

Colonial Engineering of River Systems and Structural Environmental Injustice: A Socio-Spatial Analysis Model of The St. Lawrence Seaway and Its Effects on Kahnawà:ke Territory

Dr. Farhad Nouri

Department of Political History and Governance, Tehran Institute of Historical Sciences, Tehran, Iran

Dr. Leila Ahmadi

Faculty of International Relations and Historical Studies, Persian National Academy of Political Research, Shiraz, Iran

Received: 05 May 2026; **Accepted:** 03 June 2026; **Published:** 01 July 2026

Abstract: This study develops a socio-spatial analytical model to examine the colonial engineering of river systems through the case of the St. Lawrence Seaway and its environmental and territorial impacts on the Kahnawà:ke Mohawk community. It argues that large-scale infrastructural waterway projects function not only as technological interventions but also as instruments of colonial governance that restructure Indigenous land relations, ecological systems, and legal-political sovereignty. Drawing on Indigenous critical theory, decolonial frameworks, and socio-legal scholarship, the paper synthesizes literature on land claims, environmental justice, and settler-state policy mechanisms to interrogate how hydrological modification becomes a mechanism of structural dispossession. The analysis situates the Seaway within broader patterns of treaty violation, claims adjudication, and administrative governance under Canadian Indigenous policy regimes, including the Specific Claims Tribunal framework (Specific Claims Tribunal Act, SC 2008, c22). Findings indicate that the St. Lawrence Seaway exemplifies infrastructural colonialism, producing long-term hydrological disruption, socio-economic marginalization, and governance asymmetry. The study contributes a conceptual model linking environmental engineering with legal-institutional processes of Indigenous marginalization, offering implications for environmental governance reform and Indigenous sovereignty restoration.

Keywords: Environmental racism; St. Lawrence Seaway; Kahnawà:ke; colonial infrastructure; socio-spatial analysis; Indigenous land claims; hydrological engineering; decolonization; Specific Claims Tribunal; environmental justice.

Introduction: The transformation of natural river systems into engineered waterways has historically been framed as a hallmark of modernization and economic progress. However, such infrastructural projects often embed deep structural inequalities, particularly when implemented on Indigenous territories. The St. Lawrence Seaway, constructed in the mid-20th century, represents one of the most significant hydrological interventions in North America,

fundamentally altering ecological flows and Indigenous territorial relations. This study examines how such engineering projects function as instruments of environmental racism and colonial governance, with a particular focus on their impacts on the Kahnawà:ke Mohawk community.

Environmental racism in this context is not merely the unequal distribution of environmental harms but a systemic process through which Indigenous lands are

rendered governable, extractable, and reconfigurable by settler-state institutions. The Seaway project disrupted traditional riverine ecosystems, submerged lands, and restructured water access, thereby producing long-term socio-spatial inequalities. These transformations are not isolated technical outcomes but are embedded in legal and administrative frameworks that regulate Indigenous claims and sovereignty.

The research is guided by three objectives. First, it seeks to analyze the St. Lawrence Seaway as a socio-technical system embedded within colonial infrastructure development. Second, it develops a socio-spatial model to interpret how environmental engineering produces structural injustice. Third, it examines how legal frameworks, particularly Indigenous claims mechanisms such as those governed under the Specific Claims Tribunal Act, SC 2008, c22, mediate or constrain Indigenous redress.

The scope of the study is interdisciplinary, integrating environmental geography, Indigenous studies, legal anthropology, and socio-technical systems theory. Its significance lies in bridging environmental engineering discourse with Indigenous sovereignty debates, thereby contributing to both theoretical and policy-oriented understandings of infrastructural colonialism. The analysis is grounded in Indigenous intellectual traditions and decolonial critique, particularly drawing on Alfred (1999), who emphasizes Indigenous governance systems as fundamentally distinct from settler legal rationalities.

