

IN THE SHADOW OF THE CLOUD

Project Lead:

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Design and Research Team:

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Collaborator:

Stephen Voss (Photography and Videography)

Dates & Locations:

September – October 2025

Elmaleh Gallery
University of Virginia, School of Architecture
Charlottesville, VA

March – May 2026

Kibel Gallery
University of Maryland, School of Architecture,
Planning and Preservation
College Park, MD

The modern spatial history of Northern Virginia is inextricably tangled with the development and growth of digital technologies and their networks of dissemination. As the most significant data center market in the world, the rapid expansion of data infrastructure in Northern Virginia has produced a highly fragmented urban territory that caters to the needs of technology corporations while consistently ignoring the adverse environmental impacts and the challenging socio-spatial conditions that data centers leave in their wake.

In the Shadow of the Cloud presents multimedia narratives and speculative design interventions that recount the region's emergence as a global technopole and reconsider its intertwined relationship with data infrastructure. At the center of the installation, a 1:20,000 scale model of Northern Virginia forms a multimedia palimpsest that captures the tangled histories, forces, and actors that have contributed to the region's development and continue to inform its future trajectory. Projected maps, drawings, videos, and images interact with the topographic surface of the model to create a complex and multifaceted reading of the infrastructural landscapes that lie hidden in plain sight. A textural soundscape accompanies the unfolding narrative of the project while emulating the experience of living in proximity to data centers.

Complementing the central model, speculative design interventions reimagine three prominent spatial typologies—data centers, highway interchanges, and quarries—along the Washington and Old Dominion Trail, which forms the infrastructural spine of the region. Interspersed with photographs that capture the creeping of data centers ever closer to spaces of everyday life, these design provocations reveal moments of failure and triumph, efficiency and struggle, degradation and repair, and respite and rebirth in the technical landscapes of contemporary urbanization. These interventions ultimately envision alternative forms of data infrastructures and strategies for the afterlife of data centers in NOVA and beyond.

01 | REGION IN FRAGMENTS

The northernmost edge of Virginia, stretched along the southern banks of the Potomac River, is shaped equally by history and the future. Straddling the blurred line between the North and the South, NOVA's proximity to Washington D.C. and the longstanding presence of military and intelligence agencies in the area have ensured continuous federal funding and technology contracts and have greatly influenced the direction and pace of development in the region. Home to over 3.2 million residents, the region is one of the wealthiest and fastest-growing urban areas in the United States.



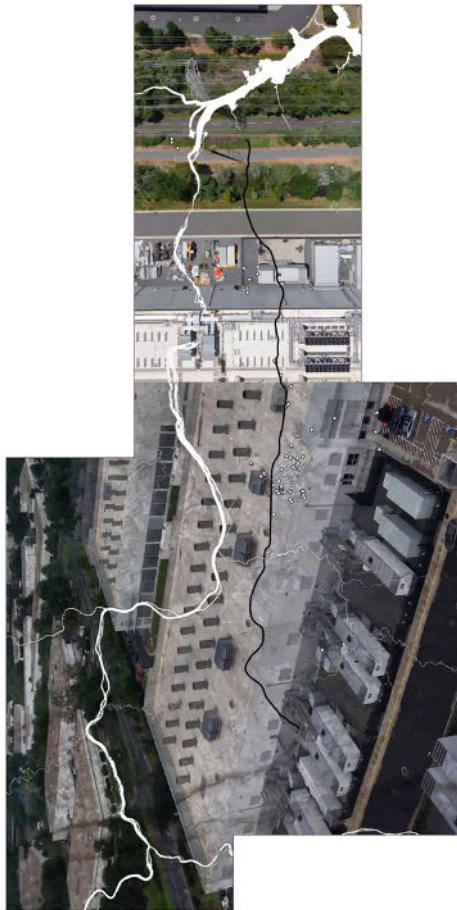
It is estimated that around 70% of all internet traffic at some point passes through the data centers and exchange hubs that dot the region. The suburban landscape of Northern Virginia currently hosts the largest concentration of data centers in the world. In Loudoun County alone, there are more than 25 million square

feet of data centers in operation, with an additional 4 million square feet under development. This is the infrastructural landscape that underwrites the rapid expansion of artificial intelligence and bolsters the growth of smart cities. This is where the cloud meets the ground.





The current spatial configuration of Northern Virginia presents a dizzying mix of uses and stakeholders. In the urban landscapes of NOVA, federal agencies share space with current and future technology campuses; historic plantations flank natural preserves; airports, logistics hubs, office parks, and data centers mingle with breweries, shopping centers, senior living facilities, golf courses, and gated communities. A thickening infrastructural mesh connects these spaces while further fragmenting the urban landscape of a region that, until fifty years ago, was largely farmland.

