

Indigenous Data Sovereignty Data Storage Analysis Project

University of Waterloo

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Overview

The University of Waterloo seeks to develop materials and recommendations in support of meeting its strategic objective: "Collaborate with Indigenous researchers to identify access to and/or design reliable and trustworthy community/local infrastructure that meets Indigenous communities' data sovereignty needs and standards". This report acts as an exploratory foundation for that process.

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We give thanks to all who contributed throughout this project for their time, wisdom, and effort regardless of how much they were able to give. Note there may be other contributors as well who chose not to have their names listed:

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Executive Summary

The objective of this report is to develop materials and recommendations in support of meeting the University of Waterloo Research Data Management Institutional Strategy & Implementation Plan.[1] These materials and recommendations will be used to build out further activities and deliverables to meet the University's commitments to respecting Indigenous data sovereignty, defined as:

> the authority of Indigenous peoples, Nations and communities over their own data, how their data is framed, and how their data is managed. The University of Waterloo respects and recognizes the sovereignty of Indigenous Peoples, Nations, and communities over research data produced by, with, for, and about them. This includes sovereignty over the collection, use, control, access, possession, and sharing of these data.[2]

This may seem like a simple endeavor, however none of the major Canadian research data repositories were created with Indigenous rights, much less Indigenous participation, in mind. Indigenous rights and wellbeing have been an afterthought in the dominant research community.[3] To remedy this situation, we recommend that the university establishes a set of protocols for Waterloo-based data storage options that are owned and operated by the University that align with relevant Indigenous data sovereignty principles:

1. Be FAIR and CARE
2. Evaluate policies, practices, relationships, and data infrastructure for alignment to the CARE Principles via the CARE Data Maturity Model
3. Maintain situational awareness of Indigenous relations and rights
4. Engage in consistent outreach activities with appropriate Indigenous Peoples
5. Improve repository protocols so they are compatible with Indigenous data sovereignty principles
6. Ensure technology development and maintenance is adequately prioritized and resourced
7. Prioritize using software designed to respect Indigenous data sovereignty

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[1] UWaterloo RDM Working Group and Advisory Board, "University of Waterloo RDM Institutional Strategy & Implementation Plan" (Waterloo: University of Waterloo, February 2023), https://uwaterloo.ca/research/resources/research-data-management-institutional-strategy.
[2] Anneliese Eber et al., "Research Guides: Research Data Management: Indigenous Data Sovereignty," accessed April 7, 2025, https://subjectguides.uwaterloo.ca/rdm/indigenous-data-sovereignty.
[3] Rowe, Robyn K., Julie R. Bull, and Jennifer D. Walker, "Indigenous Self-Determination and Data Governance in the Canadian Policy Context," in *Indigenous Data Sovereignty and Policy*, ed. Maggie Walter et al. (London: Routledge, 2020), https://doi.org/10.4324/9780429273957.

Project Context

In 2021, three Canadian federal funding agencies (SSHRC, NSERC, CIHR) released the Tri-Agency Research Data Management Policy.[4] It requires that all institutions receiving funding from these agencies must develop institution-specific Research Data Management Strategies and Implementation Plans by March 2023. This includes a recognition of Indigenous data sovereignty, but does not define what that means. Instead, it recommends that a "distinctions-based approach is needed to ensure that the unique rights, interests and circumstances of the First Nations, Métis and Inuit are acknowledged, affirmed, and implemented."[5]

Respecting Indigenous data sovereignty necessitates understanding the depth of Indigenous sovereignty as a whole. This report takes a distinctions-based approach[6] when considering what some people call "stakeholders". This is because Indigenous Peoples — and the lands, waters, plants, animals, etc. they relate to — have intrinsic rights, not "stakes", that are integral to their unique cultures, identities, traditions, languages, and institutions. The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) defines these rights in further detail including the rights to:

> practise and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts, designs, ceremonies, technologies and visual and performing arts and literature (Article 11.1).
>
> revitalize, use, develop and transmit to future generations their histories, languages, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons (Article 13.1).
>
> maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions (Article 31.1).[7]

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[4] Innovation Government of Canada, "Tri-Agency Research Data Management Policy" (Innovation, Science and Economic Development Canada, March 14, 2021), https://science.gc.ca/site/science/en/interagency-research-funding/policies-and-guidelines/research-data-management/tri-agency-research-data-management-policy.

[5] Government of Canada, "Tri-Agency Research Data Management Policy."

[6] Government of British Columbia, "Distinctions-Based Approach Primer" (Government of British Columbia, December 2023), https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/indigenous-people/aboriginal-peoples-documents/distinctions_based_approach_primer.pdf.

[7] UN General Assembly, "United Nations Declaration on the Rights of Indigenous Peoples : Resolution / Adopted by the General Assembly" (United Nations, 2007), https://social.desa.un.org/issues/indigenous-peoples/united-nations-declaration-on-the-rights-of-indigenous-peoples

Through Section 35 of the Constitution Act, Canada recognizes the rights of First Nations, Inuit, and Métis Peoples, however what this means in practice still needs to be defined. Legislation such as Canada's United Nations Declaration on the Rights of Indigenous Peoples Act[8] continues the process of Reconciliation, however progress is underwhelming.[9] The Truth and Reconciliation Commission calls upon federal, provincial, territorial, municipal governments and the corporate sector to: "adopt the United Nations Declaration on the Rights of Indigenous Peoples as a reconciliation framework and to apply its principles, norms, and standards to corporate policy and core operational activities involving Indigenous peoples and their lands and resources" (CTA 43, 92).[10]

Further, Call for Justice 15.7 from the National Inquiry into Missing and Murdered Indigenous Women and Girls calls on all Canadians to:

> Create time and space for relationships based on respect as human beings, supporting and embracing differences with kindness, love, and respect. Learn about Indigenous principles of relationship specific to those Nations or communities in your local area and work, and put them into practice in all of your relationships with Indigenous Peoples.[11]

For researchers and research institutions, this requires a distinction-based approach to respecting Indigenous rights. This is vital to the Indigenous data sovereignty movement which requires not only an understanding of Indigenous rights as a whole, but the specific rights and responsibilities involved in respecting Indigenous data through research data management plans and procedures.

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[8] Statutes of Canada, "United Nations Declaration on the Rights of Indigenous Peoples Act," S.C. 2021, c. 14 § (2024), https://laws-lois.justice.gc.ca/eng/acts/u-2.2/FullText.html.
[9] Eva Jewell, "A Decade of Disappointment: Reconciliation & the System of a Crown" (Yellowhead Institute, September 30, 2024), https://yellowheadinstitute.org/2024/09/30/a-decade-of-disappointment-reconciliation-the-system-of-a-crown/.
[10] Truth and Reconciliation Commission of Canada, "Truth and Reconciliation Commission of Canada: Calls to Action" (Winnipeg, Manitoba: Truth and Reconciliation Commission of Canada, 2015), https://ehprnh2mwo3.exactdn.com/wp-content/uploads/2021/01/Calls_to_Action_English2.pdf.
[11] National Inquiry into Missing and Murdered Indigenous Women and Girls, *Reclaiming Power and Place: The Final Report of the National Inquiry into Missing and Murdered Indigenous Women and Girls*, vol. 1b (Ottawa, ON, 2019), https://www.mmiwg-ffada.ca/final-report/.

The following Indigenous People's Rights in Data were established by a group of Indigenous researchers and their allies, derived from "Indigenous Peoples inherent rights, as collectives, to govern their Peoples, territories, lifeways, cultures, traditions, and resources and as reaffirmed by UNDRIP and treaties and agreements with nation-states and others."[12]

Indigenous Peoples' Rights in Data

Data For Governance	Governance of Data
Right to self-determination: the ability to organize and control data in relation to a collective identity	**Right to govern:** the right to lead and collaborate in the development and implementation of protocols and in decisions about access to data
Right to reclaim: the right to reclaim, retain, and preserve data, data labels, and data outputs that reflect Indigenous Peoples' identities, cultures, and relationships	**Right to define:** the right to define lifeways of knowing and being including how they are represented in data
Right to possess: the ability to exercise jurisdictional control over the ways that data flow/move/are queried	**Right to privacy:** the protection of collective identities and interests from undue attention, also including the possibility of requesting omission and/or erasure
Right to use: the ability of individuals and collectives to use data for their own purposes	**Right to know:** the ability to track the storage, use, and reuse of the data and who has had access to them
Right to consent: the expression of digital autonomy and the ability to assess risks and accept potential harms	**Right to association:** the recognition of provenance and terms of attribution
Right to refuse: the right to say "no" to certain uses of data	**Right to benefit:** the opportunity to benefit from the use of data and equitable benefit sharing from derivatives of data

Source: Maui Hudson et al., "Indigenous Peoples' Rights in Data: A Contribution toward Indigenous Research Sovereignty," *Frontiers in Research Metrics and Analytics* 8 (May 4, 2023), https://doi.org/10.3389/frma.2023.1173805.

More Indigenous rights, Calls to Action, and Calls for Justice relevant to this project are listed in the appendix and we recommend that everyone involved in the project are familiar with the ones listed above as a minimum. We have also provided a timeline of other contextual documents.

[12] Hudson et al., "Indigenous Peoples' Rights in Data."

> "Indigenous data are data, information, and knowledge, in any format, that impact Indigenous Peoples, nations, and communities at the collective and individual levels; data about their resources and environments, data about them as individuals, and data about them as collectives."[13]

Examples of Indigenous Data

Category	Questions Indigenous Peoples Ask Themselves	Data Sources
Belonging	• Who are we? • Who do we belong to? • What are our roles and responsibilities to each other? • How do we relate to our land and kinship networks? • How do we validate our identities?	Kinship connections, family histories, and genealogical records; community, band or national membership and citizenship records; settler government and administrative records.
Land	• How do we relate to the land? • Who has rights to what and where? • How do we conceptualize boundaries with ourselves and others? • Who takes what from the land and how do we give back?	Treaties, stories, and oral histories; wampum, winter counts, and petroglyphs; geographical and geological information, maps, and GPS coordinates.
Culture, Language, Art, and Technology	• How do our cultures inform the ways we think and speak? • How do our cultures influence our realities and shape the tools and technologies we create?	Teachings, languages, legends, songs, ceremonies, regalia, literature, arts, and carvings; architectures, scientific methodologies, ontologies, epistemologies.
Food	• What do we eat? • What should we eat and why? • How do we harvest ethically? • How do we cook together, feed each other, and intertwine food with ceremony?	Agricultural technologies; cooking techniques, lessons, and recipes; seed banks; oral histories and harvest or hunting locations.
Health, Well-being, and Economics	• How do we support, heal, and cherish each other? • How do we all get what we need to thrive? • How do we leave no one behind?	Teachings, medicines, and healing ceremonies; sports and social activities; trade relations, businesses and entrepreneurships.
Laws, Security, Diplomacy	• How do we know what's just or unjust, acceptable or taboo? • How do we relate to other Peoples? • How do we keep each other safe?	Laws, principles, values, ethics, morals, and mores; alliances, strategies, tactics, and histories; treaties and diplomatic records.
All the things	• What do we mean by "all our relations?" • How do we self-determine our futures without recreating the colonial ideologies we set out to avoid?	Cultural concepts, languages, philosophies, and worldviews; educational and governance systems; literature, speeches, history, and sciences.

Source: Jeff Doctor et al., *#DataBack: Asserting & Supporting Indigenous Data Sovereignty* (Animikii Inc., 2023), https://animikii.com/databack.

[13] Stephanie Russo Carroll et al., "Operationalizing the CARE and FAIR Principles for Indigenous Data Futures," *Scientific Data* 8, no. 1 (April 16, 2021): 108, https://doi.org/10.1038/s41597-021-00892-0.

Indigenous Data Sovereignty Principles

Much like the word "Indigenous" itself, Indigenous data sovereignty (IDSov) is less a definable term and more of a statement of recognition of inherent rights. That is, IDSov affirms the inherent right of Indigenous Peoples to govern the collection, access, analysis, interpretation, management, dissemination, and reuse of data related to them.[14]

Much of the literature on Indigenous data sovereignty has been focused on "governance of data" and "data for governance", but less so on the infrastructure that enables Indigenous digital data. That's not to say that Indigenous data hasn't been digitized, far from it, but the bulk of this process has been "by them, about us", that is, by non-Indigenous people about Indigenous people to satisfy the colonial gaze of Indigeneity. Dr. Maggie Walter calls these 5D data: Difference, Disparity, Disadvantage, Dysfunction and Deprivation.[15] There is no shortage of research data that purports to track Indigenous deficit, decline, decimation, and eventually, disappearance.

But Indigenous Peoples haven't disappeared. "We're still here" is a call-to-action that reminds non-Indigenous researchers not only of their professional obligations to ethical research, but their responsibilities as relative newcomers to land that their science is still relatively unfamiliar with. Indigenous Peoples have been here a very long time, have their own science, their own methodologies,[16] their own data, and, rightfully so, much hesitation about their data being "open" or "free-to-use" by the general, predominantly non-Indigenous public:[17]

> The current movement toward open data and open science does not fully engage with Indigenous Peoples rights and interests. Existing principles within the open data movement (e.g. FAIR: findable, accessible, interoperable, reusable) primarily focus on characteristics of data that will facilitate increased data sharing among entities while ignoring power differentials and historical contexts. The emphasis on greater data sharing alone creates a tension for Indigenous Peoples who are also asserting greater control over the application and use of Indigenous data and Indigenous Knowledge for collective benefit.
>
> This includes the right to create value from Indigenous data in ways that are grounded in Indigenous worldviews and realise opportunities within the knowledge economy. The CARE Principles for Indigenous Data Governance are people and purpose-oriented, reflecting the crucial role of data in advancing Indigenous innovation and self-determination. These principles complement the existing

[14] Tahu Kukutai and John Taylor, eds., *Indigenous Data Sovereignty: Toward an Agenda*, Centre for Aboriginal Economic Policy Research (CAEPR) (Erscheinungsort nicht ermittelbar: ANU Press, 2016).
[15] Maggie Walter, "The Voice of Indigenous Data: Beyond the Markers of Disadvantage," *Griffith Review* (blog), accessed April 8, 2025, https://www.griffithreview.com/articles/voice-indigenous-data-beyond-disadvantage/.
[16] Smith, Linda Tuhiwai, *Decolonizing Methodologies : Research and Indigenous Peoples*, 2nd ed. (London ; New York : New York: Zed Books ; Distributed in the USA exclusively by Palgrave Macmillan, 2013).
[17] Stephanie Russo Carroll et al., "Issues in Open Data - Indigenous Data Sovereignty (2nd Edition)," in *The State of Open Data: New Horizons*, ed. Stephen B Walker and Fernando Perini (Cape Town, Nairobi, and Ottawa: Data for Development Network and International Development Research Centre., 2024), https://www.d4d.net.

> FAIR principles encouraging open and other data movements to consider both people and purpose in their advocacy and pursuits.[18]

The Government of Canada has claimed to set "new directions to support Indigenous research and research training."[19] However, the "proposed capstone program's focus on 'internationally collaborative' and 'mission-driven' research is in direct contradiction with Indigenous research goals like building relationships with First Nations, Métis and Inuit communities and supporting Indigenous research priorities."[20] This raises vital questions such as: who is really in control of Indigenous data; how are these data being collected, stored, analyzed, shared, archived and protected; and whose interests are really being served by Indigenous research "about us", and not "by us"?

> From the vantage point of the colonized, a position from which I write, and choose to privilege, the term 'research' is inextricably linked to European imperialism and colonialism. The word itself, 'research', is probably one of the dirtiest words in the indigenous world's vocabulary. When mentioned in many indigenous contexts, it stirs up silence, it conjures up bad memories, it raises a smile that is knowing and distrustful. It is so powerful that indigenous people even write poetry about research. The ways in which scientific research is implicated in the worst excesses of colonialism remains a powerful remembered history for many of the world's colonized peoples. It is a history that still offends the deepest sense of our humanity.[21]

In 2018, with issues such as this in mind, a group of Indigenous and non-Indigenous researchers from around the world gathered in Gaborone, Botswana to draft the CARE Principles for Indigenous Data Governance, a landmark set of principles meant to augment the commonly adopted FAIR Principles with additional considerations to respecting Indigenous rights. Encouraging open data through the FAIR principles[22] is good practice for some kinds of research, but Indigenous data often requires additional safeguards to ensure that they are held, protected, and controlled by their community. The best way to do this is to #beFAIRandCARE.

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[18] Research Data Alliance International Indigenous Data Sovereignty Interest Group, "CARE Principles for Indigenous Data Governance" (The Global Indigenous Data Alliance, September 2019), https://static1.squarespace.com/static/5d3799de845604000199cd24/t/6397b363b502ff481fce6baf/1670886246948/CARE%2BPrinciples_One%2BPagers%2BFINAL_Oct_17_2019.pdf.

[19] Canada Research Coordinating Committee, "Setting New Directions to Support Indigenous Research and Research Training in Canada" (Government of Canada, December 2019), https://www.canada.ca/en/research-coordinating-committee/priorities/indigenous-research/strategic-plan-2019-2022.html.

[20] Katie Hyslop, "As Canada Modernizes Research Funding, Is It Neglecting Indigenous Priorities?," *The Tyee*, August 8, 2024, https://thetyee.ca/News/2024/08/08/Canada-Research-Funding-Indigenous/.

[21] Smith, Linda Tuhiwai, *Decolonizing Methodologies : Research and Indigenous Peoples*.

[22] Mark D. Wilkinson et al., "The FAIR Guiding Principles for Scientific Data Management and Stewardship," *Scientific Data* 3, no. 1 (March 15, 2016): 160018, https://doi.org/10.1038/sdata.2016.18.

