Identity Erosion:
Adaptive Architecture for the Evolving Coastline of Fortune, Newfoundland

by

Luke Godden

Submitted in partial fulfilment of the requirements
for the degree of Master of Architecture

at

Dalhousie University
Halifax, Nova Scotia
July 2019

CONTENTS

Abstract iv

Acknowledgements v

Chapter 1: Introduction 1

- The Establishment and Erosion of Identity 1
- Fortune: An Outport Archetype 5
- Thesis Question, Position, and Intent 8

Chapter 2: Identity Formation 12

- Foundation 12
  - (Re)discovery: New Found Land 13
  - Settlement: From Ephemeral to Perennial 15
  - Building Culture: A History of Adaptation 17
- Transition 25
  - Confederation 26
  - Resettlement 27
  - Cod Moratorium 28
  - Rural Impact 29
- Resilience 34

Chapter 3: Coastal Erosion 36

- Geological Origins 36
  - The Grand Banks 36
  - Sculpting The Rock 38
- Erosion 40
  - Causes of Coastal Change 41
  - Coastal Monitoring 53
  - Climate Change Implications 56
- Response 58
  - Defend 59
  - Vacate 61
  - Adapt 61
  - Case Study: The Retreating Village 62

Chapter 4: Design Methodology 66
Tradition and Innovation 66
Preserving Tradition 67
Embracing Innovation 68
Resilience Through Adaptation 69
Bedrock and Sediment 73
Residents and Visitors 74
Fortune's Unique Identity 74
Program Development 78
Chapter 5: Architectural Response 81
Site Strategy 81
Short-Term Intervention 83
Adaptive Wharf 85
Terminal Buildings 86
Outbuilding Pods 96
Long-Term Adaptation 99
Timescale Diversity 99
Program Evolution 101
Adaptation Scenarios 102
Chapter 6: Conclusion 111
Bibliography 113

ABSTRACT

Newfoundland's cultural identity is derived from a historical relationship with the sea. Situated to ensure access to fishing grounds, outports' dependence on the fertile waters of the Atlantic guided the settlement patterns and architectural expressions of the island's coastal communities. Despite the seemingly perennial nature of this shoreline inhabitation, coastal erosion is gradually destroying these built and natural environments. Particularly vulnerable to erosion is the town of Fortune, a southern outport that connects Canada, by ferry, with the French islands of St. Pierre and Miquelon. As erosion persists, Fortune will lose the components of the urban landscape that define its sense of identity.

Traditionally, resiliency is achieved through adaptation in Newfoundland; threatened by harsh coastal conditions, structures were once built for mobility and modification. Through a modern translation of these principles, the thesis proposes an adaptive, environmentally responsive ferry terminal wharf capable of evolving with Fortune's restless coastline.

ACKNOWLEDGEMENTS

To my parents, Tom and Heather Godden, thank you for providing a constant source of unwavering support and inspiration. You have established a foundation that has undoubtedly contributed to the successful pursuit of this passion.

To Courtney Pike, thank you for your consistent encouragement, patience, and confidence in me throughout this entire process.

To Diogo Burnay and Brian Lilley, thank you for your guidance, advice, and enthusiasm throughout this process. Your trust, devotion, and critical insight was invaluable to the project's development, and made working with you a pleasure.

To Brian Rose, thank you for welcoming me into your community and providing a helpful source of information regarding Fortune's history and development.

To Ben Cottrill and Jed Ramiscal, thank you for your help with model assembly when time was of the essence.

Finally, to my fellow classmates, thank you for generating a supportive and lighthearted studio atmosphere. You have made this an enjoyable journey.

CHAPTER 1: INTRODUCTION

This thesis explores the interface between coastal erosion and Newfoundland's traditional architectural landscape. In this chapter, a summarized background overview will introduce the project, placing the thesis site, Fortune, within the context of Newfoundland's cultural landscape and other outports facing coastal erosion.

The Establishment and Erosion of Identity

The island of Newfoundland, Canada's newest and easternmost province, has a well-established cultural identity, forged by centuries of coastal dwelling and sea-reaping. To this day, the cultural landscape of various coastal regions of the island comprises arrays of structures built precariously along cliffs and hillsides, all connected in networks of wharves, bridges, and platforms protruding from the shore. As working landscapes of marine-harvesters, such structures each had a distinct function in the fishery and required proximity to the sea. This initiated a characteristic architectural language of shore-bound settlement and building, ultimately establishing the built component of Newfoundland's cultural identity.

These settlement patterns and built characteristics were established by the pursuit of a single resource: fish. This is the connection between the lifestyles of all the island's inhabitants throughout its history, from the prehistoric Maritime Archaic, to European immigrants, to contemporary outport dwellers. Referencing the various prehistoric peoples that inhabited and migrated to the coastal regions of Newfoundland, Sean Cadigan states: "despite their many differences, one essential common trait defined those who made Newfoundland and Labrador their home: they lived by their own cunning and wits in using the riches of the sea."[1]

While Newfoundland's culture originated from such "riches of the sea," these abundant fish stocks are attributed to the geological origins of the province. Newfoundland borders the Grand Banks, a group of underwater plateaus formed during the separation of the North American, European, and African landmasses. Overlying the

1 Sean Cadigan, *Newfoundland and Labrador: A History* (Toronto: University of Toronto Press, 2009), 13.

Access to fertile waters informed the tectonics of Newfoundland's working landscape, defined by construction along the coast. (Richard Harrington, Pouch Cove, 1940).

Grand Banks, the mixing Labrador Current and Gulf Stream generate nutrient-rich waters, meaning continuous access to a wealth of cod, the island's most prominent type of fish. Newfoundland's cultural identity is thus indirectly, yet equally, the result of millions of years of geomorphological processes.

Following European discovery of these fertile waters, French and English interest eventually led to permanent inhabitation on the island, prompting Newfoundland's characteristic settlement patterns and built forms. As homes for sea-harvesters, these settlements centred around the fishery and were thus situated along or adjacent to the coast. Coastal living has endured to the present; even today, over 90% of Newfoundland's population live in coastal environments.[2] Many present-day outports resemble fragments of their former selves; wharves, houses, and fishery buildings shaped by decades of wear and weathering remain among more contemporary infrastructure. Prior to the modern era, such structures offered visitors (predominantly arriving by sea) a glimpse into the daily lives of Newfoundlanders, defined by a working landscape constructed precariously along the water's edge. Chapter 2 elaborates on the construction, materials, techniques, and essence of Newfoundland's architectural identity.

2 Melanie L. Irvine, *Monitoring Coastal Change in Newfoundland and Labrador: 2014 Update* (St. John's: Newfoundland and Labrador Department of Natural Resources Geological Survey, 2015), 263.

Despite anchoring to a secure sense of identity for centuries, life in rural Newfoundland is presently in a state of transition. Modernization has been influencing the cultural identity of outport communities since the mid-20th century, acting in tension with traditional practices. Several significant events of the modern era have contributed to such tension: Confederation, Resettlement, and the Cod Moratorium. First, following a virtually split vote in the second referendum of 1948, the Dominion of Newfoundland's Confederation with Canada meant shifting to a Canadian identity. This left half of the new province discontented with the decision as the union contradicted their pride in self-governance and autonomy. Even with the ensuing economic benefits of Confederation, rural Newfoundlanders were still plagued with a lack of access to the same quality of services that could be offered in larger urban centres. As a response, the government proposed Resettlement; beginning in 1954, various programmes offered volunteers financial compensation to relocate to government-designated "growth centres," as a "quick method of reducing the high cost of servicing rural Newfoundland."[3] Consequently, rural dwellers faced a difficult decision: resettle, and try to adapt to unfamiliar territory and industry, or remain in a rapidly depopulating outport, plagued with a dying fishing industry. The decline of Newfoundland's fisheries was induced by the overexploitation of marine resources, leading to the Cod Moratorium: the Canadian government's termination of the industry in 1992. Putting thousands out of work, the moratorium marked the downfall of the tradition that instilled outport communities with a sense of identity.

The aforementioned socioeconomic factors pulling rural Newfoundlanders from their traditional roots are supplemented with an environmental factor: coastal erosion. Coastal erosion is the removal of weathered rock materials, resulting in the landward movement of coastlines.[4] Due to the inherently exposed nature of the island, the shores of the most sensitive coastal environments are constantly weakening, posing a threat to settlements' buildings, infrastructure, and people's safety. Rates of erosion vary along the province's 17,540-kilometre coastline and are caused by the interaction of factors such as wave energy, wind, surface run-off, and sediment compos-

3 Kevin Major, *As Near to Heaven by Sea: A History of Newfoundland and Labrador* (Toronto: Viking, 2001), 419.

4 Robin Davidson-Arnott and Jeff Ollerhead, *Coastal Erosion and Climate Change* (Charlottetown, PEI: Atlantic Climate Adaptation Solutions Association, 2011), 4.

The unconsolidated cliffs of Point Verde (top left and right) and Holyrood Pond (right) are two of 112 coastal monitoring sites. Each site is eroding at higher rates than average values recorded in Atlantic Canada. (Photos from August, 2018).

ition.[5] While many coastal communities are already experiencing coastal erosion's destructive impact, rates are expected to increase from the effects that impending climate change will have on the key variables that influence erosion.[6] For this reason, the thesis considers coastal erosion a latent reason for the obscuring of Newfoundland's identity; the threat exists but has not fully manifested itself and is therefore not at the forefront of thought. The geological roots that provided the foundation for Newfoundland's identity are also contributing to its decay.

Attempts are, however, being made to monitor erosion along Newfoundland's coastline. In 2011, Newfoundland and Labrador's Geological Survey began conducting a long-term coastal monitoring program to examine and delineate erosional rates,

5 Irvine, *Monitoring Coastal Change in Newfoundland and Labrador,* 263-265.

6 Ibid., 264.

Fortune's glaciofluvial cliffs are exposed to the weathering forces of the Atlantic Ocean. The town's proximity to these cliffs poses a threat to buildings, infrastructure, and people. (Photo from August, 2018 site visit).

causal processes, and high-risk areas. These data have been used to determine the short- and long-term vulnerability to coastal change for 112 currently identified sites. One of these vulnerable sites is the coastal region of the town of Fortune.

Fortune: An Outport Archetype

A small coastal community of 1,400 residents located in southern Newfoundland on the northwestern tip of the Burin Peninsula, Fortune embodies an archetypal Newfoundland outport. For this reason, it has been chosen as the study area for the thesis; the community is tied to tradition, has been affected by the changes associated with modernization, and is threatened by coastal erosion. The name "Fortune" is a reference to its fishing heritage, believed to have originated from the Portuguese word "fortuna," meaning "harbour of good fortune."[7] The town sits along the Fortune Barasway, a sheltered inlet from the sea serving as a harbour where fishing has persisted as the town's primary industry. Relics of premodern vernacular fishing structures border the harbour, now designated heritage buildings.

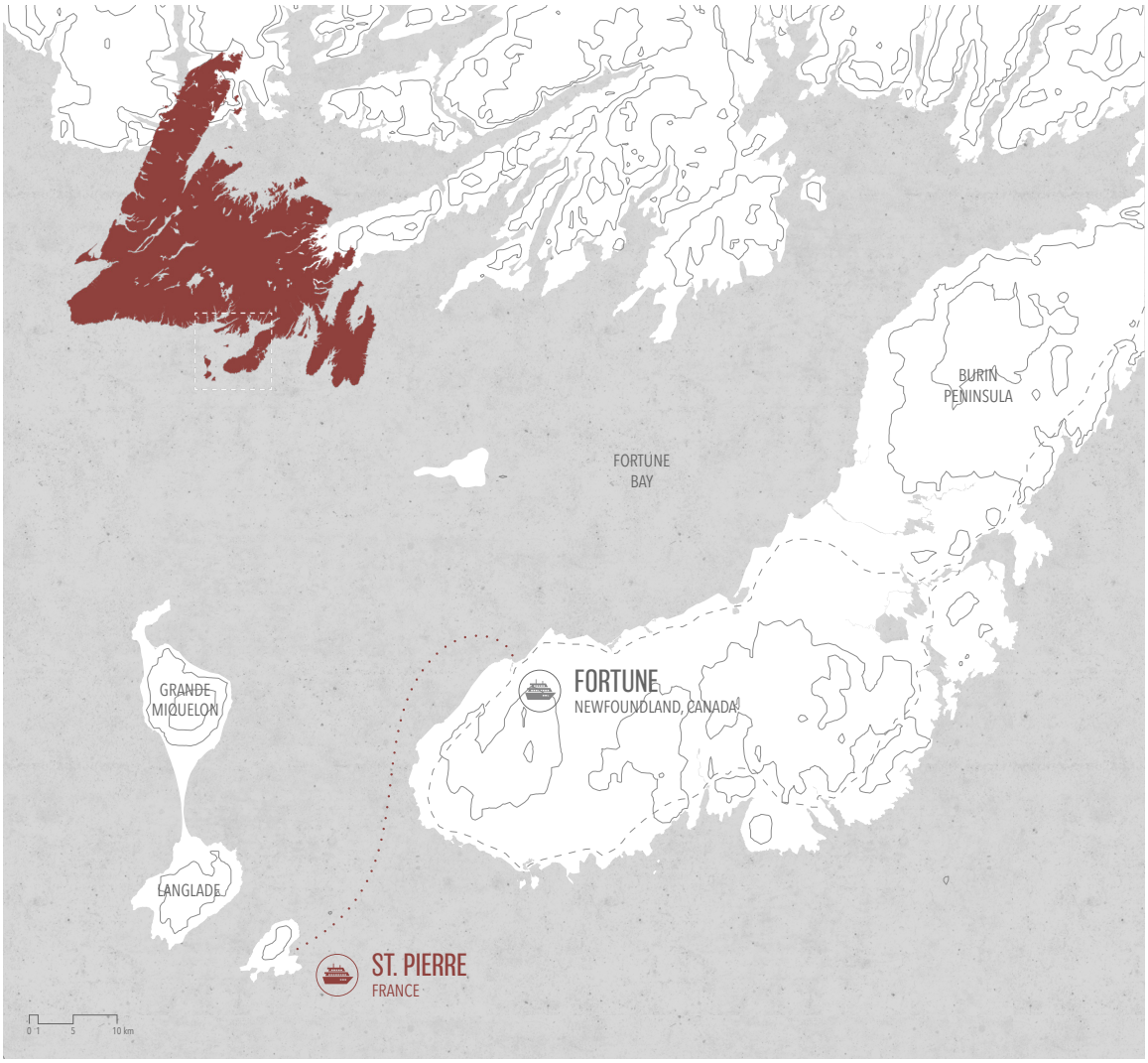
Upon entering the town via Highway 220, the vulnerable state of Fortune's built landscape becomes visibly evident, as buildings and infrastructure sit directly adjacent to the eroding coastline. Fortune rests on a coastal plain in a shallow valley, composed

7 Fay Herridge, "Our History," Town of Fortune, 2015, http://www.townoffortune.ca/our_history.php.

of various layers of unsorted sediment deposited by glacial meltwater. Fortune's cliffs are thus highly susceptible to erosion due to its geological composition and exposure to wave action and wind from the Atlantic Ocean. This puts the community at risk in the face of significant storm events in the short-term and rising sea-levels in the long-term. The persistence of climate change will only hasten erosional processes in exposed locations like Fortune, eventually leading to rural citizens' loss of their homes, infrastructure, and traditional way of life. Chapter 3 provides an in-depth analysis of Fortune in terms of the factors that provoke coastal erosion.

While Fortune exemplifies a typical Newfoundland outport identity, the town also carries a unique identity of its own. Fortune's most distinguishing modern-day attraction is its port of entry. Known as Canada's gateway to France, Fortune possesses the closest Canadian port to the overseas collectivity of St. Pierre and Miquelon, a ninety-minute ferry ride from the shores of Newfoundland. While the French archipelago and Newfoundland share similar topographical conditions, St. Pierre and Miquelon exhibit a distinctly French character expressed through urban planning and architecture. After disembarking, visitors are immediately greeted with a distinct town centre, flanked by colourfully-cladded shops, cafés, and restaurants. The islands' atmosphere is a product of its rich history, defined by French culture, fishing, and times of war. Year-round, French, English, and international visitors pass through the ferry ports of both St. Pierre and Fortune.

St. Pierre, the capital of the French archipelago, integrates with topography similar to Newfoundland. (Photo from April, 2019 site visit).



CANADA'S GATEWAY TO FRANCE

FORTUNE TO ST. PIERRE AND MIQUELON

Fortune, situated on the northwestern tip of the Burin Peninsula of Newfoundland, is the site of Canada's closest ferry port to St. Pierre and Miquelon.

Fortune has exhibited resiliency against the transitional forces of modernization. During times of Resettlement, the town was able to maintain a growing population due to its fish-processing plant. Fortune has also embraced alternative industries: small business endeavours have continually served as economic generators, aided by a consistent flow of tourists through the town's port of entry.

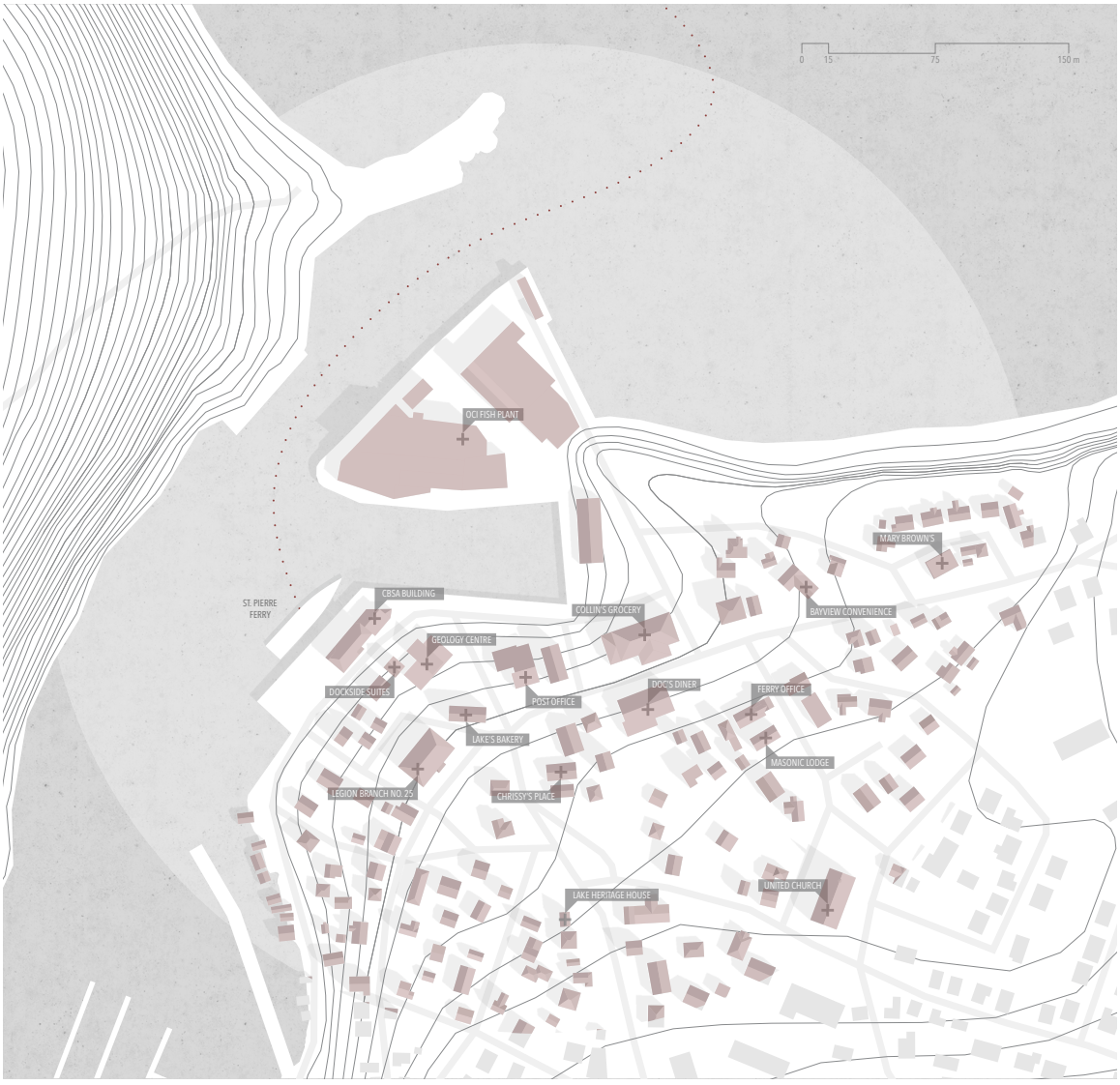
However, like many Newfoundland outports, the town still faces economic hardship and depopulation.[8] This is nothing new to the island's rural communities; today's fishing industry is far from the reliable source of income that it was before the moratorium. Consequently, financial restraints make it difficult to maintain basic services and make improvements. For instance, Fortune's town core is currently plagued with a congested, dynamic waterfront that demands further articulation in order to become a space capable of adequately supporting the integration of visitors and locals. Furthermore, as a town driven by industries and businesses that rest along the coast, any environmental threat to these structures is simultaneously a threat to Fortune's economic well-being.

Settlers in environments like Fortune historically lived a laborious, yet gratifying lifestyle of subsistence, rich with cod and a secure sense of identity. Bound to tradition and heritage, present rural dwellers insist on preserving this way of life in spite of the forces, both environmental and economic, that are pulling families from their habits, from their communities, and from the sea.

Thesis Question, Position, and Intent

The term "erosion," referring to the gradual process of deterioration, is not only a suitable description of the coastal environment, but also an apt portrayal of the current cultural conditions in rural Newfoundland. These erosional processes are interrelated; while rural Newfoundland's built-forms are situated along coasts by necessity, these edge boundaries are dynamic, gradually but constantly changing with erosion. Along with the deterioration of these coasts comes the destruction of historic struc-

8 Statistics Canada, "Fortune, T [Census subdivision], Newfoundland and Labrador and Newfoundland and Labrador [Province]," Census Profile, 2016 Census, released November 29, 2017, https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.



FORTUNE
EXISTING TOWN CORE

Fortune's town core is the most dynamic part of the urban landscape. The area comprises Fortune's customs office, the fish plant, inshore fishery, historic properties, and the town's small business district.

tures, characteristically perched upon them. Therefore, not only are buildings and infrastructure being lost, communities could institute a flight response, abandoning settlements and a lifestyle that has defined the island's cultural identity since its discovery. Outports are already depopulating; if environmental causes were to supplement the economic reasons for such abandonment, the blurring of rural Newfoundland's identity will only accelerate. How then, can Fortune and rural Newfoundland outports alike preserve their cultural identity as communities bound to the sea despite a perpetually evolving coastline?

To respond to this question, the thesis acknowledges the importance of cultural identity, the innate value of place, and the preservation of traditional building knowledge and methodology. By understanding the history behind the foundation of Newfoundland's built identity and the geology behind the weathering processes that contribute to coastal erosion, strategies can be extracted to help inform an environmentally responsive way of building. The thesis thus critically positions itself by prioritizing adaptation over mitigation, allowing rural dwellers in vulnerable sites like Fortune to continually occupy a restless coastline. Chapter 4 provides a detailed analysis of the design methodology that will be used to inform a site-specific architectural response for Fortune in Chapter 5.

The proposed architectural intervention intends to achieve several design objectives. The most explicit goal is to preserve cultural identity by uncovering ways that architecture can proactively adapt to coastal erosion. However, this endeavour should be executed in a way that complements traditional practice; a suitable proposal will simultaneously revive the built expressions of vernacular methods and suitably integrate with the existing rural landscape, all while introducing and embracing innovative building techniques.

Additional objectives are specific to the town of Fortune, intended to surface as derivative outcomes of the architectural response. These include encouraging, promoting, and providing opportunities for economic generation and engaging both visitors and residents of the community. While an architectural response to coastal erosion would satisfy the explicit thesis objective, the probability of achieving these latent

outcomes is dependent on a suitable choice of program: one that is mindful of Fortune's unique identity instead of generalizing with the intent of universal application. Ultimately, the intervention seeks to activate the shoreline as a community hub, reconnecting Fortune's town core with the waterfront and preserving rural inhabitants' innate relationship with the sea.

CHAPTER 2: IDENTITY FORMATION

While Newfoundland is the newest province in Canada, the island still constitutes some of the oldest settlements in North America. Such communities contribute to a deep-rooted heritage that defines Newfoundland's cultural identity. Any architectural intervention, therefore, must be designed with a comprehensive awareness of the rich history of the island's preceding built forms. Still present in various rural communities, surviving structures were initially informed by European settlement patterns and processes associated with the fishery. Tangible principles of building included themes of impermanence, recycling, and mobility, reflecting the environmental adaptability that was necessary due to the harsh climate conditions of these coastal settings. Newfoundlanders have always acted in tension with forces pulling them from the sea; while many of these forces are environmental, economic circumstances are also responsible. Confederation, Resettlement, and the Cod Moratorium are three significant milestones in the lives of Newfoundlanders, especially rural dwellers. Each event affected rural out-migration and employment, obscuring the cultural identity of the province's outports and eliminating some altogether. However, remaining outports last for common reasons, demonstrating a resilient nature through combinations of preservation and adjustment.

Foundation

Newfoundland's identity was forged over centuries of inhabitation of various groups who would reap the plentiful bounty of the surrounding waters. When describing the subaqueous Grand Banks of Newfoundland from which such bounty originates, Kevin Major proclaims: "in the fish lured to the waters of the continental margin is to be found the very reason for the populating of [Newfoundland], the reason generations build their houses upon the surface rock of its shores."[9] Abundant fish stocks attracted European fishing fleets, governing the patterns of settlement and coastal architecture that continue to define the cultural aesthetic of rural Newfoundland to this day.

9 Major, *As Near to Heaven by Sea,* 5.

(Re)discovery: New Found Land

Occupying coast regions has remained a tradition since the island was first populated. Descending from the earliest inhabitants of Labrador, the first humans to colonize the island of Newfoundland were those of the Southern branch of the Maritime Archaic. Beginning with Newfoundland's Northern Peninsula about 3,500 years ago, the group came to populate much of the island's coast. The name, Maritime Archaic, was bestowed by archeologists in recognition of their strong ties to the marine environment.[10] James Tuck elaborates, explaining that the term "derives from two words: 'Archaic', which refers to an ancient pre-agricultural, or hunting and gathering, way of life found throughout eastern North America and 'Maritime' for the important role that the sea and its resources played in the lives of Newfoundland and Labrador's first people."[11] The island was subsequently inhabited by several other cultures, either replacing or cohabiting with preceding groups.

Before the historic period (the period around 1500 after the emergence of written records), the last culture to reside along the island's coastline was the Beothuk. Although much is uncertain regarding their society, it is known that the Beothuk were a hunting-gathering people, forced to understand and adapt to their environment to ensure survival.[12] Physical artifacts show that this group practised no form of agriculture, as remnants of tools and bones verify carnivorous diets of coastal fauna such as seals, seabirds, salmon, and small whales.[13] Each civilization following the Maritime Archaic shared a common dependence on the sea–a dependence also felt by those hailing from the east, across the Atlantic.

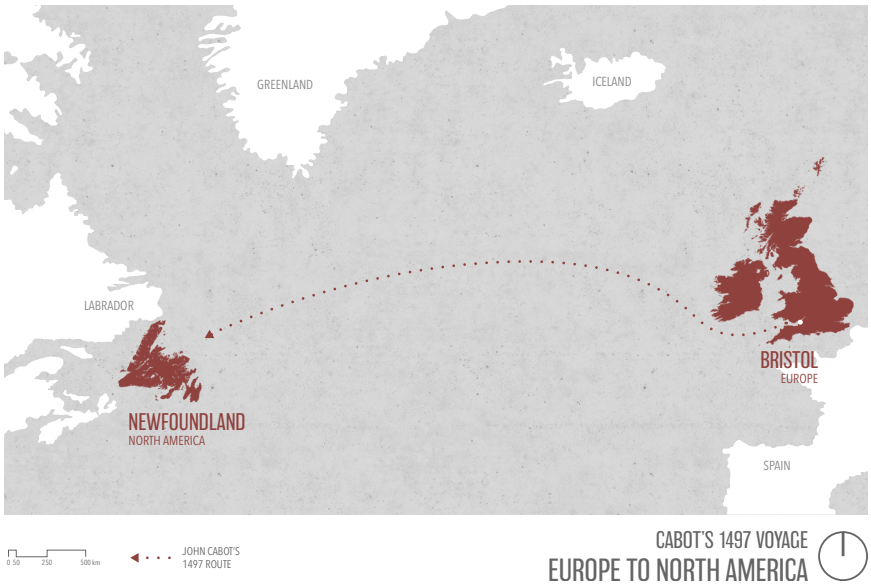
While initially discovered and inhabited by groups travelling from the west across the northern reaches of North America, eventually "migration to this eastern rim of the continent would take place from the opposite direction, from Europe, across the

10 Major, *As Near to Heaven by Sea,* 10.

11 James Tuck, "Maritime Archaic Tradition," Heritage Newfoundland and Labrador, 1998, https://www.heritage.nf.ca/articles/aboriginal/maritime-archaic.php.

