ARGONNE SITE MODERNIZATION PLAN

2013 FIFTEEN-YEAR PLAN

Argonne NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

Existing Campus Plan
Axon from the Northwest

ACRONYMS

ACHP	Advisory Council on Historic Preservation
AGHCF	Alpha Gamma Hot Cell Facility
AIC	Argonne Information Center
ANL	Argonne National Laboratory
APCF	Advanced Protein Crystallization Facility
APS	Advanced Photon Source
ARRA	American Recovery and Reinvestment Act
ATLAS	Argonne Tandem Linac Accelerator System
CARIBU	Californium Rare Ion Breeder Upgrade
CD	Critical Decision
CHP	Combined Heat and Power
CIS	Computing and Information Systems
CNM	Center for Nanoscale Materials
CRMP	Cultural Resource Management Plan
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DOE-EM	U.S. Department of Energy Office of Environmental Management
DOE-SC	U.S. Department of Energy Office of Science
EERE	Energy Efficiency and Renewable Energy
EIC	Energy Innovation Center
EM	Environmental Management
EO	Executive Order
ESB	Energy Sciences Building
ESPC	Energy Savings Performance Contract
GHG	Greenhouse Gas
IGPP	Institutional General Purpose Projects
IHPA	Illinois Historic Preservation Agency
IPNS	Intense Pulsed Neutron Source
IT	Information Technology
LEED	Leadership in Energy and Environmental Design
LNI	Laboratory Networking Infrastructure
LOM	Laboratory Office Module
LWTP	Laboratory Wastewater Treatment Plant
MDL	Materials Design Laboratory
MR	Major Repairs
NBL	New Brunswick Laboratory
NIH	National Institutes of Health
NOC	Network Operation Center
NPDES	National Pollutant Discharge Elimination System
OCP	Outside Copper Plant
OFP	Outside Fiber Plant
OSP	Outside Cable Plant
PA	Programmatic Agreement
SC	DOE-Office of Science
SHPO	Illinois State Historic Preservation Officer
SLI	Science Laboratories Infrastructure
SWTP	Sanitary Wastewater Treatment Plant
TCS	Theory and Computing Sciences
U of C	University of Chicago

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2013 Fifteen-Year Plan

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Argonne's vision is to lead the world in discovery science and engineering that provides technical solutions to the grand challenges of our time: Sustainable Energy, Clean Environment, Economic Competitiveness, and a Secure Nation

Executive Summary

OVERVIEW

Argonne National Laboratory (Argonne) is located 25 miles southwest of Chicago, Illinois. Argonne is a multi-program laboratory managed for the U.S. Department of Energy (DOE) by UChicago Argonne, LLC. Argonne was the country's first national laboratory; its founding mission in 1946 was to develop peaceful uses of atomic energy. Argonne played a strong role in the design, national implementation, and continuous improvement of the engineering and scientific technology for nuclear reactors. Argonne has subsequently grown into a multi-disciplinary laboratory with a unique mix of world-class scientists and engineers and leading-edge user facilities, working in many fields to create new knowledge that addresses the most important scientific and societal needs of our nation.

CHALLENGES

The replacement value of existing conventional facilities and other structures at Argonne is estimated to exceed $2.97 billion. The facilities' average age is approximately 40 years; with more than 64% of the facilities over 40 years old. The age factor, coupled with greater than $128.6 million in deferred maintenance of existing buildings, illustrates the challenge Argonne faces in seeking to revitalize and reshape its existing facilities and infrastructure to meet the current and emerging needs of scientific missions.

This challenge includes ensuring compliance with standards of environmental performance and safety and eliminating legacy waste and obsolete facilities, while optimizing operations and maintenance costs. The physical site imposes few constraints to expanding Argonne's role in 21st century research; it can easily accommodate modern, agile replacement research facilities and the elimination of outdated and legacy buildings. These actions are crucial if Argonne is to meet the functional and economic performance requirements associated with evolving programmatic needs and emerging technologies.

Mission Readiness

Argonne's mission readiness principles and processes function as drivers for near-term and long-range facility planning. The ongoing challenge is to use these processes to understand and fulfill the science needs and achieve full mission readiness in support of current and future scientific programs.

Building 446 - Advanced Protein Crystallization Facility (APCF)

Proposed Materials Design Laboratory (MDL), next to Buildings 222 and 241 (ESB)

THE FIVE-YEAR PLAN (FY 2013-2017)

The Five-Year Site Development Plan focuses on the planning, design, and construction for the Science Laboratories Infrastructure (SLI) funded Materials Design Laboratory (MDL), located adjacent to Building 241 in the 200 Area. The 200 Area has a large concentration of research and development activity, as well as virtually all Argonne and DOE management activities; it is the center of the permanent, multi-purpose laboratory effort in terms of floor area and numbers of personnel.

Other components of the Five-Year Plan include:

- Upgrade to the chilled water plant and transformer station in the 200 Area
- Construction of a new Combined Heat and Power (CHP) plant
- Construction of a 50,000 sq ft Energy Innovation Center (EIC), for which the State of Illinois has pledged $35 million
- Advanced Photon Source (APS) upgrade activities, including construction of an assembly/storage building
- Expansion of the Center for Nanoscale Materials (CNM) to include additional clean rooms

THE LONG-RANGE DEVELOPMENT PLAN (FY 2018+)

The Long-Range (Fifteen+ Year) Plan converges on the completion of the SLI Projects 3 thru 5:

- SLI – 3: Modern multi-program building, Bioenvironmental Sciences Building (BSB) in the 200 Area, planned for FY 2019
- SLI – 4: Multi-program replacement building, projected for the 200 Area
- SLI – 5: Modernize multi-program Building 362; this project will modernize approximately 180,000 gross sq ft of existing laboratory and office space

Other elements of the long-range plan include:

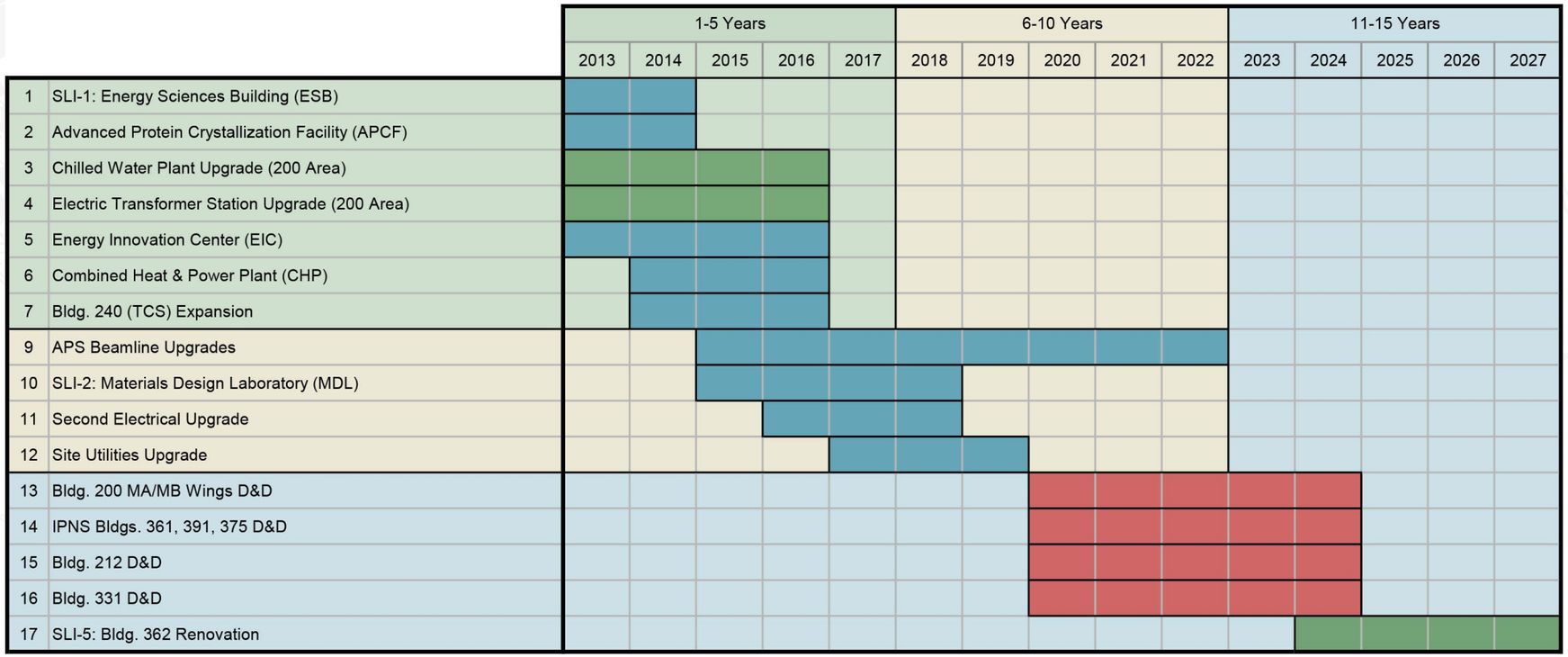
- Long beam line extension(s) at APS
- Demolition of MA/MB Wing of Building 200; IPNS Buildings 361, 375, and 391; Building 331 and Building 212 subject to availability of appropriate funding

President Obama Addresses Need for Science Funding

PLANNING OUTCOME

As the Modernization Plan proceeds, Argonne's facilities and infrastructure will become more efficient to maintain and operate, and the elimination of surplus and substandard facilities will reduce the overall development footprint. The Laboratory will reduce operating costs, increase productivity and improve performance in meeting sustainability goals and other energy-related measures. A significant portion of the current deferred-maintenance total is related to facilities identified for replacement as part of the modernization program. Therefore, the most significant reduction in deferred maintenance will occur after replacement facilities are completed and obsolete facilities are demolished.

TABLE 1: SITE MODERNIZATION PROJECTS FY 2013 - 2027



APS: Advanced Photon Source

IPNS: Intense Pulsed Neutron Source

SLI: Strategic Laboratory Infrastructure

New Construction | Demolition | Renovation

The 2013 Site Modernization Plan is committed to meeting Argonne's current and emerging mission needs as part of a major building and renovation program and the Plan has identified strategies to help create the "road map" to get there. Table 1 represents the currently planned modernization projects and is subject to change as funding is confirmed. The physical development plan recommendations are based on the following objectives:

- Transition from a facility framework based on science being practiced as a set of separate disciplines to a facility framework that integrates diverse areas of science, thereby enabling seamless multi-functionality.
- Create new, modern, state-of-the-art research space while decommissioning and demolishing select antiquated, scientifically inadequate, and functionally challenged facilities.
- Co-locate and consolidate science disciplines to achieve productivity improvements and greater collaboration while reducing Argonne's overall development footprint.
- Strengthen Argonne's ability to attract the best early-career staff by improving the Laboratory's vitality and viability.

In the coming five years, the U.S. Department of Energy's Argonne National Laboratory will launch major research initiatives to address the United States' needs for scientific discovery, sustainable energy, national security, a clean environment and a stable global climate.

— 2010-2015 Argonne Strategic Plan

Original Campus Master Plan Rendering, 1948

Advanced Protein Crystallization Facility (APCF) Groundbreaking ceremony, August 2011

Section One: Laboratory Planning Framework

1.1 VISION AND OVERVIEW

Today, Argonne National Laboratory (the Laboratory) is a 1,517-acre federally owned site accommodating approximately 4,700 persons, including U.S. Department of Energy (DOE) employees, contractors, facility users, and guests. The Argonne site includes 100 buildings with 4.8 million square feet (sq ft) of total floor space, surrounded by the 2,470-acre Waterfall Glen Forest Preserve. In addition, the site includes the New Brunswick Laboratory (NBL), a DOE-operated facility, as well as the Howard T. Ricketts Regional Biocontainment Laboratory, operated by the National Institutes of Health (NIH) and the University of Chicago. Argonne also occupies roughly 267,000 sq ft of leased space; of this total, the Theory and Computing Sciences facility (Building 240), located adjacent to the main Argonne entrance, accounts for approximately 240,000 sq ft.

Among the greatest challenges currently facing our nation and the world is the need for new discoveries that result in affordable clean energy and vastly improved energy efficiency. Making these discoveries requires strong interdisciplinary collaboration and the application of cutting-edge tools in computing, chemistry, materials science, and biology. The Laboratory has the unique scientific capabilities needed to accomplish these important DOE Office of Science (SC) missions. Argonne needs safe, efficient, modern space for research and development. Scientifically obsolete and functionally limited research space can significantly hamper efforts to deploy Argonne's scientific capabilities effectively in support of DOE-SC's missions.

Argonne's challenge is to revitalize and reshape its existing facilities and infrastructure to meet the current and emerging needs of scientific missions. This challenge includes ensuring compliance with standards of environmental performance and safety and eliminating legacy waste and obsolete facilities, while minimizing operations and maintenance costs. Argonne's physical site imposes few constraints to expanding Argonne's role in 21st century research, beyond the need to eliminate outdated and legacy buildings and provide modern, agile research facilities in their place. These actions are crucial if Argonne is to meet the functional and economic performance requirements associated with evolving programmatic needs and emerging technologies.

1.2 PURPOSE

The 2013 Site Modernization Plan articulates the long-range vision for Argonne's physical development. The purpose of this Plan is to provide a framework for modernizing existing facilities and for future development in support of Argonne's mission readiness. This Plan takes the mission needs into consideration and overlays them with physical site conditions to define strategies that provide a productive, safe, secure, and environmentally sound workplace. This Plan incorporates and builds on key planning concepts embodied in previous modernization and master plans, including the following key documents:

2012 Site Modernization Plan
2013 Annual Laboratory Plan
2010-2015 Argonne National Laboratory Strategic Plan
2010 Argonne National Laboratory Land Use Plan

The Site Modernization Plan is designed to incorporate and summarize key findings into a collective platform for planning and implementation discussions to achieve the following:

- Guide and coordinate decision-making: Define the strategy for Argonne's physical development by adopting a series of guiding principles that help inform infrastructure investment decisions.
- Establish a sound, factual information basis for implementation priorities and decisions.
- Develop a physical site plan that forms the basis for effective, consistent land-use decisions.
- Integrate mission need requirements, existing site configuration, and environment, safety, and health considerations to create a responsive, flexible physical site.

Other references for this report include:

- Land Use and Natural Resource Management Plan
- Cultural Resource Master Plan
- Americans with Disabilities Act
- National Historic Preservation Act of 1966
- National Environmental Policy Act of 1969
- DOE Order 430.1B - Real Property Asset Management
- Executive Order 13514 - Federal Leadership in Environmental, Energy, and Economic Performance
- Executive Order 13653 - Preparing that United States for the Impacts of Climate Change
- Executive Order 11593 - Protection and Enhancement of the Cultural Environment
- ANL Invasive Species Management Plan
- ANL Stormwater Management Plan
- ANL 2014 Site Sustainability Plan
- ANL 2012 Site Environmental Report
- ANL Soil Management Plan
- ANL Proc 255 - Siting of Facilities

1.3 PLANNING PROCESS AND HORIZON

A land-use framework approach is used to help ensure that the resulting site master plan is feasible from the standpoint of phasing and implementation. It also needs to be sufficiently flexible to accommodate new mission-critical programs and facility needs. This land-use framework approach involves identifying parcels most likely to be developed or redeveloped within the time horizon of the Modernization and Environmental Management funding plans, and then overlaying those parcels with recommended guidelines for future use. Section 3.2 addresses priority development parcels and Programmatic Growth Zones.

Guiding principles described in Section 1.8 shape and direct physical development patterns. These principles, coupled with the land-use plan framework, provide a flexible and responsive solution for accommodating future growth as well as a variety of options for siting facilities, depending on the functional synergies, circulation, safety, security, and infrastructure mission needs. The land-use plan drives the desired development pattern without defining the exact location of a specific building or program.

The planning horizon for the Site Modernization Plan is divided into two time line increments:

Short-Term: FY 2013-2017
Long-Term: FY 2018 and Beyond

2010-2015 LABORATORY STRATEGIC PLAN

ARGONNE CORE CAPABILITIES

- Large-Scale User Facilities & Instrumentation
- Nuclear Physics
- Particle Physics
- Accelerator Science and Technology
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Advanced Computer Science, Visualization and Data
- Applied Mathematics
- Biosciences
- Computational Science
- Applied Materials Science and Engineering
- Chemical Engineering
- Applied Nuclear Science and Technology
- Systems Engineering and Integration
- Climate Change Science

ONGOING/MAJOR INITIATIVES

- Hard X-Ray Sciences
- Leadership Computing
- Materials and Molecular Design and Discovery
- Energy Storage
- Alternative Energy and Efficiency
- Nuclear Energy
- Biological and Environmental Systems
- National Security

1.4 CORE CAPABILITIES

The stewardship of Argonne's core capabilities - it's user facilities, fundamental science and applied science and engineering programs - remain at the top of the Laboratory's strategic agenda. Each core capability is described briefly, along with plans for advancing them to address the grand scientific challenges of the future.

Large-Scale User Facilities & Instrumentation

Argonne is a recognized leader in the design, construction and operation of world-class user facilities for the DOE. Renewal of Laboratory facilities is crucial to maintaining ANL's leadership in both scientific applications and the development of next-generation facilities; Argonne user facilities include the following:

- Argonne Leadership Computing Facility (ALCF)
- Advanced Photon Source (APS)
- Center for Nanoscale Materials (CNM)
- Electron Microscopy Center (EMC)
- Argonne Tandem Linac Accelerator System (ATLAS)
- Californium Rare Ion Breeder Upgrade (CARIBU)
- Transportation Research & Analysis Computing Center (TRACC)
- Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF)

Fundamental Sciences

Nuclear Physics

Laboratory scientists use stable ion beams and radioactive isotope beams from ATLAS for several significant research topics.

Particle Physics

Findings from Argonne's international collaborations drive the direction of particle physics research; it centers around understanding the properties and interactions of particles which make up the universe and the symmetries which underlie forces of nature and matter.

Accelerator Science and Technology

Argonne's expertise in accelerator science and technology supports fundamental research in hard X-ray science, high-energy physics and nuclear physics.

Condensed Matter Physics and Materials Science

This overall objective is to understand, control and improve the properties of materials. Multiple ANL organizations from basic science through systems engineering and deployment encompass these capabilities.

Chemical and Molecular Science

The Laboratory's expertise lies in the synthesis, characterization and control of chemical processes with the potential to transform energy production into use including among many, photosynthesis, catalysis, combustion, nuclear energy and the conversion of chemical energy in batteries and fuel cells. The Energy Sciences Building and proposed Materials Design Laboratory building will have a direct impact on improving research in these capabilities and others.

Advanced Computer Science, Visualization and Data

Argonne's Advanced Computer Science, Visualization and Data capabilities are built on the Laboratory's leadership in research software. Argonne software is used worldwide and was developed using parallel processors and advanced heterogeneous clusters.

Applied Mathematics

Applied Mathematics research focuses on optimization, partial differential equations and computational differentiation. Computational Differentiation originated at Argonne between 1989 and 1992 and has been cited as one of the top ten developments in scientific computing from 1970-2000. Future program expansions will occur in new areas of research with interest for DOE.

Biosciences
Laboratory scientists characterize soluble and membrane proteins to discover new biological functions and better understand known functions. Protein characterization activities are implemented with the APS; the new APCF collocates these core capabilities for improved scientific collaboration.