The CARE Principles

CARE Principle	Description
Collective Benefit	Data ecosystems shall be designed and function in ways that enable Indigenous Peoples to derive benefit from the data.
Authority to Control	Indigenous Peoples' rights and interests in Indigenous data must be recognised and their authority to control such data be empowered. Indigenous data governance enables Indigenous Peoples and governing bodies to determine how Indigenous Peoples, as well as Indigenous lands, territories, resources, knowledges and geographical indicators, are represented and identified within data.
Responsibility	Those working with Indigenous data have a responsibility to share how those data are used to support Indigenous Peoples' self-determination and collective benefit. Accountability requires meaningful and openly available evidence of these efforts and the benefits accruing to Indigenous Peoples.
Ethics	Indigenous Peoples' rights and wellbeing should be the primary concern at all stages of the data life cycle and across the data ecosystem.

Source: Research Data Alliance International Indigenous Data Sovereignty Interest Group, "CARE Principles for Indigenous Data Governance" (The Global Indigenous Data Alliance, September 2019), https://static1.squarespace.com/static/5d3799de845604000199cd24/t/6397b363b502ff481fce6baf/1670886246948/CARE%2BPrinciples_One%2BPagers%2BFINAL_Oct_17_2019.pdf.

While the CARE Principles serve as a foundation for respecting Indigenous data sovereignty as a whole, we should also consider the distinctions between First Nations, Inuit, and Métis approaches to data sovereignty noting:

> the federal government's current relationship and imposed responsibility toward First Nations (Indian Act, 1985). Because of this relationship, 'Canada collects and holds a significant amount of information on First Nations people' (FNIGC, 2014, p. 2). This information is regulated by the Access to Information Act (Government of Canada, 1985a), the Privacy Act (Government of Canada, 1985b) and the Library and Archives of Canada Act (2004). Gaps in these policies as they relate to First Nations governance and the full implementation of OCAP® principles lead to unfavorable conditions which limit First Nations' authority over information that is relevant to First Nations individuals and communities (see FNIGC, 2014). While these gaps have been pointed out specifically by the First Nations Information Governance Center as being impediments for the implementation of OCAP®, holes within privacy and information legislation that limit governance and autonomy impact all Indigenous lives and communities.[23]

[23] Rowe, Robyn K., Julie R. Bull, and Jennifer D. Walker, "Indigenous Self-Determination and Data Governance in the Canadian Policy Context," in *Indigenous Data Sovereignty and Policy*, ed. Maggie Walter et al. (London: Routledge, 2020), https://doi.org/10.4324/9780429273957.

First Nations Data Sovereignty

OCAP® is a registered trademark of the First Nations Information Governance Centre (FNIGC)[24]. It was established in 1998 over the need to assert First Nations' agency over First Nations health research. FNIGC's mandate comes from the Assembly of First Nations and is explicitly about respecting First Nation's rights to their data:

OCAP® Principle	Description
Own	Refers to the relationship of First Nations to their cultural knowledge, data, and information. This principle states that a community or group owns information collectively in the same way that an individual owns his or her personal information.
Control	Affirms that First Nations, their communities, and representative bodies are within their rights to seek control over all aspects of research and information management processes that impact them. First Nations control of research can include all stages of a particular research project-from start to finish. The principle extends to the control of resources and review processes, the planning process, management of the information and so on.
Access	Refers to the fact that First Nations must have access to information and data about themselves and their communities regardless of where it is held. The principle of access also refers to the right of First Nations' communities and organizations to manage and make decisions regarding access to their collective information. This may be achieved, in practice, through standardized, formal protocols.
Possess	While ownership identifies the relationship between a people and their information in principle, possession or stewardship is more concrete: it refers to the physical control of data. Possession is the mechanism by which ownership can be asserted and protected.

Source: First Nations Information Governance Centre, "The First Nations Principles of OCAP®," The First Nations Information Governance Centre, 2025, https://fnigc.ca/ocap-training/.

Applying these principles is easier said than done. Collective ownership, control, access, and possession presupposes effective, democratic governance and a strong mandate of those delegated to represent the interests of the First Nation. Assuming that a band council is the legitimate authority in a community can be problematic depending on the circumstances. Not all band councils have the mandate of those they claim to represent,[25] and researchers must carefully consider who they believe has legitimate authority to determine what research protocols are appropriate. In some cases, this may necessitate acknowledging a political allegiance of sorts that many non-Indigenous researchers are hesitant to do under the guise of maintaining "objectivity".[26] Indigenous researchers, at least ethical ones, don't have that luxury.[27]

[24] First Nations Information Governance Centre, "The First Nations Principles of OCAP®."
[25] Jeff Doctor and Jen Polack, "The Data Pandemic, Zombie Voters and First Nation Governance" (Yellowhead Institute, November 19, 2019), https://yellowheadinstitute.org/2019/11/19/data-pandemic-zombie-voters-fn-governance/.
[26] Ashley Hayward et al., "A New Era of Indigenous Research: Community-Based Indigenous Research Ethics Protocols in Canada," *Journal of Empirical Research on Human Research Ethics* 16, no. 4 (October 2021): 403–17, https://doi.org/10.1177/15562646211023705.
[27] Smith, Linda Tuhiwai, *Decolonizing Methodologies : Research and Indigenous Peoples*.

FNIGC, as owners of the OCAP® trademark themselves, have a limited governance mandate as their authority stems from the Assembly of First Nations (AFN). The AFN, itself a controversial institution, is not actually a governing body but an "advocacy organization".[28] The vast majority of FNIGC's operations are funded by the Canadian federal government[29] who maintain a long tradition of going back on their funding promises.[30] While the FNIGC is seeking alternative revenue sources, their strategic plan hasn't been updated since 2020 which may indicate limited success in this regard.[31] Regardless, the BC Regional Information Governance Centre (RIGC) who were involved in the creation of this plan have been moving ahead providing leadership they hope other regions will follow.[32]

Inuit Data Sovereignty

As with other Indigenous Peoples, respecting Inuit self-determination is critical to research involving Inuit and their vast lands. While Canada claims the arctic as its own, researchers need to bear in mind that research involving Inuit "has largely functioned as a tool of colonialism, with the earliest scientific forays into Inuit Nunangat serving as precursors for the expansion of Canadian sovereignty and the dehumanization of Inuit."[33] Like First Nations, Inuit relations to land, water, and ice are not restricted to the boundaries imposed by colonial borders. However, the National Inuit Strategy on Research identified five priority areas of national Inuit strategy on research that aligns with respectful and beneficial research for all Inuit:

1. Advance Inuit governance in research
2. Enhance the ethical conduct of research
3. Align funding with Inuit research priorities
4. Ensure Inuit access, ownership, and control over data and information
5. Build capacity for Inuit Nunangat research[34]

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[28] Christopher Read, "Inside the Band Office: The History of First Nations Governance," *APTN News*, June 14, 2024, https://www.aptnnews.ca/investigates/some-assembly-required-first-nations-governance-from-the-haudenosaunee-to-the-afn/.
[29] The First Nations Information Governance Centre, "2023-2024 Annual Report to Members" (Ottawa: The First Nations Information Governance Centre, 2024), https://fnigc.ca/wp-content/uploads/2024/10/FNIGC-24-Annual-Report-EN-v15.pdf.
[30] Laura Arndt, "Re: Funding for Missing Children & Unmarked Burials Investigations," April 7, 2025, https://survivorssecretariat.ca/wp-content/uploads/2025/04/Open-Letter-to-Federal-Party-Leaders.pdf.
[31] First Nations Information Governance Centre, *A First Nations Data Governance Strategy* (Akwesasne: First Nations Information Governance Centre, 2020), https://fnigc.ca/wp-content/uploads/2020/09/FNIGC_FNDGS_report_EN_FINAL.pdf.
[32] BC Regional Information Governance Centre, "BC First Nations Regional Information Governance Centre (RIGC)," BC First Nations Regional Information Governance Centre (RIGC), accessed April 28, 2025, https://www.bcfndgi.com.
[33] Inuit Tapiriit Kanatami, *National Inuit Strategy on Research* (Ottawa, ON: Inuit Tapiriit Kanatami, 2018), https://www.itk.ca/wp-content/uploads/2020/10/ITK-National-Inuit-Strategy-on-Research.pdf.
[34] Inuit Tapiriit Kanatami, *National Inuit Strategy on Research*.

To support these efforts, the National Inuit Strategy on Research provides a series of recommendations that support partnership between Inuit and the wider research community in the four research licensing regions in Inuit Nunagat: Inuvialuit Settlement Region (ISR), Nunavut, Nunavik, and Nunatsiavut. Each have different requirements while the Inuit Tapiriit Kanatami:

> coordinates committees that utilize research and advance Inuit research priorities... As far as Inuit are concerned, more work is needed to develop processes, protocols, standards, and agreements that allow for the safe sharing [of] certain information and for the respectful incorporation of Inuit knowledge in data management and sharing design and implementation. It is important to ensure that Inuit have governance frameworks and policies that will support our data initiatives in ongoing, sustainable, self-determined ways.[35]

Where we need to go: Supporting Inuit Self-Determination in Research

X Stakeholders	→	✓ Rights holders
X Inequity	→	✓ Equity
X Invisible	→	✓ Visible
X Lack of Control	→	✓ Control
X Reactive	→	✓ Proactive
X Racism	→	✓ Respect
X Paternalism	→	✓ Agency
X Extraction	→	✓ Investment
X Exclusion	→	✓ Inclusion
X Frontier	→	✓ Homeland
X Competitive	→	✓ Collaborative

Source: Inuit Tapiriit Kanatami, *National Inuit Strategy on Research* (Ottawa, ON: Inuit Tapiriit Kanatami, 2018), https://www.itk.ca/wp-content/uploads/2020/10/ITK-National-Inuit-Strategy-on-Research.pdf.

Métis Data Sovereignty

Much of the high level principles that apply to First Nations and Inuit data sovereignty can also be considered for Métis, however their specific historical and cultural context must be taken into account. That alone is a major challenge given the governance challenges that Métis face as a whole.[36] Addressing this is beyond the scope of this report which does not seek to define who is or isn't Métis,[37] thus which data are "Métis data". Regardless, we can speak to the principles that some Métis organizations have identified as important to respecting their data sovereignty:

> The first Métis specific research engagement guide, the Principles of Métis Ethical Research, was developed by the Métis Centre of the now defunded National Aboriginal Health Organization (NAHO)

[35] Inuit Tapiriit Kanatami, *National Inuit Strategy on Research*.
[36] Brett Forester, "Métis Nation of Ontario Claims Vindication While Critics Dismiss Long-Awaited Report on Communities," *CBC News*, April 10, 2025, https://www.cbc.ca/news/indigenous/metis-nation-ontario-panel-report-1.7506119.
[37] Jean Teillet, "Indigenous Identity Fraud: A Report for the University of Saskatchewan" (University of Saskatchewan, October 17, 2022), https://leadership.usask.ca/documents/about/reporting/jean-teillet-report.pdf.

in 2010 during a Think Tank with Métis researchers, students and organizations. The principles were designed for internal use at the Métis Centre, but were also designed to be utilized by researchers engaging in research with Métis communities.[38]

These principles were a good starting point but at the time they were developed Indigenous data governance was not a concept as discussed as it is today.[39] To develop these principles further, the Métis National Council authored a report on National Métis Health Data Strategy & Principles which included the following Métis specific data governance protocol created by Drs. Caroline Tait and Robert Henry in partnership with the Métis Nation Saskatchewan (MN-S) but applicable to other Métis rights holders:

Saskatchewan Métis Health Research and Data Governance Principles©	
Reciprocal relationships	Focuses on building reciprocal relationships through meaningful and authentic engagement of research partners. Relationships can be generated by Métis individuals, communities, or organizations, or by researchers, a research team, or other rightsholders.
Respect	Highlights respect for individual and collective autonomy, identity, personal values, gender, confidentiality, practices, and protocols across research and knowledge mobilization processes.
Safe and inclusive environments	Requires assurance of cultural safety and inclusiveness of diverse Métis voices and perspectives (e.g., Elders, youth, all gender and sexual identities, diverse geographical regions) across the work of the research partnerships, and all geographical and social contexts. Inclusion of Michif or other Indigenous languages, where culturally appropriate, such as Cree, Dene, or Anishinaabeg as well as cultural concepts and ceremonies only if, and when the appropriate local people decide to include ceremony, reinforces cultural safety, and strengthens every stage of the research and knowledge mobilization processes and outcomes. Outside researchers and institutions must position their teams to be guided by the appropriate provincial, regional or local community people in a collective process of creating safe and inclusive research relationships and environments that are based upon respect, reciprocity, and relevance to the community.
Diversity	Extends the idea of safe and inclusive environments, as it recognizes the diversity of Métis perspectives and lived experiences that can influence the design of a research relationship and its process. References by outsiders to "the Métis" can mask the vast diversity of identities, lifestyles, cultural beliefs, and practices of Métis people within local, regional, and national contexts.
Research ethics	Refers directly to the ethical purpose of a research project and the processes that are followed. The principle gives direction to researchers that any research undertaken with Métis people must be relevant to those people, requiring community partners to identify research they deem to be important, have input into the design of the project, and participate in the project's activities at all stages of the research. Research must be beneficial and accountable to the community and acknowledge and protect Métis cultural knowledge and sovereignty.
Métis context	Requires researchers to be familiar with the history of Métis people, specifically the local history of the community/organization they are conducting research with. As with other Indigenous peoples, Métis people have diverse generational histories.

Source: Chelsea Gabel and Robert Henry, "National Métis Health Data Strategy & Principles" (Métis National Council, March 2024), https://macsphere.mcmaster.ca/bitstream/11375/30688/2/MNC_Final_Draft_Report_March_2024.pdf.

[38] Gabel and Henry, "National Métis Health Data Strategy & Principles."
[39] Indigenous Peoples have always been successfully governing their data but they have not used these terms until relatively recently

Discussion

This brief overview of Indigenous data sovereignty serves as a simplified look at what a distinctions-based approach could involve when addressing issues of Indigenous data sovereignty. It's best to think of Indigenous data ***sovereignties***, accounted for in an inherent set of rights and responsibilities to all Indigenous Peoples who face ongoing colonization. What this means in practice must account for *specific* historic and contemporary issues, *specific* spiritual and scientific practices, and *specific* cultural, social, legal, and political contexts of *specific* Indigenous Peoples themselves. **This makes it impossible to create a one-sized-fits-all approach to analyzing practical issues such as those involving data storage and data repositories.**

That said, to meet the scope of the University of Waterloo's Strategic Objective 6.a.ii. "Collaborate with Indigenous researchers to identify access to and/or design reliable and trustworthy community/local infrastructure that meets Indigenous communities' data sovereignty needs and standards" this report will have to attempt a generic analysis that requires further work to identify *specific* Indigenous communities' data sovereignty needs and standards.

For example, with the Indigenous communities mentioned above, the Government of Canada's Indigenous Services Canada (ISC) and Crown Indigenous Relations and Northern Affairs Canada (CIRNAC), recognizes 619 First Nations[40], or "Bands" as defined within the Indian Act.[41] Inuit Nunangat includes "40% of Canada's land area and 72% of its coastline"[42] comprises 4 regions: Inuvialuit (Northwest Territories and Yukon), Nunavik (Northern Quebec), Nunatsiavut (Labrador), and Nunavut.[43] The Government of Canada also provides funding to representative Métis organizations including: "Métis National Council, Métis Nation of Alberta, Manitoba Métis Federation, Métis Nation of Saskatchewan, Métis Nation British Columbia, Métis Nation of Ontario, Congress of Aboriginal Peoples [who claim to represent interests of Métis, status and Non-status Indians, and Southern Inuit Indigenous People living off-reserve in Canada][44]."[45]

The "Indigenous Peoples of Canada" includes an incredibly diverse range of people, Peoples, and territories, and that's just those recognized by Canada.[46] Not all Indigenous Peoples here consider themselves "Canadian", and not all Indigenous governance is respected by Canada.[47]

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[40] Crown-Indigenous Relations and Northern Affairs Canada, "First Nation Profiles," fact sheet; resource list, Welcome to First Nation Profiles, March 18, 2025, https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Index.aspx?lang=eng.
[41] Statutes of Canada, "Indian Act," R.S.C., 1985, c. I-5 § (2019), https://laws-lois.justice.gc.ca/eng/acts/I-5/.
[42] Inuit Tapiriit Kanatami, "About Canadian Inuit," Inuit Tapiriit Kanatami, 2025, https://www.itk.ca/about-canadian-inuit/.
[43] Crown-Indigenous Relations and Northern Affairs Canada, "Inuit," administrative page; resource list, February 27, 2025, https://www.rcaanc-cirnac.gc.ca/eng/1100100014187/1534785248701.
[44] Congress of Aboriginal Peoples, "About Us," Congress of Aboriginal Peoples, 2025, https://abo-peoples.org/homepage/about-congress-of-aboriginal-peoples/.
[45] Crown-Indigenous Relations and Northern Affairs Canada, "Métis," administrative page; fact sheet; resource list, January 16, 2024, https://www.rcaanc-cirnac.gc.ca/eng/1100100014427/1535467913043.
[46] The Royal Canadian Geographical Society/Canadian Geographic, *Indigenous Peoples Atlas of Canada* (Canadian Geographic, 2018), https://indigenouspeoplesatlasofcanada.ca/.
[47] Rick Montour, *We Share Our Matters: Two Centuries of Writing and Resistance at Six Nations of the Grand River* (University of Manitoba Press, 2014), https://uofmpress.ca/books/we-share-our-matters.

Further, many Indigenous people who come from all over the world[48] reside in Canada, many have citizenship and rights as Canadians.

There are over six hundred individual Indigenous communities across so-called Canada[49] representing more than fifty different Indigenous nations. Each has their own unique history, culture, values, goals, politics, and legal structures as well as needs, challenges, resources, and goals. In other words, there is no singular approach to analyzing software suitability and feasibility to respect Indigenous data sovereignty because each Indigenous context is different. This means that any software that supports Indigenous data sovereignty needs to be both replicable enough to benefit from economies of scale and modular enough to account for sometimes paradoxical, community-defined data. So how can software that supports Indigenous data sovereignty be developed with a mind towards avoiding not only a pan-Indigenous approach to identity but also a pan-Indigenous approach to technology?

