

SILICA FIELDS

REVALUING THE ROCK ISLAND SILICON SMELTER LANDSCAPE

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A thesis submitted in partial fulfillment of
the requirements for the degree of

Master of Landscape Architecture

University of Washington 2019

Committee:

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Program Authorized to Offer Degree:

Landscape Architecture

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Abstract

SILICA FIELDS

Revaluing the Rock Island Silicon Smelter Landscape

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Downstream from Wenatchee, WA, the decommissioned Rock Island silicon smelter sits on the north bluff of the Columbia River on the Columbia Plateau. Some 175,000 cubic yards of silica fume, the fine black sandy byproduct of silicon metal smelting, blanket much of the site. Abandoned since 1999 but now slated for potential industrial development, the proposed project instead intervenes to revalue the site by uncovering the site, the history and culture of Rock Island, its underlying geologic systems, and the essential role of silicon in the economy, the environment, and our lives.

Following a framework of endemism, adaptive reuse, and partialization, Silica Fields proposes a lightweight trail and node system that creates an immersive experience of the Rock Island silicon smelter landscape with a series of paths, bridges and overlooks. Using a lattice concept, Silica Fields applies a minimum frame to reveal existing and latent layers of geology, ecology, hydrology, culture and industry by creating thresholds for sensibility across scales via embodied and cognitive experiences, generating rich ecotourism opportunities and the conditions for valuing this novel and beautiful landscape.

The project and site introduction is followed by a theoretical grounding, which sets up a framework for site research, analysis and immersion. These result in a design framework followed by a design proposal and conclusion.

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NINA MROSS MLA Thesis UW/LA 2019

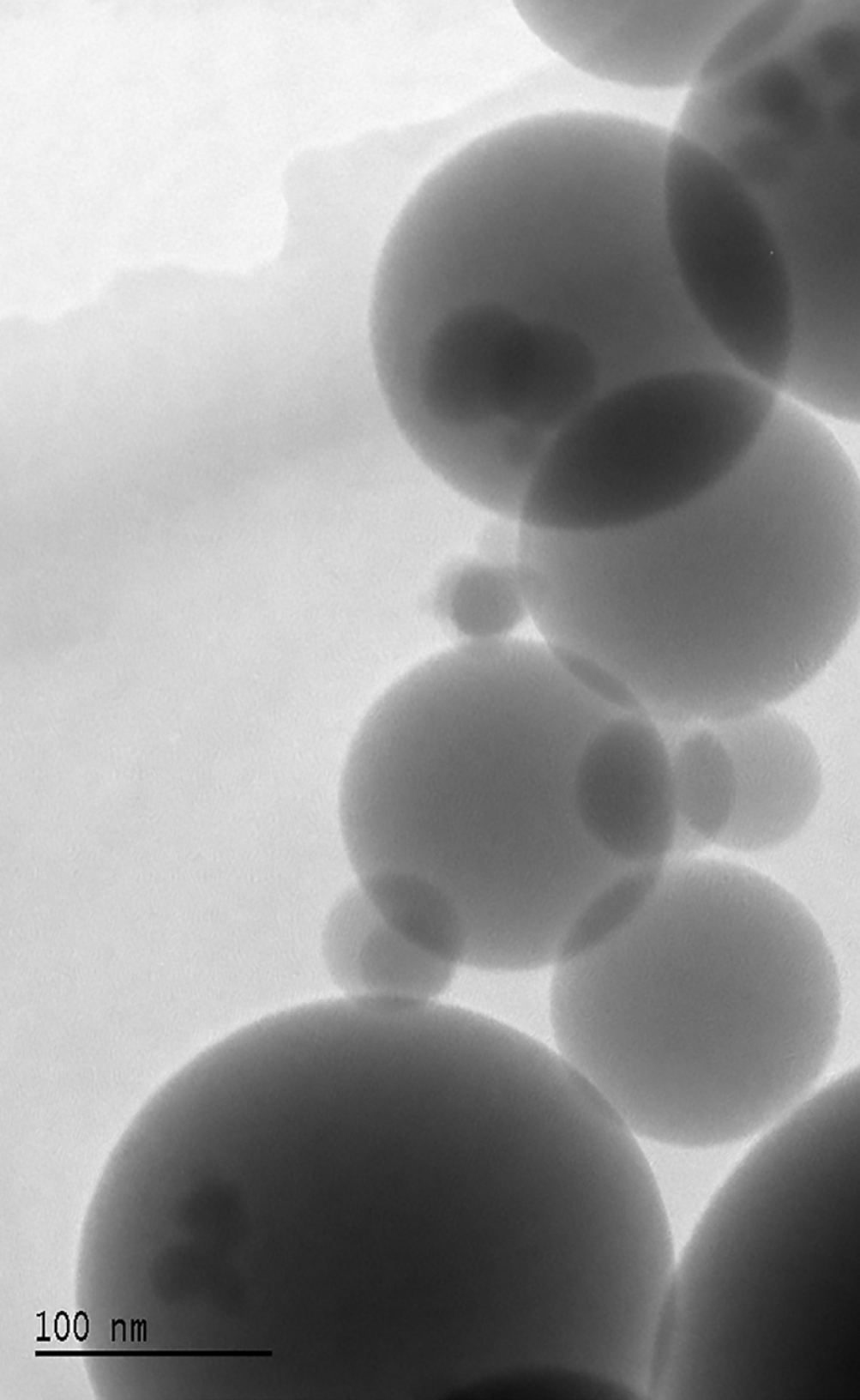
ACKNOWLEDGMENTS

This project would not have been possible without my advisors, Julie Johnson and Kathryn Rogers Merlino. I am deeply grateful for their inspiration, guidance, and support. Thank you Kathryn for introducing me to Rock Island and therefor the world of silicon and silica. Thank you Julie for always bringing me back to my path with your kind, clear mind when I felt I was grasping at theoretical straws. Thank you both for believing in me, these ideas, and the future of Rock Island.

Thank you to my cohort for their energy and unique visions of the world, to the Built Environments Library for being a source of knowledge and peace, and to all my professors and mentors who gave me the tools to think and design broadly and deeply, and develop my own path.

Thank you to Caleb for hours of driving, site visits, carrying bags of fume and sand, late night dinners, and countless other instances of emotional and logistical support, and a huge thank you to my parents and the rest of my friends and family for their love and encouragement.

Finally, thank you to the universe for giving me an existence to experience this fascinating and wonderful world.



CONTENTS

1. INTRODUCTION	8
2. THEORETICAL FRAMEWORK	18
3. HISTORY	28
4. ANALYSIS	38
5. IMMERSION	58
6. SILICON & SILICA	70
7. DESIGN FRAMEWORK	82
8. CASE STUDIES	84
9. DESIGN	90
10. CONCLUSION	124

Figure 0.1: Silica fume nanospheres. (Wikimedia Commons)

1. INTRODUCTION

LANDSCAPES OF VALUE

Throughout time, human valuation and use of landscape and the materials of the earth have evolved and changed along with culture and technology. In the last two centuries, our ability to move materials and alter the landscape has increased exponentially, in tandem with increasingly globalized economic and cultural values. At the same time, our localized understanding of the land as the source of our biological and economic success and survival has decreased, while our understanding of the global, industrialized systems that have supplanted local systems remains vague.

Land in the western United States, particularly arid lands, have been subjected to massive terraforming efforts by European and other settlers who generally did not see the landscape as valuable.¹ Rather, during and after displacing indigenous people from their homelands, they sought ways to transform the land, usually via damming and irrigation, in order to produce value via crops, as well as geologic materials and other commodities. In 1929, historian Lindley Hull described pre-settlement Wenatchee, Washington as "a weary waste of worthless ground, entirely in the possession of the jackrabbit and the coyote."² Aesthetic values influenced and continue to influence this terraforming - usually towards generic green landscapes of lawn, ornamental flowers and trees. Those areas which were not or could not be made green have often been considered wasteland, great places to detonate bombs and

1 Branch 2012; Dilsaver 2016; Limerick 1985

2 Hull 1929, 297

store nuclear waste, dump trash and toxins, or otherwise cut, tear, dismantle and transform in the service of 'development' and 'progress' - highly valuing the products, performance, or utility that can be leveraged from the land in the short term.³

Today, as the US economy and land use shifts away from heavy industry, local regions are grappling with what to do with the leftover spaces, and how to adapt their economies to a future radically different from the past. Concurrently, there is an ever-increasing awareness of the complex ecological, hydrological and material systems that humans are altering and influencing, and an interest in and need for creating resilient systems and lifeways more closely tied to place and environment. The Rock Island Silicon Smelter site is such a leftover space; a landscape at the intersection of industry, power, culture, geology and hydrology. No longer seen as valuable to its human community and in need of adaptation, the site is now at a crossroads.

As a privately-owned post-industrial brownfield covered in strange materials of unknown utility, an archaeological and historic site, a place of infrastructure and flows of power and life, a beautiful bluff in the Columbia Gorge, what value does this site have? Like many such landscapes, this site embodies layers of matter and meaning that reach across scales of time and space, from elemental particles to global systems. How those manifest on this site have created something totally unique, an endemic condition only found here and now. As we adapt this site to the future, can we preserve its unique qualities, access its vital beauty, and create sustainable value?

3 O'Connor & Wieda 2001; Di Palma 2014; Dilsaver 2016; Limerick 1985



Figure 1.1: Silicon plant and silica fume waste ponds in April 2019.

THE SITE

The Silica Fields are the former site of a silicon smelter in the small town of Rock Island, WA, along the north bank of the upper Columbia River, just downstream from Wenatchee. The dumping grounds of a silicon smelter for over sixty years, the fields contain more than 175,000 cubic meters of silica fume (small silicate spheres, the by-product of silicon metal manufacturing), as well as other incidental waste materials like concrete rubble and scrap metal. The northern edge is bounded by the railway, now BNSF, running east-west along the first trestle railroad bridge across the Columbia. Downriver about three miles is the first hydroelectric dam on the Columbia, from which high voltage power lines run north to a substation on the

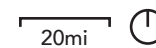
silicon smelter site, and cross the Silica Fields south across the river and north into the town. On the eastern tip of the almond-shaped site, a cascade of steel framed factory buildings slopes from the road and railway south down to the Columbia River. For 60 years, the smelter transformed the raw materials quartz, coal, and woodchips into silicon metal products. The site was once an economically productive place, but has been unused since 1999, when the silicon smelter ceased operations and the site was bought by Columbia Ventures Corp, a private investment company based in Vancouver, WA. They intended to harvest and sell the silica fume, which is a valuable additive to high performance cement. However, the fume on site has been sitting outside for decades, and is no longer a uniform, to-spec product, and thus has no value in the industrial market.

As heavy industry, encouraged by neoliberalized globalization, closes or moves operations to countries with cheaper labor and laxer regulations, Rock Island, like other rural towns, is looking to adapt their economy for the future. As of spring 2019, the Alcoa Aluminum plant in Malaga, just across the river, is closing down, leaving many without jobs and an overabundance of power coming from the Rock Island Dam. At the same time, cryptocurrency miners and server farmers have been flocking to Eastern Washington to take advantage of cheap, abundant and reliable hydroelectric power. As the economy becomes digital, it still needs to 'take place' somewhere. While some towns and counties have made efforts to restrict this influx, Rock Island and Douglas County are seeking to take advantage of these new activities, using them as catalysts to create long term economic opportunities.

1.2: REGIONAL CONTEXT



Image source: Google Earth



1.3: LOCAL CONTEXT

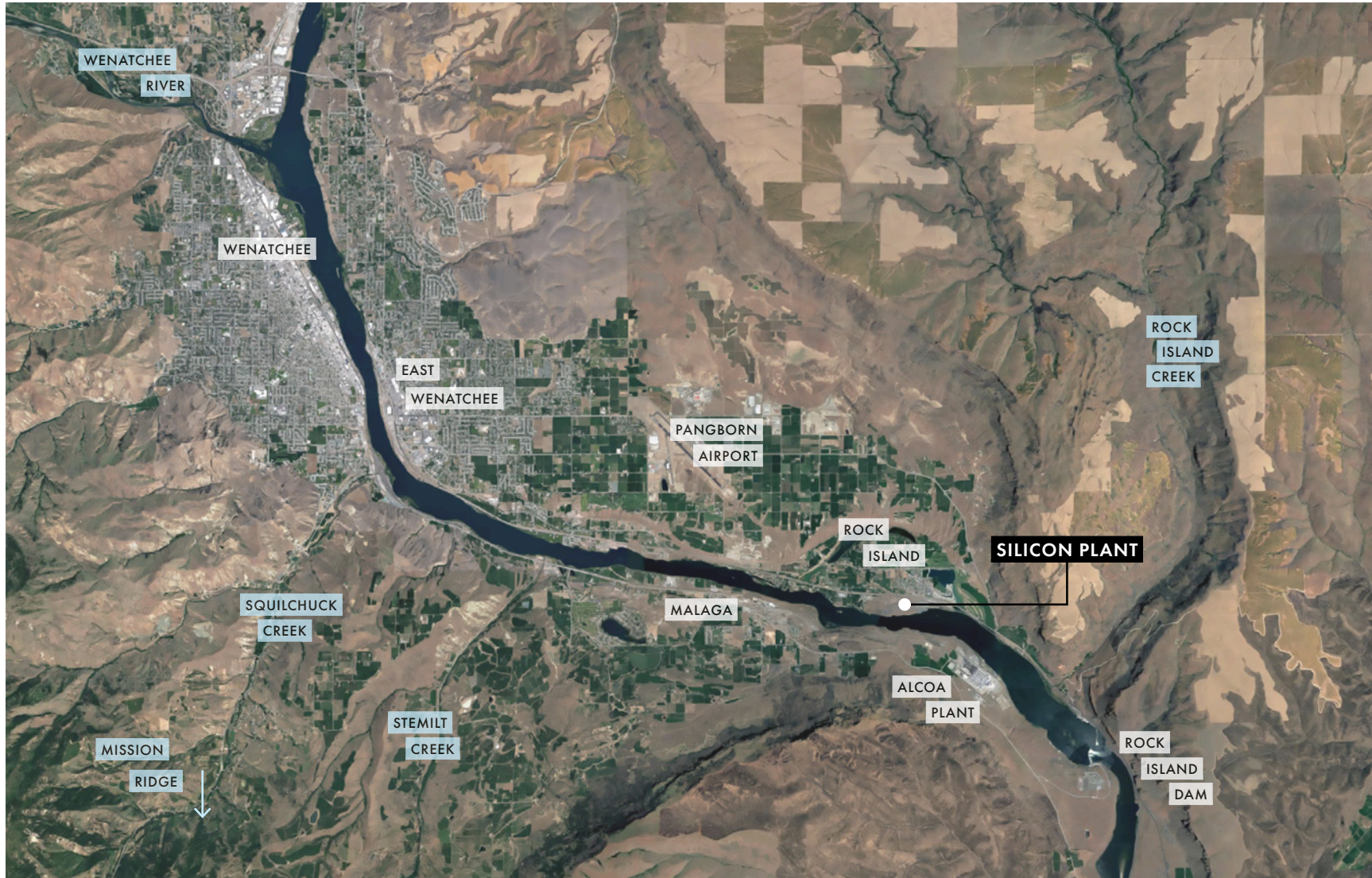


Image source: Google Earth

1.4: TOWN OF ROCK ISLAND



Image source: Google Earth

0 1M

The town of Rock Island, WA sits on a sandy, gravelly bar in the Columbia River, formed around the basalt outcroppings at the rail bridge crossing.

POPULATION:
Approx 1000

MEDIAN INCOME:
\$43,472

DEMOGRAPHICS:
52% Latinx
47% White
1% Native & others

ECONOMICS:
Agriculture
Retail
Health Care¹

1 Maul Foster Report 2017

1.5: FORMER SILICON PLANT SITE



Silica Fume dunes, April 2018.



Smelter buildings, November 2018.

Perceptions of the silicon smelter site and its potentialities have recently changed in response to these conditions. As recently as 2017, Rock Island mayor Randy Agnew saw the site as an obstacle to use and value.

“The biggest obstacle there is getting the old silicon plant removed and cleaned up. The silicon plant covers 65 acres of the prime industrial/commercial area of Rock Island. From my perspective, I want businesses that are clean, add to the visual appeal of the area, and provide benefits to the citizens of Rock Island.” - Randy Agnew, 2017⁴

Mayor Agnew, the Port of Douglas County, and a group of local industry stakeholders formed an Industrial Development District (IDD) group to work towards creating economic value and sustainability at the site. Though at first they viewed the whole site as an obstacle, reusable for industry and commerce only after being “removed and cleaned up,” they recently changed tack and now view the building as an asset that could be adaptively reused, due to cryptocurrency miners becoming interested in the silicon smelter and adjacent power station as potential server space.⁵ In 2018, the IDD group hired Seattle architecture firm Graham Baba and Kathryn Rogers Merlino, to run feasibility study on how the smelter buildings could be transformed into an economic driver and regional destination. Graham Baba designed the nearby Pybus Public Market in Wenatchee, a popular adaptive reuse project and an inspiration to the IDD.

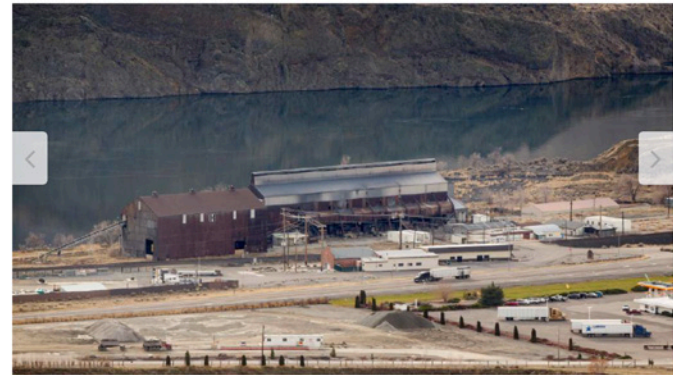
The silicon smelter feasibility study was completed in fall 2018 and proposed a range of ways to make the plant buildings valuable not only as cryptocurrency or server farm space, but as

4 Begin 2017

5 Bend Bulletin 2019

Central Washington doubles down on blockchain

After a bankruptcy and the bitcoin bust, officials in Douglas County still believe the technology will bring industry to the region



The Port of Douglas County is considering plans to breathe new life into an unused silicon plant on the Columbia River Rock Island. (Don Seabrook/The Wenatchee World/TNS)

Figure 1.6: Headline from the Bend Bulletin, January 19, 2019.

a vibrant mix of uses. In early 2019, the IDD decided to move forward with the project, reframing it as a Blockchain Innovation Campus (BIC). The Graham Baba proposal goes beyond the central blockchain program, or any single use, to diversify the program to create a more economically resilient future, with ideas for a restaurant, brewery, spa, community, event and education space, greenhouses, etc. They intend the site to be a regional tourism destination, to bring people to Rock Island and to promote local entrepreneurship and ownership. Interestingly, the building complex’s future economic life will also be silicon-based, this time in the form of computer chips.

The early images of the project show nice landscape architectural design next to and among the buildings, mostly focusing on an entrance plaza, a terrace, a soft riparian edge, and some loose ideas for a riverfront walk, but, as the project is in early scoping, they don’t mention any specific plans for what would happen to the silica fume, or any other site remediation. The larger site



Figure 1.7: Graham Baba's schematic proposal for the Blockchain Innovation Campus (BIC), spring 2019. (Images courtesy of Graham Baba)

away from the buildings' immediate surroundings is outside the scope of Graham Baba's proposal, and their images show a generic, 'cleaned up', grass-and-trees landscape as a green neutral ground. (Figure 1.7)

The larger landscape presents complex challenges and opportunities. The mayor and other interested parties have variously stated they would like to see the site cleaned up, used for housing developments, industrial development, recreation fields, a marina, a casino, so-called 'open space', or a park with trails. The Bonneville Power Administration (BPA) has identified the site as the best place for building additional high voltage power lines with attendant infrastructure, to deal with higher

electrical loads and increasing demand, even as that demand is in flux.⁶ The railroad and power lines are not going anywhere soon, and seem to support further infrastructural or industrial uses rather than residential.

The physical massiveness of the silica fume, as well as potential site toxicity, are the main 'obstacles' to the IDD's ideas of creating value through site transformation. The Washington State Department of Ecology and the Environmental Protection Agency register the site as a whole as a Level 5 brownfield, of lowest concern. Though sampling in 2013 showed that the fume contained elevated levels of arsenic, lead, copper, cadmium, zinc, silver, and selenium, soil and water samples from under and around the fume did not contain these toxins, indicating that they are not leaching out of the fume dunes. A test with 30 rainbow trout showed no toxicity in the fish after exposure to runoff from the fume.⁷ Despite the presence of toxins, their extent and severity are low.

The landscape aesthetics here are also challenging. The massive piles of black fume, dusted with scrubby dry plants and littered with scraps of rusty steel, bits of wood, and other detritus not easily identified, have an unexpected, strange beauty that enchants and beguiles. All nearby parks, except one, fit the grass-and-trees typology so prevalent in our landscape imaginary, a useful but overused Euro-centric terraforming that creates well-used and well-loved public space at the expense of biodiversity, the water table, heterogeneity, our sense and knowledge of place, and multi-faceted experience of delight. Can the unique qualities of this site provide something more valuable for Rock Island?

6 BPA Report 2016

7 EPA Site report 2013

THESIS PROPOSAL

Does the site need to be fundamentally transformed to create value? All of the current plans - except trails, perhaps - involve substantial changes to the site's ecology and ground conditions.

Alternately, is it possible to meet the stakeholder goals of income generation and public access while minimizing site impacts and protecting the qualities of this unique and beautiful site? Can its uniqueness become the very thing that redeems its 'value' in a post-industrial capitalist system? Just as the smelter has become a site not for mined quartz and coal, but for digital "mining" of information packets, the landscape's survival depends on accepting the strangeness of the world we live in, and the changes we need to roll with to survive.

This thesis seeks to retain and maintain the site's wonderful endemism in the face of an increasingly homogenized world, use it as the foundation of a new conception and valuation of the site and its potential, and to create a design that allows the site to flourish.

To catalyze the diverse, resilient potentials of this place, people need to first access and experience it. When people develop meaningful relationships with and knowledge of the site, future projects will be formed from a place of care and consideration beyond technocratic capital production.

Looking deeply into the site as it exists now, finding practical uses for the site materials, and novel ways to access, experience, and inhabit the site will give the mayor, the stakeholders, and the citizens of Rock Island new frameworks to value this treasure they already have.

This project comes out of a fundamental optimism; rather than cynicism and critique, positive visions of the future have the power to transform perceptions. Positive visioning transformed the IDD's perception of the buildings from a derelict liability to something unique and valuable. It is crucial to helping people see their relationship to the future as productive and positive.

QUESTIONS

- How can this site be reframed from 'wasteland' to 'multifaceted asset', where its inherent qualities hold ecological, social and economic value?
- Can a comprehensive site analysis via research, immersion and making create a rich site understanding, and design that comes not from outside, but from within?
- What is silica fume, what can this site teach us about silicon, and what is this site's relationship to the greater system of silicon?
- How can the design of site access and immersion convey site histories, processes and aesthetics in ways that reframe ideas of beauty in arid so-called wastelands, by maintaining the endemism, or specific uniqueness, of the site?
- Can site and local materials be used to create and support these designs and experiences?

SITE EXTENTS

The project extents are three parcels - the two that make up the silicon smelter site, and the parcel directly to the west across the railroad. (Outlined in the site plan, see page 13) This third parcel is also large, privately owned and primarily used for power infrastructure. Bringing the two sides of the railroad together creates opportunities for connection across the tracks and to more of the river's edge. All together the site is 105 acres.

PROJECT SCOPE

As a non-professional, independent project, this thesis will contain original research, graphics, and design that proposes my vision of how to answer my thesis questions.

The design creates a lightweight framework for accessing and experiencing the site as it is. Site research and analysis lead to recommendations for the Crypto Innovation Campus, and other future site projects, without designing them. The project proposes some interventions for the area around the buildings, but will assume that any major earthworks or remediation, if necessary, will happen with the Graham Baba project.

My hope is that this document will serve as a window into this site, informing and influencing future projects to encourage minimal site transformation.

GOALS

Reveal value extant in site

Create framework of understanding for future projects

Increase local & regional knowledge of:

- Silicon and site processes
- Site history and culture
- Shrub-steppe ecology
- Columbia plateau geology

Add to the field of landscape architecture by engaging with:

- Landscape adaptive reuse
- Geochemistry
- Material use & culture
- Rural landscapes & economies

Create a useful & inspiring document

DELIVERABLES

Site Maps and Analysis

Research and Data Visualization

Theoretical and Design Frameworks

Site Design

- Path Location and Schematic Nodes
- Detail Design Examples

Identity & Wayfinding Design

2. THEORETICAL FRAMEWORK

FINDING VALUE

Three major concepts (endemism, adaptive reuse and partialization) from landscape, architecture, ecology and design are brought together into a theoretical framework that operates at the intersection between perception and physical place, to create the conditions for finding, accessing, and catalyzing value on and in the site. This framework was created to ground the initial approach to research and site analysis. A second, design framework was created after the research phase, evolved from the theoretical framework and deep site analysis.

ENDEMISM

Endemism is a concept applied to many fields of thought, though the ecological definition is likely the most familiar to landscape architects. It describes the condition wherein organisms, processes, relationships, or characteristics originate uniquely from the place that they occur. Endemism can be defined as the unique conditions of a place, also known as terroir. French landscape designer, gardener, and thinker Giles Clement defines endemism as “a constant manifestation dependent on a specific territory, a landscape unlike any other, sustainable as long as the preconditions for its existence continue to exist, that is to say, its ‘insularity’ in relation to an increasingly banal and uniform world.”¹

Recently, in landscape architecture and related fields, there has

1 Clement 2015, 6

been a greater understanding of and interest in the relationship between place-based ecological and cultural diversity, that supports sustainability and resiliency across systems. However, much of the efforts to maintain or create that uniqueness get simplified into small aspects of familiar Euro-centric typologies, such as a plaza with some native plants or indigenous patterns worked into the paving. Perhaps the pitfalls with that kind of approach lie in forcing the vast complexity of the world into something “legible” and orderly.

“Our planet remains obscure, complex, full of different ecological niches scattered over the surface of land and sea, but also within the thickness of living matter, from the subsoil to the ceiling of the biosphere... It is precisely that disorder that creates diversity.” - Clement²

Diversity of life, of thought, of materials, is the very thing that keeps us alive and thriving. As anyone who recalls middle school biology knows, without genetic diversity an organism cannot adapt to its environment, and eventually dies out. Genetic inbreeding and homogeneity lead to system failure. However, total diversity of parts in a uniform solution also wouldn't support life. Separation and specificity of type are what allow unique characteristics and assemblages to evolve together.

The natural system of the world creates locales that support and create endemic conditions that are also connected to other endemic systems, a network or web of interconnected

2 Clement 2015, 6-8

nodes. In the Anthropocene age, humans are also creating interconnected webs of endemic nodes, albeit strange, unexpected, and often unintentional ones, even as we strive to homogenize and globalize our lifestyles, land use and settlement types. With post-industrial landscapes like the silicon smelter, the site's endemic ecology is often defined as 'novel,' as in not wholly natural, not wholly anthropogenic, but something in between, and likely permanently changed. Historically, the way that western science and culture has viewed the landscape is through a strict separation of pristine, cultivated, or degraded, with pristine landscapes of certain types being highly valued. Some types of wildlands, such as swamps and deserts, and most degraded sites, have been and still are viewed as wasteland, needing to be improved, fixed, cleaned, restored or otherwise transformed into something we deem valuable.³ Novel ecosystems are more recently viewed with interest by landscape architects and other land managers, and what to do with post-industrial sites a common challenge to designers and stakeholders everywhere.⁴

However, viewing the site primarily as "novel" or "post-industrial," though factual, leads to preconceptions of what the site is and does, and assumptions about its toxicity, productivity, utility, beauty and value. Alternately, using the concept of endemism creates a framework in which we can see endemism itself as valuable, something to be treasured and experienced for its uniqueness. There are of course real and legitimate concerns about toxicity and pollution, ecosystem health and

3 Cronan 1996; Di Palma 2014
4 Hobbs, Hall & Higgs, 2013; Braae 2015



Figure 2.1: *Ericameria nauseosa* (rabbitbrush), grasses, and animal tracks in a fume pond. April 2019.

connectivity, and so on, and very good reasons to change or manage sites that have been disturbed or degraded by human activity. The lens of endemism makes maintaining as much of a site's uniqueness as possible a top priority. Depending on the site context, and even if remediation or major earthworks are necessary for human or ecological health and safety, this approach could lead to cheaper, lighter, simpler interventions. Site analysis and design of the Silica Fields via endemism brings non-action and open-minded, active perception to the fore, and subdues the designer's (my) desire to fill the site with new programs, structures and forms.

ADAPTIVE REUSE

If endemism is a conceptual frame, adaptive reuse is in this project a practical and material approach. Adaptive reuse is an architectural term with the essential meaning of modifying an existing place - typically a building - to a new use.⁵ The physical changes effected in this modification could be large or small, and the place or structure may or may not be considered to have historic value - if it already exists, it can be adaptively reused. The extent of the modification is determined by the present and future uses, needs, and desires of those involved. In the best cases, every existing part is inventoried and considered for its utility and potential, and that which is found safe, functional, beautiful or otherwise valuable is kept. Adaptive reuse allows for and encourages the construction and insertion of new elements to suit the specific project goals and design. It's this close relationship between reusing the old and creating the new which makes this practice so useful and exciting.

Adaptive reuse in a broad sense has existed since time immemorial as a practical and straightforward way to make the best of what's already around us. Humans as well as other organisms have adapted existing structures and material configurations to new purposes. Recently, in response to massive environmental and social challenges, adaptive reuse, in almost all cases the 'greenest' solution, has emerged as an important and popular design practice, from upcycling and DIY to high end design projects.⁶

5 Wong 2017; Merlino 2018

6 Preservation Green Lab, National Trust for Historic Preservation 2016



Figure 2.2: Silicon smelter buildings, rabbitbrush, concrete rubble, and quartz and coal strewn over the ground. November 2019.

Adaptive reuse of the landscape, though in some senses common, is more often done via operations we call land use change, development, renovation, restoration, reinvention, remediation or simply “re-doing.”⁷ A timber plantation razed and turned into a housing development, an old vegetable garden converted to ornamentals, boulders excavated during a park project and used as site features, a landfill capped and turned into a public park are all examples of this. The distinction between what of the landscape was created for a specific use, and can therefore be modified to a new use, and what was created through a complex natural system is often hard to make. A building, created by humans for a specific purpose and consisting of generally known materials and parts, can be fairly easily seen as a discrete physical artifact. A barn can be adaptively reused and turned into a restaurant. However, the stuff, structure, and boundaries of the land are harder to pin down. Where and when does a landscape begin and end? Because of the landscape’s nebulous parameters, general ability to regrow itself, and dynamic conditions outside of humans’ direct control, anthropogenic site change is not commonly undertaken through the lens of adaptive reuse.

However, in this site, as a means to prioritize endemism and as a parallel to the building project, adaptive reuse as a primary operating principle will be useful and productive. The silicon smelter landscape is just as interesting, beautiful, and valuable as the factory buildings, not only as cultural or industrial artifact, but as a living, dynamic system and site of valuable material resources.

7 Thoren 2014

This approach calls for a comprehensive look into what already exists here, what it is, what it’s doing, and how a future design can use or intersect with these parts and features. Adaptive reuse in post-industrial landscape projects forces us to deal more directly and practically with existing endemism, and how we insert new elements can result in a wonderful mix of the familiar - allowing us a comfortable entry point - and the strange and unique.

PARTICALIZATION

Particalization is an aesthetic, material, spatial and programmatic design concept from the Japanese architect Kengo Kuma. Following endemism and adaptive reuse, particalization is a way to approach both the sensual, aesthetic site experience and the spatial and programmatic uses of the site, and a strategy for breaking down barriers between people and site.

Kuma has spoken of the blunt, overpowering harshness of contemporary projects whose “...abstract, geometric forms ... are in conflict with the surrounding environment.”⁸ Elsewhere, he describes them as resembling cubes of “white tofu.”⁹ His own buildings often use extremely precise Euclidean forms, but Kuma’s particular approach to these forms employs a concept he calls “particalization” – the breaking down of monumental objects or systems into small units, which together create something like a cloud or a field.¹⁰

8 Bognar 2009, 9

9 Kuma 2010, 6

10 Bognar 2005, 2009; Kuma 2013

In his 2013 book *Anti-Object*, Kuma neatly explains the relativistic, perceptual phenomenon of the particulate condition using the example of a rainbow. "A rainbow is not something absolute that exists anywhere, but instead it is generated by the relationship between the sun, droplets of water and the observer. Rainbows are relative because they are collections of particles."¹¹ Of course a structure is something absolute that exists somewhere, but via the rainbow metaphor we can understand that Kuma wants designs to always be seen and experienced in a relativistic way. All places are experienced differently depending on the season, time, the mood of the user, etc., but Kuma heightens this experience by means of particalization.

Particalization creates permeability, and in many cases transparency. Large sheets of glass are transparent, but in the field can be highly reflective, resulting in "confrontation,"¹² as well as fragmentation and confusion. A glass box reflecting the sky and clouds may be a beautiful image, but it creates a hard, inhumane beauty. Particalized transparency, such as in a lattice, creates a different perceptual condition, one of dappled, dispersed matter, where the person experiencing it is immersed or semi-dissolved into the world, rather than separated from it.

