

**ELECTRIC SPACE: A NEW NARRATIVE FOR AGING  
HYDROELECTRIC FACILITIES IN B.C.**

by

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## **ABSTRACT**

This thesis addresses the hydroelectric structures of the Buntzen Generating Station located within a restricted area of Indian Arm Provincial Park in British Columbia, Canada. Situated between ocean and mountain, the century-old power-generating stations of Buntzen Lake are nearing end of service. Over time, these isolated, dangerous, and increasingly obsolete machines in the landscape have been superseded by alternatives from a new energy era and out-muscled by Vancouver's relentless thirst for fresh water. As relics of the past, this is an opportunity to reimagine British Columbia's relationship with aging, purpose-built hydroelectric structures and engage the experiential, atmospheric, and imaginative capacity of this forbidden site. In addition to power generation, this thesis defends that antiquated hydroelectric structures could be used as devices of imagination, sensation and memory to decipher a landscape's invisible energy and reconnect us to nature in powerful, meaningful, and unpredictable ways. To not only remediate and reconnect a site fragmented by industry, but to strengthen our relationship to history, community, land and water as fundamental aspects of societal well-being.

## **ACKNOWLEDGEMENTS**

I would like to thank Jonathan Mandeville and Roger Mullin for their valuable insight and encouraging me to explore my own creative process.

To the work of Will Koop, whose research of Lake Buntzen's history helped me craft an informed and meaningful proposal for its future.

To the many friends and mentors who helped enrich and execute this project. In particular, Josh Nieves, for his last minute help.

To my family, Geoff, Emily, Michael, and Shay and my grandparents, Richard and Gloria, for their love and support.

To my partner, Letty, for sharing this journey with me. Your love, patience and belief in me are immeasurable.

This work is dedicated to the memory of my friends Charlie Bowins and Lucas Austin.

## CHAPTER 1: INTRODUCTION

### Machines in the Landscape

Nature was there for the use of humanity. It was not an interconnected, independent ecosystem that needed to be respected on its own terms but simply a collection of discrete resources. Mountain snows were just sources of water. Rivers were (or should be) canals. Technology was wondrous, allowing for the conquest and control of nature.<sup>1</sup>

Throughout antiquity, societies have been shaped by their interconnections with nature. As one of earth's most powerful phenomena, "few interconnections have been more important than capturing the kinetic energy of falling water".<sup>2</sup> Over the last century, the control of wild water has transformed the North American landscape at unprecedented scales. Visible from space, these unique architectural devices physically express man's technological exploitation of the edge between *aqua firm* and *terra firma*. Given British Columbia's abundance of waterfalls and fast-flowing rivers, hydroelectricity has become the province's dominant power source.<sup>3</sup> While unique for their ability to harness earth's kinetic energy, hydropower structures often disconnect us from nature -- severing a historically intimate relationship with land and water. Although the era of throwback hydro mega structures is largely over, the last century will undoubtedly be remembered as a Neotechnic age; an era defined by man's technological conquest over nature.<sup>4</sup>

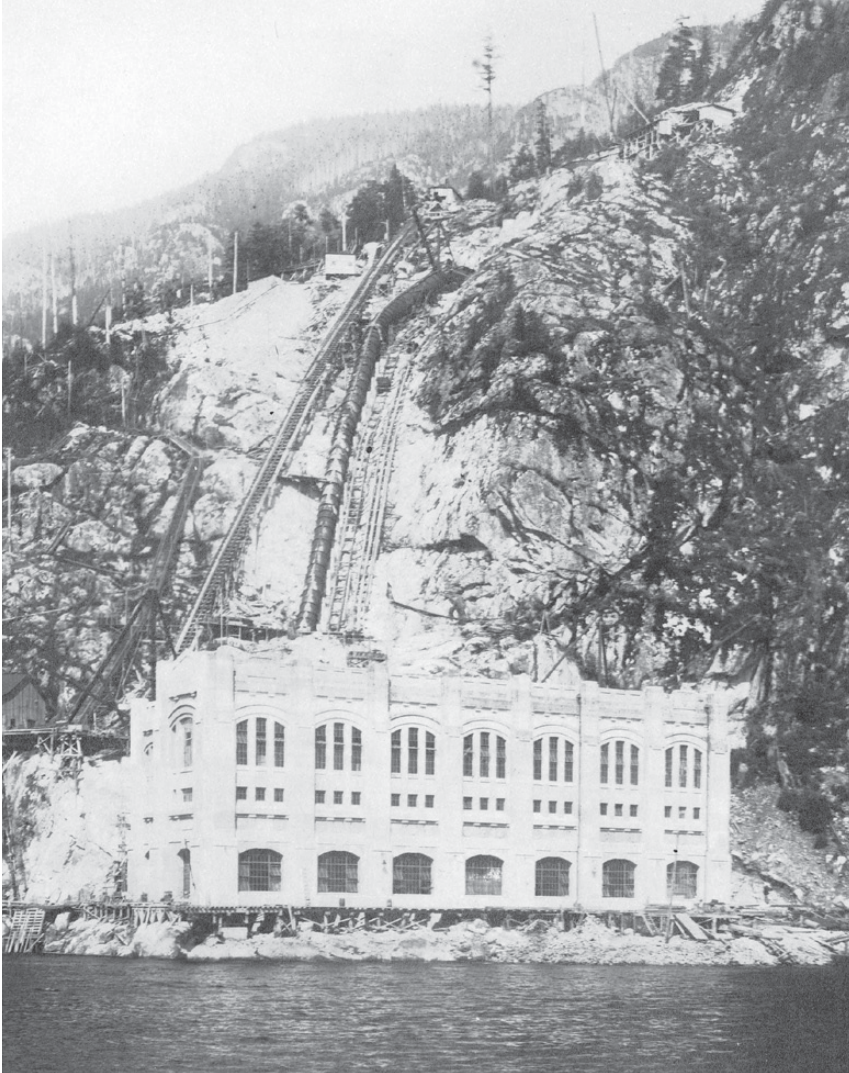
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1. James Murton, *What J.W. Clark Saw in British Columbia, or, Nature and the Machine*. BC Studies, no.142/143 (2004).

2. Ibid.

3. Ibid.

4. Ibid.



LB2 Generating Station; photograph by Major James Matthews; from City of Vancouver Archives (1913).



Wooden Penstock for Buntzen Lake Power Plant #1; photograph by Major James Matthews; from City of Vancouver Archives (1903).

## Icons of Identity

Since our feelings and understandings are rooted in the past, our sensuous connections with a building must respect the process of remembering.<sup>5</sup>

As machines in the landscape, purpose-built hydroelectric structures are some of the most recognizable buildings of our era. Though not intended as monuments, many of these sublime hydroelectric monoliths have acquired the status of national icons because they stood for a bigger idea.<sup>6</sup> In the words of Macy and Bonnemaïson,

[...] each of these buildings and landscapes were iconic representations in their era – symbolizing a perfect ideal for life in harmony with nature. Commissioned by either government or business interests, they can be seen as way stations in the development of national identity.<sup>7</sup>

Today, these amphibious artifacts represent a unique period of Canadian industrial architecture reflecting a desired -- yet often problematic -- relationship with nature. As icons, these structures have played a significant role in the Canadian landscape, visually, environmentally, culturally and economically -- making them important instruments for how we identify to place.<sup>8</sup> According to Norberg-Schulz, to identify with a place is to “experience a ‘total’ environment as meaningful”.<sup>9</sup> As a mode of settlement, hydroelectric structures bridge people to their inhabited world because the building’s presence affects one’s sense of *place* at a larger scale. Though never intended for human dwelling, these ruins in the landscape trace a dynamic process of the dreams and ambitions of a country seeking a new relationship to nature.<sup>10</sup> From small-scale rural mills to large-scale hydroelectric generating plants, these monuments of industrial heritage are an import memory in the Canadian landscape and pillars of identity for Vancouver and surrounding communities.<sup>11</sup>

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5. Peter Zumthor, *Thinking Architecture* (Basel: Birkhauser, 2010).

6. Christine Macy & Sarah Bonnemaïson, *Architecture and Nature Creating the American Landscape* (New York: Routledge Press).

7. Ibid.

8. Ibid.

9. Christian Norberg-Schulz, *The Concept of Dwelling: On the Way to Figurative Architecture*, (Milan: Electa, 1985)

10. Ibid.

11. Ascroft, Shella. *The Heritage of Power Generation*. Heritage, Volume XV, Number 1. National Trust for Canada, (2012).

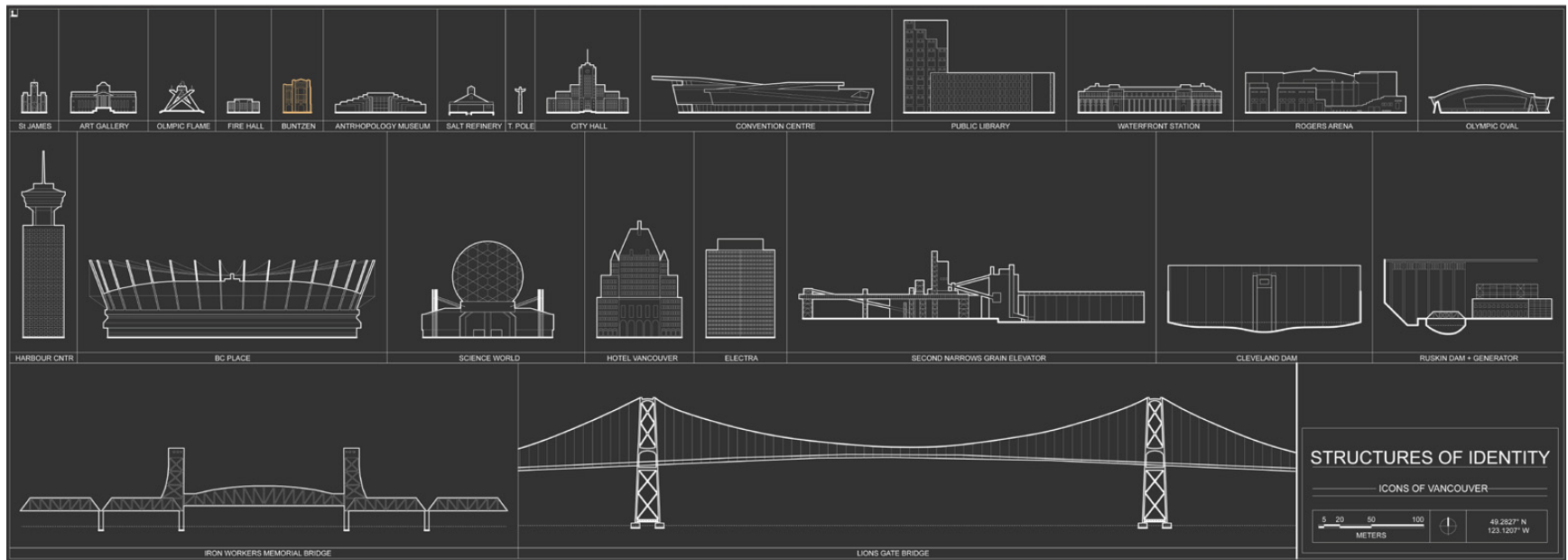


Architectural Icons of Vancouver (GeoBC).





Architectural Icons of Vancouver (GeoBC).



Structures of Identity: Vancouver.

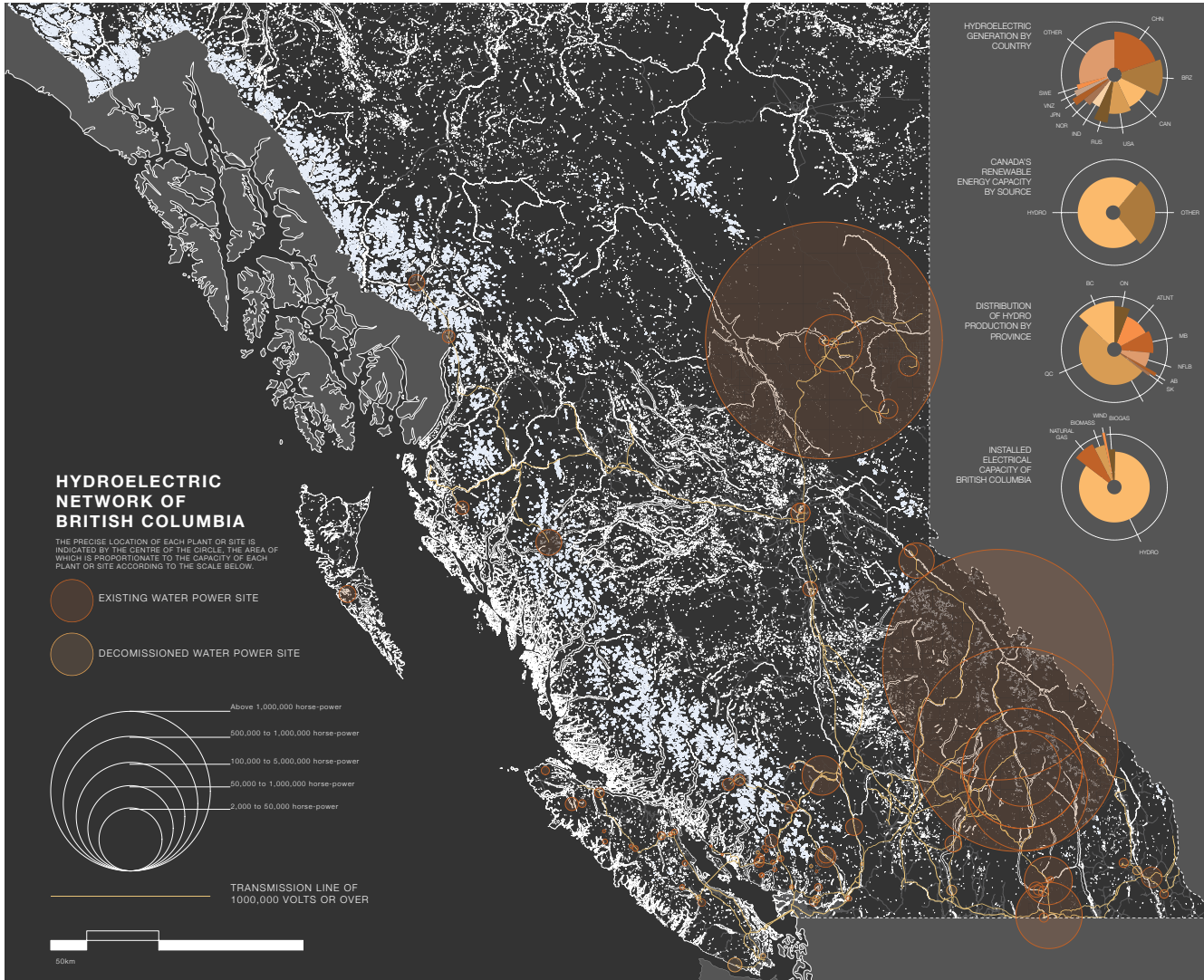
## Future Ruins

Despite their immortal appearance, hydroelectric infrastructure has a finite lifespan. While most facilities can last over a century, an impressive legacy of unique hydropower structures are nearing end of life throughout North America. The cost of seismic, structural, mechanical upgrades, combined with concern over the quality and health of wild water, is forcing a growing number of British Columbia's oldest powerhouses offline. These isolated monoliths, built of thick, reinforced concrete are remarkably difficult and expensive to remove. Like the Jordan River Generating Station on Vancouver Island, many are left abandoned to rot as they slowly become reclaimed by nature.

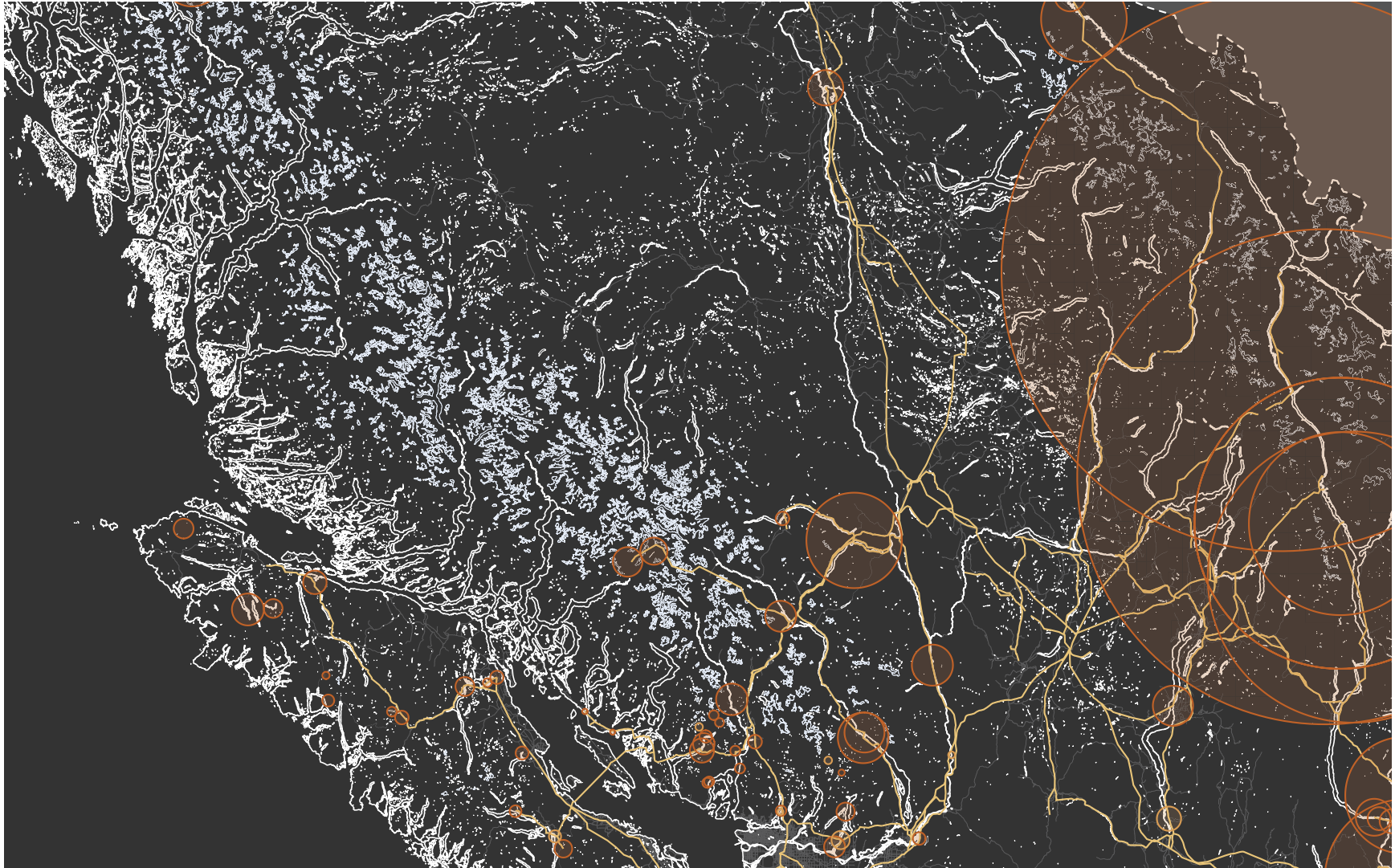
Architecturally, these abandoned structures offer unique spatial experiences irreplaceable in new construction. Like rocks in a river, these buildings have been unique weathering qualities that trace the history of water through the site. From acoustics and light to smells and textures, these oversized structures excite the senses and engage us with process of remembering that is irreplicable in new construction. Due to their need to house heavy, large-scale machinery and retain water, hydroelectric structures are often built according to strict structural grids. Once free of machinery and equipment, these flexible structural bays are capable of adapting to a variety of new programmatic opportunities.



Abandoned Jordan River Generating Station; photograph by Darren Stone; from Vancouver Sun (2008).



Hydroelectric Network of British Columbia (GeoBC, Compiled from information supplied by the Natural Resources Canada, 2015).



Hydroelectric Network of British Columbia (GeoBC, Compiled from information supplied by the Natural Resources Canada, 2015).

