Post-extraction: from sand to fabricated lakes

Post-extracción: de la arena a los lagos fabricados

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Abstract

Beyond urban boundaries, radical transformations in land use, infrastructure, and ecology, termed as manufactured sites or operational landscapes, sustain urban societies through resource extraction. While historically overlooked, these processes shape urban growth and pose challenges in fragile states. Despite the focus on celebrity materials such as coal and oil, historically, non-celebrity resources such as sand and gravel have also played vital roles. Recognizing the significance of peri-urban landscapes, particularly in regions such as the U.S. Great Plains is crucial to balancing design, extraction, and ecology. The peri-urban sand and gravel extraction sites above the Ogallala Aquifer are filling with groundwater and result in recreational and residential lakes that reshape the urban edges. This essay explores the transformation of these post-extraction sandpit lakes, highlighting opportunities for new design interventions and emphasizing the need for responsible interdisciplinary practices that balance human needs with ecological concerns.

Keywords

Extraction; Urbanization; Post-Extraction; Resources; U.S. Great Plains; Nebraska

Resumen

Más allá de los límites urbanos, las transformaciones radicales en el uso del suelo, las infraestructuras y la ecología, denominadas sitios manufacturados o paisajes operativos, sostienen las sociedades urbanas mediante de la extracción de recursos. Aunque históricamente se han pasado por alto, estos procesos dan forma al crecimiento urbano y plantean desafíos en los Estados frágiles. A pesar de centrarse en materiales célebres como el carbón y el petróleo, históricamente, los recursos no tan renombrados como la arena y la grava también han desempeñado un papel vital. Reconociendo la importancia de los paisajes periurbanos, particularmente en regiones como las Grandes llanuras estadounidenses es crucial para equilibrar el diseño, la extracción y la ecología. Los lugares periurbanos de extracción de arena y grava sobre el acuífero de Ogallala se están llenando de agua subterránea y dan lugar a lagos recreativos y residenciales que remodelan los bordes urbanos. Este ensayo explora la transformación de estos lagos de arena posteriores a la extracción, destacando las oportunidades para nuevas intervenciones de diseño y enfatizando la necesidad de prácticas interdisciplinares responsables que equilibren las necesidades humanas con las preocupaciones ecológicas.

Palabras clave

Extracción; Urbanización; Post-extracción; Recursos; Grandes llanuras estadounidenses; Nebraska

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Introduction

Radical transformations of land use, infrastructure, and ecology that take place beyond urban city limits have been described as manufactured sites,[1] operational landscapes,[2] *Planetary Mine*,[3] and technical lands,[4] all of which sustain urban society. Resource-extractive industries present particular challenges for both fragile states and developing nations via the exploitation of non-renewable natural resources.[5] The process of extraction forcibly removes natural resources from our planet to produce our cities while inherently sustaining social, spatial, economic, and environmental change at the local level. While continuous expansion is more widely understood, the removal of resources is discussed less often, and instead relegated to the shadows of discourse. Examples of resource extraction often include celebrity materials such as coal, gold, oil, and copper that attract large amounts of attention; as such, the logic and spaces of extraction-informing patterns of urbanization have historically included San Francisco's gold rush, Montana's copper mines, and Houston's oil and gas fields, all of which are nonrenewable celebrity materials.

Considering that most extraction sites occupy peri-urban landscapes, it is necessary to recognize that these landscapes are social constructs that Stephanie Carlisle and Nicholas Pevzner frame in three primary components: material, form, and process.[6] Carlisle and Pevzner suggest a close examination of the spatial disconnect between the city and its hinterland, but also how contemporary cities can begin to offer meaningful connections to their extraction landscapes.[7]

Today, the U.S. peri-urban landscape is littered with evidence of the country's extraction prowess over the last two centuries, and many of these old places, now abandoned, hold new latent value for transformation and reuse. The professional and academic discourse surrounding the awareness, understanding, and operations of post-industrial sites has been occurring for decades, including in Nialle Kirkwood's 2001 book *Manufactured Sites*[8] and Alan Berger's *Reclaiming the Mountain West.*[9] While the U.S. Midwest Rust Belt and the Mountain West regions have arguably been the most impacted by rapid post-industrial development, these discussions rarely include the U.S. Great Plains, whose extraction sites of natural resources (particularly water and sand) have serviced large metropolitan regions around the globe for over a century. To fill this gap, this essay will reveal how peri-urban post-extraction sandpit lakes have fabricated conditions that bring the process of urbanization into manufactured sites. Specifically, it focuses on the importance of designing "with" nature,[10] as suggested by Ian McHarg approach to nature and ecology rather than relying purely on engineering and science to organize space. To balance urban expansion with material extraction sites, the case study of the Great Plains state of Nebraska will be used to argue that design should be an integral part of extraction and decommissioned sites. These sites are being increasingly mined for materials, monitored by extraction companies, then left abandoned; however, in a growing trend, they are now being offered back to the public for recreation or residential occupation. Returning the resultant extraction voids (in this case, in the form of lakes), to the public introduces a new, non-traditional step that brings the process of urbanization into post-extraction sites in Nebraska. In Michael Hough's 1983 essay "The Urban Landscape: The Hidden Frontier," Hough suggests that this goal can be achieved "by integrating the concept of urbanism and nature through the discipline of urban ecology."[11] Viewed through the lens of urban ecology, these sites can be recognized for their complexity of ecology and material resources. Thus, an interdisciplinary approach is required for organizing site systems, where design is at the forefront of either shaping these manufactured sites for human habitation or designing them for a return to non-human occupation.

1 Alan Berger, *Reclaiming the American West.* (New York: Princeton Architectural Press, 2002).

2 Neil Brenner and Nikos Katsikis, "Operational Landscapes: Hinterlands of the Capitalocene," *Architectural. Design,* 90 (July-August 2020): 22-31.

3 Martin Arboleda, *Planetary Mine: Territories of Extraction Under Late Capitalism* (New York: Verso, 2020).

4 Stephen Graham. "Critical Imperialism: The Technical Lands of Mining Extraction", in *Technical Lands: A Critical Primer,* Jeffery S. Nesbit and Charles Waldheim, coord. (Berlin: JOVIS, 2022), 156-71.

