



# Genomic Monitoring of Pathogens in Water (GeMPaW)

## Community Coordination and Collaboration Hub (C3 Hub): Funding Opportunity

### 1. OVERVIEW

[Genome Canada](#) is launching a targeted genomic initiative in April 2023—known as [Genomic Monitoring<sup>1</sup> of Pathogens in Water](#) (GeMPaW)—to strengthen, complement and add value to Canada’s existing pathogen monitoring efforts.

The Community Coordination and Collaboration Hub (C3 Hub) is the first of three key components that make up the GeMPaW initiative. It will act broadly as a connector, ensuring that data from monitoring antimicrobial resistance (AMR) and emerging pathogens (EPs) are used to inform public policy decisions.

Water sources to be monitored in GeMPaW include sewage, wastewater in treatment plants, saltwater, freshwater and groundwater. GeMPaW aims to use a collaborative, multisectoral and transdisciplinary approach to:

- Address the threat of EPs, with a focus on those that can be detected in water and have been prioritized by the Public Health Agency of Canada, including respiratory viruses such as SARS-CoV-2, influenza, respiratory syncytial virus, monkeypox and polio.
- Address the threat of AMR, including antibiotic-resistant bacteria and genes.
- Advance genomic monitoring of antibiotic-resistant genes with a focus on the six “ESKAPE” pathogens prioritized by the World Health Organization: *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter*.
- Advance understanding of the connections between people, animals, plants and their shared environments (in other words, “One Health”) in relation to the genomic monitoring of pathogens.
- Increase the value of pathogen monitoring data through national data-sharing, data standards, data analysis and data visualization to strengthen an evidence-driven approach for future pandemic preparedness.
- Develop knowledge mobilization strategies to support the use of genomic data and associated metadata in public health and policy decisions.

For more details, please refer to the [GeMPaW Funding Overview](#).

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<sup>1</sup> Genomic monitoring (or “genomic surveillance,” as it is commonly referred to) is the process of constantly tracking pathogens and analyzing their genetic similarities and differences.

## 2. OBJECTIVE

The objective of this funding opportunity is to support a **single** C3 Hub team that will work to enhance provincial and national AMR/EP monitoring to support public health planning, decision-making and response and create operational structures and integrated processes to support genomic monitoring efforts across the country.

The C3 Hub will support Genome Canada's AMR/EP regional monitoring projects by developing and implementing a portfolio operation plan. A distinguishing feature of the GeMPaW initiative will be the creation of an integrated portfolio of diverse regional projects. Adopting a portfolio approach will make it possible to synergize the deliverables of the regional projects toward broader national outcomes and impact.

Specifically, the C3 Hub will:

1. Develop, coordinate and implement a portfolio operation plan. This plan will include aspects of administration (e.g. project management, meetings and reporting), data (e.g. governance, storage and analytics), and knowledge mobilization, translation and policy (e.g. communication, engagement and policy). It will also connect all the funding opportunities, including regional genomic monitoring projects and Indigenous-led monitoring projects, and will ensure international alignment and collaboration.
2. Develop the administrative structures to coordinate and co-create data-related activities across regional and Indigenous community-led AMR/EP monitoring projects in northern, remote or isolated regions.
3. Facilitate the technical development for data generation and data analytics using interoperable data standards for genomic monitoring of pathogens across Canada.
4. Engage with research, community and public sector users to promote adoption beyond GeMPaW and create evidence-driven policy to support future pandemic responses.

## 3. AVAILABLE FUNDING AND TERM

- Only one pan-Canadian team will be funded.
- Up to \$3 million of Genome Canada funding will be available.
- Co-funding equal to at least the Genome Canada contribution is required. It is expected that 50 per cent of such co-funding will have been secured by the time the Genome Canada funds are released.
- The term is four years.

