Fermilab

2015 campus master plan

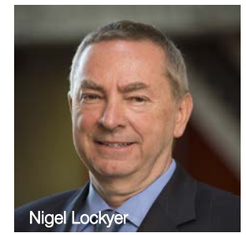
U.S. DEPARTMENT OF ENERGY | Office of Science

Fermi Research Alliance LLC

"A transformative plan creating an open, inviting and collaborative international research community."

Document Publishing and Update History
2013 First Edition, June 2013
2013 Second Edition, September 2013
2014 Third Edition, September 2014
2015 Fourth Edition, March 2016

This document may be viewed online at:
http://fess.fnal.gov/master_plan/index.html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Director's Statement

The Fermilab Campus Master Plan presents a vision for how to centralize, consolidate and modernize the facilities of a laboratory hosting a world-leading, accelerator-based neutrino program. The plan's implementation will position Fermilab as one of the top research destinations of choice for present and future generations of particle physicists.

Fermilab will be a place where researchers and staff easily connect, work collaboratively and exchange ideas in their quest to lead, inspire and enable scientists from all over the world. Just as we look to our strategic laboratory plan to direct the laboratory's scientific program, we look to the Campus Master Plan for providing a place to make the scientific program possible.

Nigel Lockyer, Fermilab director

DOE Perspective

The implementation of this plan will solidify Fermilab's position as the dedicated United States particle physics laboratory and ensure its capability to remain a vital national asset and one of the leading laboratories worldwide. The plan connects the land, equipment facilities and resource planning to the Department of Energy's scientific mission, fulfilling the DOE Office of Science stewardship role while integrating the vision for the future of high-energy physics into a master plan for the campus.

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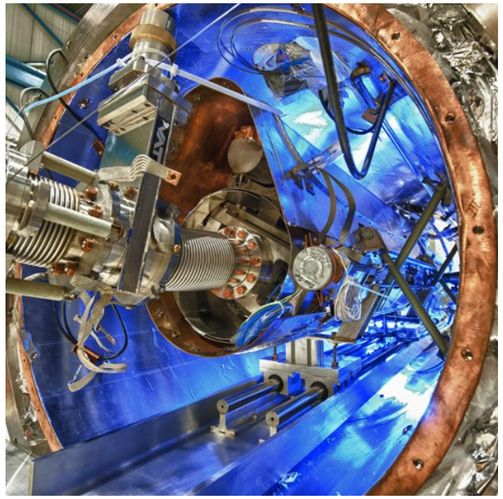
1 Introduction



Fermilab explores the universe, captures imaginations and inspires future generations.

foreword

What are we made of? How did the universe begin? What secrets do the smallest, most elemental particles of matter hold, and how can they help us understand the intricacies of space and time? Since 1967, Fermilab has worked to answer these and other fundamental questions to enhance our understanding of everything we see around us.

However, much has changed in the world of basic science research since 1967. The system of national laboratories, made up of the places where answers are researched, is undergoing a transition. The postwar laboratory model, expressed in scattered, dark and narrow bunker-like places, is giving way to open and transparent international centers for generating and sharing knowledge.

The Fermilab Campus Master Plan presents a transformative plan to create an open, inviting and collaborative international research community for 21st-century science.

Charting a path for the transition, it establishes the framework and the key elements of the Fermilab campus, reflecting a vision for future development. It synthesizes the collective goals and aspirations for the laboratory, giving them form and organization, and defines a realistic plan for implementation.

The plan is organized in three parts. Part one introduces the laboratory and provides background information, campus geography and planning context. Part two presents campus wide initiatives to organize and design the campus for future development. Part three describes development projects culminating in an international research community, with the scientific tools and supporting infrastructure to enable the next generation of world-leading research.

> The Fermilab Campus Master Plan presents a vision for how to centralize, consolidate and modernize, with the goal of hosting a world-leading accelerator-based neutrino program."
>
> Nigel Lockyer, Fermilab director

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background

The campus

About the laboratory

Fermilab, the only U.S. national laboratory dedicated totally to particle physics, was founded in 1968. Fermilab's 1,700 employees and 2,000 scientific users advance humankind's understanding of matter, energy, space and time by carrying out a world-leading program of discovery. The laboratory's core skills include experimental and theoretical particle physics; astrophysics; and accelerator science; R&D for accelerator and detector technologies; the construction and operation of large-scale facilities; and high-performance scientific computing.

Fermilab is managed by the Fermi Research Alliance LLC, an organization made up of the University of Chicago and a consortium of 86 universities. All of the laboratory's buildings are owned by the U.S. Department of Energy. The usage is predominantly divided among research and development space and administrative facilities.

The laboratory is home to one of the largest accelerator facilities in the world, including a powerful accelerator complex, test accelerators and infrastructure for the development of accelerator technologies. The laboratory's accelerator complex produces the world's most powerful high-energy beam of neutrinos, mysterious subatomic particles studied by scientists around the globe. It also provides intense beams that allow scientists to study ultrarare processes in nature. Its staff and users build, operate and lead experiments to investigate dark matter, dark energy and ultrahigh-energy cosmic rays. Additionally, Fermilab is a U.S. hub for research at the Large Hadron Collider and for R&D for the next generation of particle accelerators and detectors for use in science and society.

By the numbers

The Fermilab Campus occupies 6,800 acres of primarily farmland 42 miles west of Chicago in Batavia, Illinois. The land was purchased by the state of Illinois and turned over to the Atomic Energy Commission (a precursor to the Department of Energy). The site includes hundreds of buildings totaling about 2.4 million gross square feet of space. The laboratory includes 122 acres of parking lots and hundreds of miles of utility infrastructure, including roads, electrical, natural gas, industrial cooling water, potable water and sanitary systems.

Buildings and sculpture

Laboratory founder Robert Wilson helped design the centerpiece of the site, the stately 16-story Robert Rathbun Wilson Hall, inspired by a Gothic cathedral in Beauvais, France. The building serves as a central meeting place, housing the laboratory's cafeteria and the campus' largest concentration of offices. Adjoining Wilson Hall to the south is the 830-seat Norman F. Ramsey Auditorium, which hosts numerous talks and cultural events. Wilson also influenced the unique design and character of several other founding-era buildings and structures on campus and created several of the site's iconic sculptures.

Natural setting

But structures make up just a small portion of the Fermilab site. The campus includes over 2,500 acres of natural areas such as tallgrass prairie, oak savanna, open water marsh, sedge meadow and floodplain forest. These rich and diverse ecosystems provide habitat for many kinds of wildlife, including upwards of 300 species of birds, numerous uncommon butterflies, dragonflies and other insects, thriving populations of amphibians and reptiles, and mammals such as coyotes and mink. Visitors to the site enjoy hiking, fishing, bird watching, bicycling, cross-country skiing and photography.

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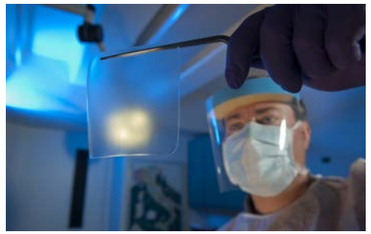
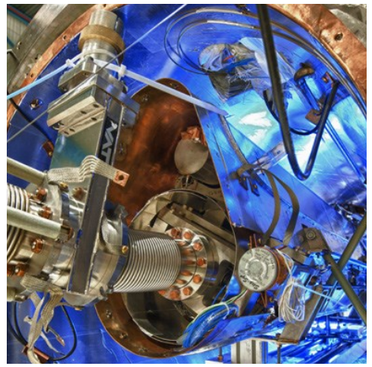
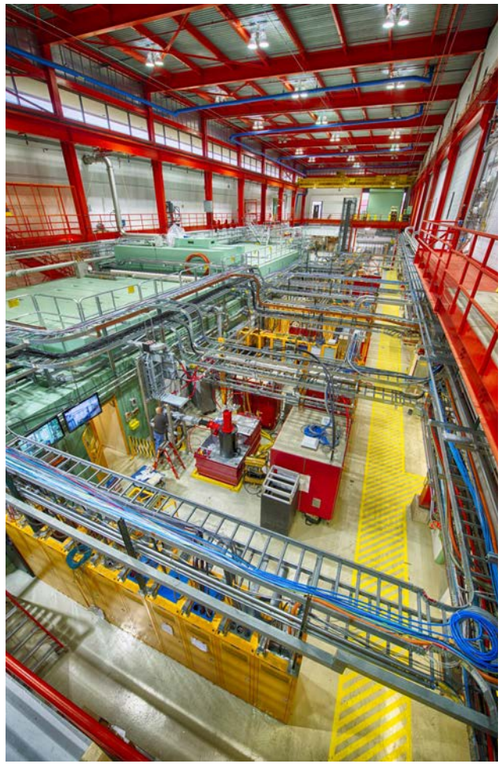
What people value most about Fermilab

Science





Particle physicists explore the building blocks of matter to answer questions all of us have asked ourselves.



Fermilab has been at the forefront of particle physics for more than 40 years. Integral to Fermilab's far-reaching mission, in its singular role as America's particle physics laboratory, is the building and operation of world-leading scientific facilities.

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International community and worldwide reach

The people of Fermilab form an international community of scientists, engineers and support staff. Intellectual curiosity is energized by sharing a zeal for discovery and by working collaboratively and cooperatively on common goals.

As an international center for particle physics research, Fermilab's scientists work with thousands of physicists around the world to conduct experiments probing the nature of matter, energy, space and time.

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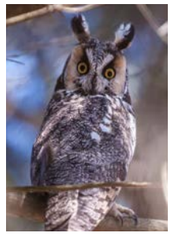
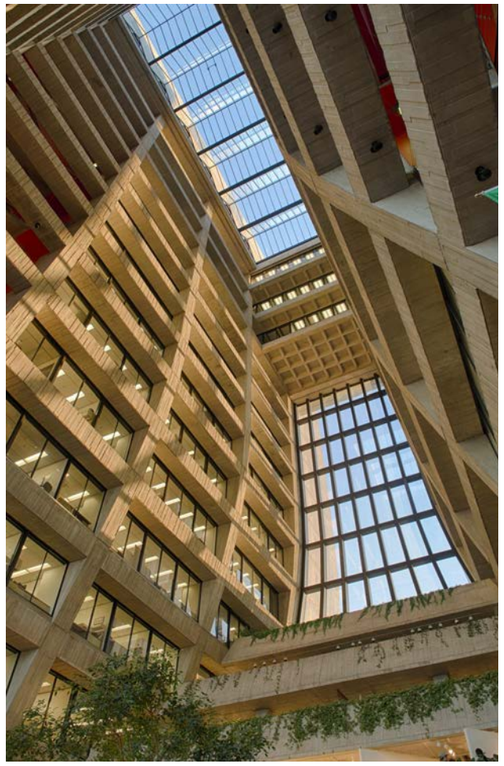
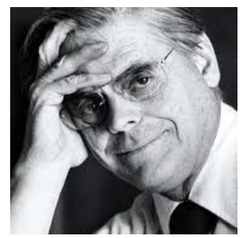
Ecology



Fermilab's 6,800-acre site has become an island of green, surrounded by residential, commercial and light industrial activity. Because of its nature preserve quality, Fermilab's neighbors view it as a positive ecological and environmental asset to the region. Fermilab is very accessible and is regularly visited by our neighbors for recreation and simply to enjoy the natural landscape. Hiking, fishing, bird watching, bicycling, cross-country skiing and photography are some of the activities enjoyed by visitors.

Art and architecture





> I have always felt science, technology and art are importantly connected…"
>
> Robert Wilson, Fermilab founder

Fermilab's respect for art and architecture is rooted in the founder's philosophy. "I have always felt science, technology and art are importantly connected; indeed, science and technology seem to many scholars to have grown out of art. In any case, in designing an accelerator, I proceed very much as I do in making a sculpture."

Robert Wilson, Fermilab founder

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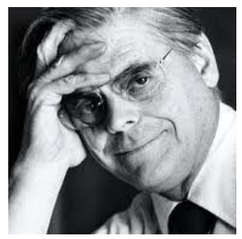
History of campus development



1968

1970s

1980s

"A building is not just a place to be, it is a way to be." Frank Lloyd Wright

1990s

2000s

2010s

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campus geography

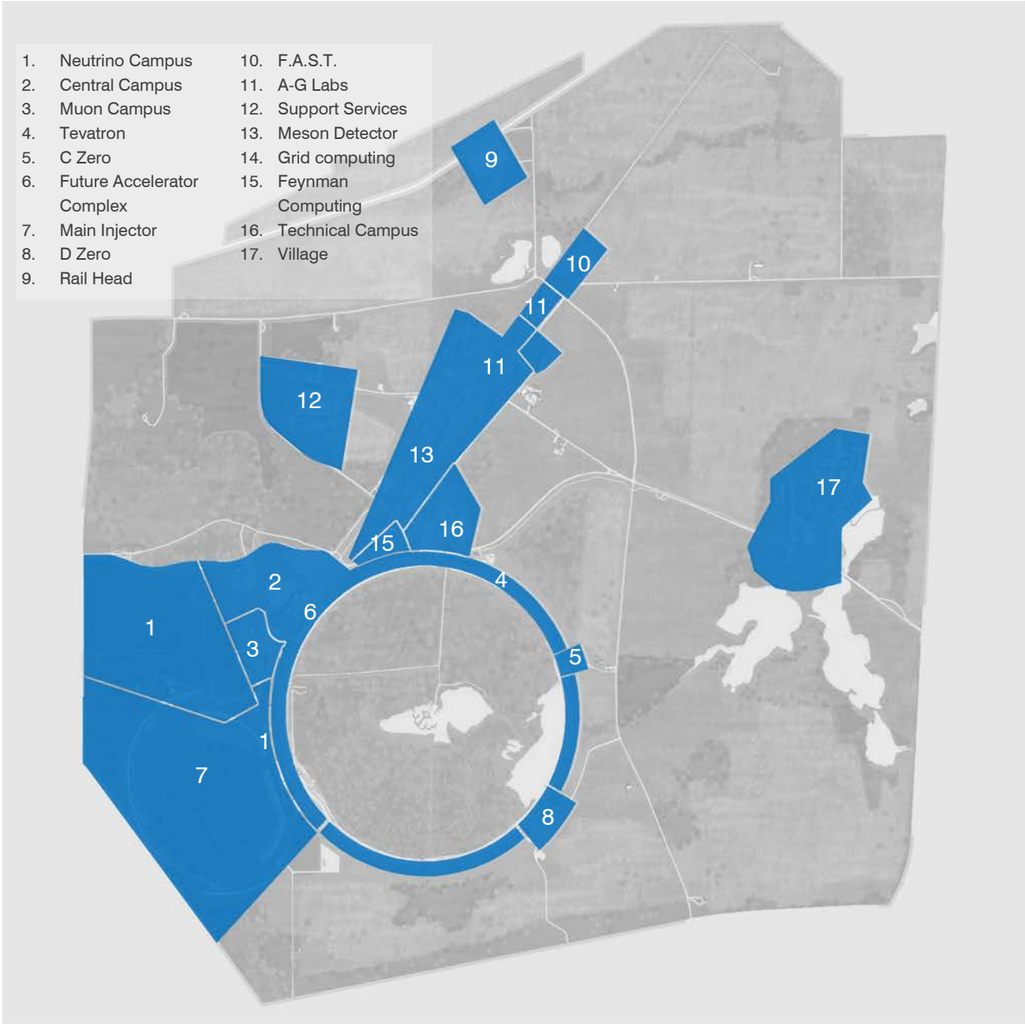
Developed regions

Introduction

How did the campus come to be? What has influenced its current configuration? The campus geography is a combination of both natural and manmade influences. In 1967 the 6,800 acres were purchased by the state of Illinois. The land was later transferred to what is now the Department of Energy for the creation of Fermilab. The area was largely farmland, with the exception of the small town of Weston, Illinois. The town, now known within Fermilab as the Village, became the headquarters for the administration and construction of the newly formed laboratory. Existing single-family homes on the site were repurposed, relocated and grouped to serve as offices, laboratories and residences. Premanufactured barn-like structures were erected in the Village to temporarily house machine shops and development facilities. This is where planning and construction of the accelerators, permanent buildings and utility systems that form the backbone of today's Fermilab took place. A system of roads evolved from the existing rural road network, and new roads were created to reach the accelerators and research buildings.

Meanwhile efforts began, and continue today, to address the many opportunities presented by the open, undeveloped land. While a vital asset for future accelerator construction, this land has become an important natural setting of diverse habitat communities and ecological areas.

Then, as now, the laboratory geography is a combination of natural setting, research buildings, accelerators, roads and utilities. The series of maps on the following pages illustrate the components that form the campus.



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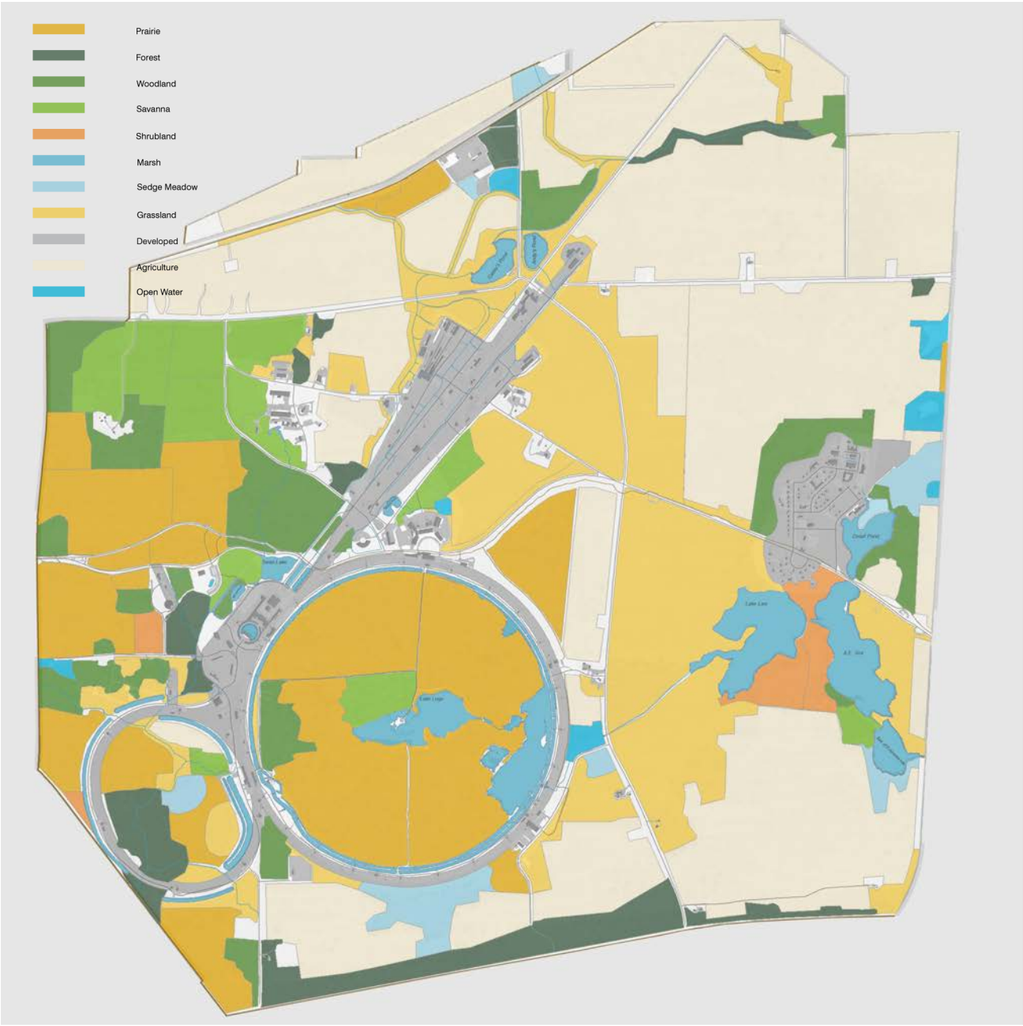
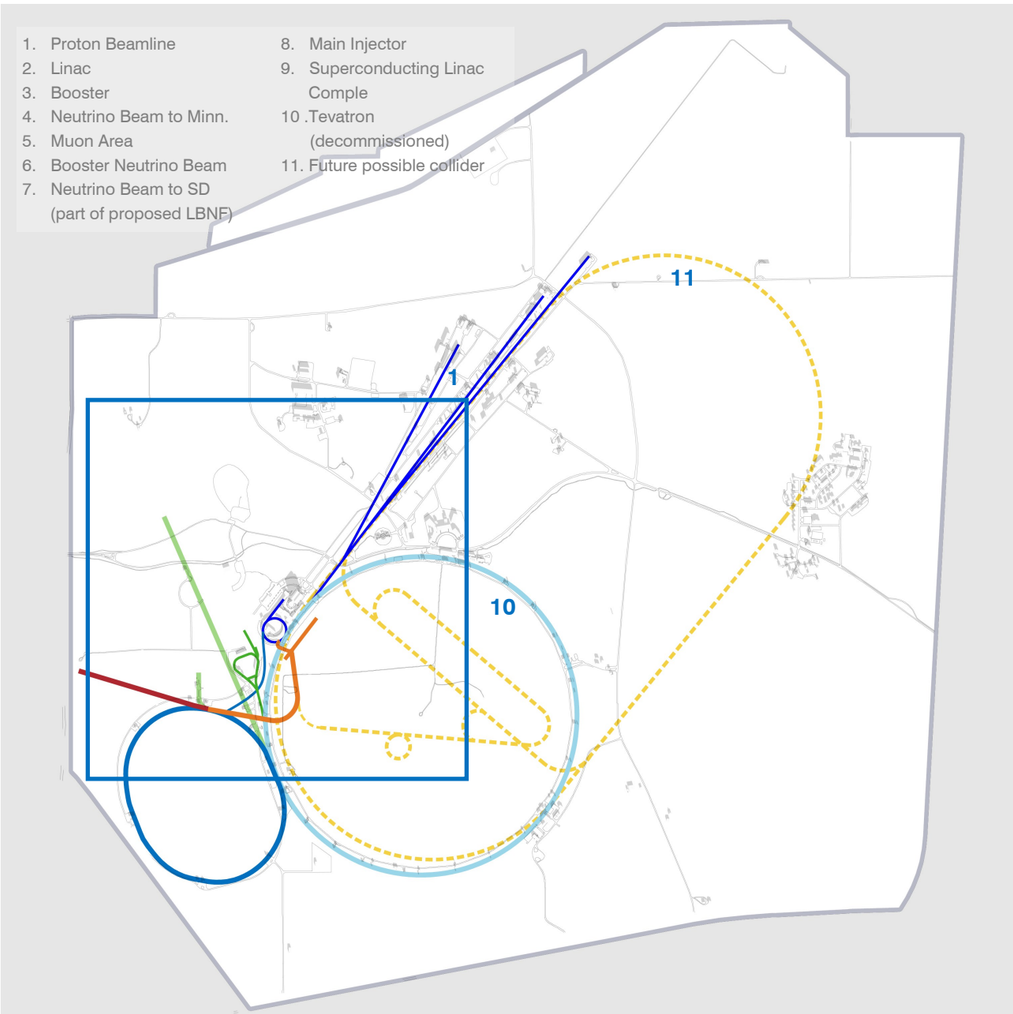
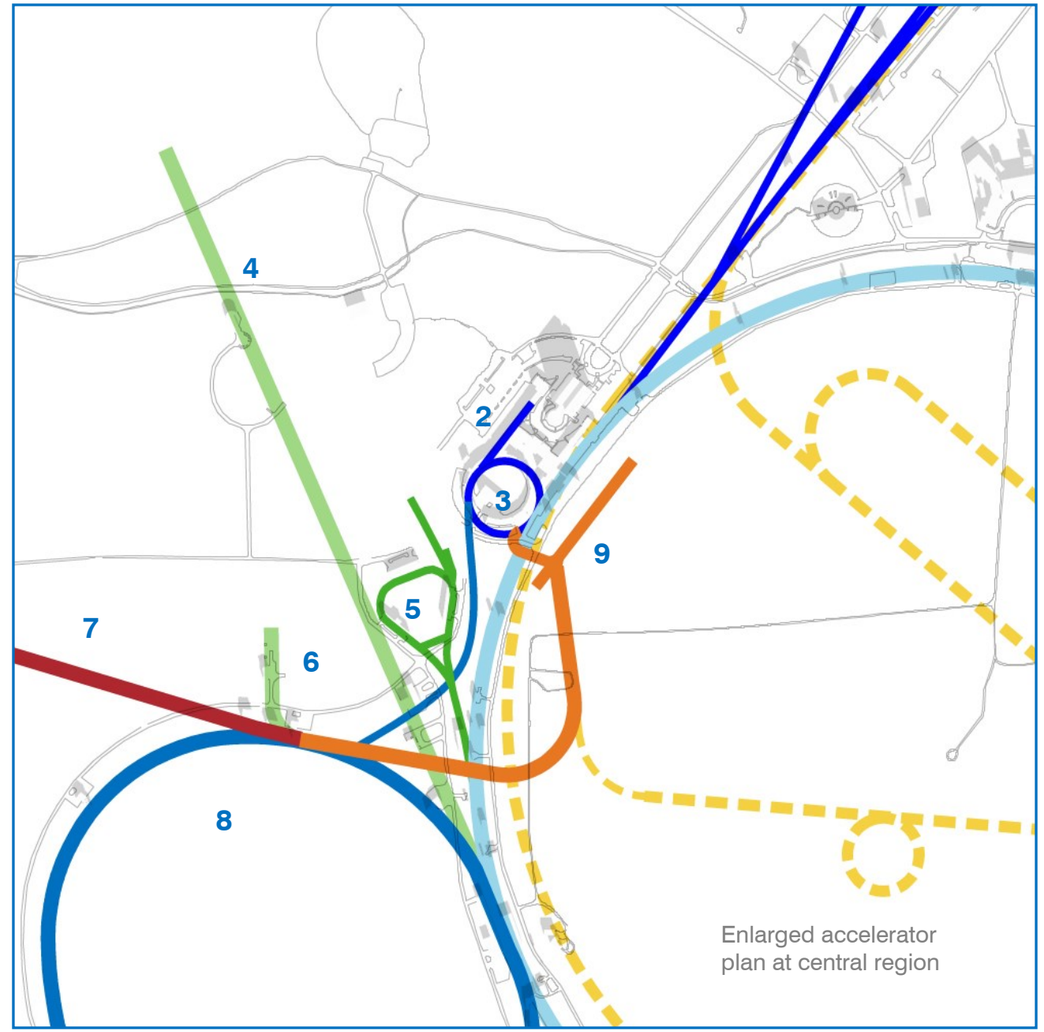
Habitat communities



Ecologically sensitive areas

Accelerator complex





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planning context

Introduction

A plan is a set of actions conceived to achieve some desired outcome. To create a master plan, the desired outcome must be clearly understood.