## Industrial Sanctuary

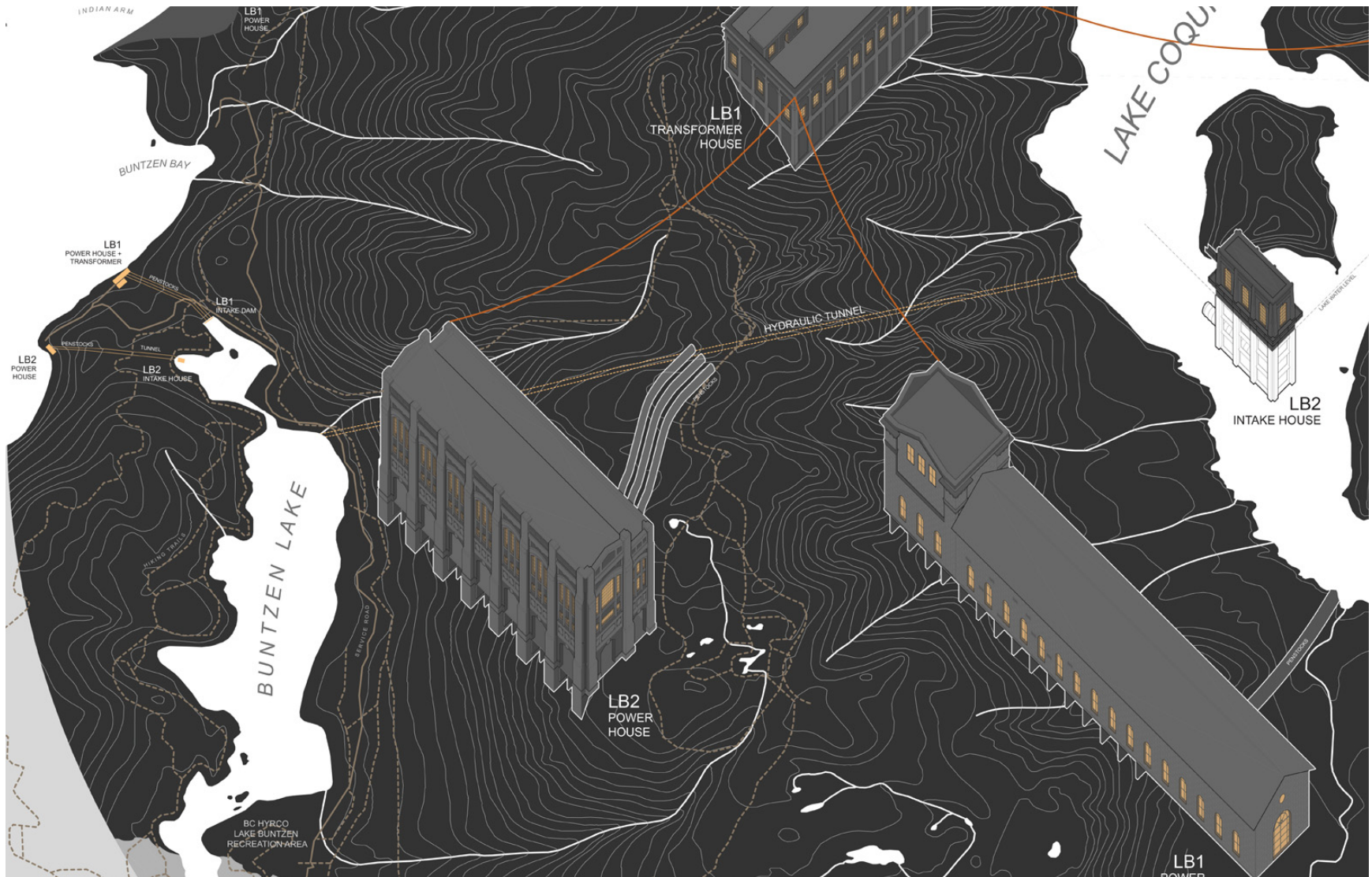
Some of the most spectacular landscapes in British Columbia are occupied by hydroelectric facilities. While initially remote, these sites have become increasingly intertwined with recreational areas, parklands, and growing metropolises. As a result, hydropower has profound implications on space, program, and occupancy -- creating disconnected places around cities and parks exclusive to industry. Although hydropower is often blamed from destroying and disconnecting areas in nature, some projects, like that of Buntzen Lake, unintentionally preserved vast wilderness sanctuaries to protect the watersheds that feed industry.<sup>12</sup> Today, these hydropower sites exist as paradoxical objects; dangerous machines in nature, existing in sites of exploration and ecological intimacy. Whether active or abandoned, these forbidden areas juxtapose their newfound context. In creating off-limit spaces, society is left to develop their own understanding of these forbidden industrial artifacts, imagining an experience in stark contrast to its ecological surroundings.

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12. Will Koop, *History of the Coquitlam Watershed and River From 1898-1914* (Vancouver: The Port Moody Ecological Society, April 6, 1994).



Existing Hydroelectric Network (GeoBC).



Existing Hydroelectric Network (GeoBC).



## Devices of Imagination

As industrial cathedrals built in nature, the adaptive re-use of obsolete hydroelectric structures presents a powerful poetic opportunity to engage the imaginative capacity of architectural ruins. Calvino's masterpiece, *Invisible Cities*, offers a tool for architects and artists alike to visualize the imaginary potential of cities and buildings. Using poetry, Calvino presents captivating alternatives for how we think about cities, how they're formed, and how they function.<sup>12</sup>

One reading of *Invisible Cities* suggests the human mind retains a deep innate desire for imaginative spaces. If this is true, where in the city do these spaces belong? In Tim Edensor *Industrial Ruins: Space, Aesthetics, and Materiality*, Edensor argues that imaginative spaces are best housed in ruins. According to Edensor,

[...] industrial ruins produce new kinds of space that are imbued with powerful meaning. Yet because their meaning and purpose are delineated and require imaginative, sensual, and conjectural interpretation, encounters with industrial ruins are liberating experiences.<sup>13</sup>

Similarly, Alberto Gomez argues that imaginative spaces are particularly propitious in fractured, inhuman sites because they have greater potential to "escape the hegemony of panoptic domination and technological control".<sup>14</sup> For Gomez, working on these sites implies greater responsibility than to simply preserve what exists. The greatest responsibility in designing these spaces, particularly in the development of appropriate program, is to understand that "history is fiction, and treat it as such".<sup>15</sup> Through approaching imaginative space according to Calvino, Gomez, and Edensor, Buntzen's ruins have the capacity to bring about moments in spatio-temporal recognition that are "completely new, yet strangely familiar".<sup>16</sup> By disconnecting artifacts from their use value, these obsolete hydroelectric sites have tremendous imaginative potential to redefine Vancouver's relationship to aging hydroelectric structures by amplifying the experiential capacity of surrounding program and enhancing our connection to place specificity.

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12. Italo Calvino, *Invisible Cities* (New York: Harcourt Brace Jovanovich, 1978).

13. Tim Edensor, *Industrial Ruins: Space, Aesthetics, and Materiality* (Oxford: Berg, 2005).

14. Alberto Gomez, "Spaces In-Between", *Terrain Vague* (Rotterdam, 2003).

15. Ibid.

16. Ibid.



Imaginative Intake House.



Imaginative Hydraulic Tunnel; photograph by Major James Matthews; from City of Vancouver Archives (1913).

## **Critical Position**

As outsiders looking in, the unique and mysterious spaces of antiquated hydroelectric facilities are a powerful opportunity to reconsider our relationship with purpose-built structures and amplify our connection to place specificity. This thesis defends that the decommissioned hydroelectric structures of Buntzen Lake must end their isolation and engage a new narrative with the city and surrounding parkland. In addition to power generation, this narrative should reflect the site's symbiotic relationship to hydrology, landscape, urbanity, and history. By activating unique intersections between building, land, and water, decommissioned infrastructure could be used as devices of imagination, sensation, and memory to engage in intense and meaningful dialogue with the site's past present, and future.

## **Thesis Question**

How might the adaptive reuse of aging hydroelectric structures amplify the experiential capacity and place specificity of surrounding parkland?

## CHAPTER 2: HISTORY, DEVELOPMENT, CONTEXT

### White Coal: Early History

On December 17, 1903 the then Trout Lake Power Station (after 1905 Lake Buntzen) started and produced the first hydroelectric power in the Lower Mainland of BC. Two days later, on December 19th, the City of Vancouver was first lit by waterpower. The Province newspaper of the day printed an article titled “Steam discarded in favour of Water Power”.<sup>17</sup>

Up until 1903, Greater Vancouver’s electricity was supplied by steam. Yet in order to meet a demand rising by 30 percent per year, the BCERC had to search for cheaper and more powerful alternatives.<sup>18</sup> ‘White coal’ – the process of capturing the energy of melting snow as it runs down the mountain in search of the sea -- spurred unprecedented investor-financed capital for ambitious hydro electrical projects throughout British Columbia.<sup>19</sup> Few were as politically charged as the Buntzen Generating Station; an ingenious scheme to divert Lake Buntzen’s water 400 vertical feet to a generating plant on sea level.<sup>20</sup> This project would take water from the Coquitlam Reservoir and divert it through a tunnel, beneath Eagle Ridge Mountain to the Buntzen Reservoir. Once there, it would travel through penstocks to powerhouses on Indian arm to produce electricity.<sup>21</sup> From the outset, this proposal was problematic because the tunnel and its associated water flow was illegal. According to the Dominion Act, “water taken from a river must return to the river [...] which, it came from”.<sup>22</sup> Despite immense legal hurdles and public opposition, the project continued in part due to political backing from powerful British investors.<sup>23</sup> On December 17<sup>th</sup>, 1903, Vancouver received its first wave of hydroelectricity. Although it was an incredible accomplishment, the BCERC quickly realized that Buntzen Lake was too small to generate sufficient electricity for Vancouver’s growing market.<sup>24</sup>

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17. Koop, *History of the Coquitlam Watershed*, 6.

18. Diana Nikolic. *Collaborating for Success? Working Together in the Coquitlam Watershed*. (Vancouver: University of British Columbia Press, 2001).

19. Koop, *History of the Coquitlam Watershed*, 8.

20. Ibid.

21. Ibid.

22. Ibid.

23. Ibid.

24. Stadfeld, *Electric Space*, 96.

## Growing City

According to historian Will Koop, the Vancouver Power Company had always envisioned raising Lake Coquitlam well beyond the original agreement.<sup>25</sup> Only a few years after its completion, the first Coquitlam dam cracked, initiating a severe leak.<sup>26</sup> Worried by legal action if the dam were to break and damage the surrounding municipality, the VPC and its investors successfully lobbied to replace it with a much larger dam.<sup>27</sup> This second phase of the Buntzen development tapped the entire Coquitlam watershed, raising the Lake by sixty feet and flooding over 900 acres of surrounding old growth forest.<sup>28</sup> Following the dam's completion, the existing tunnel beneath Eagle Mountain was enlarged, allowing triple the flow to Lake Buntzen.<sup>29</sup> In a final move, the existing powerhouse, LB1, on Indian Arm was expanded and a completely new powerhouse and intakehouse, known as LB2, was built.<sup>30</sup> Designed by architect Francis Rattenbury, LB2 features a robust and elegant powerhouse built on the arm and a smaller intake house on the lake; submerged like a tower in water. Underground, a concrete-lined hydraulic tunnel and penstocks connect these two buildings.



British Columbia Electric Railway Company's Clay Model of the Lake Coquitlam Diversion, Lake Buntzen Intake House, and Indian Arm Power Houses; Photograph from City of Vancouver Archives.



Tunnel Construction Camp 1903; Photograph from City of Vancouver Archives.

25. Koop, *History of the Coquitlam Watershed*, 12.

26. *Ibid.*

27. *Ibid.*

28. *Ibid.*

29. *Ibid.*

30. *Ibid.*



**1898**  
Tunnel Camp.



**1903**  
LB1 Complete.



**1906**  
LB2 Complete.



**1950**  
Workers Village.



**1951**  
Automation.

Settlement and Growth: Diagram of Lake Buntzen's Industrial Evolution.

## Water and Vancouver

Since Lake Buntzen's creation in 1903, North America has discovered the profound environmental consequences involved with building dams, flooding lands, and tampering with rivers.<sup>31</sup> Over a century later, as Vancouver's watersheds wrestle climate change and the consequences of limited snowpack, environmental degradation, lack of spring rains, increasingly hot, dry weather, and unprecedented municipal withdrawal, there is need to rethink municipal water management.<sup>32</sup> Today, BC Hydro has inherited an antiquated license allowing them 94 percent of Lake Coquitlam's water flow; the rest is for Greater Vancouver's growing population.<sup>33</sup> Moving forward, the city will no longer be able to divert billions of gallons of its watershed into the ocean while simultaneously providing water for a booming population over the next century.<sup>34</sup> On the one hand, BC Hydro is interested in producing power, on the other, the Greater Vancouver Regional District desires a secure drinking water supply. Today, the Coquitlam Reservoir is one of the three sources of drinking water for the Lower Mainland, containing the clearest water and highest regeneration rate.<sup>35</sup> Despite this fact, the Coquitlam watershed supplies the least amount of water due to a historically controversial water license.<sup>36</sup> Recently, the Greater Vancouver Regional District has proposed to purchase all the water rights from B.C. Hydro.<sup>37</sup> According to local historian Will Koop, the 'question over whom, historically, legally owns the watershed has lead many to argue that GVRD should not have to pay B.C. Hydro at all'.<sup>38</sup>

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31. Koop, *History of the Coquitlam Watershed*, 4.

32. Nikolic. *Collaborating for Success*, 33.

33. Ibid.

34. Ibid.

35. Koop, *History of the Coquitlam Watershed*, 24.

36. Ibid.

37. Ibid.

38. Ibid.

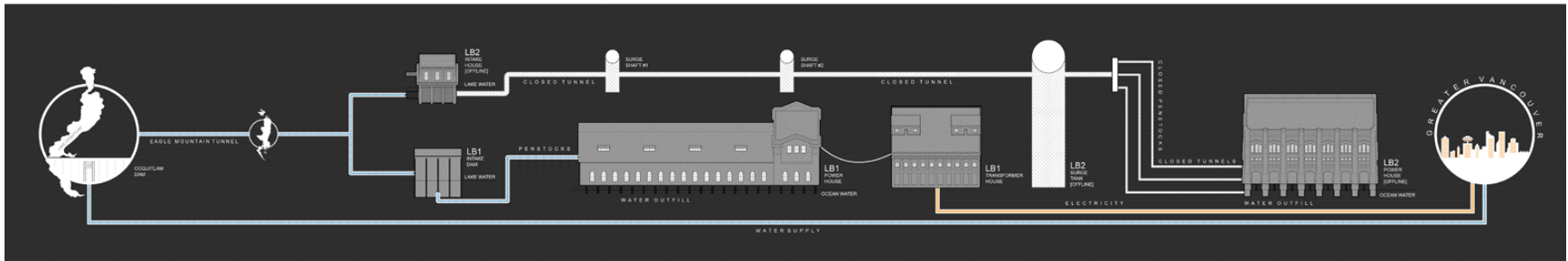


Diagram of the hydroelectric network at Lake Buntzen.



## Contemporary State of Facilities

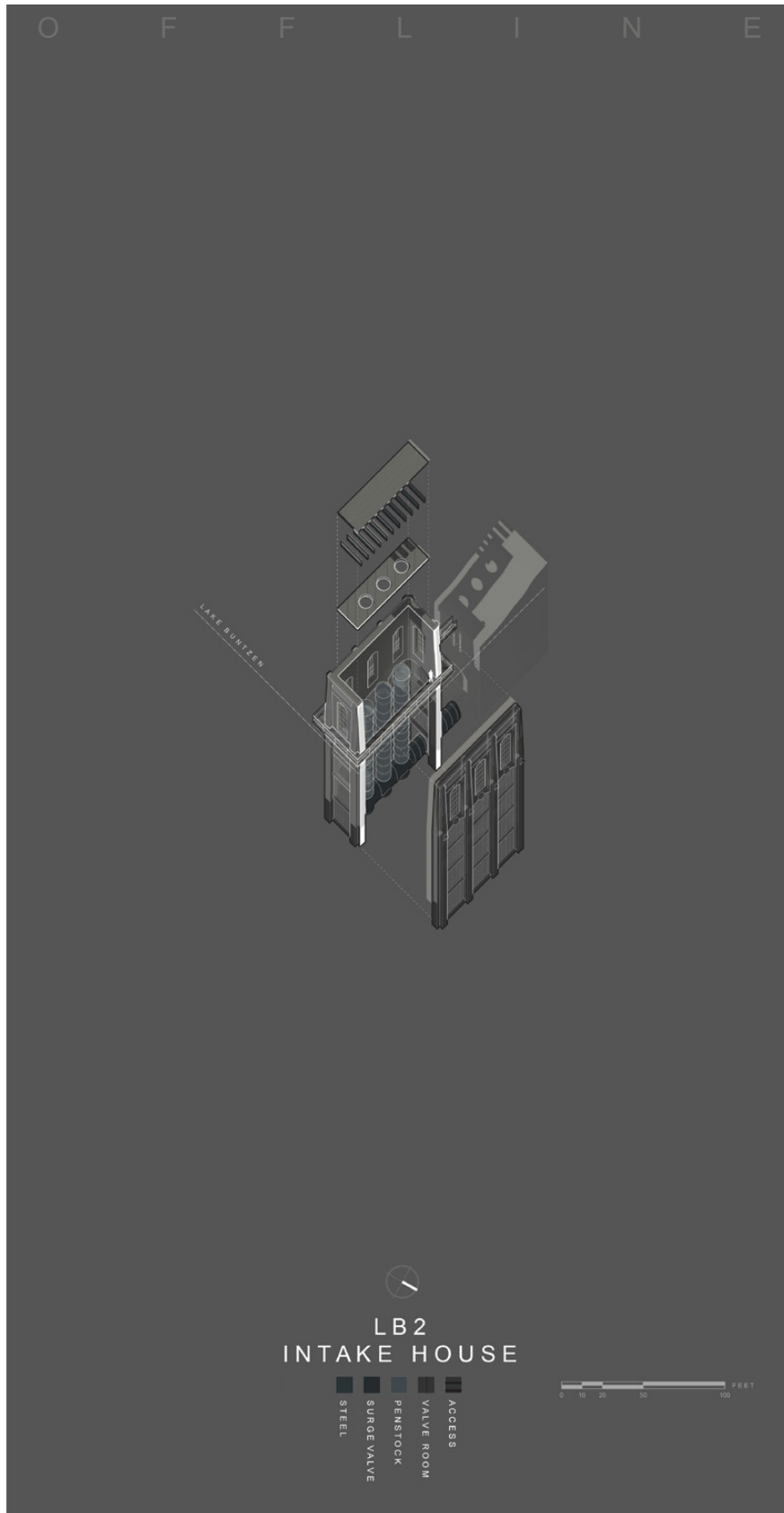
In 1906, the Buntzen Generating Facility supplied 98 percent of GVRD's electricity.<sup>39</sup> Today, it supplies less than 0.4 percent of BC Hydro's generating capacity.<sup>40</sup> Whether active or decommissioned, these structures tell the story of British Columbia's Neotechnical transformation. In recent years, BC Hydro decided that half of Buntzen's structures have met the requirements for end of service. Although much of the infrastructure remains intact, costly upgrades combined with watershed negotiations with GVRD have forced LB2 into retirement. Today, the LB2 Powerhouse and Gatehouse are offline, deactivated, and abandoned with growing talk that LB1 is soon to follow. Despite their legacy, it appears BC Hydro no longer considers these industrial titans adept for large-scale commercial energy production.

Lake Buntzen #2's deactivation has sparked a variety of positions regarding how to approach this aging site. Some argue the immense historical investments made in the past justify future upgrades. Others argue the surging value of water security will inevitably decommission the entire site. While the deactivation of LB2 was in part political, this thesis defends it represents a broader social paradigm shift reflecting new attitudes towards water management and collaborative environmental stewardship. None-the-less, it remains remarkable that with over one hundred years in service, this engineering marvel still produces inexpensive, sustainable electricity. As such, it is important to envision a future that celebrates this legacy and investment, while also creating new programmatic opportunities for the surrounding parkland and communities. As a result, this thesis accepts the reality of the situation that exists today and proposes a project scope that is limited to LB2's infrastructure, while keeping LB1 online. Currently, LB2 is deactivated, abandoned and in desperate need of a new life. Though not intended for people, these adaptable structures have tremendous potential for new forms of occupancy and renewable energy production. These forbidden spaces present a powerful opportunity to rethink our relationship to purpose built structures while creating unique programmatic opportunities for the park these facilities helped forge.

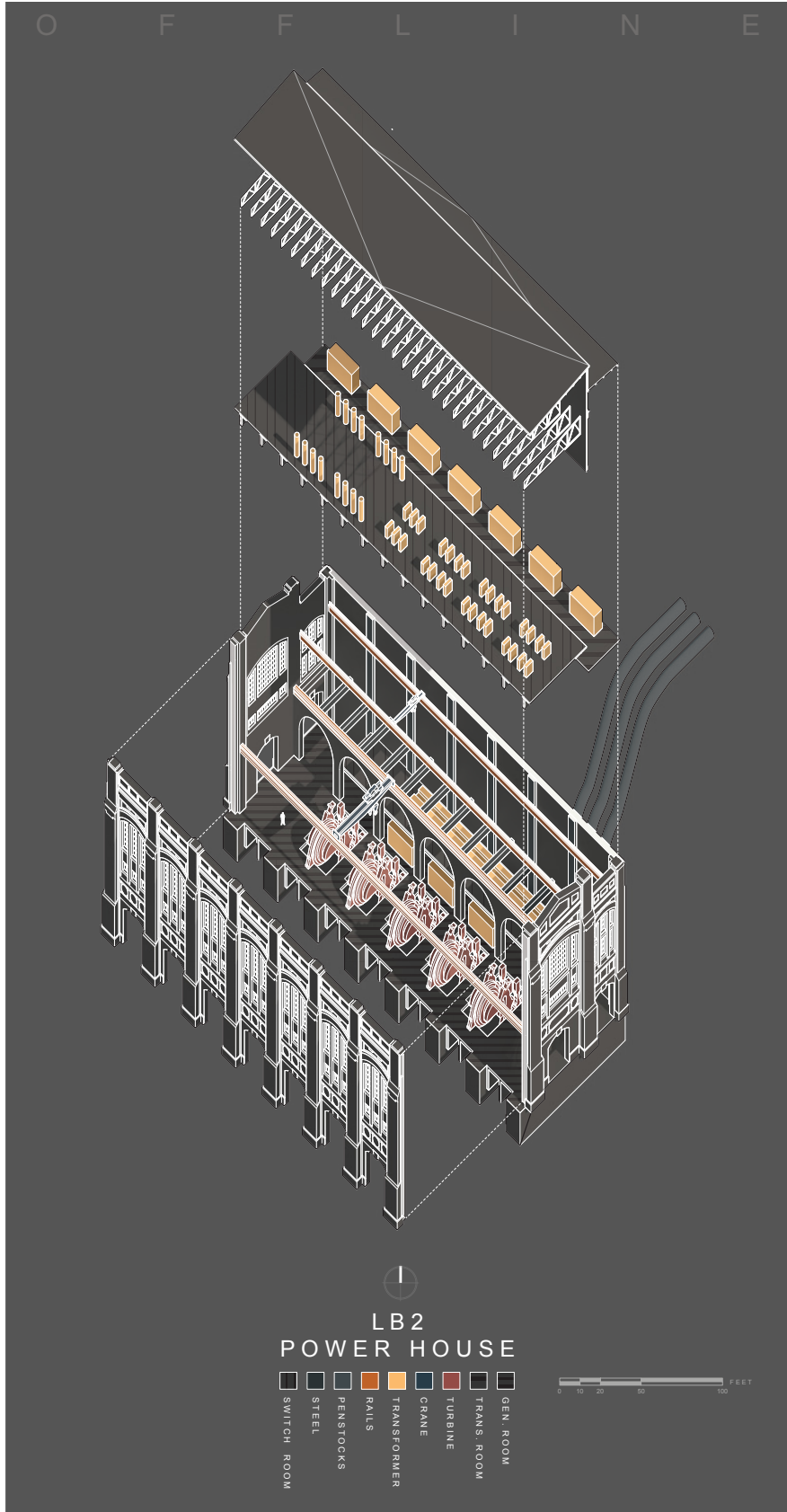
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39. Koop, *History of the Coquitlam Watershed*, 12.