## 4. REQUIRED ELEMENTS

To be eligible for this funding, the C3 Hub team must be pan-Canadian with representation from at least three regions of Canada, including a substantive role or roles for Indigenous researcher(s), knowledge holder(s) or community representative(s). The team must leverage the expertise and resources of each partner and clearly define their respective roles and responsibilities in its submission. Collectively, the team must demonstrate that it has expertise in leading multidisciplinary project teams—including strategy, execution and project management—as well as broad or specific knowledge of:

- Data, such as data-sharing, data standards, data harmonization and visualization, and data governance, including the FAIR guiding principles (which ensure that data are findable, accessible, interoperable and reusable to support future research and analysis)
- Genomic monitoring
- Pathogen monitoring, including AMR/EP monitoring
- Knowledge mobilization and transfer
- Indigenous data governance, including ownership, control, access and possession ([OCAP<sup>®</sup>](#)) principles and [CARE](#) principles

The C3 Hub team should be transdisciplinary, with representatives from institutional, not-for-profit, private and/or public research organizations. It must be led by one or more project leaders who will be responsible for its intellectual direction. As per Genome Canada’s [Guidelines for funding](#), at least one of these leaders must be eligible to receive and administer Genome Canada funds.

Applications should describe a plan that is ambitious and feasible to deliver the intended outcomes.

The C3 Hub will be required to address the following focus areas.

FOCUS AREA	KEY ACTIVITIES AND WORK
Administration and management	<p>The C3 Hub will provide administrative leadership as the secretariat for GeMPaW, including:</p> <p><b>Hub management.</b> The C3 Hub will develop a management plan that outlines the process for decision-making on hub activities.</p> <p><b>Project management.</b> The C3 Hub will ensure coordination, guidance and co-creation with advice for the regional genomic monitoring projects and overall management.</p> <p><b>Coordination.</b> The C3 Hub will develop operational structures to ensure coordination across the portfolio, including meetings, collaborative file-editing and messaging systems.</p> <p><b>Communication.</b> The C3 Hub will develop a website and social media presence.</p>



<b>Technical</b>	<p>The C3 Hub will develop the technical requirements for the portfolio of regional AMR/EP monitoring projects, including:</p> <p><b>Use cases.</b> The C3 Hub will refine the scope of work for GeMPaW by prioritizing and validating use cases.</p> <p><b>Data.</b> The C3 Hub will identify interoperable data standards for both the genomic and contextual metadata based on established international best practices. Where appropriate, the hub will be responsible for harmonizing data processes (such as data standards, metadata and protocols) and appropriate data resources (such as data sets, tools and pipelines).</p> <p><b>Case studies.</b> The C3 Hub will undertake case study research to understand the factors that contribute to the success of an initiative to monitor water-detectable AMR/EPs. Case studies should consider the needs of end users in the public sector, including planning, decision-making and responsiveness. The goal of the case studies is to identify best practices and learnings that can be shared to create impact. Case studies should include an investigation of critical questions at the intersection of genomics and society that support responsible, ethical, equitable and effective development, uptake and implementation of AMR/EP monitoring.</p> <p><b>Genomics in society (GE<sup>3</sup>LS):</b> The C3 Hub will investigate critical questions at the intersection of genomics and society to inform our understanding, strengthen research impact, and bridge gaps between genomics researchers and partners. This includes supporting responsible, ethical, equitable and effective development, uptake and implementation of GeMPaW.</p>
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>Knowledge mobilization and impact</b></p>	<p>The C3 Hub will lower economic and social barriers and facilitate inclusive participation in genomics through:</p> <p><b>Needs assessment:</b> The C3 Hub will assess implementation barriers and policy opportunities to ensure successful and inclusive uptake of the regional AMR/EP monitoring projects.</p> <p><b>Genomics in society (GE<sup>3</sup>LS):</b> The C3 Hub will investigate critical questions at the intersection of genomics and society to inform our understanding, strengthen research impact and bridge gaps between genomics researchers and partners. This includes supporting responsible, ethical, equitable and effective development, uptake and implementation of GeMPaW.</p> <p><b>Partner engagement and outreach:</b> The C3 Hub will identify key partners and develop mechanisms for ongoing engagement and outreach to drive inclusive and equitable uptake and enhance the overall impact of the portfolio of regional AMR/EP monitoring projects.</p> <p><b>One Health:</b> The C3 Hub will use the concept of One Health to link and standardize data and coordinate policy to bridge systemic gaps across the animal, human and environment continuum.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>International scale-up</b></p>	<p>The C3 Hub will develop mechanisms to learn from, link with and lead international water-monitoring data standards and policies. This will include prioritizing partners, policy and communities to influence and inform global work and position Canada as a world leader.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>Knowledge co-creation and collaboration with Indigenous communities</b></p>	<p>The C3 Hub will foster relations that respect and advance self-determination in alignment with the United Nations Declaration on the Rights of Indigenous Peoples. GeMPaW is committed to addressing the under-representation of First Nations, Métis and Inuit Peoples in Canada’s genomics landscape, data sets and governance to strengthen community-led approaches and uphold principles of Indigenous data sovereignty.</p> <p>To this end, we will align with the Indigenous-led genomic monitoring projects to co-create mechanisms and processes to support the coordination and coherence of pathogen monitoring and link with regional AMR/EP monitoring projects. The C3 Hub will centre Indigenous data governance principles, such as OCAP and CARE.</p>

