

## **Northland College's Zero Stormwater Discharge Initiative (ZSDI)**

*A campus policy promoting sound water resource management and student learning opportunities.*

**Northland College ZSDI Commitment:** Northland College will utilize a combination of green infrastructure and low impact development (LID) techniques to reduce and maintain the rate, volume, and pollutant concentration of water running off campus property ("stormwater") to pre-development conditions. Use of these techniques will occur as part of all new buildings or other impervious surfaces constructed on campus property and to retrofit all existing impervious surfaces to meet the zero stormwater discharge goal. A primary objective of the ZSDI is to provide student learning opportunities in water resource management and sustainability. *(Note: Implementation of ZSDI activities began in Fall 2013)*

**Need and/or Opportunity:** One of the most direct environmental impacts that Northland College campus facilities and facilities management decisions can have on Bay City Creek and Chequamegon Bay is the quality of water that runs off campus property following rain and snowmelt events. Similar in the way the College has committed to the President's Climate Challenge and the Local Foods Initiative, a commitment to demonstrating effective stormwater management adds another important component to delivering on the College's commitment to being a leader in adopting sustainable practices. It commits Northland College to understanding how effective its current facilities, facilities management decisions, and stormwater infrastructure are at managing stormwater runoff quantity and quality. It also commits the College to implementing improvements to its current facilities and facilities management decisions and decisions for future facilities construction to meet the goal of zero stormwater discharge.

The ZSDI is the functional equivalent of what is currently required of many urbanized areas in the United States who have municipal separate storm sewer systems (MS4s). These communities are required, under the Clean Water Act, to obtain permits and implement best management practices designed to prevent stormwater runoff from washing harmful pollutants into local surface waters. Often, retrofitting MS4s is expensive and challenging and few successful models exist on how to do this effectively. With a relatively large campus and small "urban" footprint, Northland College is in a position to demonstrate effective solutions to managing stormwater that could become a model for local communities and other college campuses and institutions who may be required to manage their stormwater in the future.

The Mary Griggs Burke Center for Freshwater Innovation (Burke Center) will coordinate the ZSDI. The project will leverage existing staff and faculty and grant dollars to develop a stormwater monitoring program that will enhance Northland College's stewardship of Bay City Creek and Chequamegon Bay while providing applied learning opportunities for Northland College students, position Northland College well for local and regional discussions about effective environmental management, and the possibility for increased revenue to the college.

**Project Description:** Primary coordination of the initiative is the responsibility of the Water Scientist with the Burke Center. The Water Scientist will lead efforts to design, coordinate and implement an applied stormwater monitoring and management program and develop recommendations on improving the College's stormwater infrastructure, facilities management decisions affecting stormwater, and making future facilities decisions to meet College commitments to the ZSDI. The majority of field and laboratory data collection to support this work will be conducted by students as part of class and internship opportunities. Typical work will include:

1. Map the current stormwater network on campus and develop a model describing existing stormsheds, impervious areas, and existing green infrastructure/LID practices.
2. Design an applied monitoring program to characterize the rate, volume, and quality of stormwater running off campus and evaluate the efficacy of current stormwater Best Management Practices on campus (i.e. rain gardens, etc.).
3. It is likely that at least one master station will be developed to include real-time flow measurements, and potentially automated water sampling capabilities, precipitation and weather data.
4. Laboratory analysis of water samples will typically occur at Northland College's Applied Research and Environmental Lab (ARELab). Likely parameters include: total phosphorus, soluble reactive phosphorus, total nitrogen, total suspended solids, suspended solids concentration, chloride, and pathogens.
5. Information collected on stormwater rate, volume, and quality will be used to compare to modeled estimates characterizing Northland College's current stormwater discharge and to estimate stormwater discharge as it may have been prior to any human development at the site.
6. The difference between current and pre-development conditions will be compared to give an indication of whether Northland College's current stormwater management practices are protecting water quality in Bay City Creek and will provide the basis for making recommendations to improve or maintain the College's stormwater management practices.
7. Implement stormwater management practices to meet the ZSDI goal, with a focus on creating student learning opportunities in areas such as surveying, design, engineering, and landscape architecture.
8. Training, leadership and mentoring of undergraduate student scientists as they develop applied skills related to water resource management.
9. Collaboration with faculty to develop and implement applied water quality and biological research that compliments water quality monitoring work.
10. Continue monitoring program as necessary to evaluate efficacy of stormwater control measures toward meeting zero stormwater discharge goal.
11. Utilize program as a model to local communities and institutions to demonstrate effective stormwater management and stewardship of Bay City Creek and Chequamegon Bay.
12. Development of grants and contracts to support programmatic initiatives.

