Camps of listening:
Speculating visceral forms of ecological awareness at resource extraction sites through an acoustically attentive architecture

by

Miguel Veillette

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The Faculty of Graduate Studies Laurentian University Sudbury, Ontario, Canada

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APPROVED/APPROUVÉ

Thesis Examiners/Examinateurs de thèse:

Prof. Bruce Wrightsman
(Thesis Advisor/Directeur(trice) de thèse)

Dr. David Fortin
(Thesis Second Reader/Deuxième lecteur(trice) de thèse)

Prof. Michaele Pride
(External Examiner/Examinateur(trice) externe)

Approved for the Faculty of Graduate Studies
Tammy Eger, PhD
Vice-President Research
Vice-rectrice à la recherche
Laurentian University / Université Laurentienne

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CONTENTS

ABSTRACT

Urgently prompted by the climate crisis, the discourse around environmental action is spearheaded by technological innovation, which promises futures of optimized mechanics and reduced carbon emissions. However, denying technology's ecological purview beyond efficiency overlooks its untapped potential in acquainting humans to ecological thinking, "a practice and a process of becoming fully aware of how human beings are connected with other beings."[1] Technology's capacity to behave organismically and autonomously make it capable of dissolving categorical thinking towards nature. In an attempt to envision a future of sustainable human existence, this thesis reimagines technology as an agent of visceral ecological thinking through its architectural integration. The mobile work camps of the Athabasca oil sand mines are at the site of this architectural speculation. The series of bitumen mines, together forming the world's largest industrial landscape, house over 30,000 workers in fly-in-fly-out camps.[2] Here, technology leverages the human's destructive capacity towards the environment to a geological scale. This thesis redefines the work camp as a tool in augmenting the oil worker's capacity to think and act ecologically. The design is speculated within the *Frontier Project*, one of the largest bitumen mines ever proposed for construction. In the face of vast public opposition, the application process for the 290 square-kilometer project was terminated in 2020 after over a decade of planning.[3]

Frontier's outcome symbolizes the conflict between Canada's resource economy, its goal of negating carbon emissions and the urgent need to acknowledge the value of land for indigenous peoples and for all life on Earth. This thesis enters the conversation around this conflict using speculative design to critique attitudes towards resource extraction and to provoke thinking around ecology, labour, democracy and technology. The intention is not to push the undertaking of the *Frontier Project* nor to propose a pragmatic alternative to current workforce housing. The speculative design posits an alternate reality wherein workers monitor the ecological impacts of the mine in visceral and intimate ways enabled by architecture. Acoustic technology integrated in the building envelope renders the camp transparent to the surrounding soundscape, creating an interior space of passive ecological analysis and intimacy with nonhuman entities of the site. The heightened soundscape condition inside the camp facilitates ecoacoustic analysis and serves as an ecopsychological means of inquiry and relaxation. The design speculates the democratization *Frontier*'s managerial structure, assigning workers regulatory capacities, ultimately cultivating their roles as constituents of ecology and industry. In treating ecological awareness as the recognition of ecological interconnectedness rather than the anxious realization of ecological peril and anthropogenic guilt, new possibilities in worker and ecosystem wellbeing are made possible.

Notes

1 Timothy Morton, *The Ecological Thought.* Cambridge, MA: Harvard University Press, 2012. 7.

2 Regional Municipality of Wood Buffalo, "Municipal Census Report 2018", 2.

3 Teck Resources Limited, "Teck Withdraws Regulatory Application for Frontier Project", February 23, 2020.

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INTRODUCTION

My short time working in the Canadian reforestation industry sparked my interest in the subject of mobile work camps. Comprised mainly of tents and a few small trailers, the tree planting "bush camp" provides little barrier between the inhabitants and their environment. Despite long days of physical labour, constant climatic challenges and the absence of any real indoor facilities, a profound sense of community and a distinct work culture often develops within tree planting camps. However, my positive experience of the remote work camp is not shared by most individuals that inhabit camps of the extractive industries. In contrast, mining camps tend to house workers in the hundreds or even thousands and are far more permanent in construction. They resemble and function like a hotel: fetishizing amenity, interiority and entertainment, thus denying their place in the land. The extraction sectors alone employ over 200,000 people across Canada.[1] Most of these operations are considered remote (distant from urban centres). Due to the isolated and destructive nature of these occupations, extraction workers are often over-romanticized or stereotyped. In reality, many social issues surround these camps, sometimes affecting the communities, often indigenous, they neighbour. Through this thesis, I do not wish to glamorize resource extraction, but rather to contribute to the urgent discussion around resource work and more specifically, how we inhabit areas of ecological destruction. What role does the workforce play? Can the work camp design improve worker wellbeing as well as become an object of ecological participation? How can work camp architecture speculate healthier relationships between workers and the biosphere that enables life on earth? These are some of the questions that drove my interest in this topic. My speculative approach to this subject reflects my desire to provoke thinking around our relationship with nature and to bring a different angle to a highly conservative industry. Speculative design involves setting aside typical constraints associated with the 'real world' to envision potential solutions to big problems or to incite critical thinking around current world views and social norms. The following design proposal forgoes many technical, social and economic realities in a search for new kinds of architectural experiences. My intention is not to make light of this vastly problematic cultural, political and ecological subject.

Relative to their primordial role in Canada's economy, work camps are very under-researched.[2] This warranted a thorough study on my part. Part 1 serves to contextualize the reader, as I had to myself, to the historical, political and social realities of the mobile work camp. Part 2 describes my approach and premise to the design proposal and Part 3 illustrates the resulting architectural proposal of a new mobile work camp model.

Fig. 1. The reforestation camp I briefly inhabited

Fig. 2. The view from inside my tent

1 Statistics Canada. "Table 14-10-0202-01 Employment by industry, annual." DOI: 10.25318/1410020201

2 Angela C. Angel, "Voices from the Shadows" (Masters thesis, University of Alberta, 2014), 7.

PART 1

THE WORK CAMP CONTEXT

"There's a look common to oil sands workers in transit. They stand in airport security lines and last calls at the gate in scuffed work boots and faded denim, their shoulders slumped under the weight of overstuffed backpacks and duffle bags. There is sometimes a weary middle-distance cast to the eyes, like the workday has already begun or stretched on too long."[1]

-Chris Turner, *The Patch*

1.1

"FRONTIER"

1.1.1 Settler colonialism

The expansion of European colonies across Canada's territory is largely characterized by the cultural concept of the frontier: the frontline in the war between man and nature.[2] The frontier signified the edge between civilization and wilderness, from which "Canada's wealth, whether fur or minerals or timber, was extracted [...]"[3] The country's vast extents of navigable waterways made the Canadian frontier much less agricultural and much more scattered and remote than the American.[4] Owned and operated by resource extraction and infrastructural development (railways, roads, etc) corporations, work camps enabled workforces to inhabit these hinterland sites. Comprised mainly of men, often immigrants in dire need of work, workers at the frontier had few other choices than to undergo back-breaking labour in treacherous conditions for relatively small earnings.[5] Unlike boom-towns, single-enterprise communities and most company towns, the work camp is most often an impermanent, 'off-grid' and disconnected settlement. The earliest logging camps around the Great Lakes were built by loggers themselves then left to decay once lumber resources had been exhausted.[6]

Settler colonialism refers to the process of colonialization through the settlement or exploitation of land.[7] This system of power has continuously characterized resource extraction and infrastructural development operations. It is not a past phenomenon but an ongoing system of exploitation.[8] To this day, Indigenous peoples continue to be stripped of their traditional lands as extractive industries exploit resources, obliterating the landscape and disrupting vast ecological systems.[9] Indigenous peoples of Canada, in their fundamental attachment to and profound love with indigenous land pose a problem for settler colonialsim.[10] Capitalism regards human displacement and disposability as a necessary and normal process in the extraction of resources.[11] The remote work camp, as much then as now, is a symbol of settler colonialism in Canada.

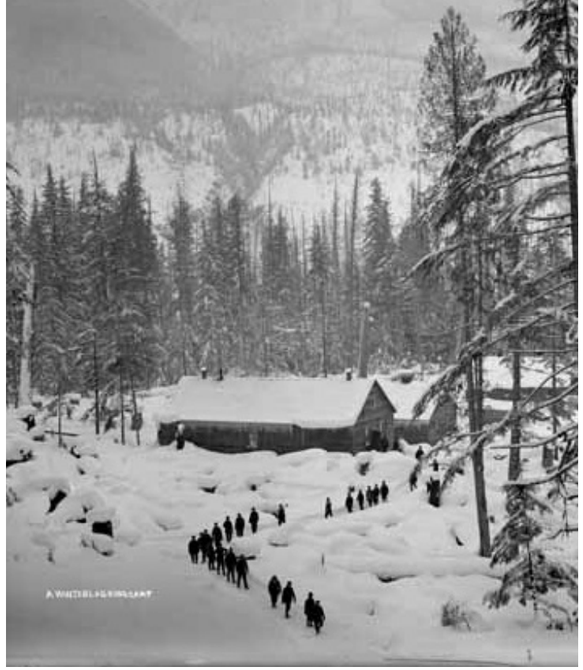

Fig. 3. A winter logging camp in British Columbia, 1910

Fig. 4. A floating work camp in British Columbia

Fig. 5.Loggers felling trees in British Columbia

1.1.2 *Wilderness*

For European settlers, the abundant and untapped wealth of Canada's wilderness prompted the confrontation of the wild to extract its resources, whether lumber, metals or coal.[12] The concept of *wilderness* stems from the thought that humans are distinct and separate from nature.[13] The dissociation from nature characterized the labour at work camps as a mere battle between the workers and the terrain, climate and the nonhuman beings posing threat to human wellbeing. This battle extended to the hours after work, forcing workers to huddle inside crammed cabins, fighting the frigid temperatures, leaky roofs and unwelcome critters.[14] Many immigrants who comprised the frontier workforce had never laid eyes on such land, let alone knew how to deal with its unforgiving conditions.[15] Individuals migrated far, often coming from Europe, to work in Canada's abundant wilderness.[16] Often barely witnessing the extents of settlements before being transported out to distant work camps, "their first impressions of the new land [...] were gleaned intermittently from a [train] car window, as the woods and rocks and lakes of the unsettled northland sped past in ever-widening circles."[17]

Fig. 6. Conquering the wilderness and developing the frontier

1.1.3 Home?

The hard labour, the unfavourable climatic conditions and the social isolation made the camp one of the only places of comfort and distraction, often regarded as the most important element for the worker.[18] Edmund Bradwin's 1928 publication *The Bunkhouse Man* serves as one of the only collections of Canadian work camp experiences giving insight into the realities of this social phenomenon. Bradwin describes the bunkhouses (dormitories) in which workers slept, as generally poorly built, damp, often permeable to rain and flies, dim, crammed, dirty and prone to lice and nits.[19] These camps were built using only easily transportable materials, limiting the use of window panes, light bulbs and of decent waterproof roofing materials.[20] After weeks or months of working and living together, workers grew easily irritated by one another in the absence of different voices and changes of scenery.[21] These conditions made for a profound need for material comfort, which was rarely achieved.[22] Attempts to advocate for worker wellbeing and enact change in accommodation quality were seldom successful in the rigid and conservative approach to camp designs at the time.[23]

Fig. 7. Eating dinner under hanging pairs of damp socks and underwear, Ottawa Valley

In the eyes of company management, the work camp was seen as a crucial opportunity to reassure recruits on their comfort and wellbeing upon their arrival at the work site.[24] The geographical conditions of the remote work camps hid the hardships and neglect from the public eye, making it much easier to exploit workers. Rarely did the camp experience reflect the promises made at recruitment offices.[25] This reality is similarly observable in Canada's early company towns, which are essentially larger, town-sized versions of work camps, owned and operated by industry corporations. In this context, it became increasingly important to keep workers content, civil and obedient in order to maintain the capitalist structures that assured owners their profits.[26] Private enterprises consequently turned to planners and architects to establish social order via calculated town plan and dwelling design.[27] In the company town of Corner Brook, Newfoundland, homes were planned to be located out of the immediate view of the industrial quarters to "preserve a sense of rural living."[28] As homes were essentially identical, minor variations were made between each of them to give a superficial sense of heterogeneity to the inhabitants all the while maintaining underlying power relations.[29]

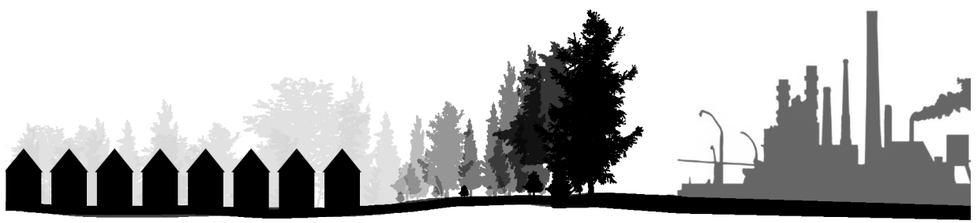

Fig. 8. Preserving the sense of rural living in company / industrial towns

Fig. 9. Company Town of Corner Brook, NL.

Notes section 1.1

1 Chris Turner, *The Patch: The People, Pipelines and Politics of the Oil Sands* (Toronto: Simon and Schuster Canada, 2017), 199.
2 "Frontier," Merriam-Webster, Accessed June 12, 2020. https://www.merriam-webster.com/dictionary/frontier.
3 Philip Fernandez, Larry Krotz, and Erica Martin, *Frontier College Letters* (Toronto, Ontario: Frontier College, 1999), 5.
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5 Ibid., 6.
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13 William Cronon, "The Trouble with Wilderness" in *Uncommon Ground: Rethinking the Human Place in Nature*, ed. William Cronon (New York: W. W. Norton & Co., 1995, 69-90).
14 Edmund W. Bradwin, *The Bunkhouse Man*, (Toronto: University of Toronto Press, 1972), 78.
15 Philip Fernandez, Larry Krotz, and Erica Martin, *Frontier College Letters* (Toronto, Ontario: Frontier College, 1999), 5
16 Edmund W. Bradwin, *The Bunkhouse Man*, (Toronto: University of Toronto Press, 1972), 57.
17 Ibid., 57.
18 Ibid., 75.
19 Ibid., 77.
20 Ibid., 77-78.
21 Ibid., 78-79.
22 Ibid., 79.
23 Ibid., 79
24 Ibid., 216.
25 Ibid., 216.
26 Neil White, *Company Towns*, (Toronto: University of Toronto Press, 2012), 52.
27 Ibid., 53-56.
28 Ibid., 55.
29 Ibid., 56.

1.2

THE OIL SANDS

1.2.1 Land: a resource

Like many others, the Canadian Association of Petroleum Producers uses the term *recovery* in describing the oil extraction process.[1] This kind of language suggests that the resource is of human property, to be recovered from nature's hands and put to good anthropogenic use. With assertive world views comes the extensive destruction of traditional Indigenous lands, the improper consulting of Indigenous communities in resource decision-making and the perpetuation of false ecological responsibility.[2] Canada's economy relies heavily on the extraction of its oil deposits, 97% of which lie in the soil of northern Alberta in the oil sands.[3] Here, the land itself is the sought-after resource as the bitumen-laden soil is excavated and refined to make crude oil.[4] Despite only accounting for 20% of the total oil sands deposits, bitumen shallow enough to be extracted via open-pit mining hosts half of all oil sands extraction operations.[5] In simple terms, open pit mining involves clearing the forest or muskeg, removing the overburden (rock absent of any particular value), excavating the bituminous soil then refining it to obtain crude oil.[6] The whole process includes many more technicalities and destructive processes, from aquifer de-watering, liquid tailings storage to seismic exploration and forest fragmentation (see fig. 13). The ecological effects of open-pit mining are less displaced yet much more destructive to the land when compared to in-situ bitumen extraction (drilling out the bitumen).[7,8] Projected to clear the boreal forest at a rate of 34.5 football fields per day by 2022, open-pit oil sand mining poses significant risks to one of the most critical ecosystems in the world.[9,10] Over a third of the Boreal Plains contain vast wetland habitats, most of which are connected in complex hydrological systems "highly susceptible to damage from tar sands development."[11] This land is home to a vast number of species including hundreds of migratory birds, making it a fundamental biome in global ecosystem health.[12] Covering thousands of square kilometers and reaching mining depths of 75m, the oil sand mines illustrate technology leveraging the human's destructive capacity at a geological scale. This warrants the assumption that we've entered an era known as the anthropocene.

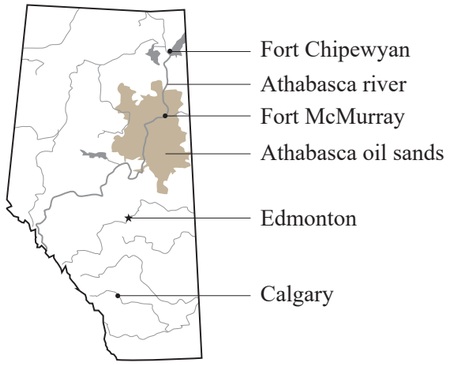

Fig. 9. Map of the province of Alberta

Fig. 10. Clearing the forest

Fig. 11. De-watering the soil

Fig. 12. Stockpiling reclamation material

seismic exploration		deforestation		overburden removal and aquifer de-watering	excavation of the bituminous soil	re-filling the reclamation material	reforestation / land restoration	official reclamation
occurs years before first mining operations		occurs gradually as the mine pit expands		occurs gradually as the mine pit expands	occurs 24/7 over the course of several decades	occurs over the course of a few years at the end of mining operations. May occur progressively during the mining phase.	occurs over the course of a few years at the end of mining operations. May occur progressively during the mining phase.	In 2017, only 0.1% of the total oil sands mining areas have been certified as reclaimed and returned to the province.

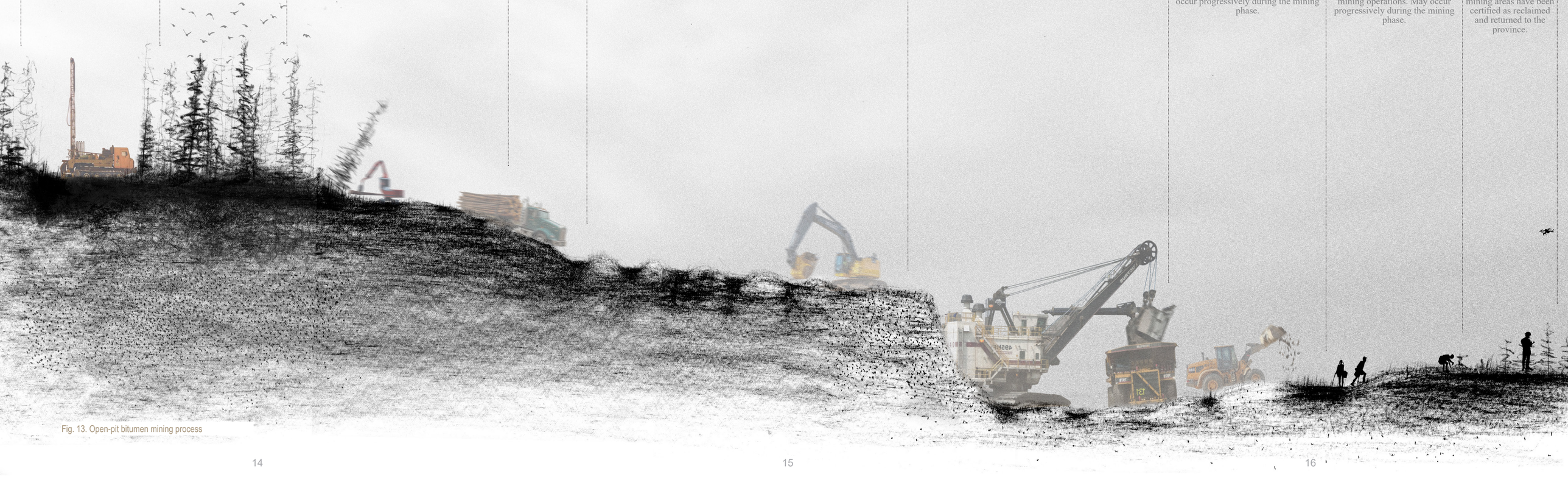

Fig. 13. Open-pit bitumen mining process

1.2.2 Petro-capitalism

The term *petro-capitalism* underlines "capitalism's systematic expansion profound dependence on the control of petroleum."[13] These are the political conditions that, in petro-states like Alberta, "simultaneously undermine the supply of non-renewable fossil fuel and - more importantly - the earth's life support systems."[14] Such characterizes the "resource curse" under which fall certain national economies like that of Canada.[15] The best interest of Canada's citizens and all inhabitants of the globe, for that matter, are lost in the efforts to support and expand the oil economy at all costs. Unconcerned with the finitude of natural capital, the petro-capitalist system's "greatest hope lies in finding new supplies from 'frontier' regions, including ultra-deep offshore wells and high latitudes, and even more so by exploiting so-called 'unconventional' reserves such as those found in the tar sands and in shale formations."[16] This economic model is tragically faulty as its extractive processes and "all the consequences they leave in their wake — are not factored into the cost of production."[17] In face of the environmental protests and increasing public awareness of environmental impacts of mining, extraction companies will employ tactics like adopting mottos of self-responsibility and false sustainability and often co-opt environmental procedures to gain control over their undertaking.[18] Companies also revert to distraction tactics through extensive publications boasting their increasingly-efficient industrial technologies, highlighting the environmental rigor of the Canadian industry compared to operations abroad.[19] When all else fails and particular individuals or groups are found damaging to industry reputation, companies resort to discrediting alarmists and even firing them if they happen to be employees.[20] It becomes increasingly obvious that not only is land seen as a resource, but so are the human bodies who make these large operations function.

