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Erosion and sedimentation management for northern community infrastructure

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Contents

Preface

This is the first edition of CSA W205, *Erosion and sedimentation management for northern community infrastructure.*

This Standard draws on industry expertise and best practices in Canada and internationally to address requirements for managing erosion and sedimentation risks in coastal and lakeshore environments, open-channel environments, and terrestrial environments.

Users of this Standard are reminded that additional and site-specific requirements could be specified by federal, territorial or provincial, regional, municipal, or other authorities or agencies, or by an owner. This Standard should not be considered a replacement for the requirements contained in any

a) applicable federal, territorial, or provincial statute;
b) regulation, license, or permit issued pursuant to an applicable statute; or
c) contract that an owner has with a contractor.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of Standards Council of Canada, as part of the Northern Infrastructure Standardization Initiative.

This Standard was prepared by the Subcommittee on Erosion Protection under the jurisdiction of the Technical Committee on Northern Water and Waste and the Strategic Steering Committee on Natural Resources, and has been formally approved by the Technical Committee.

This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
    a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
    b) *provide an explanation of circumstances surrounding the actual field condition; and*
    c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

    Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at standardsactivities.csa.ca.*
5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
    a) *Standard designation (number);*
    b) *relevant clause, table, and/or figure number;*
    c) *wording of the proposed change; and*
    d) *rationale for the change.*

CSA W205:19
Erosion and sedimentation management for northern community infrastructure

0 Introduction

0.1 Plain language summary

Erosion happens when wind, water, or ice wears away soil or rock. Sedimentation happens when the loose soil blows away, washes away, or gets dragged away by the wind, water, or ice, and the soil lands somewhere else. Erosion can wreck roads, airstrips, building pads, and the land where the people live and hunt. Sedimentation can plug up culverts, make parts of the river or shoreline very shallow so that it's hard to travel in your boat, suffocate fish eggs, and make the drinking water silty or sandy.

Because of climate change, erosion and sedimentation in Canada's North are happening faster than before, and in more places than before. Permafrost is getting warmer everywhere and, in some communities, it is even melting. For coastal communities, there is more open water and less sea ice than before. Communities next to lakes also have a longer time with open water each year. Streams or rivers running through communities can be flowing for a longer time too. Hillsides that used to be frozen for most of the year now warm up for a longer time each summer. All of these things added together mean that erosion and sedimentation can be worse than before, and so we need to work harder so that erosion and sedimentation can't start.

CSA W205 is a new Standard that was written especially for Northern communities. Because permafrost is important in the North, climate change is happening faster in the North, and lots of communities in the North are very isolated, we need solutions that work in the North. This Standard is meant to help people do a better job of managing erosion and sedimentation. The Standard is going to help us to not make the mistakes that make erosion and sedimentation worse, and it can also help us adapt to climate change. The requirements in the Standard apply to almost everything that people can build, like a road or a building pad, or a dock. The requirements also apply to all the things that people can build to help stop erosion and sedimentation, like protecting the beach from the sea, or keeping a bridge support from washing away.

The Standard has a lot of steps to follow. For large projects, most of these steps will be done by scientists and engineers. These steps can also apply to projects that people can do themselves, even at a fishing camp. If we don't understand the steps, then we need to ask for help. First, we have to understand what the land is like — is there permafrost, or a big bluff on the coast that is falling into the sea, or a lake where waves are getting too close to the houses, or a river that doesn't stay in the same channel? When we understand the problem, then we can plan and design how to avoid the problem, or how to fix it. For example, maybe we can put down a layer of big rocks to help keep our building pads from washing into the lake. After we finish building our project, we have to monitor the things we designed to help stop erosion and sedimentation, to check that it's all doing what it's supposed to do. If it doesn't work like we thought it would, then we have to try something else. Or if something fails, like in a big storm, then it has to be repaired.

When people follow the Standard, they will be able to show that they have considered erosion and sedimentation in their design. They can also show how they want to protect not just their own project,

but also keep their project from having a bad effect on their neighbour, or the land, or the fishing streams. And they will be able to show that they have thought about what might be needed to help protect permafrost or keep permafrost thaw from wrecking their project, or their neighbours' land, or the environment around them.

The new CSA W205 Standard was funded by the Standards Council of Canada (SCC). SCC has a Northern Advisory Council (NAC) that consists of northern business leaders and infrastructure experts from the North. The NAC gave the project a head start by making a list of ideas they thought should be in the Standard. Members of the CSA Technical Subcommittee who wrote the Standard are from the North, work on northern projects with erosion and sedimentation issues, and/or have special knowledge about erosion and sedimentation and how to fix those kinds of problems.