Computational Science
Argonne has developed several tools for the parallel solution of differential equations and optimization problems of science and engineering applications and also leads the development of applications for some of the most challenging computational problems. The Theory and Computing Sciences Building (TCS/240), opened in 2009, allows for deeper collaboration and cross-disciplinary programs.

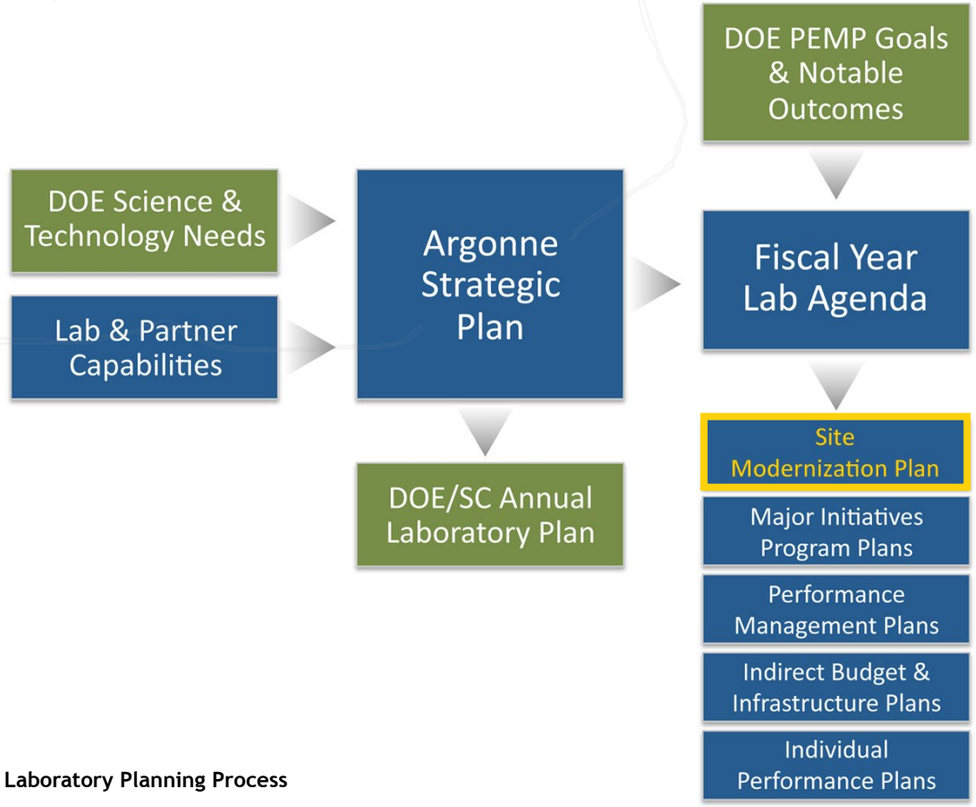
Applied Sciences and Engineering
Applied Materials Science and Engineering
Argonne's strength in the development and production of new materials provides a foundation for technology advances in energy production, storage, distribution and use.

Chemical Engineering
Chemical Engineers at the Laboratory primarily focus on developing sustainable energy resources. In particular, Argonne's advanced program is recognized as a leader among the DOE laboratories and has been active since the late 1960s.

Applied Nuclear Science and Technology
Cumulative experience over decades of research and development in nuclear reactor design has positioned Argonne as a national leader in the development of future-generation nuclear reactors and fuel cycles, which advance the sustainable use of nuclear energy through waste minimization, enhanced resource utilization, competitive economics and increased assurance of reliability, safety and security.

Systems Engineering and Integration
Argonne's multidisciplinary scientists and unique facilities enable an integrated systems research approach to various projects. Systems engineering facilities will be consolidated across the Laboratory to ensure a robust growth of programs supporting different research activities.

Climate Change Science
Argonne is a recognized pioneer in measuring and modeling climate research activities. Argonne operates the Southern Great Plains climate observation site for the DOE Atmospheric Radiation Measurement (ARM) program for measurements of clouds and climate. The ARM Climate Research Facility upgrade will add a diverse range of advanced instrumentation to support long-term and short-term science campaigns.



Laboratory Planning Process

1.5 MISSION READINESS

The mission for DOE's Office of Science (SC) is to deliver the remarkable discoveries and scientific tools that transform our understanding of energy and matter and advance the national, economic, and energy security of the United States. DOE/SC executes this mission by managing fundamental research programs in basic energy sciences, biological and environmental sciences, high energy and nuclear physics, fusion, and computational science. Argonne's expertise and its core capabilities provide a strategic framework for the Laboratory's efforts in these areas.

The two main planning drivers for Argonne's physical development pattern are science and resources. Science comprises Argonne's core capabilities and major initiatives; resources are the scientific talent and user facilities. The science and resources work in collaboration to support mission readiness, growth, and new capabilities. The relationship between these components is realized in the Laboratory's physical development pattern and organization.

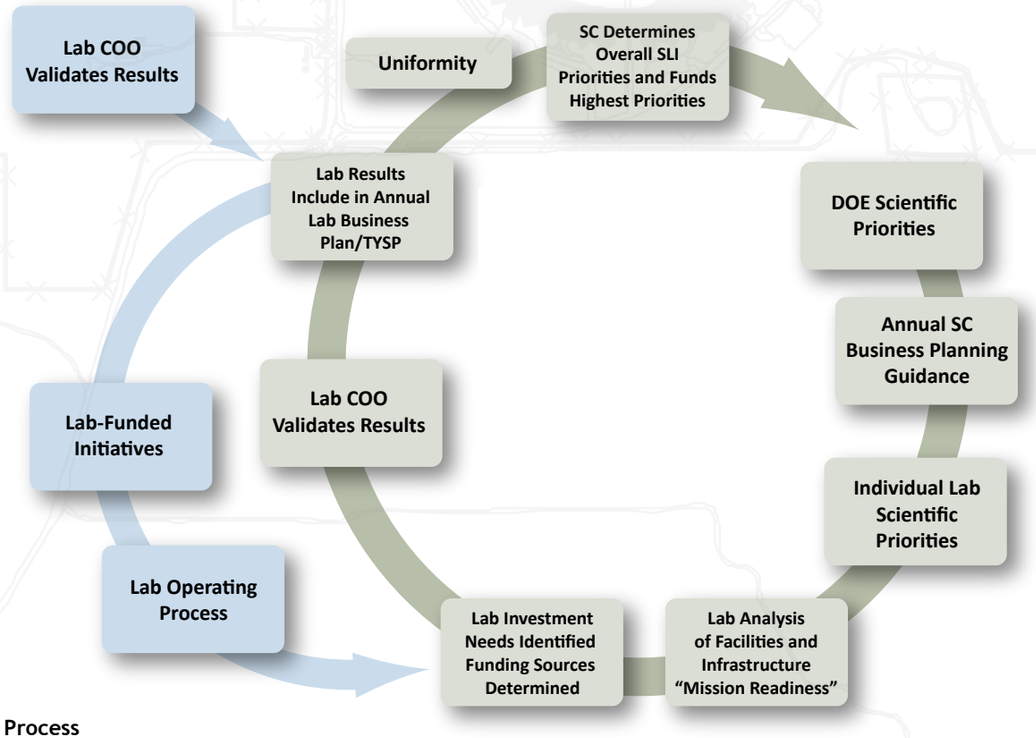
Argonne's strategy to achieve and maintain mission readiness has been developed and validated, and is realized, through adherence to and execution of the site modernization plans, as illustrated in this document. However, complete achievement of mission readiness through facility, site, and infrastructure modernization still faces challenges.

The Argonne site was originally developed at a time when science was practiced as a set of separate disciplines. Many of Argonne's buildings were single-focused, dedicated to chemistry, materials science, biology, physics, mathematics, and engineering. Although a suite of facilities dedicated to separate disciplinary missions was appropriate and effective in the mid-20th century, such segmentation is ill-suited to modern requirements for the more agile and interdisciplinary science that is the hallmark and power of today's scientific endeavors. Better integrated space is necessary to fully accomplish seamless, multi-disciplinary, and collaborative research. Current trends call for sustainable, specialized yet flexible facilities to optimize both physical and intellectual discovery.

Modern, state-of-the-art research space that meets Argonne's functional needs will close the identified mission readiness capability gaps and will allow the Laboratory to better use its unique capabilities. Providing functionally adequate space will enable the desired co-location and consolidation of science disciplines, resulting in productivity improvements.

1.6 WORKFORCE TRENDS

Argonne has launched a series of major science initiatives, enabled by the Laboratory's core capabilities, in support of the national scientific agenda. The Laboratory is dedicated to hiring, developing and retaining top-quality staff whose efforts support the Strategic Plan. These initiatives are anticipated to result in a slow but steady increase in staffing, with a commensurate growth in external facility users. The support workforce is expected to experience limited growth as well. Therefore, current site planning addresses the projected growth in staffing in support of the new initiatives on the scientific horizon.



Mission Readiness Process

1.7 FINANCIAL ISSUES AND STRATEGIC SITE INVESTMENTS

Argonne, like many other government facilities across the country, faces aging, inflexible, obsolete infrastructure and facilities which, when coupled with declining funding streams for infrastructure and facilities, jeopardize mission readiness in stringent economic times. The forecasted demand for funding significantly exceeds traditional internal funding sources. Successful Laboratory facility investment will require future programmatic proposals to include sufficient funding to meet related facility and infrastructure needs.

DOE has challenged Argonne to demonstrate leadership for executing and advancing the Site Modernization Plan under constrained funding scenarios for nuclear waste management and footprint reduction, Science Laboratories Infrastructure (SLI) projects, and other facility requirements reflecting cost and operational efficiencies. The Laboratory has a roughly $360 million shortfall in funding for facilities and infrastructure-related needs. This figure includes more than $128.6 million in deferred maintenance. For reference, the total replacement value for the conventional facilities (physical plant, utilities, and infrastructure) is approximately $2.97 billion.

In response to the challenges, the Laboratory has developed strategic initiatives to manage its facilities and infrastructure for short-, mid-, and long-term time horizons. These strategic initiatives include operational improvements and a variety of traditional and alternative funding approaches. The Laboratory is continuing to explore alternative ways to generate funds for constructing needed facilities and for maintaining existing site infrastructure where traditional funding mechanisms are not readily available. Argonne has had some success with alternative funding, using third party financing, State of Illinois funds, and Energy Saving Performance Contracts (ESPC).

With careful stewardship of limited resources, the Laboratory can meet the immediate funding shortfalls through these strategic initiatives. Argonne must continue to support its science mission with modernization of vital facilities and infrastructure. Alternative funding mechanisms will continue to be evaluated and selectively applied where appropriate.

The Laboratory is evaluating a number of new programs, including alternative storage concepts using operating funds and Institutional General Plant Projects (IGPP) funds and major space consolidation/rehabilitation of existing facilities. Several strategies for mid- to long-term horizons may also be implemented including Alternative Contracting Strategies, Joint Government Programs, and Public-Private Partnerships.

Current strategic site investments are discussed on the following pages.

Science Laboratories Infrastructure

The SLI program supports scientific and technological innovation at DOE-SC laboratories by funding mission-ready infrastructure and fostering safe, environmentally responsible operations. Providing the infrastructure needed for the DOE-SC national laboratories to be world leaders in basic scientific research now and in the future is paramount among SLI's mission objectives. Four major SLI-funded buildings plus major rehabilitation of an existing facility coupled with infrastructure upgrades, will enable Argonne to dispose of its most seriously outmoded and inefficient buildings. Funding ($95 million) has been received and work is being completed for the Energy Sciences Building (ESB). A funding request ($95 million) process is underway for the new Materials Design Laboratory (MDL). Current SLI programming estimates a total of $501 million in funding for Argonne over the life of the program. Further details regarding planned SLI investments are discussed in Section 3.1.

DOE-EM Funding

DOE-EM funding is being requested to remove contaminated facilities that will become inactive. Argonne is currently consolidating its nuclear facilities and reducing the inventory of radiological materials, while preserving the capability to perform mission-important activities. Identification of funding paths is required to clean up contaminated facilities expeditiously, dispose of material and waste, and ultimately dispose of these facilities. Argonne has initiated efforts to transfer legacy waste and nuclear material, as well as excess nuclear/radiological facilities, to DOE-EM for disposition stewardship in conjunction with Argonne's site development planning. Further details regarding planned DOE-EM initiatives are discussed in Section 3.1.

Building 301 before demolition

Building 301 during demolition

301 post demolition

State of Illinois Partnerships and Third-Party Financing

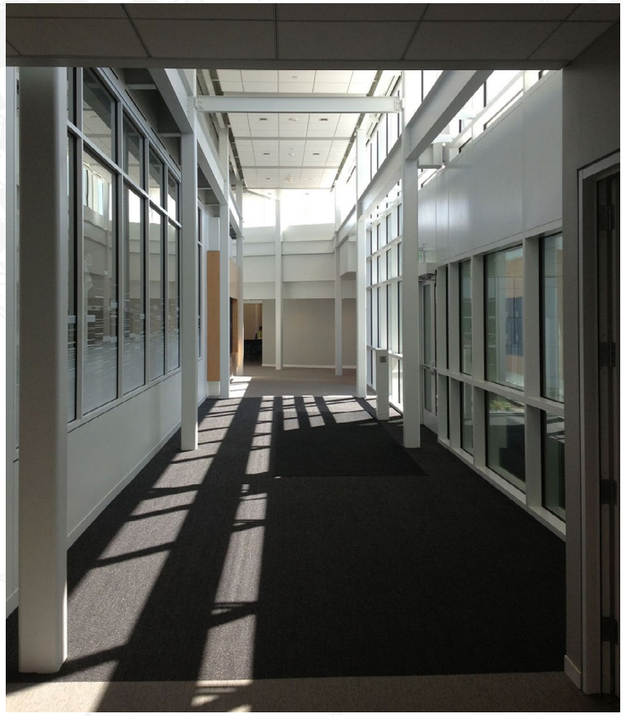
Argonne is continuing a successful partnership with the State of Illinois to construct specific core-competency-focused buildings and to facilitate more robust leased facilities. The Theory and Computing Science facility was funded by State of Illinois revenue bonds, which will be retired through lease payments. The new building provides much-needed facilities support to build on Argonne's strengths in high-performance computing software, advanced hardware architectures, and applications expertise in support of the Laboratory's core capabilities in *Applied Mathematics and Advanced Computer Science, Visualization, and Data and its initiatives in Computational Science and Leadership Computing.*

The State of Illinois also provided funds for the recently occupied 59,000 sq ft Advanced Protein Crystallization Facility (APCF), located adjacent to the Advanced Photon Source (APS) LOM 435. The APCF is a highly automated laboratory and user facility for structural genomics and systems biology, associated with *Argonne's Large-Scale User Facilities/Advanced Instrumentation* core capability.

Argonne plans to construct an approximately $18 million Combined Heat and Power(CHP) Plant adjacent to the existing boiler house that will be funded via a third-party Energy Saving Performance Contracts.

The State of Illinois has pledged funds for a 50,000 sq ft Energy Innovation Center (EIC), to support Argonne's designation as the Energy Storage Hub awardee by the Department of Energy. The EIC will be located west of Building 212 and is projected to be constructed by 2015. The EIC will establish a user facility for battery and transportation technology development.

Building 446 - Advanced Protein Crystallization Facility (APCF)



APCF Entry Corridor

Programmatic Investments

The APS is undergoing a major upgrade that will add new X-ray capabilities, make existing X-ray capabilities 100 to 1000 times more powerful, almost double the number of experiments that can be carried out in a single year, and significantly increase the number of users the facility can accommodate. The project will make revolutionary performance improvements to allow APS to address the nation's sustainable energy and health research needs. Several other smaller-scale projects are being requested that would further expand the APS capability and accommodate increased staffing and users.

DOE is also committed to continuing efficiency and intensity upgrades to the target and source beamlines of Argonne Tandem Linac Accelerator System, ATLAS/CARIBU. As part of these projects, a CARIBU target transfer facility is being considered. Concept development is underway for a proposed Exascale Computing Facility initiative. Planning to support infrastructure required for the exascale project is underway. Completion of such major projects would have a dramatic impact on the ability of the Laboratory to extend cutting edge DOE science initiatives.

Projects Supported by Internal Operating Funds

Argonne uses internal operating fund projects – Major Repairs (MR) program and Institutional General Purpose Projects (IGPP) funding to address pressing needs in facilities and infrastructure. The MR program provides replacement, repair, and maintenance funding for existing facilities and infrastructure. The IGPP funding program addresses facility upgrades in existing buildings and infrastructure; rehabilitates utility and site infrastructure; and supports energy saving projects. IGPP projects are general, institutional projects costing less than $10 million that benefit multiple programmatic or cost objectives and can be completed with indirect funding.

Setting the standard for continued excellence in stewardship of national resources remains a top priority for Argonne.

— 2010-2015 Argonne Strategic Plan

Center for Nanoscale Materials (CNM)

Building 213 Cafeteria Patio and Landscaping

1.8 GUIDING PRINCIPLES

Guiding principles are broad statements of a desired outcome that reflect the physical interpretation of this Site Modernization Plan. The following guiding principles support Argonne's core capabilities and mission readiness and promote overall high-quality design.

The guiding principles are supported by objectives that describe specific actions to achieve the desired outcomes. These statements of principle blend both tangible and intangible characteristics to influence Argonne's physical form. Argonne has practiced many of these principles in past planning. Using them for this Plan is intended to build on Argonne's existing Site Modernization momentum and expand the implementation of good design solutions.