Twenty-first-century science needs a 21st-century laboratory. What does that mean? How will it look and feel? How is it organized? What does it imply about the current state of the laboratory? Where does the lab fall short? What is missing?

To provide answers, the Fermilab master planning team developed the guiding principles for the Campus Plan. These seven principles provide the underpinning ideals for the plan. They bring the values, needs and qualities envisioned for a 21st century laboratory.

A second valuable resource for planning context are the themes described in the laboratory strategic plan. These themes, developed by Fermilab management, describe Fermilab's core competencies. The competencies help to direct the planning process and priorities. The themes are summarized on page 27.

The planning team embarked on a critique of the current campus to understand how it measured up to the guiding principles. This critique was approached from two directions. The first was internal. We engaged Fermilab staff and management on the campus' needs and its direction for the future. The second involved gaining outside perspectives. Fermilab management engaged the services of John Ronan Architects, a noted Chicago design firm. Ronan provided observations based on his expertise of state-of-the-art campus and building design. Outside critique and working sessions were also conducted with the university architect from the University of Chicago. The resulting *Current Perspectives on the Campus: A Self-Critique* represents the outcome of these studies.

Finally, planning context looks briefly at the state of the current campus infrastructure: roads, utilities, transportation and circulation.

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Guiding principles

Support cutting-edge research

The laboratory strategic plan describes how to use the laboratory's existing world-class accelerators and infrastructure and build new capabilities to support groundbreaking particle physics and accelerator science research. Campus planning and development projects will be driven by the priorities delineated in this strategic plan.

Enhance the campus experience

Fermilab's campus shall contain a diversity of inviting, accessible and safe places for the enjoyment and interaction of staff and visitors. Improvements will be made to pedestrian walkways and bicycle paths to increase safety, improve functionality and enhance opportunities for cultural and social engagement.

Reinforce community

Central to the scientific mission is the desire to foster a sense of community. The Campus Plan shall enhance the community building aspects of the laboratory by designing buildings and open spaces that bring together researchers and staff. This should result in the creation of vibrant centers of laboratory life, fostering the free exchange of ideas and enabling teamwork and collaboration.

Ensure the campus is welcoming and informative to local and international visitors

Fermilab has a long and important legacy as a place for science education and community outreach. An enriching experience for visitors is an important element of Fermilab's mission. The Campus Plan should provide a welcoming entrance and clear designation of visitor areas. The planning and design of the campus should consider the visitors, education and outreach in all aspects. Displays should promote the unique qualities of the site and explain what it has to offer in terms of science and nature.

Promote stewardship

Fermilab shall respect and manage the physical environment of its campus facilities and lands for the health and well-being of the laboratory, its staff, users, neighbors and visitors, and the ecosystems supported by the laboratory. Facilities should be designed and built in accordance with applicable guidelines for state-of-the-art sustainable design and energy conservation.

Ensure integrative planning and design

The planning and design of the campus shall integrate disciplines, connect communities, and coordinate scientific and supporting development with mobility, wayfinding, landscape and infrastructure initiatives.

Uphold the unique character of Fermilab

Fermilab has a tradition of architectural innovation and excellence defined by the founder's vision of "a utopian place" where physicists from around the globe could work in functional surroundings reflective of the magnificence of their discoveries and theories. This is evident in the design of many of its founding-era buildings and structures, representing architectural innovations for their time. The Campus Plan should perpetuate the founding vision while acknowledging what has changed in terms of science, values and performance since the founding of the laboratory.

Laboratory strategic planning themes

Neutrino science

A major aim of the Fermilab neutrino science program is to establish the first-ever large-scale international science facility hosted by the United States. The primary goal is to establish a flagship facility, the Long-Baseline Neutrino Facility, for a world-leading neutrino science program. The program needs high-power, high-energy neutrino beams, a short-baseline neutrino program, and R&D to develop the capabilities to build and operate LBNF and its associated experiment, the Deep Underground Neutrino Experiment, or DUNE.

Accelerator science

Accelerator science at Fermilab includes three core competencies: highest-intensity proton beams, highest-field superconducting magnets, and highest-gradient and highest-quality-factor accelerator cavities. Besides continuing R&D in these areas, the core competencies are used to advance accelerator facilities, develop new test facilities and support U.S. industrial competitiveness.

Large Hadron Collider science

Large Hadron Collider science includes goals dependent on laboratory capabilities to advance science at the energy frontier. Goals involve the lab's leadership role in the CMS collaboration, technological contributions to the LHC accelerator and CMS detector upgrades, and R&D for accelerator technology and the physics program of future colliders.

Precision science

Precision science involves experiments with muons that have the potential to lead physics to a low-mass Higgs boson, indicate the existence of new dark sectors responsible for dark matter, study nonstandard neutrino interactions and indirectly probe energy scales as high as 10^4 TeV.

Cosmic science

Cosmic science goals include exploration of cosmic acceleration through large-scale surveys to determine the nature of dark energy, studying the cosmic microwave background, leveraging lab expertise to advance the search for dark matter, and serving as a hub for cosmological data and data analyses.

Computational science

Computational science enables Fermilab's world-renowned scientific research program through leadership and excellence in scientific software and computing. Goals include the provisioning of common experiment analysis and DAQ frameworks, simulation tools and advanced computing fabric solutions, including both hardware and software. Computational science advances the scientific software and computing capabilities of Fermilab through close partnerships with Department of Energy's Advanced Scientific Computing Research program and helps drive the National Strategic Computing Initiative.

Building for science

Building for science is a crosscutting theme that includes goals for improving performance in projects and project management, adapting the organization to satisfy future needs, fostering innovation, and revitalizing lab facilities and infrastructure.

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Self critique: current perspectives on the campus

Fermilab employees and visitors appreciate the spirit in which the campus was originally designed and would like it upheld.

The laboratory should continue to recognize and enhance the founder's utopian vision, on which Fermilab was based and which informed its early design.

Some of the founding spirit seems to have been lost in the utilitarian and backward-looking design of the post-founding-era buildings and utilities.

Site development and building design during the post-founding era has been implemented around economy-oriented limitations and replications of the original buildings. This process has resulted in a site populated by rather nondescript, utilitarian structures.

Many of the founding-era buildings are not conducive to the workplace expectations of current and future generations of researchers.

Many of the early buildings do not prioritize quality of life or contribute a sense of place. Many of the buildings housing scientists and staff members feel as if they were designed from the outside in, prioritizing image or representation over improving experience and quality of life. They do not have usable outdoor spaces or clear and welcoming entrances.

Generally speaking, the campus is not pedestrian-friendly.

Similar to many offices and industrial campuses developed in the postwar period, the Fermilab campus was designed and meant to be experienced by automobile. Minimal accommodations exist for pedestrian travel. This conflicts with the sense of community Fermilab seeks to create among its scientists and staff members.

Some of the existing buildings tend to dominate, as well as distract from, the laboratory's natural landscape.

The natural landscape is a significant identifying characteristic of the Fermilab campus, making it unique among laboratories. The design of current buildings is not well integrated into the landscape.

Many of Fermilab's aging and inadequate facilities will need to be updated or replaced to accommodate the laboratory's scientific program plan.

Fermilab requires additional high-quality industrial, high-bay and other technical spaces to accommodate the laboratory's scientific program.

The campus has a haphazard feel due to the scattered nature of the structures, roadways and utilities about the site.

The organizational principle guiding the siting of buildings is unclear and lead to a rather random and dissonant overall character.

The visitor experience needs improvement.

Visitors on campus need to have a more welcoming and informative experience. The campus has weak entry points that are easily missed and do not convey a sense of arrival. The overall entry sequence is not a welcoming experience.

Public areas of the campus are not distinguished from private areas, and it is not clear which campus areas and buildings are open to the public and which are off limits.

Additionally, it is difficult for an outsider to understand what happens at Fermilab, and it is currently possible to pass through the site unaware that any scientific research is taking place.

Fermilab needs to facilitate a more international and collaborative environment.

From its founding in the village of Weston, Illinois (now the Village), Fermilab has developed in a geographically dispersed manner. This barrier to collaboration extends to our scientist guests, who often come from abroad for both short- and long-term visits. During their stay at the laboratory, they should feel that they are an active part of the laboratory's research environment, a goal that is currently blocked by their wide physical separation from the scientific centers of the laboratory.

The laboratory should use space efficiently.

The laboratory should strive toward alignment with comparable research institutions, generational and industry reference points and national laboratory trends. Additionally, buildings tend to be categorized by organization and divisions thereby not taking advantage of the possibilities and benefits of shared space.

The main entrance needs improvement.

The main entrance at Pine Street, aside from the sculpture “Broken Symmetry” by Robert Wilson, is unimpressive and disorienting to the uninitiated. One is not sure whether he is allowed to enter, and there is minimal indication as to what Fermilab is.

The vehicular circulation and wayfinding is inadequate and confusing.

The transportation and circulation system also present a number of challenges. The roadway layout was initially based on pre-existing rural roads. New roads were then added to access the experiments. Additionally, raised-earth berms shielding the Main Ring and linear accelerators, along with new and planned berms, interrupt roads and require alternative circuitous routes to get around campus.

Building identification and wayfinding signage throughout the site is minimal, inconsistent and inadequate.

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Infrastructure

Site utility systems

Effective and reliable site infrastructure to support the research community and the tools for science are vital to achieve Fermilab's mission. Currently, the primary distributions systems for utilities on the Fermilab site include domestic water, industrial cooling water, sanitary sewer, natural gas, electrical power, telecommunication and computing. The site has one central utility plant, the CUB, that provides both hot and chilled water to Wilson Hall and associated buildings in the campus' central district.

Here is a simple overview of the system by the numbers:

- 2 primary electrical substations
- 241 secondary substations
- 115 miles of underground electrical cable
- 3 miles of overhead transmission lines
- 27 miles of underground industrial cooling water piping
- 19 miles of underground domestic water piping
- 14 miles of underground sanitary piping
- 18 miles of underground natural gas piping

Two major utility upgrade projects are under way to address some of the challenges. One is the high-voltage electrical upgrade, replacing the Master Substation building and associated components, located about a quarter mile north of Wilson Hall. The other is the industrial cooling water upgrade, which involves the installation of a new ICW backbone-piping network from Casey's Pond to the Main Ring ICW system.

Many upgrades, improvements and repairs have been ongoing pursuits at Fermilab since its founding. However, as Fermilab is nearing its 50th anniversary, and as major new beamlines and accelerators are under development for the future, utility infrastructure will present challenges.

Transportation and circulation

Fermilab has an extensive system of 36 miles of roadway, connecting 122 acres of parking. The layout, largely based on pre-existing rural roads, has evolved to include additional roads as needed to access the experiments.

The campus has three entrances. The Pine Street entrance on the west is the main entrance and is marked by the sculpture "Broken Symmetry" by Robert Wilson. The Batavia Road entrance on the east is a major employee entrance for those traveling from the east. The Wilson Street entrance, at the northwest corner of the site, is primarily used for delivery, service and construction vehicles.

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Vision: What could Fermilab look like in twenty years?

The Campus Plan is based on a long-term vision of what the Fermilab Campus can become and how it might look, feel and function 20 years from now.

State of the art

Buildings will be state of the art places representing and furthering the advancement of Fermilab's ongoing research.

Welcoming and international

Campus improvements will continue to transform Fermilab into an ever more welcoming and international community of researchers.

Open and green

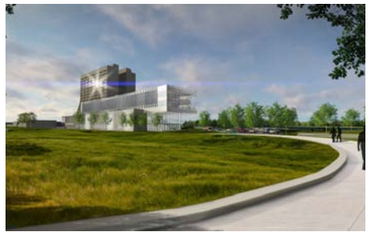
Consolidation of buildings will help preserve Fermilab's rich and diverse natural areas and make available other areas for future large-scale physics machines.

Consolidated and integrated

Currently diffuse facilities will be condensed into the central campus. Creativity and innovation will flourish as researchers and staff mingle in this distinct and vibrant place of research and collaboration.

Connected and engaged

The campus will be connected by various modes of transportation: walking, biking and, possibly, a campus shuttle.



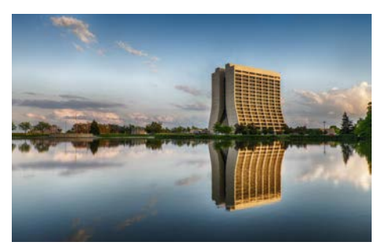
Foreword
Background
What people value most
History of campus development
Campus geography
Planning context
Guiding principles
Strategic themes
Self critique
Infrastructure
Vision

campus plan 2

Part One briefly documented Fermilab's beginnings and evolution over its nearly 50-year history. It then presented guiding principles and laboratory strategic themes that describe goals and aspirations for future campus design and development. A 20-years-from-now vision described a state-of-the-art, open and green, consolidated and integrated, connected and engaged international research community.

In that context, Part Two presents the Campus Plan. We describe our plan for organizing and designing the campus to best achieve the laboratory vision. The planning process takes into consideration the organization of the campus, functional relationships, environmental issues, landscapes, vehicular and pedestrian traffic patterns, visitor experience, architectural character and the future aspirations of the laboratory. The planning initiatives, responding to the aspirations expressed in the guiding principles, as well as the current gaps and shortcomings noted in the self-critique, create a framework and foundation to guide improvement plans and efforts.

The result will be a functionally and visually unified campus, setting the stage for future developments. When fully implemented, the initiatives will result in a campus organized to support cutting-edge research, foster international collaboration and community, and harmoniously integrate new developments with the natural setting. This campus will be inviting, easily navigated by all, and welcoming and informative to visitors.



Consolidate and centralize

Create planning regions

Define core campus districts

Establish design guidelines

Strengthen campus landscapes

Integrate sustainability

Improve mobility and wayfinding

organizing the campus

The Campus Plan looks at what type of experience we want to offer Fermilab's users, users of the future, as well as our own scientists and staff, and our community neighbors.

Tim Meyer, Fermilab chief operating officer

Consolidate and centralize

Create planning regions

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Consolidate and centralize

Condensing our footprint will enable concentrated integrated, connected and engaged, workplaces.

Approximately 500 staff members currently work in numerous, distant and antiquated facilities scattered throughout the campus. The first diagram, Fig. 2.1, identifies regional clusters of these outdated facilities. The table below quantifies the candidate structures. Figures 2.2. and 2.3 illustrate gathering and moving to the center.

The initiative to consolidate and centralize recommends moving many staff into newly proposed facilities near Wilson Hall. The resulting condensed footprint will enable the envisioned consolidated and integrated, connected and engaged workplaces. Pedestrian-friendly outdoor connections, as well as climate-controlled links between buildings, will create a collaborative community where researchers work nearby, easily meeting together to exchange ideas. Obsolete facilities will then be decommissioned and demolished.

This initiative will also contribute to an enhanced visitor experience. As the campus becomes consolidated, visitors will more easily integrate into the centers of activity. New buildings will provide the opportunity to include designated visitor areas as part of their programming and design. Concourse and mezzanine levels, open to the public, can provide views into tech spaces, assembly areas, cleanrooms and operations centers. As major new developments link to Wilson Hall with traffic flowing into the atrium, this area will be energized, and visitors can share the experience.

Area	Number of buildings	Total area in square feet	Number of occupants
1	40	135,000	50
2	10	75,000	80
3	20	185,000	370
4	40	30,000	0
Totals	110	425,000	500

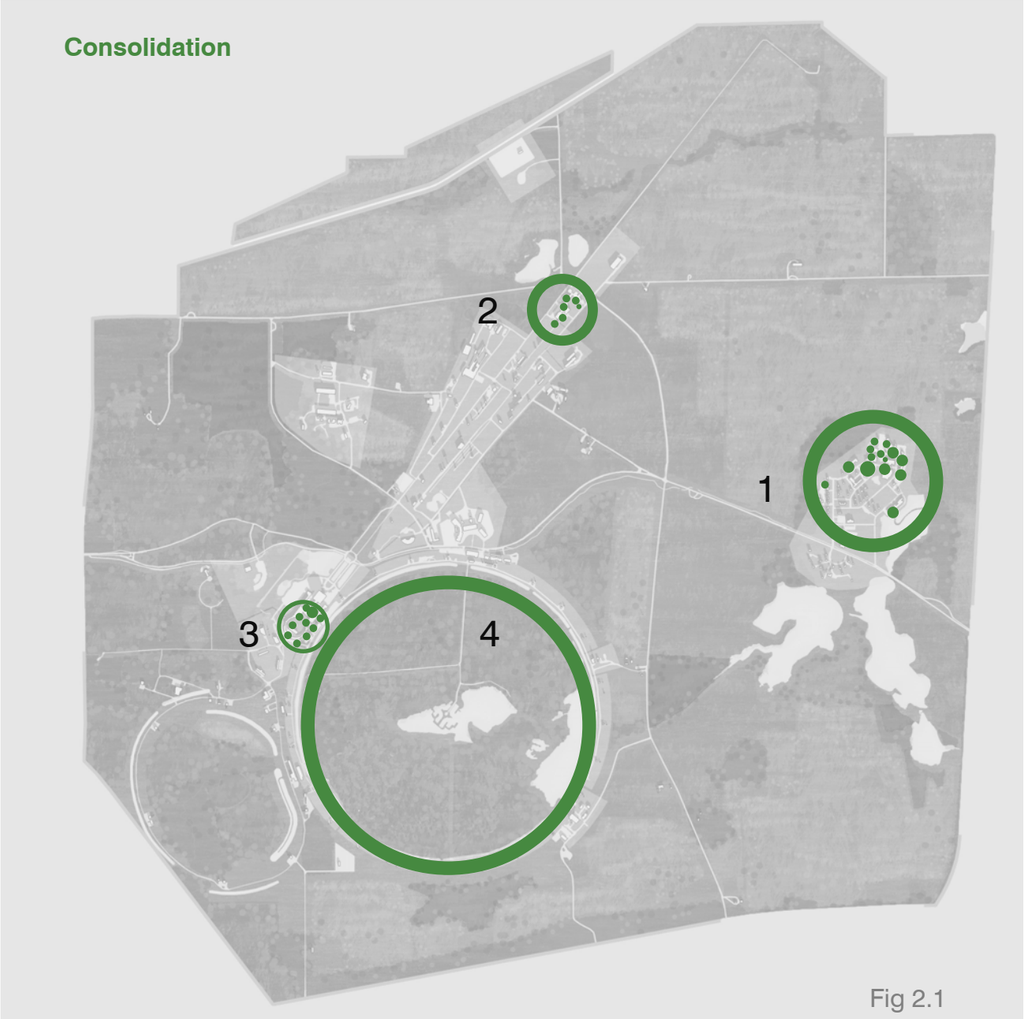


Fig 2.1

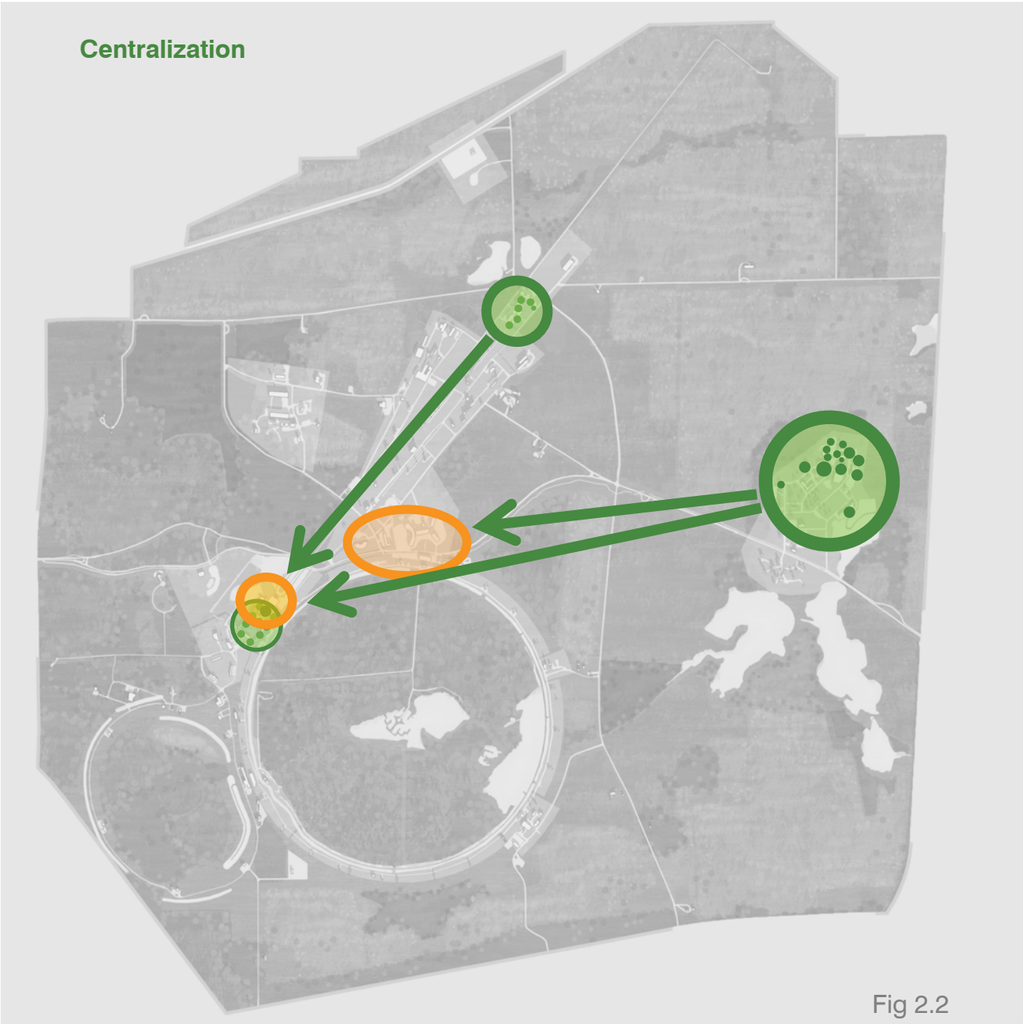


Fig 2.2

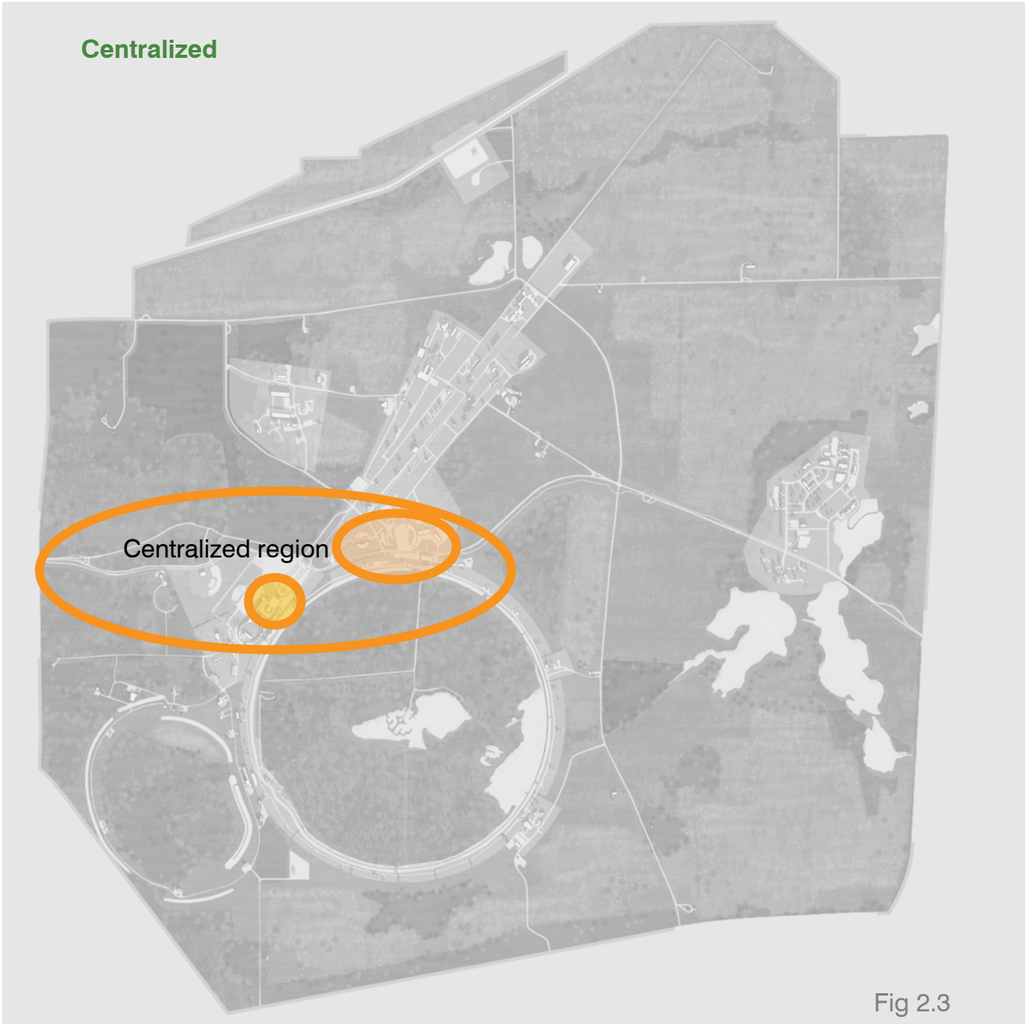


Fig 2.3

Consolidate and centralize

Create planning regions

Define core campus districts

Establish design guidelines

Strengthen campus landscapes

Integrate sustainability

Improve mobility and wayfinding

Create planning regions

Creating an organizational system will provide context, logic and a framework for future campus design and development.