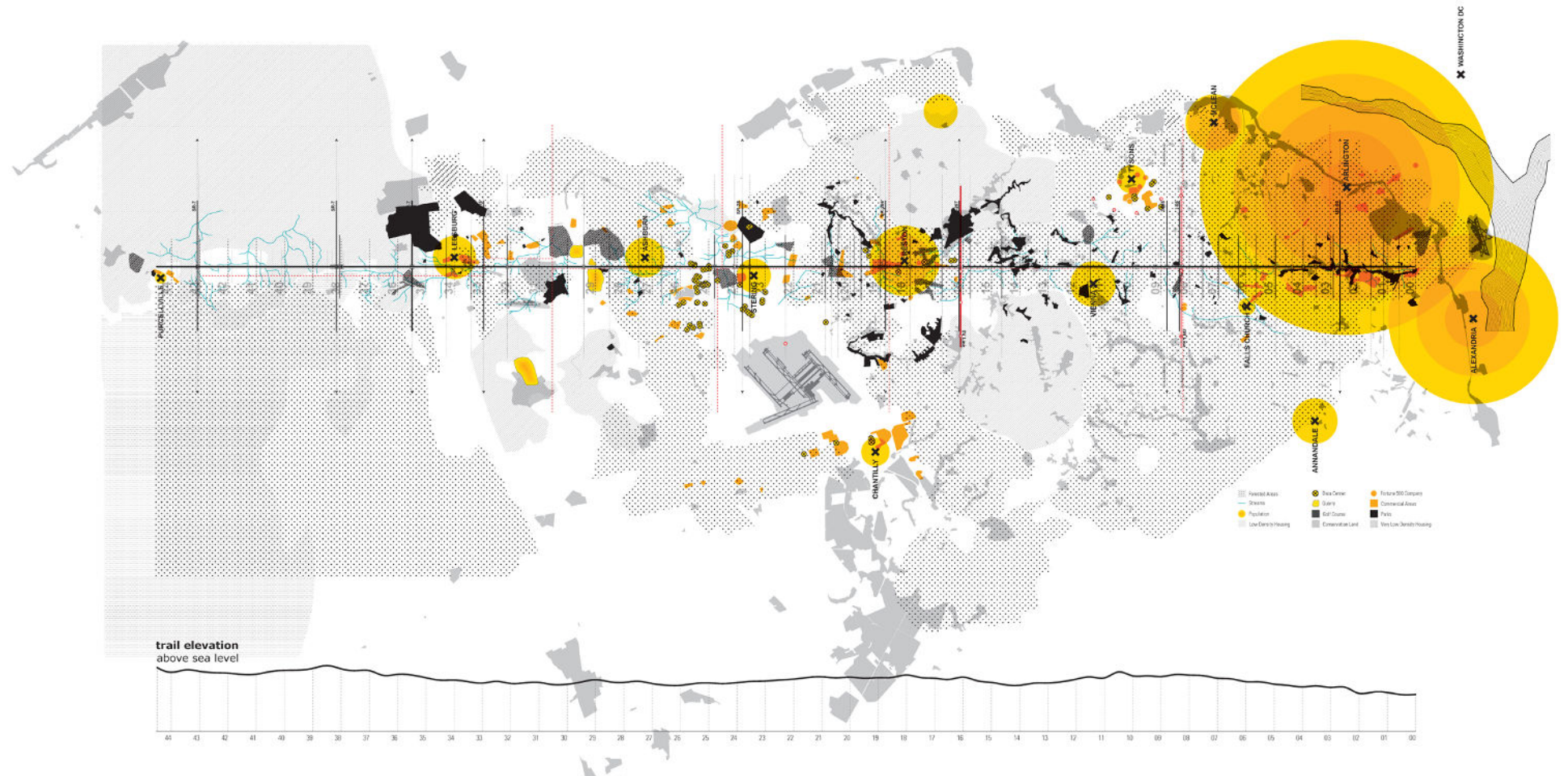


At the center of the installation, a multimedia narrative projected on a 1:20,000 scale model of Northern Virginia's topography recounts the histories, forces, and actors that have contributed to the region's development. The projected maps, drawings, videos, and images interact with the topographic model to create a complex and multifaceted reading of the infrastructural palimpsest of NOVA.