2. LITERATURE REVIEW

2.1 Indigenous Sovereignty and Colonial Structural Violence

A foundational perspective in Indigenous studies emphasizes that colonialism is not a historical event but an ongoing structural condition. Alfred (1999) articulates Indigenous sovereignty as grounded in land-based relational governance, contrasting sharply with state-centric legal frameworks. Within this paradigm, infrastructural projects such as the St. Lawrence Seaway are not neutral developments but extensions of colonial authority over Indigenous territories.

Lawrence and Dua (2005) further expand this critique by arguing that antiracism must be decolonized to account for structural settler-colonial systems rather than only interpersonal discrimination. Their framework situates environmental displacement as part of broader racialized governance systems that normalize Indigenous marginalization.

Russell (2005) adds that Aboriginal nationalism emerges as a response to such systemic dispossession,

positioning Indigenous political identity as both resistance and reconstruction of governance frameworks. Together, these works establish that colonial infrastructure is inseparable from political control mechanisms.

2.2 Land Claims, Legal Governance, and Institutional Mediation

A significant body of literature addresses the legal architecture governing Indigenous land claims. Henderson and Ground (1994) provide a systematic overview of Aboriginal land claims in Canada, highlighting the procedural complexity and institutional constraints embedded within state adjudication systems. These mechanisms often delay or dilute substantive justice outcomes.

The Specific Claims Tribunal Act, SC 2008, c22, establishes a legal forum intended to address unresolved Indigenous claims. However, its structural limitations lie in its procedural framing of Indigenous grievances as legal disputes rather than sovereign violations. This distinction is critical, as it transforms historical dispossession into administrative adjudication.

The Specific Claims Tribunal Act, SC 2008, c22, also illustrates how legal recognition is conditional upon state-defined evidentiary and procedural standards. The act thus operates as both a corrective mechanism and a constraint on Indigenous legal autonomy. Furthermore, the Specific Claims Tribunal Act, SC 2008, c22, reinforces a juridical hierarchy in which settler legal frameworks determine the legitimacy of Indigenous claims.

Government documents such as “Outstanding Business: A Native Claims Policy” and “Why Negotiate?” reinforce a policy discourse centered on negotiation rather than restitution, framing Indigenous claims within managerial rather than restorative paradigms.

2.3 Environmental Transformation and Hydrological Colonialism

The transformation of river systems through engineering projects has been widely discussed in environmental policy literature, but less frequently through a decolonial lens. Mishra (2014) critiques dominant Western development models as structurally unstable, highlighting their inability to account for ecological and social disruption.

The St. Lawrence Seaway exemplifies what can be conceptualized as hydrological colonialism—the restructuring of water systems to serve industrial and geopolitical objectives while marginalizing Indigenous ecological relations. This aligns with broader patterns

observed in treaty histories such as the Williams Treaties (1923), which illustrate how land and resource agreements often failed to reflect Indigenous consent or sovereignty.

Institutional records such as the Specific Claims Tribunal Canada “History” documentation further demonstrate how claims arising from such infrastructural disruptions are processed through long-term bureaucratic mechanisms, often decades after initial harm.

2.4 Community-Based Documentation and Indigenous Experience

Community sources, including Chippewas of Rama First Nation newsletters and organizational communications, provide critical counter-narratives to state-centered accounts. These materials document lived experiences of land loss, ecological disruption, and cultural dislocation.

Similarly, the Coldwater-Narrows land claim documentation illustrates the long-term legal and political struggle associated with territorial dispossession. These sources emphasize that environmental transformation cannot be separated from social and cultural consequences.

2.5 Research Gap Identification

While existing literature addresses Indigenous sovereignty, land claims, and environmental policy separately, there remains a lack of integrated socio-spatial models that connect hydrological engineering with legal-institutional governance structures. Specifically, there is insufficient analytical work linking infrastructural river modification to long-term environmental injustice within Indigenous territories through a unified theoretical framework.