## 5. PHASED APPROACH

Genome Canada recognizes that it will take time to develop a meaningful and realistic portfolio operation plan because there is a need for varied expertise at different phases of GeMPaW.



Accordingly, it is expected that the C3 Hub will use a phased approach to structure its activities. The core of the portfolio operation plan should include strategies to meaningfully connect the regional AMR/EP monitoring projects. The C3 Hub proposal should consider appropriate activities relevant to the following key phases:

1. **Phase 1: Engagement and development:** the activities required to develop a plan to meaningfully connect and valorize the outputs of the regional AMR/EP monitoring projects.
2. **Phase 2: Implementation:** implementation of the proposed activities.
3. **Phase 3: Sustainability and transition planning:** project hand-off and the formation of downstream partnerships to encourage adoption by end users beyond the project.

These three phases and their outputs are described in greater detail below. Genome Canada and the Genome Centres will use appropriate tracking mechanisms to ensure the appropriate milestones are met.

## **PHASE 1: ENGAGEMENT AND DEVELOPMENT OF THE PORTFOLIO OPERATION PLAN**

During the first phase of the project (approximately 18 months) the C3 Hub will:

- Establish mechanisms and structures to understand the needs of the portfolio of regional AMR/EP monitoring projects. This work will include building awareness and knowledge and coordinating and co-creating work across the portfolio of regional and Indigenous-led water-monitoring projects.
- Develop the technical requirements for GeMPaW, including undertaking needs assessments; develop interoperable data standards for both the genomic and contextual metadata based on established international best practices; and develop standard operating procedures and protocols for sample collection, processing and analysis to ensure that the data are high-quality and equivalent across regions.
- Design a case study research project that will identify implementation best practices and challenges as well as policy opportunities and that will support tools development, scale-up and evaluation methods to ensure initiatives support public health, including planning and decision-making.
- Identify and undertake portfolio-level GE<sup>3</sup>LS research that can inform how GeMPaW can best use data and achieve impact.
- Ensure that First Nations, Métis and Inuit principles of data sovereignty, including OCAP and CARE, are integrated into technical standards and intentionally centre an Indigenous Peoples' perspective and connections throughout.
- Identify and engage key external stakeholders—including end users, policy- and decision-makers, historically excluded communities, and industry—to inform monitoring and drive uptake.

**Expected outputs** at this stage include:

- Evidence of structures in place to coordinate and co-create the work across the portfolio, including mechanisms to link with an Indigenous-led stream of GeMPaW.
- A comprehensive implementation plan that includes a data strategy, an international engagement plan, and a knowledge mobilization and communication strategy.

- A roadmap for genomic data-sharing and integration, including best practices, opportunities and barriers in genomic monitoring of water in Canada.
- Comprehensive standards and harmonization tools and protocols to ensure data can be shared and integrated across regional genomic monitoring projects.
- A framework for minimum metadata standards for the regional AMR/EP monitoring projects.
- Ongoing coordinated meetings and spaces for exchange and discussion between the regional genomic monitoring projects, particularly with regards to data-sharing and knowledge translation.