02 | FROM COAL TO BITS

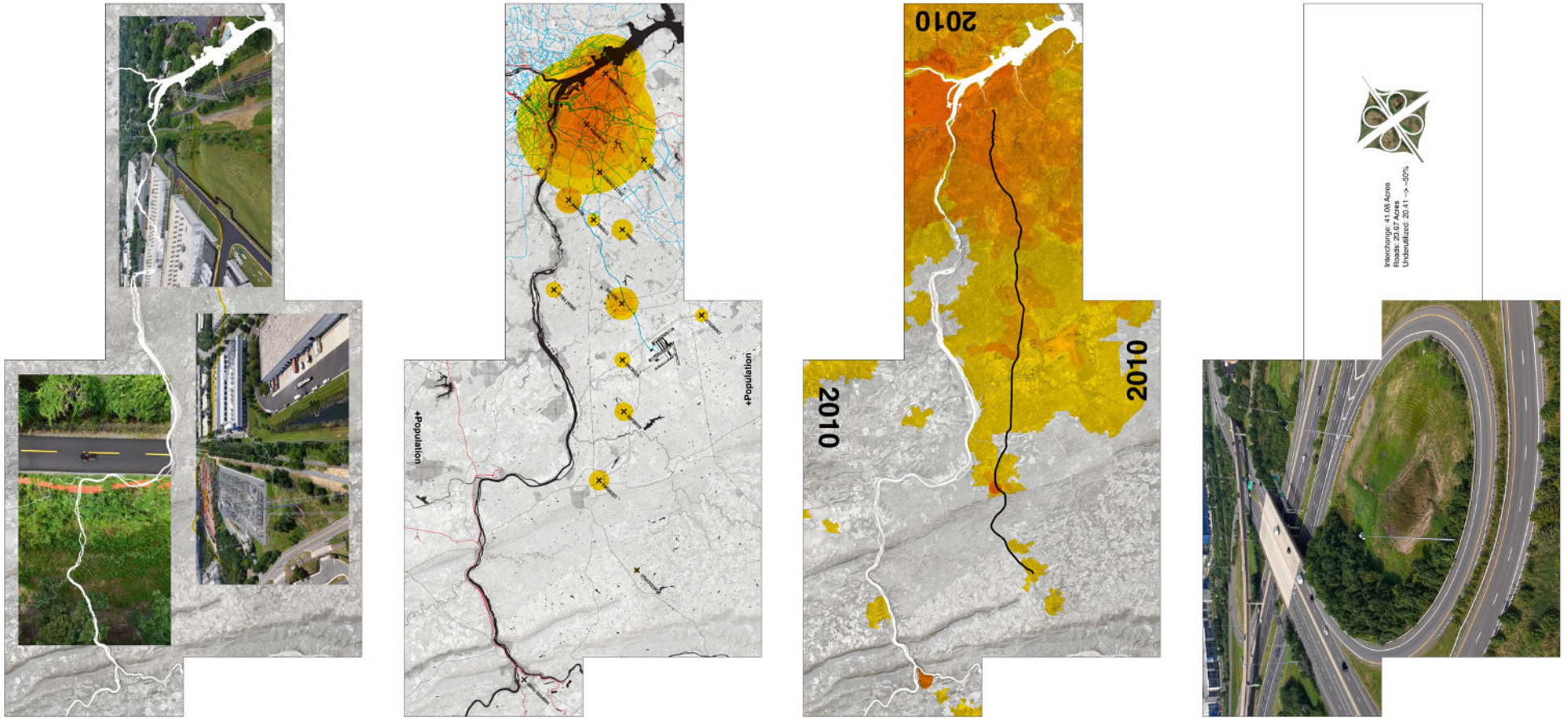
Our spatial investigation of NOVA centers around the Washington and Old Dominion Trail: a 45-mile converted rail line that stretches from Alexandria to Leesburg. Two reasons drive this exploration: First, the path of the WOD has greatly informed the trajectory of urban development in the region. Second, the right-of-way of WOD has formed an infrastructural spine for the region. Initially used by high-voltage transmission lines and later by fiber optic cables, the uninterrupted path of the trail has enabled the rapid expansion of data centers along its infrastructural corridor.

Established in 1855, the railway originally intended to cross the Blue Ridge Mountains to connect the port city of Alexandria to the coal fields of West Virginia. However, it would never go beyond the Shenandoah River. By the middle of the 20th century, the growth of automobile ownership and the extension of highways and roads in the region meant dwindling ridership on the railroad. In 1968, the railroad ceased all operations. Over the next three decades, the railroad transformed into a recreational and bike trail.



Unfolded map of the Washington and Old Dominion Trail

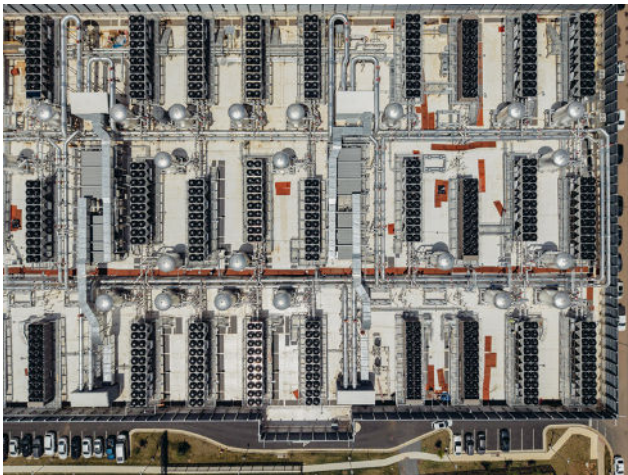
In its current incarnation as a regional trail and a linear park, the Washington and Old Dominion achieves something that its rail-based predecessor could not: a truly regional, even global, connective infrastructure. Sharing the trail with commuting bikers and parents pushing strollers are extra-high-voltage transmission lines and fiber optic cables that use the right-of-way established by the nineteenth-century rail line to mediate the region's growing dependence on electricity and to bolster its position as a global node for data traffic.



Examples of projections on the topographic model



A series of photographs by Stephen Voss illustrate the disruptive and destructive nature of data center development in Northern Virginia along the Washington and Old Dominion Trail



The series captures the tangible impact of data centers as they creep ever closer to spaces of everyday life



03 | EXHAUSTED TYPOLOGIES

Almost 35 years ago, the journalist Joel Garreau identified parts of Northern Virginia as the quintessential Edge City. Characterized by growing office and retail spaces and having more jobs than bedrooms, the concept of the edge city remains highly applicable to NOVA. But in the aftermath of the digital revolution and the ascendance of data technologies, diverse new urban types and complex urban processes have emerged in the region that have radically transformed its spatial identity. Spatial conditions and urban typologies inherited from the last century

feel increasingly exhausted and unable to respond and keep pace with the changing dynamics of contemporary urbanization in NOVA.