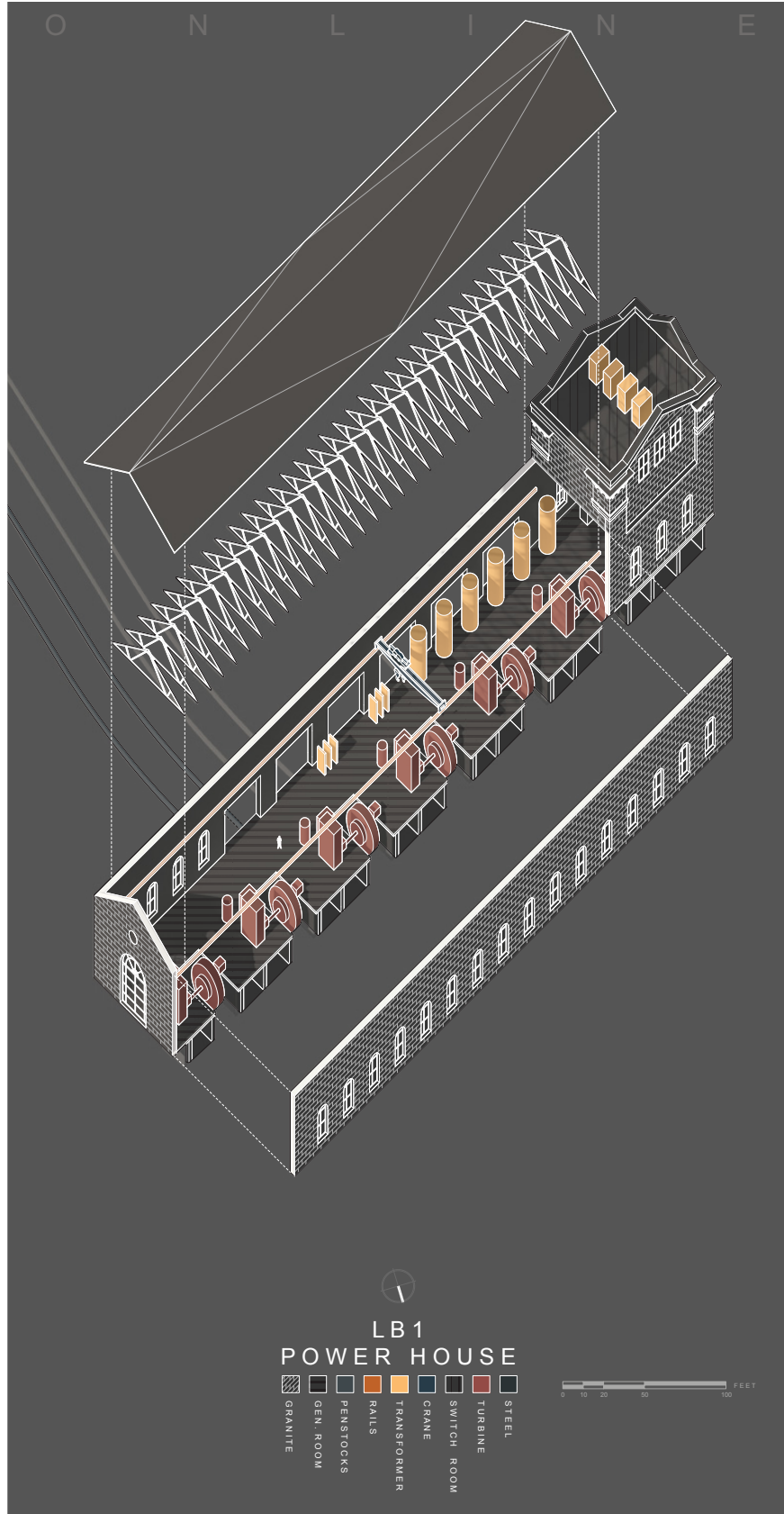
40. Ibid.



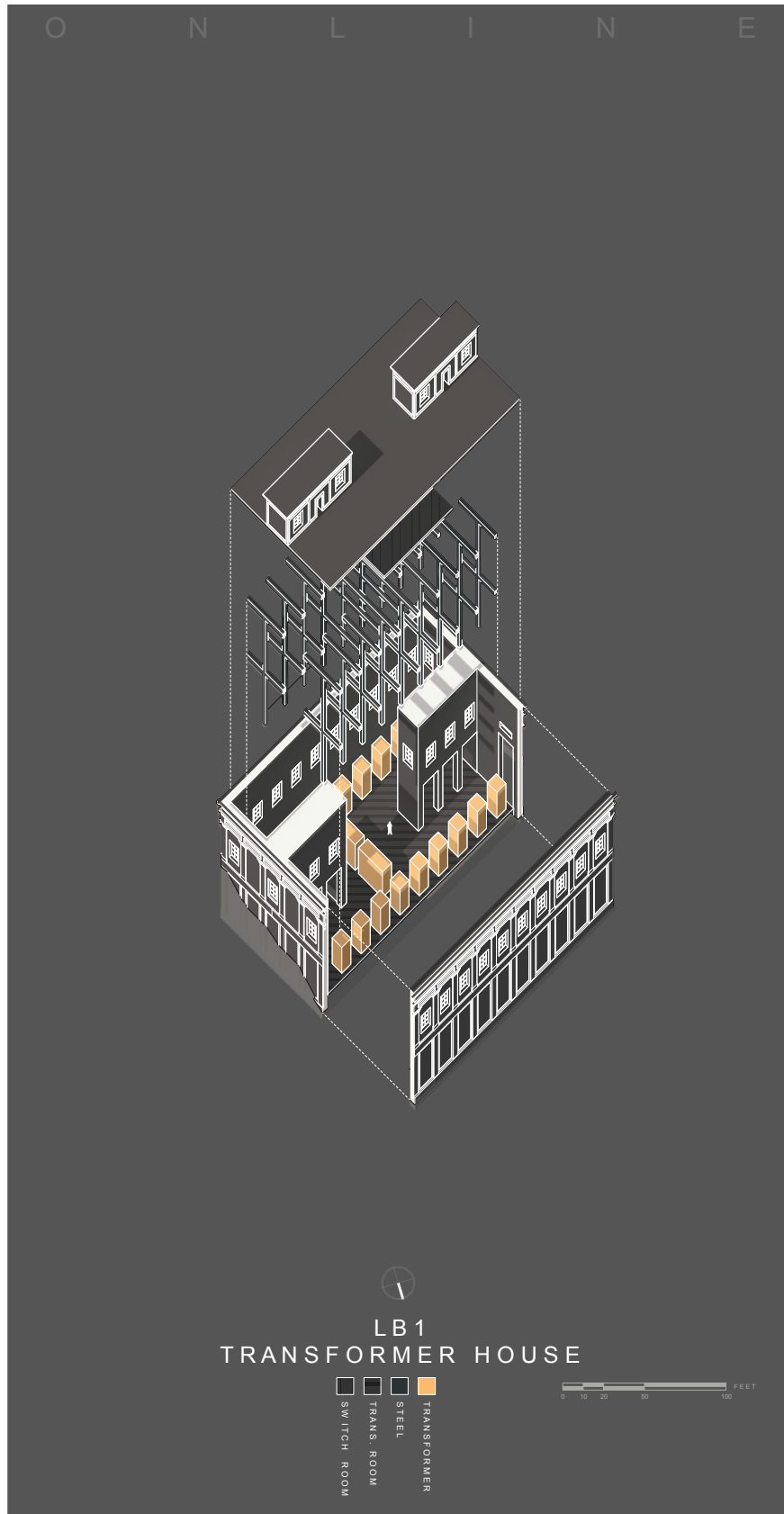
Existing LB2 Intake House.



Existing LB2 Power House.



Existing LB1 Power House.



Existing LB1 Transformer House.

## Parkland and Watershed

For over a century, the Buntzen Hydro project has held a symbiotic relationship with the surrounding parkland and watershed. Although the project was environmentally destructive, a ‘debt of gratitude is owed to BC Hydro’s predecessor, the British Columbia Railroad Company (BCERC), for having the courage and wisdom to set aside and protect the Coquitlam watershed forests’.<sup>41</sup> In the words of Will Koop,

Not only did BCERC’s self interest ensure future generations a fully functioning and pristine watershed for the public’s water supply, they also left us a sanctuary for our heritage, one of the only remaining portions of the Lower Mainland’s magnificent old growth forests.<sup>42</sup>

Since 1971, the area surrounding the Buntzen Generating facilities has officially been recognized as a conservation park in order to protect the shores an 18-kilometer fjord that extends north from Burrard inlet in Vancouver.<sup>43</sup> This park plays an important role in the BC Parks system as it provides a variety of recreational opportunities for residents and visitors alike. The salt waters of Indian Arm are ideal for motor boating, kayaking, canoeing, fishing, and scuba diving.<sup>44</sup> The fresh waters of Buntzen Lake and the beach areas along the shorelines provide opportunities for backcountry camping, picnicking and other day-use activities.<sup>45</sup> The majestic old-growth forested mountains and trails provide unique opportunities for hiking and viewing, including an infamous multi-day trail designed by engineer and trail building legend Don McPherson – creator of the Grouse Grind, a trail, which draws over 150,000 visitors annually.<sup>46</sup> Considering the important legacy between Buntzen’s generating facility and surrounding parkland, future development should respect and enhance this relationship.

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41. Koop, *History of the Coquitlam Watershed*, 24.

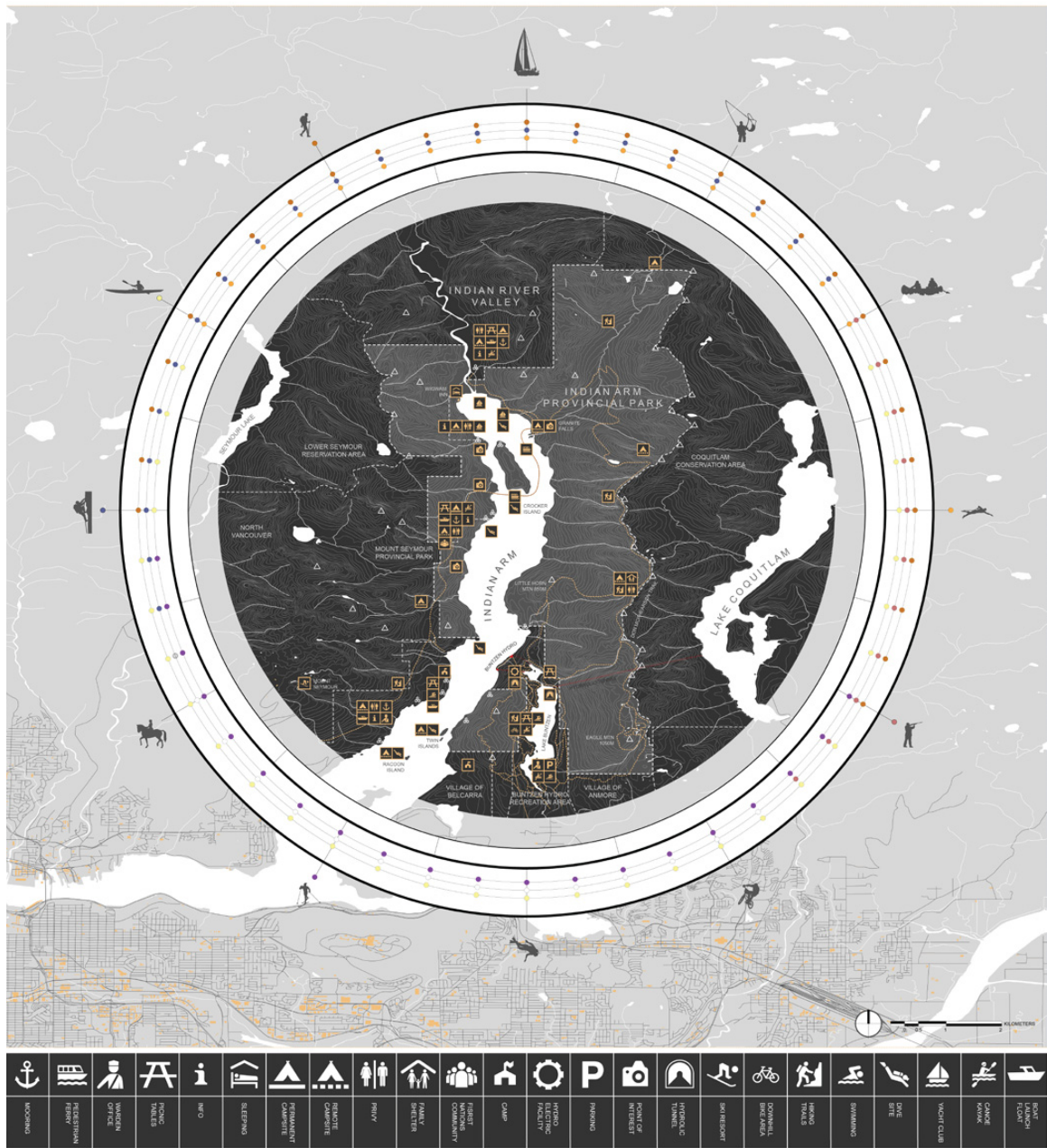
42. Ibid.

43. Environment Ministry of BC. *BC Parks Public Consultations Notifications RSS*. (Province of British Columbia: March, 2017).

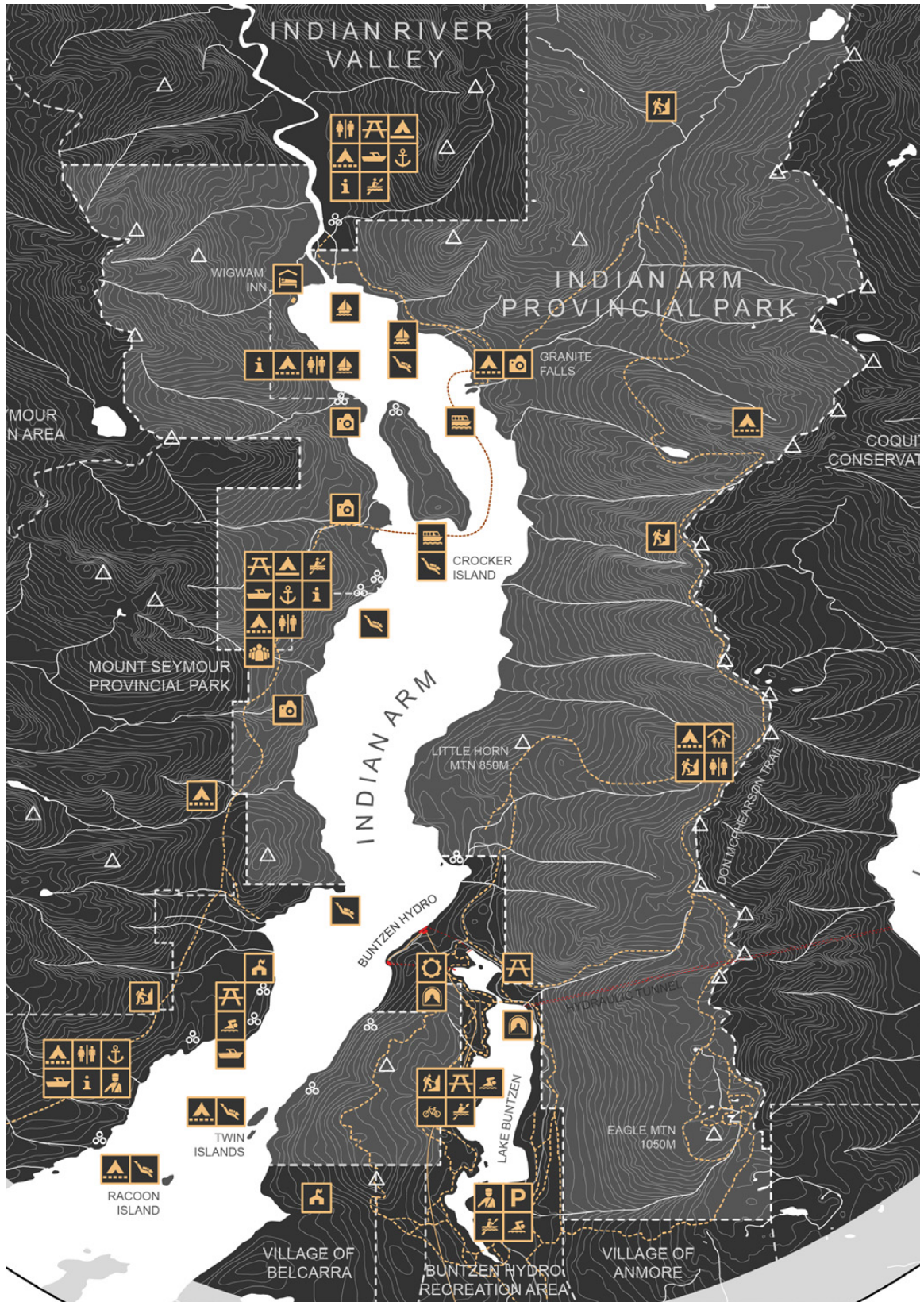
44. Ibid.

45. Ibid.

46. Ibid.

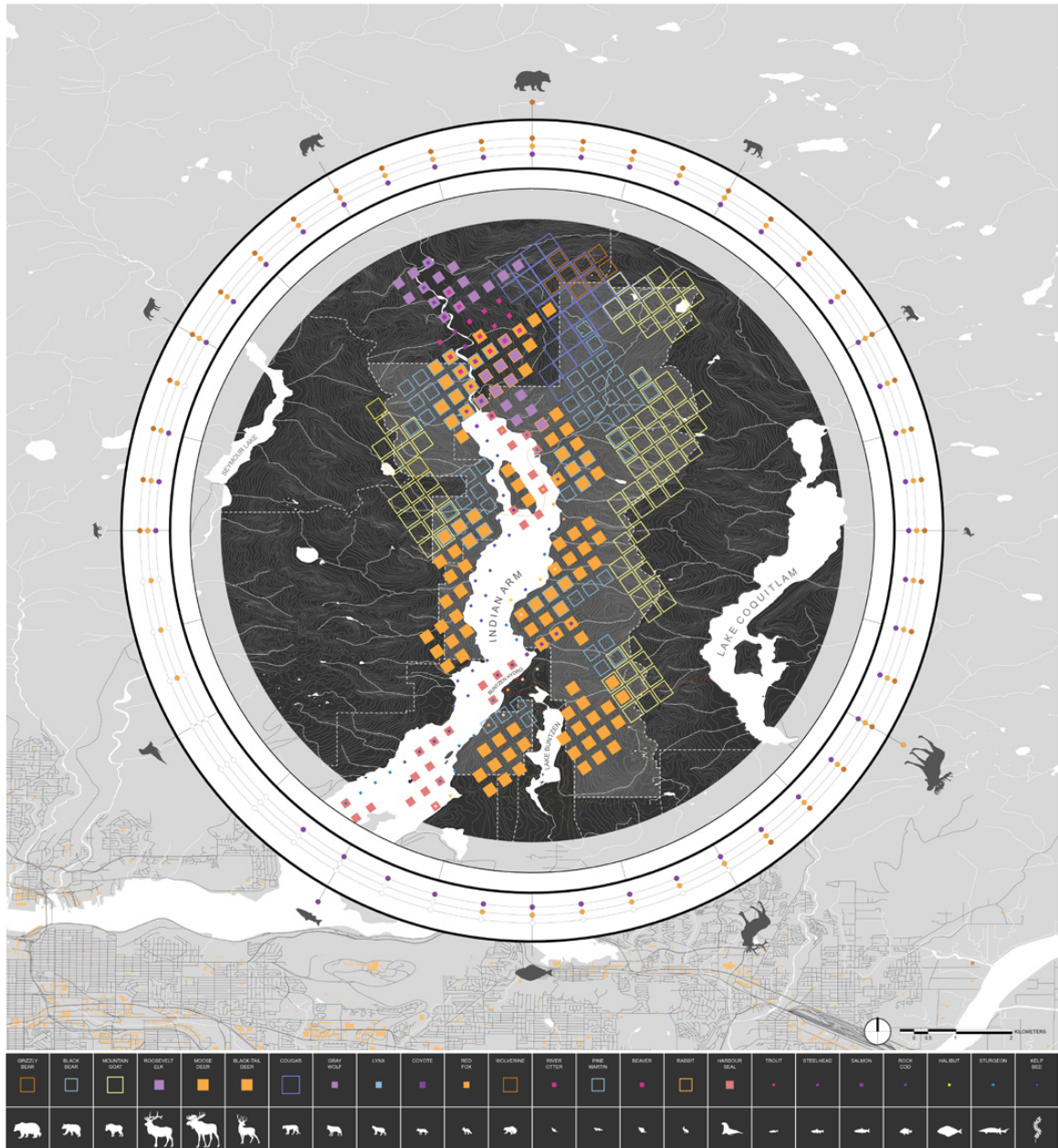


Program Map of Indian Arm Provincial Park (GeoBC, BC Parks and Say Nuth Khaw Yum/Indian Arm Provincial Park Management Plan, 2010).