5 Extractive Industries and Conflict, "The EU-UN Partnership on Land, Natural Resources and Conflict Prevention." United Nations, https://www.un.org/en/land-natural-resources-conflict/extractive-industries.shtml (consulted the 1 of April of 2024).

6 Stephanie Carlisle and Nicholas Pevzner, "Introduction: Extraction", *Scenario Journal 05: Extraction* (Fall 2015). https://scenariojournal.com/article/introduction-extraction/ (consulted the 1 of April of 2024).

7 Carlisle and Pevzner, "Introduction: Extraction".

8 Niall Kirkwood, *Manufactured Sites: Rethinking the Post-Industrial Landscape* (London: Routledge, 2001).

9 Alan Berger, *Reclaiming the American West.* (New York: Princeton Architectural Press, 2002).

10 Ian McHarg, *Design With Nature* (Garden City, New York: The Natural History Press, 1969).

11 Michael Hough, "The Urban Landscape: The Hidden Frontier," *Bulletin of the Association for Preservations Technology,* 15, no. 4, (1983): 9-14, https://doi.org/10.2307/1493930.

Extraction In the Great Plains

The Great Plains landscape has given rise to several resources elevated to celebrity status for use in building and infrastructural projects. In Nebraska, sand serves as a building block for both the ecosystem and construction. The majority of sand and gravel extraction mines in the state outside the Sandhills are located directly above the largest aquifer in North America—the Ogallala Aquifer. Unlike in other national mining locations, the Ogallala Aquifer water table extends only 10-15 feet below the surface in certain regions, causing these sandpits to quickly fill with water and form lakes. In a state without significant bodies of water, these sandpit mines transformed into freshwater lakes have generated an emergent city growth pattern and constructed ecologies that minimize the visual impact of the extraction process in rural Nebraska.

The defining spatial characteristics organizing urban form in most Great Plains towns and cities is the orthogonal Jeffersonian grid, with the occasional irregular railroad lines that follow the topography cutting diagonally across the city. Today, the urban condition of several Nebraska cities is challenging the historical top-down national planning order of the U.S. Rectangular Survey System (also known as the Jeffersonian grid), which is aligned to road and rail infrastructure and organizes the land into one-mile sections and smaller sub-sections. However, this superimposed continental grid is ill-equipped to balance vegetation and water, resulting in discontinuous and disrupted ecosystems. As a result, peri-urban ordering systems have more recently been replaced by new spatial practices based on natural features, including soil type, water table level, and fabricated lakes. The results provide a variety of unique spatial types rather than predictable and repetitive ordering systems, with one example occurring when former sand extraction sites are reclaimed as public parks and residential developments (Figure 1).

Though the sand extractive process will eventually be exhausted due to the depletion of resources, most industry creators have had little foresight about what would happen to these sites after the process is complete. What is often left in the wake of these operations is a decommissioned site—a void in the landscape with minimal function or use. These abandoned sites within peri-urban conditions index the histories and eras of urban- or infrastructural-scale agendas, which over time become scars in the landscape. Although new spaces and architecture in the U.S. traditionally come from an additive process, including buildings and infrastructure, the materials to build are an extractive process. However, extraction sites around the world, and in Nebraska specifically, are changing this narrative.

Unlike historic landscape-scale sites such as urban brickyards and cement plants that pose enormous difficulties for brownfield redevelopment, Nebraska's rural sandpit sites have value-changing capacity for emerging recreational-, architectural-, and ecological-scale interventions that alter the currency of water as a celebrity resource by creating new, untapped spatial and environmental configurations that balance systems of urban growth, material extraction, and ecology. Although not spatially noteworthy, these sites are a product of the extraction process and significant due to the size and velocity of their transformation. Nebraska's sandy soil is a space where landscapes are created and destroyed but are often only discussed through the lens of material resources and engineering, rather than through the lens of design. After the extraction process is complete, these pits in Nebraska take the form of parks, planned and unplanned residential developments, and single-family estates. These reclaimed manufactured landscapes "reflect cultural values and shape new models of consuming and occupying the land."[12] Cultural values change the built environment—often with unforeseen impacts to the space, environment, and quality of life—and to understand this impact on the built environment we must recall the historical value of extracted materials—specifically water—in the Great Plains.

