Culture of Energy: Rethinking the Inherent Value of Landscapes of Energy Extraction

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Figure 1. Aerial View of Kern River Oil Field, 2010

CHAPTER 01 | INTRODUCTION

Since the late 19th century the Kern River Oil Field in Bakersfield, California has produced over two billion barrels of oil and played a major role in establishing the petroleum industry's economic dominance in California's San Joaquin Valley. Today oil competes with agriculture in defining the economic and cultural identity of this fertile landscape, however, the Kern River Oil Field reached peak oil production in 1985 and has since been in a slow decline. Soon oil extraction on this site will cease, leaving acres of scarred industrial landscape and obsolete infrastructure (Figure 1).

As the end of the petroleum era nears what will become of these unique "landscapes of energy" that exist throughout the world? The phenomenological and social significance of these places could be forever lost as they are abandoned or erased in favor of new land uses. This thesis will explore how a landscape of energy extraction and its infrastructure embody a value

greater than the sum of its parts. I propose that the Kern River Oil Field symbolizes our culture's relationship to energy and fuel consumption and has become a prominent urban landmark in an energy producing region. Furthermore, this underutilized landscape presents a unique opportunity to integrate new land uses that will reactivate the space in new ways while maintaining and enhancing the historic identity of the site.

Analyzing petroleum as a catalyst for the expansion of the geographical, social and perceptive landscape of Southern California, this project will frame an argument for the cultural influence of the Kern River Oil Field. An analysis of the site's operations and infrastructure will provide a framework for repurposing and reoccupying the site that is unique to this landscape's character (Figure 2).

This project proposes a series of interventions that seek to directly connect the site with the community by tapping into existing cultural and recreational networks. A new cultural facility will provide exhibition and research space to support the work of the Center for Land Use Interpretation, a small organization that seeks to enhance our understanding of how society uses and manipulates land.[1] This facility will operate as a field office

Figure 2. Cogeneration Plants

for CLUI's researchers and artists. Public exhibition spaces will combine research-based interpretive exhibits with artistic works and installations in order to capture the multitude of viewpoints embedded in landscapes of energy.

The site will continue to be a place of energy production through the integration of new renewable energy technologies. But by including a program of knowledge production and recreation this project will overlay previously disparate uses and user groups, inviting unique experiences and challenging our relationship to industrial landscapes.

Endnotes

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Figure 3. Kern River Oil Field as seen from Panorama Vista

CHAPTER 02 | THEORETICAL FRAMEWORK

Culture of Energy

Architecture does not exist as a static object in the landscape. Architecture is the result of the consumption, reorganization, and reinterpretation of matter and energy over time. The built environment is a representation of humanity's biological need to consume energy to fuel our bodies, shelter our families, and modulate our environment. Unfortunately all sources of energy are finite and humanity must continuously struggle to find new resources to fuel our society. Historically energy sources have come from the earth, extracted from within its depths, cleared from the surface, or captured through mechanization. Inherent in the process of energy production has been the manipulation of the landscape through the removal of natural resources and the imposition of technology (Figure 3). Thus the need for energy has directly shaped the landscape. Furthermore, a shift in the

abundance of energy and efficiency of its use can alter humanity's perception of its value, resulting in effects that can be read across the built environment. As today's society transitions from the petroleum era into a renewable energy one, we must choose whether to ignore the value and meaning of energy's influence or to embrace and exploit it as a material and intellectual resource for the future. In order to better understand energy's relationship to humanity and to architecture this project will begin by looking at the concept of energy and the connection between energy and materials. Then an analysis of the sites of petroleum production will begin to reveal the spatial connections between energy and the landscape. Lastly this section will consider the influence of energy at the urban and regional scale through the unprecedented population dispersal and spatial development of the Los Angeles basin.

...a primitive tribe...has just come across a clearing in the wood where it plans to spend the night...There are fallen branches and some wood in the clearing. The tribe has a dilemma: whether to use the wood to build a small shelter or as firewood for a bonfire. An entire theory of architecture is encapsulated in this simple question.[2]

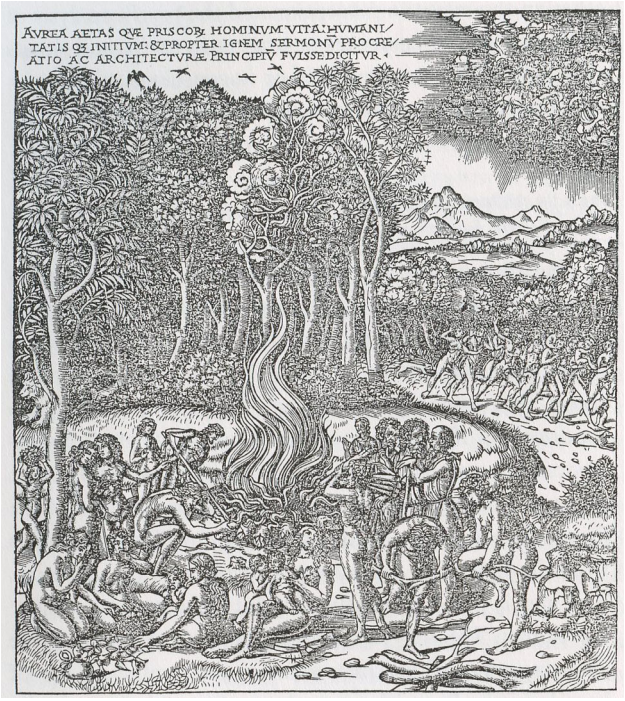

Figure 4. The Discovery of Fire

Manipulation and Understanding

In the most pragmatic sense energy supports life by enabling the manipulation of matter for the purpose of performing a task so that: "without energy, the movement of matter is reduced to locomotion, trajectories, and elastic collisions; without energy there are no processes or transformations; without it there is no life, which requires a constant flow of energy"[3] (Figure 4). Fire endures as a symbol of civilization because of its ability to manipulate and transform other elements that would otherwise remain static. The conversion of natural resources like wood, wind and the sun into a source of power is necessary for humanity's survival. Fire's role in supporting life manifests itself in the collective consciousness through tales of the origins of civilization. Spanish Professor of Architecture Luis Fernandez-Galiano expounds upon the myths that mark the discovery of fire as the foundation of civilized society. Using Reyner Banham's parable about the origins of architecture as power versus structure he writes, "it is the discovery of fire that gives rise to human society ('the collaboration between men, the communal life and coincidence of many in one place'), and with it, the construction of the first shelters and huts"[4] (Figure 5). In this example "Architecture" also holds symbolic meaning by

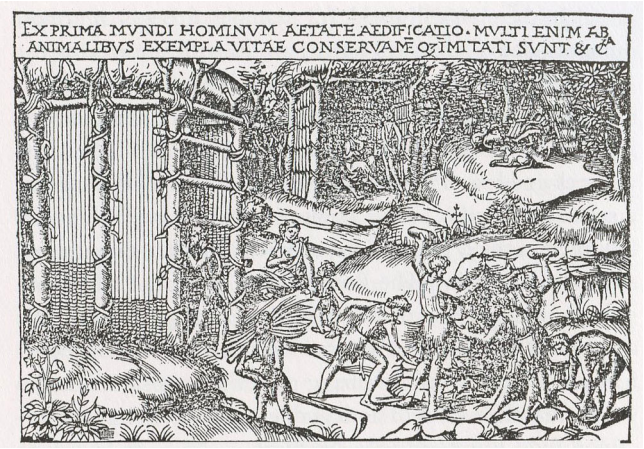

Figure 5. Building the first shelters and huts

representing the sophisticated shelter of a civilized society versus the simple shelters of primitive man. Fernandez-Galiano observes that popular tropes in literature further develop architecture's relationship with energy through equating the symbolic shelter or "home" with the warmth of the hearth and the "heart of the home." Thus energy and our ability to capture and manipulate it has a profound impact on our collective understanding of our society, especially with respect to architecture and the experience of the built environment.

According to Fernandez-Galiano "architecture can be understood as a *material* organization that regulates and brings order to *energy* flows; and, simultaneously and inseparably, as an *energetic* organization that stabilizes and maintains *material* forms."[5] Construction requires the manipulation of the environment through human skill and knowledge with the ultimate goal being the ability to serve a purpose. In this way buildings and their landscapes become artifacts of man, embodying in their form information about the processes and materials that went into their construction. Furthermore, humanity's relationship to energy and fuel consumption can be read in the built environment:

> the information that is inherent in present structures and which can be used to reconstruct the past can be

Figure 6. "Oilfield #19b" Belridge, CA - Burtynsky

> considered to be a true reflection of the energy used and degraded in the past. This energy has not been altogether lost, since the structures it has formed or informed remain important in channeling future changes, rendering certain future states more probable than others.[6]

Fernandez-Galiano's position describes the potential to extract information or knowledge from existing landscapes of energy in order to promote change in the future.

As humanity begins to consider a post-petroleum world, sites of oil extraction hold an incredible wealth of information regarding the dynamic relationship between society and energy (Figure 6). Understanding and learning from past manifestations of energy and architecture will ultimately lead to more efficient sites of energy production and consumption. Galiano describes this phenomenon when he states,

> There are hence two senses in which expended energy is actually conserved: as material organization making for a more efficient subsequent use of energy, and as mental organization resulting from a process of acquiring experience, which likewise leads to increased efficiency... Used energy accumulates as form or information resulting in greater efficiency in the subsequent use of energy.[7]

Landscapes of energy production embody value that exceeds the mineral resources held by the earth. The physical makeup of these sites, along with their economic and social significance, suggest

Landscapes of energy extraction are portals, wormholes between two worlds in which time and space work differently.[7]

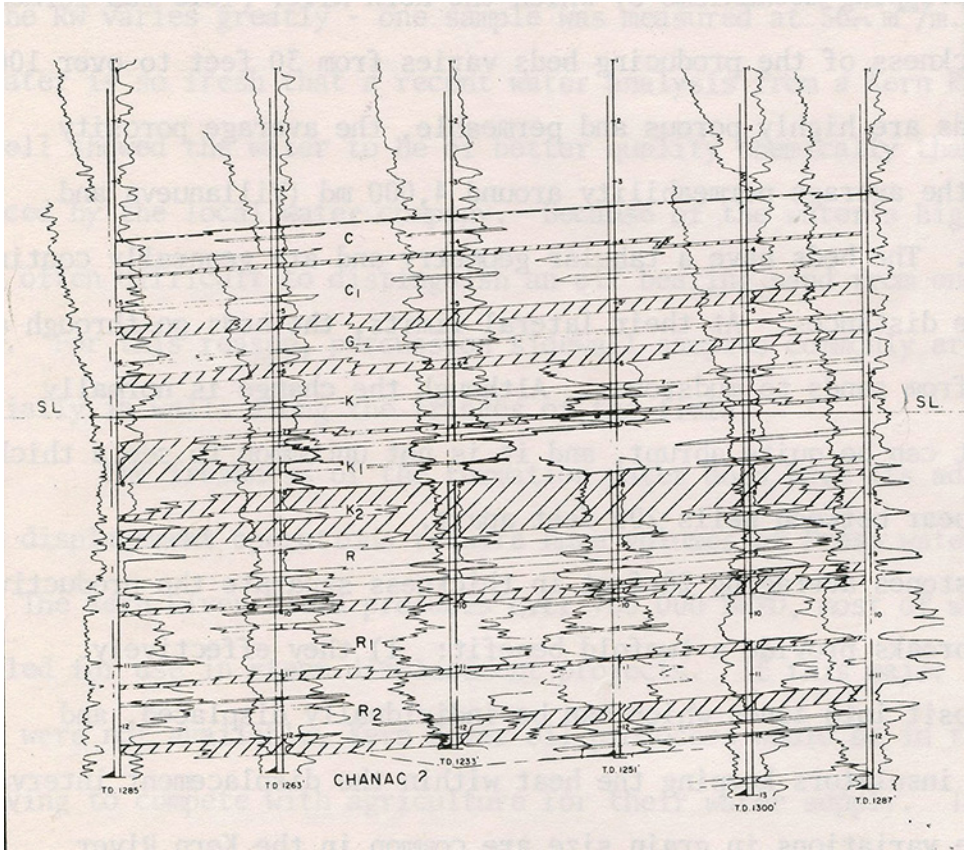

Figure 7. Cross section of geologic formations below the Kern River Oil Field, 1980

the potential to exploit this value in order to create unique and meaningful experiences. With this concept in mind we can begin to analyze the physical elements of these landscapes and their embedded value.

Reading Landscapes of Energy

The form of an industrial site contains a wealth of embodied information about the processes that shaped the site over time. Petroleum landscapes, in particular, hold distinctive characteristics that reveal the spatial influence of the extraction and distribution process and can begin to provide a new perspective on humanity's relationship with energy. The extraction process disrupts and manipulates naturally occurring relationships between time and space and parallels macro-scale shifts in urban development that occurred early in the petroleum era.

Extracting petroleum utilizes vast fields of wells that break the boundary between the surface world and layers of earth below. Time characterizes the geologic realm, with natural processes manipulating geologic material over millennia, this has been described as the world of "natural production" by Gavin Bridge (Figure 7). Movement, flow, and human experience characterize

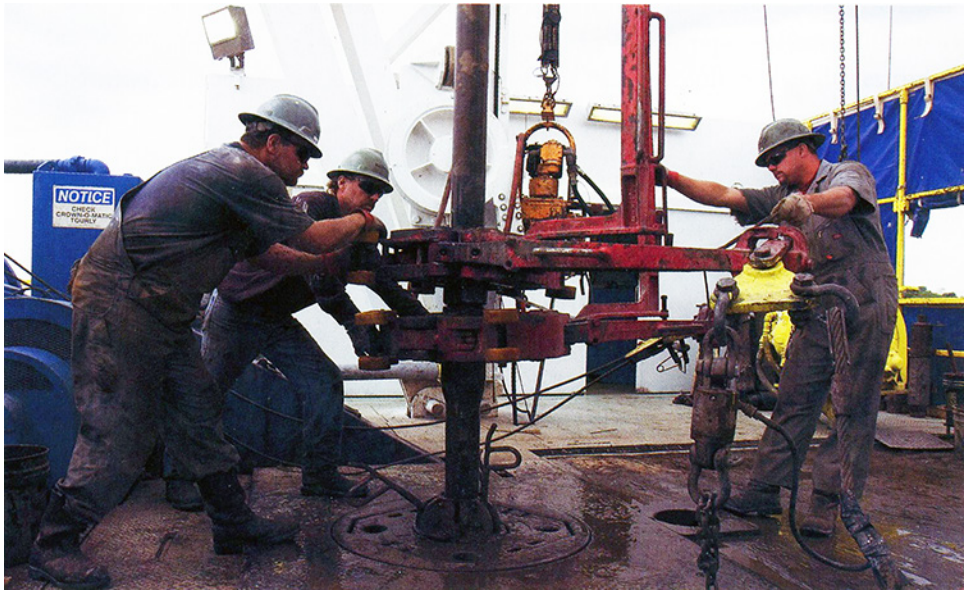

Figure 8. Drilling operations

the surface world of "social production"[9], where one measures change over days, hours, and seconds. Without regard to the geologic relationships below, petroleum extraction exploits nature's processes by drilling deep into the earth in an attempt to locate crude oil (Figure 8). This process transitions oil from a geologic element, subject to geologic time and force, into a source of energy for rapid human consumption at the surface. Time is effectively compressed as extraction, distribution, refinement, and combustion all occur within a very short timeframe compared to the thousands of years needed for formation.

Once extracted crude oil experiences patterns of rapid dispersal and concentration across the site in order to purify the product. A network of pipelines and storage nodes characterize the surface of the Kern River Oil Field. Processing occurs periodically at these nodes to further extract the most valuable elements and remove waste. Distribution pipelines move valuable material to storage nodes while waste moves to treatment systems or disposal sites. This distribution system expands the functional limits of petroleum as distant points become interconnected across space (Figure 9). At the regional scale the oil field becomes a point in a larger distribution network consisting of railroad transportation and

Figure 9. "Oil Refineries #32" Houston, Texas - Burtynsky

dedicated regional oil pipelines that allow continually flowing fuel to traverse even greater distances as part of a nationwide system.

The process of combustion transforms petroleum from its refined state into a useful form of energy that can be converted into power and used to perform work. This is how society "consumes" petroleum, by exploiting its ability to fuel the movement of mechanical systems. The consumption of petroleum, much like the extraction process, resulted in urban-scale transformations of the landscape and shifts in society's spatial understanding of distance and travel. The most notable influence can be found in the automobile revolution of the early to mid-twentieth century and its subsequent reshaping of the urban experience:

> The car as the new consumer of oil spurred the construction of extensive highway and road systems that favor long-distance transport. Oil companies have actively promoted the expansion of transportation systems. They distributed road maps designed to entice car users to destinations that were ever farther away. As these networks expanded, companies erected networks of gas stations to encourage drivers to go even farther.[10]

The introduction of automobile technology is only one example of a broader cultural shift toward expansion across great distances and the dispersal of people and material across space (Figure 10).

Through their inherent characteristics and functional history

petroleum sites act as a microcosm of the larger impact of the petroleum age. In order to understand the relationship between energy and culture, we must retain and exploit elements of these landscapes of extraction. Depleted or abandoned extraction sites can be made productive again by becoming sources of cultural meaning that recall the past through form, interpretation, and experience. The following section will further outline the large-scale impact of petroleum on urban development by examining the relationship between the spaces of petroleum extraction and the evolving urban environment of the early twentieth century.