12 Newfoundland and Labrador Heritage Web Site, "Precontact Beothuk Land Use." Heritage Newfoundland and Labrador, 2009, https://www.heritage.nf.ca/articles/aboriginal/beothuk-land-use.php.

13 Major, *As Near to Heaven by Sea,* 28-29.



John Cabot and his crew set sail from Bristol in May of 1497 seeking new sources of spice and fish. In late June they encountered the fertile waters surrounding what is now Newfoundland.

North Atlantic."[14] This migration began at the end of the fifteenth century, following the arrival of sailors from Bristol. The Beothuk were still present at the time of their arrival, but fled inland upon sight of foreigners. The foreign crew's landing marked the island's rediscovery and the beginning of the historic period, led by Italian master mariner Giovanni Caboto. Known today as John Cabot, he was commissioned by King Henry VII in 1496 to traverse the Atlantic in search of new lands that could provide England with new sources of fish and spice.[15] On the 24th of June in 1497, after departing Bristol a month prior, Cabot and his crew caught sight of new found land, surrounded by ocean with "so many fish that his majesty's kingdom would have no further need of Iceland."[16] News of Cabot's encounter was welcomed by those in eastern Europe, unaware that these prolific waters had in fact been fished for millennia.

Like the island's past occupants, "fishing is what brought [the Europeans to Newfoundland] and what spurred them to build the small structures associated with the traditional family-based inshore fishery."[17] For his fruitful expedition, Cabot is held responsible for European colonization of the island and the beginning of the codfish

14 Major, *As Near to Heaven by Sea,* 16.

15 Ibid., 33.

16 Ibid., 41.

17 Robert Mellin, *Winter in Tilting: Slide Hauling in a Newfoundland Outport* (St. John's: Pedlar Press, 2015), 18.

industry that guided the compositions of these settlements.

Settlement: From Ephemeral to Perennial

The first European settlers only occupied the island seasonally, as fishing crews were not permitted to build permanent structures or dwellings. Beginning in the early spring, Europeans would traverse the Atlantic, bringing along the necessary crews and gear for catching and processing cod. Rough structures were assembled during temporary European settlement, so the crews could spend the warmer months catching, salting, and drying as many quintals of cod as the returning ships could carry. When the colder months drew near, "fishing ships did not linger over the winter, nor did the fishermen consider settling on the island."[18] Fleets were always expected to return to Europe.

Ultimately, however, permanent inhabitation was permitted in Newfoundland by European authorities. The possibility of allowing year-round settlement began to be questioned in the late 17th century. As schemes were developed by proponents of permanent residency, settlement gradually appeared economically and politically logical. Economically, most arguments in favour of establishing permanent residency revolved around the fishery, insisting that overwintering crews of fishermen could introduce the possibility of establishing a monopoly on the dry fishery.[19] Politically, a resident fishery, as opposed to the existing migratory fishery at the time, would enable the protection of the British fishery in Newfoundland. This was necessary because fish, a common property resource, was difficult to privatize, often leading to disputes regarding land ownership. It was not uncommon for such feuds to result in physical competition and raids by interlopers, capable of stealing and destroying boats and structures belonging to rival groups.[20] In the late 1670s, the Committee for Trade and Plantations in London officially permitted permanent settlement in Newfoundland. Since resident fisheries were established, "the English term outport,

18 Candace Cochrane, *Outport: The Soul of Newfoundland* (St. John's: Flanker Press Limited, 2008), viii.

19 "Early Settlement Schemes," Heritage Newfoundland and Labrador, 1998, https://www.heritage.nf.ca/articles/exploration/early-settlement-schemes.php.

20 Jenny Higgins, "Migratory Fishery and Settlement Patterns," Heritage Newfoundland and Labrador, 2008, https://www.heritage.nf.ca/articles/exploration/settlement-patterns.php.

which was originally applied to all ports outside the city of London, [had] come to be used in Newfoundland mostly to describe its fishing villages."[21] English fishing communities began a more consistent, secure lifestyle, ultimately determining the locations of many of today's rural outports.

Territorial claim by the English to the best fishing waters of the North Atlantic was not absent conflict, however. The claim was the cause for dispute with another cultural presence in Newfoundland: the French. Despite a typically amicable relationship, a history of French-English conflict commenced; "from the late seventeenth century to the early 19th century, Newfoundland's fishing grounds and harbours were prizes in a series of wars as the French and English battled on both sides of the Atlantic for territory, resources, and colonies."[22] Proximity to permanent English fishing settlements that developed during the seventeenth century pressured the French to develop their own colony of resident fishermen to protect their seasonal stations. They did so at Plaisance (Placentia) in 1662, on the west coast of the Avalon Peninsula. Conversely, the maintenance of English fishing grounds became a priority in light of French colonization. The Treaty of Utrecht, signed in 1713, banned French settlement on the island, only allowing the continuation of fishing along the "French Shore," from Cape Bonavista to Point Riche on the Northern Peninsula.[23] This included the deportation of established French colonies like Plaisance and a small archipelago twenty kilometres from the Burin Peninsula: St. Pierre and Miquelon.

The French dimension of Newfoundland's history is accentuated by the presence of the French islands of St. Pierre and Miquelon. A fishing base for over 400 years, the French islands' inhabitants have had a varied relationship with their English neighbours in Newfoundland. Following fifty years of English settlement, St. Pierre and Miquelon were returned to France after the Seven Years War in accordance with the Treaty of Paris in 1763.[24] However, the persistent rivalry over the fisheries continued

21 Cochrane, *Outport,* viii.

22 Ibid.

23 Olaf Janzen, "French Presence in Newfoundland," Heritage Newfoundland and Labrador, 1998, https://www.heritage.nf.ca/articles/exploration/french-presence-newfoundland.php.

24 J. P. Andrieux, *St. Pierre and Miquelon: A Fragment of France in North America* (Lincoln, ON: W. F. Rannie, 1983), 7.

to bring the St. Pierrais and the English in Newfoundland into constant conflict.

After over a hundred years of invasions, warfare, and changes of ownership, the arrival of a small fleet from France in 1816 signified the beginning of relative prosperity following little activity on the islands since the Treaty of Amiens in 1802.[25] Today, while retaining its role in the fishery, St. Pierre benefits financially from a growing number of tourists seeking a glimpse of French atmosphere off the coast of Newfoundland. Fortune, historically a fishing community itself, facilitates this journey by ferry as Newfoundland's (and Canada's) gateway to France. Regularly greeting travellers arriving by sea, Fortune offers visitors from St. Pierre and Miquelon the first impression of both Newfoundland and Canada.

Building Culture: A History of Adaptation

During settlement, the materialization of Newfoundland's cultural landscape included the development of coastal building techniques, establishing an architectural character that reflected a sea-dependent lifestyle. Today, relics of these early methods of construction can be found in various outport communities, serving as glimpses into a former lifestyle. However, it is important to refrain from thinking of the past as static. Most of these aged structures have likely undergone several stages of altercation, whether involving their size, form, or even site. Reasons for such altercations ranged anywhere from social to environmental, as the owners of these structures freely modified them in whichever way necessary.

Since the livelihoods of early Newfoundlanders depended on the fishing industry, the location of settlements relied heavily on proximity to fertile cod fishing grounds. This meant outport communities were often situated in remote areas of the island's coast. Houses and working spaces were hence bound to the shore, built tightly upon hillsides situated along the water's edge. This allowed easy access to the water.[26] In reference to the older houses of Tilting, a small town on Fogo Island, Robert Mellin sees the absence of surrounding yards as a reflection of a "working" landscape in-

25 Andrieux, *St. Pierre and Miquelon,* 9.

26 Andrew Woodland, "Newfoundland Folk Architecture," Heritage Newfoundland and Labrador, 1998, https://www.heritage.nf.ca/articles/arts/newfoundland-folk-architecture.php.

stead of a modern "pleasure" landscape. Most buildings "cluster tightly around the harbour and those of one household appear to mingle with those of neighbours."[27] Common among many Newfoundland outports are houses situated "cheek by jowl," or close physical proximity, indicating a tightly knit community.[28]

The void spaces between various structures within the community created informal social spaces where residents and workers would congregate. Gerald Pocius, a professor of literature, folklore, and the arts, has been praised by Mellin for his interpretation of Newfoundland's vernacular architecture in the east-coast community of Calvert. Pocius notes that the closely-knit arrangement of houses in Calvert promotes the observation of daily behaviour, social activities, and informal visiting.[29] Therefore, while work activities undeniably influenced the composition and geographical location of communities, social interaction also shaped the configuration of buildings relative to one another.

The building blocks that defined these patterns of settlement primarily consisted of houses and auxiliary outbuildings to accommodate the working and social landscape. Mellin describes outbuildings as "single-purpose, detached structures" used in the processes associated with the fishery or agriculture.[30] Intended for practical use, such ancillary structures were built with rough materials and utilitarian construction techniques.[31] In general, each family in an outport managed their own set of outbuildings; depending on the family's livelihood, these outbuildings were primarily suited for the agricultural industry or the fishery. For agriculture, outbuildings generally sit farther from the shore, consisting of hay houses, root cellars, and cabbage houses. For the fishery, outbuildings consist of stages, flakes, twine stores, fish stores, and cradles for hauling up boats.[32] Mediating between sea and land, "stages" are

27 Robert Mellin, *Winter in Tilting: Slide Hauling in a Newfoundland Outport* (St. John's: Pedlar Press, 2015), 18.

28 Cochrane, *Outport,* viii.

29 Gerald L. Pocius, *A Place to Belong: Community Order and Everyday Space in Calvert, Newfoundland* (Athens: University of Georgia Press, 1991), 178.

30 Mellin, *Winter in Tilting,* 18.

31 Newfoundland and Labrador Heritage Web Site, "William Pye House and Outbuildings (Brooklyn)," Heritage Newfoundland and Labrador, 2004, https://www.heritage.nf.ca/articles/society/william-pye-house-outbuildings.php.

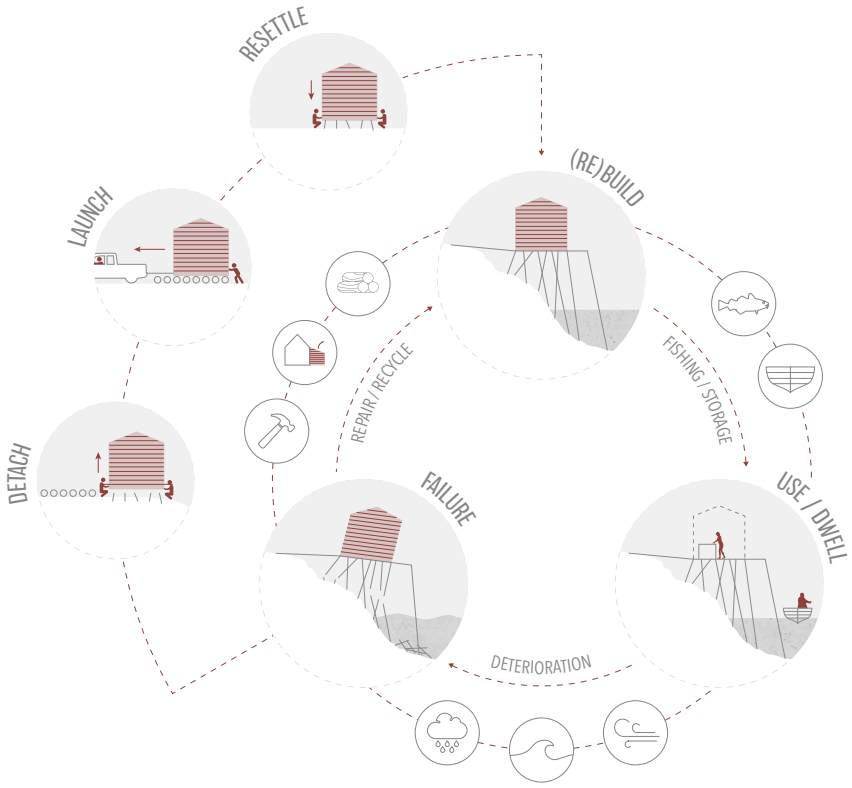
32 Mellin, *Winter in Tilting,* 18.

The Dwyer Premises in Tilting, Fogo Island consists of a house and outbuildings associated with the family-based inshore fishery. (Photos from M1 studio trip in May, 2017).

used for storing gear and processing fish, "flakes" are raised wooden platforms for drying fish, and "stores" are storage sheds.[33] Known as "the Rooms," this assemblage of fishery outbuildings is situated at the water's edge along wharves protruding into the sea. According to Shane O'Dea, at the head (the farthest end from the shore) of most of these wharves "would have been a stage, a single-storey shed for the splitting and the making of the fish" and "at the landward end of the wharf might have been a series of other sheds for various types of storage and fishery-related work."[34] Indeed, every built element in the working landscape was a fragment of the whole, facilitating a distinct function in the fishery.

33 Robert Mellin, *Tilting: House Launching, Slide Hauling, Potato Trenching, and Other Tales from a Newfoundland Fishing Village* (New York: Princeton Architectural Press, 2003), 235-236.

34 Shane O'Dea, "Built Environment," Heritage Newfoundland and Labrador, 1998, https://www.heritage.nf.ca/articles/society/built-environments.php.



Interpretive diagram of traditional building processes in Newfoundland. Coastal structures had a language of impermanence, constantly involved in cyclical processes of repair, recycling, and relocation.

Building materials employed in the construction of these structures came from various sources throughout history. Since extensive forestry was common to support the fishery, some areas would import construction elements from regions elsewhere. Pocius elaborates on this process of importation, noting that in most communities, "what were essentially prefabricated houses were imported into the region, together with a wide range of building materials such as lumber, shingles, nails, and clapboard."[35] Since the late 18th century, communities like Calvert saw the importation of building materials, and the frames of some houses were likely imported from the Maritimes (Nova Scotia, New Brunswick, and PEI).[36]

Due to the temporary nature of the island's first structures, wood was the primary material used for building, allowing for efficient construction and disassembly. At first, houses and outbuildings stood with only tentative connections with the ground,

35 Pocius, *A Place to Belong,* 200.

36 Ibid.

constructed on temporary wooden foundations called "shores."[37] Lightly touching the earth, structures' light foundations meant minimal ground intrusion, leaving no evidence of construction after crumbling.[38] The foundations of houses and outbuildings conformed to irregular topography, contacting the terrain with only point connections, leaving the landscape virtually unchanged.

Newfoundland's harsh climate toughens coastal living, constantly weakening and destroying structures by exploiting their fragile nature. If early rural dwellers were to continue inhabiting areas near the best fishing grounds, adopting a resilient nature was necessary. Over time, Newfoundlanders achieved resiliency through environmental adaptation. This ingenuity was translated to architecture; frequently, adaptation meant repairing, rebuilding, or recycling building components harvested from failed structures.

Constant maintenance work was required for coastal structures, especially for those most exposed to the relentless weather conditions of the North Atlantic. Lighter tectonic structures like flakes, bridges, and fences were even more vulnerable, often needing to be rebuilt several times in an individual's lifetime.[39] Cabbage houses demonstrate the traditional practice of recycling: "…the sills, beams, and boards of old houses were used for new houses, old boards and packing crates were turned into wooden furniture, and parts of houses or additions to them became outbuildings."[40] Likewise, "if a storm wrecked a fishing stage, materials could often be retrieved and recycled for use in the construction of a new stage."[41] Such habits of rehabilitation ensured the survival of houses and outbuildings, and therefore the survival of outports themselves.

One of rural Newfoundland's most characteristic adaptive practices, however, is the tendency for structures to be physically moved across the landscape. Built for mobility, houses and outbuildings traditionally had an ephemeral relationship with land-

37 Mellin, *Winter in Tilting,* 19.

38 Mellin, *Tilting,* 66.

39 Ibid.

40 Mellin, *Winter in Tilting,* 22.

41 Mellin, *Tilting,* 66.

scape, often being moved to more suitable locations for a variety of reasons. Both Robert Mellin and Richard MacKinnon offer insightful descriptions of this process. Mellin provides a useful explanation of the mechanics of house "launching," a term for the process evocative of the act of launching boats into the sea. For the purposes of the thesis, Mellin's term, "launch," will be used when referring to any form of moving, hauling, or relocating a building. MacKinnon, in his interpretation of house movings and altercations, describes techniques and the diversity of reasons that catalyzed such launches. While Mellin's observations were based on studies of the community of Tilting on Fogo Island, MacKinnon's findings emerged from a study of similar techniques used in the Codroy Valley, over 500 kilometres southwest of Tilting. Despite the difference in geographical location of these two settlements, and many outports alike, the techniques and reasons for launching are common among the pair.

To "launch" a building means removing the superstructure from its supporting foundation and moving it to a different location. The process is a celebrated occasion in outports; the job requires many hands for the preparation and move, turning the event into a large social gathering. Local skill in the fishery and boat-building easily transfers to house launching; in Tilting, for example, people are experienced with launching heavy boats like bully boats and schooners, which helped with the applicability to buildings.[42] Any type or size of building is therefore launched if necessary, whether the scale of an outbuilding, house, or church. Like other outports in Newfoundland, launching was a common occurrence in Tilting, as houses were often sold separately from their plots of land.[43] When sold, such buildings required transportation to another location. Buildings were not just confined to movement within their communities; often, structures were moved from one community to another.[44] Sights of houses floating across water en route to their new location were not unique to such communities.

Methods of transportation evolved over time and varied depending on the destination and route (land, water, or ice). In the Codroy Valley, a diverse set of power sources were used, ranging from oxen in the 19th century to vehicles like tractors and flatbed

42 Mellin, *Tilting,* 110.

43 Ibid.

44 Ibid.

Houses were relocated using a variety of methods across various mediums. From far right, clockwise: floating a house from NE Crouse to Conche, 1965; house being towed, 1970; pulling a house across the ice at Cook's Harbour, 1953; launching a house on South Island, 1951. (Maritime History Archive. Cropped, clarity enhanced by author).

trucks by the 1940s. Horses were used occasionally for house launching at the advent of horse-drawn farm machinery, and humans did the work manually when farm animals were unavailable.[45] On dry land, one way of launching involved the use of road graders, "skids," and "rollers." Once a building was separated from its foundation, long logs called "skids" were wedged and attached to the bottom. The entire structure, sometimes greased to reduce friction, was then pulled along green cut logs called "rollers" continuously placed in front.[46] However, House launching was not a seasonal endeavour. Buildings that required movement were also launched in the winter in addition to warmer months. In fact, hauling buildings in the winter was often preferred; it was less difficult to move across snow and ice than rough terrain. On ice, buildings were pulled across frozen rivers or harbours on purpose-built wooden sleds. On open water, they were floated and pulled by a small boat.[47] These

45 Richard MacKinnon, *Vernacular Architecture in the Codroy Valley* (Hull, Quebec: Canadian Museum of Civilization, 2002), 106.

46 Ibid.

47 Mellin, *Tilting,* 110.

techniques are a credit to the ingenuity and creative improvisation of rural dwellers.

The sale of a building is not the only motivation behind its movement across the Newfoundland landscape. Many launches simply took place due to marriages, deaths, and feuds with neighbours. Buildings were sometimes moved to sites close to train stations when the Newfoundland Railway was built.[48] In Tilting, "house launching demonstrates the community's connection with its past by reusing an old house rather than demolishing it."[49] Such movements in the Codroy Valley also reflect a tradition of recycling materials.[50] The reasons behind house launching reveal much about the culture of Newfoundland outports, ranging from economic to social and even environmental.

House launching is sometimes a direct response to the harsh environmental conditions of coastal regions. Extreme onshore winds, often gusting through towns at over one hundred miles per hour, can be detrimental to structures in exposed locations. MacKinnon references an event in the Codroy Valley caused by a gale in December 1924 that tore a ten-room house from its foundation. The winds carried it across adjacent properties, destroying another house in its path.[51] A disastrous storm event sometimes provided the only impetus necessary for relocating a building.

House launching and any alterations such as repairing, reusing, or rebuilding serve as reminders to avoid forming static impressions of the past. In reference to modifications in the Codroy Valley, MacKinnon warns that initial impressions of the architectural landscape can lead to inaccurate conclusions for those unfamiliar with local ways of altering buildings.[52] Before learning that older structures were built for mobility, Mellin noticed discrepancies regarding the locations of many of the existing buildings in his reading of a 1949 aerial photograph of Tilting.[53] Their positions on the map did not correspond with their current locations.

---

48 MacKinnon, *Vernacular Architecture in the Codroy Valley,* 111.

49 Mellin, *Tilting,* 115.

50 MacKinnon, *Vernacular Architecture in the Codroy Valley,* 112.

51 Ibid., 110.

52 Ibid., 105.

53 Mellin, *Tilting,* 110.

Coastal communities are inherently vulnerable to the destructive potential of North Atlantic storms. Right: roof torn off a house in Fortune in February, 1964. (Kathryn Ayres, posted in Fortune Then and Now Facebook group. Cropped, clarity enhanced by author).

Like Tilting and the Codroy Valley, Fortune has undergone its own share of alterations over time. Historical photographs, stories from current residents, and preserved Municipal Heritage Sites all indicate that the town has evolved from its original state, much like its coastal counterparts around the island. House launching, for instance, was also practiced in Fortune. The community's first Town Hall was a former Customs Building, purchased for 100 dollars and transported from Point May, twenty kilometres southwest of Fortune.[54] Outports like Fortune are landscapes of impermanence, reflecting a building culture defined by flexibility and adaptation, especially in the face of the transitional times of modernity.

Transition

Today, the majority of Newfoundland outports resemble obscured versions of their past selves, morphed over time by the technological and legislative influences of modernity. Rural Newfoundland has gradually developed a mingling of building typologies; for a visitor, first impressions of today's outports differ significantly with those of the past. Three significant events of the 20th century stand out as having the largest contribution to the blurring of a once clearly-defined sense of identity. Each impacted rural Newfoundland's socioeconomic status and architectural landscape.

54 Herridge, "Our History."

Confederation

The feasibility of Newfoundland and Labrador as an independent political entity was a subject of debate for over eighty years before joining Canada. Before becoming a Canadian province, Newfoundland and Labrador constituted a British Dominion. Prior to 1945, little interest was expressed in favour of Confederation; however, the end of the Second World War marked the beginning of a period of relative economic prosperity for the dominion. Newfoundland's strategic position in the Atlantic made it important to the defence of North America, leading to a program that built military facilities around the island. Following the economic hardship brought about by the Great Depression and participation in the First World War, Newfoundland's economy recovered to the extent that financial aid from Britain was no longer necessary.[55] Newfoundland's future was sincerely called into question and multiple options were proposed, one being confederation with Canada.

The Newfoundland Referendums were held in 1948 to decide the political future of the dominion. After no verdict was reached following the first referendum, a second referendum was held seven weeks later on July 22 with a choice of two options: Confederation or a responsible government. Winning 52 percent of the vote, Confederation was victorious.[56] Confederation's most significant advocate, Joseph R. Smallwood, made the union official on March 31, 1949, becoming the new province's first premier. Few of the island's residents were better versed on Newfoundland culture than Smallwood, and he was well aware of the "gross deficiencies of many outports."[57]

Those in favour of Confederation hailed primarily from rural Newfoundland and Labrador. Conversely, the Avalon Peninsula, the location of St. John's, supported a responsible government. St. John's, possessing the most political and economic power, was most likely to suffer from Confederation due to the competition prompted by the removal of tariff barriers; rural areas were enticed by the promise of increased

55 Economic Council of Canada, *Newfoundland: From Dependency to Self-Reliance* (Ottawa: Economic Council of Canada, 1980), 4-5.

56 Ibid., 5.

57 Major, *As Near to Heaven by Sea,* 388.

disposable income and social welfare programs.[58] The immediate results of Newfoundland's confederation with Canada were positive, benefitting those with lower standards of living.

Resettlement

Shortly after entering Canada, Newfoundland's population increased dramatically. Driven by the benefits of Confederation, the population rose thirty percent, approaching 460,000 by 1961. However, it was "scattered around the coast in 1,100 settlements, three-quarters of which held less than three hundred inhabitants."[59] Providing modern services like roads, electricity, and telephone and postal services became a major problem for the Newfoundland government due to the inaccessibility of these remote areas.[60] Even with the benefits of Confederation, outports could not be equipped with an equal range of amenities as larger urban centres without significant financial strain.

As a response to these high costs, the Smallwood government administered a series of Resettlement programs. The programs were aimed at relocating people from a life of isolation and deprivation to areas where they could enjoy the conveniences of 20th century life.[61] Beginning with Centralization in 1954, voluntary migrants were offered minor financial assistance to resettle in more accessible areas. Despite requiring a unanimous vote from all community members to relocate to locations of their choosing, fear-mongering resulted in many families moving back to the communities from which they came. The Fisheries Household Resettlement Programme superseded the Centralization program. Following the establishment of a Federal-Provincial partnership, this agreement identified economically viable "growth centres" to serve as the destination of resettlers.[62] More compelling financial assistance

58 Economic Council of Canada, *Newfoundland,* 5.

59 Major, *As Near to Heaven by Sea,* 419.

60 Noel Iverson and Ralph Matthews, *Communities in Decline: An Examination of Household Resettlement in Newfoundland* (St. John's, Newfoundland: Institute of Social and Economic Research, Memorial University of Newfoundland, 1968), 2.

61 Ibid., 136.

62 Melanie Martin, "Resettlement," Heritage Newfoundland and Labrador, 2007, https://www.heritage.nf.ca/articles/politics/resettlement.php.

was offered, but only upon a ninety percent vote in favour of Resettlement, a percentage that would eventually decrease over time.[63] The Federal-Provincial partnership was renewed in 1970, resulting in a third Resettlement program that saw the allocation of more money for resettlers than the first two.[64] Despite the increasing financial aid, however, the cost and availability of housing remained a constant issue throughout Resettlement.

Resettlement is heavily associated with the traditional practice of house launching. As previously mentioned, houses were physically relocated for a variety of reasons. Unsurprisingly, to mitigate housing problems during Resettlement, many migrants wished simply to bring their houses with them.[65] If relocating the entire house was unfeasible, most resettlers wanted to build a new house, preferably using materials salvaged from their old one.[66] Many would rather reuse building materials than see their old homes abandoned, again demonstrating the island-wide tradition of recycling materials. Whether relocated intact or in pieces, depriving people of their former homes, "prevents individuals from enjoying a sense of continuity with their old way of life."[67] House launching not only helped alleviate the financial struggles of housing, but also the emotional damage of relocating.

Although the intent of Resettlement was to improve the lives of Newfoundland's rural inhabitants, it was not absent social consequences. Between 1954 and 1975 more than 250 communities were resettled.[68] Such a drastic uprooting of people from their only senses of livelihood resulted in emotional pain that makes Resettlement one of the most controversial issues in Newfoundland's history.

Cod Moratorium

The Newfoundland cod fishery was the reason for permanent settlement, the mainstay of the rural economy, and the defining factor of the island's cultural identity. On

63 Iverson, *Communities in Decline,* 3.

64 Martin, "Resettlement."

65 Iverson, *Communities in Decline,* 116.

66 Ibid., 123.

67 Ibid., 132.

68 Major, *As Near to Heaven by Sea,* 419.

July 2, 1992, John Crosbie, the federal minister of Fisheries, announced the complete shutdown of the codfish industry.[69] While Confederation and Resettlement presented a combination of pros and cons for rural Newfoundland, no positive could be gleaned from the Cod Moratorium.

The abolishment of the primary industry of coastal outports was provoked by overfishing and failure to maintain a sustainable fishery. Prior to the moratorium, harvesting of cod took place inshore by local fishers in the province's coastal areas and offshore by international fleets. Despite the existence of catch quotas in the Grand Banks, some nations routinely overexploited the region. Fisheries scientists also omitted the impact of increasingly efficient technology that allowed trawling fleets to harvest unprecedented quantities of cod stocks. Focusing only on the offshore sector, the federal government "ignored warnings from inshore fishers and university scientists that cod stocks were in danger and chose to maintain quotas instead of scaling back the fishery, in large part to prevent economic losses and massive unemployment."[70] The ironic result was the severe decline in the spawning biomass of northern cod, leading to a moratorium on the catching of cod, eliminating thousands of jobs in rural Newfoundland.[71] The Cod Moratorium ended an industry that defined the lives of outport dwellers for nearly five centuries.