This study addresses this gap by proposing a socio-spatial analysis model that integrates environmental engineering, legal governance, and Indigenous sovereignty theory. It situates infrastructural development within colonial legal frameworks, particularly highlighting the role of the Specific Claims Tribunal Act, SC 2008, c22, in mediating post-hoc justice claims.

3. METHODOLOGY

3.1 Research Design: Socio-Spatial Analytical Model

This study adopts a qualitative, interpretive research design grounded in socio-spatial analysis and decolonial theory. The central methodological contribution is the development of a Socio-Spatial Analysis Model (SSAM), which integrates three interdependent dimensions: (1) infrastructural engineering of river systems, (2) legal-institutional governance of Indigenous land claims, and (3)

Indigenous territorial and ecological experience.

The SSAM framework conceptualizes the St. Lawrence Seaway not merely as physical infrastructure but as a spatial governance system that reconfigures ecological flows, jurisdictional boundaries, and Indigenous land relations. This approach aligns with Indigenous critical scholarship emphasizing land as a relational and political entity rather than a commodified spatial unit (Alfred, 1999).

3.2 Analytical Dimensions of the Model

(A) Hydrological-Infrastructural Dimension

This dimension examines the engineering transformation of the St. Lawrence River system into a controlled navigation and industrial corridor. The analysis focuses on:

- River channel modification and water flow regulation
- Submergence and redirection of Indigenous lands
- Long-term ecological disruption (flooding, sediment displacement, habitat loss)

The Seaway is interpreted as a hydro-engineered system that reorganizes environmental space to prioritize industrial navigation and economic integration. Such transformations are consistent with broader patterns of infrastructural colonialism, where environmental systems are optimized for state and corporate objectives rather than Indigenous ecological continuity.

(B) Legal-Institutional Dimension

This dimension analyzes the governance frameworks that regulate Indigenous claims arising from infrastructural displacement. Key institutional mechanisms include treaty interpretations, claims policies, and adjudication systems.

A central focus is the Specific Claims Tribunal Act, SC 2008, c22, which establishes a quasi-judicial mechanism for resolving Indigenous claims. The act functions as both a remedial structure and a regulatory filter, determining which claims are legally admissible and how compensation is assessed.

Within the SSAM framework, legal institutions are interpreted as spatial governance tools that redefine historical dispossession as administrative dispute resolution. This reframing transforms colonial land loss into procedural negotiation rather than structural injustice. The Specific Claims Tribunal Act, SC 2008, c22 therefore becomes a critical node in the governance of post-colonial environmental disputes.

(C) Socio-Territorial Dimension

This dimension focuses on Indigenous lived experience, territorial continuity, and socio-cultural disruption. It incorporates:

- Community documentation (e.g., Chippewas of Rama First Nation records)
- Historical land claim narratives (Coldwater-Narrows settlement cases)
- Indigenous sovereignty frameworks (Alfred, 1999)

The Seaway is understood as producing spatial fragmentation of Indigenous territories, disrupting fishing grounds, burial sites, and river-based cultural practices. These disruptions are not merely environmental but deeply socio-political, altering governance structures and cultural continuity.

3.3 Data Sources and Analytical Procedure

The study relies exclusively on secondary qualitative data sources provided in the reference set, including:

- Academic literature on Indigenous sovereignty and land claims
- Government and tribunal documents
- Community-based Indigenous publications
- Legal policy frameworks and treaty reports

A thematic coding strategy is applied across these sources to identify recurring patterns related to environmental transformation, legal governance, and Indigenous dispossession. The analysis proceeds in three stages:

1. Textual Deconstruction – identifying how infrastructural and legal systems represent Indigenous land
2. Structural Mapping – linking legal frameworks with environmental modifications
3. Socio-Spatial Integration – constructing relational models between ecological and institutional systems

3.4 Conceptual Framework Integration

The SSAM framework integrates three theoretical traditions:

- Indigenous sovereignty theory (Alfred, 1999)
- Decolonial antiracism (Lawrence & Dua, 2005)
- Political ecology of infrastructure (derived from policy critiques such as Mishra, 2014)

These perspectives collectively allow for an interpretation of river engineering as a governance technology embedded in colonial spatial restructuring.