Figure 10. "Breezewood" Pennsylvania, USA - Burtynsky

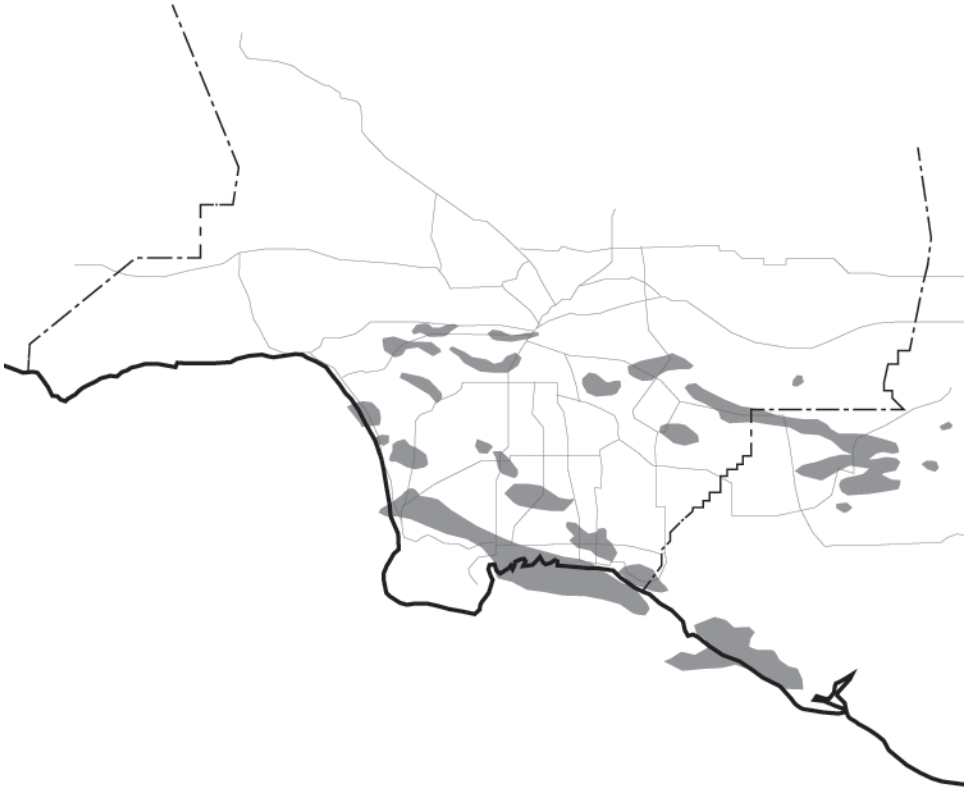

Figure 11. Los Angeles oil fields

Oil & Los Angeles

The commonly held assumption is that Hollywood, with its visibility through film production, movie stars, and popular culture, is the economic engine of the Los Angeles region. Few would even consider the region's historic foundations in petroleum extraction and refining. Oil extraction began in Los Angeles in 1892 and continues to this day, with a production to date of over 8.5 billion barrels of oil from around 3,000 wells (Figure 11). In the early twentieth century the discovery of oil brought a flow of energy, industry, and prosperity to the region that forever altered the city's development and economic activity. An analysis of urban expansion across the Los Angeles basin uncovers underlying economic and social connections between energy production and the region's urban development.

Throughout the late nineteenth century the newly established City of Los Angeles had few naturally occurring fuel sources to spur any industrial development, leaving agriculture as the primary economic power. But with the discovery of the region's rich oil resources came the rapid acceptance of petroleum as a source of fuel. According to Frank Ruchala, Los Angeles became

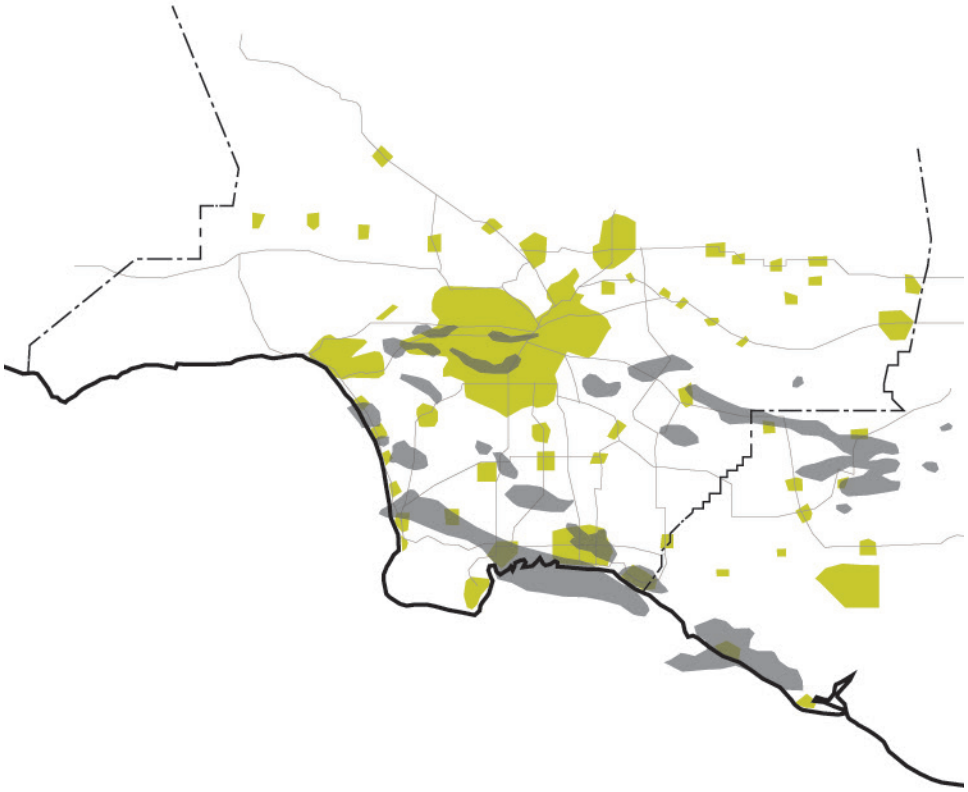

Figure 12. Los Angeles area urban development, ca. 1910

one of the first petroleum dependent American cities,

> At the turn of the century, California's per capita coal consumption fell to less than one-half ton, a fraction of the nation's 5.3 ton average. California was fueled by oil. Between 1900 and 1910 per capita oil consumption in the state climbed from three to twenty-eight barrels, compared with one-half to two barrels nationally.[11]

Citizens enjoyed modern amenities not found in other cities, including paved roads and electric lighting, all in some way a product or by-product of oil.[12] This source of abundant energy brought wealth, economic development, and eventually population growth.

Cheap energy and abundant land resulted in low-density construction as the extraction economy attracted adjacent industries such as metal production, refining, and electricity generation. New settlements were established in close proximity to oil extraction sites[13] (Figure 12 & Figure 13). A unique decentralized regional infrastructure emerged with industrial nodes established at and around oil fields. This pattern spawned further industrial and residential development in support of the petroleum industry. Typically any new industrial and residential development was of a low density, following similar patterns occurring elsewhere in the United States.[14] The increased popularity of single-family housing

Figure 13. Santa Fe Springs, California ca. 1920s

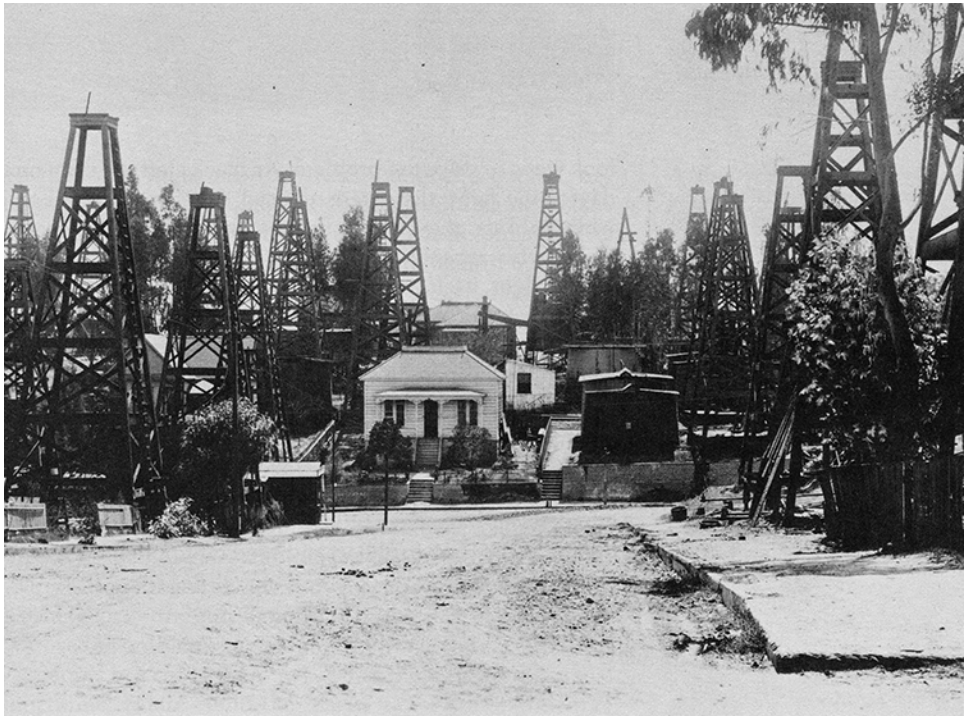

Figure 14. Wooden derricks crowding residences on Court Street in Los Angeles, 1901

supported the creation of expansive residential neighborhoods across the landscape, often in direct conflict with industrial land uses (Figure 14). Similarly manufacturers embraced the efficiency of low-density large open spaces for factory buildings and warehouses throughout newly industrialized settlements.[15]. Although other factors, such as flat terrain and access to water, influenced the density of this development pattern, sites of petroleum production acted as nodes that anchored the region's dispersed population across a large land area (Figure 15).

Transportation provided the freedom of movement that was and continues to be so critical to interfacing with this type of built environment. Over time the region's fragmented settlement patterns were joined through an interconnected public and private transportation infrastructure that included the petroleum powered Pacific Electric Railway and the region's famous freeway system. The introduction of the automobile in the early nineteenth century, fueled by gasoline, expanded the bounds of physical movement across the region by providing instant personal access to rapid transportation. Fossil fuels further supported the growing popularity of the automobile by providing cheap gasoline and related infrastructure[16]. Vehicle storage became a necessity in

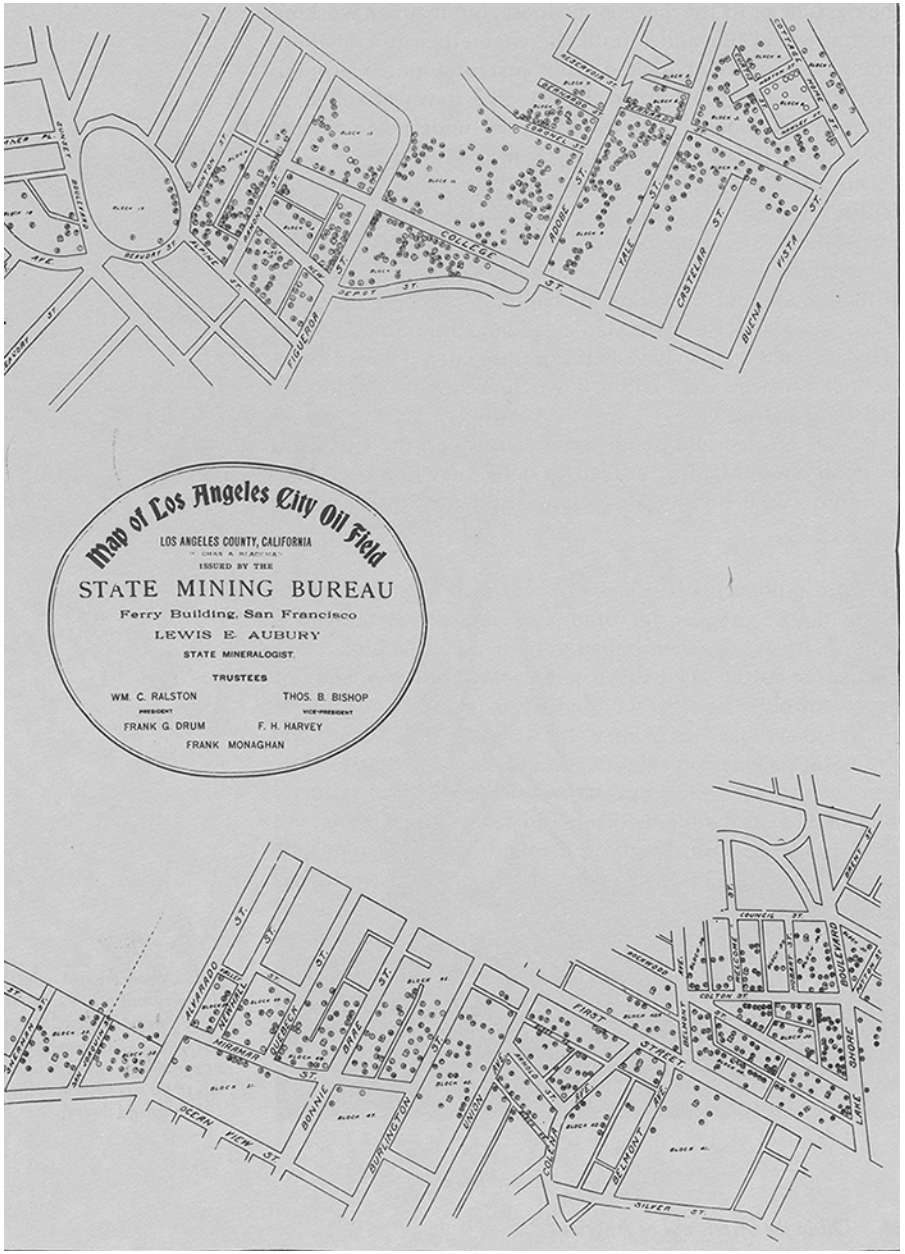

Figure 15. State Mining Bureau map of the City field, Los Angeles, 1903

order to accommodate the concentration of automobiles at various destinations resulting in the creation of parking lots and garages. This fuel distribution and storage infrastructure was expanded to provide gasoline-dispensing facilities across the region and eventually the nation, increasing the range and viability of automobile transportation.[17] Dispersed urban development patterns, together with shifting transportation preferences, created a self-sustaining loop that locked the region into the unique spatial development that defines Los Angeles today.

Cognitive perception of the region shifted along with the physical ability to transport individuals across longer distances in automobiles. The spread of many equally prominent nodes established by oil interests diluted the spatial reading of the city by not establishing a clear urban hierarchy. In the early twentieth century Los Angeles proper suffered economically from the dispersal of the region's primary industries, Fred Viehe observes that: "Instead of developing an industrial urban core surrounded by residential suburbs, the city developed an administrative-residential core surrounded by an industrial suburban network"[18] (Figure 16). The result, up until the past few decades, was a low density distribution of economic activity across almost 400 square miles

Figure 16. "Highway #5" Los Angeles, California - Burtynsky

of developed land. Having few concentrated work or residential nodes has diffused movement throughout the region, rather than to one or two job centers as is found in many cities built following nineteenth century urban forms.

In many ways the oil field mimics this spatial phenomenon. Numerous points of extraction across the landscape tap into areas of concentrated oil. Petroleum is then deconcentrated and dispersed through complex networks that unite the entire operation into one mechanism. In both cases expansion and diffusion characterizes the experience of the environment.

Los Angeles remains as one of the most striking examples of the influence of energy consumption on the built environment and the urban landscape. Petroleum's influence on the region's growth and density exemplifies the close relationship between society and energy resources. Automobile oriented development requires an incredible amount of infrastructure and energy investment in order to sustain its spatial characteristics. Across the country and throughout the world similar patterns of development are discernible; the spread of the "culture of energy" proves that it is not just an American idiosyncrasy but a reflection of humanity's unbreakable bond with energy and the need to consume.

Endnotes

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18. Viehe, 14

Figure 17. Existing southern vehicular entrance from Round Mountain Road

CHAPTER 03 | POST-INDUSTRIAL RE-USE

The redevelopment of the industrial landscape requires an understanding of the characteristics that shaped the history of the site and that continue to influence its experience. In order to extract opportunities for learning and interpreting the value inherent in these landscapes, the following case studies explore various strategies implemented in existing projects of similar scale and scope. Analyzing the success of these projects will establish a framework that will influence the treatment of the Kern River Oil Field as a post-petroleum extraction site.

Experiencing the Manufactured Landscape

Kielder Water and Forest Park – Northumberland, United Kingdom

The Kielder Water and Forest Park, near Glasgow UK, does not immediately bring to mind the term manufactured landscape.

Figure 18. Janus Chairs, Ryder Architecture, 2009

Figure 19. Belvedere Shelter, Softroom Architects, 1999

Once open fields and meadowlands, industrial uses began to reconfigure the area in the 1920s[19] when the demand for timber across the nation spurred the planting of the forest. By the 1960s regional industries pushed for increased water capacity resulting in the creation of the largest man-made reservoir in Northern Europe. Today the park barely resembles its former rural existence; and while it maintains a "natural" appearance it remains a thoroughly artificial creation (Figure 18 & Figure 19).