Rural Impact

The 20th century affected rural Newfoundland in a variety of intangible ways. Although initially beneficial, the impacts of modernization proved harmful to the socioeconomic facets of communities outside growth centres like St. John's. Furthermore, these changes also affected the tangible aspects of outports. Coastal communities today offer different aesthetic impressions than the early 20th century versions of themselves. The impacts of modernity not only altered the arrangement of such communities, but also their architectural expressions.

At the outset of confederation with Canada, the immediate socioeconomic changes in

69 Major, *As Near to Heaven by Sea,* 446-447.

70 Jenny Higgins, "Cod Moratorium," Heritage Newfoundland and Labrador, 2009, https://www.heritage.nf.ca/articles/economy/moratorium.php.

71 Ibid.

outports were positive. An increase in personal disposable income provided comfort to those whose standard of living was lowest. Employment grew in retailing, growing the economy's service sector. Social services were financed, including schools, hospitals, harbour facilities, and the Trans-Canada Highway. However, union with Canada also destroyed local industry. Before Confederation, some three thousand people worked as manufacturers, producing marine engines, fishing gear, shoes, margarine, and clothing. As "victims of the island's geographical remoteness, high transportation costs, and limited markets," local producers could not compete in the national market.[72] Despite substantial transfer payments, Newfoundland's economy became plagued with low average incomes and vast unemployment.

As for Resettlement, certain relocated groups experienced more of a financial impact than others. Among these groups were the elderly, the widowed with children, and large families. Additionally, merchants who had spent generations building their businesses suffered profoundly for they received no compensation for their business losses.[73] As significant as the economic strains were, they are virtually shrouded by the social impacts of Resettlement. It is difficult to quantify the emotional burden caused by cutting people from their cultural roots, but the upheaval persists as an unsettling topic among outports to this day.

The Cod Moratorium further augmented rural impacts like unemployment and outmigration. Putting close to 30,000 people out of work, the Cod Moratorium drastically hindered the progress of once-thriving towns. In the decade following the moratorium of 1992, the birth rate fell from the highest to the lowest in the country, over forty-five thousand people fled the province, and Newfoundland and Labrador was the only province to suffer a net loss of population in Canada.[74] The socioeconomic effects of the termination of the codfish industry made evident both the vulnerability of marine resources to exhaustion and the unsustainably of reliance on a single industry.

For the architecture and planning of outports, modernization meant technological in-

72 Economic Council of Canada, *Newfoundland,* 5-6.

73 Iverson, *Communities in Decline,* 142.

74 Major, *As Near to Heaven by Sea,* 447.

novation and shifting to a Canadian identity. Today, according to Candace Cochrane, "Newfoundland outports feel a bit more like Smalltown, Canada, and less like unique repositories of a centuries-old fishing culture."[75] Many of Newfoundland outports' characteristic features of the cultural landscape are gone or altered, considerably changing foreigners' first encounters. For this, a shift in the primary mode of transportation is largely responsible. Confederation invested great sums into the infrastructural improvement of Newfoundland's rural landscape, including the addition of new roads. Houses generally faced the harbour until about the 1960s, when travel by road became more prominent than by sea.[76] Since "the facades of the houses were oriented toward the arrival of visitors," structures in coastal communities began facing the main road.[77] The positioning and orientation of outport architecture was a direct reflection of traditional travel by sea.

In addition to changes in their orientation, buildings are not constructed in the same ways that they once were. When describing the contrast between new and old houses in Tilting, Robert Mellin states: "new houses are not mobile. They are placed on concrete foundations that change the landscape, usually requiring the use of heavy excavating equipment. When these new houses are sold, the land is sold with the house."[78] Buildings today are generally built for permanence rather than mobility.

Fortune can be considered a representative microcosm of many of the socioeconomic and architectural impacts felt by the province as a whole. Fortune was incorporated as a town in 1946, just before Confederation, with a population of nine hundred.[79] A fish-processing plant was opened in 1952, and by 1961 the population increased to 1,360 after an influx of people from other Fortune Bay communities seeking permanent employment opportunities. Therefore, Fortune saw an increasing population during the stages of Resettlement; by 1981 the population almost doubled from 1961 as more people moved in from resettled communities from around the

75 Cochrane, *Outport,* ix.

76 Mellin, *Winter in Tilting,* 18.

77 Mellin, *Tilting,* 28.

78 Ibid., 115.

79 Herridge, "Our History."

province.[80] However, depopulation ensued across rural Newfoundland and continues today. For the Burin Peninsula specifically, the Natural (NS), Historical (HS), and Replacement Survival (RS) population projection models all predict a population decline. From a baseline value of 19,795 recorded in 2016, these predictions range from 14,768 (HS Medium scenario) to 18,791 (RS High scenario) in 2036.[81] Based on the 2016 Census, Fortune's current population is approximately 1,400.[82] This is over 1,000 less than its highest recorded value of 2,473 in 1981.[83] As a fishing community, the steady erosion of Fortune's population can largely be attributed to the Cod Moratorium.

Fortune also fits Cochrane's visual description of Newfoundland outports resembling "Smalltown Canada." Like in Tilting, new buildings in Fortune sit on large footprints of concrete foundations, burrowing into the earth. Confederation's introduction of new rural roadways connected Fortune "to the rest of the Burin Peninsula, and Newfoundland, by the Burin Peninsula Highway, which was opened in 1949."[84] Before this, the coastal boat service linked much of the rest of Newfoundland's coastal communities.[85] Buildings in Fortune primarily address the entry highway that traces the town's coastline.

Architectural components of the landscape like wooden flakes and wharves were also once present along Fortune's shores, but have since vanished or been replaced by concrete counterparts. In the early 20th century, the eastern portion of the mouth of Fortune's harbour was occupied by a long wharf extending north into Fortune Bay, terminating with a lighthouse acting as a beacon for incoming vessels. This is now the location of Fortune's fish-processing plant, supported by a concrete wharf overlying

80 "Fortune," in *Encyclopedia of Newfoundland and Labrador,* ed. Joseph R. Smallwood et al, vol. 2 (St. John's: Newfoundland Book Publishers, 1984), 337.

81 Alvin Simms and Jamie Ward, *Regional Population Projections for Newfoundland and Labrador 2016-2036* (St. John's: Harris Centre Regional Analytics Laboratory, 2017), 80.

82 Statistics Canada, "Fortune, T [Census subdivision], Newfoundland and Labrador and Newfoundland and Labrador [Province]."

83 Newfoundland Statistics Agency Executive Council, *Historical Statistics of Newfoundland and Labrador* (St. John's: Government of Newfoundland and Labrador, 1994), 14.

84 "Fortune," in *Encyclopedia of Newfoundland and Labrador,* 339.

85 Ibid.

The mouth of Fortune's harbour was once the location of wharves, fish flakes, and activities like boat-building. Photo from late 1800s. (Collections Canada. Cropped, clarity enhanced by author).

By the early 20th century, improvements in the area saw the establishment of a lighthouse at the end of the harbour's eastern pier. Photo from early 1900s. (Jim Dobson, posted in Fortune Then and Now Facebook group. Cropped, clarity enhanced by author).

Today, this area is highly industrialized, occupied by Fortune's fish-processing plant. (Photo from December, 2018 site visit).

artificial infill surrounding the discharging area.[86] In place of vernacular networks of wharves and their various outbuildings extending from the shore, visitors arriving by sea are now greeted by a modern industrial material expression.

The impacts of modernization like depopulation and unemployment, coupled with spending restraints, make it difficult to maintain basic services and make improvements in outports like Fortune. However, many towns by some means are able to weather such change, demonstrating resiliency through a willingness to adapt.

Resilience

The impacts of Confederation, Resettlement, and the Cod Moratorium challenged rural Newfoundland's resilient nature. While the effects of modernization are a bleak reality, many rural inhabitants endure in the face of transition. How do outports achieve such resiliency? Answers can be gleaned from communities that have prevailed against the burdens imposed by modernity. While hundreds of outports have been completely emptied, the ones that prevail demonstrate a balance between sustaining traditional practice and adjustment to change.

Newfoundlanders are familiar with lifestyles of subsistence. Economic hardship has always been present among outports, along with out-migration. Kevin Major alludes to the optimism of Newfoundlanders in the face of adversity, post-Cod Moratorium: "'Those fish are coming back,' said one fisherman, 'and I'll be waiting on this shore, by God.'"[87] Although tried and tested by Resettlement programs and the termination of a defining industry, high spirits in outports always return, attesting to the collective social strength of these rural communities.

During the 1950s, the government of Newfoundland experimented with industrialization in an attempt to diverge from the "weaknesses inherent in Newfoundland's resource-based, export-oriented economy."[88] Although largely unsuccessful due to export costs, inexperience, expensive labour, and technologically obsolete equip-

86 Herridge, "Our History."

87 Major, *As Near to Heaven by Sea,* 447.

88 Economic Council of Canada, *Newfoundland,* 6.

Fortune's preserved fishing structures integrate with the modernized urban landscape, offering visitors a portrayal of vernacular Newfoundland building techniques. (Photo from December, 2018 site visit).

ment, the endeavour represented an attempt to embrace new industry.[89] Similarly, various outports are taking advantage of alternative industries like tourism and small business.

Resiliency is also a theme common in outport architecture. Structures that have stood the test of time continue to astonish unfamiliar visitors, vaguely illustrating a suppressed past lifestyle. As mentioned, these vernacular buildings survived through a proactive effort to build with prospective modification and mobility in mind. Fortune, hundreds of kilometres away from outports like Tilting and Calvert, possesses its own collection of remaining structures. The Fisherman's Wharf is an assortment of stages, wharves, walkways, and slipways perched along the east side of the harbour, illustrating to visitors an image of the past. In Fortune, these structures were designed for practical use as components of the inshore fishery. All constructed between 1900 and 1970, each structure has endured the rigours of the harsh Newfoundland coastal environment, substantiating their durability through adaptation.

Resiliency, whether expressed socially or architecturally, proves the desire for the persistence of culture across rural Newfoundland. The adaptive strategies used by outports can be translated to help inspire new construction in communities whose buildings and infrastructure are threatened by coastal erosion.

89 Economic Council of Canada, *Newfoundland,* 7.

CHAPTER 3: COASTAL EROSION

While Newfoundland's inhabitation, settlement patterns, and built identity can be attributed to its access to fish, the abundant supply of this marine resource is a result of the geological origins that led to such prosperity. Geomorphological processes have eternally produced and sculpted the island's landforms by weathering, eroding, and depositing sediment. Coastal erosion, a consequence of these processes, poses a threat to communities like Fortune that cling to the shore. Furthermore, climate change impacts such as rising sea-level and increased storm frequency will expedite erosional forces in these exposed coastal environments. At-risk sites along the coastline of Newfoundland have been identified by the Department of Natural Resources' coastal monitoring program, which determines and analyzes rates of erosion and causal processes specific to each site. Using findings of the program, an assessment of traditional practice in Newfoundland, and previous applications, the thesis identifies and critiques the suitability of three types of responses to coastal change: defend, vacate, and/or adapt.

Geological Origins

The codfish stocks that enticed European interest can be attributed to ancient geological processes beginning over five hundred million years ago. These same formative processes provided the groundwork for the factors that influence erosion along Fortune's coastline. To examine such factors, it is important to adequately understand the geological foundation of Newfoundland and the surrounding region.

The Grand Banks

The Grand Banks are a series of underwater plateaus southeast of Newfoundland. To Kevin Major, this extension of the island's bedrock is "as important as the landmass itself, and three times its size."[90] During the separation of the North American landmass from Europe and Africa, the Grand Banks were formed from constant tectonic pressures. Over millions of years, these relatively shallow depths filled with sediments.[91]

90 Major, *As Near to Heaven by Sea,* 4.

91 Cadigan, *Newfoundland and Labrador: A History,* 4.

NEWFOUNDLAND
GRAND BANKS

The Labrador Current and the Gulf Stream mix above the Grand Banks, a group of underwater plateaus southeast of Newfoundland. (Ocean currents: Joyce Macpherson, "Cold Ocean," *Heritage Newfoundland and Labrador*. Bathymetric contours: General Bathymetric Chart of the Oceans, Gridded Bathymetric Data).

The geographical location of the Grand Banks is where the Labrador Current and the Gulf Stream mix, producing a nutrient-rich synthesis of temperatures and salinity. This continuous blending lifts nutrients to the surface, fostering the growth of phytoplankton, "microscopic plants that are the most elemental part of the food chains of the animals of the North Atlantic."[92] The shallow waters of the Grand Banks permit solar exposure on the ocean bed, enabling photosynthesis required by phytoplankton to grow. Furthermore, the colder waters of the Labrador Current also inhibit bacteria that would kill phytoplankton in warmer waters. Microscopic zooplankton feed on the abundance of phytoplankton and constitute the food for larger fish.[93] This process is responsible for creating one of the most bountiful fishing grounds in the world, just off the coast of Newfoundland.

Sculpting The Rock

Compared to the rich marine ecologies of its surrounding waters, the land surface of Newfoundland is impoverished, veiled with infertile land. Virtually barren in terms of arable terrain, approximately one-third of the island's land-based environment has close to no soil.[94] For its rugged landscape, exposed cross-sections, and windswept topography, Newfoundland is often referred to as "The Rock," a nickname used by both its inhabitants and those from away.

Newfoundland, a 100,000 square kilometre granite slab, has been formed by millions of years of shifting tectonic plates. The island is divided into tectonic divisions by fault lines extending from southwest to northeast, each consisting of specific rock types and geological histories. During the Middle Cambrian period (the geological extent of time 540 million years ago), Newfoundland's current western division laid along the east coast of Laurentia (ancient North America). By the Early Ordovician period (490 million years ago), volcanic island arcs arose as convection currents moved the tectonic plates that contained the Laurentia continent; evidence of these island arcs exist today in the volcanic rocks of central Newfoundland. Shifting eastward, Laurentia eventually collided with another ancient continent, Gondwana, by the Early

92 Cadigan, *Newfoundland and Labrador: A History,* 5.

93 Ibid., 6.

94 Ibid., 7.

Devonian period (410 million years ago). The collision resulted in large folds of crust, forming a mountain range across the middle of this newly-formed continent. Now known as the Appalachian Mountain system, what is now Newfoundland laid halfway along this range. The continents eventually separated around the Early Jurassic period (200 million years ago), leaving fragments of Gondwana attached to Laurentia.[95] One of these fragments is the eastern division of Newfoundland, containing Fortune. Much of western Newfoundland is an extension of the Appalachian system, and many bays, peninsulas, and bodies of water are oriented parallel to this mountain range. Now an island sitting in the Atlantic Ocean, Newfoundland is separated from its mainland counterpart, Labrador, by the Strait of Belle Isle.

While exposed rock makes up a great deal of the island's surface area, more heterogeneous geological compositions exist in many of the province's low-lying coastal areas. During the retreat of the Wisconsin glaciation about 10,000 years ago, the high grounds were covered with rocks and gravel as the ice melted. While the highest elevations had nothing but bare bedrock, sedimentation left lower elevations with stratified combinations of sand, silt, and gravel. Low-lying lands with sparse areas of arable terrain are generally shallow, containing acidic soils of gravel and little humus. According to Sean Cadigan, these areas "retain little water, and frequent, often heavy precipitation and spring run-off make them vulnerable to erosion and leaching, a process whereby water drains nutrients from the soil."[96]

Fortune, resting on a shallow coastal plain amidst higher elevations, faces similar conditions. While exposed bedrock is present in the region's highest grounds, Fortune's townscape primarily sits atop unsorted glacial sediment. In addition to being subjected to constant wave exposure, the town's coastal bluffs are eroded by surface run-off carried by various meltwater channels traversing the urban landscape.

The exposed rock formations of Newfoundland attract earth scientists and tourists worldwide, offering a unique opportunity to learn about geological evolution. For

95 Trevor Bell and David Liverman, "The Newfoundland Story," Heritage Newfoundland and Labrador, 1999, https://www.heritage.nf.ca/articles/environment/newfoundland-story.php.

96 Cadigan, *Newfoundland and Labrador: A History,* 6-7.

instance, the effects of plate tectonics are studied in the preserved massive slabs of ocean floor present in the Tablelands of Gros Morne National Park, declared a UNESCO World Heritage site in 1987.[97] Fortune also has a well-documented geological history for reasons other than coastal monitoring. The Fortune Head Ecological Reserve has become world-famous for its fossils, drawing the attention of scientists since the first was discovered in 1977. This cape of exposed low cliffs just 1.6 km west of Fortune that holds the Global Stratotype Section and Point (GSSP) for the geologic time boundary between the Precambrian era and the Cambrian period.[98] Although erosion is present at Fortune Head, short- and long-term vulnerability has been deemed low, "reflecting the steep topography, steeply-offshore-dipping bedrock, and low tidal range."[99] The Fortune Head Geology Centre, the town's exhibition of its own geological heritage, offers tours to Fortune Head.

The rocky cliffs and windswept plains of areas like Fortune Head validate synonyms for Newfoundland like "The Rock." However, such areas are not reflective of the totality of the island's coastal regions. While the geological genesis of the island and surrounding continental shelf provided the foundation for Newfoundlanders' way of life, it also left extensive portions of the coastline vulnerable to coastal erosion.

Erosion

Coastal settings are dynamic environments, constantly being affected by the restless forces of nature. In spite of harsh weather conditions, the vast majority of Newfoundlanders continue to live and work in such regions. Vernacular building principles emerged from a desire to withstand these threatening circumstances, defined by adaptive practices like recycling, repairing, rebuilding, and relocating. As discussed, these principles helped shape a built landscape that contributes to the island's cultural identity.

While the relentless climate conditions of these exposed environments have influenced the architectural landscape, they have also continuously moulded the physical

97 Bell, "The Newfoundland Story."

98 Herridge, "Our History."

99 Norm Catto, *Fortune Report* (St. John's, 2012), 4.

landscape. Coastal erosion presents a latent threat to the exposed outports of Newfoundland; like climate change itself, coastal erosion is apparent but has not fully manifested itself. Catastrophic bank failures have transpired in recent history, and while predicting coastal evolution is challenging, these destructive impacts will likely persist based on climate change projections and local sea-level rise.

The interface between traditional architecture and coastal erosion will be explored relative to Fortune, previously established as a representative example of rural communities situated along an evolving shoreline. To do so, it is necessary to obtain a sufficient understanding of the factors that influence coastal erosion, how it is being monitored, and its anticipated impacts. Subsequently, this information can be used to predict potential coastal evolution scenarios in Fortune.

Causes of Coastal Change

Coastal change in a given location is influenced by a combination of external environmental forces and internal site properties. Melanie Irvine, a Project Geologist for the Government of Newfoundland and Labrador, explains that this combination consists of marine and terrestrial processes, and the variation in rates is caused by the interaction of two overarching categories: erosional processes and site characteristics.[100] Understanding a given site's susceptibility to these factors is imperative when predicting coastal evolution and short- to long-term vulnerability.

Erosional processes are the external forces caused by the climate and weather conditions of a given environment. Erratic by nature, these processes consist of factors like wave energy, wind, surface run-off, and groundwater flow. The potential for wave energy to cause a coastal bluff to become unstable depends on the orientation of the coastline relative to the effective storm direction.[101] Norm Catto, the Department Head of Geography at the Memorial University of Newfoundland, suggests that wave action is the dominant form of erosion in microtidal and low mesotidal situations, common throughout coastal Newfoundland. Catto claims that "wave action accounts for the majority of sedimentary landforms and contributes substantially to coastal

100 Irvine, *Monitoring Coastal Change in Newfoundland and Labrador,* 265.
101 Ibid.

erosion of unconsolidated cliffs."[102] Likewise, high onshore winds can remove sediment from the cliff face, resulting in undercutting and instability. Conversely, surface run-off and groundwater flow come from inland rather than the sea. These fluvial processes are the result of precipitation that flows over cliff edges from higher elevations, promoting further weakening of coastal bluffs.[103]

Site characteristics are the intrinsic properties of a given region. These characteristics consist of innate attributes like sediment composition, vegetation, coastal and nearshore geometry, sediment budget, and sea ice cover. A site's sedimentology is a significant determinant of its susceptibility to certain erosional processes. For example, sites composed of sand and gravel are prone to erosion from wind and surface run-off, while silt and clay may slump or slide if undercut or saturated with water.[104] Geomorphology also influences a site's sensitivity; surficial landforms like meltwater channels facilitate erosional processes like surface run-off. For areas exposed to frequent storm surges and large waves, the presence of sea ice can provide natural protection by dissipating this invasive energy.

The frequency and intensity of storms can augment erosional processes like waves, wind, and precipitation. According to David Atkinson et al., "storms with elevated water levels and wave action are the most effective agents of coastal change."[105] Such severe disturbances in the atmosphere can catalyze failure events like landslides, defined as "the downslope movement of unconsolidated material under the influence of gravity."[106] Increased precipitation from storms can provoke these geological disasters by introducing excess quantities of water to the slope, loading it beyond its shear strength.[107] Communities situated adjacent to the coast are therefore

---

102 Norm Catto, *Coastal Erosion in Newfoundland* (St. John's: Atlantic Climate Adaptation Solutions Association, 2012), 35-36.

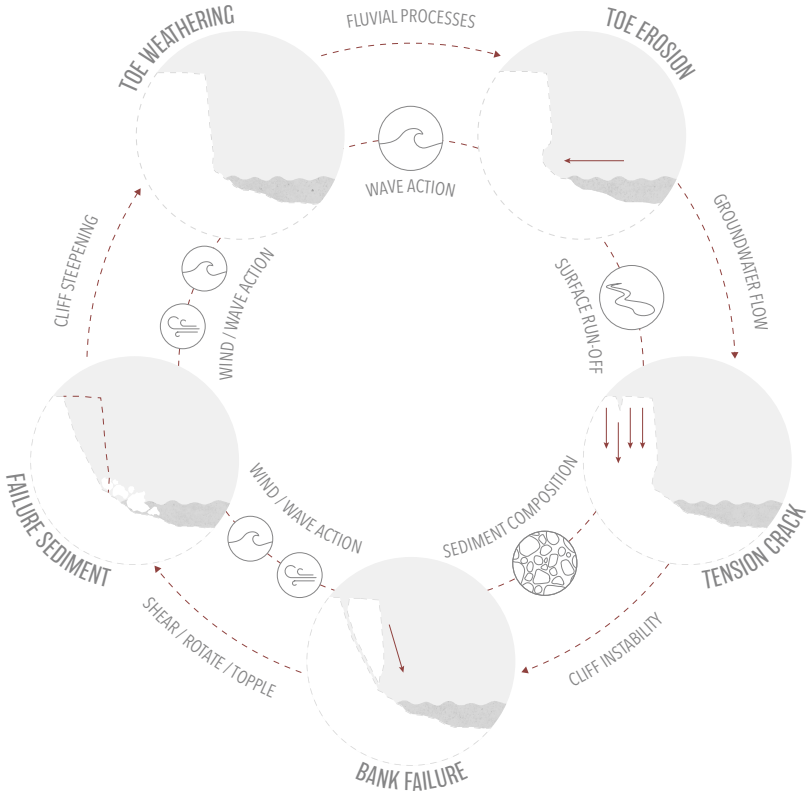
103 Irvine, *Monitoring Coastal Change in Newfoundland and Labrador,* 265.

104 Ibid.

105 D.E. Atkinson, D.L. Forbes, and Thomas S. James, "Dynamic Coasts in a Changing Climate," in *Canada's Marine Coasts in a Changing Climate,* ed D.S. Lemmen, F.J. Warren, T.S. James and C.S.L. Mercer Clarke (Ottawa: Government of Canada, 2016), 36.

106 Martin Batterson et al., *The Assessment of Geological Hazards and Disasters in Newfoundland: An Update* (St. John's: Newfoundland and Labrador Department of Mines and Energy, 1999), 97.

107 Ibid.



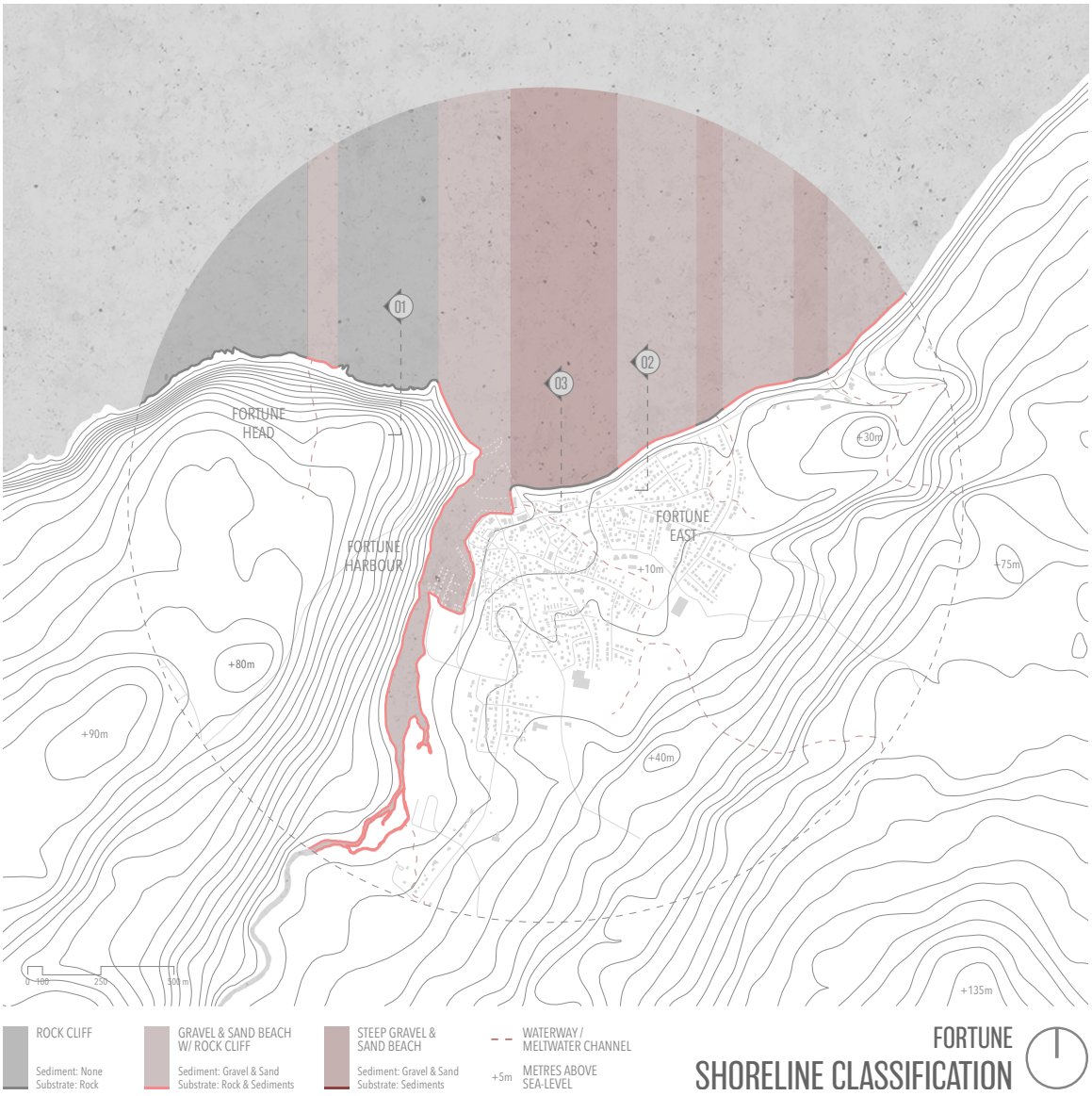
Interpretive diagram of coastal erosion processes. Coastline recession is the result of perpetual cyclical processes of weathering and erosion, leading to landslides.

the most vulnerable during severe storms, when the risk of slope failures is highest.

