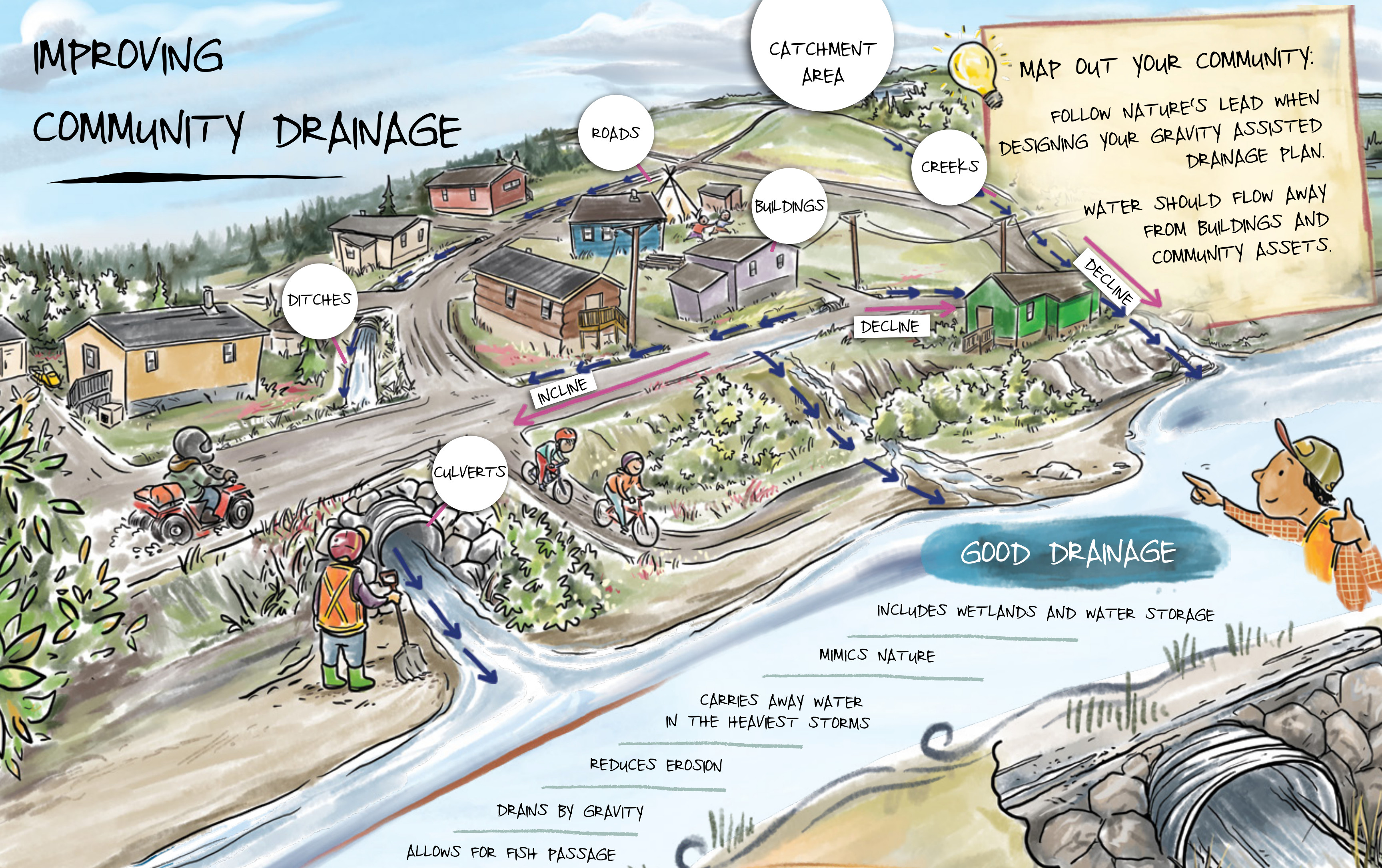


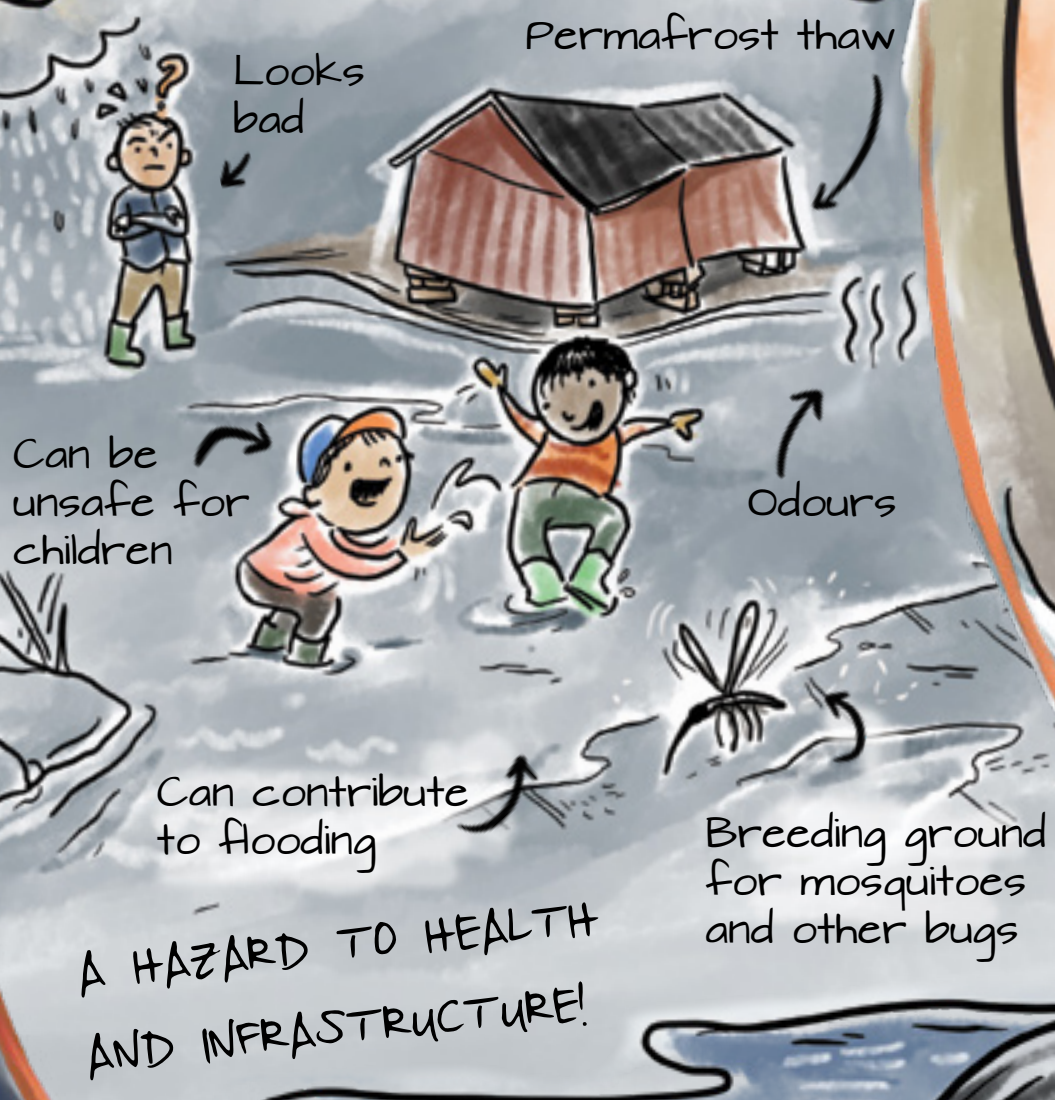
IMPROVING COMMUNITY DRAINAGE



INDICATORS OF POOR DRAINAGE

- STAGNANT WATER
- SNOW ISN'T MANAGED WELL
- CULVERTS ARE BLOCKED
- DITCHES AREN'T MAINTAINED

CONSEQUENCES OF STANDING WATER



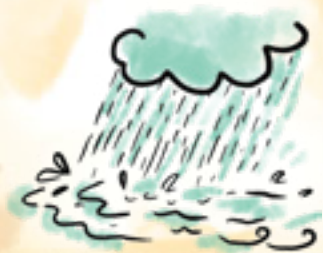
MAINTENANCE SCHEDULE



CULVERTS ARE KEY TO GOOD DRAINAGE. THEY HELP PREVENT ROAD AND DRIVEWAY WASHOUTS.

CLIMATE CHANGE IS INCREASING DRAINAGE CHALLENGES

MORE INTENSE RAIN, MORE OFTEN



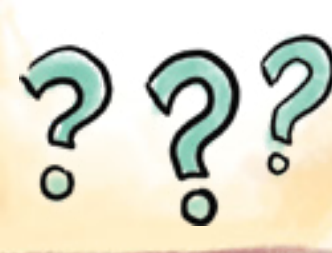
PERMAFROST THAW



MORE FREEZE/THAW EVENTS



UNPREDICTABLE WEATHER



HAVE A STRONG DRAINAGE PLAN IN PLACE TO BE PREPARED FOR THE CHANGING CLIMATE



COMMUNITY DRAINAGE

Moving water safely and efficiently through the community

The purpose of a drainage system is to collect surface water and move it away from buildings, roads, and other community infrastructure. The goal is to minimize impacts from flooding, washouts, slides, and other drainage problems.

A GOOD DRAINAGE PLAN WILL:

- * Outline the flow path water should take
- * Work with natural drainage where possible
- * Identify current drainage structures
- * Protect important community infrastructure

Use the drainage plan to help decide where to put new infrastructure and how to build it.