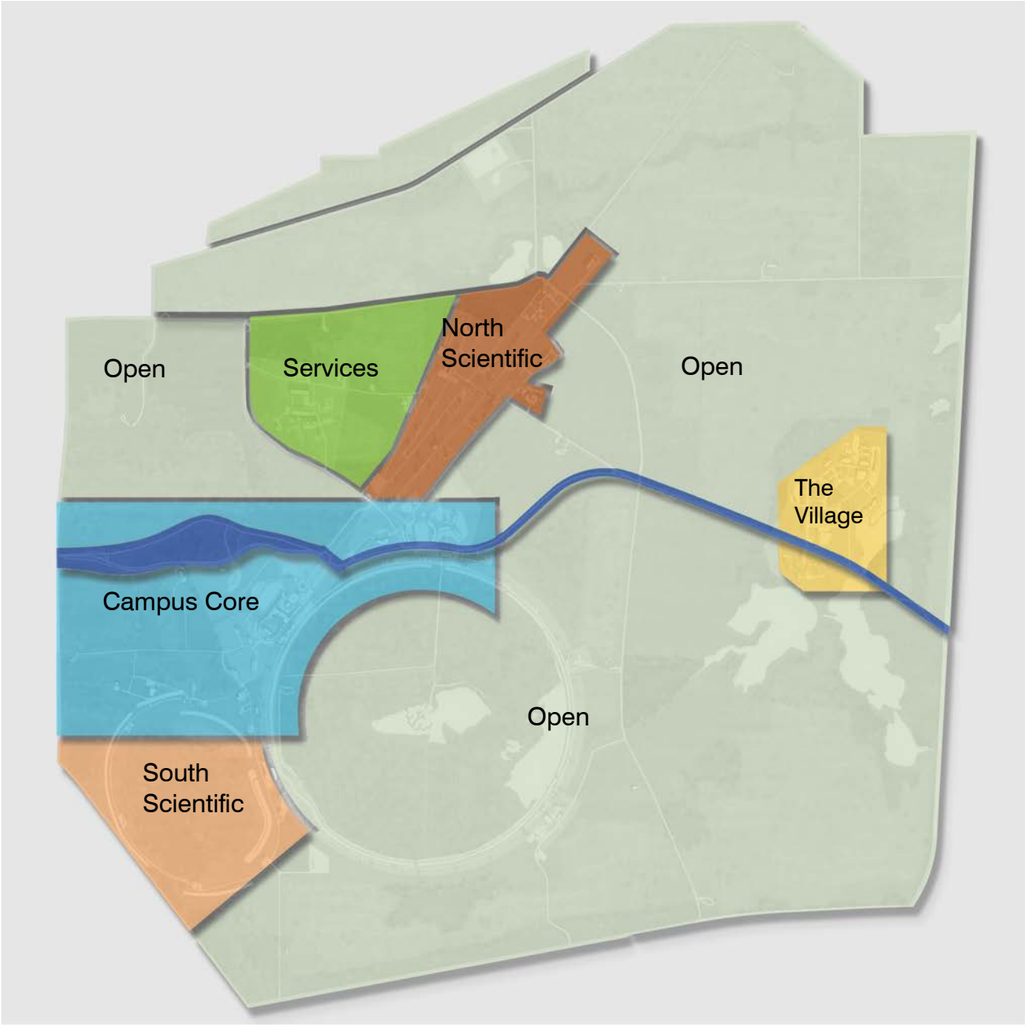
Create planning regions

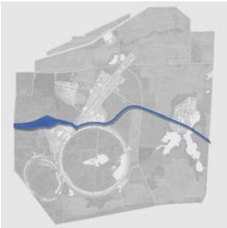
Part one of the Fermilab Campus Master Plan has noted the haphazard feel of the campus due to the scattered nature of the structures, roadways and utilities about the site. Creating an organizational system will address this issue, providing context, logic and framework for envisioned future campus design and development.

Here we describe the proposed organizational system for the developed regions. The illustration to the right delineates and identifies the major developed regions of the campus. Undeveloped ecological areas are labeled open.

Campus Core

This region is the center of activity and will become even more critical to the lab's mission as future plans unfold. It is home to laboratory research and engineering, computing, technology and science.





Boulevard

The proposed “Boulevard” creates a distinctive, functional and visually unified east-west transportation corridor across the Fermilab campus. Upgrades and improvement will include streetscaping, signage, lighting and landscaping.

North Science

The oldest science district, it includes the Meson detector area, Labs A through G, the landmark Robert Wilson-designed NML building and the recently built Cryomodule Test Facility.

Open

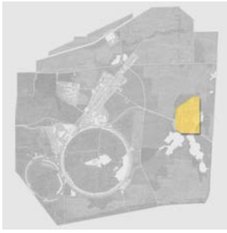
Much of the open land consists of important ecological areas and habitat communities. These important areas carry intrinsic weight. Balanced consideration is given to all issues when considering developments within these regions to avoid unnecessary impacts.

South Scientific

This is the home to the Main Injector accelerator and related supporting facilities and cooling ponds, as well as the Kautz Road electrical substation.

Services

The Services region is home to many support groups such as shipping and receiving, vehicle refueling, operations and maintenance, and the Fire Department.



Village

The Village is the founding district of the laboratory. As its major focus is housing and recreation for staff and users, consolidation and centralization will ultimately remove the obsolete shops and laboratories occupying the north end of the Village.

Define core campus districts

Campus core districts are driven by the laboratory strategic plan.

Consolidation and centralization drive the focus toward a core campus. The Campus Plan identifies seven districts within the core campus region. The districts' identities and functions are guided by the priorities of the guiding principles, and laboratory strategic planning themes.

Arrival District

Fermilab's main entrance should be impactful. The creation of a unique district will serve to focus creative planning efforts on this part of the campus. Campus Plan initiatives and development projects will transform this district into a welcoming and informational entry point for local and international visitors.

Central District

With Wilson Hall at its core, the Central District is the focus of consolidation and centralization efforts. Campus Plan initiatives and major development projects will energize and populate this district to become the heart of the envisioned, open, inviting and collaborative international research community.

Computing District

Focusing on computational science, the Computing District is home of the Computing Sector headquarters, Feynman Computing Center. Campus Plan initiatives and development projects will enhance its quality and identity, as well as its integration with the core campus.

Technical District

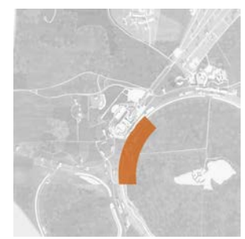
The Technical Division builds for science by developing and building accelerator and detector components. Future plans envision refurbishing its existing buildings, constructing new facilities, and improving the site to integrate and unify this district into the campus core region.

Neutrino District

Defined for neutrino science, the district encompasses existing neutrino facilities as well as the future planned Long-Baseline Neutrino Facility. The scope of the district development will include additional roadways, site configuration changes and other initiatives to fully service and access LBNF and integrate within the core campus.

Muon District

This district's theme of precision science encompasses the early-era antiproton buildings, along with the recently completed MC-1 building and the soon to be completed MC-2 building and beamline. The Campus Plan aims to provide connection and continuity within this core region.



Superconducting Linac Complex

This district, developed around the theme of accelerator science, will be home to new experiments and facilities. Campus Plan efforts include roadway and pedestrian connections to this area, tucked inside of the landmark Main Ring, easily accessible.

designing the campus

Campus improvements and new facilities will be undertaken with a view toward qualitatively reinforcing what makes Fermilab a unique and special place.

Tim Meyer, Fermilab chief operating officer

Consolidate and centralize

Create planning regions

Define core campus districts

Establish design guidelines

Strengthen campus landscapes

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Improve mobility and wayfinding

Establish design guidelines

The design of buildings and open spaces should encourage interaction, creating the settings to bring staff, users and visitors together, becoming vibrant centers of laboratory life.

A major goal of the Campus Plan is to create a campus with a sense of community, fostering the free exchange ideas that is central to the laboratory's scientific mission. The design of buildings and open spaces should support this goal by encouraging interaction, bringing staff, users and visitors together, and creating vibrant centers of laboratory life.

The following guidelines, informed by the guiding principles, will guide the creation of modern, state-of-the-art facilities. New buildings and structures should be designed to be fresh, inviting, innovative, dynamic and forward-looking. They should be designed with a view toward flexibility and efficiency, enabling them to meet the needs of current and future generations of staff and users.

Continued care and stewardship of the campus requires an appreciation for the existing buildings and open spaces defining Fermilab. New buildings and future renovations must create the best campus environment possible. Design teams should recognize Fermilab's legacy and make efforts at continuity.

Enhance the campus experience, reinforce community and ensure the campus is welcoming to visitors

Entrances and ground floors:

- Buildings should be welcoming, strengthen existing gathering spaces and provide new opportunities for social interaction.
- Entrances should be evident in the daytime and at night.
- The ground floor of buildings should emphasize transparency.
- Service and utility areas should be located so as not to negatively affect pedestrian paths, important streets or building entrances.

Public spaces:

- Public spaces should be generous, promote interaction and be visible to those using the buildings or walking past them.
- Outdoor and indoor public spaces should be designed to allow for informal gatherings and social interactions during both the daytime and evening hours.
- Lighting and security of public spaces are critical for their success.
- Rooftops and terraces should be considered participatory spaces for the campus community, accommodating social spaces, conferencing and unique offices.
- Buildings should provide universal access so they are not encumbered unnecessarily by level changes, ramps and stairs.

Long-term flexibility and life cycle value

Buildings on campus should be seen as having the capacity and flexibility to outlive the original program. Appropriate attention to the design of floor plates, floor-to-floor heights and structural systems will enable a high degree of flexibility for unanticipated future uses

Over time, campus buildings should anticipate a variety of programs and uses, responding to new needs and unanticipated demands. New projects should be designed with a commitment to flexibility, quality and durability to provide long-term usefulness.

Building design should also anticipate future changes in technology and scientific methods in the planning and design of buildings and research spaces. They should incorporate building systems and support infrastructure, facilitating easy adaptation for new programs and future demands.

When making building system decisions, consider initial capital investments as they affect long-term operational costs in the full life cycle of the project.

Uphold the unique character of Fermilab

The Fermilab campus is rooted in the tradition of architectural innovations and excellence representing the architectural innovations of the time in which they were built.

A strong component of the campus includes architecture significant for and symptomatic of its time. Design of new and renovated facilities should acknowledge this legacy while pursuing design excellence appropriate and symptomatic of the current era, continuing the tradition of design excellence. The collection of landmark buildings within the community can be captured into a community of architectural styles resulting in a dynamic relationship between the past and the future. Buildings contributing to the legacy of the campus should be retained and revitalized when feasible. Open spaces and significant landscapes should be identified and respected as critical components of the campus experience.

Strengthen campus landscapes

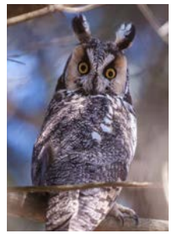
The natural landscape is a significant identifying characteristic of the Fermilab campus, making it unique among laboratories.

Conserve natural resources

The Campus Plan envisions smart growth and development to conserve open space. The land and its ecological integrity is one of the most important assets at Fermilab. The Fermilab campus is spread across four watersheds and boasts over 2,500 acres of natural areas such as tallgrass prairie, oak savanna, open water marsh, sedge meadow and floodplain forest. There are also many acres of agricultural lands and old -field grasslands. Responsible management of the physical site is an important consideration for realizing the campus of the future. Indeed, the abundant open space on the site allows for construction of the large machines needed to carry out cutting-edge particle physics research.

DOE and Fermilab recognize the significance of conserving and restoring biological diversity. Both are members of the Chicago Wilderness partnership and are committed to supporting their Biodiversity Recovery Plan for the region. The Fermilab Ecological Land Management (ELM) Committee is charged with providing sound, ecologically informed recommendations during lab planning through formal review mechanisms. The ELM Committee is composed of consulting professionals and internal experts, and together, they author a plan for enhancing the natural resources of the Fermilab site through an ecosystem management approach. This includes monitoring plant and animal communities as indicators of environmental health and assessing presence and viability of keystone and rare species. Ultimately, these contribute to restoration and expansion of core habitat, wildlife corridors and connecting remnant ecosystems across the 6,800 acre site and with adjacent public areas. This is especially true in old-field grasslands and agriculture areas. These efforts require that Fermilab remain open to experimenting with new and different land management techniques as a part of how it does business effectively.

The ecological science behind managing open land continues to guide approaches to land stewardship and resource conservation. The Elm Committee also reference the Illinois Wildlife Action Plan and relevant Executive Orders concerning environmental protection. The committee works closely with the Roads and Grounds Department to integrate the ecosystem management approach into their broader responsibility of managing the site. Individual members of the ELM Committee also serve on the Campus Facility and Planning Board and Fermilab's ESH&Q Committee, chaired by the laboratory director.



Strengthen campus landscapes

The natural landscape is a significant identifying characteristic of the Fermilab campus, making it unique among laboratories.

Create new landscapes

Landscapes beautify the Fermilab Campus, helping establish the identity of different areas, and balance development with green space and outdoor amenities. Currently, many of Fermilab's existing buildings and utility installations tend to dominate and distract from the laboratory's natural setting. Proposed landscape initiatives at select portions of the Core Campus will screen and moderate the intrusiveness of the built environment, bridging the gap between natural settings. A "connective tissue" will be created, helping shape and define the character of Fermilab for the coming generations.

The initiatives have a number of specific objectives. One is to screen utility elements and building services to minimize their detraction from the natural setting. Another is to provide structure to the open spaces along the public ways. A third is integration of new developments with the existing landscape. And a fourth is to add new courtyards and other outdoor pedestrian spaces.

It should be noted the landscape initiatives are concepts with parameters and goals; they are not designs. They are a means of articulating the vision for different areas of the Fermilab Campus within the overall Master Plan, but each will be subject to its own master plan or landscape design. Due to their scale and role as shared spaces and infrastructure, these landscaping initiatives will likely be realized in an incremental manner over many years. New development projects should include landscape improvements to soften and integrate them into the character of the site. The following diagrams illustrate example locations and conceptual designs for landscape initiatives.

The use of native plants in landscaping has become Fermilab's preferred model driven by economy and ecological value. Ongoing planting of native species to replace existing invasive ornamental species will ultimately create a more blended and sustainable campus design. The diagrams on the following pages illustrate example locations and conceptual designs for landscape initiatives.

New landscapes ~ Example A

The before-and-after photos to the left illustrate the potential positive impact of creating new landscapes. The top photo shows current conditions. The bottom photo illustrates a combination of improvements, including transportation and mobility improvements. Note the following details:

1) The road is redefined as a boulevard with curbed and planted median between the two directions of traffic.
2) Dedicated bike lanes are provided alongside the road
3) Signage is added to improve wayfinding
4) Landscaping to softens the meeting of the building and ground, moderating the starkness.
5) Landscaping screens unsightly site elements and utilities.

Consolidate and centralize
Create planning regions
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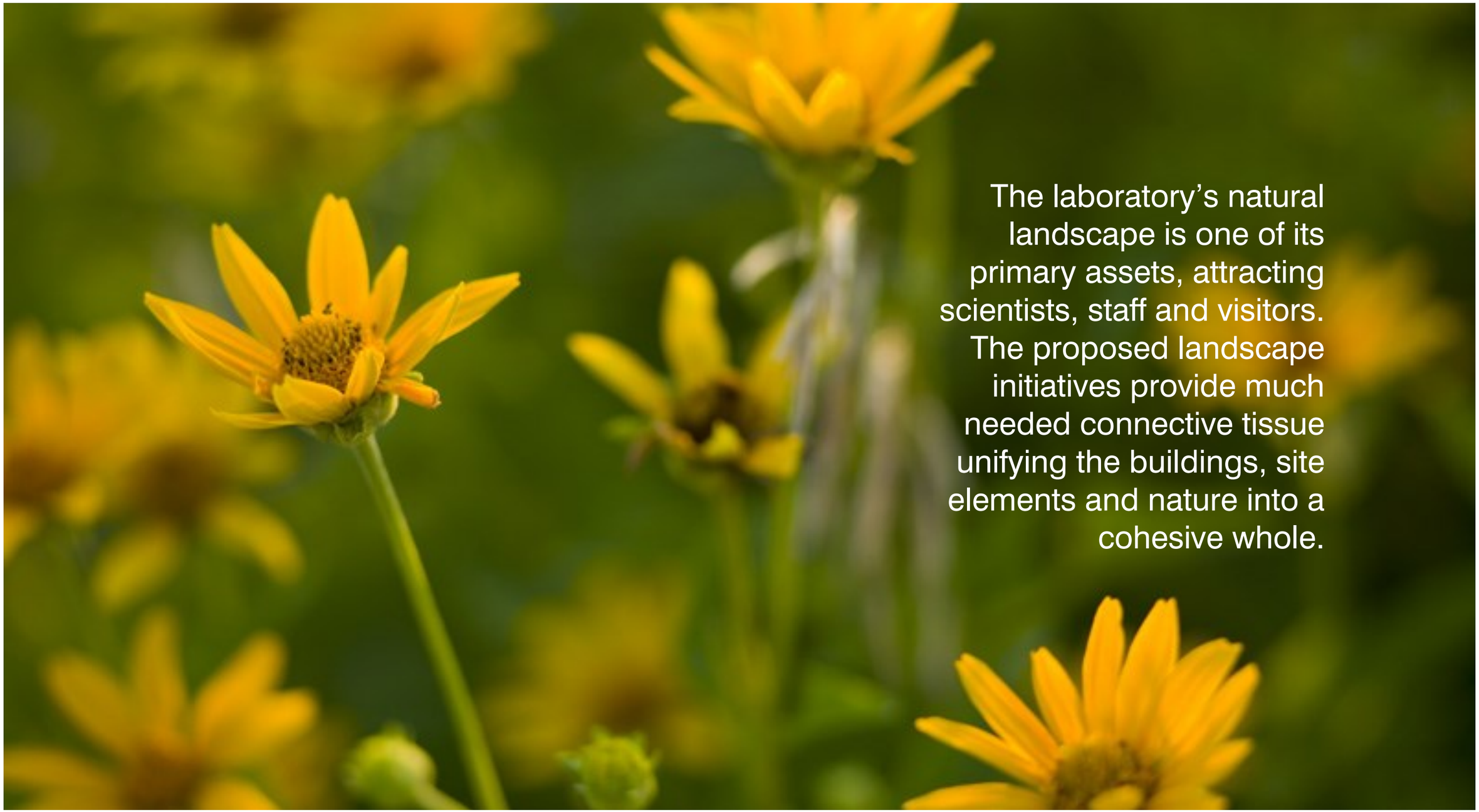
Integrate sustainability
Improve mobility and wayfinding

New landscapes ~ Example B

The before-and-after photos to the left illustrate the potential positive impact of creating new landscapes. The top photo shows current conditions. The bottom photo illustrates a combinations of improvements including transportation and mobility improvements. Note the following details:

1) Signage is added to improve wayfinding.
2) Landscaping softens the meeting of the building and ground, moderating the starkness.
3) Landscaping enhances visual interest and the campus experience.



The laboratory's natural landscape is one of its primary assets, attracting scientists, staff and visitors. The proposed landscape initiatives provide much needed connective tissue unifying the buildings, site elements and nature into a cohesive whole.

Integrate sustainability

The Campus Plan incorporates sustainability in an integrated way at all levels of the planning process.

Sustainable design comprises numerous interrelated approaches described in this Campus Plan initiative. As a whole, these varied approaches combine to form a complete systematic path to sustainability.

The Campus Plan takes into consideration environmental and sustainability issues and incorporates them in an integrated way at all levels of the planning process. Following are components of a fully integrated approach.

Regional stewardship

There are many facets to Fermilab's relationship with its surroundings: physical, ecological, social, cultural, economic and scientific. A regional view of campus planning and development is useful to ensure that this relationship continues to benefit the laboratory, the surrounding communities and the natural environment.

Climate change adaptation

Fermilab will seek to incorporate climate change resilience into campus planning and facility operations. The potential impact climate change may have on Fermilab will be proportional to incremental weather related variations currently experienced in this region of the country. The implementation of forward thinking, progressive design with an eye towards climate variability ,will help mitigate the potential variability risks to laboratory mission and function.

Surface water management

The land drainage systems at the laboratory depend on topography. Interfaces with neighboring systems are difficult to change and require management on an overall-site basis. A surface water management program will provide criteria to guide long-term development of the site with these systems in mind.

Sustainable buildings

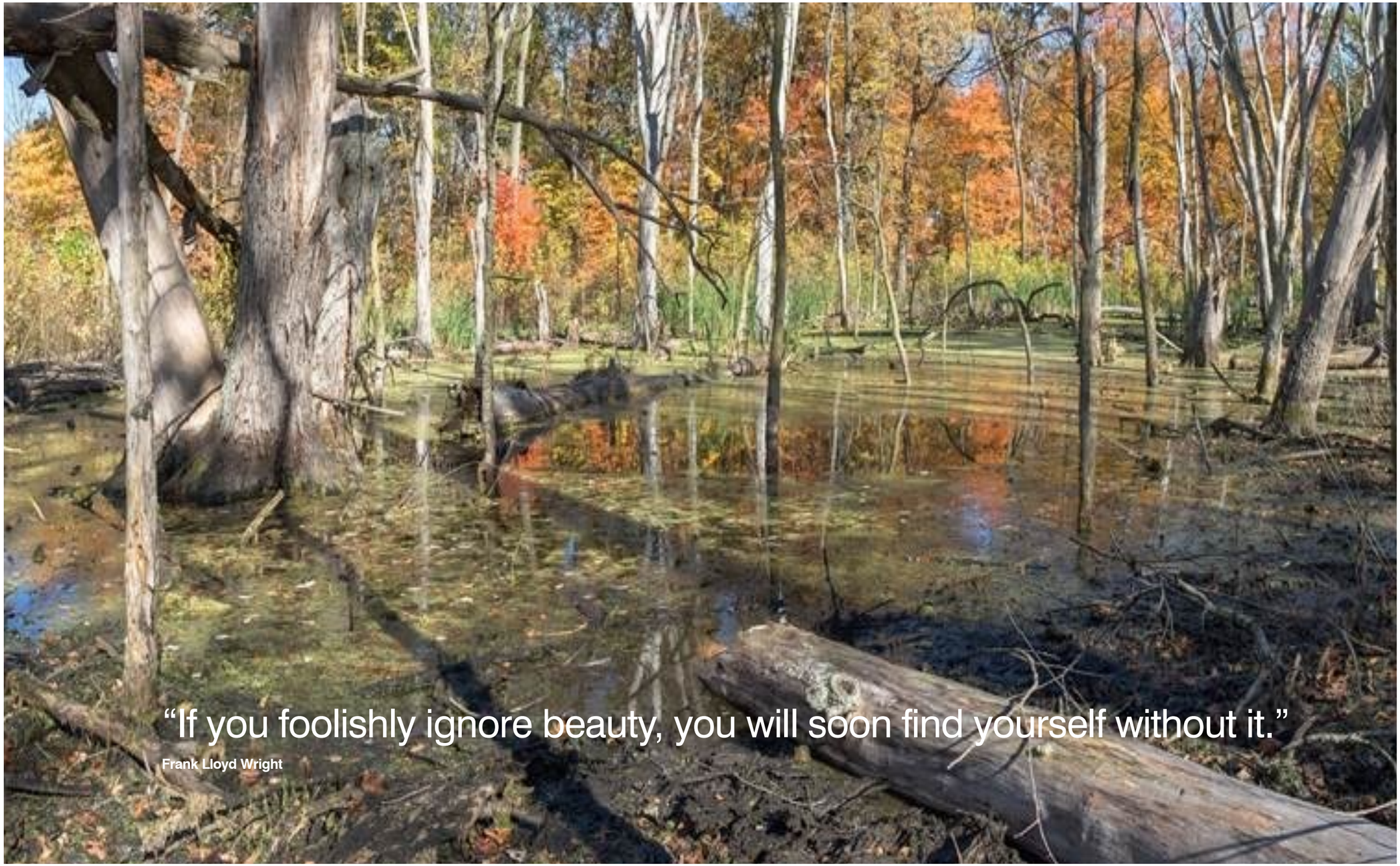
Any new buildings constructed by Fermilab will be built according to sustainability guidelines set forth by the Site Sustainability Plan, referencing the Department of Energy's guiding principles for High Performance Buildings.

