sand or media filters	
☐		Underground vaults and structures	
☐	4.2.2(3)b(1) 4.2.2(3)b(2)	Plan and/or notes pages provides a technical explanation if the controls used in 4.2.2. (b) (1) and (2).	
		Stabilization Practices (4.2.2.2)	
☐	4.2.2.2	Section D notes pages provide a schedule and description of interim and permanent stabilization practices to be included.	
☐	4.2.2.2	Estimated/actual dates provided for when disturbance will occur.	
☐	4.2.2.2	Estimated/actual date of when construction activities are suspended temporarily or permanently on an area of the site.	
☐	4.2.2.2	Estimated/actual dates when temporary or permanent stabilization measures are initiated.	
		Other Controls (4.2.2.(3)c)	
☐	4.2.2.(3).c (1)	Plan provides narrative of procedures to maintain vegetation, erosion and sediment control measures (see Section D notes).	
☐	4.2.2.(3).c (2)	Plan provides narrative of how waste and construction materials are to be stored on the site, along with the means to prevent spills and or clean them up should they occur (see Section D notes).	
☐	4.2.2.(3).d	Plan cites any applicable local controls or plans that are in addition to the general permit requirements.	
		Maintenance (4.2.3)	
☐	4.2.3	Plan provides a description of maintenance provisions and requirements for all BMP types (See Section D notes).	

Inspections (4.2.4)

Note: Regular inspections ensure the project remains in compliance with the general permit. Therefore, inspections are the focus of the construction period maintenance program.

☐	4.2.4	The narrative addresses the inspection schedule and reporting requirements (see Section D notes).	
☐	4.2.4	The narrative stipulates the basic requirements that inspections occur once every 7 calendar days and within 24 hours of the end of any event or snow melt of 0.5 in (12mm) (see Section D notes).	
☐	4.2.4	The plan includes a copy of the required inspection forms to be used.	
☐	4.2.4	Plan requires implementation of needed corrections within 7 days of the inspection (see Section D Notes).	
Signature and Plan Review			
☐	4.3.1, 6.7.1.c and 6.7.3	Signatures have been executed properly by individuals of proper authority to sign.	
Filing the NOI Notices of Intent for lands under the jurisdiction of the State of South Dakota are filed with SD DENR, for those lands under federal jurisdiction the NOI is filed with the U.S. EPA as described below.			
☐	2.5 1. For properties under State of South Dakota jurisdiction	A Notice of Intent (NOI) form must be submitted to SDDENR on the SDDENR NOI form to request coverage under the South Dakota general permit for storm water discharges from construction sites. This information must be submitted at least 15 days prior to when construction commences.	
☐	Part 2: 2.1 B. For properties under the jurisdiction of the U. S. EPA (Indian Lands and other federal lands)	Storm water discharges are authorized from construction activities under the terms and conditions of the U.S. EPA **National Pollutant Discharge Elimination System General Permit for Discharges from Large and Small Construction Activities** seven (7) calendar days after acknowledgment of receipt of your complete NOI is posted on EPA's NPDES website ***http://www.epa.gov/npdes/stormwater/cgp***, except as noted in Subpart 2.1.C.	
	Appendix B - Permit Areas Eligible for Coverage	**National Pollutant Discharge Elimination System General Permit for Discharges from Large and Small Construction Activities** **Permit Nos. Areas of coverage/where EPA is Permitting Authority** **NDR10000I** Indian country within the State of North Dakota, as well as that portion of the Standing Rock Reservation located in South Dakota (except for the portion of the lands within the former boundaries of the Lake Traverse Reservation which is covered under South Dakota permit (SDR10000I listed below) **SDR10000I** Indian country within the State of South Dakota, as well as the portion of the Pine Ridge Reservation located in Nebraska and the portion of the lands within the former boundaries of the Lake Traverse Reservation located in North Dakota (except for the Standing Rock reservation which is covered under North Dakota permit NDR10000I listed above)	

Stabilization must be initiated within 14 days of the suspension of construction activities unless earth-disturbing activities will be resumed within 21 days. Any other exceptions must be approved by the SD DENR secretary.