## **PHASE 2: IMPLEMENTATION OF THE PORTFOLIO OPERATION PLAN**

The C3 Hub will implement the portfolio operation plan once it has been developed and approved (about 1.5 years into the start of the project). The transition from the engagement and development phase to implementation will provide an opportunity to bring new skills and partners on board to align with key activities.

**Expected outputs** at this stage include:

- Evidence that milestones and deliverables are on track, as set out in the portfolio strategy plan.
- Mechanisms to ensure that the data that are generated and analyzed through the genomic monitoring projects are used to inform public health and policy decisions across Canada.
- A plan to ensure sustainability beyond the project, including any necessary revisions to activities and/or budget.

## **PHASE 3: SUSTAINABILITY AND TRANSITION PLANNING**

During the last phase of the project (approximately the final six months), the emphasis will be on developing a sustainability plan to ensure that the outputs of GeMPaW continue to have the desired impacts. This could include cooperating with Genome Canada and other partners to transition the project's leadership, transfer research and innovation to others, and help identify new objectives and funding.

## **6. STAGED APPLICATION PROCESS**

There are three stages involved in the application process.

### **STAGE 1: Individual participation registration**

Individuals interested in participating in a C3 Hub team are invited to submit a registration form and attend a virtual information session. The form will focus on the applicant's interest and relevant expertise. All individual registrations will be shared with other registrants before the virtual information session to support synergies and encourage team-building.

In collaboration with the Genome Centres, Genome Canada will host a virtual information session to facilitate connections, answer questions and support synergies for teams to form and develop cohesive team applications. This information session will have a dual purpose:

to clarify the C3 Hub goals and to provide interested participants with an opportunity to identify themselves and form teams.

**STAGE 2: Team intent to apply**

Following the information session, prospective C3 Hub leaders must indicate (through the corresponding Genome Centres) their intent to apply as a team.

**STAGE 3: Full application**

To be eligible, applications must address the required elements for the C3 Hub—that is, the focus areas, portfolio operation plan, and overall team, finance and management details.

A committee with expertise in the areas of the GeMPaW initiative (i.e., understanding of the national and international challenges associated with genomic monitoring, data standards, sharing and harmonization, One Health principles, knowledge mobilization, and AMR/EP) will review each full application. The review committee will assess the merit of the application(s) and provide strategic advice and recommendations related to the team’s ability to execute the key objectives of the C3 Hub. Full applications must address the review criteria as well as the specific requirements of the C3 Hub.

The review process may be adjusted where warranted by the complexity of the funding opportunity or other relevant factors. Any changes will be communicated promptly through Genome Canada’s website and the Genome Centres.

**7. TIMELINE**

<b>Activity</b>	<b>Deadline</b>
Launch of C3 Hub funding opportunity	April 26, 2023
Application stage 1: C3 Hub individual participation registration deadline	May 30, 2023
C3 Hub information session and introductory meeting	June 1, 2023
Application stage 2: Team Intent to apply deadline	August 2023*
Application stage 3: C3 Hub full application deadline	October 2023*
C3 Hub application review period	November 2023
C3 Hub notice of funding decision	December 2023
C3 Hub strategy and planning meeting	February 2024
C3 Hub flow of funds	April 2024

\* Please check with your regional Genome Centre.





## 8. CONTACTS

Centre	Contact
Genome British Columbia	Alison Dendoff <a href="mailto:adendoff@genomebc.ca">adendoff@genomebc.ca</a>
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## 9. INCLUSION, DIVERSITY, EQUITY AND ACCESSIBILITY (IDEA)

Genome Canada is committed to creating a diverse and inclusive environment and ensuring equitable participation by people who live with diverse visual, motor, auditory, learning and cognitive abilities. We are acting on the evidence that achieving a more equitable, diverse and inclusive Canadian research enterprise is essential to creating the excellent, innovative and impactful research needed to advance knowledge and understanding and respond to local, national and global challenges.

