

**BBE 4535/5535**  
**(previously BBE 5533)**  
**Assessment & Diagnosis of Impaired Waters**  
**(Developing Impaired Waters Knowledge & TMDL Skills)**

(3 cr; for BBE 4535 - upper div IT, upper div ESPM, upper div CBS; for BBE 5535 - grad, permission of instructor; A-F only; 2 lect per week).

**Time, Location, Instructor:**

Fall Semester

Tuesday/Thursday, 8:45 – 10:00 am. Room 106 Biosystems and Agricultural Engineering Bldg.

Course Website: <https://wiki.umn.edu/twiki/bin/view/Wilson/CLWatersAssess>

Dr. John Nieber (Professor, BBE) is the course organizer and one of the instructors.  
Dr. Joe Magner (Minnesota Pollution Control Agency, Adjunct Professor in BBE)

**Contact information for the instructors:**

Dr. Nieber; 612-625-6724 (office) or 651-249-8698 (cell), [nieber@umn.edu](mailto:nieber@umn.edu).

Dr. Magner; 651-296-9268 (MPCA), 715-222-9809 (Cell), [magne027@umn.edu](mailto:magne027@umn.edu),  
[joseph.magner@pca.state.mn.us](mailto:joseph.magner@pca.state.mn.us).

**Learning Objectives:**

The course will focus on the Clean Water Act (CWA) Section 303(d) also called Impaired Waters or TMDL (Total Maximum Daily Load). Classroom activities will involve instruction on the various legal, social and policy aspects of TMDLs, and on methods for assessing impaired waters and developing a TMDL for conventional pollutants, and approaches for preparing and communicating to TMDL stakeholder's technical information. One or two field trips will be conducted to visit field sites where impaired waters have been established. The students will be presented with one or more Minnesota water body (ies) that has (have) been placed on the state impaired waters 303(d) list, and the students will work in teams to develop the required elements of a TMDL report in line with the credit hour option selected. A final TMDL report will result from this work and the students will be expected to present (defend) their report before a TMDL study group that meets regularly on the St. Paul campus. Members of that study group will be requested to play roles of stakeholders (city official, farmer, homeowner/landowner, state agency, etc.) so as to simulate the real-life situation that a consultant would face in defending their work. After the completion of this course students should comprehend the elements of the Clean Water Act, the TMDL process and be able to communicate that understanding in the presentation of their report. Upon completion of this course, students seeking employment with an environmental consulting firm should be able to step into an entry level position with the needed

knowledge and possible skills to write at least portions of a TMDL and present information at stakeholder meetings.

### **Note on registration for BBE 4535 versus BBE 5535.**

Students will meet together for the same lecture, and exams. For BBE 4533 students will complete some aspects of a TMDL project where much of the information is provided to the students for conducting assessments. For BBE 5533 students will be required to do a full TMDL project including modeling, assessments, etc, and will be given more challenging questions on exams.

### **Text:**

Minnesota Pollution Control Agency (MPCA) training materials will be used to provide detailed information about the Impaired Waters Program in Minnesota. We will use a variety of materials relevant to the topic of discussion; most material will be available on-line. All students must become familiar with the USEPA web, go to <http://www.epa.gov>. From the home page go the site on “water”, then to the topics page. These sites will be important sources of information for your future reference. Specific to Minnesota TMDLs and listing guidance go to MPCA web sites – <http://www.pca.state.mn.us/water/tmdl/index.html> + <http://www.pca.state.mn.us/publications/reports/tmdl-guidetomaterial.pdf>

The course has a website and important reference material supporting the course lectures are posted there. Students will be directed to those materials prior to each lecture.

### **Field trip(s):**

The main focus of the field trips will be to visit one or more sites where the waters have been placed on the impaired waters list. The field trips will take place on Saturdays. Transportation, meeting location, and meeting time will be arranged by John Nieber. In general, a van will be arranged for such travel; however you are free to use your private vehicles (no mileage reimbursement) to travel to field locations. Because the weather may be unpredictable, you should plan accordingly, i.e., rain coat, warm gloves, etc. Also, because the course begins in January the first field trip will be scheduled for some time in late March. Earlier in the semester the class will be presented with one or two impaired water studies that have already been completed. Lessons learned from these cases will provide the student with good ideas of what to look for when we visit field sites, and also ideas for completing the TMDL report assignment.

### **Writing and Modeling Assignments:**

Throughout the course you will learn the legal, social and policy issues related to conduct impaired waters assessments. During the first few weeks of class you will learn about the assessment tools that are available for assessment analyses. Discussions about the assessment tools will continue throughout the course, most likely outside of class because

students will be using those tools for the term project. The instructors will provide guidance on the sources of data, and the assessment tools that will be used for the project.