Regional officials opened the park to public use in the 1990s, which began "shifting the perception of the landscape from a utilitarian resource to an aesthetic commodity."[20] A current program to commission specific sites of art and architecture provides amenities, both basic and cultural, across 250 square miles of forest. Artists and architects created over twenty built pieces throughout the site, providing shelter, seating, and viewing platforms for visitors (Figure 18 & Figure 19). Drawing inspiration from the park's manufactured character, many of the installations interact with and manipulate the visitor's experience of the park through siting, materiality, views, and tectonic qualities. One such installation entitled "55/02" by the design firm sixteen*(makers) engages the landscape and embraces the fabricated nature of the

Figure 20. 55/02, sixteen*(makers), 2009

Figure 21. Mirage Deck, Kisa Kawakami, 2006

site (Figure 20). The artists created a shelter that orients visitors towards important views and distant points across the forest while creating intimate spaces within its folded forms. 55/02's strong materiality and brutal forms recall the strength of a tank or the ruggedness of a boulder. All of the materials were prefabricated and required a tedious digital manufacturing process in order create such bold forms.[21] This completely manufactured element finds a comfortable home in Kielder's manufactured environment by drawing attention to itself and its over-the-top expression of an artist's conception while at the same time providing a recreational space and a shelter within the forest.

Each piece created by the Kielder Art and Architecture project frames and interprets the experience of the park in a variety of ways. At times the usual experience of the forest is reframed, questioned, and exploited in order to enrich the visitor's understanding of the park. The Mirage Deck (Figure 21), for example, manufactures a wooden path within a forest developed for the lumber industry, however this piece reaches beyond that concept in order to capture the unique qualities of light and space created by the forest. By combining both the symbolic and experiential qualities of the site this piece provides a more complex

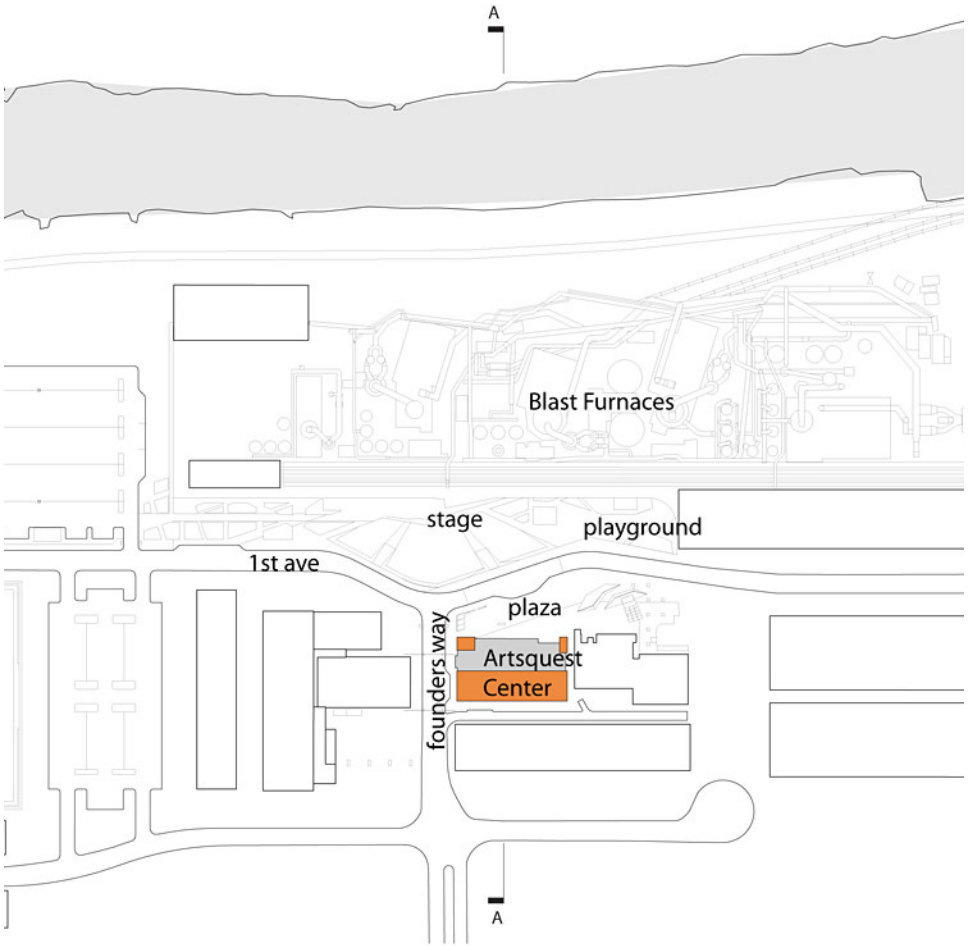

Figure 22. Artsquest Center site plan

and valuable experience. In contrast, the Belvedere Shelter (Figure 19) curates a sequence of views of the landscape - sky, land, and water - in order to influence the individual's perception of this environment. A visitor's experience of the Belvedere does not reference the site's past but rather focuses on its current character, potentially missing out on a more complex reading of the site.

Exploiting the Industrial Past

Artsquest Center at Steelstacks – Bethlehem, Pennsylvania

A more typical approach to post-industrial sites can be found in Bethlehem, Pennsylvania. The blast furnaces at Bethlehem Steel's Pennsylvania factory ceased operation in 1995, marking the end of an iconic American company's presence in a city built by the steel industry.[22] Today large redevelopment projects are helping to redefine the massive brownfield site and reconnect it to the community it once supported. In 2011 the new 65,000 square foot Artsquest Center at Steelstacks opened to the public as a multi-purpose performance venue and cinema space. Built on a portion of the former Bethlehem Steel site the architects, Spillman Farmer, took cues from the site's history and its manufacturing process to successfully reprogram a post-industrial environment using

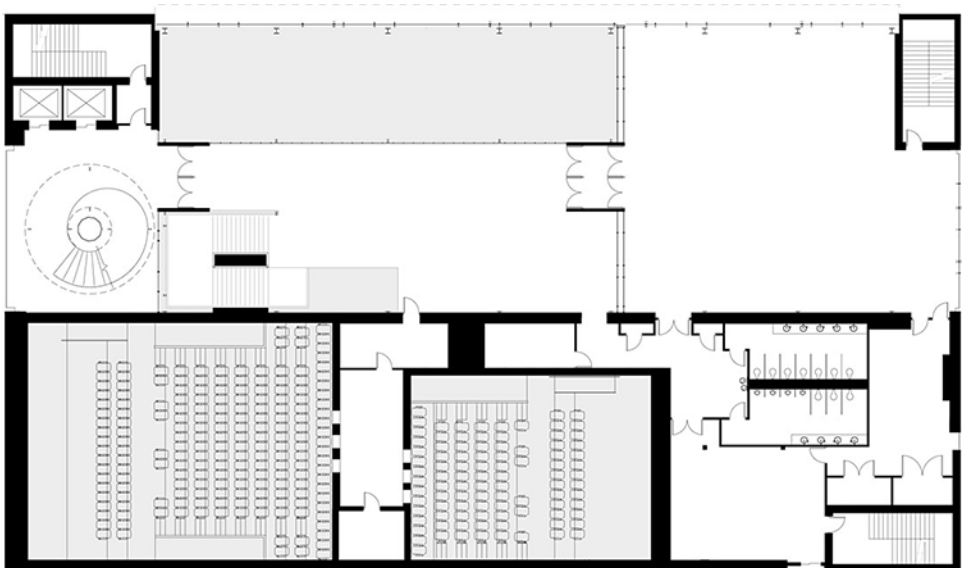

Figure 23. Artsquest Center second floor plan

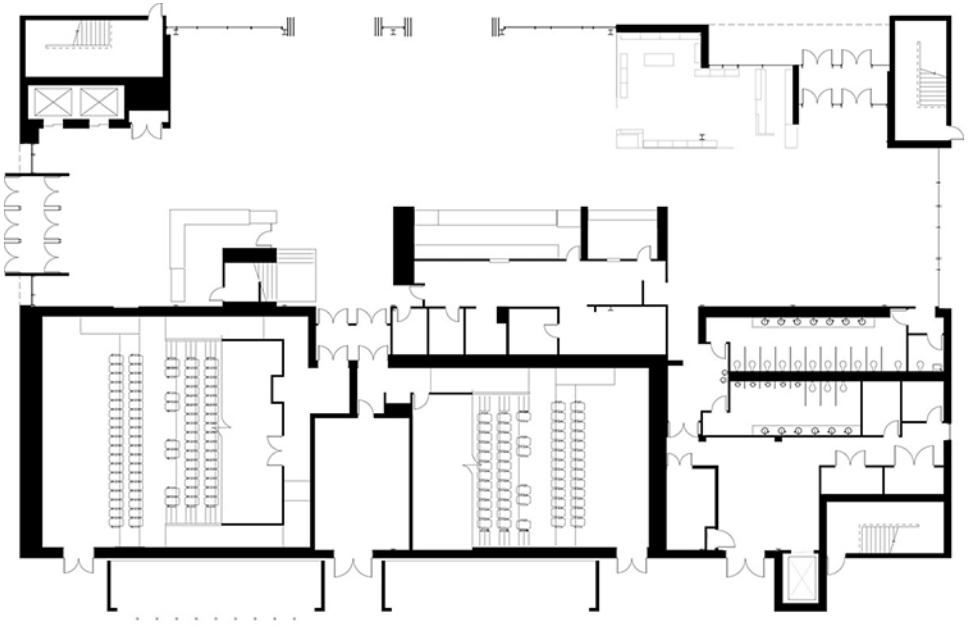

Figure 24. Artsquest Center first floor plan

elements that recall the site's past.

The Artsquest Center sits adjacent to the factory's shuttered blast furnaces so that the impact of the massive industrial ruins would become a focal point for the new program (Figure 22). The facility exploits these icons by incorporating them as a backdrop for public spaces and performance areas. Theaters and support spaces were clustered together to form a solid mass along the southern half of the structure while the other half contains open lobbies, circulation and public gathering spaces (Figure 23 & Figure 24). A plaza and outdoor stage were placed between the Artsquest structure and the existing blast furnaces. Together the new program and the furnaces form two walls that enclose the public spaces inbetween (Figure 25). Glazing and structure are used to frame views out to the furnaces while solid opaque forms enclose the theater spaces, reinforcing the visual dominance of the furnaces (Figure 26). The architects continue to recall the site's past through tectonic elements that are visible at the human scale.

Material choices and structural elements establish what the firm calls a "raw elegance" with the intention of expressing both industrial products and processes. The architects chose to retain the rough textured finish of the structure's precast concrete panels as

Figure 25. Artsquest Center section

Figure 26. Blast Furnaces as backdrop

a nod to their manufacturing process.[23] In contrast the liberal use of exposed steel structural elements celebrates the refinement of the product that was once manufactured at this site. The choice of "International Orange" paint is a nod to the Golden Gate Bridge, one of the most prominent structures built from Bethlehem steel. A steel "grand staircase" is the primary vertical circulation, its circular form recalls similar access stairs found on the blast furnaces and "pays homage to the steelworker's experience of moving vertically through the plant"[24] (Figure 27).

The Artsquest Center successfully integrates elements that are rooted in both the industrial past of the site and the cultural activities of the arts center. But while the architects clearly made the effort to reconnect with the past, at the same time, the relics of industry have in some cases been treated more as artifacts. The blast furnaces, for example, have been set off as a static set piece, a visual icon that maintains its meaning through form alone. The experience of the blast furnace is only from a distance, in a highly choreographed and shallow representation of what the site was. Activating the furnaces through programming or circulation would help to integrate the factory's narrative through a more intriguing spatial interaction.

Figure 27. Steel spiral staircase

Figure 28. Ore Bunker Gallery (Michael Latz)

New Perspectives on Old Infrastructure

Landscape Park Duisburg Nord – Duisburg Nord, Germany

Though its history closely resembles that of the Bethlehem Steel factory, the Landscape Park Duisburg Nord exemplifies a different approach to repurposing a post-industrial site while exposing past operations and significance. Designed by Peter Latz of Latz+Partner in the 1990s the project incorporates the existing infrastructure of a former steel mill into a new public recreational park (Figure 28). Visitors can wander through hulking blast furnaces, scale the sides of ore bunkers or trace the path of the factory's production process along trails that were once railroad lines. Activating these obsolete industrial elements through new uses allows for the rediscovery and active interpretation of the site.

Unlike the Artsquest Center Duisburg Nord accepts the site's existing infrastructure as integral elements with the site's new program. The conceptual foundation of the design embraces the site's manufactured character to form a new spatial language that lays the foundation for new uses.[25] By choosing to respect the site's built history the designers recognized the value of the "embodied energy" developed over years of industrial use. Yet the project

Figure 29. Climbing play point (Michael Latz)

does not fall victim to an attempt to memorialize the past by creating static artifacts within the landscape. Instead new programs integrate into existing structures to give them a new purpose and to allow for new interpretations.[26] The form of the ore bunkers, for example, provides a surface for rock climbers who can gain a better understanding of the scale and texture of the processes that occurred there (Figure 29).

Duisburg Nord provides a successful model for integrating an abandoned and polluted site back into the community through recreational activities. These new uses respect the past without being overly protective of the site and allow it to become a dynamic space that is productive well into the future. Niall Kirkwood argues that the design engages the embodied value of existing structures and serves as a prototype for reclamation of post-industrial sites today:

> The tasks of dealing with run-down industrial areas and open-cast mines require a new method-one that accepts their physical qualities but also their destroyed nature and topography. This new vision should not be one of "re-cultivation," for this approach negates the qualities that they currently possess and destroys them for a second time.[27]

Because of their unique spatial and experiential characteristics post-industrial sites have added value that would be lost through tabula-

rasa redevelopment. Within these sites exists the potential for new experiences and learning opportunities that could help us to better understand our relationship with industry.

Conclusion

As we begin to move closer to a post-petroleum world we must take a moment to look to the past and understand where we have been. Sites of energy production have the potential to redefine our relationship to energy, especially as that relationship evolves with the introduction of new energy sources. As these sites become obsolete new land uses will undoubtedly remake the post-petroleum landscape. Yet it remains to be seen whether their embodied value and potential could be lost without innovative interventions. New program should integrate into a site and utilize its characteristics rather than erase its past. Existing structures can hold symbolic meanings but should not be relegated to set pieces within a new production. New interventions must embrace the potential of manufactured landscapes to produce exciting opportunities and otherwise unimaginable interactions. With these sites we can begin to transition into a post-petroleum world while considering the future impacts of our energy-driven society.