0.2 General

This Standard addresses measures for the management and mitigation of erosion and sedimentation risks for northern community infrastructure. The Standard includes consideration of the varied climate and ground conditions that are present in the North, including the likelihood of permafrost in many of Canada's northern communities.

The present and ongoing impact of climate change is also considered. Climate change is accelerating erosion and sedimentation in Canada's North (ACIA 2013, IPCC 2014, Lemmen et al. 2016). Though all regions of Canada are experiencing environmental impacts that can be attributed to climate change, warming in Canada's North is taking place at a faster rate than the rest of Canada and more rapidly than many climate models predicted. In addition to the driving processes for erosion and sedimentation common to other regions (waves, currents, river flows, etc.), northern adaptations for erosion and sedimentation risk management are likely to require the consideration of rapidly changing ice regimes and permafrost soils, particularly in regions with already-warm permafrost and/or ice-rich soils. These issues coincide with progressively increasing exposure to open-water erosive processes, and decreased sea-ice cover in most of northern Canada.

Northern communities are also generally located in geographically-isolated and climatically-harsh regions, resulting in high construction and maintenance costs, as well as challenging logistics. Therefore, efficiency and resiliency are critical elements of built infrastructure in the North, mitigating the effects of erosion and sedimentation whether related to natural processes, construction-related changes, or climate change-related processes.

This Standard is organized according to the progression of steps that should be undertaken to address the risks associated with erosion and sedimentation to existing or new buildings, structures, utilities, transportation networks, coastal, lakeshore, and riverine facilities, and other built infrastructure. Considerations include the effects of infrastructure, and the associated potential for erosion, sedimentation, and the mitigation thereof, to impact the natural environment.

While there are numerous guidelines available to help the user in the preparation of suitable erosion and sedimentation risk management strategies and mitigation plans, no unified standard has yet been prepared specifically to address the issues in Canada's North. This Standard is intended to provide a specific erosion and sedimentation document for the North. The strategies available to proactively reduce the incidence and mitigate the effects of erosion and sedimentation, monitor, and respond to the risks as required depend on site-specific conditions. The use of this Standard therefore requires a flexible approach.

1 Scope

1.1 General

This Standard applies to the management of erosion and sedimentation risks, including the evaluation, planning, design, implementation, monitoring, and maintenance of erosion and sedimentation risk management strategies and mitigation measures for new and existing infrastructure in northern communities. This Standard provides

a) an outline of procedures for conducting an overall risk assessment, including infrastructure vulnerability;
b) factors related to erosion and sedimentation to be considered in land use and infrastructure planning;
c) an overview of the typical drivers of erosion and sedimentation hazards to which this Standard is applicable;
d) the procedures to be applied and erosion protection measures to be considered in three primary environments:
    i) coastal and lakeshore;
    ii) open channel; and
    iii) terrestrial.
e) a discussion of specific steps taken to evaluate and address erosion and sedimentation risks:
    i) site-specific evaluation and risk assessment;
    ii) planning and design; and
    iii) structural measures.
f) best practices for managing erosion and sedimentation;
g) procedures for inspecting, monitoring, and maintaining erosion and sedimentation mitigation measures;
h) discussion on incorporating adaptive management;
i) roles and responsibilities of personnel organizing or supervising the installation, inspection, monitoring, and maintenance of erosion and sedimentation mitigations;
j) emergency response and contingency planning protocols for addressing failures or imminent failures in erosion and sedimentation mitigations implemented to protect infrastructure and the environment;
k) a framework for community-based processes for addressing erosion and sedimentation, and impacts to infrastructure; and
l) background information and relevant reference material.

Compliance with this Standard will allow users to demonstrate that the design and implementation of erosion and sedimentation risk management strategies and mitigation measures take into consideration, and are compatible with, the mitigations that may be required to preserve permafrost or reduce the disruptive effects of permafrost thaw. Because the performance of permafrost is often integral to the success of erosion and sedimentation risk management strategies, compliance with this Standard will help mitigate impacts to both onsite infrastructure, and the environment and infrastructure surrounding the project site.

1.2 Users

This Standard is intended for use by the following:

a) the owners and operators of buildings, structures, transportation or utility networks and facilities, hydro dams, or other infrastructure that can be affected by erosion and sedimentation;
b) the owners and operators of other community infrastructure (e.g., drainage systems) for which the mitigation of erosion and sedimentation is important;