In the Shadow of the Cloud reexamines three of the most prominent of these exhausted spatial types: the data center, the highway interchange, and the quarry. In our interventions, the Washington and Old Dominion Trail operates as the spine of explorations, ensuring reciprocity across projects.



04 | THE INTERCHANGE

The convoluted networks of interstate highways and roads in NOVA connect together through interchanges. The standardized cloverleaf structure of a typical interchange, while efficient in directing traffic, leaves behind large tracts of underutilized spaces. There are currently more than 40 cloverleaf interchanges in our study area. On average around 44% of the spatial footprint of these interchanges remains underutilized.

Data centers in Northern Virginia now draw 1000 to 1200 megawatts of power, enough power 2 million homes

The typical Virginia clover leaf is projected to last 45 years by 2040.

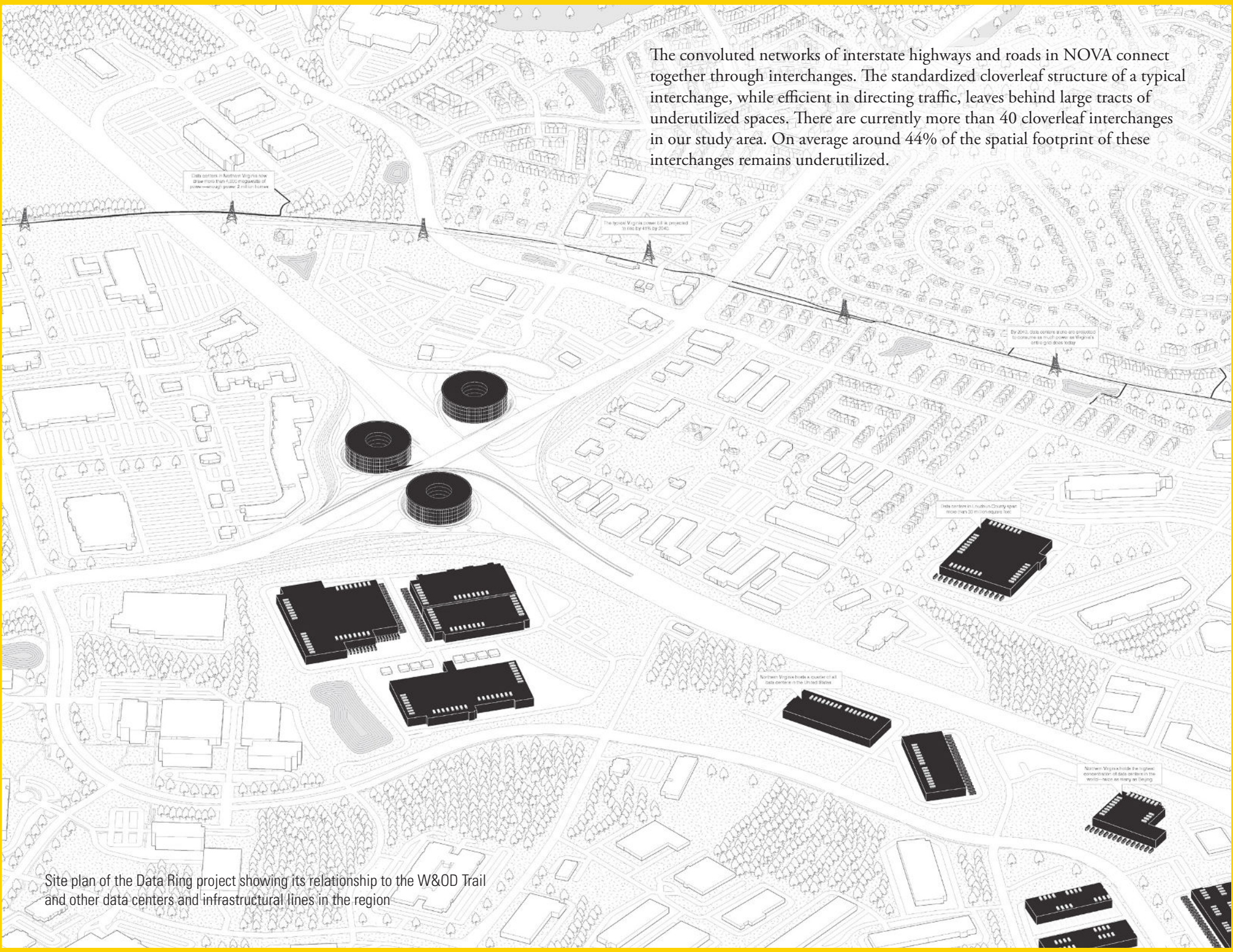
By 2040, data centers alone are projected to consume as much power as Virginia's entire grid today