The strengths of the OCAP® principles are embodied by four simple questions that anyone considering data sovereignty in general can ask:

- Who **owns** the data?
- Who **controls** the data?
- Who **accesses** the data?
- Who **possesses** the data?

If the answers to these questions aren't the nation or Peoples that the data are about or from, that nation's sovereignty might be disrespected.[50] Given the US's threats to annex Canada,[51] these questions are top of mind of many researchers, albeit they are concerned about *Canadian* data. So why can't we think about this in terms of Canada's ownership, control, access, and possession of *Indigenous* data? As Ray Taken Alive says: "No matter how it was collected, where it was collected, when it was collected, our language belongs to us. Our stories belong to us. Our songs belong to us."[52] To avoid being a mere box-ticking exercise, it is with this understanding of the complexity and nuance of Indigenous data sovereignty as a whole that this report begins its analysis.

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[48] Dwayne Mamo et al., eds., *The Indigenous World 2025*, n.d., https://iwgia.org/en/resources/indigenous-world.
[49] Crown-Indigenous Relations and Northern Affairs Canada, "Indigenous Peoples and Communities," administrative page; fact sheet; resource list, June 13, 2024, https://www.rcaanc-cirnac.gc.ca/eng/1100100013785/1529102490303.
[50] Evan Dyer, "The U.S. Has Covertly Destabilized Nations. With Canada, It's Being Done in Public," *CBC News*, March 12, 2025, https://www.cbc.ca/news/politics/trump-annexation-destabilizing-canada-1.7479890.
[51] Mark Gollom, "Trump Implies Canadians Vote for Him on Election Day, Poilievre Tells President to Butt Out," *CBC News*, April 28, 2025, https://www.cbc.ca/news/politics/donald-trump-election-canada-truth-social-1.7520212.
[52] Graham Lee Brewer, "Lakota Elders Helped a White Man Preserve Their Language. Then He Tried to Sell It Back to Them.," *NBC News*, June 3, 2022, https://www.nbcnews.com/news/us-news/native-american-language-preservation-rcna31396.

Item 1: Review and Analysis of Current Data Storage/Data Repository Options at UWaterloo from an Indigenous Data Sovereignty Lens

Digital technologies are encoded with the perspectives and biases of those who create them, and the rights of those affected by these technologies are not always considered in this process. This is why a socio-technical analysis is required when determining data storage options that support Indigenous data sovereignty.

Library Supported Services

University of Waterloo (UWaterloo) Library supports their researchers with two large research repositories, Borealis,[53] and the Federated Research Data Repository (FRDR).[54] Within Borealis is the University of Waterloo Dataverse Collection,[55] named as such as Borealis is based on the Dataverse Project[56], "an open-source data repository application developed by the Institute for Quantitative Social Science at Harvard University, with international contributors."[57] The UWaterloo dataverse collection is managed locally by the UWaterloo library. FRDR is managed by the Digital Research Alliance of Canada,[58] and it is not open-source software, but it does have a github repository.[59]

Earth Science Data Repositories: Implementing the CARE Principles[60] provides a starting point for analysis to understand the strengths and weaknesses of the two major Canadian research data repositories. Note this analysis was limited to Indigenous data sovereignty as a whole, but could be applied to the specific Indigenous Peoples that UWaterloo researchers are working with. Further, analysis was limited to publicly available software documentation. Little, if any, research was found in scientific journals that explored Indigenous data sovereignty in relation to these specific repositories so this report suggests further study in that regard, especially in relation to sensitive Indigenous data that should not be in the public domain.

In 2017, usability researcher Derek Murphy and Product Research Specialist Julian Gautier conducted a review of various data repositories to help support Dataverse Project development.

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[53] Borealis, "About," Borealis: The Canadian Dataverse Repository, May 19, 2024, https://borealisdata.ca/about/.
[54] Federated Research Data Repository, "Our Mission," FRDR, 2025, https://www.frdr-dfdr.ca/docs/en/our_mission/.
[55] University of Waterloo, "University of Waterloo Dataverse Collection," 2025, https://borealisdata.ca/dataverse/waterloo.
[56] The Dataverse Project, "Open Source Research Data Repository Software," The Dataverse Project, March 21, 2025, https://dataverse.org/home.
[57] Anneliese Eber et al., "Research Guides: Research Data Management: Data Deposit," accessed April 29, 2025, https://subjectguides.uwaterloo.ca/rdm/datadeposit.
[58] Digital Research Alliance of Canada, "The Alliance," Digital Research Alliance of Canada, 2024, https://alliancecan.ca/en/about/alliance.
[59] Federated Research Data Repository, "FRDR," GitHub, 2025, https://github.com/frdr-dfdr.
[60] Margaret O'Brien et al., "Earth Science Data Repositories: Implementing the CARE Principles," *Data Science Journal* 23, no. 1 (July 3, 2024), https://doi.org/10.5334/dsj-2024-037.

Their analysis was based on information that was publicly available at the time. It is of limited use here being that it has not been updated for over 7 years (outdated in software terms), however it helps provide some categories for comparison that this report updates to include Indigenous data concerns:

Strengths and Weaknesses in Regards to Indigenous Data Sovereignty

Category	Strengths	Weaknesses
Business Model	• Free to deposit and view • Open-source software • Developed and supported by non-profits • Diversity of funding sources	• Fees • Closed software • Developed, supported, and sold for-profits company • Risk of defunding
Governance	• Indigenous governance, collaboration, or involvement • Publicly available software development plans	• No Indigenous governance, collaboration, or involvement • No software development plans
Hosting	• Self-hosting available • Hosted within Canada • Choice of cloud provider	• Only cloud hosted • Hosted outside of Canada • Only hosted on Big Tech servers
File Upload & Handling	• Ability to embargo files	• No ability to embargo files
Account & User Info	• Flexible permissions and workspaces	• Limited permissions and workspaces
Metadata	• Support Traditional Knowledge and biocultural labels • Allows for Indigenous data provenance • Support for controlled vocabulary terms with URLs	• No support for Local Context Labels • Does not allow for Indigenous data provenance • Automatically generated URLs cannot be changed
Terms & Licensing	• Users have to actively acknowledge conditions of use when downloading data • Terms of use and copyright • Ability for communities and individuals to withdraw consent	• Anyone can download data without any acknowledgement of conditions • Only used for open data (maximum reuse) • Data are open for everyone to be accessed indefinitely
Preservation	• Designed for long-term preservation	• No public data preservation plans or strategies

Adapted from: Derek Murphy and Julian Gautier, "A Comparative Review of Various Data Repositories," *A Comparative Review of Various Data Repositories* (blog), July 25, 2017, https://dataverse.org/blog/comparative-review-various-data-repositories.

Borealis (Dataverse)

Dataverse is a well-documented, feature-rich, transparent and collaborative international project led by the Institute for Quantitative Social Science (IQSS) based out of Harvard, Cambridge MA, USA.[61] It has an "institutional impartiality" policy, seeking to "solve society's greatest challenges by helping to create, preserve, and disseminate social science knowledge."[62] However, given Harvard's historic role in promoting scientific racism[63] and withholding of Indigenous ancestors,[64] these statements must be taken at face value given the current political environment of the United States[65] and Harvard's apparent willingness[66] to "concede ground as DEI initiatives face a tidal wave of political hostility."[67]

That said, Dataverse software is open-source and Harvard's role is more of core software development rather than policy development. The spinoff instance that UWaterloo uses, Borealis, is "a shared service provided in partnership with Canadian regional academic library consortia, institutions, research organizations, and the Digital Research Alliance of Canada, with technical infrastructure hosted by Scholars Portal and the University of Toronto Libraries."[68]

Strengths

Dataverse Project is working with Local Contexts to ensure compatibility with their Notices[69] and Traditional Knowledge Labels.[70] We are unsure of the current status of this collaboration as they are listed as "Integration Partner Early Adopters"[71]. Local Contexts itself is relatively new, starting as a project in 2010 to meet the "needs of Indigenous and local organizations who wanted a practical method to deal with the range of intellectual property issues that arise in relation to managing cultural heritage materials."[72] In 2019, they started developing the Local Contexts Hub to work with existing information and collections management systems and tools to

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[61] The Institute for Quantitative Social Science, "Institute for Quantitative Social Science," 2025, https://www.iq.harvard.edu/about.
[62] The Institute for Quantitative Social Science, "Institutional Impartiality," 2025, https://www.iq.harvard.edu/institutional-impartiality.
[63] Mary Hudetz and Ash Ngu, "Tribes in Maine Spent Decades Fighting to Rebury Ancestral Remains. Harvard Resisted Them at Nearly Every Turn.," *ProPublica*, December 4, 2023, https://www.propublica.org/article/inside-wabanaki-tribes-struggle-to-reclaim-ancestral-remains-from-harvard.
[64] Ellie S. Klibaner-Schiff and Jade Lozada, "The Painful Progress of Native American Repatriation," *The Harvard Crimson*, March 2, 2024, https://www.thecrimson.com/article/2024/3/2/nagpra-scrut/.
[65] Thomson Reuters, "Trump Administration Probes Harvard University and Its Law Review," *CBC News*, April 29, 2025, https://www.cbc.ca/news/world/trump-administration-harvard-law-review-1.7521003.
[66] Cam N. Srivastava, "Harvard Will Not Fund Affinity Group Graduation Celebrations Following Ed Department Warning," *The Harvard Crimson*, April 29, 2025, https://www.thecrimson.com/article/2025/4/29/affinity-funding-cut/.
[67] Dhruv T. Patel, "Harvard Renames Diversity Office As Trump Demands Dismantling of DEI," *The Harvard Crimson*, April 29, 2025, https://www.thecrimson.com/article/2025/4/29/harvard-oedib-renamed/.
[68] Digital Research Alliance of Canada, "Digital Research Alliance of Canada 2025–2026 Corporate Plan" (Digital Research Alliance of Canada, 2025), https://alliancecan.ca/sites/default/files/2025-02/Corporate%20Plan%202025-26.pdf.
[69] Local Contexts, "Notices," 2025, https://localcontexts.org/notices/about-the-notices/.
[70] Local Contexts, "TK Labels," 2025, https://localcontexts.org/labels/traditional-knowledge-labels/.
[71] Local Contexts, "Integration Partners," 2025, https://localcontexts.org/hub-agreements/integration-partners/.
[72] Local Contexts, "About Local Contexts and the Hub," 2025, https://localcontexts.org/mi/about/.

generate labels and notices with permanent identifiers to "enhance and legitimize locally based decision-making and Indigenous governance frameworks for determining ownership, access, and culturally appropriate conditions for sharing historical, contemporary, and future collections of cultural heritage and Indigenous data."[73]

Another strength is that the Dataverse Project is an open-source research data repository software.[74] This provides transparency and accountability required to ensure UNDRIP article 31 is met.[75] Borealis datasets "are stored on Canadian servers at the University of Toronto Libraries with storage on the Ontario Library Research Cloud, a private, geographically-distributed cloud storage network built with partner universities."[76] While this may not necessarily meet the **Possession** part of OCAP®, the infrastructure required to meet that principle doesn't often exist on reserve or in other Indigenous territories. Ideally, Indigenous data should be stored by Indigenous people on Indigenous land, but that requires a massive talent and infrastructure investment unlikely to occur any time soon.

Data security, reliability, and longevity are key concerns of Borealis, and the benefit of using this network of partner universities is that the data may not be in the direct **Possession** of Indigenous Peoples, but they may be relatively "safe". Borealis has a data preservation plan,[77] however it does not mention Indigenous Peoples or their data.

Borealis datasets are "automatically assigned a Digital Object Identifier (DOI) provided by DataCite Canada to allow research data to be accessible and citable."[78] They are discoverable and **Accessible** through "tools such as Lunaris, Canada's national research data discovery service, and Google Dataset Search."[79] That said, Indigenous people would need to know what to look for as the metadata does not currently list which specific Indigenous Peoples relate to the dataset. Perhaps further integration with Local Contexts could help in this regard, but that is yet to be seen and would require much work to update existing datasets with the necessary metadata.

For example, this dataset[80] is rather explicitly Indigenous data, however none of the current citation metadata categories list the specific Indigenous Peoples that the data are about. They can be found in a search using the word "Indigenous", but not Mohawk Nation or Kanien'kehá:ka as those terms are not in the metadata. Yet the research itself is part of a larger project, Tiohtià:ke,[81] that can be found because those terms are in the titles of the research. At a minimum, to meet

[73] Local Contexts, "About Local Contexts and the Hub."
[74] Dataverse, "IQSS/Dataverse: Open Source Research Data Repository Software," GitHub, 2025, https://github.com/IQSS/dataverse.
[75] UN General Assembly, "United Nations Declaration on the Rights of Indigenous Peoples."
[76] Borealis, "About."
[77] Borealis, "Borealis Preservation Plan," June 23, 2022, https://borealisdata.ca/preservationplan/.
[78] Borealis, "Store, Share, Publish and Discover Research Data!," 2025, https://borealisdata.ca.
[79] Borealis, "Store, Share, Publish and Discover Research Data!"
[80] Pointe-à-Callière, "Tiohtià:Ke - Une Histoire Autochtone de Montréal / Tiohtià:Ke - An Indigenous History of Montreal" (Borealis, November 6, 2024), https://doi.org/10.5683/SP3/H0NTFY.
[81] Pointe-à-Callière, "Tiohtià:Ke Project - English Version" (Borealis, November 6, 2024), https://doi.org/10.5683/SP3/UKK6PG.

Indigenous data sovereignty provenance requirements these details should be in the metadata under expanded categories than what exists now. They can still be "found", but only if the user knows enough about the project to try different search keywords.

Another form of accessibility is the WCAG 2.0 AA Standards which are met by Borealis. While these are not exactly what is meant by OCAP®'s **Access**, it's worth noting that Indigenous people have disabilities just like anyone else, however research is severely limited in that regard.[82]

Weaknesses

As mentioned above, when this repository was first created, it's unlikely that Indigenous Peoples specific metadata needs were kept in mind. There are no categories that recognize Indigenous ownership rights. There are categories for "author" and "depositor", but not collective forms of ownership that may contain nested relations such as: family, clan, community, nation, titleholder, or any form of collective rights beyond "entity, such as a person or organization".

By flattening OCAP®'s **Ownership** to individuals or organizations alone, this limits how data are effectively **Controlled** within Indigenous legal contexts that may specify the need for nested rights and responsibilities rooted in relationships with humans, more than humans, the land, and time itself.[83] For example, in some Indigenous knowledge systems stories (data) can only be shared during certain times, certain ceremonies, and with certain people.[84] Missing is the granular level of metadata and data provenance required to ensure "Collective Benefit, Authority to Control, Responsibility, and Ethics" (CARE)[85] required by some forms of Indigenous data. That does not mean that *no* Indigenous data can be on this repository, far from it, but this *is* a structural and technical limitation.

Another weakness of Borealis (and likely all major research repositories) is the lack of Indigenous participation in its governance. While the governance protocols are public, there is no mention of Indigenous participation. The Digital Research Alliance of Canada, which supports Borealis, has "developed an Indigenous data sovereignty funding call… [and a] First Nations Information Governance Centre (FNIGC)-led project is in progress",[86] however specific details could not be found.

Indigenous data is not mentioned in Borealis Terms of Use, instead there is a section on sensitive and confidential data that states:

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[82] Youssef Hachouch et al., "Barriers to Accessibility Related to Internet Use: Findings from the 2022 Canadian Survey on Disability," Reports on Disability and Accessibility in Canada (Statistics Canada, March 24, 2025), https://www150.statcan.gc.ca/n1/pub/89-654-x/89-654-x2025004-eng.htm.
[83] Alexandra S. Drawson, Elaine Toombs, and Christopher J. Mushquash, "Indigenous Research Methods: A Systematic Review," *International Indigenous Policy Journal* 8, no. 2 (2017): 1–25.
[84] Christian Isbister, "Challenges in Indigenous Archiving," *News.Library.Ualberta.Ca* (blog), June 22, 2021, https://news.library.ualberta.ca/blog/2021/06/22/indigenous-history-month-challenges-in-indigenous-archiving/.
[85] Research Data Alliance International Indigenous Data Sovereignty Interest Group, "CARE Principles for Indigenous Data Governance."
[86] Digital Research Alliance of Canada, "Digital Research Alliance of Canada 2025–2026 Corporate Plan."

> By using the Service, you confirm that all your Content does not contain information that could directly or indirectly identify a subject, except where the release of such identifying information has no potential for constituting an unwarranted invasion of privacy and/or breach of confidentiality. You further confirm that all personally-identifiable information in your Content has at least one of the following conditions:
>
> - The information has been previously released to the public.
> - The information describes public figures, where it relates to their public roles and other non-sensitive subjects.
> - A sufficient length of time has passed since the collection of the information so that it can be considered historic.
> - All identified subjects have given explicit informed consent allowing the public release of their information.
> - All information was collected with an explicit statement concerning its public nature, such as information collected for governmental regulatory purposes.
> - For federal records (i.e., Content created by a Canadian federal government agency or under a federal contract) only, all identified subjects are deceased and no federal statute explicitly restricts the release of that information.[87]

It's obvious these terms were not created with Indigenous Peoples, much less the history of colonization itself, in mind. Much personally-identifiable Indigenous data is in the public domain without respect for Indigenous rights, especially those classified (by Canada) as "historic". While there is a note requiring explicit informed consent, there isn't anything about Free or Prior consent specified in UNDRIP that accounts for the inherently coercive nature of colonization, and the power imbalance between Indigenous subject and non-Indigenous researcher.[88]

Further, the section on "permission for data reuse and long-term preservation" states that "by depositing or uploading Content via the Service, you grant the Service Provider and Participating Institutions a worldwide, non-exclusive, royalty-free, and transferable license to use, reproduce, distribute, prepare derivative works of, display, and perform the Content in connection with this Service."[89] While that may be acceptable for some forms of Indigenous data, it is certainly not for all. Borealis is also limited to 5 GigaBytes of individual file sizes. This may be a limitation when dealing with Indigenous data such as video and audio, GIS, or ground penetrating radar.