This approach, used aesthetically and structurally, is related to both materials and perception. The Finnish architect Juhani Pallasmaa wrote about the physical and psychological mechanics of perception in relation to architecture in his classic

11 Kuma 2013, 99

12 Kuma 2015

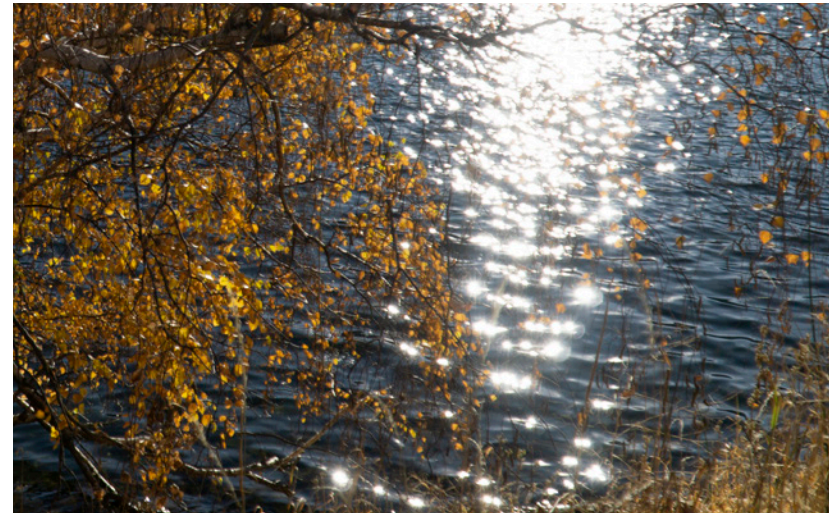


Figure 2.3: *Populus* leaves, reflected light, and dry grass. November 2019.

work *The Eyes of the Skin*. He wrote, "Architecture involves several realms of sensory experience which interact and fuse into each other... the gaze implies an unconscious touch, bodily mimesis, and identification."¹³ Sensing the world, our bodies have a multi-layered, haptic and emotional association with what we see. When we experience sites whose systems and materials we don't understand or have no connection to, we more easily see them as in need of transformation into something familiar. Conversely, when we identify with and understand the things around us, we are more likely to value them. Kuma argues that material choice and use are essential to that identification. By using obviously natural materials such as wood or stone and

13 Pallasmaa 1996, 42



Figure 2.4: Chokkura Plaza by Kengo Kuma, 2006. (KKA)

small or human scale members or parts that are relatable to human hands and craft ways, he creates an emotionally and physiologically immersive, partialized experience.

Elements like silicon and materials like silica fume are obscure to the average person. Materials and their chemical and atomic properties have deep cultural meaning and value, though it's not always immediately apparent. We may know silicone for its use in bakeware, or silicon as what makes a computer chip, but where they come from, how they're made, and how they're interconnected with the rest of the world and human culture are unclear. The landscape, the atmosphere, and the occasional meteorite are the source of all earthly materials, the sun and the earth's core the source of all energy. Whether we



Figure 2.5: Dry rabbitbrush with wind-blown seeds. November 2019.

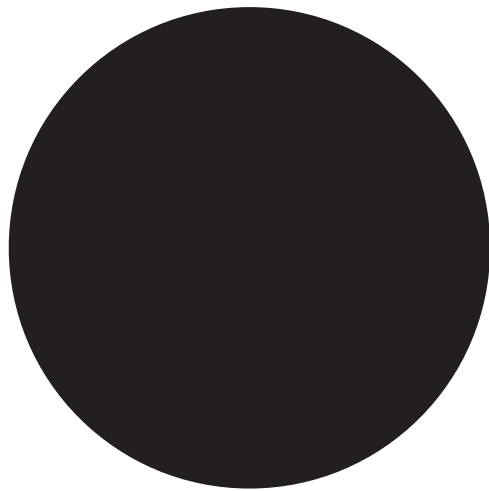
see it as 'natural' or 'artificial,' every material has its ultimate source in nature, and must somehow return to nature via de- and recomposition. Breaking down barriers between people and the landscape, creating a partialized experience, can help us see past our initial reactions to the Silica Fields as an artificial wasteland, to a more complex, nuanced understanding.

Professor Nancy Rottle of the University of Washington, in a panel discussion about ecology, aesthetics and green infrastructure, said that in general people judge what is beautiful to be *right*.¹⁴ Kuma's beautiful buildings allow people to accept ambiguity in the peripheral environment and to accept the environment infiltrating our spaces. His architecture is at once specific and

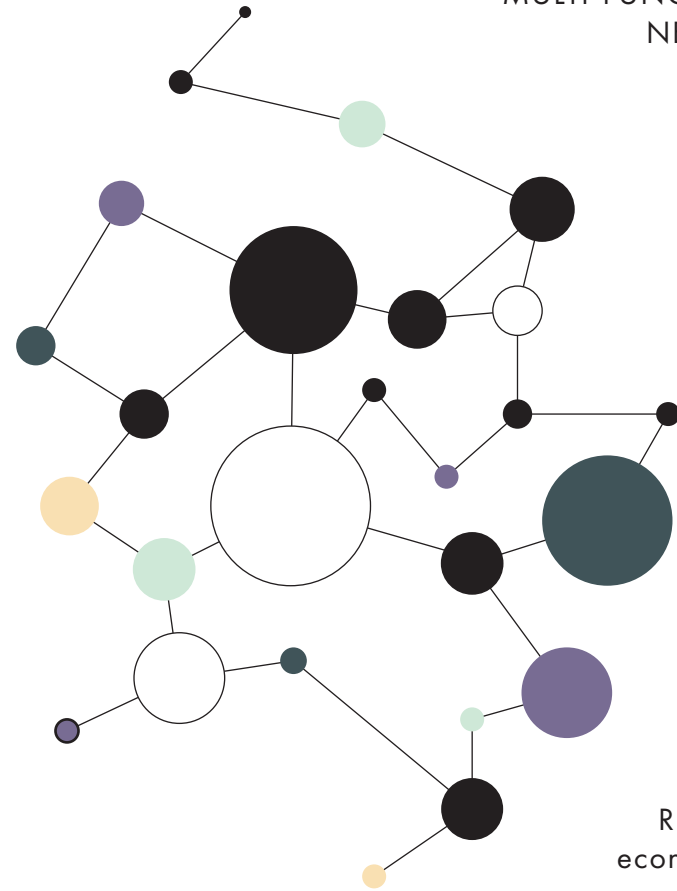
14 Seattle Green Gardening Workshop. South Seattle College, October 21, 2015.

2.6: BREAKING DOWN INTO PARTICLES

INDUSTRIAL
STANDARD
MONO-FUNCTIONAL
ONE DIRECTION
CONTROL



ARTISINAL
NON-STANDARD
MULTI-FUNCTIONAL
NETWORK
ACCESS



FRAGILE
economically
ecologically
socially

RESILIENT
economically
ecologically
socially

indeterminate, blending into the interface between humans and the world both in its literal material graspability and its perceptual blurring, placing these discrete, relatable parts in a permeable matrix. Though blurry around the edges, Kuma's precise geometric forms allow us to comfortably inhabit his spaces. An insight of Pallasmaa's applies neatly to Kuma's aesthetic and architectural approach. In speaking of architecture, he says, "We can dream and sense our being outdoors, but we need the architectural geometry of a room to think clearly."¹⁵ This relates to Joan Iverson Nassauer's concept of the 'orderly frame'.¹⁶ If we have evidence of human intention, we can accept 'messy' (ie., vital, healthy, endemic) conditions on just the other side. Simply a floor, or the suggestion of a frame - a soft boundary - can be enough to delineate a comfortably habitable or accessible space.

If humans are to find a way to a tenable future on earth, we need to dissolve the boundaries between the human world and the rest of the natural world, dissolve the distinctions between pristine, cultivated, or degraded, to more productively cohabit with landscapes we don't completely control. We need to allow nature into our world and ourselves. Particalization expands the physical and physiological boundaries of human interaction with the environment inwards and outwards. By gaining awareness of where our materials come from, we can better manage our natural resources and understand our deep relationship to the world. By allowing the ambiguous environment to infiltrate our

15 Pallasmaa 1996, 45

16 Nassauer 1995

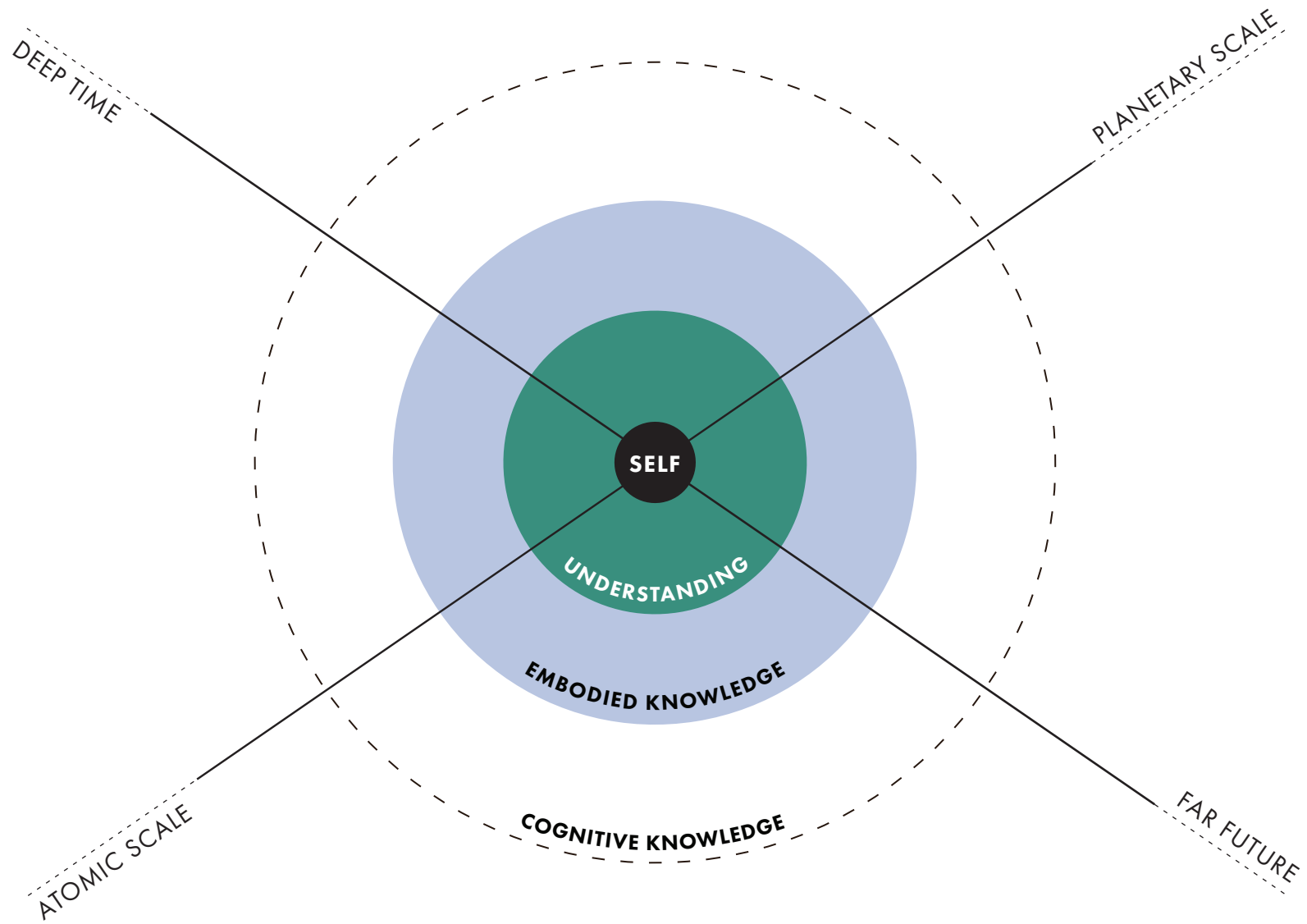
lives, even in small ways, we create acceptance of dynamism, permeability and bio-connectivity in human spaces, which it brings us closer to what Carolyn Merchant, Professor of Environmental History, Philosophy, and Ethics at UC Berkeley, calls a "partnership ethic" with nature.¹⁷

Crucially, particalization also applies to systems. Particles create relative experiences that engage people in the complex dynamism of the world while creating horizontally networked, resilient systems. Generally, mono-functional systems are not resilient. Though they are strong in some ways, when a fracture or weakness occurs, the whole system breaks down. Just as in the endemism discussion above, diversity is required for resiliency and adaptation. Here, we have a site used for a few industrial functions: silicon smelting and waste storage, and as a place for the railroad and power lines. The major site use, silicon smelting, proved unresilient to changes in the global economy. The silica fume, itself a useful commodity, is no longer valuable in a standardized, industrial system. The site's status as private property, and hard boundaries of road, rail, and river, have isolated it from the Rock Island community.

Just as the Graham Baba design proposes diversifying the building uses and program to create a more economically and socially vibrant and resilient place, the landscape uses should also be broken down into particles, to bring the site operations from industrial to artisinal, standard to non-standard, and mono to multi functional, in order to change valuelessness into lasting and resilient value.

17 Merchant 2010

2.7: LAYERS OF KNOWING ACROSS SCALES



BRINGING IT ALL TOGETHER

"The site is everything, informs everything." – D. Godshall¹⁸

Combining endemism, adaptive reuse and partialization creates a framework for seeing and valuing uniqueness for its own sake, looking carefully and deeply at what already exists and how it can move into the future, seeking to materially, physically, and perceptually intermesh people into their environment, and break down monolithic systems to create diversity and resiliency.

COGNITIVE AND EMBODIED KNOWLEDGE

To apply this framework, one must do more than a typical site analysis involving GIS, mapping, research, and other methods mediated by symbols, information and technology. To reach understanding, cognitive knowledge should be layered with embodied knowledge created by physical site immersion.

Cognitive knowledge is that which we learn through information such as words, text, images, or other media. For example, one may know that the Silica Fields has a steep bluff purely from looking at a terrain map. Embodied knowledge comes from our bodies' senses and experiences. A comprehensive understanding of the steepness of the site's terrain comes from both looking at the map and walking up and down the slopes, feeling gravity pull on one's body, seeing the view from the top, hearing a stream run downhill, smelling the sagebrush.

18 Stipinovich, M. (2016 Nov 16). Landscape Architecture with Terremoto's David Godshall. *Elle Decoration*. Retrieved from <https://elledecoration.co.za/landscape-architecture-terremotos-david-godshall/>

There are scales of time and space accessible to our understanding via these two kinds of knowing. Between the distant past and the far future, the atomic or micro scale and the planetary or universal scale, our knowledge typically encompasses what is close to us in scale, space and time. Via cognitive knowledge, we can expand the scope of our understanding, which in turn informs our interpretation of what our bodies sense immediately around us, and vice versa.

What follows is history and analysis (cognitive knowledge) and immersion (embodied knowledge) into the site, silicon and site processes layered together to create a comprehensive understanding. From this a design framework can be formed.

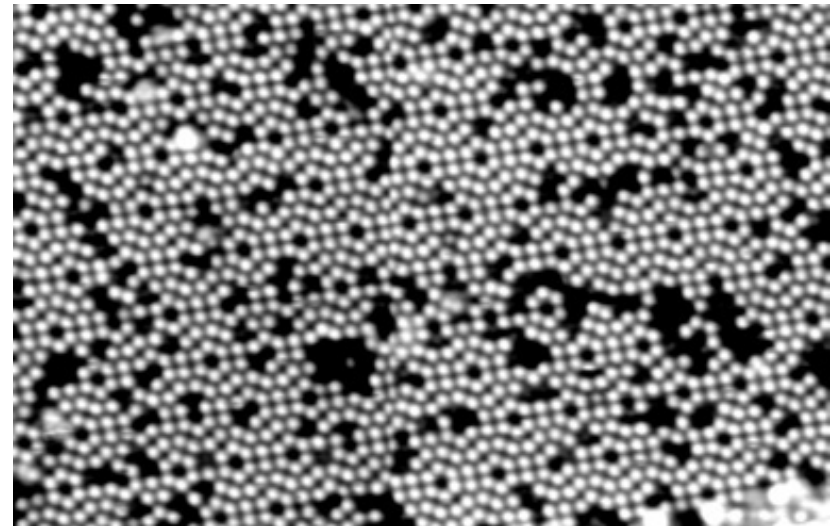


Figure 2.8: Scanning Tunneling Microscope image of silicon atoms. (PGI)

3. HISTORY

Rock Island lies in the upper Columbia River Gorge, in the Columbia Basin in eastern Washington. People have lived in this area for many millennia. Stone tools dating from around 11,000 years ago were found in Wenatchee; petroglyphs of various ages can be found along the Rock Island rapids, (figure 3.1) and the area is the territory of Wenatchi (P'squosa) and other Interior Salish peoples. In 1811, around the time that elemental silicon was named and isolated in Europe, a white traveler recorded seeing a village of tule houses along the banks of the Columbia near the Rock Island Rapids. Tule reeds grow along shallow riparian edges and in shallow lakes, and Interior Salish peoples use them to build houses (figure 3.3), weave cloaks and hats, among many other applications. In addition to tules, people hunted and harvested many other plants and animals in the area, notably salmon. The confluence of the Wenatchee and Columbia rivers was a meeting and trading point, and the Rock Island rapids were a prime fishing spot.¹

Settlers came through on their way west or looking for gold, and around 1850 a short-lived Chinese miner town became the first non-native settlement. Whites settled permanently in 1887, following railroad planning. Despite being promised a treaty, in 1902 the Wenatchi were forced off their land to the Colville and Yakama reservations far to the north and south.² Evidence remains on the smelter site of past inhabitation; there are three archaeological sites within the smelter parcel, and more are probable.³

1 Arksey 2008

2 Heffter 2003

3 Maul Foster 2017



Figure 3.1: Petroglyphs at Rock Island before the dam, c. 1930. (Washington State Historical Society)



Figure 3.2: Looking east c.1930, before the construction of the Rock Island Dam and the first water level increase. (Big Bend Railroad History)

In 1892, the Great Northern Railway built the first rail bridge over the Columbia in Rock Island. (Figure 3.5) The steep banks of the river are close together there, and made of strong, solid basalt. Thus the site was chosen as the crossing point. On the north bank, the Rock Island side, a 60' high basalt promontory was blasted through to make way for the railroad and bridge. This bridge was added to the National Register of Historic Places on July 30, 1975. In 1930 the town of Rock Island was incorporated, and in 1933 Puget Sound Power and Light built the first hydroelectric dam on the Columbia a few miles downstream. (Figure 3.4)

Pre-dam photographs of the area show a wide, soft riparian edge, (figure 3.2) where animals and plants adapted to the river's edge, such as tules, lived. Even in 1949, after the first level rise, a beach can be seen near the smelter buildings on site. (Figure 3.15) In the 2018 aerial image, the beach can still be seen just under the surface of the water. Building the dam raised the water level by over six feet in 1933, and retrofits in 1979 raised it again.⁴ Both increases inundated the river banks, covering riparian zones and petroglyphs along the rocky shores. Many petroglyphs were photographed and recorded by illustrations, and some were taken and put into the Wenatchee Valley Museum and Cultural Center in Wenatchee, which are on view today.

This region became well known for apple growing, and many orchards exist in Rock Island today. The 1949 aerial (figure 3.14) shows an orchard right next to the smelter buildings, what

4 Federal Energy Regulatory Commission Office of Hydropower Licensing 1987



Figure 3.3: Wanapum tule reed structures near Priest Rapids, c.1940 (UW Digital Collections, NA 839)



Figure 3.4: Rock Island Dam c.1950. (Chelan County PUD)

appears to be cleared or sparse scrubland, and trails through the site that still exist today. Though Rock Island remains sparsely populated and rural, by comparing the 1949 and 2018 aerial images (figures 3.12 and 3.13), it can be seen that the town's landscape as a whole has been significantly altered in the past 70 years by intensified agriculture and fishing ponds and gravel pits dug around the east, north, and west edges. The Alcoa Wenatchee Works aluminum plant was built in Malaga, just across the river, in 1951 (figure 3.13), and is now closing down due to globalized trade.

The silicon smelter was built in 1942 as part of the war effort, making ferrosilicon and silicon metal in its strategic location along the railroad. In the late 1950's an arc furnace was added and the factory switched to solely silicon metal. Silicon metal smelting creates the by-product silica fume, so-called because it fumes into the air, borne by oxygen bubbling through molten silicon. Prior to the Clean Air Act of 1970, this was vented into the atmosphere. (Figure 3.10) After 1974, the silica fume was precipitated out of the smelter's exhaust system, and collected as a fine powder. In the 1950's it was discovered that silica fume was a useful additive in cementitious mixtures like concrete,⁵ but not until 1980 was the Rock Island silica fume bagged and sold as co-product. About 85% of the fume produced was sold, with the remaining dumped on site. It is unknown at this point why so much of this valuable material was dumped as waste; the records conflict as to the exact reason.⁶

During its lifetime, the smelter changed owners seven times. In 1999, the plant closed down, unable to compete in the recently globalized economy.⁷ Columbia Ventures, Corp. purchased the property with the intention of harvesting and selling the 175,000 cubic yards of silica fume on site, which today could be worth as much as \$7 million. The owners hired the Silica Fume Association to assess their asset, but after a site visit, it was determined that because the silica fume has been sitting outside for decades, it is now a non-spec product, too full of plants, microorganisms, and other organic and incidental materials. Cleaning and purifying the silica fume to bring it up to industrial standards would be prohibitive, and so the site has been left unused.⁸

A comprehensive EPA site investigation was completed in 2013 in response to arsenic found in nearby wells (see Chapter 3. Analysis, Hazards), and a Bonneville Power Administration was study done in 2016 to assess the site for future power line expansion projects. In 2017 the Industrial Development District (IDD) formed (see Introduction), and later that year hired Seattle environmental consulting and engineering firm Maul Foster to create a site study of the IDD area, including the smelter site, weighing the project goals, environmental impacts and land use options.⁹ This study contains a comprehensive site history and socio economic analysis, and perhaps influenced the IDD's thinking about the value of their asset. As of spring 2019, the Blockchain Innovation Campus (BIC) project is going forward.

5 European Silica Fume Committee

6 EPA Site Report 2013

7 Big Bend Railroad History, 2016; Federal Register, 1999

8 Telephone conversation with the Silica Fume Association, 12/14/18

9 Maul Foster, 2017

HISTORY SUMMARY

This site history, though abbreviated, provides an understanding of the past conditions and actions which led to the site conditions today. These main points influence what should or could be done on the site in the future.

- Geology as formative factor
- Indigenous presence and current absence
- Archaeological sites
- Historic trails and paths still extant
- Historic orchard on site
- Inundated beach and riparian edge
- Railroad bridge major historic asset
- Silica fume not reusable in industrial system

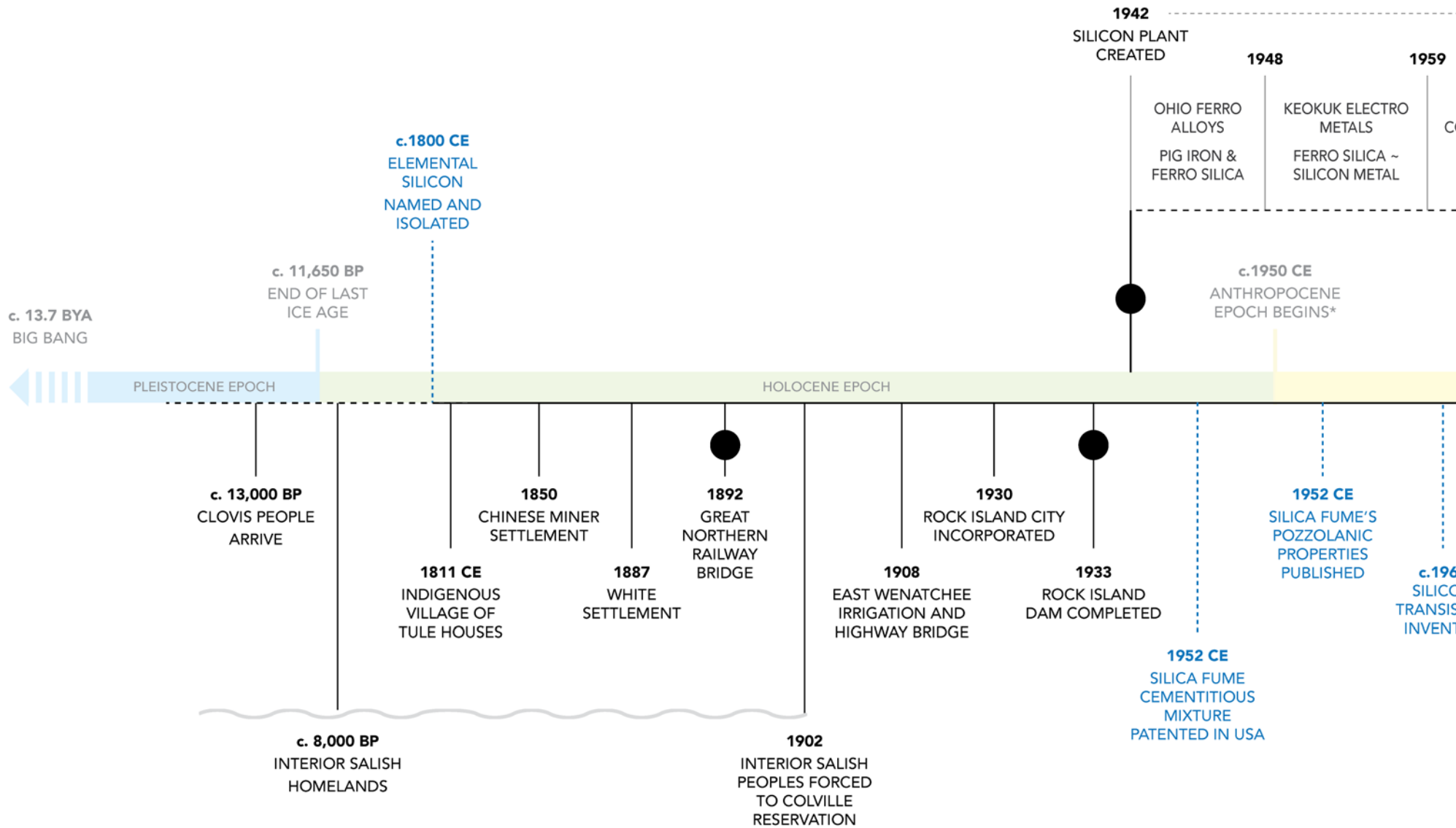


Figure 3.5: Rock Island railroad bridge c.1905. (GNRHS and NPRHA Joint Archives)

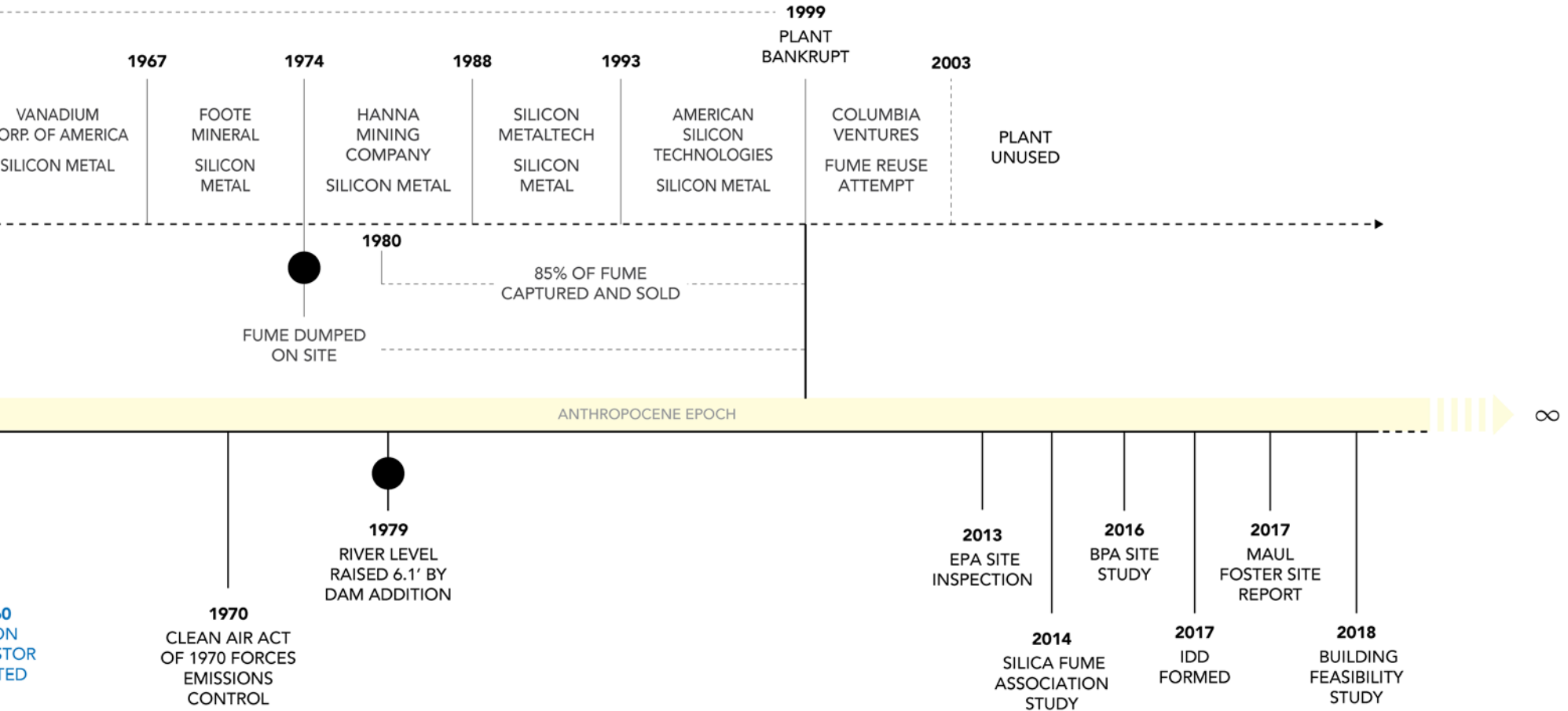


Figure 3.6: Rock Island railroad bridge. April 2019.

3.7: SITE TIMELINE



SILICON PLANT



NOT TO SCALE

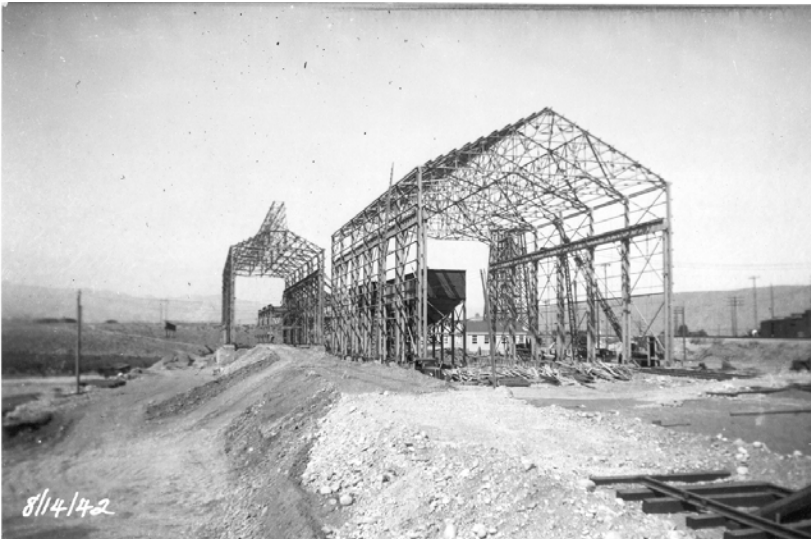


Figure 3.8: Smelter under construction, 1942. (Big Bend Railroad History)



Figure 3.9: View west, showing the cleared scrub landscape. (Big Bend Railroad History)



Figure 3.10: The smelter releasing silica fume into the air, 1955. The orchard and soft river bank can be clearly seen behind the buildings. (Big Bend Railroad History)



Figure 3.11: The smelter in 1985. Fume ponds and the raised water level can be seen clearly behind the buildings. (Big Bend Railroad History)



Figure 3.12: 1949 aerial showing the plant site and the Rock Island Dam on the far right and hand-drawn pencil lines representing parcel ownership. Riparian beaches are visible and the aluminum plant doesn't exist yet. Rock Island's lakes, gravel mine, and golf course also do not yet exist. (Douglas County)



Figure 3.13: 2018 Google Earth aerial showing the site, the Rock Island Dam on the far right, and the Alcoa Aluminum plant. The town's settlement has increased, and the terrain has been modified by digging the lakes, gravel mine, and golf course.