Effective use of space

A conservation development strategy shall be applied to ensure the effective use of space in existing buildings. One application of this strategy will be the development of new buildings to be multidivisional and interdisciplinary. This will save space by minimizing duplication of functions and creating movable internal boundaries. Another application of this strategy will be the renovation of existing office spaces into spaces with inherent flexibility and adaptability. A third strategy is to look at space as a collective asset to share and avoid duplications of functionality. This is a transition from a "my space" to an "our space" mindset of planning.

Transportation

A coordinated and integrated transportation system can promote health and reduce emissions. This integrated approach begins with making improvements for pedestrians and cyclists and then looking into the creation of a multipassenger shuttle system between the major central districts and regions within the campus. The desired result is a reduction in the use of private automobiles on campus.



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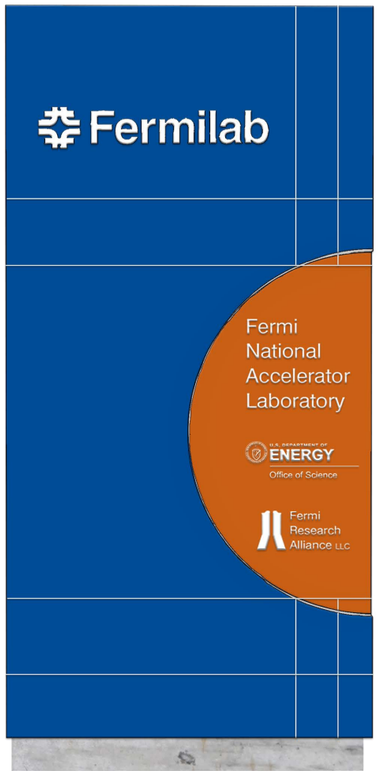
Improve mobility and wayfinding

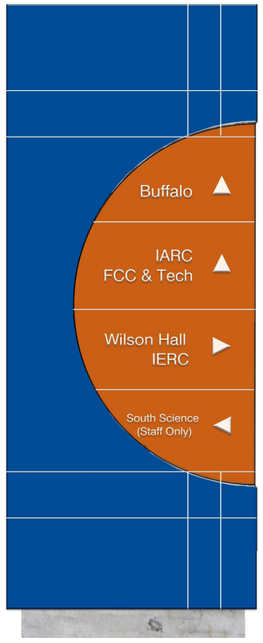
How Fermilab's campus functions and the experience it provides depend in large part on how people move about and how well-connected the lab's various parts are to one another.

How Fermilab's campus functions and the experience it provides depend in large part on how people move about and how well-connected the lab's various parts are to one another. Given its location, size and land-use diversity, Fermilab must accommodate multiple modes of travel. This section addresses aspects of the laboratory's movement systems, focusing on strategies to make the campus more pedestrian- and mass-transit-friendly.

Although upholding Fermilab's unique character is a guiding principle of the Campus Master Plan, at least three instances of its unique character are not desirable for a 21st-century laboratory. One is the dependence on the automobile to move around the site, which conflicts with the sense of community Fermilab seeks to create among its scientists and staff members. The second issue is a direct result of the first: Generally speaking, the campus is not pedestrian-friendly. The third issue is the lack of a coordinated and effective system of signage and wayfinding. Improvements in these three areas are important to creating an open, inviting and collaborative international research community for 21st-century science. Informed by the guiding principles, the "improve mobility and wayfinding" initiative has many facets, as described in the following images and narratives.



Pine Street Entrance



Approach and arrival

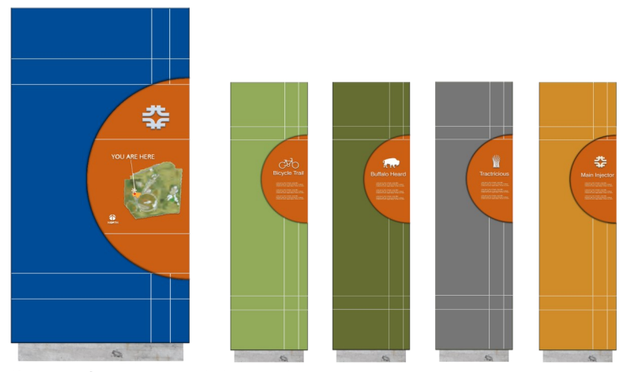
The initial experience of the first-time visitor is via the Pine Street entrance. The experience is unimpressive and possibly disorienting. Jersey barriers, flashing lights, an unoccupied guardhouse, the visual clutter of piping and mechanical equipment west of the MINOS building, the lack of signage, and a confusing intersection as they approach Wilson Hall are components of the visitor's impression upon arrival. Plan initiatives illustrated dovetail to transform this journey.

Visitor experience

As mentioned previously, a compact core campus with new visitor-friendly buildings can greatly enhance the visitor experience. Improved signage will welcome, inform and direct visitors guiding their visit and helping them understand what happens at Fermilab. The Campus Plan also proposes informative sign kiosks at key points around the site. Examples include the bison field, the prairie, the butterfly trail and the site entrance.

Proposed new gatehouse

ID signage on building



Points of interest and directories

ID signage on ground

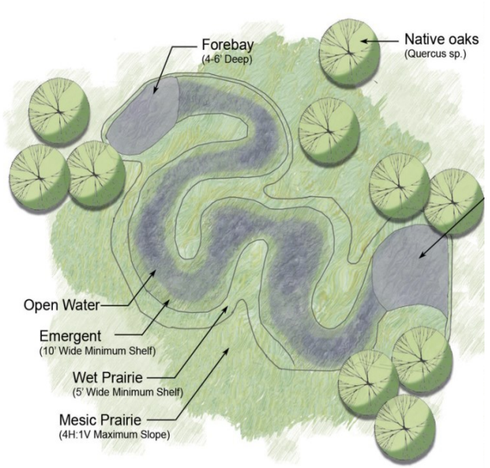
Signage and wayfinding

Signage examples and ideas are illustrated in the adove photo mock ups. It should be noted, however, that these are simply a means of articulating the vision. A complete integrated signage system approach and design needs to be developed and incrementally realized as the campus plan implementation proceeds.

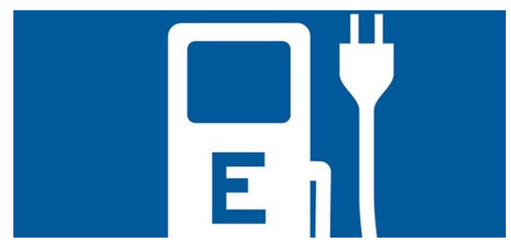
Green parking

Parking

Parking will continue to be a necessary and significant presence on the site. However, large uninterrupted fields of asphalt should be avoided. Parking lot design should be executed in the context of the full array of Campus Plan guiding principles (sustainability, campus experience, integrative planning and design) and other Campus Plan initiatives (upgrade landscapes, design guidelines). Whenever possible, parking should be reduced, consolidated, screened and/or tucked under buildings to minimize its visual impact. Paving areas should be reduced to a minimum throughout the site, and parking lots should be made of porous paving, mitigating storm-water runoff. Where vehicles are welcome, the needs of pedestrians and transit users should be a paramount concern, ensuring the development of a truly pedestrian-oriented campus.

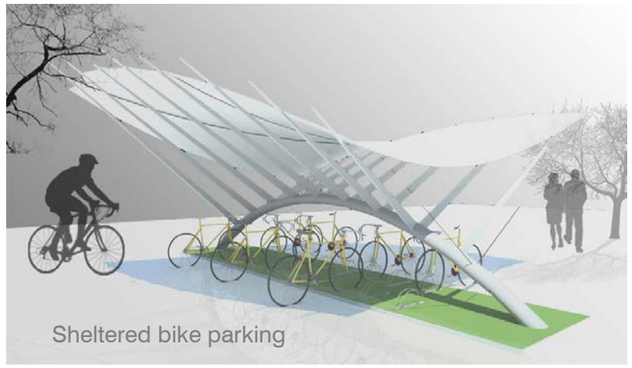


Bioretention system are proposed to handle parking area runoff. This best management practice uses natural filtration to treat storm water runoff. They are modeled after the biological and physical characteristics of a meadow ecosystem.



Electric vehicle charging stations

Green transit


Sheltered bike parking

Vehicles and traffic

Given limited mass transit options to reach Fermilab, cars will continue to have a large presence on the campus. However, as consolidation and centralization progress, the number of vehicles traveling around and across the campus can be reduced. Walking, cycling and transit use can become realistic options for day-to-day business.

Cycling

Cycling initiatives for the campus include the creation of designated bike lanes along the boulevard and improved signage and segregation for primary bike routes through campus. Major new buildings should include indoor bike storage spaces, along with shower and changing rooms. All occupied buildings should have adequate bike rack space. Consideration should be given to a bike sharing program with stations at major populations areas within the campus.

Pedestrian network

Consolidation and centralization support the feasibility of a vibrant pedestrian walkway network. Walkways will provide clear, convenient and interesting ways for people to get around on foot instead of driving. These paths should promote safety by locating them separately from driving and cycling ways. The walkway system will include pedestrian lighting improvements along primary routes within the Central Campus.

Transit

Bus and shuttle transit can affect both how people commute to and from the Fermilab campus and how they travel within the campus upon arrival. Some public mass transit from off site is available to staff living in select locations, including Chicago and its western suburbs.

Within the site, as consolidation and centralization increase, a campus shuttle should be considered to minimize the use of automobiles within the campus.

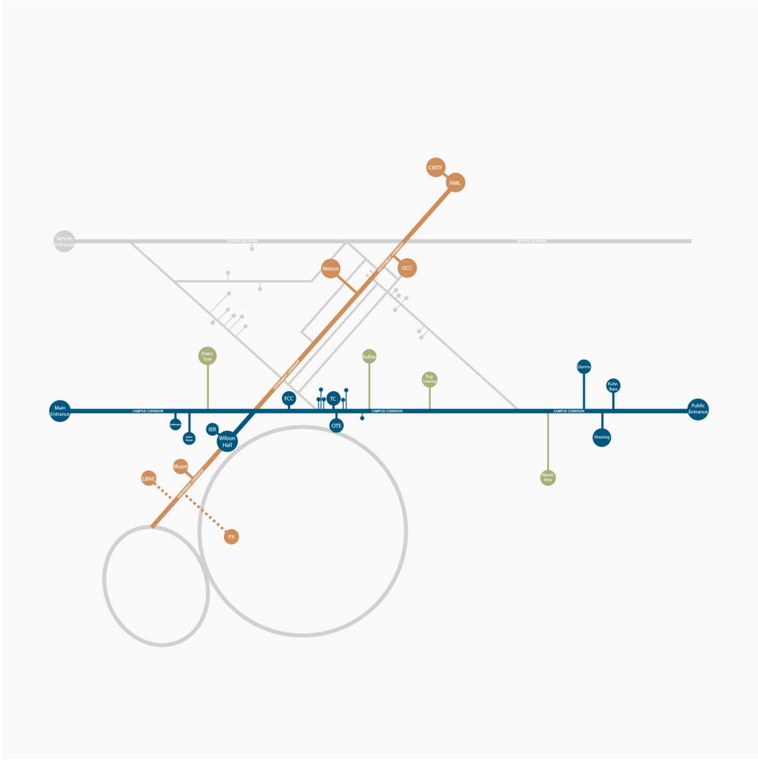
Roadway simplification and hierarchy

The Fermilab Campus Master Plan guiding principles aim to ensure an enhanced campus experience that is welcoming and informative to both local and international visitors. The campus plan initiatives envision integrative design, improvements in campus landscapes, and improvements in mobility and wayfinding,

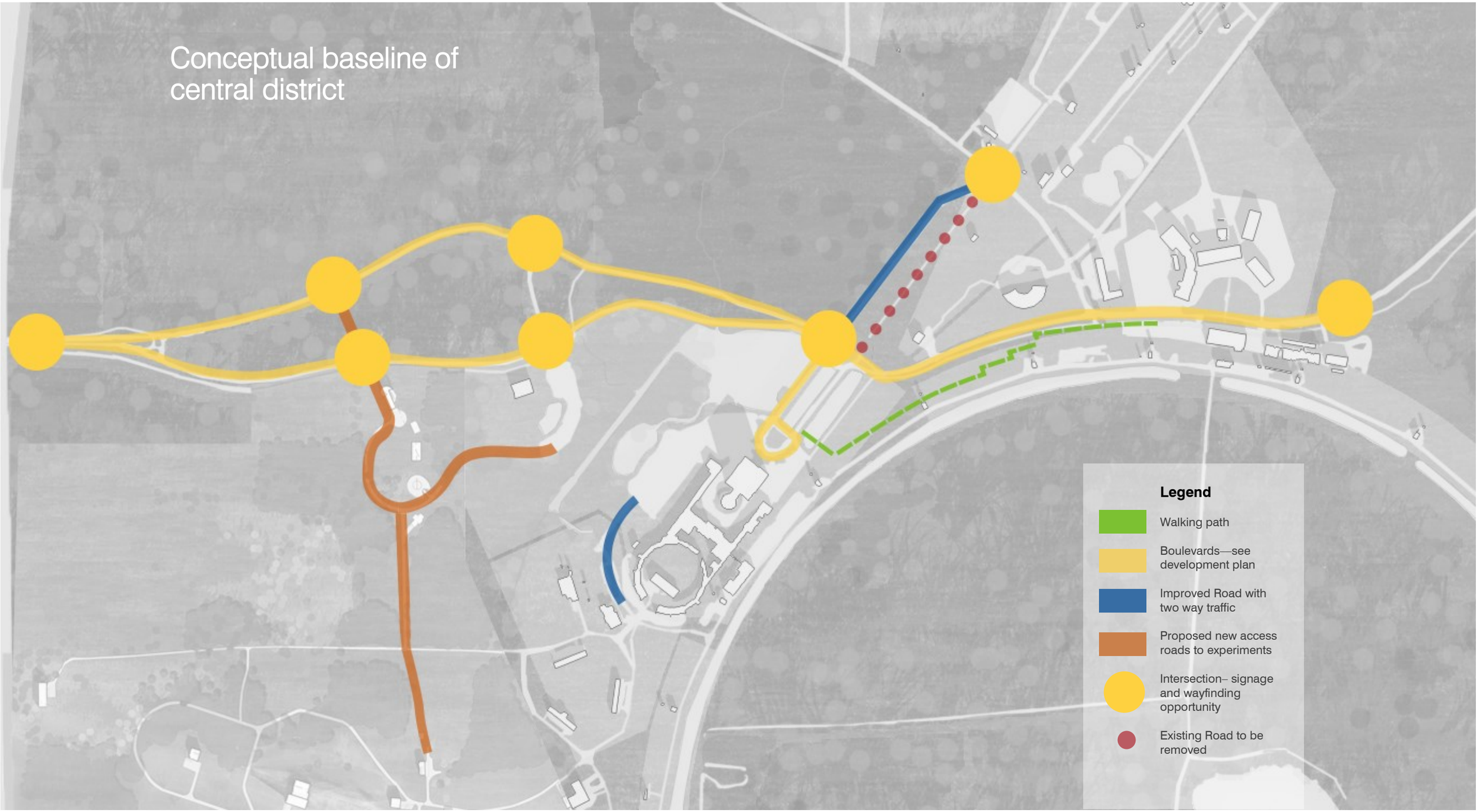
The current campus vehicular circulation system is somewhat complex. It initially grew from the rural roads in place at its founding. As the campus developed over the next 50 years, roads were added (and subtracted) in response to the construction of accelerators, beamlines, raised earth berms and experiments.

Roads are typically the same width, with curbless gravel shoulders, minimal lighting and signage, minimal landscaping, and unscreened, undesirable views of scattered utilities and support structures along the way. Effectively, all roads appear to be service roads. This creates confusion among the uninitiated as to where they should and should not travel. As the campus hosts increasing number of international visitors and users in the years to come, this condition will become more problematic.

As major planned developments and experiments migrate toward the core campus region, the clarity and improvement in the transportation corridor will prove to be an important infrastructure improvement, providing clarity to the mobility and wayfinding experience, enhancing the campus experience and facilitating.



Inspired by Harry Becks' 1933 well know "tube map" of the London Subway system, the above diagram illustrates the Fermilab roadway network. Rather than emphasizing strict accuracy, the diagram strips the sprawling roadway network down to a simple diagram of color coded line and destinations. This clarifies the roads purposes and their relative place in the planned for hierarchy of roads. Color coding is blue for public and major destinations, orange for the experiments, grey for services, green for natural area interest.


Conceptual baseline of central district
Legend
Walking path
Boulevards—see development plan
Improved Road with two way traffic
Proposed new access roads to experiments
Intersection– signage and wayfinding opportunity
Existing Road to be removed

development plan

Introduction

Part One of the Master Plan briefly documented Fermilab's beginnings and evolution over its nearly 50-year history. It then presented guiding principles and laboratory strategic themes for the goals and aspirations for future campus design and development. A 20-years-from-now vision described a state-of-the-art, open and green, consolidated and integrated, connected and engaged international research community.

Part Two laid out the foundational initiatives to create a campus with the organization and features envisioned for a 21st-century international research center. As a group, these principle-based initiatives provide the lab with "connective tissue," resulting in a functionally and visually unified campus and setting the stage for future development projects.

Part Three builds on this foundation, describing proposed future development projects for the next 20 years. The development projects are categorized on three fronts: international research community, the tools for science and Infrastructure support. While the three fronts are interrelated and mutually supportive, the proposed development projects form easily into the three thematic categories.

Completion of these strategic developments projects will culminate in the transformation of the laboratory that serves as the centerpiece of a global program in accelerator-based neutrino science and enables the next generation of world-leading research.

Research community

Here the term research community refers to the places where people work, visit, study and collaborate. The core campus region map on page 67 indicates the location of these six projects creating the envisioned global research community:

- The Integrated Engineering Research Center (IERC),
- Wilson Hall 2.0
- The Scientific Hostel
- The Global Accelerator Center
- The Next Generation Computing Center
- The Gate, Visitor Information, Education and Welcome Center

Tools for science

A second project grouping includes the accelerators and beamlines, adding to laboratory system of Tools for Science. Two projects are anticipated in the 20-year planning horizon.

- The Long Baseline Neutrino Facility (LBNF)
- The Superconducting Linac Complex

Infrastructure and Support

The third group address needed utility and infrastructure support projects for the laboratory generally. Four infrastructure support Projects are proposed:

- Industrial Center Building Addition
- Central Utility Building Expansion
- Industrial District Renewal
- Utility Upgrade Projects

research community

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Integrated Engineering Research Center

Bringing people together is a vital feature of a collaborative international research community.

Bringing people together is a vital feature of a collaborative international research community. The Integrated Engineering Research Center (IERC) creates a 93,000-square-foot facility promoting interdisciplinary collaboration and greater efficiency in designing, developing, building, commissioning and operating particle physics accelerator and detector facilities and equipment.

Replacing outdated laboratory space and obsolete facilities, the IERC will revitalize and streamline research in particle physics for the benefit of the particle physics community and the DOE Office of Science. The IERC will consolidate engineering and technical teams in a collaborative environment, bringing together engineering disciplines from Fermilab's Accelerator Division, Particle Physics Division and Scientific Computing Division. The result will be interdisciplinary collaboration built on existing laboratory capabilities and expertise, which are currently dispersed across the Fermilab site.

The IERC is a four-level structure with direct indoor connections to Wilson Hall at the ground level and the atrium level, integrating staff directly in the vibrant center of Fermilab. The ground floor contains flexible high-bay space for state-of-the-art cleanrooms. The concourse level flows from the Wilson Hall atrium, connecting all the IERC via its two vertical collaboration zones. The concourse also accesses the Wilson Hall entrance plaza, invigorating and connecting the exterior spaces. The two upper floors contain flexible and reconfigurable space for engineers and staff.

BIOSWALE, TYP.
PARKING AREA
SERVICE DRIVE
PARKING AREA 2
BIOSWALE, TYP.
MONOLITHIC BENCH, TYP
BOLLARDS
TERRACED PLANTERS
PLAZA/ DROP-OFF COURT
BRIDGE STAIRS
PLAZA PLANTERS WITH SCULPTURAL SCREEN WALL FEATURE
BRIDGE STAIRS
BRIDGE RAMP
PEDESTRIAN BRIDGE
PARKING AREA 3
BRIDGE STAIRS
BRIDGE RAMP
BIOSWALE, TYP.
TERRACED PLANTERS

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Aerial from north

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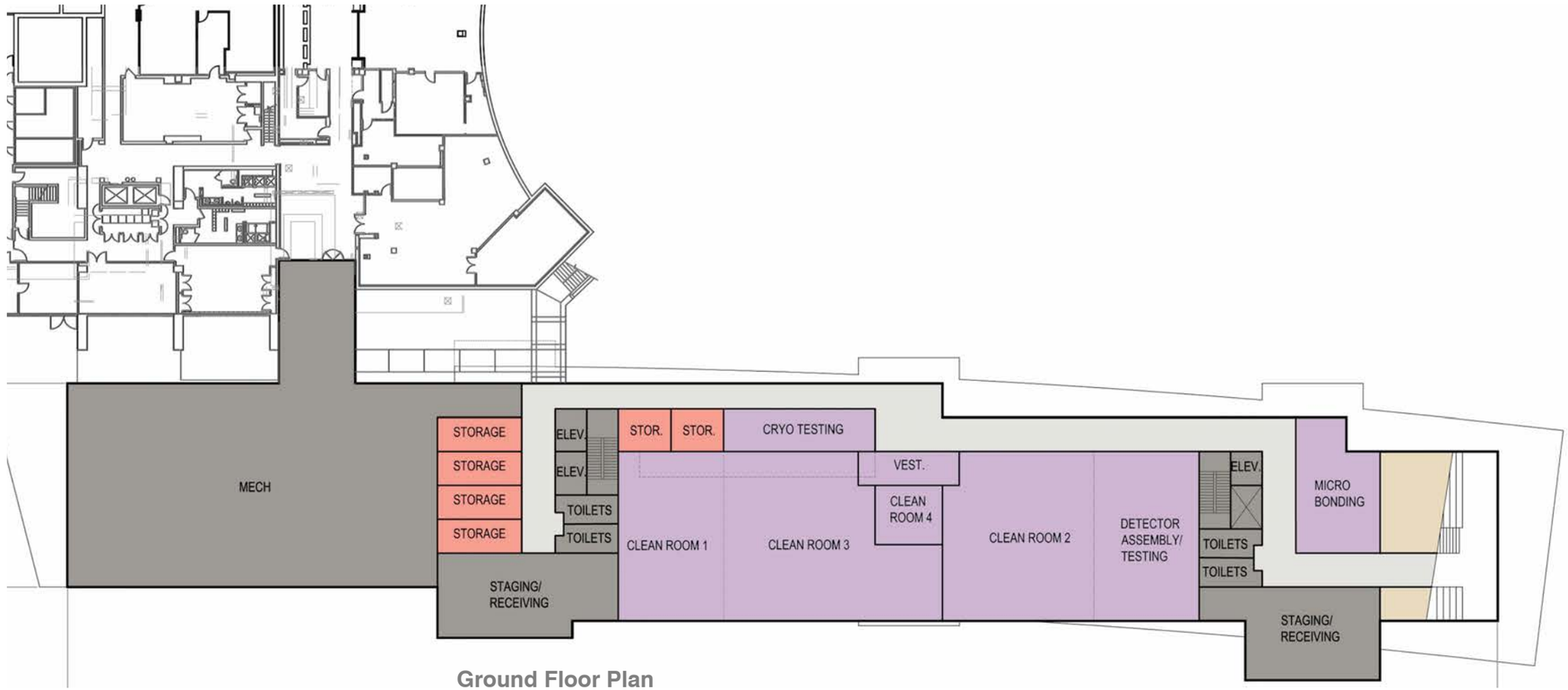
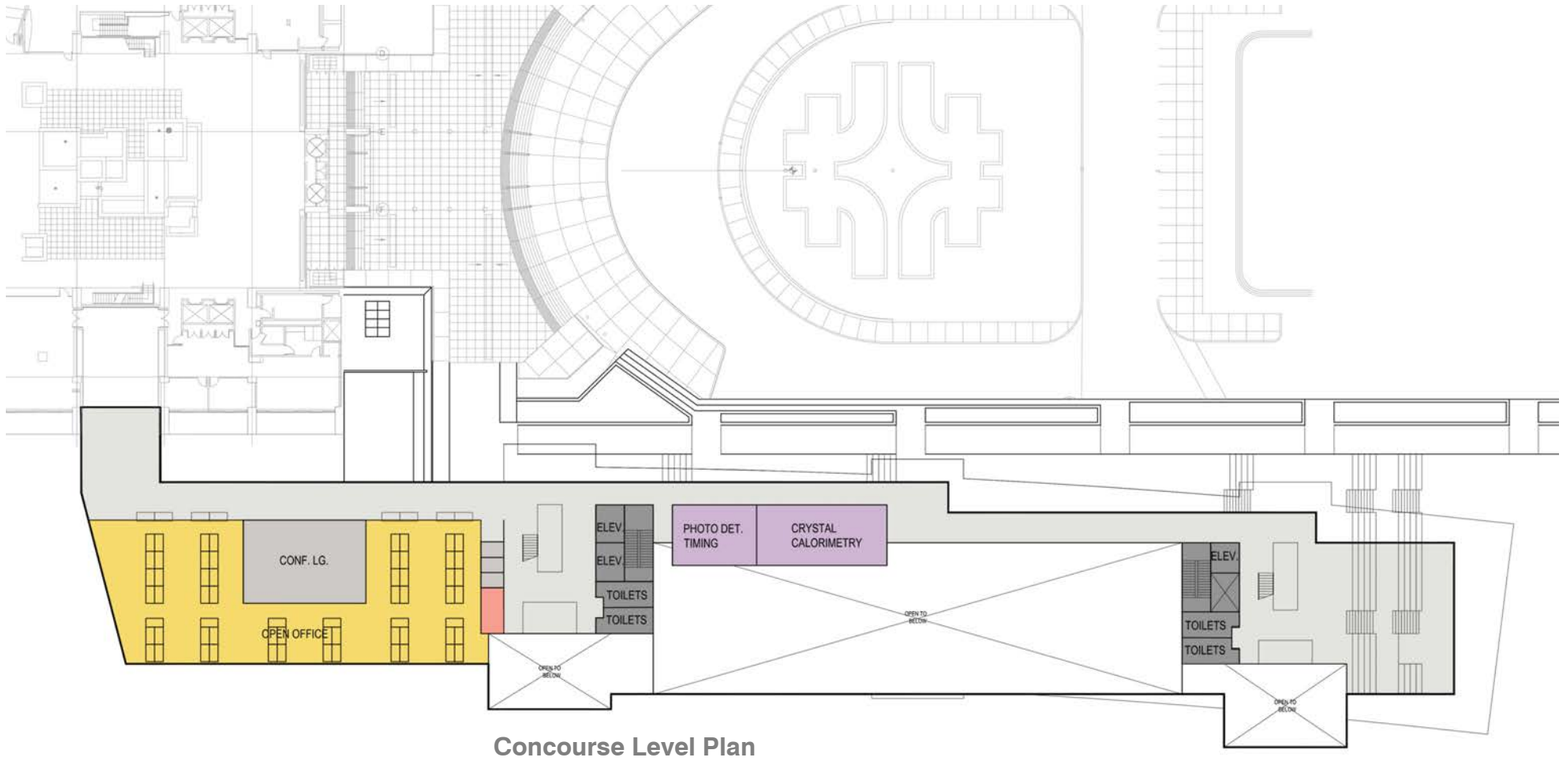


