Evaluation of Existing WEPP Model Output

Poplar River Turbidity Total Maximum Daily Load Evaluation of Existing Model Output

Task Order No. 2006-47

Prepared for:

U.S. Environmental Protection Agency Region 5
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List of Acronyms

AUAR	Alternative Urban Areawide Review
AVGWLF	ArcView Generalized Watershed Loading Function
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
GWLF	Generalized Watershed Loading Function
NAWE	North American Wetland Engineers
NRCS Service	National Resource Conservation Service
QA/QC	Quality Assurance/ Quality Control
QAPP	Quality Assurance Project Plan
RTI	Research Triangle Institute
SCS-CN	Soil Conservation Service – Curve Number
SOW	Scope of Work
STATSGO	State Soil Geographic Database
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USLE/ MUSLE/ RUSLE	Universal Soil Loss Equation/ Modified/ Revised
WEPP	Water Erosion Prediction Project

1 Summary of Model Evaluation

The RTI Team reviewed the existing Water Erosion Prediction Project (WEPP) model developed by Lutsen Mountain Resorts to assess inputs, results, and conclusions reported by Lutsen Mountain Resorts and their consultants. The review indicated that the WEPP model provides useful information about relative soil erosion and detachment within the Poplar River gorge area. The review also identified several concerns related to the use of the WEPP model for development of the Poplar River Total Maximum Daily Load (TMDL). The concerns identified during the model review are as follows:

- Spatial extent of the modeling was limited to the Poplar River gorge and does not include the entire lower Poplar River watershed;
- Quality assurance and quality control documentation does not exist (Mark Williams, personal communication, January 17, 2007)for the WEPP modeling;
- Inputs used for the WEPP modeling, as documented in the available reports, are incomplete;
- Results of the WEPP model, as documented in the available reports, are aggregated, and;
- Sediment source assessment found in the Environmental Report (NAWE, 2005) may be inappropriate due to the limited spatial extent of the modeling.

Based on these concerns, the RTI Team recommends additional characterization and analysis of sediment sources within the lower Poplar River watershed using simple predictive modeling methods. The anticipated uses of the WEPP modeling were allocation of nonpoint source loads to land use types for wet weather events, source identification, and comparison to similar watersheds that may be less impacted by development. Based on our review, the RTI Team has determined that the existing WEPP modeling is not adequate for the anticipated uses related to TMDL development. Details of the recommendations for additional characterization are outlined in the section of this report entitled Recommendations for Additional Modeling and Analysis.

2 Introduction

Computer models can provide valuable estimates of erosion. The purpose of our evaluation was to determine whether the existing WEPP modeling is suitable for developing the Poplar River TMDL. Data and modeling used for TMDL projects must meet specific data quality requirements. Good modeling practices also require that inputs, assumptions, and results are thoroughly documented and transparent to the end user. This model evaluation report identifies project requirements related to computer modeling outlined in the scope of work (SOW), Quality Assurance Project Plan (QAPP), and U.S. Environmental Protection Agency (EPA) computer modeling guidance.

The WEPP computer model developed by the U.S. Department of Agriculture's Agricultural Research Service was used by Lutsen Mountain Resorts to predict sediment detachment within the lower Poplar River gorge. The computer modeling and analysis were conducted by the SE Group. The RTI Team reviewed the WEPP computer modeling to determine how, if at all, it should be used for the Poplar River TMDL. This

review examined the modeling framework, inputs, application, and results of the WEPP model. Based on the review of the WEPP model and requirements of the TMDL program, the RTI Team has concluded that additional erosion assessment is required.

The SOW requires that the existing WEPP model prepared by Lutsen Mountain Resorts consultants, North American Wetland Engineering (NAWE), and the SE Group be critically evaluated. The purpose of the evaluation is to review the model output and its use in characterizing and estimating the pollutant sources affecting turbidity in the Poplar River. The WEPP model review includes the following:

- Designation of model results as high-, moderate-, or low-quality data as defined by the Poplar River TMDL QAPP;
- Review of modeling approach;
- Evaluation of input parameters;
- Evaluation of computer model results and application;
- Review of conclusions derived from modeling;
- Evaluation of model uncertainty;
- Anticipated uses within the framework of the Poplar River TMDL, and;
- Additional watershed and stream modeling recommendations for addressing factors contributing to the turbidity impairment.

The evaluation of the WEPP computer model results and application will be based on the information presented in the Environmental Report, SE Group Preliminary Summary, Poplar River Impairment Study, and personal communication with Mark Williams of the SE Group. These information sources include documentation of the existing model input, methodology, and output. The evaluation will include the strengths and weaknesses of the model, focusing on its application to the turbidity TMDL study for the Poplar River.