Endnotes

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Figure 30. View of Kern River Oil Field from Panorama Vista, ca. 1910

CHAPTER 04 | KERN RIVER OIL FIELD

History of the Kern River Oil Field

In May of 1899 James Munroe Elwood and Jonathan Elwood followed a trail of rumors that took them about 7 miles north of Bakersfield California to the edge of the Kern River (Figure 30). There the two used pick and shovel to carve a hole into the sandy arid earth. Using a hand auger the men continued drilling to a depth of 73 feet. Heavy crude oil seeped from the hole and was used to supply a drilling rig owned by Milton McWhorter to drill down another 187 feet. With that, the first drilled oil well in the Kern River Oil Field was completed.[28]

By 1901 oil production from the field reached upwards of 12,000 barrels a day with new wells constantly being drilled. Land prices in the oil field skyrocketed to over $1,000 an acre as outside investors clamored to own a piece of land for themselves and their newly incorporated companies. Over a four-year period the field

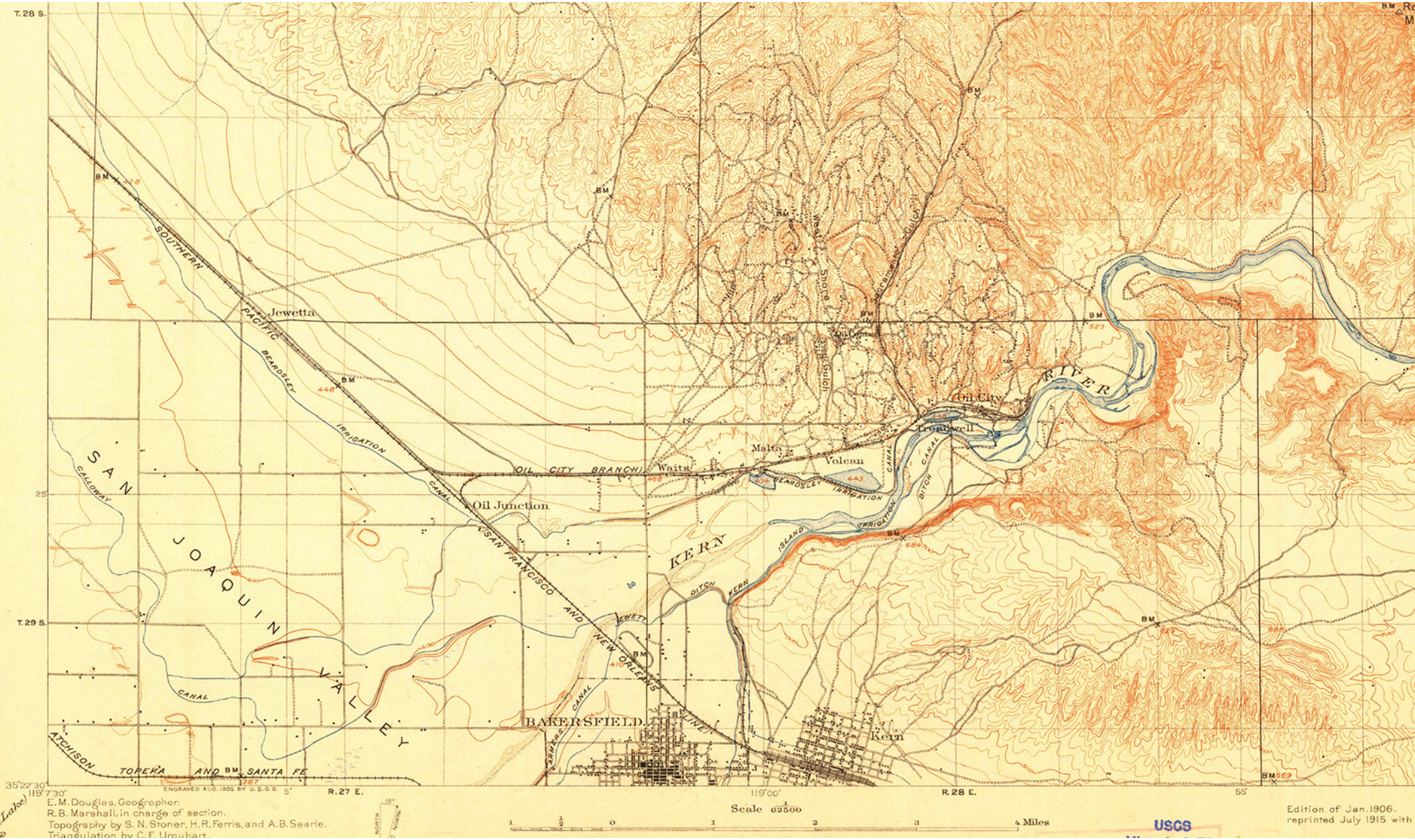

Figure 31. Topographic Map of Kern River Oil Field and Bakersfield, California, 1906

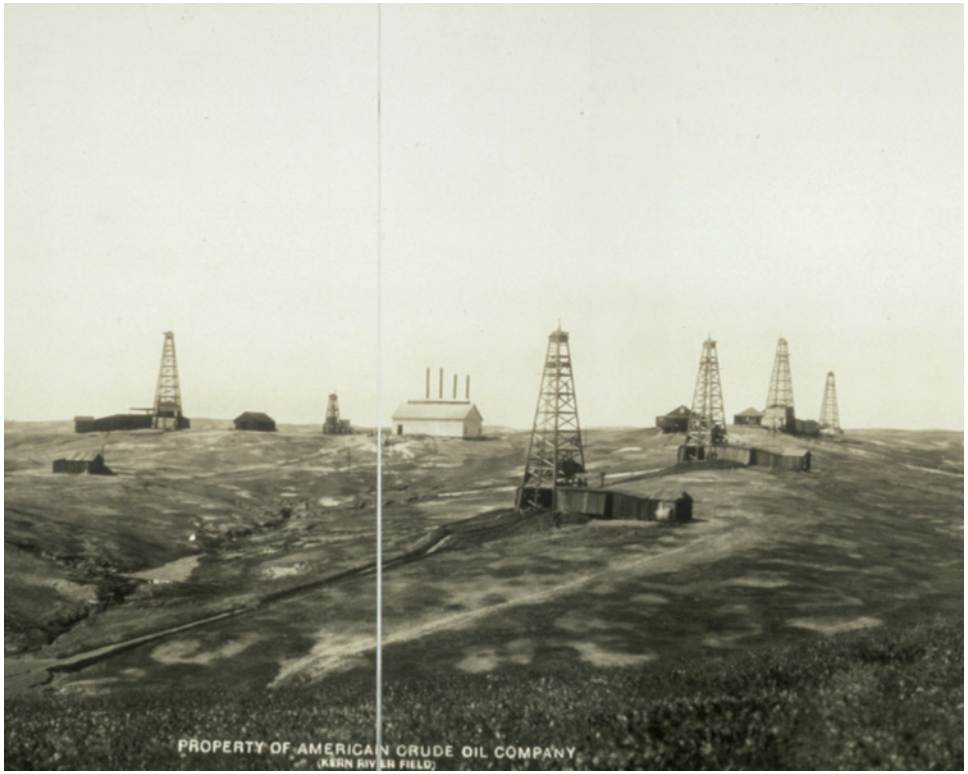

Figure 32. Early Infrastructure, 1910

grew from one well to hundreds of wells, some already abandoned, scattered across numerous privately owned parcels of land (Figure 31). Operations expanded outward and primarily toward the north from the initial Elwood well site, eventually moving from the flatlands adjacent to the river toward the foothills of the Sierra Nevada mountain range (Figure 32).

Once the oil was extracted, a distribution and storage infrastructure was needed to support the horizontal movement from the extraction point to the point of refinement. Early distribution used wooden troughs that deposited extracted material into wooden storage tanks placed adjacent to long-distance transportation infrastructure. Internal distribution became increasingly complex as the number of pipelines grew to meet the needs of a continuously expanding field.

The rising production and consumption of oil demanded more distribution capacity between inland oil producing regions like Bakersfield and the larger refining, storage, and shipping hubs located near the coast. Railroads were initially the most popular method of oil transport and by 1903 lines provided a direct channel of distribution between the Kern River Field and storage and refining operations over 280 miles away in the San Francisco Bay

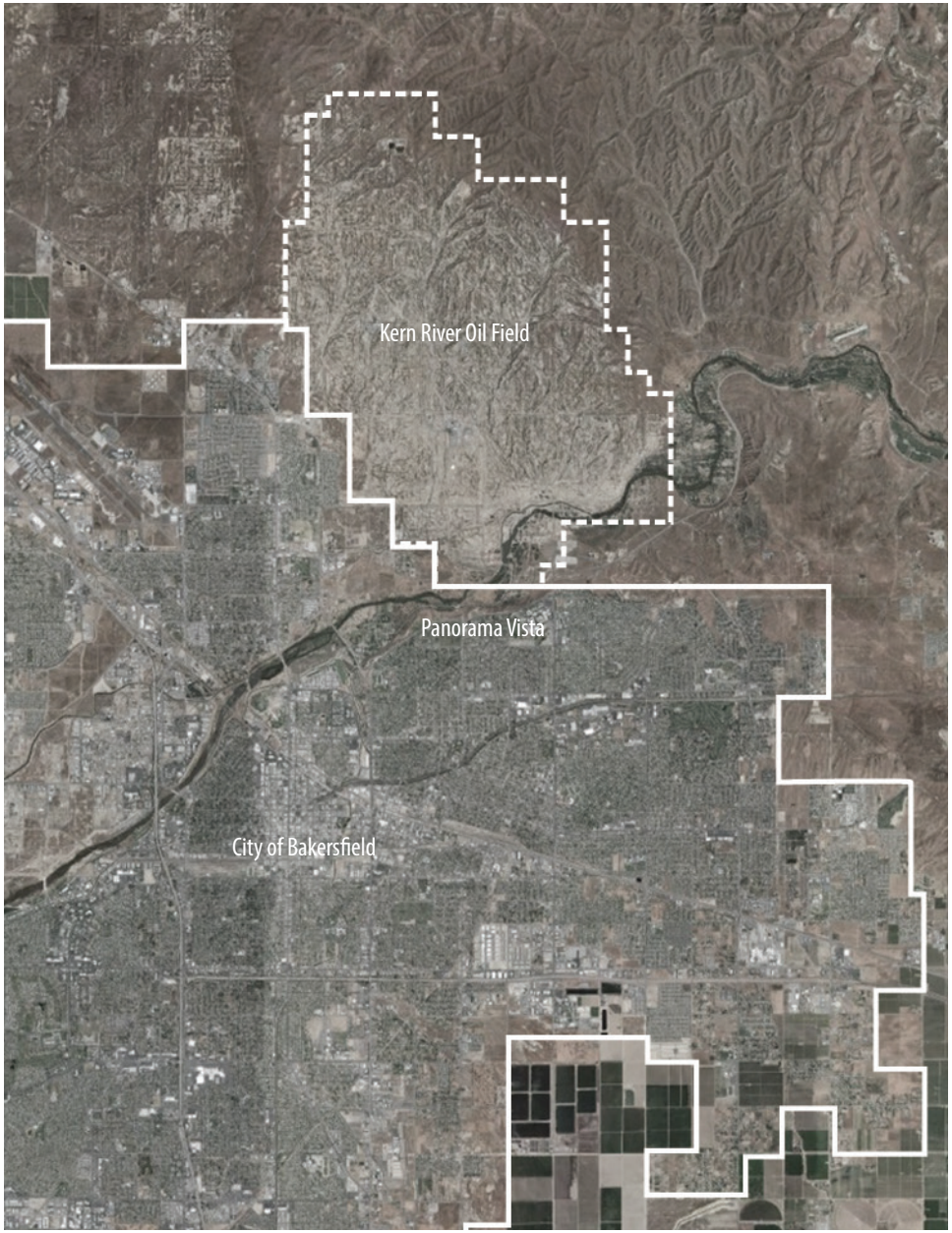

Figure 33. City of Bakersfield with Kern River Oil Field, 2012

Area. Concerns over the cost of rail transportation spawned the development of pipeline technology that could move the heavy and viscous crude oil long distances. By 1921 a complex network of pipelines were constructed that more affordably linked the state's oil-producing regions to the coast. Within 20 years the Kern River Oil Field became part of an industrial system of a scale that had never before existed in the state. The flow of oil resulted in economic prosperity at both the extraction and receiving points along the system, which are still in operation as major oil refining and shipping facilities.

Today the Kern River Oil Field occupies over 20 square miles of land straddling the eastern foothills of the southern San Joaquin Valley. The field sits adjacent to the City of Bakersfield, a once quiet agricultural town that saw rapid expansion following the discovery of oil nearby (Figure 33). Chevron Corporation currently operates the field, consolidating the extraction, distribution, and refinement process under one entity. In 2011 the Kern River Field became the second largest producer of crude oil in the state of California, having extracted over 26.8 million barrels in just that year.[29] Oil remains a major economic driver for the region, second only to agriculture in employment.

Figure 34. View facing north of Kern River Oil Field with storage tanks and cogeneration plant visible

Existing Infrastructure

As of 2011 the Kern River Oil Field contained over 9,000 active wells producing upwards of 73,000 barrels of crude oil a day. In addition the extraction process produces over 722,000 barrels of water and 3,000 cubic feet of natural gas per day.[30] According to the state Department of Conservation the field reached peak production around 1985 and began declining in production every year since.[31] With over 110 years of oil production history the field is a scarred industrial landscape composed of layer upon layer of infrastructure.

When viewed from the Panorama Vista along Bakersfield's northern edge, the prominence of the field and its largest built elements becomes clear (Figure 34). Massive cogeneration plants and storage tanks break the gentle slopes of low rolling hills, forming a strong contrast along the horizon to the landscape below. These landmarks represent the start and end point of the extraction process. Cogeneration plants burn natural gas in order to produce steam, which is then injected into the oil deposits below the surface, increasing the viscosity of the dense crude oil. Integrated steam-powered turbines produce electricity that powers other site machinery or is sold back to the local utility.

A. LANDMARKS/NODES

Cogeneration/Steam Generation Plants
Storage Tanks
Administrative Offices

B. PIPELINES

Steam Pipelines
Major Oil Distribution Lines

C. WELL LOCATIONS

Active Oil Extraction
Active Steam Injection
Active Water Disposal

Figure 35. Mapping Infrastructure at Kern River Oil Field

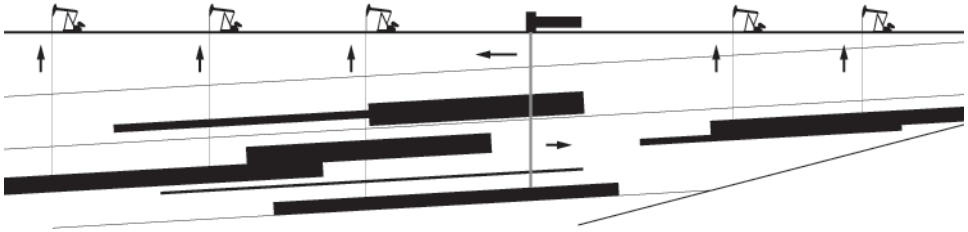

Figure 36. Typical field operations with pumpjacks extracting crude oil and being injected into oil deposits

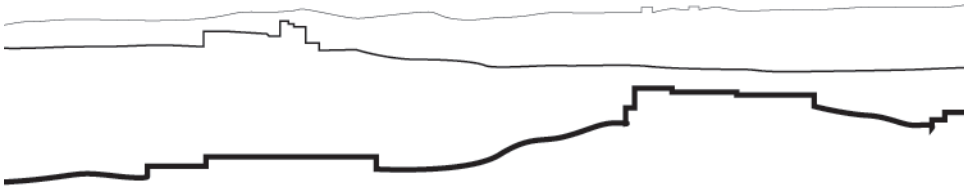

Figure 37. Major infrastructure breaks the site's soft topography

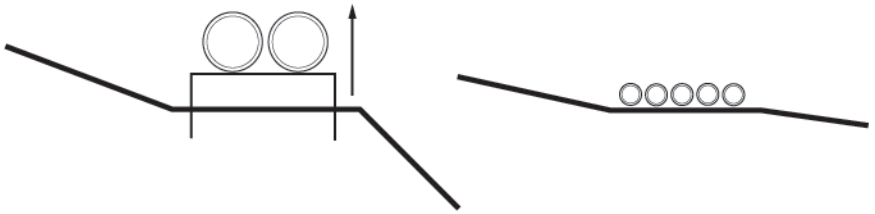

Figure 38. Larger and more permanent infrastructure is elevated off the ground

Storage tanks mark the end point of the oil's movement within the site (Figure 35A & Figure 37). Once the crude has reached the tanks it awaits distribution to refineries and production facilities throughout the state. Their size, number, and location reveals the amount of production occurring on site, and is a visual reminder of the consolidation of operations to one entity.

Pipelines form a secondary network of pathways within the site that speak to the movement of materials across the site rather than the movement of people or machinery (Figure 35B). Their size and relationship to the ground reveals their potential temporality; larger more permanent structures support major steam distribution lines while smaller crude pipelines simply drape the landscape with little connection to the ground (Figure 38). Steam lines could continue to be active as the site transitions to other uses while obselete crude oil pipes can be recycled as building material or turned into other products.

Most recognizable among the mechanisms of the site is the sucker-rod pump. This unit mechanically extracts oil from a cylindrical chamber that fills with oil on the pump's down stroke and pulls the oil up from the ground on the upstroke[32] (Figure 36). Thousands of pumps mark the landscape, defining the extents

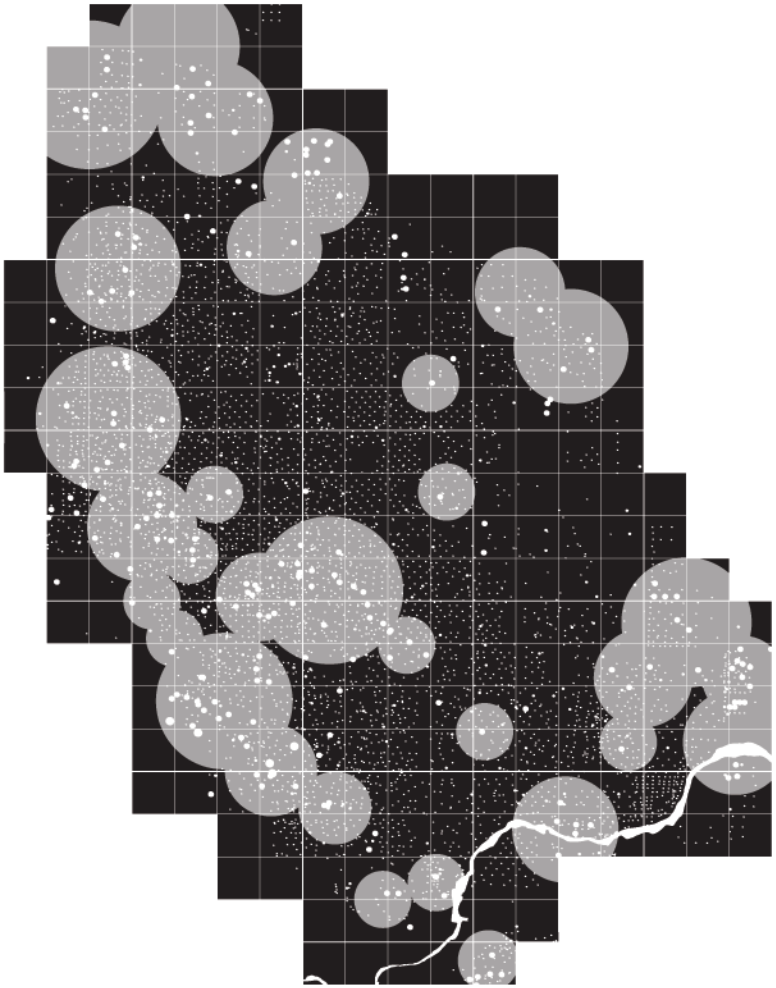

Figure 39. Well locations with areas of steamflooding highlighted

Figure 40. Shading indicates areas with highest extraction potential, unshaded areas may deplete within 10-20 years

Figure 41. Assumed depletion timeline in years - Darker shaded areas will deplete later

of the site and revealing the extent of the geologic oil deposits below (Figure 35C). Their constant operation enlivens the sensory experience of the site through rhythmic motion and sound. Well depths range from 500' to 1500', the size of a pump is directly related to the depth of the well.