Ground Floor Plan



Concourse Level Plan

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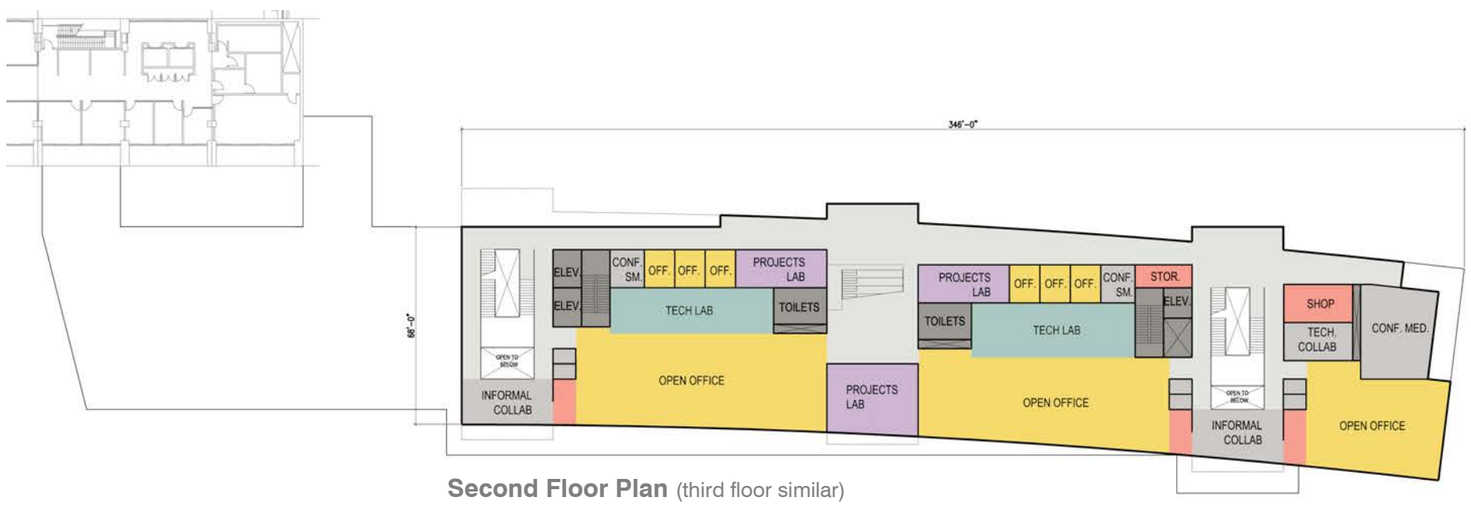
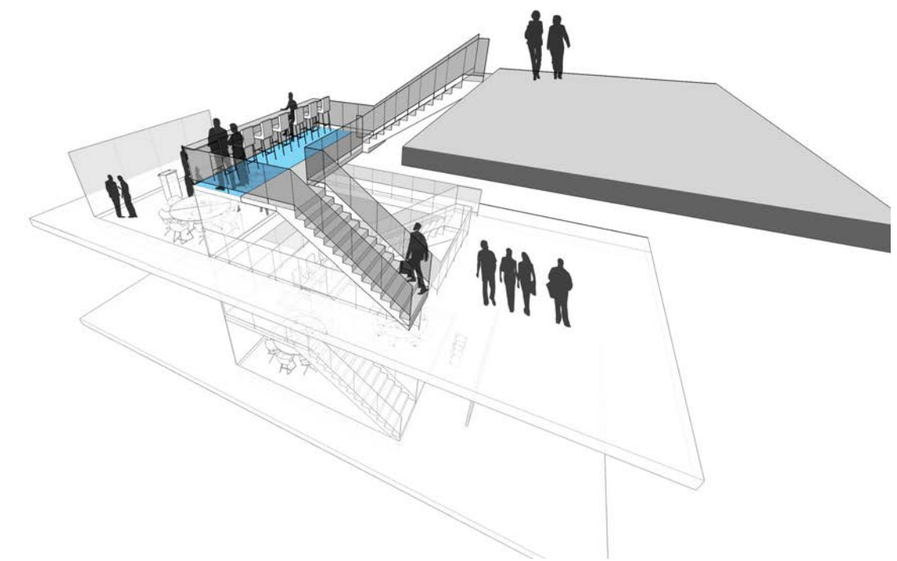
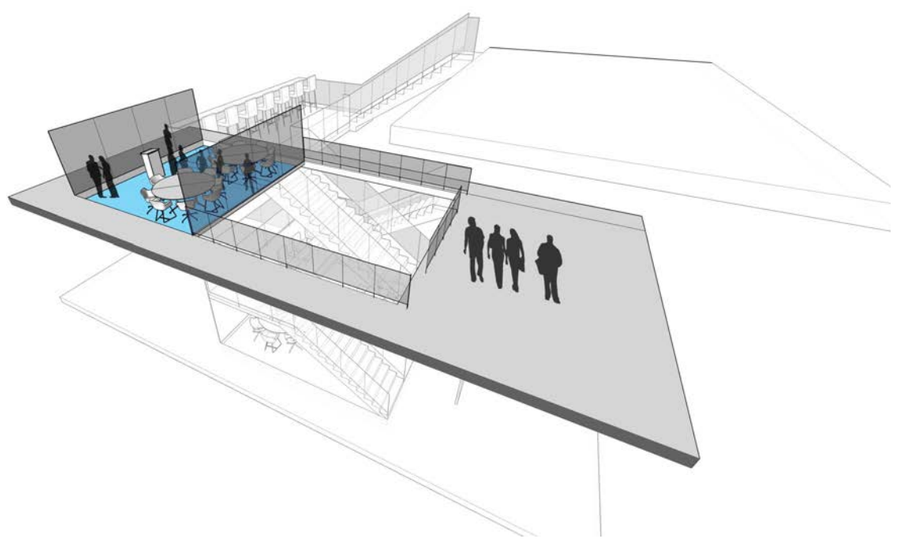


Second Floor Plan (third floor similar)





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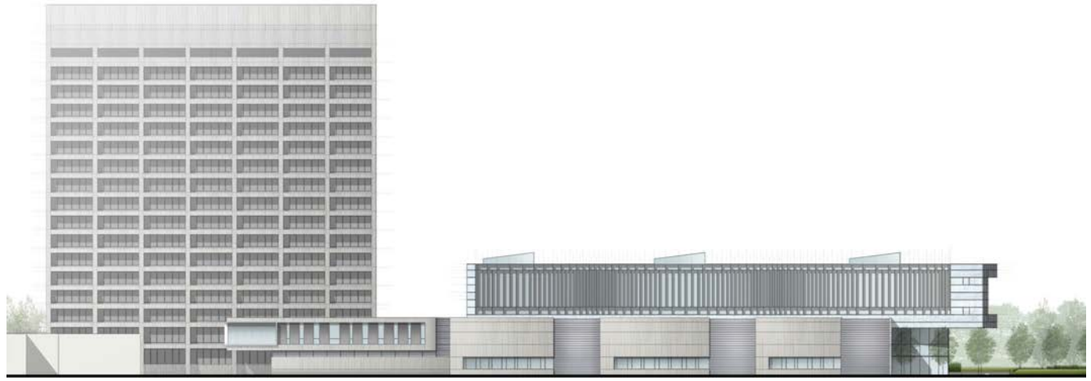
North Elevation



East Elevation

West Elevation

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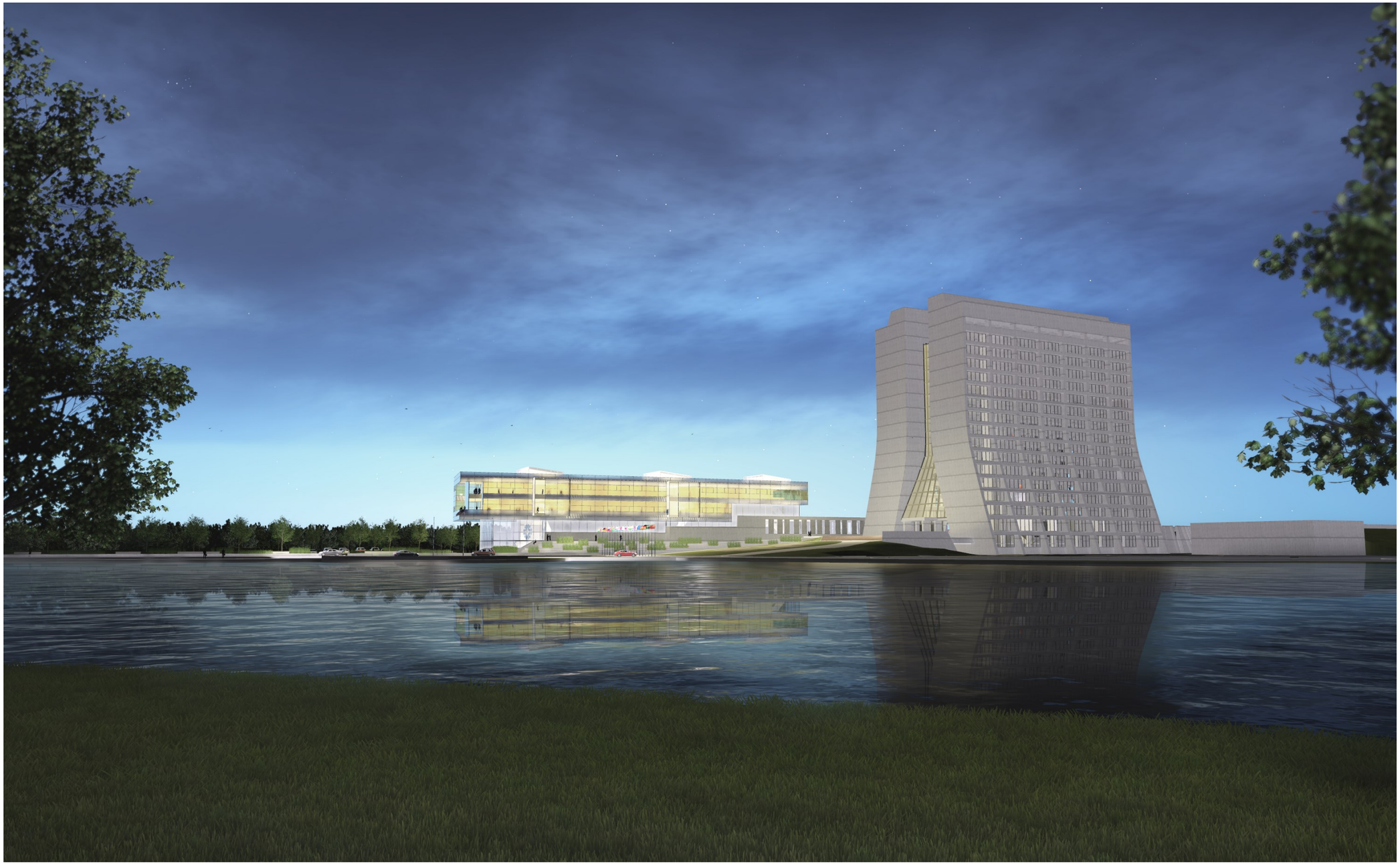

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Wilson Hall 2.0

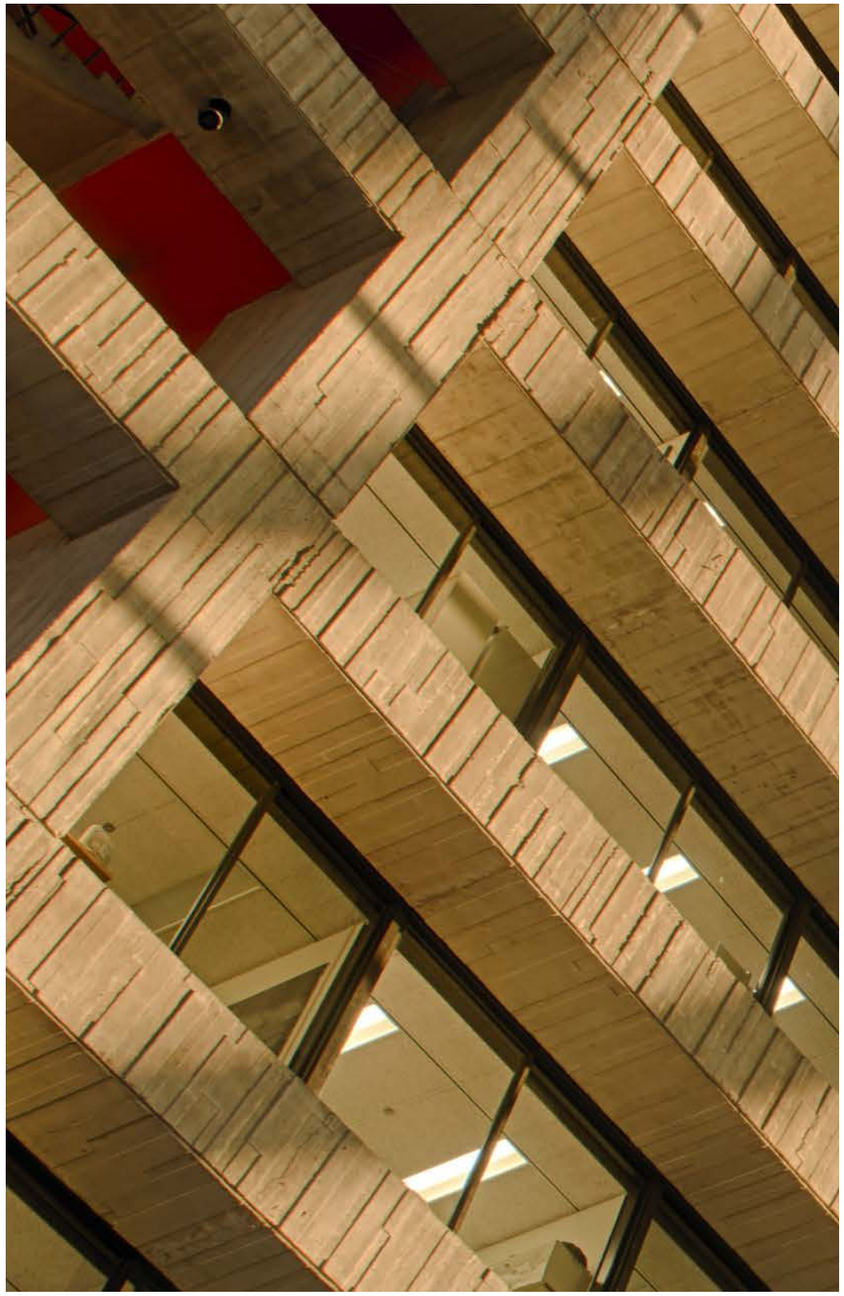
Workplace design is more important than ever before. A fundamental shift has occurred in the ways we work. Younger generations and recent graduates expect multiple possible types of workspaces, including ones that are more casual and open than the office or the cubicle.

Wilson Hall 2.0 reimagines the iconic hub of Fermilab life and culture. Completed in 1972, this 240,000-square-foot structure has experienced many iterations of office design during its nearly 45 years. As the laboratory's most populous building, it houses over 700 researchers, visiting scientists, and management and support staff. Additional functions include a cafeteria, employee services, a library and a wide variety of conference and meeting rooms.

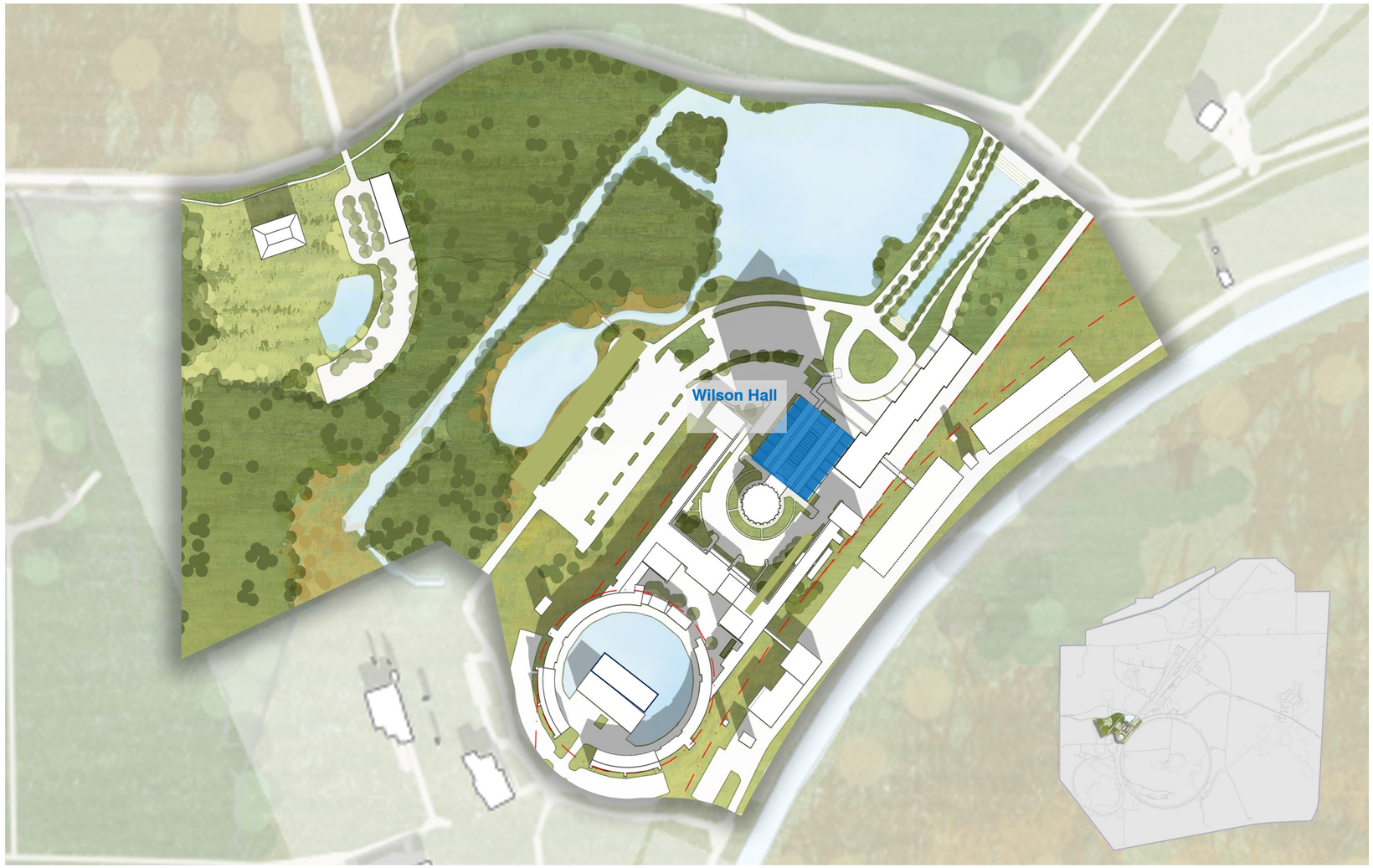
Significant technological, cultural and sociological changes have occurred since 1972. As Fermilab moves into its next generation of workers, creating the open, inviting and collaborative international research community envisioned at Fermilab necessitates the renovation and reorganization of Wilson Hall. Workspaces will be transformed into places designed to foster collaboration, attract and retain the next generation of scientific researchers, promote well-being, and use space efficiently.

In addition to workspace design on floors 4 to15, Wilson Hall 2.0 also reimagines the public and shared spaces, most notably, the ground floor and atrium level. Also to be considered are the usage and layouts of the second and third floors, as well as consideration of ways to add elevators to the building.

Wilson Hall 2.0 is not one large project but rather an umbrella encompassing numerous, evolving and ongoing revitalization efforts over the next 10 to 15 years. In that spirit, the following pages illustrate recent improvement to the atrium, as well as highlights of the Wilson Hall Renovations GPP project, an effort currently in design. This already funded project, anticipated for occupancy by early 2018, reimagines and renovates the 13th floor, as well as portions of the ground floor, into state of the art, open, inviting, and collaborative places the next era of research.

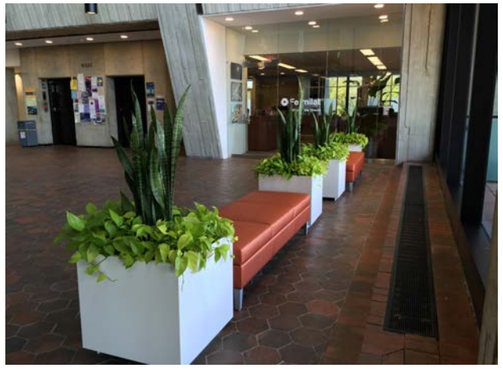


Location plan

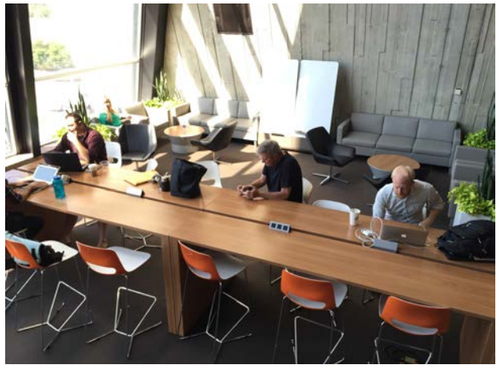


Recent Atrium improvements

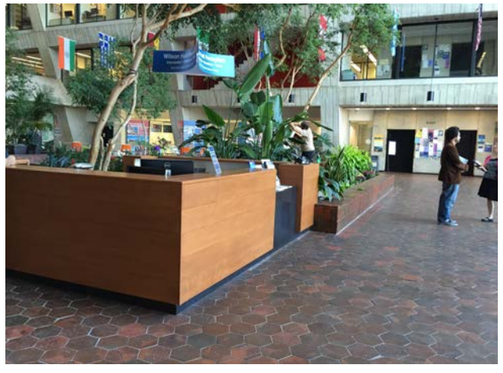
An area for visitors to feel welcome and view compelling Fermilab video presentations has been recently unveiled. Located behind the video wall are two fully renovated public restrooms.



Formerly heavy and off-putting concrete wall were removed to create an open and transparent entrance to the new location of the directors office (beyond). Seating groups and planters have been placed around the atrium creating a warm and hospitable environment.



The southeast and southwest corners of the atrium have been reimagined and renovated as “work café” areas. These function as informal collaboration and meeting spaces, as well as alternative individual work areas.



The newly installed reception desk, staffed during business hours, directs business visitors to their destinations, while informing the casual curious visitor about what to do and what to see during their visit.

