IDENTIFICATION

Department	Position Title	
Environment and Climate Change	Hydrological Modeller	
Position Number	**Community**	**Division/Region**
23-16464	Yellowknife	Water Monitoring and Stewardship/ HQ

PURPOSE OF THE POSITION

The Hydrological Modeller is accountable to lead the implementation of computational and spatial hydrological models, conduct data analysis and interpretations, and conceive, initiate, and conduct scientific studies in the Northwest Territories (NWT) to achieve departmental objectives, including providing recommendations consultations and engagement with northern communities, government agencies and academics.

SCOPE

Located in Yellowknife and reporting to the Senior Hydrologist in the Water Monitoring and Stewardship Division, the Hydrological Modeller is responsible for improving territorial capacity to address water quantity assessment including uncertainties related to climate change by developing a consistent pan-territorial hydrological modelling approach and framework, in consultation with stakeholders. The Hydrological Modeller is knowledgeable about hydrological science and methodologies and incorporates this knowledge and computational expertise to support water management goals and objectives. The Hydrological Modeller conducts research, analyzes data, and prepares and disseminates reports.

The Department of Environment and Climate Change (ECC) works to promote and support the sustainable use and development of natural resources and to protect, conserve and enhance the NWT environment for the social and economic benefit of all residents.

The Water Monitoring and Stewardship Division bears the primary roles and responsibilities related to water-related monitoring and research, water quality and quantity data collection, and water stewardship and planning. The Division, in cooperation with Environment and Climate Change Canada (ECCC) and other federal and territorial departments, collects and interprets information about water quantity and quality in the NWT. The Division works with

its water partners on a collaborative approach to water stewardship and planning in the NWT, including transboundary water management agreements.

The Northwest Territories (NWT) is the ultimate downstream jurisdiction in the Mackenzie River Basin (MRB). Understanding the hydrology and water movement in the basin and its tributaries is critically important for understanding the availability and health of water in the NWT. The MRB drains an area that consists of a fifth of Canada's land mass and it is one of the largest river basins in the world. The flow of the Mackenzie River plays a significant role in regulating oceanic circulation and maintaining Arctic climate systems. The MRB is subject to industrial activity which has the potential to influence water flow and quality and it is experiencing climate change at a rate disproportional to the rest of Canada. The Hydrological Modeller works with federal and provincial/territorial colleagues, as well as academic partners, to implement and assess the performance of cold region hydrological models. Where appropriate, the Hydrological Modeller uses accepted modelling frameworks to design and modify, hydrological models for their use in watersheds that are located within, or contribute to, the waters of the NWT. These models will be developed to assess climate change impacts at a basin scale, as well as flow prediction on major waterways. The models will provide information that will help the GNWT better plan for barge transportation, hydro-electricity generation planning, public safety and infrastructure design.

The Hydrological Modeller works within a legislative and regulatory framework that includes the: *Waters Act*, NWT Water Stewardship Strategy and Action Plan, 2030 NWT Climate Change Strategic Framework and Action Plan, as well as other GNWT and departmental policies and transboundary water management agreements with neighbouring jurisdictions.

The Hydrological Modeller focuses on adapting, improving and modernizing hydrologic and hydraulic models for the development and general improvement of territorial floodplain maps. This will require the incumbent to work with other scientists in the unit and other GNWT colleagues (Northwest Territories Geological Survey (NTGS) and NWT Centre for Geomatics).

The Hydrological Modeller develops, plans, and implements hydro-climate research and monitoring projects in support of improving hydrological models. The Hydrological Modeller develops numerical models under existing Canadian modelling frameworks. The performance of the models will be limited by data availability in regions where field data are scarce. As such, the Hydrological Modeller has a working knowledge of the performance and shortcomings of different available reanalysis datasets in northern Canada, particularly in the NWT. The Hydrological Modeller has experience extracting data from national databases including those provided by ECCC (e.g., DataMart) and from third party sources (e.g., CaSPaR, GlobSnow).