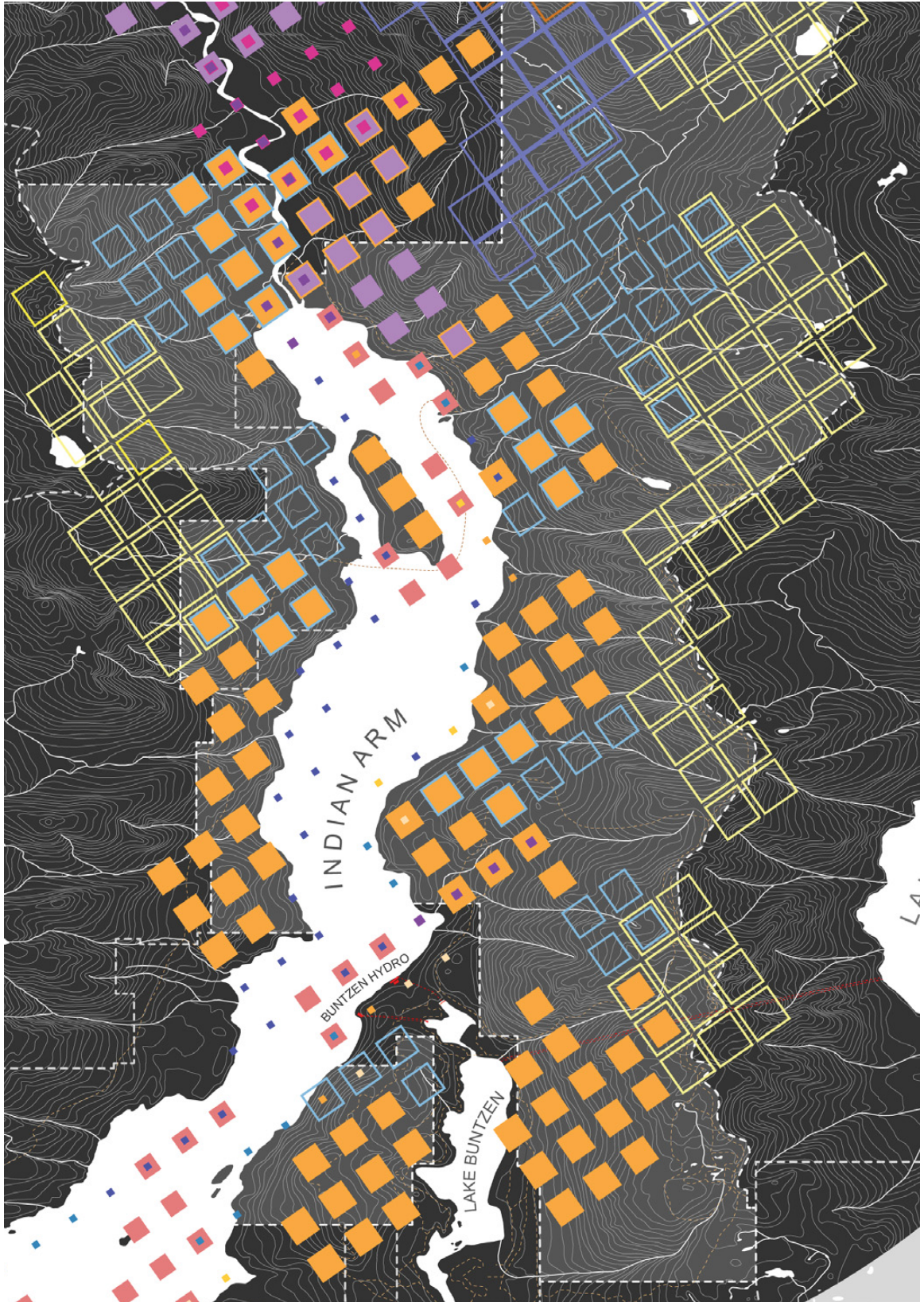


Program Map of Indian Arm Provincial Park (GeoBC, BC Parks and Say Nuth Khaw Yum/Indian Arm Provincial Park Management Plan, 2010).

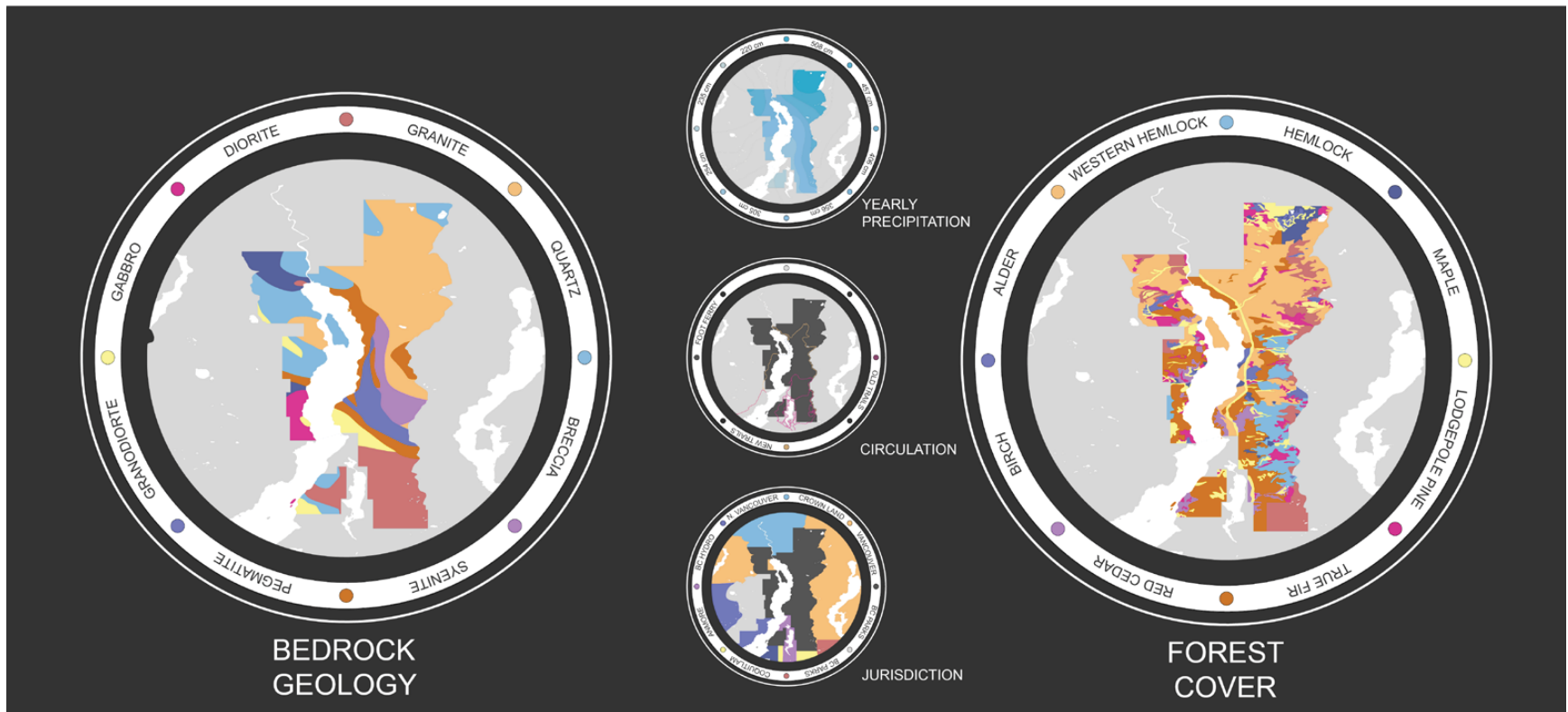




Animal Taxonomy of Indian Arm Provincial Park (GeoBC, BC Parks and Say Nuth Khaw Yum/ Indian Arm Provincial Park Management Plan, 2010).



Animal Taxonomy of Indian Arm Provincial Park (GeoBC, BC Parks and Say Nuth Khaw Yum/ Indian Arm Provincial Park Management Plan, 2010).



Taxonomy of Indian Arm Provincial Park (GeoBC, BC Parks and Say Nuth Khaw Yum / Indian Arm Provincial Park Management Plan, 2010).

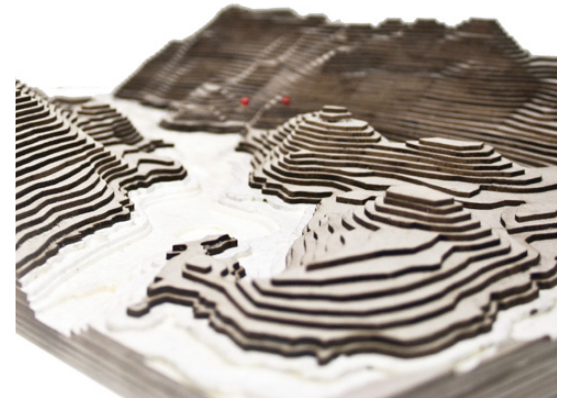
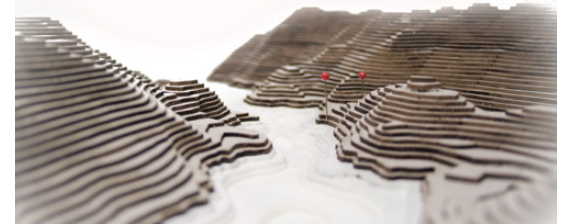
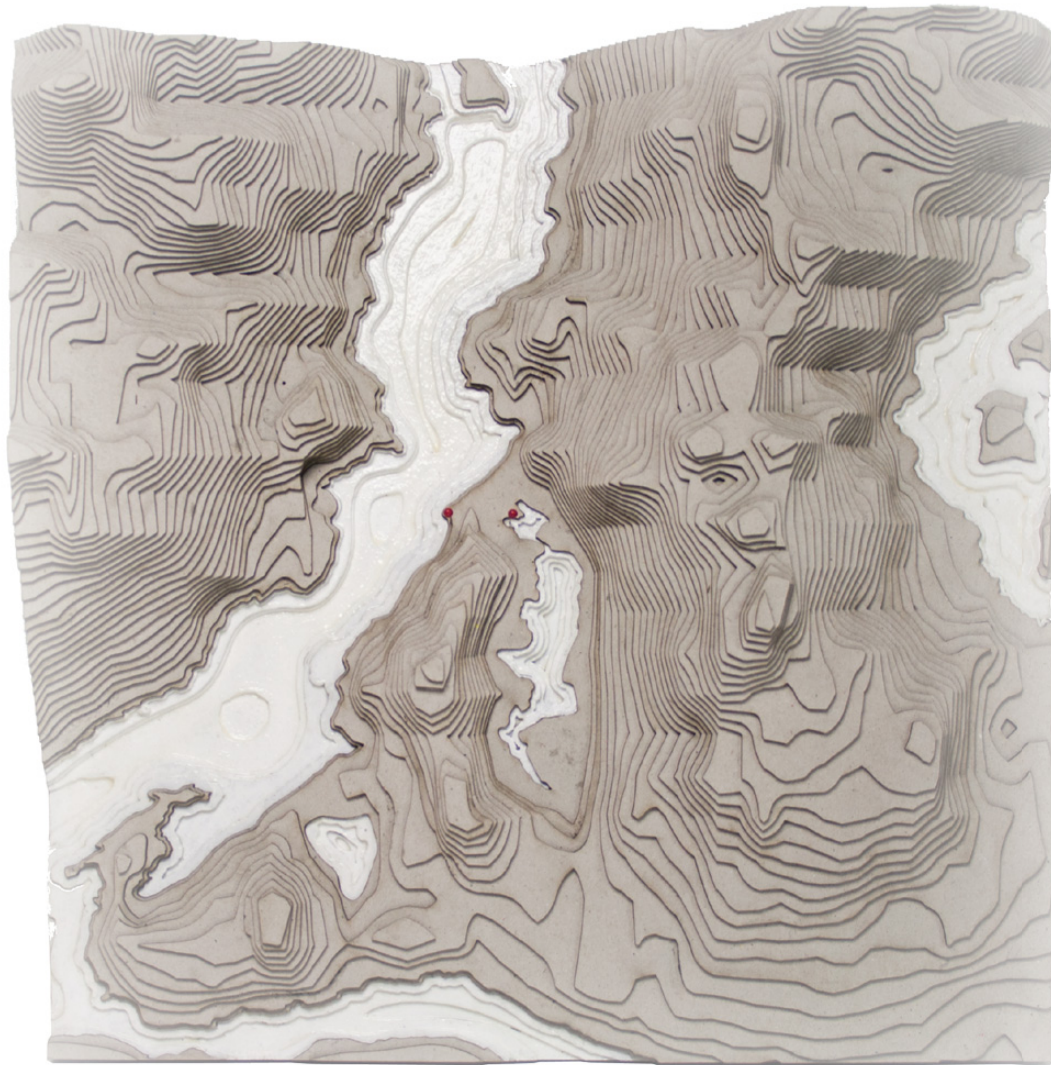
## CHAPTER 3: OPPORTUNITY, STRATEGY, ANALYSIS

### Anatomy of Terrain

Indian Arm was once heavily glaciated, leaving behind a spectacular landscape of rugged, forested mountains, alpine lakes, creeks and waterfalls.<sup>47</sup> As a result, the topography surrounding Buntzen is remarkably steep, forcing Buntzen's architects and engineers to forge unique relationships between building, land and water. Considering these relationships, the proposed adaptive reuse strategy for LB2's powerhouse, gatehouse, and hydraulic tunnel must consider how to harness this dynamic link. Identifying the physical and spatial arrangements between this architectural trilogy will allow architects to couple the programmatic needs of the park with the unique landscape qualities inherent in these infrastructural pieces. For example, the powerhouse sits on a rocky shore occupying a small in-filled slip at the edge of a steep cliff. Perched between ocean and mountain, this powerhouse has a unique relationship to both salt water -- whose high tides flood beneath the building -- and abundant fresh water, which is gravity-fed from Buntzen Lake. Meaningful program development in this building should therefore leverage this powerful aquatic intersection. Travelling up the penstocks, the abandoned hydraulic tunnel offers a unique and powerful opportunity to occupy the interior of a mountain. This thirty-two foot diameter, concrete-lined surge tank near the exit of the hydraulic tunnel presents a rare and unique opportunity to inhabit a connection between earth and sky, light and dark. On the lake, the gatehouse exists as a tower submerged in water. This body of water exists within the building as it rises and falls throughout the seasons. Given the unique landscape characteristics of an aquatic tower, the proposed adaptive-reuse strategy must emphasize the wild water that exists within the building. In order to create meaningful adaptive reuse strategy for these infrastructural workhorses that amplifies park experience and place specificity, we must look towards and celebrate the powerful landscape qualities that exists today.

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47. Environment Ministry of BC. *BC Parks*, 2017.



Topographic Model of Lake Buntzen, Lake Coquitlam and Indian Arm: Pins Locate LB2 Powerhouse and Intake House.

## Anatomy of Structure

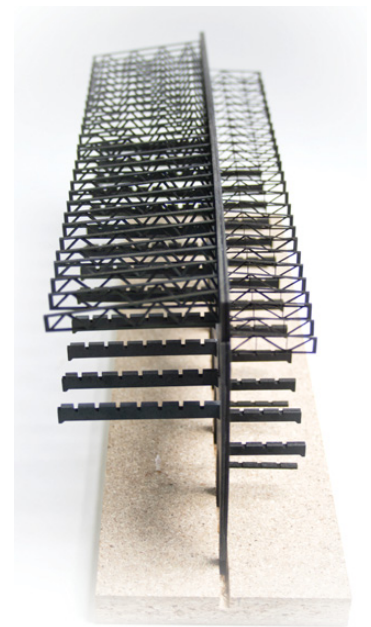
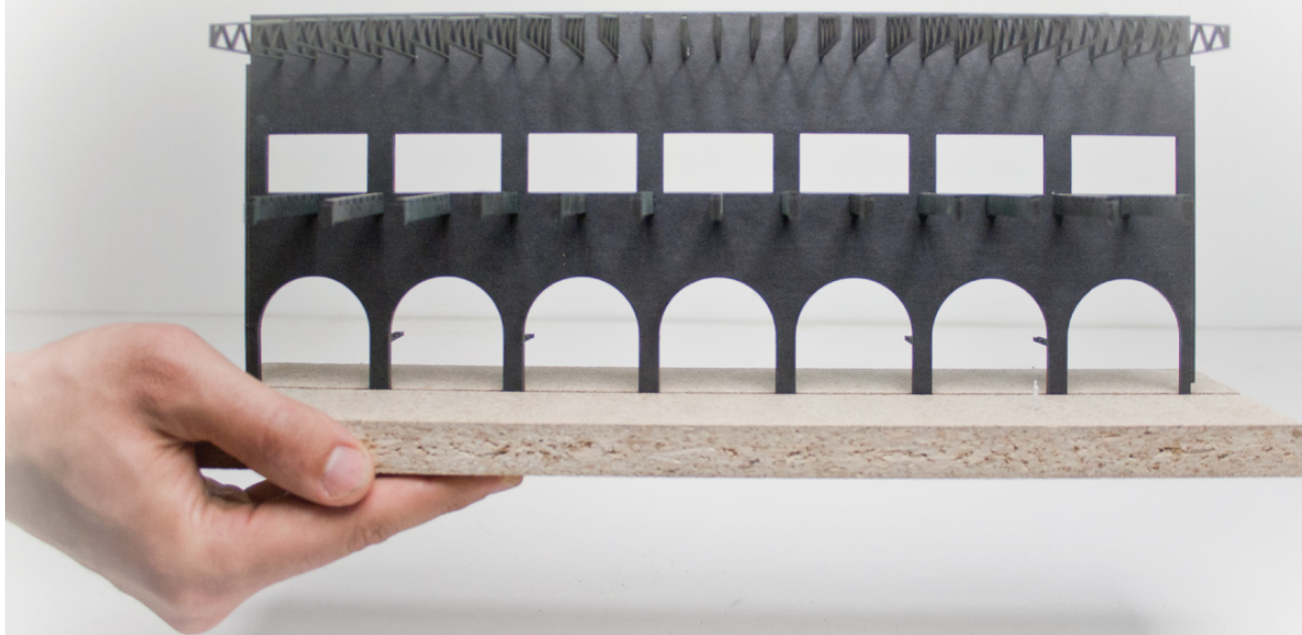
I personally like the structure of engineered buildings. Where you have the feeling there is no architect. Only a civil engineer who has made a very logical sort of structure, which I admire because they have a lot of strength.<sup>48</sup>

The network at Buntzen is significant not only for its spectacular landscapes, but also for the unique industrial structures housed inside these buildings. As a result, the proposed adaptive reuse strategy must not only consider qualities of landscape, but also understand how to leverage the unique structural anatomy of these industrial titans. Although the gothic-like facades of Buntzen are important to character, it is their anatomy of structure that truly defines essence. By preserving the essence of these industrial structures, designers are able to couple these beautiful and historically powerful architectural spaces contained inside with new programmatic opportunities for the surrounding parkland.

This thesis proposes strategies that shift the aging power-generating infrastructure of LB2 from a utilitarian entity into catalytic prototype that inspires a new relationship between the society, nature and obsolete hydroelectric landscapes. Now offline, the collective memory of how this facility shaped an authentic sense of place identity is retained through preserving their structural essence and by establishing a dialogue between old and new. By cutting away targeted portions of the structure and inserting new wood, steel, and glass interventions, these spaces offer a powerful opportunity to leverage the strength of the existing structure while creating new modes of occupation that are strangely familiar, yet entirely new.

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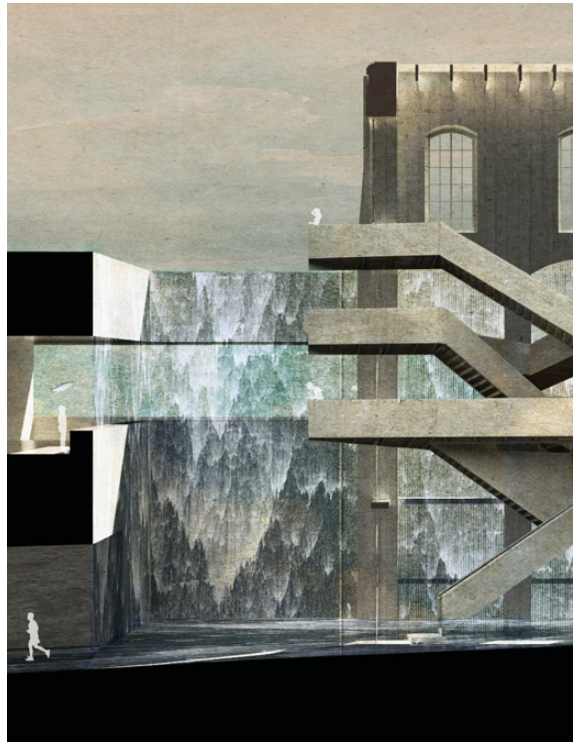
48. Peter Zumthor, *Thinking Architecture* (Basel: Birkhauser, 2010).



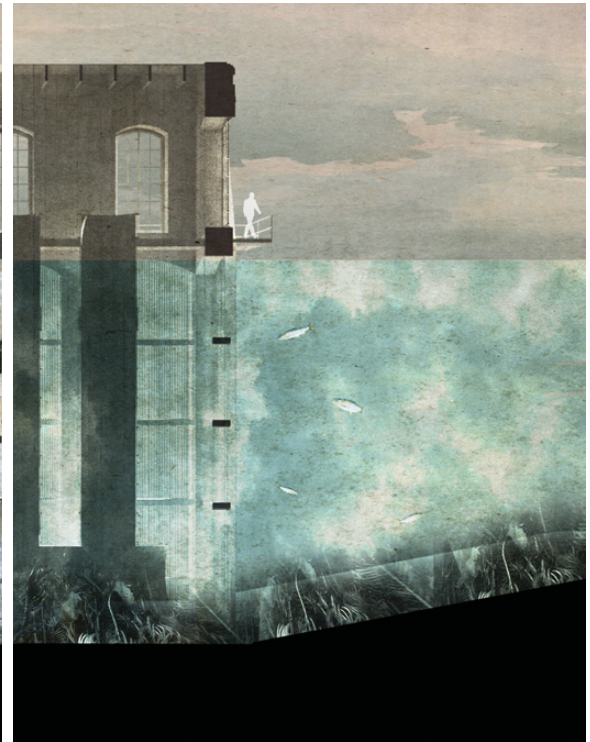
LB2 Power House: Spatial Studies of Existing Structure.



Floating Floor.



Exposed Weathering.



Existing Condition.

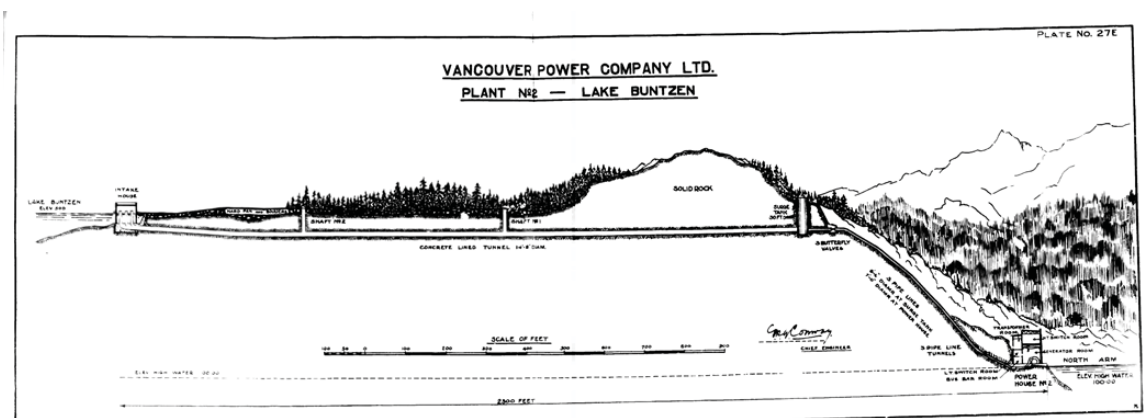
Adaptive Reuse Strategy: Explorations of the Aquatic Conditions.