It is important to note that the existing WEPP model developed by the SE Group was not intended for use with the TMDL project or to develop a comprehensive sediment source assessment for the Poplar River watershed. The RTI Team evaluated the model with the hope that it would serve multiple purposes and be suitable for a portion of the TMDL tasks. The review is intended to insure that only appropriate computer modeling be used to develop the Poplar River TMDL.

3 QAPP Requirements

As defined in the Poplar River TMDL project QAPP, data and information (including computer modeling results) will be placed in hierarchical categories based on the documented quality assurance and quality control processes. The WEPP modeling documentation will be evaluated with respect to the data requirements outlined in the QAPP and placed into a high, moderate, or low data category (RTI, 2007). The QAPP characterizes data as high, moderate, or low quality and specifies how these data categories should be used.

QAPP Designation

According to guidelines set forth in the Poplar River QAPP, the data used for WEPP modeling are low-quality data because quality assurance and quality control documents do not exist (Mark Williams, personal communication, January 17, 2007). No QAPP or QA/QC plan for the WEPP application exists detailing the computer modeling process. Furthermore, the existing documentation does not provide detailed information regarding the computer modeling input, process, or output. Model input and results are summarized and/or aggregated to such an extent in the reports from Lutsen Mountain Resorts that independent QA/QC of the reported results is not possible.

The designation of low-quality data does not address whether the computer model results are accurate. It does, however, indicate that the quality of the model results could not be verified with the documentation provided.

4 Model Assessment

In reviewing the existing WEPP model, the RTI Team followed recommendations outlined in the Draft Guidance on the Development, Evaluation, and Application of Regulatory Environmental Models (EPA, 2003). The review focuses on three primary components of the modeling process: model development, model evaluation, and model application.

Model development is the process of constructing a mathematical representation of an environmental problem. This process typically includes development of a conceptual model, selection of a mathematical model, and parameterization of the model. Our review of the model development process addresses each topic. The conceptual model used by the SE Group is reiterated, the WEPP model is described, and the parameters selected for the WEPP modeling are evaluated.

Model evaluation is the process of determining whether the modeling tool developed is adequate for making water quality decisions. This determination includes a review of whether the model uses and applies sound science and that has been applied correctly, the model complexity is consistent with the available data, and is representative of the system being studied. Our review of the model evaluation will address whether (1) WEPP was applied to the lower Poplar River watershed correctly, (2) WEPP is an appropriate choice for simulating erosion in the lower Poplar River watershed, and (3) the input parameters are representative of existing conditions.

Model application is the use of a model to make decisions or draw conclusions about the environmental problem under investigation. Our review will focus on the documentation provided for the WEPP modeling, results, and conclusions presented in the modeling documentation.

Our review of the model development process addresses each topic. The conceptual model used by the SE Group is reiterated, the WEPP model is described, input parameters are evaluated, and output and conclusions are analyzed.

4.1 WEPP Overview

According to the Agriculture Research Service (Becker, 1997), the WEPP model

> is a project of the USDA's [U.S. Department of Agriculture's] Forest Service, Agricultural Research Service and Natural Resources Conservation Service and the U.S. Department of the Interior's [USDI's] Bureau of Land Management. WEPP is the result of 10 years of research by dozens of USDA and USDI scientists, plus cooperators from universities and several foreign countries. In tests, the model's predictions have been validated by 1,000 plot-years of data on water runoff and erosion from 12 sites and 15 watersheds around the United States. A plot- year is a year's worth of data on a specific plot of land.

The WEPP model has been used by government agencies, consultants, and universities throughout the United States and abroad. More than 200 WEPP-related articles have been published in journals, conference proceedings, and agency reports.

The US EPA guidance document Protocol for Developing Sediment TMDLs (1999) classifies WEPP as a simple modeling method. Key capabilities and limitations listed for a simple model follow:

- Delivery is not simulated;
- Typically reliable only for relative comparisons of sources, not load estimates.
- Requires limited data, and;
- Does not require calibration.

The WEPP model guidance is consistent with US EPA conclusions, except that it indicates WEPP ~~is~~ has an estimated error of plus or minus 50 percent. This discrepancy is worth noting. US EPA documentation indicates that moderate to highly complex models are necessary to quantify loads; however, in practice, simple methods, such as WEPP and the Revised Universal Soil Loss Equation, are often used for this purpose. The 50 percent error reported in the WEPP documentation is representative of the uncertainty associated with simple methods that do not require calibration.