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WH Renovations: 13th floor

The Wilson Hall Renovations project is funding and currently in the design stages. Anticipated for occupancy by early 2018, the 13th floor component reimagines and renovates the entire floor, transforming the space into a state of the art headquarters for the LNBF. Kick starting the WH office renovations, this project will stand as a prototype for future office renovations.

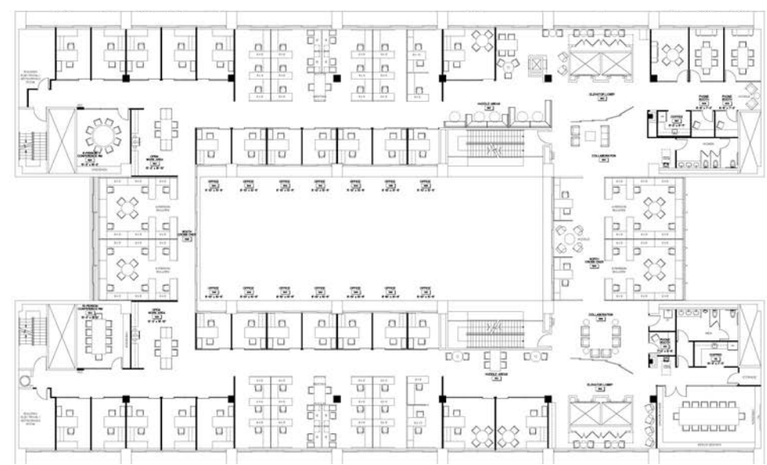
The zone planning diagram at the right indicates idealized locations of the various office types and functional spaces. The idea is to create an organizational motif the best locates each function with regard to accessibility, privacy, views, daylight, visibility and other planning criteria.

The 13th floor concept plan below illustrates one possible layout based on the zoning concept. The final plan will likely vary, but will grow out of the zone diagram and the various “plug and play” component ideas shown in the concept plan.

Zone Legend

- Open office
- South crossover
- Work Cafe
- North crossover
- East conference area
- West lobby / huddle
- West conference area
- East lobby / huddle
- West elevator wrap
- East elevator wrap

Office floor planning zone diagram

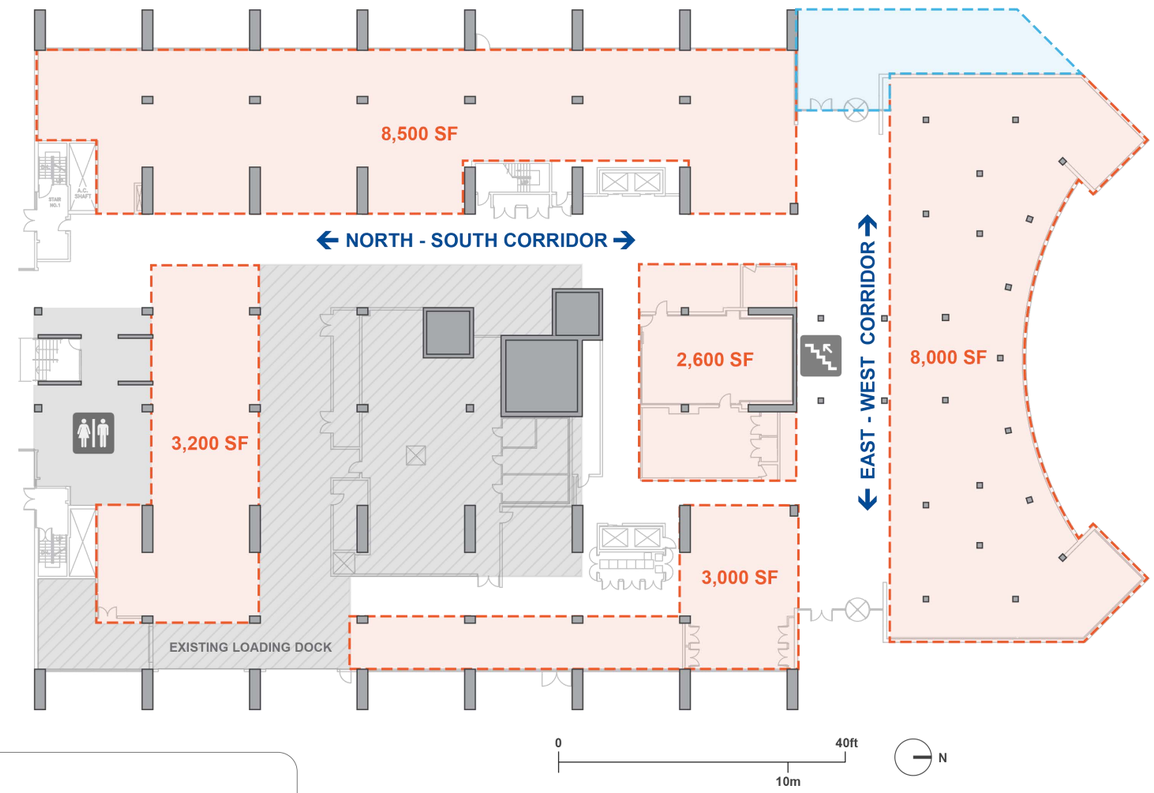


13th floor concept plan

WH Renovations GPP: Ground Floor

The ground floor component of the Wilson Hall renovation project reimagines this foundational component of the building. Creating the framework for its long term usage as an inviting portal into the full vitality of Wilson Hall it first puts in place a master plan concept. The plan identifies various space that could be considered for alternate or adaptive reuse. The goal is to make the best long term use of the ground floor by locating commonly used staff wide and visitor wide functions within its footprint.

As of this writing the planned scope of work is unfolding, but it appears as if the efforts under this project will focus on the north end of the floor and on improvements to the west entrance.



LEGEND

- West Entrance Improvments
- Tenant Space
- Back-of-House Operations
- CORRIDOR
- Future Stairs to Atrium/Mezzanine
- Future Restrooms

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The Scientific Hostel

The Fermilab approach to uncovering the mysteries of the universe is eat, sleep and work to drive discovery.

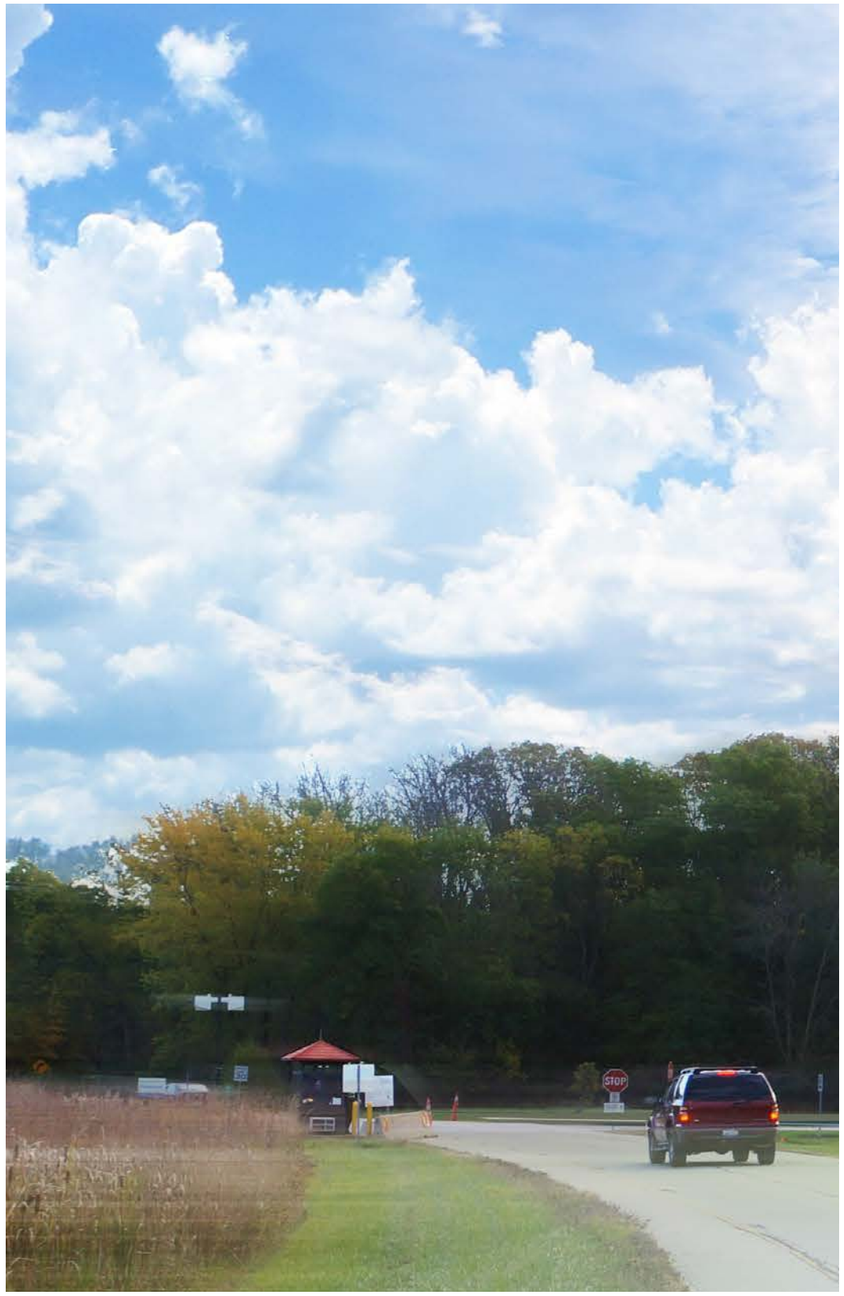
Convenient temporary lodging is important to the creation of an open, inviting and collaborative international research community. The Scientific Hostel will augment currently available on-site housing for short-term visitors. It provides an attractive, efficient and convenient modern hostel.

The phrase “eat-sleep-work to drive discovery” has become a Fermilab motto. Fermilab envisions the character of the atmosphere critical to implementing its role in the Particle Physics Project Prioritization Panel (P5) Strategic Plan for U.S. Particle Physics in the Global Context, also titled “Building for Discovery.”

In that spirit, Fermilab proposes the development of a 100-room hostel as part of our laboratory complex. Drawing from the Master Plan vision, the guiding principles and the motto, this facility is to be located in the Central Campus district of the site, the laboratory’s hub of activity.

The design concept begins with an understanding of the needs, expectations and lifestyle of the current and next generation of researchers and visitors. It brings together the best of both the domestic and international character of our laboratory culture.

The typical guest will possess a “younger” sensibility and expectations. Typical travelers will check into their room, leave their bags and go back to the lobby to use their computer or meet associates. Alternatively, they will often take the short quarter-mile walk to Wilson Hall to meet colleagues for meals, meetings or work.



A compact but connected room
Guest rooms will be much smaller than the average American hotel (190 square feet versus typical 300 square feet), but without sacrificing amenities and a quality experience. The room designs use space efficiently while providing state-of-the-art technology to keep visitors connected and engaged during their working visits. This approach positively affects stewardship of natural and financial resources as well as energy consumption.

A compact "work café" lobby
Emphasis is placed on the design of the lobby. It will be a bright and airy setting characterized by high ceilings and a contemporary coffee-shop feel. It will be a place where visitors can relax, work or connect with friends and associates.

Ground Floor

Second Floor

Third Floor

Fourth Floor

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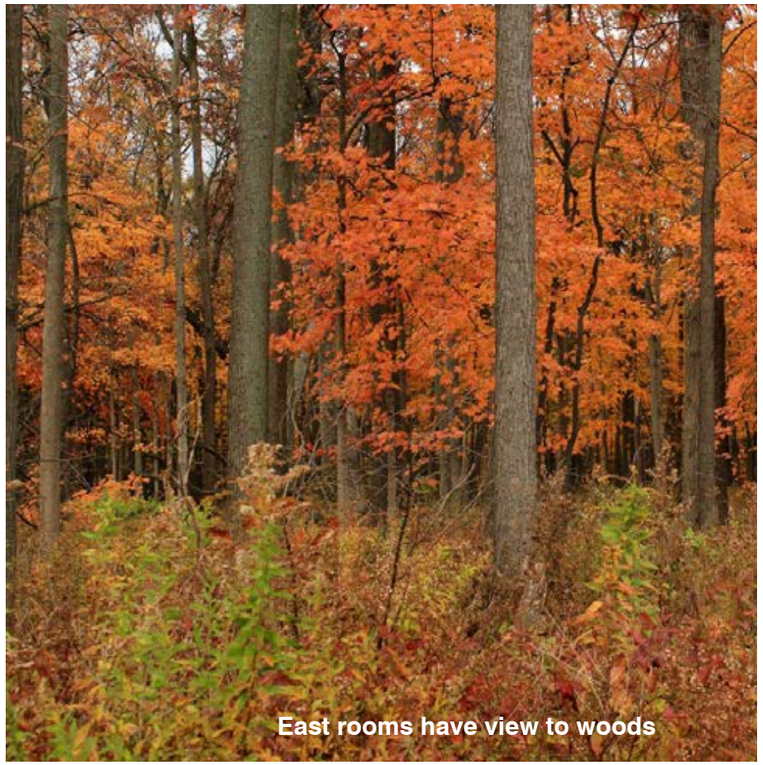

East rooms have view to woods

Typical guest room interior

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Global Accelerator Center

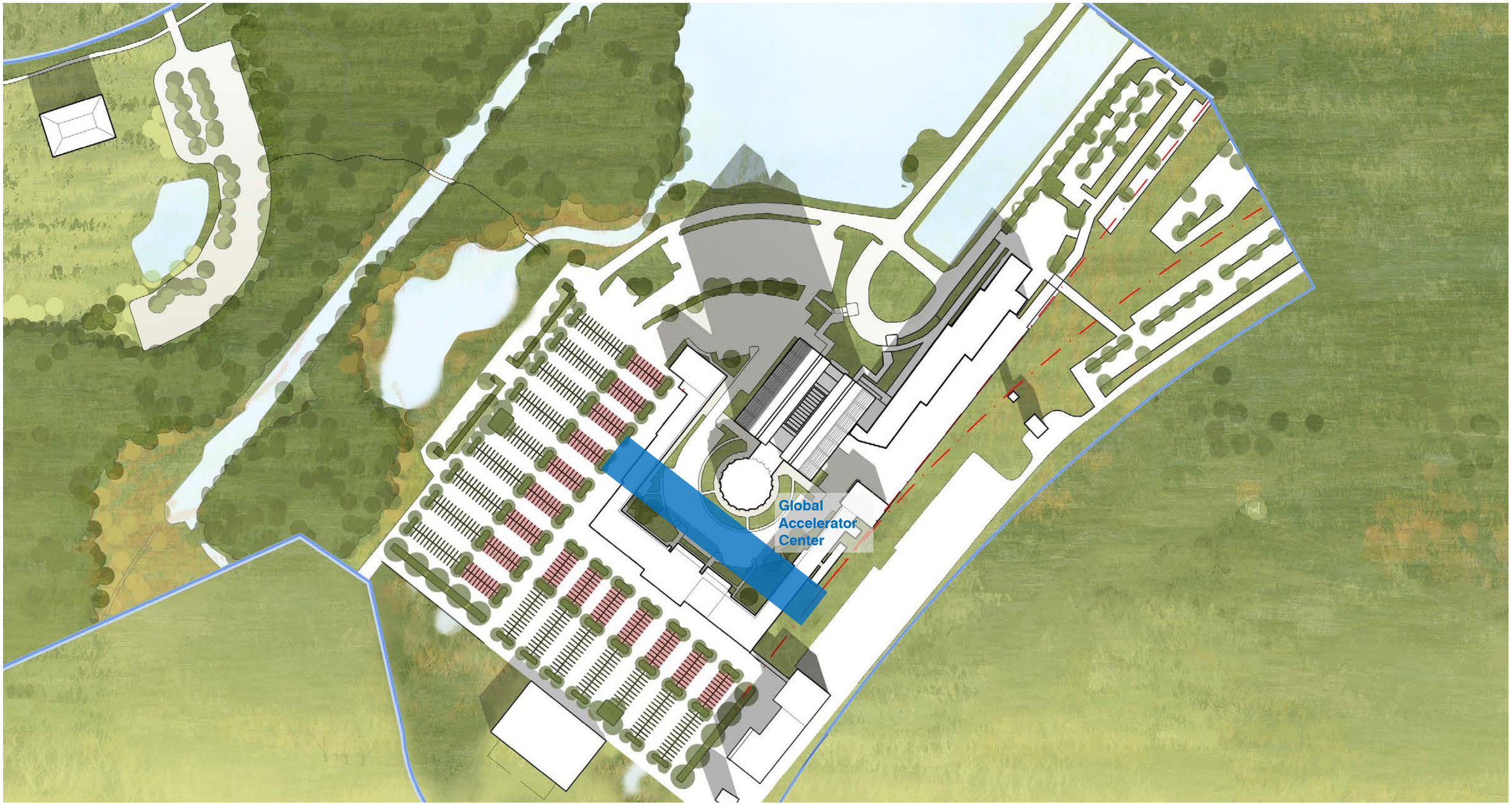
The Global Accelerator Center provide modernized working conditions for over 25% of the laboratory staff. It creates a unified culture with a strong sense of community both for the laboratory and national and international visiting and collaborating accelerator scientists.

Fermilab has transitioned from operations focused on high energy colliding beams at the Tevatron to providing high intensity proton beams for neutrinos and precision physics measurements using muons, as well as leading national and international teams of accelerator scientists to develop transformational accelerator technologies for use across the SC complex and elsewhere. This transition, combined with the condition and age of Fermilab accelerator facilities, creates the need to consolidate core research functions and modernize key support buildings.

In that spirit, the campus plan development program proposes the construction of the Global Accelerator Center. This modern facility will provide modernized working conditions for over 25% of the laboratory staff, creating a unified culture with a strong sense of community both for the laboratory and national and international user community. It will house both laboratory accelerator scientists and visiting and collaborating national and international accelerator scientists.

The Global Accelerator Center will replace current, 40-year-old, outdated and inefficient buildings and portable trailers, spread across the laboratory. It will enable integration of the accelerator science, operations, and technology community, and allow these scientists to better support the science missions at the laboratory. In addition, the project will renovate for and adaptive reuse two 1970's era buildings (the Cross Gallery and Transfer Gallery). The project will result in interdisciplinary collaboration built on existing laboratory capabilities and expertise, currently dispersed across the Fermilab site.

Viewed together with the current Wilson Hall renovation projects, and the planned Integrated Engineering Research Center (IERC), the Global Accelerator Center will complete the transformation of Fermilab's Central Campus for the next generations of scientific discovery.


Global
Accelerator
Center

Next Generation Computing Center

Fermilab's core capability in Advanced Computer Science, Visualization, and Date is at the heart of understanding and interpreting the scientific mission.

Computational science is an important strategic theme at the laboratory. Fermilab's core capability in Advanced Computer Science, Visualization, and Date is at the heart of understanding and interpreting the scientific mission. Major computational science initiatives on the horizon include the High Energy Physics Cloud, an active archival Facility, and a scientific workflow system.

Supporting these initiatives requires ongoing improvements in Computational Science infrastructure and facilities, to keep pace with fast developing technology and scientific demands. In that spirit, the campus plan development plan proposes the construction of the Next Generation Computing Center (NGCC). Located in the computing district near the Iconic Feynman Computing Center (FCC), this facility will provide additional functionality complementing the FCC and setting the stage for the next generation.

A number of elements are included in the conceptual program for the new NGCC. The first is Big Data Storage. This storage driven component will provide large disk storage, tape storage and networking space. This space is planned to be located underground, protected from weather disasters, as it will house "treasure data" from experiments.

The second element will provide functionality needed by the computing division but not currently available in the existing FCC building. Chief among these is meeting and collaboration space. Collaboration space will range from the smallest "hoteling" type group workspaces, through conference rooms of 8 to 12 people, and up to and including a 300-seat auditorium capable of providing division wide meetings.

The final element is the construction of space to provide additional computing systems and equipment. Two system augmentations are envisioned; one system for business needs, and a separate more open system for the scientific community and other general-purpose needs. These systems will employ open air, state of the art, and green cooling systems.

When completed the NGCC will provide much needed facilities and capacity for the "Next Generation" of computational science at Fermilab.

NEXT GENERATION
RUTING CENTER

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Welcome and Outreach Center

As an inviting portal to the campus, the Welcome and Outreach Center will be a multifaceted place, creating a powerful and informative bridge between the laboratory and the world beyond its borders.

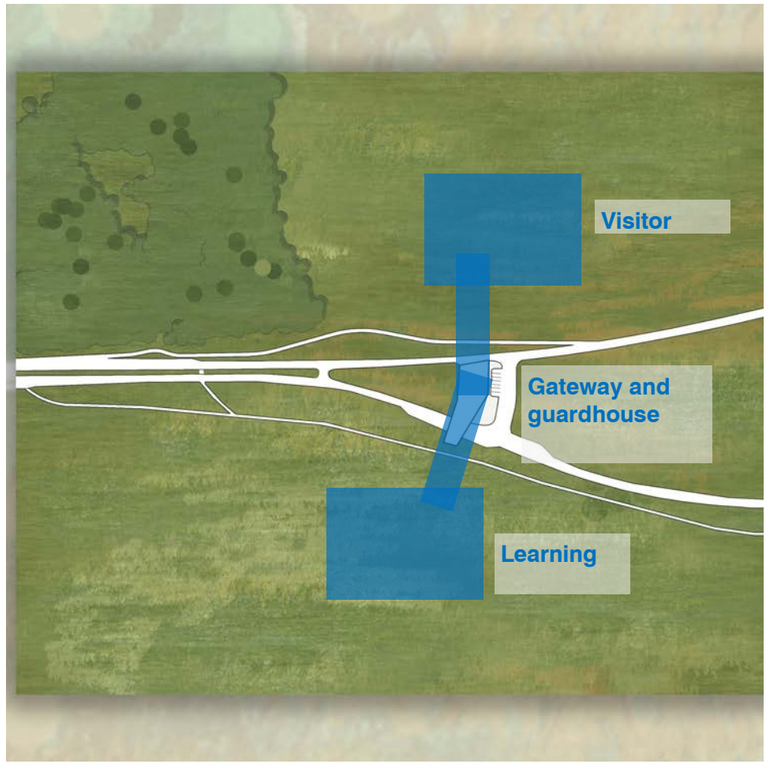
There is an adage that states, “You never get a second chance to make a first impression”. In that spirit, the development plan proposes the Welcome and Outreach Center. As an inviting portal to the campus, it will be a multifaceted place, creating a powerful and informative bridge between the laboratory and the world beyond its borders.

Currently, most first impressions are created at the Pine Street (west side) entrance to the campus. The perceptions created fall short of the welcoming and informative visitor experience envisioned by the master plan.

The planned welcome center will replace confusing, obsolete, aging and redundant elements comprising the current entrance, while envisioning a complex that collocates public interface and information functions into a fully reimagined arrival district.

When complete, the Welcome Center will create a larger presence within the broader community. Its location, highly visible from Kirk Road, will elevate Fermilab’s profile to surrounding communities in a fresh and more present way. Fermilab would become less mysterious and more accessible to all.

Site plan



Central to the project is a new consolidated 24-hour, manned entrance gateway and guardhouse replacing the two existing structures. Attached to the guardhouse will be a new sate of the art security office.

Beyond the gateway and security element the project proposes a new home for the education center integrally entwined with the new functionality of a visitor center. Fermilab has no visitor center, and the current education center struggles with the space constraints presented by its current facility further inward on the campus. A new facility could greatly enhance Fermilab currently ambitions and successful program partnering with school districts all over the state of Illinois and beyond. The visitor center would expand outreach to persons of all generations, offering opportunities to communicate Fermilab's scientific research to all.

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The Boulevards

The “Boulevards” develops distinctive, functional and visually unified transportation corridors connecting the major entrances with the major destinations within the campus.

The Fermilab Campus Master Plan guiding principles aim to ensure an enhanced campus experience that is welcoming and informative to both local and international visitors. The campus plan initiatives envision integrative design, improvements in campus landscapes, and improvements in mobility and wayfinding,

Responding to these challenges and aspirations, the development plan proposes the “Boulevards”. This project, brings a together an array of design elements and approaches, creating distinctive, functional and visually unified transportation corridors connecting the major entrances with the major destinations within the campus.

The current campus vehicular circulation system is somewhat complex. It initially grew from the rural roads in place at its founding. As the campus developed over the next 50 years, roads were added (and subtracted) in response to the construction of accelerators, beamlines, raised earth berms and experiments.

Roads are typically the same width, with curbless gravel shoulders, minimal lighting and signage, minimal landscaping, and unscreened, undesirable views of scattered utilities and support structures along the way. Effectively, all roads appear to be service roads. This creates confusion among the uninitiated as to where they should and should not travel. As the campus hosts increasing number of international visitors and users in the years to come, this condition will become more problematic.

As major planned developments and experiments migrate toward the core campus region, the clarity and improvement in the transportation corridor will prove to be an important infrastructure improvement, providing clarity to the mobility and wayfinding experience, enhancing the campus experience and facilitating.

Design notes

The design of all areas shown in green on the diagram bring together multiple campus plan initiatives to clearly elevate the experience of the boulevards, in the hierarchical sense.

Landscaping and other screening approaches hide all undesirable views of equipment and the like. A fully integrated, coordinated and signage and wayfinding program foster simple navigation of the site. A unified system of efficient roadway lighting will be implemented.