#1: Development Program

Statement: *Modernize Argonne to revitalize and reshape its existing and new facilities and infrastructure to meet the current and emerging needs for Argonne's scientific missions.*

Objectives:

- Identify key mission-critical renovations and alterations
- Develop a flexible program for new facilities that: Provides efficient facilities and a safe working environment that identifies phasing and building disposal time frames, based on anticipated funding cycles and is complemented by a well-defined move management and staff migration strategy
- Recognize the holistic impact of supporting new facilities, while addressing infrastructure and utility modernization

#2: Development Pattern

Statement: *Seek a balance between increased building heights, closer building proximity, simplified but sufficient circulation networks, and open-space preservation to reinforce a range of pedestrian-oriented settings.*

Objectives:

- Create a unique design vision and development guidance for each developed area
- Redevelop and/or expand within previously developed areas
- Accommodate flexibility and expansion of mission capabilities
- Position new buildings for the purpose of solar management and energy efficiency and to avoid conflicts with existing utilities

#3: Visual Character

Statement: *Create well-designed Laboratory facilities that visually reflect leading-edge science.*

Objectives:

- Reinforce visual continuity with design guidelines for buildings, site features, landscaping, utility system placement, and building identification
- Create pedestrian scale open spaces and "hardscape" elements that take into account views and relationships between buildings
- Create a hierarchy of streets that are visually pleasing, easy to navigate, and can accommodate multiple modes of transportation in a safe and consistent manner
- Leverage the abundance of Argonne's natural environment by incorporating and encouraging the infusion of natural and indigenous elements into designs

#4: Circulation, Parking, and Accessibility

Statement: *Improve the movement of people, emergency vehicles, services and goods.*

Objectives:

- Provide safe and efficient access for all able and disabled individuals
- Create an easily understood wayfinding system, one in which people can easily orient themselves and navigate from place to place
- Develop standard street and road sections that incorporate safety recommendations for vehicular traffic, bicycles, and pedestrian circulation.
- Formulate a consensus for parking standards, addressing maximum walking distances, design, wayfinding, landscaping, and lighting
- Provide sufficient lighting and landscaping to enhance the quality of the pedestrian experience and to create a safe walking environment

#5: Environment and Sustainability

Statement: *Implement proactive policies and procedures to achieve environmentally and fiscally responsible development and operations while ensuring progress toward Executive Order (EO) 13514 (Sustainability), 13112 (Invasive Species), and 13653 (Climate Change Adaptation).*

Objectives:

- Reduce energy consumption, increase renewable energy generation, increase use of alternative fuels, reduce water use, maximize diversion of waste from landfill to reuse or recycling facilities, and achieve High Performance Sustainable Building goals for all new construction
- Minimize environmental impacts to, and support environmental restoration of, site natural resources to benefit biodiversity, stormwater management, air quality, and scenic value
- Protect and preserve environmentally sensitive areas
- Develop and integrate climate adaptation strategies into plans for development and restoration projects
- Recognize and celebrate oak savannahs, wetland, prairie, and other high-quality, high-value habitats as special, defining characteristics of Argonne National Laboratory

#6: Safety and Security

Statement: *Protect employees and users, other site personnel, visitors, the public, and the environment from hazards and risks.*

Objectives:

- Apply current security best practices related to anti-terrorism, setbacks, cyber security, and safety in all site and facility planning
- Improve the operational and security functions at the gates and points of access
- Eliminate points of vulnerability
- Integrate security measures with mission, functional, and visual goals in mind

#7: Infrastructure and Utility Systems

Statement: *Continue modernizing Argonne infrastructure that directly supports Argonne's Core Capabilities, is critical to its missions, and will enable reducing deferred maintenance and eliminating excess space while providing a good return on investment.*

Objectives:

- Reshape existing infrastructure to be more energy-efficient and sustainable, while meeting current and emerging science needs
- Execute priority projects to increase capacity and rebuild infrastructure systems
- Route utilities in a logical manner to avoid environmental impacts and operational disruptions and to allow easy expansion
- Recycle and reuse utility system by-products and waste streams where advantageous

New Sidewalk Preserving Oak Tree on Meridian Drive

New Sidewalk Connection to Building 241 (ESB)

Programmed **renewal** of Argonne's facilities is crucial to maintaining the **Laboratory's leadership** – not only in scientific applications but also in the science behind the development of **next generation** facilities.

– 2010-2015 Argonne Strategic Plan

Section Two: Existing Conditions and Design Considerations

This section describes both natural and man-made conditions both at and around the Argonne campus that could influence how the site evolves. The discussion consists of the following components:

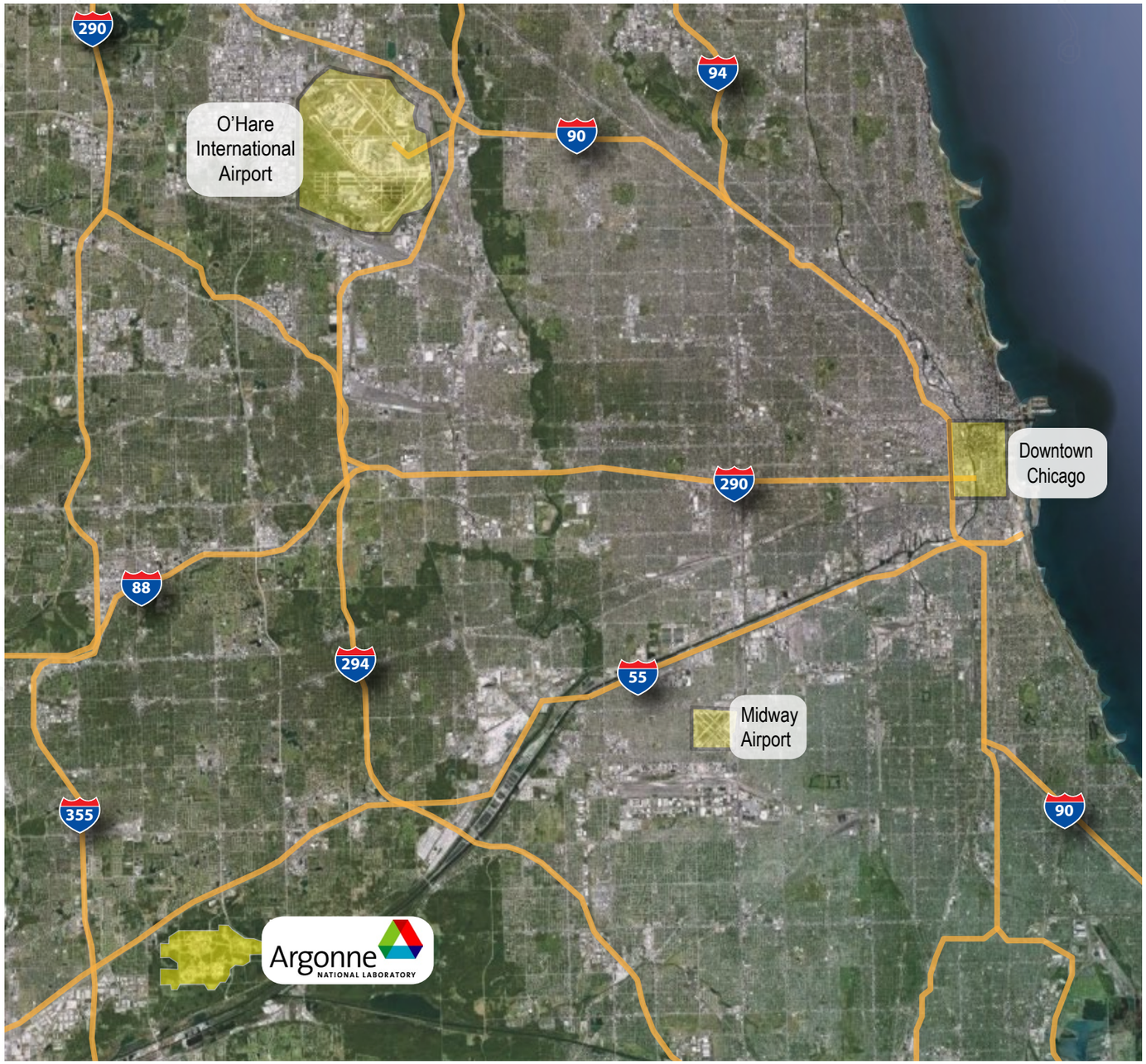
2.1 Location and Context
2.2 Laboratory Overview
2.3 Landscape and Open Space
2.4 Environmental Considerations
2.5 Cultural Resources
2.6 Sustainability
2.7 Circulation
2.8 Wayfinding
2.9 Parking
2.10 Physical Site Security
2.11 Utility Considerations
2.12 Infrastructure Technology & Information Systems
2.13 On-Site Handling of Radiological Material
2.14 Space Utilization
2.15 Building Operation Costs

Selected components are supported by design recommendations, where applicable. These baseline conditions, including physical opportunities and constraints, define the future development suitability of the site. Additional technical evaluations and condition assessments documentation have been conducted in support of the site planning efforts.

2.1 LOCATION AND CONTEXT

Regional Location

Argonne National Laboratory is located about 25 miles southwest of Chicago, in DuPage County, Illinois. The site location offers excellent interstate access, with two interchange access points on Interstate Highway 55 (I-55), one at South Cass Avenue, and a second at Lemont Road between the Tri-State Tollway (I-294) and the Veterans Memorial Tollway (I-355). Argonne is also accessible at the main entry gate via public transportation on the PACE bus line operating from the Westmont Metra Station and by a shuttle operating to and from the University of Chicago (U of C).



Chicago Region Locational Map

Surrounding Context

Argonne lies within an area bounded on the north by I-55 on the east by Illinois Route 83 (Kingery Highway), on the west by Lemont Road, and on the south by the Des Plaines River Valley. I-55 is the primary east-west interstate serving the site, and I-294 and I-355 are the primary north-south interstates serving the site. With the exception of the immediate buffer provided by the Waterfall Glen Forest Preserve, the areas surrounding Argonne are largely developed incorporated suburban communities (i.e., Woodridge, Darien, Willowbrook, and Burr Ridge in DuPage County; and Lemont, south of the Des Plaines River, in Cook County).

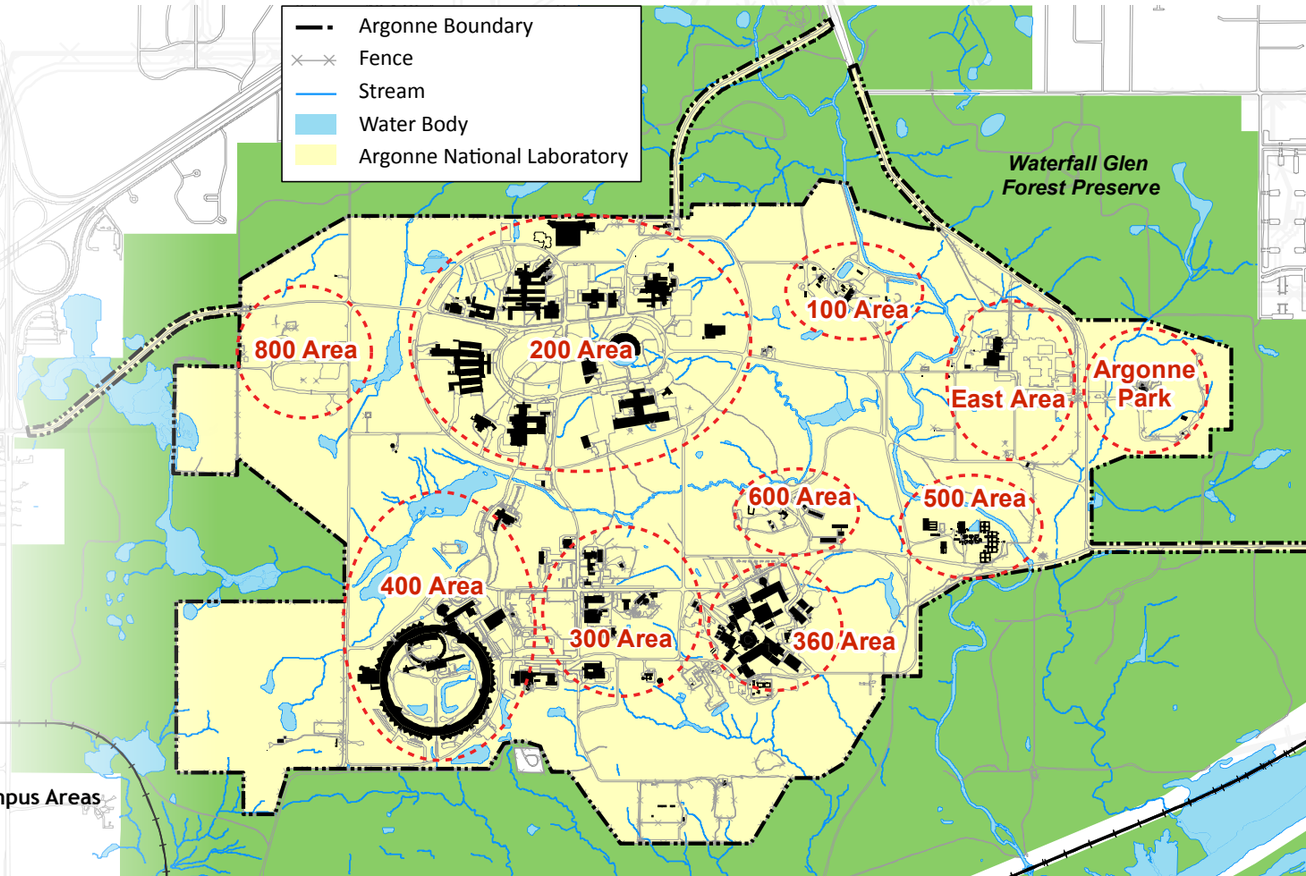
The Waterfall Glen Forest Preserve surrounds Argonne National Laboratory. The 2,470 acre preserve is a contiguous area of largely deciduous and some mixed conifer woodlands and a dolomite prairie. Residential land use predominates the areas to the north, with some lands located along the northern property boundary in commercial use. Warehousing and industrial land uses predominate adjacent to the western and southern property boundaries.

2.2 LABORATORY OVERVIEW

Argonne has multiple existing developed areas, most of which were constructed at the outset of operations in the early 1950s or in later phases of mission growth; the 360 and 600 Areas are largely of 1960s and 1970s vintage, while the 400 Area was initiated in the 1990s. Most of Argonne's basic research activities occur in the 200 and 400 Areas. Two non-Argonne facilities are also located on the site: The DOE-operated New Brunswick Laboratory (NBL) is located in the 300 Area and the National Institutes of Health (NIH)-operated Howard T. Ricketts Regional Biocontainment Laboratory, operated by U of C, is located in the 200 Area.

The following narrative briefly describes each of the developed areas:

- The 100 Area (62 acres) provides support services and includes the steam generation and domestic water treatment and distribution plants.
- The 200 Area (280 acres) contains predominantly research and development facilities as well as U.S. Department of Energy (DOE) and Argonne administrative offices. The development pattern in this area largely corresponds to that of a typical suburban office park of one, two and three-story buildings. The Energy Sciences Building (ESB) completed occupancy in 2013, and the Argonne Tandem Linac Accelerator System (ATLAS) is housed in Building 203.
- The 300 Area (180 acres) encompasses the greatest variety of development patterns and mixed building forms. This area, formerly dedicated to supporting nuclear research, is undergoing selective mission change and Environmental Management (EM)-funded decontamination and decommissioning (D&D).
- The 360 Area (97 acres) was designed around a high-energy accelerator and support facilities, including laboratories, office, and high-bay space. It is now the center of high-bay and industrial technology research, including vehicle, engine, and related transportation systems research and accelerator and computational science laboratories.
- The 400 Area (100+ acres) is the most recent area to be developed; it contains the Advanced Photon Source (APS), Center for Nanoscale Materials (CNM), and the Advanced Protein Crystallization Facility (APCF).
- The 500 Area (18+ acres) contains the wastewater treatment plant, which treats laboratory drain water and sanitary sewage.
- The 600 Area (56 acres) contains visitor lodging and recreational facilities.
- The 800 Area (51 acres) and the East Area (113 acres) were originally constructed as contractor staging and support facilities and the initial temporary scientific quarters. All of the original buildings have been demolished, and the area is available for redevelopment and mission assignment.
- The 900 Area (53 acres), located outside of the perimeter fencing, includes the Argonne Park and the Child Development Center.



Argonne Campus Areas

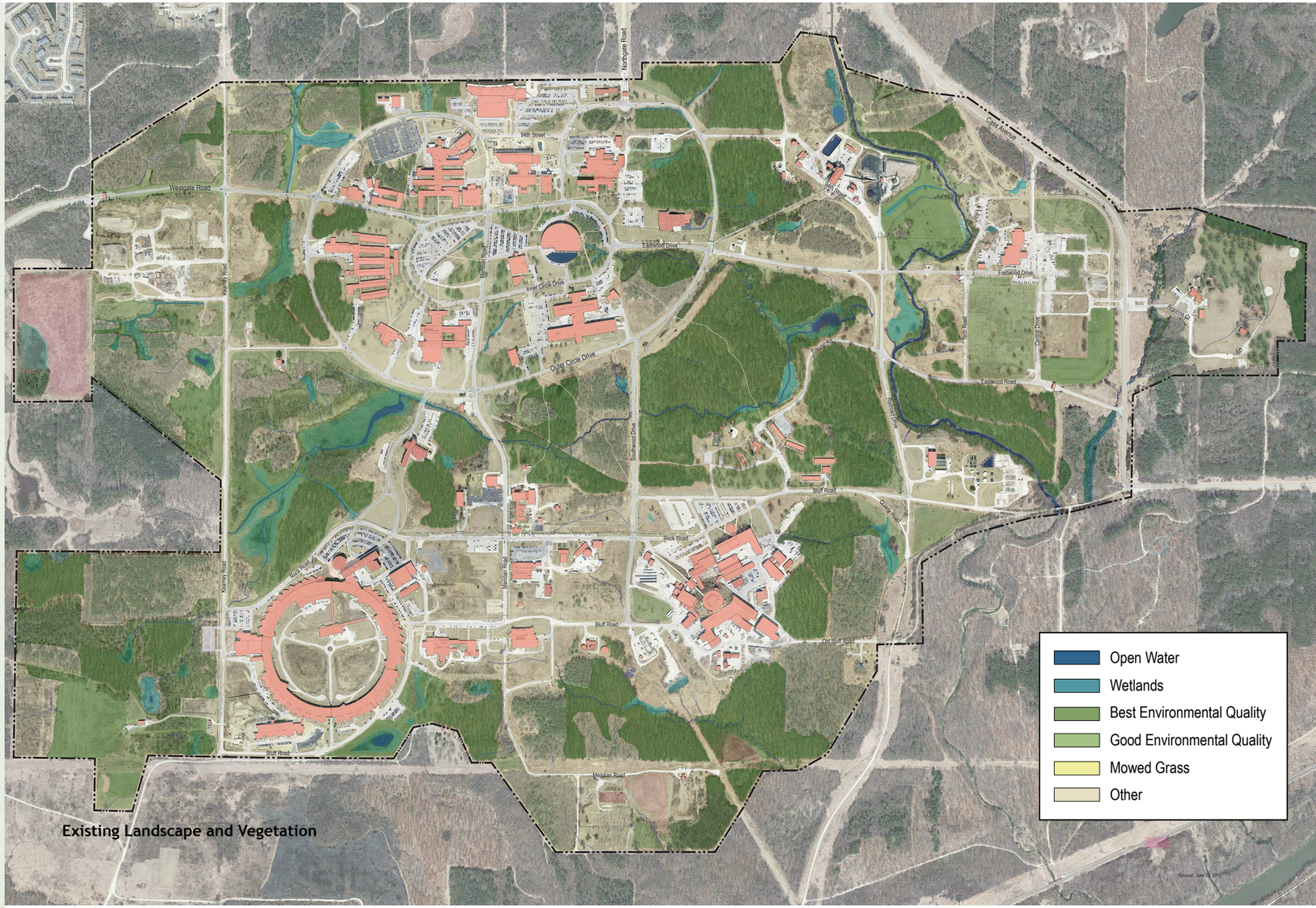
2.3 LANDSCAPE AND OPEN SPACE

Argonne's terrain is gently rolling, partially wooded, former prairie and farmland. The grounds contain a number of small ponds and streams. The land is drained primarily by Sawmill Creek, although the extreme southern portion drains directly into the Des Plaines River, which flows along the southern boundary of the forest preserve that surrounds the campus.

Vegetation

Argonne lies within a mosaic of oak forest, oak openings, and tall-grass prairie. Much of the original natural vegetation has been modified by clearing and tillage. Most of the land that Argonne occupies was actively farmed (about 75% plowed field and 25% pasture), open oak woodlots, and oak forests. Starting in 1953, some of the cultivated fields were planted with jack, white, and red pine trees. Other fields are dominated by bluegrass. The deciduous forests on the remainder of the site are dominated by various species of oak, generally as large, old, widely spaced trees, which often do not form a complete canopy. Other tree species include hickory, hawthorn, cherry, and ash. Recent regional infestation of the Green Ash Borer has significantly reduced the number of Ash trees in the campus.