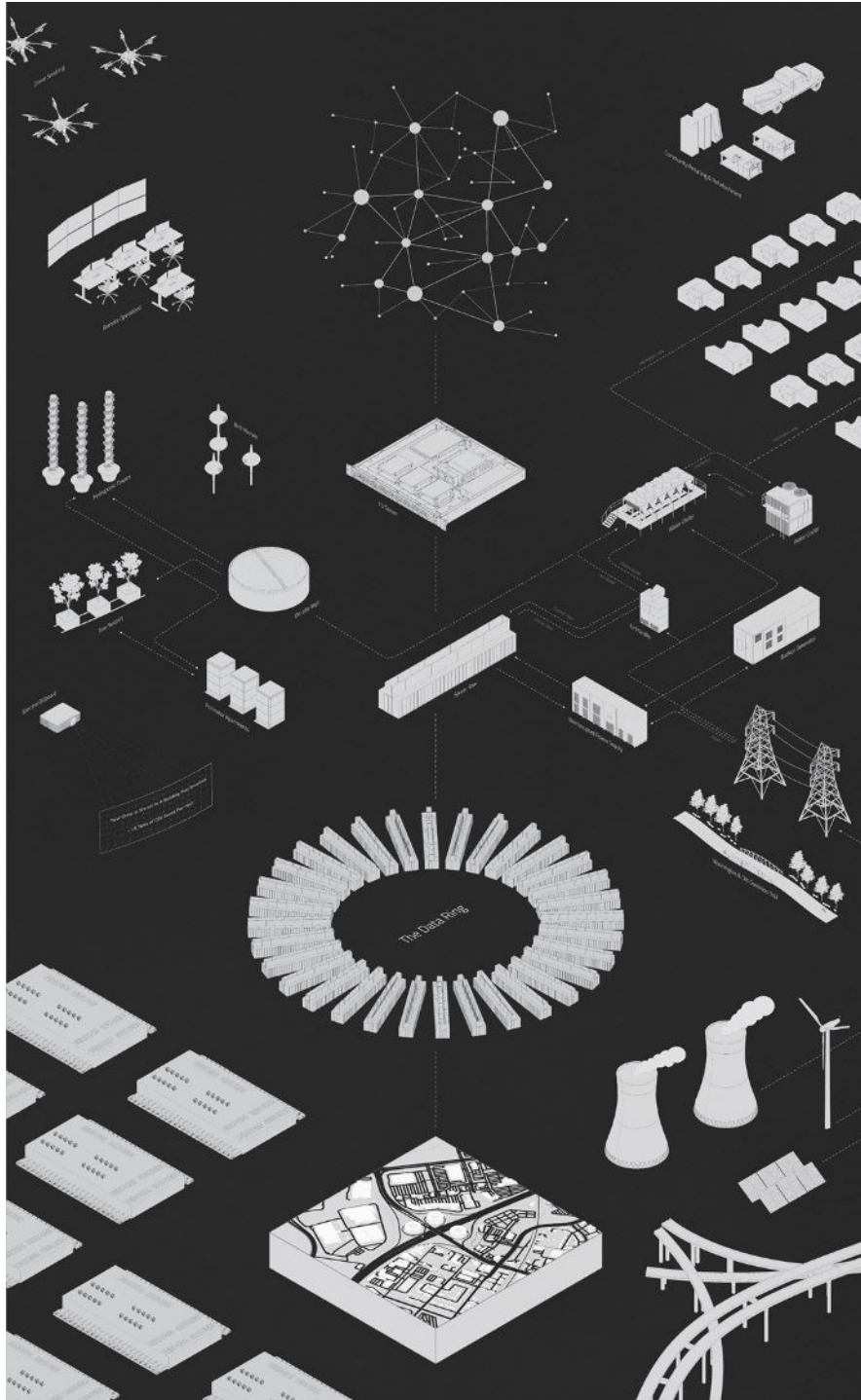
Data centers in Loudoun County spend more than 50 million dollars a year

Northern Virginia holds a quarter of all data centers in the US and State

Northern Virginia holds the highest concentration of data centers in the world - more so than any other region

Site plan of the Data Ring project showing its relationship to the W&OD Trail and other data centers and infrastructural lines in the region





We propose integrating a new breed of data centers into the cloverleaf form. As existing spaces of flow, these interchanges provide the infrastructural connectivity that data centers require while allowing for the activation of otherwise wasted landscapes that are not ideal for other uses. By creating space where it seemingly doesn't exist, this strategy keeps the outward territorial march of data centers in check, while creating new potential sources of revenue for state transportation agencies.

The system diagram of the Data Ring project (left)
detail view of the model (below)





In addition to the increasing energy demands of data centers, they also consume massive quantities of water. Data center water usage in Northern Virginia has increased by almost two-thirds since 2019, in the context of the region's growing susceptibility to droughts. To address the increasing projected demand for water, new initiatives in Loudoun County are exploring the potential to retrofit quarries at the end of their life into water reservoirs. We suspect that a large portion of this water would go toward quenching the thirst of data centers.

We posit that the public should receive something more substantial in return. We therefore propose activating the quarry, turned reservoir, through a diversity of recreational and cultural programming that integrates the quarry back into the urban fabric that surrounds it.