[3] It is recommended that maintenance be addressed by BMP type. The specification sheets and templates can carry standard maintenance requirements and be cited in the narrative.

APPENDIX C

SWPPP MOBILIZATION CHECKLIST

MOBILIZATION CHECK LIST
(Inspection)

Use this check list to aid your inspection of the site. Make sure this form is maintained with the required SWPPP project records. *Note: No construction activities should take place until all items on this list have been completed.*

General Permit Documentation (SWPPP and NOI)

☐ Approval of the NOI and SWPPP received from SD DENR.
☐ SD DENR authorization letter, NOI, name of contacts, and SWPPP location posted so they can be read without entering the site (this may be a construction entrance or a visible corner).
☐ Contractor information, site superintendent name(s), contact numbers, and address has been appended to the SWPPP and posted along with the other required information (see above).
☐ Contractor's designated site superintendent has successfully completed the SDDOT Water Quality Enhancement Certification Program.
☐ The conformed SWPPP is in place as posted.
☐ The contractor and the designated site superintendent have been instructed with regard to regular inspections, record keeping, and SWPPP maintenance.
☐ Contractor has secured coverage under the SD DENR permit for all offsite facilities: batching plants, staging sites, borrows, or other areas that will provide materials to the project.

Deployment of Erosion and Sediment Control BMPs

☐ Areas that will be disturbed in the initial phase of work have erosion controls shown on the plan, are in place and properly installed.[1]
☐ The installed erosion controls appear to cover all potential erosion hazards of the site.[2] Provide notes and corrections required on the appropriate forms and attach them to this checklist.
☐ Sediment controls are provided in all disturbed side slopes and down slopes that may direct runoff to adjacent properties or water bodies. Note any deficiencies on the appropriate forms and attach them to this checklist.
☐ All ingress and egress to the construction site occurs at designated points designed to prevent tracking of sediment from the site.
☐ Contractor has made provisions for wind erosion control and dust control.

[1] It is understood that, depending on the scope of the project, the contractor is encouraged to phase the work to minimize the amount of area disturbed at one time. This item applies only to the areas of the project that will be disturbed in the initial phase of the work. In subsequent phase the erosion and sediment controls must be in place prior to any disturbance of the surface.
[2] Inspectors should be alert for any potential erosion hazards that may not have been identified during the plan preparation process.

MOBILIZATION CHECK LIST (cont.)
(Inspection)

Waste Disposal and Spill Management

☐ Containers are in place for the storage and disposal of waste material.
☐ Hazardous materials spill kits are in place and have the prescribed minimum materials described in the SWPPP.
☐ Materials and equipment are in place to manage any chemical or petroleum spills as described in the SWPPP.

NOTES:

In this section note any deficiencies, additions, or corrections that need to be made prior to beginning construction. Use the SWPPP Revision Form to document any additions, deletions or changes that need to be recorded on the SWPPP.

Signature: _____ Date: _____

SDDOT Project Engineer

Signature: _____

Contractor Site Superintendent

APPENDIX D

SWPPP SITE INSPECTION FORM

SWPPP SITE INSPECTION FORM

Use this form to record required site inspections during the course of constructing a project. It is a primary tool for ensuring compliance with SD DENR's General Permit for Storm Water Discharges Associated with Construction Activities. Forms are to be completed and maintained with the other SWPPP documentation.

Project Information

Project Number: **PCN:** **County:**	**Inspection Type** ☐ **24 hr. After a > 0.5" Event** ☐ **Regular 7th Day Inspection**	**Inspection Date:** **Date of Last Rainfall:** **Depth of Last Rainfall:**

Areas Inspected

Area Type	Inspected ✓/NA	Area Type	Inspected ✓/NA	Area Type	Inspected ✓/NA
Disturbed Areas **Material Storage Areas**		**Structural BMPs** **Sediment Controls**		**Construction Entrance(s)** **Other:**	

How was inspection conducted? (check all that apply) ☐ Windshield ☐ Walking ☐ Aerial

Erosion and Sediment Controls Inspected

Except for the instances listed below, all structural sediment and erosion controls have been inspected and were found to be in working order, to require no maintenance, corrective actions, or additional controls.

