

Tailings Geochemical and Mineralogical Analysis Program

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Introduction

The Critical Minerals Geoscience Data (CMGD) initiative is a federal program led by the Geological Survey of Canada (GSC) and Natural Resources Canada (NRCan) with the purpose of strengthening Canadian critical mineral supply chains. The Province of Nova Scotia, through the Department of Natural Resources, actively participates in this program by advancing projects that expand geoscience knowledge, assess economic potential, and identify pathways for development.

One ongoing project focuses on upstream inventories for downstream applications and thus aims for a better understanding of the potential for critical minerals from secondary sources, such as tailings. To support this, a preliminary assessment of historical tailings material was undertaken.

Tailings Sampling Program

Between August and December 2025, several sites were selected for tailings sampling in conjunction with previously planned phased environmental site assessments by external consultants (Figure 24). The collection of tailings samples was carried out at legacy mine and mine tailings sites on Crown land, presently under environmental site assessments (ESAs).

Generally, tailings material was collected as sample sets (a shallow, weathered tailings sample and a deeper, unweathered tailings sample) using a hand auger. In addition, grab samples were collected from waste rock piles and submitted for Rare Earth Element (REE) Analysis.

All samples were analyzed for metals by way of multi-acid digestion followed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and/or Inductively Coupled Plasma Mass Spectrometry Optical Emission Spectroscopy (ICP-OES) and X-Ray Diffraction (XRD). A combination of digestion and analytical methods were used. A brief report was prepared by the consultants collecting the samples, and summarizing the findings.