Site plan of the Quarry showing the project in relation to the trail and other quarries towards the end of their life-cycle



Detail view of the Quarry model



06 | THE DATA CENTER

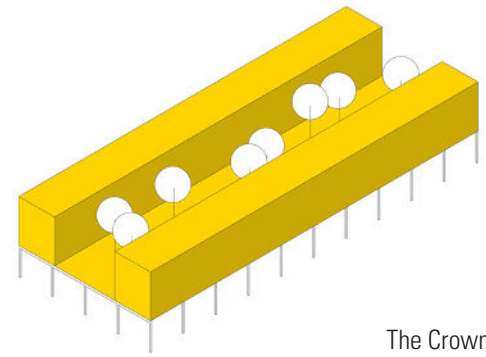
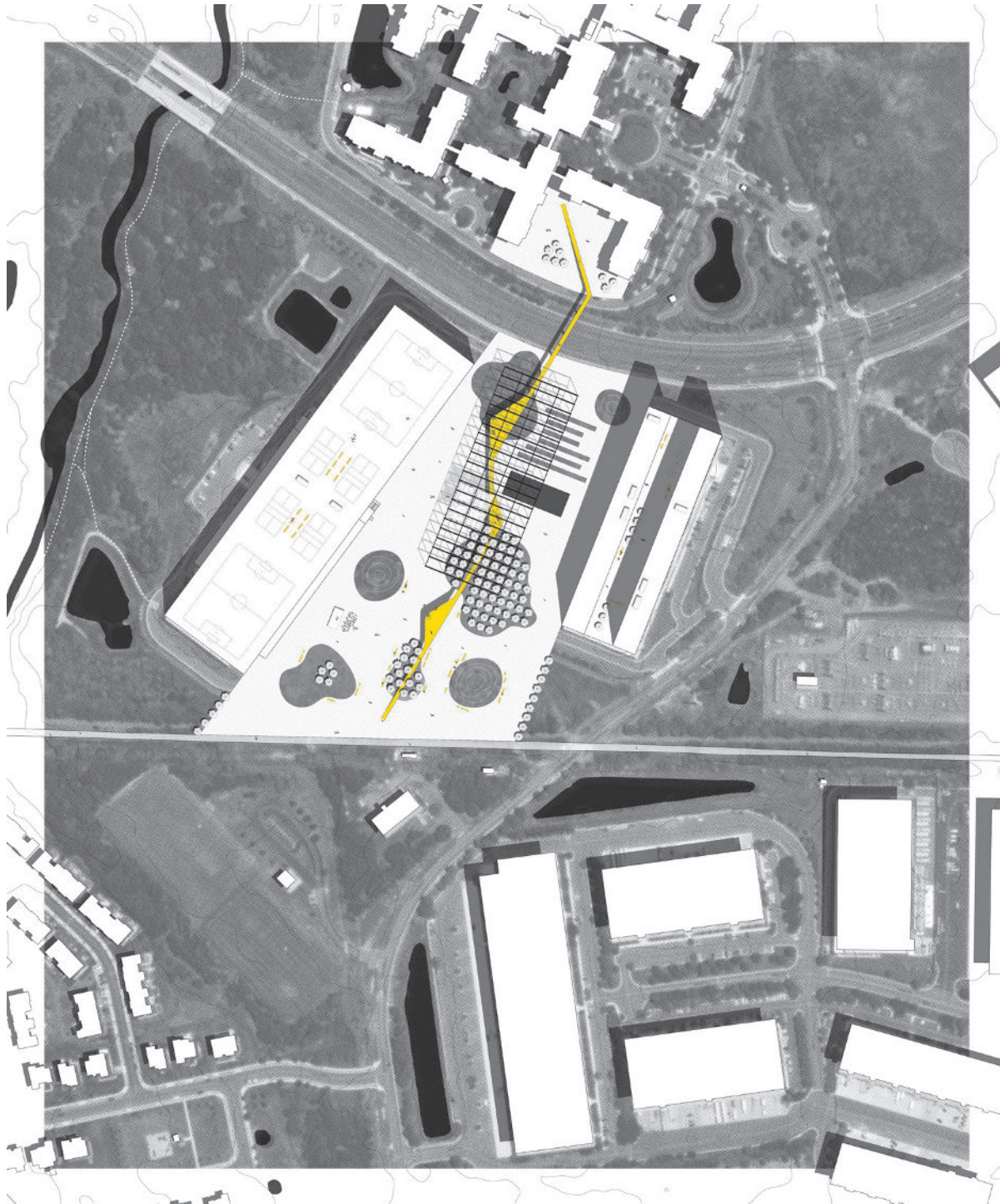
A typical enterprise data center is designed for a lifespan of around twenty years. After that, the cost of maintenance and refurbishment may outweigh that of constructing new data centers. What becomes of the football field-sized boxes, the impervious surfaces, and the toxic backup energy landscapes when there are no platforms to occupy and maintain them? What becomes of urban geographies forcefully bent to the territorial demands of the cloud once the cloud leaves?