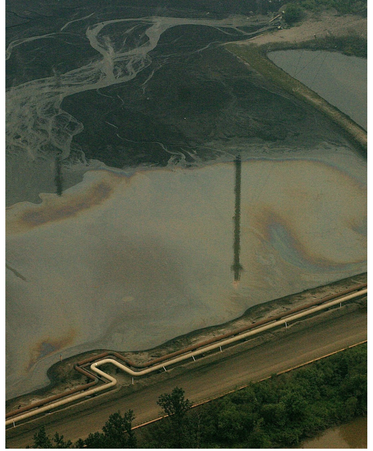

Fig. 14. Oily sheen on a tailings pond

Fig. 15. Poor air quality near Syncrude oil sands site

Fig. 16. The vast tailings ponds of an oil sands mine

Notes section 1.2

1 "Crude Oil Extraction and Drilling Methods," Canadian Association of Petroleum Producers, Accessed December 17, 2020. https://www.capp.ca/oil/extraction/.
2 Toban Black et al., *A Line in the Tar Sands*, (Toronto, Ontario: Between the Lines Press, 2014), 12-13.
3 "Crude Oil Facts," Natural Resources Canada, October 6, 2020. https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/crude-oil-facts/20064.
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6 "Surface Mining Techniques Used in the Oil Sands," Oil Sands Magazine, https://www.oilsandsmagazine.com/technical/mining/surface-mining.
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10 Jeff Wells et al., *Danger in the Nursery: Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest,* (Boreal Songbird Initiative and Natural Resources Defense Council), https://www.pembina.org/reports/borealbirdsreport.pdf
11 Ibid.
12 Ibid.
13 Toban Black et al., *A Line in the Tar Sands*, (Toronto, Ontario: Between the Lines Press, 2014).
14 Ibid., 39.
15 Ibid., 24.
16 Ibid., 27.
17 Paul Hawken et al., *Natural Capitalism: Creating the Next Industrial Revolution*, (Boston: Little, Brown and Co., 1999), 3.
18 Toban Black et al., *A Line in the Tar Sands*, (Toronto, Ontario: Between the Lines Press, 2014), 47.
19 Ibid., 51.
20 Ibid., 52.

1.3

THE HUMAN RESOURCE AT THE OIL SANDS

1.3.1 The mobile worker

Like most remote work sites, oil sands mining operations rely on work camps to house the majority of their workers.[1] Most operations accommodate thousands of on-site workers plus hundreds of camp staff in rotational shifts typically ranging from 10 to 21 days.[2] These days are all spent working 10-12 hour shifts until the end of the rotational shift, where workers return home to rest 4 to 7 days.[3] Almost all camps are fly-in-fly-out (FIFO), meaning workers are flown in from the nearest municipal airport for each rotational shift. This practice makes the commute more convenient and safe for workers, but also allows the industry to cope with the volatility of the oil market by handling workers in and out of the operation at the company's convenience.[4,5] Coined by Angela Angel, the term *boomshphere* seeks to include the home, commute, camp, work and the host community "spheres" that comprise the mobile worker's territory (see fig. 17).[6] The mobile worker's environment is bound by a multitude of particular places and schedules exceeding those of typical home to work commute.

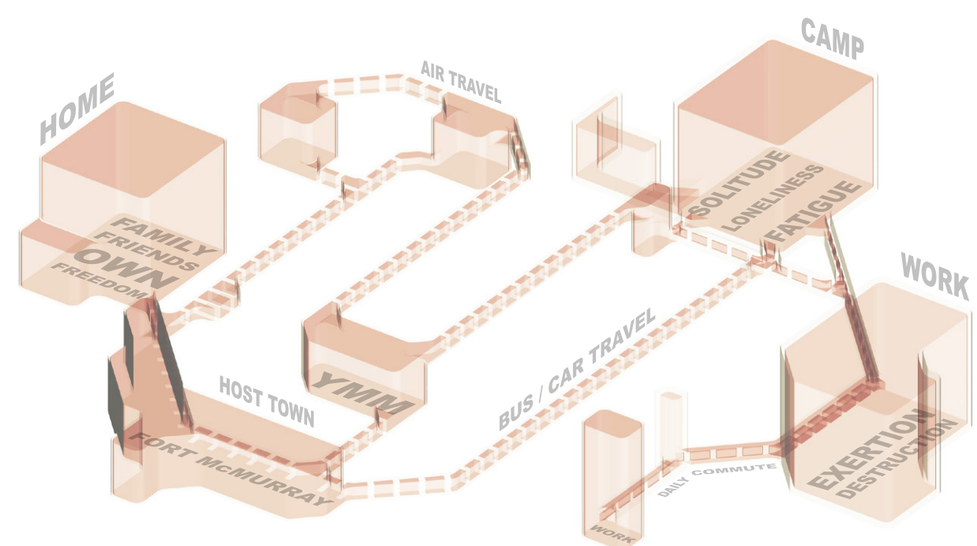

Fig. 17. The "Boomsphere" (environment of the typical mobile worker)

The rotational shifts place workers on a continuous move to and from their home.[7] At camp, waking hours are mostly spent getting ready for work, working, and eating, with very little time left for leisure. The functioning of the camp adheres to a strict schedule revolving around day shifts and night shifts, making life at camp almost robotic and systematically routinely. Maintaining strong work friendships remains extremely difficult when coworkers are switched to opposite shifts.[8] Similarly, the long weeks spent away from home pose a significant barrier to maintaining healthy relationships back home. The temporary absence of a member from home places additional stress and burden upon the family, which destabilizes the existing relationships.[9]

Fig. 18. Wapasu Camp next to the Suncor Aerodome

1.3.2 Camp life

Camp designs and operations revolve around material comfort, cost-effectiveness and the logistics associated with rotational shift work. Camps are comprised of ATCO type modular units linked together on large expanses of granular fill (see fig. 19 to 22).[10] Camps typically consist of individual dormitories for the workers, a cafeteria, a lounge space for social activities, a fitness centre, a laundromat, a commissary and a mudroom. Some less common spaces and services include: an outdoor sports pitch, guest rooms, specialty indoor recreation such as a theatre, running track, gymnasium or even hockey rink and health resource centres or on-site doctor as "many camps do not have health or wellness staff."[11] Despite a myriad of amenities, life at camp is often described as monotonous, where workers commonly undergo a loss of personal identity and have even described it as prison-like.[12] In recent years, the workforce has been increasingly confined to the work camp itself. This is perhaps in response to negative experiences between mobile workers, and local community members. There have been numerous instances of Indigenous women falling victim to male worker aggression during days off, so much so that many Indigenous communities have opposed the construction of worker camps near mines.[13] Communities neighbouring work camps often stereotype mobile workers and portray them negatively, which has a negative effect of its own.[14] Many camps offered frequent shuttles into town or provided the option of renting a company vehicle, but have ceased in doing so, also due to associated costs.[15] From 2007 to 2017, the number of backcountry activities undertaken by workers dropped by half to an average of 0.5 times per year per worker, perhaps also due to stricter camp regulations.[16]

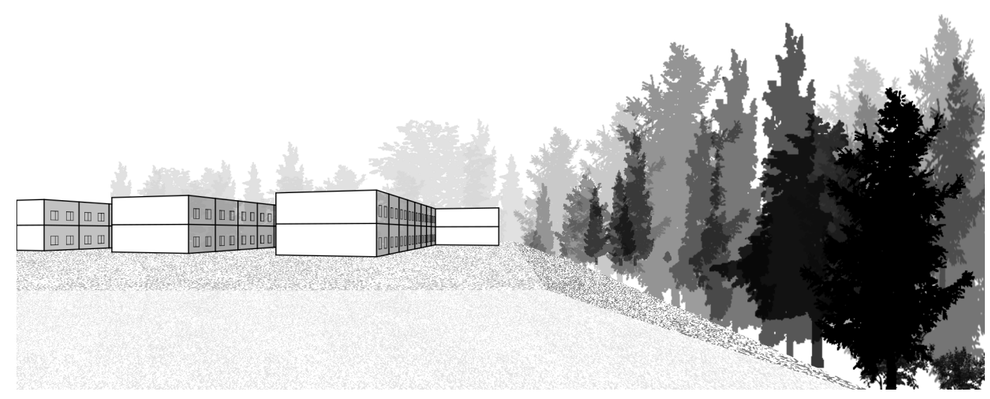

Fig. 19. Typical oil sands work camp arrangements

Sleep-deprived, overworked and stripped of intimate relationships, many workers find themselves on the brink of mental collapse.[17] The unfavorable work conditions force companies to inflate salaries to attract workers. Consequently, the rotational workforce often adopts competitive, hyper-masculine, "work hard play hard" attitudes, particularly among the men (who comprise the majority of the work force.)[18,19] For this reason, some camps resort to completely banning workers from bringing "mind-altering substances" to the camp, including alcohol.[20] The high salaries, lack of social stimulation, mental hardships and exhaustion form the conditions that may entice some workers to experiment with drug use.[21] The privacy and isolation associated with individual dorm-style rooms provide ideal conditions for workers to partake in drug use, particularly those already suffering from addiction.[22] Some may even use drugs to "as a way to enhance work performance, or as a way to cope with stress."[23] In the publication of her *Alberta Story*, one housekeeper described having to smile at the workers during their shift changes as the exhaustion was visible in their eyes. This story also recalls a housekeeper walking into a room to find the occupant having committed suicide.[24] For this reason, some camps undertake daily room checks to ensure worker wellbeing.[25] Suicide rates in Alberta have been directly linked to the fall of oil prices as it often leads to large worker layoffs.[26]

Fig. 20. Exterior view of the Civeo Buffalo Lodge

Fig. 21. A Large hallway at the Barge Landing Lodge

Fig. 22. Workers outside Syncrude's Mildred Lake Village

1.3.3 Gendered occupations and polarized income

The social reproduction of the male oil worker strongly characterizes workforce dynamics and camp functioning.[27] Due to the 10-12 hour rotational shifts, the highly choreographed "camp life is geared towards reproducing the oil worker for the next day (or night) of labor shapes the spatial and temporal experience of care work."[28] A 2018 study on the gendered circuits of care within the camps "[...] found the camp staff – especially in housekeeping, kitchen and dining services, and janitorial work – to be more often female, racialized non-white, and foreign-born."[29] Those working the higher-paying oil jobs where six-figure salaries are not uncommon, are typically white men.[30] Within the FIFO camp context, responsibilities of care are seen "[...] as a gendered, as well as a raced and classed, enterprise."[31] In addition to the lower pay, this demographic is subject to "longer rotational schedules, and less robust travel support."[32] All workers endure the difficulties of isolation and separation from their family.[33] However, those occupying feminized work tend to see their jobs less as a sacrifice in seeking material provisions for their families than do those in the oil work or maintenance staff.[34] Tarnished with sexist, homophobic and even racist views bred among the oil worker, unhealthy views and treatment of female workers often arises within the camp setting.[35] The fostering of hypermasculine attitudes and values within the workplace is often manifested in workers' behaviours at home. Many may adopt hobbies related to fossil fuel consumption: riding ATVs, snowmobiles, large trucks and fast cars.[36] These pastimes are also a result of the high salaries that many workers receive coupled with an often rural home context.[37] It is clear that the industry promotes hypermasculine values and that a distinct "petro culture" arises in many of these work operations, an issue not eased by the work camp design and functioning.

Fig. 23. The predominantly male workforce

1.3.4 The energy transition

What is a much needed energy transition to the world is also to many people a significant job security concern. Over 53,000 jobs were terminated between 2014 and 2019 in Canada's oil and gas industry from changes in market demand.[38] Oil workers are familiar with mass-layoffs. The current time is a crucial one for securing what is known as a just transition, one that ensures as little turbulence as possible for those most affected by the shift. Not only is a just transition ethical, but it is paramount to the success of the transition itself. Although unions of the energy sector historically tend to support fossil fuel-related projects to secure more employment, new generations of union leaders are beginning to embrace the greater employment opportunity that presents the transition. Unfortunately, "the Canadian energy industry is highly unorganized, with less than one in five people being covered by a collective agreement (down from one in four in 2001)."[39] Therefore the fight for a just transition cannot rest solely on the shoulders of unions, it must also be supported by non-unionized workers, governments, industry leaders and policy makers.

Fig. 24. A large group advocating for green jobs at the 2017 DC Climate March

The just transition forms a key component in Canada's *Leap Manifesto*, calling for the full participation of workers in the transition itself.[40] This manifesto sets the goal of democratizing energy sectors, essentially transitioning the control of these systems towards communities and away from private corporations.[41] The idea that the only way forward is by letting private renewable energy producers take control of the sector and gain government subsidization is being perpetuated within the trade union politics.[42] However, de-privatization and democratization is more than just a formality within the transition, it's fundamental to addressing the greatest climate-change struggle.[43] To Sean Sweeney, coordinator of *Trade Unions for Energy Democracy*, this implies

> extending [the trade union] solidarity to the biosphere and the ecosystems itself. Why should, if we're talking about life holistically, as a total thing as we are part of the environment, then the environment is part of us, then why does solidarity stop in the human form, why should we be anthropocentric? We need to be totally Earth-centred in our approach."[44]

The current climate crisis calls for a far greater transition than simply that of energy. Without out greater changes, the myriad of aforementioned social problems and barriers in transparency associated with the petro-capitalist system risks remaining, only this time under an electric energy system. The current climate crisis calls for radical changes in the way humans see themselves and the concept of nature. This is the fundamental change on which other changes may occur most successfully (see fig. 25).

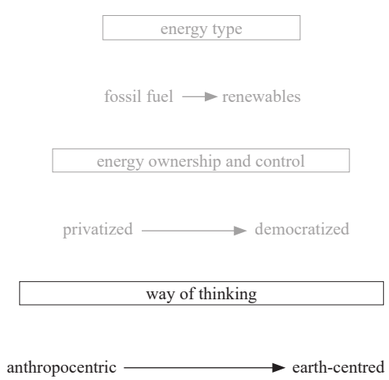

Fig. 25. The earth-centered approach as the foundation of ecological action

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10 Sara Dorow and Shingirai Mandizadza, "Gendered Circuits of Care in the Mobility Regime of Alberta's Oil Sands" *Gender, Place & Culture*, 25, no. 8 (2018).
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PART 2

DESIGN APPROACH AND FRAMEWORK

"The ecological thought doesn't just occur 'in the mind.' It's a practice and a process of becoming fully aware of how human beings are connected with other beings - animal, vegetable, or mineral. Ultimately, this includes thinking about democracy. What would a truly democratic encounter between truly equal beings look like, what would it be-can we even imagine it?"[1]

-Timothy Morton, *The Ecological Thought*

2.1

PHILOSOPHICAL APPROACH

ESTABLISHING A PHILOSOPHICAL ANGLE

2.1.1 The Ecological Thought

The thesis sets out to explore the potential of mobile work camp architecture in alleviating the social, political and ecological issues associated with the oil sands mines and the petro-capitalist system that enables their continuance. This warrants the adoption of a theoretical framework to critique current realities and to speculate alternate ones. Although the transition and democratization of energy symbolizes profound changes in sustainable human existence, a radical transition in the way humans see themselves in nature is imperative to long-term prosperity of life on earth and needs to be folded into the energy transition discourse. Writer Timothy Morton's thinking on ecology provides fruitful philosophical insight in this regard and thus serves as the primary material for orienting an approach to the architectural thinking. Rooted in object-oriented ontology (OOO) and primarily exhibited in publications *The Ecological Thought, Ecology Without Nature* and *Dark Ecology,* Morton's philosophy describes ecology as a complex, completely interconnected and in many ways uncanny reality.[2] Using the concept of *the mesh,* Morton likens ecological interconnectedness to a weaving whose constituents are inextricably tied to one another, absent of any centre, edges or governing hierarchical structure (see fig. 26).[3] Not only are all things interdependent, but the more one tries to grasp ecological interconnectedness, the stranger and more ambiguous it becomes.[4] Ecological thinking involves acknowledging this infinitude along with the perceptive and therefore limited nature of the human ontological scope. Thinking otherwise, by assertively positing ecology as a healthy, straightforward and 'bright-green' concept sets the conditions for neglecting the life systems that enable human existence. In other words, thinking in a non-anthropocentric way better positions humans to enact sustainable behaviours, ironically ensuring better conditions for human prosperity. This prompts the rethinking of cultural concepts like 'nature', which actually fail to serve ecology well."[5] Notably, Morton voices the need to steer the ecological discourse away from impossible-to-grasp data around global warming and anthropogenic peril and towards deep modes of inquiry into the ecological mesh.[6] Doing so opens the door for a more democratic, intimate, enchanting and pleasant existence with other beings.[7] Morton asks "what would a truly democratic encounter between truly equal beings look like?"[8] In the context of the work camp this may entail proposing different ways of experiencing, or being aware of, other beings at the mine site. In other words, setting the conditions for a more intimate, pleasant and contemplative experience of a place otherwise seen as a resource or a place of disaster. Fig 27 illustrates the transition in thinking about nature that may guide the speculative work camp design. That is, a shift of focus away from the control, conservation and categorization of nature and towards coexistence, democracy, and solidarity with other beings. In other words, nature and ecology are not simply seen as externalities to the human, but that in fact all things are part of nature and are all equally natural. Thinking this way in the design process means thinking differently about geographical space, technology, industrial metabolism, efficiency, intimacy with other beings and particularly about the idea of an 'environment'. It also involves treating the architecture as a speculative and even provocative medium. Architecture can be explorative, and like art, it can "allow us to glimpse beings that exist beyond or between our normal categories."[9] This approach was used to imagine how the work camp could be both a result of and a tool in ecological thinking. How would humans inhabit a place of "ecological destruction" like the Alberta oil sands?

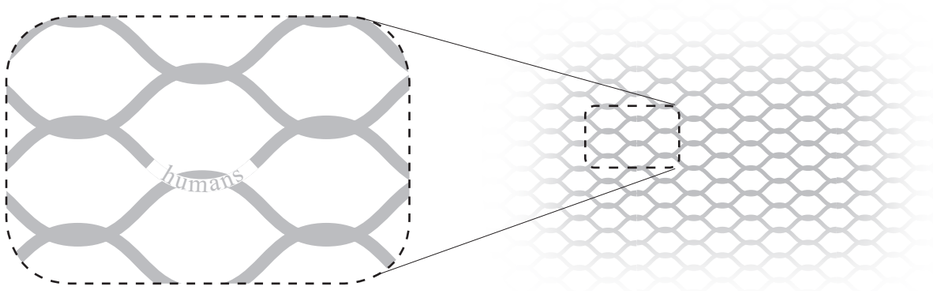


Fig. 26 . The ecological mesh

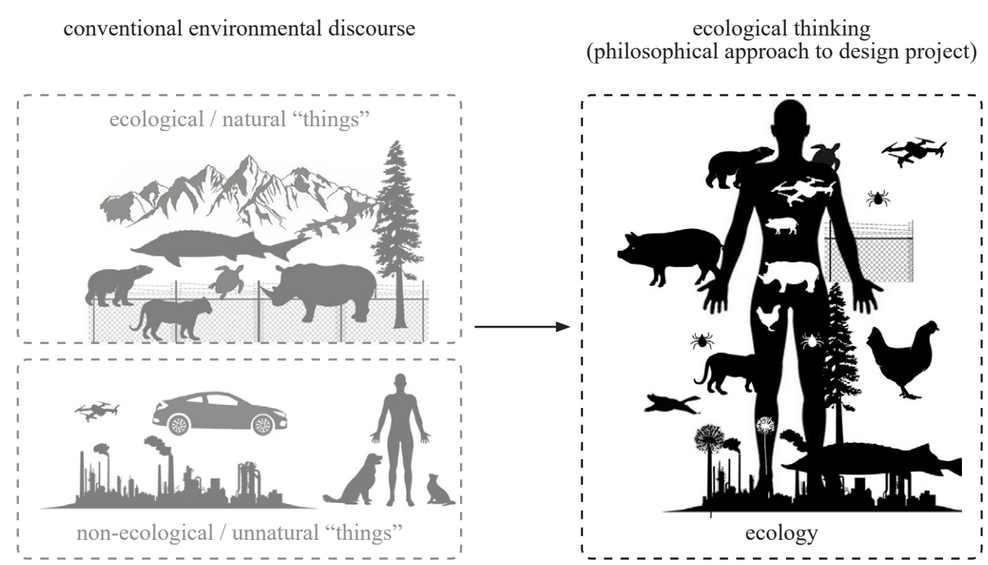


Fig. 27. The shift away from conventional environmental discourse

2.2

SPECULATED SPATIAL LOCATION

LOCATING THE DESIGN PROPOSAL WITHIN A PARTICULAR GEOGRAPHICAL SITE

2.2.1 Site in space: the Frontier Project

The work camp design is posited within a particular oil sand mining operation, *The Frontier Project*. Located 100 km north of Fort McMurray near the Athabasca River, the project plans to develop one of the largest bitumen extraction operations of the area.[10] The company, Teck Resources invested over one billion dollars and ten years of planning in the project only to withdraw the final application in February of 2020 in light of vast amounts of controversy.[11] This mine does not exist, it is only a plan. Projected to produce 260,000 barrels of oil per day for over 40 years, the 240 square-kilometer mine would contribute significantly to the decimation of boreal forest in the Athabasca region (see fig. 29).[12] Frontier's outcome symbolizes the conflict between Canada's resource economy, its goal of negating carbon emissions and the urgent need to acknowledge the value of land for indigenous peoples and for all life on earth. This looming reality speaks for many other bitumen mining operations currently awaiting favorable economic conditions to undertake.[13] Frontier provides a relevant and fruitful framework of exploitative attitudes in which to locate the thesis' speculative design and approach to ecological thinking (see fig. 28).