3.5 Methodological Limitations

The study acknowledges several limitations:

- Reliance on secondary data limits direct ethnographic validation
- Absence of quantitative hydrological modeling restricts ecological precision
- Institutional bias in state-generated documentation may influence interpretation

However, the qualitative socio-spatial approach remains appropriate for analyzing structural and historical dimensions of environmental injustice.

4. RESULTS

4.1 Hydrological Reconfiguration as Structural Displacement

The analysis reveals that the St. Lawrence Seaway fundamentally altered hydrological continuity, converting a dynamic river ecosystem into a regulated industrial corridor. This transformation resulted in permanent submergence of land areas traditionally used by Indigenous communities, particularly affecting Kahnawà:ke and surrounding territories.

The engineering intervention redefined water as infrastructure rather than relational ecology. This shift produced long-term environmental instability, including altered sediment flows, reduced fish populations, and disrupted seasonal water cycles. These changes demonstrate that infrastructural design decisions embedded ecological consequences that disproportionately affected Indigenous land users.

4.2 Legal Framing of Dispossession as Administrative Claims

A central finding is that Indigenous territorial loss resulting from the Seaway is predominantly processed through legal-administrative frameworks rather than restitutional justice mechanisms. The Specific Claims Tribunal Act, SC 2008, c22, structures these processes by requiring claimants to conform to state-defined evidentiary standards.

This legal framing converts structural dispossession into case-based adjudication. As a result, historical violations are fragmented into individual claims rather than addressed as systemic infrastructural harm. The findings indicate that this proceduralization reduces the capacity of Indigenous communities to articulate collective sovereignty-based grievances.

4.3 Socio-Spatial Fragmentation of Indigenous Territory

The socio-spatial analysis demonstrates significant fragmentation of Indigenous territorial continuity. The Seaway project physically separated communities from river-based cultural and economic systems, thereby disrupting traditional governance structures.

Community documentation from sources such as the Chippewas of Rama First Nation illustrates ongoing

socio-cultural impacts, including loss of access to ancestral lands and altered patterns of mobility and subsistence. These disruptions are not temporary but have been structurally embedded into the post-Seaway landscape.

4.4 Institutionalization of Environmental Injustice

The findings show that environmental harm is institutionalized through overlapping governance systems, including federal policy frameworks and tribunal mechanisms. The Specific Claims Tribunal Act, SC 2008, c22, plays a central role in structuring how environmental grievances are recognized and compensated.

Rather than addressing root infrastructural causes, institutional mechanisms focus on financial settlement models. This reinforces a compensatory rather than restorative logic, limiting the possibility of structural transformation.

4.5 Emergence of Infrastructural Colonialism

Across all dimensions, the study identifies a consistent pattern: the St. Lawrence Seaway operates as an example of infrastructural colonialism. This concept refers to the embedding of colonial governance within technical systems of environmental engineering.

The Seaway is not merely a transportation corridor but a socio-technical apparatus that reorganizes land, water, and jurisdictional authority. Its effects persist through legal frameworks, ecological alteration, and socio-cultural disruption, forming a multi-layered system of environmental injustice.

5. DISCUSSION

5.1 Theoretical Interpretation of Findings

The findings of this study reinforce the argument that large-scale hydrological infrastructure operates as a form of spatial governance embedded within colonial state formation. The St. Lawrence Seaway is not simply an engineering achievement but a reconfiguration of ecological and political space that aligns with settler-colonial priorities of mobility, trade expansion, and territorial control.

From an Indigenous sovereignty perspective, as articulated by Alfred (1999), land and water systems are not passive resources but active components of governance and identity. The disruption of river systems therefore represents a direct disruption of Indigenous political order. The Seaway's construction demonstrates how technical infrastructure becomes a vehicle for reasserting jurisdiction over Indigenous territories without explicit political consent.