Technical assistance with the assessment tools will be provided by the instructors. Example assessment tools include the Load Duration Curve analysis, Stream channel assessment methods, EPA Stressor ID method, watershed modeling and Tailored Integrated Stream Watershed Assessment (TISWA). For the watershed modeling tool the students will be instructed in the use of the SWAT model. The SWAT model is a watershed-scale hydrology and water quality model that allows the user to examine the impact of land-use management on the hydrology and water quality of a watershed. Other hydrology/water quality models will also be discussed, but the focus will be on hands-on learning of the SWAT model.

The TMDL project report will be required to be in a format similar to reports typically submitted by consultants for TMDL analyses. Students will be required to prepare a project plan (based on project tasks), and to submit project task reports on schedule. The submitted final report will be judged critically for format and content.

#### **Evaluation/Assignments:**

There will be a total of 575 points based on two exams (a midterm and a final), writing, and project presentation. The midterm exam will be worth 100 points and the final exam will be worth 100 points. 75 points will be earned for regular assignments, 50 points will go for the project task reports, 200 points will go for the project final report, and 50 points will be evaluated for the final report presentation. Grades will be based on your percentage of the total points where: 95-100 % = A; 90 – 94.9 % = A<sup>-</sup>; 86.6-89.9 % = B<sup>+</sup>; 83.6-86.5 % = B; 80-83.5 % = B<sup>-</sup>; 76.6-79.9 % = C<sup>+</sup>; 73.6-76.5 % = C; 70-73.5 % = C<sup>-</sup>; 66.6-69.9 % = D<sup>+</sup>; 63.6-66.5 % = D; 60-63.5 % = D<sup>-</sup>; < 60% = F

#### **Course Schedule:**

**A reading assignment guide associated with the lectures will be provided prior to the first week of class. This guide will be posted on the course website. Assigned lecturers will also be listed at that time.**

Week 1	Introductions, Goals, Logistics and Clean Water Act
Week 2	Assignment of TMDL project and discussion of data sources for the project; development of level-of-effort proposals; project planning  SWAT modeling for TMDL assessments  (Tutorial on use of the SWAT model. An 8-hour hands-on learning session on Saturday, January xx)

- Week 3      Clean Water Act; Water Quality Standards; Minnesota Impaired Waters Program; Clean Water Legacy Act
- Sensitivity testing of SWAT
- Week 4      Sensitivity testing of SWAT (cont'd)
- Calibration of SWAT using watershed data
- Week 5      Calibration of SWAT (cont'd)
- Method for developing pollutant loads – FLUX
- Week 6      Pollutant Assessment methods – Load Duration Curve
- Pollutant Assessment methods – Load Duration Curve
- Week 7      Case study discussion of completed TMDL – Long Prairie Low-DO TMDL
- Index of Biological Integrity (IBI)
- Week 8      Watershed Assessment (WARSSS, TISWA)
- EPA Stressor ID
- Week 9      Midterm exam
- Case study discussion: Biological Impairment – Hardwood Creek
- Week 10     Stream assessment methods – Channel geomorphology
- Channel stability assessments; BSTEM modeling
- Field trip to an impaired waters site (weather permitting)
- Week 11     Assessment methods – sediment transport modeling – CONCEPTS
- BATHTUB model (lake nutrient dynamics)
- Tutorial on use of the BATHTUB model. An 8-hour hands-on learning session on Saturday, February xx
- Week 12     Determination of Waste Load Allocation (WLA), Load Allocation (LA), Assignment of Margin of Safety (MOS), & Reserve Capacity (RC)

- Implementation Plan
- Week 13      BMP Effectiveness Monitoring
- Case study discussion of completed TMDL – Sunrise River Fecal TMDL
- Field trip to an impaired waters site (weather permitting)
- Week 14      Communication and the Public Participation Process
- Adaptive Management
- Week 15      Presentation of final reports for TMDL study. **Final written TMDL report the last day of class**

**Final exam is on May xx, xx:xx – xx:xx**

All field trip times and locations will be weather dependent. If there is an impending storm the instructor will send an e-mail Friday afternoon with instructions. Possible field trip locations include: point and non-point sources of pollution Hugo MN (Hardwood Creek impaired biota TMDL), Shingle Creek, and Sunrise River Watershed, Chisago County, MN. We will discuss these trips and options during the first class. **You are expected to attend all of the field trips!**

Besides homework assignments, documents that need to be turned in are:

1. Level-of-Effort proposal for the TMDL project.
2. Project Task reports (on time!)
3. Final project report.
4. Hard copies of final report presentation.

**Academic Integrity:**

All students at the University of Minnesota are obligated to follow the Student Conduct code, found in the Statement of Student Conduct Enforceable by University Agencies. This University policy was first enacted in 1970 and carried out by Student Judicial Affairs. Please pay particular attention to sections IV and V, which outline the conduct code and related procedures and sanctions. Other resources related to Academic Integrity are available through the Office for Student Academic Integrity <http://www.umn.edu/oscai/>.