BMP Type **(see table)**	**Approximate Station**		**Left or Right of centerline**	BMP Maintenance or Corrective Action Needed Describe required corrective actions, maintenance, or additions needed, conducted, or directions given to the contractor or subcontractor responsible.
	From	**To**		

Additional BMPs Needed

Any additional BMPs not shown on the SWPPP must be approved by the Project Engineer. If multiple locations are involved identify the exact location of each addition.

Approximate Station		**Right or Left of Centerline**	**Description**
From	To		

Temporarily or Permanently Suspended Construction Activities

Where construction activities (grading, excavating, embankment filling, or other land disturbing activities have been suspended either temporarily or permanently, describe why stabilization measures were not initiated within 14 days, or if additional disturbance will occur within 21 days of when construction activities were temporarily suspended. Include the general location of the area.

Approximate Station		Left or Right of Centerline	Description
From	To		

Actions To Be Taken As a Result of This Inspection

A copy of this inspection is to be furnished to the contractor if made by an SDDOT inspector, or if made by the prime contractor, a copy will be furnished to the SDDOT Project Engineer. A permanent copy must be filed with the SWPPP records as required by the SD DENR General Permit for Storm Water Discharges Associated with Construction Activities.

Prime Contractor Representative Name:	Title:	Date:

Compliance Certification (check only one)

☐ With the maintenance and improvement actions noted, the site is in compliance with the SWPPP and SD DENR Regulations.

Potential Noncompliance Issues

Describe the potential noncompliance issue(s) e.g. repeated failure of a BMP, failure to install a required BMP, a visible off-site discharge of material (silt, sand, oily water, etc.), or potential off-site discharges or potential failures.	Approximate Station		Left or Right of Centerline
	From	To	

Inspection Certification

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

Certifying Representatives Name:	Title:	Date:

Signature: _____

Table of BMP Types

1	Temporary Seeding	8	Bonded Fiber Matrix	15	Side Inlet Protection	22	Construction entrance/exit
2	Permanent Sod or Seed	9	Diversion Berm	16	Culvert Inlet Protection	23	Slope Roughening
3	Mulch (hydraulic)	10	Diversion Swale	17	Sediment Trap (textile)	24	Floating Silt Curtain
4	Crimped straw mulch	11	Pipe Slope Drain	18	Sediment Basin	25	Other
5	Erosion Control Blanket	12	Rock Check Dam	19	Wattles	26	Other
6	Flexible Channel Liner	13	Rock Rip Rap	20	Erosion Bales	27	Other
7	Silt Fence	14	Drop Inlet Protection	21	Triangular Silt Barrier	28	Other

APPENDIX E

FINAL INSPECTION CHECKLIST

FINAL INSPECTION CHECK LIST
(Inspection)

Use this form for the final inspection of the site leading up to the NOT filing. Prior to filing the NOT, all temporary erosion and sediment controls are to be removed from the site. This check list should be used to inspect the site and maintained with the required SWPPP project records as required by the SD DENR.

Removal of Structural Erosion and Sediment Control BMPs

☐ All erosion controls shown on the revised SWPPP and plan sheets have been removed.
☐ Any additional disturbance caused by the removal of BMPs has been reseeded or repaired so that no sediment-laden discharge will leave the site.
☐ All side slopes and embankments have achieved a cover equivalent to 70% of adjacent surface cover. Cover is generally uniform with no large bare spots, and no significant rilling is present.
☐ All ingress and egress points to the site have been restored and have either permanent paved surfaces or have been revegetated to the standard of 70% of adjacent cover.

Waste Disposal and Spill Management

☐ No areas of the site have, or appear to have, any residual contamination from spills. Any spills that did occur have been completely cleaned and appropriate surface cover is in place.
☐ There is no evidence of petroleum residue or spills left in areas used for equipment or material storage, and surfaces have been properly restored.

NOTES:
In this section note any deficiencies, additions or corrections that need to be made prior to filing the NOT.

_____
_____
_____
_____
_____
_____
_____
_____
_____

Signature: _____ Date: _____
SDDOT Project Engineer

Signature: _____
Contractor Site Superintendent