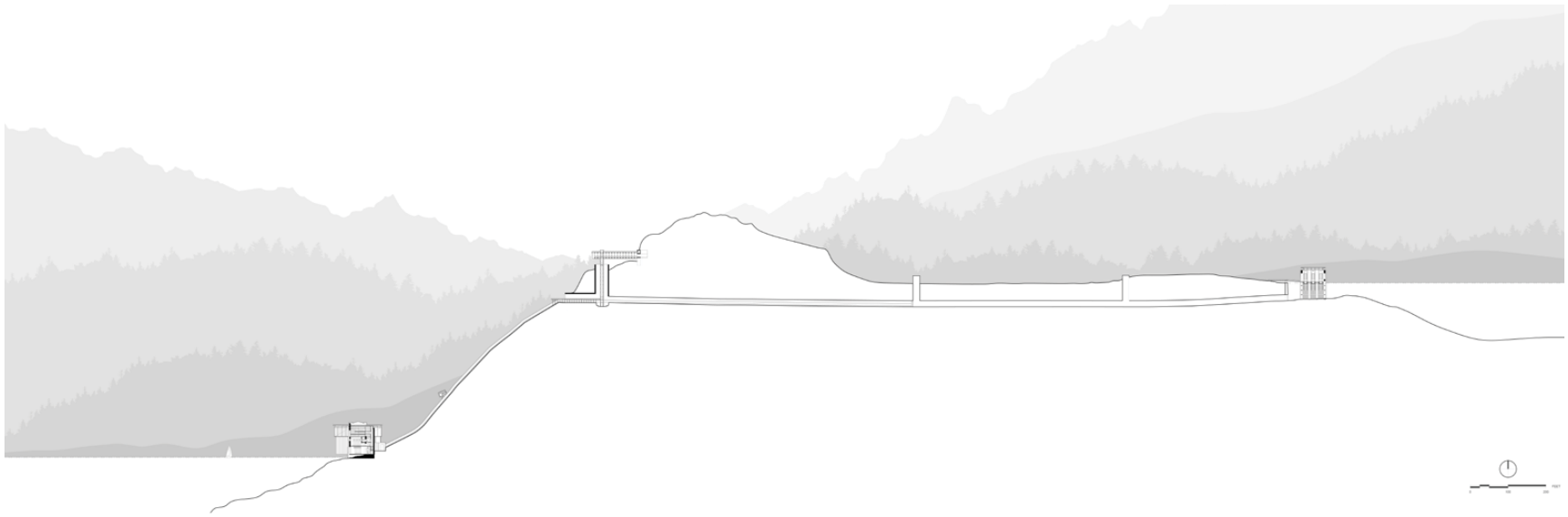
## Strategy

My architectural strategy is to preserve the unique structural anatomy of these buildings in order to juxtapose them with new, light architecture interventions that utilize their infrastructure qualities while illuminating rare and unique spaces. While the gothic-like facades are beautiful, these deteriorated, expensive and high-maintenance skins should be allowed to weather naturally. In preserving the structural anatomy of these unique hydroelectric structures, we preserve their character -- regardless of facades. Viewing these structures as capsules, my intention was to graft light, steel structures with soft, wooden inserts to give warmth and a human scale inside these concrete giants. These interventions contrast the existing while re-orienting users to the unique relationships each has to land and water.

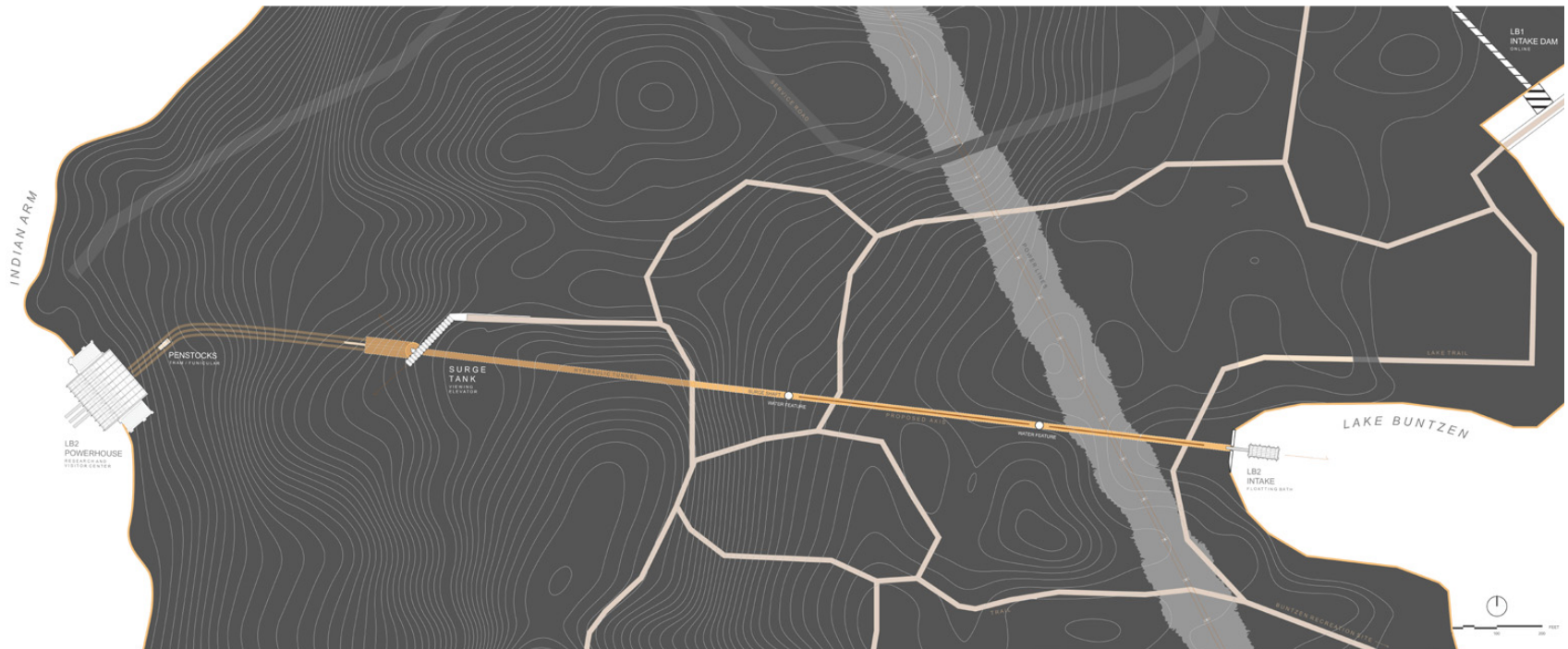
Although these structures are connected underground, experientially, they appear isolated and disconnected. My site strategy is to invert the existing network. Instead of taking water from the lake, through the mountain, to the ocean -- I want to guide people through a series of thresholds -- from the ocean, up the penstocks, through the mountain, and to the lake. An experience that is both linear and fragmented. My goal is to pair the unique qualities of these devices with the programmatic needs of their surroundings, amplifying park experience and place specificity.



Section of the LB2 Network; drawing by G. R. G. Conway; from Coquitlam-Buntzen Hydro Electric Development Report (1915).



LB2 Hydroelectric Network: Site Proposal as Series of Thresholds.



LB2 Hydroelectric Network: Site Proposal as Series of Thresholds (GeoBC).

## CHAPTER 4: DESIGN

### Phase 1: Building as Catalyst

The first phase of development transforms the LB2 powerhouse by adaptively re-using it into a hybrid building that serves both as a gateway for Indian Arm Provincial Park and a research facility for the University of British Columbia and BC Hydro. Programmatically, this building will serve as an interpretive center for the Park that simultaneously houses a micro-algal biofuel research facility. By integrating these two programs, this building will serve as a catalyst for new programmatic development throughout the park while preserving the site's legacy of sustainable energy production. Located at the bottom of a mountain, the powerhouse once produced electricity by extracting water from Lake Buntzen to spin its turbines 500 feet below. Now, this site serves as a maritime arrival point for visitors to enter the park at sea level, through the same place where water once exited.

Structurally, I believe the existing powerhouse could support the added weight of a new industrial structure. In recent years, microalgae as an alternative liquid fuel has generated tremendous investment and excitement throughout the world. I believe the robust south-facing structure of the powerhouse -- in addition to its access to abundant, gravity-fed fresh water for cultivation, as well as salt water for routine decontamination -- lends itself well to a vertical algae growth reactor.<sup>49</sup>

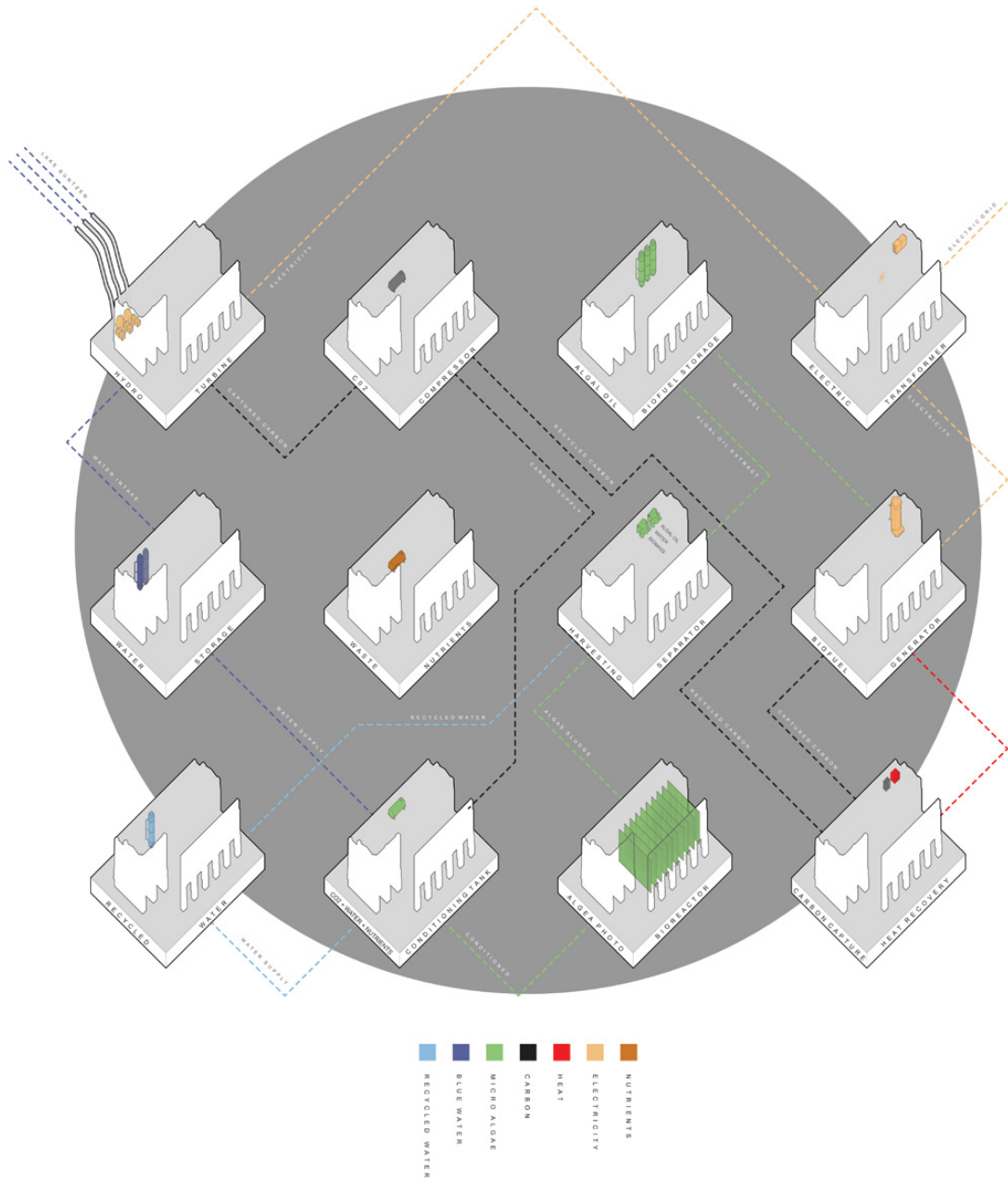
By integrating these two programs, the Powerhouse Research and Visitors center serves as a catalyst for new programmatic development throughout the park -- all the while preserving the site's legacy of sustainable energy production.

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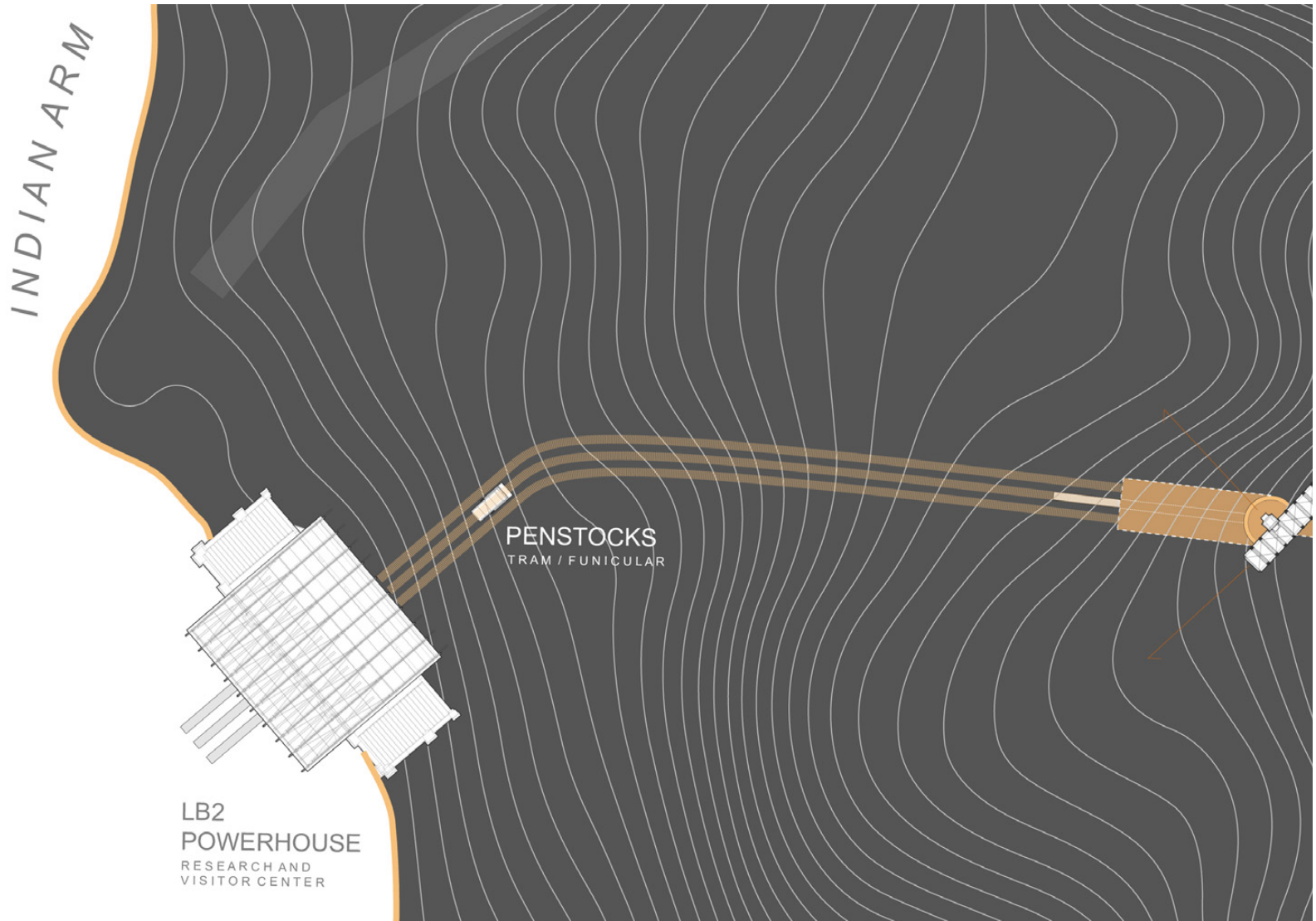
49. Palsson Javanmardian. "High-density Photoautotrophic Algal Cultures: Design, Construction, and Operation of a Novel Photobioreactor System". *Biotechnol, Bioengng* 38, 2012.



Marine Approach to LB2 Powerhouse: Park Visitor's Center and Micro Algal Research Facility; Original Photograph by Oliver Tomas (2009).



Micro-Algal Systems Diagram.



Site Plan of LB2 Powerhouse: Park Visitor's Center and Micro Algal Research Facility (GeoBC).

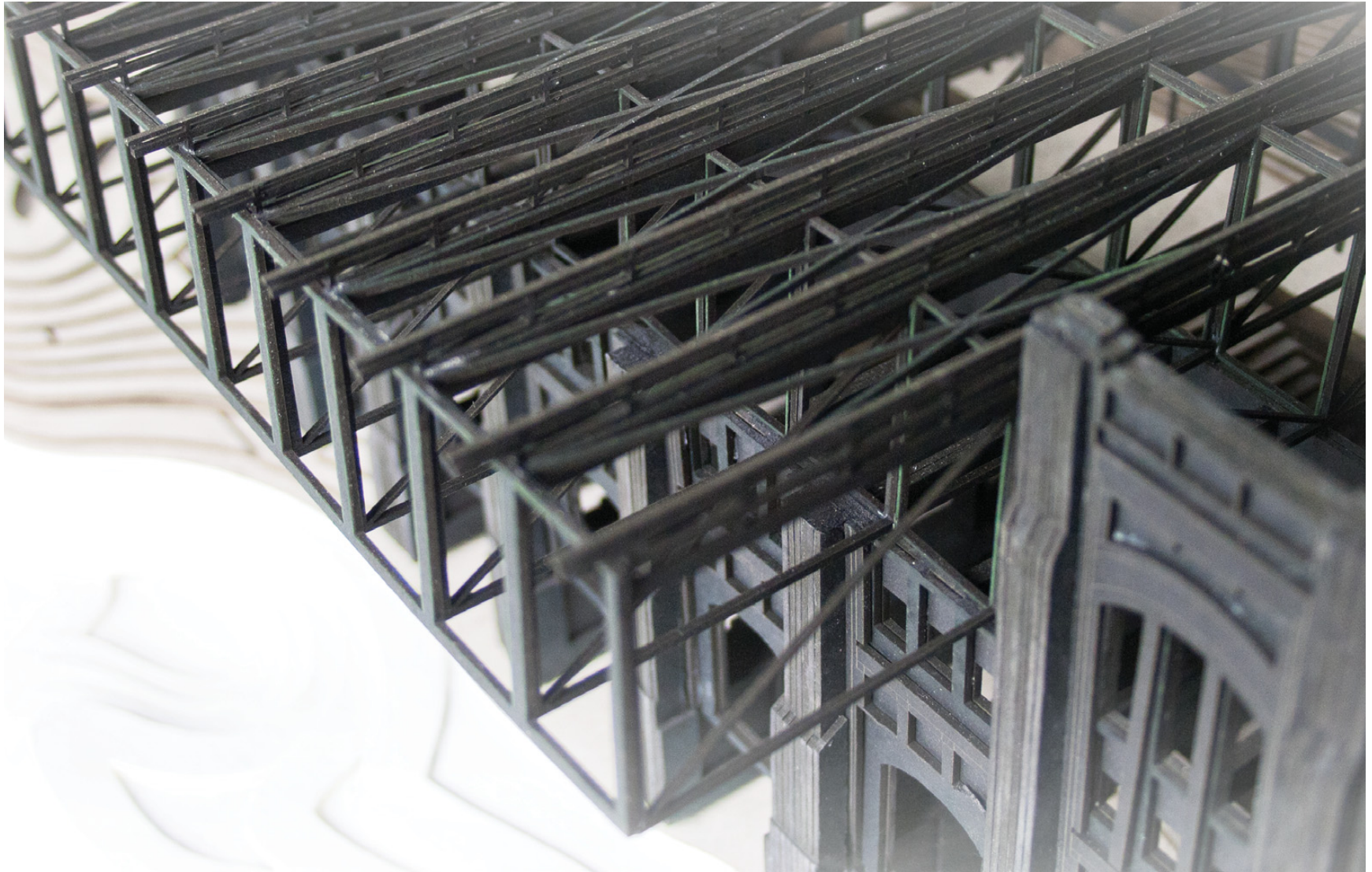


Section of the LB2 Powerhouse: Park Visitor's Center and Micro Algal Research Facility.