SITE CONDITIONS 1949

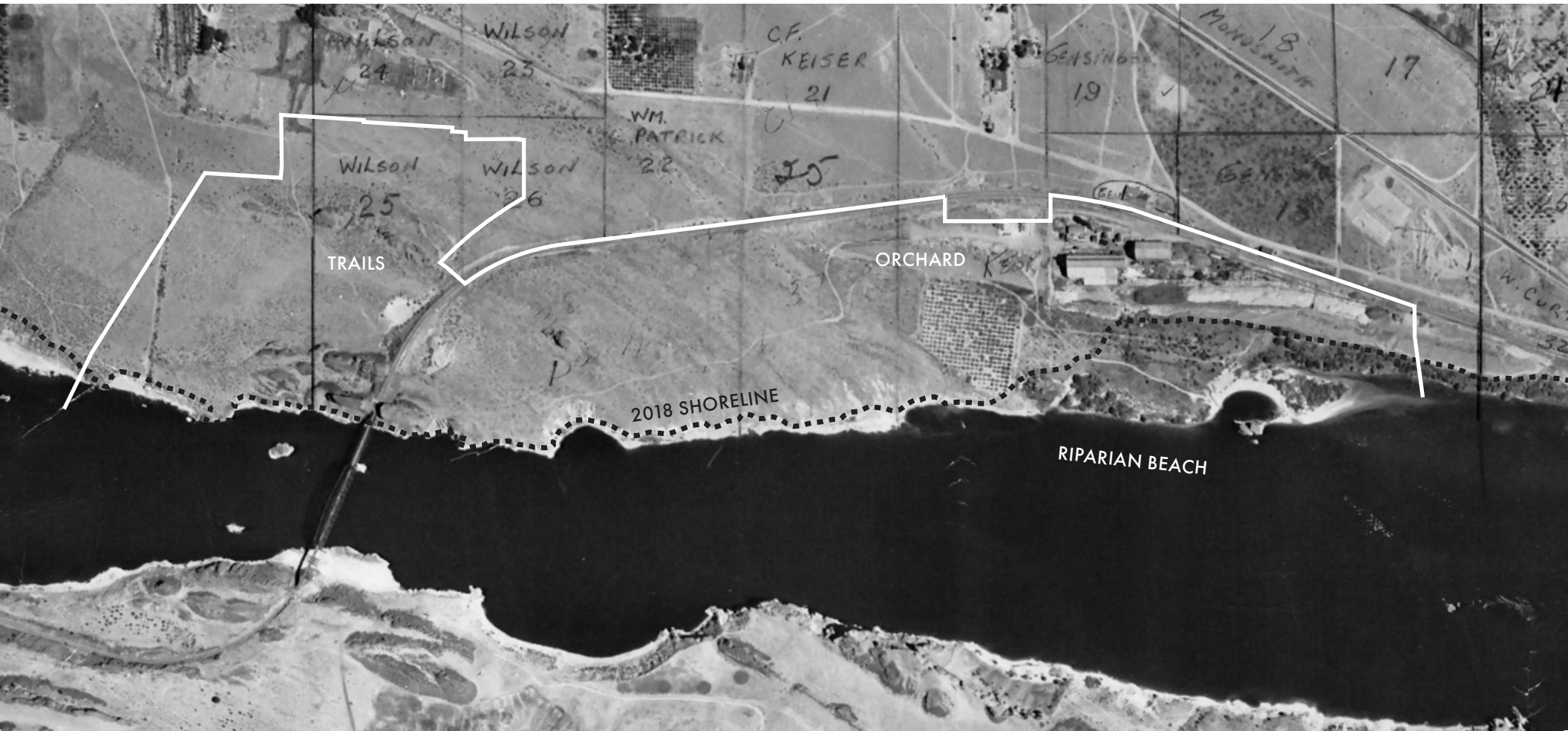


Figure 3.14: 1949 aerial photograph of the Rock Island silicon plant site, with hand drawn parcel lines. Trails, an orchard or plantation, and riparian beaches can be seen on the site. The water level had already been raised by the 1933 dam. (Douglas County)

SITE CONDITIONS

2018



Figure 3.15: 2018 Nearmap aerial showing current conditions. Rock Island Dam renovation in 1979 raised the river level by 6.1' feet, inundating the riparian beaches; the 1949 shoreline is shown by a dashed line, and the pre-flood landscape is still visible under the water's surface.

The ponds to the east have been created, the orchard and scrub landscape south of the railroad has been converted to fume storage, and SR 28 runs east-west directly to the north of the site.

4. ANALYSIS

APPROACH

Site analysis is largely a cognitive method, using second-hand information from sources such as maps, texts, images. This information is essentially impossible to produce via bodily senses, and can only be accessed via technology. The goal was to compile and synthesize this information into knowledge about the site and its context that informs the design framework.

METHODS

Site, context, and topography maps and models were created using GIS data and LIDAR surveys from Douglas and Chelan Counties' public archives, and a high resolution aerial image taken in August 2018 provided by Nearmap. Regional cultural and geotourism context information was found from Google Maps. Ecology, climate, site features and hazards, and potential future scenario information was gleaned from available information sources, and noted on the site and town maps. Site analysis, a potential materials inventory, and potential program and experience nodes were synthesized from this data.

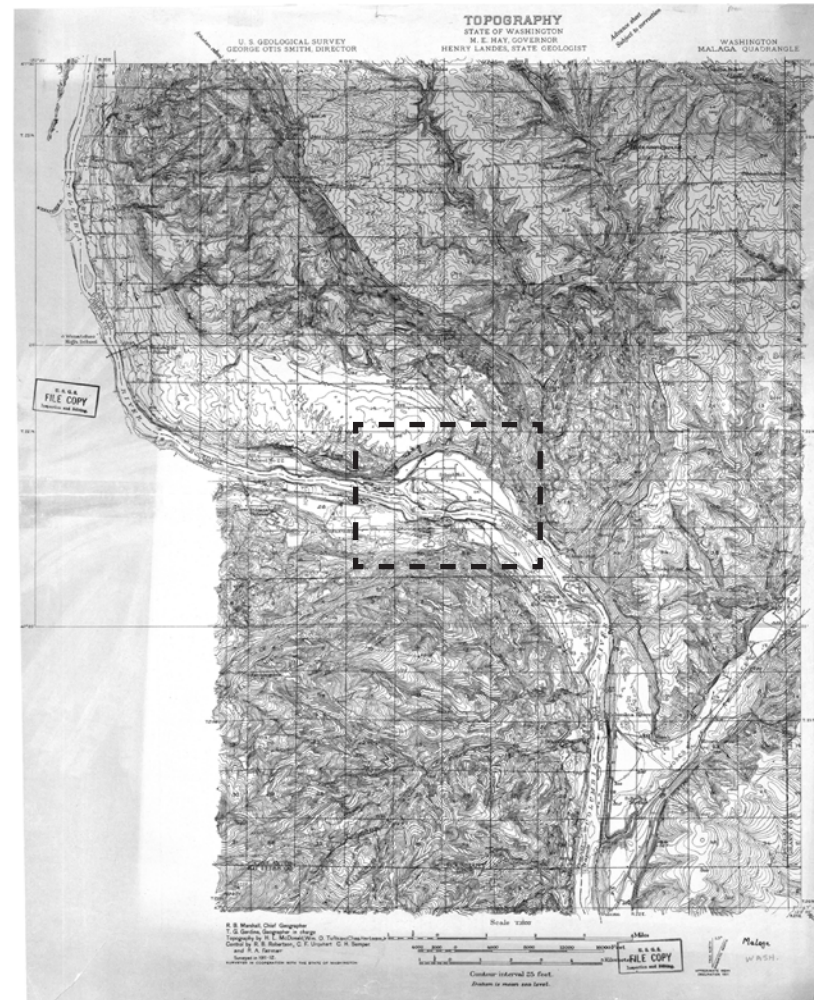
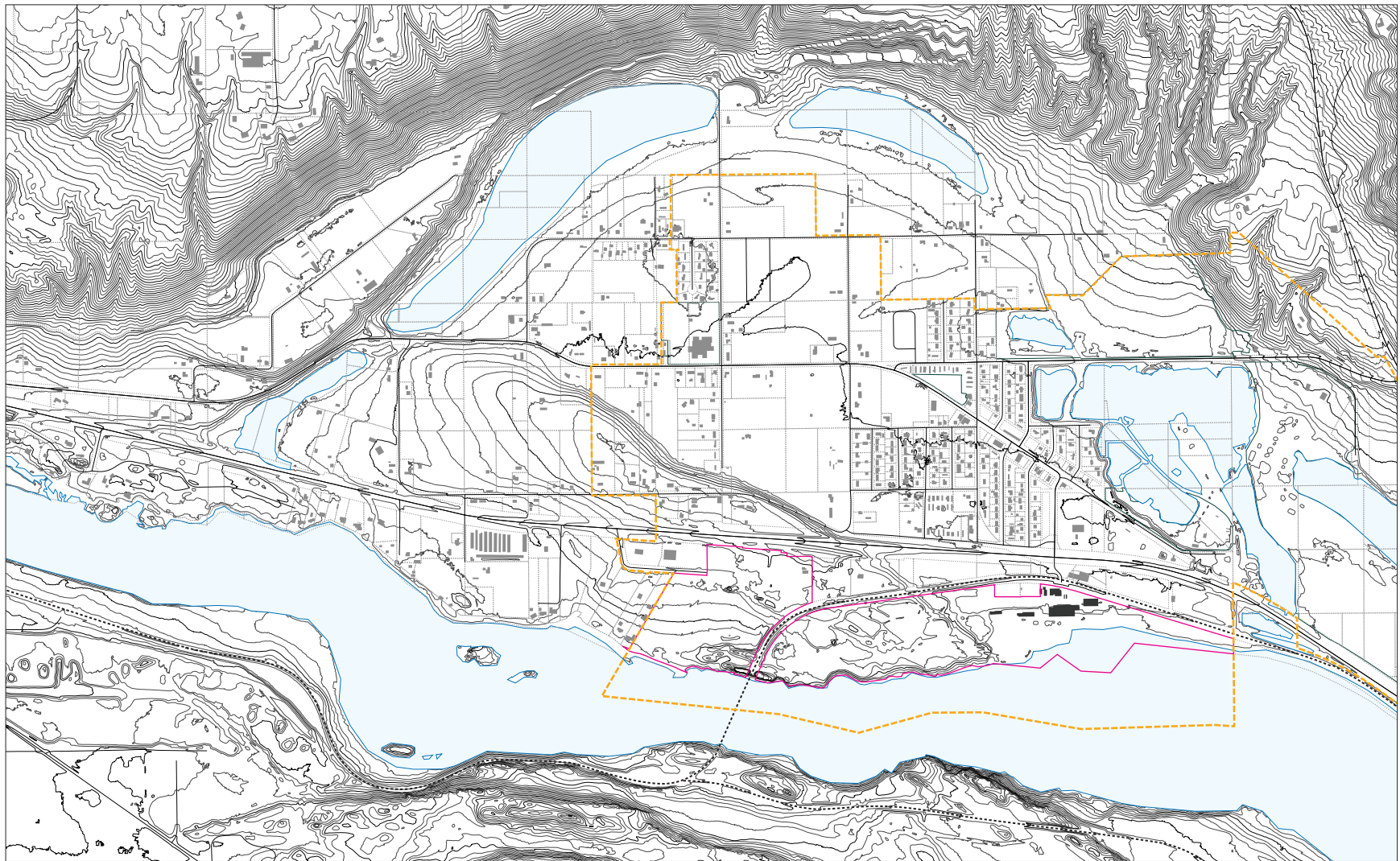


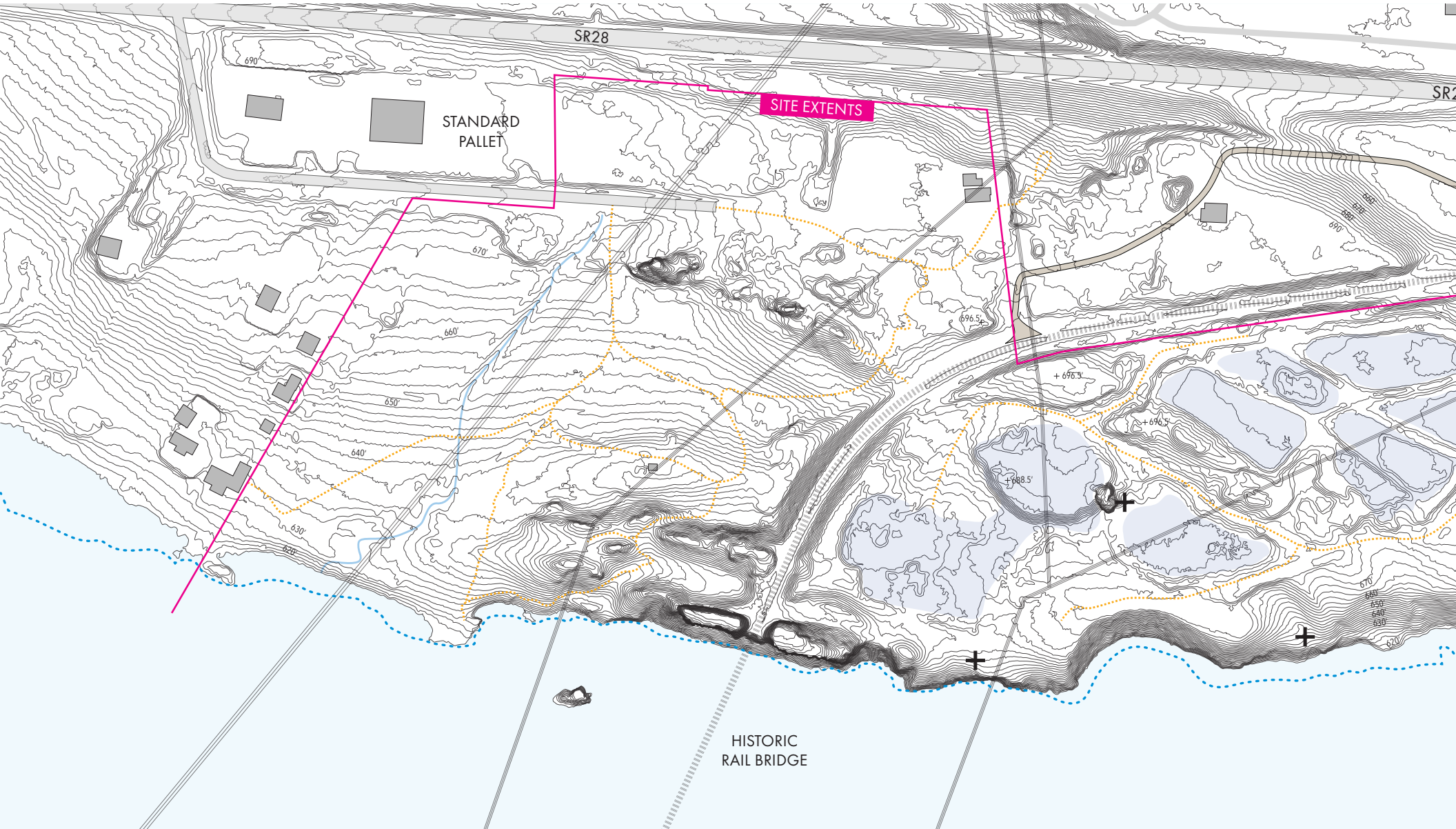
Figure 4.1: 1912 US Geologic Survey map of the Rock Island area, highlighted by the dashed line. (USGS)

4.2: TOWN OF ROCK ISLAND

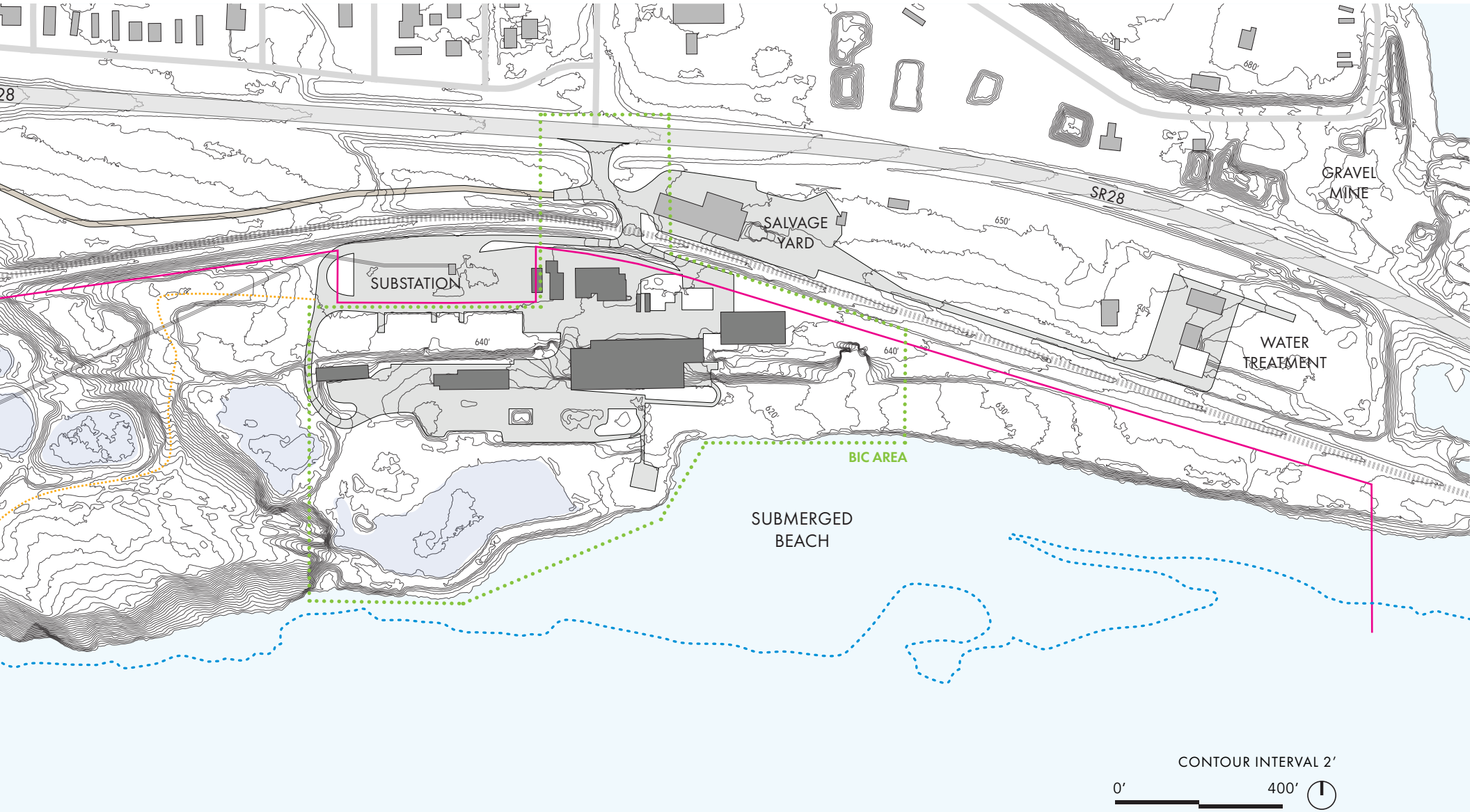





CONTOUR INTERVAL: 10'




-  SILICON SMELTER
-  RAILROAD
-  SITE PARCELS
-  TOWN BOUNDARY



4.3: EXISTING SITE PLAN



 SMELTER BUILDINGS
 PAVED SURFACE
 SILICA FUME

 ARCHEOLOGICAL SITES
 TRAILS & TRACKS
 DIRT ROADS

 RAILROAD
 HIGH VOLTAGE LINES
 POWER LINES

 1949 SHORELINE
 SITE EXTENTS
 DRAINAGE DITCH

4.4: EXISTING SITE CONDITIONS

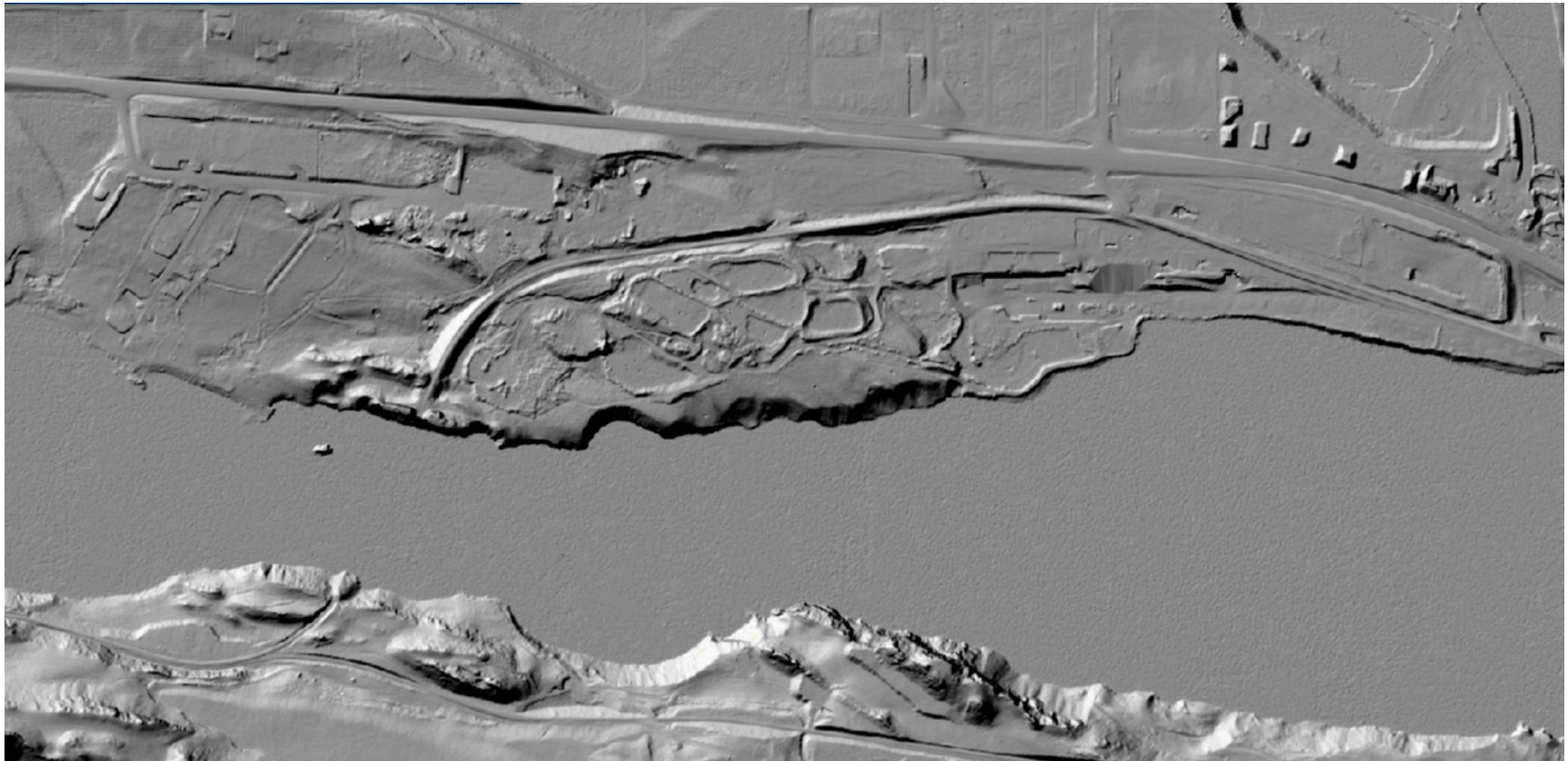




Image source: NearMap



4.5: LIDAR SURVEY



2009 Douglas County LIDAR survey of the smelter site. The fume ponds and dunes are clearly visible along with the drainage ditch, trails, site topography and graded areas. (WA Department of Natural Resources LIDAR Portal)

0' 600' 1,200' ⓘ

4.6: SECTIONAL ANALYSIS

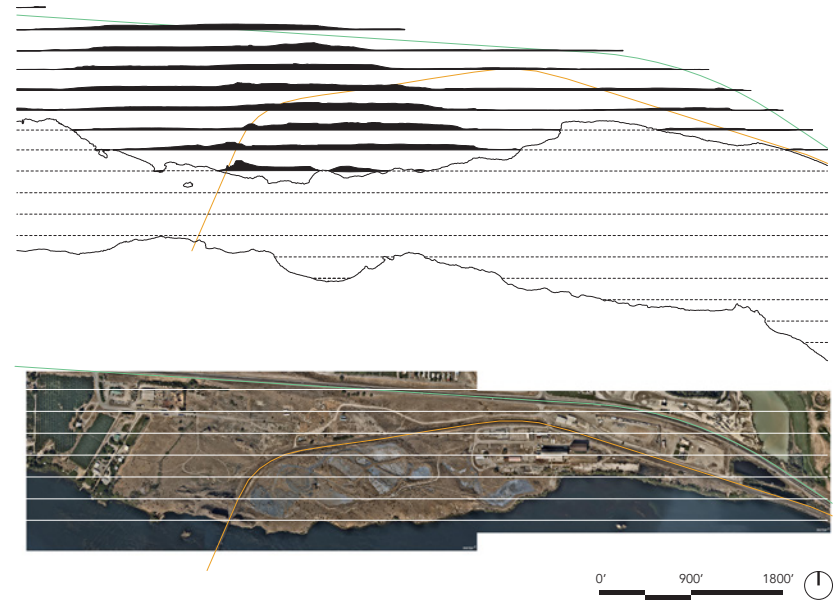
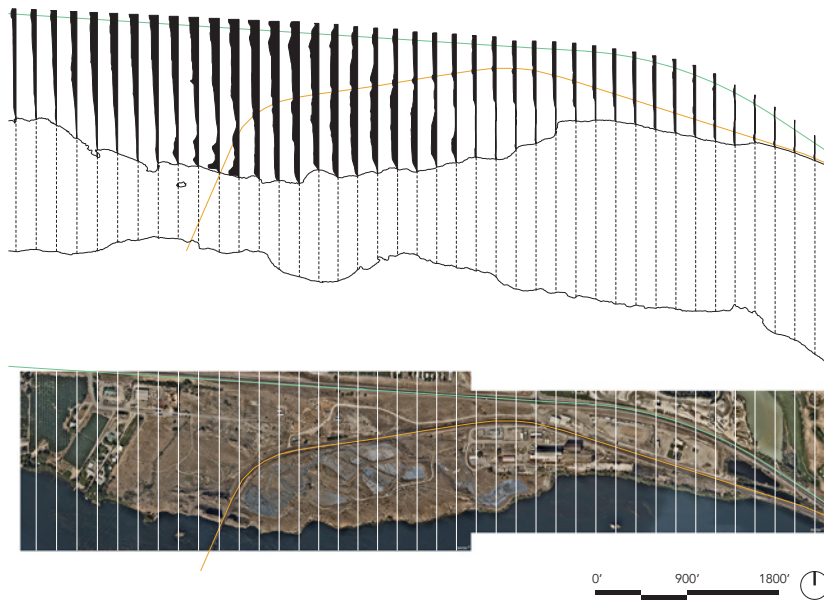


Figure 4.6a, left: Latitudinal sections. **4.6b, right:** Longitudinal sections.

Sections were taken at 200' intervals using the river's surface as the zero point. SR 28 is shown in green, and the BNSF railroad in orange. Horizontal and vertical scales are at a 1:1 ratio, showing the steepness of the basalt bluff rising from the river and running northwest into the town. This bluff is likely what precipitated the bar of very sandy loam deposits that make up the rest of the terrain of Rock Island. (Nearmap aerial)

4.7: SITE LAYERS

SURFACE TYPE

- SHRUB STEPPE
- SILICA FUME
- BASALT ROCK
- RIPARIAN EDGE
- PAVED INDUSTRIAL

CIRCULATION

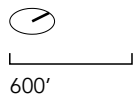
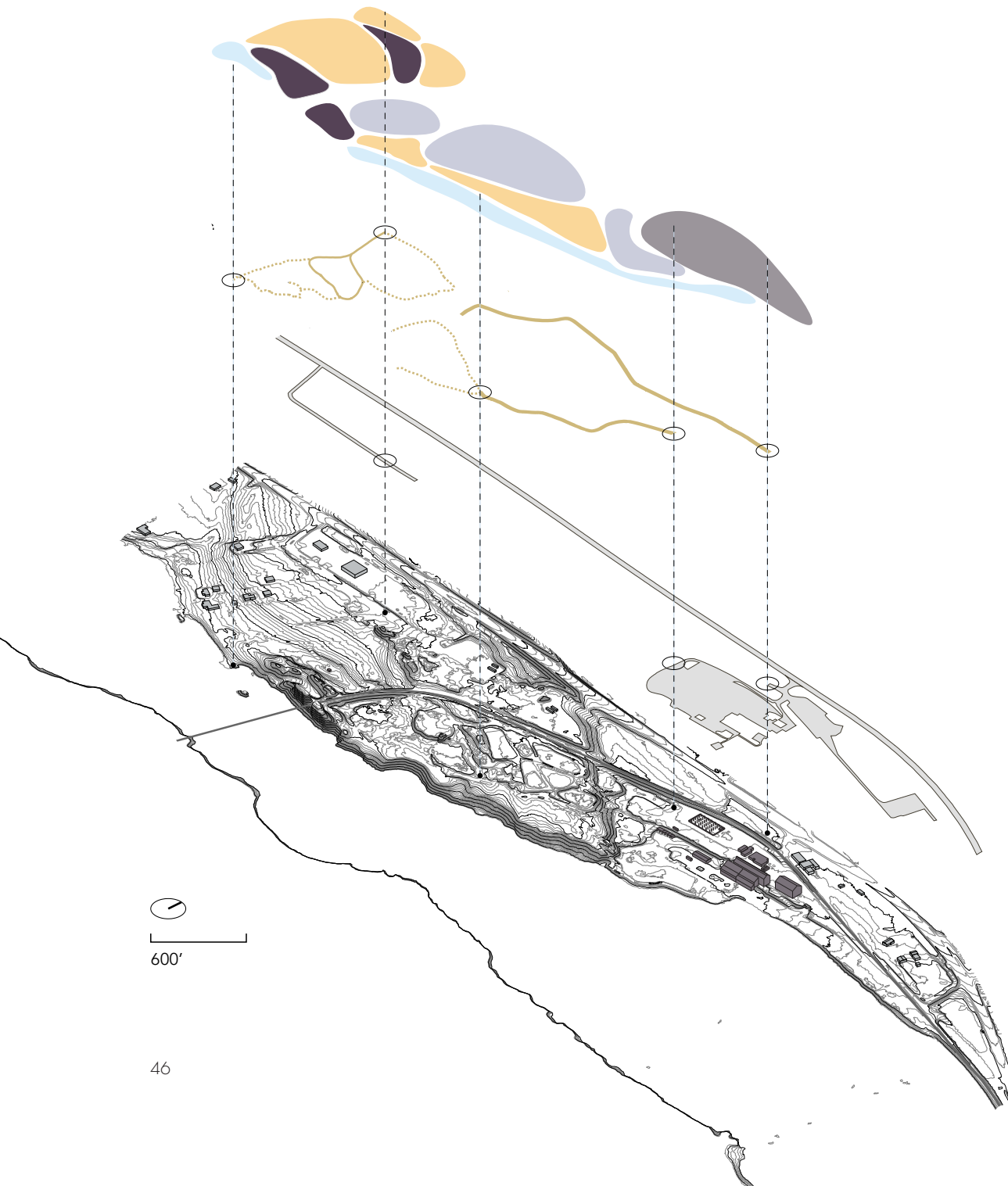
- PRIVATE ROAD
- PRIVATE TRACK
- BNSF RAILROAD
- PAVEMENT

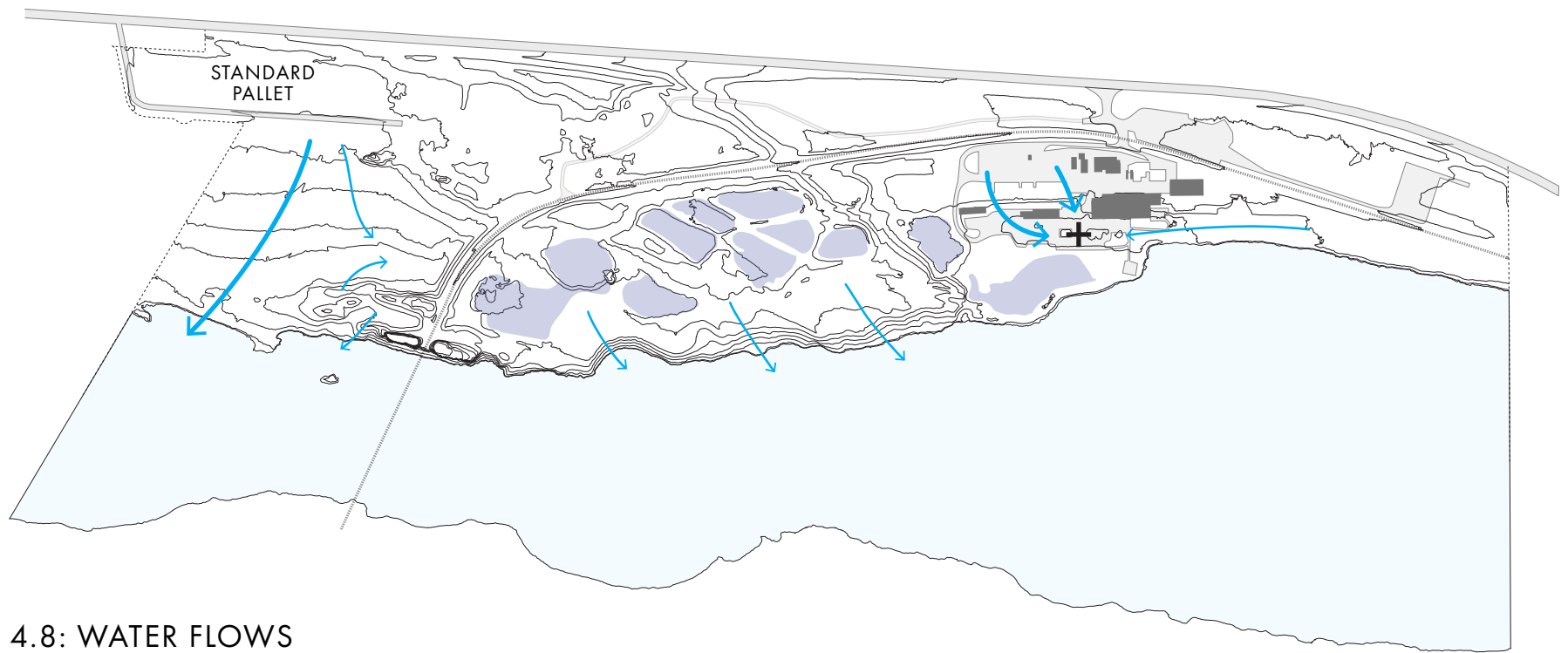
STRUCTURES

- SMELTER & SITE STRUCTURES
- NEIGHBORING STRUCTURES

TOPOGRAPHY

- 10' CONTOURS
- 2' CONTOURS








4.8: WATER FLOWS

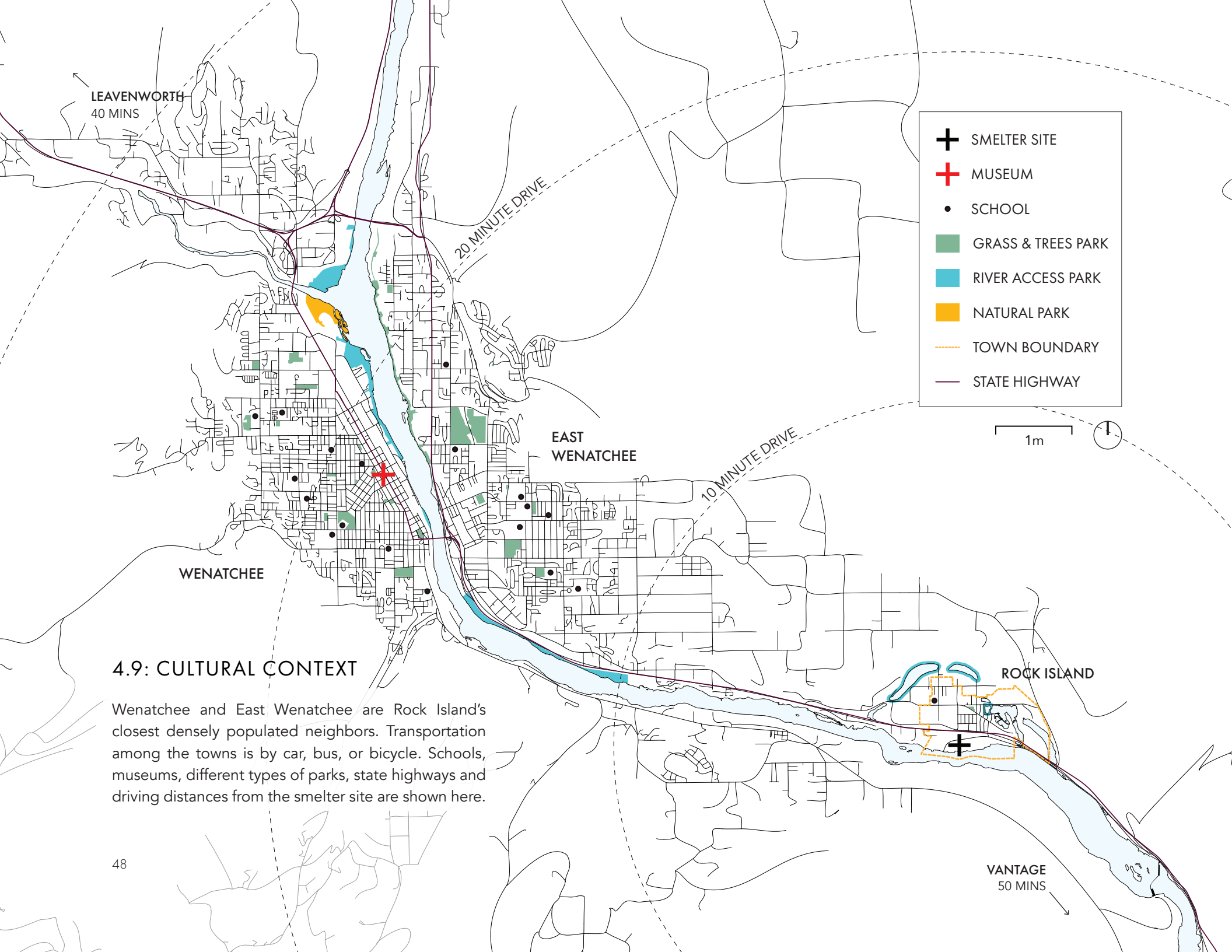
This site receives an average of 9" of rain and 16" of snowfall per year. Due to the sandy loam soil and plant cover, the site is highly permeable. Almost all of the precipitation infiltrates into the ground. The fume ponds and dune areas collect and infiltrate water, which, according to the EPA site study, does not leach any toxins out into the groundwater or river.¹

There are two major runoff areas. A vegetated ditch on the western end drains the road and Standard Pallet's parking lot, and the impermeable surfaces around the buildings runoff to the lowpoint marked with a + on this map. This lowpoint is a major concern for future projects.