Reoccupation Strategy

The Kern River Field is unique in that it employs steam flooding as a method of extracting more oil from previously low producing wells. The high viscosity of Kern River oil requires the periodic injection of steam into the production wells in order to lower the viscosity and move the oil through the distribution network.[33] Most steam injection wells exist generally within the southwest corner of the site with a few located along the northeast edge of the field (Figure 39). The concentration of steam injection wells suggests that these areas have the most potential to produce more oil in the future. With overall oil extraction at this site in decline it is assumed that the areas with little to no steam injection will be depleted first, thereby suggesting zones of land to be opened for reoccupation (Figure 40). An analysis of the rate of depletion suggests that the site has around 30-50 years of

Figure 42. Comparison of 1 sq. mile of cccupied land area for energy production

production capacity left. Over that timespan land will incrementally open to new uses (Figure 41).

Expanded Uses

The Kern River Oil Field occupies 20 square miles of land that has been set aside for a single use. In order for the site to continue to be a productive and vibrant post-petroleum landscape new uses must be integrated into the field's existing infrastructure. As a place of energy extraction the site already retains systems that could support new renewable energy technologies. Being adjacent to the City of Bakersfield, the site holds a unique opportunity to build upon the region's identity as an energy producing area by embracing the site's character and interweaving cultural and recreational uses.

Many landscapes of energy extraction and production require the occupation and manipulation of large areas of land, yet the majority of that land isn't required to capture the sought-after resource. Oil field infrastructure occupies roughly 25% of the land surface area leaving open space inbetween (Figure 42). Many popular clean renewable energy technologies follow a similar pattern of land use. Solar energy structures inhabit up to

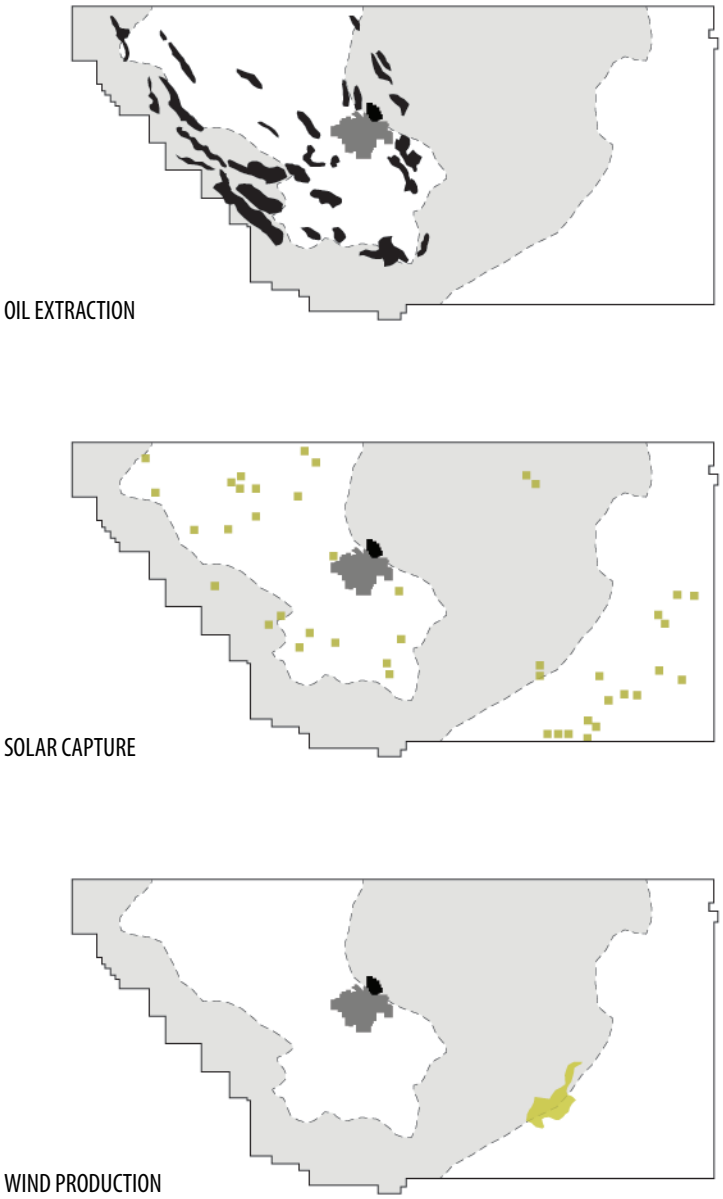

Figure 43. Proposed and existing areas of energy production in Kern County

43% of land area in their most efficient configuration while wind farms utilize only 8% of land area within their boundaries (Figure 42). Furthermore, numerous solar and wind facilities are being developed or proposed in Kern County (Figure 43). Unfortunately the majority of these facilities will be built on fertile agricultural land or untouched desert landscapes. By choosing to build these facilities within existing oil production sites, energy producers can tap into existing networks of infrastructure and avoid the potential destruction of greenfield sites. The integration of renewable energy facilities across the Kern River Oil Field site would serve to enhance the identity of Bakersfield and the region as a leader in energy production in California. Its proximity to the city allows it to become a prominent symbol of the historic and future influence of energy production on the area.

Physically reconnecting the community to the Kern River Oil Field will further enhance the relationship between individuals, energy landscapes, and the region's identity. Recreational and cultural sites such as parks, trails, museums, performance venues and open spaces exist throughout Bakersfield (Figure 44). These sites work together to shape the collective character of the city. The physical, economic, and cultural prominence of the Kern River

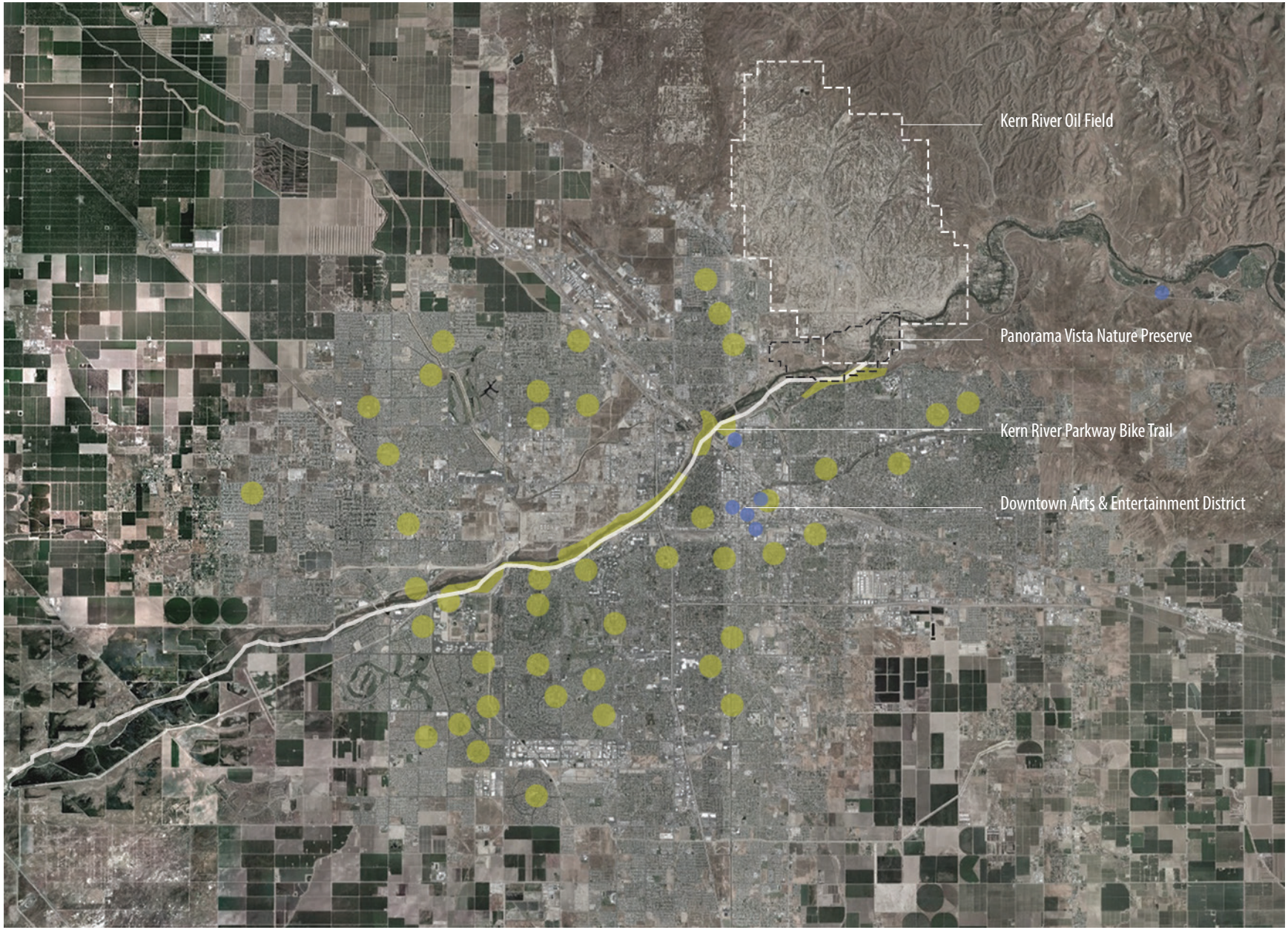

Figure 44. Recreation spaces (green) & cultural sites (blue) in Bakersfield

Oil Field suggests that the site should be considered as vital to the city's identity as the Museum of Art or Kern River Parkway. By connecting to the recreational and cultural networks of the city the oil field will become part of the fabric that defines Bakersfield. Opening the site recognizes the current inefficient utilization of space and questions the existing relationship between the oil field and the city. Establishing a cultural institution within the site will provide a unique space in which to embrace the character of this landscape and provide a backdrop for further understanding its past and future influence on our society.

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Figure 45. "Oilfields #27" Bakersfield, California - Burtynsky

CHAPTER 05 | DESIGN

Site Interventions

This project proposes the introduction of new land uses into an existing site of energy extraction in order to more efficiently utilize the land and to enhance the site's identity. The integration of recreational and cultural programming will craft a unique spatial experience that questions our interaction with and the value of industrial sites. The transition timeline presented in the previous chapter outlines a hypothetical plan of reoccupation with the intention of transitioning the entire site into a multi-use space. This project proposes three interventions that begin reconnecting the site with the larger community (Figure 46) now rather than at the point of complete depletion. A new recreational entrance at the southern end of the oil field marks the historic site of the discovery well and announces the changes occuring in the site. A new pedestrian path traverses the site by interacting with and revealing

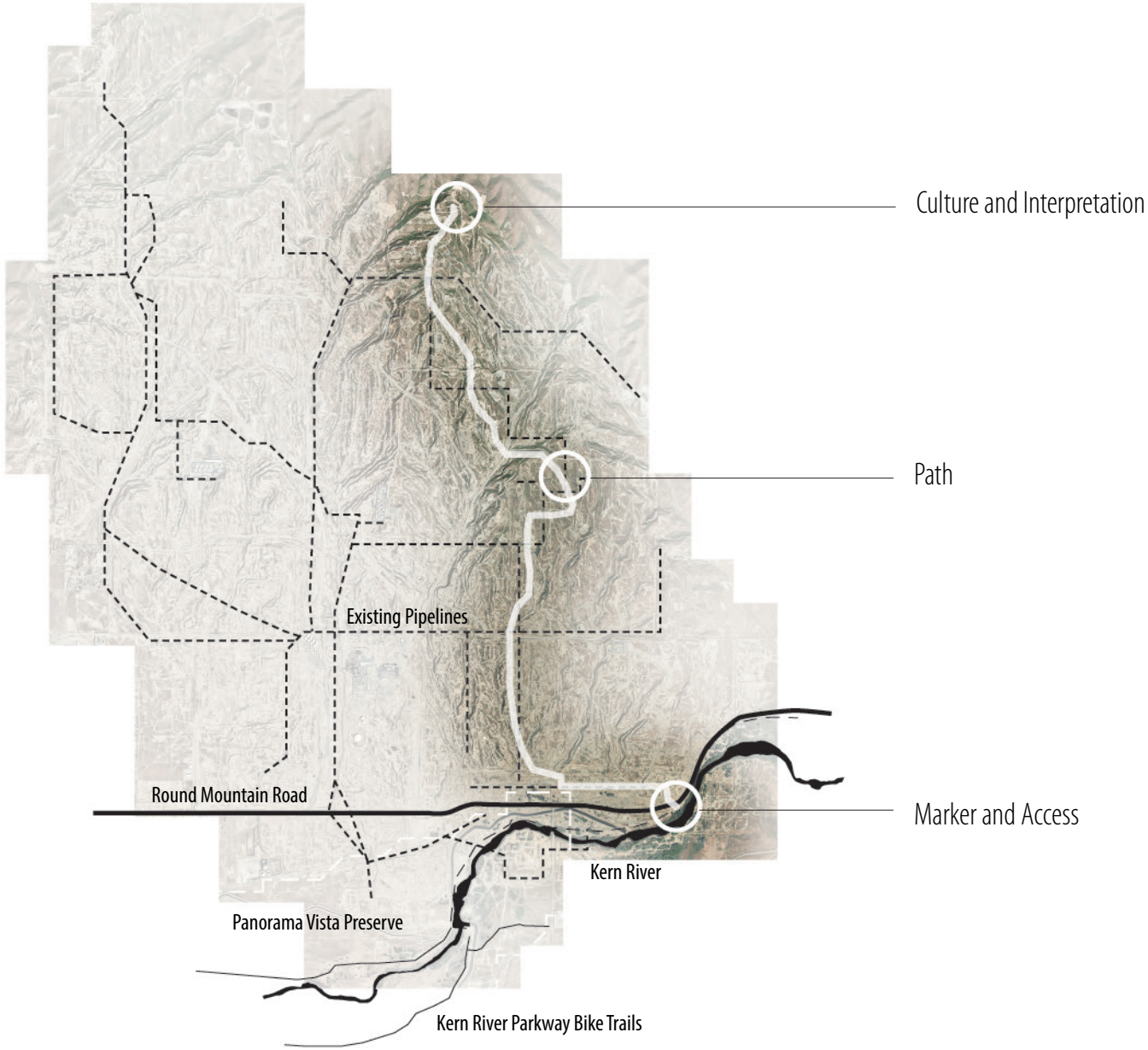


Figure 46. Plan of new recreational path and locations of detailed site interventions (with existing pipeline infrastructure)

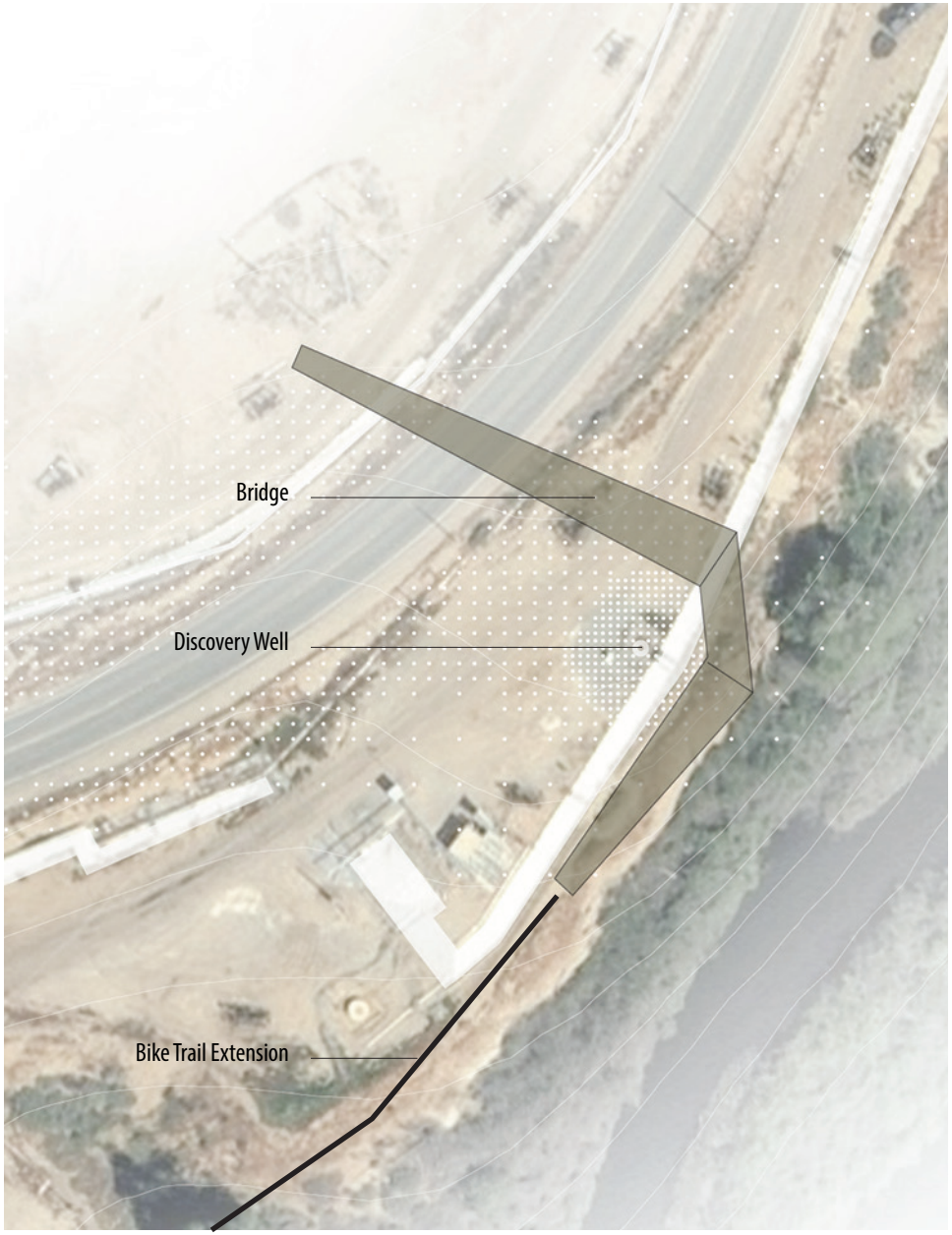


Figure 47. Plan of Bridge and Discovery Well Monument

the operations of the field. Lastly, this project proposes a new cultural facility, located within the Kern River Oil Field, that presents a unique combination of artistic and interpretive exhibitions based on this site and its influence throughout the region.

