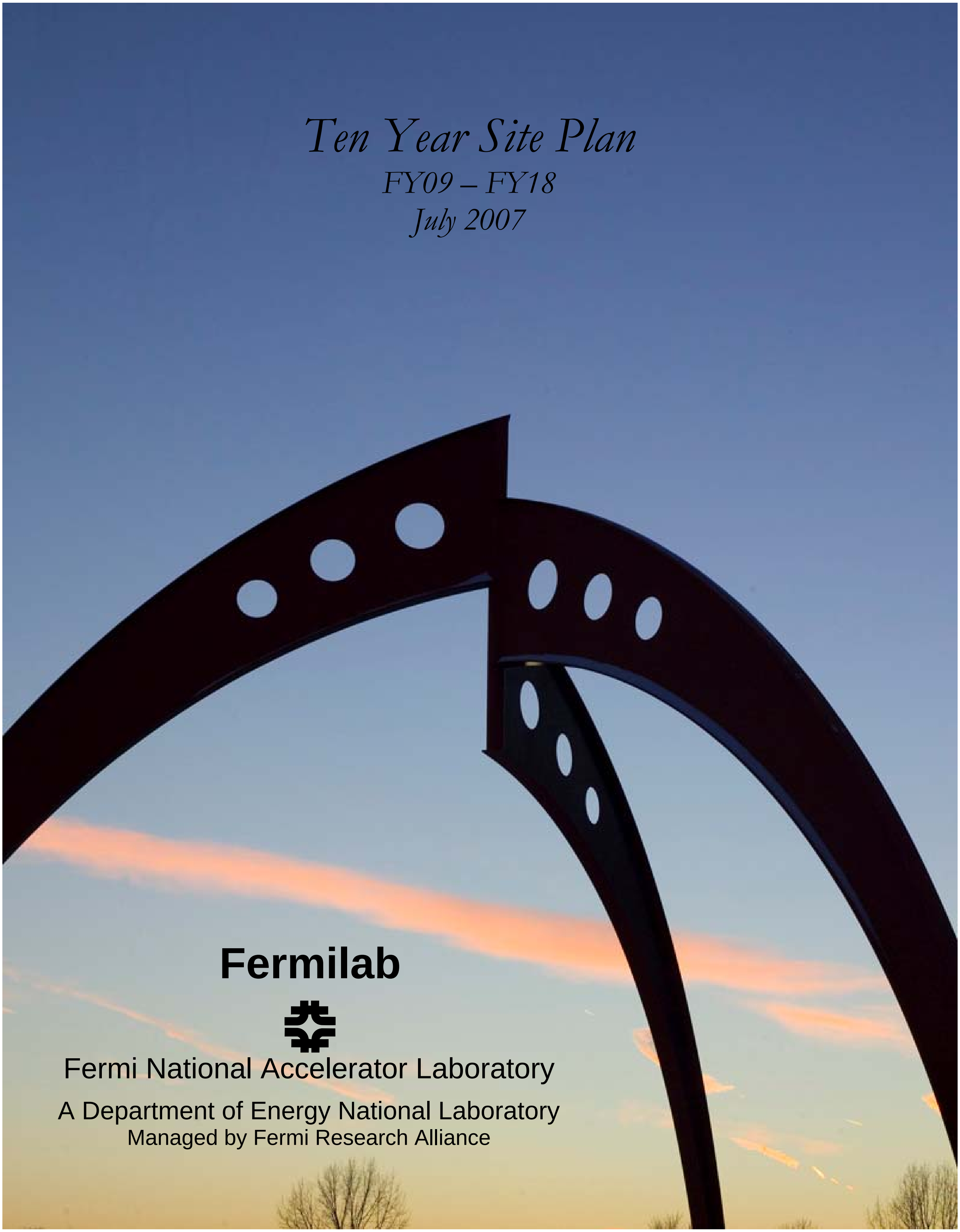


Ten Year Site Plan

FY09 – FY18

July 2007

Fermilab

Fermi National Accelerator Laboratory

A Department of Energy National Laboratory

Managed by Fermi Research Alliance

The Fermilab Ten Year Site Plan (TYSP) describes the current and future mission at Fermi National Accelerator Laboratory. Under the Department of Energy's Real Property Management (RPAM) Order, DOE O 430.1B, this plan serves as one of Fermilab's planning documents with its annual updates to mission opportunities and resource requirements. The TYSP also supports development of the Integrated Facilities and Infrastructure (IFI) cross cut budget and aims to describe how the Laboratory's real property assets support the Department's Strategic Plan and annual program direction.

Integrating functional components of land use, facilities and infrastructure acquisition, maintenance, recapitalization, safety, security, and disposition plans into an all-encompassing site wide management plan, the TYSP includes an assessment of past performance and projected future outcomes, and strengthens communication and accountability.

In addition to a discussion on current mission, the Fermilab TYSP addresses future mission possibilities as defined in the Fermilab Long-Range Planning Committee 2004 report titled, "The Coming Revolution in Particle Physics," recent Laboratory presentations as well as the October 2006 Particle Physics Project Prioritization Panel (P5) report, "The Particle Physics Roadmap." With annual updates, the TYSP serves as the record of Fermilab planning consistent with High Energy Physics program direction that ensures resources are identified and allocated in the most efficient and effective manner. The mission discussion highlights Fermilab's position at a scientific crossroads with the end of the Tevatron Run II and the startup of the Large Hadron Collider.

Figure 1
Fermilab site, aerial view

The TSYP also highlights Fermilab's recent successes such as its partnership with the neighboring City of Batavia and the associated electrical Pi pole replacement. The Laboratory has demonstrated stewardship with respect to recent facility demolitions and well-executed GPP completions such as GCC Computer Room Upgrades, LCC Room 107 Upgrade and the LHC @ FNAL Upgrades in Wilson Hall. Finally, this year's Science Laboratory Infrastructure (SLI) proposals address the Laboratory's most critical infrastructure systems and are presented in this TYSP. These SLI project proposals consider the Laboratory's general infrastructure needs and long-term viability under any mission scenario.

While Fermilab's current mission and associated resource requirements are presented in terms of years 2010 and 2020, more detailed resource requirement projections will be needed as mission planning continues. Furthermore, in acknowledging Fermilab's status as a world-renowned center of research and development on particle accelerator technology, the TYSP solidifies Fermilab's future as the leading U.S. laboratory for hosting particle physics research. The ongoing planning process and associated resource requirements will be satisfied through reuse of existing facilities or with modernization or new construction consistent with sustainability guidelines. These attributes and the flexibility to adjust to new mission needs position Fermilab well in its collaboration with the international network of particle physics laboratories and institutions. Such operational versatility also helps Fermilab align to goal 5.3 of the Department's Strategic Plan: "Build, modernize, and maintain facilities and infrastructure to achieve mission goals and ensure a safe and secure workplace."

In 1967 the U.S. Atomic Energy Commission, under a bill signed by President Lyndon B. Johnson, commissioned the National Accelerator Laboratory. Renamed on May 11, 1974, in honor of Enrico Fermi, the 1938 Nobel Prize for Physics winner, Fermi National Accelerator Laboratory's primary mission is advancing the understanding of the fundamental nature of matter and energy.