In summary, the WEPP model is a simple model suitable for the conditions and data of the lower Poplar River watershed. It is capable of simulating soil detachment and predicting relative contributions and "order-of-magnitude" load estimates from soil type, land use type, and slope combinations. This level of certainty is consistent with computer models designed to predict erosion from land surfaces using limited data.

Several versions of WEPP exist. The currently available versions range from fairly complex watershed models that require substantial data to a simplified on-line version that require significantly less data. All versions are built with the same basic algorithms. The simplified versions use standardized assumptions to streamline model input requirements. The existing WEPP model for the Poplar River Gorge area uses a simplified on-line version. The versions used by SE Group were the WEPP: Roads and WEPP: Disturbed. For this report reference to the "existing WEPP model" refers to these applications. Other WEPP versions may have additional capabilities.

4.2 Conceptual Model

A conceptual model is a theoretical construct that represents the processes important in the study area. It allows a logical set of relationships and assumptions to be developed to help with reasoning and decision making related to the scientific process involved with soil erosion in the lower Poplar River watershed that contributes to the turbidity of the river.

The following purpose, constraints and assumptions for modeling erosion in the lower Poplar River are provided in the SE Group memorandum (SE Group, 2005). The purpose of the modeling is to "…help quantify the overall and relative contributions of sediment from various land uses and land cover types…." Estimated sediment loads are based on the potential for soil detachment from environmental processes and watershed characteristics such as soil type, land use type, and slope. This is assumed to result in an overestimate of loads because transport and buffering are not included. Gully erosion was not included, thus, assumed to not be a significant factor in the total sediment load to the Poplar River by the SE Group.

Furthermore, the WEPP modeling did not include all of the land area in the lower Poplar River watershed. According to the Lutsen Environmental Report (NAWE, 2005) the lower Poplar River watershed is 1,317 acres. The WEPP modeling was limited to the Poplar River gorge subarea, which is 274 acres (NAWE, 2005). This area was the focus of the WEPP modeling, according to Lutsen Resorts, because due to its steep sloping topography it is the most probably area to contribute sediment to the Poplar River (NAWE, 2005). Figure 1 shows the watershed boundary of the lower Poplar River as delineated in the Cook County Alternative Urban Areawide Review (AUAR). Figure 2 shows the boundary of the Poplar River Gorge subarea modeled using WEPP. Although the scales of Figures 1 and 2 are different, they clearly show that the gorge area is a subset of the lower Poplar River watershed. In addition, the aerial photograph used as the background for Figure 2 indicates that ski trails, buildings, roads, and other developed roads exist outside the gorge area and within the lower Poplar River watershed. These areas have the potential to contribute sediment to the river.

The Poplar River gorge is the area closest to the river and would be expected to provide a significant sediment load to the river; however, areas further from the river are still capable of delivering sediment to the river, albeit at a lesser rate.

The concept of sediment delivery ratio (the percentage of detached soil transported to a river) is applicable to the question of what land area should be included when assessing sediment load to the Poplar River. The sediment-delivery ratio is dependent on drainage area, slope, drainage network density, cover type, and runoff. The sediment delivery ratio typically decreases with increases in drainage area and distance from drainage networks.

Potential weaknesses of the conceptual model for purposes of generating a TMDL include the following:

- Only a limited portion of the lower Poplar River watershed is used, and;
- Transport of sediment is not simulated.

These weaknesses should be addressed. The limited spatial extent of the modeling should be expanded to include the entire lower Poplar River watershed. The Poplar Gorge area may contribute significant sediment loads directly to the Poplar River due to steep slopes and close proximity to the river; however, areas of the watershed further from the river will also contribute sediment via intermittent drainage channels, roadside ditches, gullies, and other drainage channels and, therefore, should be included in the analyses.