- +** LOW POINT
-  FUME POND/DUNE
-  LIGHT FLOW
-  RUNOFF



1 EPA Site Report 2013



- + SMELTER SITE
- + MUSEUM
- SCHOOL
- GRASS & TREES PARK
- RIVER ACCESS PARK
- NATURAL PARK
- - - TOWN BOUNDARY
- STATE HIGHWAY

1m

4.9: CULTURAL CONTEXT

Wenatchee and East Wenatchee are Rock Island's closest densely populated neighbors. Transportation among the towns is by car, bus, or bicycle. Schools, museums, different types of parks, state highways and driving distances from the smelter site are shown here.

Image source: Google Earth



ROCK ISLAND

GORGE AMPHITHEATER



4.10: GEOTOURISM

The Wenatchee area is well known for its geological features, and there are many eco- and geotourism sites in the area. The four closest, major destinations are shown here, along with the Gorge Amphitheater, a 50 minute drive from the smelter site.

5mi



(MS Murphy)

PESHASTIN PINNACLES STATE PARK



(WenatcheeWA.gov)

SADDLE ROCK



FRENCHMAN COULEE



(Northwest Photos)

GINKGO PETRIFIED FOREST

GEOLOGY, ECOLOGY & CLIMATE

Rock Island lies at the western edge of a geographic region known by several names. Geologically, it is known as both the Columbia Plateau and the Columbia Basin, as a river basin between mountain ranges and as a high plateau cut by the Columbia River. Colloquially, this area is referred to as Sagebrush Country, the shrub steppe, the high desert, or simply eastern Washington. The EPA delineates it as Level III Ecoregion 10, the Columbia Plateau, and further defines the specific area around Rock Island and other Columbia Plateau riverbanks as Level IV Ecoregion 10a, Channeled Scablands. This refers to the deep channels created by huge floods during and before the last ice age, which created the characteristic coulées, buttes and basalt bluffs seen in this region. The soils are predominantly patchy loess deposits over a thick basalt layer, resulting in a sandy loam topsoil with basalt outcroppings and boulders.¹ Over time, the ground has eroded, resulting in the steep, flat-topped bluffs you can see today along the river.

The region has a cold semi-arid or cold steppe climate under the Köppen climate classification, with hot dry summers, cold, somewhat wetter winters, and diurnal temperature swings. These hot, dry, sandy conditions support shrub steppe plant communities, with related riparian communities in the wetter places and biotic soil crusts along the ground's surface. Shrub steppe is a scrub land ecology of sagebrush (*Artemesia tridentata*), rabbitbrush (*Ericameria nauseosa*) and bluebunch wheatgrass (*Agropyron spicatum*) among many others species. Native trees, however, are restricted to riparian zones. Fauna also abounds: coyotes, badgers, marmots, jackrabbits, osprey,

1 Cheney 2009

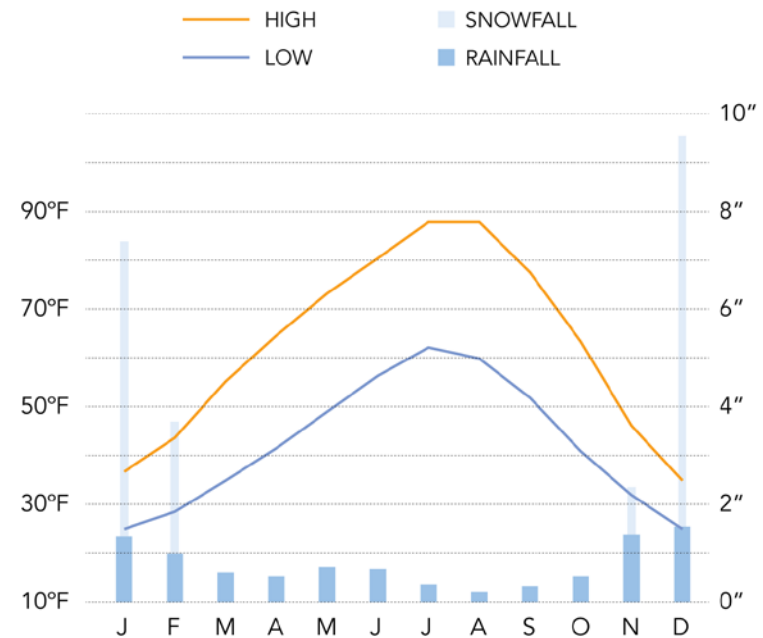


Figure 4.11: Rock Island average temperatures, rainfall and snowfall. Adapted from US Climate Data.

magpie, killedeer and many other species live here, along with countless microorganisms.²

Along the Columbia River, dams have altered the water levels along hundreds of miles of shoreline. At Rock Island, the water level has been raised by over six feet, inundating the soft banks. (See Site History) A riparian zone remains, though narrowed, and in some places on the site, particularly near the material intake area, has been covered in rip rap. The nearest large riparian habitat can be found at the human-made Horan Natural Area 12 miles north in Wenatchee. (Figure 4.9)

2 Pacific Northwest National Laboratory

COLUMBIA PLATEAU ECOREGION

Summer high: 88°F / low: 60°F

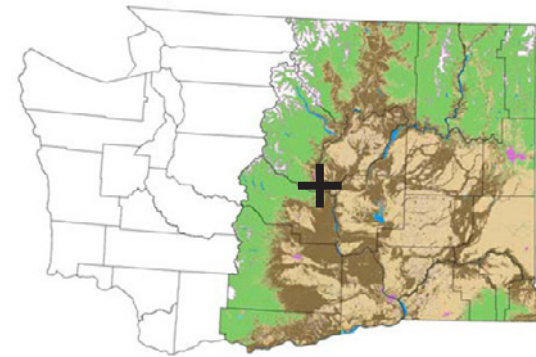
Winter high: 35°F / low: 25°F

Annual rainfall: 9"

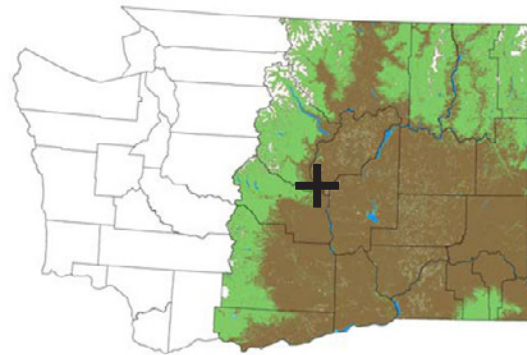
Annual snowfall: 16"³

The shrub steppe ecosystem is today highly fragmented and endangered. Until 100 years ago, more than 200,000 acres existed across the American West, including in Washington State. Settlement, land use change, and introduced invasive plants, as well as increased fires due to these changes and climate change, have greatly reduced the shrub steppe. It is estimated that today's functional shrub steppe is less than 15% of its historic extents in Washington.⁴ As sprawl and climate change exacerbate these deleterious effects, the ecoregion is likely to continue to decline. However, as knowledge of and concern about ecosystem health and connectivity, the relationships between indigenous communities and ecosystems, and watershed and water source management continues to increase and improve, there seems to be potential for reversing the recent history of misuse and decline into something more sustainable and productive.⁵

In the Silica Fields, the extent and health of plant and animal communities is difficult to discern from afar, and a comprehensive ecological health study should be done here.



SHRUB-STEPPE CURRENT EXTENTS



SHRUB-STEPPE HISTORIC EXTENTS



3 WA Department of Ecology

4 Shrub-steppe and Steppe Ecosystems of Washington, Rex Crawford, 1993

5 Washington Native Plant Society

Figure 4.12: Adapted from the WA Department of Ecology.

HAZARDS

Several factors make conditions on the site hazardous or potentially hazardous to human safety and well being. The site is bisected by an unfenced BNSF rail line, and bounded along the north edge by a state highway. High and medium voltage power lines run east, west and south, connecting to and from a substation near the site entrance. Rubble, abandoned structures, and debris and detritus of unknown status litter the site here and there. And of course, there is the silica fume itself, mixed with traces of other materials and toxins created over the life of the smelter and dumped on the landscape. The train, road, rubble and power lines are known dangers, but the fume present a somewhat more ambiguous risk.

2013 EPA REPORT

The 2013 EPA Site Investigation was initiated due to arsenic found in wells near the smelter site. After comprehensive well testing (figure 4.13, right) it was determined that the arsenic in the area is from historic lead arsenate pesticide use in orchards, including the orchard that once existed on the site. Though traces of arsenic, lead, copper, cadmium, zinc, silver, and selenium were found in some fume areas, soil and water samples from under and around the fume did not contain these toxins, indicating that they are not leaching out of the fume dunes. A test with 30 rainbow trout showed no toxicity in the fish after exposure to runoff from the fume.¹ The site is categorized as a Level 5 brownfield, the lowest risk, with one well near the buildings listed as a Level 4 due to traces of mercury near an

1 EPA Site report 2013

old well. Clean up efforts have happened there, but today's extent of contamination is unclear, and will certainly be a factor in the building project.

SILICOSIS

Silicosis is a serious health condition that is caused by inhaling fine particles of crystalline silica, such as that created by cutting stone, and is a common hazard in construction sites and mines. Because silica has an amorphous molecular structure, the risk of silicosis is little to none.² (Figure 4.14)

SUMMARY

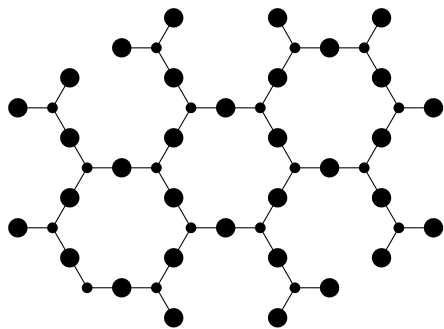
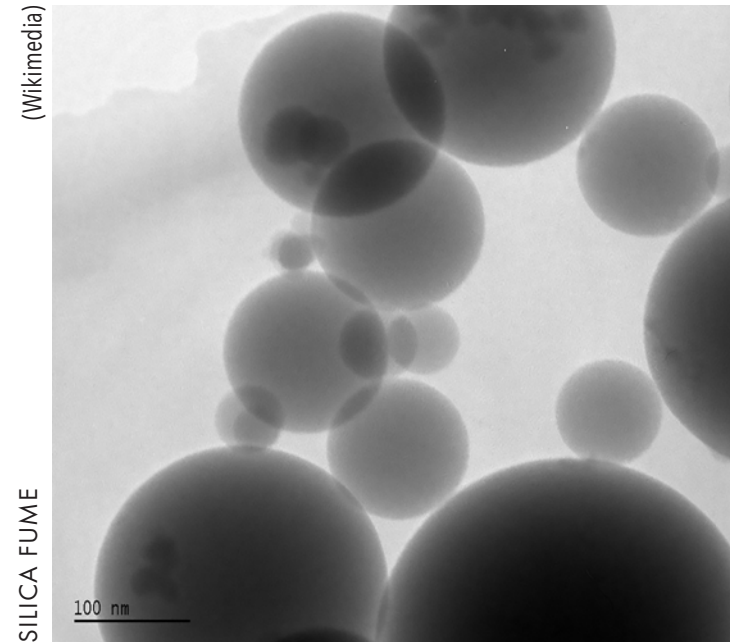
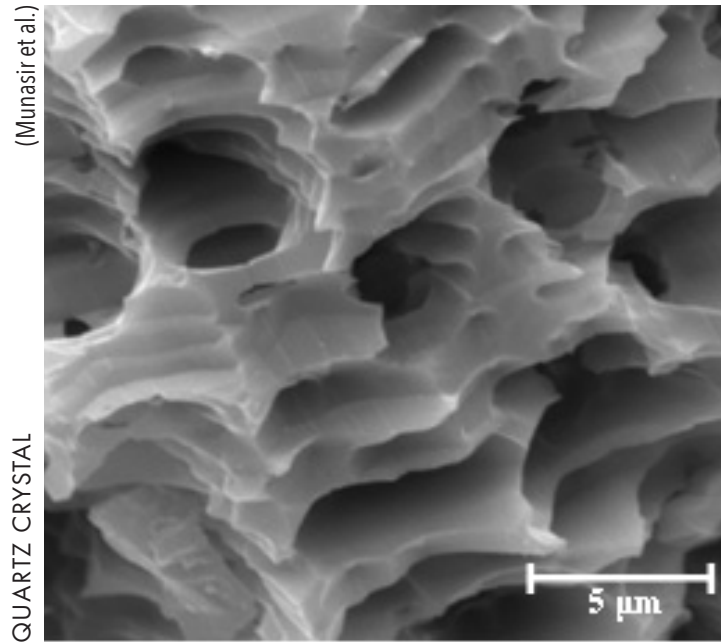
Seismic and floods risks are low in this area, and the site specific physical dangers are clear and manageable. Given the somewhat unclear nature of the fume risks create a sense of terrain vague - does the question become: is inhabiting this site any more dangerous than living in a city like Seattle? Would a site-wide "cleanup" effort that disturbed the fume dunes en masse result in erosion, leaching, or dust clouds, ultimately doing more harm than good? Even if the fume was entirely scraped and removed from the site, where would it go? Would it be worth the time, money, site disturbance, and carbon footprint? It seems that keeping the fume on site and allowing it to sequester in place is the best approach.

2 Merget, Bauer, Küpper, Philippou, Breitstadt, & Bruening. (2002). Health hazards due to the inhalation of amorphous silica. *Archives of Toxicology*, 75(11), 625-634.

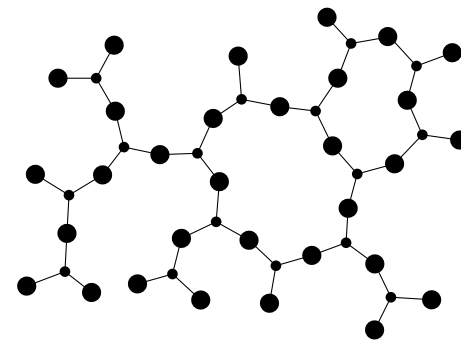
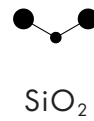


Figure 4.13: Map of toxicity test sites, EPA Site Report.

4.14: CRYSTALLINE AND AMORPHOUS SILICA



CRYSTALLINE SILICA
HAZARDOUS TO BREATHE



NON-CRYSTALLINE / AMORPHOUS SILICA
LOW TO NO HAZARD

POTENTIAL FUTURE CONDITIONS

CLIMATE CHANGE

Climate change forecasts for Rock Island are similar to those in the rest of Washington State: hotter, drier summer and warmer, wetter winters. This area might see a 5-10% increase in winter precipitation, which is small relative to natural variation. Less snow may become more rain, and these factors could lead to an increased risk of flash floods. Increased atmospheric CO₂ will affect plant communities, though it is unknown how exactly that will play out. It is known that the combination of hot, dry weather and increased amounts of invasives like cheatgrass will, and already has been, increasing the incidence of fires. Native plant communities of the shrub steppe have evolved to tolerate extreme drought in the summers, but it is unknown how they will adapt to future temperature regimes.¹

DEMOGRAPHICS & ECONOMY

Rock Island, like much of eastern Washington, has become a majority Latinx community, with the white population skewed towards older people. The major economic sectors are agriculture, retail, and health care.² The population is expected to grow, and the demographic trends to continue. Land conversion to hardened or controlled use is highly likely. The economic conditions are already changing, with server farming and cryptocurrency mining becoming the main driver of change, as seen in the Blockchain Innovation Campus.

1 WA Dept of Fish and Wildlife; WA Dept of Ecology
2 Maul Foster, 2017

INFRASTRUCTURE

The current IDD plans include increasing and improving the transportation and utility infrastructure on the site, though it is unclear the extents of those plans. The main entrance to the smelter site will be changed from an intersection to a roundabout, slowing traffic and increasing the ease and likelihood of people entering the site.³ The amount of green stormwater infrastructure will likely be increased.

Far in the future, it could be that the power lines no longer exist due to decentralization of the power grid. The dams along the Columbia may be removed as we realize the need to restore natural processes to our river systems. However, these scenarios are speculative, and have only tangential impact on today's site planning.

3 Maul Foster, 2017



Figure 4.15: Power lines in front of the railroad bridge. April 2019.

ANALYSIS SUMMARY

The site and context analysis leads to some key takeaways that influence the design approach and goals.

- Terrain is low in the east, high in the west, with steep slopes between the building and the bluff, and the river and the bluff
- ADA access across whole site difficult
- Site access restricted by road and railroad
- Hot dry summer and cold snowy winter
- Ecology fragmented and highly valuable where extant
- Many grass and trees parks and water access parks nearby
- Area well known and used for eco- and geotourism
- Water runoff from most of the site is not an issue
- Water runoff from building site is main concern
- Fume not dangerous to be near, but disturbing the ground runs the risk of exposing toxins, so sequestering or remediating in place is a good strategy
- Climate change causing increased fire and flood risk

EXPERIENCE & INTERPRETATION

The design should provide experiences and interpretation of these aspects of the site, whether currently extant or not.

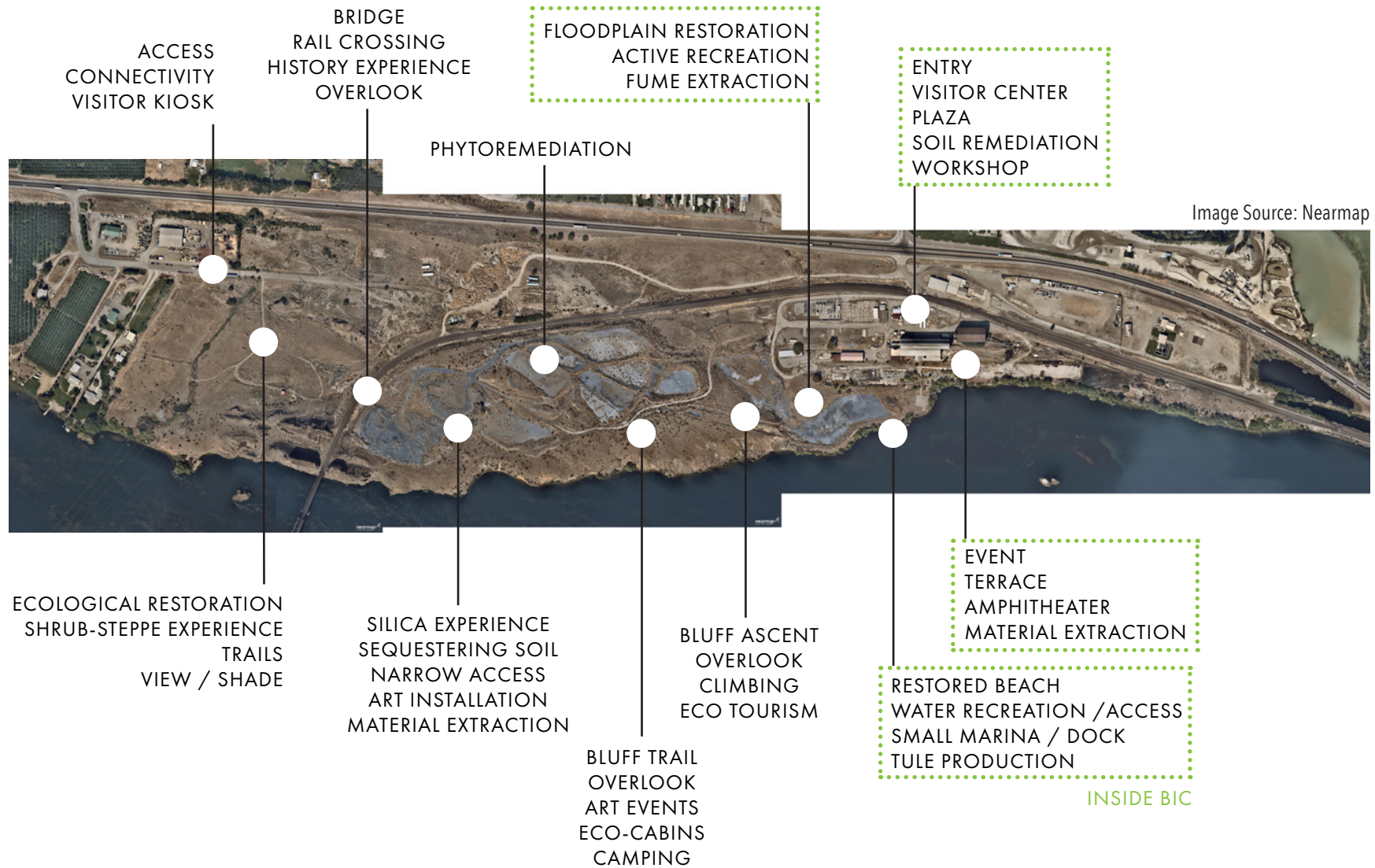
- Geochemistry
- Industry
- Site Productivity
- Riparian Edge
- Indigenous Culture
- Material Conditions
- Site Aesthetics

PROGRAM IDEAS

After studying the site history and site and context analysis, I created a list of programs that could meet the stakeholder goal of economic value and dovetail into some of the IDD's ideas such as housing, river recreation, and creating a tourist destination, while using the site as it is and avoiding major transformation. Perhaps there could be a Desert X¹ style art festival, a series of eco-cabins to provide housing and rental income, or a small marina. Figure 4.16, right, locates these ideas on the site. The green boxes denote those within the BIC area.

1 Desert X is an annual installation art festival centered around the Coachella Valley.

4.16: INITIAL PROGRAM IDEAS



5. IMMERSION

EXPLORATION

I made two site visits, one in November 2018, and one in April 2019. Though infrequent, these two visits provided rich information. In November, using only Google Maps, I touched only the east and west edges. In April, using the detailed maps I made during analysis, I explored the whole site on foot, largely following the existing paths seen on the aerial images. I had some idea of paths I wanted to take, but in some areas the way unfolded based on in the moment decisions. The experience was one of discovery and exploration, and took about two and a half hours to walk the 105 acre site. In all cases, care was taken to cause minimal disturbance or destruction to the site.

PHOTOGRAPHY

Site photography capturing the site from vistas to small details was very important as a way to document and organize my experiences. Though photography cannot capture a whole body experience, it can convey meaningful information and is especially powerful as a medium for conveying landscape to others who haven't been there.

FLORA AND FAUNA IDENTIFICATION

After two site visits, I used the photographs to identify flora and fauna seen on site. The species found created a portrait of the life of the site, and of the different habitat regions on site. Researching these species and their distribution patterns merged my experiential and cognitive understanding of the site ecology.

MATERIAL INVENTORY & COLLECTION

Samples of sand, silica fume, rubble, *Artemesia* sprigs, quartz, coal and other unidentified but likely non-toxic materials were collected in small amounts from easily accessible places. Potentially useful materials were noted and photographed (see page 67). These could be useful in constructing new site interventions, or in making artisanal products that could be sold from the BIC.

NON-VISUAL EXPERIENCES

Sensory immersion in the site isn't easily conveyed in text or photographs. The southern edge of the site was very quiet, with almost no road sounds. The sound of a goose landing on the river was loud and sudden. The train went by every 30 minutes or so, blasting its horn and rolling over the bridge. The ground was very soft and spongy or sandy in most places, and rocky in others, making clacking sounds when a piece was dislodged. In November, the dryness of the air was palpable, and dried seedheads stuck to my ankles, poking my skin. In April, the site had a strong, fresh scent of *Artemesia*, and a softness to the air due to ambient moisture and a sense of fresh growth. The combination of these sensual experiences with visuals created an ephemeral, unique, multi-layered experience.

A small selection of the photographic results of these methods is shown on the following pages.

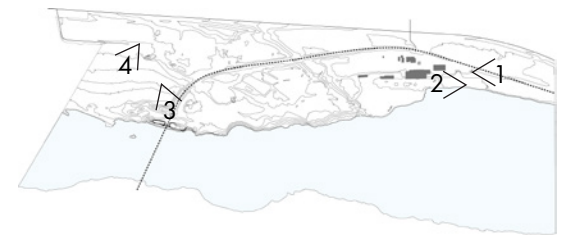


View looking southwest across the fume dunes to the railroad bridge with a BNSF train about to cross from north to south. April 2019.



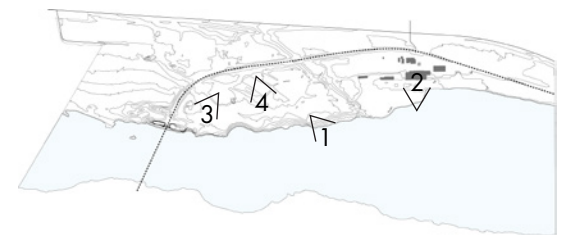
SITE PHOTOS

Nov 2018



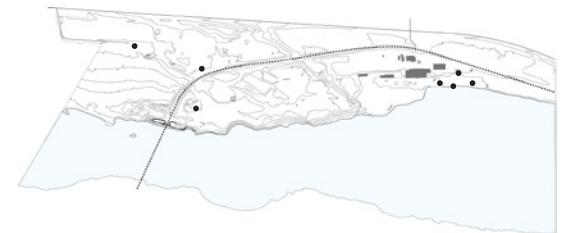


SITE PHOTOS
April 2019



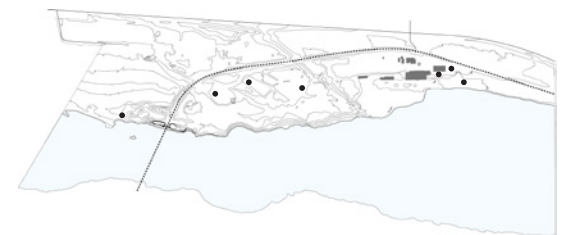


GROUND CONDITIONS
Nov 2018





GROUND CONDITIONS
April 2019



PLANTS

HOT / DRY / SUNNY



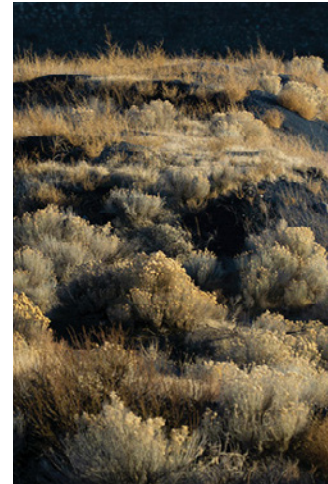
Artemesia and Purshia tridentata



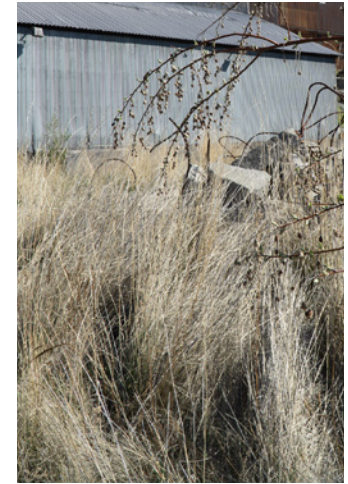
Balsamorhiza sagittata



Phlox longifolia



Ericameria nauseosus



Agropyron spicatum

COOL / WET / SHADY



Amelanchier spp.



Fraxinus ?



Ribes cereum



Salix spp.



Lomatium

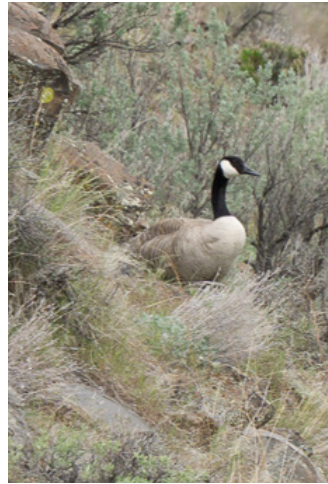
WILDLIFE



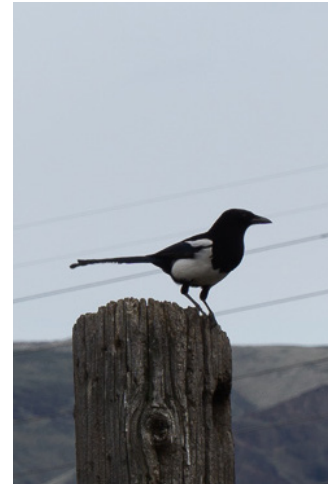
Bees



Osprey



Canada Goose



Black-billed magpie



Killdeer



Mammal tracks criss-cross the fume



3-4" track - Canis? Felis?

Others seen but not photographed:
Barn swallow
Mourning Dove
Redwing Blackbird
Yellow-bellied marmot
Beaver

SITE MATERIALS



Silica Fume



Orchard Wood



Beams



Masonry



Concrete Rubble



Sandy Soil



Basalt Rubble



Rebar

MISCELLANEOUS



Jaw piece of a large herbivore.



Tumbleweed, also known as Russian Thistle, *Salsola tragus*.



Moss and lichen growing on the north side of a basalt boulder.



Large rock showing geologic strata.



View of the railroad bridge and basalt bluff, looking south from the west entrance trail. The rabbitbrush, tumbleweed, grasses and other plants are silver, gold, and ocher, glowing in the light of the setting sun. November 2018.

SITE IMMERSION RESULTS

A NEW PERSPECTIVE

After this site immersion, my thinking about the site's future profoundly changed. Rather than needing to particalize the functions of the site, and fill it with diverse programs to create interest and value, I realized that the site is already particalized, already interesting, and already extremely valuable. Left to its own devices and protected by the very conditions which isolate it from Rock Island, the site has *particalized itself*; diverse life has flourished here, even under these novel conditions. There are many different eco-regions, micro-climates and topography which support diverse flora and fauna, as well as diverse and unique experiential possibilities. There is matter, life and energy flowing through this site, and the river, power lines and railroad are part of that.

Being in the site was an experience of intense beauty, wonder, discovery, and adventure. Though I had cognitive knowledge of the site's size, the huge scale of it could only be experienced in person. The aerial image gave an impression of emptiness and openness; being on the site, however, I discovered that the thickness of the vegetation and the topography obscure views. Moving through enclosure to vista points was powerful, allowing attention to move between small, near details to far landscapes like the snow-capped Cascades. The aerial also made it seem that the surfaces of the silica fume and paved areas were barren - this was also untrue. What seemed at a distance to be in need of human intervention to restore function, had in fact restored life to itself. All this came from only two site visits, in late autumn in the evening and a spring morning. So much more could be experienced in the summer and winter.