In 2018, Western University Libraries conducted an Indigenous Collections Metadata Inventory. Their recommendations are worth noting in full:

- Acknowledging the structural biases and inadequacies in existing schemes of knowledge organization and information retrieval arising from colonialism;
- Adopting an ethic based upon the commitment to integrating Indigenous and Western knowledges into access, arrangement, description, classification, and cataloguing praxis;

[87] Borealis, "Borealis Terms of Use," June 23, 2022, https://borealisdata.ca/termsofuse/.
[88] Smith, Linda Tuhiwai, *Decolonizing Methodologies : Research and Indigenous Peoples*.
[89] Borealis, "Borealis Terms of Use."

- Engaging with their user communities, particularly Indigenous communities, in integrating regionally-relevant Indigenous knowledges into their cataloguing practice, arrangement, description, etc. including descriptive metadata;
- "Respect: Recognizing the complex and diverse nature of Indigenous Knowledge systems and languages, and the need to foster congruence between Indigenous paradigms and academic worlds. Respect also requires the recognition and support of Indigenous peoples' inherent constitutional rights to self-determination.[90]

They also make note of:

- University of British Columbia's Xwi7xwa Library, authorities, and Deer Classification System https://xwi7xwa.library.ubc.ca/
- University of Alberta's Decolonizing Description project: https://era.library.ualberta.ca/items/e1431abd-abf8-46e0-a039-eadc39752113
- University of Manitoba's changes to authorities in the Manitoba Archival Information Network database: https://libguides.lib.umanitoba.ca/c.php?g=455567&p=3278374"[91]

Lastly, it's worth nothing that all technology is embedded with the political, cultural, social, and legal biases of its creators.[92] Dataverse, originally created and maintained by researchers at Harvard, shares space with an institution that has a grim record when it comes to respecting Indigenous data. While that does not necessitate that by extension anything they create is guilty of association, we must remember that the era of salvage ethnography never really ended[93] and we must design our technology accordingly.

Federated Research Data Repository (FRDR)

The other major research repository recommended to UWaterloo researchers is the Federated Research Data Repository (FRDR), a "national, bilingual platform for sharing and preserving Canadian research data. The FRDR service provides Canadian researchers in any discipline with a robust repository option into which large research datasets can be ingested, curated, processed for preservation, discovered, cited and shared."[94] The ability to upload larger file sizes as compared to Borealis appears to be a major selling point and key distinction. It does not advertise itself as open-source, and is explicitly not currently meant for sensitive or restricted data. It's funded by the Digital Research Alliance of Canada, which is itself funded by Innovation, Science, and Economic Development Canada. Like Borealis (through the Dataverse Project) it's well

[90] Leanne Olson et al., "Western Libraries Indigenous Collections Metadata Inventory" (Borealis, January 9, 2019), https://doi.org/10.5683/SP2/IC7729.
[91] Olson et al., "Western Libraries Indigenous Collections Metadata Inventory."
[92] Abdullah Alsaleh, "The Impact of Technological Advancement on Culture and Society," *Scientific Reports* 14, no. 1 (December 30, 2024): 32140, https://doi.org/10.1038/s41598-024-83995-z.
[93] *Redefining Narrative with Kevin White*, Redefining Narrative, 2023, https://www.youtube.com/watch?v=DH9qVsbL2pA.
[94] Digital Research Alliance of Canada, "Federated Research Data Repository," 2024, https://alliancecan.ca/en/services/research-data-management/federated-research-data-repository.

documented, with an extensive FAQ.[95] FRDR is open to the public to search for and download data, however only:

> Principal Investigators (PIs), or their sponsored designates, may create a FRDR account and deposit data for publication. PIs must be a faculty member, librarian, or community-based researcher at an institution or organization eligible to receive Tri-Agency funding, including Indigenous not-for-profit organizations eligible for funding from the Social Sciences and Humanities Research Council (SSHRC). Sponsored designates include external collaborators, graduate and undergraduate students, data managers, non-research staff, postdoctoral fellows, and research assistants.[96]

Strengths

FRDR shares many strengths with Borealis, including being explicitly FAIR compliant (Findable, Accessible, Interoperable, Reusable), well documented, and supported by the Digital Research Alliance of Canada.[97] In addition, it also supports much larger datasets than Borealis with a default of 1 TB of curated storage with the ability to request more. Datasets over 5 GB or more than 300 files require the use of Globus Endpoint, separate third party software developed and operated by the University of Chicago.[98]

FRDR is spread across "multiple National Advanced Research Computing Host sites", and has a regular backup schedule that supports "the long-term accessibility and usability of data, including file identification, validation, characterization, and normalization."[99] FRDR is also well indexed and can be found via "Lunaris, Google Dataset Search, OpenAIRE, DataCite, ProQuest and others".[100]

Weaknesses

FRDR shares many of the same weaknesses of Borealis, including that it is not meant for sensitive or restrictive data. Its terms of service is similar as well:

> "Submitters and their licensors retain all ownership rights to their Content. By submitting Content to the Service, Submitters will be asked to consent to the Terms of Use which grants FRDR a worldwide, non-exclusive, royalty-free and transferable license to use, reproduce, distribute, prepare derivative works of, display, and perform the Content in connection with the Service. This includes, but is not limited to, the creation of copies, back-ups, and alteration of the data for the purposes of preservation. The Submitter further authorizes the Service Host to migrate the Content to any medium or format for the purpose of preservation."[101]

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[95] FRDR, "FAQ," 2025, https://www.frdr-dfdr.ca/docs/en/faq/.
[96] FRDR, "Our Mission," 2025, https://www.frdr-dfdr.ca/docs/en/our_mission/.
[97] FRDR, "FAQ."
[98] Globus, "Data Transfer With Globus," 2025, https://www.globus.org/data-transfer.
[99] FRDR, "FAQ."
[100] Digital Research Alliance of Canada, "Federated Research Data Repository."
[101] FRDR, "Data Submission Policy," March 27, 2024, https://www.frdr-dfdr.ca/policies/en/data_submission/#60-rights-and-ownership.

FRDR has the ability to offer a temporary embargo to protect data from being downloaded, however eventually all FRDR data will be made publicly available. The software itself appears to be closed-source however, meaning that users must put extra trust that their data is safe. This is less of a risk considering the data are meant to be shared, and FRDR does have plans in place for long-term data preservation however details on data security or where the servers themselves are located don't appear to be publicly available.

Further, FRDR is relatively new (started in 2016 with full launch in 2021). As it is custom-made software solely funded by the Digital Research Alliance of Canada it risks being vulnerable to stagnation and obsolescence, especially if development funding ceases to continue. That does not mean it's not an appropriate repository to use, but it may have more limited development that is less open to public consultation and scrutiny. Further, there appears to be little to no Indigenous involvement in FRDR itself beyond the general efforts of the Digital Research Alliance of Canada. That means features necessary to respect Indigenous data sovereignty are unlikely to be prioritized, and while this may be appropriate for large and Indigenous data sets, it does not appear to be made with Indigenous rights in mind or have a public strategy to address these shortcomings.

Discussion

As a whole, Borealis is a more appropriate repository for Indigenous data given that it is explicitly working on compatibility with TK labels through the Dataverse project.[102] Also, its open source design means that it could be forked if necessary to account for more specific Indigenous data needs in the future. It's also likely more resilient to political interference or defunding by the Canadian government, however that is more of a speculation than an analysis.

Further, FRDR is explicitly designed for only open data, and while some Indigenous data is appropriate to be widely disseminated, that is not always the case. Borealis does have more flexible permissions in regards to collaboration and sharing, as well as support for restricted file access and embargos, however what that means in practice is unknown given the lack of public documentation on working with sensitive Indigenous data through Borealis.

While these are not the only research repositories available to University of Waterloo researchers, they are the recommended Canadian generalist ones supported by the University's library services.[103] There are other repositories around the world,[104] however they are likely to share many of the same general strengths and weaknesses of Dataverse and FRDR. Each may have more specific features that serve specific research purposes, but that's beyond the scope of this report.

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[102] Philipp Conzett, "TK Labels and Dataverse," January 4, 2025, https://groups.google.com/g/dataverse-community/c/BqCGdZw_GOU?pli=1.
[103] Eber et al., "Research Guides."
[104] Anneliese Eber et al., "Research Guides: Research Data Management: Finding Repositories," 2025, https://subjectguides.uwaterloo.ca/rdm/repositories.

Item 2: Research and Recommendations on Data Storage Options that Support Indigenous Data Sovereignty

Data flows through many kinds of software before they end up in any research repository. A research data management plan must consider not only where these data will be archived and how they will be accessible over time, but what happens to the data throughout their entire lifecycle: from collection to eventual deletion or degradation.[105] The lists below provide a summary review of common software options and provide general strengths, weaknesses, suitability, and feasibility in relation to Indigenous data sovereignty.

A general assumption is that few, if any, of these software were built with Indigenous Peoples, much less Indigenous rights, in mind. Researchers must be accountable for conducting ethical research involving Indigenous people when collecting sensitive or sacred Indigenous data,[106] data of Indigenous people at risk of being criminalised,[107] or data of those targeted by so-called child welfare authorities.[108]

An in-depth, feature-by-feature comparison of all potential data storage options is beyond the scope of this report. Most research repositories operate under the assumption that data should be open to the public to ensure scientific accessibility, reliability, and replicability. In some cases, this can conflict with Indigenous data sovereignty principles for sensitive data not fit for open distribution or use. This does not mean that these repositories or other software are not suitable for storing Indigenous data, but they must be collected, stewarded, and cared for appropriately as long as they exist which may be longer than the lifetime of the person or people who created them.

In the terms of service for most, if not all, of these software are clauses that they are not to be used for illegal purposes, and most additionally indicate that they may be accessible by law enforcement upon appropriate legal request. How each handles the privacy of its users and the data they provide depends on the jurisdiction of their operation. This may have consequences in how they are accessed by governments who may be hostile to Indigenous Peoples or other marginalized or vulnerable groups.[109] This is especially the case in the US given the current political

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[105] Anneliese Eber et al., "Research Guides: Research Data Management: Get Started," accessed April 28, 2025, https://subjectguides.uwaterloo.ca/rdm/getstarted.
[106] Connie Strayer and Robyn Grebliunas, "Considerations When Bringing Indigenous Traditional Knowledges Online," in *Indigenous Digital Literacies* (Pressbooks by BCcampus, 2024), https://opentextbc.ca/indigenousdigitalliteracies/chapter/traditional-knowledges-online/.
[107] Andrew Crosby, "The Racialized Logics of Settler Colonial Policing: Indigenous 'Communities of Concern' and Critical Infrastructure in Canada," *Settler Colonial Studies*, October 2, 2021, https://www.tandfonline.com/doi/abs/10.1080/2201473X.2021.1884426.
[108] Kathleen S. Kenny et al., "Inequities in Child Protective Services Contact among First Nations and Non-First Nations Parents in One Canadian Province: A Retrospective Population-Based Study," *BMC Public Health* 25, no. 1 (April 2, 2025): 1224, https://doi.org/10.1186/s12889-025-21813-5.
[109] Tomas Apodaca and Colin Lecher, "How California Sent Residents' Personal Health Data to LinkedIn – The Markup," April 28, 2025, sec. Pixel Hunt, https://themarkup.org/pixel-hunt/2025/04/28/how-california-sent-residents-personal-health-data-to-linkedin.

climate,[110] however, data can last for a long time and in any country what was legal today may not be tomorrow.[111] While it's unreasonable for researchers to imagine every possible political scenario years from now, they are still responsible for what they put on the open internet and should act accordingly.

UWaterloo Central Information & Systems Technology Services Supported Software

Microsoft Office365 Products:[112] SharePoint / OneDrive / Teams / etc.

Strengths

Microsoft's Office platform (now branded as Microsoft 365 Copilot app) has had market dominance for decades making it familiar to most users. It works best on Windows computers, however is still compatible with MacOS albeit with limitations and bugs unless using their browser-based apps. It's well supported by dedicated IT staff with customizable Sharepoint Intranet and OneDrive storage options. Teams may not be the best videoconferencing and messaging software out there, but it is well integrated with the rest of the Microsoft stack. University students, faculty, and staff already have institutional access making it the easiest platform to use right away for most people. Encryption options are available, however the specific details are dependent on the institutional plan and deployment.

Weaknesses

Microsoft is one of the largest and most profitable multinational corporations in the world. Its software is designed primarily to generate profit for its parent company through monopolization making it very vulnerable to enshittification:[113] vendor-lock in, user surveillance, gross privacy violations and data breaches, Microsoft has it all.[114] In the last few years generative "AI" data mining has made their products worse as Microsoft seeks to justify exorbitant generative "AI" capital expenditures.[115] While Microsoft's SaaS platform can be convenient for its end users, it can be very

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[110] Alana Wise, "NIH Autism Study Will Pull from Private Medical Records," *NPR*, April 23, 2025, sec. National, https://www.npr.org/2025/04/23/nx-s1-5372695/autism-nih-rfk-medical-records.
[111] Haeck, Pieter. "Microsoft Would Push Back against Trump Order to Suspend European Cloud Operations." *Politico*, April 30, 2025. https://www.politico.eu/article/microsoft-pitches-european-data-center-expansion-amid-tense-transatlantic-tech-ties/.
[112] Microsoft. "Welcome to the Microsoft 365 Copilot App," 2025. https://www.office.com/.
[113] Thurrott, Paul. "Microsoft Is Silently Reversing Some OneDrive Enshittification in Windows 11." *Thurrott.Com* (blog), July 4, 2024. https://www.thurrott.com/windows/windows-11/305040/microsoft-is-silently-reversing-some-onedrive-enshittification-in-windows-11.
[114] Goodin, Dan. "That Groan You Hear Is Users' Reaction to Recall Going Back into Windows." Ars Technica, April 11, 2025. https://arstechnica.com/security/2025/04/microsoft-is-putting-privacy-endangering-recall-back-into-windows-11/.
[115] Zitron, Edward. "Never Forgive Them." *Ed Zitron's Where's Your Ed At* (blog), December 16, 2024. https://www.wheresyoured.at/never-forgive-them/.

expensive over time often with costs increasing per user depending on the enterprise contract.

Bulk Storage[116] and NetApp Snapmirroring[117]

Strengths

Using the University's existing Bulk Storage and NetApp Snapmirroring options are easier than self-hosting, with lower upfront costs, security handled by professionals, large bandwidth, and backup mirroring included with the ability to have a second mirror. For UWaterloo faculty, researchers, and staff, it's available as a network drive, Samba share, and more. Assuming that data are encrypted in transit and at rest, this is likely an appropriate option for larger datasets that require more computational power to process.

Weaknesses

Affordable up-front costs but may be expensive over time. Requires knowledge of basic networking and data sharing security protocols (but university IT support is available to remedy this). Only annual pricing is available and Snapmirroring is limited to staff.

While each research project has different requirements we cannot generalize, in terms of respecting Indigenous data sovereignty, the following software and storage providers are recommended in most cases:

Recommended Data Storage Options That Support Indigenous Data Sovereignty

Mukurtu:[118] Digital cultural heritage content management system (CMS)

Strengths

A free and open-source project developed on a hub and spokes model, has had successful projects built with Indigenous collaborators with Indigenous Peoples' rights and needs in mind. It can be self-hosted or deployed on a shared host with Reclaim Hosting for only ~$120/year (smaller sites), or $600+/year (larger sites, more support) at time of writing. It's designed to respect Indigenous data sovereignty principles and focuses on archiving public cultural knowledge.

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[116] Ahn, Ryan, and Matthew Verlis. "Bulk Storage Purchasing." University of Waterloo, March 21, 2024. https://uwaterloo.atlassian.net/wiki/spaces/ISTSERV/pages/42583588985/Bulk+storage+purchasing.
[117] Ryan Ahn and Gwendolyn Shaver, "NetApp Snapmirroring," University of Waterloo, March 22, 2023, https://uwaterloo.atlassian.net/wiki/spaces/ISTSERV/pages/42583392389/NetApp+snapmirroring.
[118] Mukurtu, "Mukurtu CMS | The Free, Mobile and Open Source Platform Built with Indigenous Communities to Manage and Share Digital Cultural Heritage," 2025, https://mukurtu.org/.

Weaknesses

Core development is potentially vulnerable to Trump administration Executive Orders and defunding (Institute of Museum and Library Services,[119] National Endowment for the Humanities,[120] NSF,[121] Washington State University[122]). It does not have core development in Canada (beyond individual volunteers), is currently running on obsolete Drupal 7 (but upgrade plan is in place), may be difficult to scale and maintain for larger, more complex datasets. It's not really meant as a research repository, more for storing and presenting cultural heritage. Its mobile app is Apple App Store based (Android compatibility planned for future date), and generally lacks feature parity with commercial software as it's dependent on limited and unpredictable development resources.

Niiwin:[123] Database / app builder / content management system (available to the public soon)

Strengths

A Ruby-On-Rails based web-app (no need for app store), allows for custom data structure design, secure data management, flexible user role and workspace, and ability to self-host or deploy on any cloud. Made by Animikii, an Indigenous B-Corp based in Canada, it's designed to respect Indigenous data sovereignty principles.

Weaknesses

A SaaS product not yet released to the public market (ETA late 2025), it's still sold on a custom-software development basis (and price), which requires Pathfinding services (~$25k) before software development can begin. It's developed by a for-profit company (albeit a B Corp), and is not currently open-source, limiting its transparency and interoperability.