Our intervention imagines three possibilities for the adaptive reuse of data centers:

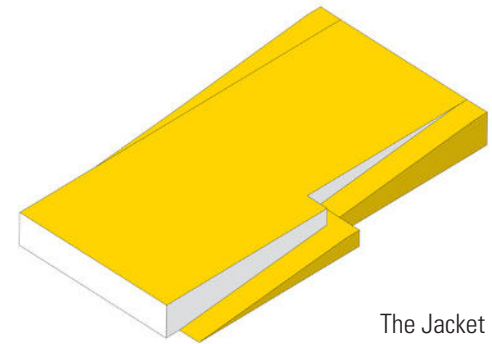
The “Jacket” strategically activates the outer skin of data centers with recreational and cultural programming. This strategy enables the continuation of data operations while concealing their massive spaces with connective and community-oriented programs.

The “Crown” incorporates much-needed high-density housing on top of disused data centers. Data centers, especially the ones in proximity to airports, are designed to withstand massive structural loads, like a falling jet engine, for example. This means that the empty structure of a data center can act as an activated podium for a variety of housing typologies.

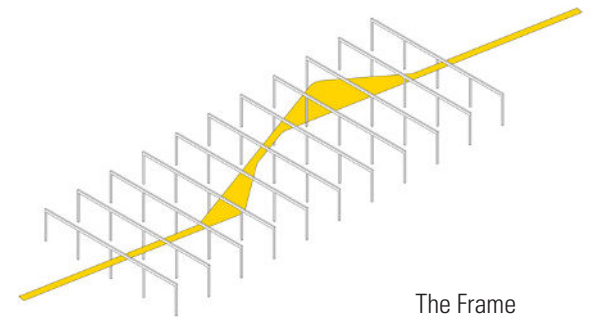
The “Frame” adaptively reuses the structural skeleton of abandoned data centers. The spatial logic and structural rhythm of data centers can accommodate a range of social amenities and community spaces. These new spaces can help connect disjointed areas of the region while positively contributing to the socioenvironmental quality of life in NOVA.