DOE and Argonne are members of the Chicago Wilderness Coalition, a partnership of more than 170 public and private organizations that have joined forces to protect, restore, and manage some 200,000 acres of natural areas in the Chicago metropolitan region. Several activities are planned or are in progress to enhance oak woodland, savanna, wetland, and prairie habitats on the approximately 700 acres that remain undeveloped at the Argonne site.



Existing Landscape and Vegetation

2.4 ENVIRONMENTAL CONSIDERATIONS

Environmental considerations influence the character of Argonne's land use and recommended development pattern and provide significant opportunities to strengthen, direct, and continuously improve future conservation and stewardship efforts. A brief summary of site environmental issues is described below. More specific descriptions of the environmental considerations can be reviewed in the current Argonne Site Environmental Report.

Geology

The geology of the Argonne area consists of glacial drift on top of nearly horizontal bedrock. The soils on the site were derived from this glacial drift and are primarily moderately well-drained upland soils (Morley series) with a slope ranging from 2 to 20%, a relatively low organic content in the surface layer, moderately slow subsoil permeability, and a large water capacity. The remaining soils along creeks, intermittent streams, bottomlands, and a few small upland areas are generally poorly drained and have a high organic matter content and large water capacity. No tectonic features are known to be seismically active within 60 miles.

Groundwater and Surface Hydrology

Two principal aquifers are used as water supplies in the vicinity of Argonne. The upper aquifer is approximately 200 ft. thick and has a surface between 50 and 100 ft. below the ground for much of the site. The lower aquifer lies between 500 and 1,500 ft. below the surface and is separated from the upper aquifer, reducing the hydraulic connection between the two. Groundwater pumpage over the past 100 years has led to severe overdraft. Delivery of Lake Michigan water to the nearby suburban areas, which began in 1992, is relieving this problem. Argonne now obtains all of its domestic water from the DuPage Water Commission, which obtains potable water from Lake Michigan through the City of Chicago water system.

Sawmill Creek flows through the eastern portion of the site. Along the southern margin of the property, the terrain slopes abruptly downward, forming forested bluffs. In addition to the streams, various ponds and cattail marshes are present on the site. A network of ditches and culverts transports surface runoff toward the smaller streams. The greater portion of the Argonne site is drained by Freund Brook into Sawmill Creek. Treated sanitary and laboratory wastewater from Argonne are combined and also discharged into Sawmill Creek.

Fauna

Terrestrial vertebrates that are commonly observed or likely to occur on the site include about five species of amphibians, seven species of reptiles, 40 species of summer resident birds, and 25 species of mammals, including white tailed deer. More than 100 other bird species can be found in the area during migration or winter; however, they do not nest on the site or in the surrounding region. Few fish are present in the site waterways because of low summer flows and high temperatures. Other aquatic habitats on the Argonne site include beaver ponds, artificial ponds, ditches, and Sawmill Creek.

Endangered Species

No federally listed threatened or endangered species is known to occur on the Argonne site, and no critical habitat of federally listed species exists on the site. Three federally listed endangered species and one federally listed threatened species are known to inhabit the Waterfall Glen Forest Preserve that surrounds the Argonne property or occur in the area.

Land Management and Habitat Restoration

Land management and habitat restoration has been an area of interest, as is documented in the 2010 Land Use Plan. Stewardship practices for the site are based on the need for mitigation, environmental restoration, and diversification of landscape forms and materials.

Waters of the U.S. and Wetlands

As part of the Clean Water Act (CWA), the National Pollutant Discharge Elimination System (NPDES) permitting system establishes the discharge limits for pollutants in site waterways. Site planning takes stormwater discharges into consideration to prevent NPDES violations.

Floodplain Management

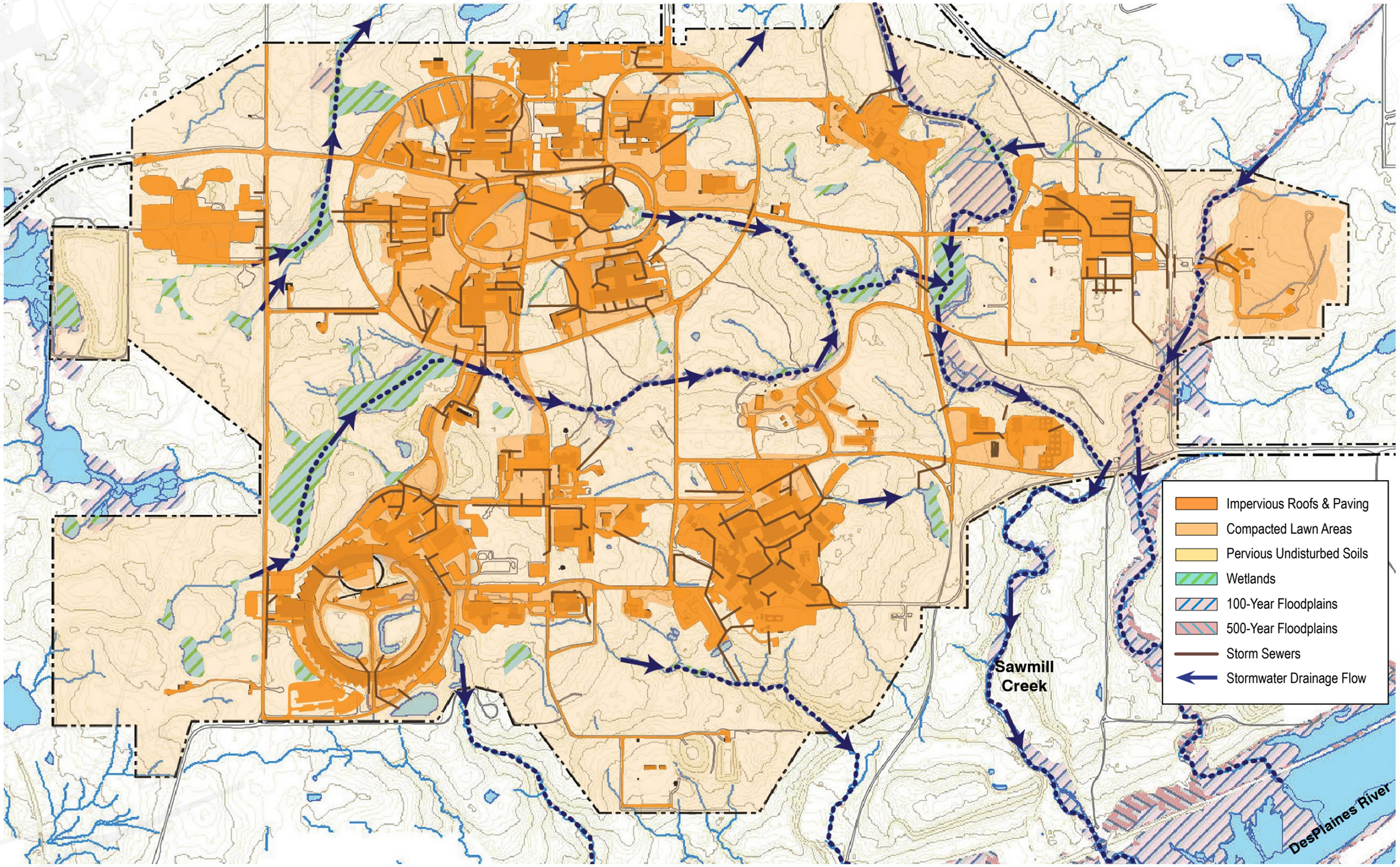
Argonne's site is located approximately 150 ft. above the nearest large water body (Des Plaines River) and is thus not subject to major flooding. The 100- and 500-year floodplains are limited to low-lying areas of the site near Sawmill Creek, Freund Brook, Wards Creek, and other small streams and associated wetlands and low-lying areas. These flood plain delineations are included in Argonne's site development standards and are generally contained within areas not intended for development and designated as environmentally sensitive or for conservation use. No significant structures are located in these areas, although the existing canal water pumping station and inlet structure are situated in the Des Plaines River floodplain south of the site.

Protection of Wetlands

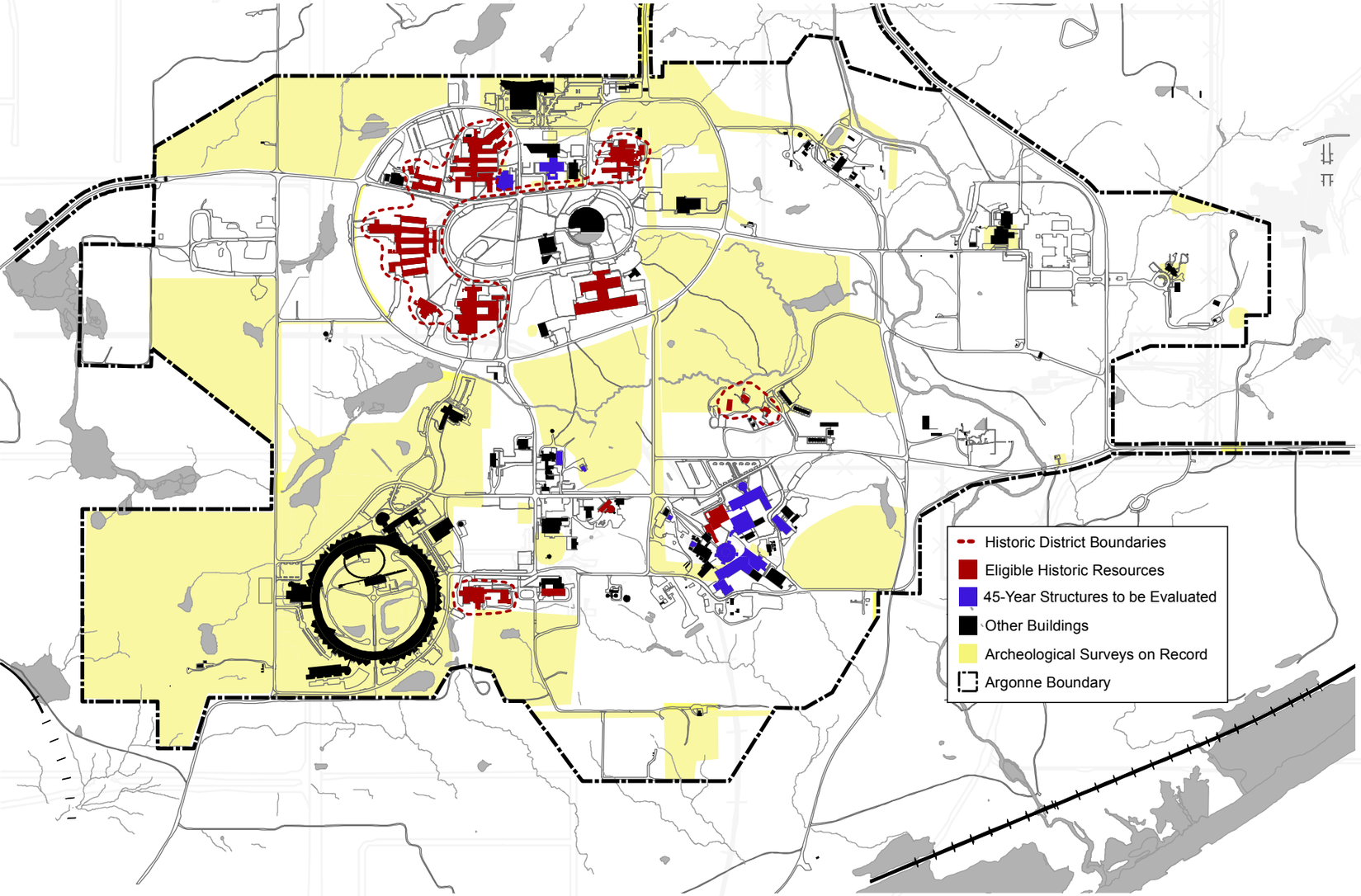
Federal and DOE policies require Argonne to identify potential impacts on wetlands resulting from proposed activities and to minimize these impacts. Where impacts cannot be avoided, mitigating action must be taken by repairing the damage or replacing the wetlands with an equal or greater amount of a restored wetland or a man-made wetland as much like the original wetland as possible. A site-wide wetland delineation completed in 1993 identified and mapped 35 individual wetland areas present on site (approximately 50 acres).

Stormwater Runoff

Stormwater runoff is generated by rainfall on impervious surfaces such as roofs and paved areas and on saturated soils (see Impervious Surfaces and Stormwater Runoff figure). Water absorption in soils varies widely with the least absorption in compacted turf lawn soils and the most absorption in undisturbed forested areas. Forested areas have been known to absorb over 4" rainfall events whereas compacted turf lawn soils absorb less than 1" of rainfall before becoming saturated. Most of the stormwater runoff goes into Sawmill Creek, which in turn empties into the DesPlaines River. There are no significant structures subject to flooding from Argonne stormwater runoff in that drainage path. However, to meet sustainability goals, Argonne is taking steps to reduce the area of impervious surfaces and compacted turf lawn soils.



Impervious Surfaces and Stormwater Runoff



Cultural Resources

2.5 CULTURAL RESOURCES

Both Federal and State of Illinois statutes require consideration of cultural resources during project planning. Cultural resources may include structures, buildings, archaeological sites, districts (a collection of related structures, buildings, and/or archaeological sites), cemeteries, objects, and places of traditional cultural significance. Compliance with these laws requires consultation, as appropriate, with the Illinois Historic Preservation Agency (IHPA), Illinois State Historic Preservation Officer (SHPO), and/or federally recognized tribes to determine a project's effects on cultural resources.

In 2001, DOE developed a Programmatic Agreement (PA) with IHPA and the Advisory Council on Historic Preservation (ACHP) for the management of cultural resources at Argonne. The PA mandates consultation and determination of mitigation measures for demolition or relocation of an eligible historic resource. DOE and Argonne subsequently established the Cultural Resource Management Plan (CRMP) which summarizes previous studies and existing cultural resource conditions at Argonne. It also includes a list of known historic and archaeological resources. Additional details are available in the CRMP.

Archaeological Resources

Archaeological surveys were conducted between 1978 and 2012. A total of 46 archaeological sites were recorded at Argonne. The CRMP contains a complete list and detailed information on known Argonne archaeological sites and their eligibility status.

Non-Archaeological Historic Resources

Historic Argonne contexts have been identified for nineteenth-century farming and agriculture before Argonne was constructed, and for the 20th-century Cold War years after construction. A site-wide reconnaissance survey conducted in 2001 evaluated all Argonne buildings constructed before 1989. Three districts and 17 structures were determined to be eligible for inclusion in the National Register of Historic Places. The districts include the Main Campus Historic District, Freund Estate Historic District, and the 314-316 Historic District. Other structures over 45 years are to be evaluated for potential eligibility as historic structures.

2.6 SUSTAINABILITY

Executive Order (EO) 13514 requires Argonne to improve environmental, energy and economic performance by 2020. Argonne is meeting these requirements through planning, executing, evaluating and continually improving the performance of campus programs and projects.

Argonne's Site Sustainability Program is divided into the following key focus areas:

1. Greenhouse Gas Reduction and Energy Conservation
2. High Performance Sustainable Buildings
3. Fleet Management
4. Water Efficiency
5. Pollution Prevention & Waste Reduction
6. Sustainable Acquisition
7. Electronic Stewardship
8. Site Innovation
9. Renewable Energy
10. Climate Change Adaptation
11. Employee Engagement

Argonne is concentrating on further integrating sustainability planning into its programming and budget development processes, and finding new solutions to policy, procedural and operational challenges to reduce water, waste, energy, and fuel use, as well as leveraging corporate culture to emphasize sound environmental stewardship. Argonne has an aggressive strategy to meet its goals . The Laboratory is exceeding goals set in the areas of petroleum use, alternative fuels, and water reduction.

Almost 95% of Argonne's GHG emissions come from three sources: purchased electricity, on-site steam production and sulfur hexafluoride (SF6) use. The key strategies for meeting Argonne's GHG reduction goals include:

- Construct and operate a new Combined Heat and Power Plant;
- Implement an Advanced Building Intelligence and Analytics information system;
- Support SF6 leak detection and recovery projects; and
- Renovate and construct energy-efficient buildings.

Solar Array at Building 372

A significant challenge for Argonne is achieving sustainability progress during a period in which the Laboratory is undergoing significant population and energy consumption growth. To balance this growth, Argonne is both retrofitting existing facilities and demolishing underused and/or legacy facilities that, although no longer performing their originally assigned missions, still require heat, space conditioning and power for safety and security reasons.

Design Considerations

Argonne's current strategy to meet Executive Order goals heavily emphasizes the renovation of existing facilities and replacement of older facilities with new facilities certified to achieve High Performance Sustainable Building goals including US Green Building Council LEED Gold certification.

Argonne recognizes that all new buildings that enter the planning process in 2020 and thereafter are required to achieve net zero energy standards. Argonne staff is investigating the commitment needed for facility conversion to net zero.

Sustainability in Large Scale Redevelopment (LEED Criteria)	Included in Plan
Sustainable Sites:	
Site Selection	YES
Alternative Transportation	
Bicycle Storage	YES
Low Emitting/Fuel-Efficient Vehicles	YES
Parking Capacity	YES
Site Development	
Protect/Restore Habitat (Campus)	YES
Maximize Open Space (Campus)	YES
Stormwater Design	
Quality Control (Campus)	YES
Quantity Control (Campus)	YES
Heat Island Effect	
Non-Roof	YES
Roof	YES
Water Efficiency:	
Water Efficient Landscaping	YES
Energy and Atmosphere:	
Optimize Energy Performance	YES
Passive Design Configurations	YES
Daylighting/Shading	YES
Storage/Materials Selections	YES
On-Site Renewable Energy	YES
Green Power	YES
Materials and Resources:	
Indoor Environmental Quality:	
Outdoor Air Delivery	YES
Increased Ventilation	YES
Daylight and Views	YES
Innovation in Design:	
Exception Design – Campus Approach	YES
Specific Regional Environmental Priorities	YES

2.7 CIRCULATION

Argonne is served by a robust regional and local vehicular transportation system. I-55, I-294, and I-355 provide Argonne with exceptional regional access. Direct connections to I-55 are made through nearby surface arterials, including Illinois Route 83, Lemont Road, and Cass Avenue. Site circulation includes:

- Entrance/security gates controlling access to Argonne's facilities,
- A hierarchy of internal (non-public) roadways,
- Parking areas, and
- Walking paths between the parking areas and the buildings, as well as among the buildings and connecting the various developed portions of the site.