Fermilab is the largest laboratory in the United States dedicated to particle physics. The Tevatron, commissioned in 1983, is four miles in circumference and is the highest energy collider in operation. Housed in a tunnel 30 feet below the ground, a series of accelerators send particles around the Tevatron at 99.9999 percent of the speed of light in a vacuum. As the particles complete the four-mile course nearly 50 thousand times a second, two kinds of particles, protons and antiprotons, circulate around the ring in opposite directions. At two points in the ring, streams of particles collide into each other at the rate of almost two million each second. To see these tiny particles, two collider detectors (CDF & DZero), each about four stories high and 5,000 tons, contain instrumentation to study the collisions. Teams of scientists build and operate these detectors.

The newest component in the accelerator chain, the Main Injector, was added in 1999. This increased the number of proton-antiproton collisions in the Tevatron, enhancing the chances for important discoveries in Run II. Since it began in March 2001, Run II has involved more than 1,500 particle physicists exploring the unification of forces, the nature of dark matter, and the mysteries of antimatter using the detectors (CDF & DZero) at the Fermilab Tevatron.

In addition to the collider experiments at CDF & DZero, the accelerator complex supports neutrino experiments, experiments with hadron beams and experiments to test new accelerator and detector technologies. All of these activities serve to accomplish the mission of the Department of Energy's High Energy Physics (HEP) program to discover and explore the laws of nature as they apply to the basic constituents of matter, and the forces between them. The mission centers on investigations of elementary particles and their interactions, advancing Department of Energy (DOE) missions and objectives through the development of key cutting-edge technologies and trained manpower.

Fermilab is situated on a 6,800-acre site 30 miles west of Chicago, on land previously home to farms and the Village of Weston. Many of the original farm and village structures are still in use by the Laboratory for housing, storage and laboratory space. Some of these farm structures are more than one hundred years old. All other facilities were built after site acquisition to house people and experiments.

Fermilab's proximity to Chicago allows it to benefit from a major U.S. transportation, educational, cultural and metropolitan hub. The collection of physicists, engineers, and technical staff who operate and improve the accelerator complex is an international community. Approximately 4,000 employees, visitors and users work at Fermilab, many from Fermi Research Alliance (FRA), LLC member universities. FRA, an alliance between Universities Research Association, Inc., and the University of Chicago, commenced management and operational responsibility of Fermilab on January 1, 2007.

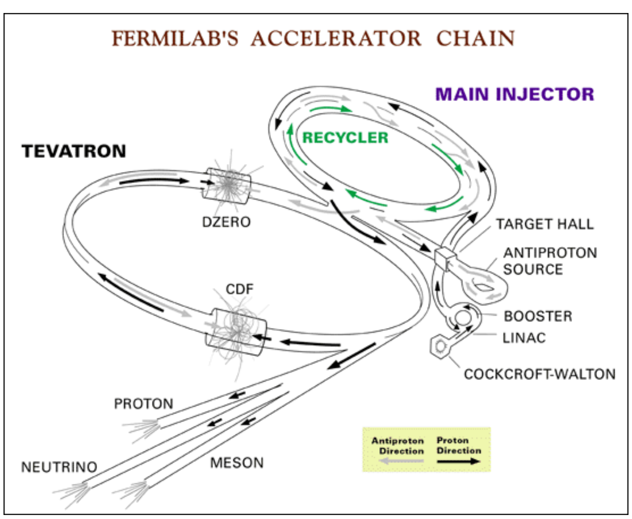
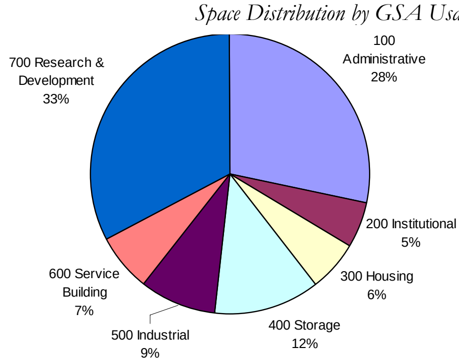


Figure 2
Fermilab's accelerator chain

With 346 buildings comprising 2.4 million gross square feet and miles of utility infrastructure, including electrical, natural gas, pond water systems, potable water and sanitary lines, Fermilab's total real property replacement plant value is $1.5 billion, including its programmatic tunnel assets. The detailed property information and capitalized value detail associated with each of these assets is maintained in the United States Department of Energy's (DOE) Facilities Information Management System real property database. All of the Laboratory's buildings are used and owned by DOE; the usage is predominately divided among research and development space and administrative areas (Figure 3). The annual operating budget of the Laboratory is in the range of $300 million, funded largely by the Office of High Energy Physics (HEP), part of DOE's Office of Science.

In a September 9, 2004, memo, "Maintenance Investment and Replacement Plant Value" the Office of Science (SC) and Office of Engineering and Construction Management (OECM) baselined Fermilab's infrastructure Replacement Plant Value (RPV) at $518M. Fermilab's February 2007 RPV snapshot, used as the baseline RPV in this Ten Year Site Plan is $676M, including the conventional components of the OSF 3000 structures. Fermilab will continue to notify the Office of Science regarding additional RPV changes beyond 5% in any asset category (buildings, OSFs or Programmatic OSFs), as outlined in the September 2004 memo. Additional RPV data and discussion, including projections for the 10-year planning period, is included in Section D.6.

Figure 3
Space Distribution by GSA Usage



As the administrative center of the Fermilab campus and comprising 20% of the building RPV is Wilson Hall. This 16-story office building is 22% of the total Fermilab gross square footage and 77% of the site's office space. Fifteen percent of the remaining square footage – about 1/3 of all Fermilab buildings – is accelerator service buildings, with grade level access and mechanical support along the length of the accelerator chain.

As the age profile in Figure 4 indicates, the ages of Fermilab buildings vary widely. Of the total Fermilab square footage, 63% represents buildings more than 30 years old, with 6% over 100 years old (20 buildings). The buildings less than 40 years old were constructed specifically for Laboratory operations in the early 1970s, while the buildings older than 40 years were part of the original land acquisition for the site and included a residential village complete with utility systems. These older facilities present different operational and maintenance challenges in comparison to the buildings less than 40 years old (127 buildings or 37% of total number of buildings). Generally, these newer buildings fare well when the ratio of deferred maintenance to RPV, or the Facility Condition Index (FCI), is considered. In FY06, the overall site building FCI was 1.5%, with 69% of buildings scoring as Excellent. When measured by gross square footage, rather than number of buildings, 80% of the facilities rate Excellent (<2% FCI).

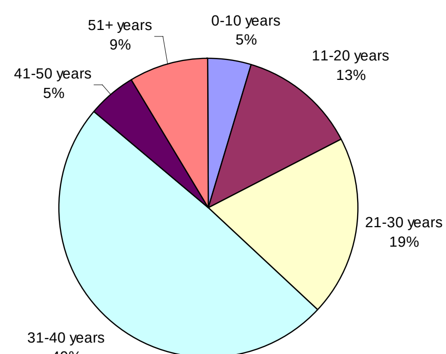


Figure 4
Building Age

The existing building facilities are meeting the current operational and experimental needs of the site, which is currently operating with an overall Asset Utilization Index of 0.988 (Excellent). Specific facility reuse and consolidation plans related to mission needs are discussed in this Ten Year Site Plan. Recently, the Meson Detector Building underwent a series of enhancements to enable reuse as a test beam area for Superconducting Radiofrequency cavities. In similar situations, Laboratory management works to identify and satisfy facility needs through re-assignment and modernization. However, as future mission opportunities continue to develop, additional new experimental facilities will likely be needed.