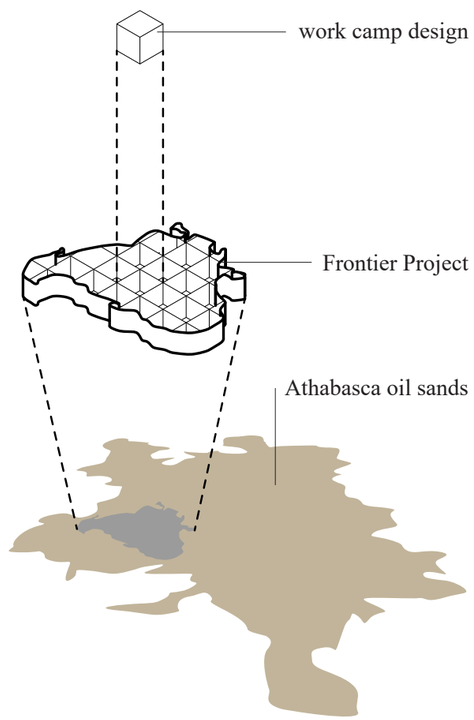


Fig. 28. Frontier as the framework for speculation

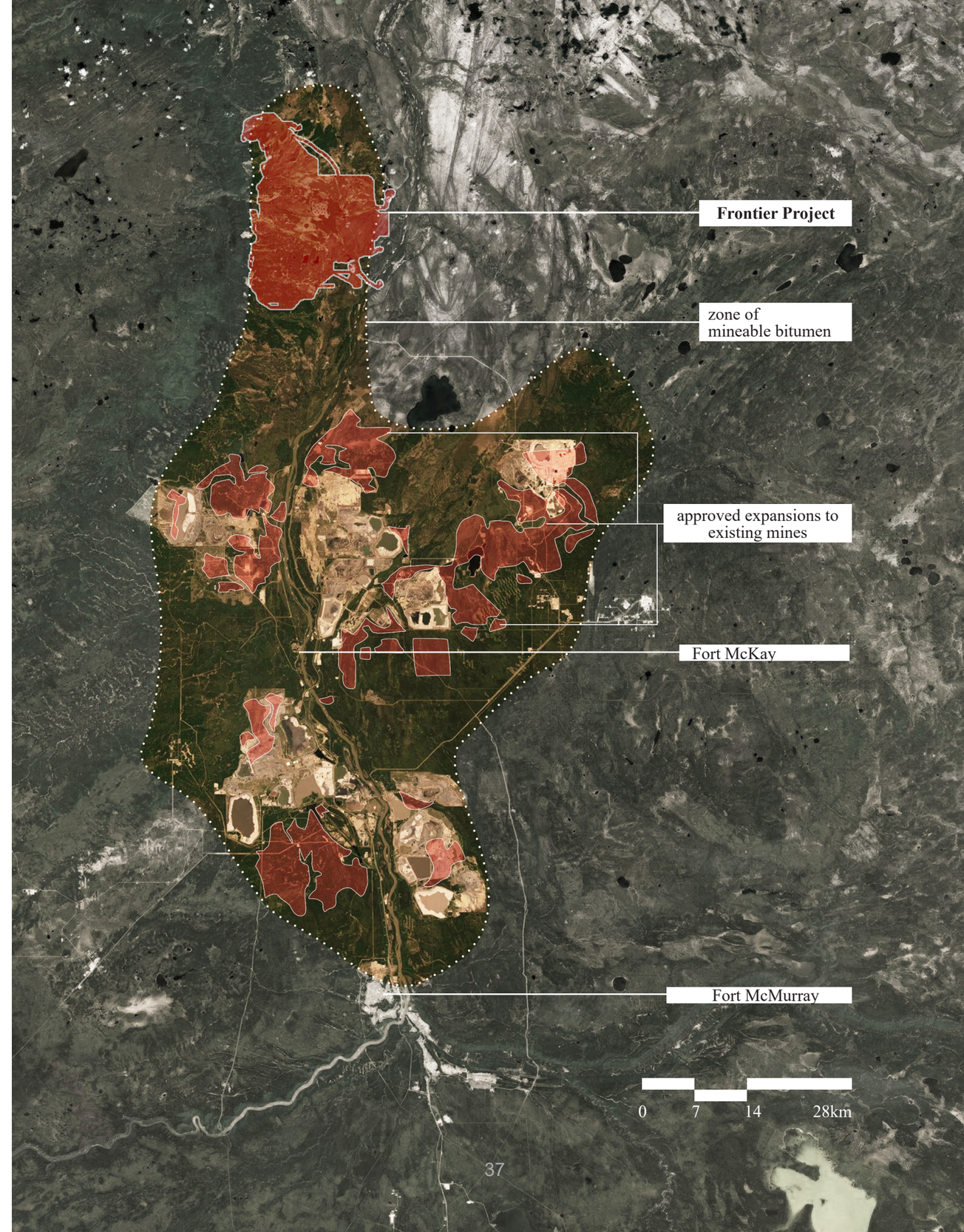


Fig. 29. The Athabasca oil sands mining region

The scale of the Frontier Project is difficult to grasp, but when placed over the city of Toronto, one quickly realizes its colossal footprint (see fig. 30). In its shear scale, the proposed plan greatly threatens the wellbeing of animal and plant species, destroys traditional Indigenous hunting grounds and poses great risks to the Athabasca River and the vast ecosystems it supports.[14] Oil sands mines in this area "are having a cascading effect on [the Mikisew Cree First Nation] individuals and families, on the intergenerational transmission of cultural knowledge, and on the ability of Mikisew members to meaningfully practice sakaw pimacihiwin, or way of life [...]."[15] Teck has failed to fully involve affected Indigenous communities in the decision-making process of the Frontier mine.[16] The project poses great risk to several culturally-valuable and threatened species, namely the Ronald Lake wood bison herd, the Red Earth and Richardson caribou herds, the whooping crane and hundreds of other migratory birds.[17] Wood bison and caribou will be most affected by the destruction of their respective habitats and forage territories, the increase in predation areas and the sensory disturbance caused by mining activities.[18,19,20] Deforestation and aquifer de-watering will displace significant populations of migratory birds that depend on the wetlands and old-growth forests as habitat and stopover areas.[21] Mine infrastructure (cables, towers, lights, etc) and especially the deleterious substances in the vast tailings ponds also significantly increase the risk of bird mortality at Frontier.[22] Outside the mining area, vegetation biodiversity patterns will change with significant aquifer alterations from de-watering activities and with constant exposure to SO_2 fumigation, provoking additional ecological shifts in the area.[23,24] Figure 31 illustrates how the Frontier Project will expand outwards year by year until all the bitumen has been exhausted. The project plans to undertake reclamation progressively, meaning that some portions of the land will be remediated while mining is still underway. Figures 32 to 38 illustrate some of the ecological effects that the Frontier Mine would impose. These photographs are taken at existing oil sand mines in the Athabasca region.

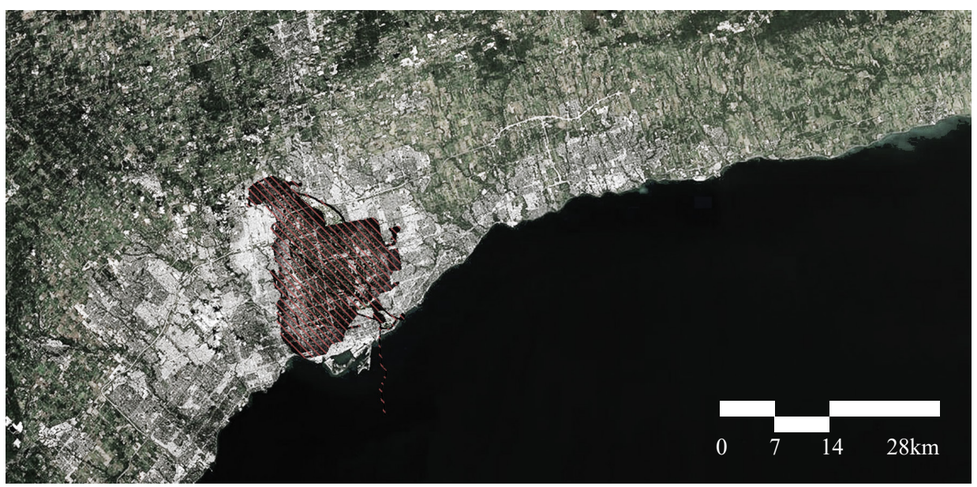


Fig. 30. The Frontier Project's footprint on Toronto

Fig. 31. The spatial evolution of the Frontier Mine

Fig. 32. The edge of a tailings pond

Fig. 33. Clearing the boreal forest to expand the mining area

Fig. 34. A propane cannon and robotic bird to scare birds away from toxic tailings

Fig. 35. A line of scarecrows to deter birds from landing in toxic tailings

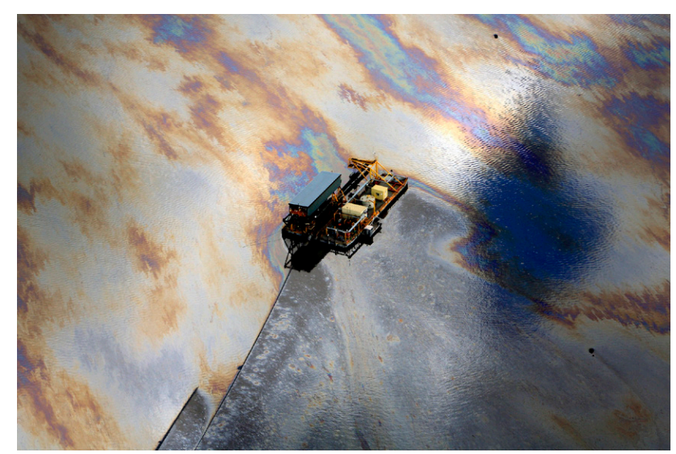


Fig. 36. A “skimmer” removing the layer of oil in the tailings ponds

Fig. 37 A fenced area where a bison herd has been reintroduced

Fig. 38. An area undergoing reclamation

Teck admits the project would undoubtedly displace wolf, moose and white-tail deer, likely tampering with predation patterns in the process.[25] To mitigate these effects, Teck proposes progressive reclamation and calculated transplantation and recolonization of plant species as a measure of habitat restoration but the effectiveness of this strategy remains unclear.[26] Progressive reclamation involves restoring the disturbed landscape as early as possible in the mine's life, reclaiming areas shortly after their extraction. However, animals like the wood bison may not become habituated to the mining processes or may not be able to access the proposed reclaimed areas conveniently.[27] Besides, it may take hundreds of years for disturbed land to return to suitable conditions for inhabitation, foraging and breeding, with ecosystems like peat lands almost impossible to return to the original state.[28] Environment and Climate Change Canada (ECCC) has responded to Teck's proposal with multiple recommendations to mitigate the project's effect on the aforementioned species. Most include undertaking ongoing studies to monitor key species during the life of the mine, and to take the measures needed to deter animals from coming into contact with mining equipment, infrastructure and toxic storage areas.[29] As of May 2021, the site of the Frontier Project remains unexploited. However, the site has been extensively scarred by seismic lines cut in the last decade during exploratory drilling operations (see fig. 39). Seismic lines facilitate the transportation of drilling equipment and are approximately 9-10m wide on average at the Frontier site (see fig. 40). The future of the Frontier mine remains uncertain. In a time where the energy transition is bound to make fossil fuel mining obsolete, the prospects for undertaking a four-decade long extraction project seem bleak. However, the energy transition by no means marks an end to extractive practices. What if this were the last fossil fuel extraction mine? How would it be inhabited? How would it be undertaken?

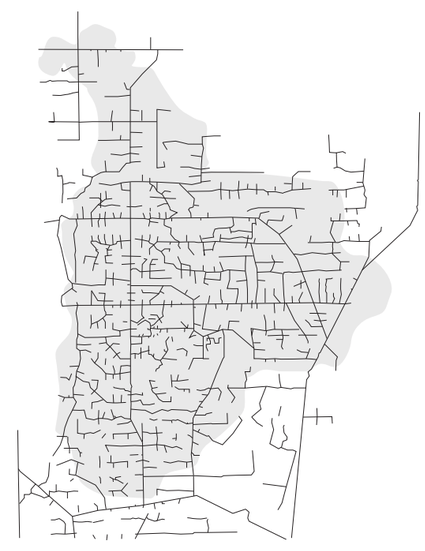


Fig. 39. The seismic lines of the Frontier Mine site

Fig. 40. The seismic lines of Suncor's Firebag operation

2.3

SPECULATED TEMPORAL LOCATION

LOCATING THE DESIGN PROPOSAL WITHIN A PARTICULAR TIME FRAME

2.3.1 A new cultural era

Establishing the speculative premise requires locating the Frontier project and, the work camp that reimagines its undertaking, within a future time frame (see fig. 41). The proposed architectural model enables the imagination of this new time frame but also requires the presupposed establishment of an alternate time period. The project is posited sometime within the next decade. In this time, fossil fuel energy is still in significant demand and oil sands mining still serves as a common method of energy extraction, but what has shifted is the way humans view themselves in relation to nature. This orients the speculation away from the discourse on the type of energy and imagines a world where greater, more radical transitions have occurred. The proposed work camp and the Frontier project are henceforth speculated within the frame of a new cultural era. This signifies a time where humans are fundamentally concerned with the ecological condition of the world in their unanimous acknowledgment of ecological interconnectedness. This stage in time can be illustrated as a sort of 'peak oil' scenario, but in terms of environmental ontology: anthropocentric thinking is in a deliberate phase-out (fig. 42). While the crude oil production has not yet peaked, energy production and ownership is now democratized, and lies in the hands of communities, scientists and labour unions. These changes have occurred because of policy-making and an economic restructuring, but at thus time, the difficult task remains to extend democratic thinking to the biosphere, essentially seeking an ontological integration into the ecological 'mesh'. This implies seeking out a visceral connection to nonhuman beings in realizing that remaining focused on the dooming facts of climate change and ecological collapse serves no purpose at this critical time. For the Frontier Mine, this means rethinking ways in which human workers interact with the affected life systems. In this new cultural era, ecological monitoring is now synonymous with the monitoring of human health. Resource extraction operations function with the same care, precision and patience as that of an open-heart surgery. With that said, what would the work camp design resemble and how would it function in these circumstances? As a deeply phenomenological experience, architecture may serve as a potent agent in acquainting humans to ecological thinking. As shown in fig. 43, how can architecture be used to deliberately tune the human to an ecological democracy in this time of urgent ontological transition? More precisely, how could the work camp design cultivate the Frontier worker's role in ecological action by becoming a democratizing agent? These are the questions that initiated the focus on technologies in the development of this speculative design.

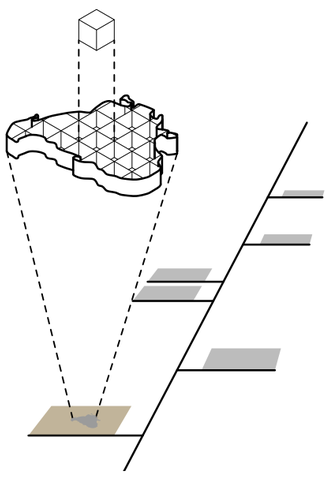


Fig. 41. Locating the project within a future time frame

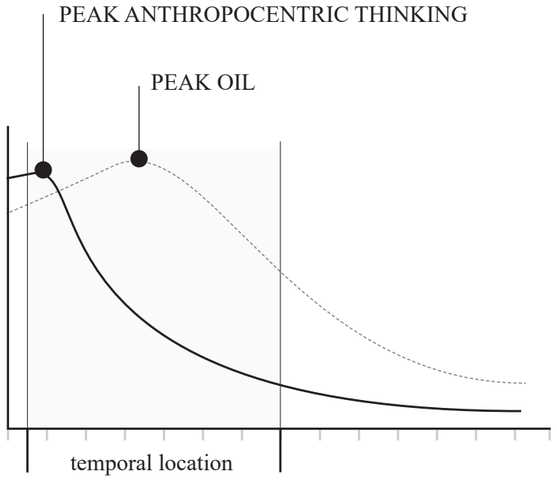


Fig. 42. Temporal location of the design proposal

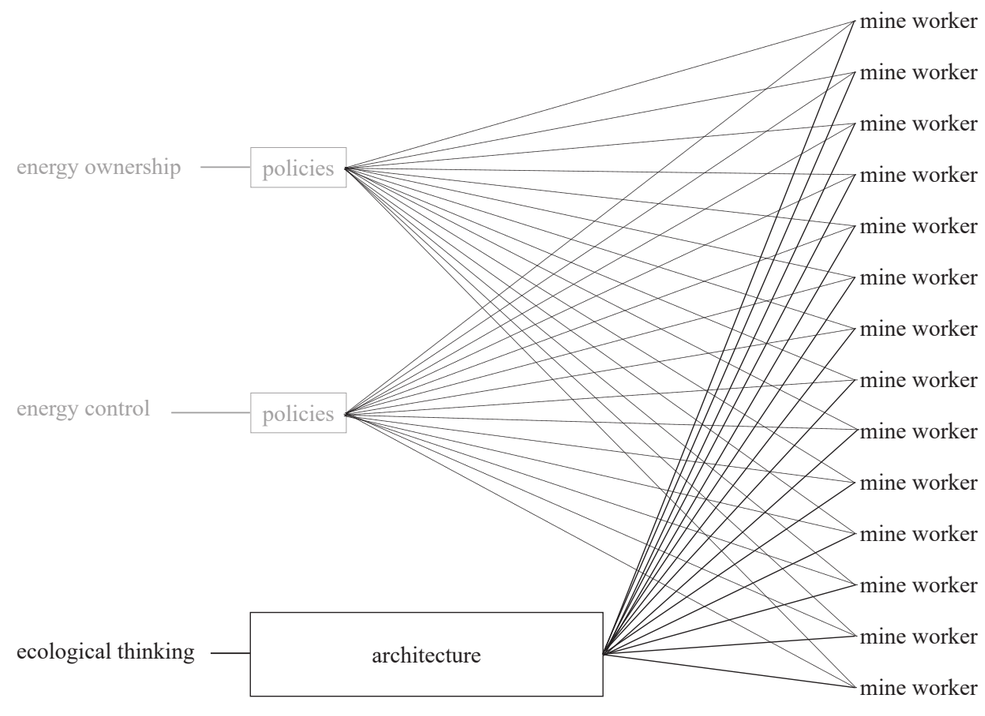


Fig. 43. Architecture (the work camp) as an agent of ecological democracy

2.4

INITIATING THE DESIGN: PROBING THE SOUNDSCAPE

IDENTIFYING A POINT OF ARCHITECTURAL INTERVENTION

2.3.1 Acoustic Remote Sensing

The approach to the design initially revolved around an intervention at the building's envelope (see fig. 44). This first idea sought to explore how the camp could become a type of inhabitable lens that would transmit exterior information inside the camp, enabling mine workers to interactively learn about the effects of the mining operation as it progresses. If the camp became a place of engaged learning through spatialized forms of technology, new possibilities regarding ecological action could be imagined in the workforce and in the Frontier mine. This lead to the idea that the camp could be subdivided into multiple camps, each to act as a monitoring station (see fig. 45). This lead to extensive research on remote sensing technologies used in ecological analysis, which presented either previous or potential future utility at the oil sands mines. These included LIDAR sensing, chemical sensing, drone and satellite imagery and acoustic sensing. This is not an exhaustive list but rather the few technologies that had the best likelihood of becoming viscerally experienced or spatialized through their architectural integration. The variety of ecological problems (threats to the biosphere) posed by the Frontier mine made it difficult to choose and explore a sensing method. Additionally, many require tacit knowledge to interpret and communicate findings in hard data, but acoustic sensing proved most promising in this regard. Many organisms (bats for instance) use acoustic analysis to perceive space, as do submarines, but acoustic data also holds vast potential in ecological analysis.

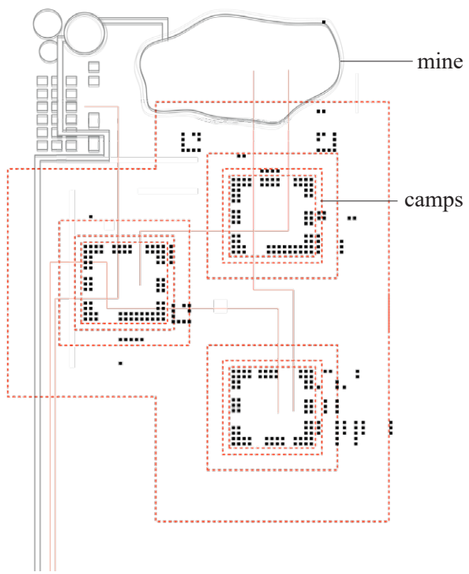


Fig. 44. Preliminary concept of reorienting and permeating the camp design, December 2020

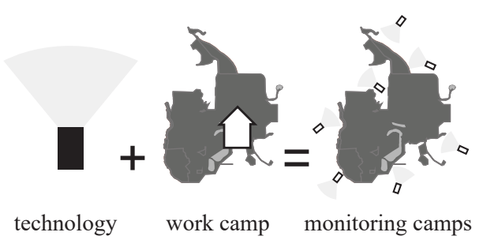


Fig. 45. Seeing the camp as monitoring instruments

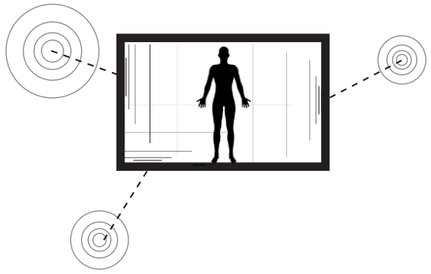
Today, the field of *ecoacoustics* "considers sound as an ecological attribute that can be utilized to investigate a broad array of applications including the diversity, abundance, behavior, and dynamics of animals in the environment."[30] Listening is non-invasive, is an intrinsic human ability, can be passive or active, is central to the human's spatial perception and is also strongly related to architectural experiences. The acoustic dimension of the work camp thus became the primary point of focus in this speculated design. This focus also enabled the camp to become a place of relaxation, contemplation and immersion into the soundscape, acting as an agent of ecopsychological therapy. Fig. 46 shows one of the first concept drawings from this idea of acoustic transparency and sensitivity.