Other circulation considerations include:

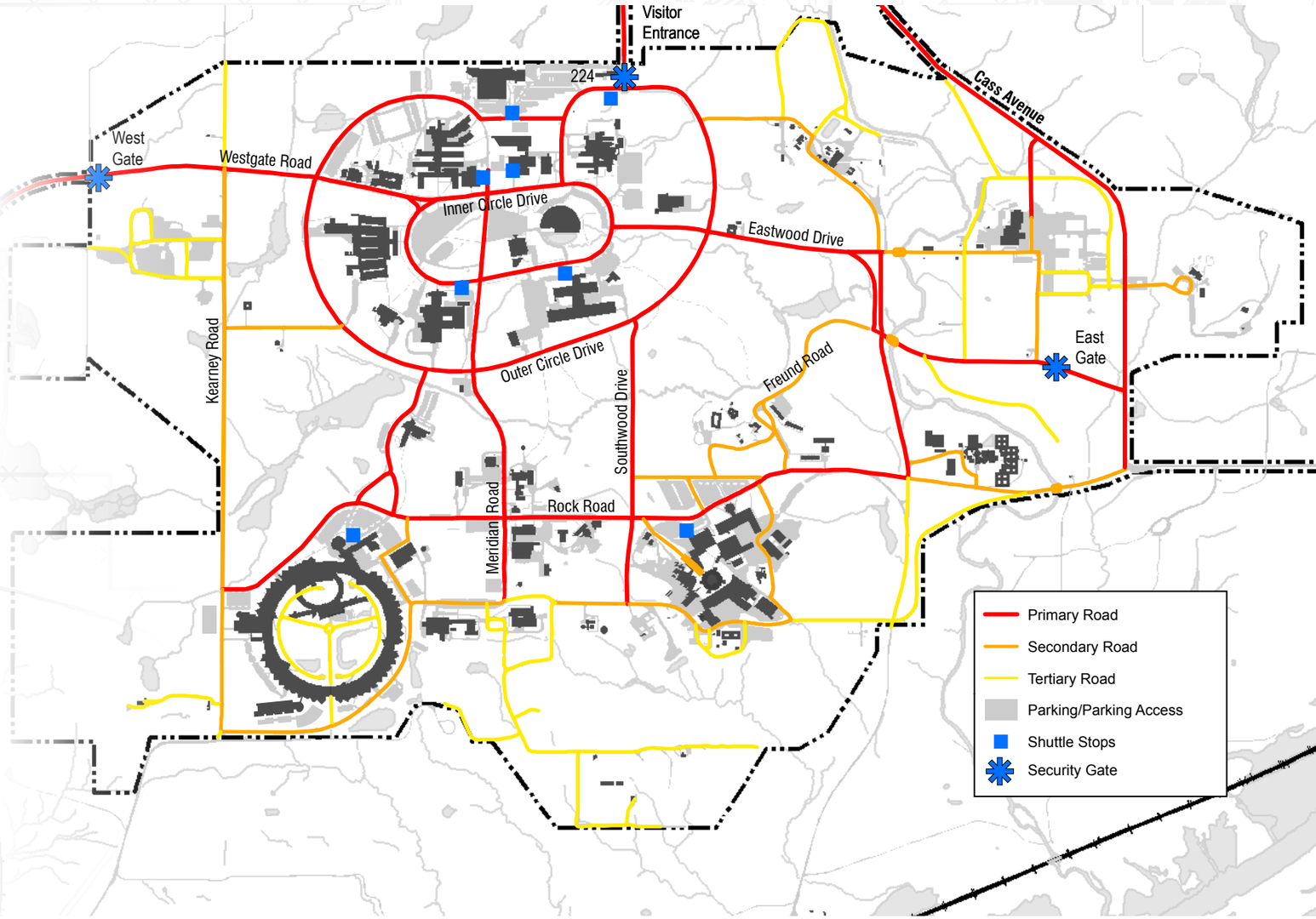
- Public transit (bus) service,
- Freight and materials delivery/service to facilities, and
- Non-motorized travel, such as bicycle and pedestrian paths and lanes.

Entrance/Security Gates

Three gates provide access into and out of Argonne: Northgate, Westgate, and Eastgate. Northgate is open 24 hours a day, 365 days a year, and serves as the main entry point for the site. This location also includes the Argonne Information Center (AIC) in Building 224, where visitors, construction, sales, and delivery personnel obtain visitor badges. Westgate is open during normal working hours Monday through Friday with a daily traffic volume comparable to Northgate. The Eastgate entrance is open Monday through Friday from 6:00 am to 6:00 pm. Eastgate is used for all truck deliveries that need direct access to campus locations other than Building 046.

Internal Roadways

Internal roadways serve and interconnect the various developed areas within Argonne. The roadways were based on the original site development and incorporated significant portions of the pre-existing rural roadway system. Subsequent development of expanded areas along with resultant changes in employee circulation and commuting habits has generally not required significant alignment changes. No significant capacity issues exist other than the formation of queues at the Lemont/Westgate and Cass/Northgate travel routes during peak commuter periods.



Existing Vehicular Circulation

Transit Service

Public transit service between the area Metra train stations and the North Gate Visitor Entry is provided by PACE Suburban Bus, but serves a very limited segment of the Laboratory's transit needs. An Argonne-University of Chicago Shuttle allows students, post-docs and faculty from the University to visit the laboratory for academic and scientific collaboration.

Freight/Materials Deliveries

Most truck deliveries arrive at the Shipping and Receiving Department, Building 46. Trucks arriving at the main gates create a concern due to the limited maneuvering areas at these locations. However, truck traffic comprises only a small part of the traffic on the Argonne campus.

Non-Motorized Travel

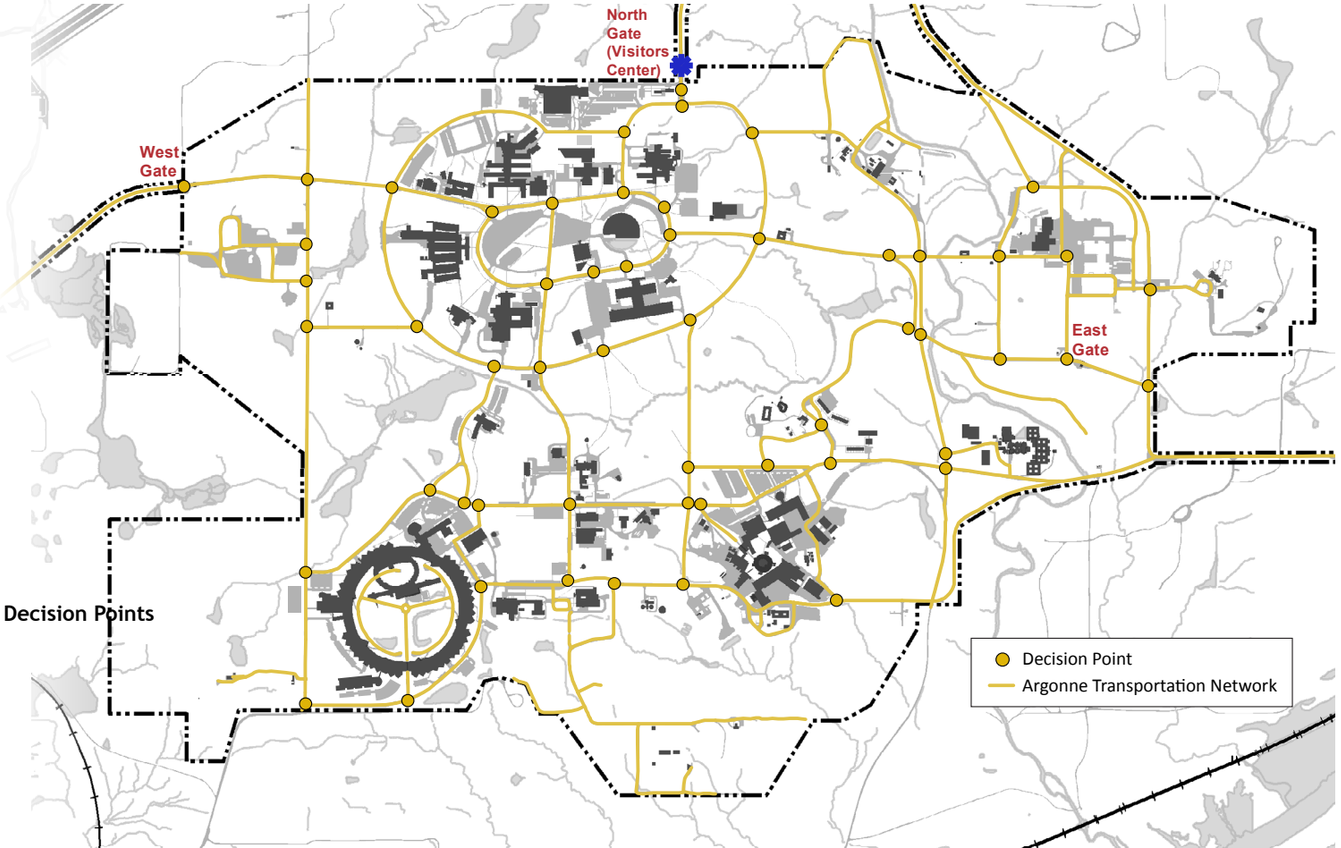
As a whole, Argonne's transportation system was designed for vehicular traffic, primarily personal automobiles. A limited, but growing number of individuals walk or bicycle to or from Argonne. Walking and bicycling between various areas on site constitute the most significant instances of non-motorized travel. Pedestrian and bicycle paths are gaining connectivity necessary to facilitate broad usage; however, most existing traffic lane widths and shoulders do not encourage walking or bicycling. Argonne has initiated a well-used seasonal program of providing employer-purchased and -maintained bicycles to promote bike travel, in support of Executive Order 13514, Leadership in Environmental, Energy, and Economic Performance.

2.8 WAYFINDING

Visitors should be clearly guided from the main entry at the site along a direct path of travel to their final destinations. For efficient wayfinding, this process should occur with as few decision points as possible. A robust wayfinding system should include both vehicular and pedestrian routes and supporting signage indicating both intermediate and final destinations, such as parking locations and building identification.

An integral component of the facility modernization program and its supporting infrastructure will be to strengthen the sense of location and direction and reinforce the sense of identity for existing areas throughout Argonne. The Laboratory has established standards for use of the Argonne logo and color schemes for building designations and area indicators, which will contribute to the unified campus wayfinding system.

Pedestrians at the Argonne Community Open House



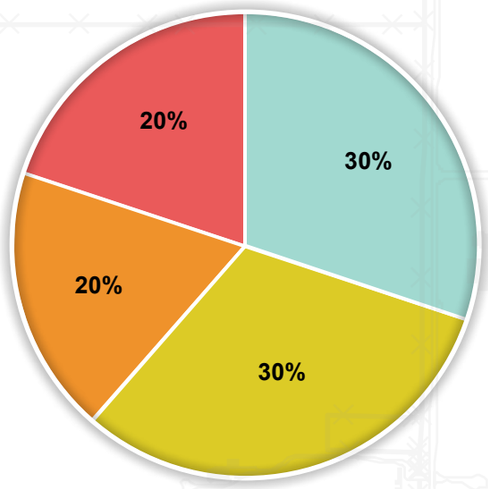
Wayfinding & Decision Points

2.9 PARKING

Argonne currently provides more than adequate surface parking capacity in all areas of the campus. While some parking lots are much more heavily used than others, there are always available parking spaces within a reasonable walking distance (See Appendices 1 and 2 for parking proximity diagrams for the 200 and 400 Areas). Sidewalks have been added to facilitate pedestrian movement to and from parking lots. Repair and maintenance of parking facilities is an ongoing issue and is being addressed in annual major repair site works budget allocations.

The primary issue is the distance from available parking to building entrances. A related issue is the potential for pedestrian/vehicular conflict and sloping walking surfaces that could become slippery in snow or ice. The positive side of the distance is that more walking can be good physical activity.

200 Area Parking Lots within Inner Circle Drive



Current Parking Utilization Rates:

- 95 - 100% utilized
- 80 - 95% utilized
- 50 - 80% utilized
- Less than 50% utilized

The following design considerations should be incorporated to meet site parking needs:

- The number of parking spaces provided in each lot should be proportional to the aggregate requirements of nearby buildings.
- Continuous pedestrian access and adequate connectivity should exist between the parking lots of all buildings that they would be expected to serve, including sufficient lighting for nighttime visibility.
- Routes of travel from the centers of parking areas to the entrance(s) of the buildings they serve should be within approximately 1,100 feet[1] of each building.
- Pedestrian facilities should be designed to make travel between the parking areas and the buildings as safe and pleasant as possible.
- Parking surfaces should be designed to provide shade and good surface drainage or rain gardens, and should be constructed of pervious materials when possible.

[1]How Far Should Parkers Have to Walk?, Mary S. Smith and Thomas A. Butcher, National Parking Association, May 2008. This distance is to reflect a Level of Service (LOS) C operation.

200 Area

The 200 Area includes approximately 2,900 parking spaces, with the estimated demand of approximately 2,400 spaces. The recent move of staff from Buildings 200, 205, 223, and 212 into Building 241 (Energy Sciences Building) has relocated parking needs to areas closer to 241. These needs have been addressed by development of parking near Buildings 223, 241 and north of 202.

400 Area

Parking in the 400 Area has been bolstered with the addition of parking lots near Building 450, at Building 446 (APCF), and Building 440 (CNM). A sidewalk from the lot near 450 to APS has been constructed to improve pedestrian access and safety to that lot.

Ride Sharing

Ride sharing through van pooling, car pooling, and bus ridership is being encourage to meet laboratory sustainability goals. Combined with other alternative modes of commuting such as bicycling, ride sharing will help to reduce the number of parking spaces needed. Additional resources to improve “last mile” campus transportation infrastructure would advance employees’ participation in alternative commute options.

2.11 UTILITY CONSIDERATIONS

The initial development of the Argonne site required careful and detailed evaluations of the programmatic missions being undertaken, architectural and engineering technologies, environmental conditions, and developmental considerations posed by the various infrastructure systems and utility services necessary to support mission operations. Integration of these factors also offered opportunities inherent in the overall location and building technologies of the 1940s and 1950s. The site as a whole has integrated these constraints and has been planned and constructed along physical patterns that shaped the infrastructure, just as the needs of the infrastructure systems and their functional requirements have informed the layout, development, and additions to the site development, and now continue to influence the redevelopment and modernization process.

Significant mission potential, environmental opportunities and constraints, and infrastructure conditions exist that will enhance the site planning opportunities to realize greater success in meeting operational requirements more effectively. Significant site planning opportunities also exist to enhance the reliability and operational effectiveness of several of the site utility and infrastructure systems by concurrently incorporating infrastructure and utility considerations into the comprehensive plans and implementation programs.

Transportation Network and Infrastructure

Transportation infrastructure includes roadways and bridges, parking and vehicle loading areas, and pedestrian circulation, including sidewalks and trails. The approximately 28 miles of roadway at Argonne include the access roads to Cass Avenue and Lemont Road. Approximately 4.5 miles are unpaved; an additional 2 miles of roadway are maintained by DuPage County along Cass Avenue and Bluff Road. These roads serve unrestricted local traffic as part of the general county road system connecting to I-55 and Illinois Route 83.

Transportation within the Argonne site is generally adequate for current and projected vehicle and pedestrian circulation and the internal movement of goods and materials. Parking for visitors and guests is presently adequate in aggregate, and will be improved with the removal of obsolete facilities and their supporting parking and the construction of newer facilities and more efficient parking layouts. Redevelopment of the central 200 Area and increased programmatic activity in the APS-related 400 Area will ultimately affect the large-scale circulation patterns on the site.

Steam Production/Distribution System

The central heating plant and its extensive piping distribution network provide steam to most facilities, excluding the East Area, the 600 Area, and several minor buildings. Steam is used primarily for space conditioning (i.e., heating, humidity control, absorption chilled-water production) of Argonne buildings, as well as domestic hot water production and for various steam-turbine-driven equipment.

The central heating plant generates most of the steam required by the Laboratory; consisting of five Wickes conventional water tube boilers and various auxiliary systems. The maximum operating capacity of the total central heating plant is 398,000 lb/h of principal fuel used for generating steam at the plant is natural gas. Gas supply and distribution is discussed below.

Several central heating plant components and parts of the related steam distribution system have reached what the industry considers the end of the equipment's useful life, even though they have been well-maintained and retrofitted over the years. Reliability issues and operating cost can be expected to increase year over year as these systems are maintained. Various Argonne experiments and programmatic processes create waste heat streams, which are being evaluated to determine their viability to supplement or replace steam use on various parts of the Laboratory. Steam is currently reduced from 190 psig to 35 psig at the building level. Energy production opportunities are being reviewed that take advantage of the difference of these pressures.

A new Combined Heat and Power Plant has been approved by DOE, with groundbreaking slated for FY 2015. This facility will supplement the steam production of the central heating plant.

Water Distribution Systems

Three water distribution systems are used at Argonne:
1) domestic and fire suppression water;
2) laboratory water; and
3) canal water.

Domestic Water System

Argonne originally drew ground water from several separate wells in the eastern and northern parts of the site. Since 1996, potable water for Argonne has been supplied by the DuPage Water Commission from Lake Michigan. The supply line runs parallel to Cass Avenue and connects at a pressure reduction station adjacent to the central heating plant. From there, water is pumped into the general distribution system, which provides for domestic and laboratory process use and for fire protection.

Laboratory Water System

A separate laboratory water system prevents potential contamination of the domestic water system by back-siphonage. To eliminate this hazard, water is pumped from the on-site water supply system to a point above the high-water level. From there, the water is discharged through an air gap into an elevated storage tank south of Water Tower Road. This storage tank supplies the Laboratory water system.

Canal Water System

The canal water system is a separate sourced non-potable system, constructed in 1962 using water drawn from the Chicago Sanitary and Ship Canal, south of Argonne's property. The canal water distribution system is the primary water source for Argonne's cooling towers. On an emergency basis, the DuPage water system may also be available to supply the cooling towers.

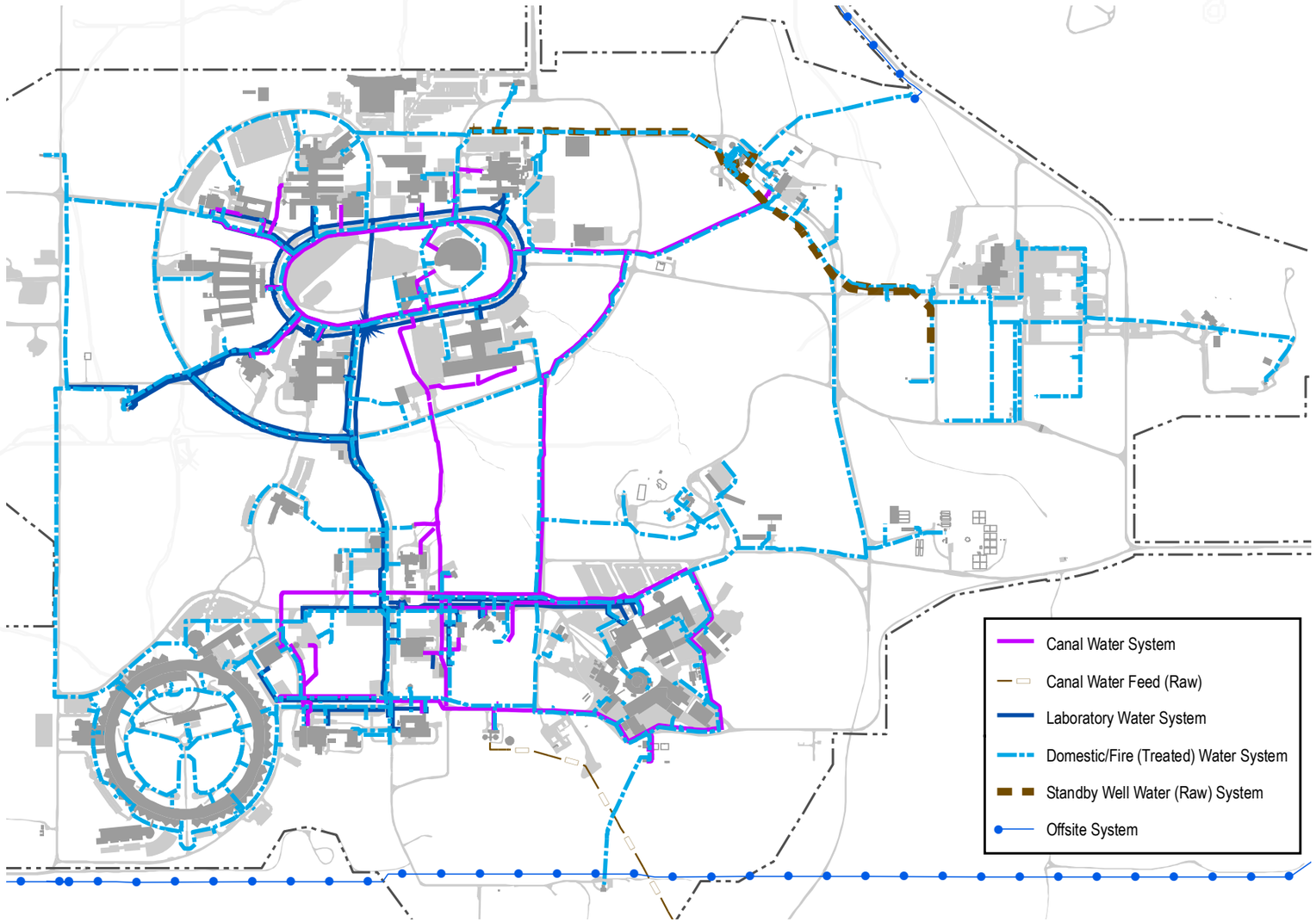
All three water distribution systems provide on-site fire protection through hydrants distributed along roadways and buildings. Each of these three systems currently relies on a single source which, if interrupted, would leave Argonne with approximately a one-day supply of water for the affected system(s). Each system needs to secure an alternate source to achieve a more robust reliability to serve the Laboratory at current and projected operational capacities. Because the Laboratory water system is derived from the larger domestic water system, combining both into an integrated distribution would allow better interaction with new development as it occurs.