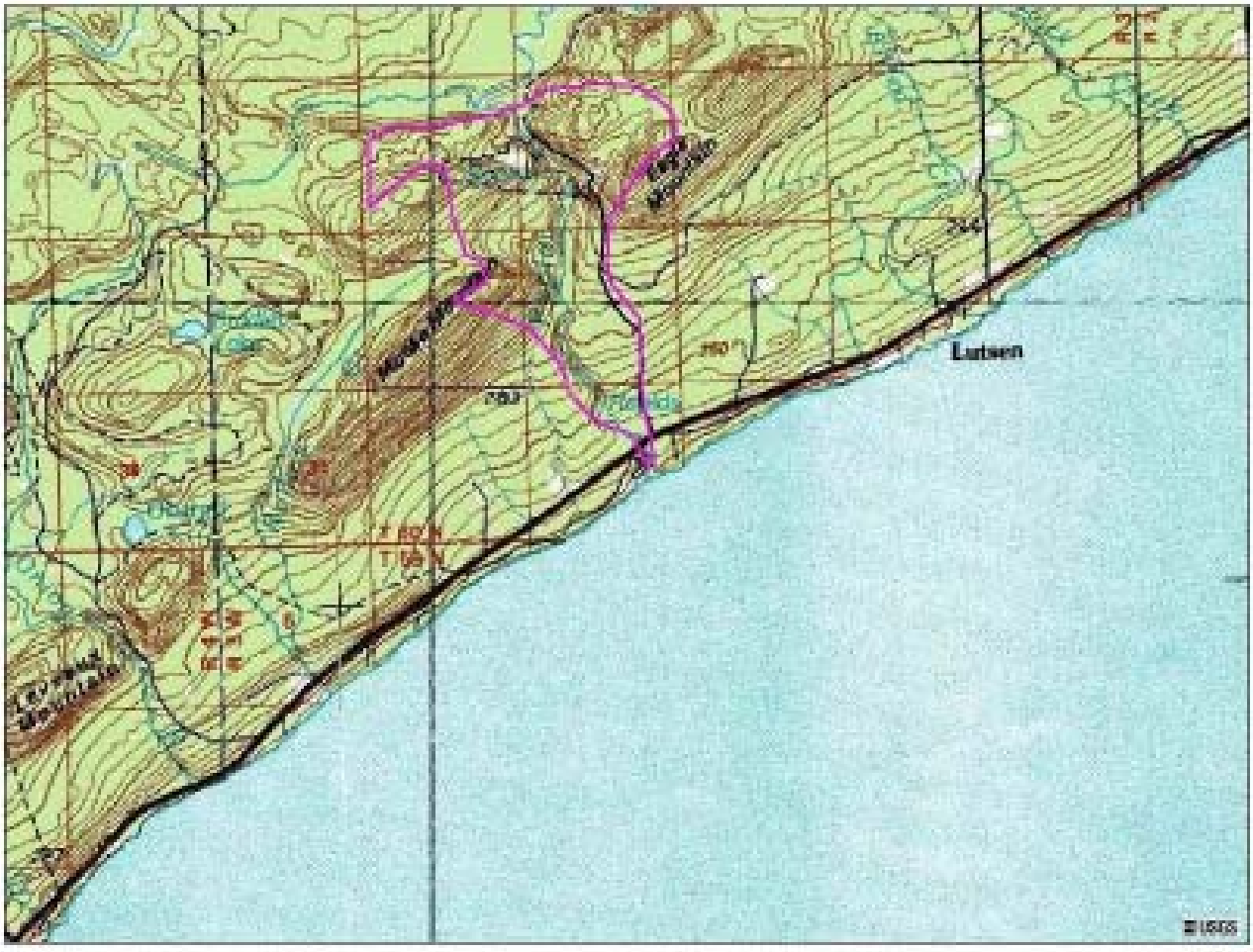

Figure 1. Lower Poplar River watershed as delineated in the Cook County AUAR. This is figure 5-1 in the AUAR. No scale is provided in the original.