I realized that many of my initial ideas, though intended to use the site for what it is now, not what it could or should be, would result in a high level of disturbance and transformation, which now seems destructive and unnecessary. I too, when looking from afar, imagined the site to be in need of my interventions to catalyze its value. Value here doesn't need to be catalyzed, only accessed.

Leaving the site exactly as it is not an option, nor is it the best option. The BIC project is going forward, so there will inevitably be ground disturbance in those areas, creating an opportunity to extract materials, deal with runoff, and restore habitat connectivity, among other things. The greater site has tremendous value, but it cannot be realized if the Rock Island community can't access it, and so remains under threat.

SUMMARY

- Site already particalized & flowing
- Protected for the last two decades
- Abundant flora and fauna, diverse ecosystems
- Energy, water and transport flows
- Beautiful and unique
- Huge scale, enclosed and open views
- Abundant value already here
- People need physical access to realize site value

6. SILICON & SILICA

INTRODUCTION

The Rock Island Silicon Smelter was both created by, and created, silicon and silica. It acts as a kind of hinge or nexus between the global and the local, the atomic and the universal, geologic time and daily operations. In a region defined by geology, this smelter came to exist where it is through the circumstance of the Columbia River's narrowness and solidity along this stretch of the channel. Thus this spot was chosen as the crossing for the Great Northern Railroad, thus a permanent settlement accrued, thus a hydroelectric dam was built, thus the railroad and electricity supported a silicon smelter. During its lifetime, it produced silicon metal from quartz, coal and woodchips, sending its products outwards along the railroad and eventually dumping silica fume on the site. This string of events led to this strange, anthropogenic material to be aggregated on the site as it is today. Going forward, the smelter's usefulness will again depend on silicon in the form of semiconductors, supported by hydroelectric power, its new products transported across the globe via electricity in the form of data.

Silicon, silica, silicon metal and silica fume were used and made here. What are these materials, and where did they come from? How were they transformed in the smelter to valuable commodities, and where did they go from there? The processes that happened here were and still are interacting with the vast and complex system of the global silica cycle, the biogeochemical cycle of silica through the earth's spheres. To understand this fundamental material and its importance and influence, these questions are answered below.

SILICON

Silicon, element 14, is the second most abundant element in the earth crust after oxygen, with which it almost always binds to create silicon dioxide, otherwise known as silica. Elemental silicon is formed by supernovae, from which it eventually accretes into rocky planets like the earth. It is the seventh most abundant element in the universe. Silicon has four valence electrons, and can form covalent and ionic bonds, similar to carbon. Because of this similarity, some have speculated that silicon-based life could exist in the universe.¹ Because of its affinity for oxygen, pure silicon is very rare in nature, while silica and silicate mineral are abundant.

SILICA

Silica is one silicon atom, two oxygen atoms (SiO_2 or silicon dioxide), which commonly bond together to form tetrahedral structures. (Figure 6.2, right) Silicate minerals (rocks containing silicate compounds) make up over 95% of the earth's crust, most often found in the form of sand and quartz. Almost everything commonly known as rocky, sandy, or glassy is composed largely of silica. Silica is also essential to many life forms, including human beings, and is thought to have been crucial to the origins of life and earliest biological carbon fixation.² Silica's ubiquity makes it a major factor in the composition and functioning of the systems of the earth. The flow of silica through these systems is called the silica cycle.

1 Jefferson Lab

2 De La Rocha & Conley 2017

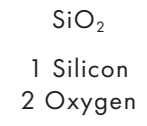
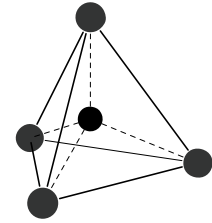
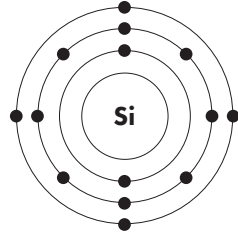
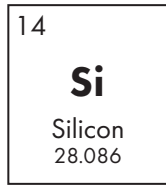


Figure 6.1: Silicon atom and pure silicon metal. (Tongwoo)

SILICON



Figure 6.2: Silica tetrahedron and crystalline silica quartz. (Wikimedia Commons)

SILICA CRYSTAL

ENVIRONMENTAL SILICA



Figure 6.3: Potassium Feldspar, a type of granite. (Andrew Alden, ThoughtCo)

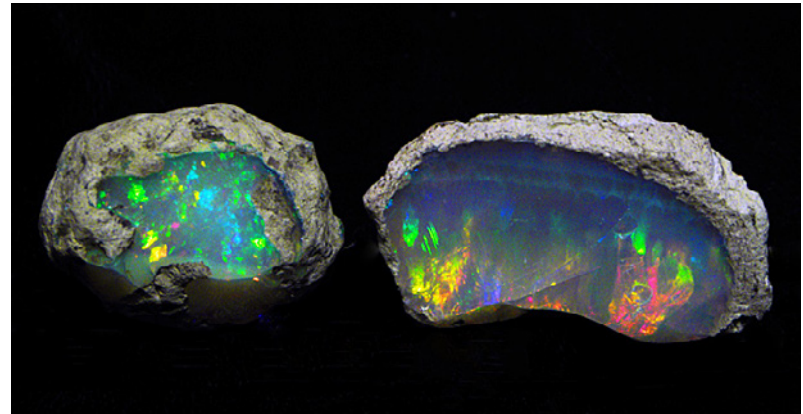


Figure 6.4: Opal, hydrated amorphous silica. (Gemsounds)



Figure 6.5: *Equisetum* (Wikimedia)

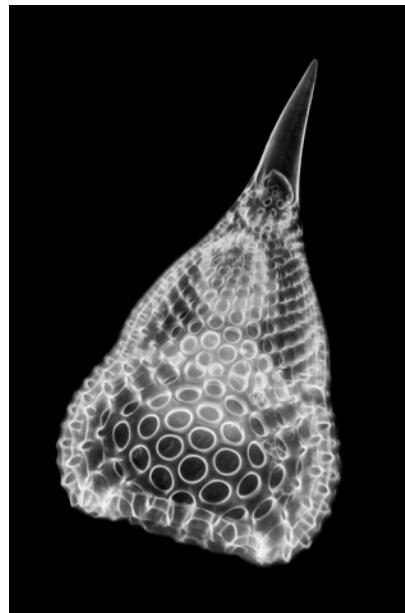


Figure 6.6: Radiolarian (Wikimedia)

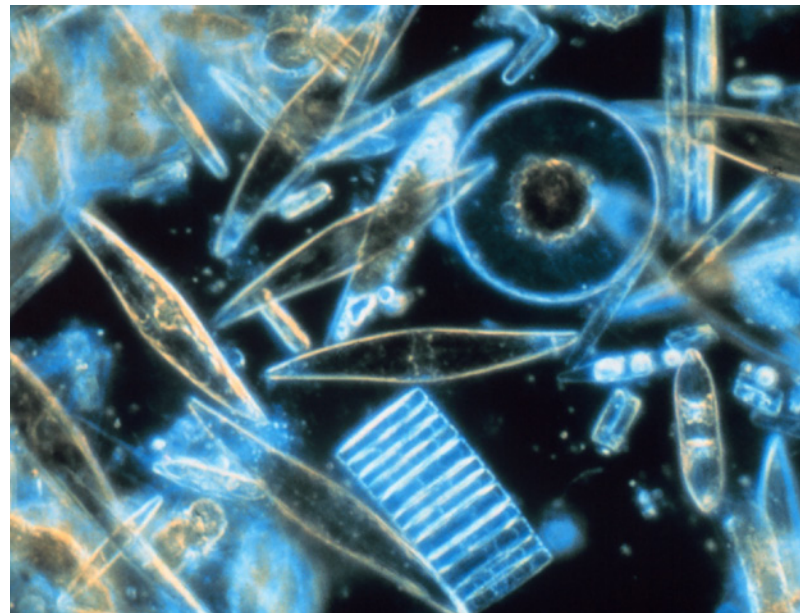


Figure 6.7: Diatoms (Wikimedia)

SILICA & SILICON IN MATERIAL CULTURE & THE ECONOMY



Figure 6.8: Gravel aggregate. (Vigoro)



Figure 6.9: Fused silica glass. (Corning)

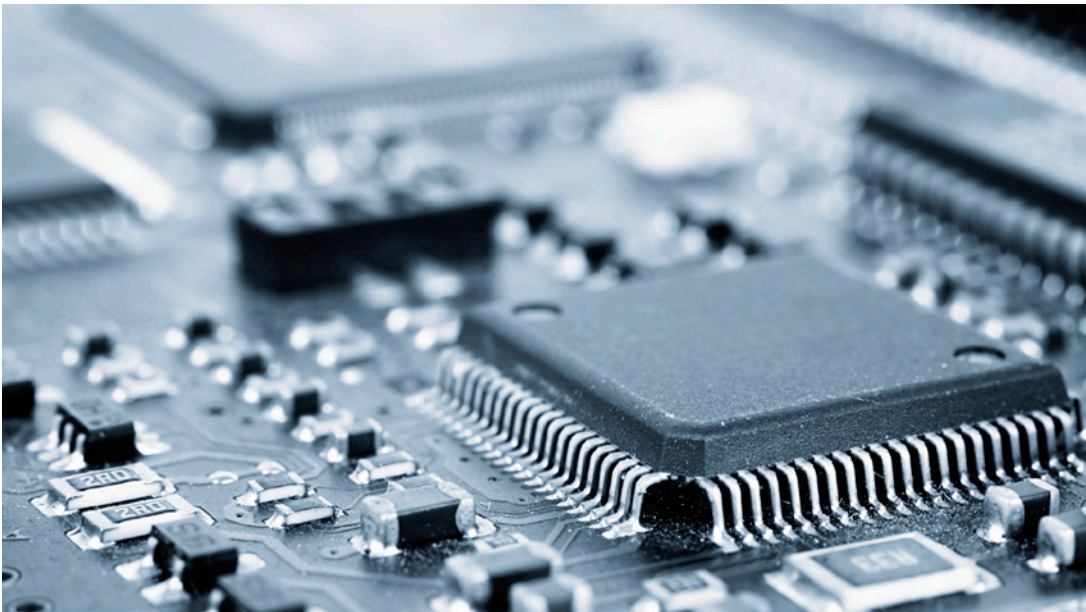


Figure 6.10: Silicon wafer semiconductors. (Viewpoints)

Silicon and silica are used extensively in our material culture and economy. While impossible to list every use, some of the major applications are described here. In their raw natural forms, silicate minerals are used for sand, aggregates, clays, gemstones, and so on. Plant fibers, some such as rice husks up to 20% silica, are used extensively by humans and other organisms.

Silicate minerals are further processed into useful materials such as ceramics, glasses, cement and pigments. Artificial quartz is created for use as piezoelectric crystals, which is used in sonar, ultrasound, radios, and similar applications.³

Purified silicon, also called silicon metal, is an anthropogenic material created arc furnace smelters. The purest silicon metal is used for refined applications like semi-conductors and photovoltaics. Less pure silicon metal, like that made in Rock Island, is used mainly for alloying aluminum.

It is difficult to overstate the importance of silicon and silica. We would do well to better understand their role in the world and our lives.

3 Conversation with Dominic Muren, February 2019.

THE SILICA CYCLE

Silica, like carbon, has a biogeochemical cycle. The silica cycle describes the complex and meandering flow of silica through the spheres of the earth. Silica moves through the lithosphere, biosphere, hydrosphere and to a lesser extent the atmosphere, as well as increasingly through the sphere of human industry. It is closely linked with the carbon cycle and carbon sequestration.⁴

Humans are massively disrupting the natural silica cycle, in ways we don't understand and are just beginning to realize. We are pulling silica out of the cycle and aggregating it in places like Rock Island, landfills, sewage and dams, at an estimated rate of 106 billion pounds of silica per year.⁵ Though not a large percentage of the global silica content, it is still significant.

- 1 The cycle can be said to start with silicate minerals. Water dissolves silica and washes it into soil in a process called weathering, at which point some carbon is caught up.
- 2 From the soil, plants and animals take it into their tissues, biomineralizing silica into cell walls, skeletons, scales, collagen, and so on. This can continue up the food chain.
- 3 Terrestrial silica is eroded from the land into rivers, where it cycles through freshwater life.
- 4 Dams on these rivers can create silica sinks, precipitating dissolved silica from the stream onto the riverbed. If there is fertilizer runoff, diatom blooms can occur from the combination.

4 De La Rocha & Conley 2017

5 Ibid

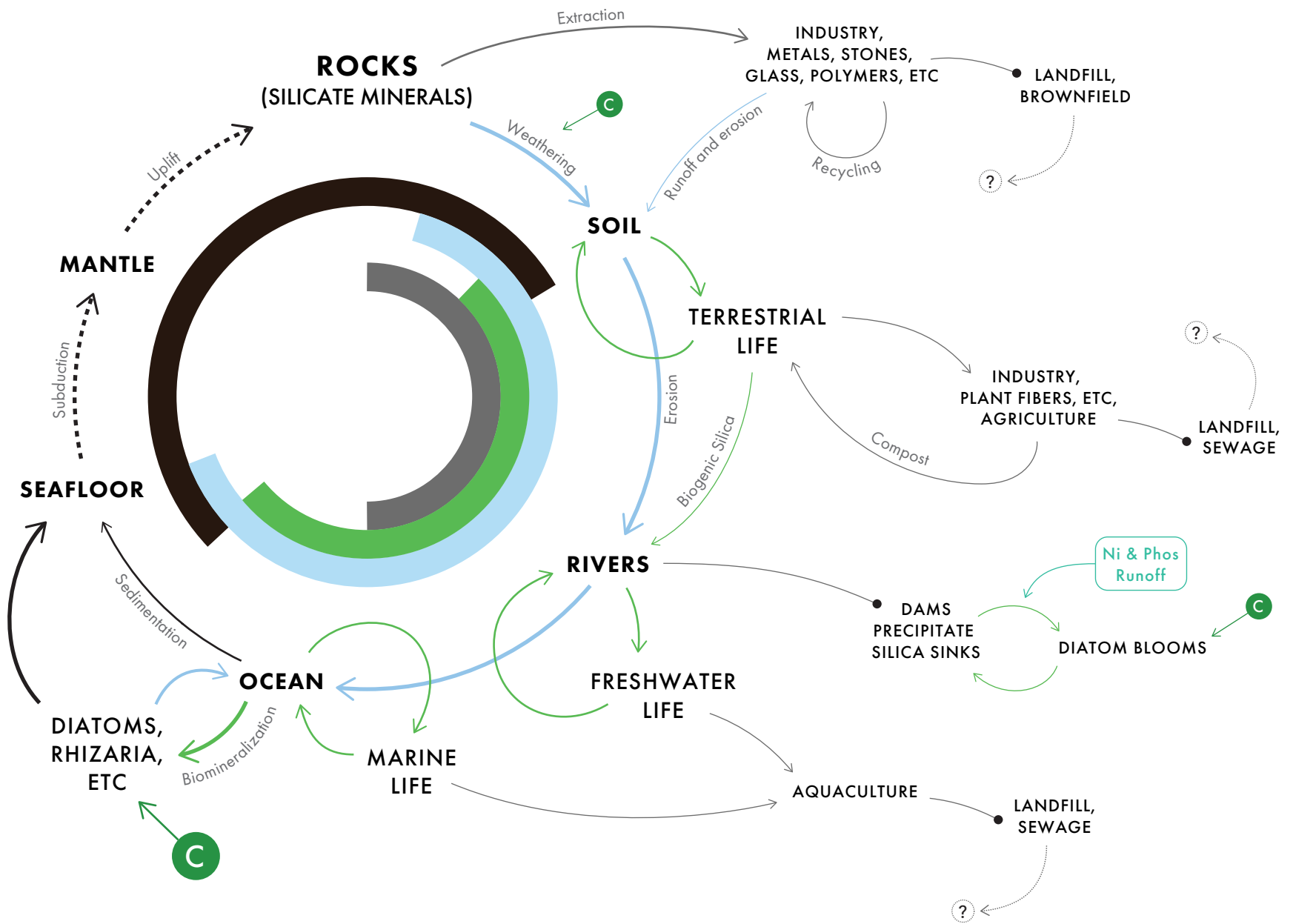


Figure 6.11: The Silica Cycle.

- 5 Silica in rivers is washed to the ocean. Here it cycles through marine life - notably through diatoms, microorganisms who build their skeletons of silica. (Figure 6.7) Deposits of ancient diatom skeletons can be found across the world. Diatoms photosynthesize, accrete silica out of the water, and sequester atmospheric carbon near the ocean's surface. When they die, their skeletons sink to the bottom with a bit of carbon trapped inside.⁶ We are altering this by decreasing the amount of silica reaching the oceans.
- 6 Over time, silica collected on the seafloor goes through subduction into the molten earth's mantle, and uplifts out again as silicate minerals. This process can take over 70 million years, locking carbon into the earth.⁷

6 Schaechter 2018; Leng 2013

7 De La Rocha & Conley 2017



SILICA IN ROCK ISLAND

At Rock Island, the smelter's purpose was to reduce silica in the form of quartz to pure silicon metal by melting it in an arc furnace with coked coal and wood chips, which provided the C (carbon) to burn the oxygen out of the silica. Oxygen fumed up and out, bringing some of the molten silicon and a tiny bit of carbon with it. After the Clean Air Act forced emitters to follow emissions standards and silica fume became known as a valuable concrete additive, they started capturing this 'fume' of amorphous silica with trace amounts of carbon which add the blue black color.

SILICON METAL

Silicon metal is almost pure silicon, whose atoms are arranged in a crystalline structure. Due to its ability to bind with other elements, pure silicon metal is not often found in nature. Silicon metal is, however, very useful and valuable to us. It is perhaps best known for being a semi-conductor of electricity, and for its role in computer chips and digital technology, photovoltaics, and silicone bakeware. Lesser known but by far the most common use is in aluminum alloying. Silicon metal made in Rock Island was used in aluminum alloying in the Alcoa plant in Malaga right across the river. Silicon metal is also used to make organic polymers like silicone, which are used in many things including skin and hair care, urethane foam, lubricants, sealants, and food additives.⁸ Higher purity material is used for higher tech applications.

8 Ferroglobe

SILICA FUME

Silica fume, also known as microsilica, is a fine particulate dust of amorphous SiO₂ (silicon dioxide) nanospheres created as a by-product of silicon and ferrosilica manufacturing. (Figure 6.12) Due to its tiny size, it has a very high surface area per volume. This combined with its silica content make it a highly useful pozzolanic⁹ additive to concrete mixtures. Silica fume can replace a portion of the Portland cement in a mixture, reducing its carbon footprint and creating a high performance concrete.¹⁰

NON-STANDARD VALUE

As discussed above, most of the silica fume captured at Rock Island was sold on as a concrete additive, and it is unclear why so much of it ended up sitting on the site. Columbia Ventures, Inc. initially meant to sell the fume, but as it's been sitting outside for decades, it can no longer be sold as a to-spec industrial product. This fume has left the sphere of industry and is being slowly retaken by the silica cycle. This design should bring some of it back into our world, in the form of site interventions or artisanal products, but much of it will continue back from whence it came. Who knows what long term effects it will have to re-release this hybrid material back into the wild.

9 Pozzolans are fine materials that become cementitious in the presence of calcium hydroxide (as in Portland cement).

10 Norchem

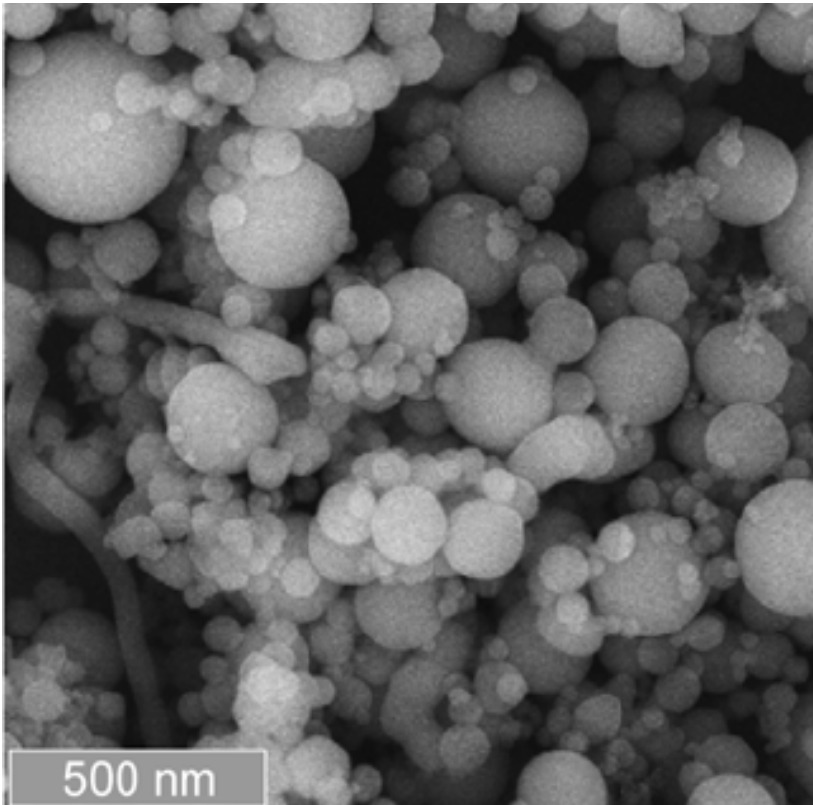


Figure 6.12: Silica fume nanospheres. (Joe et al.)

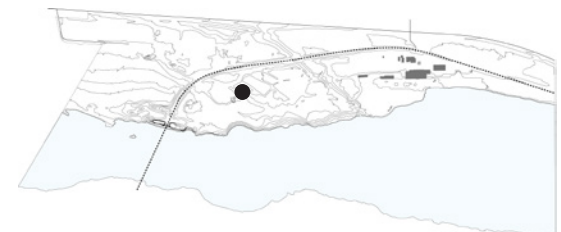


Figure 6.13: Silica fume on the site, April 2019. It is no longer an even texture or composition. Mammal tracks cross it, organic matter is mixed in, and chunks have formed.

6.14: SILICA FUME ON SITE



(Image Source: Nearmap)





6.15: FUME DUNES

6.16: SILICA FLOW ON SITE

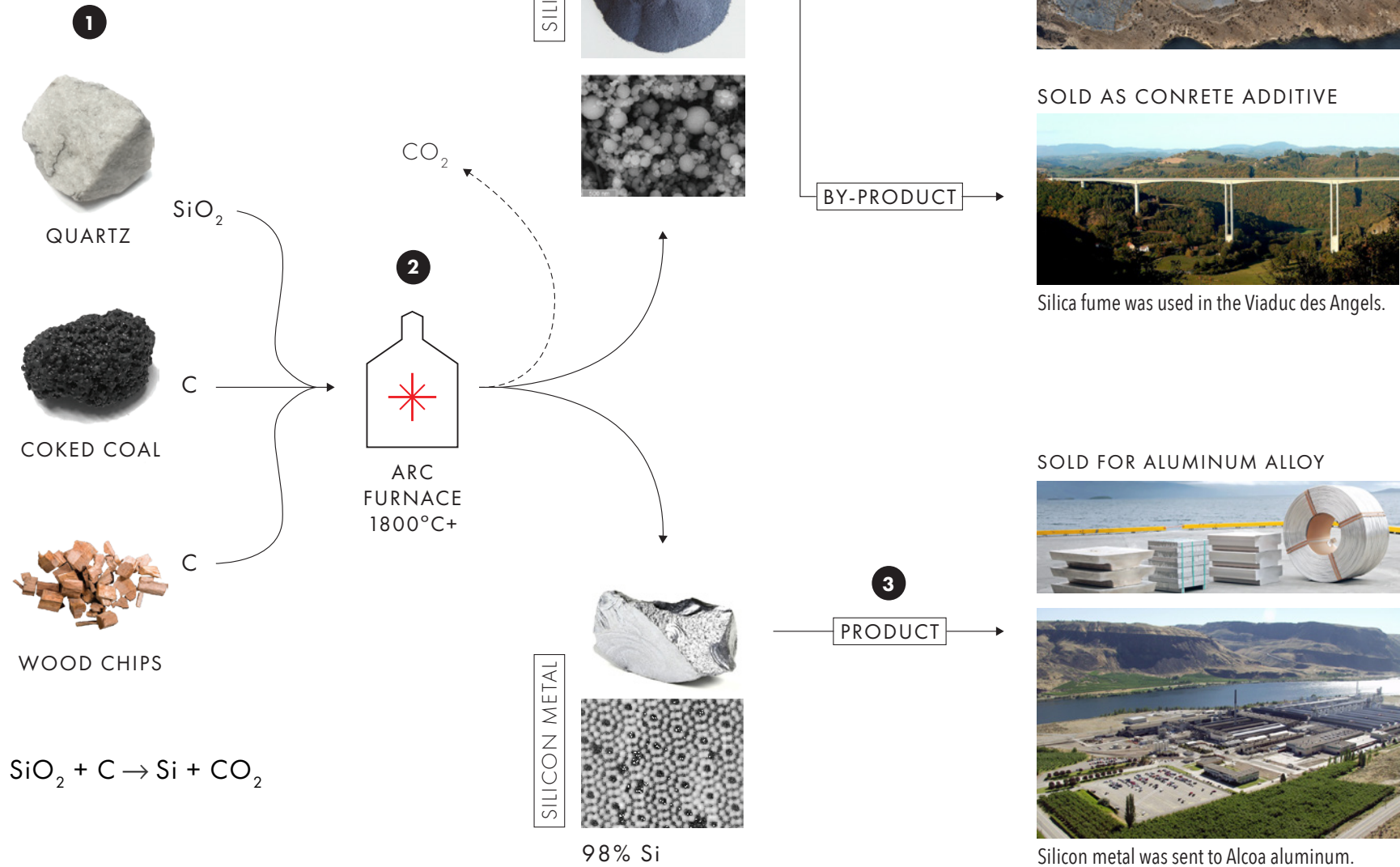


(Image Source: Nearmap)

- 1 RAW MATERIALS INTAKE
- 2 SMELTING IN ARC FURNACE
- 3 PRODUCTS TRANSPORTED OUT

- 4 WASTE SLURRIED INTO FUME PONDS
- 5 TRUCKED TO "STORAGE"

6.16: SILICA PROCESSING ON SITE, 1948 - 1999



7. DESIGN FRAMEWORK

SYNTHESIS

From the initial theoretical framework of endemism, adaptive reuse and partialization, through my analysis, immersion and research, I synthesized a framework to guide the site design.

Value and partialization are already here in this unique and beautiful site, which does not need large-scale transformation to create value. Minimal ground disturbance is the best approach to protect archaeological sites and sequester any possible toxins in-place and protect the river and groundwater from further runoff. As a vital piece of the dwindling shrub steppe, and a functioning ecological corridor, this place's vitality should be preserved. A combination of historical interest, recreation and eco tourism which use the endemic conditions to create economic value are the best choice in conjunction with the Blockchain Innovation Campus project.

In order for the public to realize the great asset they already have, they need to be able to access, experience and understand this site with minimal intervention.

OPERATIONS

- Realize value via understanding
- Understanding via immersion
- Immersion via lattice

COGNITIVE AND EMBODIED EXPERIENCES

Just as I needed both cognitive and embodied knowledge to understand the site, so should the design provide these layered experiences for visitors. The design needs to immerse people in the site to create embodied knowledge, and provide thresholds for understanding aspects of the site beyond our bodily senses, via visual and tactile interpretation and information.

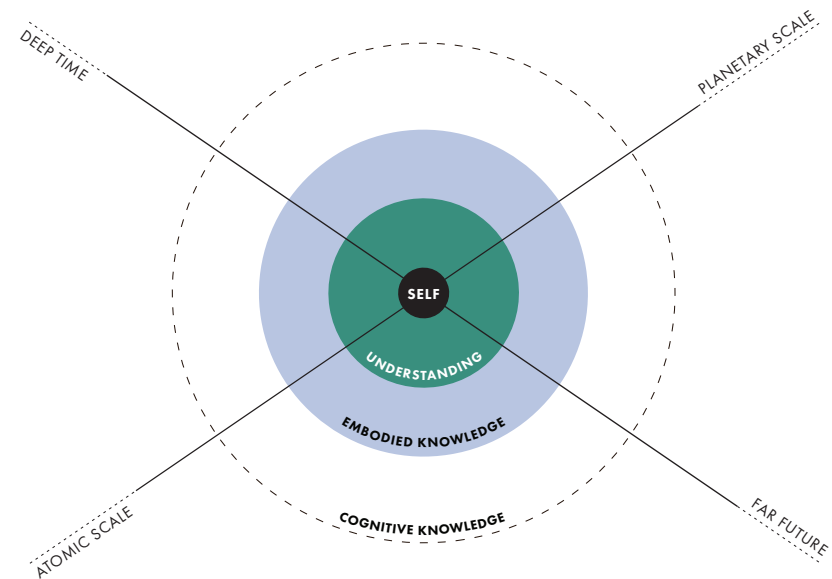
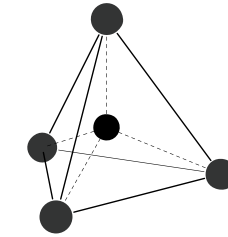


Figure 7.1: Cognitive And Embodied Experiences

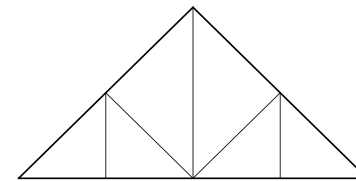
LATTICE CONCEPT

In order to achieve immersion with minimal interventions, I synthesized the concept of a lattice, inspired by the silica tetrahedron and the truss. These forms are efficient in energy and material use, direct energy and mediate interactions along their forms. From the atomic scale to the building to the planetary scale, these structures form strong and porous lattices that allow systems to flow through them.

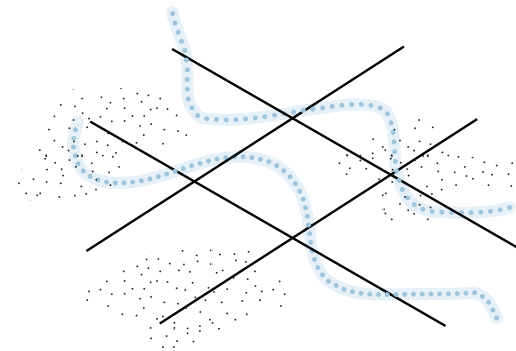
This site needs a lattice overlay, to create an 'orderly frame'¹ of access and a mediator of experience and understanding. This will achieve immersion, and therefore understanding and value, without destroying, blocking, or transforming the site or its processes.



SILICA
TETRAHEDRON



TRUSS



LATTICE

Figure 7.2:
Lattice Concept

1 Nassauer 1995

8. CASE STUDIES

The Rock Island Silica Fields site has great potential for public access, recreation and interpretation, material use and reuse, ecological growth and productivity, and livelihood and income generation via ecotourism. It has unique characteristics which help to define and support these potentialities, which seem like great challenges when considering total transformation or 'development,' but can become great assets when seen from an ecotourism lens.

These case study sites have a lattice-like approach to access, design and interpretation of both natural and post-industrial landscapes. They have prioritized site endemism, adaptive reuse, and embedded or partialized experience to create popular and valuable ecotourism and recreational opportunities for their communities.

TUDELA CULIP RESTORATION

DESIGNER: Estudio Marti Franch (EMF)

LOCATION: Paratge de Tudela-Culip, Cap De Creus, Catalonia, Spain

TIMELINE: 2005-2010

SIZE: 90 hectares / 225 acres

MISSION: Restoration, Interpretation, Public Access

DESCRIPTION

This project removed a Club Med resort and restored natural habitat as well as visitor access and interpretation to 225 acres of the Cap de Creus National Park in Catalonia. It removed acres of invasive plants and over 450 buildings, revealing the natural rock formations underneath. The team from Estudio Marti Franch (EMF) walked the site extensively to carefully place paths and shelters that responded to and meshed into (sometimes literally) the unique site conditions.¹

LESSONS

This project shows the power of walking the site to determine the best locations for paths, and how path changes in response to site can magnify experience and immersion, even along a narrow frame.

¹ Lecture by Marti Franch. The City and the River lecture series, Cal Poly Pomona, October 10, 2016.