The Hydrological Modeller collaborates closely with the Senior Hydrologist, the Hydrologist and Hydrogeologist in the Division. The Hydrological Modeller works collaboratively with colleagues within ECC, particularly within the Climate Change Unit. The Hydrological Modeller

regularly collaborates with GNWT colleagues in other Departments, with external contacts (e.g., Indigenous governments and Indigenous organizations, federal government departments including Natural Resources Canada and ECCC, other provinces/territories and academia). The Hydrological Modeller also works with communities and other groups within and external to the GNWT to provide timely data and information to support community flood-watch programs.

Included in the model development process are situation assessment, program and budget development, planning and implementation. The position is required to develop, validate and advise on, testing and calibration will be completed in partnership with academic, government methods and techniques that will be best suited to the needs, priorities, environmental conditions and data availability within the NWT. Much of the model and remote sensing development and industry leaders in this field of study. The Hydrological Modeller is responsible for authoring papers and developing publications that are of high technical quality and suitable for publication. The incumbent is also responsible for developing plain language reports on the water levels, flow and water quantity in the NWT.

The Hydrological Modeller also identifies and assesses use of innovative technology for the remote assessment of water, snowpack and ice to assess changes including those related to a changing climate. Primary among the responsibilities is remote assessment of river ice to determine potential risks of flooding due to the formation and release of ice jams during spring freshet.

The Hydrological Modeller will follow proven research and scientific methodology in the development of models that meet the goals of the Strategic Plan and supports/reflects the mandate of the Department, the GNWT and the people of the NWT.

The Hydrological Modeller has significant latitude, provided that best practices in data collection, research and scientific methodology are compiled with while supporting the needs of NWT departments, communities and residents.

RESPONSIBILITIES

1. **Develops and implements conceptual and numerical hydrological models in the NWT.**
   - Leads the advancement of hydrological modelling and development of prediction models in collaboration with external governments and universities.
   - Develops scripts to create scientifically defensible and reproducible statistical analysis of hydro-climate parameters to better understand the effects of climate change on water resources in the NWT.
   - Develops and collaborates on proposals to secure internal and external funding to improve spatial coverage and resolution of hydrological modelling domains in the NWT.

- Evaluates and interprets results of hydrological modelling studies by other researchers and determines the applicability and transferability of the models to the NWT.
- Reviews scientific literature and maintains professional level of expertise and contacts to keep informed of advances in the hydrological sciences.
- Supervises and mentors casual staff in conducting field and office-based work, collecting and managing field data, and incorporating these data and other scientific findings into hydrological models.

2. **Develops and implements field- and office-based research and monitoring programs in support of hydrological model development.**
   - Uses field, aerial and satellite-based surveillance systems to support the development of a river ice break up monitoring program.
   - Develops a series of criteria for the assessment of potential high-water conditions for identified at-risk communities.
   - Reviews hydro-climate monitoring networks to ensure appropriate spatial and temporal coverage to study and model the impacts of climate change on water resources in the NWT.
   - Contributes to budget and operational planning to ensure hydro-climatic monitoring networks remain current, cost effective and appropriate to address research questions and internal and external client needs.
   - Plans fieldwork and leads field activities, both as a research leader and as a scientific contributor to collaborative projects.
   - Ensures cost-effective, efficient and safe work practices in the field and office.
   - Manages administrative aspects of research projects, which may including supervision of field staff, the acquisition of permits and licences, and engaging with local communities and land managers to share information and obtain clearances.
   - Collaborates with academics and government research scientists, and in some cases oversees graduate and undergraduate student research related to the hydrology, hydrological modelling and the Departments mandate.