Similarly, the Laboratory's utility infrastructure may require expansion as future mission is identified. Deferred maintenance requirements of the Laboratory's utility infrastructure currently comprises 83% of the site's total FY06 Deferred Maintenance backlog. Most significantly, the Industrial Cooling Water and Electrical system are in need of investment. While substantial GPP efforts identified in the FY09 Integrated Facilities and Infrastructure crosscut budget plan, investment via the Office of Science's SLI Modernization Initiative will definitively improve the reliability of these most critical utility systems. Finally, when siting future projects, Fermilab's Facilities Engineering Services Section (FESS) works closely with experimental planning groups to efficiently utilize existing utilities or easily expand such facilities.

The utility systems include the following assets:

- Electric – 345kV power is received from utility grid at two primary substations, 280 secondary substations, 110 miles of cable (80 miles underground)
- Natural Gas – 14 miles of underground piping
- Cooling Pond Water – 140 acres of ponds with return and supply channels
- Industrial cooling water – 21 miles of piping; also serves as the site's source of fire protection water
- Sanitary System – 12 miles of sewer collection piping and lift stations
- Domestic water – During FY05/06 Fermilab installed new domestic water supply mains between the east and west side of the campus, providing site-wide water from the City of Warrenville municipal water service. The Fermilab wells and treatment facilities have been disconnected from the domestic water network.

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A. Introduction

From its founding in 1967, Fermilab's mission has remained to advance the understanding of the fundamental nature of matter and energy, by providing leadership and resources for qualified researchers to conduct research at the frontiers of high-energy physics and related disciplines.

This section of the plan describes Fermilab's core competencies, and the Laboratory's existing scientific operations. The vision for Fermilab in 2010 and 2020 as discussed in the Fermilab Director's May 25, 2004, publication, "Discovery at Fermilab: The Next Twenty Years" serves as a roadmap for describing, planning and directing the future of the Laboratory.

B. Core competencies

Fermilab leads the nation in the construction and operation of large facilities for particle physics research, and in developing the underlying technology for high-energy physics research.

The Laboratory's mission is built on a foundation of core competencies:

1. Construction and operation of experimental facilities for particle physics and particle astrophysics
2. Research, design, and development of accelerator technology
3. High-performance scientific computing and networking
4. International scientific collaboration
5. Theoretical particle physics and astrophysics

C. New Initiatives at Fermilab

1. Overarching Goals
   a. Enable the most powerful attack on the fundamental science questions of our time
   b. Provide world class facilities for HEP as part of the global network
   c. Develop science and technology for particle physics and cosmology research
2. Specific Goal: Resolve US crisis of no domestic program beyond 2010:
   a. Recovering the energy frontier through construction of an International Linear Collider
   b. Maintain the world's foremost neutrino program through enhancement of the proton accelerator complex, and construction and operation of next generation experiments including NOvA.

Figure 5
(from left) April 2006:
Rob Roser (CDF),
Secretary of Energy Samuel Bodman,
Fermilab Director Pier Oddone
Jerry Blazey (DZero)
& Office of Science Director Ray Orbach

WHAT IS THE NATURE OF THE UNIVERSE AND WHAT IS IT MADE OF?
WHAT ARE MATTER, ENERGY, SPACE, AND TIME?
HOW DID WE GET HERE, AND WHERE ARE WE GOING?

Throughout human history, scientific theories and experiments of increasing power and sophistication have addressed these basic questions about the universe. The resulting knowledge has led to revolutionary insights into the nature of the world around us. In the last 30 years, physicists have achieved a profound understanding of the fundamental particles and the physical laws that govern matter, space, and time. Researchers have subjected this "Standard Model" to countless experimental tests; and again and again, its predictions have held true. The series of experimental and theoretical breakthroughs that combined to produce the Standard Model can truly be celebrated as one of the great scientific triumphs of the 20th century.

Now, in a development that some have compared to Copernicus' recognition that the earth is not the center of the solar system, startling new data have revealed that only five percent of the universe is made of normal, visible matter described by the Standard Model. Ninety-five percent of the universe consists of dark matter and dark energy whose fundamental nature is a mystery. The Standard Model's orderly and elegant view of the universe must be incorporated into a deeper theory that can explain the new phenomena. The result will be a revolution in particle physics as dramatic as any that have come before.

From "Quantum Universe, The Revolution in 21st Century Particle Physics, 2004, DOE/NSF and the High Energy Physics Advisory Panel in response to a charge by Dr. Raymond L. Orbach, Director of the Office of Science of U.S. Department of Energy and Dr. Michael Turner, Assistant Director of Mathematics and Physical Science of the National Science Foundation.

D. Fermilab Today

Fermilab is the largest particle physics laboratory in the United States. Its scientific program is designed to address key scientific issues as identified in the report, "Quantum Universe." The Tevatron collider is the highest energy collider in operation and is the only facility in the world that can now address many of the central questions above. Fermilab's accelerator complex supports the most diverse particle physics program of any laboratory in the country, a program that includes collider experiments, neutrino experiments, experiments with hadron beams, and experiments testing new accelerator and detector technologies.

About 3,000 physicists currently perform research with Fermilab facilities on the most compelling questions in particle physics:

1. Run II of the Tevatron: Over 1,500 particle physicists explore the unification of forces, the nature of dark matter, and the mysteries of antimatter using the CDF and DZero detectors at the Fermilab Tevatron. Measuring the mass of the top quark and the W boson more precisely at the Tevatron will probe whether the Standard Model is showing signs of the new physics ahead. The experiments are exploring new territory in the hunt for extra dimensions, supersymmetry and quark substructure.

2. Research at the Large Hadron Collider will continue exploring the new physics opening up at the energy frontier, U.S. physicists will use Fermilab as the home laboratory for research using the Large Hadron Collider (LHC) at CERN. Fermilab is the research center for the

collaboration of 400 physicists from U.S. institutions looking for discoveries at the energy frontier with data from the CMS experiment at the LHC. It is also the host laboratory for the collaboration of accelerator physicists from three laboratories building accelerator technology for and doing accelerator research with the Large Hadron Collider.

3. Neutrino physics: About 250 physicists conduct research at Fermilab using the only two neutrino beamlines operating in the U.S. The MiniBooNE experiment is looking for exotic neutrinos using a low-energy neutrino beam from the Fermilab Booster. The MINOS experiment's 5,400-ton Far Detector, sited more than 400 miles northwest of Fermilab in the Soudan mine in northern Minnesota, measures the evolution of neutrinos produced by the Fermilab Main Injector. NuMI's 980-ton near detector at Fermilab enables study of neutrino oscillations. In addition, smaller experiments are being proposed to study nuclear structure with neutrinos, using both existing beams.

4. Particle Astrophysics: Fermilab was the first particle physics laboratory to establish a group dedicated to the exploration of the exciting science at the convergence of particle physics and astrophysics. The laboratory builds and operates experiments for three large collaborations, whose membership totals about 650 scientists doing research in particle astrophysics. The Sloan Digital Sky Survey, a continuing source of astronomical discoveries, has been used with NASA's Wilkinson Microwave Anisotropy Probe mission to pin down the amount of dark matter and dark energy in the universe. The Cryogenic Dark Matter Search, operating in the Soudan mine, is the leading experiment in searching for direct evidence of the Dark Matter halo and its interactions with normal matter. The Auger Cosmic Ray Observatory, in the high Argentine desert, is the largest array of detectors in the world observing cosmic rays.