Marker and Access

Today all that remains of the 1899 Elwood discovery well is a capped hole in the ground and a small plaque locked behind a fence. Few passersby give the location a second thought as they drive around the massive oil field. This location's historic significance and logistical proximity to the field and adjacent recreational trails suggest the need for a new monument and access point for the field (Figure 47).

A dense forest of vertical poles clusters around the discovery well. The density decreases the farther a pole is from the well, establishing a rhythm that can be registered by passing vehicles along Round Mountain Road. This monument reveals the unseen verticality and unique density of wells that cover 20 square miles of land inside the oil field.

Taking cues from the site's development a new footbridge announces the existence of a new type of infrastructure. Built for

Figure 48. View facing northeast of footbridge and discovery well monument

the recreational user this bridge links an extension of the Kern River Parkway bike trail to a new path network created inside the site. The bridge unapologetically carves a path through the dense discovery well monument, bringing cyclists, joggers, and horseback riders to a newly available open space (Figure 48). Materials are simple and meant to relate to the economical nature of industrial infrastructure. Wood decking brings a warmer and more humane intimacy to the bridge, in contrast to the layers of metal pipelines and machinery found in the oil field. The bridge's presence over Round Mountain Road signals to drivers that a new type of infrastructure inhabits the site and suggests the contemporary uses one will find stitched into the fabric of the oil field (Figure 49).

Figure 49. View facing southwest of footbridge crossing over Round Mountain Road

Figure 50. View of new recreational path at intersection with existing infrastructure and field operations

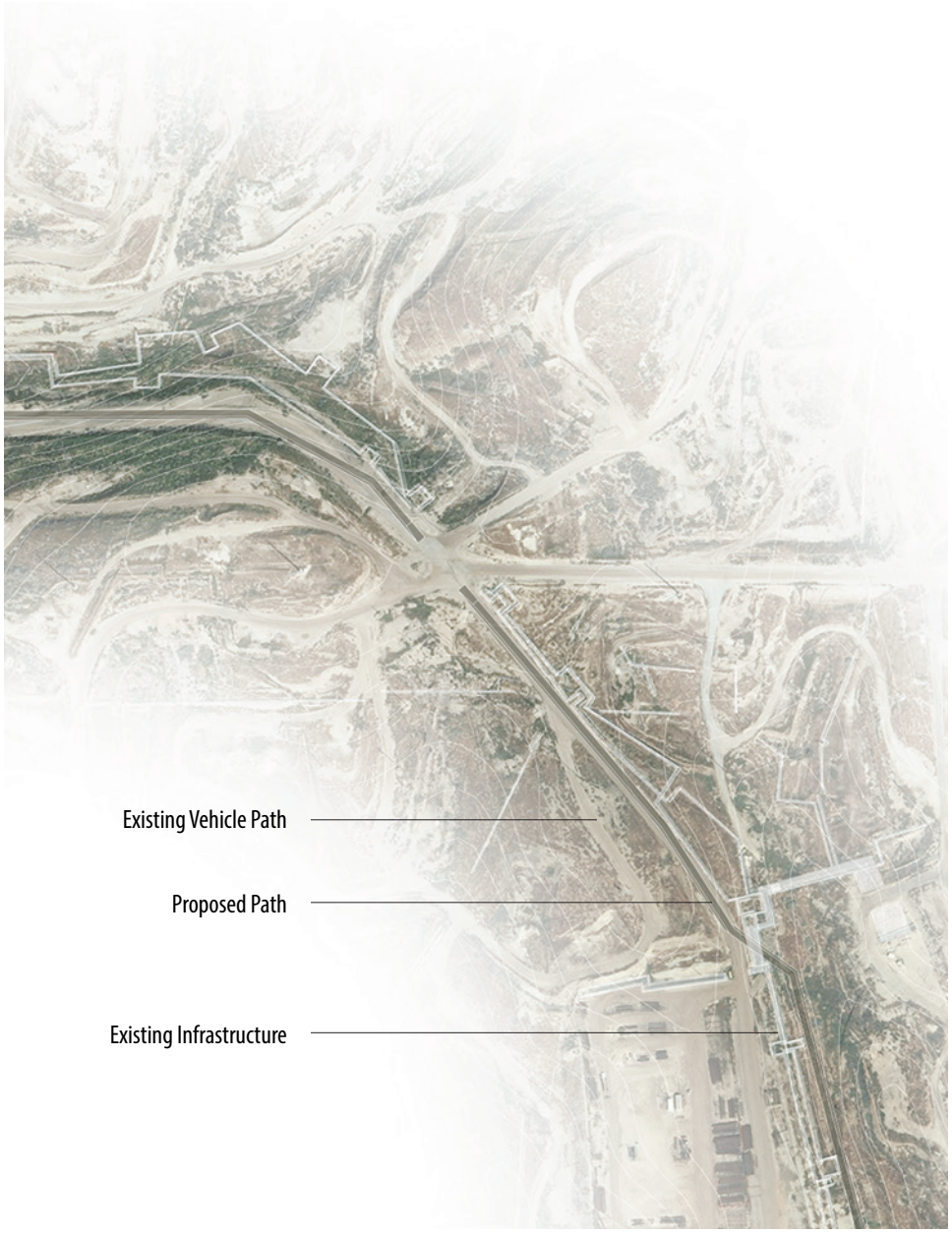


Figure 51. Plan of portion of proposed recreational path

Path

A varied topography awaits visitors to this site, a result of the Kern River Oil Field's location straddling the floor of the San Joaquin Valley and the foothills of the Sierra Nevada mountain range. Almost no open space exists near Bakersfield that takes advantage of this unique topography for the purpose of recreational hiking, cycling, or horseback riding. Opening the oil field to recreational uses provides the opportunity to rethink the potential user groups that could inhabit an operating industrial site. This project proposes the creation of a new recreational path that would connect with existing trail networks adjacent to the oil field. Users would experience both the varied topographic qualities of the landscape as well as the unique activities that occur within a transitioning energy landscape (Figure 50).

Carved into the landscape the path establishes a presence that distinguishes itself from the scarred paved and unpaved pathways that crisscross the site. The path's orientation is generally north-south and closely follows a primary steam pipeline, establishing a connection to existing and potentially permanent infrastructure (Figure 51). A dynamic relationship exists between the path and site infrastructure as they both weave their way

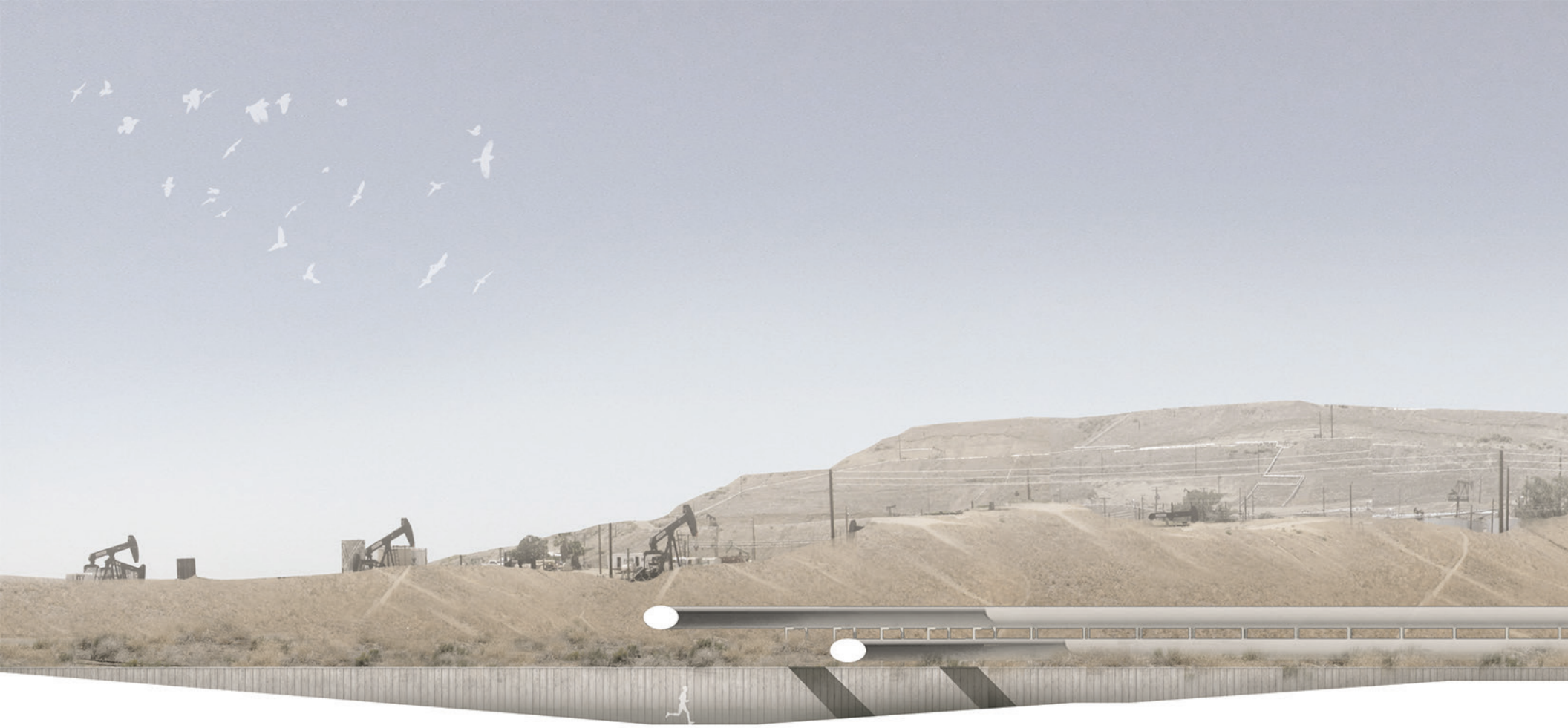


Figure 52. Section facing west of proposed pathway and existing infrastructure

Figure 53. Section facing north of proposed pathway with materials highlighted

through the site (Figure 52). A visitor's relationship to the pipeline and adjacent infrastructure changes as the path rises and falls into the landscape. A retaining wall composed of corrugated metal bulkheads (Figure 53A) establishes a datum registering the dynamic topography of the path and the landscape.

The path's surface alternates between simple wood slats and gravel fill to allow for drainage and to provide a sense of human scale amid the machine of the oil field (Figure 53B). Furthermore, wood relates the path to the wood infrastructure historically used to extract oil from the site. Rather than create a sharp contrast between the path and the ecological landscape, as existing roads do, this path seeks to blur the lines between path and habitat by easing the transition from one to the other. Gravel fill transitions into soil allowing grasses and small shrubs to infiltrate the edge of the path (Figure 53C). By forgoing a clear boundary between path and landscape visitors may choose to explore beyond the realm of the built intervention and more organically experience the site.

Figure 54. View facing northeast of proposed exhibition and research facility within the Kern River Oil Field

Figure 55. Site Plan of exhibition and research facility with proposed path and abandoned infrastructure

Culture and Interpretation

Energy production and consumption is an integral component for a functioning society. The fuels we choose to use and the manner in which we exploit those fuels reveals how we prioritize our need to consume versus the real world impact of energy production. Oftentimes the economic influence of energy can shape the identity and culture of a community.

Being the second largest economic force in Kern County the energy industry as a whole can impact the success or failure of the region. One cannot overlook the cultural capital inherent to energy production in Kern County. This project recognizes the opportunity to exploit that capital by establishing a cultural facility that is fully embedded both physically and programmatically in the identity of this landscape of energy production. A gallery space placed within the field will provide a forum for exhibiting a variety of artistic and pragmatic interpretations of this site and similar sites around the world. The goal of this facility is to provide a setting that transcends the experiential understanding of the site by interacting with the collective cultural signficance of this oil field.

Edward Burtynsky's inspiring photographic work *Oil* presents the powerful and often unseen impacts of the oil industry.

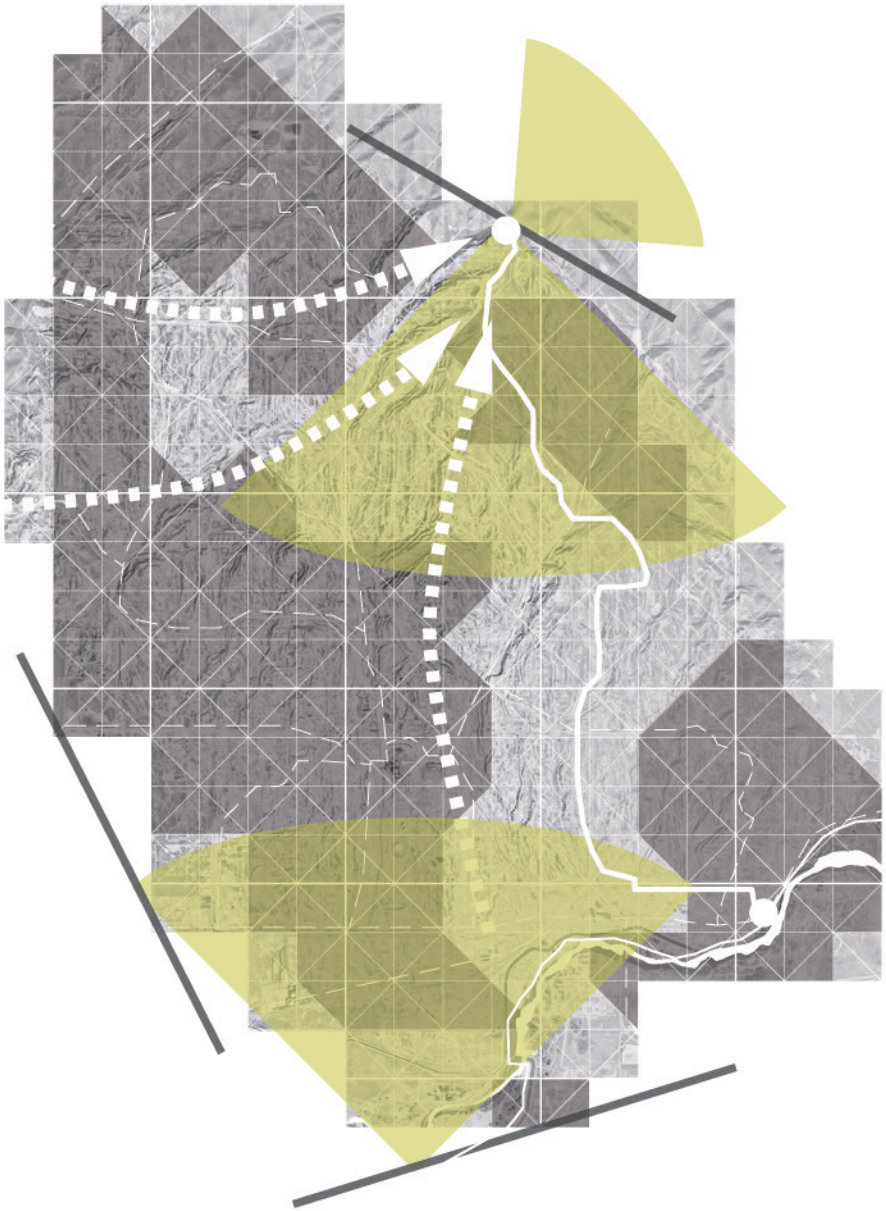


Figure 56. Cultural facility's location straddles the boundary of the oil field and the untouched foothills to the east

His artistic interpretation is both emotional and thought provoking, revealing one of many lenses from which to view our complex relationship with oil. A gallery space within the field combines the experience of the site's unique physical presence with the impacts, both positive and negative, of its output. Transitioning from oil to renewable energy production will no doubt reveal similar conflicts between land use and energy production.