Genome Canada encourages applicants to increase the inclusion and advancement of equity-deserving and under-represented communities in leadership positions to enhance excellence in research and training. Equity-deserving and under-represented groups can include Indigenous Peoples, people of African descent, members of other racialized groups, women, persons with disabilities, members of 2SLGBTQ+ communities, and early-career researchers. Inclusion, diversity, equity and accessibility (IDEA) should be key considerations for team management and composition.

To help Genome Canada better understand the demographics of its applicant pools, address equity gaps as they develop, and assess and maintain its programs and processes, applicants are encouraged to complete a short anonymous questionnaire following their submission. The information collected will not influence the adjudication of any applications.

## 10. INDIGENOUS TRUTH, RECONCILIATION AND ENGAGEMENT

Genome Canada is committed to Indigenous truth, reconciliation and engagement and the right of self-determination as set out in the United Nations Declaration on the Rights of Indigenous Peoples. This commitment is reflected in our support for Indigenous data governance principles that are people- and purpose-oriented and that recognize the crucial role of data in advancing Indigenous innovation and self-determination.

## Appendix 1. C3 Hub evaluation criteria

The C3 Hub team will be selected through a peer-reviewed process that assesses the scientific merit, portfolio operation plan, and alignment of activities in each proposal, based on the following criteria.

CRITERIA	ASSESSMENT
Administration and management	<p><b>Leadership</b></p> <ul style="list-style-type: none"> <li>• The degree to which the C3 Hub lead(s), institution(s) and partners have strong records of past research activities (quality, quantity and value) and resulting outputs and outcomes in disciplines related to genomic monitoring of AMR/EP.</li> <li>• The degree to which the portfolio operation plan is well-defined and outlines engagement with a diverse and inclusive research community.</li> </ul> <p><b>Hub management</b></p> <ul style="list-style-type: none"> <li>• The degree to which the management and decision-making plan is appropriate.</li> </ul> <p><b>Project management</b></p> <ul style="list-style-type: none"> <li>• The degree to which the portfolio operation plan clearly articulates cross-cutting activities.</li> </ul> <p><b>Coordination</b></p> <ul style="list-style-type: none"> <li>• The degree to which operational structures to ensure coordination across the portfolio are developed, including meetings, collaborative file-editing and messaging systems.</li> </ul> <p><b>Regional AMR/EP monitoring project coordination</b></p> <ul style="list-style-type: none"> <li>• The degree to which the portfolio operation plan outlines the approach to establish mechanisms and structures across the portfolio of projects to coordinate work, activities and efforts related to knowledge mobilization and data.</li> </ul> <p><b>Communication</b></p> <ul style="list-style-type: none"> <li>• The degree to which a plan for a website and associated social media presence, as well as other means of communication, is demonstrated.</li> </ul> <p><b>Training and talent development</b></p> <ul style="list-style-type: none"> <li>• The degree to which safeguards to ensure team development and training opportunities are equitably distributed.</li> <li>• The reasonableness of the presented IDEA (inclusion, diversity, equity and accessibility) training plan.</li> </ul>
Technical	<p><b>Harmonization</b></p> <ul style="list-style-type: none"> <li>• The degree to which a robust process is outlined to develop a portfolio operation plan (for knowledge mobilization and data), building on regional AMR/EP monitoring projects to advance outputs.</li> </ul>