[119] American Library Association, "FAQ: Executive Order Targeting IMLS," April 23, 2025, https://www.ala.org/faq-executive-order-targeting-imls.
[120] Elizabeth Blair, "Cultural Groups across U.S. Told That Federal Humanities Grants Are Terminated," *NPR*, April 3, 2025, sec. Culture, https://www.npr.org/2025/04/03/nx-s1-5350994/neh-grants-cut-humanities-doge-trump.
[121] Jessica Blake, "National Science Foundation Sets New Priorities," Inside Higher Ed, April 22, 2025, https://www.insidehighered.com/news/government/science-research-policy/2025/04/22/nsf-terminates-grants-focused-dei-or.
[122] Nicholas K. Geranios, "WSU Could Lose up to $25M per Year from Trump Research Funding Cuts | Cascade PBS," *Cascade PBS*, February 19, 2025, https://www.cascadepbs.org/news/2025/02/wsu-could-lose-25m-year-trump-research-funding-cuts.
[123] Animikii, "Take Control of Your Data," Niiwin, 2025, https://niiwin.app/index. Developed by Animikii, the author of this report

Baserow:[124] Database / app builder

Strengths

An open source MIT licensed, no-code database platform, it can self host or cloud host, is GDPR, HIPAA, and SOC 2 compliant, and can be further customized and extended with plugins. The free version allows unlimited databases, 3,000 rows per workspace, 2GB of storage per workspace, grid, form, and gallery views, template library, and 2-factor authentication.

Weaknesses

It's built and maintained by a for-profit company with servers located in Germany. The paid versions bill per user, and is not built with Indigenous sovereignty in mind.

Proton:[125] Email / VPN / Cloud storage / Password manager / Calendar

Strengths

A collection of privacy-oriented end-to-end encrypted software services. It has free services without ads, otherwise subscriptions can be bundled. It has enterprise options and its core selling point is that Swiss jurisdiction has very strict privacy laws that appear to be reliable and unlikely to be compromised given Switzerland's reputation for neutrality.

Weaknesses

Maintained via a SaaS model through a for-profit company. Its largest shareholder is its own non-profit entity. It does not allow for local or customizable hosting and subscription costs add up over time. It's not built with Indigenous sovereignty in mind and has had a recent public relations controversy that eroded the trust of many of its progressive users.[126]

See the appendix for other UWaterloo storage options that require further investigation to ensure compatibility with Indigenous data sovereignty principles. Note this was an example of a high level overview based on publicly available data. Further analysis can be conducted using the protocols established in Item 3 as needed.

[124] Baserow, "The Data Collaboration Platform for Your Teams," Baserow, 2025, https://baserow.io/.
[125] Proton, "A Better Internet Starts with Privacy and Freedom," accessed April 30, 2025, https://proton.me/.
[126] Nikita Mazurov, "Proton Mail Says It's 'Politically Neutral' While Praising Republican Party," The Intercept, January 28, 2025, https://theintercept.com/2025/01/28/proton-mail-andy-yen-trump-republicans/.

Discussion

Respecting Indigenous data sovereignty means respecting Indigenous data throughout its entire life cycle. A research data management plan must include much more than where the data will ultimately reside (and with whom). It's beyond the scope of this report to thoroughly analyze every possible kind of research project and when asked about which software or storage should be used the only answer is: it depends.

Ideally, any software used by researchers should be open source in both its design and its data format. There should be the ability to audit every part of the software to ensure that it's doing what it's supposed to and the data are not inadvertently leaked or scraped by the software provider. This is particularly important in the so-called "artificial intelligence" (AI) age that has nearly every software company forcing generative "AI" upon its users regardless of the actual utility of such a feature.[127] Worse, software companies are often compelled by their investors to seek new ways to gather more revenue and this usually occurs by collecting, repackaging, then selling customer data or metadata.[128] A research data management plan should factor in this risk, and while most researchers are not digital privacy experts, they still have an obligation to steward Indigenous data and not violate the privacy or rights of the people whom the data are about.

There are many cases where technical or highly specialized research requires using proprietary software with proprietary data formats because there are no other viable options. In these cases, a researcher must understand the risks of using any software that may not be interoperable (the I in FAIR[129]), that may require an ongoing subscription, and may change its features at any time.

Most off-the-shelf software is now sold as a service (known as software-as-a-service, or SaaS). While researchers and Indigenous Peoples may retain ownership of data the software uses, at least in a legal and sometimes physical sense, if those data are inaccessible or not usable by any other software, they are considered behind "walled gardens – roach motels that are hard to escape once they've been entered."[130] Cory Doctorow coined the term "enshittifcation"[131] to describe what happens when software companies don't allow for interoperability and increase "switching costs"[132] because their business model requires them to extract ever-increasing value from their customers, not by offering a good and competitive product on an open market, but by monopolizing the market

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[127] Ian Capstick et al., *Truth Before "Indigenous AI" Understanding and Resisting Generative AI* (Animikii, 2024), https://animikii.com/databack/understanding-and-resisting-generative-ai.
[128] Edward Ongweso Ongweso Jr., "Abolish Venture Capitalism," *The Nation*, May 23, 2023, https://www.thenation.com/article/economy/abolish-venture-capitalism/.
[129] Wilkinson et al., "The FAIR Guiding Principles for Scientific Data Management and Stewardship."
[130] Cory Doctorow, "Big Tech and 'Captive Audience Venues,'" *Pluralistic: Daily Links from Cory Doctorow* (blog), March 28, 2025, https://pluralistic.net/2025/03/28/street-pricing/#sportball-analogies.
[131] The American Dialect Society, "2023 Word of the Year Is 'Enshittification,'" American Dialect Society, January 5, 2024, https://americandialect.org/2023-word-of-the-year-is-enshittification/.
[132] Cory Doctorow, "Enshittification Isn't Caused by Venture Capital," *Pluralistic: Daily Links from Cory Doctorow* (blog), October 14, 2024, https://pluralistic.net/2025/01/20/capitalist-unrealism/.

while holding their customers and their data hostage.[133] As in the popular Eagles song Hotel California: "You can check out any time you like, but you can never leave".[134]

If software isn't interoperable, customers, or in this case researchers and the Indigenous Peoples they work with, may "own" their data, but if they can't effectively "access", "possess", or "control" them do they really "own" them at all? Further, if they can't "find" or "reuse" their data (or determine how they are to be reused), again, do they own the data in practice? If anything, without these principles met through both the design and business model of Software-as-a-Service (SaaS), researchers and Indigenous Peoples are essentially "renting" their data as long as they continue to pay for the software that makes their data useful. That doesn't sound very sovereign.

Doctorow states that the way to get around this problem is to reduce switching costs: make it possible for the data to move from one software application to another and still be useful while not losing any of their functional value. His solutions-oriented book is due to be released after this report in October 2025.[135]

One last thing to consider is how the data move: can they be intercepted or leaked, and if so, what can be revealed of them? Are the data encrypted end-to-end in transit or at rest? Who has the decryption keys and how does that work? Does the software or internet provider keep logs? Do metadata reveal anything sensitive? These are advanced security questions that responsible researchers should have basic familiarity with.[136] The more sensitive the data, the more these questions need to be taken into account.

Using a reliable and reputable Virtual Private Network (VPN) should be necessary any time a researcher uses an insecure network such as hotel or public WIFI or personal cellular data. It doesn't matter how appropriate any software or storage options are if the data moving to and from them can be intercepted or tampered with, especially if those data are transmitted in plain text. This isn't a problem if the data involved are safe for open use, but researchers should always be considerate of the implications if any of the data they are responsible for are leaked or lost, both now and in the indefinite future.

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[133] Dickinson, Jim. "How to Resist the Enshittification of Higher Education." *Wonkhe* (blog), August 27, 2025. https://wonkhe.com/blogs/how-to-resist-the-enshittification-of-higher-education/.
[134] *Eagles - Hotel California (Live 1977) (Official Video) [HD]*, 2022, https://www.youtube.com/watch?v=09839DpTctU.
[135] Cory Doctorow, *Enshittification: Why Everything Suddenly Got Worse and What to Do About It* (Macmillan Publishers, 2025), https://us.macmillan.com/books/9780374619329/enshittification/.
[136] Animikii, "Demystifying Digital Storage Solutions for Indigenous Data Sovereignty," Animikii Indigenous Technology, 2020, https://animikii.com/insights/demystifying-digital-storage-solutions-for-indigenous-data-sovereignty.

Item 3: Indigenous Data Storage Governance Protocols for UWaterloo-based Data Storage Options

Much of respecting Indigenous data sovereignty happens long before data are deposited in repositories. Understanding Indigenous rights, building healthy relationships with Indigenous Peoples and people, engaging in mutually beneficial research partnerships, developing proper data governance agreements, showing respect for free, prior, and informed consent, etc., are all important parts of an ethical research process involving Indigenous Peoples. The following are the proposed Indigenous data storage governance protocols for UWaterloo-based data storage options:

1. Be FAIR and CARE

Much work has already been done to establish how to implement FAIR principles, but significant further resources need to be dedicated to augmenting them with the CARE Principles as well. Implementation of FAIR is relatively easy considering it's furthering the status quo, however implementing CARE is a much more difficult social, political, and technical challenge involving all steps of the data lifecycle and must be prioritized and resourced accordingly.[137]

2. Evaluate policies, practices, relationships, and data infrastructure for alignment to the CARE Principles via the CARE Data Maturity Model

Currently in development by some of the key researchers in the Indigenous data sovereignty movement, the CARE Data Maturity Model will provide criteria and indicators that help ensure alignment with the CARE Principles. Some of these have already been drafted and can be further refined to account for First Nations, Inuit, and Métis research needs.[138]

3. Maintain situational awareness of Indigenous relations and rights

This should occur at all levels of research, both strategic and policy, but also day-to-day tasks and interactions. Researchers have a responsibility to conduct ethical research involving Indigenous data, but the University must provide adequate support to ensure this is actually possible throughout the entire data lifecycle from collection to archiving.[139]

4. Engage in consistent outreach activities with appropriate Indigenous Peoples

Given the legacy of colonial research practices, Indigenous Peoples have little reason to trust that Universities will not only treat them with respect, but adequately safeguard and archive

[137] Research Data Alliance International Indigenous Data Sovereignty Interest Group, "CARE Principles for Indigenous Data Governance."
[138] Taitingfong et al., "CARE Data Maturity Model."
[139] Duerr et al., "Earth and Environmental Science Repository Activities in Support of the CARE Principles."

their sensitive data. Just as museums have much work to do to rematriate Indigenous ancestors, Universities must also build trust with relevant Indigenous communities to ensure that their best interests are prioritized and protected both now and in the future.[140]

5. Improve repository protocols so they are compatible with Indigenous data sovereignty principles

Research repositories must consider Indigenous Peoples as key rights-holders and develop protocols, policies, procedures, and software design that ensures these rights are respected at all parts of the archiving workflow. This requires a significant investment in resources and direct involvement of appropriate Indigenous people in positions of power and influence to ensure compliance with relevant Indigenous law and protocols.[141]

6. Ensure technology development and maintenance is adequately prioritized and resourced

The vast majority of software developers and digital infrastructure engineers have not been trained to account for Indigenous Peoples, their rights, needs, and experiences as users. The genealogy of their disciplines, as well as digitization as a whole, comes from developing technologies that form the logistical backbone of colonization itself. Further, Indigenous Peoples are a relatively small demographic due to colonization, so their needs are not often given the priority needed to achieve basic equity. Fortunately, what's good for Indigenous Peoples is often good for the wider public, so investing adequate resources in digital equity will lead to better software and infrastructure in the long run.[142]

7. Prioritize using software designed to respect Indigenous data sovereignty

Ideal software should have customizable user roles and permissions that consider and allow flexibility in Ownership, Control, Access, and Possession (OCAP®). Multiple hosting options should include a multi-user database that allows for real-time collaboration that makes it easier to work and share data with Indigenous rights-holders. Industry-standard and beyond data security practices and features should include off-site backups and disaster recovery plans. Further plans should include budgets for ongoing software development that includes business or economic model considerations that affect software usability, reliability, and long-term archiving. Indigenous people should be involved in all aspects of software design to ensure distinction-based solutions to their specific needs[143] [144]

[140] Duerr et al., "Earth and Environmental Science Repository Activities in Support of the CARE Principles."
[141] Duerr et al., "Earth and Environmental Science Repository Activities in Support of the CARE Principles."
[142] Duerr et al., "Earth and Environmental Science Repository Activities in Support of the CARE Principles."
[143] Doctor et al., *#DataBack: Asserting & Supporting Indigenous Data Sovereignty*.
[144] Capstick et al., *Truth Before "Indigenous AI" Understanding and Resisting Generative AI*.

The CARE Principles are core to respecting Indigenous data sovereignty as whole, and thus are the best starting point for developing a set of Indigenous data storage governance protocols that can be further refined to meet the specific needs of First Nations, Inuit, and Métis as appropriate:

How Institutions and Researchers Can Apply the CARE Principles

Principle	Issues raised by communities	Actions for institutions and researchers
Collective Benefit	Data for self-determined development	➔ Collect and code using categories that identify Indigenous communities and individuals in ways that they define; disaggregate data, especially in global or large geospatial datasets, to increase relevance for Indigenous communities.
Authority to Control	Recognize Indigenous Peoples' rights to and interests in their knowledges and data	➔ Establish institutional principles or protocols for research development, data management and publication (for example, scholarly works, presentations and datasets) that support Indigenous Data Sovereignty; include metadata fields available for disclosure of Indigenous rights and interests.
	Recognize the rights of Indigenous People to free, prior and informed consent	➔ Ensure data use is consistent with individual and community consent provisions; ensure ongoing consent processes, including the ability to refuse, withdraw and reconsent.
	Data available for Indigenous governance	➔ Ensure Indigenous communities have access to data and metadata about their people, communities, and non-human relations in a usable format; return all outputs to the appropriate tribal authorities.
	Develop and enact Indigenous Data Governance protocols	➔ Ensure community control and ownership of data and data protocols; use Indigenous frameworks and principles to inform data management protocols and processes; Indigenous community control of how, what, who and where research is conducted, and stewardship of data; publication standards require documentation of community support, participation and approval for publishing data and authorship.
Responsibility	Respect reciprocity, trust and mutual understanding with those to whom data relate	➔ Record the Traditional Knowledge and biocultural labels of the Local Contexts Hub in metadata; ensure review of draft publications before dissemination; identify and address sensitive data, including privacy issues for individuals and communities.
	Data-generating resources for languages, worldviews and lived experiences	➔ Use the languages of Indigenous Peoples; affirm community worldviews; upload data with appropriate metadata labels (that is, Traditional Knowledge and biocultural labels, and provenance) in culturally accessible formats (digital storytelling, seasonal calendars, visual art forms and so on).
Ethics	Data governance accounts for potential future use	➔ Apply community protocols for infrastructure, metadata and secondary use; include Traditional Knowledge and biocultural labels and metadata fields for community and/or tribal affiliation; use community guidelines for the use and reuse of data; allow data removal and/or disposal requests from aggregated datasets; record and recognize provenance.

Source: Lydia Jennings et al., "Applying the 'CARE Principles for Indigenous Data Governance' to Ecology and Biodiversity Research," *Nature Ecology & Evolution* 7, no. 10 (October 2023): 1547–51, https://doi.org/10.1038/s41559-023-02161-2.

Dr. Riley Taitingfong, Dr. Stephanie Russo Carroll, Andrew Martinez, and Maui Hudson, are developing the CARE Data Maturity Model as a "tool to iteratively assess and improve the strength of CARE implementation. The CARE Data Maturity Model team is currently drafting a set of criteria and indicators (i.e., measurable actions for the governance of Indigenous data) to evaluate an organization or project's policies, practices, relationships, and data infrastructure for alignment to the CARE Principles."[145]

Overview of Draft CARE Indicators (in development)

CARE Principle	Description
Collective Benefit	• Conduct data needs assessment • Utilise Indigenous identifiers • Supporting Indigenous use • Alignment of permissions for data access and re/use to Indigenous frameworks • Indigenous approval of outputs from research projects • Ensure Indigenous Peoples determine benefits • Develop benefit sharing plans • Fund training and education
Authority to Control	• Recognition of Indigenous data sovereignty • Recognition of Indigenous Peoples' rights to FPIC • Transparent ethics approval processes • Transparent community permissions processes • Enable audit of Indigenous data • Make disclosures to Indigenous communities about Indigenous data
Responsibility	• Build relationships with Indigenous Peoples • Support community capacity-building • Promote equitable attribution including acknowledgment and authorship • Collect data relevant to Indigenous languages and worldviews • Ensure data of interest are findable by communities • Enable Indigenous metadata fields
Ethics	• Support use of Indigenous ethical frameworks • Promote Indigenous interpretation and presentation of findings • Share data of interest with Indigenous organizations • Reflect Indigenous knowledge systems in agreements • Compensate research participation • Share copyright • Agreements reflect Indigenous methods for dispute resolution • Administrative mechanisms for rights violations in research

Source: Riley Taitingfong et al., "CARE Data Maturity Model," The Collaboratory for Indigenous Data Governance, May 8, 2024, https://indigenousdatalab.org/care-data-maturity-model/. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. Contact: usindigenousdatasovnetwork@gmail.com

[145] Riley Taitingfong et al., "CARE Data Maturity Model," The Collaboratory for Indigenous Data Governance, May 8, 2024, https://indigenousdatalab.org/care-data-maturity-model/.