Sanitary and Laboratory Sewer Systems

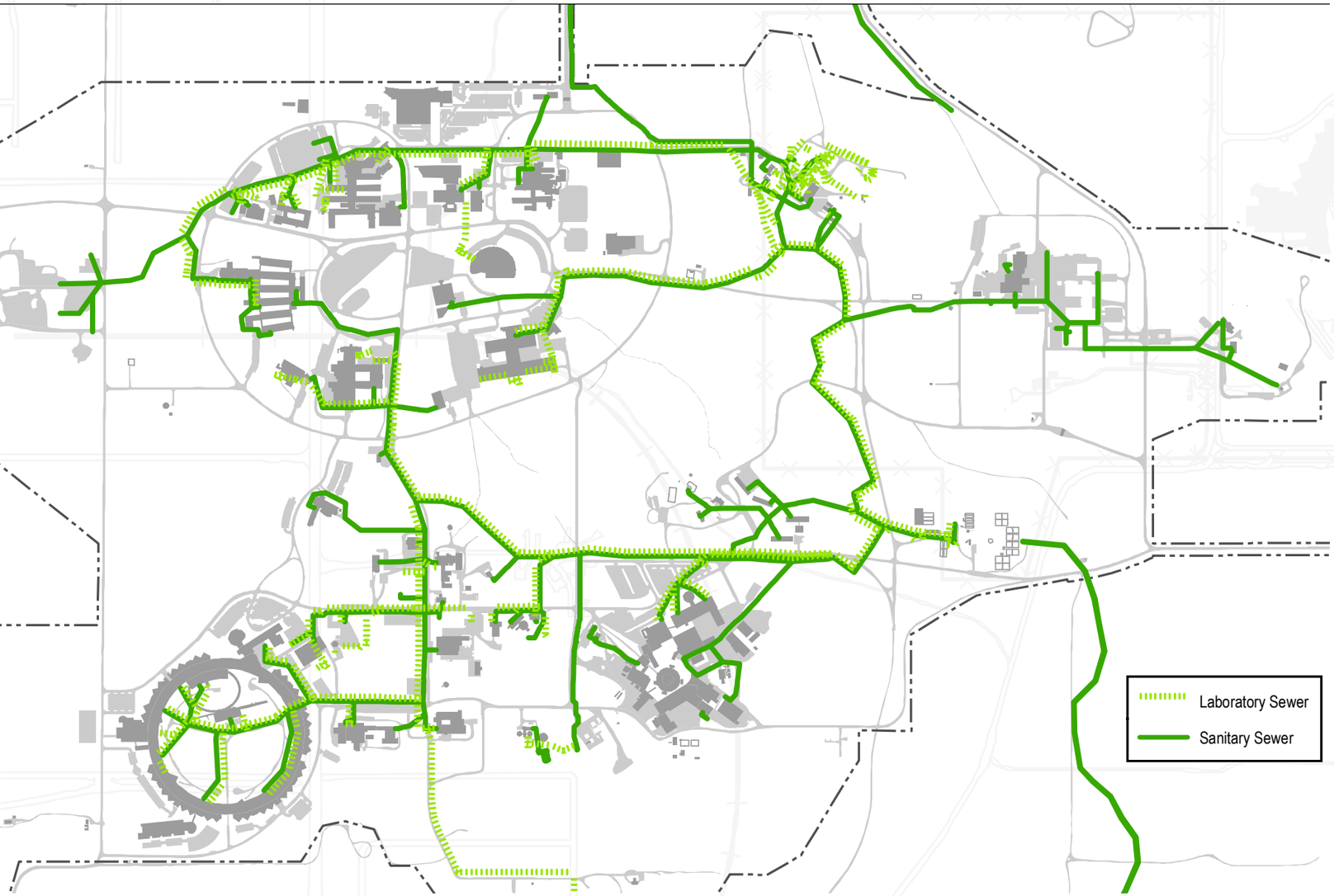
Sanitary sewage from various buildings is conveyed through an underground sewer system to the sanitary wastewater treatment plant (SWTP) located at the lowest point within the site where Sawmill Creek exits the security fence. The system is for domestic waste only; drains subject to radioactivity or chemical contamination are not connected to this system.

A separate laboratory sewer system serves all areas of the Argonne site, except the East Area and the 800 Area. To prevent inadvertent emptying of radioactive waste or other toxic substances into laboratory sinks or drains, a separate drain system is installed in all radiochemical laboratories. Laboratory sinks or floor drains that might receive chemical or radioactive wastes are connected to tandem retention tanks within each facility; wastewater is monitored for radioactivity before the contents of the retention tank are pumped into the laboratory sewer system. All such laboratory sewers are connected to the laboratory wastewater treatment plant (LWTP) adjacent to the SWTP.

At most locations, the laboratory and sanitary collection systems run in parallel, have the same slope, and are constructed of the same pipe material; they often run through a double manhole, with an internal concrete wall to segregate the flows. A small separate pumped discharge transports 100 Area discharges to a nearby DuPage County treatment plant off-site.



Water Service Systems



Sewer Service Systems

Storm Water System

Roof drains, downspouts, and some minor cooling water discharges are connected to storm sewers at most permanent buildings. Storm sewers discharge into the nearest suitable outfall point, usually a creek or a well-drained low area. Existing storm sewer discharges do not contain provisions for detention or retention of storm water, other than natural capacities inherent in the surface drainage system. The Laboratory is taking measures for stormwater detention or retention in new and proposed projects.

Most of the storm sewers on site are more than 25-30 years old. Most sources of storm water are directed toward collection systems that lead to the outfalls covered under the NPDES permits. Though the water is untreated, the discharges are permitted and are monitored as required by the NPDES permit; the results of the monitoring are transmitted to the State of Illinois.

The federal guidance for stormwater management has been upgraded in the 2013 EPA "Office of Water - Draft Climate Change Adaptation Implementation Plan" programs, that include:

> *"Wetlands programs that help protect and restore wetlands that serve as sponges to retain water from more intense events, increased precipitation, and more rapid snowment; Stormwater permit programs that reduce pollution levels and the rate of runoff of rainfall in developed area with large percentages of impervious surfaces and programs that promote improved sormwater management through implementation of "green infrastructure" practices;"*

Argonne is implementing the intent of these stormwater management goals, making them part of new construction projects such as the ESB and APCF, and by identifying opportunities to convert specific landscape areas to better meet federal guidance. In addition, storm sewer lines and discharges are aging and in need of major maintenance, including cleaning and repair of culverts, discharges, and swales along roads.

Sustainable, low-impact development techniques will allow increased development density and facilitate on-site treatment and abatement of storm water runoff from development at or near its source, such as parking lots and other impervious surfaces.

Chilled Water Systems

Reliable chilled water systems are crucial to buildings on site. The loss of cooling for even short times can invalidate long-term experiments. Many chilled water systems serving individual buildings, aside from the central chilled water system, also serve vital process cooling loads. Chilled water for process and comfort cooling is provided by three separate chilled water systems, serving many of the major buildings on site. These systems serve the:

- 200 Area,
- 360 Area, and
- 400 Area (APS).

Central (200 Area) Chilled Water System

Approximately 4.2 miles of buried chilled water supply and return piping connects most of the major buildings in the 200 Area (202, 205, 212, and 223) to the central chilled water plant. Four additional buildings (203, 211, 221, and 222) were connected at the beginning of FY 1993; Building 200 was added to the system in FY 1999. The system was expanded to provide Building 204 (H.T. Rickets Laboratory) with emergency backup support only. Building 216 was connected in 2008.

The chilled water plant, located in Buildings 371 and 371D was built in 1989 and expanded in 1997 to a 4,200 ton capacity. Typical load on the plant is approximately 3,500 to 4,000 tons. An additional 1,500-ton absorption chiller was installed at Building 212 in 2004; it ties into the central chilled water loop for additional capacity, but primarily services the load in Building 212. Local chilled water systems are used at various buildings in the 200 Area for other process and critical loads and to provide the primary source of in-building cooling, with the central plant providing a back-up source. If these systems were taken off-line the central plant could not handle the total chilled water needs for the 200 Area.

Recent new construction and continued research in the existing 200 Area facilities required additional cooling capacity. These requirements were met with the construction of a modern, efficient, state-of-the-art chilled water plant in the 200 area. The new plant, with an installed capacity of 2,600 tons refrigeration is expandable to 17,000 tons to meet foreseeable future needs. The new plant is designed to serve the TCS, ESB, MDL buildings, ATLAS and other facilities as needs arise. The plant will initially supplement the existing Facility 371 chiller plant, but is anticipated to become the dominant supplier of chilled water for the area.

360 Area Chilled Water System

The 360 Area chilled water system is located in Building 364 and has a total cooling capacity of 1,200 tons. Options to increase the use of this plant are currently being reviewed to realize increased energy savings. These options involve interconnecting the 360 Area chilled water plant with the central (200 Area) chilled water plant or relocating the Building 364 chillers to optimal locations.

APS Chilled Water System

The APS chilled water system serves only the APS complex and has a total cooling capacity of 12,350 tons. Recent upgrades involve an additional 1,600-ton chiller for the CNM and a 1,750-ton chiller for Building 437 operations and reserve capacity. The chilled water system peak load is currently 10,485 tons.

Natural Gas System

Natural gas is supplied per a contract via the Defense Energy Support Center, and is transported through a 36 in.-diameter, 285 psig pipeline owned by Nicor Inc., reaching the site along Cass Avenue. A 6 in. branch line from the nearby high-pressure Nicor main supplies gas at 150 psig to a regulator at Building 108, which reduces the pressure to 60 psig. From that regulator, gas is piped to the central heating plant, where it is metered for the boilers.

A second branch line extends from the central heating plant, where the site-wide gas supply is metered and regulated to maintain 10-12 psig and distributed to the site for use in laboratory and experimental areas. The entire gas distribution system was replaced in FY 1999 and FY 2000, making the Argonne natural gas system highly reliable.

Electrical System

Electric power for the Argonne site is provided at 138kV by ComEd. The Argonne point of service is a terminal on the ComEd line, which the Joliet and McCook substations feed on each end. The utility's transmission line is routed adjacent to the Atchison, Topeka, and Santa Fe Railroad in the Des Plaines River valley south of the site.

Primary distribution lines are generally 13.2kV throughout the site. A network of overhead lines operating at 13.2kV forms the backbone of Argonne's electrical distribution system. A notable exception is the redundant looped underground distribution system in the 200 Area. The underground system's design is fault tolerant and was modernized in 2010 with new switching units. Voltage reduction transformers and switchgear are adjacent to or within each individual facility.

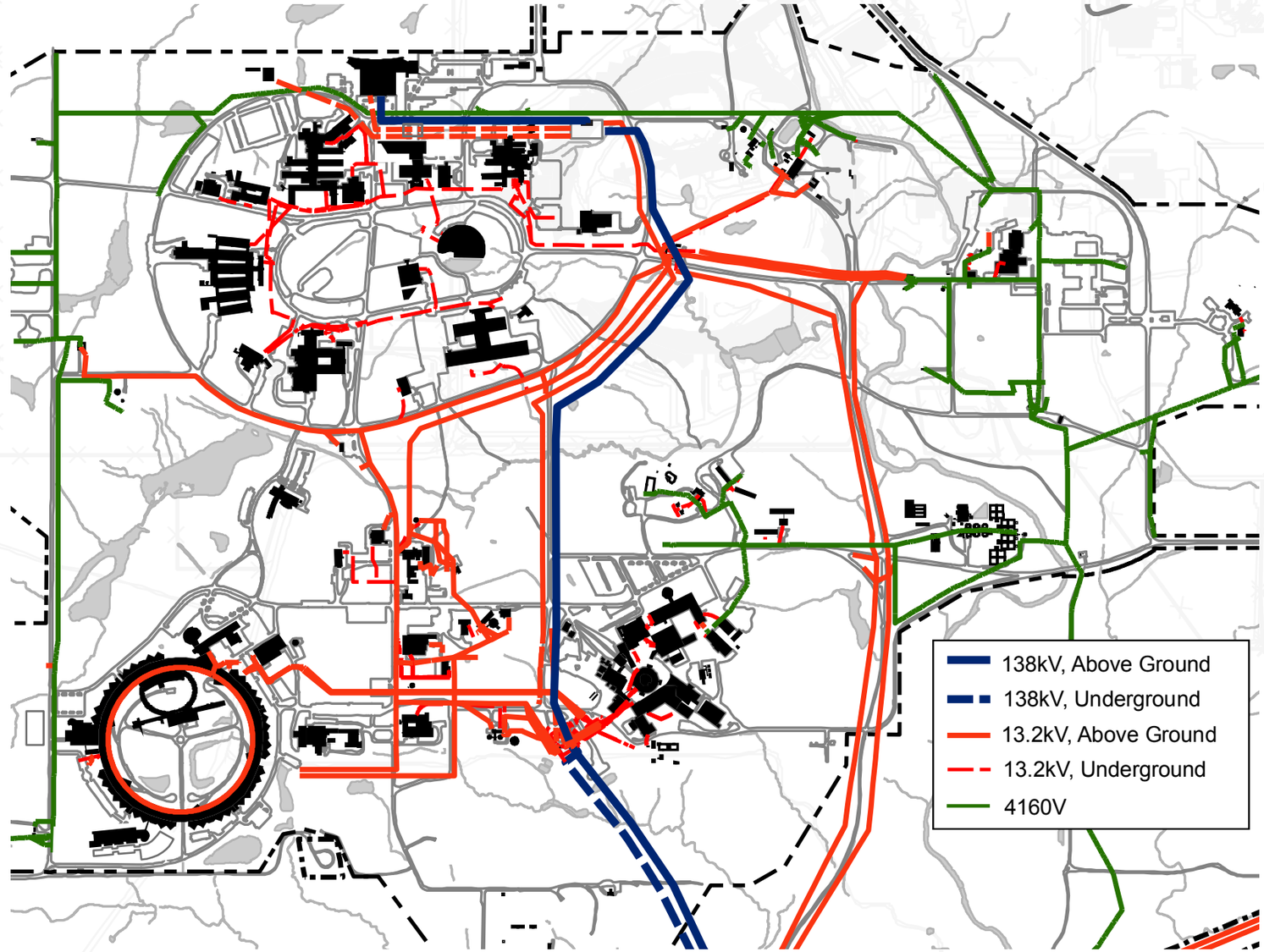
A second overhead distribution system is operated at 4.16kV with distribution lines serving the East Area (except for Building 046), portions of the 200, 360, and 400 Areas, and the 100, 600, 800 and 900 Areas. This system is more than 60 years old and continues to serve a number of critical and non-critical loads across the site.

The primary Argonne electrical distribution system, which originates at Facility 543, was originally constructed in 1949. Major system rehabilitation has been necessary to maintain high levels of reliability and safety. Significant upgrades to the system since the early 1990s include replacement of transformers and associated equipment and replacement of all exterior and interior transformers filled with polychlorinated biphenyls (PCBs).

The underground distribution cable system and equipment were also replaced and upgraded in the 200 Area. A supervisory control and data acquisition system was installed in 1996 for remote control and monitoring of protective equipment at Facilities 543 and 544. A second 138kv transmission line and associated equipment were installed between Facilities 543 and 549 in FY 2001.

The most recent upgrades to the laboratory electrical system are relocation of the 300 Area transformer station prior to demolition of Building 301 in 2009 and increased electrical service capacity to the northern portions of the 200 Area with the construction of Substation 551, located northeast of Building 202. The location of the substation provides economies of service to ongoing and projected mission growth in support of planned computing facility expansion at Building 240, the CARIBU Upgrade and related service needs for ESB, MDL, the 200 Area Chilled Water Plant (including planned capacity expansion capabilities).

System-wide capacity is also capable of meeting significant overall load growth through expansion of the ComEd substation at Facility 543 and the adjacent Argonne facilities. This capacity expansion potential provides on-site capability for servicing 100% or greater load growth, whether to accommodate new or increased accelerator or computer missions comparable to existing operations as well as related projected cooling requirements.



Electric Distribution System

2.12 INFORMATION TECHNOLOGY INFRASTRUCTURE AND SYSTEMS

Computing Network

Laboratory communications networking infrastructure consists of the network electronics, the in-building cabling, and the outside cable plant (OSP). The network is a mission-critical element to support the Argonne mission by providing for electronic communications and supporting building monitoring, the emergency communication systems, and transport of laboratory data to our collaborators.

The location of long-term Network Operation Centers (NOCs) is critical to ensure that Argonne's investment in the proposed solution is sustainable for 25 years. A networking strategy to support the Argonne mission aligns with planned site development and redevelopment project investments. A new NOC has been constructed near Building 308 to serve the southern part of the campus.

Cabling Infrastructure

The two primary components of the site's structured cabling infrastructure are the outside fiber plant (OFP) and outside copper plant (OCP) and the in-building cabling system. Fiber and copper cabling interconnects the buildings across the campus, and the cabling within buildings provides voice and data connectivity to offices, computer rooms, and laboratories. The capacity, performance characteristics and age are creating significant risks for mission-critical Argonne services. A program is underway to complete the implementation of a site-wide cabling plant renovation that includes replacement of outside plant cabling.

Telephone System

Argonne's phone system, which supports over 7,500 digital, analog and VoIP telephones, is significantly dependent on the aging OSP. The telephone system is also dependent on interfaces with external service providers for both local and long-distance phone calls. The OSP's copper infrastructure that connects Argonne to external service providers (AT&T and Verizon) for local and long-distance phone calls has almost reached capacity. All communication circuits are being transferred to the new fiber-optic cabling infrastructure.