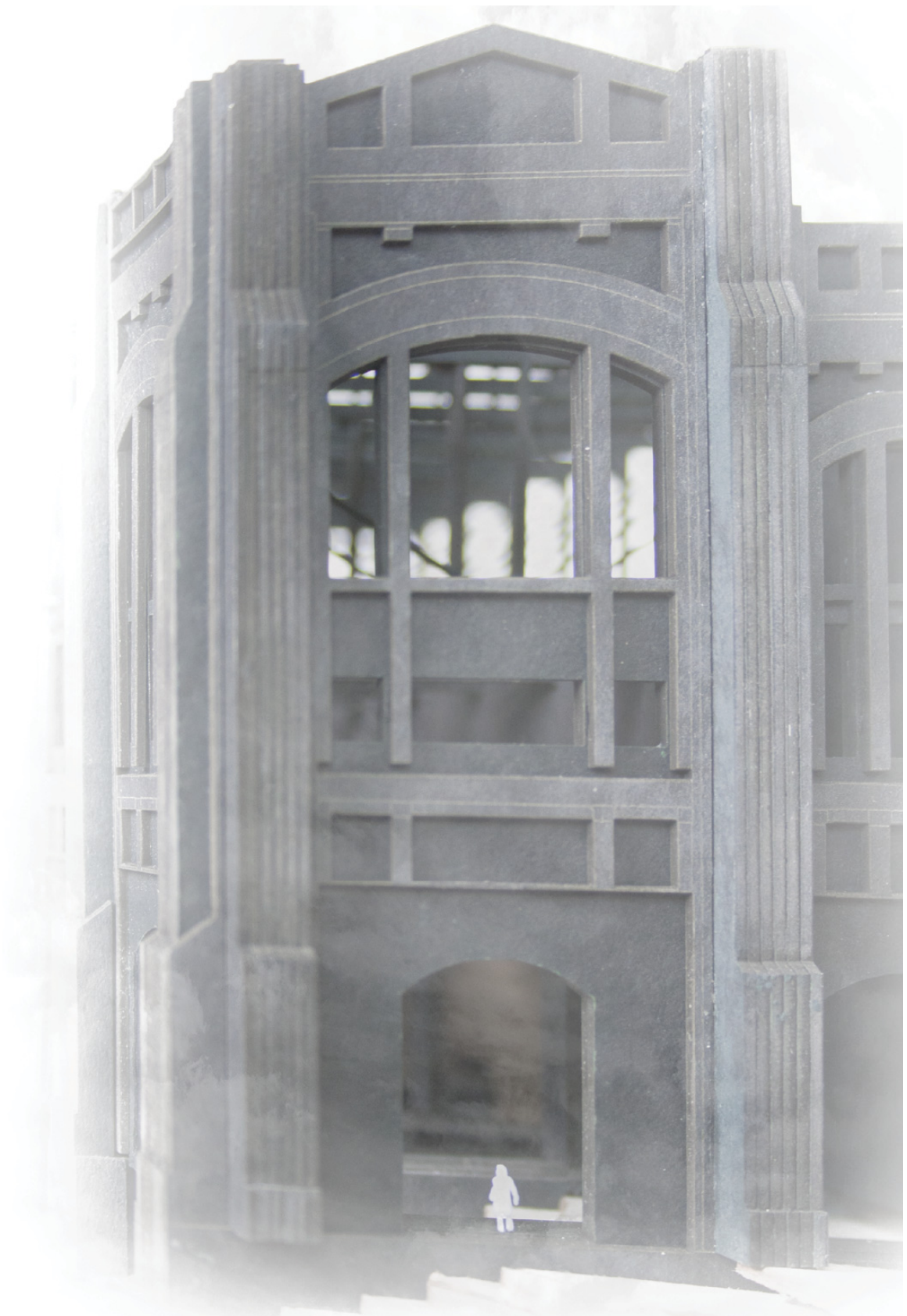




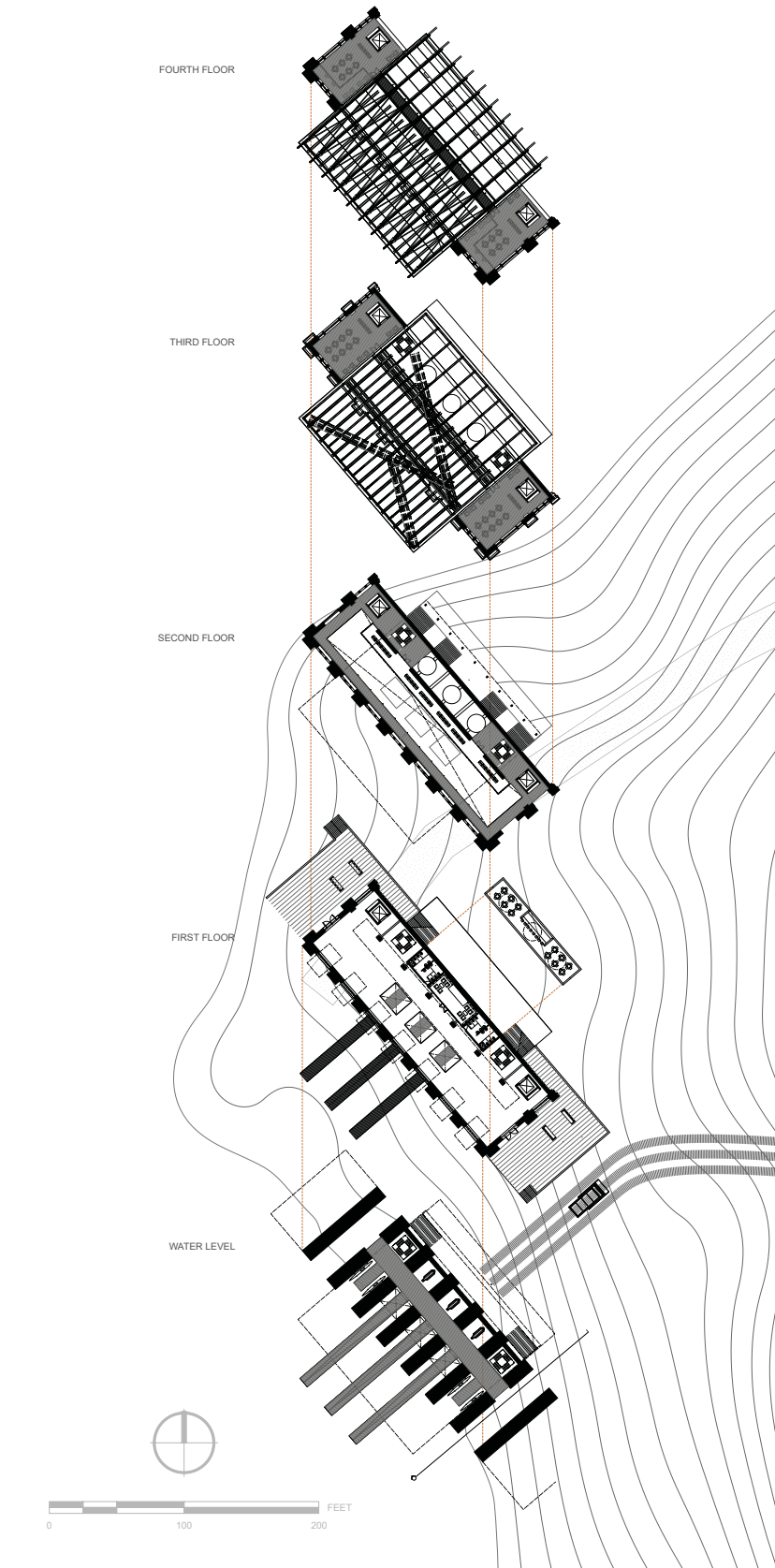
Model of the Proposed Park Visitor's Center and Micro Algal Research Facility.



Model of the Proposed Park Visitor's Center and Micro Algal Research Facility.



Model of the Proposed Park Visitor's Center and Micro Algal Research Facility.



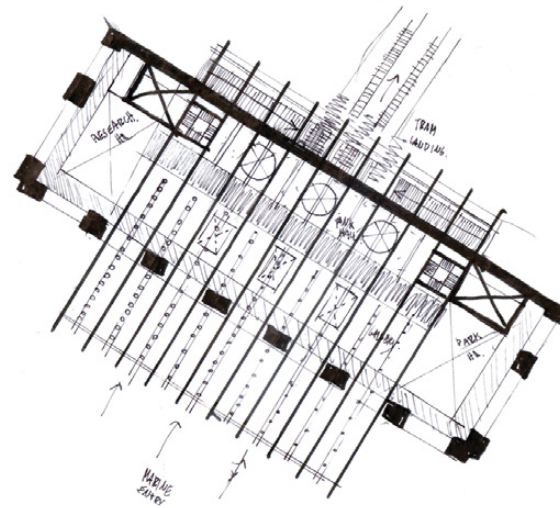
LB2 Park Visitor's Center and Research Facility: Floor Plans.

## Catalyst Narrative

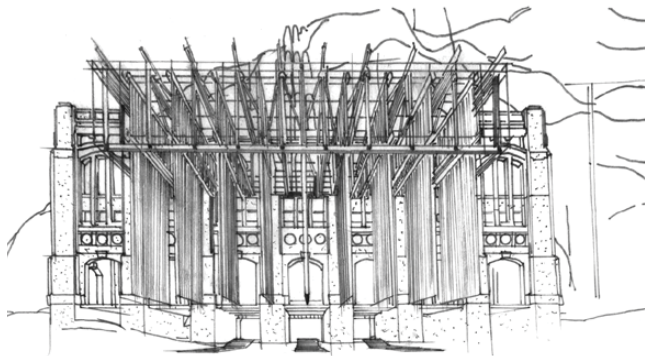
I subtracted part of the original façade and inserted a new cantilevering structure that uses the mountain as its anchor. This cantilever allows the reactor to extend past the original footprint, maximizing sun exposure and creating a dramatic water-level procession into the park. On either side of the subtraction are left two towers. One for park administration and one for the researchers. These anchor programs are clad in wood and glass to create a human scale inside an otherwise hard building. These insertions are connected together by a series of bridges and catwalks through the reactor space.

Occupying the four-story gallery below is the Park visitor's center, which contains a cafe, information desk, bathrooms, equipment rentals, first aid and other park amenities. Suspended above this public space are glowing green glass tubes that hang from above like a vertical forest. Inside is encapsulated lake water, as it reflects green algae light throughout this ancient building.

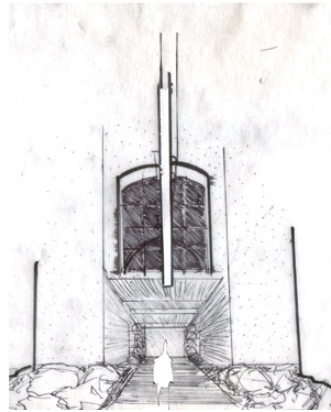
I extended the structure back towards the mountain not only to help balance the cantilever, but to make a threshold between mountain and building. Here, along the North opaque wall -- you rise up the stairs towards the penstocks, which then becomes a landing for a small alpine tram.



LB2 Hybrid Program: Schematic Plan.



1. Marine Arrival.

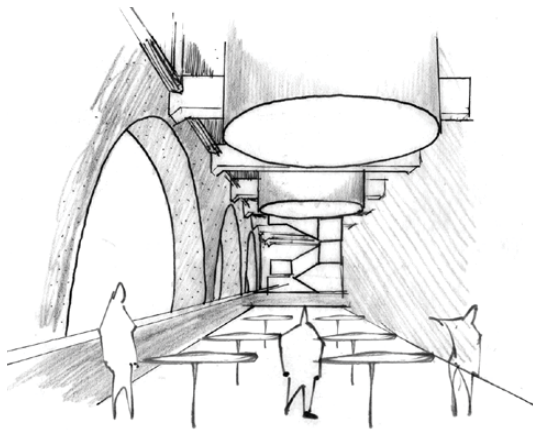


2. Water Outfill Entry.

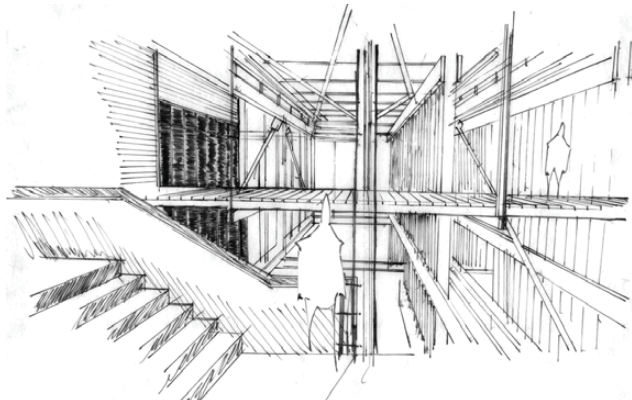


3. Public Gallery Below Suspended Reactor.

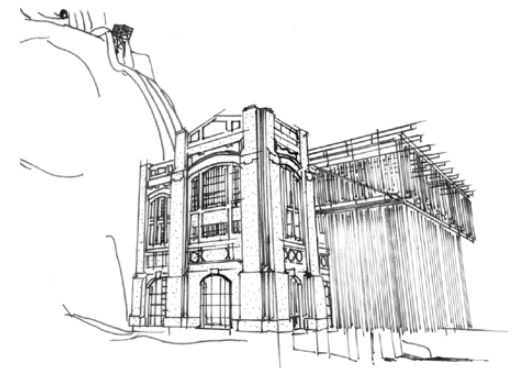
Sequence of Thresholds.



4. Cafe Below Tanks.



5. Reactor Above.

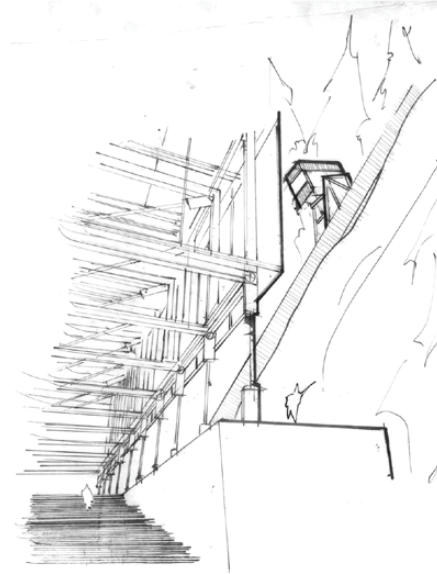


6. Connecting Building to Mountain.

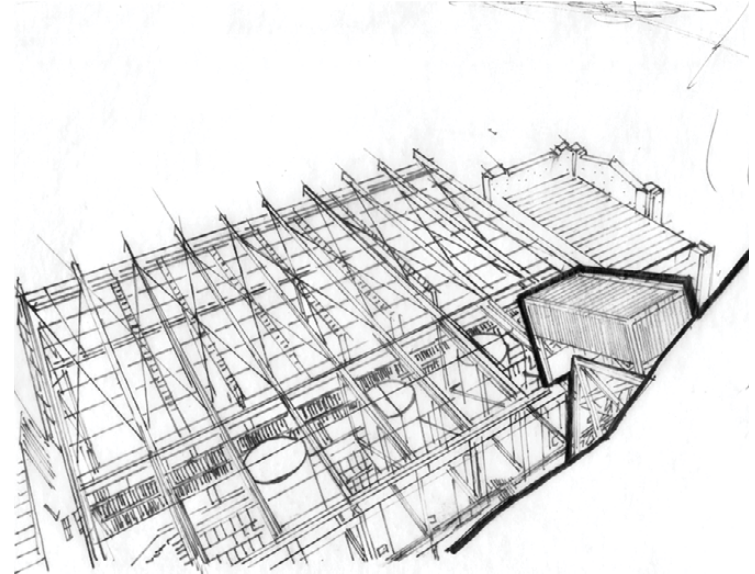
Sequence of Thresholds.



7. North Wall Entry.



8. Stairs to Penstocks.



9. Penstocks Funicular.

Sequence of Thresholds.







Cross Section of LB2 Powerhouse: Intersection Between Park Visitor's Center and Micro Algal Research Facility.

## **Phase 2: Building as Connection**

The second phase seeks to utilize the penstocks and hydraulic tunnel as a circulation network to travel between Indian Arm's shoreline and Lake Buntzen. Grafting onto the penstocks, a cable tram will allow visitors to travel along the penstocks five hundred vertical feet to the mouth of the hydraulic tunnel. Once there, visitors will travel a short distance into the tunnel and arrive at the surge tank. Overhead, this surge tank extends over a hundred feet to the sky above.

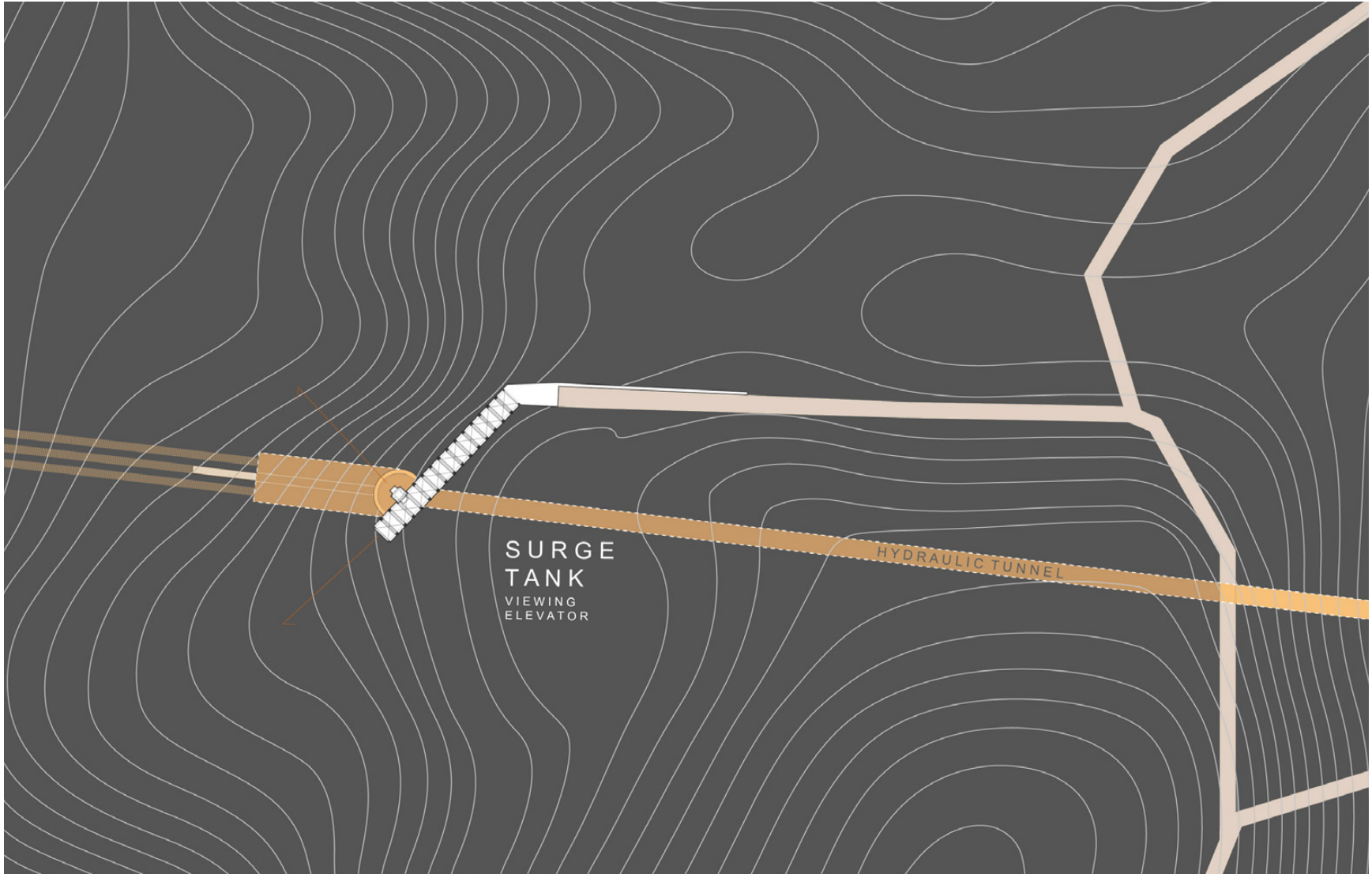
My proposal is to insert a tower inside the surge tank to create a vertical circulation axis between the tunnel below and the forest above. This will enable a direct, public link between the existing trail network and Indian Arm, which are currently separated by steep terrain and forbidden hydroelectric spaces. By exploring this steep ocean cliff, mountain tunnel and oculus-like surge tank, we engage with a power architectural experience that ascends from dark to light, forest to earth, and ocean to mountain. Above ground the tower structure and cladding is analogous to the solid and void of the surrounding forest. Allowing slits of views between the corten screens and dappled light trickling through perforations. At the top of the tower, you exit onto a bridge which serves both as a connection to the forest and as an observation lookout, reorienting visitors to a spectacular view of Vancouver; the city this site has powered for over a century. Ultimately, this phase seeks to invert a network that once carried water from lake to ocean as armature for vertical circulation, linking disconnected areas in the park.



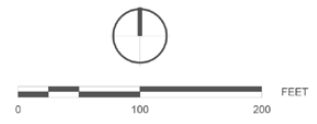
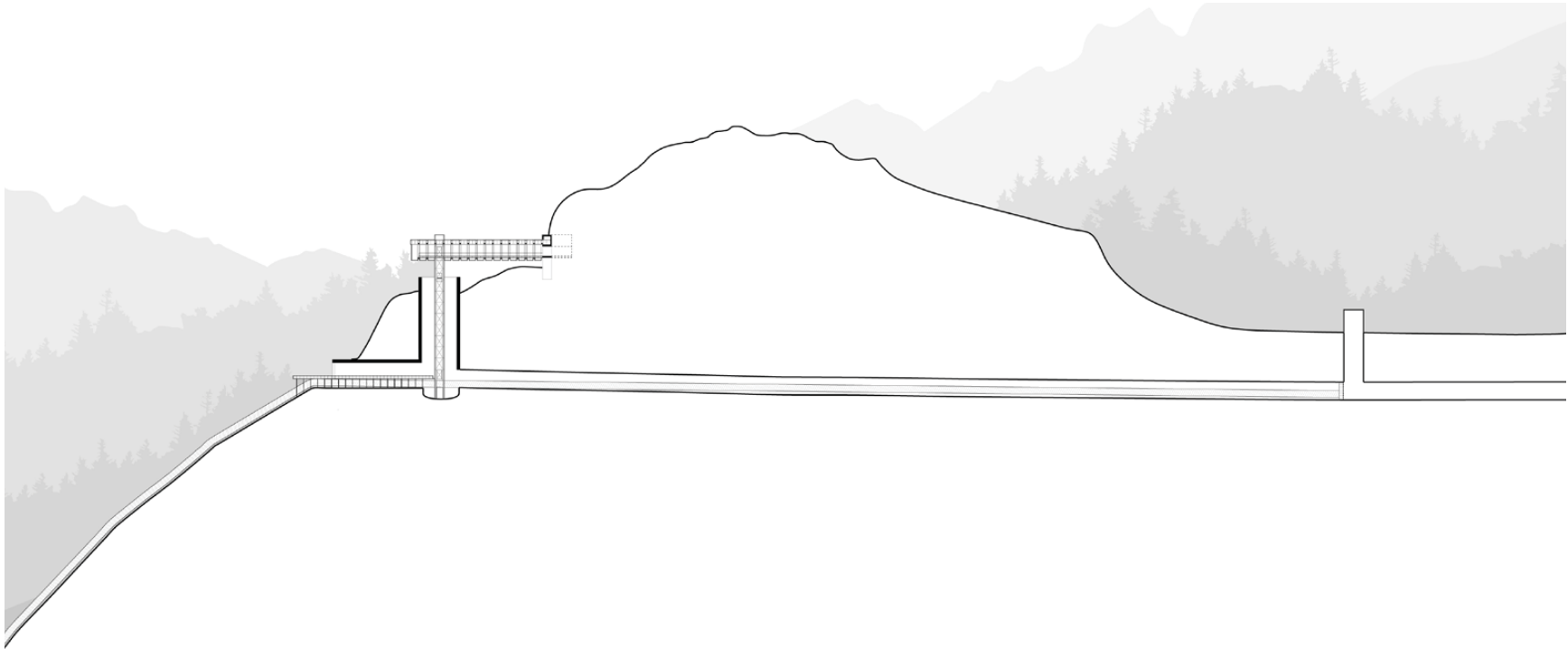
Trail Approach: LB2 Surge Tank as Viewing Bridge and Tower.