Many of the original creators of the CARE Principles provide a foundation for repository activities involving Indigenous data and people in their 2024 research paper, Earth and environmental science repository activities in support of the CARE Principles:

Repository Activities Involving Indigenous Data and People

Category	Code	Recommended Repository Activity	CARE Principles
Situational Awareness	S1	Ongoing engagement with Indigenous communities	C2, A1, R1, R2
	S2	Understand Indigenous legal rights	C3, A1, E2
	S3	Understand consequences of publishing Indigenous data	E1, E2, E3
	S4	Identify types of data of interest to communities	C3, A3, R3
	S5	Understand and respect the changing needs of communities	R1
	S6	Be aware of changing roles/relationships over time	R1
	S7	Determine if data access restrictions are necessary	C3, A3, R3, E1
	S8	Determine if data obfuscation is necessary	A3, R1, R3, E1
	S9	Recognize when collection agreements were needed for data	C3, A1, A3
	S10	Ensure design of data products, metadata and tools are appropriate for communities	R3, C2, A2
Outreach	O1	Facilitate relationships between data provider and user communities	R1
	O2	Include Indigenous representatives on repository advisory board, if relevant	A1, A2, E2
	O3	Anticipate working with more communities	C2, R1
	O4	Ensure repository practices are publicized and transparent	A1
	O5	Publicize your governance protocols	A1
	O6	Identify your repository as a holder of Indigenous data	A1, A2, A3
	O7	Liaise between communities and vocabulary maintainers	A1, R3
	O8	Share materials with the Indigenous workforce	C1, A2, R2
	O9	Clarify types of uses with communities	A3, E3
	O10	Identify educational opportunities with communities	R2
	O11	Identify types of data that cannot be supported technically	C1, R3
Repository Protocols	R1	Develop data policies and acquisition/curation procedures	A1, R2, E1
	R2	Ensure data management policies are justifiable	E2, E3
	R3	Develop procedures to work with depositors to address necessary restrictions	A1, E1
	R4	Develop procedures to request required documents during data submission	A1, E1
	R5	Develop procedures for determining if needed technologies are within technical plans	E1, E3
	R6	Develop processes to identify communities for engagement and collaboration	C1, E1, E2
	R7	Develop community contact protocols and follow up processes	C1, A1, R1, E3
	R8	Develop continuity plans	A2, R1, E3
	R9	Allocate educational funds equitably	C1, C3, R2

Repository Activities Involving Indigenous Data and People

Category	Code	Recommended Repository Activity	CARE Principles
	R10	Include funds for specific targeted tools in technical plans as possible	A3, R2, R3
Technology	T1	Enable granular embargoes	A1, A3
	T2	Support tracking data provenance	A2, E2, E3
	T3	Link between data, papers and other outcomes	A2
	T4	Create data access control mechanisms (who/when/changing roles)	A1
	T5	Implement systems that allow transfer of responsibilities	C2, A1, A2, A3, E1, E3
	T6	Package data with associated, required documents	A1, E1, E3
	T7	Support communication of rights and restrictions	A1, E1
	T8	Implement badging mechanisms	E1, E3
	T9	Use a metadata format that handles multiple languages	C1, A1, R3
	T10	Keep a list of data "actors" and be able to link data to them	A1, E2, E3
	T11	Use community-vetted vocabularies	A1, C1, R3
	T12	Support customized data views	C1, C2, R3
	T13	Identify metadata fields for recording required documents, proper use and limitations	A1, E1, E3
	T14	Identify metadata fields to support targeted repository technologies and tools	A2, R3, E1, E3
	T15	Display required documents, badges, proper use and limitations on landing pages	A1, C3

Source: Ruth Duerr et al., "Earth and Environmental Science Repository Activities in Support of the CARE Principles," January 17, 2024, https://zenodo.org/records/10521041.

Animikii, an Indigenous software development company (and author of this report), recommends the following software features that respect Indigenous data sovereignty:

Recommended Software Features That Support Indigenous Data Sovereignty

Feature	Description
Customizable user roles and permissions that consider and allow flexibility in Ownership, Control, Access, and Possession (OCAP®)	Some Indigenous data requires extra layers of confidentiality. Each user should have permissions appropriate to their rights and responsibilities. Well defined user roles can keep data safe from insider attacks by utilizing the Principle of Least Privilege (PoLP). Indigenous data should be collectively held by the people and Peoples they are about, while at the same time only accessible to those who have rights to the data. This can be achieved through user roles established through PoLP which give specific and defined users access to only certain prespecified parts of a dataset or software program. Further, it's not always appropriate to share all data with all members of a community making OCAP® even more challenging to implement. It's less a matter of compliance to a set of standards, and more a matter of application of the basic principles that OCAP® details: Ownership, Control, Access, and Possession.
Cloud or self-hosted multi-user database that allows for Real-time Collaboration (RTC)	Not knowing which data source is the most up-to-date can cause errors, inefficiencies, and misunderstandings. Storing data on a central database that many users can use at once encourages a Single Source of Truth (SSoT) which eliminates the need for multiple copies of the same data, such as spreadsheets or text documents. Passing around static documents that only one person can work on at a time can be inefficient and detrimental to collaboration, team building, camaraderie, and a sense of collectivity. Real-time collaboration technology usually requires a consistent internet connection to a remote server with a SSoT, but it can improve data security and privacy because it reduces the need to manually share data or documents. However, PoLP needs to be considered to ensure sensitive data is not inadvertently leaked or shared.
Industry-standard and beyond data security practices and features including Off-Site Backups and Disaster Recovery	Digital data are a physical asset vulnerable to decay, disaster, theft, etc. but also loss of electricity. Backing up data in different physical locations means that if something was to happen in a specific place, backups of the data are safe elsewhere. However, the process of restoring backups needs to ensure reduced down-time or data degradation. Indigenous data are not only valuable, but they can be sacred. When digitizing and archiving traditional knowledge or storing the confidential information of community members there needs to be absolute protection guaranteed. Robust and culturally sensitive security practices gives everyone peace of mind that their information is protected and secure.
Plan for ongoing software development that includes social, economic, and political considerations	Software is never finished or 100% secure. Bugs or flaws in code can be exploited, leading to crashes or data loss, and all software requires patching and updates to remain compatible with ever-changing hardware. While the software may still "work," it may not be secure on the internet or compatible with modern hardware. This is why operating systems such as Windows, MacOS, and Android always require ongoing updates. If software can't keep up with wider technological ecosystems, security and obsolescence risks will accumulate and grow exponentially. This means that the business or economic model of software is

Recommended Software Features That Support Indigenous Data Sovereignty

	important to consider, especially if it's used to house sensitive data or data that needs to be preserved for a long period of time or even indefinitely. Labour has costs, and free volunteer labour cannot always be guaranteed in open-source projects. Further, if software is maintained by an enterprise that requires endless growth of profits, design decisions or planned obsolescence may have unforeseen (or foreseen) consequences. One-off payments for software development can lead to significant problems in the future if funding is no longer available for software updates.
Indigenous people, and Peoples, involved in distinctions-based software design that meets their specific needs	As stated throughout this report, there is no one-sized-fits-all approach to respecting Indigenous data sovereignty. A distinctions-based approach is necessary meaning software itself must be customizable enough to meet the needs of a specific Indigenous People. While there may be many commonalities across basic rights, there are practical matters such as having the choice as to where to host data depending on local capacity or specific needs. Localization goes beyond just ability to use specific Indigenous languages, but also the usability of the app through the user interface and user experience. Also, local governance needs to be taken into account in terms of access permissions, cultural protocols, legal restrictions, and security of collective intellectual property. Software needs to be designed from its inception through Indigenous lenses, worldviews, and wisdoms that have respect for Indigenous data sovereignty principles and Indigenous rights in general.

Source: derived and updated from Jeff Doctor et al., *#DataBack: Asserting & Supporting Indigenous Data Sovereignty* (Animikii Inc., 2023), https://animikii.com/databack, and Ian Capstick et al., *Truth Before "Indigenous AI" Understanding and Resisting Generative AI* (Animikii, 2024), https://animikii.com/databack/understanding-and-resisting-generative-ai.

Discussion

Once Indigenous data are created, they must be properly attributed, curated, audited, and shared according to relevant Indigenous laws and protocols. There's an ongoing legacy of Indigenous ancestors and their data stolen or appropriated, and sometimes information about these items or places must stay hidden, accessible only to the appropriate community who claims them, so they remain protected. Anything published on the internet that isn't behind a login wall will likely be scraped and used to train generative "AI" models regardless of legal notices that prohibit such activities.[146]

Software itself depreciates over time, especially if it's not maintained, and will someday need to be patched, updated, and even replaced. What then?

- In case of software failure or obsolescence, can the data be recovered and migrated to something else?

[146] Capstick et al., *Truth Before "Indigenous AI" Understanding and Resisting Generative AI*.

- Are there ongoing costs to maintaining data exclusive to a specific format?
- Is the data format exclusive to aging or vulnerable software?

Software becoming obsolete or unusable for whatever reason is fine if the data found within is compatible with whatever new software solution is implemented. The FAIR principles (**Findable**, **Accessible**, **Interoperable**, **Reusable**)[147] account for this which is why they are so popular in academia and beyond. Much has already been written about that in regards to research repositories; it won't be discussed further here beyond mentioning the CARE Principles are meant to compliment the FAIR principles, thus the Global Indigenous Data Alliance's catchy slogan: #BeFAIRandCARE.[148]

CARE was chosen as an acronym because it illustrates how "the use of Indigenous data should result in tangible benefits for Indigenous collectives through inclusive development and innovation, improved governance and citizen engagement, and result in equitable outcomes."[149] To insure inclusivity, any software should also comply with relevant accessibility compliance standards. While this doesn't apply to the back-end and administrative pages, public-facing pages should conform to World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG) 2.2 Level AA:[150]

Accessibility Requirements

Principle	Description	Recommendation
Perceivable	Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.	• AA minimum standards for Color Blind user and colour contrast ratios.
Operable	User interface components and navigation must be operable.	• Desktop Browser accessible. • Touch friendly via mobile phones and tablets.
Understandable	Information and the operation of the user interface must be understandable.	• Plain Language focus. • Use a Style or Communication Guide.
Robust	Maximize compatibility with current and future user agents, including assistive technologies.	• Parsing: Content should be well-formed so it can be parsed successfully by browsers and other user agents such as screen readers. • Status Messages: Assistive technology users are made aware of new status messages added to the page. • Name, Role, Value: The name and role of user interface components (e.g. form inputs, buttons,

[147] Wilkinson et al., "The FAIR Guiding Principles for Scientific Data Management and Stewardship."
[148] Research Data Alliance International Indigenous Data Sovereignty Interest Group, "CARE Principles for Indigenous Data Governance."
[149] Carroll et al., "Operationalizing the CARE and FAIR Principles for Indigenous Data Futures."
[150] World Wide Web Consortium, "Web Content Accessibility Guidelines (WCAG) 2.2," December 12, 2024, https://www.w3.org/TR/WCAG22/.

Accessibility Requirements

Principle	Description	Recommendation
		links, etc.) should be programmatically determinable.

Further details on accessibility requirements can be found at: MDN contributor, "Understanding the Web Content Accessibility Guidelines (WCAG) - Accessibility | MDN," mdn web docs, April 3, 2025, https://developer.mozilla.org/en-US/docs/Web/Accessibility/Guides/Understanding_WCAG.

IEEE Draft Recommended Practice for Provenance of Indigenous Peoples Data

> The Recommended Practice for the Provenance of Indigenous Peoples' Data establishes a common set of parameters for the provenance of Indigenous Peoples' data. This Recommended Practice supports appropriate disclosure of Indigenous Peoples' relationships and/or links to all data. Provenance of Indigenous Peoples' Data includes information that facilitates Indigenous Peoples' governance, decision-making, participation, collaboration, and engagement in and for current and future uses of Indigenous Peoples' data.[151]

This standard is the first of potentially many to come that support the implementation of Indigenous data sovereignty principles. It's still in development and thus has not been included in this report. However, many of the people cited throughout this report are involved so the outcome will likely be standards that are already reflected in the recommended protocols.

While much of this analysis has considered technical features, there are socio-political considerations that can help determine if any technology is suitable to respecting Indigenous rights. A way to assess respect for Indigenous rights, self-determination, and thus Indigenous data sovereignty, is to ask questions that address Free, Prior, and Informed Consent:

Free, Prior, and Informed Consent

FPIC	Relevance to Data Governance Protocols	Data Governance Questions
Free	While open data, data transparency, and data reuse is important to scientific research, it also presents a distinct challenge given the context of Indigenous data. Processes need to be in place that protect and segment sensitive data so they are still accessible to rights-holders and relevant parties but inaccessible to the public. Open data access could further exacerbate pre-existing power imbalances. Everyone may have *access* to open data, but not everyone can leverage those data. "Knowledge is power", but it's also a process which requires wisdom. How we leverage, use, and disseminate data are what becomes knowledge. However, this process is not devoid of power relationships. Before we make any research	Can researchers use the notion of "closing the gap" as moral, practical, or legal leverage to perpetuate harmful research practices? Can researchers or the general public take the data out of context through poor interpretation or analysis and use them to cause harm? Can researchers or the general public disrespect, co-opt, appropriate, or steal

[151] IEEE SA Standards Association, "IEEE Draft Recommended Practice for Provenance of Indigenous Peoples Data," IEEE Standards Association, 2025, https://standards.ieee.org/ieee/2890/10318/.

Free, Prior, and Informed Consent

FPIC	Relevance to Data Governance Protocols	Data Governance Questions
	data decisions, we must identify and plan for these potential conflicts of interest as a key principle of free consent.	data to the detriment of the Indigenous people or Peoples who they are about?
Prior	The burden of sharing research outputs with the rights-holders often falls to community leadership or staff who may not have the resources they need to do the job. This is not because they don't want to serve their community, but rather sometimes - not always - the tools needed to translate and distribute data generated by researchers is either convoluted, bureaucratic, or non-existent. For example, reports or datasets may be too dense and indecipherable, or the community may not have accessible internal data that can verify the researcher's findings. Having the right people, data, and technology to account for the added responsibility of appropriately sharing research data with the Indigenous people and Peoples they are about is vital to ensuring that information is understood throughout the community.	How much time and resources have been set aside beforehand to seek consent? Do the people giving consent have adequate technical or social capacity to understand what is being asked of them? Is capacity development considered an essential part of this process?
Informed	Western worldview often considers experts as individuals who embody a rigid professional expectation gained through years of formalized education, labour, and recognition. In many Indigenous worldviews, experts are found in the past (ancestors), present (elders), and future (the faces yet to come). While elders may be able to draw on a deeper pool of collective wisdom throughout the ages, individually their knowledge may miss important perspectives possessed by younger or yet-to-come generations who still have a lot of life ahead of them. This means that considering an individual as an "expert" can be considered arrogant and shortsighted. This can create a potential disconnect between researchers and their subjects making data governance decisions, difficult, complicated, and time consuming.	How is consent tracked and can it be revoked? Whose voices are represented by these data and do they speak for the collective? Who verifies that the data are accurate and free from harmful bias? What are the impacts of the data being made available to the public?
Consent	How often do researchers consider whose consent they are really seeking? This is one of the biggest challenges for many communities whose ancient leadership systems or governments have survived colonialism and are in conflict with more recent forms of governance. Divided communities and infighting may skew or complicate notions of *collective* consent. This leads to challenging questions that, when ignored, increase the risk of research project delays, conflicts or cancellations.	Chief and Council governing through the Indian Act may represent the "band", but do they represent the *nation*? How are Inuit interests respected when many of them don't speak much English or French? How are Métis, who have a specific history of displacement and dispossession, fairly and adequately identified, represented, and respected?

Adapted from: Jeff Doctor, Jen Polack, and Jeff Ward, "Decolonizing Digital: Our Data Is Our Right," *Decolonizing Digital: Our Data Is Our Right* (blog), 2019, https://web.archive.org/web/20230204230734/https://animikii.com/news/decolonizing-digital-our-data-is-our-right.

The most awkward question any university needs to ask is who exactly has the right to give consent to access, analyze, distribute, and disseminate Indigenous data?

- Who belongs to the collective as defined by the collective itself?
    - Are there competing or conflicting definitions?
- How have definitions of membership to the collective changed over time?
    - Who controls or influences these definitions?
- How stable or reliable is the collective's representation?
    - Are researchers contributing to internal division and disruption?

Because of the incessant destabilization of Indigenous identity through settler colonialism and genocide, there can be competing and controversial ideas of who belongs to a specific Indigenous People. Also, each Indigenous People may have different leadership structures that are not always recognised by outsiders. In the final analysis, can a collective ever give consent if another state determines their governance structure? Are Western notions of "democracy," such as anonymous voting or parliamentary representation, incompatible with Indigenous governance mechanisms that put a higher priority on direct responsibility and accountability? Can a nation, confederacy, community, clan, family, house, or individual give free, prior, and informed consent if their sovereignty is not respected?

Technologies can empower, but they can also entrap. Some things are better served as physical records or information kept safe in the minds of the People. Just because we can put something into a computer doesn't mean we should. Computers themselves can be liabilities. They need electricity, software updates, physical maintenance, and can become obsolete as new products seek to disrupt and dominate the market. Due to ongoing colonization, Indigenous Peoples have little to no control over the international infrastructure that powers the internet and the global supply chains that create electronics and digital technologies in the first place. This begs a disturbing question outside the scope of this report, can *any* Indigenous digital data truly be *sovereign*?

While Indigenous Peoples are mentioned in Canada's National Data Strategy,[152] their actual sovereignty isn't really part of that discussion. In these kinds of documents, when Indigenous data sovereignty is mentioned it's usually framed as "Canada's relationship with *its [emphasis added]* Indigenous peoples".[153] This endless paternalism closes off the imagination to what a radically different Canada could look like.[154] If Indigenous Peoples are to move forward with their self-determination, they don't just need their land back, they need their data back too.[155]

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[152] Anil Arora, Nathalie G. Drouin, and Catherine Luelo, "2023-2026 Data Strategy for the Federal Public Service" (Government of Canada, April 19, 2023), https://www.canada.ca/en/treasury-board-secretariat/corporate/reports/2023-2026-data-strategy.html.
[153] Teresa Scassa, "Considerations for Canada's National Data Strategy," *Centre for International Governance Innovation* (blog), March 5, 2018, https://www.cigionline.org/articles/considerations-canadas-national-data-strategy/.
[154] Jeff Doctor, "We Can Do Something Different," *Jeff.Doctor: LandBack, CashBack, DataBack* (blog), February 16, 2025, https://jeff.doctor/blog/we-can-do-something-different.
[155] Doctor et al., *#DataBack: Asserting & Supporting Indigenous Data Sovereignty*.