5. All of these experimental programs are unique, and all are recognized as essential components of the world program in particle physics. Fermilab is the leading U.S. laboratory studying unification with colliders and the only one studying neutrinos with accelerators.

E. Fermilab's leadership role

The system of seven accelerators at Fermilab provides a uniquely diverse and flexible platform for doing experiments across the spectrum of particle physics. As a result, the array of experiments operating at the Fermilab accelerators covers the widest possible range of physics at any U.S. laboratory, and the community of scientists doing research with them is the largest. The collection of physicists, engineers, and technical staff who operate and improve the accelerator complex is an asset of incalculable value in planning the future. The large Fermilab site and its surroundings provide an excellent physical environment for building large new accelerators. Fermilab is also a world-renowned center of research and development on accelerator technologies, such as superconducting magnets and superconducting radio frequency accelerating structures. For all of these reasons Fermilab is, and will remain, the leading U.S. laboratory for hosting particle physics with accelerators. At the same time, all of the major future projects at Fermilab will be collaborative efforts within the international network of particle physics laboratories and institutes.

F. Fermilab in 2010

By the year 2010, particle physics is likely to be in the midst of the revolution. New data from the Large Hadron Collider (LHC) at CERN in Switzerland will show signs of whatever new physics – extra dimensions, supersymmetry, one or more Higgs bosons – shows up at the TeV mass scale. A new round of neutrino experiments will have completed the first major step in

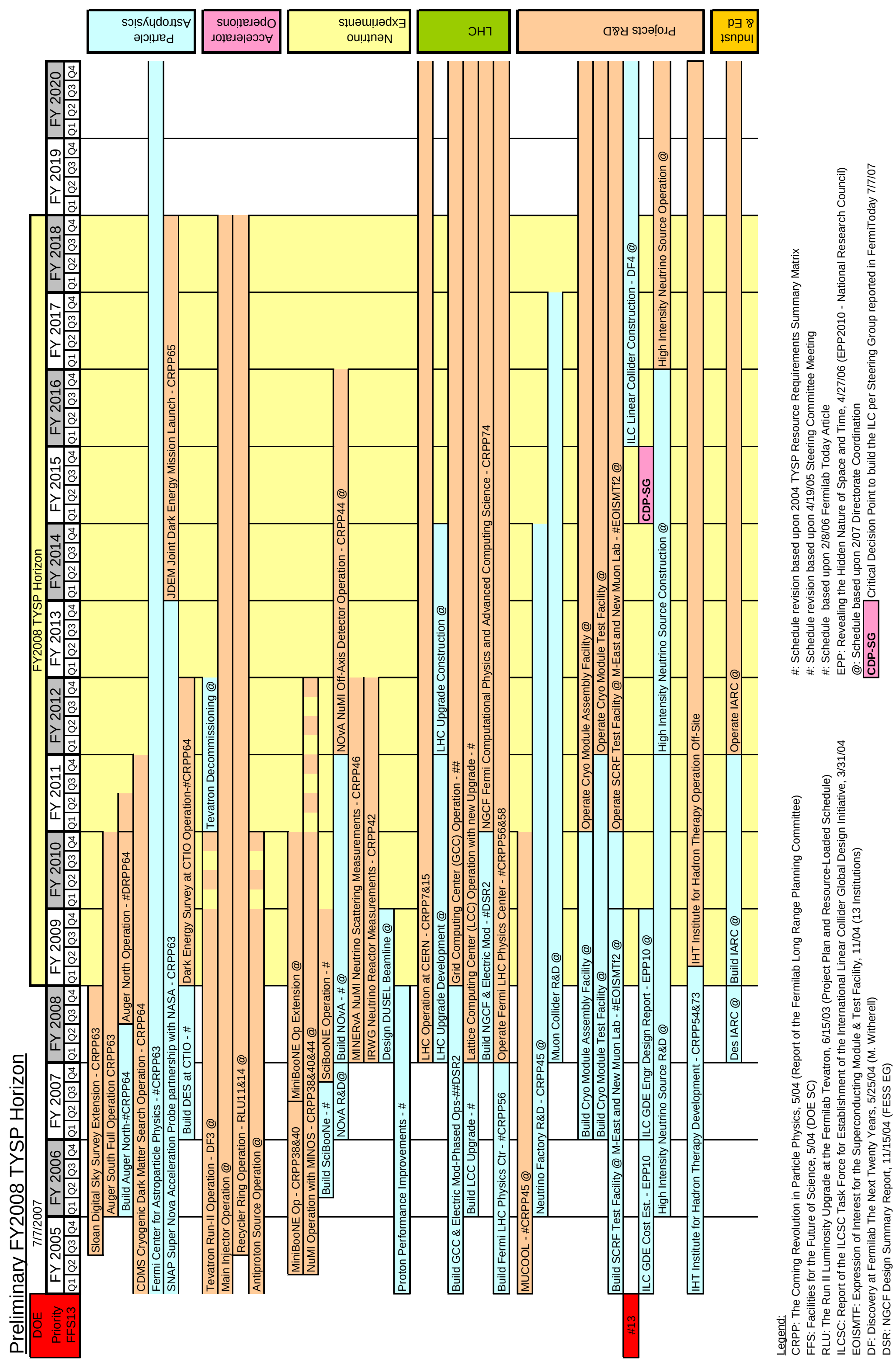

Figure 6
Fermilab's program horizon

understanding the nature of neutrino mass. If dark matter is due to supersymmetric particles, physicists should have observed their interactions underground and produced them in colliders. All of these new discoveries and measurements will lead to a new round of experiments to understand the underlying physics.

While the LHC will represent the energy frontier in 2010, the Fermilab accelerator complex will remain a unique platform for particle physics experiments. Fermilab will continue to be responsible for a large fraction of the U.S. program in particle physics at this time, with a primary role in several initiatives central to the Office of Science's Twenty Year Plan:

1. The Energy Frontier: Fermilab is the lead U.S. laboratory in the LHC Compact Muon Solenoid (CMS), the LHC Accelerator Research Program (LARP), and the ILC technology and site development programs. The ILC effort is likely to require a significant test facility on the Fermilab site by the end of the decade, dedicated to the industrialization process, leading to construction of the ILC on or near the Fermilab site in the following decade.
2. Neutrinos: Fermilab conducts the world's foremost accelerator based neutrino program based on the NuMI facility, supporting the MINOS experiment, which will be upgraded in capability to support the follow-on Nova experiment. In addition Fermilab will continue with development of technologies that could support a multi-MW neutrino source in the decade following 2010.
3. Particle Astrophysics: Fermilab provides leadership within the expanded and upgraded Cryogenic Dark Matter Search (CDMS) experiment which will extend its investigation of the nature of dark matter; the Auger cosmic ray observatory will start to operate a second array in North America, in addition to the one in Argentina. The Dark Energy Survey, based on a large new state-of-the-art camera built at Fermilab and mounted on the telescope at Chile's Cerro Tololo Inter-American Observatory, could be making first observations. Finally, Fermilab will be working with lead laboratory Lawrence Berkeley National Laboratory and other laboratories in building the Joint Dark Energy Mission.