Separate biking lanes will be provided in both directions along the side of the roads and clearly identified. Streetscaping and other unifying elements will be designed and implemented.

Center Point

"The Boulevards" proposes to establish a "State and Madison" baseline location for organizing the campus. Just as Chicago emanates from the intersection of State and Madison streets, Fermilabs addressing and order will emanate from this point. A turnabout proposed for this crossing of the two boulevards, will become a strong geographical marker, creating a sense of arrival, a sense of place, and centering the site. Wayfinding at this location will direct the traveler to all major destinations. The proposal also aims to rename these streets, making them more identifiable and memorable.

A tree lined divided road with dedicated bike path will characterize portions of the boulevard. Visitors will clearly perceive a distinction between this major arteries and lower level service roads.

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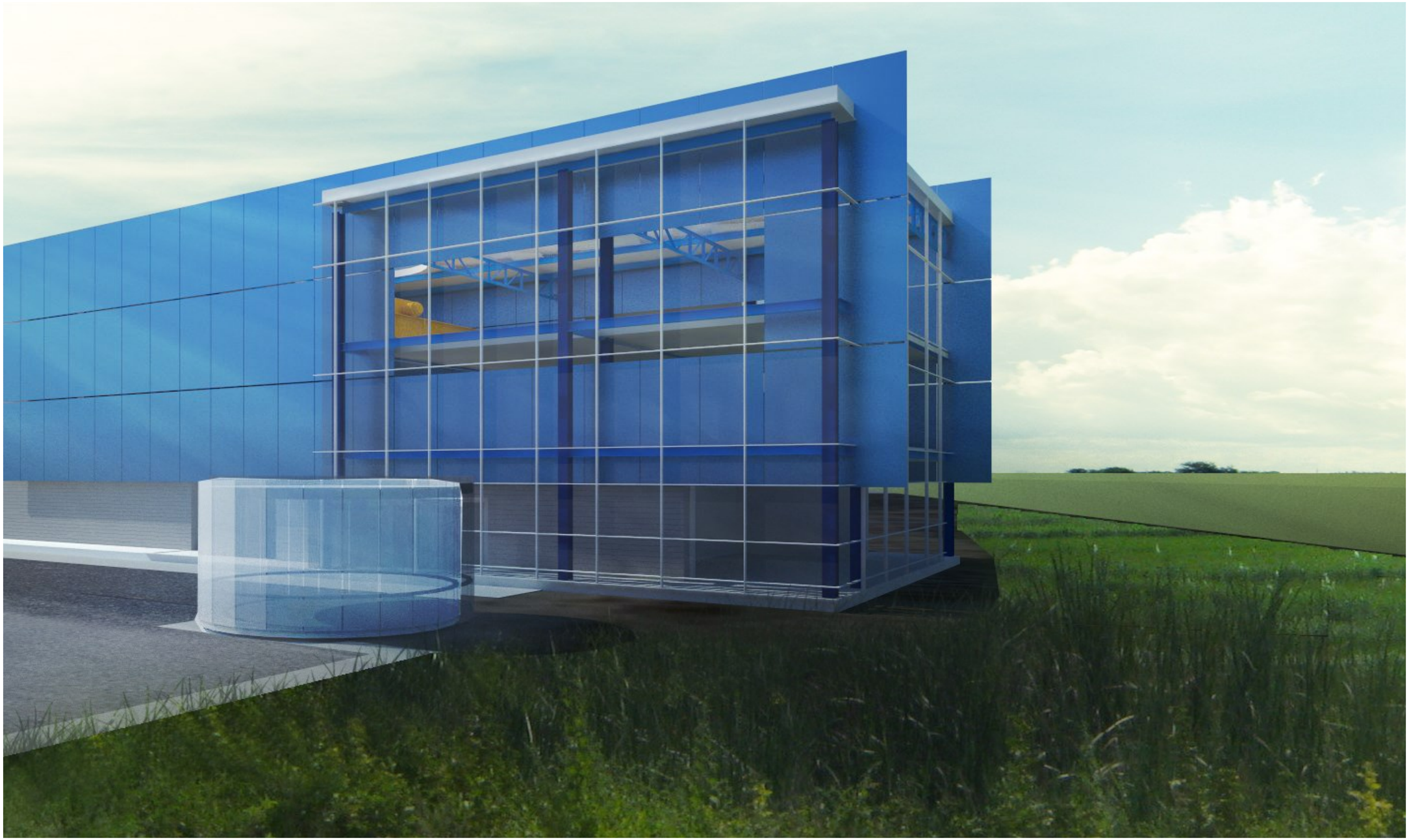
Long Baseline Neutrino Facility

The Long Baseline Neutrino Facility is an international mega-science project for hosting the Deep Underground Neutrino Experiment in the United States.

Located in the Neutrino District of the core campus at Fermilab, the Long-Baseline Neutrino Facility (LBNF) constructs a complex of buildings and beamlines. Its location within the campus core provides easy proximity to Central District facilities housing the international community of researchers and engineers supporting the science program. The resulting powerful particle accelerator complex will produce the worlds most intense neutrino and antineutrino beams and send them 800 miles straight though the earth to the partner Dune detectors in South Dakota.

The complex, currently in the planning stages, will include the construction of a number of surface buildings, an earth berm and extensive underground construction. The scope of development will include additional roadways and access from the Central District, as well as site configurations to accommodate the new facilities.



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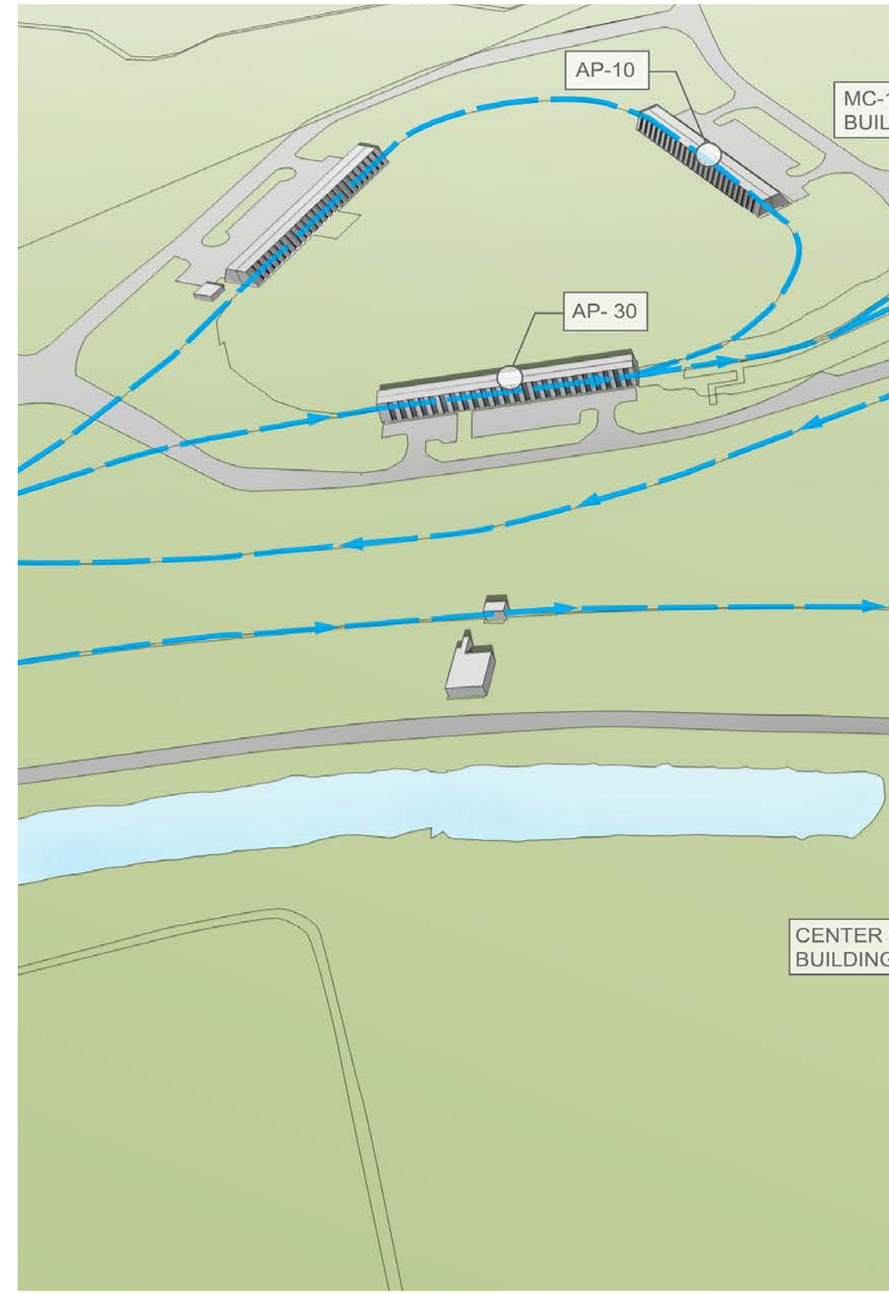
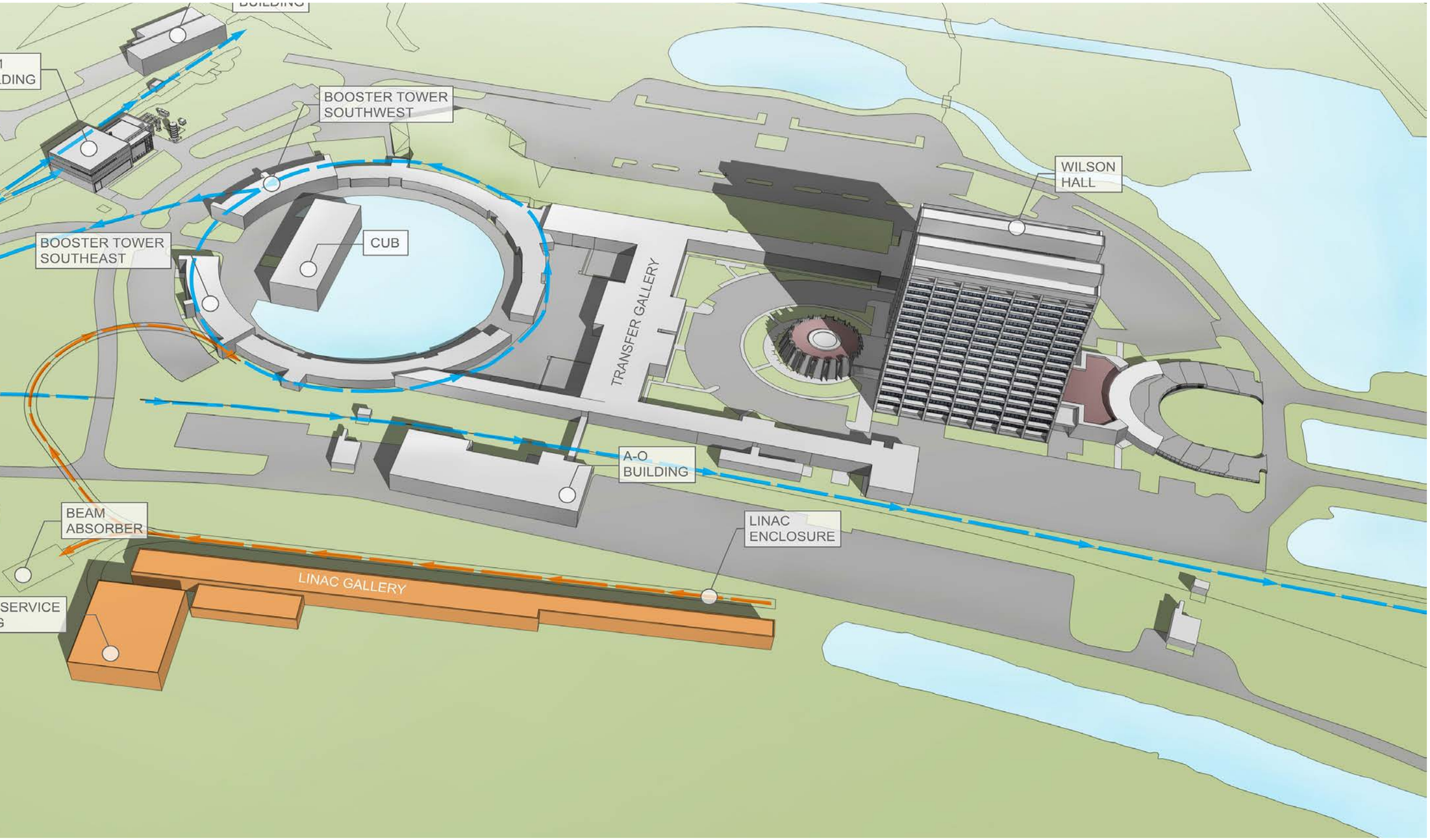
The existing linac and booster have served Fermilab for decades. The envisioned Superconducting Linac Complex will eventually replace these facilities with even more powerful accelerators for the next era of science.

Superconducting Linac Complex

The Superconducting Linac Complex (SCLC) is a set of improvements to the existing accelerator complex which will provide high-power proton beams in support of the Fermilab particle physics research program. The SCLC comprises the construction of a new 800-MeV superconducting linear accelerator injecting into the existing accelerator complex. Upon the completion of PIP-II, the existing 400-MeV linear accelerator will be retired from service.

The immediate goal of SCLC is to provide more than 1 Megawatt of proton beam power onto the LBNF neutrino production target (the PIP-II experiment facility) The secondary goal is to provide a platform for long-term development of the Fermilab complex to support higher beam power to LBNF and to support a broader research program based on high power proton beams.





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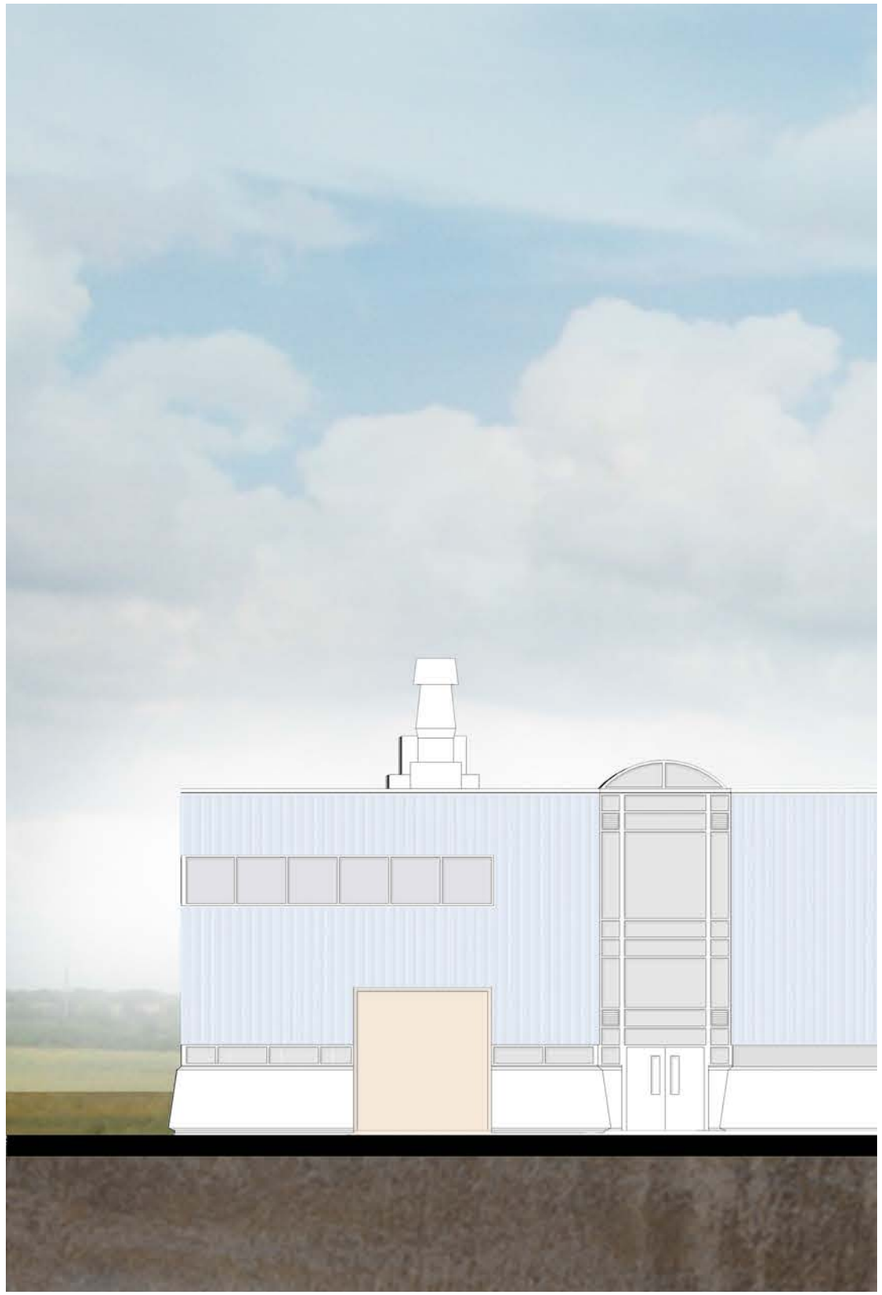
Industrial Center Building Addition

Fermilab's ongoing ambitious science program is pressing the industrial facilities toward a particularly intense period of component processing and assembly.

For over 30 years, the Industrial Center Building (ICB), with its two 30 ton overhead cranes, has served as the Technical Divisions premier space to build and assemble the largest components for accelerators and detectors. Surrounded by four buildings with lower capacity cranes, the industrial district carries out its mission of design, development, fabrication or procurement, and the testing of accelerator and detector components at the heart of Fermilab's overall mission. Here Technical Division personnel not only build the components of the accelerators and detectors of today and the near future, but also think far in advance to prepare for the next generation of high-energy physics machines.

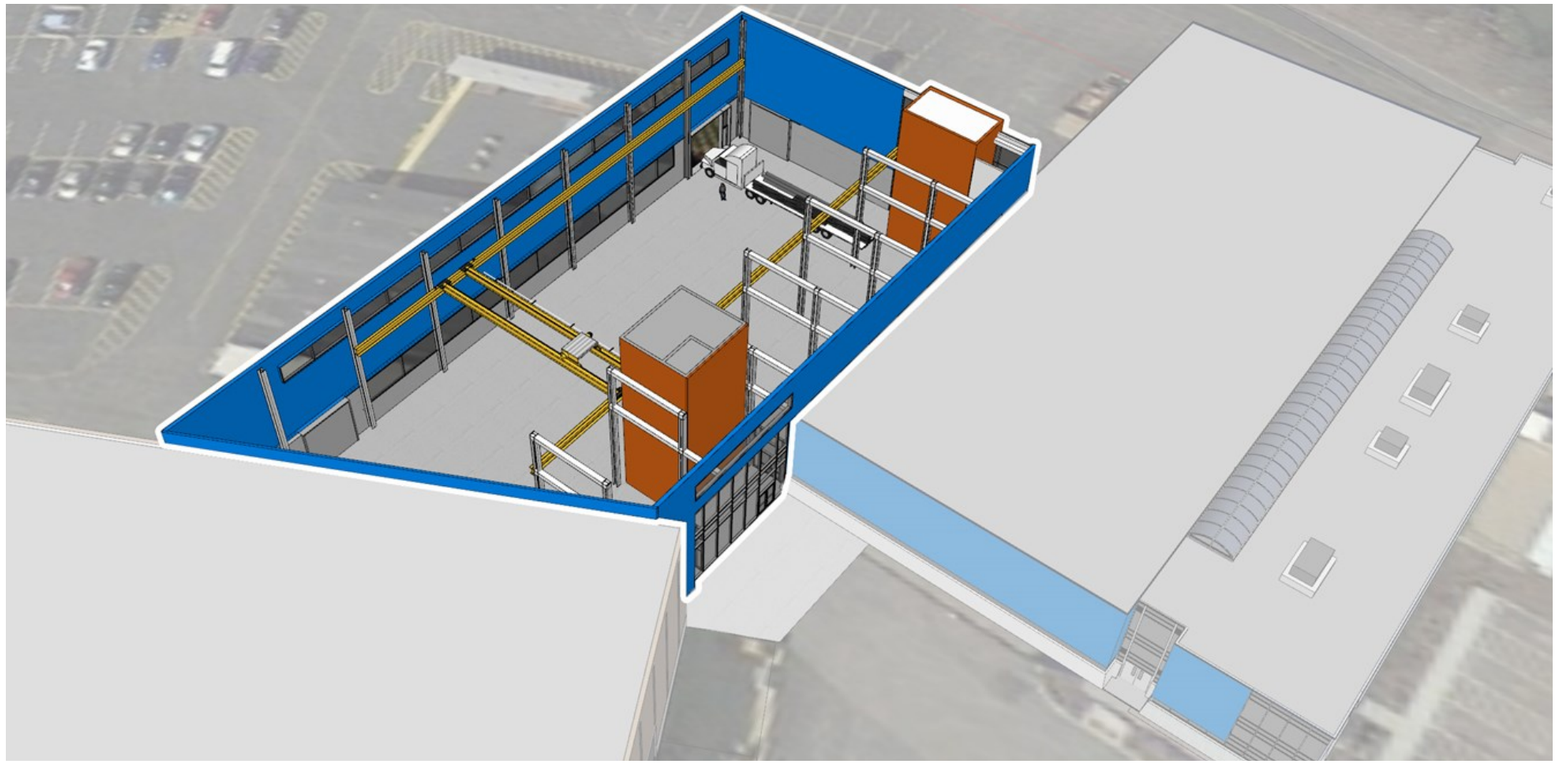
Fermilab's ongoing ambitious science program is pressing the industrial facilities toward a particularly intense period of component processing and assembly. Responding to the ever-growing demand placed on the current infrastructure, the campus plan development plan proposes the construction of the ICB –Addition, providing additional high bay and supporting office space to meet this demand.

The project will build a new high-bay addition to the Industrial Center Building (ICB). The proposed addition will include 15,000 gross square-feet at grade comprised of 10,500 square-feet of high-bay space with 40-ton crane coverage and 2,400 square-feet of low-bay space. When completed the ICB Addition will provide critical high bay space for component processing and assembly, well positioning the complex for the future.



South Elevation

IB-CA
IB-3
IB-2
IB-C
Future Development
IB-4
IB-1
Future Courtyard
IARC
HAB
Future Development
327



The ICB-A project includes direct connections between the existing and new high bay areas. This addresses the immediate need for additional assembly space and presents an opportunity for future flexibility. The project represents steps towards centralizing activities, executing the planned expansion, and providing improved access and circulation for the buildings in the Industrial Complex.

A glass entry attached to adjacent to an atrium corridor will serve as the main entrance for pedestrian traffic and will provided visitors and employees with direct indoor access to the Industrial Center Building (ICB) and the Industrial Building 3 (IB-3).

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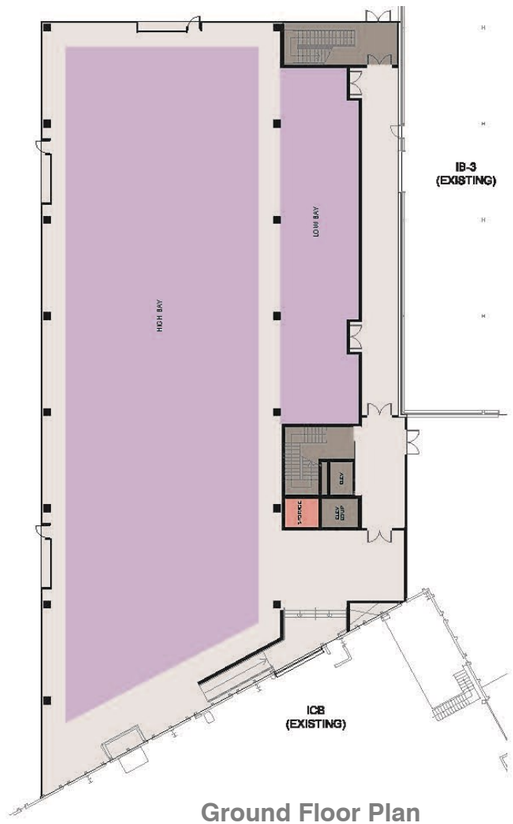
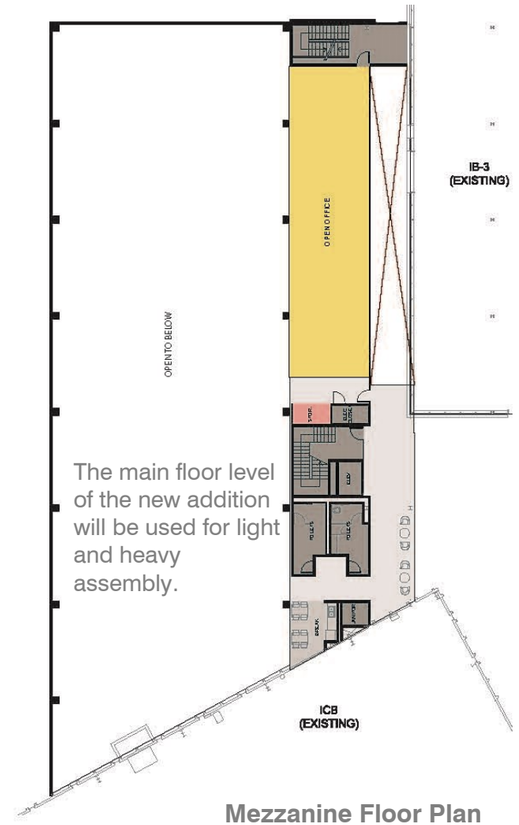
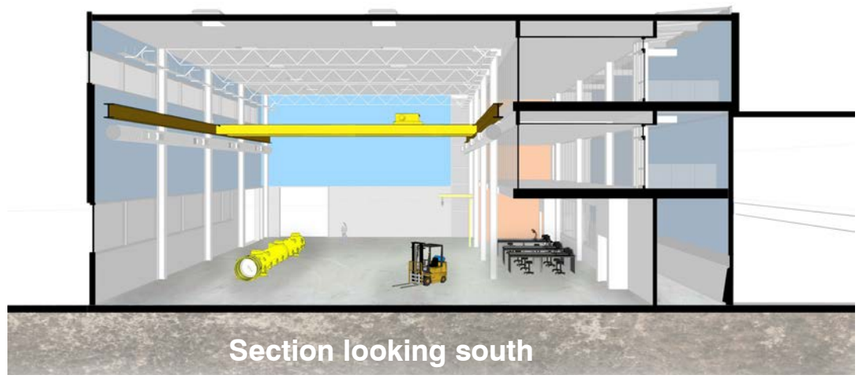


Ground Floor Plan



Mezzanine Floor Plan



Section looking south

Additional office space is also needed. Office occupancy of the permanent buildings in the Industrial Area is currently running at 100%. Over the low bay area the new building will have two floors of mezzanine designated for offices.

