Vulnerability of surface water bodies to potential contamination by ammunition residues from military training ranges

André Guy Tranquille TEMGOUA, Richard MARTEL, Uta GABRIEL, Adriana FURLAN, and Marie-Juliette JOUVEAU

Research Associate, INRS-ETE, Quebec, Canada (andre_guy_tranquille.temgoua@ete.inrs.ca)

Over the last decade, a major effort has been made by Canadian Forces to understand the hydrodynamic of groundwater flow on range training areas (RTA). However, there is also a need to study surface water bodies and especially its vulnerability to potential contamination by ammunition residues.

Nearly half of the surface (42%) of the studied RTA is located on bedrock prone to high rate of surface runoff. Rugged terrain is located to the north of the RTA, whereas to the south; the surface is on deltaic sediment made of sand that is favorable to high infiltration rate.

Digital Elevation Models (DEMs) of topography were used in Geographic Information System (GIS) Software (ArcGis) to derive hydrologic processes. The GIS grid cells encompass basic terrain flow data that can be used to represent the flow processes at the free surface. They can also be used to derive a wide variety of information useful for the study of hydrologic processes such as topographic slope, water flow direction, contributing and drainage areas, catchments, watersheds and channel networks. The free surface flow was defined everywhere in the RTA but more specifically around targets locations, firing positions, and in impact areas.

The developed methodology allows determining the hydrologic network with potential accumulation areas. The main objective is to identify areas where surficial geology and hydrological properties are favorable to rainfall-runoff and to establish if the quality of surface water may be altered by training ranges activities and subsequently if potential contaminants may migrate to receptors such as lakes and rivers.

Vulnerable sectors that have high, medium or low rainfall-runoff index and surface water flow accumulation were shown on a regional map. Many other local maps were produced to define in more details surface water vulnerability in specific ranges.

The possible relationship between the detection of ammunition residues in surface water bodies, the vulnerability index, the flow accumulation, the rainfall-runoff index and, the location of range training activities was investigated.

Key words: hydrologic processes, surface water, ammunition residues, range training areas