**Relation to Existing Positions, Programs and Initiatives:** The ZSDI will complement a range of existing positions, programs and initiatives at the Burke Center, academic programs, and the college as a whole. The ZSDI will provide a convenient applied learning opportunity for students in a variety of chemistry, biology, and/or natural resource courses, for Capstone and other independent research opportunities, and for students hired as researchers with the Burke Center.

The ZSDI provides a convenient platform for collaboration between faculty and Burke Center staff to promote applied learning activities and student leadership in developing solutions to real water management issues.

The Initiative will be complimentary to Northland College's efforts to become climate neutral through the American Colleges and Universities Presidents' Climate Commitment and is another critical component to the College's commitments to being a leader and model with regards to sustainability and environmental management..

**Budget Impacts:** The majority of the Zero Stormwater Discharge Initiative will be budget neutral or revenue generating. There may be the need for expenditures by the College depending on the type and magnitude of facilities upgrades or additional expenses that may be incurred with future facilities construction. It is likely that many of these costs could be off-set through grants and/or donors.

All direct and indirect staffing costs to develop and implement the ZSDI are already budgeted through the Burke Center Water Scientist and Environmental Chemist, along with a range of student research opportunities funded through Burke Center. All field equipment required for this work will be purchased using available funds and supplemented with external grant funds and course fees.

The primary ongoing expense for the project will be for water quality analysis. All analysis work will be completed at Northland College's ARELab and will be funded primarily through course fees and supplemented with internal (e.g. REFund, Parsonage Fund) and external (e.g. the National Fish and Wildlife Foundation's Five-Star grant program) grant funds. We anticipate annual laboratory expenses to complete the monitoring activities outlined in the *Project Description* to be no more than \$5,000 per year, depending on the number of sites monitored and samples collected. Monitoring activities will be scaled according to available funds. Until enough monitoring data exists to determine the current rate, volume, and quality of campus stormwater runoff with respect to the zero discharge goal, the extent (or lack thereof) of upgrades that may be required for the College to meet the goal is unknown. There are currently external grant funds available that could offset the majority of these costs, but there may be the need for College funds depending on the type and extent of upgrades needed. Some of these costs could include: modifications of current rain gardens, modifications of turf management activities, costs associated with new building construction (e.g. green roofs, pervious pavement, new rain gardens, etc.) in order to maintain zero stormwater discharge.

## Northland College Zero Stormwater Discharge Initiative (ZSDI)

Update on project activities as of 12/31/2017

### **Integration with Classes**

1. BIO 115 – Concepts of Biology, Fall 2013 – Fall 2017. Collaboration between Wendy Gorman (BIO 115 Instructor), Matt Hudson and Chris McNerney (Burke Center) to sample and analyze water from stormwater outfalls and existing green infrastructure around Northland College campus and nearby community. Approximately 100 students have participated in these classes over 5 years.

Students in the class gain experience collecting water samples, analyzing them for parameters such as *E. coli*, turbidity, pH, temperature, and conductivity, and presenting results to their peers and Burke Center staff. Results are maintained by Burke Center staff and create a baseline of stormwater quality running off campus.

2. CHM 212 – Water Quality Lab Techniques, Spring 2016. Collaboration between Sharon Anthony and Chris McNerney (CHM 212 Instructors ) and Matt Hudson (Burke Center) to expand BIO 115 work and sample and analyze water from stormwater outfalls and existing green infrastructure around Northland College campus and nearby community. There were about 10 students in the class.