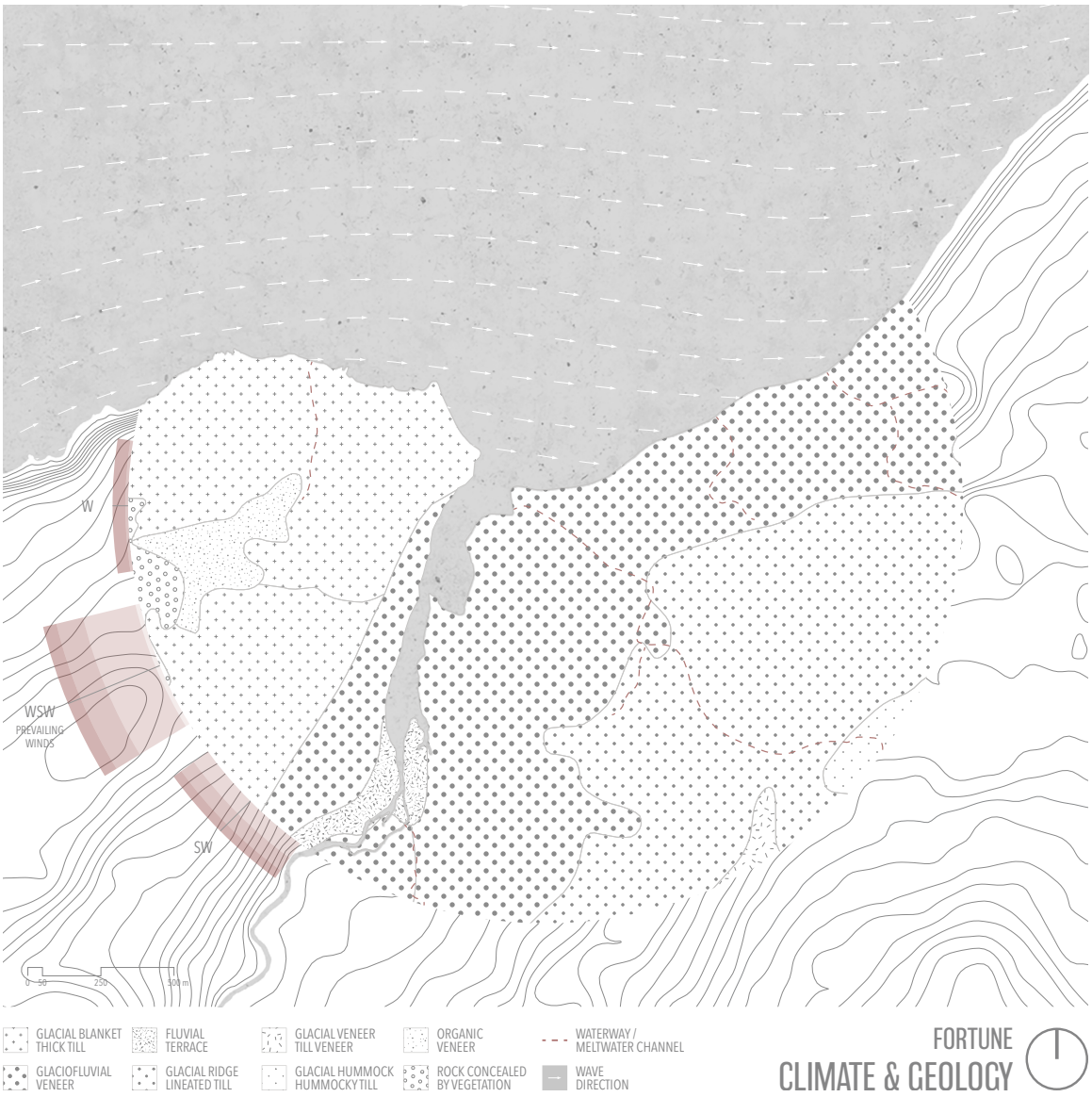
Fortune is susceptible to many of the aforementioned causes of coastal change. This is a product of the town's exposure to erosional processes and its geological composition. In a report describing the town in terms of its geology and sensitivity to erosion, Norm Catto divides Fortune into three regions: Fortune Head, Fortune Harbour, and Fortune East.[108] For the purposes of the thesis, Fortune East and Fortune Harbour will be the primary regions of focus as these sections encompass the majority of the urban landscape. Specifically, the coastline will be analyzed from the fish-processing plant eastward.

The geomorphology and sedimentology of various segments of the coast of Fortune East and Fortune Harbour place the regions into different categories of the Shoreline Classification system. This system, consisting of 27 classes, was developed as a base-

108 Catto, *Fortune Report,* 1.



Fortune's site characteristics were used to classify its shoreline in terms of erosion susceptibility. While flanked by a resistant rock cliff, the urban landscape sits adjacent to highly vulnerable gravel and sand beach bluffs. (Regions: Norm Catto, *Fortune Report.* Classifications: Geological Survey of Newfoundland and Labrador, Geoscience Atlas. Contours: United States Geological Survey, Global Data Explorer).



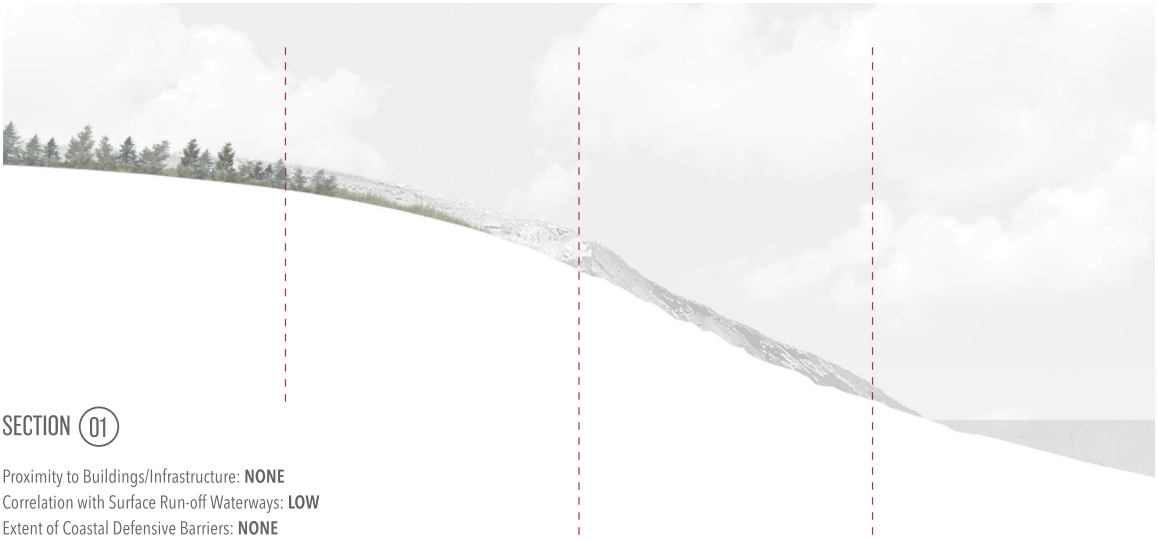
Fortune has been analyzed in terms of the key weathering processes and site characteristics that influence coastal erosion: wave action, wind, sediment composition, and surficial landforms (Surficial geology and waterways: Geological Survey of Newfoundland and Labrador, Geoscience Atlas. Wind and wave information: Meteoblue. Contours: United States Geological Survey, Global Data Explorer).

line for the examination of erosion individual sites. Largely composed of pebbles, cobbles, and coarse sand, Fortune East and Fortune Harbour comprise lengths of coast that fall under two categories: gravel and sand beach with rock cliff (Class 9), and steep gravel and sand beach (Class 18).[109] These classifications comprise various combinations of layered substrates and sediments; Class 9 is composed of "rock and sediments" and "gravel and sand," respectively, and Class 18 has a substrate of "sediment" underlying "gravel and sand."[110] By comparison, the unconsolidated sediment of Fortune East and Fortune Harbour are much more susceptible to erosion than Fortune Head, classified as rock cliff (Class 3).[111]

While Fortune Harbour and Fortune East share a similar sediment composition, they differ in terms of exposure. Despite evident erosion along the harbour, the natural protection of the Fortune Barasway means a low vulnerability in this region compared to the exposed state of Fortune East. The susceptibility of Fortune East to erosional processes is a product of climate conditions and weather patterns. Waves in Fortune Bay predominantly travel east through little ice cover, leaving the coast swash-aligned and highly susceptible to unrestricted wave action. In addition to the water saturation of Fortune's glaciofluvial deposits during overland flow, Catto claims that Fortune's slope failures are subject to undercutting by this wave energy.[112] This weakens the cliff toe, increasing the chance of storm-induced slope failures.

As mentioned, major storm events trigger the slope failures that lead to landward coastal recession; erosion has occurred in Fortune due to such disturbances. Catto alludes to several storm events that threatened or damaged Fortune's infrastructure. For example, storm-induced river flooding in spring 1986 resulted in overland erosion, "coupled with a storm surge that badly damaged Fortune's sewage disposal system."[113] Considerable coastal erosion caused by significant storm events has continuously been documented into the 21st century. While difficult to predict due to the episodic nature of storm surges, "tentative estimates of the maximum rate of

109 Catto, *Fortune Report,* 1.
110 Catto, *Coastal Erosion in Newfoundland,* 8-9.
111 Catto, *Fortune Report,* 1.
112 Ibid., 8.
113 Ibid., 9.



SECTION 01

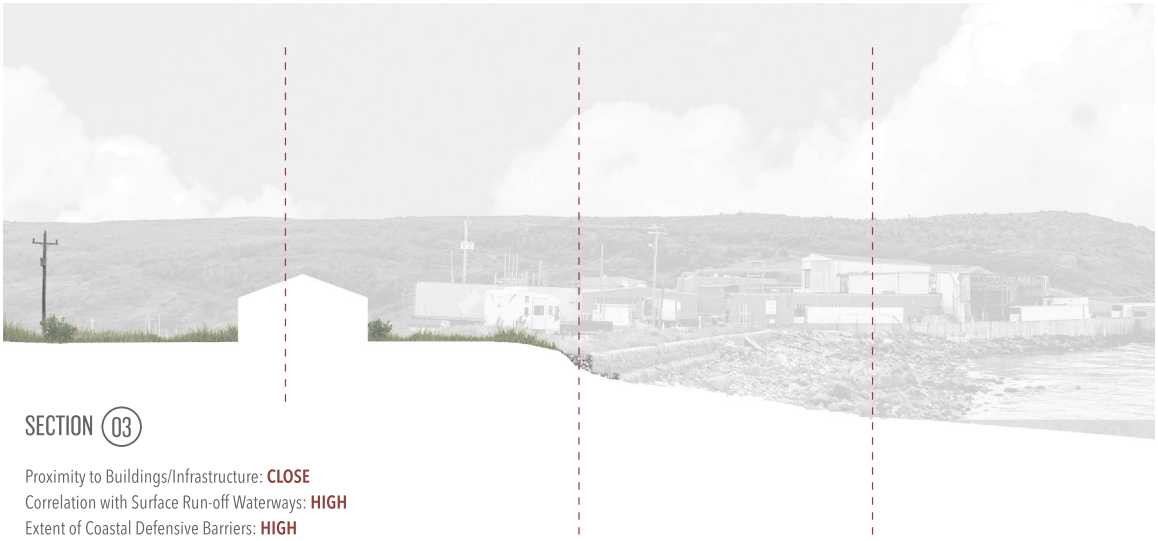
Proximity to Buildings/Infrastructure: **NONE**
Correlation with Surface Run-off Waterways: **LOW**
Extent of Coastal Defensive Barriers: **NONE**

Class 3: Rock Cliff. These segments of Fortune's coastline are prominent along the Fortune Head region, distant from the town's urban landscape. (Four rightmost photos by Anthony Martin. Cropped, colour enhanced by author).

SECTION 02

Proximity to Buildings/Infrastructure: **CLOSE**
Correlation with Surface Run-off Waterways: **MODERATE**
Extent of Coastal Defensive Barriers: **MODERATE**

Class 9: Gravel and Sand Beach with Rock Cliff. These segments of Fortune's coastline are found along Fortune Harbour and portions of Fortune East.



SECTION 03

Proximity to Buildings/Infrastructure: **CLOSE**
Correlation with Surface Run-off Waterways: **HIGH**
Extent of Coastal Defensive Barriers: **HIGH**

Class 18: Steep Gravel and Sand Beach. These segments of Fortune's coastline are prominent in the Fortune East region. They are situated close to buildings and infrastructure, have a high correlation with meltwater channels, and are extensively fortified with defensive barriers like gabion walls.

retreat, based on aerial photograph analysis and discussion with Fortune Town Councillors and residents, are approximately 20-30 cm/year since 1986."[114] Continued investigations and more data accumulation over a longer time period will increase the accuracy of this rate.

Across three site visits from August 2018 to April 2019, change was evident in Fortune due to the threat of coastal recession. Upon entering the town in August, I was greeted with signs of ongoing construction work on Highway 220. This was the result of recent efforts to shift the highway inland, farther from the steep, unstable embankment of Fortune East. Evidence of the old highway remains adjacent to the new one. The project was provoked by a concern for the safety of vehicles (school buses in particular) passing over the unstable slope.[115] In 2014, the original plans suggested relocating the road 300-400 feet inland.[116] However, the Department of Transportation and Works has only shifted it 15 metres (approximately 50 feet) at its farthest point. The Department has labelled this a "permanent solution to address any potential erosion concerns that might otherwise have formed in the future."[117] This statement contradicts recent findings; if the recorded rates of recession since 1986 were to continue, this 2-million-dollar project will require repetition every 50-75 years.

An additional concern involves the erosion of artificial infill below the concrete wharf of Fortune's fish-processing plant. This triangular quay constantly absorbs and redirects wave energy, protecting the harbour along with Fortune's breakwater, strategically positioned on the western edge of the mouth of Fortune Barasway. Resulting instability under the platform has prompted recent repairs and continuous maintenance.

---

114 Catto, *Fortune Report,* 9.

115 Paul Herridge, "Slope Erosion Being Addressed in Highway Project Between Grand Bank and Fortune," *The Telegram,* June 11, 2018, https://www.thetelegram.com/news/local/slope-erosion-being-addressed-in-highway-project-between-grand-bank-and-fortune-217544/.

116 CBC News, "Road Erosion Tearing Apart Highway Near Grand Bank," *CBC*, October 8, 2014, https://www.cbc.ca/news/canada/newfoundland-labrador/road-erosion-tearing-apart-highway-near-grand-bank-1.2792842.

117 Herridge, "Slope Erosion Being Addressed in Highway Project Between Grand Bank and Fortune."

Taken about a century apart in the same position, these photos show the extent of erosion and resulting coastal recession in Fortune. (Top: Jim Dobson, posted in Fortune Then and Now Facebook group. Right: Photo from August, 2018 site visit).

The combination of Fortune's external environmental forces and internal site properties has led to significant coastal erosion. Typically, these substantial rates of erosion draw a response, especially when roads, buildings, and other critical infrastructure are threatened. For Fortune in particular, the proximity of Highway 220 to sensitive beach bluffs presents a concern for the safety of both residents and visitors. Communities in similar states of jeopardy provide the impetus for the recent efforts to monitor such circumstances. Data from these surveying efforts grant the ability to deduce region-specific patterns of erosion such that suitable responses can be conceived and implemented.

The highway between Fortune and Grand Bank was shifted inland in 2018, away from the unstable embankment. (Photo from December, 2018 site visit).

Fortune's breakwater and fish plant quay protect the harbour from the intense wave action of Fortune Bay. Visible to the right is evidence of ongoing repairs to the quay due to the erosion of its underlying infill. (Photo from December, 2018 site visit).

View of the relatively calm waters of Fortune's Harbour from atop the breakwater. (Photo from December, 2018 site visit).

Coastal Monitoring

Like Fortune, sensitive zones of Newfoundland's coastline are being researched to provide baseline data for coastal erosion. Building upon earlier research by the federal and provincial geological surveys, the coastal monitoring program attempts "to provide reliable estimates of coastal change, to identify areas vulnerable to coastal erosion, and to determine how coastal evolution may change in the future."[118] Beginning in 2011, this ongoing effort involves investigating the effects of storm surge activity, analyzing wave and surge dynamics, determining the rates and processes of coastal bluff erosion, and considering the effectiveness of response strategies. Data collection comes from sources like maps, research (field, office, laboratory), detailed community reports, and ongoing digitization and interactive database construction.[119] These data are imperative when predicting coastal change.

Geological disasters often provide the impetus for coastal monitoring. For example, landslides took place in Daniel's harbour on the province's west coast in 2007. The erosion claimed thousands of tonnes of clay-based soil, several sheds, and a bungalow.[120] Another destructive slope failure occurred in the town during November, 2013, when the displacement of large amounts of sediment damaged part of a roadway that had been closed following the 2007 disaster.[121] In Placentia, on the west coast of Newfoundland's Avalon Peninsula, storm-induced waves flooded and considerably damaged portions of the boardwalk and road adjacent to the beach.[122] Daniel's Harbour, Placentia, and Fortune are three of 112 currently identified coastal monitoring sites.

In addition to the in-depth analyses of the 112 identified settlements, the Shoreline Classification system has been used to determine the short- and long-term vulner-

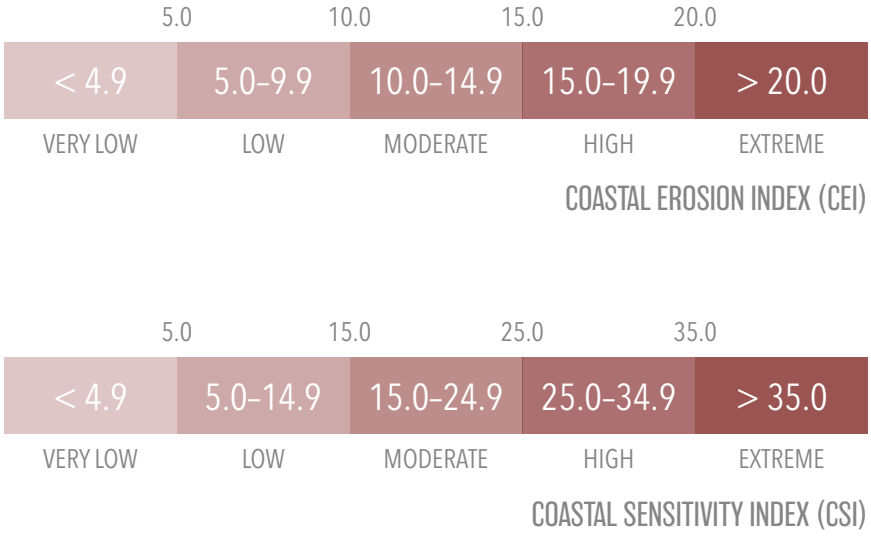
118 Irvine, *Monitoring Coastal Change in Newfoundland and Labrador,* 263.

119 Norm Catto, "Coastal Erosion Sensitivity and Consequences for Communities and Infrastructure" (presentation, Atlantic Coastal Zone Information Steering Committee Meeting #70, St. John's, NL, September 12, 2013).

120 CBC News, "Residents Fret as 'Active Slide' Causes Havoc in Daniel's Harbour," *CBC,* April 19, 2007, https://www.cbc.ca/news/canada/newfoundland-labrador/residents-fret-as-active-slide-causes-havoc-in-daniel-s-harbour-1.640239.

121 Irvine, *Monitoring Coastal Change in Newfoundland and Labrador,* 264.

122 Ibid.



The short- and long-term vulnerability of certain segments of Newfoundland's coastline can be measured using the Coastal Erosion Index (CEI) and Coastal Sensitivity Index (CSI), respectively. The scales to the right indicate the values' relative severity. (Norm Catto, "Coastal Erosion Sensitivity and Consequences for Communities and Infrastructure").

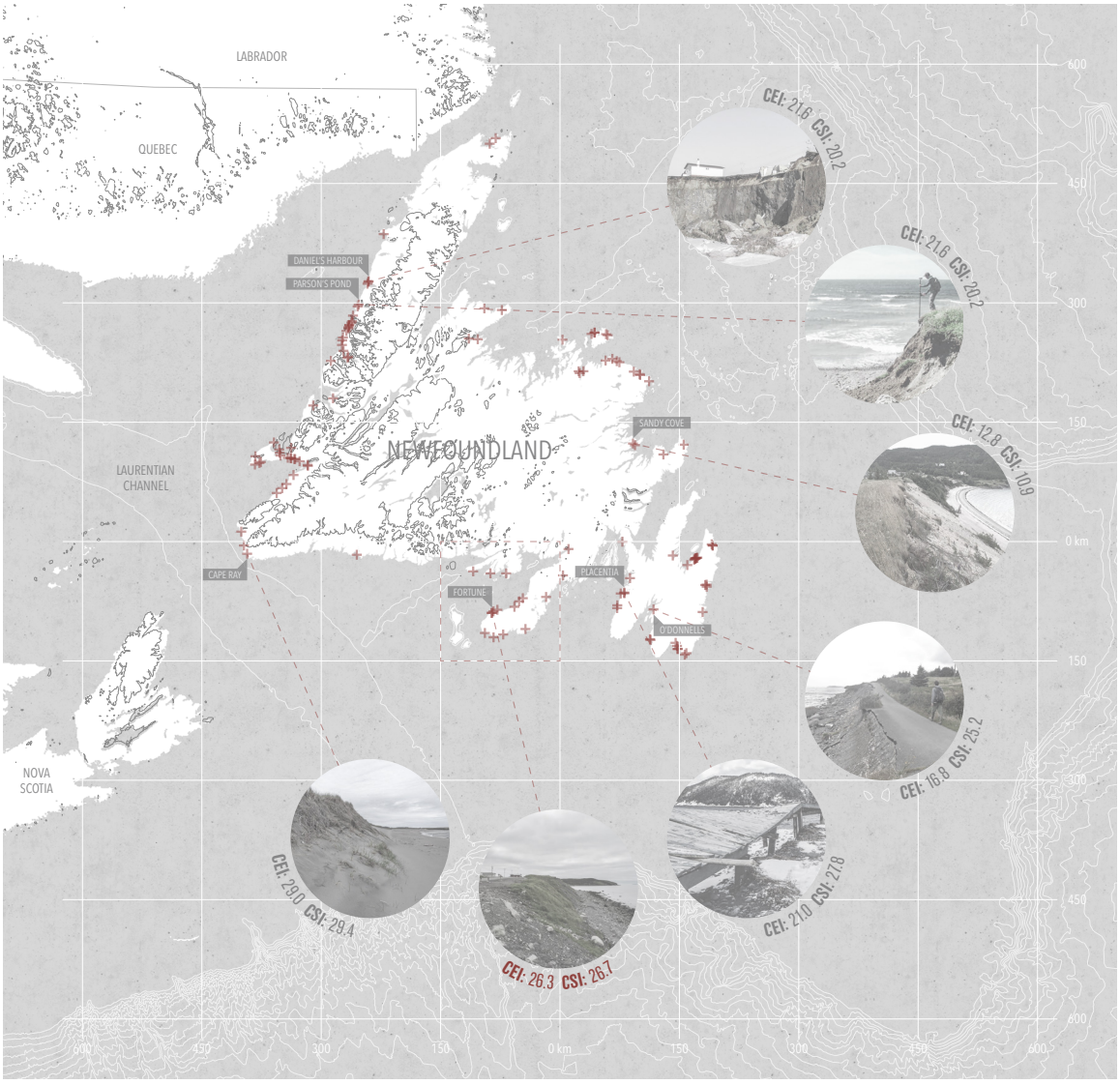
ability to coastal change of 1472 segments along the coastline of Newfoundland. Short-term susceptibility to erosion is determined by the Coastal Erosion Index (CEI) while long-term susceptibility uses the Coastal Sensitivity Index (CSI). While CEI values take into account variables such as sediment type, shoreline classification, and extent of seasonal ice cover, CSI values factor in sea-level change, landform types, lateral shoreline displacement, and tidal range.[123] Higher CEI and CSI values indicate higher short-term and long-term vulnerability, respectively.

Fortune East has a CEI value of 26.3 and a CSI value of 26.7. According to Catto's qualitative scale of the CEI and CSI value range, these values are characterized as "extreme" and "high," respectively. Conversely, Fortune Harbour has been assigned values of 8.8 (low) and 23.9 (moderate) for CEI and CSI respectively, indicative of reduced exposure to the waves of Fortune Bay.[124] The extreme CEI value of Fortune East "is based on the exposure of the shoreline to wave action in Fortune Bay, the limited sediment flux to the beach (in part, the result of shoreline protective measures), the absence of sea ice and limited snow cover, and the sediment type and shoreline classification."[125] The high CSI value "reflects the ongoing sea-level rise (ca. 3 mm/y),

123 Catto, "Coastal Erosion Sensitivity and Consequences for Communities and Infrastructure."

124 Catto, *Fortune Report,* 11.

125 Ibid.



+ COASTAL MONITORING SITE

NEWFOUNDLAND
COASTAL EROSION MONITORING

Many of Newfoundland's rural communities are experiencing variable rates of coastal erosion; Newfoundland's coastal monitoring program currently oversees 112 of these sites, including communities like Fortune, Daniel's Harbour, and Placentia. Each has been assigned a corresponding Coastal Erosion Index (CEI) value for short-term vulnerability and Coastal Sensitivity Index (CSI) value for long-term vulnerability.

the significant wave height in Fortune Bay along this exposed coastline, and the evidence of shoreline displacement and erosion."[126] Based on these values, buildings and infrastructure adjacent to Fortune's beach bluffs are therefore vulnerable in the short- and long-term.

While CEI and CSI values are informative and serve as sufficient baselines for analysis, they remain predictions and not proof. Catto reminds us that "in many cases, like shoreline displacement in particular, we are trying to infer longer term processes with relatively short time series."[127] Coastal evolution is erratic; a significant slope failure typically follows several years of negligible erosion. Extensive data is thus required before long-term predictions of rates coastal change can be substantiated. As more data becomes available, the long-term sensitivity values can be adjusted to more precisely reflect the impacts that climate change will have on outports affected by coastal erosion.

Climate Change Implications

Projected changes in climate will modify the factors that influence coastal erosion. Specifically, aforementioned erosional processes like wave action, wind, and groundwater flow will increase in magnitude and frequency, thereby amplifying the prevalence of failures and damage. The manifestations of climate change that will most significantly impact these processes include increased storm frequency, increased precipitation, and rising sea-levels. Each change in climate has an associated implication for coastal regions like Fortune.

Hurricanes and tropical storms are becoming increasingly prevalent in Newfoundland. Compared to an average of six such events per 10 year period from 1900 to 1989, the province is now subject to an average of 11.5 storms per 10 year period.[128] Implicit in the growing number of storm surges in Newfoundland is a higher

126 Catto, *Fortune Report,* 11.

127 Catto, "Coastal Erosion Sensitivity and Consequences for Communities and Infrastructure."

128 *Climate Change Projections for Newfoundland and Labrador Late 20th Century to Mid 21st Century (*St. John's: Government of Newfoundland and Labrador Office of Climate Change, Energy Efficiency, and Emissions Trading, 2013), 6.

frequency of slope failures caused by the destructive forces of wind and wave action. Unprotected coastal regions like Fortune will likely suffer the most from these projections; when emphasizing the exposure of Fortune East to wave action, Catto claims that "a change in the amount of storm activity will have a direct impact on erosion along the Fortune shoreline."[129]

The number of days with significant (greater than 10 millimetres) precipitation is also expected to increase across the province. Depending on the intensity of rainfall, measured as volume per time interval, precipitation greater than 10 millimetres can cause flooding and erosion.[130] As established, Fortune's site sedimentology is vulnerable to slope movement associated with groundwater flow and surface run-off. Therefore, more days per year of significant rainfall may expedite rates of erosion resulting from these fluvial processes.

Global warming can influence coastal change by reducing the extent of sea-ice cover and increasing sea-levels relative to the land surface. Growing temperatures translate to warmer ocean temperatures the melting of glaciers and ice sheets. Not only do rising sea-levels move the shoreline inland, but they also elevate the height at which wave processes operate.[131] When describing key findings of observed and projected climate changes in eastern Canada, Savard lists sea-ice cover and sea-level rise as "key determinants of coastal erosion rates" stating that "future coastal erosion rates will likely increase in most areas" where mild winters and low ice coverage prevail.[132] By 2100, under the high emissions scenario, sea-level rise relative to Fortune is expected to increase by 70 centimetres. Using the Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT), this translates to a vertical allowance of 89 centimetres, meaning any new coastal infrastructure must be built at least this high above current

129 Catto, *Fortune Report,* 11.

130 Joel Finnis and Joseph Daraio, *Projected Impacts of Climate Change for the Province of Newfoundland & Labrador: 2018 Update* (St. John's: Government of Newfoundland and Labrador Department of Municipal Affairs and Environment, 2018), 84.

131 Davidson-Arnott, *Coastal Erosion and Climate Change,* 22.

132 J.-P. Savard, D. van Proosdij, and Stéphan O'Carroll, "Perspectives on Canada's East Coast Region," in *Canada's Marine Coasts in a Changing Climate,* ed. D.S. Lemmen, F.J. Warren, T.S. James and C.S.L. Mercer Clarke (Ottawa: Government of Canada, 2016), 101.

water levels.[133] Resting on a naturally low-lying coastal plain, Fortune is therefore susceptible to erosion induced from ascending water levels.