-LIDAR (monitoring vegetation growth)

-chemical sensing (monitoring toxic leaks)

-drone/satellite imagery (monitoring animal and plant species populations, etc)

-acoustic sensing (much broader applications)



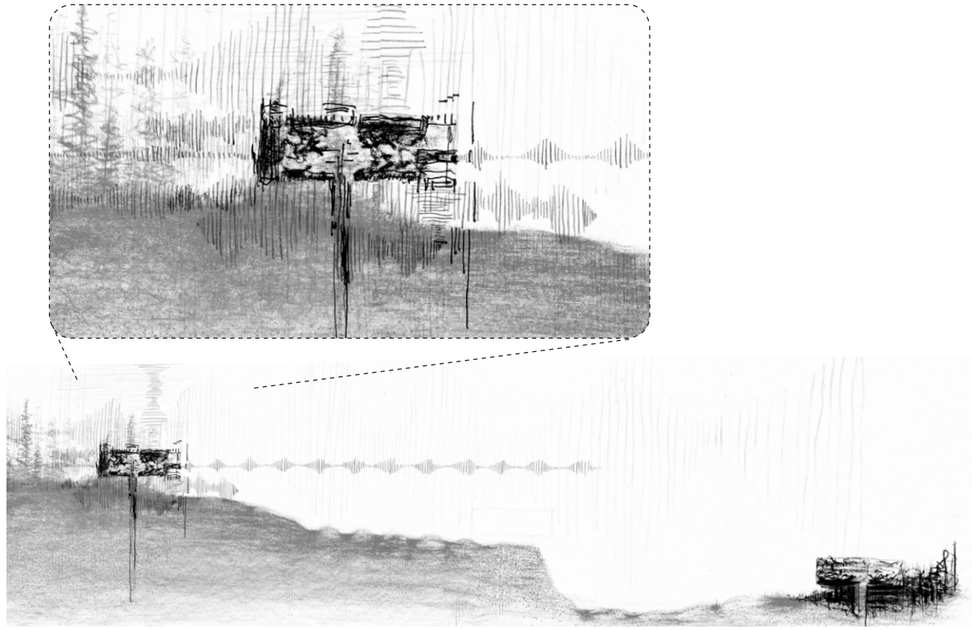


Fig. 46. Early concept of making the camp permeable to the Frontierès soundscape, February 2021

2.3.2 Soundscape ecology

Following Racheal Carson's 1962 publication, *Silent Spring*, the term "'ecology" became part of everyday vocabulary."[31] The book's title makes a poignant reference to the unsettling absence of songbirds in the Spring from the effects of toxic pesticides.[32] Carson herein exposed the irresponsibility of governments and corporations but also "foresaw the importance of biological sound as an indicator of the health of ecosystems."[33] Although listening as a means of environmental analysis undoubtedly predates 1962, this acoustical elucidation served as a large proponent in environmental rhetoric at the time.[34,35]

Soundscape ecology refers to the study of sonic data as a landscape. This includes the myriad of sounds within a soundscape, the relationships between them and particularly "the overlap of three distinct sonic sources: geophonies, biophonies, and anthrophonies."[36] These categories refer to sounds of the earth (wind, water, soil), of the biosphere (organisms) and human activities (industry, technology) (see fig. 48).[37] Soundscape ecology is particularly useful in monitoring the effects of climatic change and anthropogenic activities on geological and biological patterns.[38] It represents the amalgamation of landscape ecology, psychoacoustics, acoustic ecology and bioacoustics. For this reason it is key in understanding the individual components within it, particularly in this changing world. The soundscape is a fundamental and inseparable dimension to the geographical landscape as virtually all organisms affect and become affected by the soundscape in some way, humans included.[39]

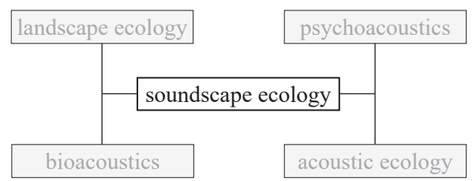


Fig. 47. The trans-disciplinary character of soundscape ecology

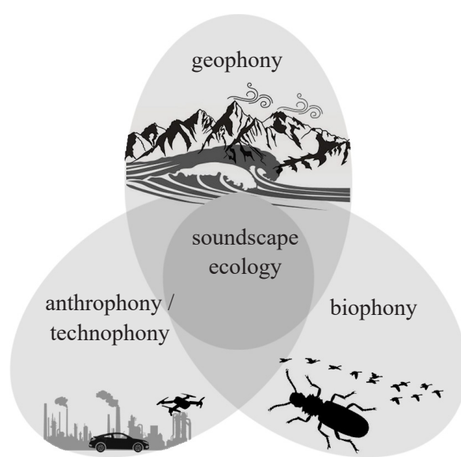


Fig. 48. The geophony, biophony and anthrophony / technophony of soundscape ecology

Various hypotheses and models exist to explain and analyze the complexity of soundscapes. The acoustic niche hypothesis (ANH) serves to explain and examine the chorus-like repartition of species vocalizations among the soundscape (see fig. 49). It suggests that "every species has a unique acoustic space in which to structure the sonic species-specific signature to reduce interspecific competition and to optimize intraspecific communication mechanisms."[40] Similarly, the acoustic adaptation hypothesis (AAH), highlighting the ability for many organisms to alter the frequency and volume of their vocalizations in response to other sounds encroaching upon their acoustic niche. The AAH is of particular value with the increasing prevalence of anthrophonic sounds and warrants the attention of humans in these times of change.

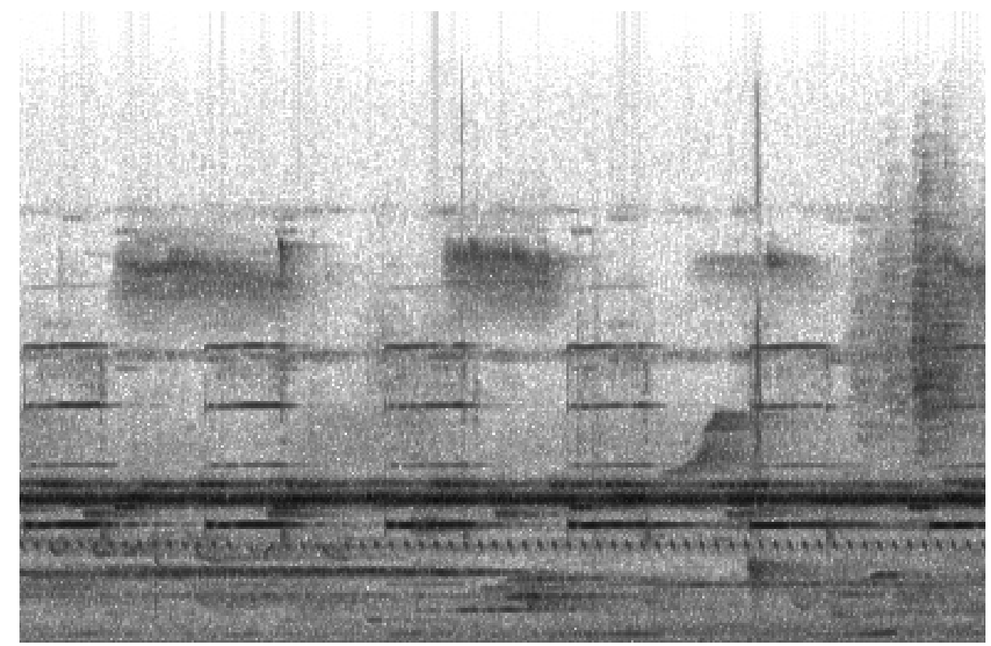


Fig. 49. A spectrogram depicting the acoustic "niches" of various species within a recording of a forest

2.3.3 The democracy of listening

Listening is a fundamentally democratic aptitude. With respect to ecology, listening has the potential in including nonhuman beings in democratic thinking for "it is difficult to be responsible to an environment if we have first not listened in to find out who and what is present."[41] Sound has the ability to immerse the listener, connecting them viscerally and intimately to the source.[42] As shown in fig. 50, the soundscape can be experienced at varying levels, from the physical (merely feeling a sound), the perceptive (hearing audible sounds) and the interpretative (analyzing and decodification of sound).[43] With the increased affordability of electroacoustic technologies, the opportunity for public engagement and the development of citizen-science networks are increasingly promising in soudscape ecology.[44] This means of democratizing ecological data proves vital in a time when media blackouts and corporate greenwashing pose great threats to the transparency regarding the ecological condition of the earth. The acoustic dimension therefore provides a window into the decentralization and dissemination of fundamental information, which warrants the investigation of its implications across multiple disciplines. Architecture is no exception to this, in fact it may be a key point of intervention in this regard.

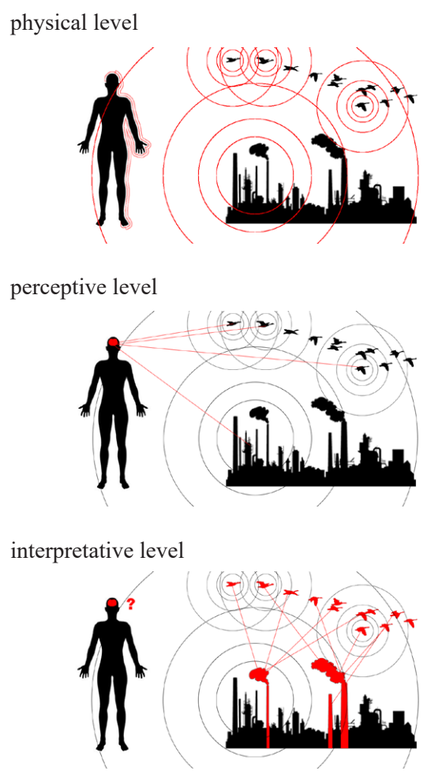


Fig. 50. The three levels of soundscape interaction

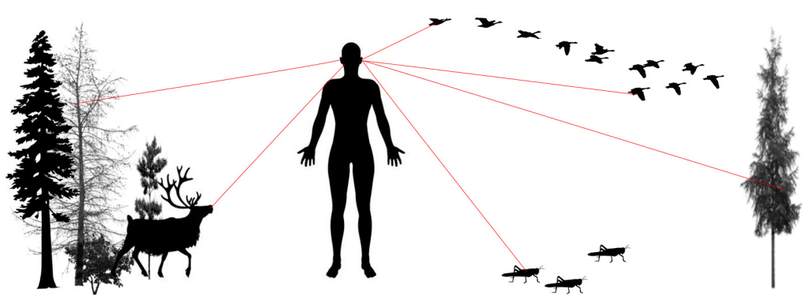


Fig. 51. Listening as an ecological democracy

2.3.4 Designing for listening

As architecture serves the primary purpose of sheltering its occupants, the treatment of acoustics in today's architecture tends to revolve around the control of sound, more specifically the abatement of noise pollution.[45] The increasing efficiency of wall assemblies in sealing the interior from the exterior has many performance benefits and has characterized much of the passive house movement in recent decades. However, this well-intended effort has segregated the inhabitant from the exterior, further perpetuating the distinction between humans and the environment and improperly dealing with issues surrounding noise pollution (see fig. 52). Architect Juhani Pallasmaa refers to tranquility as "the most essential auditory experience created by architecture [...]."[46] This is not to say that tranquility and silence are inherently bad. In fact Pallasmaa acknowledges the emotional and intimate power of sound, that hearing the organ in a church "makes us immediately experience our affinity with the space."[47] For this reason, many architectural spaces over the course of time have been designed for listening. Historically, such spaces rely on specifically-designed geometries and materials that either reverberate or attenuate sound to cultivate a particular acoustic condition.

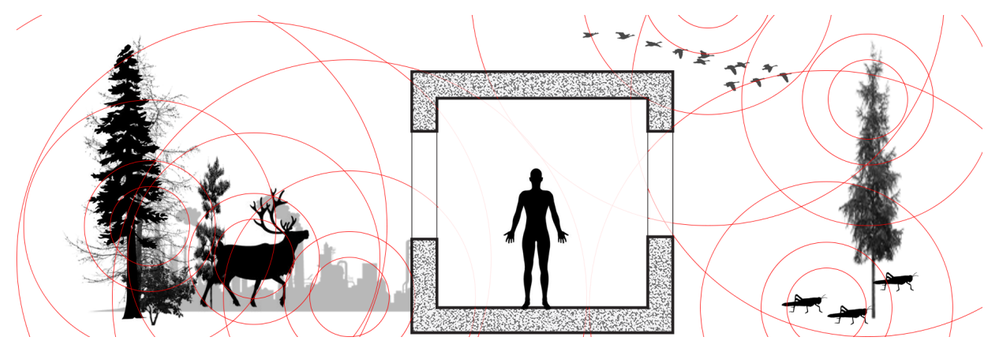


Fig. 52. The sound-isolating nature of typical building envelopes

Technological advancements have enabled the creation of 'synthetic' versions of these heightened sensory environments (ex. music concerts and movie theatres). Installation art has greatly benefited from this and has inspired the design of deeply immersive and visceral indoor environments, a notable example being Olafur Eliasson's *The Weather Project*. Here, numerous lamps form a semi-circle while a large mirror clads the ceiling, mimicking a setting sun as a mist carries the warm glow in an atmospheric manner (fig. 53).[48] In a similar way, immersive environments have been created with sound. Canadian sound artist Robin Minard uses hundreds of loudspeakers to effectively 'rebuild' a pre-recorded soundscape in an interior setting. The multiplicity and arrangement of the speakers make very high-resolution spatialization of the sound, creating the feeling of periphery and intimacy (fig. 53).[49] Minard like to cultivate quiet sound conditions with very slight incongruences forcing listeners to pay close attention to the piece.[50] Visually, he brings a sense of to life to the installation as he arranges the technical elements in ways "that are reminiscent of organic elements."[51]

Fig. 53. Olafur Eliasson's The Weather Project, 2003

Fig. 54. On and Between by Robin Minard

In a similar way, sound art proves potent in transmitting ecological information as it has "the potential to contextualize scientific information with humanity's innate qualities [which] adds meaning to data and scientific investigations."[52] The ability to get immersed in soundscapes, however synthetic or re-created, provides a basis for the heightened experience of acoustic information.[53] Italian ecoacoustic composer David Monacchi uses high-quality recording devices to capture the acoustic complexity of some of last remaining rainforest ecosystems in the world to replay them in an immersive setting.[54] The listeners can experience in 3D the dynamics and depth of the threatened areas (see fig. 55-57).[55] These projects have proved particularly inspiring to the development of this work camp design.

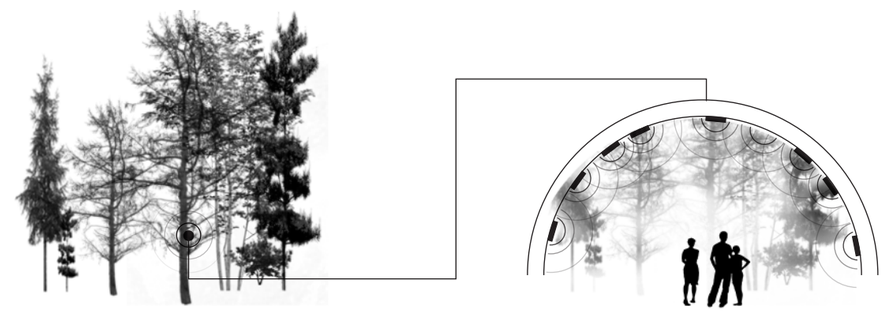


Fig. 55. Fragments of extinction

Fig. 56. Fragments of extinction

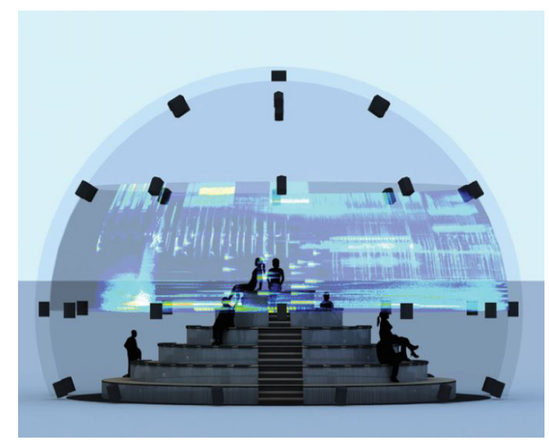


Fig. 57. Fragments of extinction

Notes section 2

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PART 3

DESIGN: CAMPS OF LISTENING

"If the sentimentality associated with the mythological image of nature is eliminated, the aesthetics of gentle stewardship and bias against artifice would go with it, leaving nothing but impossible questions regarding what exactly constitutes maximum benefit for human occupation."[1]

-David Ruy, *Returning to Strange Objects*

3.1

CONCEPT

SUMMARY OF THE DESIGN PROPOSAL

3.1.1 A place for listening

The final architectural proposal speculates ecological awareness as a democratized and visceral experience enabled via sensing technologies attuned to human phenomenology. A technologized building envelope and wall system makes the camp permeable to the surrounding soundscape, turning it into an instrument of both scientific analysis and ecopsychological inquiry. The work camp is subdivided into multiple smaller camps which are relocated away from the mine site into the surrounding boreal forest. Here, workers inhabit the areas most observably affected by the mining process. The extensive integration of recording instruments on the camp's exterior captures the soundscape into digital format, allowing it to be replayed inside and experienced in an immersive and heightened way. These conditions foster literal and figurative listening among the workforce, whose best interest lies in undertaking the mining project as best as possible within the democratized mining operation. Via immersion into the soundscape, the camp environment serves as a place of learning, inquisition and relaxation, helping workers to cope with the sensory stress of the job. In treating ecological awareness as the recognition of ecological interconnectedness rather than the anxious realization of ecological peril and anthropogenic catastrophe, new possibilities in worker and ecosystem wellbeing are made possible. By translating the soundscape into the camp, the architecture reframes the notion of the environment as a fundamental part of human experience and not as an externality.

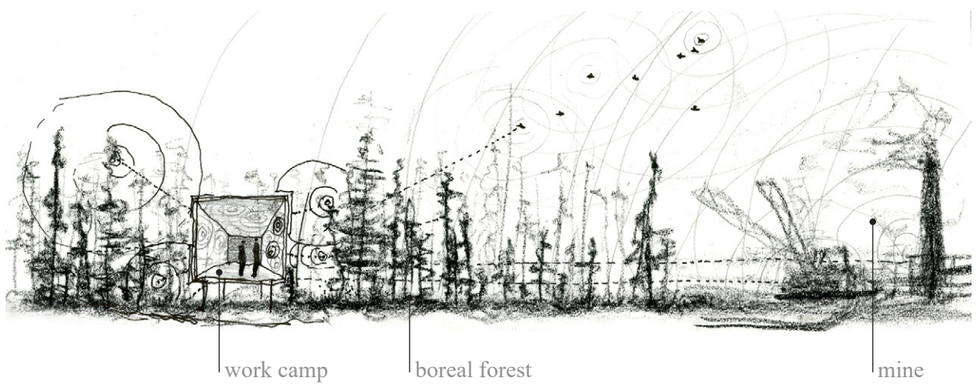


Fig. 58. Concept sketch

The work camp simultaneously becomes an ecological record for future reclamation processes, a tool for real-time soundscape analysis, an ecopsychological tool and a teacher of ecological knowledge (see fig. 59). These key functions are enabled by several prominent design characteristics, namely: the extensive use of acoustic technology in the camp architecture, the camp's modular and nomadic nature and its spaces of occupation. The work camp is herein assigned a key occupational role that engages all mine workers in the management of the mining operation, placing its ecological fate within the workforce's domain. This sets the conditions for better managing the mine's progressing encroachment, its methods of extraction and its reclamation processes. Simultaneously, the viscerally and formally acquired ecological knowledge helps workers transition away from fossil-fuel related occupations and into new vocations in times of energy change. The camps are comprised of modular units, enabling their constant relocation within the Frontier mine, making them each an object of monitoring and assigning them spatial power over the advancement of the mine. The architecture symbolizes the need to monitor the state of affected life systems but also to create space for intimacy, inquisition and attentiveness to other life forms. By turning the camp into a responsive, intelligent and immersive technologized space, new modes of existing ecologically are speculated, along with a radically different work camp dynamic.