12 Berger, *Reclaiming the American West*.

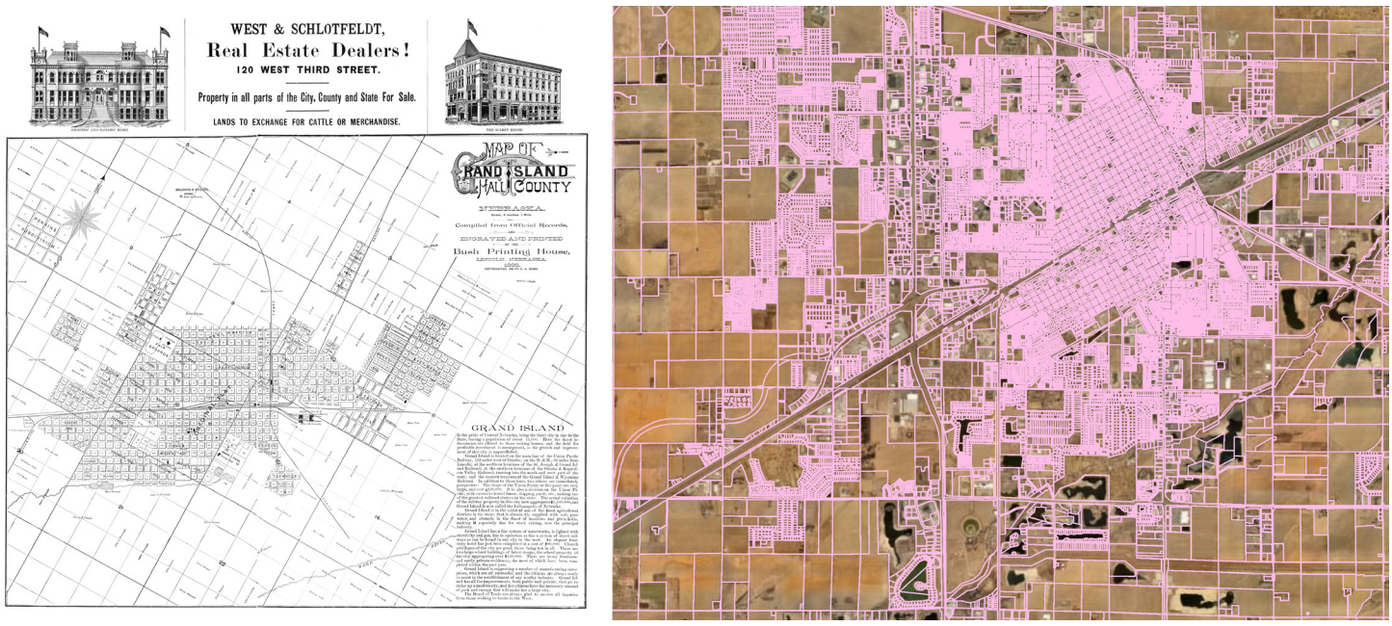

Figure 1. 1888 Grand Island, Nebraska city map, with the city grid oriented to the railroad (left) alongside the 2022 Grand Island city map, with the city grid (parcels in pink) aligning to the diagonal railroad, the Jeffersonian grid, and the extraction pits at the agrarian edge (right).

Fabricating Water in the Great Plains

The Great Plains has seen numerous strategies to maximize local spatial conditions to improve the viability of the land. The land is seemingly a blank canvas or tabula rasa, which has continuously been reinvented by extracting, harnessing, exposing, and adding elements to fabricate space. Though sand and water have become two regional celebrity resources used to fabricate space in the Great Plains, over the years, the region's relationship to water has been complicated.

Nebraska's one significant body of water, the Platte River, is a sandy, broad, shallow river that crosses the state and historically served as an essential guide for transcontinental migrations, including the Oregon Trail. The braided river edge and high water table also made it an ideal location to consider sand and lakes as both a resource and an amenity. As early as 1907, a mining operation began extracting sand and gravel from the river and transporting raw materials to Lincoln and Omaha. After mining operations ended in 1915, and by 1924, both the transcontinental railroad and the highway connecting Nebraska to Colorado were attracting travelers to Linoma Beach, a former sand pit extraction site turned fabricated lake due to the locally high water table caused by the Ogallala Aquifer.

A larger series of fabricated lakes along I-80 built on a long history of the U.S. government regulating land and resources in the Great Plains after President Dwight D. Eisenhower signed the Federal Aid Highway Act in 1956, authorizing construction of the National System of Interstate and Defense Highways. This was a grand plan that required both vision and material resources to produce the necessary 41,000 miles of highway surface. In Nebraska, the decision was made to align the Interstate 80 highway with the state-spanning Platte River over a distance of 150 miles in the middle of the state. During the construction of the interstate's overpasses and on-off-ramps, the extraction pits quickly filled with water due to the high water table. At the time, Mel Steen, head of the Fisheries Division of the Nebraska Game and Parks Commission, was aware of this effect and sought to challenge assumptions related to water and extraction pits in the Platte River valley by advocating for a chain of fabricated lakes similar to Linoma. Steen determined specifications and "strongly recommended the contractor be required to take fill dirt from a series of small, concentrated surface areas to a depth of approximately 15 feet."[13] The sand, gravel, and fill from these sandpits were needed to construct the roadbeds and overpass approaches, and mining these materials off the right-of-way was an easy way to complete the task.

13 Bill Thomas, "Super Highway Lakes," *Field & Stream,* May 1970.

Steen knew these excavations could create unique fishing opportunities for anglers, and engineers and fishery biologists lobbied hard to keep them within the public right-of-way of the interstate. Their efforts were eventually successful: the 150-mile section of I-80 from Grand Island to North Platte currently has more than 116 excavated lakes, 46 of which are publicly owned, making up 720 surface acres of water available for public fishing. These sites are collectively referred to as the "I-80 Lakes."[14] These artificially fabricated freshwater lakes are an example of a constructed ecology, and are a spatial type overlooked by the design disciplines; they hold immense potential for balancing global extraction processes with local recreation hobbies, ecological systems, and residential development.

Grand Island: Fabricating Post-Extraction Occupation

The city of Grand Island learned from Steen and the I-80 lakes in the 1950s, and as a result, since then the expanding city has reclaimed its own post-extraction sandpit lakes for residential development and revalued them as desirable places for occupation. Over the past 50 years, Grand Island has served as an important example of how peri-urban post-extraction sandpit lakes have fabricated conditions that bring the process of urbanization into manufactured sites. Grand Island, or "Central Nebraska's Platte River Oasis," as it is fondly referred to, is a growing city that addresses Carlisle and Pevzner's prompt to provide meaningful connections to their extraction landscapes.[15] The city has a long history of considering water and sand as a resource and amenity, and sandpit extraction sites are helping to facilitate expansion and annexation between the city center and the Platte River, centered around the assumption that an infinite supply of gravel exists in central Nebraska (see Figure 2).

Grand Island, located within an agrarian landscape in central Nebraska where the Platte River and I-80 meet, has a population of 52,000 and is the fourth-largest city in Nebraska behind Bellview, Lincoln, and Omaha. Grand Island has embraced both the sand and gravel extraction process to reconsider the value of water as an amenity. The city's sand extraction sites are typically mined for as little as a single season or as long as multiple decades, with the majority currently out of production. As of 2020, more than seventy post-extraction sandpit lakes are helping to facilitate population growth in Grand Island, mostly on the peri-urban edge, where most of the city's development is occurring.

Though some of Grand Island's historic sandpit sites were located in the urban center, most were located near the agrarian edge, and their overall size ranged from several hundred feet to a half mile in length. The resultant lakes generally have steep banks and dramatic changes in depth,[16] and some smaller lakes have microtopography ranging from 15-30 feet deep, with larger lakes reaching depths of 70-plus feet.[17] Lucy Lippard, writer, activist, and curator, posits that "most landscapes are actually designed by culture at the hand of anonymous amateurs who work by trial and error and privileged function over form."[18] Likewise, the shapes and forms of these sandpits are often irregular, and based around machine mining until they are no longer economically viable.