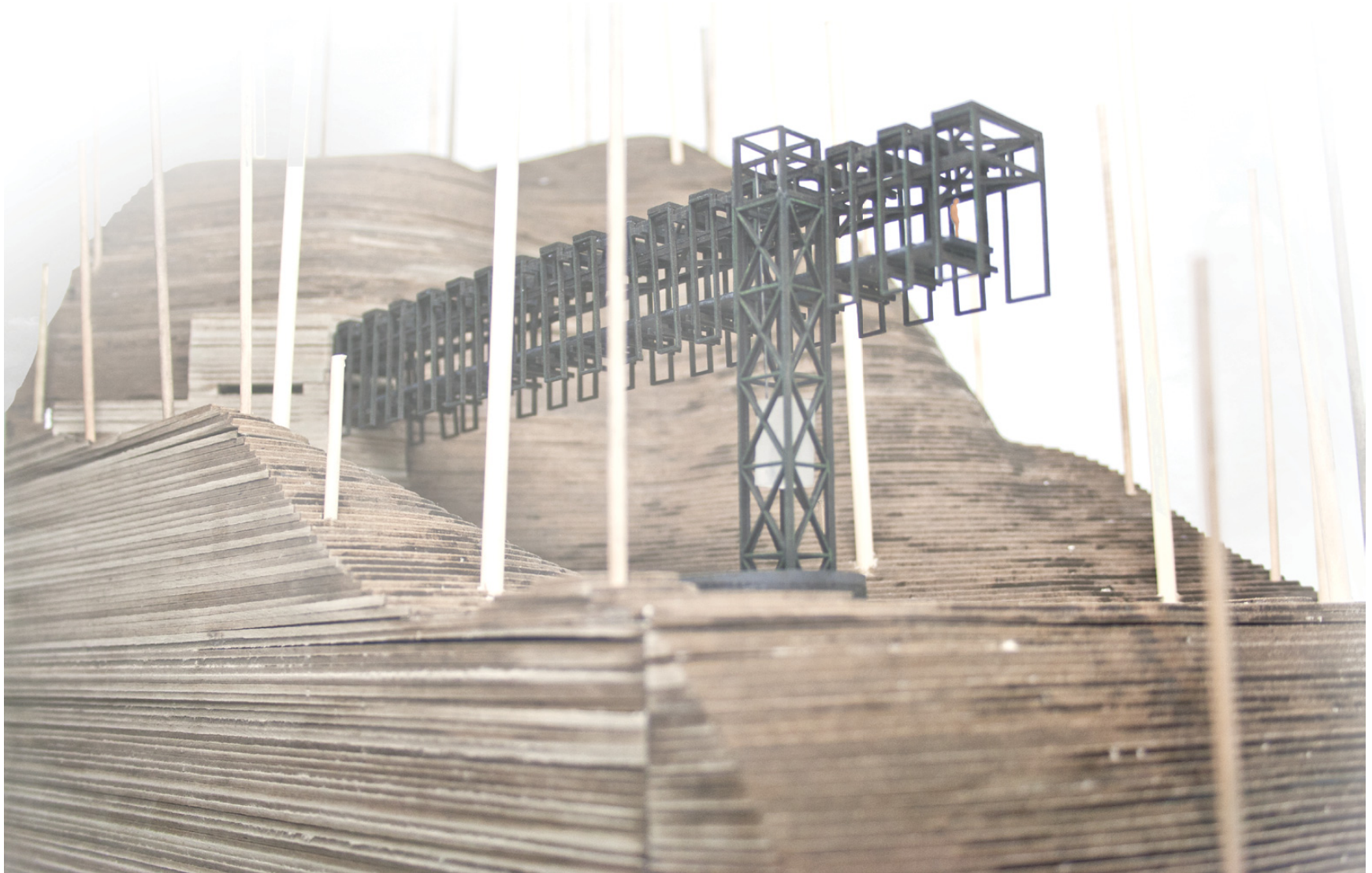
Looking Back to the City: Bridge View Overlooking Indian Arm, Burrard Inlet, and Vancouver (render made in collaboration with Josh Nieves).



Site Plan of LB2 Surge Tank: Penstocks as Funicular and Surge Tank as Circulation Tower (GeoBC).

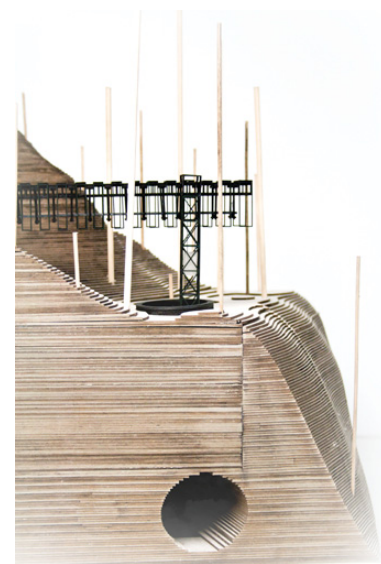


Section of LB2 Surge Tank: Penstocks as Funicular and Surge Tank as Circulation Tower.



Model of LB2 Surge Tank as Viewing Bridge and Tower.





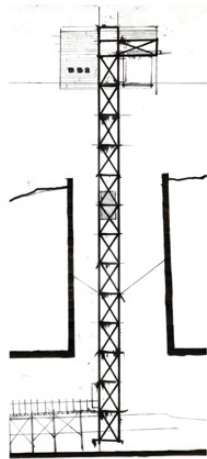
Model of LB2 Surge Tank as Viewing Bridge and Tower.

## Connection Narrative

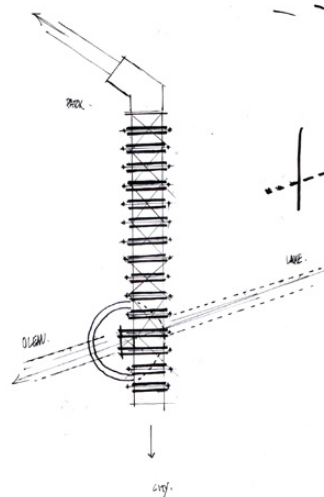
Exiting the tram, you enter a dark tunnel travelling along an elevated, wooden path and walk towards light in the distance. Once inside, you arrive to the surge tank, an oculus inside the mountain that opens to the sky above. Here you enter a copper and glass elevator car, which takes you up to the mountain forest above.

At the top, you step out of the elevator and onto a bridge. Once there, you are reoriented to a different axis than the tunnel below. Turning to this new axis, the bridge frames a view of Indian Arm and Burrard Inlet overlooking Vancouver.

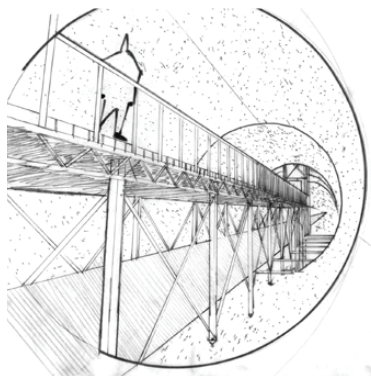
Once on the bridge, you notice the floor hangs from a roof truss above. As you walk along the interior, this allows visitors to see between the skin of the building and the edge of the floor -- giving an incredible view of the dramatic sloping terrain below as well as a bird's eye view of the surge shaft. Situated in trees, the bridge's cladding is analogous to the solid and void of the surrounding forest -- giving slices of view with dappled light. Leaving the tower, we are now in the park, entering a popular, and well-used trail system; connecting Lake Buntzen to Indian Arm Park.



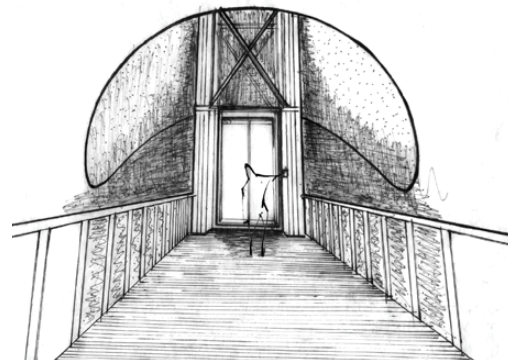
Sketch: Schematic Section.



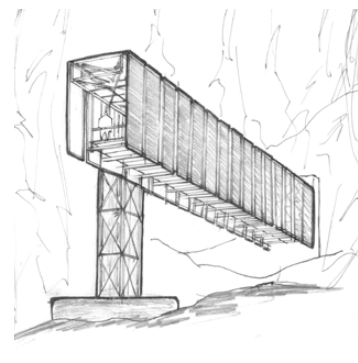
Sketch: Schematic Plan.



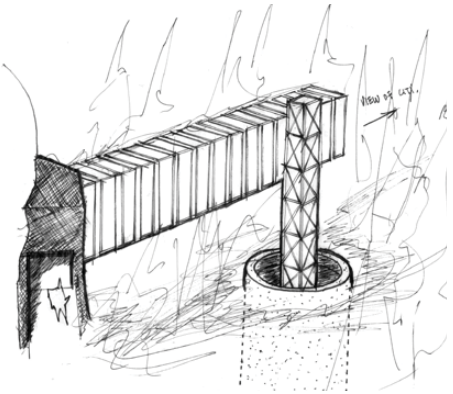
1. Tunnel Path.



2. Elevator Base.

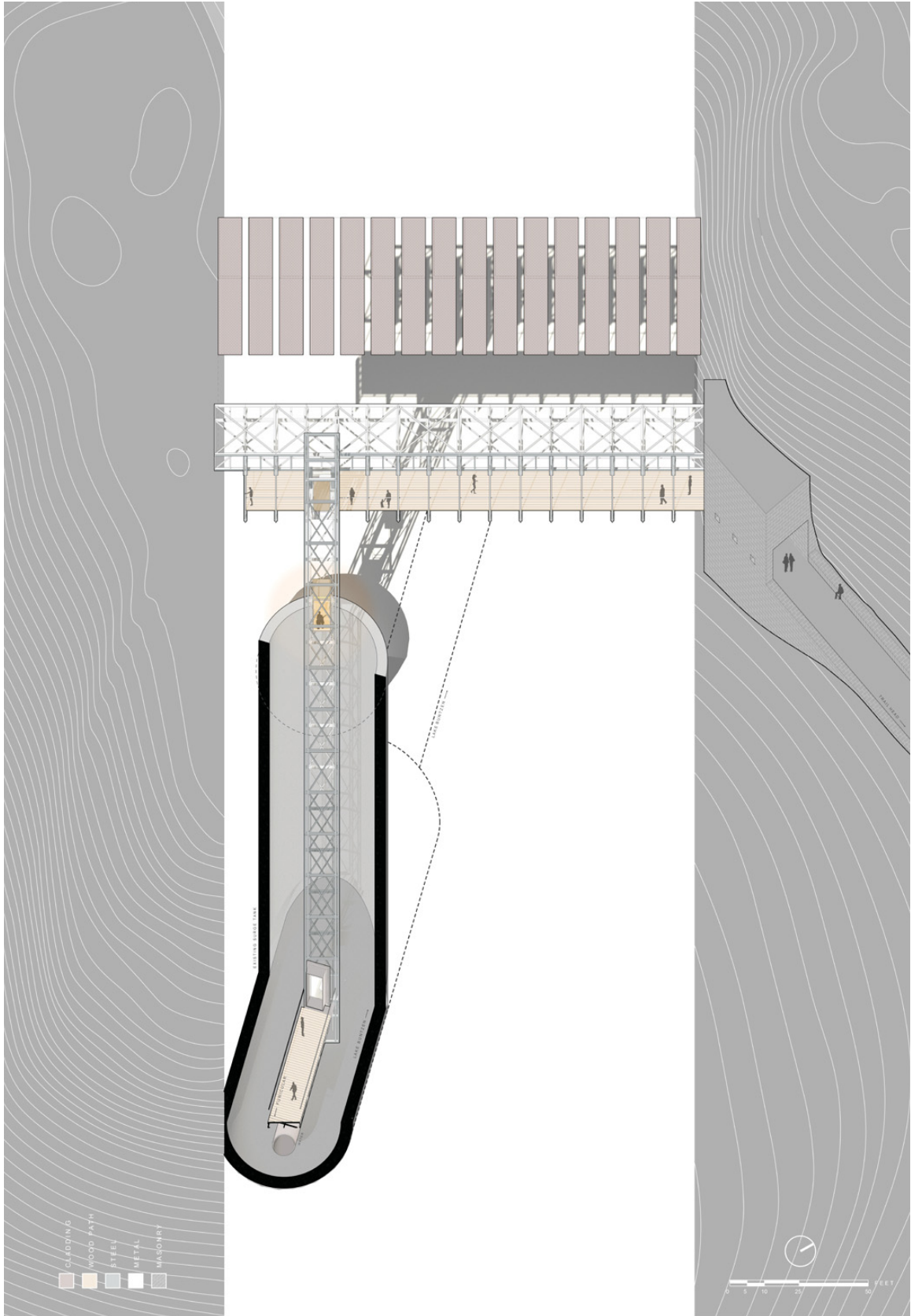


3. Tunnel to Sky.

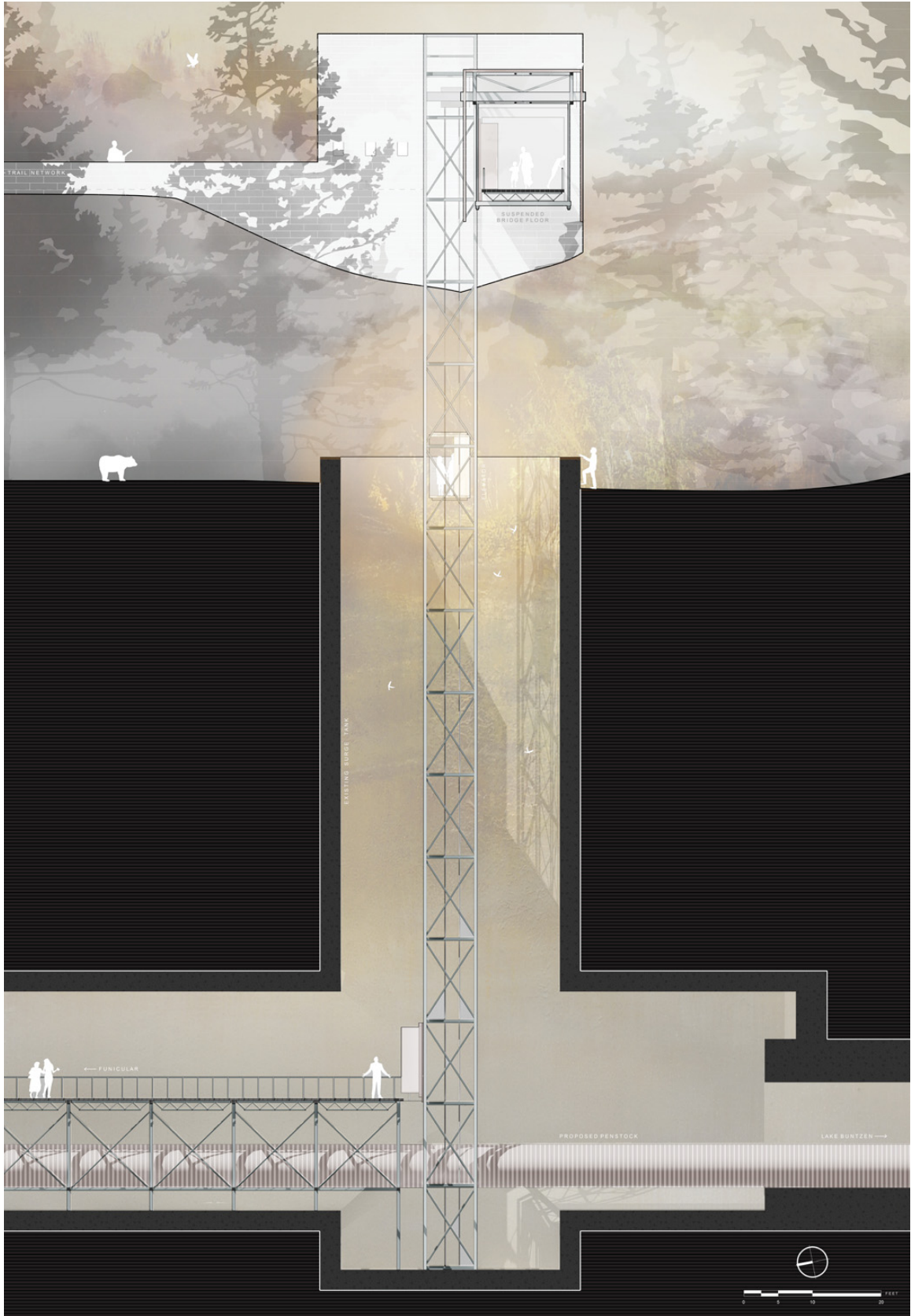


4. Bridge to Forest.

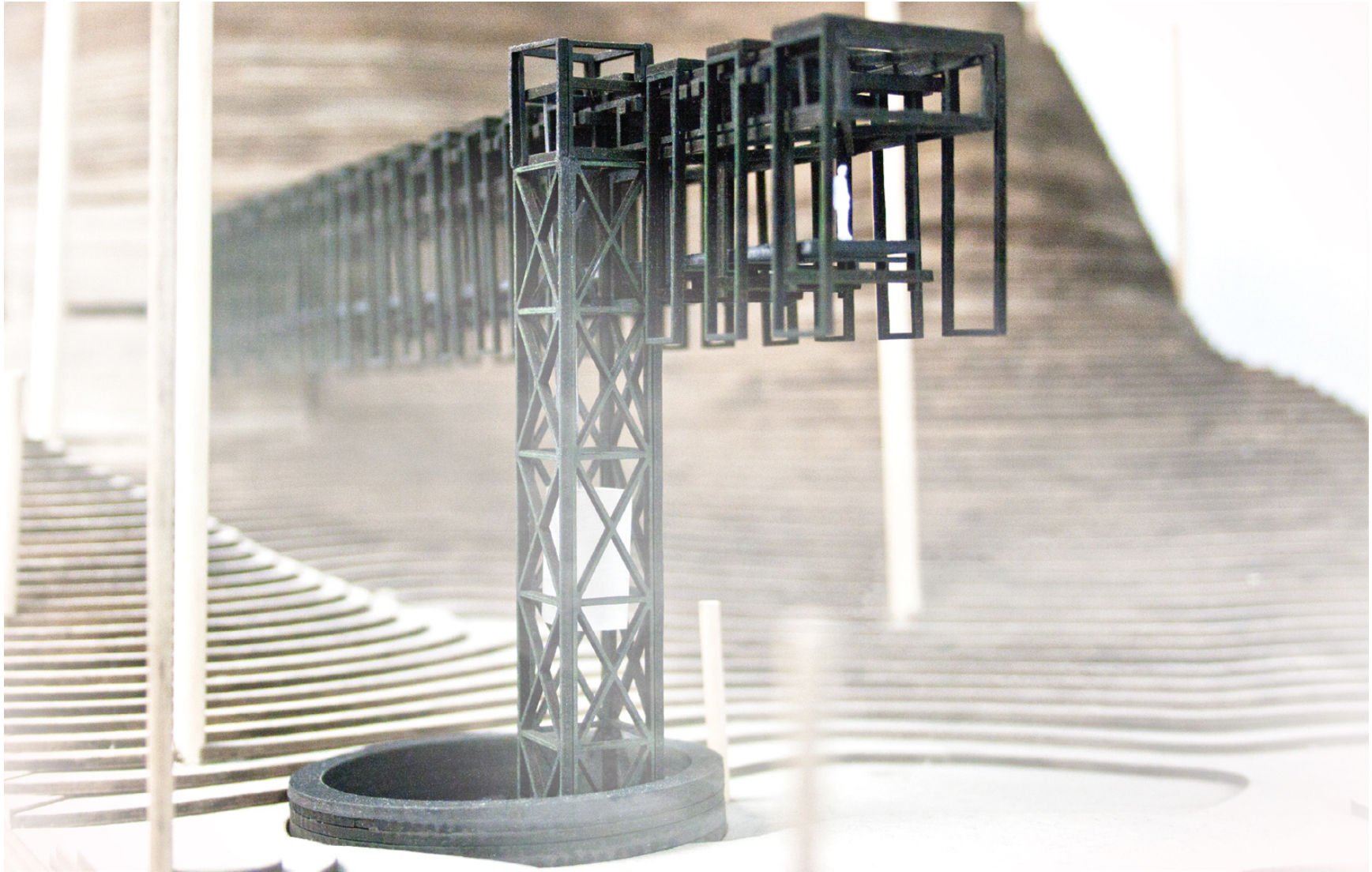
Sequence of Thresholds.



LB2 Surge Tank Tower and Viewing Bridge: Exploded Axonometric.



LB2 Surge Tank Tower and Viewing Bridge Cross Section.



Model of LB2 Surge Tank as Viewing Bridge and Tower.