Along with the artistic programming of the site a proposed research and documentation program incorporates the work of the Center for Land Use Interpretation (CLUI). Their presence in this site will allow them to document the responsible transition from old to new energy technologies. Understanding the conflicts, failures, and successes of such a transition will undoubtedly influence similar sites around the world. CLUI will facilitate the exhibition programming through their relationship with installation artists, policy-makers, and researchers.

Location

This facility's location must capture the site's character as an "in-between" space. By choosing to place the building along the boundary of the site the form and experience of the galleries could connect with the juxtaposition of the scarred landscape versus

Figure 57. View from entry plaza facing south toward Kern River Oil Field

Figure 58. View from entry plaza facing east toward "natural" landscape framed by exhibit building

the "natural" landscape of the foothills to the east of the oil field. Along that boundary is the highest point within the site, allowing sweeping views of the entire oil field, the city, and much of the valley beyond. Access to the building requires traversing the much of the oil field thereby encouraging visitors to experience the site's physical character (Figure 56).

Program Space

The facility is separated into exhibition/public spaces and research/private spaces. Exhibition spaces are elevated off the ground and divided into two open galleries and an informal theater/entry space (Figure 59). The orientation of the upper gallery allows for the untouched foothills to act as a backdrop for the exhibits within the space while the larger lower gallery orients the visitor to the vastness of the oil field (Figure 60). This juxtaposition of views is repeated at the ground level entry plaza. Visitors arrive at an open plaza space that connects the gallery and CLUI buildings where views are less controlled but still made prominent as visitors circulate around the site (Figure 57 & Figure 58).

CLUI's research, administration, and archive spaces are made to inhabit the ground. Views are expansive but remain controlled, focusing on the ever-changing condition of the oil

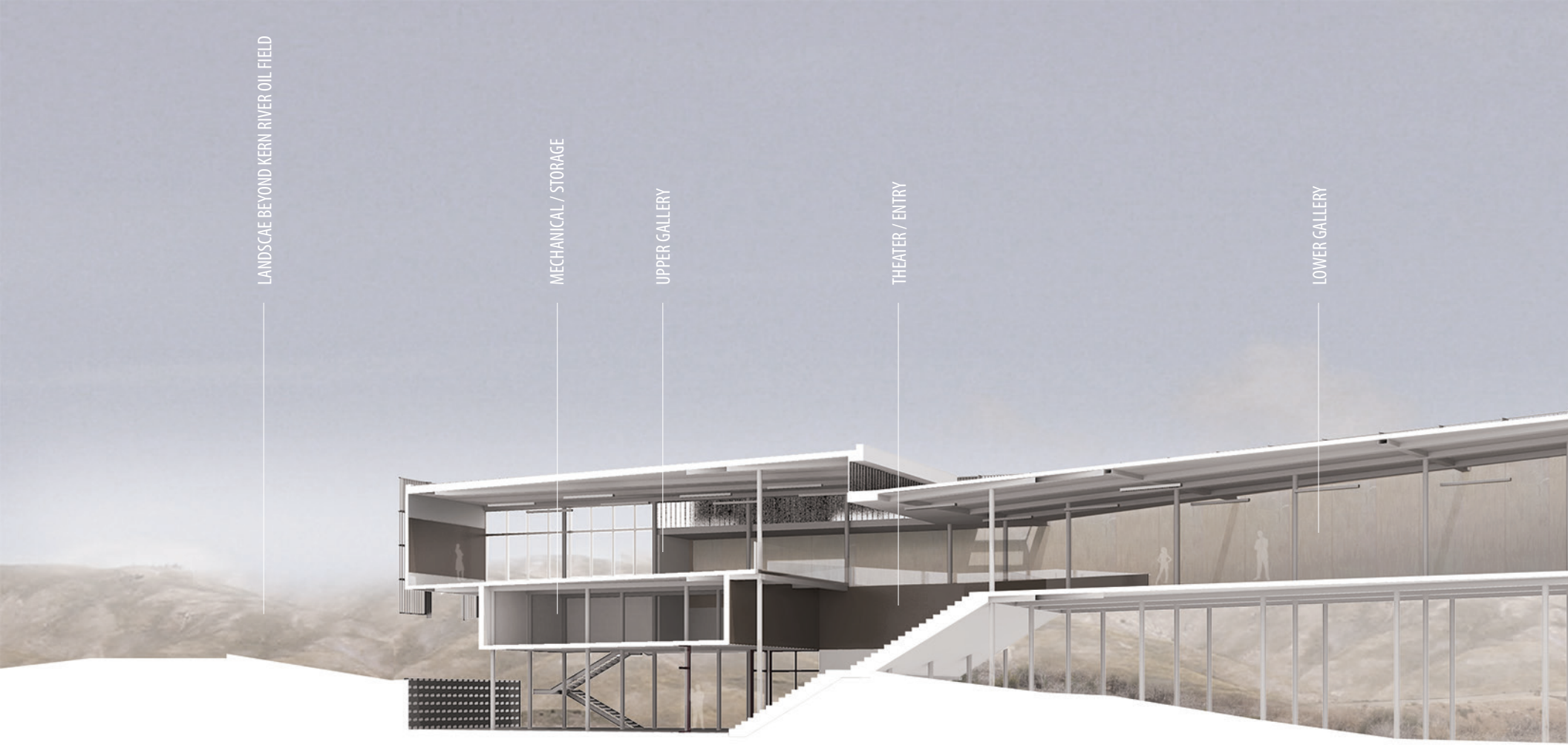


Figure 59. Section perspective facing east through proposed exhibition and gallery spaces

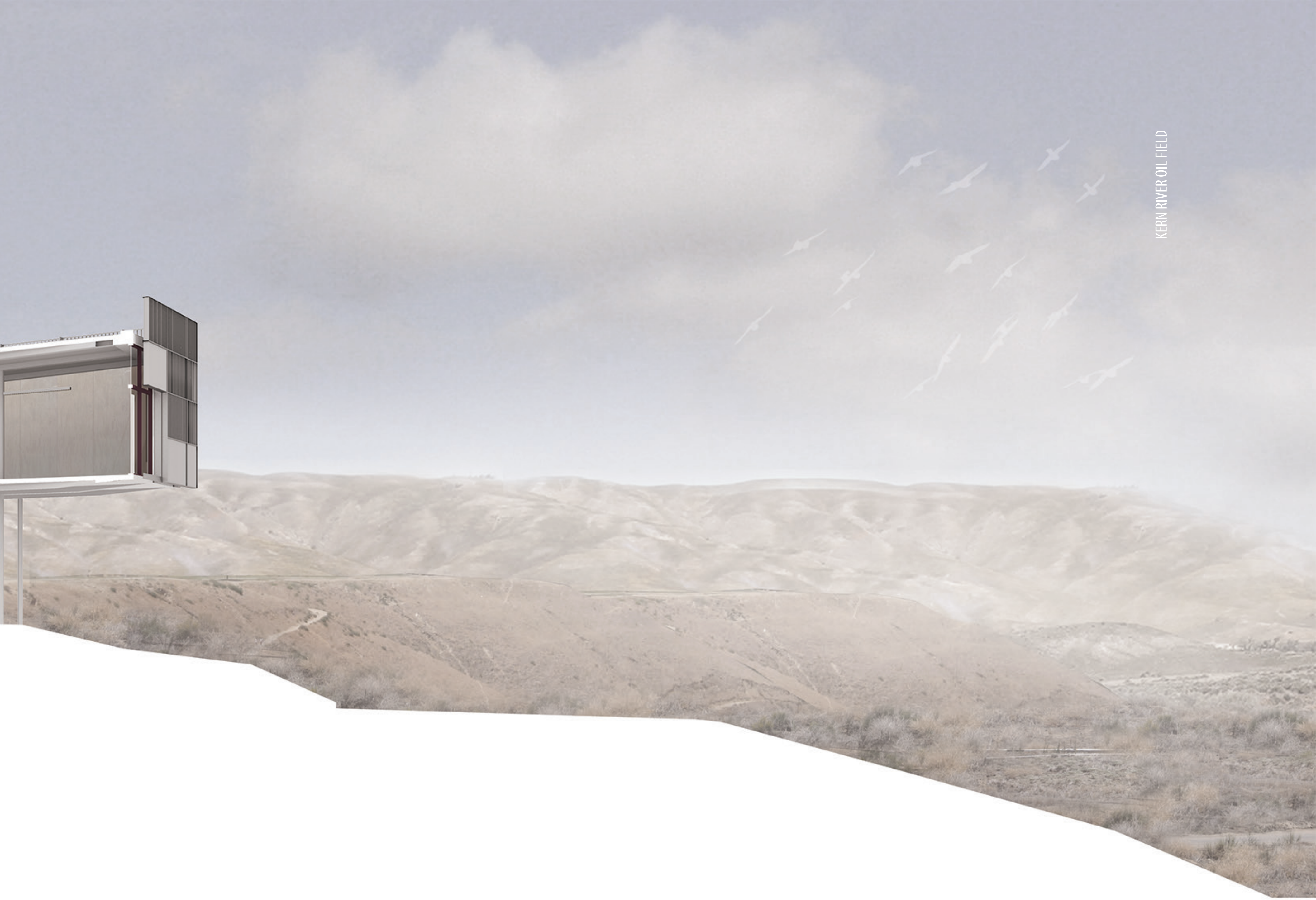

KERN RIVER OIL FIELD

Figure 60. Interior facing southwest of lower gallery with view toward Kern River Oil Field beyond

field and the relationship to the public gallery building (Figure 61). Program is separated into a bar of informal open space and a bar of administrative space, restrooms, and a mechanical room. The open area houses the land use archive but can accommodate a variety of functions including an artist workshop, retail/bookstore kiosk, or temporary exhibit space (Figure 62).

Users

This facility is intended to accommodate three main user groups: the CLUI researcher, the gallery visitor, and the casual recreationalist (Figure 65). By overlapping these groups the site becomes a node and a landmark within the oil field. Although each user group may have a singular purpose upon arrival at this facility the proximity of uses and their intermixing reveals the variety of recreational and educational activities occupying the site. Casual recreationalists may develop an interest in the cultural exhibitions developed by CLUI while gallery visitors may find a desire to hike the site's unique topography. Experiencing and understanding the site involves a spectrum of activities rather than a strict binary of physical experience or educational and artistic enrichment. Visitors are encouraged to discover the significance and value of this unique landscape in its current state and as it transitions over time.

Figure 61. Section perspective facing south through proposed upper gallery and CLUI research & archive building

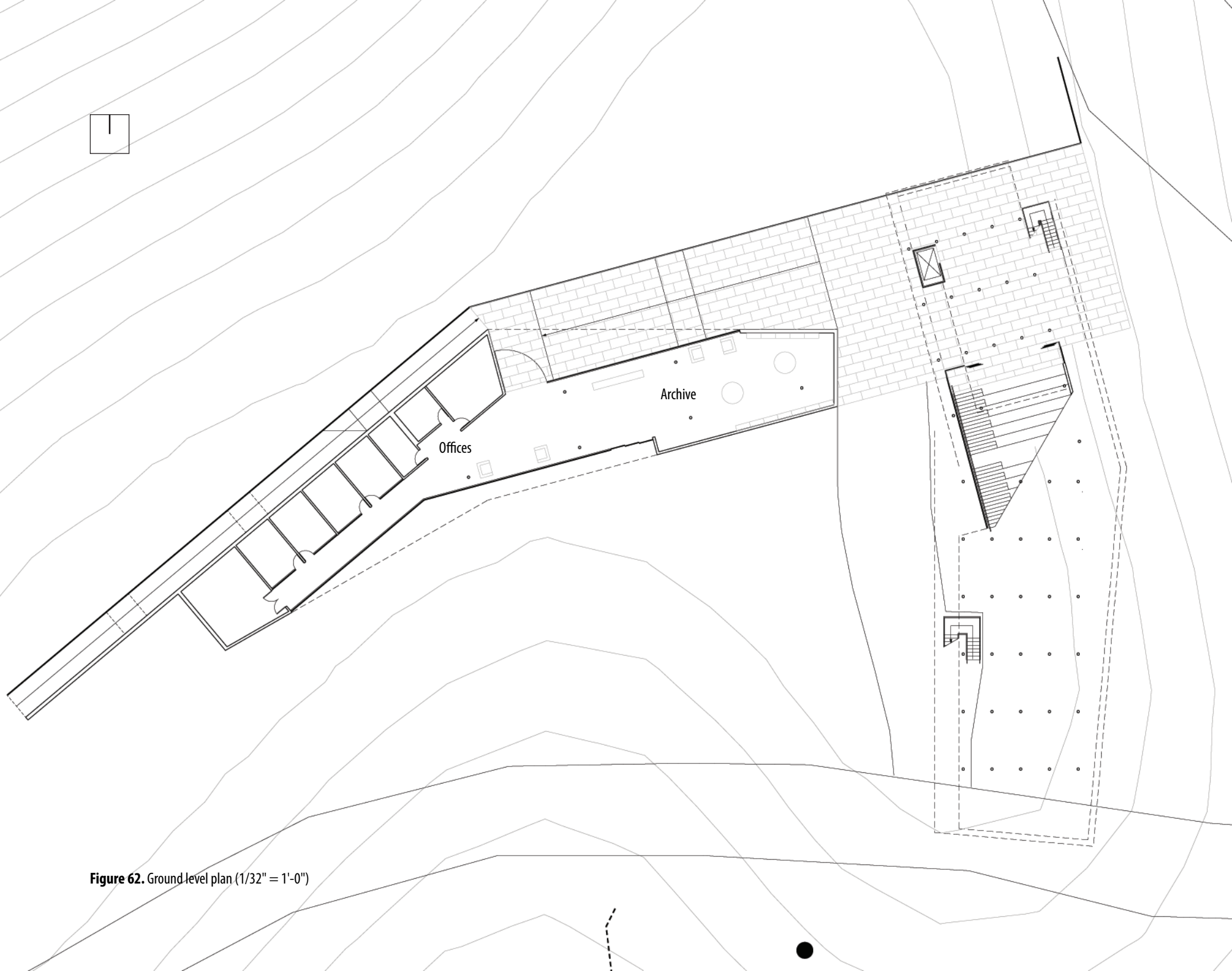


Figure 62. Ground level plan (1/32" = 1'-0")

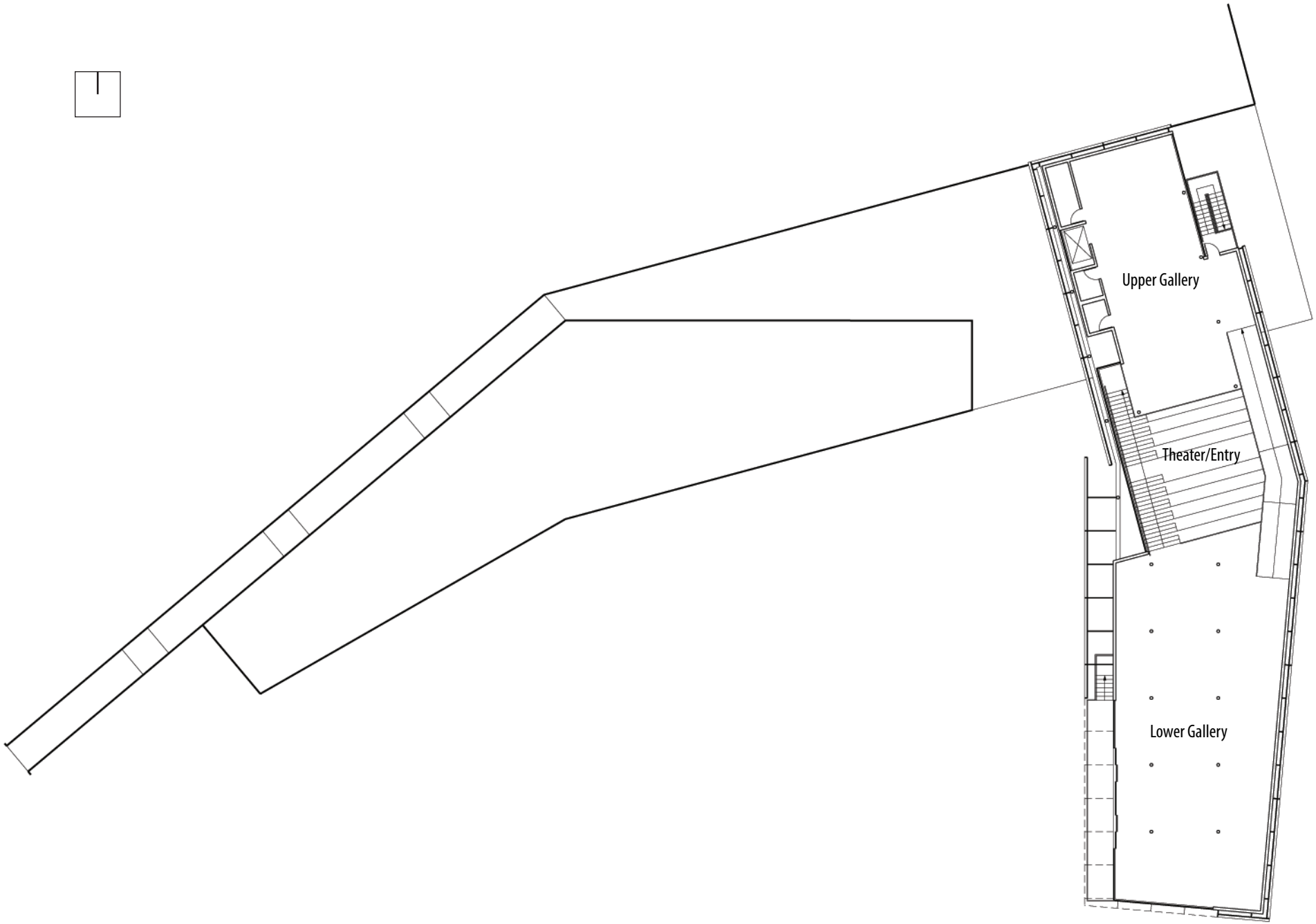


Figure 63. Gallery level plan (1/32" = 1'-0")