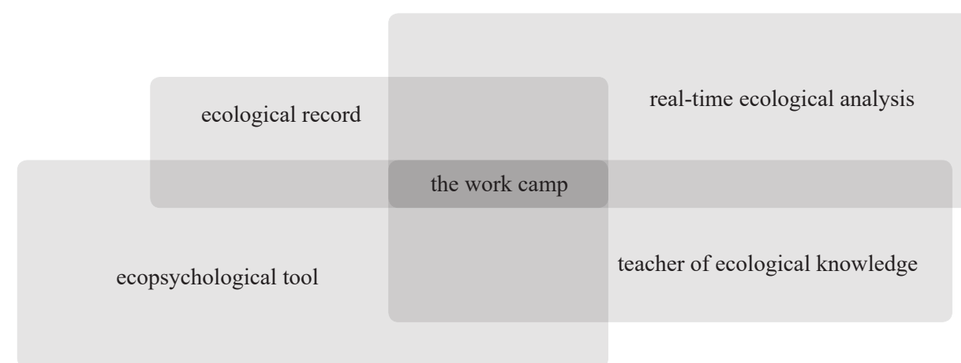


Fig. 59. Programmatic strategy - amalgamation of various roles

3.1.2 Instrumental transparency

In their ability to detect and translate phenomena otherwise imperceptible by human senses, technologies are fundamental in ensuring a transparency regarding ecological information. As seen in section 2.3.4, technologies also have the power to enhance ecological experiences and enable intimate encounters with nonhuman beings. The initial design thoughts for the camp design revolved around how the acoustic barrier of the building's envelope could be bypassed via acoustic technology. Figure 60 depicts the initial idea that the partitions of the camp could become technological interfaces phenomenologically attuned to the occupants to viscerally communicate ecological information, while relying on the human as the primary interpreter. This launched a technical investigation into various acoustic recording technologies, and how these could ornament the camp's facades to make an acoustically-receptive surface (see fig. 61). Simply eliminating the insulative layer of the camp's envelope, although feasible (i.e. tent-like structures), did not suffice in permeating the camp to the soundscape. Doing so would not only compromise the building's thermal performance in Alberta's frigid winter conditions, but it would ultimately forgo the opportunity to digitize the surrounding soundscape. Equipping the facade with numerous digital microphones would deconstruct the soundscape into various audio channels, which could then be played back at different volumes and spatial arrangements in the interior. Through multiple iterations, the acoustically-transparent wall system became the driving architectural language that enabled the programmatic development of the camp.

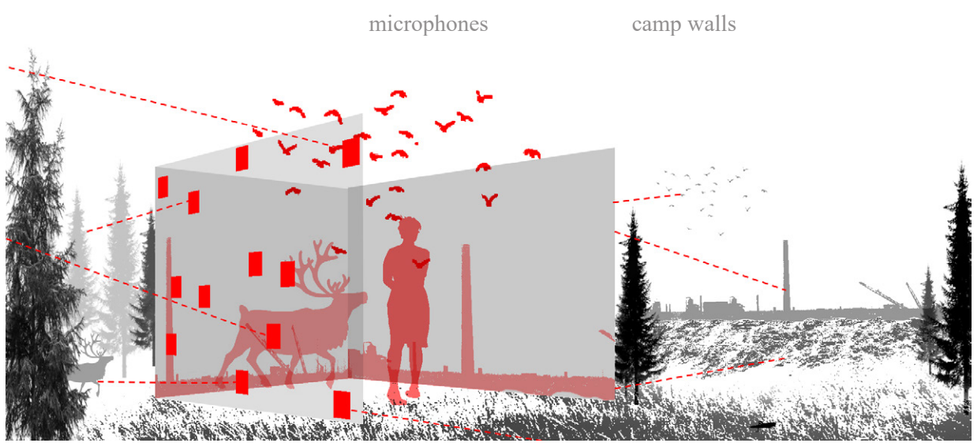


Fig. 60. Technology enabling heightened sensorial experience at the camp

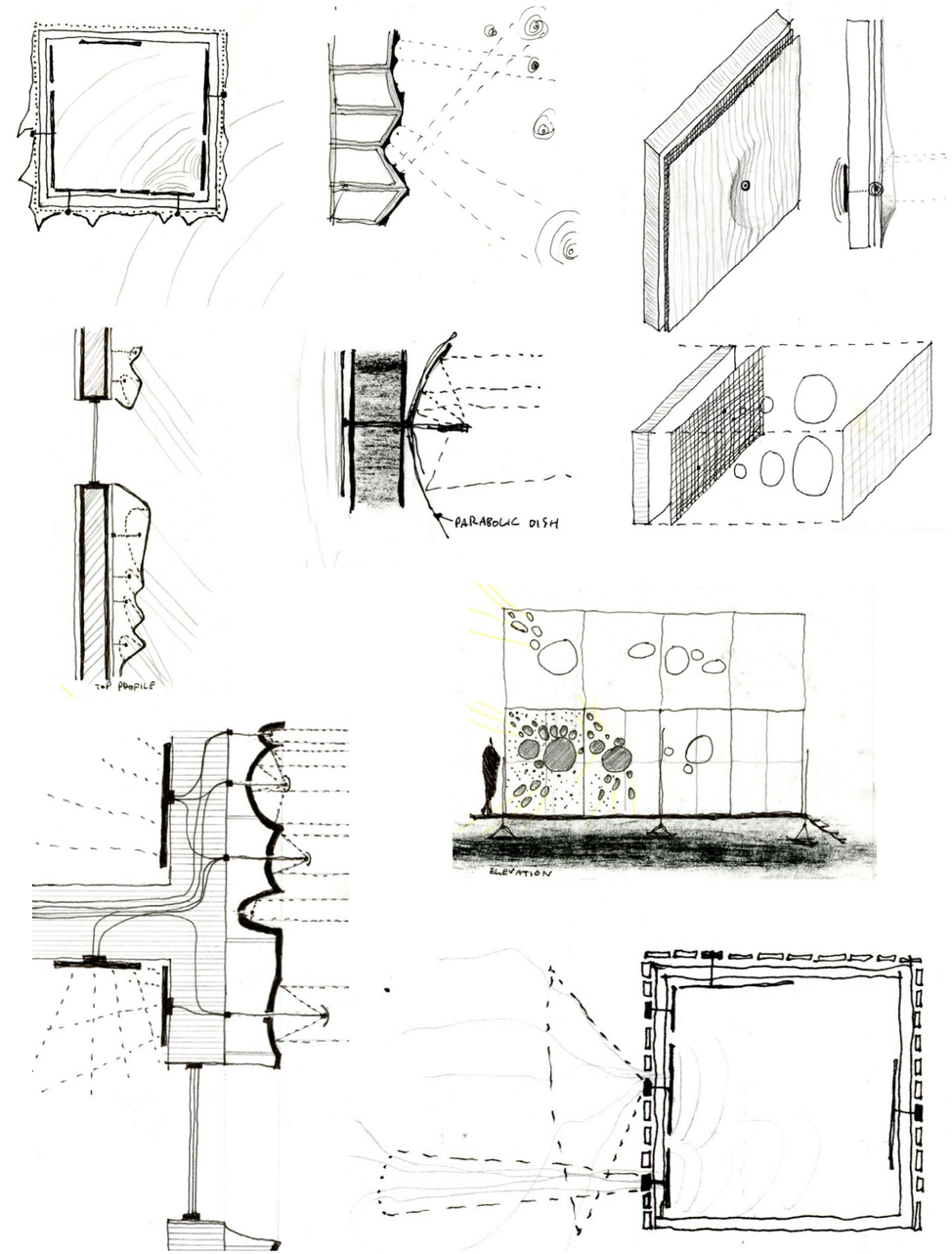


Fig. 61. Iterations on an acoustically transparent envelope and wall system

It became obvious that some form of sound amplification would be required if any chance at capturing the dynamic and vast soundscape was to be achieved, no matter the microphone type. The parabolic dish was found to be the most effective tool in this regard, as its unique geometry focuses incoming sound waves to a very specific point, making it an effective sound amplifier (see fig. 62). Satellite dishes adopt parabolic shapes to better receive signals and the parabolic dish is commonly used in commercial audio recording to record distant sounds such as on sports pitches, in the forest and at wedding events.[2] The dish provides a means of experiencing distant sounds intimately, making it an ideal instrument for this architectural application. Any sound within the pointed direction of the dish will be recorded, diminishing in volume and quality the more distant and quiet the sound. Depending on the depth and diameter, parabolic dishes may record various frequencies and range as far as 600 feet.[3] Ornamenting the facade with numerous parabolic dishes equipped small microphones and pointed in various directions seemed like a promising means of capturing the complexity of the soundscape as figure 64 illustrates.

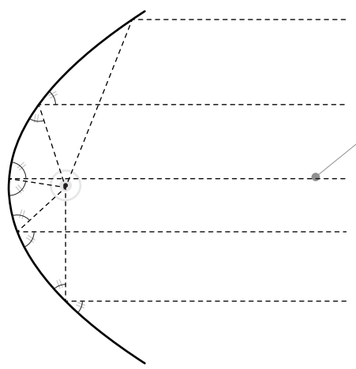


Fig. 62. The parabolic curve

Fig. 63. Recording frog sounds with a parabolic dish microphone

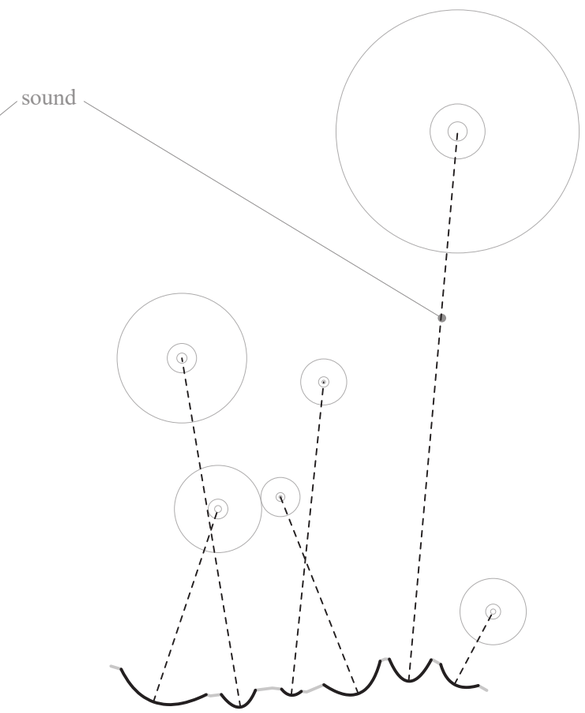


Fig. 64. Capturing the omni-directionality of the soundscape

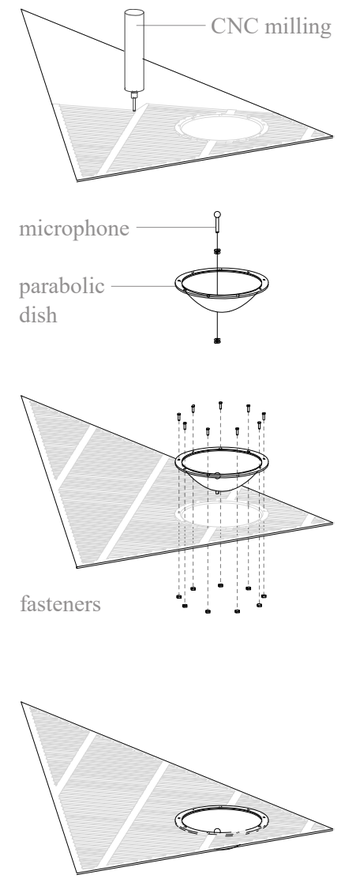


Fig. 65. The assembly of one panel

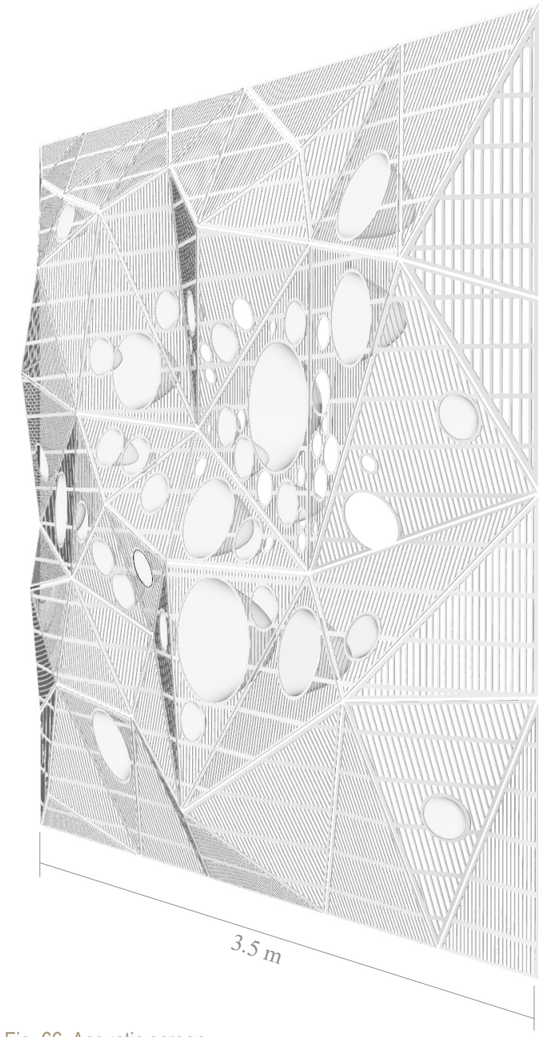


Fig. 66. Acoustic screen

The acoustic screen that was devised is comprised of multiple triangulated aluminum panels that allow an array of parabolic microphones to be mounted at varying angles on the building's envelope (see fig. 66). Each panel is pre-cut to hold an acoustic dish, inside which weather-resistant microphones are mounted (fig. 65). Just like the commercially-available parabolic dish microphone attachments, these are made of transparent polycarbonate and mounted to each aluminum panel by a series of bolts along their circumference. The microphones are mounted at the back of each dish in a similar fashion. The perforated nature of the panels allows the screen to be relatively transparent as it is mounted over window openings along the camp's facades.

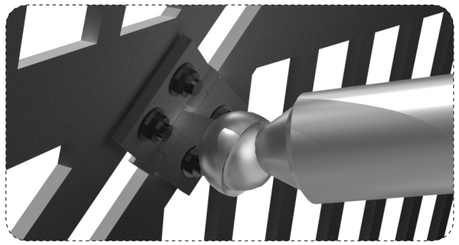


Fig. 67.Connection from panels to aluminium mounts

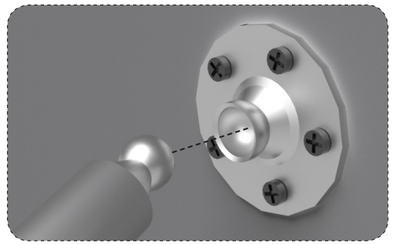


Fig. 68. Connection from mounts to wall

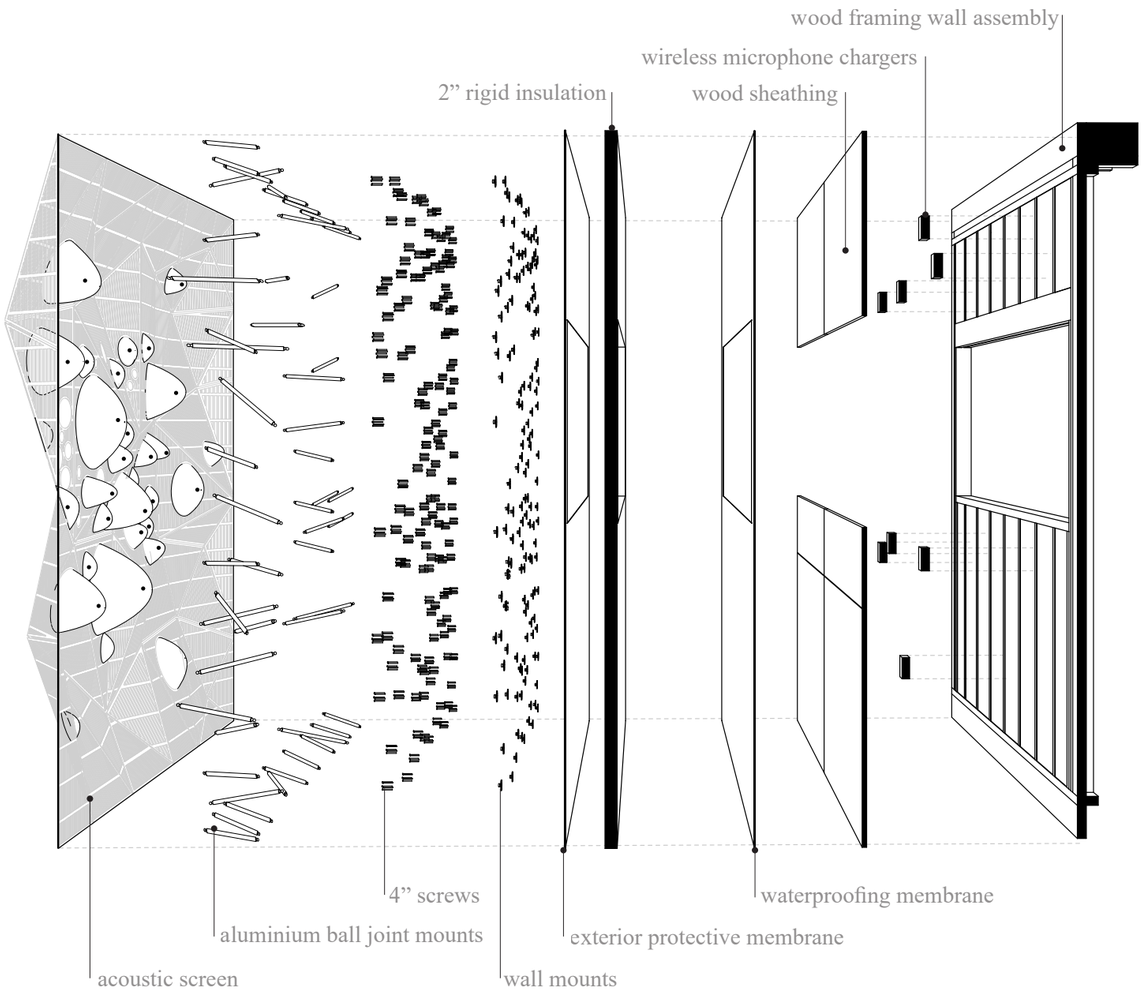


Fig. 69. The assembly of the acoustic screen onto the camp’s exterior wall

The perforated panels connect to one another via hinges on their sides. Each hinge connects to an aluminum mount, which then mounts to the conventional wall sheathing membrane of the camp to hold the screen in place (see figures 67 and 68). Ball joints facilitate the installation and removal of the mounts and panels. The majority of the camp’s interior walls are clad with a translucent polycarbonate panel back-lit by an electronic ink screen in which a grid of small speakers is laid (fig. 70-71. These screens display visualizations of the sounds being played by the multiple speakers mounted to the walls. Visual cues help communicate the intricacies in the soundscape to inhabitants, making more obvious its subtle changes and complex relationships only detectable by experienced listeners or advanced software. The camp therefore relies on software technology and an AI system in mediating the heightened environment and in generating a dynamic digital wallpaper. The audio channel of each microphone is relayed wirelessly to the camp’s acoustic system as shown in figure and so is the supply of electrical power via short-range power outputs integrated in the wall.