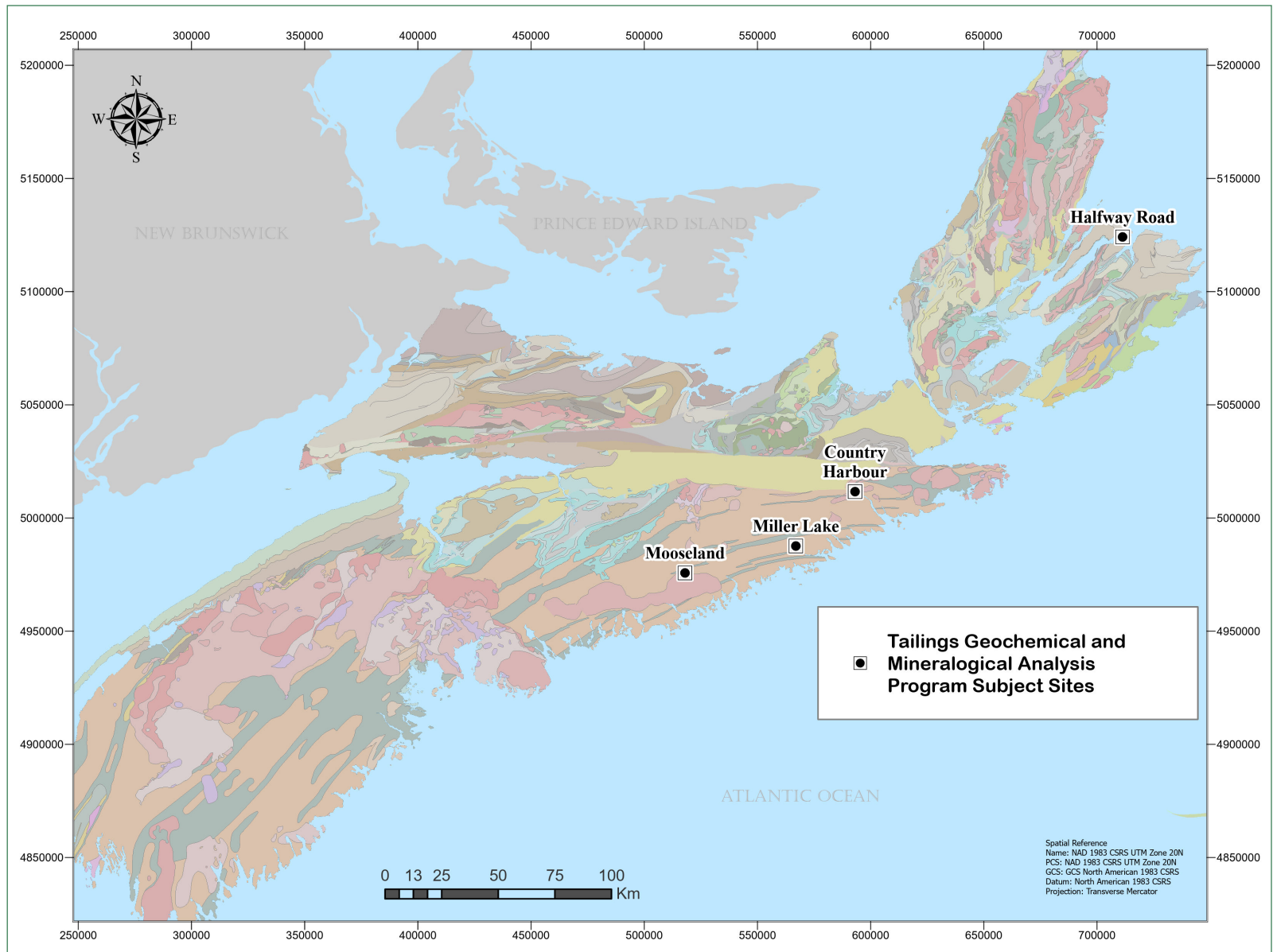


Figure 24. Tailings Geochemical and Mineralogical Analysis Program Sample Locations.

Site Geology

Mineralization on the Country Harbour property is typical of Meguma-style gold occurrences, consisting of gold-bearing quartz veins hosted in metre-scale slate units within the dominantly metagreywacke rocks of the Goldenville Group. The Country Harbour Mine was mined in the late 1800s and returned to in the 1930s. During historical mining activities, approximately 5,500 tonnes of gold tailings were produced.

The Halfway-Tobin Road area is primarily underlain by the Sydney Mines Formation and consists of fluvial and lacustrine mudstone, shale, siltstone, sandstone, limestone, and coal.

The Miller Lake area is underlain by metawackes and metasilstones of the Goldenville Group. Gold bearing quartz veins are stratabound and vary from a few centimetres to 30 centimetres thick. The Miller Lake area was mined in the early and mid 1900's, with approximately 1,200 tonnes of gold tailings being produced.

The Mooseland area is underlain by metawacke, quartzite and slate units of the Goldenville Group. Mining in the Mooseland area was conducted in the late 1800s and into the early 1900s, with approximately 1,200 tonnes of gold tailings being produced.

Preliminary Results

Tailings at the former Country Harbour site consisted predominantly of quartz, muscovite, and biotite, with residual gold concentration ranging from 0.421 ppm to 0.887 ppm.

Waste rock material at the former Halfway-Tobin Road site consisted of a mix of fluvial and lacustrine mudstone, shale, siltstone, sandstone, limestone, and coal. A total of five waste rock samples were collected and submitted for analysis. The results indicated negligible concentrations of economically significant metals.

Tailings at the former Miller Lake site consisted predominantly of quartz, and muscovite, with residual gold concentration ranging from 0.165 ppm to 6.32 ppm.

Tailings at the former Mooseland site consisted predominantly of quartz, and muscovite, with residual gold concentration ranging from 0.454 ppm to 1.78 ppm.

Future Work

Tailings and waste rock material collected from historical gold and coal mine sites are planned to continue, including five sample sets at the former Harrigan Cove gold mine. These samples are planned to be collected for analysis of metals via ICP-MS with multi-acid digestion, and XRD. At the former coal mines located in Joggins and River Hebert, four samples are planned to be collected, and at the former coal mine located in Point Aconi, eight samples are planned to be collected for analysis of REE's. Fieldwork has been completed at the former Port Hood site; however, analytical results have not yet been received.

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References

AECOM Canada, 2025. Miller Lake and Mooseland Former Mine Sites – Metals and Mineralogy Test Results.

Dillon Consulting Limited, 2026. Mineralogical Sampling Results, Former Country Harbour Mine Site, Country Harbour Mines, Guysborough County, Nova Scotia, Parcel Identification Designation Nos.: 35091354 and a Portion of 35094366 – Final

Dillon Consulting Limited, 2026. Mineralogical Sampling Results (Final), Former Halfway Road Mine Site, Sydney Mines, Nova Scotia, Parcel Identification Designation (PID) Numbers 15505324, 15164866, 15504681, and 15505449

Hennick, E. W., and Poole, J. C., 2024. Nova Scotia Mine Tailings Database, Nova Scotia Department of Natural Resources and Renewables, Digital Product ME 533, Version 2. <<https://novascotia.ca/natr/meb/download/dp533dds.asp>>

MacRae, K-D., Neyedley, K., Baldwin, G. J., and Poole, J. C., 2024. Nova Scotia Mineral Occurrence Database. Nova Scotia Department of Natural Resources, DP ME 2, Version 12. <<https://novascotia.ca/natr/meb/download/dp002.asp>> [Accessed on April 9, 2026]