Figure 8.1: Concrete path dissolving into the rock. (EMF)

TUDELA CULIP RESTORATION



Figure 8.2: The site before restoration. (EMF)



Figure 8.3: Interpretation marker. (EMF)

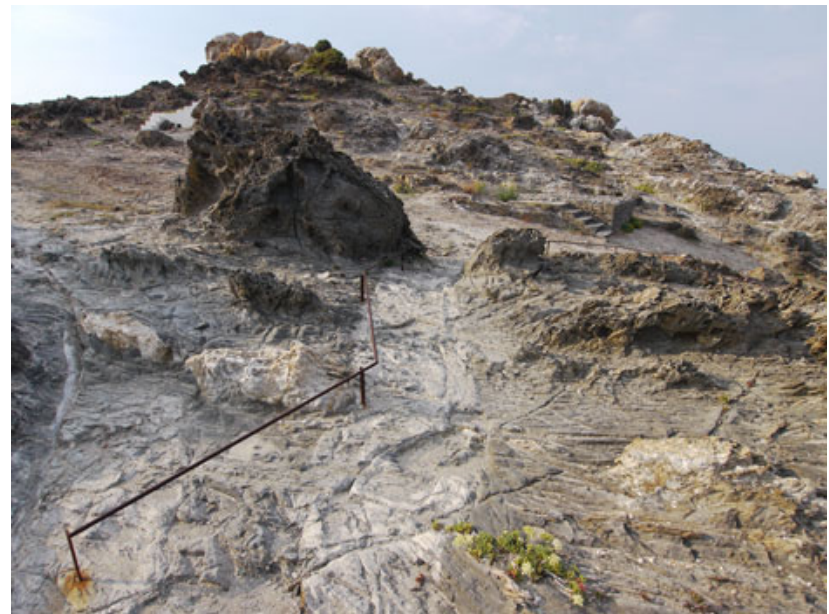


Figure 8.4: Path delineated by a low railing. (EMF)

Figure 8.5: A steel grate elevated path. (EMF)



WILLAMETTE FALLS RIVERWALK

DESIGNER: Snøhetta, Mayer/Reed, DIALOG

LOCATION: Oregon City, Oregon

TIMELINE: Beginning Summer 2018

SIZE: 22 acres / 960,000 sqft

MISSION: Interpretation, Adaptive Reuse, Public Access

DESCRIPTION

This project is a trail and node system worked into a defunct industrial complex at Willamette Falls dam, Oregon City, OR. Some structures are removed, some preserved, and some new structures built, to access and experience the site and enhance and maintain the river.¹

LESSONS

This site, like the Silica Fields, has a rich and complex history involving indigenous use, industry, and hydrology. Its unique qualities are maintained and highlighted, and the project creates a balance between removal, preservation, and transformation. Each move seems to be deeply considered, with a tendency towards lightness and minimal action. According to the Willamette Week, "... the Portland area is about to gain a gorgeous new attraction it never knew it had."²

1 Lecture by Craig Dykers of Snøhetta, USC January 11, 2017.

2 Singer, Matthew. "There's A Forgotten Wonder In Oregon City. It'll Soon Be Revealed." Willamette Week, 7 Feb. 2017.



Figure 8.6: Willamette Falls hydroelectric dam, 2015. (Edison Tech Center)



Figure 8.7: Willamette Falls project rendering. (Snøhetta, Mayer/Reed, and Dialog)

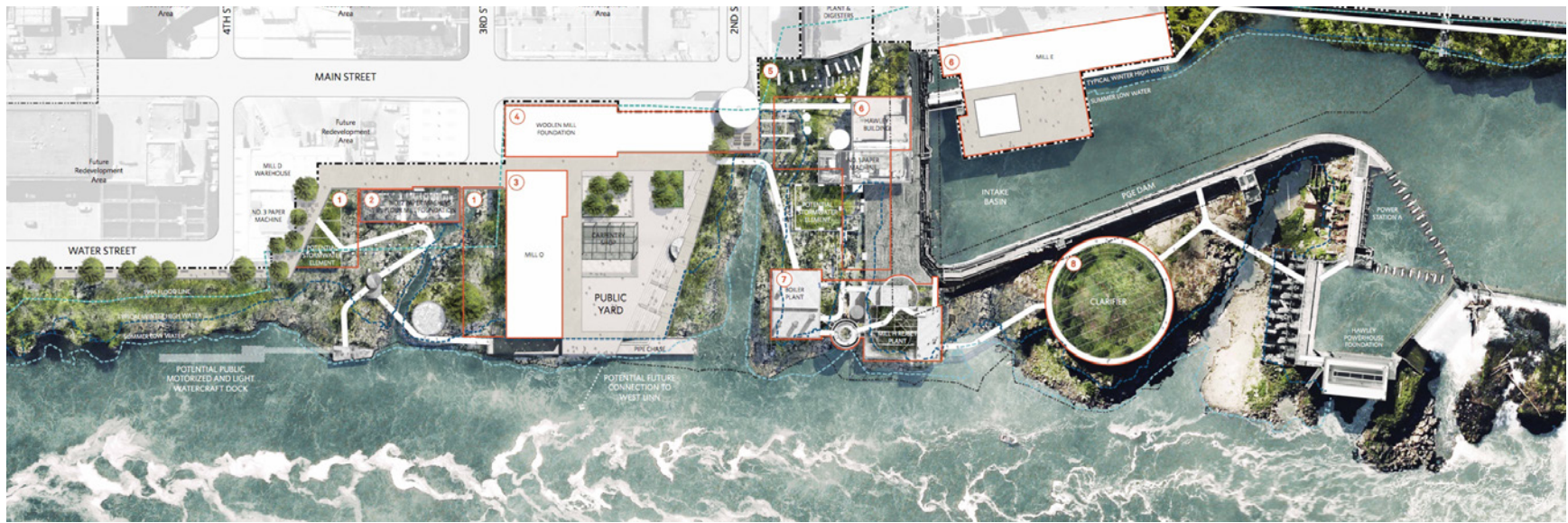


Figure 8.8: Site plan and rendering. (Snøhetta, Mayer/Reed, and Dialog)

9. DESIGN

APPROACH

This design overlays a lattice of paths and nodes on the site, to achieve immersion, understanding, and value via a minimum frame. The exact path location and type became the most important aspects of this design, and the parts that could and should be mapped in advance. Proposals for interpretation, lighting and wayfinding details are also shown. There is only so far a design should go when working remotely, as I am. The final, detailed design of this project should be developed on the site, with local craftspeople and materials, in collaboration with the land and the community. The details and tectonics of the path, wayfinding and interpretation should respond in minute detail to site conditions. Features such as an interesting rock, a particularly inviting piece of shade, or a particularly well used wildlife corridor should be found and incorporated into the design. A wrinkle in a hand rail, the angle of a bench, a boardwalk footing, or any part of a site intervention could call attention to or frame these details, and bring them into the broader context of site, silica, history or culture.

The design shown here creates the armature for this future design development, and was created to meet the below goals and needs.

GOALS

- Directly respond to the site conditions
- Maintain precious endemism
- Experience of adventure and discovery
- Thresholds of understanding for many facets of the site
- Immersive cognitive and embodied experience
- Tourism, ecological and cultural value for Rock Island
- A formal and material language that comes from the site

NEEDS

- Access & safety
- Clear path, orderly frame
- Rest spots, shade
- Wayfinding and interpretation

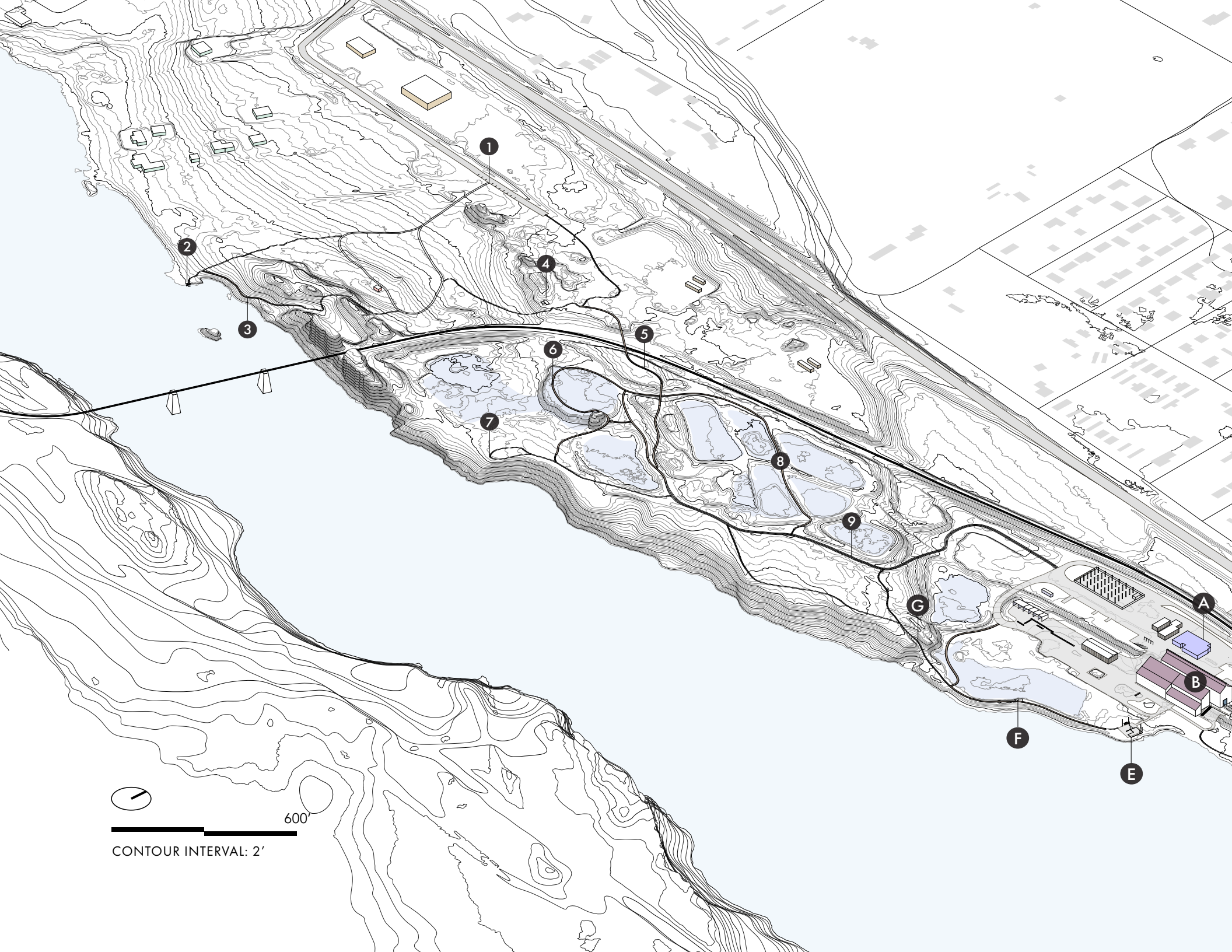
DESIGN

- Path & node system
- Tactile hand rail
- Wayfinding, interpretation, lighting



Figure 9.1: View of the River's Edge node area. April 2019.

Figure 9.2, Opposite: Proposed Plan.



600'

CONTOUR INTERVAL: 2'



- A** VISITOR CENTER
- B** BUILDINGS WALK
- C** RAIL SPUR TRAIL
- D** INTAKE BEDS
- E** BEACH TERRACE
- F** RIVERWALK
- G** HILL CLIMB

- 1** WEST ENTRANCE
- 2** RIVER'S EDGE
- 3** FLOWER VALLEY
- 4** RAILROAD OVERLOOK
- 5** BRIDGES
- 6** DUNE WALK
- 7** RIVER OVERLOOK
- 8** SILICA PONDS
- 9** SAGEBRUSH TRACK

SILICA FIELDS

PROPOSED PLAN

DESIGN PROPOSAL

This path and node system was created by walking and experiencing the site, and choosing the exact location of each based on flow, topography, ground condition, experience, views, and so on. The system creates a lattice of access into the site that maximizes the synergy between site and visitor. A visitor station and parking lot at both the east and west ends, and a bridge over the railway, connect visitors to and across the site. Each node allows for stopping, sheltering, gathering, learning, and/or experiencing, depending on the location. Four path types use and respond to site conditions for best effect.

The series of spaces and interventions outlined below together create an experience of discovery and adventure, each node and interpretation element unique to that place.

A VISITOR CENTER

A historic masonry unit building near the smelter is converted into a visitor center, with restrooms, maps, a small shop, and perhaps a snack counter. This can operate on its own, or more likely be integrated into the Blockchain Innovation Campus (BIC) project design.

B BUILDINGS WALK

If the BIC doesn't go forward, trails and elevated boardwalks will take visitors through the smelter buildings. If and when the BIC does happen, connections to the larger site trails will be integrated into the new site design.

C RAIL SPUR TRAIL

This part of the trail follows the existing tracks of the smelter's rail spur, across an open frame bridge where train cars were emptied into hoppers.

D INTAKE BEDS

The trail here loops through the woodchips, coal and quartz covering the ground in the intake area. Interpretation highlights these raw materials and their chemistry, and the rail system that brought them here.

E BEACH TERRACE

This node is a large gathering space on the spot that appears to be a former helicopter pad, with shelters, seating and tables. The riparian edge should be restored here, with tules and sand, and people provided with clear, designed water access points.

F RIVER WALK

A low boardwalk runs over the berm along the riverbank and the fume pond, back to the rubble piles.

G HILL CLIMB

Inlaid tracks stabilize the climb up the strange furrow scraped into the bluff.

1 WEST ENTRANCE

Nature Shore Drive, off of SR 28, becomes a new site entrance, with parking along the end of the road past Standard Pallet, a small visitor's kiosk and restrooms.

2 RIVER'S EDGE

The existing track under the power lines leads to a narrow footpath near the river's edge, to a small rocky point forming a cove, where this node provides seating, interpretation, and limited water access.

3 FLOWER VALLEY

A low boardwalk leads through the rubble and balsam root valley to the west of the bridge.

4 RAILROAD OVERLOOK

This larger, C-shaped node hugs the south side of a basalt outcrop on the west side of the new pedestrian bridge over the railroad. The handrail contains a site timeline and embedded materials and bas relief.

5 BRIDGES

Two bridges span between the railroad overlook to the west and the high berms in the fume ponds to the east.

6 DUNEWALK

A low boardwalk curves onto the bluff of silica fume overlooking the dune field. A node here supports the experience of the dunes and a nearby large boulder - the site of lithic archaeological elements.

7 RIVER OVERLOOK

This node is on the point of a high bluff looking east-south-west. The U-shaped deck and bench frame views and interpretation of the site.

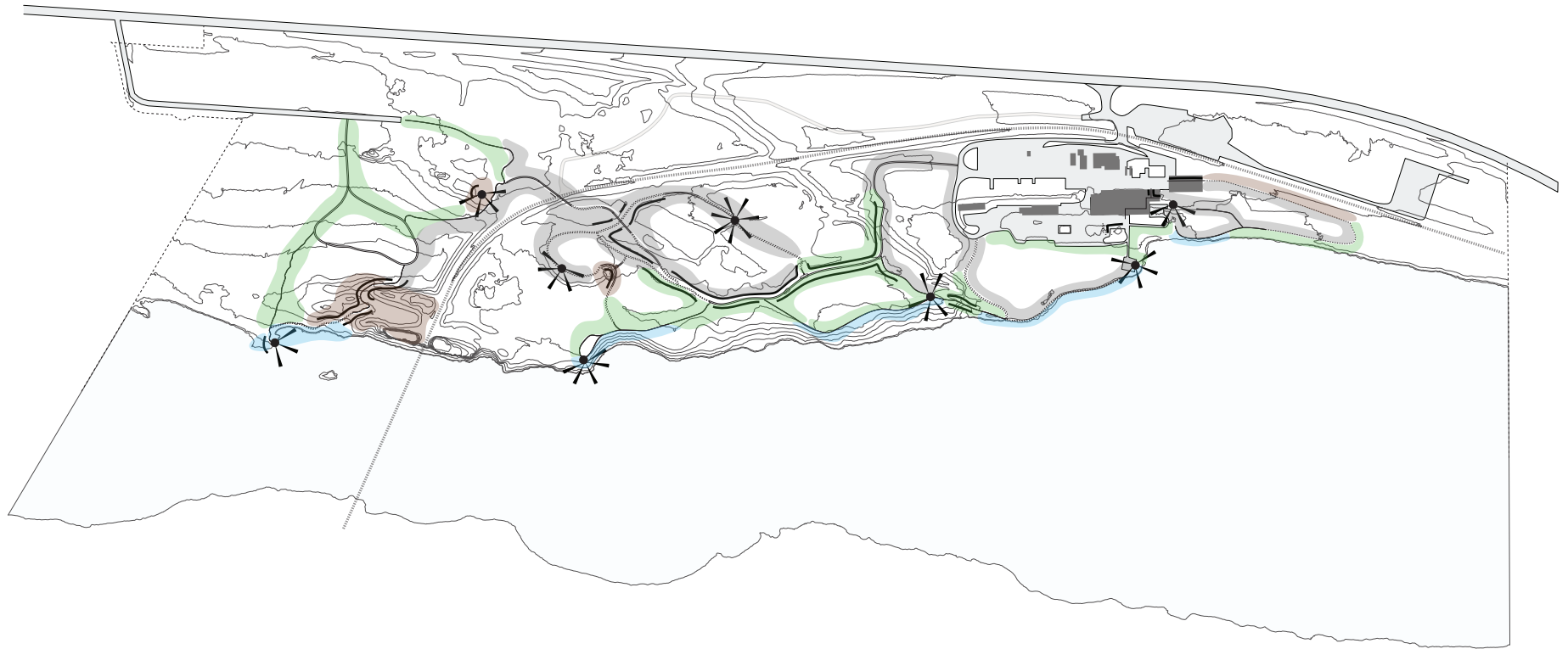
8 SILICA FUME PONDS

The boardwalk here runs along berms between fume ponds. A node creates a sheltered moment for seating.

9 SAGEBRUSH TRACK

This path reuses the existing quartz gravel track running through the mature sagebrush steppe habitat on the bluff to the south of the fume ponds.

9.3: PATH EXPERIENCE



 NODE AND PROSPECT

 ENCLOSED EDGE

 LITHOSPHERE

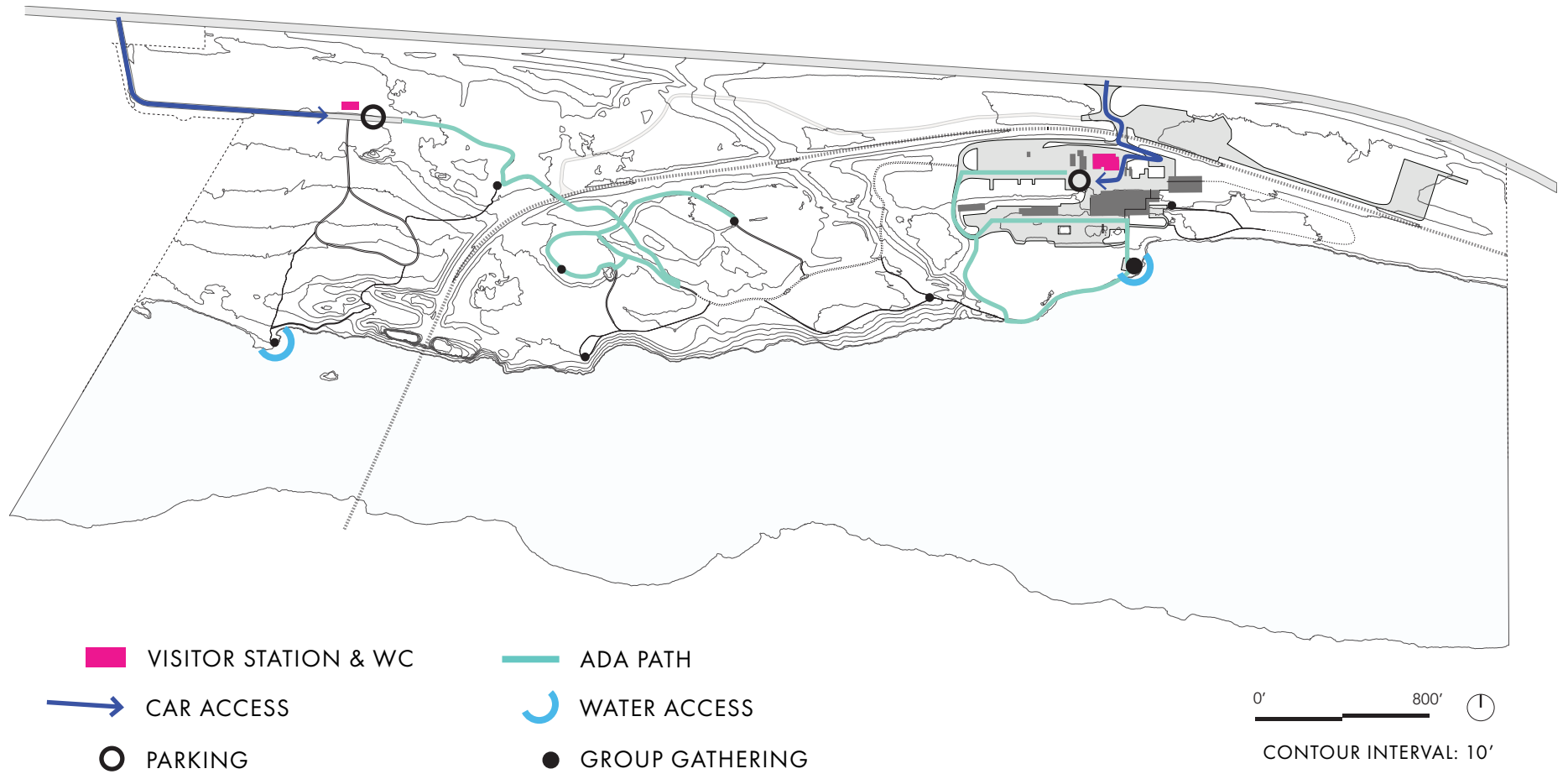
 HYDROSPHERE

 BIOSPHERE

 INDUSTRY

0'  800' 
CONTOUR INTERVAL: 10'

9.4: ACCESS TYPES



NODES

The nodes interact with the specific site conditions and experiences to be found at each site, chosen through the analysis and immersion process. Depending on their location and condition, they may have railings, shade, benches, tables, restrooms, information, drinking water, or lighting. The two entrance nodes have parking and a visitor center or kiosk. The largest node is (E) Beach Terrace, the group gathering space within the trail system. The smallest node is (2) River's Edge, just two benches near the small cove in the river. All the nodes have interpretation elements.

DESIGN APPROACH

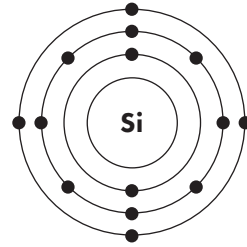
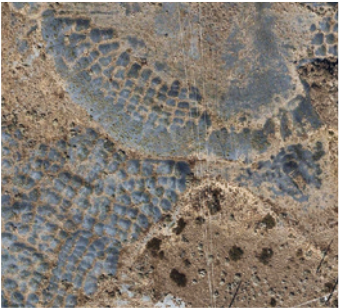
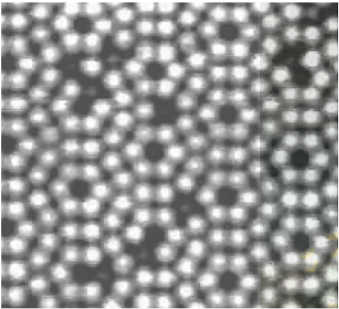
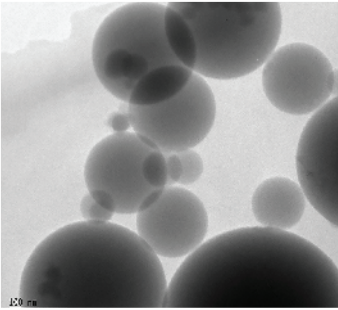
The landscape is lush and alive, so the paths and nodes too have a lushness to them. Minimum does not equal austere minimalism - it means carefully choosing elements for their best effect. Here at the Silica Fields, humans need moments of respite and easy comfort. The landscape is large and at times disorienting, and the summer is hot and dry, so the nodes will offer wayfinding, seating, shade, and elevated views.

To create a formal language for the nodes, forms found on the site, from micro to macro scale, were studied and broken apart. The circle of an atom, opened into the arc of a cove, rabbitbrush branch, or fan of silica, and partialized into pieces. These simple, curving forms were used to create the basic forms of the node designs.

TACTILE HANDRAIL

A wide, smooth handrail allows people to lean against the railing and feel secure. In the places where contact with the ground is dangerous or undesirable, physical contact - embodied knowledge - is still very important. In a vast and somewhat disorienting place like the Silica Fields, a handrail steadies and directs. This simple and intuitive touch of a hand to a handrail creates an opportunity to bring visitor's into physical contact with materials and interpretive elements. Built into the handrail is interpretive information, a cast terrain map to touch, lighting, inlaid panels of site materials and materials made from silica such as glass, textures and other artful, interesting, and effective features. These will be developed working together with local artists and craftspeople. Former employees of the smelter, members of the Wenatchi and other tribes or groups, and Rock Islanders of all kinds could participate in their design and creation.

Figure 9.5, Opposite: Node Design Research.
(Google Earth, Wikimedia, PGI, Author Photos.)



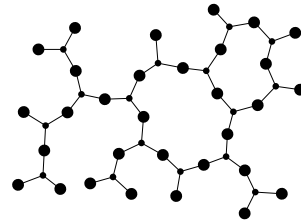
CIRCLE



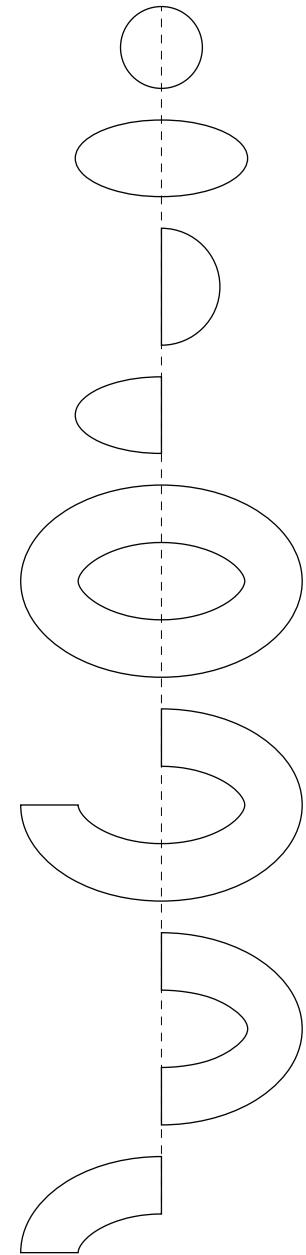
OPEN



ARC



PARTICLE



7 RIVER OVERLOOK

TACTILE INFORMATION HANDRAIL

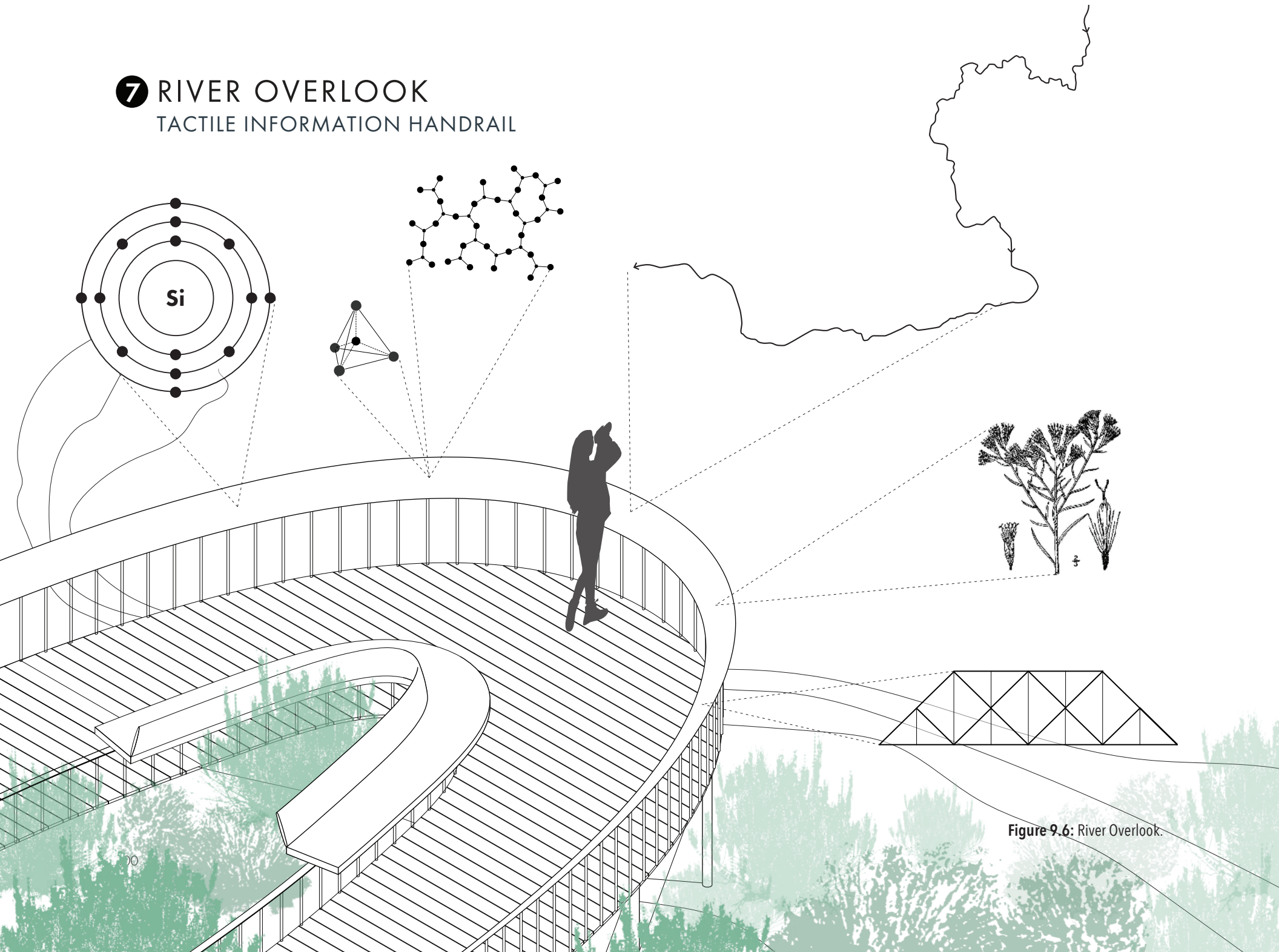


Figure 9.6: River Overlook.

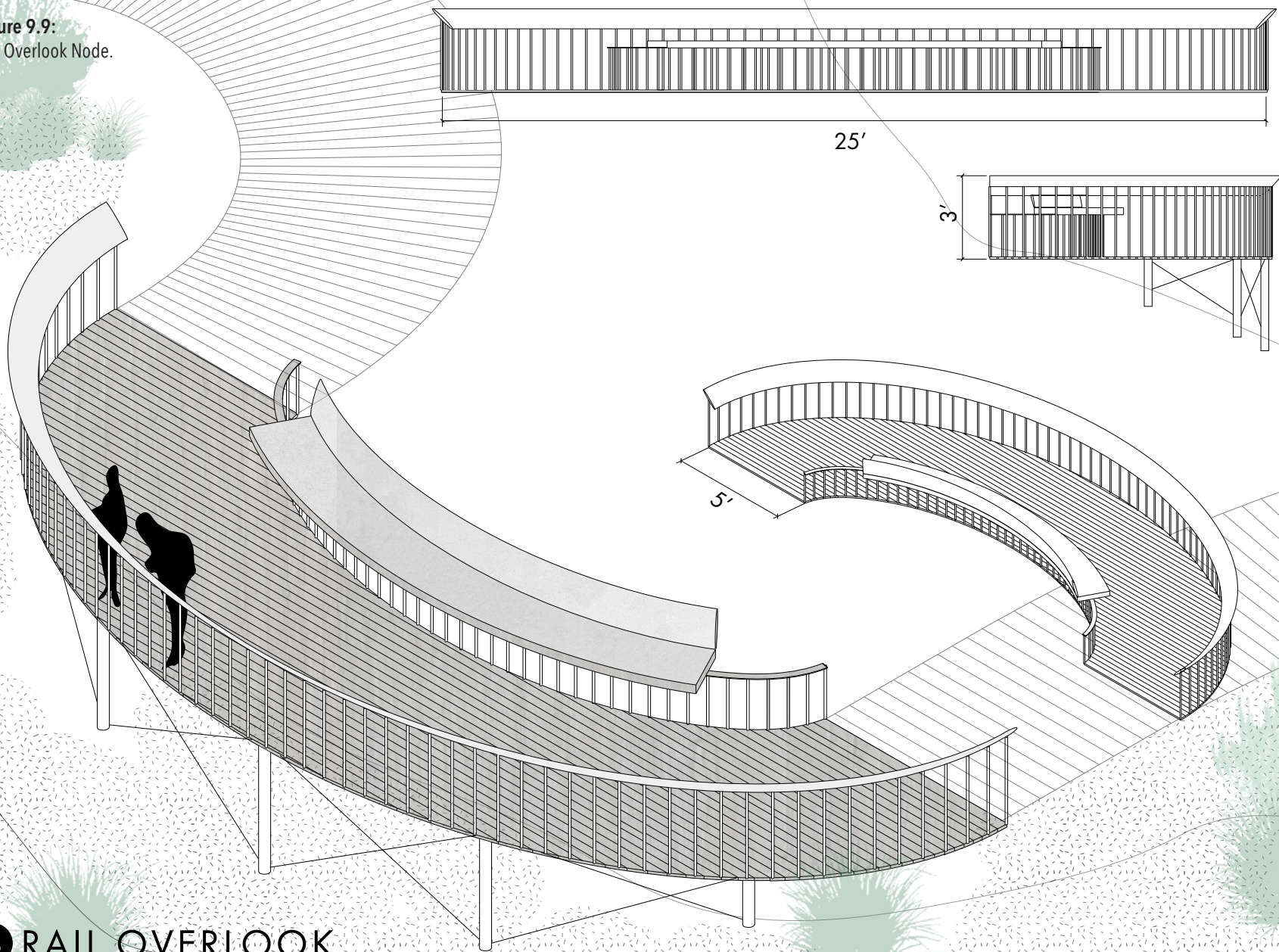


Figure 9.7: Looking east along the Columbia from the River Overlook node.



Figure 9.8: Looking south across the rabbitbrush covered slope toward the railroad bridge, from the Rail Overlook node.

Figure 9.9:
Rail Overlook Node.



4 RAIL OVERLOOK

PATH TYPES

Four path types are used to provide access to and connect across the site. The path type, design, and materials respond directly to the ground condition where it is, ranging from up close and personal to removed and protected. Interpretation and design details along the paths also respond directly to small-scale site conditions.