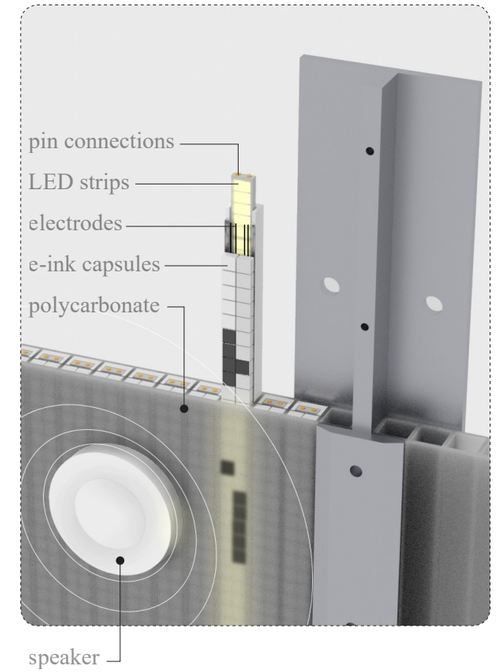


Fig. 70. Detail of the interior acoustic walls

Fig. 71. The heightened experience of the soundscape with visual cues from an electronic wall

3.2

SPATIAL STRATEGY

INHABITING THE FRONTIER MINE

3.2.1 Microsites

The camp is designed to inhabit the seismic lines that currently scar the boreal forest on the Frontier Mine site. The camp slots into the seismic corridor while an adjustable foundation keeps it 3m off the ground to allow the passage of small vehicles and living beings below, as figures 72 and 73 illustrate. Workers travel to and from work and supplies are hauled in off road vehicles in the corridors. the entire camp fits in the length of the corridor, while the open square areas are left for outdoor activities, large gatherings, parking vehicles, etc. Locating the camp here makes use of already-cleared segments of the forest, brings inhabitants in close proximity to the affected biosphere and provides transportation routes to and from the mine. Within a few hundred meters of the mine's edge, these locations will enable workers to experience the changing soundscape at its most drastic and nuanced point. As the mine encroaches on the forest, the soundscape of inevitably undergoes a drastic transition. Soundscape ecology and the Acoustic Adaptation Hypothesis tell us that the increased prevalence of anthropogenic noise, namely the beeps, rumbles and clashing of machines and mining equipment will force many vocalizing species of the old growth forests and wetlands to change their acoustic habits. Many species will flee the area, plant biodiversity will change, the drone of diesel engines far in the distance will replace the drone of crickets and loud metal crashing sounds will mark the routinely loading and unloading of the endless truckloads of bituminous soil. In the seismic line,

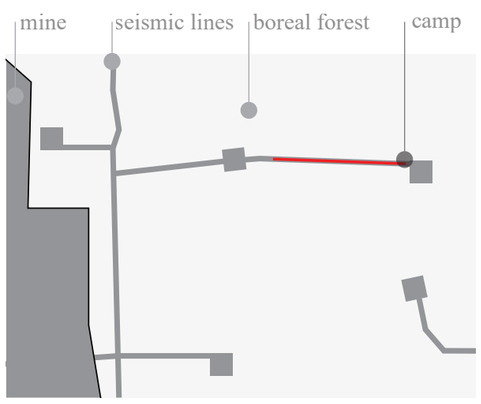


Fig. 72. Camp location in the seismic lines

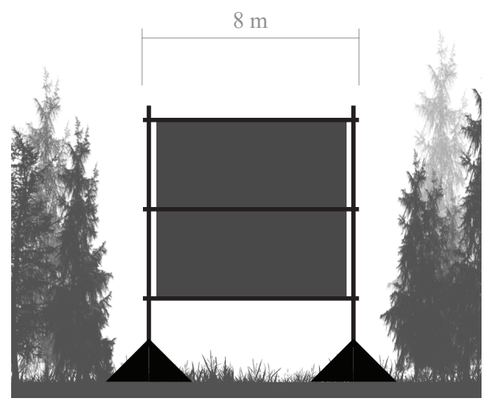


Fig. 73. Location in the seismic lines

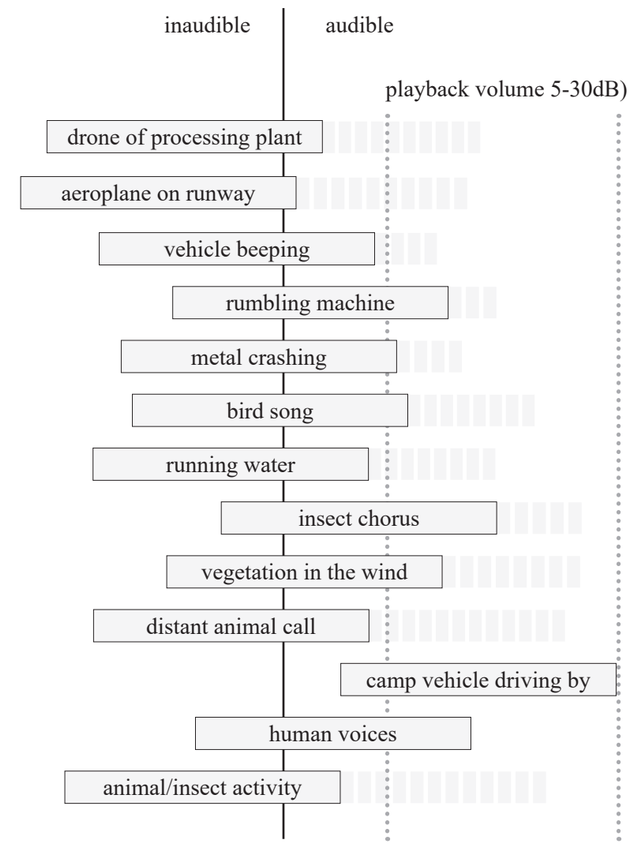


Fig. 74. Augmenting of various sounds surrounding the camp

the camp hears and serves to mediate the changing chorus of sounds, some of which are far too loud (i.e. nearby mining equipment) or too quiet and even inaudible and will be lowered or augmented as they're replayed inside the camp. Fig 74 illustrates how some typical sounds of the area may be either augmented or suppressed. The system is designed to limit the volume of sounds to 30 decibels, the approximate volume of a whispered conversation. Figure 64 illustrates the end portion of the camp in a seismic line and the outdoor activities that occur after a day's work. Most seismic lines have large 50 x 50 m clearings where gatherings and games can take place. The rooftops, which can be accessed by all inhabitants, serve as observation areas, exercise platforms and also hold garden boxes to grow fresh produce. Figure 75 illustrates a site view of the camp as it captures the changing soundscape near the mine

Fig. 75. Isometric view of the end portion of a camp

Fig. 76. Site plan of a camp

3.2.2 Fragmented camps

While the original plan of the Frontier Project proposes to house operational workforce in one large camp, this design fragments the typical camp arrangement into a fleet of fifteen smaller camps each housing on average 150 workers (see fig. 77). The smaller camps provide two major advantages. Firstly, they better promote internal social bonding and facilitate interdisciplinarity within the camp. Camp communities can much better develop in smaller social circles where neighbours are more familiar with one another and where shared common rooms don't hold hundreds of people. Each of the fifteen camps are also subdivided into multiple sub-camps of approximately 30 workers. These sub-camps are typically connected end-to-end over 250-300m to form a full camp. This secondary fragmentation reduces the need for workers to walk long distances by keeping all the basic amenities within 30m of one's dormitory. Secondly, the smaller camps obtain the ability to cover more ground for ecological analysis, acting as satellite stations within the Frontier Mine. Each camp serves as a sort of outpost deployed to the perimeter of the 240 sqaure kilometer mine, allowing each corner of the operation to be monitored by the workers.

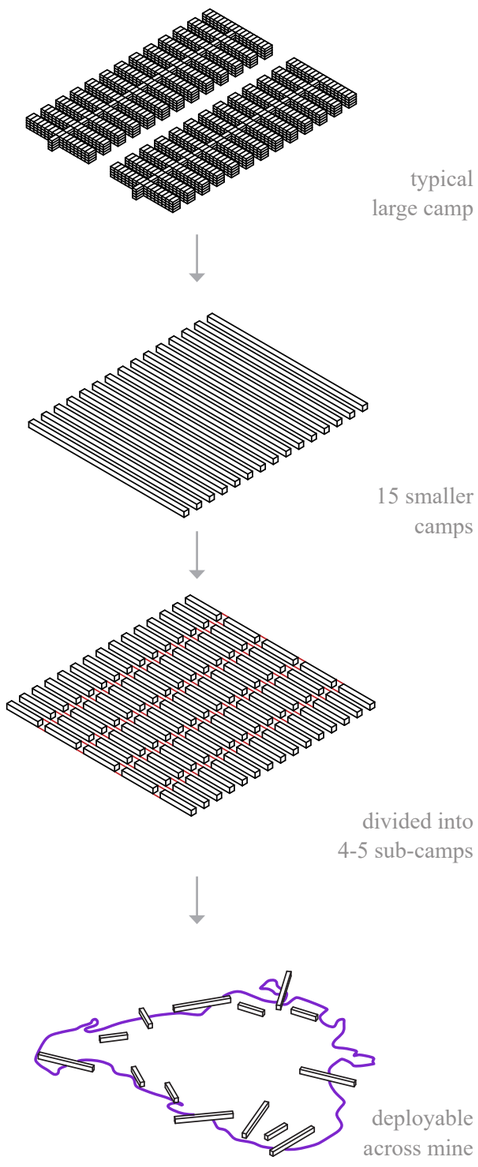


Fig. 77. Subdivision of large camp into mutliple small camps

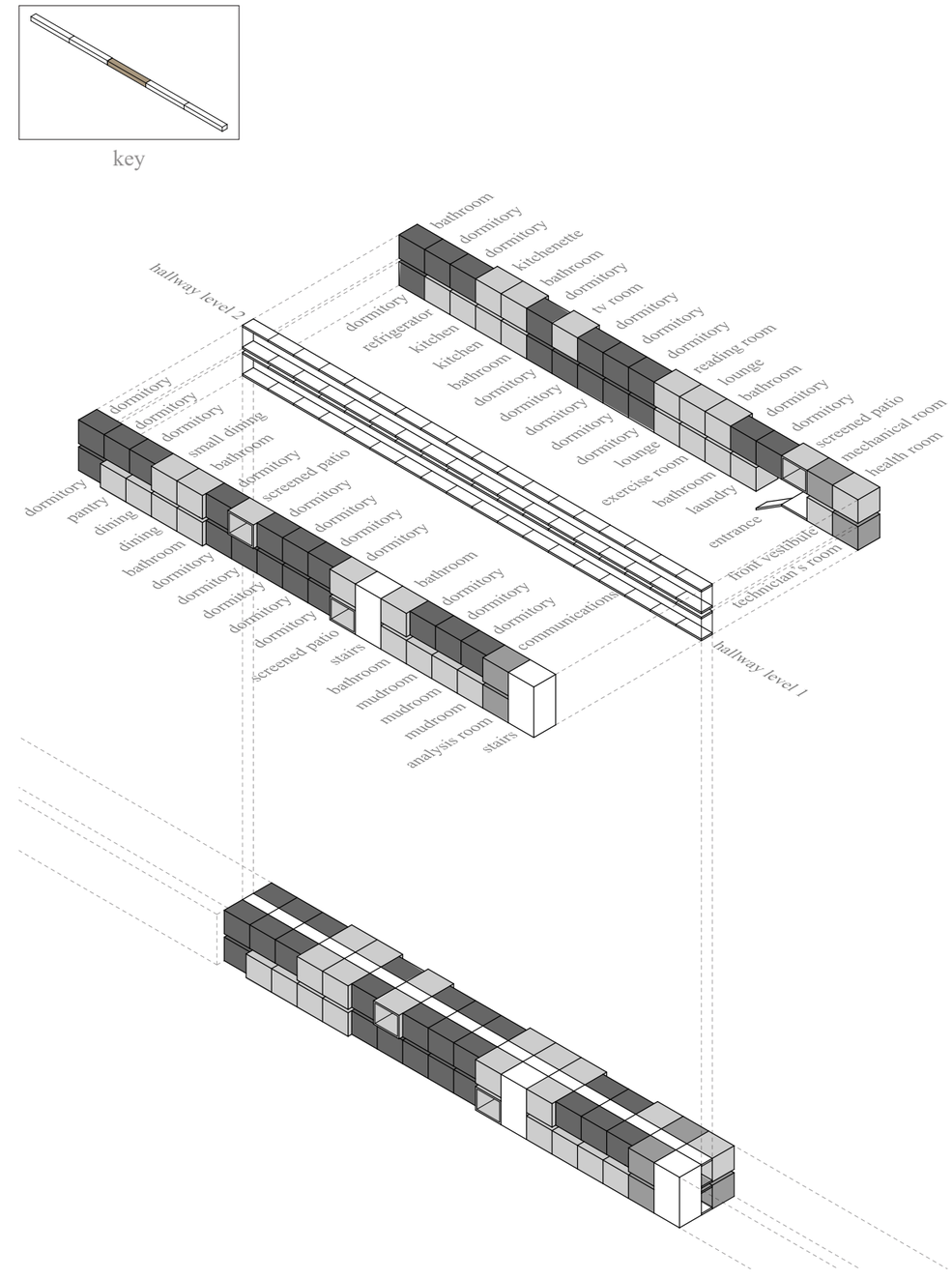


Fig. 78. The camp's modules

3.2.3 Peripheral control

Over the course of four decades, the Frontier Project is planned to deforest, de-water and excavate the soil bit by bit. For this reason, the camps are designed to be hyper-mobile, allowing them to relocate every 3-7 years on average as they 'pace' the growth of the mine. During its 'growth' phase, each camp has a respective path of migration across the site with a start and end point (see fig. 79). Each camp has the power to regulate the expansion of the mine based on the information acquired at camp and the decisions made between workers of various disciplines. These location and hypermobility patterns symbolize a deliberate vulnerability to the industry and in particular. This places workers in the best position possible to reconsider the mining process, the technologies used in mining, the path of encroachment, the reclamation time and process and all other technicalities relating to the mine that demonstrate some sort of ecological consequence to be dealt with. As shown in figure 80, the site of the Frontier project holds a wide variety of upland ecosite phases and wetland classes, making for nuanced and complex ecological biodiversity to be experienced by Frontier workers as camps move from site to site.

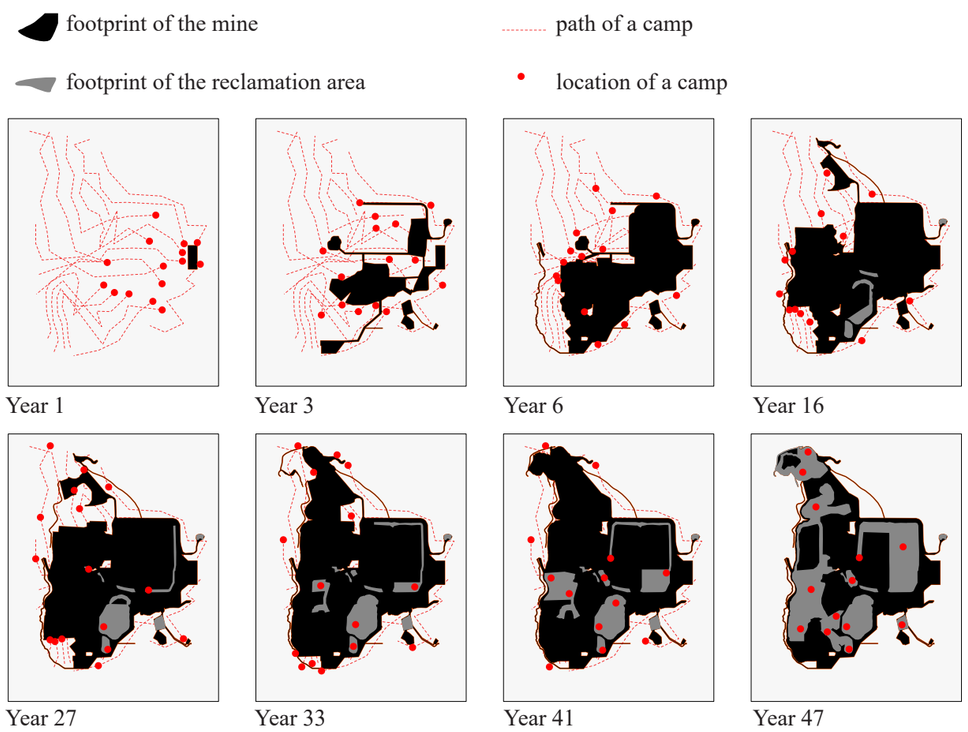


Fig. 79. Camps pacing the mine's expansion

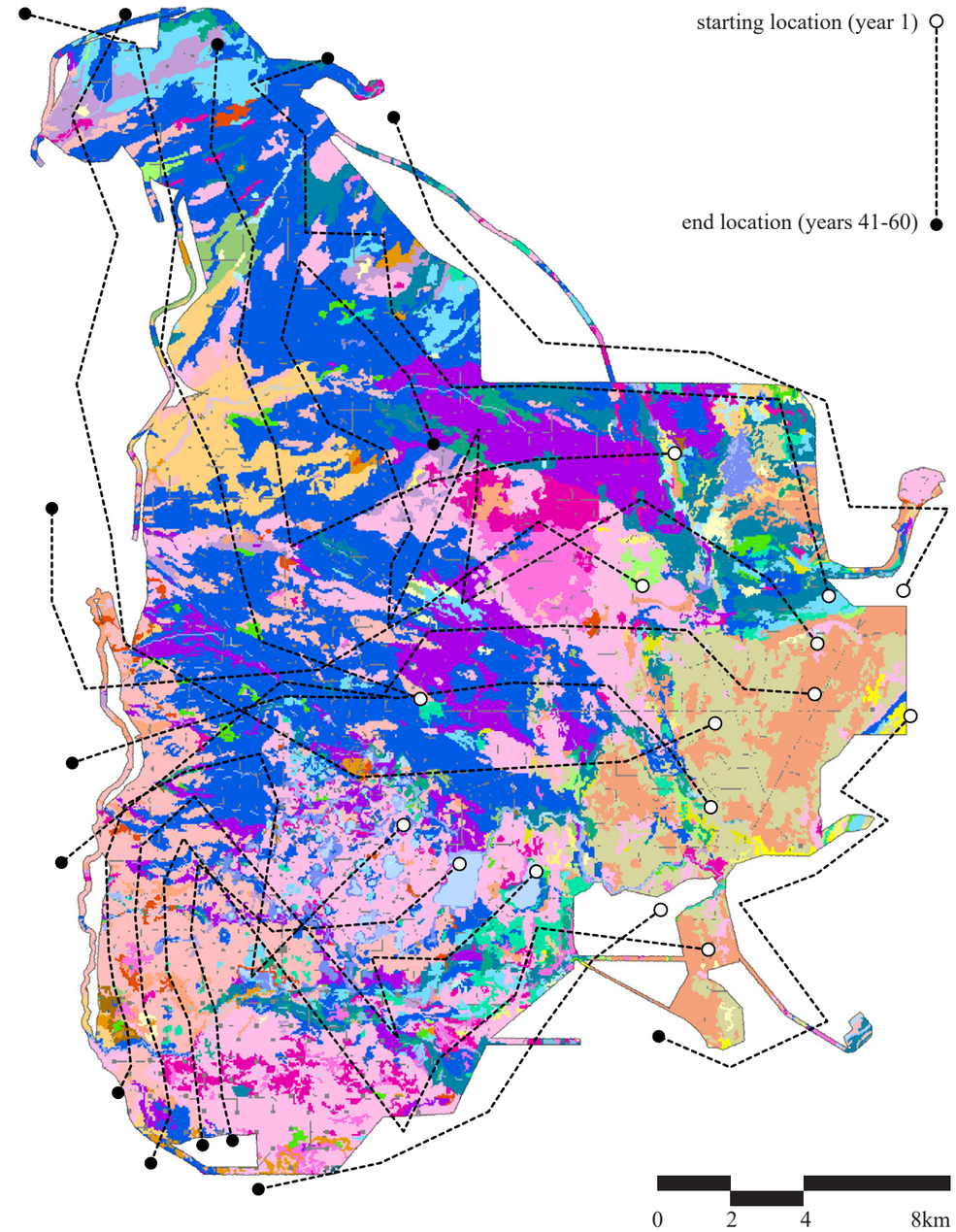


Fig. 80. The movement of camps across ecosites

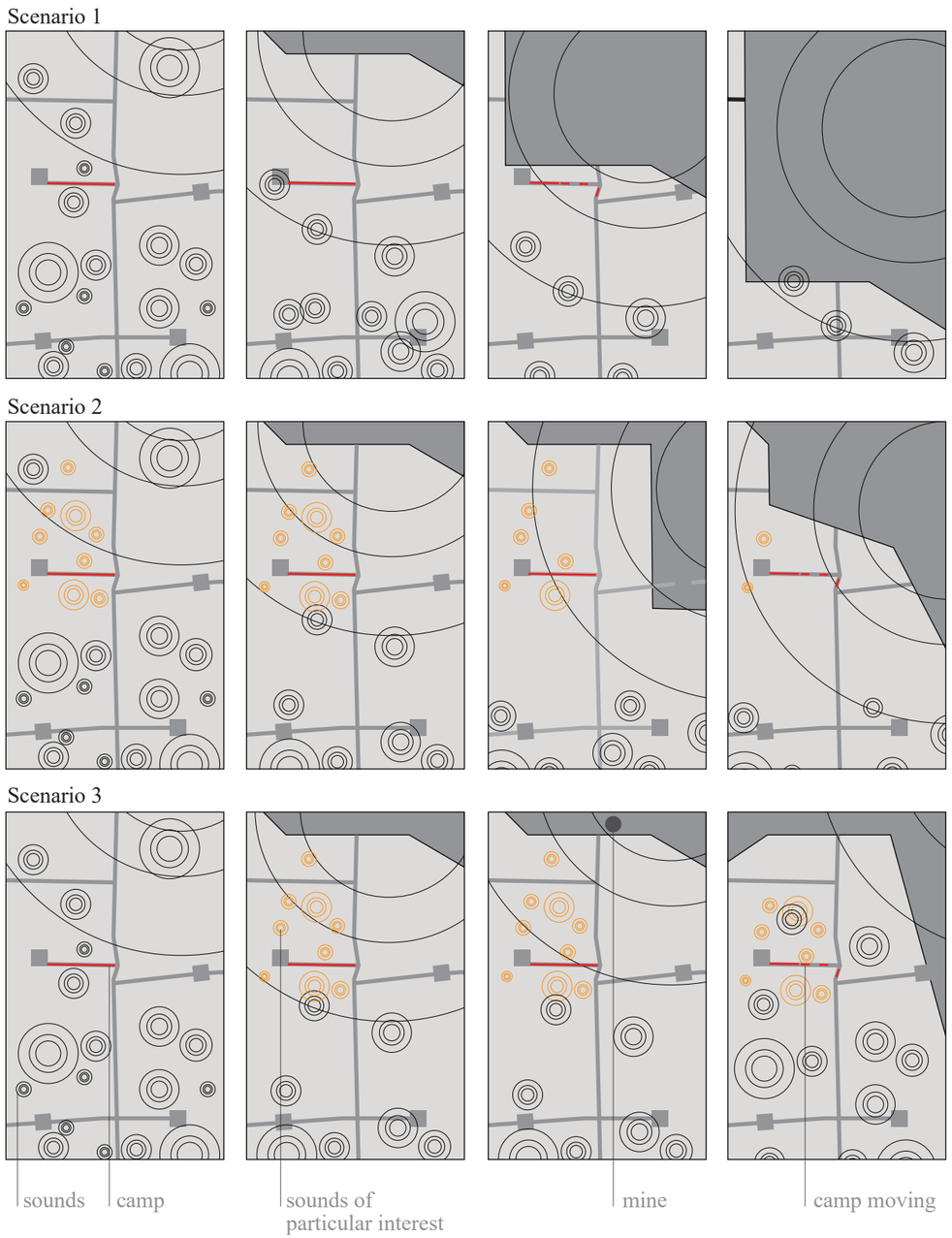


Fig. 81. Three potential scenarios of a site residency

3.2.4 The migration

Although specific itineraries are planned for each camp's movement across the mine over the life of the operation, there is no determining precisely when exactly and why camps relocate to the next site. In general, the camp constantly seeks to inhabit the dynamic soundscape that characterizes the mine's edge condition in the goal of better understanding human relationships to the biosphere/ However, there are multiple outcomes to a microsite residency (refer to fig. 81):

Scenario 1: The mine expands as planned, in which case the camp relocates once the the soundscape characterizing the site is virtually completely anthrophonic and acoustic analyses reveal the absence of most biodiversity in the area. In this case, the camp may not relocate until the deforestation of the area is undertaken should the soundscape warrant further analysis.