CRITERIA	ASSESSMENT
	<p><b>C3 Hub vision</b></p> <ul style="list-style-type: none"> <li>The degree to which the proposed vision is bold and impact-driven, but also achievable, adaptable and appropriate in the context of GeMPaW.</li> </ul> <p><b>Team expertise</b></p> <ul style="list-style-type: none"> <li>The degree to which the team has the right expertise to develop and implement the elements of the portfolio operation plan.</li> </ul> <p><b>Data</b></p> <ul style="list-style-type: none"> <li><b>Vision.</b> The degree to which the proposed data vision is appropriate.</li> <li><b>Merit.</b> The degree to which the proposed data infrastructure is well-described, achievable and appropriate to ensure that GeMPaW will deliver the desired impact.</li> <li><b>Sustainability.</b> The degree to which the proposed vision leverages existing technology platforms and digital partners, such as the VirusSeq Data Portal.</li> <li><b>Interoperability.</b> The degree to which the proposed data infrastructure is standards-based, includes relevant metadata, and is consistent with FAIR, CARE and OCAP principles.</li> <li><b>Data visualization:</b> The degree to which the vision for analyses and tool development will advance GeMPaW’s objectives and genomic monitoring.</li> </ul> <p><b>Case studies</b></p> <ul style="list-style-type: none"> <li>The degree to which case studies should consider the needs of end users in the public sector, including planning, decision-making and responsiveness.</li> <li>The degree to which case studies identify best practices and learnings that can be shared beyond GeMPaW to create impact.</li> <li>The degree to which case studies support an investigation of critical questions at the intersection of genomics and society, that support responsible, ethical, equitable and effective development, uptake and implementation of emerging pathogen and AMR/EP monitoring.</li> </ul> <p><b>Genomics in society (GE<sup>3</sup>LS research)</b></p> <ul style="list-style-type: none"> <li>The degree to which the team will investigate critical questions at the intersection of genomics and society to inform our understanding, strengthen research impact, and bridge gaps between genomics researchers and other partners. This includes supporting the coordination of GE<sup>3</sup>LS research across the regional strategic initiatives. It could include directly addressing gaps or synergies and undertaking portfolio-level GE<sup>3</sup>LS research (such as research, economic analysis and barriers and/or pathways).</li> </ul>
Knowledge mobilization and impact	<b>Gaps and opportunities</b>



CRITERIA	ASSESSMENT
	<ul style="list-style-type: none"> <li>The degree to which a robust process is outlined to identify gaps and opportunities across the portfolio, including GE<sup>3</sup>LS, data and implementation science research.</li> </ul> <p><b>Needs assessment</b></p> <ul style="list-style-type: none"> <li>The degree to which there is a clear plan in place to assess implementation barriers and policy opportunities to ensure successful and inclusive uptake of the regional AMR/EP monitoring projects.</li> </ul> <p><b>Partner engagement and outreach</b></p> <ul style="list-style-type: none"> <li>The degree to which the team has articulated a clear process for engaging and identifying key partners and developing mechanisms for ongoing engagement and outreach to drive inclusive and equitable uptake as well as the overall impact of the portfolio of regional AMR/EP monitoring projects.</li> </ul>
International scale-up	<ul style="list-style-type: none"> <li>The degree to which there is a plan to develop mechanisms to learn from, link with and lead international genomic water-monitoring data standards and policies. This will include prioritizing partners, policies and communities to influence and inform global work and position Canada as a global leader.</li> </ul>
Co-creation and collaboration with Indigenous communities and equity	<p><b>Research design and methodological approach</b></p> <ul style="list-style-type: none"> <li>The extent to which there is a clearly demonstrated understanding of and commitment to IDEA.</li> </ul> <p><b>Team composition and inclusion</b></p> <ul style="list-style-type: none"> <li>The degree to which appropriate safeguards are implemented to ensure IDEA principles and best practices have been considered in portfolio team composition and management.</li> </ul> <p><b>Indigenous engagement</b></p> <ul style="list-style-type: none"> <li>The degree to which considerations for incorporating Indigenous Ecological Knowledge have been incorporated.</li> <li>The extent to which there is a clear commitment to consult and co-create with Indigenous Peoples.</li> <li>The degree to which there is a plan to develop safeguards to ensure that principles for Indigenous data governance are key considerations for data design.</li> </ul>
Finance	<p><b>Finance</b></p> <ul style="list-style-type: none"> <li>The degree to which the budget is appropriate for the proposed activities.</li> <li>The degree to which the proposed co-funding plan is well-documented, eligible and feasible.</li> <li>The degree to which the proposed co-funding (cash and in-kind) is integrated with and directly supports the objectives of the project.</li> </ul>