Appendix

Report Requirements

Item 1: Review and Analysis of Current Data Storage/Data Repository Options at UWaterloo from an Indigenous Data Sovereignty Lens

To meet the scope of the Strategic Objective 6.a.ii. "Collaborate with Indigenous researchers to identify access to and/or design reliable and trustworthy community/local infrastructure that meets Indigenous communities' data sovereignty needs and standards", the consultant will be provided with a list of the most-used current data storage and data repository options that researchers use at the University of Waterloo, based on previously collected information from the RDM survey and current work underway by IST (Information Systems & Technology). The consultant will conduct research into these options and assess for strengths and weaknesses based on Indigenous Data Sovereignty principles.

Item 2: Research and Recommendations on Data Storage Options that Support Indigenous Data Sovereignty

To meet the scope of the Strategic Objective 6.a.ii. "Collaborate with Indigenous researchers to identify access to and/or design reliable and trustworthy community/local infrastructure that meets Indigenous communities' data sovereignty needs and standards", the consultant will research and provide recommendations on data storage options that support Indigenous Data Sovereignty that are not part of the list in Item 1. The consultant will conduct research into these options and assess for strengths, weaknesses, suitability, and feasibility based on Indigenous Data Sovereignty principles and data storage needs.

Item 3: Indigenous Data Storage Governance Protocols for UWaterloo-based Data Storage Options

To meet the scope of the Strategic Objective 6.a.ii. "Collaborate with Indigenous researchers to identify access to and/or design reliable and trustworthy community/local infrastructure that meets Indigenous communities' data sovereignty needs and standards", the consultant will research and draft Data Storage Governance Protocols for University of Waterloo-based Data Storage Options that are owned and operated by the University that align to Indigenous Data Sovereignty principles.

Other UWaterloo Data Storage Options

Software	Type	Strengths	Weaknesses
Dryad	Research repository	Operating since 2008, non profit, new platform as of 2019, fees can be waived	Limit of 10GB uploads, 300GB per publication, $150 USD cost per submission
IEEE DataPort	Research repository	Backed by IEEE, free for members	Requires subscription
Digital Commons Data	Research repository	"Full Control: Administrators can manage datasets, customize the showcase page, and audit repository activity with customizable metadata options. Moderators can approve datasets or request edits before publication, FAIR Compliance: Designed to make data Findable, Accessible, Interoperable, and Reusable with high-level security and data encryption included. Comprehensive reports provide detailed usage and engagement insights, including PlumX metrics."	Elsevier for-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Mendeley	Research repository	"Elsevier open generalist data repository to create, share and access FAIR data globally provided free to journal authors and researchers who may not have access to institutional or domain-specific repositories."	Amazon Web Services (AWS), version of Digital Commons Data, a Elsevier for-profit product
openICPSR	Research repository	Services of the Inter-university Consortium for Political and Social Research (ICPSR). Free to deposit, access data, meets FAIR principles, "particularly well-suited for the deposit of replication data sets", options available to host a repository, can host restricted data, good for self-publishing open data	Supposed to be for "social, behavioral, and health sciences research data", no curation services provided
ICPSR	Research repository	"ICPSR is an international consortium of more than 810 academic institutions and research organizations. ICPSR (Inter-university Consortium for Political and Social Research) provides leadership and training in data access, curation, and methods of analysis for the social science research community." https://www.icpsr.umich.edu/web/pages/about/ - data will be curated for free	US-based, data needs to meet selection criteria: https://www.icpsr.umich.edu/web/pages/datamanagement/lifecycle/selection.html#criteria, available to only researchers from membership institutions
PANGAEA	Research repository	Open to any project, institution, or individual scientist, supported by EC	Based in Europe
Qualitative Data Repository	Research repository	Designed for qualitative data https://qdr.syr.edu/about "approach requires limitation to the secondary uses of any of the data we publish (for scholarly and pedagogical purposes only)" https://qdr.syr.edu/about/faq	Fees for depositing data "The amounts for most typical deposits range from $500 to $1,500. The volume of files to be deposited (number and size), as well as the need for a lot of manual tasks, such as personally identifiable

Other UWaterloo Data Storage Options

Software	Type	Strengths	Weaknesses
			information disclosure review or similar, might lead to higher prices. Researchers typically cover this fee with a grant budget item dedicated to the data deposit or local research funds." https://qdr.syr.edu/about/faq
Zenodo	Research repository	Private and public options for embargos, open source, hosted by CERN, created by OpenAIRE	For EC funded research
Figshare	Research repository	Meets FAIR requirements, large data sets, free for individual researchers	Private, for-profit company
Open Science Framework (OSF)	Research repository	Free, open platform, integrated with a lot of software, private and public options for embargos, maintained and developed by Center for Open Science (COS), a 501(c)3 non-profit organization. COS is supported through grants from a variety of supporters, including federal agencies, private foundations, and commercial entities, new projects can be stored in Montréal datacenter, Institutional membership ~$5000 USD	Dependent on Google Cloud
NocoDB	Database / app builder	No-code database builder, open source	For-profit proprietary software
Retool	Database / app builder	App builder, self-hosting or cloud	
Wasabi	Database / app builder	Affordable	Private, for-profit company, limited server locations, US-based
Ninox	Database / app builder	Low-code platform, GDPR compliant	For-profit proprietary software
data.world	Database / app builder	Enterprise data catalog	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
AirTable	Database / app builder	No-code database builder	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
MS Access	Database / app builder	No-code database builder	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining, only on windows, one user at a time, last one-time purchase was 2019, now

Other UWaterloo Data Storage Options

Software	Type	Strengths	Weaknesses
			SaaS for latest versions
PocketBase	Database	Open-source backend	Self-hosted only, no business model, only a personal open-source project with minimal additional development
Te Pā Tūwatawata	Database / app builder or cloud storage? "Distributed storage network" (coming soon)	"Distributed storage network that Māori have designed in Aotearoa New Zealand to empower their tribal nations and communities to collect, store, protect, access, and control their own data. This world-first data storage infrastructure is led by the Te Kāhui Raraunga Charitable Trust (TKR), which aims to create a unique data storage system that promotes sovereignty over data and digital futures."	Made by Māori for Māori, currently hosted in Aotearoa New Zealand but may be coming to North America in the future.
Amazon Web Services	Hyperscale Cloud provider	Secure, oldest cloud and well supported in tech, scalable with per second pricing with a 60-second minimum	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Oracle	Hyperscale Cloud provider		For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Microsoft Azure	Hyperscale Cloud provider	Well-integrated with Microsoft stack, per-minute pricing	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Apple iCloud	Personal cloud storage	Easy to use, built for the Apple ecosystem, can be encrypted	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Google Cloud	Personal cloud storage	Per-minute pricing	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
Dropbox	Personal cloud storage	Easy to use, affordable, available cross platform and compatible with a wide range of software	For-profit proprietary software, potential for enshittification, vendor-lock in, user surveillance, and generative "AI" data mining
USB/Local hard drive storage	Personal local storage	Decentralized, easy to create backups (at least for smaller data), relatively cheap for smaller data, easy to encrypt	Data security (especially if not encrypted), data corruption, data breach, hard to securely share

Other UWaterloo Data Storage Options

Software	Type	Strengths	Weaknesses
Physical data storage (eg. paper)	Personal local storage	physical backups, harder to copy and distribute, can be physically secured	Data security, data corruption and deterioration, data breach and leaks. Hard to share over large distances, takes physical space, harder to analyze

Shared Language

Shared language allows for definitions of key terminology, but also a critical examination of language itself. This is a **living document**, it will grow and change throughout the lifetime of the project. The University of Waterloo maintains a glossary,[156] detailed below are some of the terms relevant to this project.

Project Terms

Term	Related Terms	Don't Say	Additional Notes
The term and whether or not it should be capitalized.	Synonyms, related terms, or similar concepts to the term.	For clarity, consistency, and/or sensitivity, avoid this or these words.	Could be a definition, further details if it's a self-explanatory term, and/or notes for reference or further discussion.
CARE Principles			"The CARE Principles for Indigenous Data Governance are people and purpose-oriented, reflecting the crucial role of data in advancing Indigenous innovation and self-determination. CARE stands for Collective Benefit, Authority to Control, Responsibility, and Ethics. These principles complement the existing FAIR principles to encourage open and other data movements to consider both people and purpose in their advocacy and pursuits" (https://subjectguides.uwaterloo.ca/rdm/indigenous-data-sovereignty).
CIHR			Acronym for "Canadian Institutes of Health Research". One of the three government funded research agencies in Canada, also known as the Tri-Agency" (https://cihr-irsc.gc.ca/e/193.html).
Data			"Information that may be recorded in various forms" Institute of Network Cultures | TOD #29: Good Data, 2019

[156] Anneliese Eber et al., "Research Guides: Research Data Management: RDM Glossary," accessed April 8, 2025, https://subjectguides.uwaterloo.ca/rdm/glossary.

Project Terms

Term	Related Terms	Don't Say	Additional Notes
Data Management			"Data Management refers to the storage, access and preservation of data produced from a given investigation. Data management practices cover the entire lifecycle of the data, from planning the investigation to conducting it, and from backing up data as it is created and used to long-term preservation of data deliverables after the research investigation has concluded" waterloo-rdm-institutional-strategy).
Data Management Plan			"A formal description of what a researcher plans to do with their data from collection to eventual disposal or deletion" (https://ecampusontario.pressbooks.pub/canadardm/)
Data Stewardship			"The process of Data Stewardship involves ensuring effective control and use of data assets and can include creating and managing metadata, applying standards, managing data quality and integrity, and additional data governance activities related to data curation. It also may include creating educational materials, policies, and guidelines around data at an institution" (https://www.nnlm.gov/guides/data-glossary/data-stewardship).
FAIR Guiding Principles			"Set of foundational principles [...] that all research objects should be Findable, Accessible, Interoperable and Reusable (FAIR) both for machines and for people" https://vocabs.ardc.edu.au/viewById/685).
Indigenous Data Sovereignty			"Indigenous Data Sovereignty is the authority of Indigenous peoples, Nations and communities over their own data, how their data is framed, and how their data is managed. The University of Waterloo respects and recognizes the sovereignty of Indigenous Peoples, Nations, and communities over research data produced by, with, for, and about them. This includes sovereignty over the collection, use, control, access, possession, and sharing of these data." (https://subjectguides.uwaterloo.ca/rdm/indigenous-data-sovereignty).
Interoperability			"The ability of data or tools from non-cooperating resources to work with or communicate with each other with minimal effort using a common language" (https://ecampusontario.pressbooks.pub/canadardm).

Project Terms

Term	Related Terms	Don't Say	Additional Notes
The First Nations Principles of OCAP®			"The First Nations Principles of OCAP® are a set of standards that establish how First Nations data should be collected, protected, used, or shared. It is a tool to guide and support information governance and First Nations data sovereignty. Standing for Ownership, Control, Access, and Possession, OCAP® Principles recognize and support the diversity among and within First Nations communities" (https://subjectguides.uwaterloo.ca/rdm/indigenous-data-sovereignty).
NSERC			"Acronym for "Natural Sciences and Engineering Research Council". One of the three government funded research agencies in Canada, also known as the Tri-Agency" (https://www.nserc-crsng.gc.ca/index_eng.asp) .
TRUST Principles			"Following a year-long public discussion and building on existing community consensus[1], several stakeholders, representing various segments of the digital repository community, have collaboratively developed and endorsed a set of guiding principles to demonstrate digital repository trustworthiness. Transparency, Responsibility, User focus, Sustainability and Technology: the TRUST Principles provide a common framework to facilitate discussion and implementation of best practice in digital preservation by all stakeholders." https://www.nature.com/articles/s41597-020-0486-7
Open Data			"Online, free of cost, accessible data that can be used, reused, and distributed provided that the data source is attributed" (https://ecampusontario.pressbooks.pub/canadardm).
Research Data			"Research Data refers to any information created or collected as evidence in the research process or commonly accepted in the research community as necessary to validate results and conclusions" (https://uwaterloo.ca/research/university-waterloo-rdm-institutional-strategy).
Research Data Management	RDM		Research data management (RDM) covers practices associated with the collection, documentation, storage, sharing, and preservation of all research data. It involves the active organization and maintenance of data throughout the entire research process which

Project Terms

Term	Related Terms	Don't Say	Additional Notes
			includes the periods before, during, and after the active research phase. RDM eases the facilitation of the research process during active research, while also promoting greater data accessibility and supporting research excellence. (https://subjectguides.uwaterloo.ca/rdm/whatisrdm)
SSHRC			"Acronym for "Social Sciences and Humanities Research Council". One of the three government funded research agencies in Canada, also known as the Tri-Agency" (https://www.sshrc-crsh.gc.ca/home-accueil-eng.aspx).

General Terms

Term	Related Terms	Don't Say	Additional Notes
The term and whether or not it should be capitalized.	Synonyms, related terms, or similar concepts to the term.	For clarity, consistency, and/or sensitivity, avoid this or these words.	Could be a definition, further details if it's a self-explanatory term, and/or notes for reference or further discussion.
band membership			"Before 1985, those with Indian status were automatically entitled to band membership. The 1985 amendments recognized the rights of bands to determine their own membership or citizenship codes according to procedures set out in the Indian Act. As a result, people may possess Indian status, but not be members of a band." https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/MMIWG_Lexicon_FINAL_ENFR.pdf
colonialism	settler colonialism		"**The subjugation in part or wholly of a people or country by a dominant group or imperial power**. In the modern era, European powers attempted to subjugate the world to their control" (https://challengeracistbc.ca/).
cultural humility			"a process of self-reflection to understand personal and systemic biases and to develop and maintain respectful processes and relationships based on mutual trust. Cultural humility involves **humbly acknowledging**

General Terms

Term	Related Terms	Don't Say	Additional Notes
			oneself as a learner when it comes to understanding another's experience" (https://www.fnha.ca/WellnessSite/CulturalHumilitySite).
cultural safety			"Cultural safety goes beyond the idea of cultural "appropriateness" and **demands the incorporation of services and processes that empower Indigenous Peoples.** The creation of cultural safety requires, at a minimum, the inclusion of Indigenous languages, laws and protocols, governance, spirituality, and religion" (https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Calls-Web-Version-EN.docx).
decolonization	resurgence	reconciliation, indigenization	"The process of **dismantling the institutions and culture of colonialism** that continue to exist and that underpin systematic racism" (https://challengeracistbc.ca/).
family			"The definition of "family" is not limited to a nuclear family. "Family" must be understood to include all forms of familial kinship, including but not limited to biological families, chosen families, and families of the heart. We maintain the need for this approach to implementation of all Calls for Justice, ensuring that the specific measures taken fully engage these perspectives and this expertise" (https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Calls-Web-Version-EN.docx).
First Nations	First Nation, First Nation community	Indian, Native, band, First Peoples	"**First Nations**" refers to a segment of **Indigenous Peoples** in what some call Canada. First Nations people include both "status" and "non-status Indians" in regards to the Indian Act. "**First Nation**" is often used to refer to a single reserve community whereas the plural "**First Nations**" describes a collective of First Nations people which may include many reserve and non-reserve communities.
genocide	atrocities, assimilation, cultural genocide, colonization	dark/sad chapter, tragic history/mistake, troubled times, painful legacy, went wrong	"'The Canadian state was founded on colonial genocidal policies that are inextricably linked to Canada's contemporary relationship with Indigenous peoples… Modern Canadian policies perpetuate these colonial legacies, and have resulted in clear patterns of violence and marginalization of Indigenous peoples, particularly women, girls and [2SLGBTQIA+]"

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Term	Related Terms	Don't Say	Additional Notes
			(https://www.cbc.ca/news/indigenous/genocide-case-inquiry-1.5160941).
Indian day schools	day schools, day school system		"In addition to residential schools, the Canadian government and Christian churches also ran Indian day schools... where First Nations, Métis and Inuit children were sent during the day, but lived with their parents and remained in their communities" (https://irshdc.ubc.ca/learn/indian-residential-schools/indian-day-schools/).
Indian residential school system	residential school system, residential schools, IRS, mission schools, northern hostels, boarding schools, industrial schools		"An extensive school system set up by the Canadian government and administered by churches that had the nominal objective of educating Aboriginal children but also the more damaging and equally explicit objectives of indoctrinating them into Euro-Canadian and Christian ways of living and assimilating them into mainstream Canadian society" (https://indigenousfoundations.arts.ubc.ca/the_residential_school_system/).
Indian Status			"refers to a specific legal identity of an Aboriginal person in Canada. With the creation of the in 1876, the Canadian government developed criteria for who would be legally considered an Indian. This criteria continues to be outlined in Section 6 of the Indian Act, thus defining who qualifies for Indian status" (https://indigenousfoundations.arts.ubc.ca/indian_status/).
Indigenous community			An open definition of a temporary or permanent gathering of **Indigenous people** who share a common cause, purpose, history, politics, culture, language, etc. May include a reserve, an urban setting, a virtual collective, etc. There is no singular "Indigenous community".
Indigenous Peoples	First Nations, Inuit, Métis, First Peoples, Original Peoples	savage, redskin, primitive, vanishing, uncivilized, *Indian, Aboriginal, Native	For the purposes of this report, this refers to **First Nations, Inuit, and Métis** in what some call Canada. It's both a term and a concept that affirms the right of colonized peoples to self-determination. **should only be used in the context of the "Indian Act" or other government documents, when it is in the official name of a group, institution or organization, or when referring to "Indian status".*

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Term	Related Terms	Don't Say	Additional Notes
Inuit	1: Inuk 2: Inuuk 3 or more: Inuit	Eskimo, Inuit people, Inuits	"The **Indigenous people of the north** who live in Nunavut, Nunavik (northern Quebec), Nunatsiavut (Newfoundland and Labrador), and the Inuvialuit Settlement Region (western Arctic). Inuit means "people" in the Inuktitut language. The term "Inuk" denotes a one Inuit person" (https://challengeracistbc.ca/).
Métis	Métis people, Métis Nation	Half-Breed, mixed, Metis	"means a person who self-identifies as Métis, is distinct from other [Indigenous] peoples, is of historic Métis Nation Ancestry and who is accepted by the Métis Nation." (https://www2.metisnation.ca/about/citizenship/)
Fly in, ice road, island, coastal, and/or rural community		"remote" centers urban areas and erases the specificity of individual communities.	These communities may be interdependent, close to each other, and/or consider the rest of the world to be "remote." **Use the descriptor that the community prefers.**
settler colonialism	Colonialism, colonization, assimilation, genocide	dark-chapter, colonial past	"The colonial **subjugation of Indigenous lands** particularly through the **deployment of non-Indigenous peoples as settlers who then become the dominant group** in the affected territory. British settler colonies today include the United States, Canada, New Zealand, and Australia" (https://challengeracistbc.ca/).
impacts of the residential school system	concentric trauma, intergenerational trauma, PTSD, cycle of violence, multigenerational trauma		Historical and contemporary trauma on the community, both as individuals and collectives.
reserve	band	res; rez; reservation	"An Indian Reserve is a **tract of land set aside under the Indian Act and treaty agreements for the exclusive use of an Indian band**. Band members possess the right to live on reserve lands, and band administrative and political structures are frequently located there. **Reserve lands are not strictly "owned" by bands but are held in trust for bands by the Crown**. The Indian Act grants the Minister of Indian Affairs authority over much of the activity on reserves" (https://indigenousfoundations.arts.ubc.ca/reserves/).
sacred			Aspects of reality that are not to be trifled with that demand respect, appreciation, and are to be honored at all times.