Public Address (PA) System

The site-wide emergency public address system is a mission-critical system that is required for life safety purposes to alert on-site personnel to emergency situations. The new PA system that was installed in 2010 included the replacement of the audio distribution system and capabilities to monitor system integrity and detect system failures; the system remains at significant risk of failure from a network or power outage. In order to fully use the new system's functionality, improvements to in-building networks are required and back-up power needs to be assured.

Emergency Communications

Argonne's emergency radios are part of a state-wide trunked-network of transceiver sites, one of which Argonne hosts (Building 364). Argonne's 10 fixed-base units and 75 handheld portable units primarily serve the Argonne Fire Department, Emergency Management and Security. Opportunities for improvement exist for the on-site location of transceiver and base station equipment, in terms of environmental conditions, security, and network connectivity.

Cellular Communication Upgrades

The Laboratory is pursuing development of a new on-site cellular tower by AT&T, and upgrades to cellular service offerings with AT&T and Verizon.

Data Centers

Information technology (IT) operations are critical to support Argonne's mission. IT enables the execution of network communications, data acquisition and storage, enhanced collaboration, and efficient Argonne business processes. These services depend on "data centers" (enterprise-class computer rooms) containing servers, storage devices, network communication lines, power cabling, and specialized environmental controls.

CIS maintains a primary data center in building 240. This data center is the heart of information technology operations at the laboratory; all business systems, core networking, email, databases, and other critical IT services reside in this datacenter.

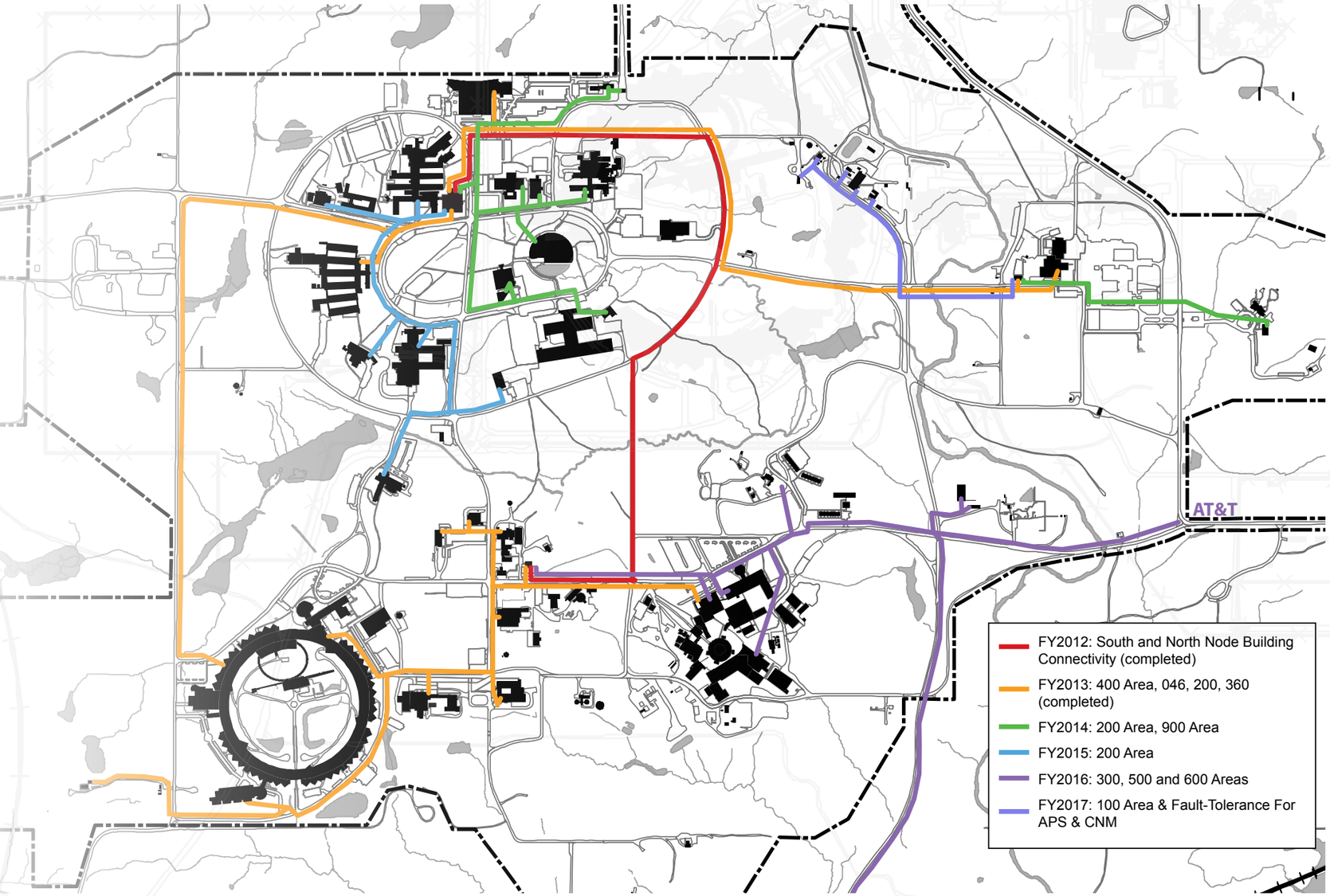
The laboratory has several "moderate size" data centers with different strengths, weaknesses, and capabilities. These data centers are located in APS (401), CNM (440), ALCF (240), and CIS (221). A large percentage of the laboratory's IT assets are contained within less-than-ideal facilities. These IT assets typically run critical or sensitive applications, which are relied upon by many people and collaborators, yet reside in locations which may provide inadequate power, cooling and environmental controls and monitoring.

Data Center Upgrade

Argonne has begun planning for a modern data center with growth capacity that contains redundant power cooling and networking. Green initiatives can be undertaken in a more manageable, focused way to measure and help reduce environmental impacts. State-of-the-art techniques and equipment can optimize power, cooling and monitoring. In addition to improving the computing systems' reliability and energy usage, it will support the sustainability initiatives defined within Executive Order 13514.

Outside Cabling Plant (OSP) Infrastructure

The Computer & Information Systems (CIS) Division is currently constructing an integrated cabling infrastructure upgrade for the Laboratory. As part of this plan, existing fiber optic and copper communications and data infrastructure will be replaced with an all-fiber system. The OSP plan is an aggressive, multi-year phasing of upgrades to each area of the Laboratory over FY 2012 to FY 2017, to replace degraded and obsolete cables and parts. Upgrading the +25 year old infrastructure will provide the Laboratory with the critical technology to support its scientific missions. OSP upgrades began with the location for the new south campus Network Operation Center. This south node provides a physical point where new and old cables can be interconnected.



Computing & Information Systems Division Integrated Fiber Network Upgrade

2.13 ON-SITE HANDLING OF RADIOLOGICAL MATERIAL

Radioactive materials are used on the Argonne site to fulfill its science and applied science and technology missions for DOE-SC and other ANL sponsors. These sponsors rely on Argonne's ability to safely and efficiently manage the use of radioactive materials for programmatic research and development. Radioactive materials are handled safely in a number of ways, depending upon each's particular hazards. Highly radioactive materials are typically handled in hot cell facilities or glovebox facilities located throughout the site; these facilities reduce potential for the spread of contamination and protect workers from unnecessary ionizing radiation exposure. Hot Cells and gloveboxes are typically protected by radiological confinement systems consisting of concrete walls and HEPA filtered ventilation systems that remove any radioactive particulate matter from the exhaust air stream before exiting the building.

In addition to the programmatic use of radioactive materials, Argonne's Operations Division maintains facilities to manage radiological waste materials resulting from the science and technology work conducted at the Laboratory. Waste treatment and storage facilities process the radioactive waste generated on-site into a suitable form for final treatment and disposal. Certain waste treatment and storage facilities are managed as nuclear facilities (i.e., Hazard Category 2 and 3 Nuclear Facilities) because waste from the programmatic work is consolidated at these facilities.

2.14 SPACE UTILIZATION

In order to optimize physical laboratory infrastructure and operating costs, the Laboratory is addressing several initiatives to better manage utilization of interior space. Moving scientific equipment between laboratories is a costly procedure; careful planning measures must be undertaken to ensure both a reduction in overall lab moves, and a successful move when necessary.

As new buildings are complete and occupants move into their new lab and office spaces, old space must either be renovated for new occupants or prepared for D&D. The process of backfilling these spaces requires a detailed data collection effort to compile an accurate database of existing conditions and space utilization records.

As spaces are renovated, using modular components and standard room sizes allows for future flexibility with different users. Building this flexibility into lab space generates a better space utilization and creates more efficiencies for the scientists.

Rendering of proposed renovated laboratory space using flexible lab standards

2.15 BUILDING OPERATION COSTS

Laboratory building costs are compiled annually to determine maintenance and operating costs figures. These costs include:

- Average maintenance
- Custodial/ Refuse/ Recycle/ Pest Control
- Natural Gas
- Electricity
- Steam
- Water/ Sewer

Annual maintenance costs vary based on the complexity and general condition of the facilities. The laboratory commits to fund annual maintenance based on the DOE minimum expectation of 2% of facility Replacement Value (RPV).

In many buildings, energy losses contribute heavily to building costs at the Laboratory. Lab exhaust fans, minimal insulation levels and lab ventilation requirements of once-through conditioned air, all lead to inefficient heating and cooling. For these reasons, most of the original 200 Area buildings have much higher operating costs than their newer counterparts built after 1980.

New buildings, such as the Energy Sciences Building (ESB) now under construction, will be more efficient to heat and cool with modern equipment and technology. New buildings will all be built to high performance standards required by the Department of Energy, resulting in lower loss factors than existing campus facilities. In addition, new buildings will be more highly utilized per square foot compared to the interior layout of older buildings which does not meet modern efficiencies.

Renewals and upgrades are either planned or being planned for virtually all of the Laboratory's user facilities and major instruments.

Section Three: Plan Implementation

The 2013 Site Development Plan is committed to meeting Argonne's current and emerging mission needs as part of a major facility modernization program. This Plan identifies strategies to guide the program; the strategies are based on the following goals:

- Transition into a infrastructure and facility framework that integrates diverse areas of science and promotes collaboration.
- Strengthen Argonne's ability to attract and retain the best early-career and senior staff.
- Co-locate and consolidate science disciplines to achieve productivity improvements and greater interaction, while reducing Argonne's overall development footprint.
- Create modern, state-of-the-art research space, while decommissioning and demolishing deteriorated, obsolete, and inefficient facilities.

3.1 PLANNED SLI PROJECTS

New facilities and major projects at Argonne are funded and implemented in a variety of ways. Planned projects that will significantly affect the physical plan include:

Science Laboratories Infrastructure (SLI)

The current SLI program includes construction of four major buildings, renovation of one existing building, and rehabilitation of the supporting infrastructure over the next 15+ years. The Illustrative Site Development Plan Maps (5 year and 15+ year phasing) depict the currently planned location for each facility.

The planned projects are as follows:

SLI – 1: Energy Sciences Building (ESB)

Currently under construction, the ESB project will construct approximately 174,000 gross sq ft of laboratory and office space to house 230 employees on the north side of the 200 Area. The ESB is projected for completion in FY 2014.

SLI – 2: Materials Design Laboratory (MDL)

Currently in the conceptual planning phase, the MDL facility will consist of approximately 105,000 gross sq ft of laboratory and office space adjacent to the ESB, as well as renovation of office and lab space in adjacent Energy Quad buildings. The MDL is currently planned for completion in FY 2018.

SLI – 3: Infrastructure Upgrade

The third major construction project, scheduled to start in 2016, will provide a new, redundant electrical feed from our electrical supplier, repair/replace underground utility piping, upgrade high-voltage electrical lines, upgrade chilled water plant, upgrade communication lines, excess space that is no longer needed, and prepare designated facilities for EM demolition. Current plans call for this project to be complete by FY 2020.

SLI – 4: Multi-program Replacement Building

Construction of the final multi-program replacement building is scheduled to start in 2022. This approximately 140,000 gross sq ft building will allow the Laboratory to vacate an additional approximately 200,000 gross sq ft of obsolete space. Current plans call for this project to be sited in the 200 Area.

SLI – 5: Modernization (Renovation) of Multi-program Building 362

Modernization of Building 362 is scheduled to start in the year 2024. This project will modernize approximately 180,000 gross sq ft of existing laboratory and office space.

Building 241 (ESB) Lobby

Building 241 Fume Hood

State Funded Project

The State of Illinois pledged $35 million for a 50,000 sq ft Energy Innovation Center (EIC). The EIC will provide laboratory and office support space for the Joint Center for Energy Storage Research (JCESR) program. The project has begun design and is targeted for completion in FY 2016.

Third-Party Funded Projects

The Laboratory is constructing a Combined Heat and Power (CHP) Plant adjacent to the existing boiler house that will be funded via an approximately $18 million Energy Savings Performance Contract (ESPC). The project scope is currently under development for construction in FY 2015.

Planning is also underway for a third-party funded Central Assembly and Storage Facility (CASF) in the 300 Area that will support multiple programs.

Infrastructure Upgrade Initiative

Revitalizing the Laboratory's existing facilities and infrastructure to meet the current and emerging needs of scientific missions is a major challenge for Argonne. This includes the elimination of legacy waste and obsolete facilities, while both optimizing operation costs and minimizing maintenance costs. Upgrading the Laboratory's infrastructure is identified as a Mission-critical objective. A rigorous data collection process is underway for all Laboratory infrastructure systems (electricity, steam, water, etc.). A detailed, system-specific analysis will allow the Laboratory to plan for future upgrades, maintenance and avoid Mission-critical system failures.

Data Center Consolidation

To promote energy efficiency and power/cooling reliability, planning is being conducted for potential consolidation of on-site data centers.

Lab Backfill Planning

Planning is underway for potential upgrade and reuse of laboratory and office space vacated by moves into the new ESB and APCF facilities. This represents an opportunity to consolidate scattered research work, upgrade lab space and clean out buildings slated for D&D.

Programmatic Initiatives

APS Upgrade

The Advanced Photon Source (APS) is undergoing a major upgrade to add new X-ray capabilities, make existing X-ray capabilities 100 to 1000 times more luminous, almost double the number of experiments that can be carried out in a single year, and significantly increase the number of users the facility can accommodate. The performance improvements will allow the APS to better address the nation's sustainable energy and health research needs. Several other smaller-scale programmatic projects are requested that would further expand the APS's capabilities and accommodate increased staffing and users.

CARIBU

The U.S. Department of Energy (DOE) is also committed to continuing efficiency and intensity upgrades to the target and source beamlines of Argonne Tandem Linac Accelerator System (ATLAS)/Californium Rare Ion Breeder Upgrade (CARIBU). As part of these projects, a CARIBU target transfer capability is being considered.

Advanced Photon Source (APS)

MIRA Supercomputer in Building 240 (TCS)

Exascale

Concept development is underway for a proposed Exascale Computing Supercomputer Facility initiative; an attempt to advance capabilities to one million trillion calculations (10^{18}) per second (known as exascale). Preliminary planning for the support infrastructure required for the Exascale project is underway. Infrastructure upgrades and capability expansions are necessary for the immense cooling and power required, which will be accommodated with increased capacities at the Chilled Water Plant (CWP) and Electrical Substation. Pending funding determinations, completion of such major projects would have a dramatic impact on the ability of the Laboratory to extend cutting edge DOE science initiatives.

Nuclear Science and Technology (NS&T)

Argonne's Nuclear Science and Technology programs rely upon the existing site infrastructure to conduct advanced modeling and simulation, to conduct experimental work with and without radioactive materials and to provide an atmosphere that will attract bright and energetic young scientists and engineers to Argonne's NS&T programs. Maintaining and improving site infrastructure that supports Argonne's Nuclear Science and Technology mission is critical to the near-term and long-term success of Argonne. Planning is underway to determine ways to support NS&T programs while meeting other laboratory objectives.

Institute for Molecular Engineering (IME)

The Institute of Molecular Engineering is at the forefront of an emerging field. This new field involves the incorporation of synthetic molecular building blocks including electronic, optical, mechanical, chemical, and biological components into functional systems that will impact technologies from advanced medical therapies to quantum computing. IME will be moving into the MEM expansion of the Energy Science Building when completed in FY 2014.

Center for Electrical Energy Storage (CEES)

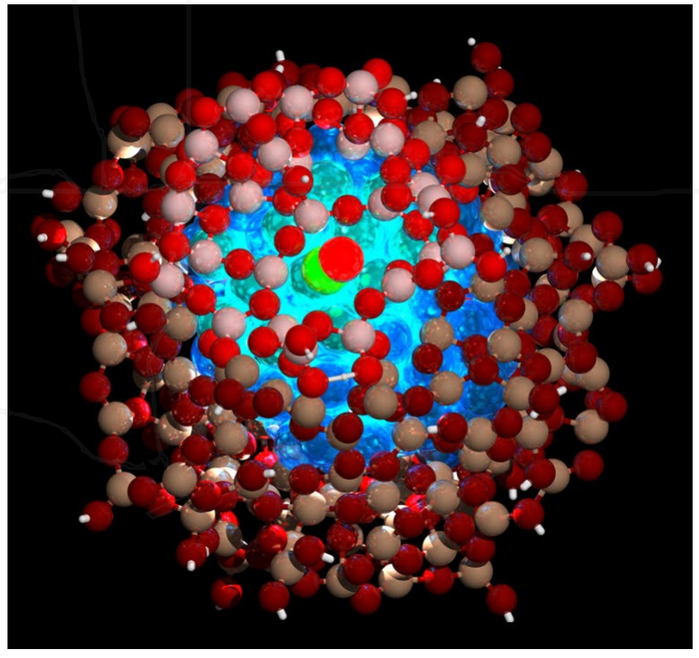
The Center for Electrical Energy Storage (CEES) was funded in FY 2013 and tackles the scientific limitations of today's electrochemical energy storage technologies for transportation, residential, and commercial use. CEES is one of two Energy Frontier Research Centers (EFRCs) centered at Argonne.

Institute for Atom-Efficient Chemical Transformations (IACT)

The Institute for Atom-Efficient Chemical Transformations (IACT) was also funded in FY 2013 and employs a multidisciplinary approach to address key catalytic conversions that could improve the efficiency of producing fuels from biomass. IACT is one of two Energy Frontier Research Centers (EFRCs) centered at Argonne. IACT will make use of the Advanced Photon Source at Argonne National Laboratory and several Office of Science computational facilities.

Northwestern-Argonne Institute of Science and Engineering (NAISE)

A Chicago-based consortium led by Northwestern University in FY 2013 was awarded $25 million over five years from the National Institute of Standards and Technology (NIST), an agency of the U.S. Department of Commerce, to establish a new center of excellence for advanced materials research. The Center for Hierarchical Materials Design (CHiMaD) will focus on developing the next generation of computational tools, databases and experimental techniques to enable the design of novel materials, one of the primary goals of the Obama administration's Materials Genome Initiative (MGI).