Scenario 2: The mine's original plan of encroachment is delayed upon the discovery of significant ecosystems that require further analysis or even call for intervention and support. Such an event could be the discovery of a particularly important stream, and endangered population of nonhuman beings or even a newly discovered behaviour or phenomena in response to anthropogenic activities. In this case, the camp remains at the site while other areas are mined.

Scenario 3: The mine's original plan of encroachment is permanently halted upon the discovery of indispensable ecosystems that require not only further analysis but protection and noninterference. Such areas may be returned to and mined once less invasive technologies exist in the last decades of the operation.

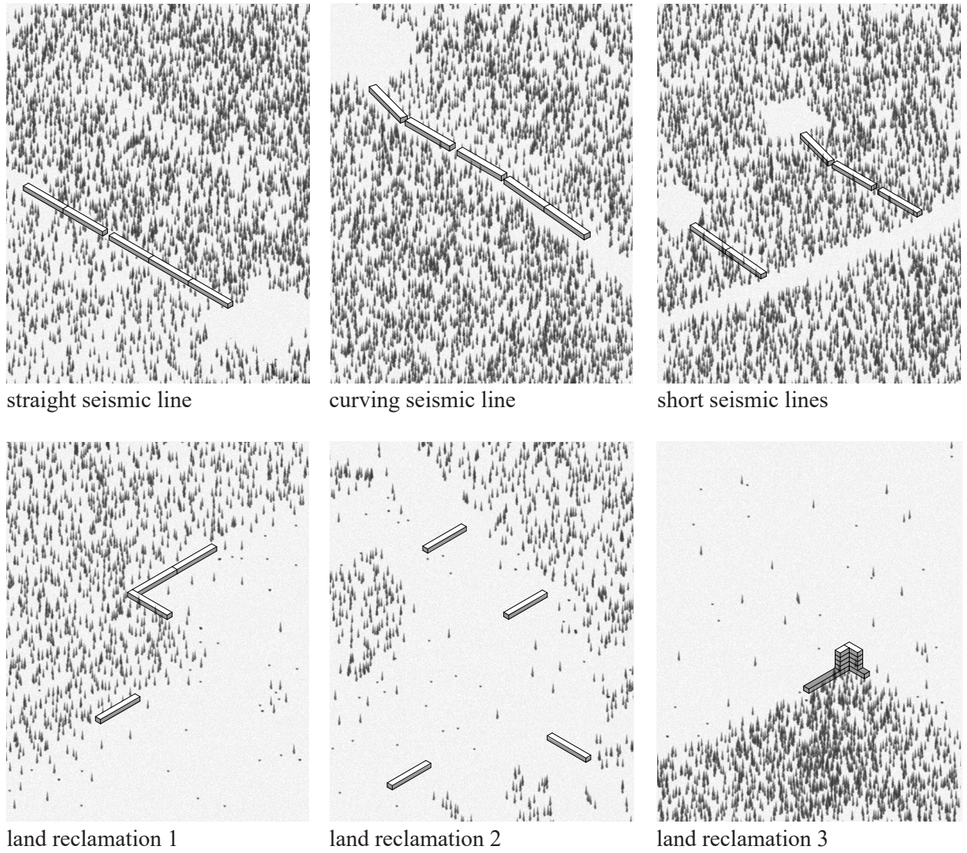


Fig. 82. Spatial reconfiguration possibilities of the camp

Fig. 83.The process of disassembly during a camp move

A camp relocation occurs over the course of several days. Large vehicles tow the modules to the next microsite one section at a time, allowing workers to inhabit the camp during the migration. Assembly is undertaken with the use of a pile driver, a small crane and several boom lifts as shown in figure 83. The foundation system remains a separate system, allowing the arrangement of the modules on top of the supporting structure. The modular nature of the camp allows its reassembly into different configurations based on varying site conditions and on the phase of the extraction operation. After the mine's 'growth' (mining) phase, reclamation operation may warrant different camp arrangements to better experience the soundscape and accommodate smaller work crews. Figure 82 depicts these various arrangements.

Figure 84 illustrates the structural assembly of the camp, which consists of steel beams and columns with cable cross bracing. Helical "screw" piles allow for quick and temporary installation of foundations. The softer ground conditions call for wide footings to help distribute loads to the ground and stabilize the foundations. The camp's rooftop is lined with purlins on which deck boards and solar panels are mounted. Figure 84 depicts the systems and assemblies within the modules. Each module is fitted with in-floor radiant heating, operable window and ceiling vent for passive ventilation. Kitchen, laundry and bathroom units are the only modules with plumbing. The wastewater is stored below the camp in large tanks, while freshwater is pumped from drilled wells. The primary power source is generated from the solar panels, which feed electrical power to each unit via the modular hallway ceiling and floor components.

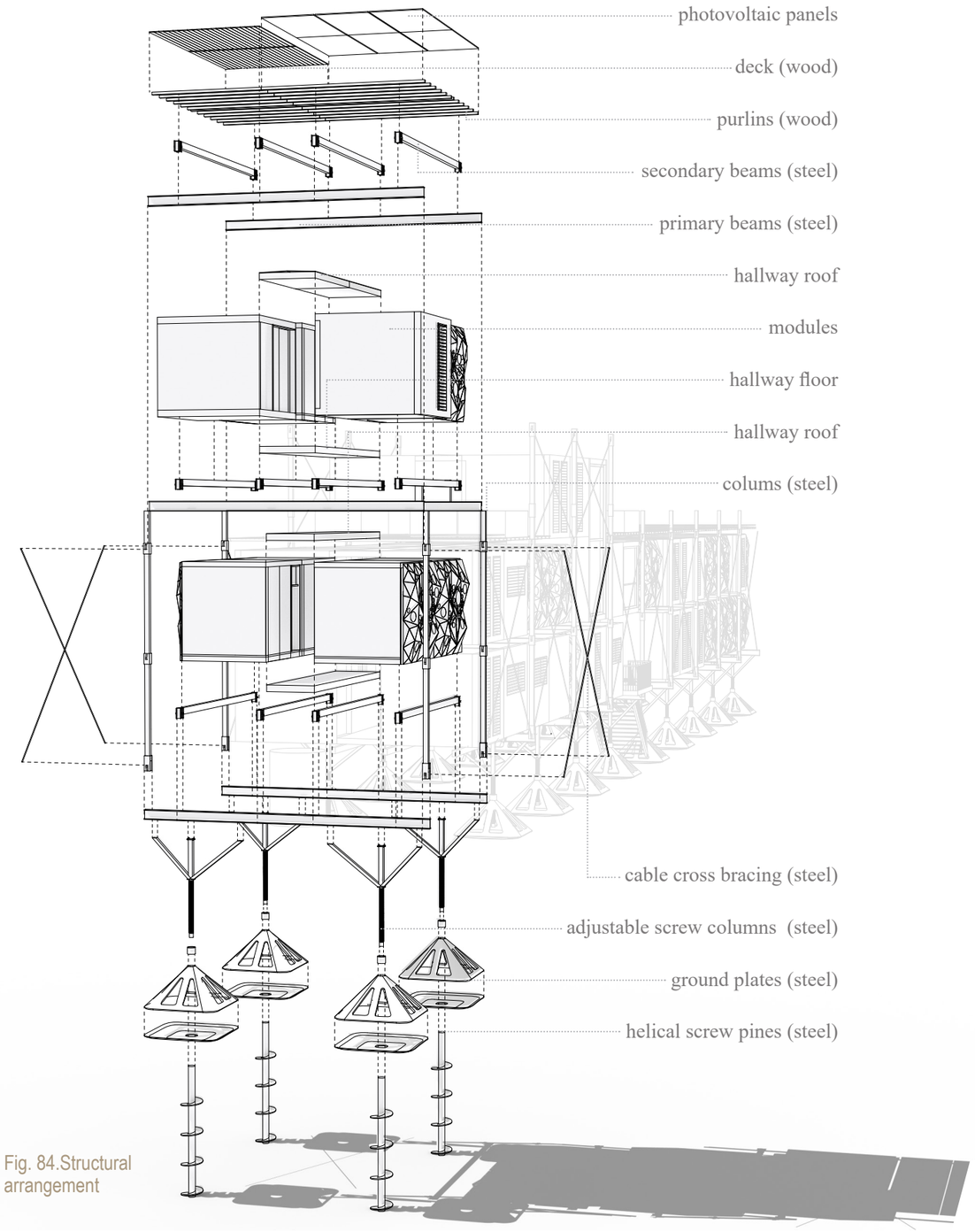


Fig. 84.Structural arrangement

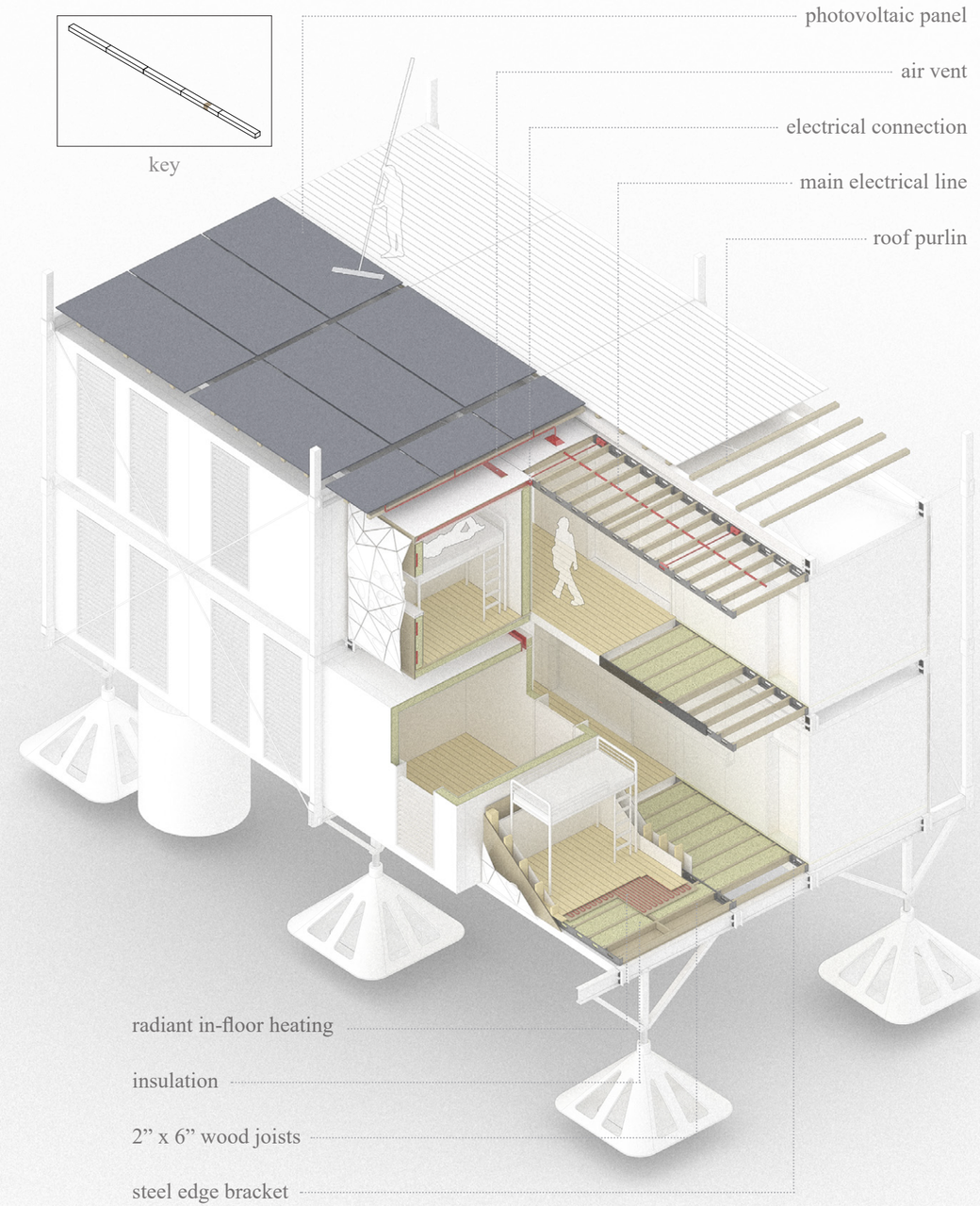


Fig. 85. Module systems and assemblies

3.3

LISTENING CULTURE

THE INHABITANTS, THE PROGRAM

3.3.1 Work community

A typical mine worker, whether an equipment operator, an engineer or a plant labourer, begins their time at the Frontier mine with little ecological knowledge. Through their gradual involvement in the management of the mine, workers become increasingly knowledgeable about the ecological implications of such operations. As figure 86 illustrates, workers acquire more and more knowledge about the soundscape through their time at camp. This knowledge is to be passed on to the next generation of workers. Part of the speculation involves proposing the democratization of ecological analysis by assigning occupational roles relating to knowledge sharing, discussion of information, acoustic and non-acoustic eco-analysis and decision making. The more workers acquire ecological knowledge, the more their roles change within the camp and the mine, fostering an experience and seniority-based cycle of collaboration. The proposed workforce is supplemented with ecologists, biologists, restoration specialists, acoustic technicians and psychologists to work at camp full-time in contributing to the ecological function of the camp (see fig 87). This involves workers in a fundamental task in resource extraction and acts as a means of education and participation.

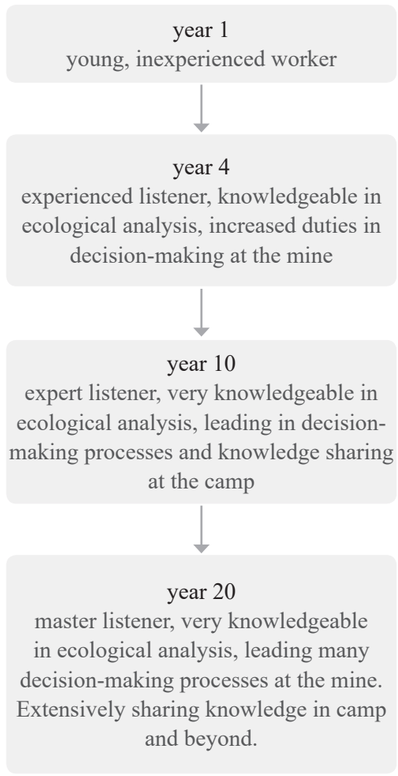


Fig. 86. The listening journey

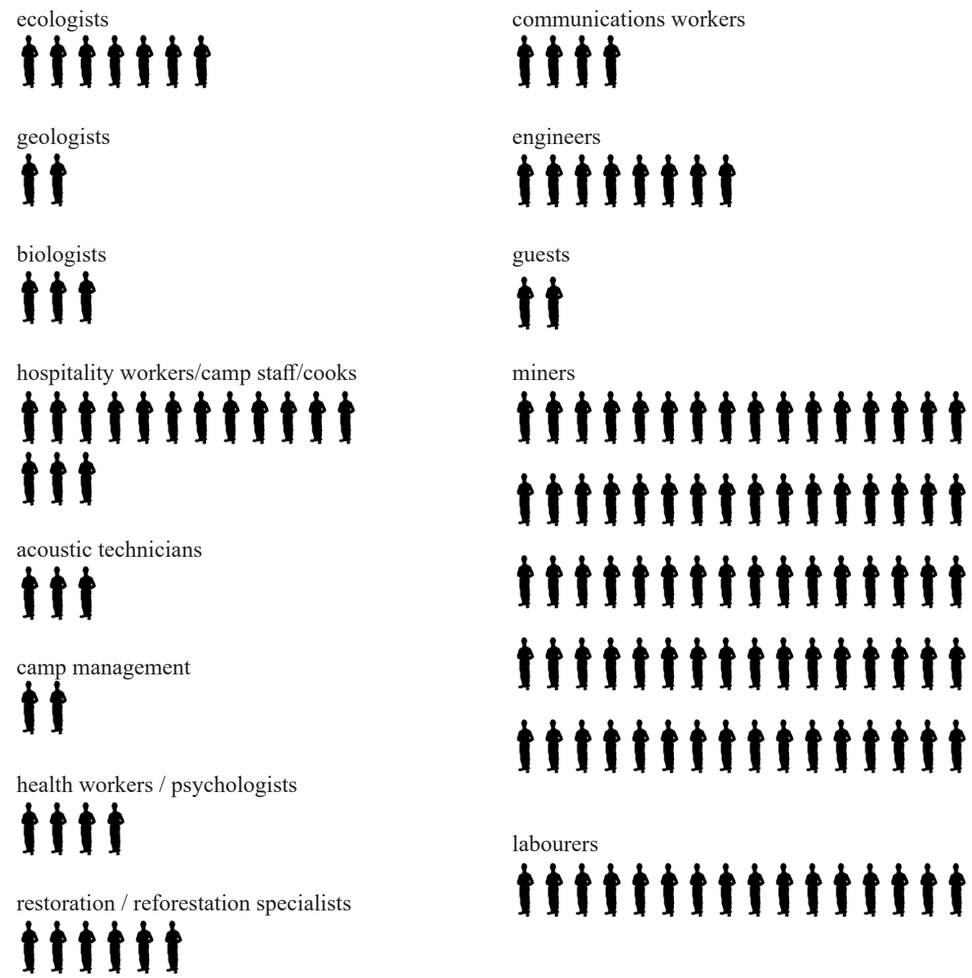


Fig. 87. List of camp inhabitants and their roles

Fig. 88. Elevation view of part of the camp

3.3.2 A mediated space

Through the acoustic screen that clads the building, the soundscape is deconstructed into hundreds of separate audio channels that are then reconstructed on the interior of the camp to form new, heightened soundscapes. This reconstruction of sound creates new listening opportunities and ultimately reconfigures the spatial perception of the camp by extending the acoustic periphery beyond the walls that delimit its spaces. A deliberate system was devised to organize the playback and distribution of sound throughout the camp to assign agency to workers while allowing an artificial intelligence (AI) software to curate the soundscapes. The different modules of the camp have different roles in the soundscape ecology, in part influencing the program of each space. Figure 89 illustrates the systematic functioning of these various modules. Every camp has a dedicated acoustic analysis module where ecologists work full-time listening to the soundscape and documenting data (room A), along with a communications room where this sonic info is compared with other ecological research on site and broadcasted to other camps and research stations out of the mine (room B). Each camp also holds meeting rooms for inhabitants to discuss ecological findings as part of their occupations along with numerous exterior pods which enable workers to listen to the sound in an unmediated way by going outside (room C). Each camp contains a mechanical room where all the acoustic channels terminate and where acoustic data is stored (room D). Each dormitory serves as an acoustic "input" as the only unit type equipped with the acoustic facade. Workers have full control of their dormitory's acoustic environment to be experienced privately and even turned off when desired (room E). This same acoustic information is replayed directly outside the dormitory into the hallway, which then becomes a highly nuanced space coloured with the various sounds emitted from each dormitory (see fig. 80). Workers can essentially broadcast their acoustic environment into the hallway. Certain modules are designated meeting rooms for the discussion of ecoacoustic information (room F). The final room type, the common room, is where sounds are experienced in a highly-curated way (room G).