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Term	Related Terms	Don't Say	Additional Notes
Survivor			"A respectful alternate is also to avoid a label altogether, and simply refer to "people who have experienced violence" or "those who have experienced violence" (https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/MMIWG_Lexicon_FINAL_ENFR.pdf)
Reconciliation			"For Indigenous peoples, **reconciliation is often associated with a form of healing—healing ourselves from the violence of settler colonialism**. We often think about it as a nation-to-nation reconciliation, so reconciling our hostile and violent relationship. But the settler state and its courts understand the term as reconciling the existence of Indigenous peoples' title, jurisdictions, nationhood, and laws with the sovereignty of the crown" (https://uppingtheanti.org/journal/article/19-from-recognition-to-decolonization). "... establishing and maintaining a **mutually respectful relationship between Indigenous and non-Indigenous peoples** in this country. In order for that to happen, there has to be **awareness of the past, an acknowledgement of the harm that has been inflicted, atonement for the causes, and action to change behaviour**" (https://nctr.ca/assets/reports/Final%20Reports/Executive_Summary_English_Web.pdf).
resurgence and regeneration	decolonization, restitution	indigenization	A balance of **resisting colonization** while **embracing Indigenous law, culture, tradition, language, community, and connection to land.** It's about recentering Indigeneity as something that exists in the present, respects the past, and builds for future generations - the faces yet to come.
the Creator	Creator, the Great Spirit, the Giver of Life, the Great Mystery, Wakan Tanka, Gitche Manitou, *God		Not to be confused with "content creators". *Note this is contextual as some Indigenous people use the term "God" depending on their religious and/or spiritual beliefs. "The Creator" can be more inclusive as a catch-all term to describe a supreme being responsible for many, if not all, aspects of creation. However, the name is always culturally specific.
Truth	testimonial, experience,	myth, legend, allegation	"Understanding truth means **understanding and honouring lived experiences**; it means

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Term	Related Terms	Don't Say	Additional Notes
	community story		looking at all scenarios not with cold objectivity, but understanding that it sometimes means either **weaving together multiple perspectives**, or holding differing perspectives together at once." (https://www.animikii.com/about/values).
Trauma-informed			"Recognizes the widespread impact of trauma and understands potential paths for recovery. It recognizes the signs and symptoms of trauma in clients, families, staff, and others involved with the system and it responds by **fully integrating knowledge about trauma into policies, procedures and practices.** The goal of a trauma-informed approach is to not re-traumatize people, but to **support healing** in a manner that is **welcoming and appropriate** to the needs of those affected by trauma." https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/MMIWG_Lexicon_FINAL_ENFR.pdf "Incorporating knowledge of trauma into all policies, procedures, and practices of solutions and services is crucial to the implementation of the Calls for Justice. It is fundamental to recognizing the impacts of trauma and to responding appropriately to signs of trauma. Interpretation and implementation of the Calls for Justice must include funding to ensure all necessary steps to create a trauma-informed approach and to deliver trauma-informed services are viable" (https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Calls-Web-Version-EN.docx).
Turtle Island			Derived from many Indigenous creation stories, such as that of the Haudenonsaunee and the Anishinabek people, refers to what some call North America.

Supporting Documents

Below are key documents that provide important contextual information for this project. Like the shared language section, use this as a quick reference tool so we are all in alignment.

Timeline of Essential Rights Instruments, Commissions, Inquiries, Documents, and Reports

Year	Title
1493	Papal bull Inter Caetera (Doctrine of Discovery)
1763	Royal Proclamation
1839	Crown Lands Protection Act
1857	Gradual Civilization Act
1868	Rupert's Land Act
1869	The Gradual Enfranchisement Act
1876	The Indian Act (last amended 2019)
1951	The Indian Act (1951 amendment)
1966	International Covenant on Civil and Political Rights (ICCPR)
1966	International Covenant on Economic, Social and Cultural Rights (ICESCR)
1969	International Convention on the Elimination of All Forms of Racial Discrimination (ICERD)
1969	Statement of the Government of Canada on Indian policy (white paper)
1970	Citizens Plus (Red Paper)
1973	Calder et al. v. Attorney-General of British Columbia
1979	The Committee on the Elimination of Discrimination against Women (CEDAW)
1982	Constitution Act, 1982, Rights of the Aboriginal Peoples of Canada
1984	Guerin v. The Queen
1989	International Labour Organization Indigenous and Tribal Peoples Convention (No. 169)
1990	United Nations Convention on the Rights of the Child (UNCRC)
1990	R. v. Sparrow
1996	Royal Commission on Aboriginal Peoples (RCAP)
1997	Delgamuukw v. British Columbia
1998	First Nations Information Governance Centre First Nations Principles of OCAP (Ownership, Collaboration, Access, and Possession of Data)
2005	Kelowna Accord
2005	Jordan's Principle
2006	Guidelines for the Ethical Engagement of Young People, FN Caring Society
2007	United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)
2010	Principles of ethical Metis Research [PDF]
2015	2030 Agenda for Sustainable Development, Sustainable Development Goals (SDGs)
2015	Truth and Reconciliation Commission of Canada (TRC), Calls to Action
2016	Indigenous Data Sovereignty: Toward an Agenda
2018	National Inuit Strategy of Research (ITK)
2019	National Inquiry into Missing and Murdered Indigenous Women and Girls (MMIWG2S), Calls for Justice

Timeline of Essential Rights Instruments, Commissions, Inquiries, Documents, and Reports

Year	Title
2019	Bill 41 – 2019: Declaration on the Rights of Indigenous Peoples Act
2019	CARE Principles for Indigenous Data Governance
2019	Land Back: A Yellowhead Institute Red Paper
2020	USAI Research Framework
2020	Indigenous Data Sovereignty and Policy
2021	Cash Back: A Yellowhead Institute Red Paper
2022	#DataBack: Asserting and supporting Indigenous data sovereignty
2022	Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans – TCPS 2
2023	Calls to Action Accountability: A 2023 Status Update on Reconciliation - Yellowhead Institute
2023	University of Waterloo RDM Institutional Strategy & Implementation Plan
2025	Indigenous Statistics: From Data Deficits to Data Sovereignty

UNDRIP Articles, TRC Calls to Action, and MMIWG2S Calls for Justice

United Nations Declaration on the Rights of Indigenous Peoples

Article	Description
11	1. Indigenous peoples have the right to practise and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts, designs, ceremonies, technologies and visual and performing arts and literature. 2. States shall provide redress through effective mechanisms, which may include restitution, developed in conjunction with indigenous peoples, with respect to their cultural, intellectual, religious and spiritual property taken without their free, prior and informed consent or in violation of their laws, traditions and customs.
12	1. Indigenous peoples have the right to manifest, practise, develop and teach their spiritual and religious traditions, customs and ceremonies; the right to maintain, protect, and have access in privacy to their religious and cultural sites; the right to the use and control of their ceremonial objects; and the right to the repatriation of their human remains. 2. States shall seek to enable the access and/or repatriation of ceremonial objects and human remains in their possession through fair, transparent and effective mechanisms developed in conjunction with indigenous peoples concerned.
13	1. Indigenous peoples have the right to revitalize, use, develop and transmit to future generations their histories, languages, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons. 2. States shall take effective measures to ensure that this right is protected and also to ensure that indigenous peoples can understand and be understood in political, legal and administrative proceedings, where necessary through the provision of interpretation or by other appropriate means.
15	1. Indigenous peoples have the right to the dignity and diversity of their cultures, traditions, histories and aspirations which shall be appropriately reflected in education and public information. 2. States shall take effective measures, in consultation and cooperation with the indigenous

United Nations Declaration on the Rights of Indigenous Peoples

Article	Description
	peoples concerned, to combat prejudice and eliminate discrimination and to promote tolerance, understanding and good relations among indigenous peoples and all other segments of society.
31	1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions. 2. In conjunction with indigenous peoples, States shall take effective measures to recognize and protect the exercise of these rights.

Source:
https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf

Truth and Reconciliation Commission of Canada: Calls to Action

CTA	Description
10	We call on the federal government to draft new Aboriginal education legislation with the full participation and informed consent of Aboriginal peoples. The new legislation would include a commitment to sufficient funding and would incorporate the following principles: i. Providing sufficient funding to close identified educational achievement gaps within one generation. ii. Improving education attainment levels and success rates. iii. Developing culturally appropriate curricula. iv. Protecting the right to Aboriginal languages, including the teaching of Aboriginal languages as credit courses. v. Enabling parental and community responsibility, control, and accountability, similar to what parents enjoy in public school systems. vi. Enabling parents to fully participate in the education of their children. vii. Respecting and honouring Treaty relationships.
11	We call upon the federal government to provide adequate funding to end the backlog of First Nations students seeking a post-secondary education.
13	We call upon the federal government to acknowledge that Aboriginal rights include Aboriginal language rights.
45	We call upon the Government of Canada, on behalf of all Canadians, to jointly develop with Aboriginal peoples a Royal Proclamation of Reconciliation to be issued by the Crown. The proclamation would build on the Royal Proclamation of 1763 and the Treaty of Niagara of 1764, and reaffirm the nation-to-nation relationship between Aboriginal peoples and the Crown. The proclamation would include, but not be limited to, the following commitments: i. Repudiate concepts used to justify European sovereignty over Indigenous lands and peoples such as the Doctrine of Discovery and terra nullius. ii. Adopt and implement the United Nations Declaration on the Rights of Indigenous Peoples as the framework for reconciliation. iii. Renew or establish Treaty relationships based on principles of mutual recognition, mutual respect, and shared responsibility for maintaining those relationships into the future.
92	We call upon the corporate sector in Canada to adopt the United Nations Declaration on the Rights of Indigenous Peoples as a reconciliation framework and to apply its principles, norms, and standards to corporate policy and core

Truth and Reconciliation Commission of Canada: Calls to Action

CTA	Description
	operational activities involving Indigenous peoples and their lands and resources. This would include, but not be limited to, the following: i. Commit to meaningful consultation, building respectful relationships, and obtaining the free, prior, and informed consent of Indigenous peoples before proceeding with economic development projects. ii. Ensure that Aboriginal peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects. iii. Provide education for management and staff on the history of Aboriginal peoples, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and Aboriginal rights, Indigenous law, and Aboriginal–Crown relations. This will require skills based training in intercultural competency, conflict resolution, human rights, and anti-racism.

Source: https://ehprnh2mwo3.exactdn.com/wp-content/uploads/2021/01/Calls_to_Action_English2.pdf

National Inquiry into Missing and Murdered Indigenous Women and Girls Calls for Justice

CFJ	Description
2.1	We call upon all governments to acknowledge, recognize, and protect the rights of Indigenous Peoples to their cultures and languages as inherent rights, and constitutionally protected as such under section 35 of the Constitution.
2.4	We call upon all governments to provide the necessary resources and permanent funds required to preserve knowledge by digitizing interviews with Knowledge Keepers and language speakers. We further call upon all governments to support grassroots and community-led Indigenous language and cultural programs that restore identity, place, and belonging within First Nations, Inuit, and Métis communities through permanent, no-barrier funding and resources. Special measures must include supports to restore and revitalize identity, place, and belonging for Indigenous Peoples and communities who have been isolated from their Nations due to colonial violence, including 2SLGBTQQIA people and women who have been denied Status.
11.1	We call upon all elementary, secondary, and post-secondary institutions and education authorities to educate and provide awareness to the public about missing and murdered Indigenous women, girls, and 2SLGBTQQIA people, and about the issues and root causes of violence they experience. All curriculum development and programming should be done in partnership with Indigenous Peoples, especially Indigenous women, girls, and 2SLGBTQQIA people. Such education and awareness must include historical and current truths about the genocide against Indigenous Peoples through state laws, policies, and colonial practices. It should include, but not be limited to, teaching Indigenous history, law, and practices from Indigenous perspectives and the use of Their Voices Will Guide Us with children and youth.
15.1	Denounce and speak out against violence against Indigenous women, girls, and 2SLGBTQQIA people.
15.2	Decolonize by learning the true history of Canada and Indigenous history in your local area. Learn about and celebrate Indigenous Peoples' history, cultures, pride, and diversity, acknowledging the land you live on and its importance to local Indigenous communities, both historically and today.
15.3	Develop knowledge and read the Final Report. Listen to the truths shared, and acknowledge the burden of these human and Indigenous rights violations, and how they impact Indigenous women, girls, and 2SLGBTQQIA people today.

National Inquiry into Missing and Murdered Indigenous Women and Girls Calls for Justice

CFJ	Description
15.4	Using what you have learned and some of the resources suggested, become a strong ally. Being a strong ally involves more than just tolerance; it means actively working to break down barriers and to support others in every relationship and encounter in which you participate.
15.5	Confront and speak out against racism, sexism, ignorance, homophobia, and transphobia, and teach or encourage others to do the same, wherever it occurs: in your home, in your workplace, or in social settings.
15.6	We call on all Canadians to protect, support, and promote the safety of women, girls, and 2SLGBTQQIA people by acknowledging and respecting the value of every person and every community, as well as the right of Indigenous women, girls, and 2SLGBTQQIA people to generate their own, self-determined solutions.
15.7	Create time and space for relationships based on respect as human beings, supporting and embracing differences with kindness, love, and respect. Learn about Indigenous principles of relationship specific to those Nations or communities in your local area and work, and put them into practice in all of your relationships with Indigenous Peoples.
15.8	Help hold all governments accountable to act on the Calls for Justice, and to implement them according to the important principles we set out.
18.3	We call upon all governments, service providers, and those involved in research to change the way data is collected about 2SLGBTQQIA people to better reflect the presence of individuals and communities, and to improve the inclusion of 2SLGBTQQIA people in research, including 2SLGBTQQIA-led research.
18.4	We call upon all governments, service providers, and those involved in research to modify data collection methods to: i Increase accurate, comprehensive statistical data on 2SLGBTQQIA individuals, especially to record the experiences of trans-identified individuals and individuals with non-binary gender identities. ii Eliminate "either-or" gender options and include gender-inclusive, gender-neutral, or non-binary options – for example, an "X-option" – on reporting gender in all contexts, such as application and intake forms, surveys, Status cards, census data and other data collection. iii Increase precision in data collection to recognize and capture the diversity of 2SLGBTQQIA communities: for example, the experiences of Two-Spirit women/lesbians, and differentiations between Two-Spirit and trans-identified individuals and between trans-masculine and trans-feminine experiences.

Source: https://www.mmiwg-ffada.ca/wp-content/uploads/2019/06/Calls_for_Justice.pdf

Animikii, as a business, is guided by the 7 Grandfather Teachings from Anishinaabe culture: **Humility**, **Truth**, **Honesty**, **Wisdom**, **Respect**, **Courage**, and **Love**. While these principles guide our software development practice, they may also be useful in the context of this project as a starting point to exploring appropriate principles and values for University of Waterloo researchers.

Animikii Working Principles

Teaching	Description
Humility	➔ We understand that technological interventions impact both people and the land, and as such we are responsible for ensuring that no harm comes to either. People and the land are intrinsically linked. ➔ We work in close collaboration with those most impacted by our work and act as learners in this relationship, always seeking guidance and **Wisdom** so we can build better software collectively.
Truth	➔ We honour that everyone's perspectives are valid even if they seem foreign or unusual. ➔ We hold space for multiple **Truths**, and work to find a balance that works for all while appreciating that this may lead to discomfort that we'll work through together.
Honesty	➔ We speak Truth, saying things "as they are," and act with care, **Courage**, **Humility**, **Respect**, and **Love** while doing so. ➔ We are always learning and will make mistakes. We will be accountable for our mistakes and expect the same from others.
Wisdom	➔ We recognize that we don't know everything, no one does, our collective experiences are where we find **Truth**. ➔ We learn from everything we do, good or bad, and improve on each iteration of our work so that all of our partners benefit. ➔ We actively listen and seek to understand, not just hear.
Respect	➔ We don't work alone or unilaterally, and we **Respect** what everyone brings to the collaboration. We trust that users are the experts of their lives and develop software based on their experiences. ➔ We seek to build consensus, not conflict, and recognize that this can be awkward and that's ok. ➔ We don't interrupt others and we hold space for everyone to participate if they choose to do so. We also hold space for silence, for our Ancestors, and for more-than-human relatives to contribute as well.
Courage	➔ We lead when it's necessary and step back when it's appropriate. ➔ We take things one step at a time, and while we have a plan and a vision, we don't hesitate to adapt when it's necessary. ➔ We ask questions, we don't assume, we give credit where credit is due.
Love	➔ We appreciate everyone in this partnership along with the values they bring, and seek appropriate ways to unite everyone's visions, goals, hopes and dreams. ➔ We build on consensus and act in solidarity with each other even if we don't agree on everything.

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