The most important role for Fermilab in this decade will be preparing to build a new accelerator facility in the next decade.

G. Fermilab in 2020

The overarching vision for Fermilab in 2020 is that it will be the primary site for particle physics accelerators in the U.S.

In its May 2004 report, the Fermilab Long-Range Planning Committee identified two alternative visions for Fermilab in the period 2010 to 2020, depending on the development of the International Linear Collider (ILC), the next worldwide project for particle physics.

The most favorable option for U.S. particle physics is the construction of the International Linear electron-positron Collider with initial energy 0.5 TeV, built sometime in the decade 2011-2020. North America, Europe and Japan have all identified this as the next big facility for particle physics because of its unique ability to address the most important issues in the field. Representatives from North America, Asia, and Europe have established a collaboration to design this facility. It is anticipated that the ILC will be constructed and operated with international collaboration. The countries within these regions are not interested in funding a new permanent laboratory in addition to the existing national ones, so it is imperative that the plan make optimum use of the assets residing at the present laboratories.

A critical element in planning the ILC is choosing a site that is geologically suitable, located on or under available land, and at or very close to an existing particle physics laboratory that serves as host. During the long period of building up the infrastructure at the ILC site, it is critical that staff can shuttle between work at the host laboratory and at the ILC on a daily basis. Another requirement is the availability of up to 500 MW of electrical power at an affordable cost. The best site in the world, given all of these constraints, is one within 25 miles of Fermilab, and the U.S. Department of Energy has indicated that Fermilab is the preferred U.S. site. Whether the ILC is sited in the U.S., and specifically in northern Illinois, will be a decision made at the highest level of several governments. From technical and project cost perspectives, however, the best site is near Fermilab; and everything should be done to promote such a solution. Fermilab has therefore launched an effort to develop in detail all of the information needed to support a bid to host the ILC here.

The physics of the ILC will be whatever the revolutionary new physics turns out to be. Whether it is supersymmetry, extra dimensions, or some other extension of the Standard Model of particle physics, the ILC will provide a completely new type of instrument to explore the new territory. Just as the cosmic microwave background and distant supernovae provide completely different measurements needed to understand the contributions of dark matter and dark energy to the energy budget of the universe, so the ILC will provide different insights from those provided by the LHC. They may also provide indirect evidence of new physics that might come from dark matter searches or decays of B mesons.

Wherever the ILC is built, the model will be quite different from earlier accelerator projects. Several laboratories around the world will build major components of the accelerator complex and the detector, in addition to making intellectual contributions to the design. As a result, the role of the host laboratory will not be as all-encompassing as it is for the LHC or the Tevatron. Of course, the ILC would be the largest effort at Fermilab, as it would be for the other laboratories. But Fermilab could not and should not abandon its other critical roles such as its host role for the US part of the CMS collaboration, which will still be very active and producing great physics in 2020.

To follow the path of neutrino discovery will take larger experiments and more intense neutrino beams than any being built today. The NuMI neutrino beam and the MINOS experiment started operating in February 2005. They will form the basis of a series of steps along the path of discovery, each one designed to take best advantage of what is learned earlier. The next step is a larger experiment built off axis to the NuMI beam line, coupled with intensity upgrades to the existing accelerator complex. This experiment, named Nova, is currently proposed for funding starting in FY2008.

The neutrino experiments that might be operating by 2015 include Nova and a shorter-baseline experiment at Japan's

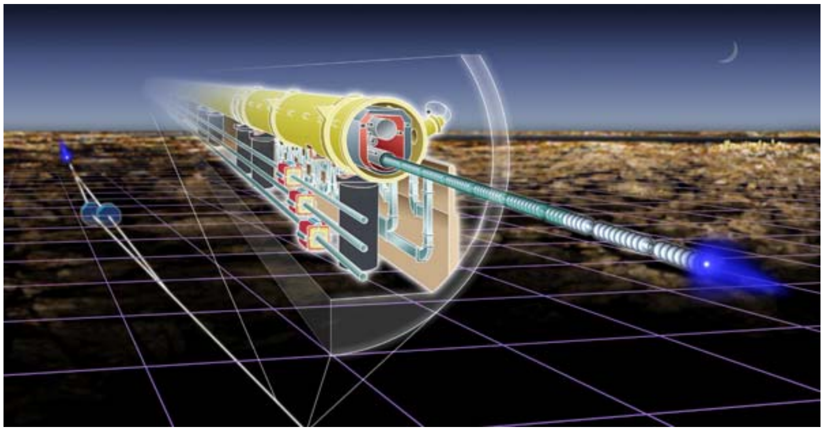

Figure 7
International Linear Collider conceptual rendering

Proton Accelerator Research Complex (J-PARC). Although we will know from these experiments far more about neutrinos, the least understood particles of any that we have yet seen, it is overwhelmingly likely that a more powerful experiment will be needed to explore the possibility of CP violation in neutrinos, the matter-antimatter asymmetry that could explain the survival of matter from the early universe until today. Such an experiment would likely require the construction of a new dedicated proton facility at Fermilab to support beam powers in excess of 2 MW. The most likely configuration of such a facility would be an 8 GeV proton linac, based on superconducting rf technologies developed for the ILC, and used as an injector into the Main Injector synchrotron.

In summary, there are two alternatives for U.S. particle physics and for Fermilab in 2020. In the first, preferred scenario, Fermilab would be the host of the ILC in northern Illinois, in which several laboratories around the world would be major stakeholders. Construction of ILC would start in the first half of the decade and following construction physics at the ILC would be the largest research activity at the laboratory. There would also be continuing research at Fermilab on particle astrophysics, LHC, and neutrino physics, following the evolution of those fields based on the discoveries of the previous decade.

In the second scenario, in which there is no ILC built in the U.S., Fermilab would develop its unique set of accelerators further and would likely construct a new High Intensity Neutrino Source, based on an 8 GeV superconducting proton linac, which would become the world's leading instrument for accelerator based neutrino physics. A series of upgrades to the present accelerators and detectors would be needed. Fermilab would continue its role in LHC physics and particle astrophysics. It would also have a role in the ILC somewhat similar to its present role in the LHC.

Fermilab would be the U.S. site for accelerators operating at the forefront of particle physics. The LHC and the ILC, international science enterprises, involve all of the major particle physics laboratories around the world.

The discoveries of the coming decade will significantly clarify the picture of U.S. particle physics twenty years from now. The physics program in 2020 and beyond will be shaped by all that we learn about the physics of the universe between now and 2010.

For the interim period, between the end of the Tevatron's Run II and the ramp up of the ILC, multiple experimental tracks are under exploration. The Fermilab Steering Group has been tasked by Director Pier Oddone with development of a roadmap. Separate from the EPP 2010 and P5 panels, the Steering Group is focusing on synergistic opportunities, either with the ILC or the existing Fermilab accelerator complex. More information on the Steering Group and its final report (to be submitted 1 August) is available at www.fnal.gov/directorate/longrange/steering_public/index.html.

The Fermilab Accelerator Advisory Committee (http://www.fnal.gov/directorate/Fermilab_AAC_mtgs.htm), the Physics Advisory Committee (http://www.fnal.gov/directorate/program_planning/phys_adv_com/PACdates.html) and the P5 Roadmap (http://www.science.doe.gov/hep/P5RoadmapfinalOctober2006.pdf) all provide peer oversight and review for the Fermilab mission well into the next decade, after completion of Run II.