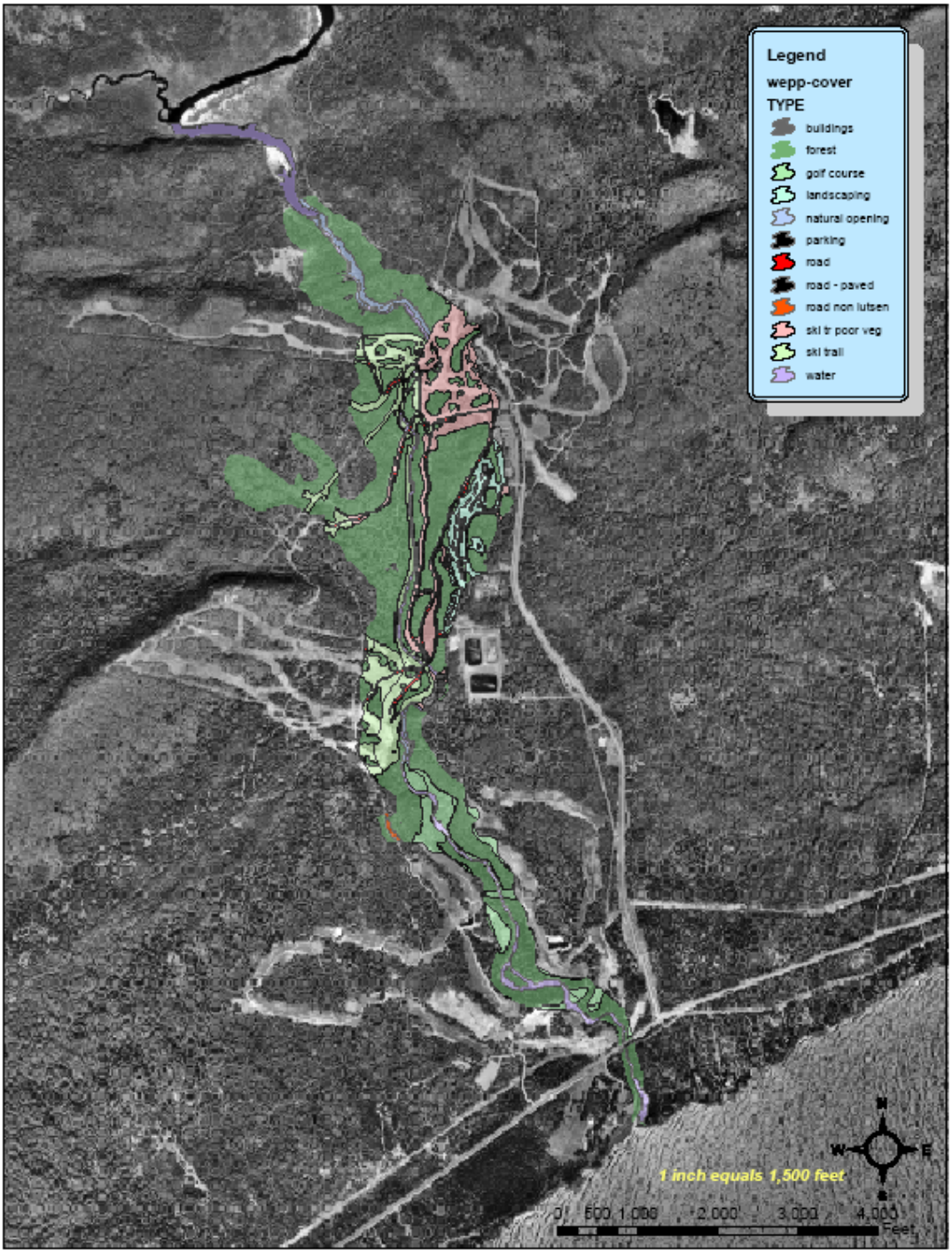

Figure 2. Lower Poplar River Gorge area simulated using WEPP (NAWE, 2005). This figure was provided by the SE Group.

4.3 WEPP Inputs

The Lutsen Environmental Report (NAWE, 2005) indicates that two versions of the WEPP model were used to calculate potential soil erosion. These two online interfaces, hosted by the USDA Forest Service, are the Disturbed WEPP (allows hillslope modeling) and WEPP. Roads interfaces available at the following website: http://forest.moscowfsl.wsu.edu/fswepp/. Other versions of WEPP exist that provide additional capabilities and require additional input data. References to the WEPP model in this report refer to the on-line interfaces documented at the web site above (as of May 2007).

Unfortunately, the inputs used for the WEPP models are not transparent in the report. The following list of steps outlines the RTI Team's understanding of how the WEPP modeling was conducted:

1. An evaluation of soil type, land use type, and slope was conducted using a geographic information system.
2. The areas of distinct combinations of soil type, land use type, and slope were calculated for the Poplar River gorge area.
3. The land use type, soil type, and slope combination were simulated using WEPP.
4. Ski trails (tall and short grass); bare soils, forest, natural openings, and golf courses were simulated using the WEPP Hillslope model.
5. Roads (Lutsen and non-Lutsen) were simulated using WEPP: Roads.

The Lutsen Environmental Report (NAWE, 2005) provides information about the soils found in the lower Poplar River watershed. The report does not provide information on how the SE Group identified soil types in combination with land use types and slopes; however, this information was obtained via personal communication with Mark Williams of the SE Group. In addition, the cover and rock percentages required by WEPP were not provided in the Environmental Report, other memoranda, or via personal communication.

The missing model inputs make it impossible to fully evaluate the results presented in the Environmental Report. Specifically, horizontal length, slopes, percent cover, percent rock, and soil type and land use type combinations are required to recreate model results. In addition, the report does not explain why Lutsen and non-Lutsen roads would have significantly different loading rates as indicated by the reported model output.