3. **Leads the development and maintenance of data management systems for the hydro-climate monitoring networks.**
   - Collaborates with GNWT partners to develop and implement an open-source hydro-climate database.
   - Develops standardized and reproduceable quality assurance and quality control procedures to review and archive hydro-climatic data collected in the NWT.
   - Writes scripts (e.g., R, MATLAB) to easily query databases to extract and visualize hydro-climate data parameters.
   - Collaborates with the Climate Change Unit and federal government agencies to develop a consistent time-series of NWT climate data.
   - Works with NTGS Geoscience Editor to publish and update technical open reports.

- Develops and supports territorial, national, and international partnerships to improve hydro-climate data and information sharing standards.
- Evaluates and solves hydro-climatic data management problems that are unique in the NWT.
- Procures goods and services, including management of contracts.

4. **Publishes and presents scientific reports and data in an appropriate and timely manner.**
   - Authors or co-authors reports, maps, web content, books, digital atlases and other material to meet objectives of the Department. This may include publishing monitoring and research in peer-reviewed scientific journals and publishes data as open reports.
   - Designs and maintains a spring break up reporting platform, including development of scripts for ingestion and display of multi-parameter data and imagery.
   - Leads the production of daily Spring Break up Reports and monthly Water Monitoring Bulletins for distribution to a wide range of stakeholders.
   - Completes Spring Water Level Outlook for distribution to other government departments and the public.
   - Prepares briefing materials, communication products and media responses related to hydrological research and monitoring programs, findings and conditions in the NWT.
   - Prepares technical and plain language reports that include high quality figures, maps and images.
   - Prepares and presents research and monitoring results at professional scientific meetings, conferences and workshops, and to various levels of government and community information and outreach activities.
   - Develops and delivers communications for a variety of audiences to support understanding of hydrology information across the NWT.

5. **Provides expert advice to a wide range of stakeholders on hydrology-related topics in the NWT.**
   - Assesses and provides expert advice on the potential impacts of climate change on water resources and hydrological processes in the NWT.
   - Provides continuous situational awareness of water level and flow conditions of concern to Municipal and Community Affairs (MACA) Emergency Management Organizations and the public.
   - Identifies emerging issues/challenges related to hydro-climatic data in the NWT and recommends approaches to address them.
   - Represents the GNWT on the national Community of Practice on Operational Hydrological Prediction in Canada (CoP-OHPC) and other working groups, as required.
   - Leads technical sessions/workshops/discussion tables, as subject matter expert.
   - Conducts or contributes to community information sessions and outreach activities,

with the priority of compiling information about high and low water events.
- Evaluates collaborative research proposals and makes recommendations on departmental support.
- Maintains membership in, and periodically serves on, Boards of national-level hydrology associations.

WORKING CONDITIONS

Physical Demands

The incumbent will usually work in a normal office environment with intermittent field work. In the summer field season, the incumbent will be hiking over rough terrain with a backpack and collected samples (up to 50 pounds) for eight hours per day, up to three weeks per year; will be travelling in small aircraft and helicopters for up to four hours per day, up to three weeks per year; will be travelling in small watercraft for up to one hour per day, up to three weeks per year. In the winter field season, work involves travelling by snowmobile, work at extreme cold temperatures, and operation of one-person ice augers or other equipment.

Environmental Conditions

The incumbent usually works in a normal office environment with intermittent field work. While in the field, the incumbent can be exposed to rapidly changing weather and to conditions such as cold (hypothermia), intense sun (burn), wind, rain; helicopters, airplanes, ATVs, road vehicles (physical injury, hearing loss, gas/fumes); insects and insect bites; dangerous, unforeseen, uncontrolled field situations such as vehicular accidents, attack by wild animals, falls; and other accidents while on traverse (cuts, muscle sprains, broken bones, etc.). The incumbent will be exposed to these environment conditions every day up to three weeks per year every day.

Sensory Demands

The incumbent will usually work in a normal office environment with intermittent field work.