EXISTING PATHS

The simplest thing, and the first approach, is to reuse the existing paths on site. The quartz gravel tracks and paved paths can be simply reused as they are or clarified by cleaning or pruning. Some paved areas, though not offering a clear line to follow, create the opportunity for open-ended exploration, and should be left as they are. This path offers the closest contact with the site.

INLAID TRACKS

This path type uses boards or blocks to create a trail that mimics the existing tracks on site, while creating new paths and stabilizing the ground. This path type only slightly distances visitors from the site.

LOW BOARDWALK

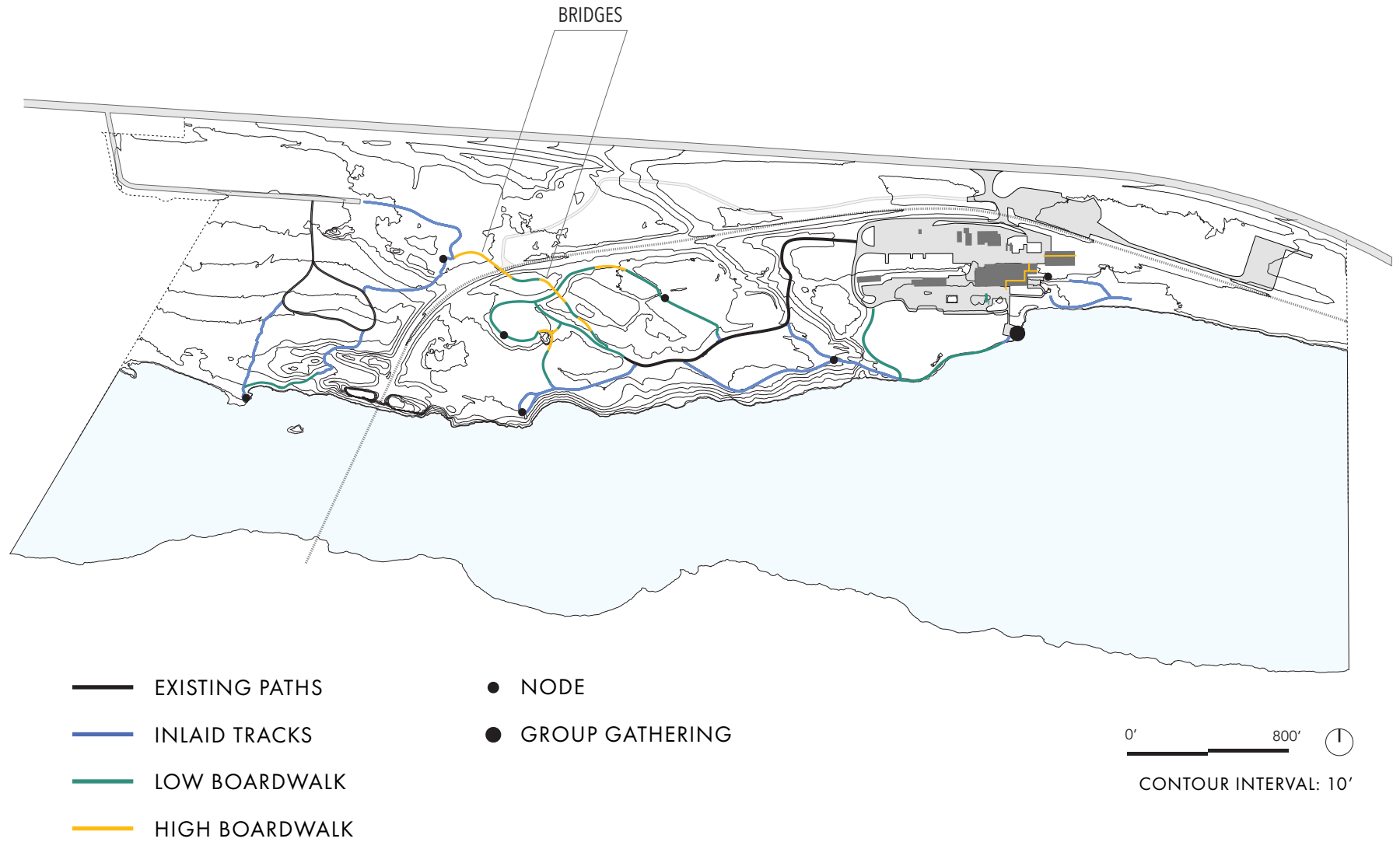
Low boardwalks bring people up and off the ground by less than 1', and have a low toe rail built into the structure to provide safe ADA access. They are used in places where the ground should be protected from trampling, such as in the Flower Valley, or where people should be kept away from the ground surface, such as over the material intake track or walking over silica fume. This simple frame allows comfortable and safe access while keeping people on a defined path.

HIGH BOARDWALK

High boardwalks are used for bridges, lookouts, over dangerous or variable terrain, and anywhere a high degree of separation is needed. They are used rather than disturbing regrading the ground. These have handrails, and can be integrated into the structure of nodes. They provide a comfortable, safe and appealing entrance into otherwise confusing or dangerous areas.

These paths types and their applications are illustrated on the following pages.

9.10: PATH TYPES



USE EXISTING PATHS

9.11: DO NOTHING, OPEN THE GATES



SAGEBRUSH TRACK

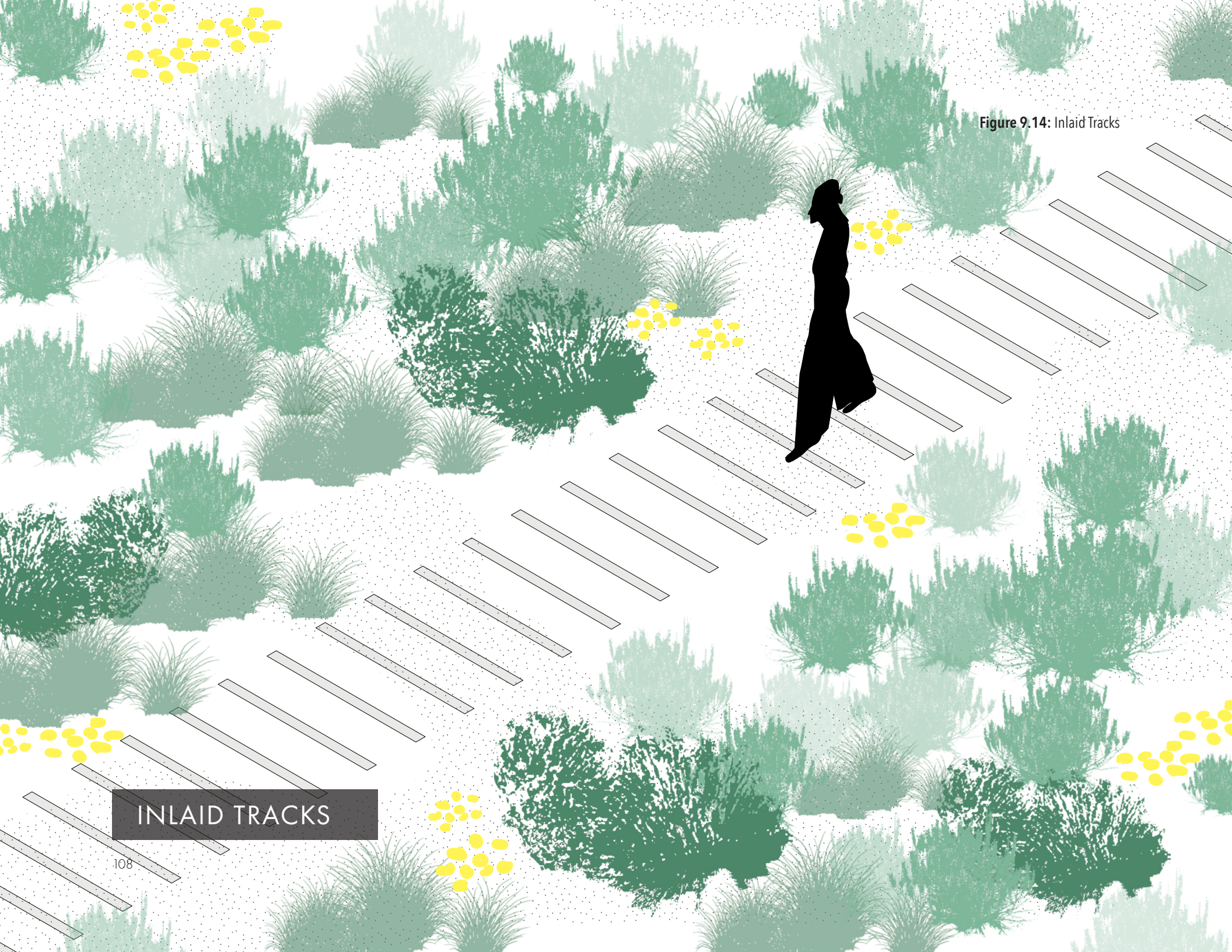
9.12: CLARIFY EDGES



9.13: LEAVE OPEN ENDED



Figure 9.14: Inlaid Tracks



INLAID TRACKS

9.15: EXISTING REMNANTS



9.16: STABILIZE SLOPES



INLAID TRACKS

This path type is inspired by existing track and track remnants found of the site. Wood or concrete bars will be in laid in the ground to create a semi-permeable path that leads the way and stabilizes the ground.

This path is used for making new paths in the shrub steppe areas, along sandy loam, and up hillclimbs, where the ground is safe to touch and interact with, and small, low growing plants can grow up in between.

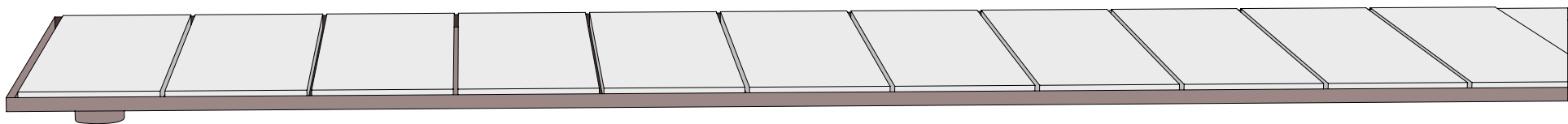
LOW BOARDWALK

9.17: PROTECT HABITAT



FLOWER VALLEY

9.18: SAFE ACCESS



9.19: SILICA FUME CONCRETE TILES IN FRAME

HIGH BOARDWALK

INTERLACED FLOWS

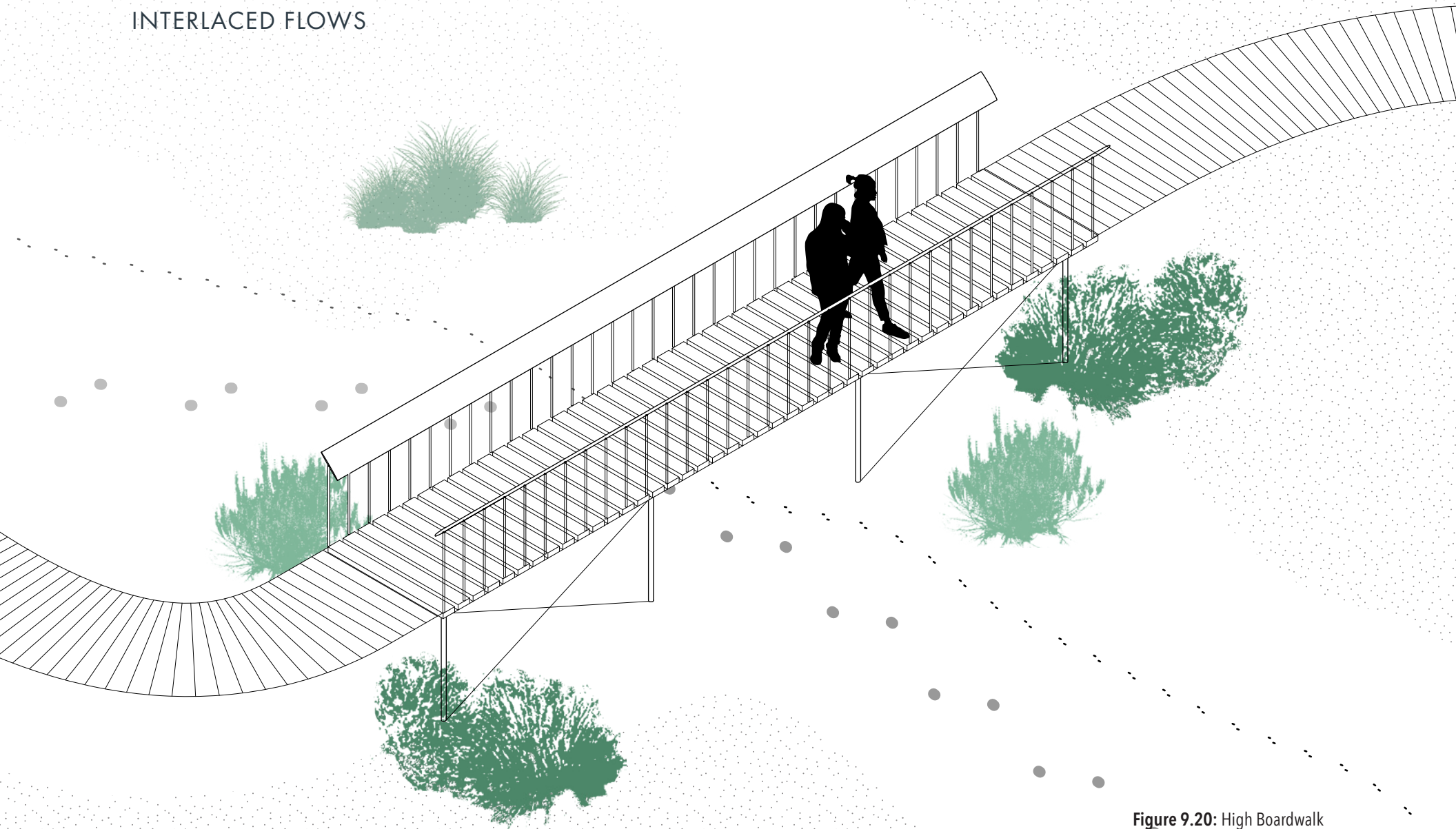


Figure 9.20: High Boardwalk

9.21: SMEDENPOORT BRIDGE - NEY & PARTNERS



(Urbastyle)

HIGH BOARDWALK

When spanning the railroad, traversing deep silica dunes, or entering one of the smelter buildings, a high boardwalk is used to keep visitors safe from the landscape hazards.

This should be made of high performance silica fume tiles made from site materials. A bridge by Ney & Partners in Bruges, Belgium, (figure 9.21) is a nice example of an elegant, minimal bridge with concrete tiles held in a steel frame.

9.22: USE FUME FROM STORAGE SHEDS TO MAKE TILES



9.23: BRIDGE OVER RAILROAD



LOOKING EAST FROM THE WEST SIDE

9.24: CROSS UNSTABLE TERRAIN



9.25: THROUGH SMELTER



WAYFINDING

DESIGN APPROACH

Like the nodes, the wayfinding and signage design was developed from site forms. In this case, vertical and highly visible forms: the buildings, the truss, and the bluffs of the Columbia Gorge were abstracted into the simple operations of Irregular, Repeat, 2:1 and Cascade. These lines were layered, offset, slid, and arrayed to break the original form into particles.

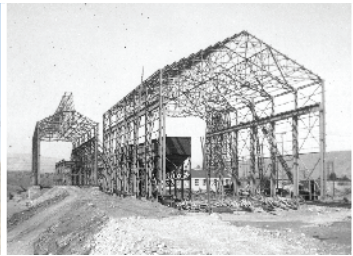
After digital manipulation, paper models further refining the concepts in 2:1 and Cascade were made to bring these forms to life. The Offset Cascade model became the most intriguing and useful for wayfinding signage.

OFFSET CASCADE SIGN

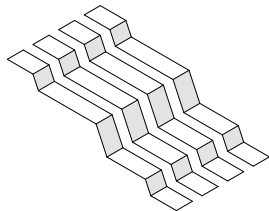
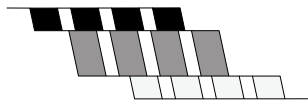
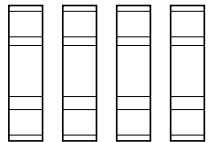
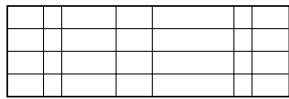
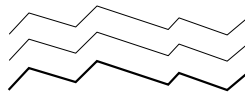
This sign, created through the above process, is a flexible and modular group of four zig-zagging columns, usable on their own or in a group. Graphics on the upward-facing panels can provide wayfinding, branding or identity and interpretation. To reflect their context, these signs will be in English, Spanish, Interior Salish, and Braille. The downward-facing surfaces contain solar lighting.

These signs are placed along the path as trail markers, in nodes, at the visitor centers and parking lots. They are also enlarged and used as site identification and brand along SR28, to draw visitors to the site.

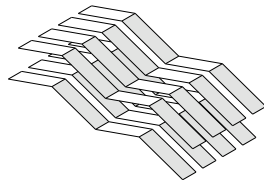
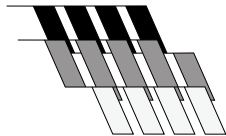
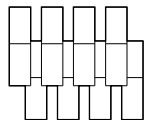
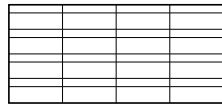
Figure 9.26, Opposite: Wayfinding Design Research.
(Big Bend Railroad History, Author Photos.)



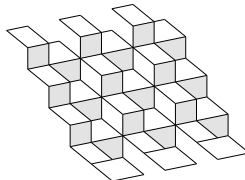
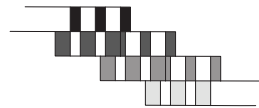
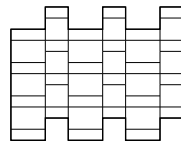
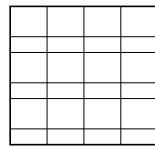
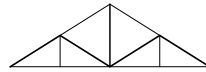
IRREGULAR



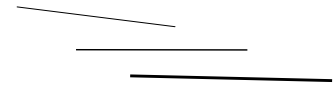
REPEAT



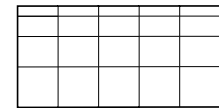
2:1



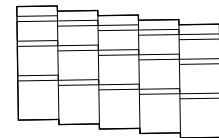
CASCADE



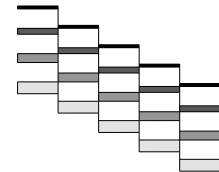
LAYER



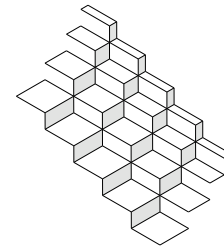
OFFSET



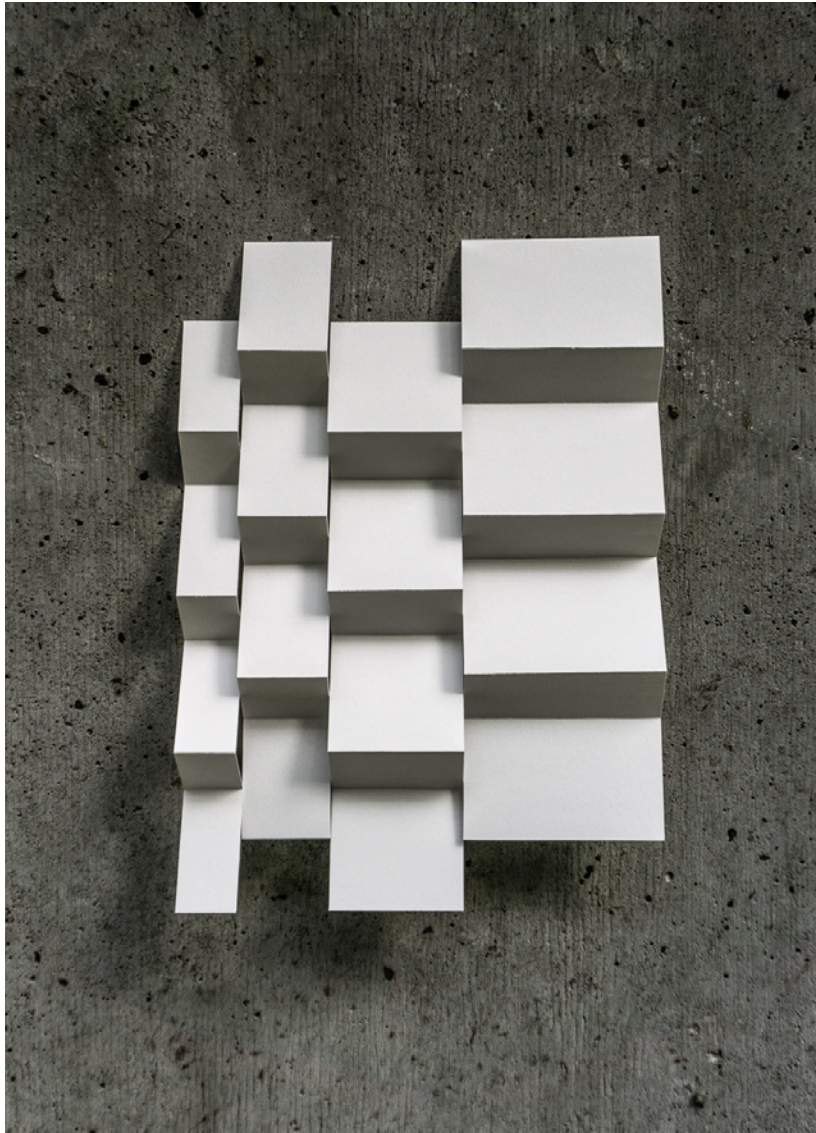
SLIDE

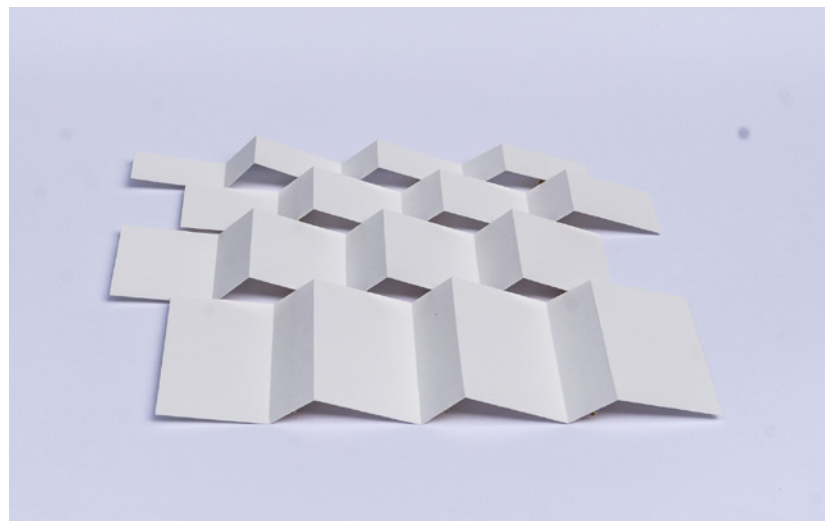
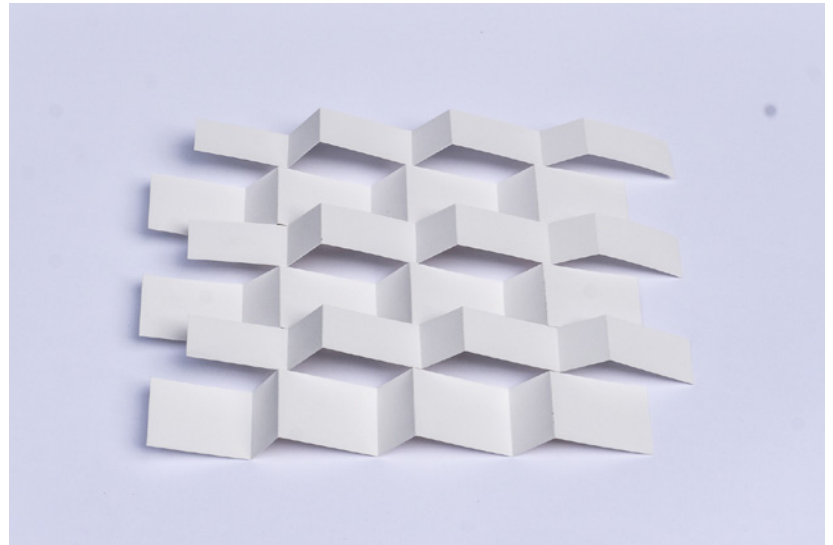
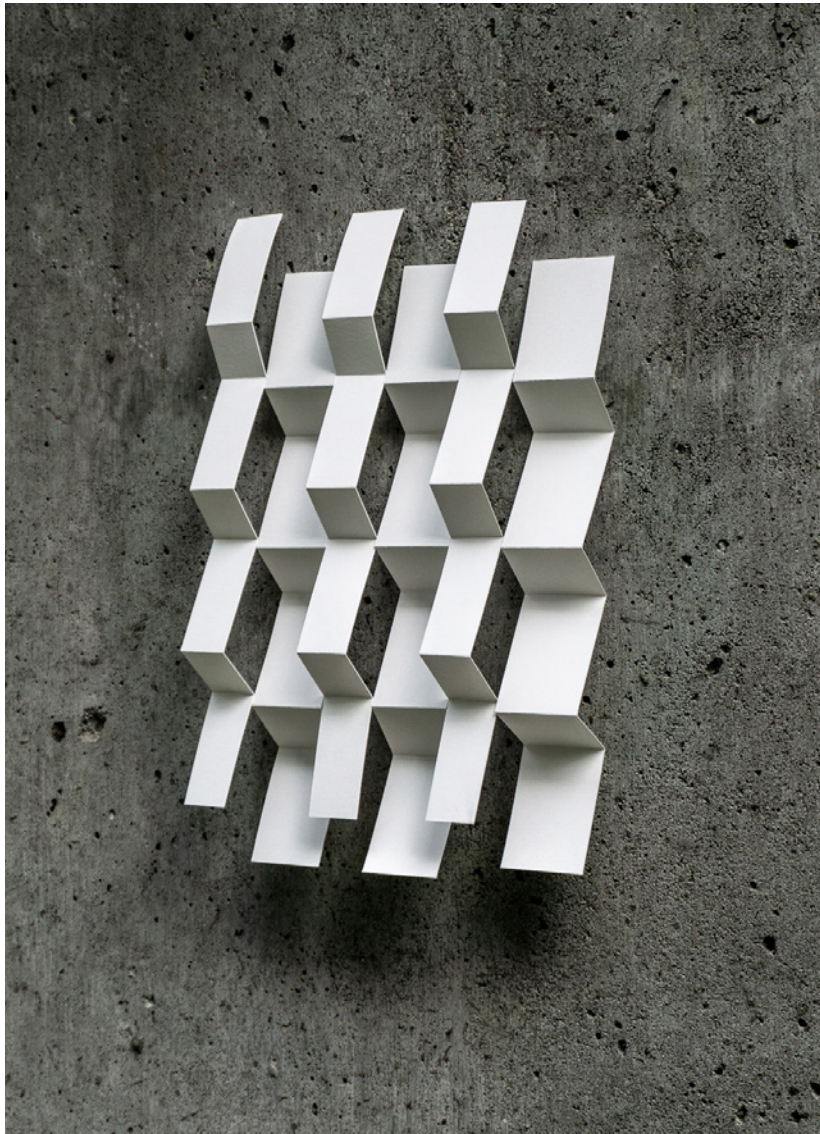


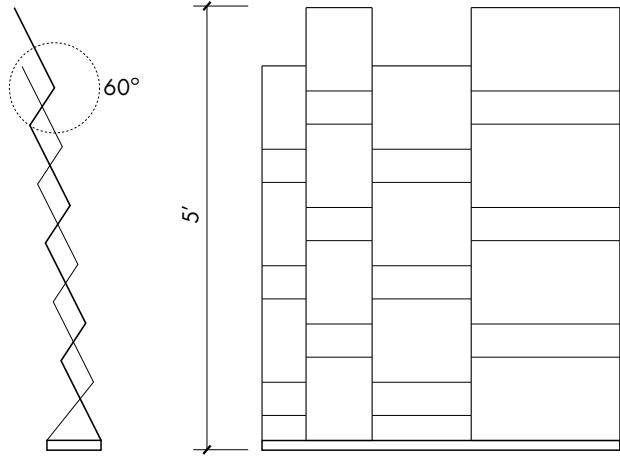
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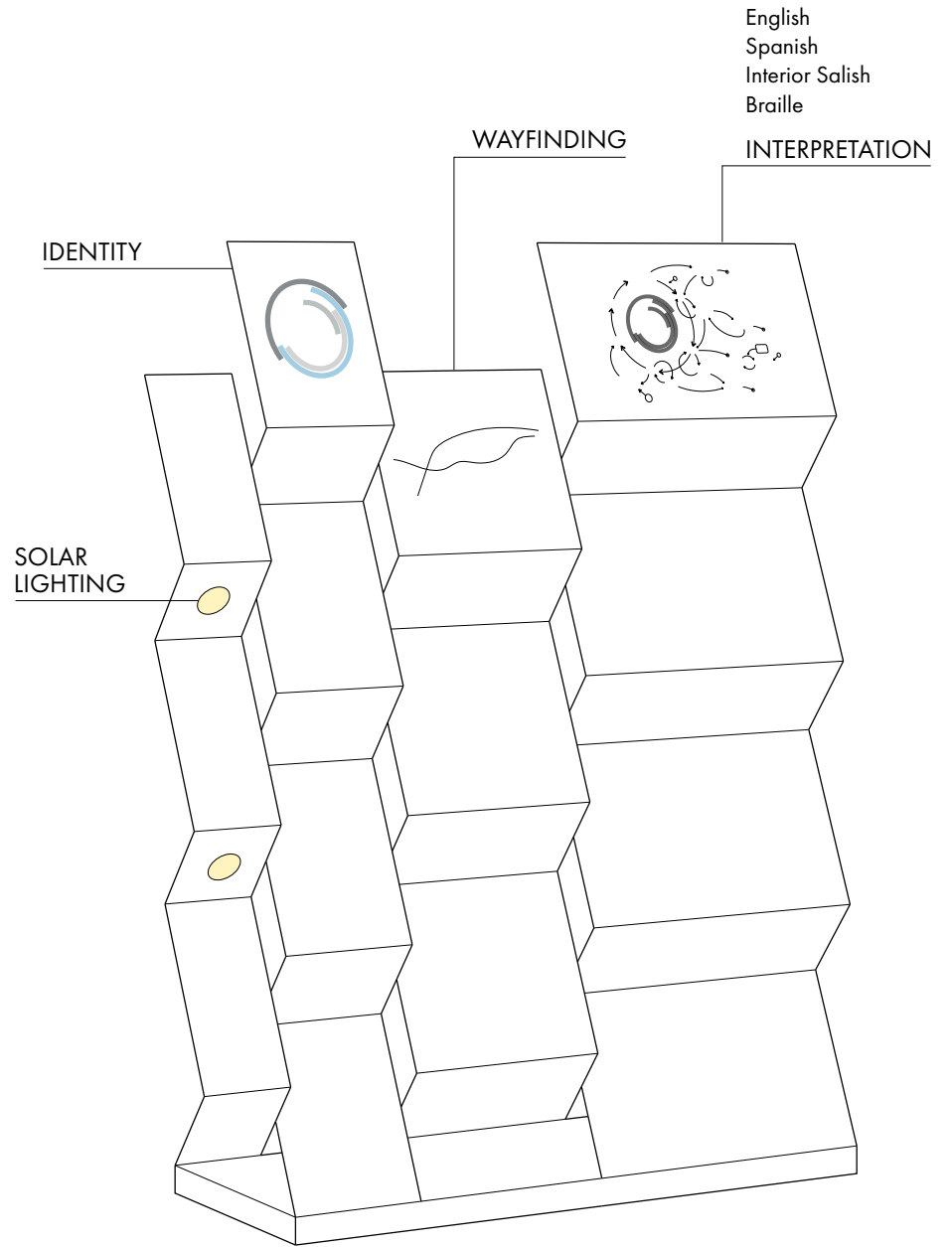
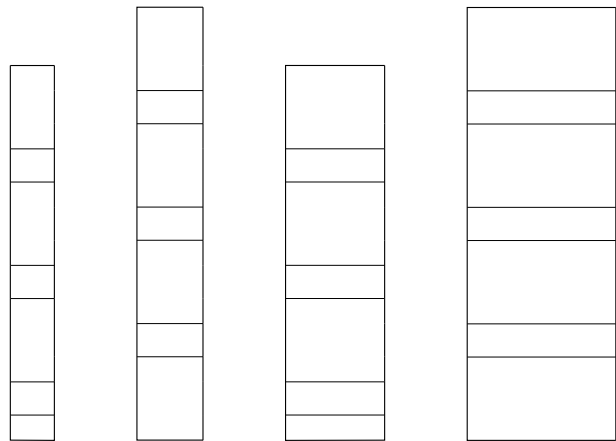
9.27: DESIGN RESEARCH MODELS





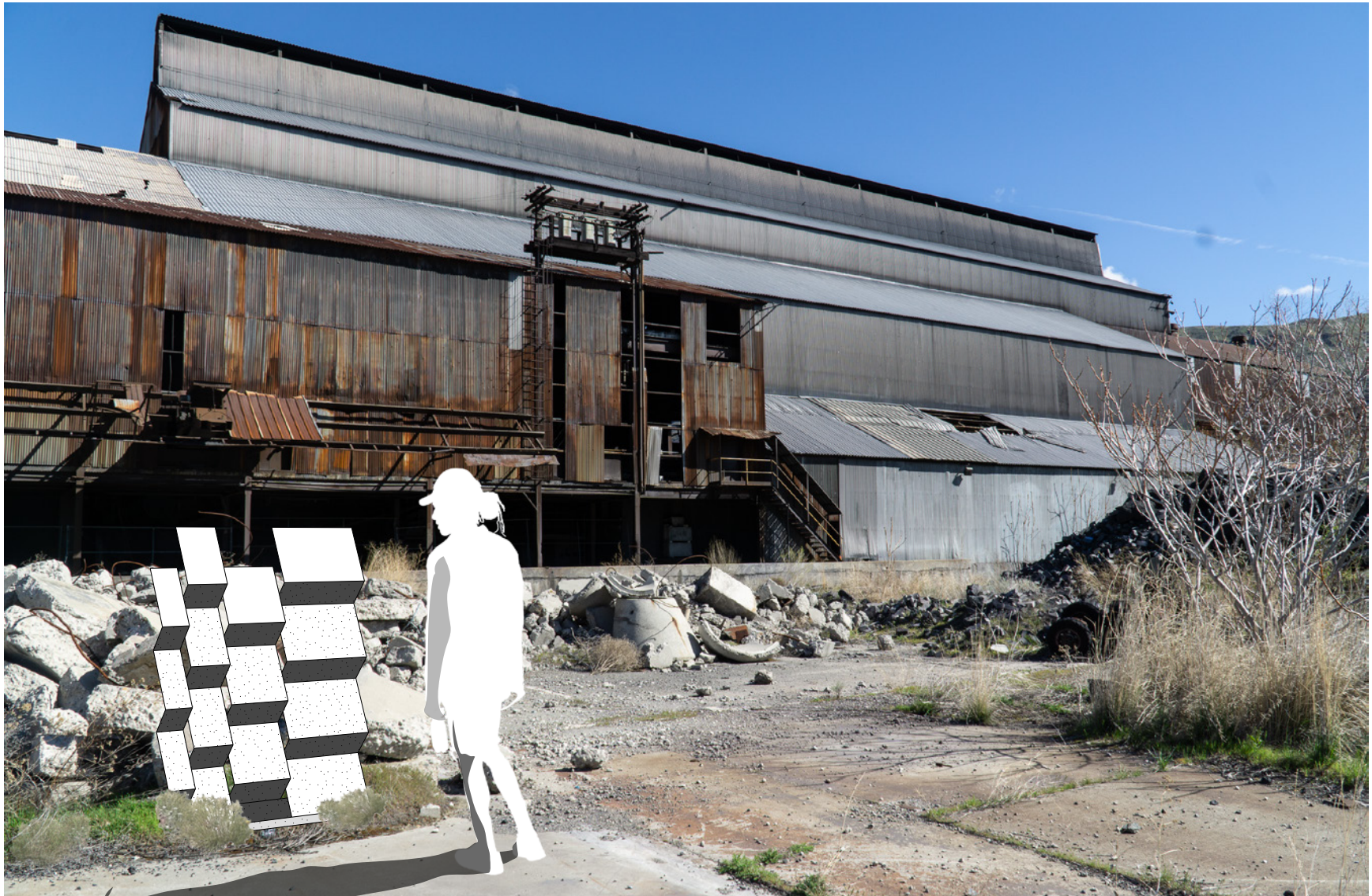


INDIVIDUAL OR GROUPED



9.28: OFFSET CASCADE
WAYFINDING & INTERPRETATION SIGNAGE

9.29: OUTSIDE THE SMELTER BUILDING



MATERIALS & MAKING

Using materials from the site further enmeshes the design into the landscape, and bring people closer to its physical self. Site and local materials will be used as much as possible to guide and construct this design. Silica fume will be reused to make pavers, tiles, blocks, pylons, and anything else appropriate. Aluminum can be used for fasteners, railings, and other components, wood or concrete for handrails, sand for earth blocks or in the concrete mix, rubble for gabion, masonry blocks, and so on.