The WEPP modeling tools selected (Roads and Hillslope) are appropriate for predicting potential erosion in northern Minnesota; however, insufficient information on the model inputs is provided to determine whether it was applied in a scientifically rigorous manner. To conduct a full and complete evaluation of the model, the RTI Team would need to have the additional model input parameters required by WEPP for all land uses.

4.4 WEPP Results

WEPP model results are provided for eight land use types that comprise the lower Poplar River gorge. Table 1 lists the area and load from each land use type as reported in the Lutsen Environmental Report (NAWE, 2005).

Table 1. WEPP sediment detachment results as reported in Lutsen Mountain Environmental Report (NAWE, 2005).

Class	Acres	Ton/year
Ski-Trail - Tall Grass	32.6	12.6
Ski-Trail - Short Grass	28.8	24.6
Bare Soils within slump zones	2.6	30
Roads - Lutsen	6.8	84
Roads - Non Lutsen	0.5	10.1
Forest	183.4	12.7
Natural Openings	5.8	0.5
Golf Course	14.4	5.1
Total	274.9	179.6

The model results presented in Table 1 are aggregated from a more detailed representation of each land use type that includes soil type and slope. The refined estimates of sediment detachment from the land use type, soil, and slope combinations were not provided for the non-road land uses. This additional information would be useful to identify specific areas for restoration and/or source control. In addition, only average annual loadings are reported. WEPP reports a statistically based range of sediment loadings that would be useful quantifying variable sediment loading from the Poplar Gorge.

The model results in Table 1 can be manipulated to provide additional information and insight into what the sources of sediment are within the watershed. Table 2 includes percent land use type, ton/acre-yr, and percent load for each land use type. This additional information also provided insight into significant sources of sediment and which land use types should be targeted during implementation.

Table 2. Additional WEPP sediment detachment results (with additional manipulation of results by RTI Team).

Class	Acres[a]	% Area	Ton/year[a]	Ton/acre-yr	% of Sediment Load
Ski-Trail - Tall Grass	32.6	11.86	12.6	0.4	7
Ski-Trail - Short Grass	28.8	10.48	24.6	0.9	14
Bare Soils within slump zones	2.6	0.95	30	11.5	17
Roads – Lutsen	6.8	2.47	84	12.4	47
Roads - Non Lutsen	0.5	0.18	10.1	20.2	6
Forest	183.4	66.72	12.7	0.1	7
Natural Openings	5.8	2.11	0.5	0.1	<1
Golf Course	14.4	5.24	5.1	0.4	3
Total	274.9		179.6		

[a]Data from Lutsen Environmental Report (NAWE, 2005).

The Lutsen Environmental Report (NAWE, 2005) specifies that the values reported in Tables 1 and 2 are average values of a 30-year simulation. The report further states that during years with low surface runoff, no erosion may take place and that in other years with high surface runoff more than the average erosion may take place; however, specific ranges and return periods for expected sediment loads are not reported. In addition, the Lutsen Environmental Report (NAWE, 2005) quotes WEPP documentation that estimates the erosion predictions of any model as being plus or minus 50 percent of the actual value. The Environmental Report (NAWE, 2005) also stresses that WEPP predicted soil detachment, not soil particles delivered to the Poplar River and may over predict sediment loading.

Uncertainty of the model application is discussed in general terms, and references the WEPP model documentation. The 50 percent error referenced is a general uncertainty estimate derived from past WEPP computer modeling applications and is not specific to the Poplar River application.

4.5 Conclusions Based on WEPP Results

The Environmental Report concludes that watershed sources contributed 180 tons of sediment during 2002 and that the rest of the sediment (932 ton/yr) was from other sources. This calculation was completed using annual average WEPP results and observed sediment load for 2002. The difference between these estimates (1,112 ton/yr – 180 ton/yr = 932 ton/yr) was concluded to be from other sources.

This conclusion is faulty. The simulated erosion predicted, 180 ton/yr, is for an average year. A specific year, such as 2002, may have significantly greater or less sediment loading to the stream from sheet erosion. Without additional analysis, no conclusions should be made on how much of the total estimated sediment load for 2002 is from other sources, or whether 180 ton/yr is representative of sheet erosion for 2002. Furthermore, since the results are for a subset of the lower Poplar River watershed, they may not represent the entire load to the river.

In addition, potential sediment load for the gorge area only, not for the entire lower watershed, was assessed. The gorge is likely to provide direct sediment loading to the river because it includes steep slopes and is close to the river. However, the gorge makes up only 20 percent of the watershed. Because erosion from land use activities farther upland may also contribute significant sediment to the river, a more robust analysis of the watershed is necessary.