Students in the class gain experience collecting water samples, analyzing them for parameters such as *E. coli*, suspended solids, pH, dissolved oxygen, conductivity, nitrogen, phosphorus, and alkalinity and presenting results to their peers and Burke Center staff. Results are maintained by Burke Center staff and create a baseline of stormwater quality running off campus.

3. GSC 305 – Hydrology, Fall 2017. Co-instructors Dave Ullman and Matt Hudson. There were 18 students in the class. As part of the unit on urban hydrology, students were introduced to the Northland College ZSDI and asked to design a rain garden to treat runoff from the Ponzio Campus Center parking lot (currently the largest untreated impervious surface on campus) using the Wisconsin Department of Natural Resources RECARGA model. As a result of this activity, three students were inspired to submit a REFund proposal to provide funding for a student to develop a design and cost estimate to implement an actual green infrastructure project at this site.

### **Capstone and Independent Research Projects**

1. Elizabeth Alexson
  - a. The Story of Stormwater: Understanding Stormwater and its Role at Northland College.
  - b. Completed April, 2014.
  - c. Utilized ArcGIS to map campus stormsheds and determine impervious area within each.
2. Nile Merton
  - a. Zero Storm Water Discharge Initiative (ZSWDI): WinSLAMM Modeling
  - b. Completed May 2015.

- c. Student utilized data from Elizabeth Alexson's Capstone in 2014 to develop a widely used stormwater model for Northland College campus. Results of the model provide a baseline for current College stormwater runoff characteristics compared to pre-settlement conditions. This provides the College with a preliminary zero discharge goal.

### **Other Student Applied Learning Opportunities and Green Infrastructure Implementation**

1. Center for Science and the Environment (CSE) Rain Garden Repair
  - a. Fall 2014 – Northland Initiative grant proposal funded. Matt Hudson, Chris McNerney, and Wendy Gorman submitted a proposal to repair a rain garden next to the CSE that was not functioning as intended and collect DNA sequencing data in an attempt to identify sources of *E. coli* contamination found in campus stormwater runoff.
  - b. Summer 2015 – Burke Center students conducted topographic surveys of CSE rain garden and Fenenga Hall rain garden as part of training on use of a total station and to provide data useful for CSE rain garden repair. Results of the surveys showed that the CSE rain garden needed to be redesigned (in addition to the repair proposed in fall 2014) to capture runoff from impervious surfaces draining to it.
  - c. Fall 2015 – Burke Center student, Nile Merton, developed a re-design of the CSE rain garden and worked with Matt Hudson and Facilities and Maintenance staff to begin implementing the re-design. Due to lack of staff capacity, Facilities and Maintenance staff were unable to complete project activities.
  - d. Spring 2017 – Matt Hudson worked with Nile Merton (now owner of Bay Area Restoration Services, LLC, a private consulting firm he created) and student Marisa Ulman, to complete a successful REFund proposal to complete repair on the CSE rain garden.
  - e. Summer 2017 into Spring 2018 – Nile Merton hired a contractor to implement his CSE rain garden repair (summer 2017) and will implement his planting plan to complete rain garden project (spring 2018).
2. Food Systems Building rain garden design – Three students from Matt Hudson and Dave Ullman's Fall 2017 Hydrology class submitted a REFund proposal, originally to design a rain garden for the Ponzio Campus Center parking lot, changed the location of the rain garden to the new Food Systems building. Todd Rothe, Director of the Food Systems building contacted Matt Hudson with concerns about water drainage from the new building. In response, the students submitted a successful REFund proposal to have Matt Hudson and the Burke Center work with a student to design a green infrastructure solution for the Food Systems building and develop a cost estimate (Phase 1). A future Phase 2 proposal will ask for funding to construct the design from Phase 1.
3. Ponzio Stadium retention basin – A large retention basin was incorporated into the design and construction of the new Ponzio Stadium in 2015. The retention basin is located beneath the playing field and captures runoff from the impervious surfaces created by the new stadium footprint. The retention basin is an example of the ZSDI policy in action.