The locality of the site's processes extends beyond materials. Construction, craft, maintenance, leadership, ownership and profit should also be local. Working with local artisans and material sources would result in different details and designs, and certainly a more richly layered experience.

NIGHTLIGHTING

Solar powered, ecologically-friendly nightlighting is a highlight of the night time experience here. The interpretation and wayfinding signs have lights, along with the nodes. At night, those will act as beacons in the dark. Parts of the path, like bridges, will light up via motion sensor, thereby making a flow of light that follows walkers through the dark.

Ecological night lighting does not disrupt the circadian rhythms of flora or fauna, by using highly localized, downward-facing red-shifted light. The project will work with a lighting designer to create a system that's safe, and also has a feeling of magic and discovery.

CHANGE OVER TIME

Far in the future, when we get our electricity from nuclear fusion and we un-dam the Columbia, this site can be adapted again, and the power line structures creatively reused to new ends. Particalization of our heavy infrastructural systems could someday come through decentralization of control and production.

Silica fume taken from the site to be used in landscape features can be washed and tested. Over time, these materials can be a monitoring mechanism of the site's chemical composition.

The path system can be used as an armature to study and track the different site habitats over time. If needed, people could intervene in the site ecology, to help protect and increase shrub steppe and arid riparian ecozones.

It's highly likely that the area's population will continue to grow. Unless a major shift in society happens, the extents of the human population and settlement will continue to get larger and larger. Protecting places like the Silica Fields is a crucial piece of sustaining biodiversity and biocorridors, as well as cultural heterogeneity and richness.

The landscape itself will continue to be a "landscape factory,"¹ and the effect of silica fume and smelting on the landscape will play out over the years and centuries to come.

1 Conversation with Keith McPeters, May 2, 2019.

RECOMMENDATIONS FOR THE B.I.C.

Though this site study focused on the larger site not included in the proposed building project, many aspects of the site revealed by this study should inform the BIC project and any future site developments. The following recommendations address the ecological and cultural vitality of the whole site.

REVEAL BEACH

The submerged beach near the helipad / beach terrace is a great opportunity to restore and reveal the riparian edge that once existed here. A soft beach can be restored and combined with a hard terrace and boat launch or kayak dock.

RESTORE TULE BEDS

Tules should be replanted along the shallow-grade riparian edges, and in particular in a restored beach. These will help to stabilize the emergent and submerged soil, and create an opportunity for material production and use. This should reengage indigenous peoples and others, to enhance craft and artisanship, and create economic possibilities.

MANAGE LOWPOINT

The lowpoint near the buildings should be the focus of runoff treatment, and possibly retention. Though total rainfall is low, the impervious surface could create flash flood conditions, especially as the climate changes. Due to soil contamination and paving, toxic runoff is a high concern here, and could catalyze a water-based design that ties into a restored beach.

CONDUCT ECOLOGICAL RESTORATION STUDY

A comprehensive ecological health study should be undertaken by regional ecologists. Though 'restoration' was not a main goal of this project, habitat restoration may be the best approach for certain areas vulnerable to invasive monocultures, increased fire risk, or area already disturbed by the building project. Though invasives were seen on site, they were not in any great number, and the shrub steppe and riparian ecosystems appeared healthy. However, an expert opinion is necessary, and a reframing of goals in those terms is advised if found useful.

MATERIALS USE

A workshop or arts center could be incorporated into the building program to use site materials like off-spec silica fume to make things, conduct research, or etc. Landscape materials that are safe to harvest, like the rubble near the lowpoint, should be used in the building-adjacent landscape design and construction.

INCLUDE LATINX AND INDIGENOUS COMMUNITY

The IDD has done some community outreach in forming their goals and plans. Going forward, the past and present community of Rock Island should be invited to more actively participate in the site design, construction, maintenance, and economic activity, and to create its future community. If the Silica Fields trails were to exist, the same is of course true.

10. CONCLUSION

The Rock Island Silica Fields lie at the intersection of water and land, industry and ecology, control and wildness. The dry, black dunes of silica fume, created from quartz and coal, abandoned for decades on a basalt bluff on the north bank of a bend of the Columbia River, are a kind of hinge between deep time and a tenuous but possible future. Cut off from the town by a railroad, defended by fences, property lines, and security cameras, the fields have slowly gone about their business settling into the angle of repose, growing and spreading rabbitbrush, Russian thistle and cheatgrass, on their way to becoming another layer of strata in a region defined by geology. At this critical crossroads, the site is revalued by this thesis.

This project used a framework of **endemism**, **adaptive reuse**, and **particalization** to do site analysis, immersion, and research via overlapping cognitive and embodied knowledge, and ultimately to serve as the guiding forces for the lattice design.

Endemism values uniqueness for its own sake, as a driver of diversity, beauty, community and resilience.

Adaptive reuse is a practical and logistical approach to working with endemism by reusing materials and spaces while introducing new elements of design. Adaptive reuse minimizes footprint and waste, and supports skilled labor and craft.

Particalization is programmatic, spatial and perceptual. It breaks down massive or monolithic systems and structures into small parts, allowing dynamism and diversity. When the smelter was privately owned, closed to the public, and actively smelting, it was a closed fist. If the people of Rock Island saw it

only as a smelter, their minds were also closed to it, and the two sides could not open to each other. By opening the site to the public, and opening the public's minds to the site, the two can intermesh, layering both cognitive and embodied knowledge and creating understanding and appreciation of the diversity and richness within, that results in value.

After **analysis**, **immersion** and **research**, it became clear that the site was already highly particalized, and that industrial and infrastructural use is the very thing that has protected the site and allowed it to flow as particalized novel ecosystems. I found the site to be very beautiful, and to have highly endemic qualities, abundant materials for reuse, and rich opportunities for particalized experiences.

In order for the site to be seen as valuable, people need to understand the site's complex condition. Understanding can only be reached by both cognitive and embodied knowledge, which are created through immersion. To immerse people in the site, the lattice concept was applied to a path and node design for the site. A lattice, like a silica tetrahedron and a truss, creates specific interactions along a thin frame, while allowing flow between its parts. The lattice became the path and node system.

Valuing this place will lead to a positive feedback loop between the community and the site. The site will generate ecotourism, educate and inspire, and be a testing ground and model for reusing and revaluing this kind of site. People will come to care for and understand the site on a deeper level, increasing the likelihood that this site will be protected for its rich biodiversity,

beauty and layers of history, even as it adapts its economic strategies to the future.

Rock Island has shown bold thinking and the ability to accept radical change through its embrace of blockchain mining and server farming, and the IDD and Graham Baba's creation of the Blockchain Innovation Campus. Bold thinking is also required in creating sustainable value for the Silica Fields, and for all kinds of places like this one. Sometimes, the boldest move is to relinquish control, and simply look at what already exists in a new way. In this case, doing absolutely nothing is not possible or desirable, so the design used a lattice concept to create a carefully planned path and node system.

There are many challenging sites like this one in the world, novel and post-industrial, not toxic but not pure or controlled, strangely beautiful or repulsive. Landscape architecture is well equipped to help transform these places into resilient and valuable systems, but the designer's desire to control everything, activate everything, fill a place up with program, and remake the ground in their own image is very strong. We bring our own cultural and aesthetic biases to site analysis and design, which cannot be easily overcome. The framework used in this project can be applied by designers and stakeholders to assess their site and create low-disturbance, lower cost, integrated design approaches. Landscape architects are trained in systems-based design, but often our work results in us trying to create and control those systems. This framework allows us to see that in fact these systems are so strong, it is usually our constant attempts at control that are suppressing them.

We need to look with clear eyes at what exists around us, and resist overlaying our fantasy of aesthetics and control on everything we see. We need to think about how much of our nonrenewable resources we are using. Silica renews itself, but over a cycle of 70 million years. Our need to remake the landscape in our own image, to see, eat and experience the same plants and animals everywhere we are, has resulted in major ecosystem degradation and loss of diversity. We need to learn how to give up control of everything, and to see that the world produces enough abundance, if we work with its systems, instead of against them.

The Japanese architect Kengo Kuma wrote, "*Our smallness is the world's abundance.*"¹ We humans too are particles in the system of the world, but we usually endeavor to become larger, to subsume or control the other particles around us, be they other people, other species, or the atomic particles flowing around us. In order to sustain human life and settlement, we need to be small particles acting along narrow, open frames. We need to allow natural systems more room to breathe and flow, so they can continue to grow and adapt to changing conditions. As human settlement continues to sprawl over the surface of the earth, the lattice concept can help us avoid continuing to rapidly convert soft and heterogeneous landscapes to hard and homogeneous constructions. We evolved in the wild, dynamic world, and we too need wildness and uncontrolled spaces among us, and need to support human diversity to allow many types of peoples and thoughts to mix and synergize. That is how resilient systems work.

1 Kuma 2015, 45

REFLECTION

As the culmination of my master of landscape architecture degree program, the thoughts and ideas I've developed over the last three years related to material culture, lightness, non-violence, non-action² and partialization in terms of landscape found expression and crystallization in the Silica Fields. This site forced me to confront my own urges to remake the world in my own image, and to put my theories into practice. I realized what parts of the project I could design well from my limited access and ability, and what should be suggested or recommended for others to do. The circumstances of the site's development plans force some action to be taken here, and through this project I realized my design could restrain itself *and* provide the value needed to change the course from transformation and control to reinterpretation and coexistence. This was an amazing opportunity that synergized knowledge, experiences and conclusions I never imagined before starting this project, and the realm of my own understanding was stretched far into time and space, both micro and macro.

I too was smelted by Rock Island. ■

2 Though related to the Taoist principle of "Wu-wei" (non-action), here I interpret this phrase to mean taking little or no action, rather than expansionist, positivist problem solving, when these actions often cause more problems than they solve.



Figure 10.1: Fume ponds. April 2019.

LIST OF FIGURES

All image sources are provided in figure captions unless created by the author.

0. CONTENTS

- .1 **Silica fume nanospheres.** Silicaman [CC BY-SA] Retrieved from https://commons.wikimedia.org/wiki/File:Silica_fume_agglomerate,_Transmission_Electron_Microscopy.jpg

1. INTRODUCTION

- .1 **Silicon plant and silica fume waste ponds, 4/19.** Author photo
- .2 **Former Silicon Plant Site.** Nearmap aerial, author photos.
- .3 **Regional Context.** Adapted from Google Earth aerial.
- .4 **Local Context.** Adapted from Google Earth aerial.
- .5 **Town and Site Context.** Adapted from Nearmap and Google Earth aeriels.
- .6 **Central WA Doubles Down on Blockchain.** Don Seabrook/The Wenatchee World/TNS. Retrieved from <https://www.bendbulletin.com/business/6853387-151/central-washington-doubles-down-on-blockchain>
- .7 **Graham Baba's Blockchain Innovation Campus.** Images by Graham Baba.

2. THEORETICAL FRAMEWORK

- .1 **Ericameria nauseosa (rabbitbrush), grasses, and tracks. 4/19.** Author photo.
- .2 **Silicon smelter buildings. 11/19.** Author Photo.
- .3 **Populus leaves, light and dry grass. 11/19.** Author Photo.
- .4 **Chokkura Plaza by Kengo Kuma, 2006.** Kengo Kuma and Associates. Retrieved from <https://kkaa.co.jp/works/architecture/chokkura-plaza/>
- .5 **Dry rabbitbrush with wind-blown seeds. 11/19.** Author Photo.
- .6 **Breaking Down Into Particles.** Graphic by author.
- .7 **Layers of Knowing Across Scales.** Graphic by Author
- .8 **Silicon atoms.** Peter Grünberg Institut (PGI), Retrieved from https://www.fz-juelich.de/pgi/pgi-3/EN/Forschung/Functions/ChargeTransportThroughNanostructures/chargeTransportThroughNanostructures_node.html

3. HISTORY

- .1 **Petroglyphs at Rock Island.** AG Simmer, WA State Historical Society. Catalog ID Number: 2004.0.929
- .2 **Looking east c.1930.** Big Bend Railroad History. Retrieved from <http://www.bigbendrailroadhistory.com/2019/01/1930s-rock-island-bridge.html>
- .3 **Wanapum tule reed structure.** Gladys Mcilveen, UW Digital Collections, NA839.
- .4 **Rock Island Dam c.1950.** Chelan County PUD. Retrieved from <http://www.bigbendrailroadhistory.com/2015/08/rock-island-dam-construction-scene.html>
- .5 **Rock Island railroad bridge c.1905.** GNRHS and NPRHA Joint Archives. Retrieved from http://www.gn-npjointarchive.org/GN_Misc/GNRockIslandbridge_fromoldstereoviewc1905.jpg.
- .6 **Rock Island Railroad Bridge. 4/19.** Author Photo.
- .7 **Site Timeline.** Graphic by the Author.
- .8 **Smelter under construction, 1942.** Big Bend Railroad History. Retrieved from <http://www.bigbendrailroadhistory.com/2016/09/ohio-ferro-alloys-at-rock-island.html>
- .9 **View west, showing the cleared scrub landscape, 1942.** Ibid.
- .10 **The smelter releasing silica fume into the air, 1955.** Ibid.
- .11 **The smelter in 1985.** Ibid.
- .12 **1949 aerial.** Douglas County Public GIS Archives.
- .13 **2018 aerial.** Google Earth.
- .14 **1949 aerial.** Douglas County Public GIS Archives.
- .15 **2018 aerial.** Image Courtesy of Nearmap.

4. ANALYSIS

- .1 **1912 US Geologic Survey map of the Rock Island area.** US Geologic Survey.
- .2 **Town of Rock Island.** Graphic by the Author, using public GIS and LIDAR data.
- .3 **Existing Site Plan.** Graphic by the Author, using public GIS and LIDAR data.
- .4 **Existing Site Conditions.** Image Courtesy of Nearmap.
- .5 **]2009 Douglas County LIDAR survey.** WA Dept of Natural Resources LIDAR portal. Retrieved from <http://lidarportal.dnr.wa.gov/#7.36881:-120.14857:16>
- .6 **Left:** Latitudinal sections. **Right:** Longitudinal sections. Image Courtesy of Nearmap.

- .7 **Site Layers.** Graphic by the Author, using public GIS and LIDAR data.
- .8 **Water Flows.** Graphic by the Author, using public GIS and LIDAR data.
- .9 **Cultural Context.** Graphic by the Author, using public GIS and LIDAR data.
- .10 **Geotourism Context.** Map by Google Earth. **Peshastin Pinnacles State Park.** MS Murphy, Inspirock. Retrieved from <https://www.inspirock.com/united-states/wenatchee/peshastin-pinnacles-state-park-a810888787>. **Saddle Rock.** WenatcheeWA.gov. Retrieved from <https://www.wenatcheewa.gov/Home/Components/FacilityDirectory/FacilityDirectory/48/1312>. Frenchman Coulee. Author Photo. **Ginkgo Petrified Forest.** Northwest Photos. Retrieved from <https://northwestphotos.wordpress.com/2011/08/29/site-seeing-the-scablands-of-washington-state/>
- .11 **Rock Island Climate.** Graphic by the Author, adapted from US Climate Data.
- .12 **Extents of the Shrub Steppe.** Graphic by the Author, adapted from the WA Department of Ecology.
- .13 **Map of toxicity test sites.** EPA Site Report 2013.
- .14 **Crystalline Silica.** Munasir, Triwikantoro, Zainuri Mochamad, & Darminto. (2015). Synthesis of SiO₂ nanopowders containing quartz and cristobalite phases from silica sands. *Materials Science-Poland*, 33(1), 47-55. **Amorphous Silica.** Silicaman (CC BY-SA 3.0) Retrieved from https://commons.wikimedia.org/wiki/File:Silica_fume_agglomerate_Transmission_Electron_Microscopy.jpg
- .15 **Power lines in front of the railroad bridge.** 4/19. Author photo.
- .16 **Initial program ideas.** Adapted from Google Earth aerial.

5. IMMERSION

All images by the author.

6. SILICON & SILICA

- .1 **Silicon metal.** Tongwoo. Retrieved from http://www.tongwoo.co.kr/bbs/bbs/?bbs_no=14
- .2 **Silica quartz.** JJ Harrison, Wikimedia Commons. (CC-BY-SA-2.5) Retrieved from https://en.wikipedia.org/wiki/Quartz#/media/File:Quartz,_Tibet.jpg
- .3 **Feldspar.** Andrew Alden. <https://www.thoughtco.com/gallery-of-feldspars-4122850>
- .4 **Opal.** Gemsounds. Retrieved from <https://gemsounds.files.wordpress.com/2016/01/slide15.jpg>
- .5 **Equisetum.** Rror, Wikimedia Commons (CC BY-SA 3.0) Retrieved from <https://commons.wikimedia.org/wiki/File:Equisetopsida.jpg>
- .6 **Radiolarian.** Picturepest, Wikimedia Commons. (CC-BY-SA-2) Retrieved from [https://commons.wikimedia.org/wiki/File:Radiolarian_-_Podocyrctis_ampla_\(29391267424\).jpg](https://commons.wikimedia.org/wiki/File:Radiolarian_-_Podocyrctis_ampla_(29391267424).jpg)
- .7 **Diatoms.** Gordon T. Taylor, Stony Brook University. 2365, NOAA Corps Collection.
- .8 **Gravel aggregate.** Home Depot. Retrieved from <https://www.homedepot.com/p/Vigoro-0-5-cu-ft-All-Purpose-Decorative-Stone-54775V/202026926>
- .9 **Fused silica glass.** Corning. Retrieved from <https://www.corning.com/cal/en/products/advanced-optics/product-materials/semiconductor-laser-optic-components/high-purity-fused-silica.html>
- .10 **Silicon wafer semiconductors.** Viewpoints on Innovation. Retrieved from <http://viewpoints.io/entry/three-new-leading-practices-for-semiconductor-innovation.jpg>.
- .11 **The Silica Cycle.** Graphic by the author.
- .12 **Silica fume nanospheres.** Jo et al. (2007), *Construction and Building Materials*, Vol. 21, Fig. 1, p. 1352
- .13 **Silica fume on the site.** 4/19. Author photo.
- .14 **Aerial showing fume ponds and storage area.** Image courtesy of Nearmap.
- .15 **Fume dunes.** 11/19. Author photo.
- .16 **Silica flow on site.** Image courtesy of Nearmap.
- .17 **Silica processing on site, 1948-1999.** Graphic by the author.
Raw Materials: Author photos.
Silica Fume, Top: Henan Superior Abrasives. Retrieved from <http://www.microsilica-fume.com/product/94-silica-fume.html>. **Bottom:** Jo et al. (2007), *Construction and Building Materials*, Vol. 21, Fig. 1, p. 1352.
Silicon Metal, Top: Alternativ Gesund. Retrieved from <https://shop.alternativgesund.de/kolloide/mehr-kolloide/kolloidales-silizium.html> **Bottom:** Peter Grünberg Institut (PGI), Retrieved from https://www.fz-juelich.de/pgi/pgi-3/EN/Forschung/Functions/ChargeTransportThroughNanostructures/chargeTransportThroughNanostructures_node.html
Dumped on Site: Image courtesy of Nearmap.
Fume Sold as Concrete Additive: Viaduc des Angels. Marie Photo Passion, Wikimedia Commons. (CC-BY-SA-2) Retrieved from https://fr.wikipedia.org/wiki/Fichier:Viaduc_des_Angles_A_89_-_Naves,_Corrèze,_France-2.jpg

Sold for Aluminum Alloy, Top: Alcoa. Retrieved from <https://www.alcoa.com/global/en/what-we-do/aluminum/default.asp> **Bottom:** Alcoa Wenatchee Works, Seattle Time. Retrieved from http://www.ifiberone.com/columbia_basin/alcoa-wenatchee-works-remains-idle-but-manages-to-pay-million/article_fd2d29a2-733d-11e8-99a0-074ca34489c2.html

7. DESIGN FRAMEWORK

- .1 **Cognitive and Embodied Experiences.** Graphic by the Author.
- .2 **Lattice Framework.** Graphic by the Author.

8. CASE STUDIES

- .1 **Concrete path dissolving into the rock.** Estudio Marti Franch (EMF). Retrieved from <http://www.emf.cat/en/projects/l/253-public-reception-project-in-the-site-of-tudel.html>
- .2 **The Club Med Site Before Restoration.** Ibid.
- .3 **Interpretation Marker.** Ibid.
- .4 **Path delineated by a low railing.** Ibid.
- .5 **A steel grate elevated path.** Ibid.
- .6 **Willamette Falls Hydroelectric Dam, 2015.** Edison Tech Center. Retrieved from <https://edisontechcenter.org/Willamette.html>
- .7 **Willamette Falls project rendering.** Snøhetta, Mayer/Reed, and Dialog. Retrieved from <https://snohetta.com/projects/336-willamette-falls-riverwalk>
- .8 **Site Plan and Rendering.** Ibid.

9. DESIGN

- .1 **View of the River's Edge node area.** Author Photo.
- .2 **Proposed Plan.** Graphic by the Author, using public GIS and LIDAR data. .
- .3 **Path Experience.** Graphic by the Author, using public GIS and LIDAR data.

- .4 **Access Types.** Graphic by the Author, using public GIS and LIDAR data.
- .5 **Node Design Research.** Google Earth, Wikimedia, PGI, Author Photos.
- .6 **River Overlook.** Graphic by the Author.
- .7 **Looking east along the Columbia from the River Overlook.** Author Photo.
- .8 **Looking south towards the bridge from the Rail Overlook.** Author Photo.
- .9 **Rail Overlook.** Graphic by the Author.
- .10 **Path Types.** Graphic by the Author, using public GIS and LIDAR data. .
- .11 **Do Nothing.** Author Photo.
- .12 **Clarify Edges.** Author Photo.
- .13 **Leave Open Ended.** Author Photo.
- .14 **Inlaid Tracks.** Graphic by the Author.
- .15 **Existing Remnants.** Author Photo.
- .16 **Stabilize Hillclimb.** Author Photo.
- .17 **Protect Habitat.** Author Photo.
- .18 **Safe Access.** Author Photos.
- .19 **Low Boardwalk, Silica Fume Tiles in a Frame.** Graphic by the Author.
- .20 **High Boardwalk.** Graphic by the Author.
- .21 **Smedenpoort Bridge by Ney & Partners.** Urbastyle. Retrieved from https://www.urbastyle.com/sites/default/files/smedenpoort_passerelle_side.jpg
- .22 **Use Fume From Storage Sheds To Make Tiles.** Author Photo.
- .23 **Bridge Over Railroad.** Author Photo.
- .24 **Cross Unstable Terrain.** Author Photo.
- .25 **Through Smelter** Author Photo.
- .26 **Wayfinding Design Research.** Big Bend Railroad History, Author Photos.
- .27 **Design Research Models.** Author Photos.
- .28 **Offset Cascade Wayfinding & Interpretation Signage.** Graphic by the Author.
- .29 **Outside the Smelter Buildings.** Author Photo.

10. CONCLUSION

- .1 **Fume ponds, 4/19.** Author Photo.

BIBLIOGRAPHY

Arksey, L. (2008) *Wenatchee - Thumbnail History*. HistoryLink.org Essay 8634. <https://www.historylink.org/File/8634>

Bégin, G. (2017) *Rock Island River Acreage*. The Wenatchee Business Journal, 07/05/2017.

Bell, T. (2019) *The Properties and Uses of Silicon Metal*. The Balance. <https://www.thebalance.com/metal-profile-silicon-4019412>

Bognar, Botund. (2009). *Material/Immaterial: The New Work of Kengo Kuma*. New York: Princeton Architectural Press.

Braae, E. (2015). *Beauty redeemed: Recycling post-industrial landscapes*. Risskov : Basel: IKAROS Press ; Birkhäuser.

Branch, M. (2012, January). The Hills Are Alive. *Places Journal*. Accessed 29 Nov 2018. <https://doi.org/10.22269/120103>

Cheney, E. (2009) *Floods, Flows, Faults, Glaciers, Gold and Gneisses, From Quincy to Chelan to Wenatchee*. Northwest Geological Society Field Guide, June 2009.

Clement, G., Tiberghien, G. A., & Morris, S. (2015). *The planetary garden and other writings* (Penn studies in landscape architecture). Philadelphia: University of Pennsylvania Press.

Cronon, W. (1996). 'The Trouble with Wilderness; or, Getting Back to the Wrong Nature', in, *Uncommon ground: Rethinking the human place in nature*. New York: W.W. Norton & Co.

Department of Labor. Employment and Training Administration. (1999). *American Silicon Technologies, Rock Island, WA*. Federal Register [TA-W-35,535] <https://www.govinfo.gov/content/pkg/FR-1999-07-23/pdf/99-18841.pdf>

Dilsaver, L. (2016). A National Park in the Wasteland: American and National Park Service Perceptions of the Desert. *The Public Historian*, 38(4), 38-55.

Federal Energy Regulatory Commission Office of Hydropower Licensing. (1987). *Rock Island Hydroelectric Project No. 943*. Washington: Environmental impact statement.

France, R. (2012). *Environmental restoration and design for recreation and ecotourism* (Integrative studies in water management and land development). Boca Raton, FL: CRC Press.

Gosden, C. (2004). *Esthetics, Intelligence and Emotions: Implications for Archeology*. In, DeMarrais, E., Gosden, C., Renfrew, C., & McDonald Institute for Archaeological Research (eds.) *Rethinking materiality: The engagement of mind with the material world* (McDonald Institute monographs). Cambridge: Oakville, CT: McDonald Institute for Archaeological Research; Distributed by Oxbow Books, David Brown Book.

Goshall, D., and Lopez, D. (2018) *In Praise of Illegibility*. Terremoto LA. Retrieved Dec 1, 2018 from <http://terremoto.la/project/abbott>

Heffter, E. (2003). A forgotten tribe, a lost homeland The Wenatchi people, with hearts set on reclaiming their long-promised reservation near Leavenworth, have finally captured the attention of lawmakers. (ROP News). *The Seattle Times* (Seattle, WA), p. A1.

Hobbs, R. J., Higgs, Eric, and Hall, Carol M. (2013). *Novel Ecosystems : Intervening in the New Ecological World Order*. Chichester, West Sussex ; Hoboken, NJ: Wiley-Blackwell.

Hollander, J., Kirkwood, Niall, & Gold, Julia L. (2010). *Principles of brownfield regeneration: Cleanup, design, and reuse of derelict land*. Washington: Island Press.

Hull, L. (1929). *A history of central Washington including the famous Wenatchee, Entiat, Chelan and the Columbia Valleys : With an index and eighty scenic-historical illustrations*. Spokane: Shaw & Borden.

Kerschner, J. (2010) *East Wenatchee - Thumbnail History*. HistoryLink.org Essay 9553.

Kennen, K., & Kirkwood, Niall. (2015). *Phyto: Principles and resources for site remediation and landscape design* (First ed.). New York, NY: Routledge.

Kuma, Kengo. (2013). *Anti-object*. London: Architectural Association.

Kuma, Kengo. (2015). *Small Architecture, Natural Architecture*. London: Architectural Association.

Leng, M. (2013) The Global Silicon Cycle. Geoblogy: Science from the Core of the British Geological Survey. <http://britgeopeople.blogspot.com/2013/02/the-global-silicon-cycle-by-prof.html>

Limerick, P. (1985). *Desert passages: Encounters with the American deserts* (1st ed.). Albuquerque: University of New Mexico.

Link, S., Mast, W., & Hill, R. (2006) Shrub Steppe. In, Sinclair, M., Apostol, D., & Society for Ecological Restoration International (eds). *Restoring the Pacific Northwest: The Art and Science of Ecological Restoration in Cascadia*. Washington, DC: Island Press.

Merchant, C. (2010) *Environmentalism: From the Control of Nature to Partnership*. Bernard Moses Memorial Lecture, University of California at Berkeley (5/4/2010).

Merlino, K. (2018). *Building reuse: Sustainability, preservation, and the value of design* (Sustainable design solutions from the Pacific Northwest). Seattle: University of Washington Press.

Nassauer, Joan Iverson. (1995). Messy Ecosystems, Orderly Frames. *Landscape Journal*, 14: 2, 161-170.

Nisbet, J., & Nature Conservancy of Washington. (1999). *Singing grass, burning sage: Discovering Washington's shrub-steppe*. Portland: Graphic Arts Center.

O'Connor, G., & Wieda, Karen. (2001). *Northwest arid lands: An introduction to the Columbia Basin shrub-steppe*. Columbus, OH: Seattle, WA: Battelle Press; Distributed by University of Washington Press.

Pallasmaa, J. (1996). *The Eyes of the Skin, Architecture and the Senses*. New York: Wiley.

Preservation Green Lab. (2016). *The Greenest Building: Quantifying the environmental Value of building reuse*. National Trust for Historic Preservation.

Rader, C., Behler, M., & Wenatchee Valley Museum Cultural Center. (2012). *Wenatchee* (Images of America). Charleston, S.C.: Arcadia Pub.

Renfrew, C. (2004) Towards a Theory of Material Engagement. In, DeMarrais, E., Gosden, C., Renfrew, C., & McDonald Institute for Archaeological Research (eds.) *Rethinking materiality: The engagement of mind with the material world* (McDonald Institute monographs). Cambridge: Oakville, CT: McDonald Institute for Archaeological Research.

Ruby, R., Brown, J., Collins, C., Kinkade, M., & O'Neill, S. (2010). *A guide to the Indian tribes of the Pacific Northwest* (3rd ed. / revised and updated by Sean O'Neill. ed., Civilization of the American Indian series; v. 173). Norman: University of Oklahoma Press.

Silica Fume Association of America. (n.d.) Website, <https://www.silicafume.org>

Thompson, R. (2002). *False promises: The lost land of the Wenatchi* (Filmmakers Library online). New York, NY: Filmmakers Library.

Thoren, R. (2014). *Landscapes of change: Innovative designs and reinvented sites*. Portland, Oregon: Timber Press.

Treib, M. (2016). *Austere gardens: Thoughts on landscape, restraint, & attending* (First ed.). Novato, California: ORO Editions.

Washington Native Plant Society. (2018) The Shrub Steppe. <https://www.wnps.org/ecosystems/shrub-steppe>

Washington State Department of Ecology. (2012) Preparing for a Changing Climate, Washington State's Integrated Climate Response Strategy. Pub 12-01-004. <https://fortress.wa.gov/ecy/publications/documents/1201004e.pdf>

Wong, L. (2017). *Adaptive reuse: Extending the lives of buildings*. Boston: Birkhäuser.