This is a user-friendly outline of CAN/CSA S503-15 Community drainage system planning, design, and maintenance in northern communities.

Together with climate change, our long winters, short springs, and frozen ground can create complex issues with surface drainage. This guide will help you develop an effective drainage plan for your community.

Ecology North adapted this guide for use by community administrators, building and land owners, asset managers, regulators, and policy makers across the north.



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Ecology North is a charitable organization, founded in 1971 to support sound environmental decision-making on an individual, community, and regional level.

Contact us or visit our website for information and other guides in this series.

CLIMATE CHANGE

Huge impacts on surface water

With climate change, weather is less stable. Extreme rain/weather events are more common. These events can create huge and costly problems with drainage.

SOME EFFECTS OF CLIMATE CHANGE:

- * Faster melting in spring
- * More intense precipitation, more often
- * Unexpected rain
- * Rain in winter
- * Warming and degrading permafrost
- * Erosion, slumping, and landslides

Consider climate forecasts when you plan new drainage structures or maintain old ones. Be prepared for the unexpected, and be proactive with maintenance.



UNDERSTANDING DRAINAGE

Collect info for your drainage plan

USE DIFFERENT SOURCES:

- * Local and traditional knowledge
- * Topographic data
- * Legal land surveys
- * Engineering reports
- * Subsurface geotechnical studies
- * Aerial/satellite imagery

GATHER INFORMATION ON:

Water sources, flow paths through the community, where water ends up.

Current drainage structures, such as ditches, berms, and culverts.

Natural drainage features, like streams, ponds, lakes, and rivers.

Community infrastructure, such as roads and buildings.

Places to protect, such as the airport, health station, water treatment and power plants, and key roads.

Background information on the geology, terrain, vegetation, permafrost, climate, and weather data.



THE FOUR SEASONS

Maintaining drainage year-round

WINTER

- * Identify areas where snow piles up
- * Monitor year after year to record changes
- * Pick a good place to pile the snow

SPRING

- * Note any issues during peak melt
- * Clear snow properly
- * Thaw culverts blocked with snow and ice
- * Clean debris from drainage pathways
- * Identify repairs that need to be done
- * Fix any immediate issues

SUMMER

- * Inspect ponding in ditches
- * Find and trim overgrown vegetation
- * Replace or fix culverts as needed
- * Flush gravel from culverts (a fire hose works)
- * Build walkways through wet areas

FALL

- * Check on problem drainage areas
- * Maintain, repair, replace as needed

EROSION CONTROL

Water is powerful

Erosion happens when water (or wind) moves soil and other surface materials from one place to another. Erosion depends on the type of soil, the amount of water (or wind), and how fast it is moving.

Flowing water can have a lot of force. It can undercut roads, bridges, and buildings.

Erosion control techniques can help absorb the force of water and control erosion. These methods help reduce problems before flooding happens.

Vegetation: grass and bushes slow water flow.



Riprap: loose stone below culverts, foundations, or steep ditches that dispel the force of water.

Sediment traps: a basin-like area that holds water short term, so sediment can settle.



Silt curtains: a short-term barrier that traps sediment.

POOR DRAINAGE

Things to watch for

SIGNS OF PROBLEMS:

- * Standing water
- * Flooding
- * Overland flow
- * Damaged, plugged, or frozen culverts
- * Ground sinking or eroding

Record this information. Fix issues immediately if possible, otherwise schedule maintenance in low-water periods in the summer and fall before they become serious.

Poor or slow drainage can create hazards for community infrastructure and human health.

STANDING WATER

- * Promotes permafrost thaw
- * Is a breeding ground for mosquitoes
- * Can be a safety hazard for children
- * Promotes waterborne odours
- * Can contribute to flooding



REGULAR INSPECTIONS

Keep records

Inspect and list all drainage structures. Note the condition. Do upkeep and repairs or replace them as needed. Check culverts and ditches before, during, and after spring freshet and summer downpours.

CULVERTS

- * Location and size
- * Condition: shifted, plugged, or damaged

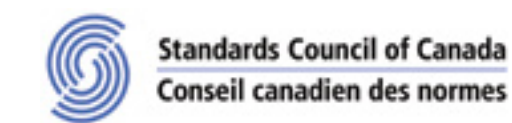
DITCHES

- * Standing water
- * Erosion
- * Too much/not enough vegetation
- * Unnatural obstacles

DRAINAGE AND PERMAFROST

Keep permafrost frozen when building drainage infrastructure.

- * Ponded water can thaw permafrost
- * Avoid building where water is known to pond
- * Consider berms instead of ditches
- * Disturb the ground as little as possible
- * Minimize erosion



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IMPROVING COMMUNITY DRAINAGE