Response

Inherent in the efforts to monitor coastal erosion is the intention to determine an appropriate response to the situation. Worth noting is that coastal evolution is not by any means a novel phenomenon; however, geomorphological processes pose a threat when the boundary dividing land and sea begins approaching buildings and infrastructure at accelerating rates. This threat is characterized by the Geological Survey as a geological hazard, which equates to a potential disaster. As explained by Martin Batterson et al., "a geological disaster occurs when natural geological processes impact on our activities, either through loss of life or injury, or through economic loss."[134] Since 1863, at least 80 people have been killed in Newfoundland by geological-related disasters such as landslides, avalanches, and tidal waves.[135] While many recorded disasters were unavoidable, Batterson asserts that "some were predictable and therefore preventable, either because a similar event had previously occurred in the same area or that geological factors, such as rapid coastal erosion or rising sea-levels, were not considered during the planning process."[136] Any proposed construction in vulnerable coastal regions should therefore be designed with an awareness of potential future environmental scenarios.

Responses to geological hazards aim to increase safety by diminishing the risk of disaster. The implementation of such interventions is often reactive, following catastrophe. However, increased awareness and understanding of erosional processes can lead to the introduction of proactive responses, actualized in anticipation of disaster. The thesis will examine the suitability and effectiveness of three responses to the threat of coastal change: defensive, engineered strategies (defend), retreat to inland locations (vacate), and adjustment to change (adapt).

---

133 "CAN-EWLAT, Fortune, NL," Bedford Institute of Oceanography, Government of Canada, March 23, 2016, http://www.bio.gc.ca/science/data-donnees/can-ewlat/selected-location-en.php?type=SCH&prov=NL&loc=FORTUNE&station=17.

134 Batterson, *The Assessment of Geological Hazards and Disasters in Newfoundland,* 95.

135 Ibid.

136 Ibid.

Defend

For the purposes of the thesis, to "defend" against coastal erosion means using engineering approaches to reduce the impact of erosion on sand and gravel beaches like Fortune. Robin Davidson-Arnott and Jeff Ollerhead group these structural approaches into two major classes: physical barriers that protect the coast from wave attack (1) and structures that reduce sediment transport alongshore or offshore, designed to trap sediment and build the beach (2).[137] Group 1 includes "seawalls and revetments built in concrete, wood, or steel at the back of the beach" which may be impermeable or absorbent (in the case of armourstone) to "absorb wave energy and reduce wave reflection."[138] Group 2 consists of structures like groynes that are shore-perpendicular. On beaches where longshore sediment transport is prominent, groynes can "trap sediment being transported alongshore, thus building a wider beach and reducing wave erosion."[139] By either protecting the structural integrity of beach bluffs or preventing excessive sediment loss, each group of engineered approaches aims to mitigate the potential for catastrophic erosion.

Defensive responses, however, can be more damaging than protective. According to Savard et al., although suitable in some areas inflicted by sea-level rise and coastal flooding, hard coastal defence structures "disrupt coastal processes and can exacerbate erosion, sedimentation and coastal squeeze, leading to degradation and loss of coastal habitats and ecosystem services."[140] Davidson-Arnott and Ollerhead also express the difficulty in justifying the application of such barriers: over time, engineered barriers are "subject to greater wave energy and a greater potential for overtopping during storms so that more maintenance is required and eventually the structure must be abandoned."[141] Unless properly designed and employed in a suitable scenario, the costs of implementing and preserving defensive responses seldom justify their application.

Defensive barriers are pervasive in Fortune. Not only have such structures been im-

137 Davidson-Arnott, *Coastal Erosion and Climate Change,* 29.

138 Ibid.

139 Ibid.

140 Savard, "Perspectives on Canada's East Coast Region," 101.

141 Davidson-Arnott, *Coastal Erosion and Climate Change,* 29.

Segments of Fortune's coastline subject to the most intense erosion are lined with coastal defence barriers like gabion walls. (Photo from August, 2018 site visit).

plemented along the coast adjacent to Highway 220, but they also exist inland at the base of steep embankments or along riverbeds. These engineered interventions reflect the weakening state of Fortune's sediment composition across the urban landscape. As for the barriers situated along the coast, where the land meets Fortune Bay, gabion walls, riprap, and large boulders have been positioned in correspondence to segments subject to the most intense erosion as outlined by the Shoreline Classification system. For instance, extensive structural barriers exist directly east of the fish plant wharf, along a segment classified as steep gravel and sand beach (Class 18).

However, like Savard, Davidson-Arnott, and Ollerhead, Norm Catto denounces the effectiveness of these structures. Although coastal erosion present along Highway 220 "necessitated installation of the shoreline protection, it has had the effect of increasing the amount of wave energy delivered to the toe of the bluff, triggering undercutting and further erosion."[142] The introduction of coastal barriers in Fortune appears to be more of a reactive measure than a calculated response that accounts for long-term coastal evolution.

While defensive strategies represent the desire to continue occupying Newfoundland's coastal regions, their intended effect is regularly negated by their empirical performance.

142 Catto, *Fortune Report,* 11.

Vacate

The term, "vacate" is used to describe any form of inland retreat from eroding coastlines. Given the "fight or flight" scenario prompted by the threat of coastal failure, these reactions represent flight responses to such environmental hazards, taking the form of setbacks, land-use zoning, and evacuation.

If an urban setting like Fortune (flanked by beach bluffs composed of loose sediment) chooses to enforce setbacks and land-use zoning, Davidson-Arnott and Ollerhead suggest the distance for the construction of new developments from the shore should "incorporate the likely maximum extent of storm surge plus an allowance for wave erosion."[143] Depending on the sedimentology of the beach, this hazard zone can range from 20-50 metres.[144] Since the largest distances correlate with sandy beaches on exposed coasts, Fortune's setbacks would likely fall into the upper values of this range, completely changing the town's settlement patterns.

Although the "vacate" response may appear a pragmatic reaction to coastal erosion, this strategy contradicts the resilient nature of rural Newfoundlanders. As discussed, the cultural identity of outports stems from coastal inhabitation propelled by an innate relationship with the sea. Persistence in the face of change has been an ever-present theme in Newfoundland culture. While setbacks, land-use zoning, and even total evacuation exist as optional responses, they are representative of the negative connotations of Resettlement in Newfoundland. If outports like Fortune were to enforce such requirements, the resultant would be a complete transformation of the traditional urban landscape, and an ensuing loss of identity.

Adapt

For the purposes of the thesis, to "adapt" means to continue inhabiting the coast while allowing natural erosional processes to proceed without intervention. Instead of environmental manipulation, adaptation involves a rethinking of practices employed in the built environment to address long-term concerns.

---

143 Davidson-Arnott, *Coastal Erosion and Climate Change,* 28.

144 Ibid.

Responses to coastal erosion like engineered coastal defence systems and zoning setbacks fail to address the social and cultural aspects of settlements in coastal environments. When discussing his observations across the variety of landscapes that make up America, landscape architect James Corner interprets measure as the interrelationship between quantum, instruments, and ethics. The ways that measures are used in seeing the world "affect actions taken within it and how particular kinds of realities are then constructed."[145] Subsequently, Corner asserts that these resultant actions become problematic "when the producer of instruments neglects to attend to the social and cultural ends of their work, emphasizing instead the instrument (or the means) as an end in itself."[146] The third dimension of measure, ethics, is ignored when decisions are made based on immediate profit and measurable benefit. Coastal monitoring endeavours can be considered the combination of numerical and instrumental dimensions of measure in the analysis of Newfoundland's vulnerable coastal landscape. In this way, defensive strategies and evacuation represent the resultant actions to coastal erosion that fail to take into account the social and cultural ramifications of modifying outports in such ways. "Defend" and "vacate" strategies may produce localized short-term relief, but these responses disregard certain cultural values that characterize coastal landscapes such as Fortune.

By comparison, adaptation represents the resilient middle ground between resistance and surrender. As opposed to reacting impulsively, adapting to coastal erosion involves the thoughtful reinterpretation of coastal planning and architecture that retains an awareness of past erosion while considering potential ranges of future climate scenarios.

Case Study: The Retreating Village

Smout Allen's "Retreating Village" provides a compelling conceptual precedent for a scheme that envisions the development of a physically adaptable built environment.

Smout Allen, based at the Bartlett School of Architecture, UCL, is an architectural design research practice consisting of Mark Smout, Professor of Architecture and Land-

145 James Corner and Alex S. Maclean, *Taking Measures Across the American Landscape* (New Haven: Yale University Press, 1996), xvi.

146 Ibid., xviii.

scape Futures, and Laura Allen, Professor of Architecture and Augmented Landscapes. According to Smout, the practice "scrutinizes and interprets the fluxing urban and rural landscape and its reaction and adaptation to natural environmental events and the 'artificial' influence of man."[147] Smout Allen proposes that "the built environment can develop a reading of and synergy with its (changing) surroundings informed by understanding the complex interaction of living and artificial systems, environmental processes and emerging technologies."[148]

In 2007, Smout Allen published *Augmented Landscapes,* volume 28 of the *Pamphlet Architecture* series. The work comprises descriptions of five case studies, each an architectural intervention by Smout Allen that responds to the dynamic environmental conditions of certain sites. In his forward for the publication, Neil Spiller praises Smout Allen for their attention to the intrinsic characteristics of site, remarking that "much inspiration is gleaned from geomorphic natural phenomena" and "their work is always attuned to issues of time, duration, weather, and weathering."[149]

Of particular relevance to this thesis is the project titled "The Retreating Village: Architecture for a Restless Landscape." The conceptual study addresses the vulnerable state of the coastline adjacent to Happisburgh in Norfolk, England, a village victimized by climate change and a lack of government action. Coastal erosion in Happisburgh is causing recession rates as high as five metres per year; consequently, "streets, hotels, houses, sheds, and flower beds which had always been perilously close to the cliff, have all gone over the edge."[150] Further along the coast, despite their magnification of the problem, hard sea defences have only been implemented and maintained where the local council deems it necessary. As for Happisburgh, government policies have withdrawn from active intervention, planning to leave the village unprotected with "a long-term view to retreat and relocate."[151]

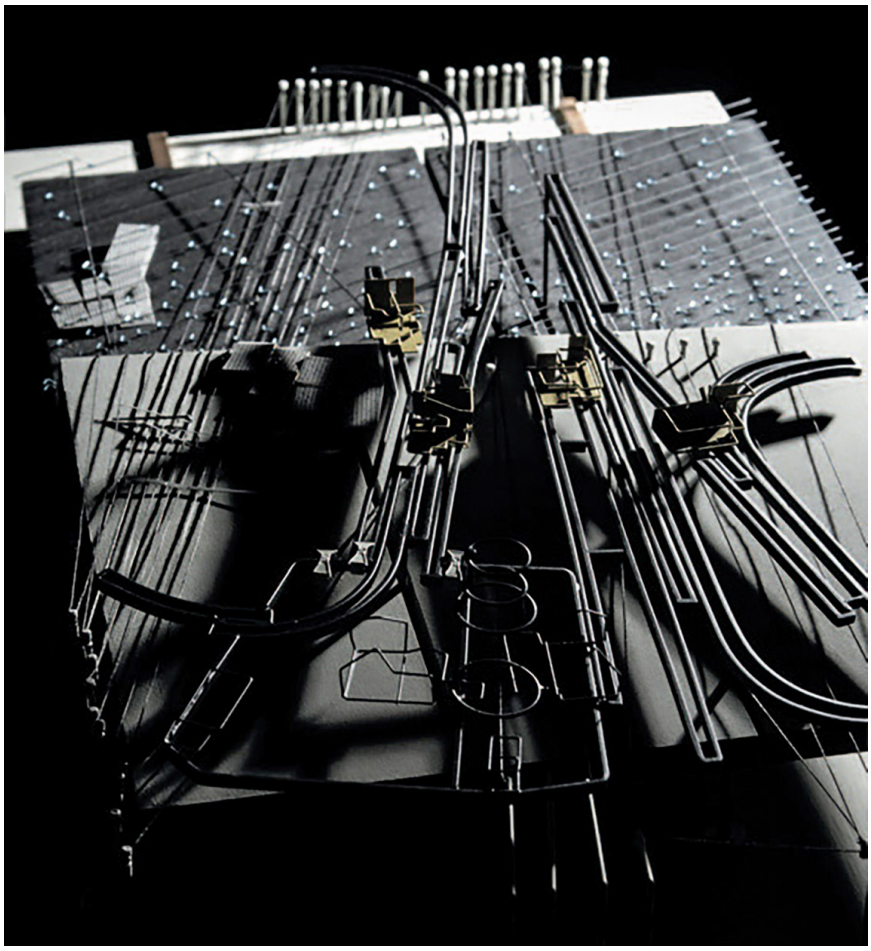
147 Mark Smout, "Prof Mark Smout," University College London, accessed November 25, 2018, https://www.ucl.ac.uk/bartlett/architecture/prof-mark-smout.

148 Ibid.

149 Neil Spiller, foreword to *Pamphlet Architecture 28: Augmented Landscapes* (New York: Princeton Architectural Press, 2007), 4.

150 Mark Smout and Laura Allen, *Pamphlet Architecture 28: Augmented Landscapes* (New York: Princeton Architectural Press, 2007), 55.

151 Ibid.



Smout Allen's "Retreating Village" proposes a dynamic landscape that can be shifted as the coast of Happisburgh falls to erosion. The 1:500 model to the right shows the trajectory of the village set onto a frame atop the cliff. (Smout Allen, *Pamphlet Architecture 28: Augmented Landscapes*).

As an alternative response to permanent evacuation, Smout Allen envisions an intermediate solution between defence and abandonment that allows Happisburgh to occupy the perpetually shifting edge. The duo proposes "the retreating village," a settlement of small houses and streets arranged directly in the deteriorating region. The retreating village reacts to predicted rates of coastal recession by physically sliding and shifting to safer land. The execution of this scheme involves employing "a mechanical landscape of winches, pulleys, rails, and counterweights, mimicking techniques for hauling boats from the waves." [152] "Mounted on steel and concrete skids that allow each house to be dragged across the landscape," the structures of the village "are manipulated by no fewer than three pulleys that are anchored in the landscape."[153] The built landscape adopts an architectural expression of impermanence, comprising inexpensive materials that complement the dynamic landscape.

152 Smout, *Pamphlet Architecture 28: Augmented Landscapes,* 55.

153 Ibid., 72.

The intervention also includes subsidiary protective and environmentally responsive features. Large slatted revetments conceal the main inhabitable spaces, providing secondary protection from the elements; these slats "are reflective on one side and are tilted and placed eccentrically to achieve a disruptive pattern."[154] Inclement weather can be tracked by swarms of buoys undulating in the waves of the sea to forewarn residents of potential damage. In critical areas, the cliffs are strengthened by temporary timber props until they are consumed in the landscape.[155] This reinforcement will be continuously revealed as the coast retreats.

In "The Retreating Village," architecture responds to the migratory landscape by becoming dynamic itself. Parallels can be drawn between Smout Allen's "Retreating Village" and themes of environmental adaptation present the architectural practices of rural Newfoundland. Through reinterpretations of Newfoundland's vernacular building culture, examinations of the dynamic processes that guide geomorphology, and analyses of conceptual examples of environmental adaptation like "The Retreating Village," a design methodology can be formulated to allow exposed outports like Fortune to sustainably inhabit a perpetually evolving edge.

154 Smout, *Pamphlet Architecture 28: Augmented Landscapes,* 57.
155 Ibid., 73.

CHAPTER 4: DESIGN METHODOLOGY

The proposed thesis response for Fortune is informed by a framework of principles extracted from the preceding analyses of cultural identity and coastal erosion in Newfoundland. This chapter describes the methodology behind the approach to the intervention, justifying adaptive architecture as a suitable response to coastal erosion in outports like Fortune.

Fortune particularly demonstrates a dichotomy of anchored and migratory elements. Apart from the evident environmental pair (fixed bedrock concealed by migratory sediment), Fortune exhibits two other discernible dualities of static and dynamic conditions. First, the town preserves traditional practices while being influenced by the innovative endeavours of modernity. As a reflection of Fortune's resilient nature, this phenomenon will help inform the architectural aspect of the intervention; traditional building principles reinterpreted from vernacular practices will ensure the proposal is suitable for a coastal environment with respect to both performance and cultural identity. The second pair consists of grounded residents of Fortune living among an influx of tourists. This interaction lends itself to the programmatic development of the intervention such that the resultant benefits all end users, including tourists and Fortune locals.

As pairs of environmental, cultural, and socioeconomic facets of the town, the reciprocal relationships of these anchored and migratory elements will be translated to an architectural language of permanence and impermanence, connecting the geological world to the architectural.

Tradition and Innovation

The tension between established practices and modern influences has continually tested Newfoundlanders' capabilities for perseverance, notably during revolutionary 20th century events like Confederation, Resettlement, and the Cod Moratorium. As established in Chapter 2, maintaining a balance between traditional and progressive values strengthens the durability of Newfoundland outports.

Preserving Tradition

In reference to Newfoundland folk architecture, Andrew Woodland claims that "architectural heritage is not only of value to economic growth, it also contributes to social survival."[156] The preservation of architecture like stages, stores, and fish flakes does not only perpetuate cultural identity, it also contributes to the tourist industry that stimulates the economy of the island's communities. Woodland continues by stating: "If the value of what our ancestors built and the documentation of the skills used in constructing these buildings are recognized, then Newfoundland heritage in our Canadian society will be further enhanced."[157] While the thesis recognizes the possibilities of modern technologies, acknowledgment of vernacular methods is considered fundamental in the development of a framework for the architectural response.

Anchoring to tradition provides stability amidst the dynamic flows of transition in outport communities. The variety of spaces found in rural settlements have innate value, often expressed through architecture and informal social spaces. Translating cultural "anchoring" to architecture, Steven Holl describes this concept as the relationship of building to site. Anchoring is "more than the physical siting of a building, anchoring involves both a conceptual rooting and an experiential one."[158] Bound to immediate surroundings and circumstances, "architecture does not so much intrude on a landscape as it serves to explain it."[159] In Newfoundland outports, architecture explains two primary facets of coastal inhabitation: (1) a lifestyle intertwined with the sea and (2) the harsh climate conditions of coastal environments. These aspects of outport living are reflected in the economical, utilitarian construction of structures perched along the water's edge.

Promoting the inherent values of place and tradition is reflected in the objectives of the Shorefast Foundation, a registered Canadian charity founded by Zita Cobb. Dedicated to building cultural and economic resilience on Fogo Island, the Shorefast

156 Woodland, "Newfoundland Folk Architecture."

157 Ibid.

158 Steven Holl, *Anchoring: Selected Projects 1975-1991,* 3rd ed. (New York: Princeton Architectural Press, 1989), 4.

159 Ibid., 9.

Foundation views architecture and design as systems of organizing and expressing value. Architecture can "reinforce the specificity of place, and shape our relationships with each other, with time, and with place itself."[160] The Shorefast Foundation is a reminder of the desire for the persistence of cultural identity, supported by strong themes of collaboration, camaraderie, and togetherness that have traditionally bound communities together in times of hardship.

Fortune is exhibiting cultural preservation by securing its ties with the sea. This is indicated by the survival of fish-processing as the town's primary industry and conservation efforts dedicated to preserving relics of the town's vernacular architecture like Fortune's fishing stages.

Embracing Innovation

While the thesis deems knowledge of traditional practices imperative in the pursuit of a suitable architectural response for Fortune, innovative efforts will not be neglected in the process. Although lacking a consistent success rate, Newfoundland has pursued alternative industries such as agriculture and land-based industrialization. Such endeavours represent a culture of flexibility.

Socioeconomically, embracing alternatives to tradition is common among various modern-day outports affected by the Cod Moratorium. In Bonavista, for example, the socioeconomic potential of the "creative class" led to the establishment of Bonavista Creative. Aiming to "foster and promote new and unique businesses that will contribute to the local economy," Bonavista Creative provides an alternative outlet for community residents to generate economic stability.[161]

Similarly, Fortune's local businesses provide supplementary economic generation to the fish-processing industry. Like Bonavista Creative, Fortune's history of entrepreneurship can be exploited similarly, promoting an endogenous, community-centred approach in the pursuit of economic prosperity. Although the thesis involves exter-

160 The Shorefast Foundation, "Welcome," The Shorefast Foundation, accessed September 18, 2018, https://shorefast.org/.

161 Bonavista Creative, "About Bonavista Creative," Bonavista Creative, accessed September 18, 2018, http://www.bonavistacreative.com/about-us-1.html.

nal intervention, the intent is to provide the initial means for growth from within the community, such that Fortune's inhabitants are active members of future planning.

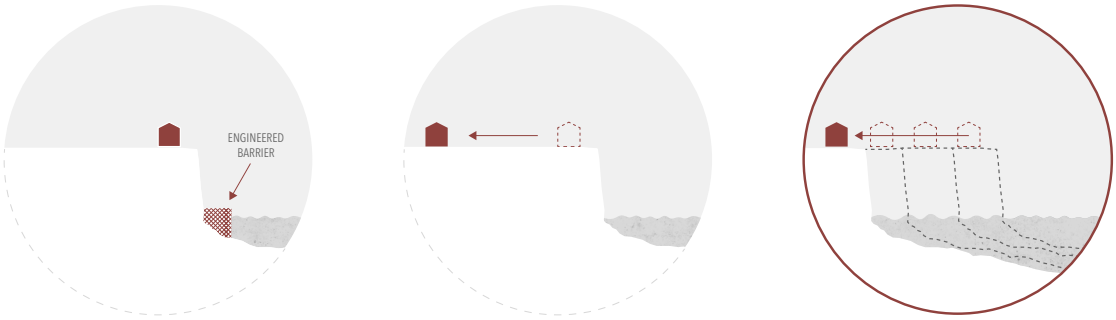
The theme of embracing alternatives can also inspire architectural development. For the thesis, modern building techniques and materials will be integrated with those of the vernacular and transitional forces will be treated as opportunities for adaptation, instead of obstacles to resist. In the case of Fortune, this means perseverance in the face of coastal erosion through a rethinking of built practices propelled by environmental adaptation.

Resilience Through Adaptation

Coastal erosion threatens the physical, artificial, and cultural landscape of Newfoundland outports. The physical landscape, pertaining to the geological layering of sediments, substrates, and bedrock that comprise coastal environments, is in an eternal state of evolution. Defence through attempts to manipulate the physical environment is often expensive and ineffective. This suggests that a more suitable option would involve shaping the artificial (built) environment in an act of adjustment instead of unsustainable resistance. In the case of rural Newfoundland, an adaptive (as opposed to mitigative) response will translate to the preservation of the cultural landscape, and in turn cultural identity, by employing techniques inspired by the island's vernacular architecture.

Frameworks for adaptive approaches can be derived from principles extracted from studies of Newfoundland building culture and Smout Allen's "Retreating Village." Smout Allen's case study takes cues from the environment to inform an architectural response to coastal erosion. The proposal suggests the implementation of a dynamic system in which architecture is equally as responsive to the environment as the landscape itself.

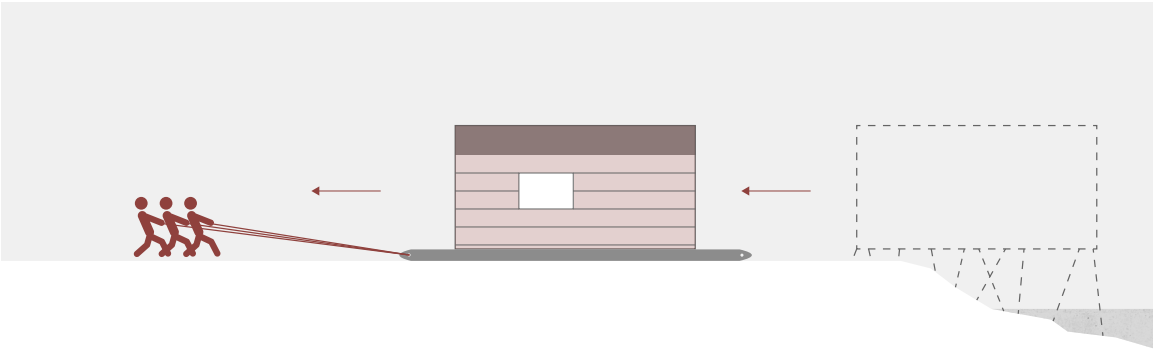
The mechanics of this method are analogous to the traditional act of "launching" buildings in Newfoundland. As one of the most visibly evident adaptations to change, launching represents a historical precedent for a contemporary reinterpretation of the practice. The dynamic processes of launching and erosion are cyclical by



DEFEND
AMPLFIES EROSION ELSEWHERE

VACATE
INTERRUPTS COASTAL RELATIONSHIP

ADAPT
CONTINUOUS COASTAL INHABITATION



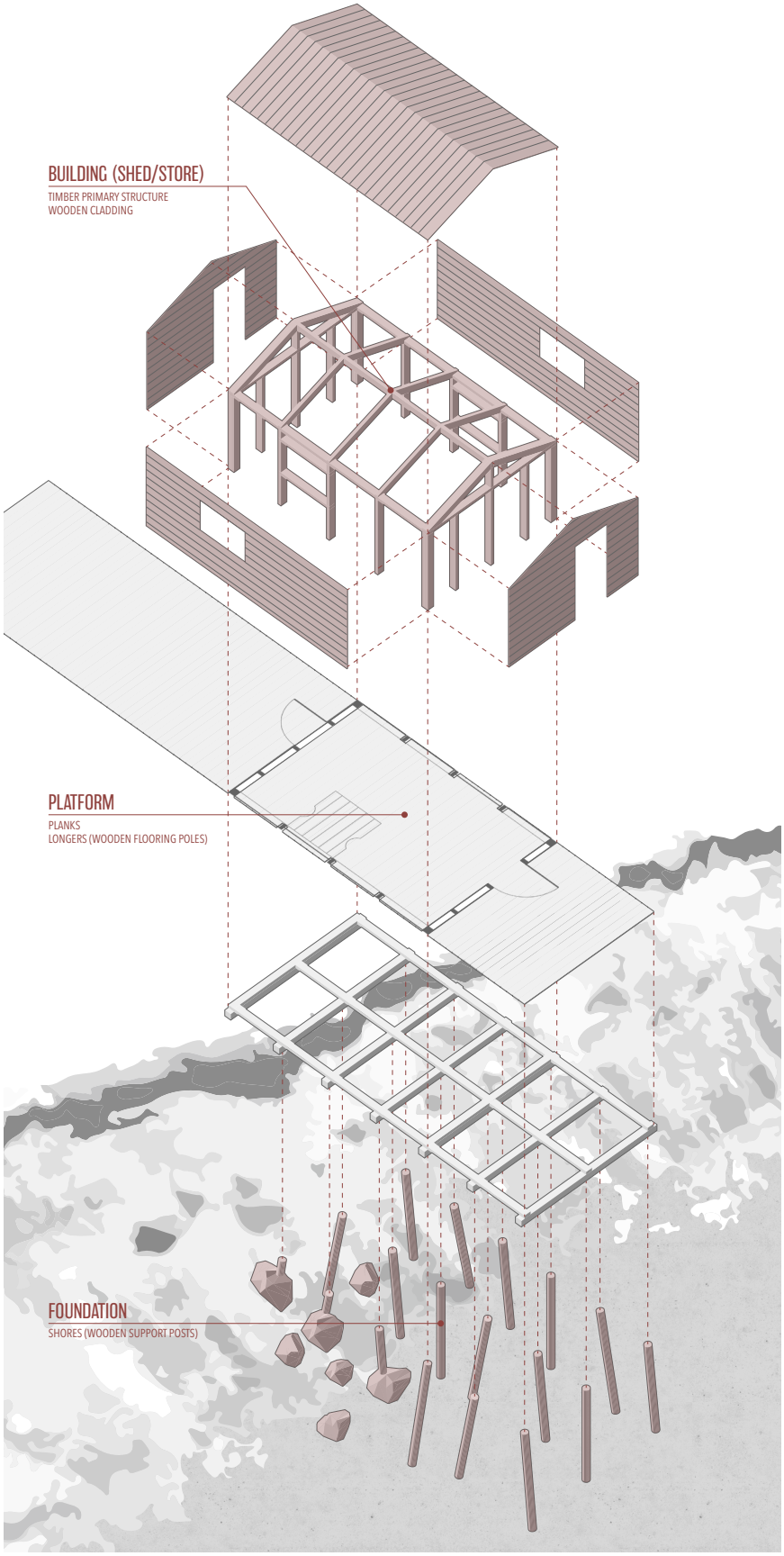
House launching is a traditional method of adaptation in Newfoundland. In the case of coastal erosion, it serves as a historical precedent for adjusting to a receding coastline, representing an alternative response to defensive strategies or permanent evacuation. (Launching diagram adapted from drawing on page 113 of Robert Mellin's *Tilting*).

nature; erosion occurs in cycles of weathering, failing, and steepening, while launching involves repetitive stages of use, detachment, and relocation.