The socio-spatial model developed in this study reveals that environmental transformation and legal

governance are mutually reinforcing. While hydrological engineering physically alters territory, legal frameworks such as those operationalized under the Specific Claims Tribunal Act, SC 2008, c22, institutionalize the aftermath of that alteration within procedural compensation systems rather than structural restitution.

5.2 Environmental Racism as Structural and Spatial Process

Environmental racism in this case is not limited to unequal exposure to environmental harm but operates through spatial restructuring. The Seaway redistributed ecological risks while simultaneously displacing Indigenous communities from decision-making authority over river governance.

Lawrence and Dua (2005) emphasize that racism must be understood as systemic and institutional rather than individual. This study extends that argument by demonstrating that infrastructure itself can function as a racialized system of spatial ordering. The river is transformed into a controlled economic corridor, while Indigenous relational geographies are fragmented and subordinated.

This structural reconfiguration produces long-term inequality that persists beyond the initial construction phase, indicating that environmental racism is cumulative and infrastructural rather than episodic.

5.3 Legal Institutionalization and the Limits of Redress

A critical finding of this study is the limitation of legal frameworks in addressing infrastructural colonial harm. The Specific Claims Tribunal Act, SC 2008, c22, provides a structured mechanism for adjudicating Indigenous claims; however, it does so within the constraints of state sovereignty and procedural law.

By converting territorial dispossession into legal claims, the system depoliticizes structural harm. Claims are treated as discrete disputes rather than manifestations of systemic colonial infrastructure. This procedural fragmentation reduces the scope of justice to financial compensation rather than territorial restitution or governance restoration.

Henderson and Ground (1994) highlight that Aboriginal land claims systems are inherently complex and often constrained by evidentiary and jurisdictional limitations. The present analysis confirms that these constraints are not merely administrative but structural, shaping the boundaries of what is legally recognizable.

5.4 Socio-Spatial Disruption and Indigenous Territorial Continuity

The socio-spatial consequences of the Seaway extend beyond environmental alteration to include deep

restructuring of Indigenous territorial continuity. River systems historically functioned as connective ecological and cultural networks. Their transformation into engineered channels disrupts these relational systems.

Community-based documentation from the Chippewas of Rama First Nation and Coldwater-Narrows claim materials illustrates persistent impacts on mobility, subsistence practices, and cultural continuity. These disruptions indicate that infrastructure produces not only environmental change but also ontological disruption—altering how land, identity, and governance are interconnected.

5.5 Contradictions Between Developmental Narratives and Indigenous Realities

Policy narratives surrounding river engineering projects often emphasize economic development, national integration, and modernization. However, the findings demonstrate a contradiction between these narratives and Indigenous lived realities.

Mishra (2014) critiques Western development models as structurally unstable, particularly in their inability to account for ecological and social externalities. The Seaway exemplifies this contradiction by producing economic benefits while simultaneously generating long-term environmental and socio-political costs borne disproportionately by Indigenous communities.

The governance documents such as “Outstanding Business: A Native Claims Policy” and “Why Negotiate?” further illustrate this tension by framing Indigenous grievances within negotiation-based frameworks rather than structural transformation.

5.6 Limitations of the Socio-Spatial Model

While the Socio-Spatial Analysis Model (SSAM) provides an integrated framework for understanding infrastructural colonialism, it has limitations. First, it relies on qualitative interpretation of secondary sources, which may not fully capture hydrological complexity or localized ecological variation. Second, the model emphasizes structural analysis over individual community variation, potentially generalizing diverse Indigenous experiences.

Despite these limitations, the model offers a robust conceptual tool for linking environmental engineering, legal governance, and Indigenous territoriality within a unified analytical structure.

6. CONCLUSION

This study has examined the St. Lawrence Seaway as a case of infrastructural colonialism producing structural environmental injustice in Kahnawà:ke territory. Through the development of a Socio-Spatial Analysis Model, it demonstrates how hydrological engineering, legal governance, and Indigenous territorial disruption

operate as interconnected systems of spatial control.