Mental Demands

The incumbent usually works in a normal office environment with intermittent field work. From May to August there is expectation of some field-based work. While in the field, the incumbent is subject to substantial disruption of family life due for field work in distant locations. The incumbent is also responsible for the continuous management of scientific and logistical activities and safe work practices while in the field, including the prediction and mitigation of potentially hazardous situations and managing personality conflicts amongst field staff. The incumbent will be exposed to these demands every day up to three weeks per year.

The incumbent is also required to present research or work plans to scientific peers, collaborators, community groups, etc. and may attend workshops or research meetings in southern Canada two to four times per year.

KNOWLEDGE, SKILLS AND ABILITIES

- Knowledge of scientific principles and techniques pertaining to cold regions hydrology research and monitoring including field-based data acquisition, management, and analysis.
- Knowledge of the different hydrological modelling platforms used in Canada.
- Knowledge of model parameterization methods and implementation of improvements to modelling frameworks.
- Knowledge of the inherent limitations of models and how they may not always represent reality.
- Knowledge of new and evolving hydrological and meteorological data collection methods and sensors.
- Ability to build and refine models for gauged and ungauged water basins.
- Ability to identify areas where more data are needed and will improve model performance.
- Knowledge of diverse and complex elements of hydrologic science.
- Knowledge of scientific measurement and analysis techniques.
- Knowledge of statistical methods to review, analyze and interpret data and produce reports.
- Knowledge of technical and plain language report writing methods, practices and standards to produce detailed scientific study/survey reports.
- Knowledge of databases and basic computer coding to upload, search, evaluate, manipulate, and analyze datasets
- Demonstrated track record of computational modeling or coding, data management experience and peer-reviewed scientific writing/publication.
- Ability to analyze and modify methods, techniques and practices, generate independent research results and/or validate the research findings generated by others.
- Ability to produce scientific reports of high technical quality suitable for publishing in peer-reviewed journals
- Ability to conceptualize, design, and implement a hydro-climate database
- Ability to efficiently use computer hardware and software for data collection, data management, synthesis and modelling, and presentations (e.g. MS Office, R, MATLAB, Python, ArcGIS, QGIS, Delft-FEWS, and other statistical and modelling software).
- Ability to use programs that require some degree of computer coding.
- Oral and written communication skills, including the ability to read, understand and effectively communicate, to both professional and lay audiences, complex scientific ideas including methodologies and reports.
- Project management, organizational and logistical skills to effectively manage and participate both in independent and collaborative research projects and lead field projects.
- Field skills that are grounded in best practices in hydrological research and monitoring.

- Knowledge of arctic survival, transportation of dangerous goods, first aid, firearms, remote communications, equipment repair and navigation techniques.
- Knowledge of current NWT water initiatives, such as the NWT Water Stewardship Strategy, Cumulative Impact Monitoring Program and *Healthy Land, Healthy People: GNWT Priorities for Advancement of Conservation Network Planning.*
- Ability to commit to actively upholding and consistently practicing personal diversity, inclusion, and cultural awareness, as well as safety and sensitivity approaches in the workplace.

Typically, the above qualifications would be attained by:

Completion of a graduate degree (M.Sc.) in hydrology, environmental science or engineering with at least two (2) years of experience in the hydrological sciences and relevant experience in either the public or private sectors, preferably with field experience conducting cold regions hydrology.

Equivalent combinations of education and experience will be considered.

ADDITIONAL REQUIREMENTS

Position Security (check one)

☒ No criminal records check required
☐ Position of Trust – criminal records check required
☐ Highly sensitive position – requires verification of identity and a criminal records check

French language (check one if applicable)

☐ French required (must identify required level below)
Level required for this Designated Position is:
ORAL EXPRESSION AND COMPREHENSION
Basic (B) ☐ Intermediate (I) ☐ Advanced (A) ☐
READING COMPREHENSION:
Basic (B) ☐ Intermediate (I) ☐ Advanced (A) ☐
WRITING SKILLS:
Basic (B) ☐ Intermediate (I) ☐ Advanced (A) ☐
☐ French preferred

Indigenous language: Select Language

☐ Required
☐ Preferred