The traditional buildings of Newfoundland's coastal landscapes are capable of being detached and launched due to a clear architectural system. The fundamental components of coastal structures include combinations of stick foundations (called "shores"), platforms (walkable surfaces made of planks or "longers"), and the enclosures themselves, often constructed with a timber endoskeleton cladded with wood siding. The components of vernacular structures were clearly differentiated, meaning each could be replaced, recycled, or detached for relocation. This suggests that if new developments are designed with a similar clarity of components and with the intention of detachment and mobility, they could be relocated within the landscape in anticipation of imminent coastal erosion.

As discussed in Chapter 2, buildings in Newfoundland are launched in a variety of different ways over various types of terrain. Power sources range from humans to trucks, carrying structures across ground conditions from dry land to ice. Inherently, a larger structure requires a larger power source; as a fishing community, Fortune is frequently involved with the transportation of relatively large fishing vessels. Consequently, a mobile boat hoist is stationed in Fortune's harbour area to facilitate boat launches and movement as necessary. Using rubber-coated slings spanning across a steel frame, the mobile boat hoist is capable of lifting a diverse set of vessels and transporting them where required. For the purposes of the thesis, Fortune's mobile boat hoist is proposed as the activator for a contemporary method of launching buildings. In this way, structures situated in exposed coastal settings like Fortune will be afforded the ability to move concurrently with the evolving coastline.

An adaptive response differentiates itself from defensive strategies and evacuation by adjusting to variable circumstances, whether driven by transient or enduring stimuli. In terms of either time or displacement, this may occur on a variety of scales, allowing structures to be moved gradually over time with shoreline recession, or immediately in response to forthcoming storm events. Using house launching as a model for environmental adaptation provides a method for simultaneous evolution with the



Exploded axonometric of a traditional fishing shed in Newfoundland. The essential components of these coastal structures are combinations of stick or cribbing foundations, platforms, and single-purpose enclosures.

Fortune's mobile boat hoist is parked in the shipyard along the harbour. The device is capable of transporting and launching vessels where required. (Photo from April, 2019 site visit).

coastline, rejuvenating the mobile characteristic of Newfoundland's architecture.

Bedrock and Sediment

In erosion-prone environments, there exists an interplay between rigid bedrock and migratory sediment. Landscapes are dynamic entities like humans and weather patterns, but shift and change at different rates. Like Smout Allen, Stan Allen and Marc McQuade allude to the relationship between architecture and the environment, noting that "architecture is situated between the biological and the geological – slower than living beings but faster than the underlying geology."[162] Not only can architecture be personified as dynamic, but also environmentally responsive.

In environments like Fortune, where the landscape is in a perpetual state of being moulded by the relentless nature of a coastal climate, buildings and infrastructure should be afforded the ability to change concurrently. Continuing to build in vulnerable coastal locations such as Fortune with concrete foundations provides little ability for salvation when the surrounding landscape is threatened and eventually fails. Following cliff failures comes the deterioration of buildings supported by concrete now left exposed and unstable. This means little chance of recovery or restoration, posing an obstacle in the town's pursuit of economic stability. The intended product

162 Stan Allen and Marc McQuade, *Landform Building: Architecture's New Terrain* (Baden, Switzerland: Lars Müller Publishers, 2011), 20-22.

of this adaptive methodology is thus an architecture of resilience: structures that can respond to coastal change, reflecting a tradition of durability through adaptation by embracing the shore and allowing it to erode.

Residents and Visitors

As Canada's gateway to France, Fortune sees more tourist traffic in its harbour than a typical outport of rural Newfoundland. Flows of visitors integrate with residents almost daily, albeit in an often chaotic manner due to the populous state of Fortune's port area. By examining the extent and causes of the deficiencies of Fortune's port of entry, a regulating system can be devised to reinforce Fortune's identity as both a gateway and the first impression of Newfoundland from St. Pierre and Miquelon.

Fortune's Unique Identity

The preservation of Newfoundland's identity as a province is a critical component of the thesis. However, the site strategy and programmatic development for an architectural intervention specific to Fortune should embrace its unique identity as a port town.

First, Fortune's history of entrepreneurial endeavours has helped characterize the town as a small-business community. Beginning with occupations like blacksmiths, tinsmiths, cobblers, and furniture manufacturers, Fortune now features small shops and restaurants like Collin's Grocery, Doc's Diner, and Lake's Bakery. Prominent in the port area, these establishments benefit from the visitor traffic brought about by their proximity to the customs office. For those travelling to the French Islands, the placement of these businesses near the border crossing also provides an introductory dining experience ahead of the ensuing French culinary culture of St. Pierre and Miquelon. While the fish plant remains the mainstay of Fortune's economy, these small businesses and institutions generate supplementary local income and constitute the town core.

However, although Fortune's port now assists travellers year-round, its present state is not equipped to properly facilitate the dynamic processes involved with marine transportation services. As the only port of call for vessel traffic between the French

Fortune's port area serves the town in a variety of ways. Not only does it accommodate constant flows of travelers, but it also has a functioning harbour and small business district. (Fortune Harbour Authority. Cropped, colour enhanced by author).

islands and Newfoundland, the port area of Fortune is often quite congested.[163] The extent of this congestion is only expected to increase with the introduction of two new ferries that are now operating between Fortune and the French islands. Following a 2015 tender launch by St. Pierre and Miquelon awarded to the Damen Shipyards Group, two new ferries, the Nordet and Suroît, were commissioned in late 2017 to facilitate the journey. Ferry service was extended year-round with the new vessels, replacing the ferry that formerly serviced this route, Le Cabestan, a catamaran that only provided passenger service and seasonal travel.[164] For Fortune's small busi-

163 Carl Rose, "Fortune Holds Second Consultation Session on Downtown Development Plan," *The Southern Gazette,* SaltWire Network, September 30, 2017, https://www.southerngazette.ca/news/local/fortune-holds-second-consultation-session-on-downtown-development-plan-89884/.

164 Colin Farrell, "Fortune Working with St. Pierre and Miquelon on Ferry Issue," *The Telegram,* May 11, 2018, https://www.thetelegram.com/news/local/fortune-working-with-st-pierre-and-miquelon-on-ferry-issue-209587/.

Businesses and institutions that comprise Fortune's town core. From top left, clockwise: Collin's Grocery; Doc's Diner; Fortune Head Geology Centre; Canadian Border Services Agency (CBSA) building; Fortune United Church; George and Mary Lake Heritage House; St. Pierre Ferry Office; Lake's Bakery. (Photos from December, 2018 and April, 2019 site visits).

The Suroît ferry entering Fortune's harbour. The Suroît is one of two new ferries commissioned in 2017 to operate between Fortune and St. Pierre. (Photo from April, 2019 site visit).

nesses, year-round service with two new ferries means an increase in economic activity through an expanded tourist influx.

The Nordet and Suroît are Fast Ropax 5510 ferries, designed collaboratively between Damen Shipyards Group and St. Pierre and Miquelon. Each vessel is 55 metres long, 11 metres wide, and has a capacity for 192 passengers and crew, 3 trucks or 18 cars, motorcycles, and cargo.[165] However, despite the "roll-on-roll-off" capability of the new ferries, Fortune currently lacks the proper infrastructure to accommodate vehicle loading and offloading, meaning travellers are unable to bring their cars to or from St. Pierre and Miquelon.[166] For those travelling from the French Islands, the absence of this infrastructure poses an immediate obstacle in the journey across Newfoundland. Without a viable solution and with tensions growing between Newfoundland and St. Pierre, some "fear that the ferries will look for another port of entry."[167] As a town that relies on employment and business around the port, losing the customs office would be detrimental to Fortune's economy.

165 "La Collectivité Territoriale de St. Pierre et Miquelon selects Damen for Two Fast Ferries," Damen Shipyards Group, April 18, 2016, https://www.damen.com/en/news/2016/04/la_collectivite_territoriale_de_st_pierre_et_miquelon_selects_damen_for_two_fast_ferries.

166 Rose, "Fortune Holds Second Consultation Session on Downtown Development Plan."

167 Colin Farrell, "Fortune Mayor Concerned Over Standstill With Wharf Renovation," *The Telegram,* September 13, 2018, https://www.thetelegram.com/news/fortune-mayor-concerned-over-standstill-with-wharf-renovation-241108/.

Despite the need to address issues surrounding pedestrian and vehicle flow, Fortune's port area is the source of its rich history that has defined its sense of identity. Constantly facilitating the arrival and departure of visitors, Fortune's port has the opportunity to become a focal point of the journey to and from the French islands instead of a mere thoroughfare. As one of only a few towns that are still experienced from the sea almost as frequently as the road, Fortune can celebrate its border and connection to France by emphasizing the port area as a recreational destination for both residents and visitors.

Program Development

As established, Fortune currently faces two primary issues that threaten its economic wellbeing: an eroding coastline and a ferry port that lacks sufficient planning and infrastructure. The combination of these predicaments in addition to the economic opportunities of the town's port area has helped delineate a suitable programmatic intervention: a new, re-envisioned ferry terminal. As a program that serves the explicit function of facilitating international marine transportation and border crossing, the siting and design of the new ferry terminal must address the infrastructural shortcomings of Fortune's existing port area. Through site-specific, community-centred planning and architectural design, the intent of the proposal includes acting as a contributor to the decongestion and articulation of the waterfront, such that residents and visitors can enjoy an orderly and efficient process of integration and travel.

Fortune's existing ferry terminal is the Canadian Border Services Agency (CBSA) building located along the east side of the harbour, south of the fish plant. This building currently serves a variety of functions associated with marine transportation, including ticket reception, a departure waiting area, CBSA offices, an arrival waiting area, and border crossing and security services. Although a recent addition to the building has provided more area for this array of programmatic elements, the approximately 500 square metre building has insufficient capacity to accommodate the number of passengers awaiting fully-booked ferry. The proposed ferry terminal will address these issues by optimizing the arrangement of programmatic spaces to ensure ample space and an efficient circulation system for travellers.

St. Pierre's urban core centres around the ferry terminal. From top left, clockwise: St. Pierre customs office; le Square Joffre; public boulevard opposite customs office. (Photos from April, 2019 site visit).

The proposal can also draw from the public atmosphere of St. Pierre's waterfront to inspire and inform an engaging programmatic intervention. Upon disembarking the Nordet or Suroît at St. Pierre's ferry terminal, visitors are immediately greeted with a clear town core that serves as a point of congregation for locals and tourists. Flanking the public boulevard is a variety of colourful buildings that house programs like restaurants, bakeries, inns, and heritage museums. East of the ferry terminal is a series of relics of wartime and a public park called le Square Joffre, a memorial plaza dedicated to the sailors who lost their lives at sea. Like St. Pierre, Fortune can revitalize its own town core by reactivating the waterfront as a place for informal social interaction and resident-visitor congregation. Such reinvigoration will smoothen the transition between the two borders, thus strengthening Fortune's characteristic connection to St. Pierre and Miquelon.

Fortune's CBSA building currently facilitates border crossing services for arriving passengers from and departing passengers to St. Pierre and Miquelon. The Nordet and Suroît dock along the adjacent wharf. (Photo from December, 2018 site visit).

The thesis recognizes the potential for Fortune's port area to capitalize on increased tourism and become a more substantial economic generator for the community. However, this objective can only be realized through a rethinking of the configuration of Fortune's port area, the core of the coastal town. Coupled with coastal erosion in the region, the intervention must address the inevitability of geological evolution. The proposed ferry terminal must satisfy its explicit function as a facilitator of marine transportation services; however, occupying the coast by nature, the intervention and any auxiliary program spaces also have the responsibility to communicate a reinterpreted method of occupying eroding environments.

CHAPTER 5: ARCHITECTURAL RESPONSE

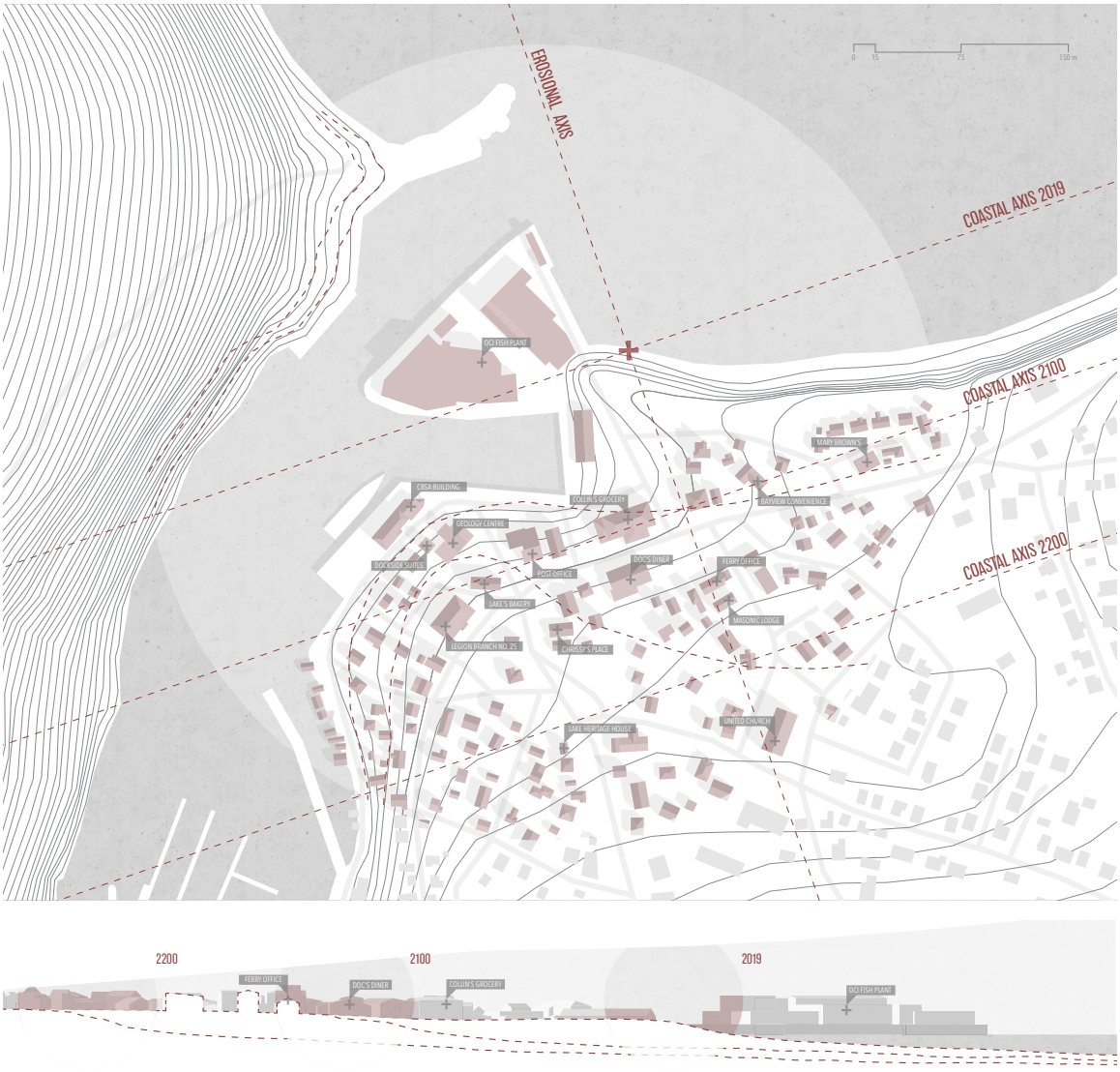
Guided by the preceding design methodology developed through an examination of Fortune's dichotomies of anchored and migratory elements, the architectural response described in this chapter represents an initial attempt in the pursuit of a harmonious relationship between coastal inhabitation and coastal erosion.

Site Strategy

Like a typical Newfoundland outport, the most active region of Fortune neighbours its harbour. As established in the previous chapter, this area constitutes the town core, including the port and the majority of Fortune's businesses and institutions.

Directly north of this urban centre, however, is a segment of Fortune's coastline subject to some of the town's most intense erosion. According to the shoreline classification map in Chapter 3, this portion of Fortune's exposed shoreline is classified as a steep gravel and sand beach, composed of a layer of gravel and sand overlying an unstable substrate of unsorted sediments. Presently, this area is heavily fortified with various types of gabion walls in an attempt to protect Fortune's adjacent buildings and infrastructure.

For its proximity to the core of Fortune's urban landscape and evident susceptibility to erosion, this coastal segment has been selected as the site for the proposed ferry terminal. However, inherent in the previously established design methodology is the intent for mobility; therefore, the proposed location is not considered static. It is more aptly characterized as a delineated axis: a path perpendicular to the coast for anticipated movement. For the purposes of the thesis, this path has been deemed the "erosional axis". Not only does the erosional axis correspond with projected coastal recession, but it also aligns with certain businesses and institutions that will eventually be threatened by the approaching boundary between land and sea. Perpendicular to the erosional axis is the "coastal axis". While the selected erosional axis remains constant for the thesis, the position of the coastal axis is variable, representing the shifting water line point of intersection of the two axes.



PROPOSED SITE LOCATION EXISTING BUSINESS / INSTITUTION PREDICTED COASTLINE

FORTUNE
PREDICTED COASTAL EVOLUTION

Site plan and section showing the relationship between the components of Fortune's urban core and possible coastal recession. The proposed thesis site location is situated at the intersection of the erosional axis and the 2019 coastal axis. Cut at the erosional axis, the site section identifies certain buildings that will become vulnerable to failure at each year of focus.

The coastal axis recedes over time with impending geological evolution. Despite the inability to assume constant rates of erosion due to its episodic nature, anticipating future coastal change is imperative in the design of a proactive intervention. Therefore, using the pool of resources currently available, the thesis has attempted to predict how Fortune's coastline might evolve. Primarily drawing upon analyses from Chapter 3, these resources include factors like Fortune's climate, shoreline, sedimentology, geomorphology, and projected climate change impacts like sea-level rise and increased storm surge frequency. By no means should the accuracy of these predictions be considered reliable or conclusive; they merely represent an effort to foresee prospective future scenarios to which we might adapt.

The following sections of this chapter are divided into two parts based on different timescales: the short-term architectural intervention and long-term adaptation scenarios based on predicted coastal evolution. These will be viewed as snapshots in time, beginning in 2030 upon the completion of the short-term intervention and proceeding in 2100 and then 2200. While the short-term intervention depicts the initial components of the architectural response, the adaptation scenarios provide a framework for how these elements and Fortune's urban landscape can evolve with and adapt to an eroding coastline.

Short-Term Intervention

Drawing from the language of construction of Newfoundland's traditional coastal structures, the proposed intervention for Fortune is an adaptable ferry terminal wharf comprising deep foundations, a public promenade, and detachable buildings. Protruding from the shore as many structures once did along Fortune's coastline, the wharf extends parallel with the designated erosional axis as an extension of the town core. As the initial focal point in time for the response, the design of the wharf will be described with regard to its status in the year 2030.

Prior to the construction of the wharf, however, is the proposed relocation of Fortune's fish-processing plant. This decision, involving the modification of the present configuration of Fortune's harbourfront, follows two primary motives. First, currently situated on a concrete quay that overlaps the proposed thesis site, Fortune's fish

The proposed ferry terminal wharf occupies the present location of Fortune's fish plant at the intersection of the erosional axis and coastal axis. The fish plant will be relocated south of its current position to Fortune's shipyard, a more sheltered area of the harbour.

plant provides the initial impression of a Newfoundland outport to those arriving by sea. While the plant is programmatically representative of Fortune as a historical fishing community, its architectural expression more closely resembles a conventional industrial port. Gated barriers surrounding the quay obstruct public access, characterizing the area as the antithesis of the welcoming border of St. Pierre. Secondly, as previously noted, the present location of the fish plant at the mouth of Fortune's harbour makes it susceptible to ongoing erosion beneath the quay. The constant cycle of deterioration and repair of the underlying infill poses an economic burden on the town. As an alternative, the proposed site for the fish plant is therefore a more sheltered position farther south along the harbour near the existing shipyard. As a separate design project in itself, the integration of the fish plant into this established portion of Fortune's harbour requires further articulation. However, this area's existing relationship to the fishery and accessibility to vessel traffic make it a suitable alternative.

The thesis recognizes the importance of Fortune's fish plant as a primary economic

asset for the community; however, for a project dedicated to projected environmental scenarios, its relocation has been deemed necessary in the pursuit of an economical long-term outcome. The proposed wharf represents a return to a time prior to the introduction of the fish plant, when Fortune's shoreline was an active public atmosphere abundant with opportunities for social interaction. The short-term intervention will thus provide an initial framework in the pursuit of a decongested, welcoming port area for Fortune.

Adaptive Wharf

Inspired by the traditional elevated platforms of Newfoundland's traditional architectural landscape, the proposed wharf acts as a mediator between land and sea and a framework for the configuration and addition of functional spaces.

As the site-scale organizing component of Fortune's re-envisioned port and ferry terminal, the wharf has been oriented and designed to efficiently assist the arrival and departure of passengers, vehicles, and the Nordet and Suroît ferries. For passengers, the primary linear component of the wharf serves as a pedestrian boulevard and extension of Fortune's town core. Positioned directly north of the existing St. Pierre ferry ticket office on Bayview Street, the initial threshold between coast and wharf is steps away for travellers eager to begin their journey. For vehicles, the western edge of the wharf is equipped with a protruding segment upon which embarking and disembarking cars and trucks can traverse ahead of entering the ferry or Fortune's roadways. For the Nordet or Suroît, a floating linkspan provides the means for their connection to the western wharf protrusion, allowing vehicles to load and offload. As a result of the location and orientation of the wharf, Fortune's existing breakwater almost entirely protects the structure from the wave activity of Fortune Bay. As the least exposed side of the wharf, the western edge thus makes a suitable area for the ferries to dock.

As a structure intended for an eroding environment, the wharf is designed with a system that permits its own adaptability and reconfiguration. In reference to the recycling and modification motifs of Newfoundland's vernacular architecture, a system of modular construction components allows portions of the wharf to be recomposed

in a subtractive or additive process as required over time. To attain such capabilities, the following structural composition was developed.

First, a six-by-twelve metre grid was established for the supporting substructure of the wharf platform. Below the wooden planks of the boardwalk surface is an overlapping pattern of steel transverse and stringer beams through which a service channel carries power and sewage to and from the wharf's programmatic elements. The components that comprise this platform are all connected to socketed caisson foundations arranged according to the predetermined grid. As opposed to other types of deep foundations like belled caissons, socketed caissons are drilled into rock, meaning their bearing capacity comes from both their end bearing and frictional forces against the rock.[168] Each socketed caisson, reinforced with a steel column embedded in concrete, anchors to stable bedrock beneath the site's layers of loose sediment and substrate. This ensures that ensuing coastal erosion will not impair the structural stability of the wharf. In keeping with the proactive essence of the intervention, the foundation elements support the wharf at an elevation set above the region's vertical allowance of 89 centimetres, as prescribed by the CAN-EWLAT.

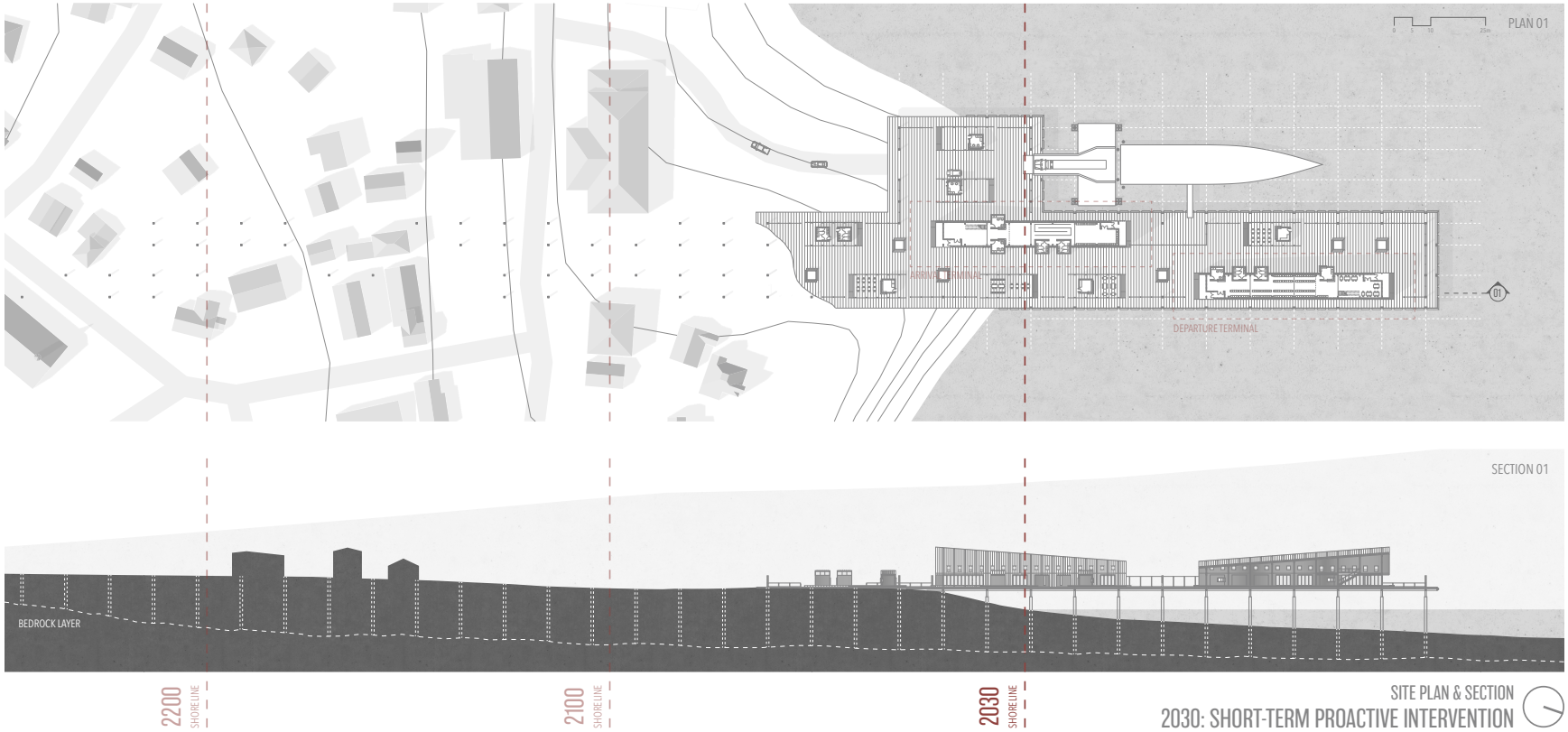
Fortune's receding coastline will inherently affect the present composition of the existing town core. In response, the adaptive wharf introduces a framework for the expansion and continuous development of Fortune's urban centre in spite of coastal evolution. The following sections will elaborate on the programmatic components of the wharf, characterized as terminal buildings and outbuilding pods.

Terminal Buildings

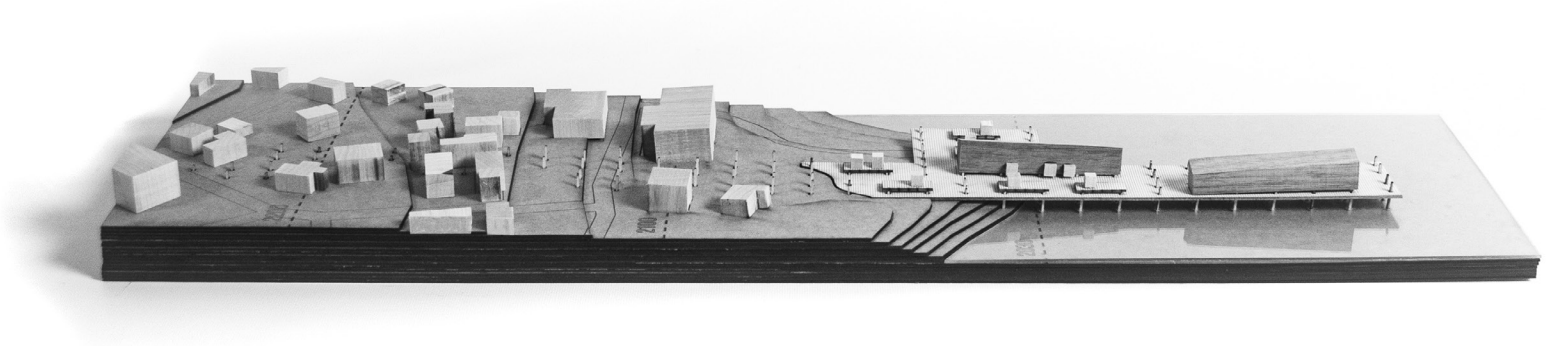
Anchored atop the wharf in conformity with the foundation grid, the two primary programmatic assets of the intervention are the arrival and departure terminal. The pair of structures are positioned to address the sea and the town respectively.