Projects Supported by Laboratory Operating Funds (IGPP)

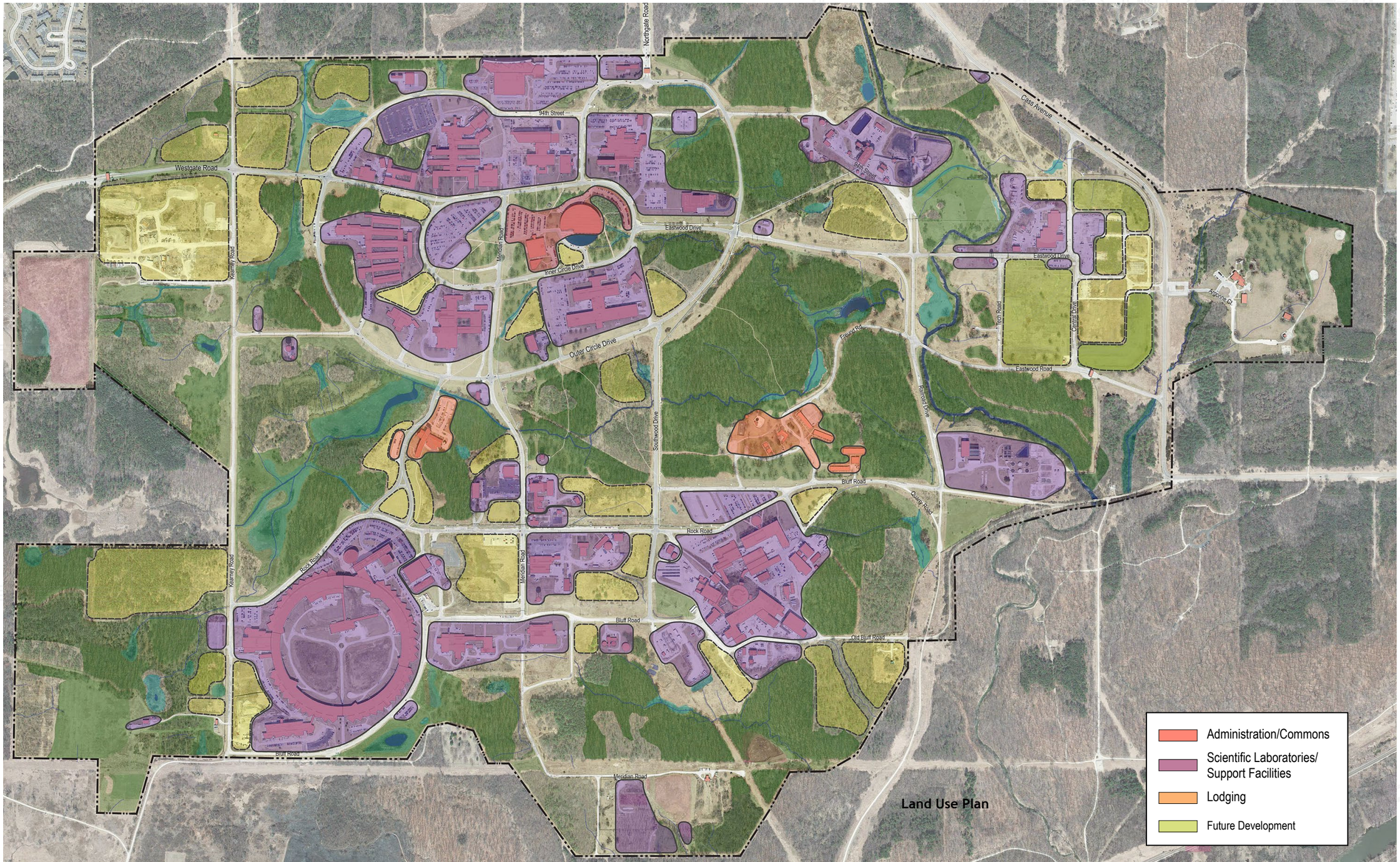
Argonne uses internal operating fund projects – Major Repair (MR) program and IGPP funding – to address pressing needs in facilities and infrastructure. The MR program provides replacement, repair, or maintenance funding for existing facilities and infrastructure. The IGPP funding program addresses buildings and infrastructure facility upgrades, rehabilitates utility and site infrastructure, and supports energy-saving projects. IGPP projects are general, institutional, (<$10 million) projects that benefit multiple cost objectives and can be completed with indirect funding.

DOE-EM Funding

Removal of legacy facilities supports responsible stewardship of nuclear material, contaminated equipment and facilities, aligns infrastructure assets with mission performance and reduces overhead costs associated with nuclear and radiological facilities. Current estimates indicate a total remaining unfunded non-recurring liability of approximately $600 million.

A significant portion of the Laboratory's unfunded liability cost is legacy waste. Decontamination and Decommissioning (D&D) and demolition comprise the remaining needs. The Laboratory's strategy is to seek DOE-EM funding to address these needs. Proposed DOE EM-funded projects include:

Building 200: MA/MB D&D	**42,000 gsf**
Buildings 361, 375, and 391: (IPNS) D&D	**64,000 gsf**
Building 212: Cleanout and D&D	**305,000 gsf**
Building 331: Cleanout and D&D	**39,000 gsf**
Total:	**450,000 gsf**


Northgate Road
94th Street
Westgate Road
Kearney Road
Meridian Road
Eastwood Drive
Inner Circle Drive
Outer Circle Drive
Cass Avenue
Eastwood Lane
Central Drive
Ten Road
Eastwood Road
Rock Road
Bluff Road
Old Bluff Road
Meridian Road
Land Use Plan
Administration/Commons
Scientific Laboratories/ Support Facilities
Lodging
Future Development

3.2 LAND USE

This land use plan is intended to efficiently support the evolving facility needs of scientific programs. Key elements of these needs include consolidation of programmatic laboratory locations, co-location with other related scientific programs, room for expansion/new programs, and fit between laboratory needs and available facilities. The result of effectively meeting all of these needs is a higher level of mission readiness for Argonne National Laboratory.

Guiding Principles

Guiding principles (see pages 16-17) ensure that the ongoing development on the Argonne campus will be done in a way that preserves and enhances other assets. The Visual Character goal is to create a well-planned campus with streetscapes and landscapes that reflect a high-quality working environment. Environmental Stewardship promotes implementation of proactive policies and procedures to achieve energy-efficient and environmentally responsible development. This includes meeting DOE sustainability targets. The goal of Cultural Resource Management is to manage and preserve campus cultural resources including archeological areas, eligible historic structures, and eligible historic districts. The final guiding principle is Accessibility that improves the movement of people, emergency vehicles, services and goods throughout the campus.

Preservation of Sensitive Environmental Areas

The 1,500 acres of land in the Argonne campus includes numerous areas of exceptional ecological value and biodiversity (see page 21). Underlying proposed land use development is preservation and stewardship of sensitive environmental areas. These areas include wetlands, streams, floodplains and other high quality natural environments.

Land Uses

The Land Use Plan (to the left) profiles five different basic categories of land uses:

Administration/Commons - Administration uses include Argonne, Argonne Site Office and DOE offices in Building 201. Commons uses include the Cafeteria in Building 213 and Abri Bank in Building 233. These provide administrative direction, and a crossroads for site-wide staff support.

Scientific Laboratories/Support Facilities - Scientific Laboratories and Support Facilities covers the bulk of the facilities supporting core research capabilities (see pages 10-11) at Argonne National Laboratory. Within this category are laboratories, offices, user facilities, supporting utility systems, and parking. Some of the facilities in this land use category are on the EM list for removal (see page 50). Once these structures are removed, surface parking or open field will be the most likely land uses due to potential contamination in the soil.

Lodging - Lodging uses include the Argonne Guest House, and lodging facilities including the Freund Lodge in the 600 Area.

Future Development - Future Development zones are areas that are not currently in active use, are not sensitive environmental areas, and are location close to where expansion of existing facilities would provide the most value. Future Development areas of particular note include those near the Advanced Photon Source for scientific uses and support that relate to APS; areas in/near the 200 Area for expansion of scientific programs there; the East and 800 Areas for potential research park type uses; and the 300 Area for future potential future user facilities. Note that areas within the Scientific Laboratories/Support Facilities land use can supplement Future Development land use areas for development of new facility projects.

Sensitive Environmental/Other - In addition to sensitive environmental areas this category includes a variety of land areas that are not part of the areas outlined in the above four land uses above. They include Argonne Park, Child Care facilities, relatively remote parcels of land, smaller strips of land near roadways, and areas being monitored for contamination. Miscellaneous and remote parcels of land could be moved into the Future Development land use when development potential is greater.

More information about land use planning is available in the Land Use and Natural Resource Management Plan. This plans includes more in-depth discussion of:

- Climate change adaptation
- Invasive species control
- Sustainable landscapes planning and management
- Land use planning and natural resource management organization
- Communication outreach

3.3 MODERNIZATION PLAN PHASES

This section is divided into phases of Near-Term, Five and Fifteen+ years. Each phase includes projects planned for that specific time frame, expected building demolition, as well as other significant changes in the physical development pattern. The projects depicted in these illustrative site plans are still in the preliminary planning phases; exact location, size, programmatic organization(s) or numbers of occupants are still undetermined. The site plans indicate a general location for those components as they are presently conceived, but do not reflect exact building footprints.

EXISTING / NEAR-TERM PLAN

A. ESB and APCF
The Energy Sciences Building (241) and the Advanced Protein Crystallization Facility (446) are nearing completion.

B. Off-Site Bicycle Access
A bicycle path parallel to Northgate from Cass Avenue will improve the safety for bicyclists coming to Argonne. Bicycle access from the north and west will minimize traffic conflict with trucks that are now entering from Eastgate.

C. Bike Lane Enhancements
Bicycle lanes will be added when possible to on-site roadways, especially in and around the 200 Area. Bicycle traffic will continue to be on roadways to minimize conflict with pedestrians on sidewalks. Exceptions to this policy may occur on extra-wide sidewalks where there is no nearby roadway, and bicycle access is clearly indicated.

NEAR-TERM ON-SITE TRUCK ACCESS

A. Eastgate On-Site Truck Access

On-site truck access, including construction vehicles and specialty delivery trucks have been shifted to Eastgate site entry. Badging for truck drivers is now available at Eastgate. A sign is installed at the Northgate/Cass Avenue entry indicating all trucks coming to Argonne to continue south to the truck entrances at Building 46 and Eastgate. This access will reduce the mistaken access of delivery trucks into Northgate, and the minimize parking of numerous trucks along Northgate near the visitor entry to the site.

B. 200 Area Pedestrian Zone

Another objective of truck access from Eastgate is to significantly reduce the number of trucks that travel on roads in the 200 Area Reduced Speed Zone (shaded area). Trucks that need access to destinations in the 200 Area will also utilize the Outer Circle Drive to get close to their destinations, rather than going through the Pedestrian Zone.

NEAR-TERM VEHICULAR CIRCULATION

A. 200 Area Outer Circle Drive

The Outer Circle Drive will become the primary circulation road in the 200 Area. Cars coming from Northgate, Westgate and Eastgate will use it to access parking within the 200 Areas, and to get to roads leading to other parts of the Argonne campus. The speed limit on Outer Circle Drive will remain at 30 mph.

B. 200 Area Reduced Speed Zone

The area inside the Outer Circle Drive (and 94th Street) will be designated as the 200 Area Reduced Speed Zone. This zone has many pedestrian crosswalks and a speed limit of 25 mph. The primary purpose of roads in this zone is for visiting motorists to access the front of buildings, and through traffic will be discouraged.

C. 400 Area Circulator

Existing roadways around the APS are improved to accommodate vehicular access to the new Building 446, in addition to 440 and all APS LOMs.

NEAR-TERM PEDESTRIAN CIRCULATION

A. Forest Pathways

Forest pathways leading the 600 Area and the 360 Area will continue to be maintained for pedestrian use. Opportunities for additional pathways that enhance pedestrian campus access will be pursued, especially those that traverse portions of the site with particular natural beauty.

B. Sidewalk Enhancements

There will be numerous sidewalk enhancements to support pedestrian circulation throughout the Argonne campus, including:

- Sidewalk connecting Buildings 440 to 446 along Kearney Road.
- A sidewalk next to the Guest House (460) to allow a continuous pedestrian path connection from APS to the 200 Area.
- Sidewalk segment around the west end of the Inner Circle Drive to allow continuous pedestrian access around it.

Because of the lack of connecting pedestrian pathways to the surrounding communities, it is not anticipated that off-site access to Argonne will include pedestrian traffic (except from the Forest Preserve).

C. 200 Area Reduced Speed Zone

The purpose of the 200 Area Reduced Speed Zone is to enhance pedestrian access between buildings in the 200 Area, particularly to the Cafeteria, Building 213. This will support the laboratory goal of increasing the opportunities for cross-disciplinary interaction between scientists. Combined with reduction of vehicular traffic and speed, it will also increase pedestrian safety.

FIVE YEAR SITE DEVELOPMENT PLAN

A. Site Modernization and Space Utilization

Argonne facilities will be developed to continue to better meet the needs of scientific research. Development of new laboratory/office buildings and expansion of infrastructure systems will provide state -of-the-art facilities and support. These improvements will be complemented by measures to improve space utilization in new and existing structures. New and better utilized space will also allow the movement of scientific work from buildings on the EM list for Decontamination and Decommissioning, such as Building 212 and M-Wing of Building 200.

B. New Buildings / Expansions

A number of significant scientific buildings and supporting infrastructure expansions are slated for completion in the Five Year Plan including:

- Combined Heat and Power Plant (CHP)
- Expansion of Substation 551
- Materials Design Laboratory (MDL)
- Energy Innovation Center (EIC)
- Expansion of Building 240
- 440 Clean Room Expansion (CNM)
- Expansion of Chilled Water Facility 528

5 YEAR SITE DEVELOPMENT PLAN - 200 AREA

C. New Center of Gravity

The planned construction of MDL and the expansion of TCS will continue the shift in the campus center of gravity for scientists in the 200 Area toward the Energy Quad (Buildings 222, 223, 241, MDL). Removing scientific programs from 212 in preparation for D&D adds to this trend. Existing parking facilities next to Buildings 202 and north of Building 203 were built to accommodate the growing number of scientists and support staff in this part of the 200 Area.

D. Existing Building Upgrades

To better serve scientific research and improve space utilization, significant existing building renovation projects are planned, including:

- Building 200 laboratory/office renovations
- Building 201 cubicle office renovations
- Building 202 Data Center renovations
- Building 202 laboratory/office renovations
- Building 222 laboratory/office renovations
- Building 223 laboratory/office renovations

E. Landscape Enhancements

To support the continuity of the historic core of the 200 Area, street trees will be planted to replace diseased Ash trees and to create a continuous tree-lined character for the Inner Circle Drive.

15+ YEAR SITE DEVELOPMENT PLAN

A. Site Modernization and Space Utilization

Buildings listed on the EM list for removal will be vacated as a result of moves into the new buildings built in the Five Year Site Development Plan. Remaining existing structures will continue to be upgraded with renovations that support the needs of the scientific research. Improved space utilization opportunities will continue to be implemented in a manner that maximizes mission readiness.

B. Site Availability for Removed Structures

Removal of decontaminated & decommissioned (D&D) buildings on the EM list are planned to include 212, 331, the IPNS structures, and M-Wing of Building 200. These D&D projects will significantly reduce facilities maintenance and operations costs, and will free up land for other future development.

C. Existing Building Upgrades

To better serve scientific research and improve space utilization, continued existing building renovation projects are planned, including:

- Building 360 laboratory/office renovations
- Building 362 laboratory/office renovations
- APS beamline upgrades

D. Site Enhancements

Infrastructure systems including site lighting, wayfinding, electrical distribution, and underground utilities will be upgraded to improve facility support, and enhance the visual character of the campus.

E. Heart of the Campus

The 15 Year Plan includes transformation of the central portions of the 200 Area into the “heart of the campus”. Improvements include a pedestrian plaisance that stretches from Building 201 to Building 200, and an outdoor pavilion structure that can host numerous events and performances, with grassy areas for people to sit and enjoy them.

15+ YEAR SITE DEVELOPMENT PLAN - 200 AREA

E. Existing 200 Area Building Upgrades

To better serve scientific research and improve space utilization, continued existing 200 Area building renovation projects are planned, including:

- Building 200 laboratory/office renovations
- Building 201 cubicle office and lobby renovations
- Building 202 Data Center renovations
- Building 202 laboratory/office renovations
- Building 221 laboratory/office renovations

PLAN SUMMARY

This Plan provides a flexible framework that establishes an integrated implementation schedule for long-range modernization at Argonne. The key planning objective is to fully support Argonne's leading-edge science missions. Adherence to the guiding principles described in this Plan will also result in Argonne's facilities becoming increasingly effective and attractive to recruit and retain the scientific and operational talent necessary to attain the envisioned class of discoveries consistent with its future vision.

Argonne's facilities and infrastructure will become more efficient to maintain and operate; the elimination of surplus and substandard facilities will reduce the overall facility footprint. Argonne will benefit from reduced operating costs, improved productivity and increased performance in meeting energy-related objectives. A significant part of Argonne's deferred-maintenance total is related to facilities that are identified for replacement as part of the modernization program. Therefore, the most significant reduction in deferred maintenance will occur after replacement facilities are completed and obsolete facilities are demolished.

Reducing or further delaying the SLI modernization funding will seriously affect the viability of various existing facilities and in some cases, limit Argonne's ability to ensure mission readiness in future years.

APPENDIX 1 - 200 AREA PARKING

Walking Distance to Parking

The dotted circles indicate walking radius of 1,100 feet from Buildings 201 and 241. Most pedestrians can walk the distance from the center to the circle in less than four minutes. They reflect the maximum recommended distance from a building to parking.

Pedestrian Safety

Pedestrian safety is important, especially at roadway crosswalks. Given the significant amount of pedestrian traffic all roadways inside the area bounded by Outer Circle Drive and 94th Street have a reduced 25 mph speed limit.

Highest Use Parking Areas

The red and orange areas indicate that the most heavily used parking is near 201, the Energy Quad (Buildings 222, 223, 241), and 240.

Underutilized Parking

There is significant underutilized parking capacity in the 200 Area. Lots of particular note are those behind 203, near 202, and near 224. Much of the underutilized parking near 212 will be used with the proposed Energy Innovation Center (see the Five Year Plan).

Parking Utilization

Parking utilization reflects the maximum occupancy of each parking lot during a typical day:

- 95 - 100% Utilized
- 80 - 95% Utilized
- 50 - 80% Utilized
- < 50% Utilized

APPENDIX 2 - 400 AREA PARKING

Walking Distance to Parking
The dotted circle indicates walking radius of 1,100 feet from Building 401. Most pedestrians can walk the distance from the center to the circle in less than four minutes. They reflect the maximum recommended distance from a building to parking.

Pedestrian Safety
Pedestrian safety has been enhanced by minimizing the number of parking lot access sidewalks that cross roadways.

Highest Use Parking Areas
The red and orange areas indicate that the most heavily used parking are near the APS ring, 401, 402 and 440.

Underutilized Parking
There is underutilized parking capacity within the 400 Area. The overflow parking lot of particular note is located near 450. To enhance vehicular safety, parking along the roadway shoulder should be discouraged in favor of using the lot near 450. Additional parking near 440 was recently constructed to accommodate increasing parking needs due to the anticipated APS upgrade project.

Parking Utilization
Parking utilization reflects the maximum occupancy of each parking lot during a typical day:

- 95 - 100% Utilized
- 80 - 95% Utilized
- 50 - 80% Utilized
- < 50% Utilized

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