Several of the seventy-plus former extraction pits in Grand Island have been decommissioned, but by adding new social programs to these lakes, they can be viewed through the lens of what Alan Berger describes as a "reclaimed landscape." According to Berger, "reclaiming landscape is the creation of a new condition in which land is rescraped in accordance with a new program (e.g., subdivisions, grazing fields, ponds."[19] The resultant form occupies the land through the co-existence of the previously abandoned old sites and the new amenity-based programs. The reclaimed ground or space for programming around these extraction pits is changing the process of city expansion in Grand Island as the industrial- and ecological-scale networks form new development patterns that no longer rely either

14 Thomas, "Super Highway Lakes".

15 Carlisle and Pevzner, "Introduction: Extraction".

16 Nebraska Game and Parks, "Managing Sandpits for Better Fishing," https://outdoornebraska.gov/wp-content/uploads/2023/03/SANDPIT-MANAGEMENT-for-Better-Fishing-2013.pdf (consulted the 1 of April of 2024).

17 Katie Pekarek, University of Nebraska, Institute of Agriculture and Natural Resources, UNL Water Extension Educator, 2019.

18 Lucy Lippard, *Undermining: A Wild Ride Through Land Art, Politics, and Art in the Changing West.* (New York & London: The New Press, 2014), 7.

19 Alan Berger, *Reclaiming the American West.* (New York: Princeton Architectural Press, 2002), 151.

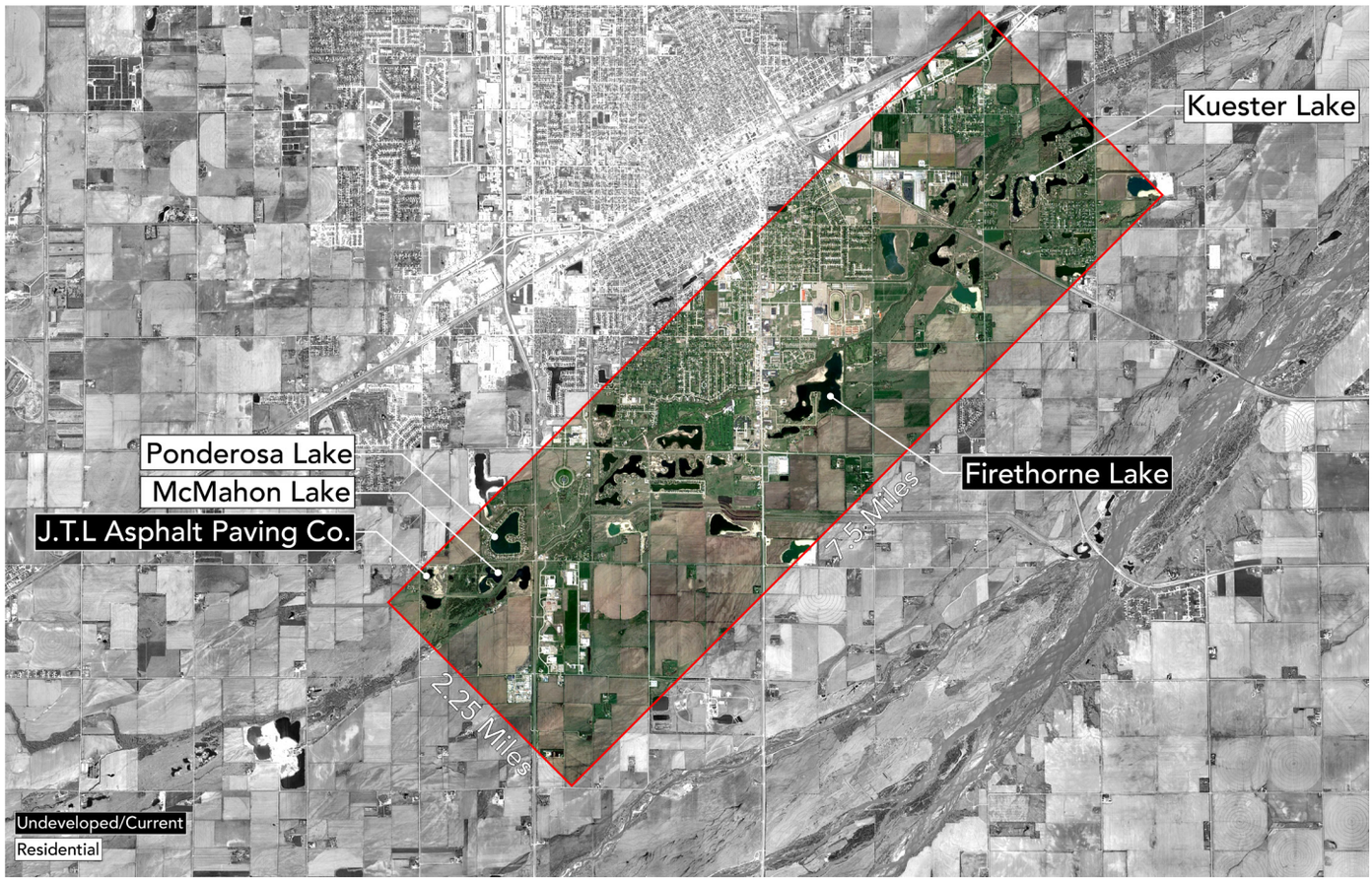

Figure 2: Extraction pits occur at the peri-urban edge between the Platte River on the right side of the map and the Grand Island city center. Visualization by author.

on the dominant Jeffersonian grid or on architecture's historic role as the basic building block for organizing space. Instead, these development patterns depend on the operating procedures of material extraction in the peri-urban condition and the resultant lakes.

Indexing Extraction

Changes to the built environment of a city are often difficult to visualize or spatialize due to their overall size and increment. In Grand Island, the extraction process and resulting desirable waterfront property are singlehandedly redefining the city limits. To understand this process, we must visualize the seen and unseen transformation, and examining the visualizations of the city over time allows us to understand the correlation between the years of active mining operations and the size fluctuation of the lake profile. This presents a clearer understanding of the evolution of these sites and catalogs the discrete moments that represent the city as both an object within a field of extraction and an urban condition undergoing changes over time.