### **Phase 3: Building as Reflection**

The gatehouse once filtered and controlled the intake of water into the hydraulic tunnel. Though odd an unassuming, this building is perhaps the most interesting of all. Built in a lake, this gatehouse is regularly submerged 2/3rds underwater. It is not loud, but a quiet and sublime building one discovers as a ruin hidden within a densely forested lake.

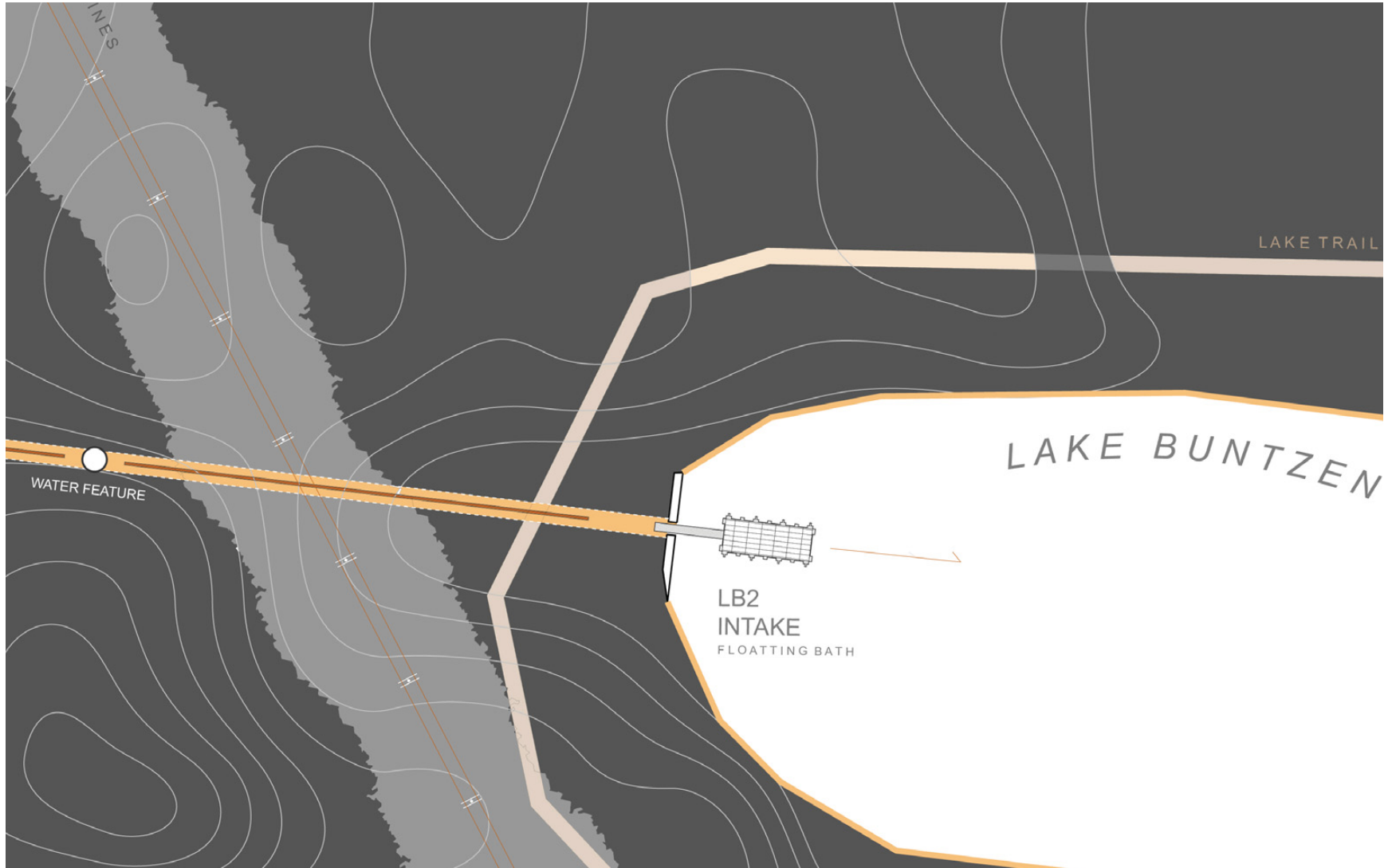
The third development phase responds to the building's site condition as a ruin one discovers in the forest. This proposal seeks to transform the gatehouse into a meditative space to reflect upon the history of the site by amplifying existing aquatic recreational activities on the lake and embracing the building's relationship to wild water. Given this desire, my programmatic response is to transform this infrastructural piece into a public bath; a place to reflect, meditate and relax inside a building originally designed with inward-looking machines.

In addition to the building's inner-directed qualities, my proposal is to remove the existing floor and replace it with one that floats on the water inside the structure. This move is to emphasize the unique hydrological qualities that make Buntzen an unusual lake. The two mile long sub-mountain tunnel connecting Buntzen to Lake Coquitlam forces the water level in this active, hydroelectric holding pond to change dramatically throughout the year. During certain seasons, it is common to find well-used park bridges and picnic areas underwater. I wanted to embrace this wild force of nature, and use the water that transforms the park, to also transform our experience with this building.

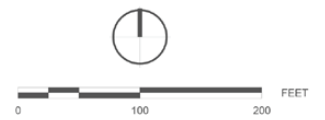
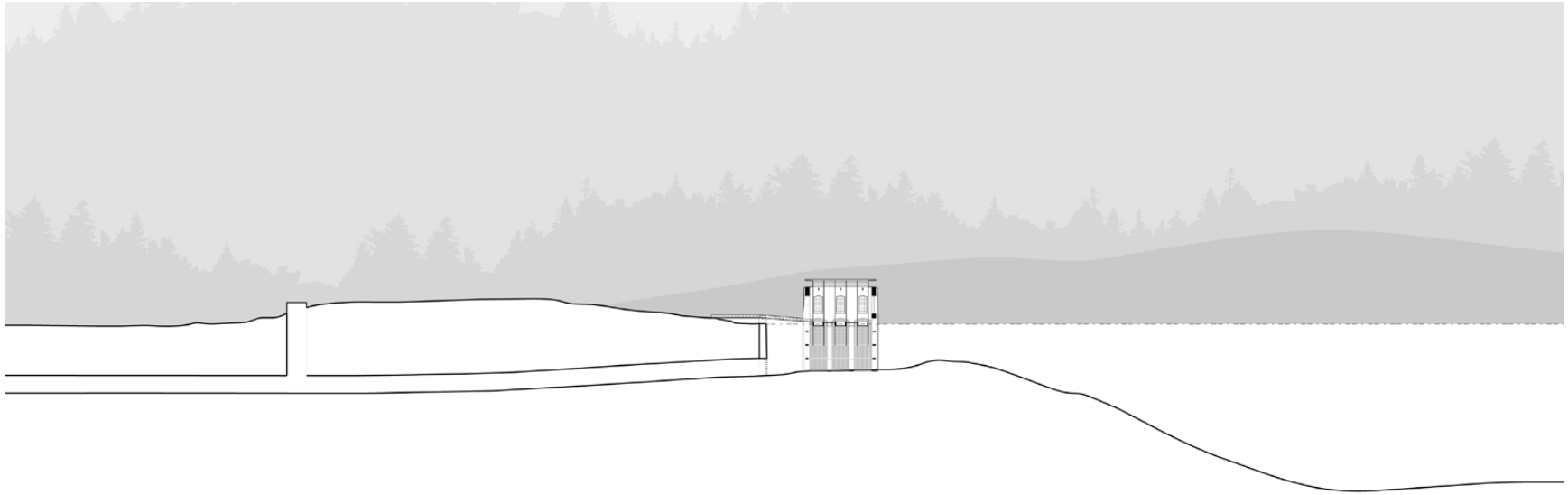


Bath Aproach: Ruin Found in the Forest; photograph by Graeme Owsianski (2015).





Site Plan of LB2 Intake House: Floating Bath (GeoBC).



Section of LB2 Intake House: Floating Bath.

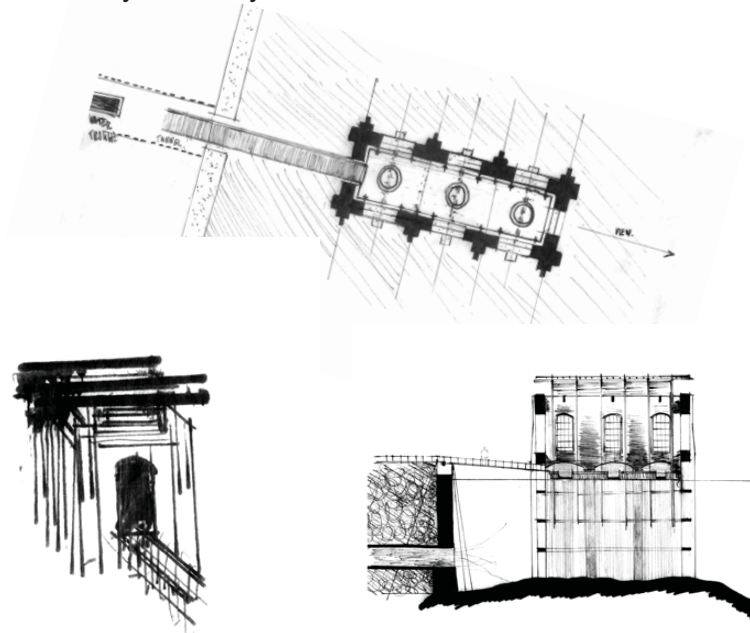


Model of LB2 intake House as Floating Bath.

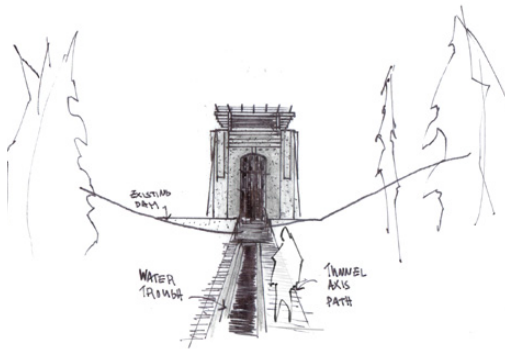
## Reflection Narrative

Hidden along the shores of a densely forested lake, we arrive to the bath. We could see it across the lake like a beacon, as the steam rises through an elegant, light, steel roof. Inside, the floor has been removed. In its place, a thick, chunky, cedar slab floats on the lake water inside the building. As the seasons change, this buoyant surface rises and falls with the fluxuating water level -- sliding along new steel columns like rails. This bobbing surface allows us to engage with a unique and rare temporal as the water level changes throughout the year; exposing, hiding, and revealing new spatio-temporal sequences. These columns do not touch the wall -- they are pulled away on steel pins, so to only touch the old lightly.

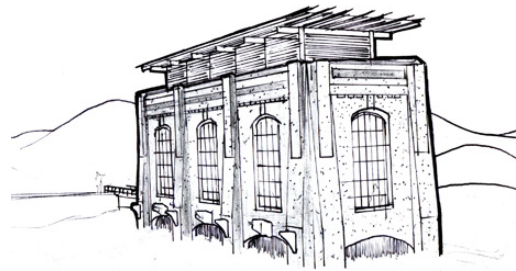
As a tower submerged in water, this architectural idea emphasizes the cold, body of water that exists within the building and its century-long symbiotic relationship to the lake. The wooden floor gives warmth to the human body and stands in contrast to the cold, concrete industrial walls. Inserted in the floor are three tubs built the same diameter and location of the building's original valves. These bathing vessels create a place of warmth, relaxation, and mediation; a sanctuary bath inside a hydroelectric ruin. These tubs allow us occupy a memory of the building's former function. A powerful experience that is strangely familiar, yet entirely new.



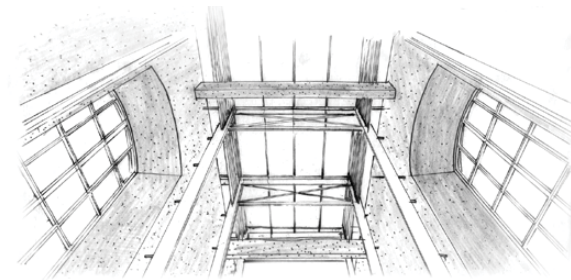
LB2 Intake House as Floating Bath: Schematic Plan, Section and Perspective.



1. Hydraulic Tunnel Trail:  
Forging a New Axis Within  
Existing Park Trail Network.

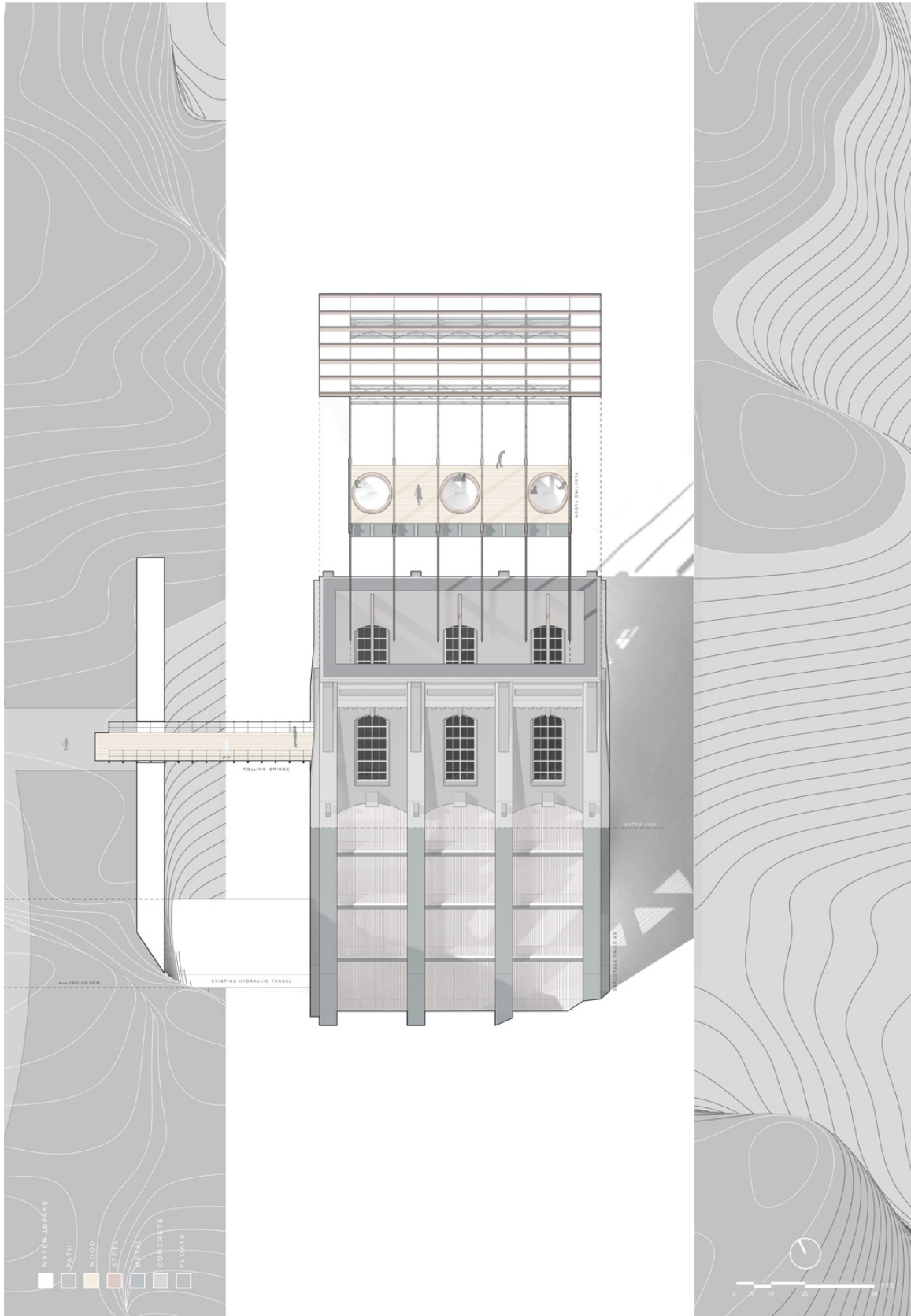


2. Occupying a Ruin in the Lake.



3. Bather's View of Steel  
Insertion: Steel Pins Lightly  
Connect Old and New.

Sequence of Thresholds.



LB2 Intake House as Floating Bath Exploded Axonometric.

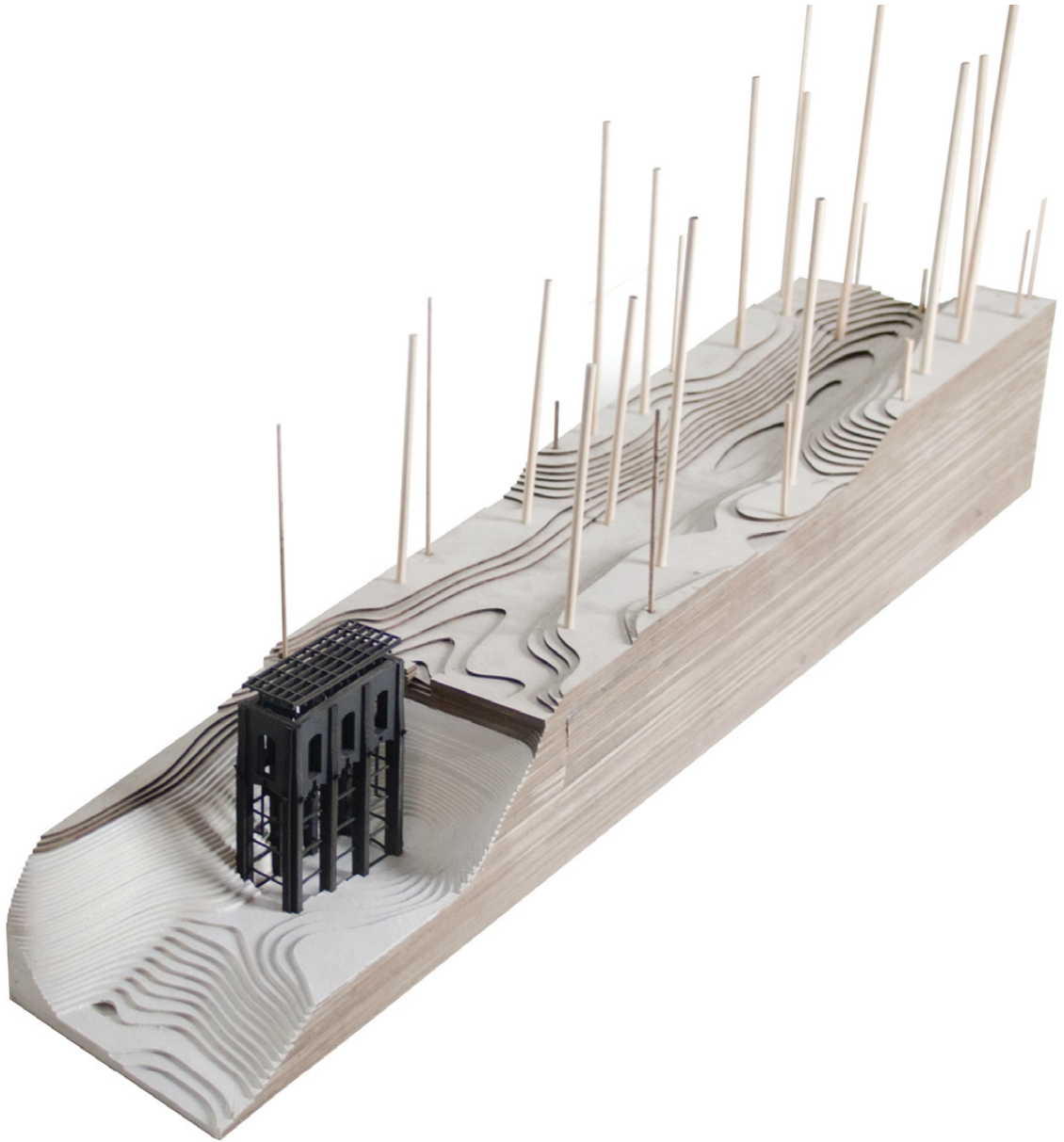


LB2 Intake House as Floating Bath: Cross Section.



Model of LB2 Intake House as Floating Bath.





Model of LB2 Intake House as Floating Bath.



Bath Approach: Ruin Found in the Forest; photograph by Major James Matthews; from City of Vancouver Archives (1913).

## CHAPTER 5: CONCLUSION

Buntzen's hydroelectric landscape and its dynamic relationship to Vancouver and surrounding parkland reflect the distinct physical and political forces that transformed the area. Although Buntzen is remarkably unique, the decommissioning of LB2 is a challenge many aging hydroelectric sites will face in the future. As our energy networks transition away from the throwback mega-projects that characterized the last century, Buntzen's structures stand as relics of a Neotechnic age that redefined North America. Like monuments, these structures embody past ambitions for a domineering -- yet aspirationally sustainable -- relationship between humans, machines and nature. This collective memory establishes an effective link between history, culture, industry, and nature -- crafting a meaningful, place specific identity that allows future generations access to this past era.

As a recently decommissioned site, there is much uncertainty pertaining to the future of LB2's aging infrastructure. Although no longer fit for large-scale hydroelectric production, these monoliths have the capacity to support newly emergent, renewable energy industries and imaginative park amenities that captivate and amplify the site's historical investments. By working within this legacy, the inherent sustainability benefits of adaptively reusing decommissioned hydroelectric sites may prove catalytic -- spurring prototypes for regenerative development in similar decommissioned sites across the continent. By forging a new narrative, the adaptive reuse of decommissioned hydroelectric sites presents an incredible partnership opportunity for parks, researchers, communities, and industry to re-engage these disconnected, forbidden sites with the wilderness sanctuaries and communities they unintentionally forged.

When approaching these decommissioned hydroelectric sites, our goal must go beyond to simply preserve what exists.<sup>50</sup> By reimagining their former function and pairing the qualities of these devices with the programmatic needs of their surroundings, the adaptive re-use of hydroelectric sites can dramatically enhance the experiential capacity and place specificity of surrounding parkland. In this new narrative, there is a powerful opportunity to decipher the invisible energy of a landscape, creating a sense of place that transcends time by connecting memory, community, and nature inside these rare and unique spaces.

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50. Alberto Gomez, *Spaces In-Between*, 89.

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