H. Currently the Fermilab staff is slightly less than 2000 individuals, of whom approximately fifteen percent have scientist appointments. Perhaps two-thirds of the remaining employees are technical (engineers, computing professionals or technicians). The long-range plan for the laboratory envisages a vigorous maintenance of an accelerator-based elementary particle physics program and a growing astroparticle physics program. The most likely evolutionary path for the size of the laboratory staff is that it should maintain approximately its current size. The long-range plan pointed to the International Linear Collider built near Fermilab as a highly desirable possibility. In that situation, it will be important to differentiate between the two entities. Current models of governance envisage that the ILC would utilize a maximum of the host laboratory infrastructure. Nevertheless, there would be an influx of personnel, both employees and personnel seconded from other large laboratories contributing to the ILC. In this scenario, the total employed complement between the two entities could increase by 50%. On the other hand, it is likely that most of this expansion would take place in the out-years with respect to the current plan with a ten-year horizon. The on-site user community is dominated by the large numbers associated with the two collider experiments. From five years hence the activities associated with these collider experiments would begin to tail off; operations would cease but analysis would continue. The LHC@FNAL enables a smooth transition from the current era to that of the LHC. It is anticipated that Fermilab will be home to a substantial number of users who would find Fermilab to be an attractive base for participation in the CMS experiment. The neutrino program is also expected to develop more strength with a possible build up to an era of the Superconducting Radiofrequency Facility (SCRF). A relatively stable resident user community is more likely than either a dramatic reduction or a very rapid increase. Again, in the outyears, the impact of an incipient ILC program might drive an increase in the user population.

As part of their bid proposal in 2006, FRA proposed development of an Organization and Human Asset Plan. The Plan includes a forward-looking succession planning process, a comprehensive workforce planning process and written roles - responsibilities- accountabilities - and - authorities (R2A2). This effort is currently underway, and when aligned with mission planning will best develop staffing plans throughout the planning period of this Ten Year Site Plan.

The budget and staff summary in Figure 18 presents a flat scenario for the planning period.

Sponsor:	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
SC-HEP ($M)			353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2
Total SC ($M)			353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2
Other DOE													
Work for Others													
Total ($M)			353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2
Total Staffing: (FTEs)		1950	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950

Figure 18
Budget & Staffing Summary

I. Effects on Facilities and Infrastructure.

The opportunities identified for Fermilab in 2010 and 2020 as well as the ongoing operations provide a roadmap for a path forward, and each opportunity may or may not advance depending on discoveries in the field of High Energy Physics. Figure 6 provides a tentative timeline by scientific activity for how Fermilab may advance over the next two decades. As one might expect, planning for Facilities and Infrastructure of both a programmatic and conventional nature in support of these dynamic opportunities will be a challenge from many aspects but a challenge for which Fermilab is actively preparing. This effort will include annual updates to coincide with the TYSP annual budget submission, with identification of both programmatic and conventional facility projects as part of the required resource projections.

There are several things Fermilab needs to do now to realize the opportunities for discovery in the next decade and to be ready to build the facilities needed for the discoveries in the decade after that.

1. Continue to push Run II physics to its limits over the next few years. Nothing could advance the field more than a first discovery of dramatically new physics at the energy frontier with CDF and DZero. There is a well-thought-out plan to optimize the physics from Run II, and a new round

of exciting results will be coming out every year. As Run II TeVatron operations may wind down near the end of the decade, the impact on the associated infrastructure will be addressed.

2. Provide more protons for the neutrino program. Neutrino experiments can always make good use of more protons, and steps are being taken to increase proton intensity utilizing the existing accelerator complex. In addition a possible new facility, based on a superconducting proton linac, could be constructed if the ILC is significantly delayed or built elsewhere.
3. Increase the performance profile of the present set of accelerators. The Accelerator Division is developing a plan for improvements in the next few years, and is also looking at major upgrades that could be done before the SCRF is ready for construction.

As newly-identified future projects progress through the planning phases, the laboratory must be cognizant of space utilization and re-use of existing facilities as well as that of utility support from a reliability and capacity standpoint. Dispatch and scheduling of maintenance crews from a centralized location or remote locations will need to be determined for requirements along the 25-mile length of a linear collider.

As existing experiments and other scientific activities reach scheduled completion over the next 3-10 years, infrastructure will likely become available for excess and demolition that could be used for space offsets; alternatively, the space could be refurbished and reused in support of new mission. The level of radiation and its impact on demolition or reuse will be an important part of developing this plan.

Existing electric and cooling water utilities cannot likely support the projects described in this plan and will be a significant element of future planning efforts.

J. Fermilab has recently taken the following actions to implement recommendations of the Long-Range Planning Committee.

1. Grow the research effort on the ILC, on both the accelerator and detector fronts, and do detailed studies of nearby sites.
    a. Most critical need: establish world-class expertise in SCRF technology in the US.
    b. Facilities at Fermilab: buildings exist; need to reinvest in infrastructure (power,cryo,RF) for cryomodule assembly and testing.
    c. Integrate this work into the global effort.
2. A CMS Center, including the LHC@FNAL Center was also established in FY2007 to help build the research program.
3. The Fermilab Center for Particle Astrophysics was established earlier this year to serve as the intellectual center for astrophysics research at the laboratory.

For U.S. physicists to be at the forefront of the coming revolution in particle physics, Fermilab should lead the way and it is our plan to do so.

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PART 1 **VISION, GOALS & STRATEGY (VGS) FOR F&I**

Vision Statement:

To *plan for, establish,* and *maintain* a *dependable base* from which Particle Physics and other FNAL programs can be *safely* accomplished *without interruption*.

The success of any program is dependent on the clarity of the vision. For achievement of the Laboratory's ongoing mission, proactive transition to future opportunities, and attentiveness to the Department's Strategic Plan goal of management excellence for infrastructure, the following vision, objectives and goals have been established. This framework also aligns to the Office of Science's Science Laboratory Infrastructure modernization objectives: right size, preferred working environment which is modernized, safe, healthy and secure.

A. Objectives:

- *Provide leadership* - Recruit and retain a high level of expertise for real property management with responsibility to:

  Investigate, analyze, prioritize and execute infrastructure requirements necessary to satisfy the mission in the "best" possible manner, including sustainable design, equipment standardization, and effective operations and maintenance.

  Assess and strengthen infrastructure planning and data collection.

- *Avoid unscheduled downtime* - the operating platform used to successfully conduct High Energy Physics (HEP) missions including the facilities, utilities, and other general services shall be operated and maintained at the highest levels to avoid unscheduled downtime.