This visualization process used data captured from the online GIS viewer website for Hall County/Grand Island,[20] which provided aerial images between 1938 and 2020 along with parcel information, and this data can be stitched together to frame a visual narrative about the histography of the site, as shown in Figures 3-5. In addition to the online data sources, data were collected through personal interviews with local citizens and city planners, and when data are tracked over several decades, the site narrative shows the development pattern of the sandpit sites' transition from extraction to post-extraction occupation. The GIS Viewer parcel data provide a link to the county assessor page, which provides data on ownership, lot size, property value, and, if appropriate, home size and schematic outlines of a home's livable space, garage, and porches (see Figure 3). This data help tell the post-extraction narrative of occupation and inhabitation ranging from high-end residential homes to public parks.

20 Hall County / Grand Island, "GIS Viewer," https://gis.grand-island.com/maps/parcel/ (consulted the 1 of April of 2024).

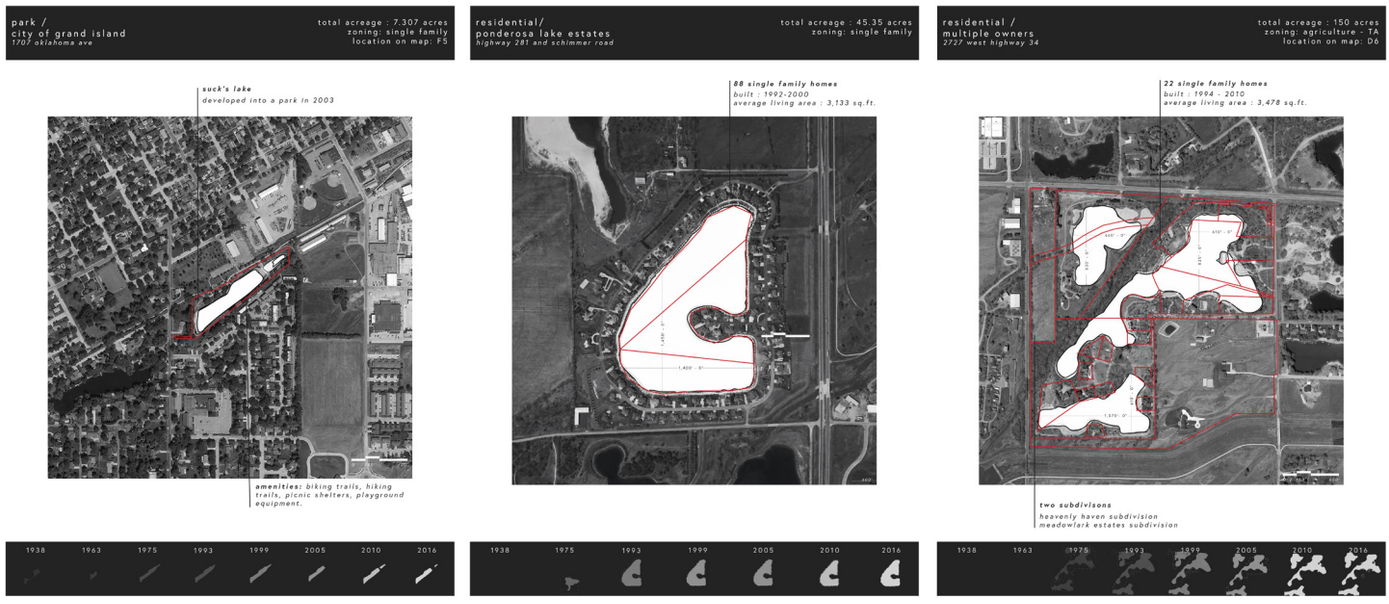

Figure 3: Three sandpit lakes in Grand Island: a planned urban park (left), planned residential development (middle), and unplanned development (right). Visualizations by author.

A comparative assessment of each lake relative to its geographical location indicated several trends among lake types: for example, most residential lakes and park lakes lie inside the city limits, while undeveloped lakes, all current extraction pits, and business/agricultural lakes lie mostly outside the city limits (see Figure 4). Each lake form tells the story of the evolution of the material removed, and these forms include commercially owned, currently in use, park, residential, and no longer in use or undeveloped. The history of these sites is diverse, ranging from landowners creating their own lakes by allowing extraction companies to mine their land to families purchasing property at the edge of an existing lake on which to build a house.

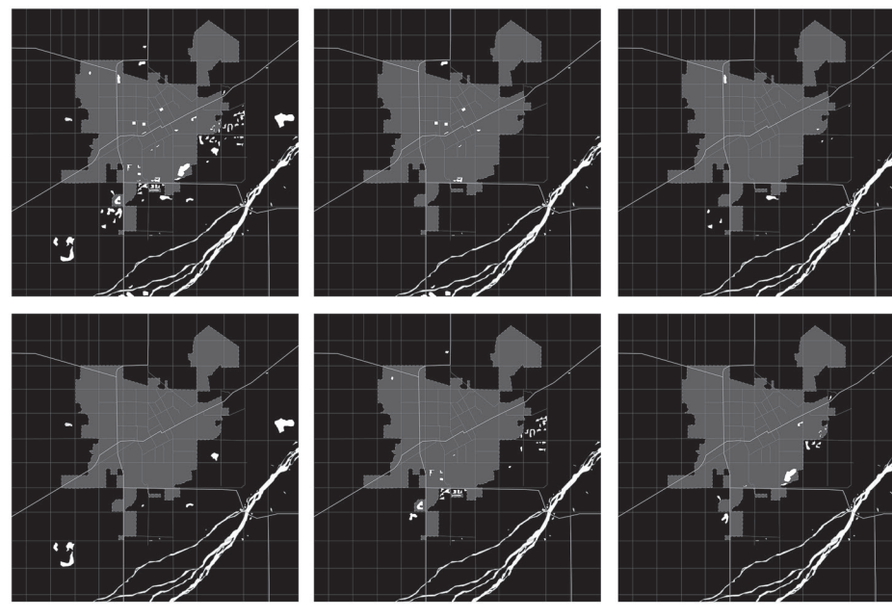

Figure 4: Clustering of lake types (shown in white) across the Grand Island city limits (shown in gray): all lake types (upper left), parks/park lakes (upper middle), business/agricultural lakes (upper right), mines currently in use (lower left), residential lakes (lower middle), and undeveloped lakes (lower right). Visualizations by author.