The decision to divide the ferry terminal into two buildings was based on two dominant factors. First, this separation ensures the project scale respects that of buildings

168 Edward Allen and Joseph Iano, *Fundamentals of Building Construction: Materials and Methods,* 5th ed. (Hoboken, NJ: John Wiley & Sons, 2009), 57-58.



The initial intervention for Fortune's re-envisioned ferry terminal involves the introduction of the adaptive wharf, establishing a framework for long-term adaptation.

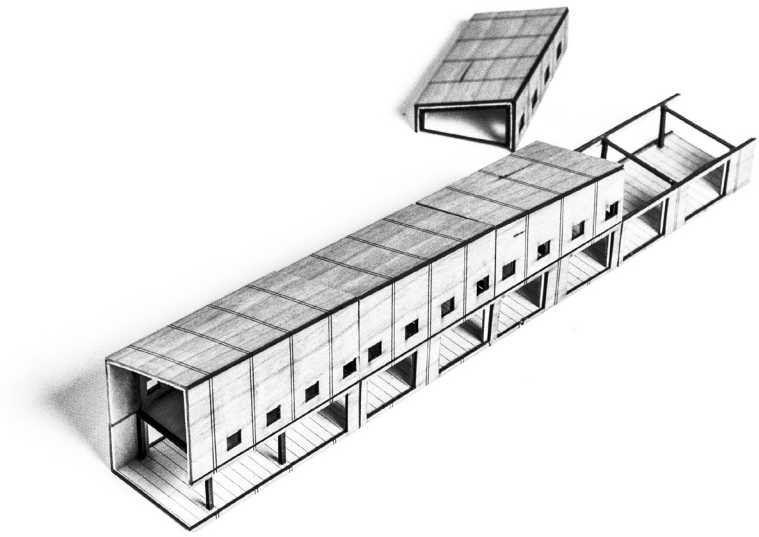


Site model of the proposed short-term intervention.

that comprise Fortune's urban landscape. Considering the extent of programmatic requirements for the new ferry terminal (particularly to accommodate two new ferries), combining every space into a single entity could result in a disproportionate outcome. This would disrupt the town's existing urban fabric and potentially obstruct characteristic views and sightlines. Secondly, the division references the tradition clarity of the single-purpose structures of Newfoundland's vernacular architecture. In place of one building that houses a partitioned set of interior program spaces, dividing the program itself into two categories (arrival and departure) permits two independent entities. Consequently, each retains a distinct function during either the beginning or conclusion of marine travel such that occupants sharing the same intent and destination are grouped together.

Sharing the same form, both the arrival and departure terminal consist of eight prefabricated components, permitting a streamlined system of assembly, detachment, and mobility. Reinforced with a structural steel endoskeleton, each prefabricated module is designed to be transported to site and subsequently joined to create a whole. First, the steel base frames of the four lower components are bolted atop the socketed caissons along connection points corresponding with the grid framework. To permit such attachment, each caisson foundation is capped with a top connection plate, separating the buildings from the wharf surface. Anchored to the base frame of each module is a series of steel portals composed of pairs of C-channel members; this permits a module-to-module connection. Similarly, construction proceeds with the anchoring of the upper roof structure modules to the lower components.

Once anchored and assembled, the holistic buildings express a formal language of an elongated spine that progressively grows in height from one end to the other. Capped at these extremities with glazing, the arrival and departure buildings are designed to frame and emphasize views of Fortune (for those arriving) and the sea (for those departing), respectively. On the interior, the comprehensive assemblage of modules establishes an open plan partitioned by a sequence of structural bays. An open loft at the enlarged end provides additional floor area and an elevated perspective of each terminal's predominant view. Inserted along the east and west facades of the buildings are various service spaces that contribute to the primary program



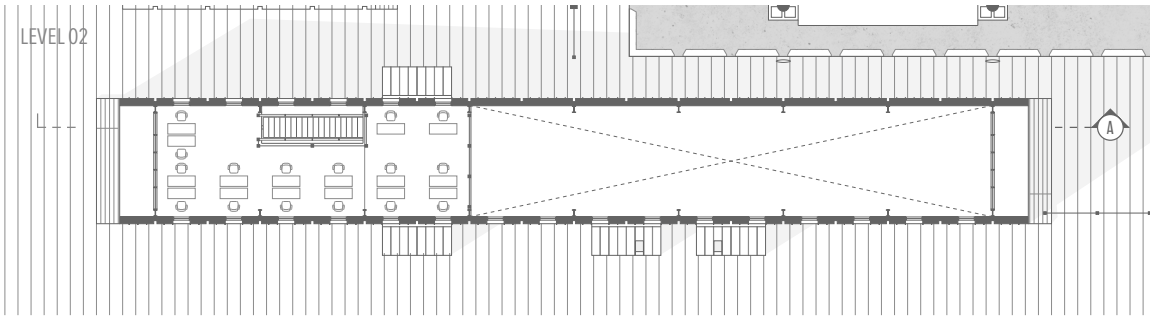
Terminal building model composed of eight prefabricated modules.

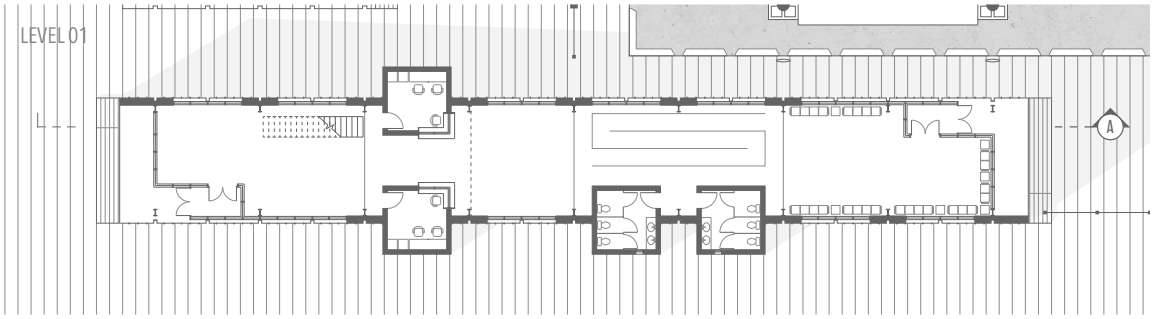
of each terminal. Characterized as "outbuilding pods," these units reference the detachable secondary structures of the traditional working landscape of Newfoundland. Their precise functionality as components of the adaptive intervention will be elaborated in the following section.

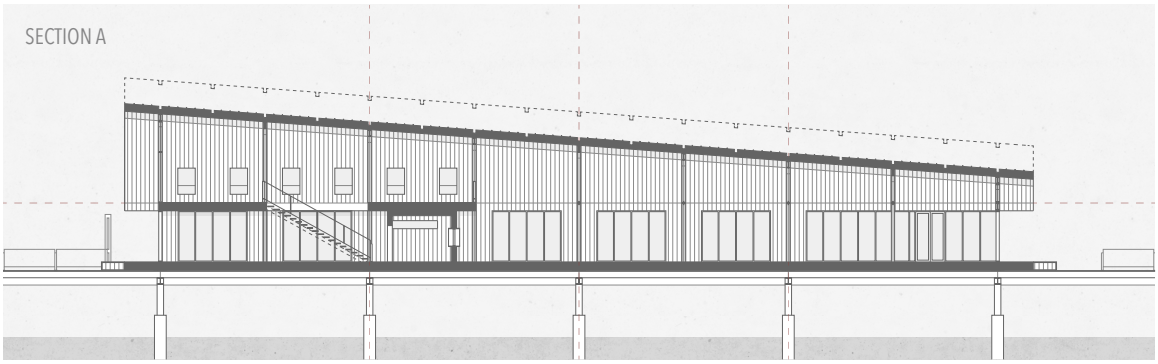
Like traditional structures in Newfoundland outports, the terminal buildings are designed and built for mobility. The division of the buildings into separate prefabricated components not only references historical acts of importing building materials and frames, but also permits their detachment and relocation as smaller parts of a whole. After detaching each module from each other and the caisson top plates, the structures are ready for transportation by means of Fortune's mobile boat hoist, the designated method for launching introduced in Chapter 4. Channels, integrated with the standing seam facade, align with the steel endoskeleton to serve as guides for the slings of the boat hoist. Additionally, wrapping the roof plane sloped along two axes, the channels also provide drainage routes for rain, snow, and ice loads.

While the pair of buildings share a similar language of construction and form, the interior of each terminal is configured uniquely as a reflection of their primary function as either a facilitator of arrival or departure processes.

As the initial space to be occupied by a flow of travellers, the arrival building has been



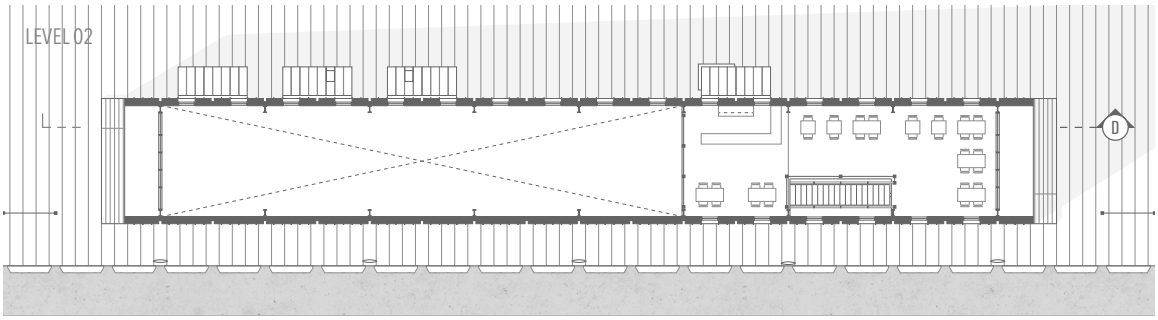


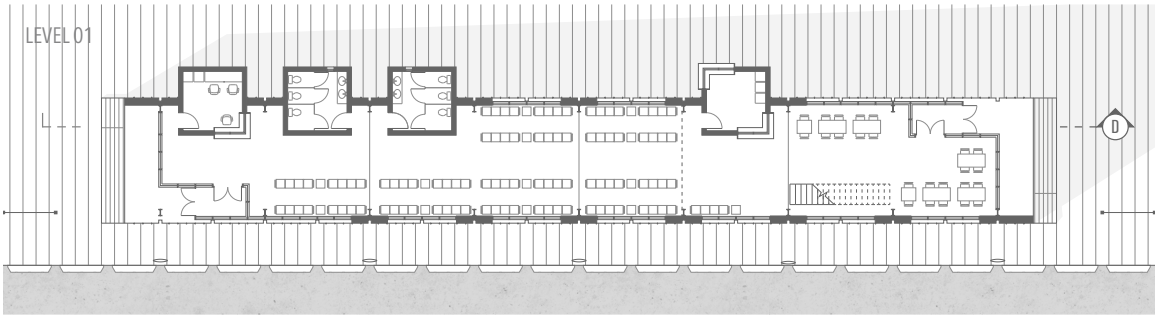


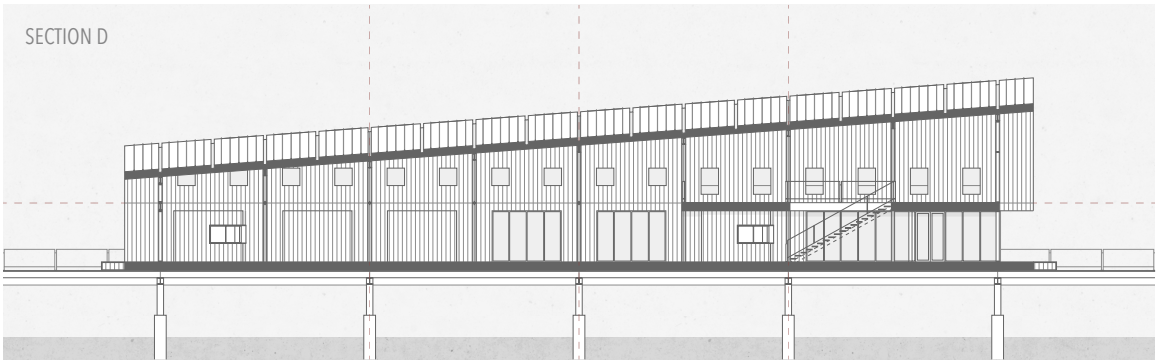
0 1 5 10m

PLANS & SECTION
ARRIVAL TERMINAL

The arrival terminal facilitates border crossing services for those traveling from St. Pierre and Miquelon. As these processes occur in a sequenced system, each bay of the building's linear form assists the progress of a specific function as one proceeds southward toward Fortune.







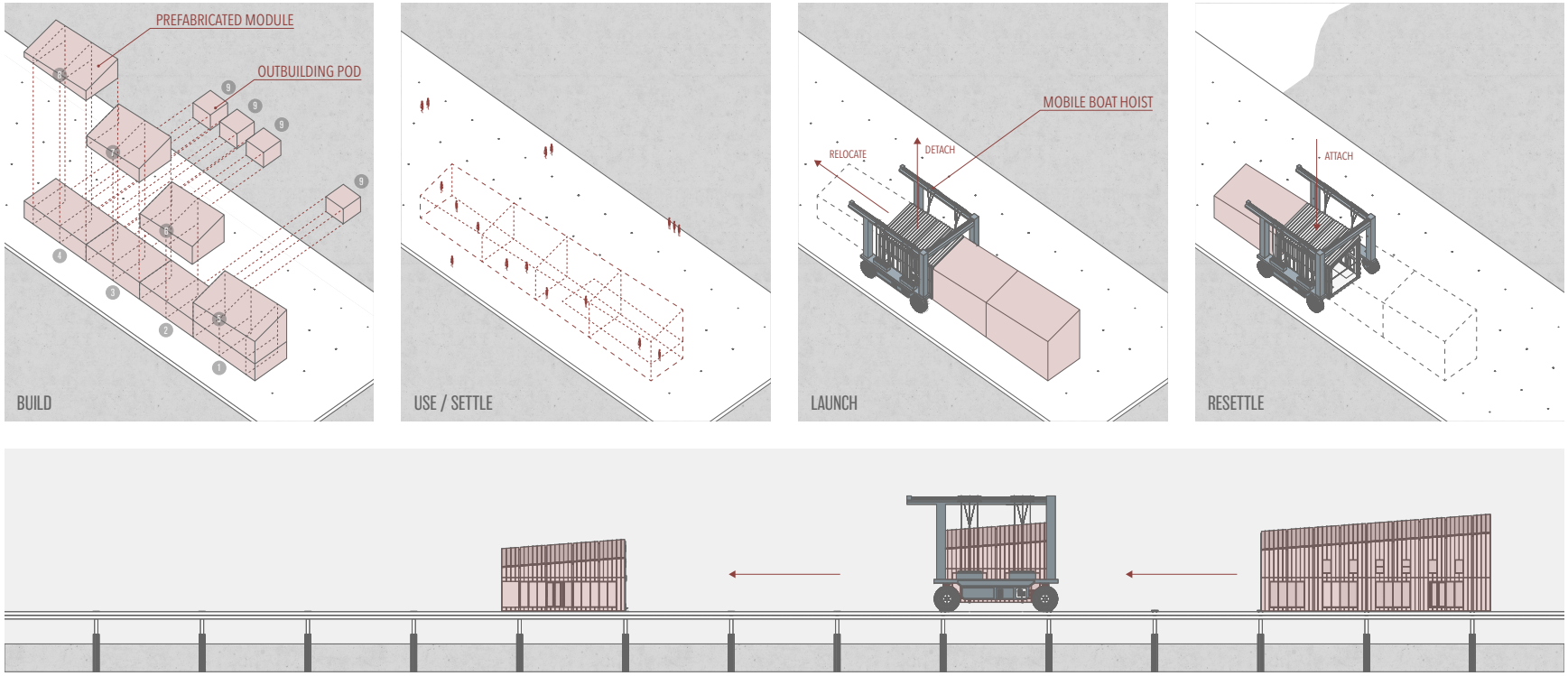
PLANS & SECTION

DEPARTURE TERMINAL

The departure terminal serves as a waiting and lounge space for travelers heading to St. Pierre and Miquelon. Between the first and second level, the building has adequate space for passengers awaiting a ferry booked at full capacity.

Defined on the interior by a steel endoskeleton, the structural bays of both the arrival and departure buildings are used to organize the arrangement of sub-program spaces.

The southern end of the arrival building and the northern end of the departure building comprise glazing to offer expansive views of the town and the sea, respectively. Illustrated above is the view granted in anticipation of the Nordet ferry at the northern extremity of the departure building.



The proposed construction and launch sequence of the terminal buildings is a contemporary interpretation of the traditional cyclical process of building, use, launching, and resettling. As the proposed power source for this methodology, Fortune's mobile boat hoist will be used to transport the prefabricated modules that combine to constitute each building.

designed to promote an efficient border crossing procedure. First, a secure space along the wharf is designated for disembarking passengers to claim their baggage prior to entering the building. Upon entry, travellers are greeted with a clear sense of direction translated through the linear arrangement of spaces along the structure's longitudinal axis. The first five bays of the terminal provide space for travellers awaiting their turn to traverse customs ahead of entering Canada. Security checks are implemented by border services officers stationed in two primary inspection line pods inserted into the east and west facades at the end of terminal nearest Fortune. After passing customs, occupants are presented with a view of Fortune's urban landscape and are free to begin their visit in or return to Newfoundland.

The departure terminal is positioned northeast of the arrival terminal, oriented to address the sea in anticipation of the Nordet or Suroît. As travellers enter the building's southern entrance, a pod is immediately positioned to serve as a ticket reception counter. Following check-in, occupants are free to proceed to any of the interior lounge spaces, whether the seats lining the intermediate structural bays or the two-level café and bar at the northern extremity.

As two essential components of the marine transportation system, the proposed terminal buildings are intended to endure for a considerable time period as the supporting wharf evolves with coastal erosion. To ensure such persistence, the proposed architectural response has examined the reasons behind the survival of coastal structures that still remain among various outports. Drawing from characteristic techniques of Newfoundland's vernacular architecture like repair and recycling, the terminal buildings have been designed as a set of tectonic components to permit a similar strategy of modification and adaptability.

Outbuilding Pods

For the purposes of the thesis, the secondary programmatic assets of the adaptive wharf have been named "outbuilding pods." As previously noted, these units reference Robert Mellin's description of the detached, supplementary buildings of the traditional working landscape. Surrounding the terminal buildings, the outbuilding pods house secondary program such as retail shops and food establishments that ad-

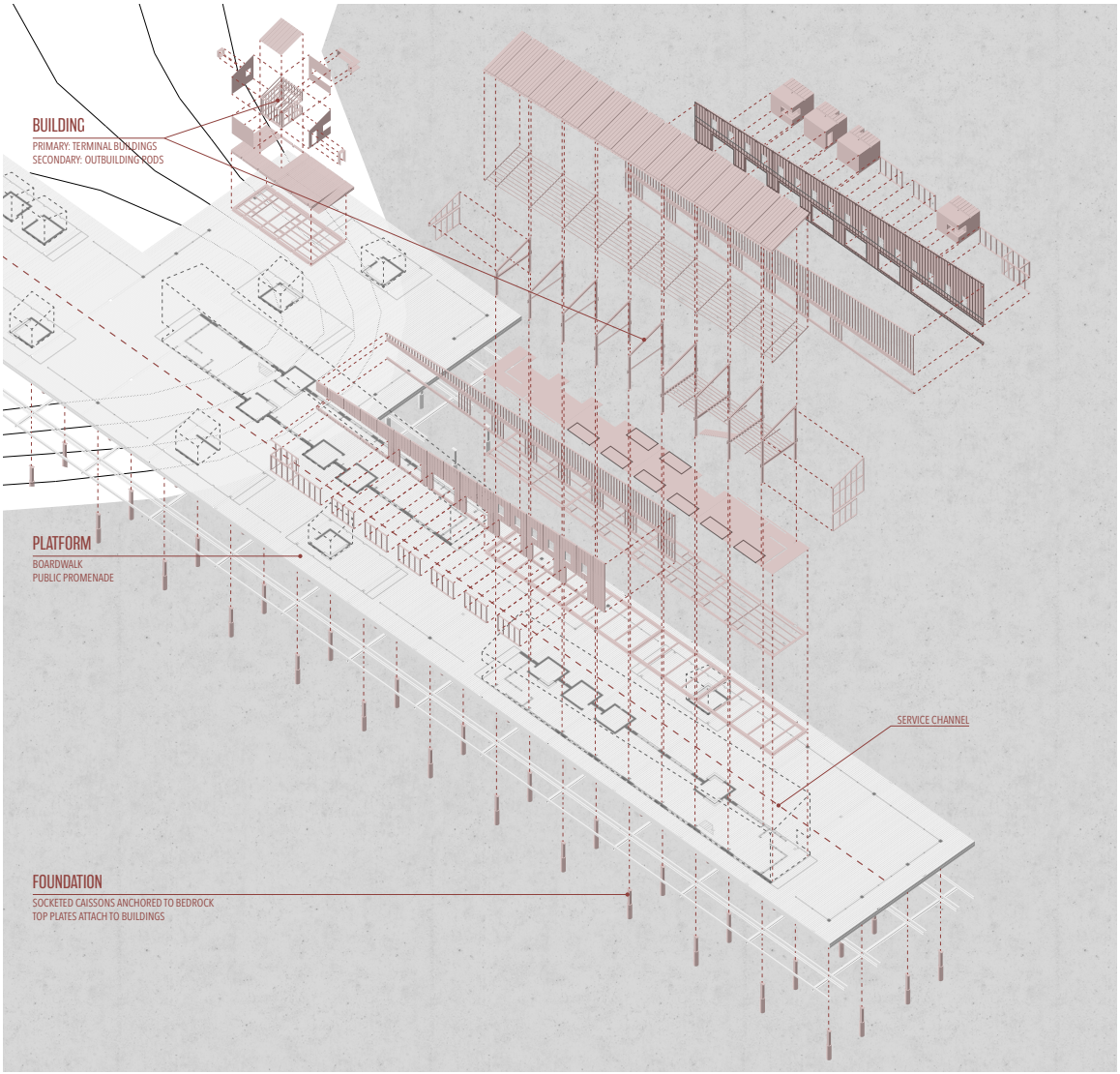
dress the public atmosphere of the wharf.

Also designed with the intention of mobility, the outbuildings pods are constructed on platforms that integrate a steel base frame similar to those of the terminal buildings. When relocation is required, the mobile boat hoist need only lift and transport the pods and platforms as it would the arrival or departure terminal modules. These platforms also anchor atop the connection plate caps of the socketed caisson foundations, allowing them to hover above and resemble protrusions of the boardwalk surface. The marginally higher elevation of the outbuilding platforms relative to the wharf establishes both a seating surface and a threshold that differentiates it from the expansive promenade.

As for the enclosed components of the outbuilding pod assembly, these are simplified structures produced using traditional, utilitarian stick framing construction techniques. While the adaptation of these spaces is encouraged to suit a variety of functional requirements for different entrepreneurial endeavours, the short-term intervention has introduced outbuilding pod typologies such as vendor stalls, snack bars, washroom facilities, and open-concept shelters. For the retail-oriented outbuilding pods, the enclosed spaces are primarily private while the platforms provide public congregation points for social gatherings. It is these commercial typologies that will benefit the most from the introduction of the two new ferries and year-round service; dispersed throughout the wharf, each business has the opportunity to capitalize on the ongoing increase in tourist influx at Fortune's port of entry.

An additional outbuilding pod typology serves as a primary inspection kiosk for disembarking vehicles along the wharf's western protrusion designated for automobile traffic. Positioned adjacent to the arrival terminal, two such pods assist in the process of ticket reception and customs inspections for embarking and disembarking vehicles, respectively.

Despite the aforementioned typologies, for its purposes, the thesis intends to be less prescriptive with regard to the specific design of individual outbuilding pods. Together with their supporting platforms, these auxiliary structures are more aptly characterized as prototypes, able to be modified and expanded as necessary depending on the



In reference to the clear articulation of the building components of traditional coastal Newfoundland architecture, the proposal employs a reinterpreted relationship between foundation, platform, and building. The exploded axonometric above portrays the fundamental structural methodology of the components that constitute the short-term proactive intervention.

desires of the community.

Cumulatively, the assemblage of terminal buildings, outbuilding pods, and supporting wharf structure represents a contemporary interpretation of historical fishing "rooms" that defined the cultural landscape and architectural identity of Newfoundland outports. In traditional coastal communities like Fortune, structures were once bound to the shore and scattered in ways that defined in-between voids used as informal social spaces. Similarly, the proposed system of structures arranged atop the wharf establishes a variety of positive void spaces intended to encourage such interaction in an inclusive, public setting. While the proposal serves as a beacon for those travelling by both car and ferry, the protruding wharf welcomes visitors from the sea with a traditional first impression of an outport, historically offered by Newfoundland's coastal boat service.

However, as noted in Chapter 2, the composition of Newfoundland's traditional landscapes is far from static. Outport's constituent buildings and outbuildings remain in a perpetual state of modification, repair, and relocation. The configuration of the 2030 short-term intervention portrays a mere moment in time amidst a dynamic process of evolution, as opposed to a rigid setup aimed toward a permanent solution. Based on a proactive approach to coastal erosion, the short-term intervention intends to provide Fortune with the means for adaptation to ambiguous, yet possible forthcoming long-term scenarios.

Long-Term Adaptation

As a project dedicated to the persistence of coastal inhabitation through proactive approaches to climate (and geological) change, it is important to consider how the proposed response might evolve following various stages of adaptation. Henceforth, the proceeding sections depict the wharf and its constituents as dynamic entities, capable of both physical and programmatic adaptation.

Timescale Diversity

Inspired by traditional practice, the proposal is designed to adapt to change through a perpetual cycle of settling, launching, and resettling. However, some components

of the intervention will inherently be launched or modified more frequently than others, following an array of timescales. As noted previously, Stan Allen and Marc McQuade observe architecture as situated between biological and geological timescales, changing at a rate slower than organisms but faster than topographical conditions. Conversely, the proposal suggests a unique methodology in which the architecture changes at a rate determined by the underlying geology. Here, each primary component of the proposal, the wharf, terminal buildings, and outbuilding pods, will be analyzed with regard to its frequency of evolution.

First, the adaptive wharf is designed to shift at a rate concurrent with the underlying geology of the proposed site. While geological timescales are associated with geomorphological evolution over periods divided by millions of years, the rate at which Fortune's coastal geology evolves permits examination across an intergenerational, and even annual timescale. Evidently, this is a product of the site's susceptibility to erosion, where observable change occurs erratically, yet frequently. Designed for modification, the wharf is thus capable of adapting to such episodic change; following a significant slope failure that disrupts access at the landward edge, the wharf can be reconfigured to re-establish a tethered connection with the landscape. When necessary, the wharf is extended along anticipatory caisson foundations, proactively positioned in conformity with predetermined grid ahead of impending landslides. Before functioning as supportive infrastructure, the anticipatory foundations serve as street lanterns, protruding vertically along the erosional axis as wayfinding devices through the town core. Anchored atop the top plates like the terminal buildings and outbuilding pods, these lanterns continue onto the wharf to provide lighting for nightfall activities and signals for approaching vessels. As the coast erodes, foundations are progressively revealed; for the community, this provides a visible indication of recession, spreading awareness of ongoing erosion. As for the wharf head, its platform components can be reused for extension at the landward extremity if deemed economically necessary. If so, remaining foundations are intended to prevail as both a harbour breakwater framework and additional indicators of erosion.

Similarly, the terminal buildings are intended for movement at a rate that corresponds with coastal erosion. To ensure an efficient arrival process, the arrival terminal

is situated adjacent to the western wharf protrusion where the ferries dock for loading and offloading. To ensure vehicle access to Fortune's roadways, the western protrusion moves with shoreline recession; therefore, the arrival building relocates concurrently. As for the departure terminal, its position relative to the arrival building is not imperative; however, maintaining an appropriate proximity to the ferry similarly assures an efficient embarking process for travellers.

Designed to change and adapt most rapidly are the outbuilding pods. The movement of these units is less contingent on underlying geology, instead depending on the fluctuating demands of the community for various program configurations along the wharf. For example, using the existing grid framework, sets of outbuilding pods can be organized such that their collective arrangement creates public venues like community markets, performance spaces, art exhibits, or dining areas. In this way, the movement of outbuilding pods based on social stimuli reflects the empirical reasons other than environmental that motivate a traditional launch.