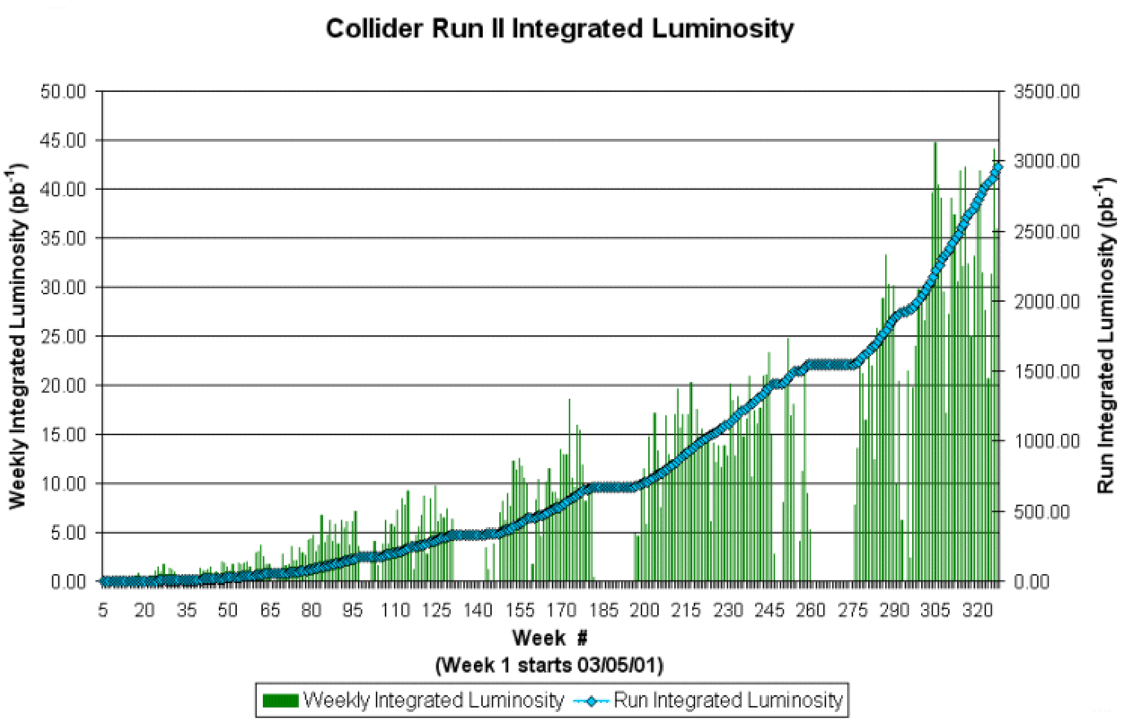

Figure 8
Fermilab Luminosity performance

- *Achieve and maintain an ES&H conscious environment* – create a workplace that eliminates the potential for threat or harm to human, material, and environmental resources.

- *Establish and Improve infrastructure to the identified standards* – get all infrastructure to the desired point of operational effectiveness and modernization consistent with established criteria and guidelines.

- *Operate and Maintain infrastructure for peak performance and sustainability* – is the function of upkeep, preservation and repair ideally once a maintainable state has been achieved that succeeds in the establishment of a new or improved system in order to obtain the best operating efficiencies at the least total cost of ownership over the life of a particular system.

B. Goals

1. Luminosity is the number of particle collisions from which scientific data is collected, analyzed and discoveries made. The Laboratory's most significant goal is increased integrated luminosity. Among other elements, luminosity is a function of facility condition, successful management of infrastructure related items, and utility reliability/capacity. Figure 8 shows the increased luminosity over the last six years.
2. Reduction of unscheduled accelerator and detector downtime due to utility infrastructure failures specific to increased integrated luminosity impact will be mitigated.
3. Elimination of safety-related accidents that result in any injury or damage to property or the environment.
4. Conduct condition assessments per DOE order 430.1B, on all assets.
5. Maintenance investments in real property assets at levels recommended by the Office of Science.
6. Management of real property asset deferred maintenance growth is controlled at an acceptable level.
7. Periodic external reviews of laboratory administrative areas, including real property management, will be conducted.
8. Stewardship of real property assets: Compliance with all policies involving real property asset management including maintenance, investment levels and space management.

C. Strategy

The strategy to achieve the goals of this Ten Year Site Plan and ultimately the Fermilab Facilities & Infrastructure vision includes an ongoing assessment process of policies and procedures, peer reviews on infrastructure management, achievement of operational performance measures, ensuring the in-house maintenance work force and contracted services operate safely using the latest proven best practice technologies and equipment.

Continuous assessment of existing policies and procedures relative to work requirements will include maintenance backlog evaluation, warehouse spare parts inventories and skill of craft training.

Annual laboratory peer reviews are an important critical evaluation by industry experts. Predictive maintenance will continue to be a means to identify and forecast repairs items before they impact laboratory operations.

PART 2 PROCESS FOR IDENTIFYING F&I NEEDS & DEVELOPMENT OF PLANS TO MEET THE VGS

Facilities and infrastructure, including utilities, are integral components of all HEP project proposals. The broad level of program review provides ample opportunity to evaluate the potential for modernization and re-use of existing facilities in lieu of new construction. The recent Congressional requirement to offset new construction with demolition of equivalent space ensures consideration of retrofitting old space for new mission needs.

Current and future facility utilization plans are compiled annually as part of the development process for the Ten Year Site Plan. This annual site-wide comprehensive space management review is the tool relied upon by Laboratory management to verify space decisions are appropriate.

Existing facilities and infrastructure are subject to ongoing condition assessments, and numerous evaluation processes. Whitestone Research's Building Maintenance and Repair Cost Forecasting System, updated with information from these on-going inspections, forms the basis for Fermilab's proactive F&I component replacement management plan.

These assessments, coupled with landlord facility needs aid prioritization across the laboratory, for both GPP expenditures and annual maintenance work. Prioritization efforts will continue as the Laboratory's mission evolves, as discussed in Part C.

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PART 3 LAND USE PLANS

Fermilab's Comprehensive Land Use Plan (CLUP, http://www.fnal.gov/directorate/FNAL_Land_Use_Plan.pdf) is based on DOE Policy 430.1, Land and Facility Use Planning, and was last updated in 2002. The CLUP includes Regional Conditions, Local Existing Site Conditions and a Planning Analysis.

The laboratory policy for land use proposals considers multiple factors in evaluating any land use proposal. Factors include:

1. Effect on mission
2. Any irreversible change to the site
3. Effect to Fermilab's future
4. Impact to all stakeholders
5. Effect to non scientific areas
6. Effect on health and safety
7. Effect on security
8. Effect on neighboring communities
9. Impact to site aesthetics

The area surrounding Fermilab is developing rapidly. In addition to routine land management issues requiring necessary coordination of storm water management associated with neighboring development and requests for utility easements, Fermilab monitors regional transportation issues including road and rail construction activities.

DuPage County's proposal to extend the north/south road along Fermilab's eastern boundary dates back to 1998. The DOE and Fermilab position has always been that a road or any facility proposed for the Fermilab site must not compromise Fermilab's ability to carry out its mission as a particle accelerator laboratory.

Management of the industrially developed portions of the Fermilab site is the responsibility of the occupying organizations in compliance with Directors Policy statements. Fermilab's Environmental Management System assists management in decision-making by providing the structure for determining environmental hazards and necessary mitigating methods relevant to impacts that operations have on the surrounding environment. The Environmental Monitoring Program Plan documents the rationale for effluent monitoring and comprehensive environmental surveillance. The results of annual monitoring are available publicly in the Annual Environmental Report to the Director at http://www.fnal.gov/directorate/documents.html. The program monitors air, surface water, ground water, penetrating radiation, and ecological changes.