The lakes can also be viewed typologically, providing an alternate reading of the resultant forms. Indexing the lake shapes and uses (i.e., current programming) provides a new reading for understanding how the process and resultant form may or may not be considered for future use (see Figure 5). Through this reading, one can examine the lakes through the spatial themes of fragmented, horseshoe, peninsula, and uniform. These themes help reveal the spatial, geographical, and machine patterns that culminate in each form. The visualization of the parks and several of the residential lakes can be viewed as more intentional during the extraction process, resulting in these lakes having straight, defined edges. Alternatively, the visualizations of the undeveloped lakes show that these lakes are irregular, fragmented, and likely not as easy to develop.

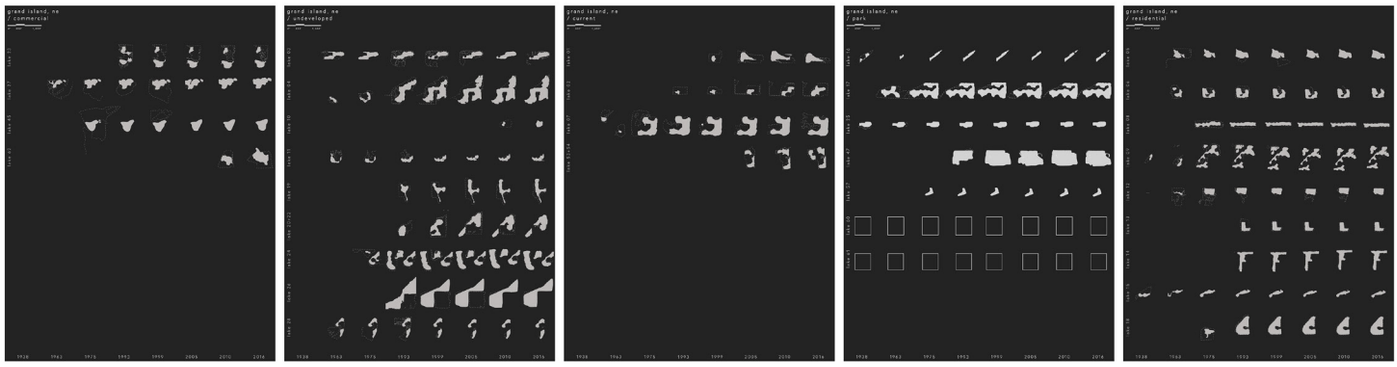

Figure 5: Visualization diagrams of Grand Island lakes typologically organized by current use, including (from left to right) commercial use, undeveloped, currently being mined for sand, parks, and residential. Visualizations by author.

Indexing Post-Extraction Residential Development

Throughout Grand Island, 28 lake areas reminiscent of typical suburban subdivisions were intentionally excavated and converted into desirable high-end housing. Closer analysis of the lakes in Figures 3 and 4 reveals that several lakes were intentionally extracted or planned while several others were extracted ad hoc and were, in this sense, unplanned. The majority of both planned and unplanned residential lakes remain on the peri-urban edge of Grand Island's city limits, suggesting a direct correlation between material resources of water, sand, and gravel and suburban development. Using a method of evaluation based on the shifting profile boundary of each lake and the uniformity of the surrounding development, it was determined that only about 20% of residential lakes were originally planned for domestic development. These lakes share two common characteristics: relatively unchanged lake profiles and an organized array of housing. These planned developments often replicate traditional suburban models with front and back yards, forming continuous yards of grass in the front and back of each house with a strip of sand following the perimeter of the lake. Each house sits perpendicular to the water, offering a 180-degree view of the lake with an attached garage in front and front doors facing the street. Most of these planned residential lakes operate as homeowners' associations, and many could have considered public open space or additional community amenities, including parks, playgrounds, or sports fields for use by residents.

A good example of such amenities can be seen in the horseshoe-shaped Kuester Lake, which contains a restaurant/bar at one end and a large park with tennis courts on the lake's peninsula (see Figure 6). This residential lake is one of the oldest sandpits in Grand Island and was mined from 1919 to 1937 by an Omaha sand and gravel company to support asphalt pavement in Omaha. While it was an active mining site, rail cars would take sand and gravel to building projects, though after operations ceased, the mine's two ponds were dredged to create the lake's distinct horseshoe shape. The consideration of factors such as machine mining and architectural buildings serves as an appropriate example of design to determine the resulting lake site, and future lakes could provide similar amenities for people, animals, and the regional ecological network. Additionally, McMahon Lake is one of twenty-two sites not planned for development during excavation, with one home on the property and a location outside the city limits. McMahon Lake is an example of a lake shape divorced from the orthogonal Jeffersonian grid, suggesting that the lake's irregular form and unplanned nature leave it essentially free to assume an open-ended shape free from the orthogonal grid.

Overall, the planned residential lakes have about half of the average and median property acreage compared to other, unplanned lake types. Both planned and unplanned lakes outside the city limits are most easily implemented as new residential areas, likely due to their high desirability and the lack of density and city regulations. The reclaimed landscapes of these sandpits serve a new programing

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Figure 6: Visualization worksheets indexing changes in sandpit extraction sites and resultant lake changes from 1993, 1999, 1995, 2010, and 2016. Shown are Kuester Lake (left), which had a short extraction period in the 1930s with a purposeful horseshoe shape large enough to incorporate recreational activities in the middle. McMahon Lake (right) had an extraction period that lasted over a decade, though it is unclear whether its shape was purposefully planned. Visualizations by author.