The Crown



The Jacket

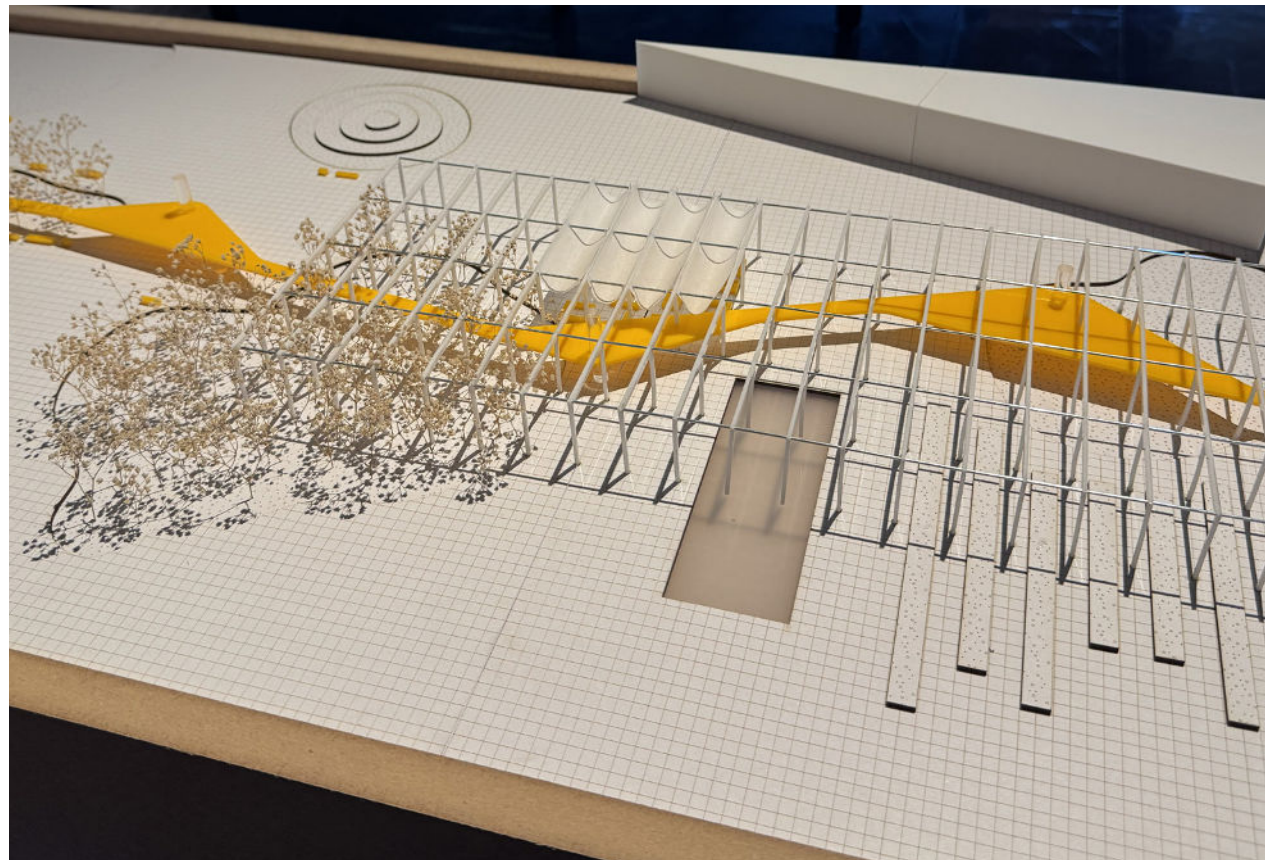
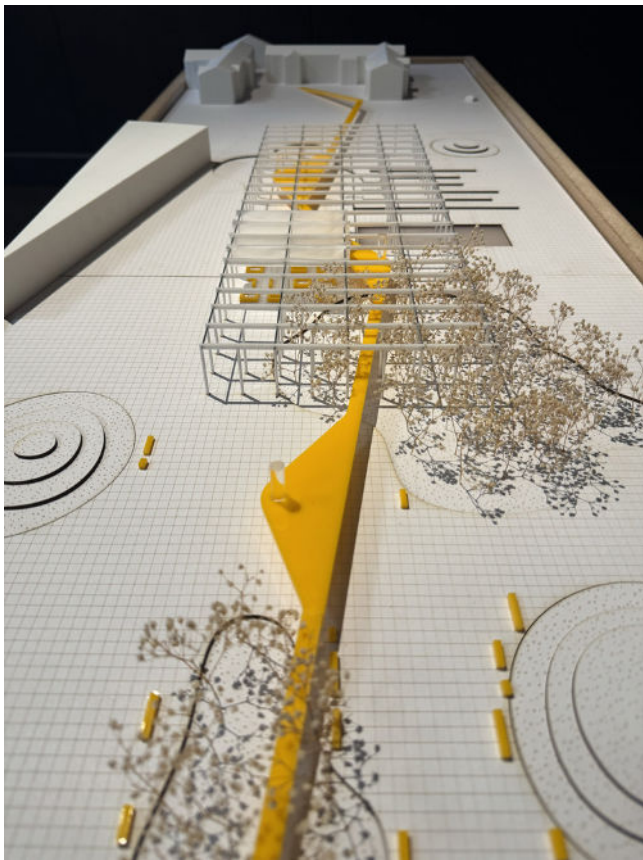
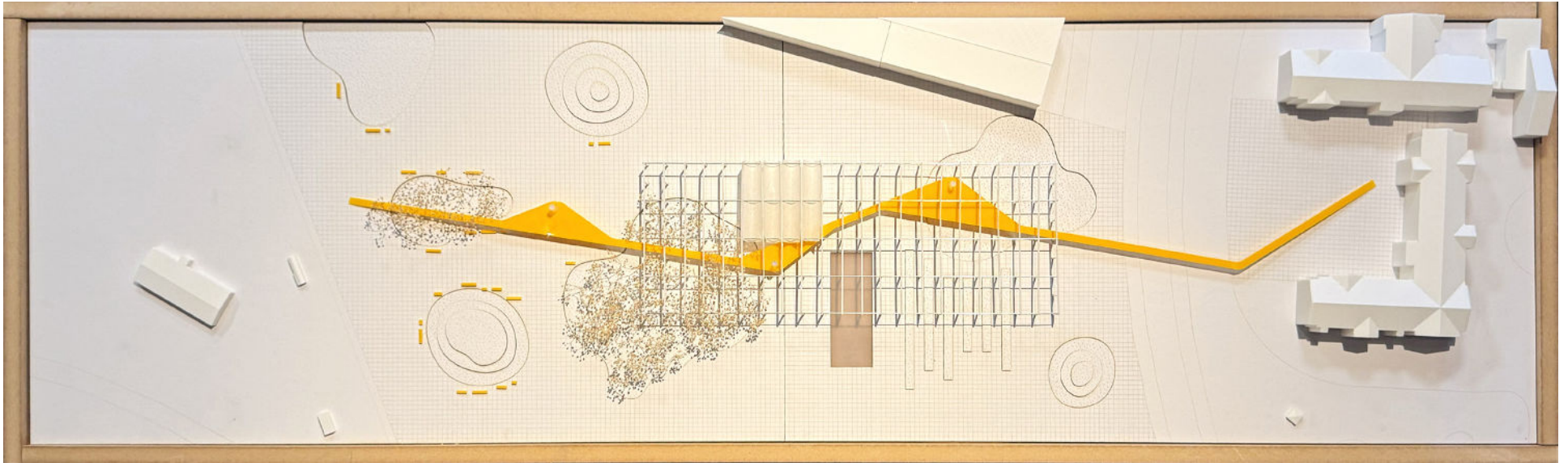


The Frame

Above: Adaptive reuse strategies of data centers

Left: Site plan of the Data Center project showing the interaction of the three strategies

Next page: The Data Center project model showing "the frame" strategy



Additional Contributors:

Trevor Kemp and Melissa Goldman (Fabrication)

Kyle Sturgeon (Exhibition Coordination)

Installation Photographs:

Tom Daly

MIST lab

Student Contribution and Compensation

Five graduate and undergraduate student research assistants from across architecture and landscape architecture formed the research and design team. Student research assistants were involved in all stages of the work, from research and drawing to fabrication and curation. All student research assistants were compensated hourly for their work, which totaled 668 hours over a four-month period.

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UVA School of Architecture Dean's Office

UVA Environmental Institute