Functions not requiring crane coverage will be located in the low-bay under the future mezzanine offices.

West Elevation

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Central Utility Building Expansion

Central plants are prized for their efficiency of design, operation, and maintenance as well as energy savings. Expanding Fermilabs Central Utility Building will enable Fermilab to build on its efficiency while expanding capacity to service a number of projects within the twenty year development vision.

The central utility plant at Fermilab's Central Utility Building (CUB) has a proven, decades long track record of efficiently providing heating and cooling water for both conventional and programmatic uses. The conventional side provides water for heating and cooling Wilson Hall, as well as the footprint area building south of Wilson Hall. The programmatic side of the plant provides treated water to experimental areas and facilities beyond the footprint.

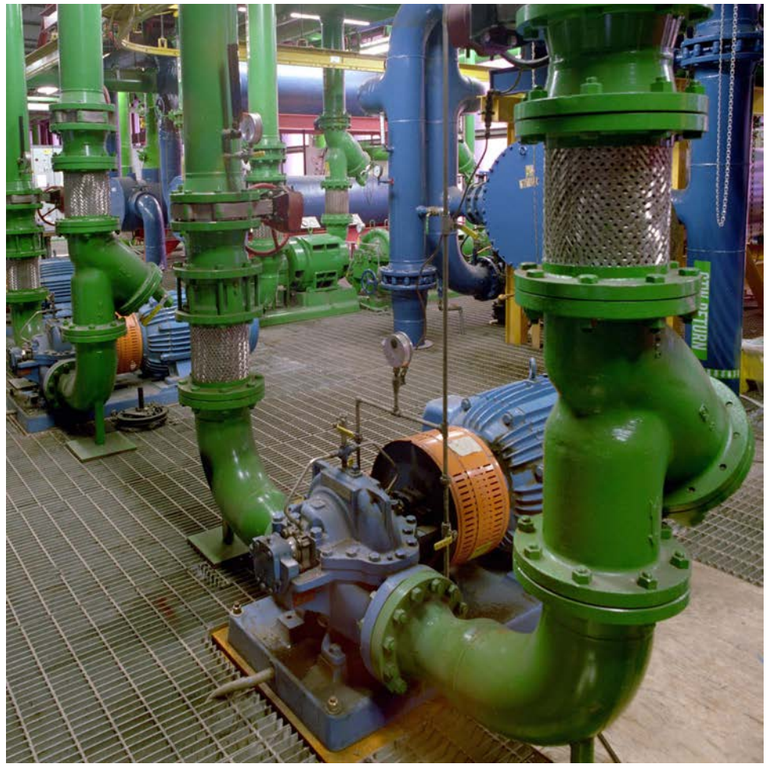
As described elsewhere in the master plan, a number of new central district development projects are in planning stages. One, the Integrated Engineering Research Center will relocate up to 200 staff from the fringes of the campus to the central district into a new state of the art facility interconnected with Wilson Hall. Another, the Global Accelerator Center, proposed just south of Wilson Hall will draw another 100 staff to the district. Ongoing renovation projects within Wilson Hall will gradually increase the population density of this 16-story icon. Additionally, the Superconducting Linac Complex hosting the PIP II and ultimately PIP III accelerators is to be located east of Wilson Hall, very near to the central district.

This convergence of next era developments presents an important opportunity for synergy of projects. Central plants are prized for their efficiency of design, operation, and maintenance as well as energy savings. For these reasons, the opportunity to expand the CUB to provide heating and cooling water for both occupant comfort and programmatic loads to support central district expansion is compelling.

In that sprit, expanding the CUB is proposed. The expansion is necessary and beneficial on two fronts. The first is assuring its continued efficient operation to meet current loads, by providing much needed space for maintenance access, equipment replacement and redundancy, and functional separation needs. Secondly, it will facilitate the provision of heating and cooling water to potential future central campus developments. In summary, the enlarged facility will serve the needs for the next twenty years, in a safe, maintainable, efficient, and accessible manner.

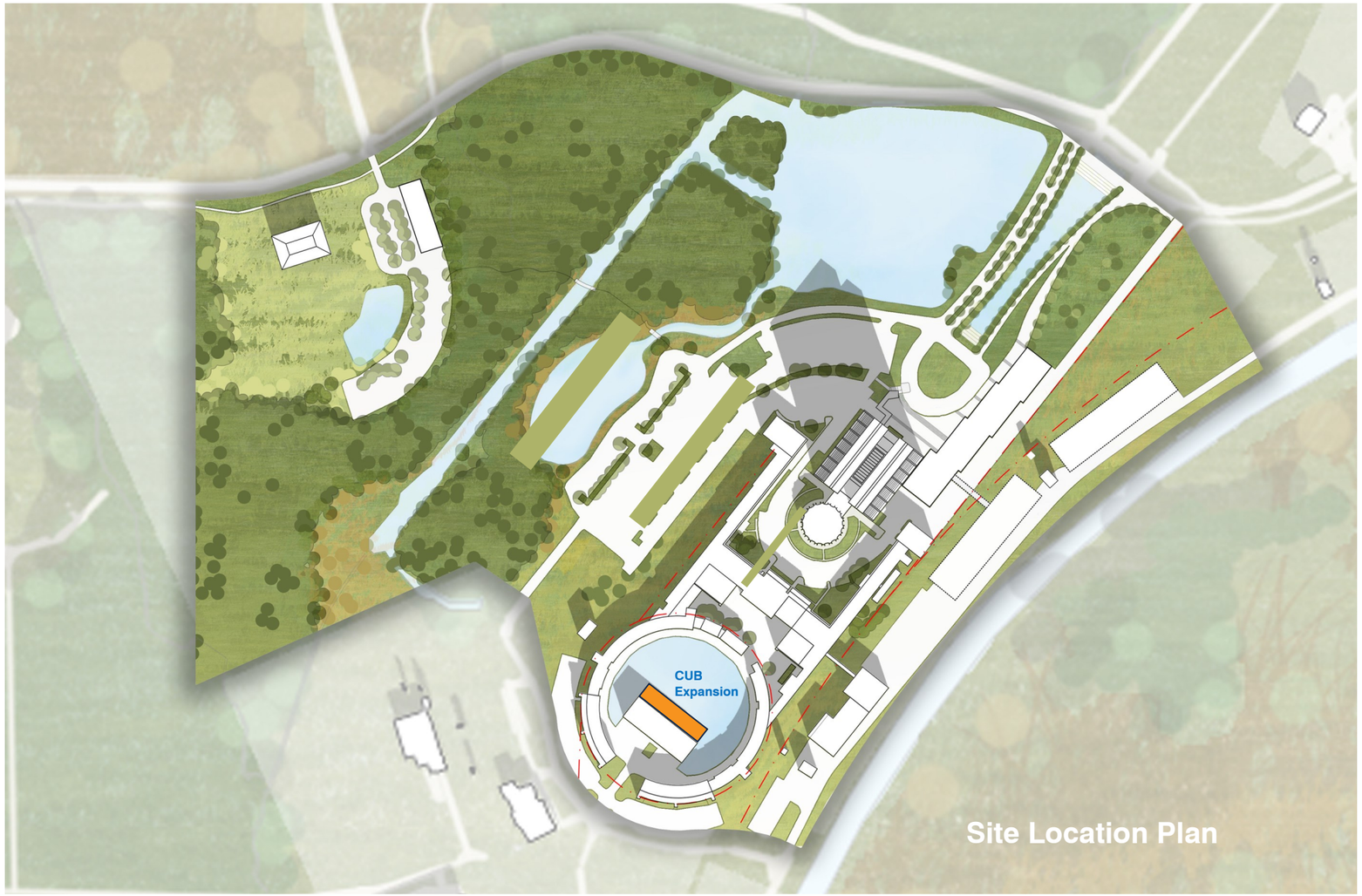
The proposed location for the building expansion is currently a pond. The pond was used in conjunction with other ponds surrounding the central footprint as a primary element for heat rejection. However, a number of years ago it was abandoned in lieu of the cooling towers currently in use. The pond system has silted up and can no longer function as it once did. The CUB pond will be removed and backfilled to provide a base for the new addition as well as additional parking.

Based on current and future needs, the proposed CUB Expansion will increase the area of the building from its current 16,000 SF to a total of 28,000 SF.



The existing CUB, operated and maintained by FESS Facility Management, supports a number of the footprint buildings with cooling and heating for both HVAC and equipment cooling. It is congested and has little to no space for additional equipment. Its current cooling capacity is marginally adequate to handle some of the proposed future loads, but leaves no spare capacity for redundancy or expansion. System reliability and servicing cycles, indicated the need for near 100 percent redundancy, which is not achievable within the current space confines.

An expansion of roughly two thirds of the existing building will comprise the proposed addition. A portion of the expansion will allow for the separation of certain more corrosive operations by expanding existing functions housed in the current structure into the proposed building addition. Other areas of the existing building contain controls and variable frequency drives requiring an increased level of cooling for operations will be addressed with the addition. Possibly the greatest benefit of the expansion is to re-plan some of the existing equipment to eliminate the hazards of servicing congested areas.



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Industrial District Revitalization

For nearly 40 years the technical district complex has been home to the creation of accelerator components. Revitalization will prepare the district for the next decades.

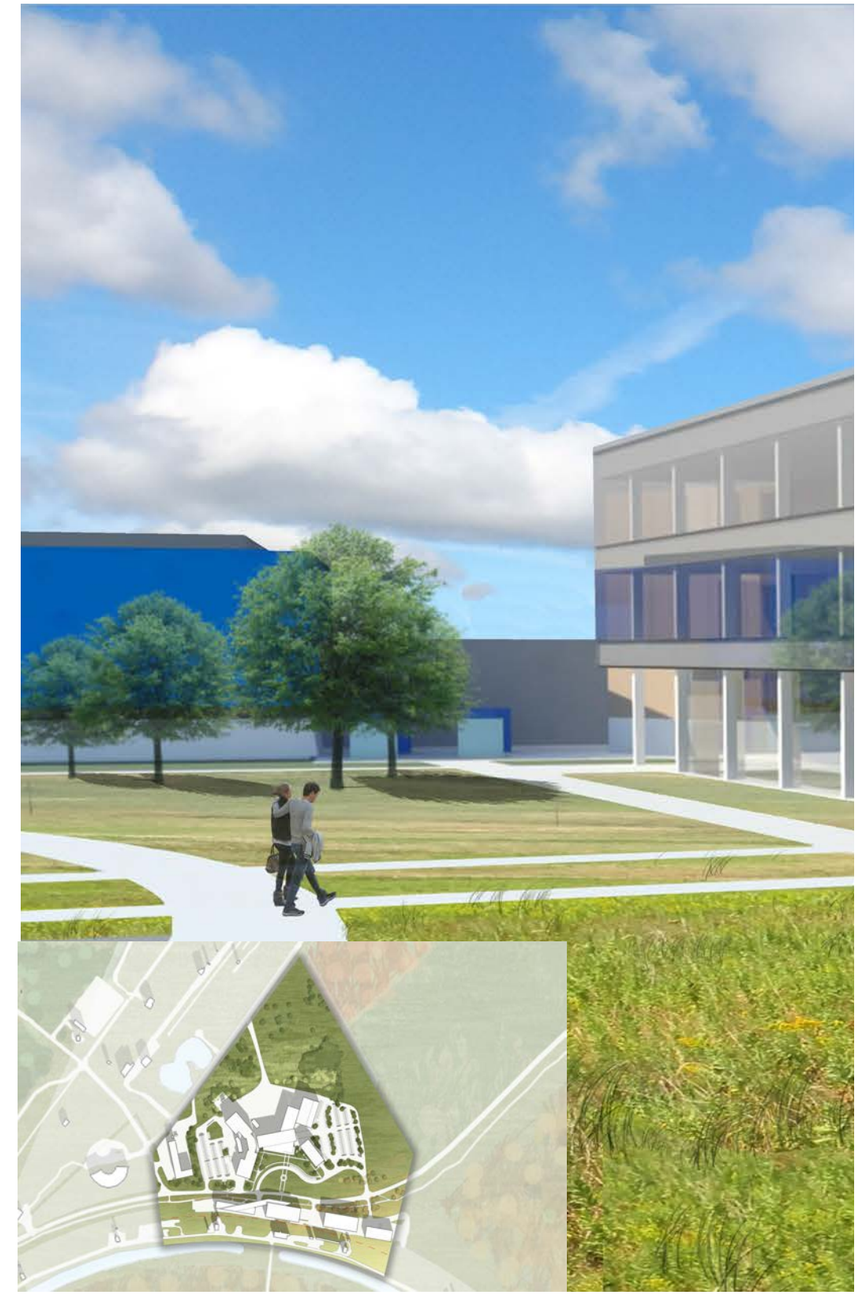
For nearly 40 years the technical districts complex of industrial have been home to the vital mission of design, development, fabrication, procurement and testing of accelerator components. Here Technical Division personnel not only build the components of the accelerators and detectors of today and the near future, but also think far in advance to prepare for the next generation of high-energy physics machines.

As Fermilab embarks on its next major scientific initiatives the complex is in need a makeover. In that spirit, the Fermilab Campus Plan development plan proposes the Industrial District Revitalization (IDR) project. This project will address important needs present at the facilities in two ways.

The first will be to replace the siding and windows in the four metal-sided high bay buildings. The existing siding and widows are past their useful life. New state of the art siding and window systems will provide increased energy efficiency and a durable envelope and finish.

Secondly the project proposes and expansion of the technical division (TD) headquarters office space to the south of the Industrial Center Building. This will allow new state of the art, flexible, day lit office space for division management and staff. This will replace the dark, narrow, bunker like spaces currently used for this purpose. This expansion will also reimagine the outside courtyard area and of the district and create a more open and unified entrance and connection between elements of the complex.

When completed the project will provide a renovated and reinvigorated technical district, exemplifying the master plan guiding principles and setting the stage for its next 40 years and beyond.



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Utility Upgrade Projects

Maintaining a dependable utility infrastructure from which science programs can be accomplished are vital to the Fermilab Campus.

Maintaining a dependable base from which science programs can be accomplished depends upon robust, redundant, maintainable, and flexible utility systems. The major utility systems in place at the Fermilab Campus are High Voltage Electrical (HV), Industrial Cooling Water (ICW), Domestic (DWS), Sanitary Sewer System (SS) and Natural Gas piping (GAS). Without these systems, science at Fermilab cannot exist. Over recent years upgrades and improvements have been ongoing. Currently two major Utility Upgrade Projects (UUP) are underway.

The first is an upgrade to portions of the Industrial Cooling Water (ICW) infrastructure. This project is putting in place a newly restored backbone including new piping, isolation valves and new lateral connections throughout the site. It is also upgrading the master pump house to best serve the required system loads. Additionally, in order to maintain adequate system pressures, two additional pump stations are being installed to support the anticipated loads.

The second project is a new high-voltage (H/V) Master Substation facility, replacing the obsolete original Master Substation. The project is putting in place a new substation building housing the new state of the art electrical systems and components essential to the support of accelerators, experiments, and computer operations in a safe and reliable manner.

These two projects make significant headway in the ongoing efforts to keep site utilities in peak condition to support science. However, work remains as founding era systems continue to age. Ongoing UUP efforts aimed at continued refurbishment are needed to continue providing a reliable and flexible utility infrastructure. These efforts will establish a stable base from which to serve both programmatic and conventional power requirements across the site for the decades to come.

The following pages provide a summary of known utility improvement needs as Fermilab moves forward. They are grouped by systems and affinities into possible project groupings. These groupings serve to provide information and planning outlooks. Funding packages and actual project groupings and schedules will be determined as plan implementation proceeds.

Without replacement of aging equipment, maintenance costs and service interruptions will continue and likely grow in both frequency and severity (increasing exponentially), putting our scientific programs at risk.

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Electrical

Oil Switch Replacements: An inventory of existing oil-filled switchgear and transformers across the site has been completed. Using this compilation as a foundation, unit substations and oil switches will be replaced with modern switchgear and air switches. The current switches pose an environmental risk, and per DOE direction, oil switches will be replaced with ones using SF-6 gas.

High Voltage Feeders: End-of-life high-voltage feeder cables need to be replaced. Additionally, as part of this effort, feeder loops will be created to provide redundant capabilities, improving electrical service reliability.

Unit Substation Replacements: This initiative will replace approximately 30 obsolete original equipment (founding era) unit substations original to the lab. They will be replaced with modern, technologically current, state of the art equipment.

Industrial Cooling Water

Main injector ICW: The industrial cooling water piping system network serving the Main Injector complex is nearing end of life and should be scheduled for replacement.

ICW Pond System: The network of ponds comprising the ICW Pond system are in need of improvements. The goal of this work is to increase storage capacity of water on site, supporting the surface water management program.

Cress Creek Flood Mitigation: Flooding problems are troublesome at the north end of the site. Various buildings, including the Casey's Pond Pump House, have suffered flooding during times of heavy rainfall. The Cress Creek Flood Mitigation project will construct site modifications at the north end of the site to help mitigate flooding alleviating the present issues.

Domestic Water System

Among a number of domestic water issues are systems close to failure in the Village, at Site 38 and at Lab 8. Additional issues at various locations around the site include water quality resulting from resident time of water in pipes.

Sanitary piping system

Sanitary piping is in need of replacement at a number of locations throughout the site. A persistent problem is pipe failure which allows groundwater infiltration into the pipes. This infiltration artificially increases the quantities of water needing to be sent offsite to treatment facilities.

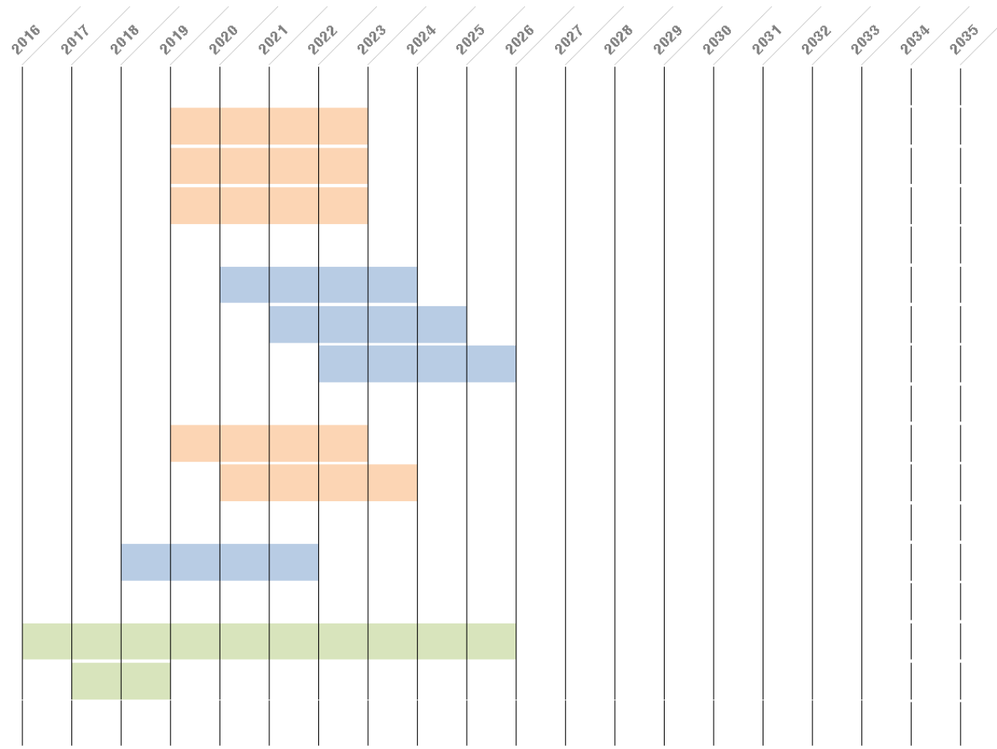
General system wide initiatives

Metering: As a green monitoring and management utility program, and to meet DOE direction, meters should ultimately be installed on all essential systems throughout the campus.

Utility Master Plans: In support of the Fermilab Campus Master Plan, individual system master plans are needed. Just as the master plan enables global and integrative planning, the system plans can do the same. This will allow capacity optimizations, flexibility, proper resource and improvements focus, best leveraging utility improvement upgrade efforts.

Utility Upgrade Projects Outlook	Proposed Funding
Electrical (H/V)	
Oil Switch Replacement	*
High Voltage Feeders	*
Unit Substation Replacement	*
Industrial Cooling Water (ICW)	
Main Injector ICW	*
ICW Pond System	*
Cress Creek Flood Mitigation	*
Domestic Water (DWS)	
System failure replacements	*
Water quality	**
Sanitary System (SS)	
GW Infiltration failure repairs	**
General	
Metering	**
Utility Master Plans	**

* Combination funding (GPP, Operating)
** Ongoing with incremental funding - various sources



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Implementation Outlook

Project Implementation Outlook	Proposed Funding
Research Community	
Integrated Engineering Research Center (IERC)	SLI
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Scientific Hostel	***
Next Gen Computing Facility (NGCF)	**
Global Accelerator Center	SLI
Welcome and Outreach Center	**
The Boulevard	****
Tools for Science	
Superconducting Linac Complex	Line
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Industrial Center Building Addition (IBC-A)	GPP
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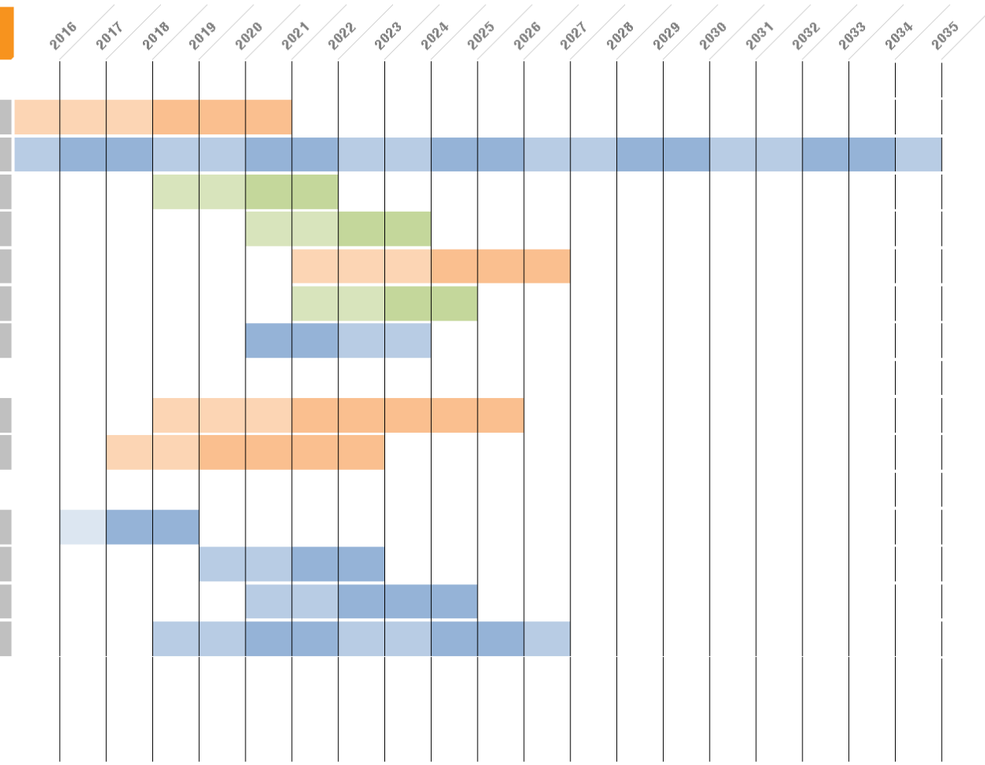

* Combination funding (GPP, Operating)
** Potential private funding
*** Private funding and operation model
**** Ongoing with incremental funding - various sources

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