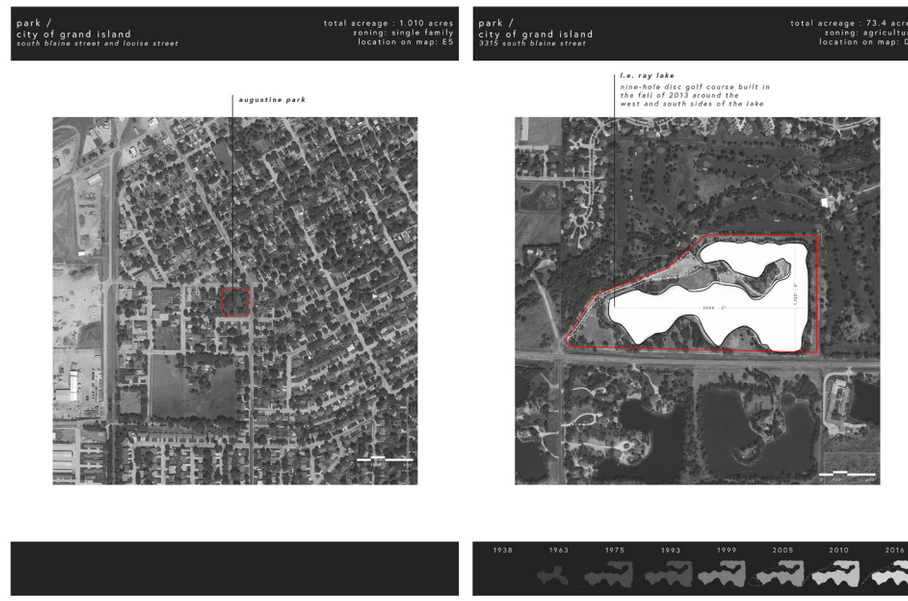

Figure 7: Visualization worksheets indexing Augustine Park (left), which was planned as a square extraction pit and a square park within the Jeffersonian Grid. The irregularly shaped Ray Lake (right), drawn at the same scale, encompasses approximately four urban residential blocks. Visualizations by author.

and urban order for the city by bringing urban development into former extraction sites, and through this kind of speculative mapping, the city could choreograph its expansion through decommissioned extraction sites.

Indexing Post-Extraction Public Parks

Out of Grand Island's seventy mining sites, ten have been converted into public parks in or near the urban center. These lakes have an interesting history: several were hand-dug, and as early as 1910, prior to refrigeration, they were harvested for ice that was sold to residents in the era of iceboxes. In the 1930s, three sites became public parks when they were filled in with topsoil from other pits. Augustine Park (a.k.a. Sunken Garden), which is depressed by about five feet, was used as a borrow pit for an elementary school. These public spaces formerly aided in the development of the urban center by supplying sand and gravel during the 1920s and 1930s for making concrete (see Figure 7).

Overmining: Concerns and Impacts

In addition to maintaining the value of sandpit lakes for recreation, as industrial extraction processes have increased, new concerns have surfaced related to quality of water, habitat, and architecture. Mining has had local impacts on the built environment and surrounding ecology, and the sandpit lake extraction sites often mask the

Figure 8: The piping plover's inhabitation of residential lakes (left) and secured nesting ground new gravel site adjacent to a residential neighborhood (right). Photos by Lauren Dinan.

undiscussed shortcomings resulting from their lack of design: challenges include issues with settling house foundations; lack of awareness; and disagreements among residents regarding best water management practices, temperature and thermal stratification, and chemistry and chemical stratification. Such issues may partly stem from the reclamation of these lakes, since, as Katie Pekarek, Nebraska Extension Educator on Water Quality, states, "sandpits and stormwater ponds are marketed to homeowners as an amenity, but are not developed with the primary intention of being an amenity and are therefore not designed to serve the purposes that they are sold for."[21] As a result, over time, these land-use transformations are likely to trigger small-scale environmental changes leading to impacted wildlife, the introduction of new species, and vegetation change, among other ecological consequences.

Two specific examples of wildlife in Nebraska have grown to depend on fabricated lakes. The interior least tern and the piping plover, both of which are currently endangered, have had difficulty finding suitable nesting grounds due to the changing water level in the Platte River. As a result, both species began relying on the sandpit lakes for survival. These sandpit lakes as habitats are an example of a constructed ecology—or what David Fletcher describes as the unavoidable result of the interaction of infrastructural and natural systems.[22] Because sand provides an adequate place to nest and the lakes offer opportunities for feeding, these birds frequently nest in these human-created habitats outside of the river channel: in 2018 there were 47 off-river nesting sites, including 21 at lakeshore housing developments and 26 at sand and gravel mines. These off-river sites are aided by the significant efforts of local activists, university partnerships, and mining and construction companies who incorporate bird nesting into the industrial process (see Figure 8).[23] The human-created habitats represent the coexisting of old sites and new functions in an urban context, and are examples of proactive environmental thinking and complex spatial research by the Tern Plover Conservation Partnership,[24] who annually meets with production crews, property managers, real estate developers, and homeowners associations to establish site-specific management and monitoring plans.

Future Scenarios

The peri-urban landscape of Grand Island offers an opportunity to plan the city's future through extraction. As the peri-urban landscape outside of Grand Island continues to be defined by extraction, the city must strategically embrace future scenarios that use an interdisciplinary approach to designing "with" nature while considering the negative effects of urbanization impacting ecological ecosystems and architecture. This landscape has the ability to challenge conventional development patterns and, more importantly, the post-extraction environment. This raises the question of how well the sandpits at the edge of the city that are being developed by homeowners associations or as single-family residences contribute to the daily experience for Grand Island citizens in a manner similar to that of the urban parks. Or, is it too late for these lakes at the edge of the city to engage in public experience, since so many of them have been privatized?

21 Katie Pekarek, 2019.

22 David Fletcher, "Los Angeles River Watershed: Flood Control Freakology", *The Infrastructural City: Networked Ecologies in Los Angeles.* (Barcelona: Atrar Press, 2009), 34-51.

23 Mary Bloomberg Brown, Lauren R. Dinan, and Joel G. Jorgensen, "Interior Least Tern and Piping Plover Monitoring, Research, Management, and Outreach Report for the Lower Platte River, Nebraska", University of Nebraska, http://ternandplover.unl.edu/download/annualreport/2015_TPCP_annual_report.pdf (consulted the 1 of April of 2024).

24 University of Nebraska, "Tern and Plover Conservation Partnership", School of Natural Resources, http://ternandplover.unl.edu/ (consulted the 1 of April of 2024).

DAVID KARLE

Post-Extraction:
From sand to fabricated lakes
Post-Extracción:
De la arena a los lagos fabricados

Figure 9: Photographic collage depicting a hybrid scenario balance ecology in the foreground, material extraction in the middle-ground, and residential development in the background. Visualizations by A. O'Neill.