Figure 64. Interior facing west of theater/entry and facade screen element

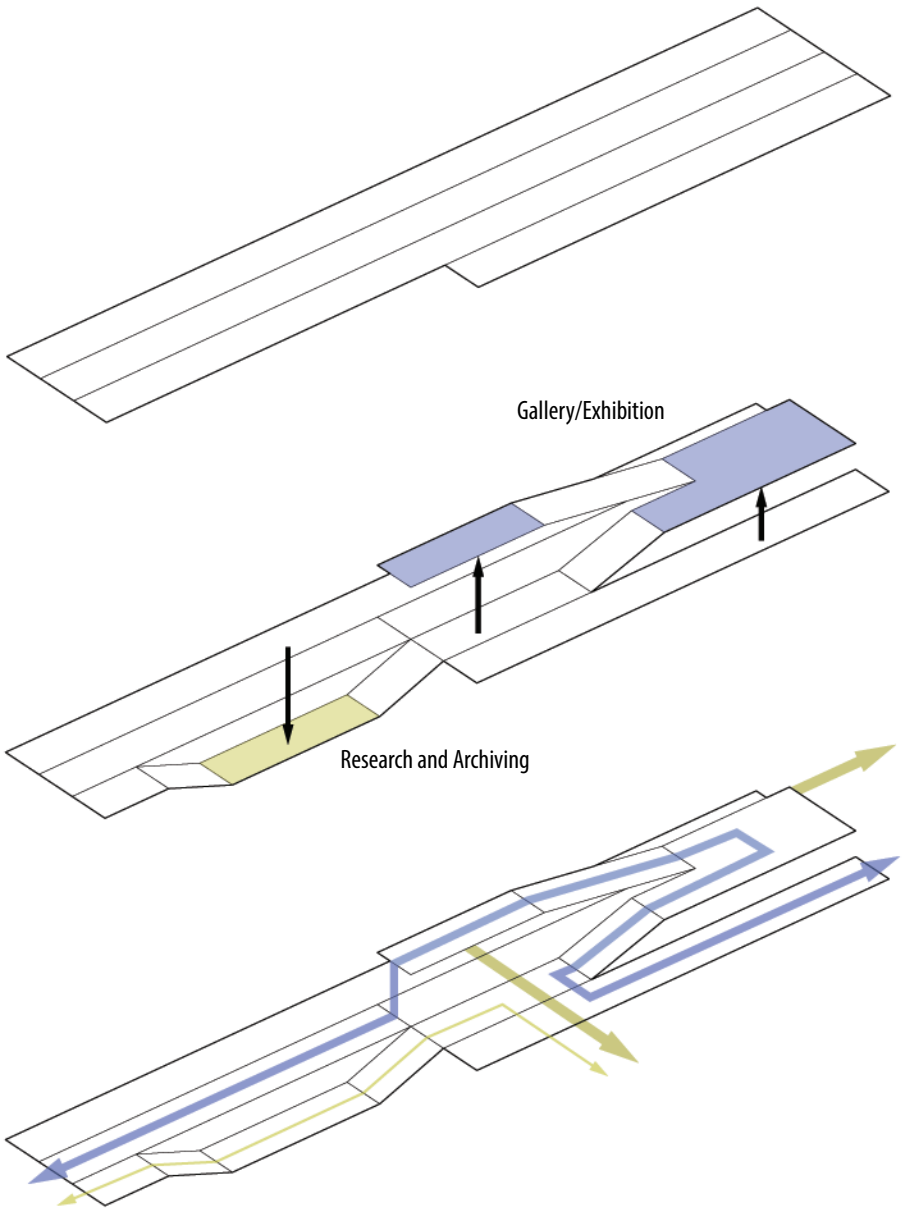


Figure 65. Distribution of program and circulation paths for CLUI (yellow), gallery visitors (blue), and recreationalists (green)

Tectonics

Juxtaposed on the site are the earthbound nature of the CLUI researcher and the reflective activities of the gallery visitor. Gallery spaces rise from the landscape to capture a previously unattainable view, allowing the site to become a backdrop upon which layers of information can be added (Figure 65). Simple concrete columns again evoke the verticality of drilling operations while the stratification of spaces recalls the unique geologic formations that allow the site to produce oil.

Metal facade elements add an additional layer of understanding to the site by modulating sunlight and protecting the building from intense summer heat gain. As you move through and around the building alternating louvers reveal and conceal the view from inside out and outside in.

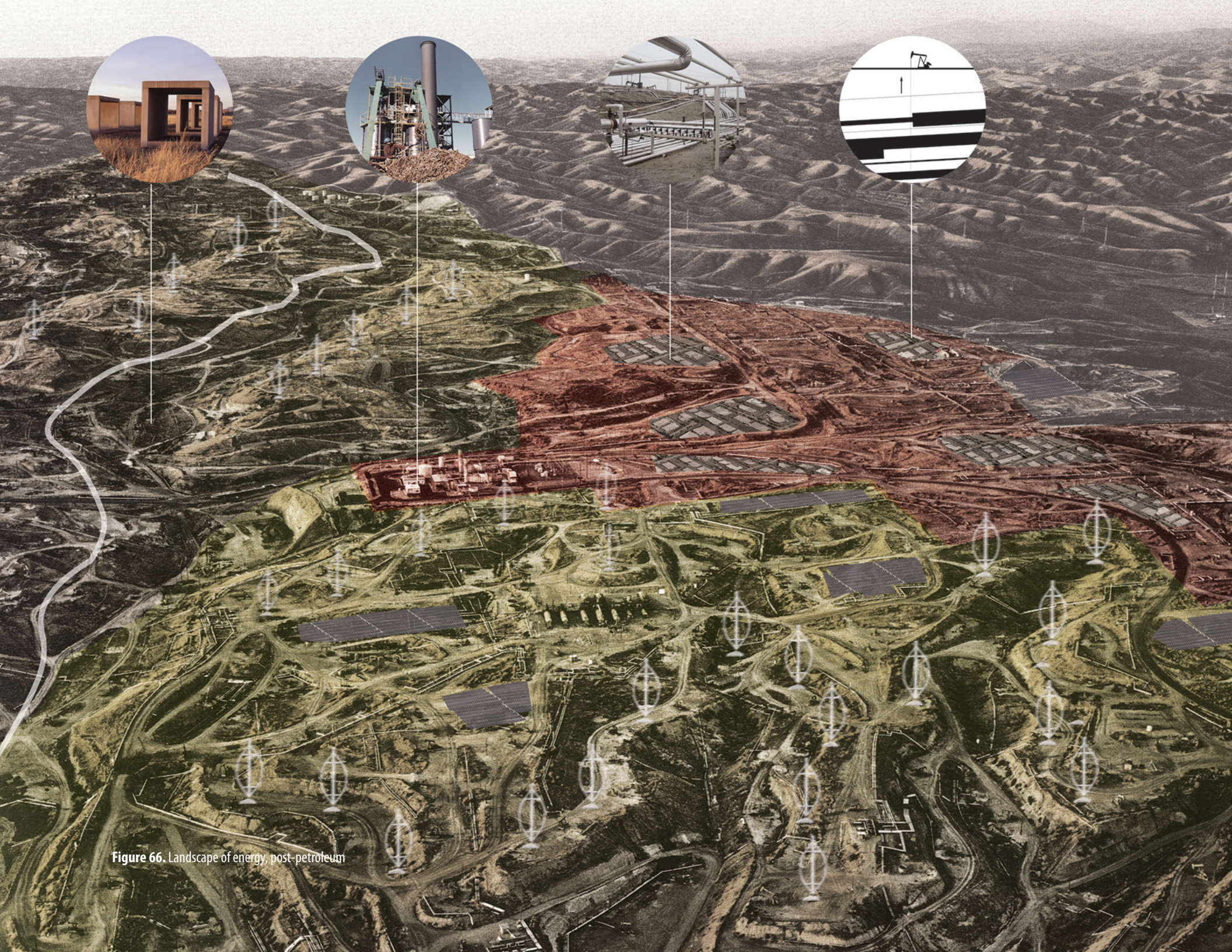


Figure 66. Landscape of energy, post-petroleum

Landscape of Energy

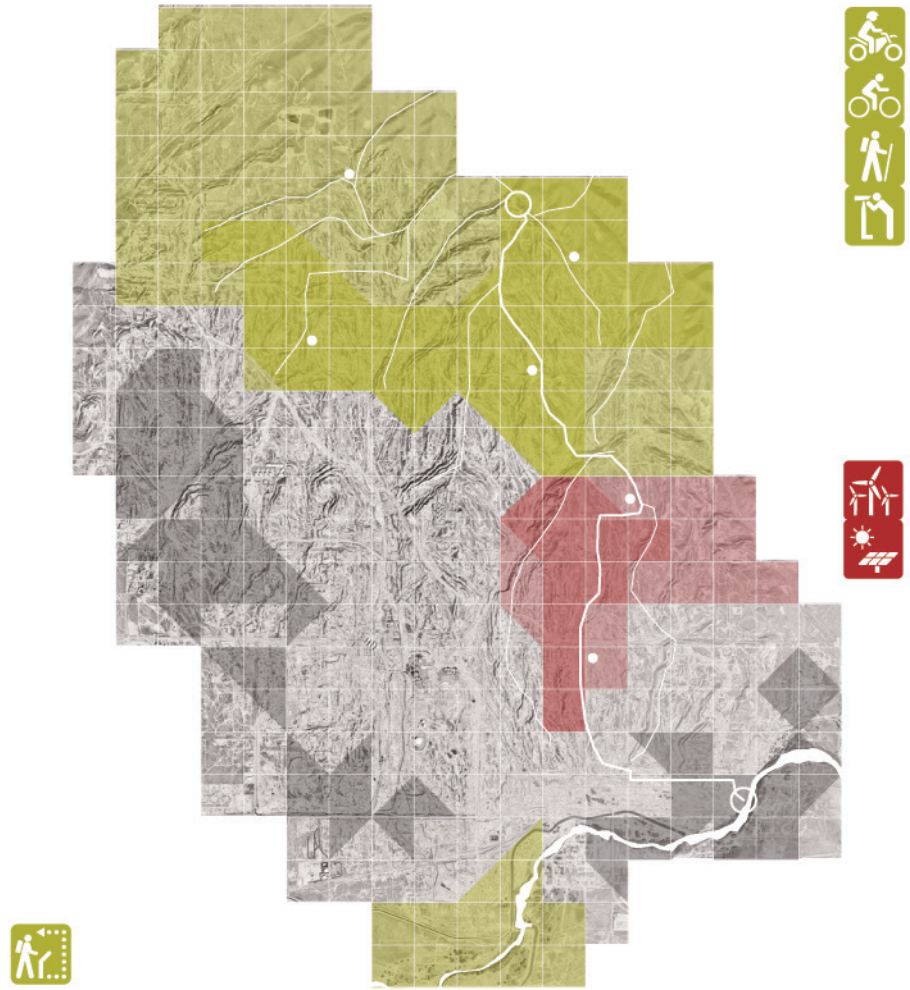
Over the 40-50 year lifespan of the Kern River Oil Field's land will incrementally transition to new uses (Figure 67). The framework started by this initial set of interventions will be expanded to allow for a broad range of recreational experiences in the site. New hiking and nature trails will branch out from the first path to connect the site's varied topographic conditions. Art installations will begin to break out of the confines of the gallery and inhabit the land itself, allowing for a more complete sensory experience.

The productive capacity of the site will be challenged as new industrial and urban uses begin to occupy the site, infilling the land between energy producing infrastructure (Figure 66). Cogeneration plants will be converted to burn the abundance of agricultural waste found throughout the valley. The steam generated will continue to flow through the existing distribution network, heating buildings and powering manufacturing machinery. Electricity generated onsite will power the adjacent community, building a greater sense of ownership in a new decentralized energy infrastructure.

2012

2027

Figure 67. Transition plan for the Kern River Oil Field



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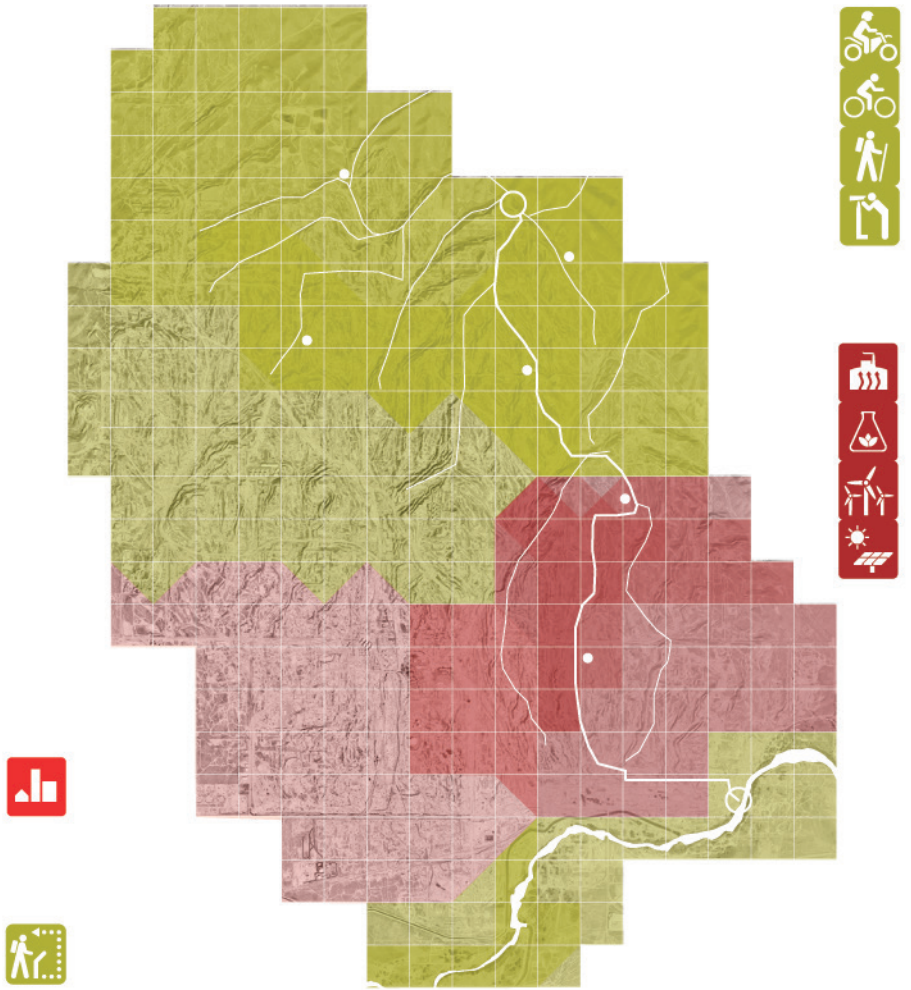

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Figure 68. View from lower gallery balcony facing south

CHAPTER 06 | CONCLUSION

Our culture is in many ways defined by our relationship to energy. An abundance of a fuel as versatile as petroleum ultimately results in the full-scale integration of that fuel into everyday life. Today Los Angeles and much of the United States epitomizes our culture of energy and the impact natural resources can have on the built environment. Clearly there exists a need to recognize the value of energy as not just a source of fuel but as a cultural stimulus. Our oil supply will soon deplete, therefore this is another transitional time in our history. How will the switch to renewable energy resources shape our built environment in the future? How will landscapes of energy production physically integrate into our experience of the environment?

Furthermore, the Kern River Oil Field reveals the possibility of a deeper and more intimate connection with landscapes of energy. It has come to symbolize the immense power and

economic control of the oil industry on the surrounding region. This field provided jobs, supported families, and influenced generations of San Joaquin Valley residents. In this community it is a cultural icon, a place that holds more value than the price of a barrel of oil. For this reason it became the primary goal of this project to embrace and maintain that value beyond the depletion of the oil deposits below the earth. By doing nothing the loss of oil would mean the loss of identity, and ceasing operations would mean abandoning acres of infrastructure and investment.

In the end architecture plays only a minor role in the transition of this landscape of energy. Economic forces and technological advancements will ultimately determine the productive capacity of this site. The architecture presented in this project is merely a recognition of the intangible cultural value of the Kern River Oil Field and the desire to expose that value to the community through experience, art, and information. These interventions are meant to foster dialogue about where our collective sense of community comes from and how we can enhance it. Although a building alone cannot influence our culture it can serve as a vessel for reflection and can support the dynamic interactions that truly define our society.

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