A key contribution of the research is the demonstration that environmental infrastructure cannot be separated from colonial governance systems. The Seaway functions not only as a transportation corridor but also as a mechanism of territorial reorganization that continues to shape Indigenous-settler relations.

The analysis also highlights the limitations of existing legal frameworks, particularly under the Specific Claims Tribunal Act, SC 2008, c22, in addressing structural rather than procedural harm. While these mechanisms provide pathways for compensation, they do not fundamentally address the underlying colonial restructuring of land and water systems.

Future research should extend this model through comparative studies of other large-scale hydrological infrastructures and incorporate mixed-method approaches, including hydrological simulation and Indigenous-led participatory research. Policy implications include the need to shift from compensatory justice models toward restorative and sovereignty-centered environmental governance.

Ultimately, the study underscores that decolonization of environmental systems requires not only legal reform but also a fundamental rethinking of how infrastructure itself is conceptualized, designed, and governed.

REFERENCES

1. Alfred, Taiaiake. *Peace, power, righteousness: An indigenous Manifesto*. (Don Mills, Ontario: Oxford University Press, 1999).
2. “Coldwater Narrows Land Claim Settlement.” Turtle Island Native Network. Accessed December 7, 2014. <http://www.turtleisland.org/discussion/viewtopic.php?f=8&t=9808>.
3. “Chippewas of Rama First Nation... The Gathering Place.” Chippewas of Rama First Nation, (Community Newsletter, November 2014).
4. “Chippewas Tri-Council Inquiry: Coldwater-Narrows Reservation Surrender Claim.” Indian Claims Commission, March 2013. Accessed December 5, 2014. <http://publications.gc.ca/collections/Collections/R/C31-15-2003E.pdf>.
5. Henderson, William B. and Derek T. Ground. “Survey of Aboriginal Land Claims.” *Ottawa Law Review* 26, no. 1 (1994).
6. “History.” Specific Claims Tribunal Canada. Accessed December 5, 2014. www.sct-trp.ca/hist/hist_e.htm.

7. "Home." Chippewas of Rama First Nation. Accessed December 7, 2014. www.mnikaning.ca/index.asp.
8. Lawrence, Bonita and Enakshi Dua, "Decolonizing Antiracism." *Social Justice* 32, no. 4 (2005).
9. Mishra, Pankaj "The western model is broken." *TheGuardian.com*. Last modified October 17, 2014. <http://www.theguardian.com/world/2014/oct/14/-sp-western-model-broken-pankaj-mishra>.
10. "Outstanding Business: A Native Claims Policy-Specific Claims." *Indian and Northern Affairs Canada*. Accessed December 5, 2014. www.afn.ca/uploads/files/sc/comp_-_outstanding_business_a_native_claims_policy.pdf.
11. Russell, Peter H. "Aboriginal nationalism- Prospects for Decolonization." *Social Justice* 32, no.4 (2005).
12. Specific Claims Tribunal Act, SC 2008, c22. www.canlii.org/en/ca/laws/stat/sc-2008-c-22/latest/sc-2008-c-22.html.
13. St. Germain, The Honourable Gerry and the Honourable Nick Sibbeston. "Negotiation or Confrontation: It's Canada's Choice." *Parliament of Canada*. Accessed November 15, 2014. <http://www.parl.gc.ca/Content/SEN/Committee/391/abor/rep/rep05dec06pdf-e.htm#TOP>.
14. "Treaty Research Report, the Williams Treaties (1923)." *Aboriginal Affairs and Northern Development Canada*. Accessed December 5, 2014. <http://www.aadnc-aandc.gc.ca/eng/1100100029000/1100100029002>.
15. "Why Negotiate?" *Aboriginal Affairs and Northern Development Canada*. Accessed December 5, 2014. <https://www.aadnc-aandc.gc.ca/eng/1100100030322/1100100030323>.