5 Conclusions

The documentation provided by Lutsen Mountain Resorts and the SE Group does not include adequate quality assurance documentation related to the development of the WEPP model. In addition, the model results are not repeatable without additional information, and inputs and results have been aggregated. The lack of transparency about what data were used in the model from the reports and memoranda provided by Lutsen Mountain Resorts and the SE Group do not allow for a complete understanding of the technical details of the sediment detachment modeling. Several important parameters necessary to evaluate the results are missing, and intermittent data products required for computer modeling are not documented in the reports and memoranda. In addition, only average annual loading rates are reported.

The scope of modeling was also limited to the Poplar River gorge area, which is a subarea of the lower Poplar River watershed. The RTI Team recommends that future computer modeling include the entire lower Poplar River watershed because the entire watershed drains to the lower Poplar River and may be contributing to the observed turbidity levels.

Based on the missing data and the importance of this model for the Poplar River TMDL, the RTI Team recommends additional soil erosion modeling. The additional modeling will document important parameters used for soil detachment modeling and report results for additional return periods.

To efficiently develop erosion estimates for the lower Poplar River watershed, the existing WEPP modeling should be used to the extent practical. The many useful qualities of the analysis conducted should be used and built upon. The weaknesses of the model, as it applies to TMDL development should be addressed. Table 3 summarizes the strengths and weaknesses of the WEPP computer modeling described in the report.

Table 3. Strengths and Weaknesses of WEPP Model Application.

Strengths	Weaknesses
Discusses model uncertainty and provides quantitative estimate of uncertainty	Inputs are not transparent
Provides quantitative estimate of soil detachment	Provides only select output (i.e., average load reported)
Provides soil detachment estimates for land use types found in watershed	Compares average model results with specific year of data
	Does not discusses several important input parameters
	Does not provide QAPP or QA/QC documentation
	Does not predict gully erosion
	Does not simulate entire lower Poplar River watershed

6 References

Becker, H., 1997. Model Provides Major Advance in Controlling Water Erosion. US Department of Agricultural, News and Event accessed online April 10, 2007 at http://www.ars.usda.gov/is/pr/1997/970430.htm

Haith, D.R., R. Mandel, and R.S. Wu, 1992. GWLF: Generalized Watershed Loading Functions User's Manual, Vers. 2.0. Cornell University, Ithaca, NY.

NAWE, 2005. Environmental Report. Prepared for Lutsen Mountain, Cook County, Minnesota. Prepared by North American Wetland Engineering and SE Group. October 18, 2005.

RTI, 2007. Poplar River Turbidity Total Maximum Daily Load Quality Assurance Project Plan. Prepared for US EPA Region 5, 77 West Jackson, Chicago, IL 60604. Prepared under contract 68-C02-110. March 6, 2007.

SE Group, 2005. "Preliminary Summary, Poplar River Impairment Study." Memorandum to Charles Skinner. October 13, 2005.

USEPA, 2003. Draft Guidance on the Development, Evaluation, and Application of Regulatory Environmental Models. United States Environmental Protection Agency's Council for Regulatory Environmental Modeling. Office of Science Policy, Office of Research and Development, Washington, DC. November 2003.

USEPA, 1999. Protocol for Developing Sediment TMDLs: First Edition. United States Environmental Protection Agency, Office of Water, Washington, D.C. November 1999. EPA 841-B-99-004.

Appendix A

Resources Available for WEPP Review

The RTI Team utilized all available resources to evaluate the WEPP modeling conducted by the SE Group. The following documents are available for review:

- The SE Group memorandum from Curt Sparks, dated October 13, 2005, titled Preliminary Summary, Poplar River Impairment Study.
- The Environmental Report prepared October 18, 2005, for Lutsen Mountain Resorts by NAWE and the SE Group.

In addition, the SE Group was contacted via telephone and e-mail. The following contacts occurred (resulting e-mails are included as Appendix B):

- Troy Naperala telephoned Mark Williams in early December 2006. The discussion focused on additional documentation of the WEPP modeling such as complete output, complete input record, and additional documentation. SE Group indicated that they would send additional information if they had any.
- Troy Naperala e-mailed Mark Williams on January 16, 2007, requesting additional information.
- Mark Williams replied on January 17, 2007, indicating that no additional information was available.
- Troy Naperala e-mailed Mark Williams and Bill Granger requesting corporate QA/QC policies and other modeling information.
- Mark Williams provided intermediate modeling information used as input to the WEPP model via e-mail on February 27, 2007.