Program Evolution

While time plays a crucial role in the physical development of the adaptive wharf and its constituents, the temporal aspect of the architectural response also contributes to its continuous programmatic development.

In the pursuit of preserving Fortune's unique identity, the thesis acknowledges the question of the fate of the existing structures that constitute the urban core of the community. Inherent in the position advocating for the natural progression of environmental processes like erosion is the inevitable fact that existing buildings will eventually fail. However, while the structures that house these businesses and institutions will fall to erosion, their specific programs are provided the opportunity to persist as functional additions to the wharf. The proposal is therefore not only adaptable in terms of form and composition, but also functionality over time.

This process occurs in a sequence of phases that form a proactive approach for business owners in the face of an eroding coastline. First, when the coastline reaches a position that threatens the stability of the existing building of interest, a timeline is

delineated for its eventual decommissioning. The owner is then provided the opportunity to claim a portion of the wharf along the grid framework. If claimed, a prototypical outbuilding pod is used as the initial framework for a design that suits the specific requirements of the program to be added. For example, once Lake's Bakery is threatened and subsequently decommissioned, an outbuilding pod can be designated and adapted to support the functional requirements of a functional bakery kitchen, plugging into the wharf's underlying service channel for a power source. Although adapted, each outbuilding pod retains a steel base platform and thus the ability to be launched; hence the site of each addition along the wharf remains impermanent.

Following multiple repetitions of this additive process, the ways in which one experiences, interacts with, and circulates about the wharf becomes different from one visit to the next. For Fortune, the intervention provides a vehicle for the persistence and evolution of the composite network of existing economic generators that supplement the ferry port and define Fortune's business district.

Ephemeral with regard to both siting and program, components of the wharf (whether new or added from existing town assets) are intended to address the varying desires of the community over time and provide a diverse set of experiences for returning visitors. By abstaining from programming every aspect of the intervention, the proposal seeks to establish a framework for the addition of content not yet known, allowing Fortune to determine a program distribution applicable to the collective desires of the town.

Adaptation Scenarios

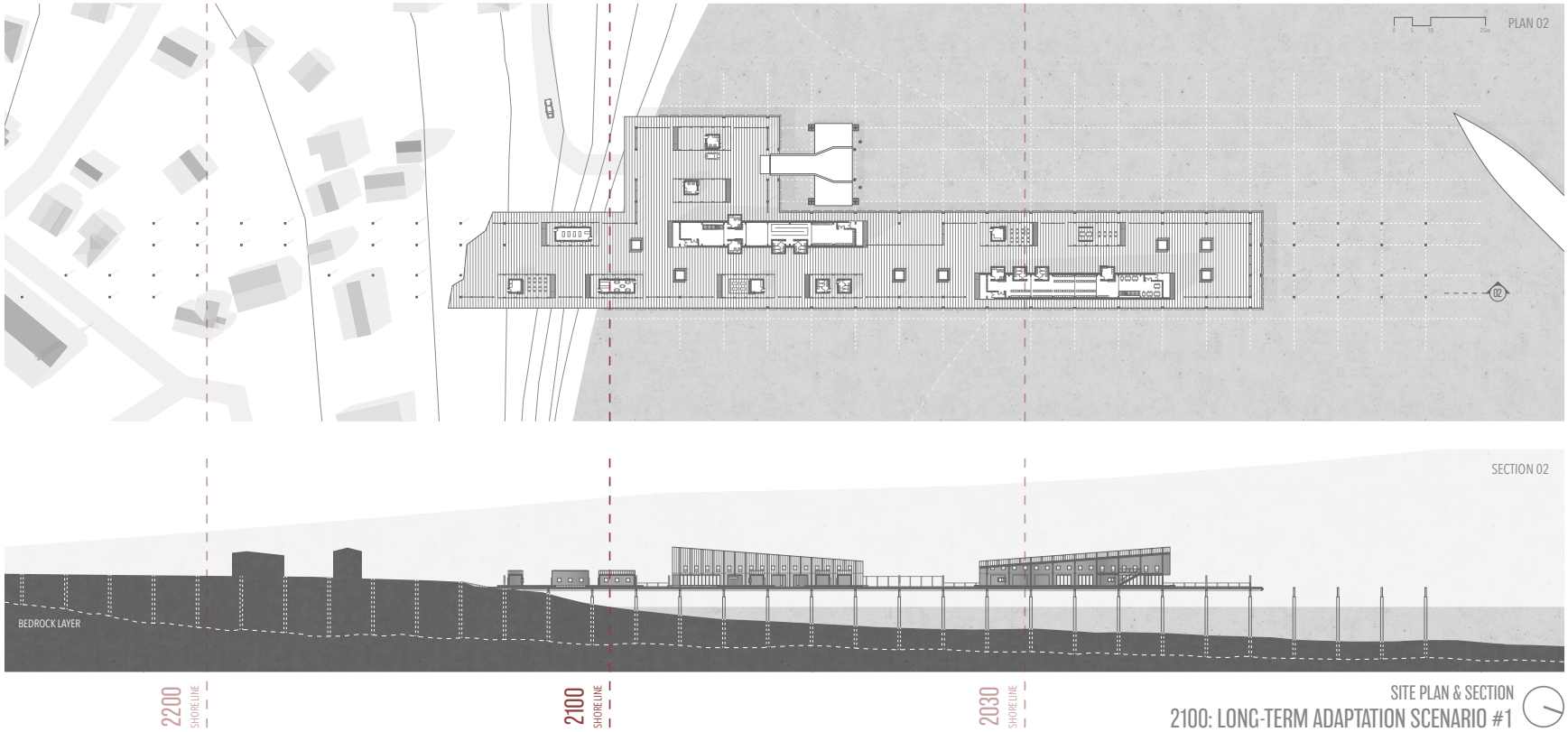
The long-term adaptation scenarios represent speculative insights regarding how Fortune might change following significant coastal erosion over time.

The first scenario is a moment in time during the year 2100. As of 2019, many climate change projections use this year as a baseline for future analysis; therefore, 2100 has been selected as a focal point. According to the predictions noted previously in this chapter, Fortune's coastal axis will have reached several elements of the town core by this point, including Collin's Grocery and Doc's Diner. In this adaptation scenario, the

two programs have been added to the wharf after their decommissioning and subsequent fall to erosion. As businesses centred around the food industry, their introduction to the public boulevard has enhanced its status as a communal market space.

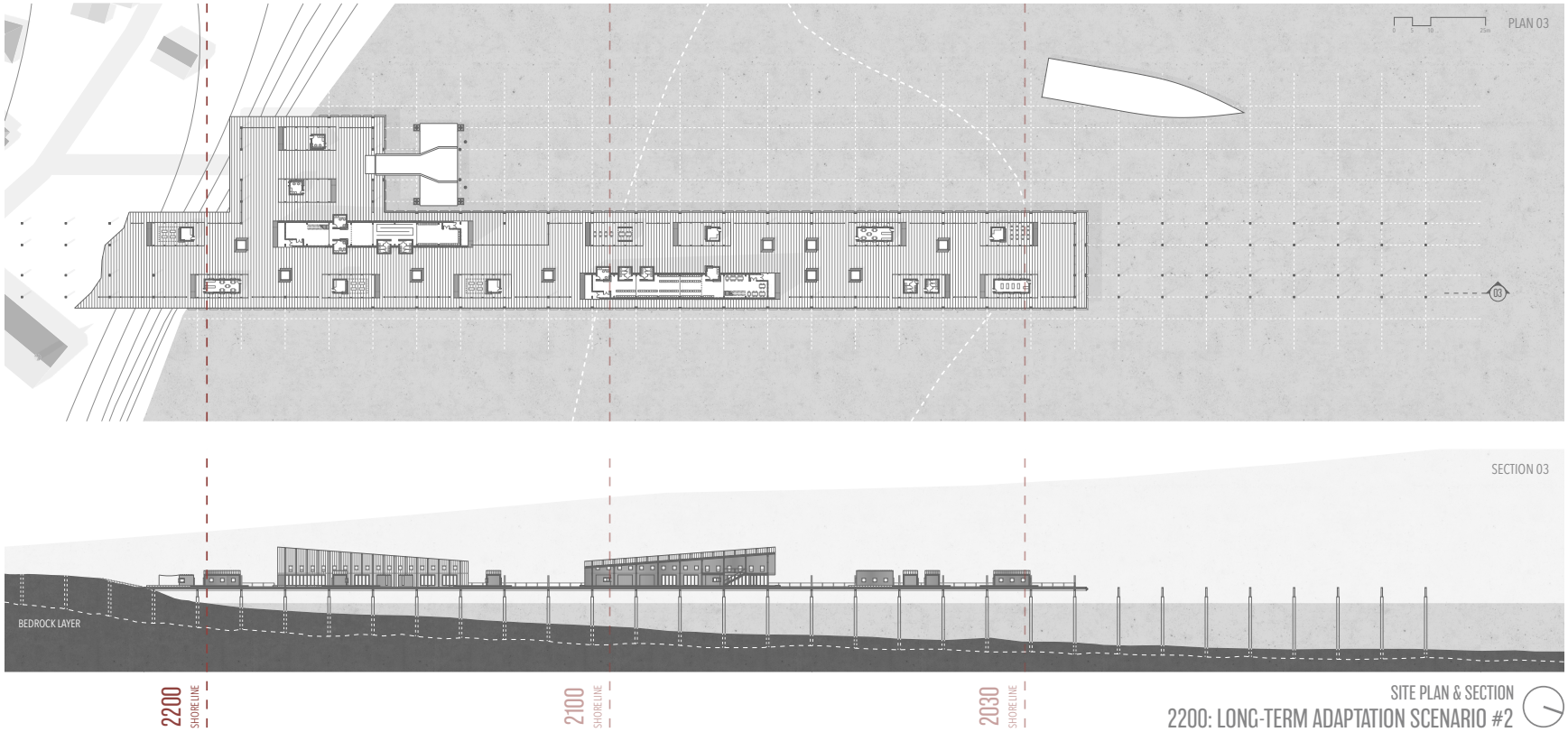
The second adaptation scenario looks at the potential state of the architectural response during the year 2200. By this time the intervention will have endured throughout an intergenerational timescale. The wharf is an elongated version of its original state, indicating more program additions and launch occurrences. The wharf is now a fully-functioning public atmosphere that constitutes the majority of the town's preserved urban core. Integrated as a component of the coastal landscape, the ferry terminal wharf has developed into an architectural expression of Fortune's identity as a port town.

Constant throughout each stage, from the 2030 short-term proactive intervention to the 2200 speculative long-term adaptation scenario, is the importance of the architectural intervention to hold true to the explicit and latent objectives of the proposal. Despite the eternal process of physical and programmatic adaptation, the response aims to continually facilitate marine processes in an efficient and organized manner, decongest the port area, connect Fortune's border to that of St. Pierre by providing space for public life to unfold as residents and visitors integrate, and serve as the vehicle for the perseverance of a town core situated along an eroding coastline.



SITE PLAN & SECTION
2100: LONG-TERM ADAPTATION SCENARIO #1

The first long-term adaptation scenario focuses on how the proposal might have evolved by the year 2100 since the initial proactive intervention in 2030. As portrayed above, the wharf has expanded and extended in conformity with Fortune's receding coastline.



The second long-term adaptation scenario is a speculative prediction regarding the status of the intervention by the year 2200. By this point, the wharf has undergone several additional successive stages of expansion, now accommodating the majority of the businesses and public spaces of Fortune's urban core.

Existing procession to the project site from Fortune's entry highway.

Initial impression of the proposed wharf from Fortune's entry highway.

Existing procession to the project site from the sea aboard the Nordet or Suroît ferry.

Initial impression of the proposed wharf from the sea aboard the Nordet or Suroît ferry.

Initial impression upon entering the public atmosphere of the proposed wharf.

CHAPTER 6: CONCLUSION

Beginning with a cultural, architectural, and environmental analysis of Newfoundland, this thesis has developed a proactive architectural strategy in the pursuit of a harmonious relationship between coastal inhabitation and coastal erosion. Through a reinterpretation of traditional building culture, the resulting proposal demonstrates that a culturally retrospective approach can be used to inform a response to a prospective issue. Drawing from traditional house launching as a historical precedent for adaptation, the architectural response accedes to the natural progression of a restless coastline by becoming dynamic itself, capable of concurrent growth and reconfiguration with fluctuating coastal conditions.

Focusing on Fortune, an archetypal outport of Newfoundland, the project evolved to not only encompass an adaptive architectural methodology, but also to address specific concerns of the community as a gateway to St. Pierre and Miquelon.

While the explicit objective of this thesis is to adapt to coastal change, latent goals include decongestion and the provision and expansion of opportunities for economic growth and social interaction in Fortune's urban core. The project thus seeks to serve as a vehicle for an endogenous, community-centred approach in which Fortune is provided the means to achieve economic prosperity and reactivate the shoreline as a place of resident-visitor congregation.

Worth noting is the fact that the architectural intervention proposed by this thesis represents not the response, but a response to coastal erosion in a shore-bound community. While many of Newfoundland's coastal settlements are predisposed to the burdens of an eroding coastline, specific needs fluctuate based on the historical and contemporary environmental, cultural, and socio-economic context of each outport. The suitability of a response thus relies upon an effort to acknowledge, analyze, and understand the circumstances that define the innate values and unique identity of a place. Across three site visits, I had the opportunity to observe and experience Fortune in an attempt to interpret the fundamental components that form the town's identity. By interacting with locals, observing development, monitoring coastal

change, and travelling to and from St. Pierre, I was able to establish an idea of Fortune's site-specificity, enabling me to speculate about prospective evolution and suitable interventions.

Moving forward, the initial site intervention could develop in terms of suitability with increased collaboration with Fortune and St. Pierre and consultation with geologists and geographers to refine the accuracy of geomorphological predictions. This thesis has served as an opportunity to learn about the geological context of a site. The most notable takeaway from this informative process was that coastal erosion is episodic by nature; the validity of future speculation rests on data accumulation.

Certain, however, is that Fortune will be a different community in the future. While recognizing that Fortune's urban landscape will change following imminent erosion, the architectural proposal put forth by this thesis represents a proactive effort to conserve the innate components of the town that define its site-specificity. Fortune's persistent inhabitation of the waterfront in the face of climate change and coastal evolution is a display of cultural resiliency, preserving an omnipresent identity shared by all Newfoundland outports, defined by an innate relationship with the sea.

BIBLIOGRAPHY

"About Bonavista Creative." *Bonavista Creative.* Accessed September 18, 2018. http://www.bonavistacreative.com/about-us-1.html.

Allen, Edward, and Joseph Iano. *Fundamentals of Building Construction: Materials and Methods.* 5th ed. Hoboken, NJ: John Wiley & Sons, 2009.

Allen, Stan, and Marc McQuade. *Landform Building: Architecture's New Terrain.* Baden: Lars Müller Publishers, 2011.

Andrieux, J. P. *St. Pierre and Miquelon: A Fragment of France in North America.* Lincoln, ON: W. F. Rannie, 1983.

Atkinson, D.E., D.L. Forbes, and Thomas S. James. "Dynamic Coasts in a Changing Climate." In *Canada's Marine Coasts in a Changing Climate,* edited by D.S. Lemmen, F.J. Warren, T.S. James and C.S.L. Mercer Clarke, 27-68. Ottawa: Government of Canada, 2016.

Ayres, Kathryn. "And Landed in Uncle Harry's Backyard." Facebook, March 27, 2015. https://www.facebook.com/groups/653765304693011/?ref=group_header.

Batterson, Martin, David Liverman, J. Ryan, and D. Taylor. *The Assessment of Geological Hazards and Disasters in Newfoundland: An Update.* St. John's: Newfoundland and Labrador Department of Mines and Energy, 1999.

Bell, Trevor, and David Liverman. "The Newfoundland Story." Heritage Newfoundland and Labrador. 1999. https://www.heritage.nf.ca/articles/environment/newfoundland-story.php.

Cadigan, Sean T. *Newfoundland and Labrador: A History.* Toronto: University of Toronto Press, 2009.

"CAN-EWLAT, Fortune, NL." Bedford Institute of Oceanography, Government of Canada. March 23, 2016. http://www.bio.gc.ca/science/data-donnees/can-ewlat/selected-location-en.php?type=SCH&prov=NL&loc=FORTUNE&station=17.

Catto, Norm. *Coastal Erosion in Newfoundland.* St. John's: Atlantic Climate Adaptation Solutions Association, 2012.

Catto, Norm. "Coastal Erosion Sensitivity and Consequences for Communities and Infrastructure." Presentation at the Atlantic Coastal Zone Information Steering Committee Meeting #70, St. John's, NL, September 12, 2013.

Catto, Norm. *Fortune Report.* St. John's, 2012.

CBC News. "Road Erosion Tearing Apart Highway Near Grand Bank." *CBC.* October 8, 2014. https://www.cbc.ca/news/canada/newfoundland-labrador/road-erosion-tearing-apart-highway-near-grand-bank-1.2792842.

CBC News. "Residents Fret as 'Active Slide' Causes Havoc in Daniel's Harbour." *CBC.* April 19, 2007. https://www.cbc.ca/news/canada/newfoundland-labrador/residents-fret-as-active-slide-causes-havoc-in-daniel-s-harbour-1.640239.

Climate Change Projections for Newfoundland and Labrador Late 20th Century to Mid 21st Century. St. John's: Government of Newfoundland and Labrador Office of Climate Change, Energy Efficiency, and Emissions Trading, 2013.

Cochrane, Candace. *Outport: The Soul of Newfoundland.* St. John's: Flanker Press Limited, 2008.

Corner, James, and Alex S. Maclean. *Taking Measures Across the American Landscape.* New Haven: Yale University Press, 1996.

Davidson-Arnott, Robin, and Jeff Ollerhead. *Coastal Erosion and Climate Change.* Charlottetown, PEI: Atlantic Climate Adaptation Solutions Association, 2011.

Dobson, Jim. "Flakes in Fortune." Facebook, December 18, 2017. https://www.facebook.com/groups/653765304693011/?ref=group_header.

Dobson, Jim. "One of the Clearest and Oldest Pics of Fortune I Have Seen." Facebook, January 16, 2018. https://www.facebook.com/groups/653765304693011/?ref=group_header.

"Early Settlement Schemes." Heritage Newfoundland and Labrador. 1998. https://www.heritage.nf.ca/articles/exploration/early-settlement-schemes.php.

Economic Council of Canada. *Newfoundland: From Dependency to Self-Reliance.* Ottawa: Economic Council of Canada, 1980.

Farrell, Colin. "Fortune Mayor Concerned Over Standstill With Wharf Renovation." *The Telegram,* September 13, 2018. https://www.thetelegram.com/news/fortune-mayor-concerned-over-standstill-with-wharf-renovation-241108/.

Farrell, Colin. "Fortune Working with St. Pierre and Miquelon on Ferry Issue." *The Telegram,* May 11, 2018. https://www.thetelegram.com/news/local/fortune-working-with-st-pierre-and-miquelon-on-ferry-issue-209587/.

Finnis, Joel, and Joseph Daraio. *Projected Impacts of Climate Change for the Province of Newfoundland & Labrador: 2018 Update.* St. John's: Government of Newfoundland and Labrador Department of Municipal Affairs and Environment, 2018.

Floating Mike and Hilda Symmonds House from NE Crouse to Conche. 1965. Digital photograph. Maritime History Archive, St. John's, https://www.mun.ca/mha/resettlement/larger_version.php?img=moving_house/moving_house_conche_3&galleryID=House2.

Fortune Harbour Authority. Digital photographs of Fortune's harbour. Accessed November 2, 2018. https://fortuneharbour.ca/.

"Fortune." In *Encyclopedia of Newfoundland and Labrador.* Edited by Joseph R. Smallwood et al. Vol. 2. St. John's: Newfoundland Book Publishers, 1984.

Fortune, Late 1800s. Accessed January 16, 2019. Photograph. Centre for Newfoundland Studies, St. John's, https://www.collectionscanada.gc.ca/eppp-archive/100/200/301/ic/can_digital_collections/nfld/fortune.html.

Geological Survey of Newfoundland and Labrador. Geoscience Online. *Geoscience Atlas: Interactive Maps of Geology, Geophysics, Geochemistry, Mineral Occurrences, Claims, Drill Core Reports, Maps and More.* <https://gis.geosurv.gov.nl.ca/> (September 10, 2018).

"Global Data Explorer." United States Geological Survey. Last modified July 10, 2018. https://gdex.cr.usgs.gov/gdex/.

"Gridded Bathymetry Data." General Bathymetric Chart of the Oceans. Last modified 2018. https://www.gebco.net/data_and_products/gridded_bathymetry_data/.

Harrington, Richard. *Fishing Stages, Pouch Cove.* 1940. Photograph. 25.4 × 20.6 cm. The Rooms, St. John's, http://gencat1.eloquent-systems.com/webcat/request/Action?ClientSession=70e43ad0:16c5b2a1e42:-7ed8&UniqueID=6000_3355_2&TemplateProcessID=6000_3355&PromptID=&ParamID=&TemplateProcessID=6000_1051_1051&PromptID=&ParamID=&CMD_(DetailRequest)[0]=&ProcessID=6000_3363(0)&KeyValues=KEY_74785.

Herridge, Fay. "Our History." Town of Fortune. 2015. http://www.townoffortune.ca/our_history.php.

Herridge, Paul. "Slope Erosion Being Addressed in Highway Project Between Grand Bank and Fortune." *The Telegram,* June 11, 2018. https://www.thetelegram.com/news/local/slope-erosion-being-addressed-in-highway-project-between-grand-bank-and-fortune-217544/.

Higgins, Jenny. "Cod Moratorium." *Heritage Newfoundland and Labrador.* 2009. https://www.heritage.nf.ca/articles/economy/moratorium.php.

Higgins, Jenny. "Migratory Fishery and Settlement Patterns." *Heritage Newfoundland and Labrador.* 2008. https://www.heritage.nf.ca/articles/exploration/settlement-patterns.php.

Holl, Steven. *Anchoring: Selected Projects 1975-1991.* 3rd ed. New York: Princeton Architectural Press, 1989.

House Being Towed Along a Road. 1970. Digital photograph. Maritime History Archive, St. John's, https://www.mun.ca/mha/resettlement/larger_version.php?img=moving_house/e249_row1_no4&galleryID=House6.

Irvine, Melanie L. *Monitoring Coastal Change in Newfoundland and Labrador: 2014 Update.* St. John's: Newfoundland and Labrador Department of Natural Resources Geological Survey, 2015.

Iverson, Noel, and Ralph Matthews. *Communities in Decline: An Examination of Household Resettlement in Newfoundland.* St. John's, Newfoundland: Institute of Social and Economic Research, Memorial University of Newfoundland, 1968.

Janzen, Olaf. "French Presence in Newfoundland." *Heritage Newfoundland and Labrador.* 1998. https://www.heritage.nf.ca/articles/exploration/french-presence-newfoundland.php.

"La Collectivité Territoriale de St. Pierre et Miquelon selects Damen for Two Fast Ferries." *Damen Shipyards Group.* April 18, 2016. https://www.damen.com/en/news/2016/04/la_collectivite_territoriale_de_st_pierre_et_miquelon_selects_damen_for_two_fast_ferries.

Launching Alex and Annie Stacey house on Sound Island, Placentia Bay. 1951. Digital photograph. Maritime History Archive, St. John's, https://www.mun.ca/mha/resettlement/larger_version.php?img=moving_house/sound_island3&galleryID=House1.

MacKinnon, Richard. *Vernacular Architecture in the Codroy Valley.* Hull, Quebec: Canadian Museum of Civilization, 2002.

Macpherson, Joyce. "Cold Ocean." *Heritage Newfoundland and Labrador.* 1997. https://www.heritage.nf.ca/articles/environment/cold-ocean.php.

Major, Kevin. *As Near to Heaven by Sea: A History of Newfoundland and Labrador.* Toronto: Viking, 2001.

Martin, Anthony. *Ediacaran-Cambrian Boundary Stratotype and Section at Fortune Head.* August 15, 2012. Digital photograph from "Fortune Head Ecological Reserve: Standing at the Ediacaran-Cambrian Transition and Seeing the Explosion of Life in the Strata." Coffee With Hallelujah (blog). http://coffeewithhallelujah.blogspot.com/2012/08/fortune-head-ecological-reserve.html.

Martin, Anthony. *Watching the Ichnologists from Above.* August 15, 2012. Digital photograph from "Fortune Head Ecological Reserve: Standing at the Ediacaran-Cambrian Transition and Seeing the Explosion of Life in the Strata." Coffee With Hallelujah (blog). http://coffeewithhallelujah.blogspot.com/2012/08/fortune-head-ecological-reserve.html.

Martin, Melanie. "Resettlement." *Heritage Newfoundland and Labrador.* 2007. https://www.heritage.nf.ca/articles/politics/resettlement.php.

Mellin, Robert. *Tilting: House Launching, Slide Hauling, Potato Trenching, and Other Tales from a Newfoundland Fishing Village.* New York: Princeton Architectural Press, 2003.

Mellin, Robert. *Winter in Tilting: Slide Hauling in a Newfoundland Outport.* St. John's: Pedlar Press, 2015.

Newfoundland Statistics Agency Executive Council. *Historical Statistics of Newfoundland and Labrador.* St. John's: Government of Newfoundland and Labrador, 1994.

O'Dea, Shane. "Built Environment." *Heritage Newfoundland and Labrador.* 1998. https://www.heritage.nf.ca/articles/society/built-environments.php.

Pocius, Gerald L. *A Place to Belong: Community Order and Everyday Space in Calvert, Newfoundland.* Athens: University of Georgia Press, 1991.

"Precontact Beothuk Land Use." *Heritage Newfoundland and Labrador.* 2009. https://www.heritage.nf.ca/articles/aboriginal/beothuk-land-use.php.

Pulling a House Across the Ice at Cook's Harbour, Great Northern Peninsula. 1953. Digital photograph. Maritime History Archive, St. John's, https://www.mun.ca/mha/resettlement/larger_version.php?img=moving_house/stevens2_1953&galleryID=House1.

Rose, Carl. "Fortune Holds Second Consultation Session on Downtown Development Plan." *The Southern Gazette.* September 30, 2017. https://www.southerngazette.ca/news/local/fortune-holds-second-consultation-session-on-downtown-development-plan-89884/.

Savard, J.-P., D. van Proosdij and Stéphan O'Carroll. "Perspectives on Canada's East Coast Region." In *Canada's Marine Coasts in a Changing Climate,* edited by D.S. Lemmen, F.J. Warren, T.S. James and C.S.L. Mercer Clarke, 99-152. Ottawa: Government of Canada, 2016.

Simms, Alvin, and Jamie Ward. *Regional Population Projections for Newfoundland and Labrador 2016-2036.* St. John's: Harris Centre Regional Analytics Laboratory, 2017.

Smout, Mark, and Laura Allen. *Pamphlet Architecture 28: Augmented Landscapes.* New York: Princeton Architectural Press, 2007.

Smout, Mark, and Laura Allen. *The Retreating Village, 1:500 Model.* In Pamphlet Architecture 28: Augmented Landscapes. New York: Princeton Architectural Press, 2007, 76.

Smout, Mark. "Prof Mark Smout." *University College London.* Accessed November 25, 2018. https://www.ucl.ac.uk/bartlett/architecture/prof-mark-smout.

Spiller, Neil. Foreword to *Pamphlet Architecture 28: Augmented Landscapes,* 4-5. New York: Princeton Architectural Press, 2007.

Statistics Canada. "Fortune, T [Census subdivision], Newfoundland and Labrador and Newfoundland and Labrador [Province]." Census Profile, 2016 Census. Released November 29, 2017. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

Tuck, James A. "Maritime Archaic Tradition." *Heritage Newfoundland and Labrador.* 1998. https://www.heritage.nf.ca/articles/aboriginal/maritime-archaic.php.

"Weather in Fortune." *Meteoblue.* Accessed November 2, 2018. https://www.meteoblue.com/en/weather/week/fortune_canada_5955964.

"Welcome." *The Shorefast Foundation.* Accessed September 18, 2018. https://shorefast.org/.

"William Pye House and Outbuildings (Brooklyn)." *Heritage Newfoundland and Labrador.* 2004. https://www.heritage.nf.ca/articles/society/william-pye-house-outbuildings.php.

Woodland, Andrew. "Newfoundland Folk Architecture." *Heritage Newfoundland and Labrador.* 1998. https://www.heritage.nf.ca/articles/arts/newfoundland-folk-architecture.php.