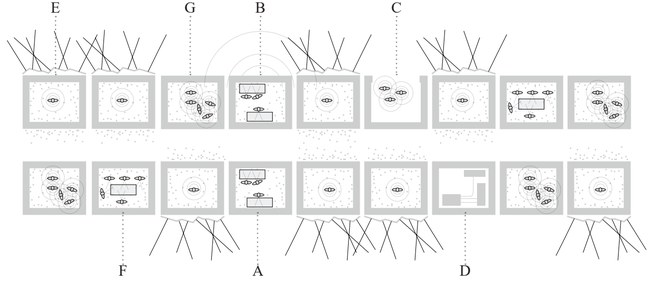
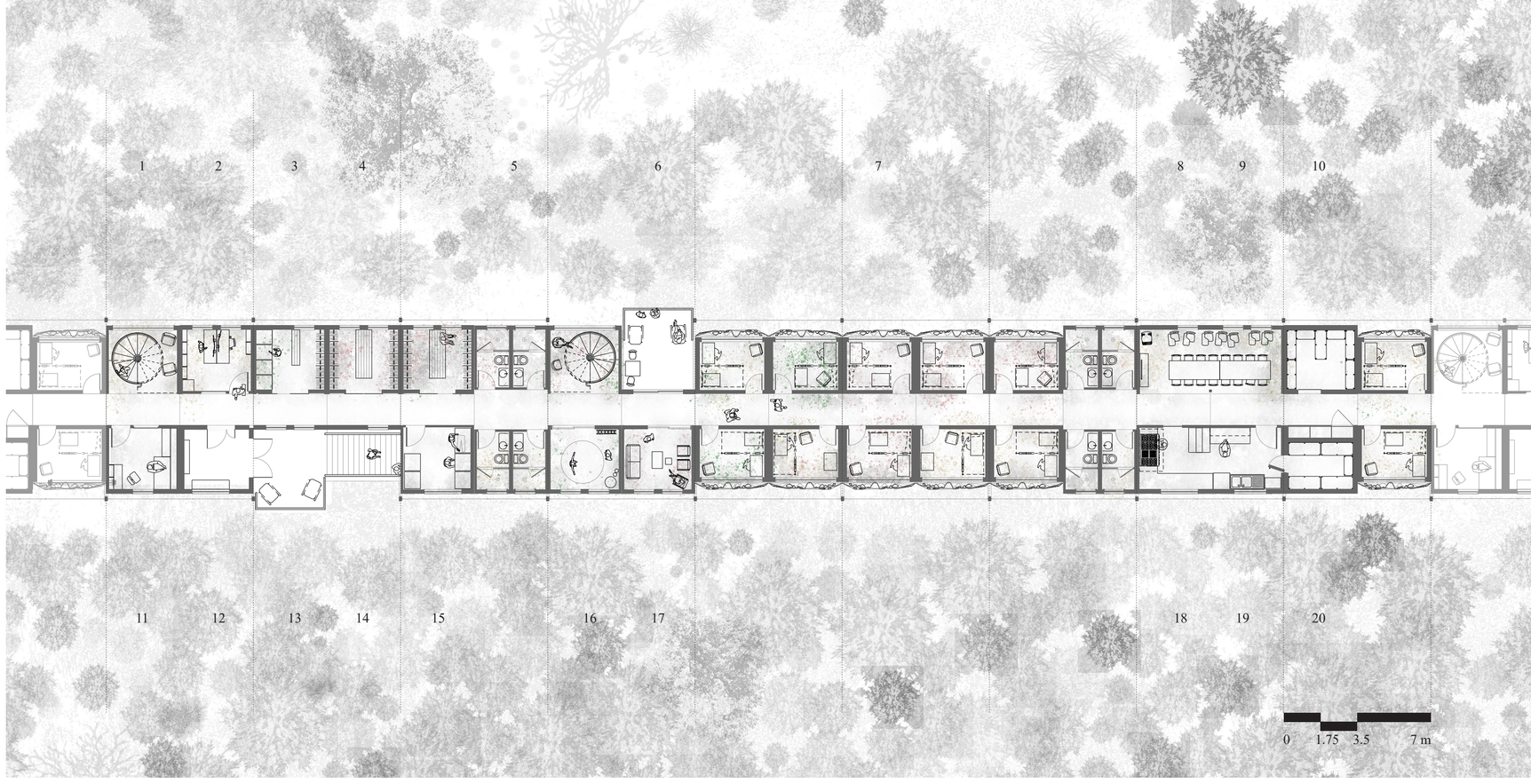


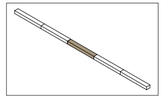
Fig. 89. Types of rooms in the acoustic programming of the camp



Colours and textures inside plan represent sound

Fig. 90. Typical camp plan (level 1)

1. stairs to level 2
2. acoustic analysis room
3. mudroom and storage
4. mudroom
5. bathroom
6. screened patio (outdoors)
7. dormitory
8. dining / class room 1
9. dining / class room 2
10. kitchen pantry
11. acoustic technician's room
12. main entrance vestibule
13. main entrance platform
14. stairs from ground level
15. laundry room
16. exercise room
17. lounge
18. kitchen unit 1
19. kitchen unit 2
20. refrigerator and pantry



key plan

Figure 91 illustrates how the common rooms of the camp have their acoustic environments curated by AI software based on multiple variables. These variables set the conditions for experiencing the complexities and subtleties of the soundscape while appropriating the acoustic environment to the activity and ambiance of each room. These are: the listening patterns of each worker, those of the full-time ecologists at camp, the system's own interpretation of the soundscape, and the location and number of occupants in said room. The software's fundamental role in curating the acoustic environment brings a life and sentience to the architectural fabric and the day-to-day life at camp. Motion sensors and small microphones in each room determine the number and location of occupants and determines the social atmosphere.

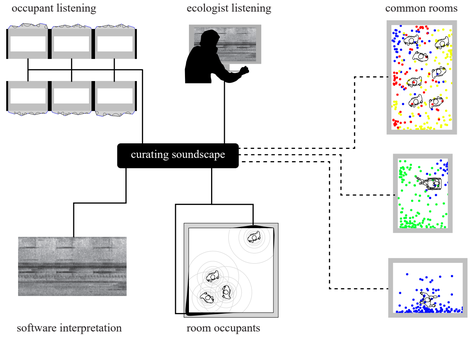
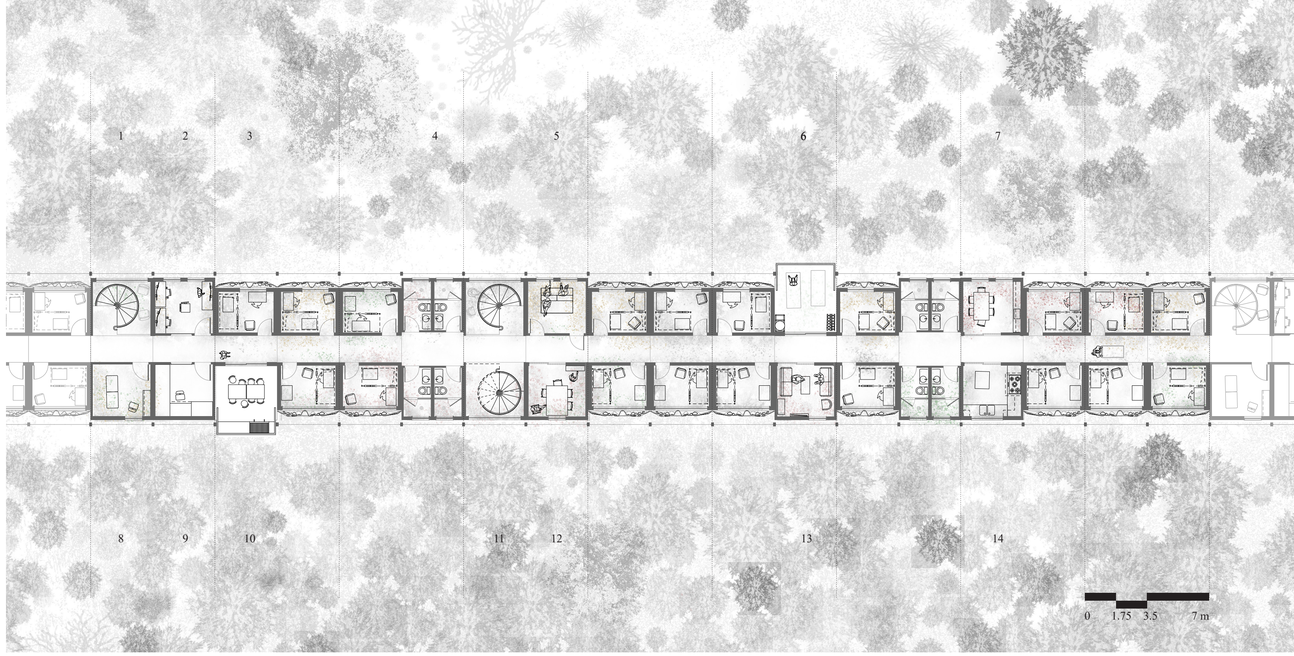


Fig. 91. Factors in the curation of common room acoustic environments



Colours and textures inside plan represent sound

Fig. 92. Typical camp plan (level 2)

1. stairs to level 1
2. communications room
3. dormitory
4. bathroom
5. listening room
6. screened exercise patio
7. communal dining room
8. health room
9. data storage and mechanical room
10. screened dining patio
11. stairs to rooftop
12. reading/study room
13. tv lounge room
14. communal kitchenette

key plan

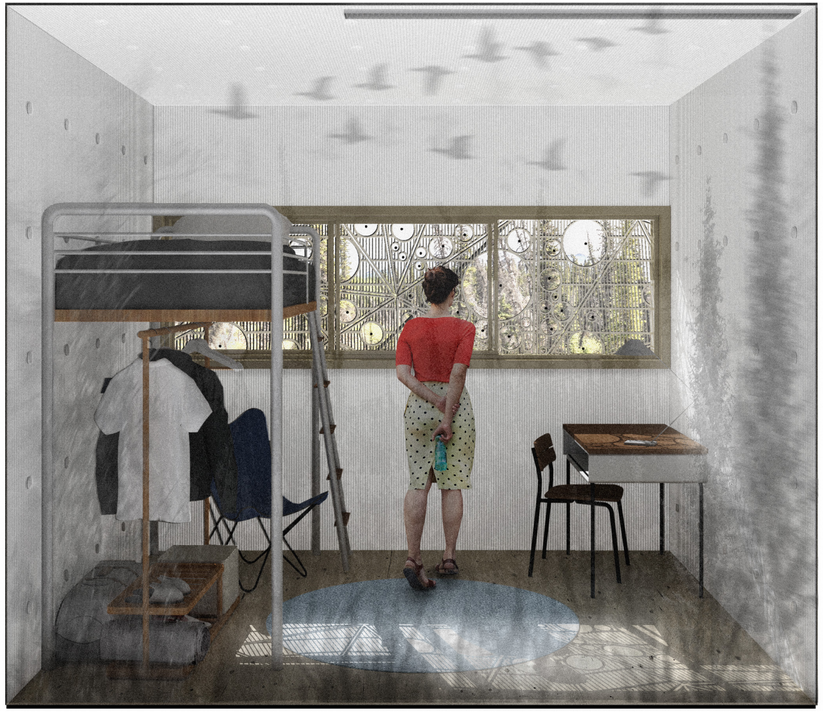


Fig. 93. View inside a camp dormitory

Figure 94 illustrates the experiential (acoustic) qualities of the interior. Figure 93 seeks to illustrate the space in a more conventional rendering.

Fig. 94. The illustrated soundscape of the dormitory

3.4

THE CAMP'S LIFE AND DEATH

A SHORT NARRATIVE OF THE CAMPS OF LISTENING OVER THE LIFE OF THE FRONTIER MINE

This last section illustrates some details of both the camp and the mine at key points in the speculated undertaking of the Frontier Project. The short narrative presents five particular years (one, twelve, thirty, forty-seven and sixty) that adhere to the actual plan of the Frontier Project and the major moments along its life, as well as some speculated moments based on the architectural intent.

3.4.1 Year one

The construction of the mine begins. Extraction will not begin for another six years as the infrastructure is built, but the camps are collecting the first bits of ecoacoustic data. Workers are getting familiar with one another and with the functioning of the camps. Vast amounts of land are being deforested and the soundscape is changing quickly as species flea the area and biodiversity patterns begin to change.

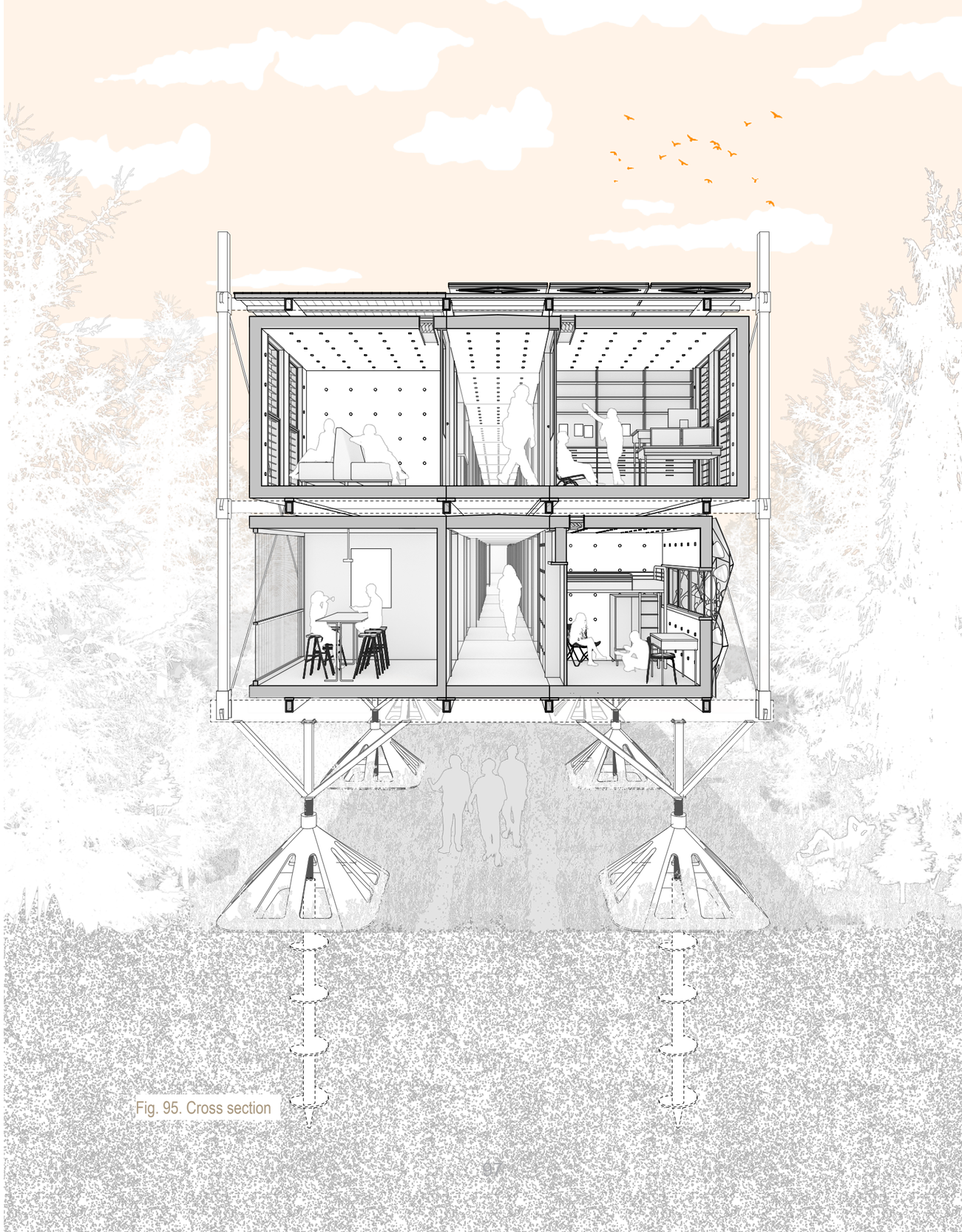


Fig. 95. Cross section

3.4.2 Year 12

By year 12, almost all camps have relocated. The encroachment of the mine has had significant effects as some camps have recorded the presence of large fauna like bison, caribou and moose, likely not to be seen in the area again. Experienced listeners at the mine whose knowledge and insights on the last decade of operations and soundscape analysis is transmitted to the new generation of workers.

Fig. 96. View of a communal area and hallway

Fig. 97. Satellite view of the mine and camps at year 30

3.4.4 Year 30

By year thirty, the course of the mine's expansion has changed significantly. Some areas have been left un-mined as they warrant further ecological study. Moreover, the methods and technologies of extraction have changed drastically as a result of the ecological insights acquired through the camps. Viewed from a satellite, the Frontier Project looks like no other oil sand mine. The profound involvement of all workers in its undertaking has resulted in unprecedented innovation in mining. As the global demand for petroleum has dropped significantly, many workers leave the industry to pursue other occupations. In this changing world, acoustic ecologists are in strong demand for their skill and experience in soundscape analysis, making the job transition easy for most workers.

0 0.1 0.2 0.4 m

3.4.5 Year forty-seven

The 47th year marks the end of mining operations at the Frontier Mine. The majority of camps have been transported out of the mine, as only a few are left to undertake the lengthy reclamation process. Some of the remaining camps are hauled out to other mining operations.

Fig. 98. Workers restoring the land

3.4.6 Year sixty

Year sixty marks the end of the functional life of the camps. The land of the Frontier mine is by no means reclaimed but with thousands of workers and over six decades of listening, much has changed in the way resource extraction is undertaken and in the way the reclamation process takes place.

Fig. 99. Camp being dismantled

Notes section 3

1 David Ruy, “Returning to (Strange) Objects,” (January 30, 2013, SCi-Arc, YouTube video, 1:18:11), https://www.youtube.com/watch?v=bxAbiNu9Xhw&ab_channel=SCI-ArcMediaArchiveSCI-ArcMediaArchive.

2 Nichols-Wright, Phillip. “The Ps and Qs of Parabolic Microphones.” B&H Photo Video, May 14, 2019. https://www.bhphotovideo.com/explora/pro-audio/buying-guide/the-ps-and-qs-of-parabolic-microphones.

3 Phillip Nichols-Wright, “The Ps and Qs of Parabolic Microphones,” (B&H Photo Video, May 14, 2019), https://www.bhphotovideo.com/explora/pro-audio/buying-guide/the-ps-and-qs-of-parabolic-microphones.

CONCLUSION

This design project, in its ambitious and idealistic architectural intent has sought to provoke thinking around many problems currently faced in both architecture and resource extraction. From the initial research on the subject, it was quickly realized just how many issues surround the mobile work camps, and it became increasingly difficult to find a way to address these issues. Speculative design has enabled us to probe many of these problems at once, while letting the design revolve around soundscape ecology and the possibilities associated with this field.

Our focus on efficiency and gentle stewardship are well-intended and have a place in architectural discourse but may simultaneously be further perpetuating the idea that humans are separate from the environment. This way of thinking poses great threats to the survival of the human species as it does to all other life forms. This design proposal attempts to probe these very issues and re-imagine how architecture could partake in transitioning away from this mode of thinking. The design is by no means complete as many architectural details and technicalities remain unresolved. The project is speculative and perhaps even hypocritical in certain aspects. Much more time is required to think about the consequences and disadvantages of such a work camp model.

However, if the project has incited just a bit of thinking around our views towards nature, resources and labour and the role that architecture may play in reframing these views, then the thesis has succeeded to a great degree. If it has allowed us to glimpse at alternate ways of existing with technology and viewing it as not only a leverage for extraction but also for ecological thinking, then it has also succeeded. Finally, I hope it has made evident the many issues and tragedies associated with the work camp context, resource extraction and specifically the Frontier Project. If the thesis has underlined the impossibility of counterbalancing the scale of consequences from such mining operations then it has also succeeded because ultimately, the Frontier Project, like arguably all other large-scale extraction operations, operate at a fundamental loss in the long-term. This speculative design required a great deal of 'non-architectural' speculation - the democratization of the industry, positing an alternate cultural attitude and even a different economic system - because architecture alone cannot nearly alleviate, let alone solve, problems of this magnitude. The project is a call for radical changes that must go beyond merely switching energy sources. Resource extraction will always exist as a reality, regardless of how obsolete fossil fuels become. How we choose to both undertake and portray extraction projects and the problems associated with them is a question that warrants far more of our attention.

APPENDIX

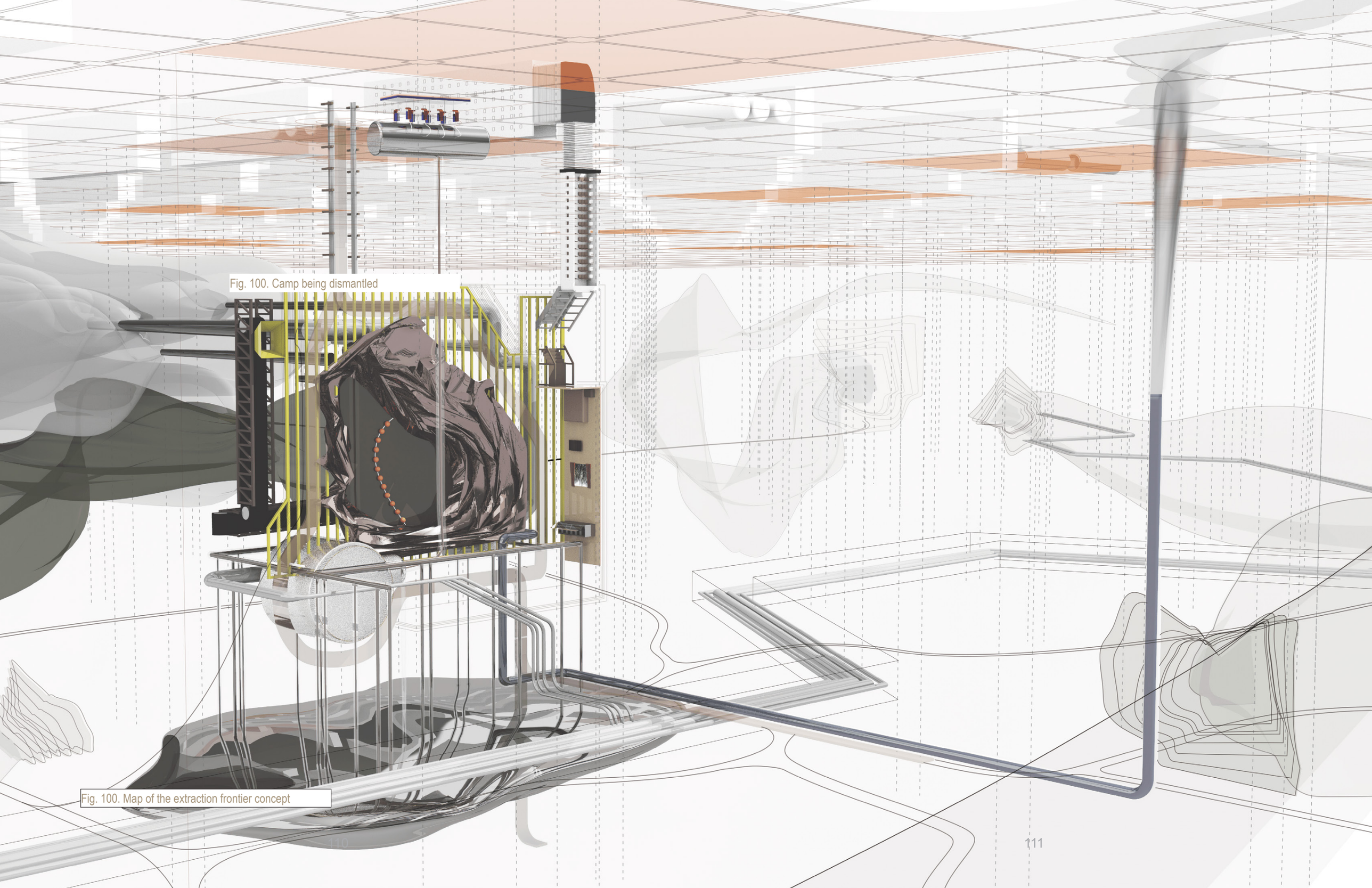


Fig. 100. Camp being dismantled

Fig. 100. Map of the extraction frontier concept

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