Appendix B

E-mail correspondence regarding WEPP documentation

Troy Naperala/TraverseCity/URSCorp
01/16/2007 01:01 PM To
mwilliams@segroup.com
cc

bcc

Subject
Lutsen Mountain WEPP Modeling

Mark:

We spoke before the holidays about the WEPP modeling you did for Lutsen Mountain. At that time I requested additional information to help with the EPA review. Can you please forward me any relevant material you have
on the WEPP modeling conducted. I have the summary report and Environmental Report delivered to Lutsen Mountian, but would also like the
modeling files (input, output, and required data files) and any other documentation you may have.

Thanks,

Troy

> "Mark Williams"
> <mwilliams@segrou
> p.com>
To
> <Troy_Naperala@URSCorp.com>
> 01/17/2007 10:17
cc
> AM
>
Subject
> RE: Lutsen Mountain WEPP
Modeling
>
>
>
>
>
>
>

>
>
>
> Hello Troy,
>
> I apologize for not responding to you sooner. However there was a
> pressing project deadline that required nearly all of my time during
the
> month of December, which delayed my ability to respond to you.
>
> In reviewing my files on the Lutsen WEPP modeling, the modeling was
> conducted utilizing the USFS on-line implementation of WEPP. The
on-line
> implementation and its associated technical documentation may be
> reviewed at:
>
> http://forest.moscowfsl.wsu.edu/fswepp/
>
> Insofar as the modeling was done via an online interface, the input
and
> output files are prepared and stored on the FSWEPP server, and were
not
> stored locally on our systems. Thus these are unavailable to transmit
to
> you.
>
> As we discussed on the telephone, the WEPP modeling done for the
Lutsen
> report was purely of a conceptual nature and meant to portray nothing
> more accurate or sophisticated than order-of-magnitude type
estimates.
>
> I would recommend that you conduct your review on that basis and with
> the available summary material that is presently in hand (i.e. the
> report)--additional source data or technical materials have not been
> created by our efforts.
>
> Thank you,
> Mark Williams
>

Troy Naperala/TraverseCity/URSCorp
01/19/2007 03:29 PM
To
"Mark Williams" <mwilliams@segroup.com>
cc
bgranger@segrp.com
Subject
RE: Lutsen Mountain WEPP Modeling

Mark:

Thank you for the additional information regarding the WEPP modeling the
SE Group completed for Lutsen Mountain. I appreciate the difficulty that
the on-line interface may present with transferring files; however. Since
the WEPP data requirements are fairly simple is it possible for you to provide me with the model inputs you used and the 30 years of model output? Also, if your firm has any documented QA materials that would also be very useful.

This information is critical. We will be classifying your data as high, moderate, or low quality. Part of the ranking is dependent on documentation of inputs, outputs, and QA/ QC procedures, thus any information you can provide will be useful. The ultimate ranking received
by the modeling will directly affect how it can be used during TMDL development.

Please give me a call if you have any questions.

Thank you,

Troy

Troy Naperala/TraverseCity/URSCorp
02/20/2007 02:43 PM

To
bgranger@segrp.com, "Mark Williams" <mwilliams@segroup.com>
cc

bcc

Subject
RE: Lutsen Mountain WEPP Modeling

Mark:

The Environmental Report states that the WEPP model was run for each combination of soil, slope, and land cover type present in the lower Poplar River watershed to develop a detachment rate for each combination
of characteristics. From this information sediment detachment was estimates were made for each land use type.

Can you send me a table with the soil, slope, and land cover type combinations (and area of each) used for the WEPP modeling?

Thanks,
Troy

"Mark Williams" <mwilliams@segroup.com>

02/27/2007 05:53 PM To
<Troy_Naperala@URSCorp.com>
cc
"Bill Granger" <bgranger@segroup.com>
bcc

Subject
RE: Lutsen Mountain WEPP Modeling

Hi Troy,

Sorry to take a while to respond to you on this. Attached is a ZIP file that contains the summary spreadsheets for detachment rates, landcovers,
and area by landcover by slope classification. The WEPP-Summary.xls does
the cross-calculation by landcover by slope class, and contains the overall calculated erosion rate by land class. Landcover/slope queries were made from a GIS database and exported to Excel. WEPP-Summary.xls contains formula links to the individual slope/erosion spreadsheets which you'll need to edit once you've unzipped to a local directory on your system. The WEPP-Landcover.pdf file portrays the land cover area that was modeled for the "Poplar Gorge" sub-area as referred to in the environmental report. As mentioned in the "environmental report", this methodology uses hillslope WEPP to account for detachment only and does not perform hydraulic flow routing of sediment to the stream system as does watershed WEPP. I hope this helps. Let me know if there are questions.

Thanks,
Mark Williams
SE Group

Data Assessment Summary