Post-extraction site development in Nebraska has seen landscape and ecology become primary vectors where these systems are inherent to water usage, land use, and urbanization. As such, we must continue to challenge the development status quo and advocate for the role of designing "with" urban and rural ecologies.[25] These sites have great value for balancing the demands of global resource extraction with the needs of local design and planning efforts. In Grand Island alone, eight active and fourteen inactive and undeveloped extraction sites exist, all of which have the potential for a new sensibility that balances the value of water as a developer-driven amenity.

As Nebraska continues to confront changing assumptions about water and sand, post-extraction manmade lakes serve as a critical cultural-natural nexus. Reclaimed sandpit lakes reflect cultural values by forming a suburban residential development pattern and creating new freshwater ecologies across the state. The performance of these lakes, however, should be designed prior to and during the mining process by considering factors related to post-extraction futures (see Figure 9). Responsible solutions must be forged through the spatial disciplines of architecture, landscape architecture, urban design/planning, and ecology, but it is also up to the extraction companies, developers, local planning agencies, and environmental agencies to design these post-extraction sites in accordance with large ecological and social systems of corridors and networks. The human reoccupation of post-extraction sites in Nebraska is a growing trend that has quickly escalated over the last 20 years, and spatial designers need to look ahead of this growing typology and consider what interdisciplinary strategies they might need to engage in this work. Further, it is imperative that designers exhibit agency in challenging the commonplace assumption that these lakes should be used solely for human occupation, rather than allowing extraction companies and developers to manage this process, which could result in a homogenized typology of post-extraction residential lakes. As such, some locations should be released back to the post-extraction wilderness of the Great Plains to su-

25 Mohsen Mostafavi, "Why Ecological Urbanism? Why Now," *Ecological Urbanism,* Mohsen Mostafavi and Gareth Doherty, coord. (Baden: Lars Müller Publishers, 2010), 12-3.

pport animal and bird habits. Public agencies and design disciplines cannot overlook this emerging spatial type and the benefits of its hybrid development pattern at the risk of it being taken over by the developers of rapid urbanization.

In short, those seeking future possibilities for sandpit lakes as both operational landscapes and amenities should acknowledge the foresight of Mel Steen in valuing the I-80 lakes for recreation, as well as the development potential of the lakes themselves to simultaneously provide social, economic, and ecological benefits.

Figure Sources

Figure 1. Hall County, Nebraska Government (left) Hall County GIS Viewer (right).
Figure 2-7. Visualizations by Author.
Figure 8. Photos by Lauren Dinan.
Figure 9. Visualizations by A. O'Neill.

Bibliography

Arboleda, Martin. *Planetary Mine: Territories of Extraction Under Late Capitalism.* New York: Verso, 2020.

Berger, Alan. *Reclaiming the American West.* Princeton, NJ: Princeton Architectural Press, 2022.

Brenner, Neil, and Nikos Katsikis. "Operational Landscapes: Hinterlands of the Capitalocene." *Architectural Design* 90 (July-August 2020): 22-31.

Brown, M.B., L.R. Dinan, and J.G. Jorgensen. *Interior Least Tern and Piping Plover Monitoring: Research, Management, and Outreach Report for the Lower Platte River, Nebraska.* University of Nebraska, 2015. http://ternandplover.unl.edu/download/annualreport/2015_TPCP_annual_report.pdf (consulted April 1, 2024).

Carlisle, Stephanie, and Nicholas Pevzner. "Introduction: Extraction." *Scenario Journal* 05: Extraction (Fall 2015).

Cronon, William. "A Place for Stories: Nature, History, and Narrative." *The Journal of American History* 78, no. 4 (1992): 136.

"Extractive Industries and Conflict." *The EU-UN Partnership on Land, Natural Resources and Conflict Prevention.* https://www.un.org/en/land-natural-resources-conflict/extractive-industries.shtml (consulted April 1, 2024).

Fletcher, David. "Los Angeles River Watershed: Flood Control Freakology." In *The Infrastructural City: Networked Ecologies in Los Angeles*, coord. Kazys Varnelis, 36-53. Barcelona: Actar Press, 2009.

Graham, Stephen. "Critical Imperialism: The Technical Lands of Mining Extraction." In *Technical Lands: A Critical Primer*, coords. Jeffrey S. Nesbit and Charles Waldheim, 156-171. Berlin: JOVIS, 2022.

"Hall County / Grand Island GIS Viewer."https://gis.grand-island.com/maps/parcel/ (consulted April 1, 2024).

Hough, Michael. "The Urban Landscape: The Hidden Frontier." *Bulletin of the Association for Preservation Technology* 15, no. 4 (1983): 9-14. https://doi.org/10.2307/1493930.

Kirkwood, Niall. *Manufactured Sites: Rethinking the Post-Industrial Landscape.* London: Routledge, 2001.

Lippard, Lucy. *Undermining: A Wild Ride Through Land Art, Politics, and Art in the Changing West.* New York & London: The New Press, 2014.

McHarg, Ian. *Design With Nature.* Garden City, New York: The Natural History Press, 1969.

Mostafavi, Mohsen. "Why Ecological Urbanism? Why Now." In *Ecological Urbanism*, coords. Mohsen Mostafavi and Gareth Doherty, 12-13. Baden: Lars Muller Publisher, 2010.

Nebraska Game and Parks. "Managing Sandpits for Better Fishing." 2013. https://outdoornebraska.gov/wp-content/uploads/2016/12/SANDPIT-MANAGEMENT-for-Better-Fishing-2013.pdf (consulted April 1, 2024).

Pekarek, Katie. "University of Nebraska, Institute of Agriculture and Natural Resources, UNL Water Extension Educator," 2019.

Pospisil, Stu. "1920s Ads Touted Venice as a 'Summer Resort,' But It Ended Up as the Nebraska City That Never Was." *Omaha World Herald,* July 29, 2021, section Topical.

Tern and Plover Conservation Partnership. University of Nebraska, School of Natural Resources. http://ternandplover.unl.edu/ (consulted April 1, 2024).

Thomas, Bill. "Super Highway Lakes." *Field & Stream,* May 1970.