The agricultural or otherwise undeveloped portions of the site are managed in accordance with the Ecological Land Management (ELM) Plan. The laboratory's standing ELM committee (http://www.fnal.gov/pub/about/campus/ecology/elm/index.html) provides technical assistance and development recommendations for the maintenance and restoration of available lands. The Fermilab 6800-acre parcel is divided into management tracts as shown in Figure 10 called the Fermilab Land Management map. The ELM Plan is updated annually and is meant to be dynamic with changes based on management needs and ecological considerations.

Ongoing planning activities for the Laboratory's existing mission and future mission opportunities will continue to be consistent with the CLUP and the ELM recommendations, and land use proposal guidelines

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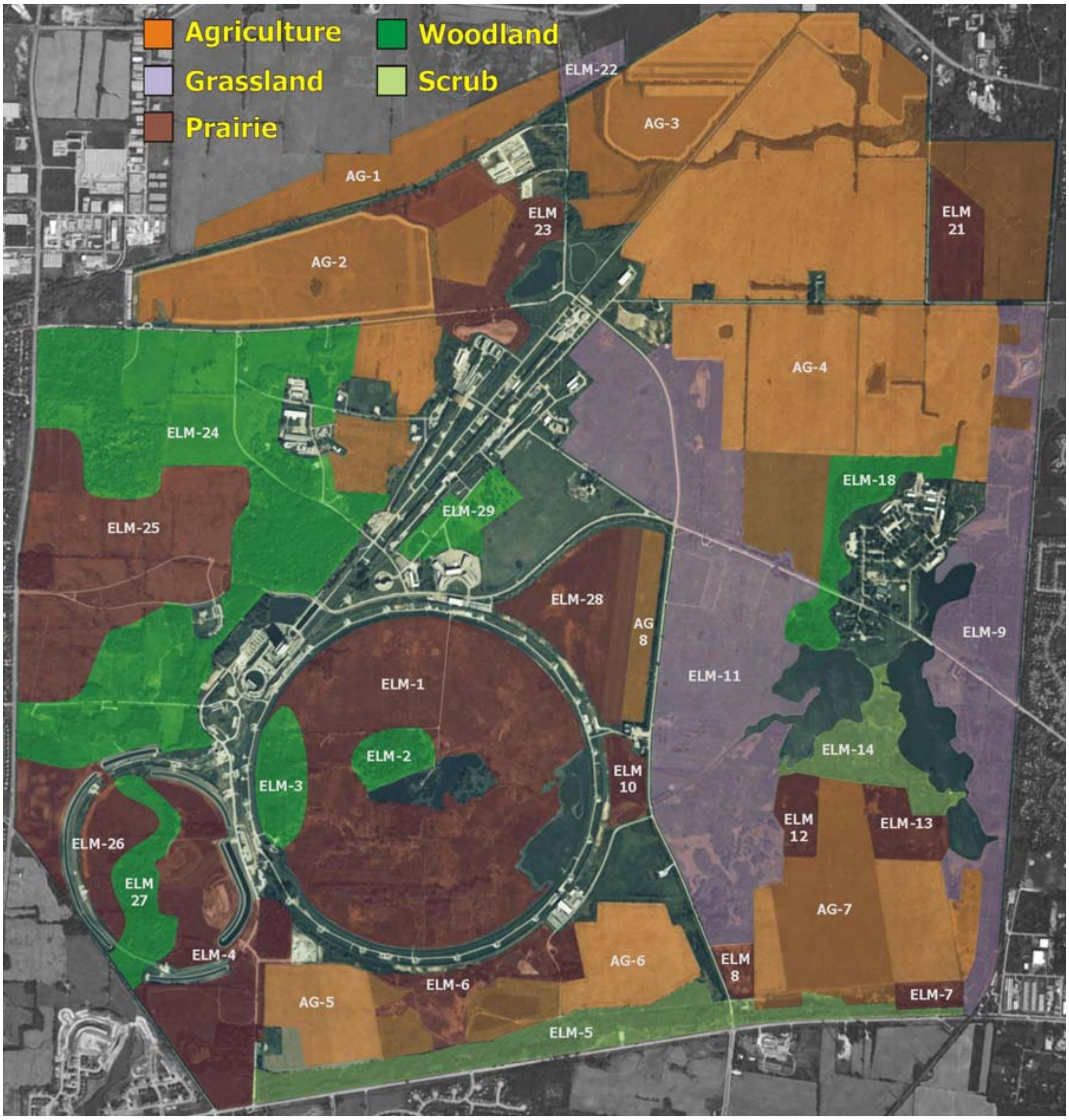
Figure 10
Fermilab Ecological Land Management map



PART 4 **UTILIZATION & EXCESS REAL PROPERTY**

The facility and infrastructure planning effort at Fermilab includes an annual facility utilization survey. Facilities that appear underutilized are referred to the Laboratory's Chief Operating Officer for excess consideration or consolidation. If identified as no longer needed (Facility Reuse Program http://www.fnal.gov/directorate/Policy _ Manual .html#No_36), facilities are nominated for funding through the Office of Science Excess Facilities Program.

Fermilab's excess facility program has developed recently, with the help of the SC Excess Facilities Program, by motivation of the preparation of this TYSP as well as future mission planning at Fermilab. In FY04, in addition to the demolition of 774 GSF at Site 50 Shed B, the Bubble Chamber equipment removal permitted reuse of 1,280 GSF in Neutrino Lab B. Further, 3,622 GSF of muon enclosure beamline have been demolished. Eight real property trailers and five buildings were demolished with FY05 funding, removing 8,533 gross square feet from the Fermilab inventory. Combined with 1836 gross square feet of demolitions in FY03 and 1,494 gross square feet in FY04, this space will be used to offset the Computing Division's GCC 6,950 gross square feet addition. FY06 demolitions included four real property trailers as part of a space consolidation effort and potential future move for Accelerator Division personnel currently housed near the NWA Lab. Project scopes for outyear projects are not yet developed as mission needs are evolving and space requirements will respond to these mission needs. Prior to FY07, all demolitions were fully funded by the SC Excess Facilities Program. In FY07, a portion of offsetting demolition cost was borne by a GPP, the 479-square foot SciBooNE Detector Enclosure, and classified as Other Project Costs. The Laboratory's Chief Financial Officer has determined, based on the DOE Accounting Handbook, that offsetting demolition costs cannot be capitalized as part of a given project, and thus should not be included as part of the GPP's Total Estimated Cost.

Several sections of the Neutrino and Proton Fixed Target beam enclosures were identified as potential candidates in the FY06 planning cycle. Prior to full-scale demolition of any of these areas, a study would be conducted to characterize radioactive or hazardous materials, review strategies for reutilization, and determine methods and costs for partial and/or complete demolition.

As part of the Laboratory's Master Planning process, Fermilab is investigating space consolidation and additional excess actions to support the requirement for offsetting demolition square footage for each new construction project that adds building space. The Department's real property database, the Facilities Information Management System, serves as the real-time record of all facility information at Fermilab and continues to be a useful tool for site planning efforts, particularly as FIMS validations are completed successfully.

However, with the addition of significant new mission described in Section C, the Laboratory will likely not be able to meet the space banking requirements from Fermilab demolitions so may request a waiver and space banking support from other sites.

Asset Utilization Index (AUI) Targets						
Performance Measure		Fermilab	Target			
		FY07	FY07	FY08	Long Term	Achieve Target
Asset Utilization Index	Office	99.91	93.50	94.00	95.00	2011
	Warehouse	91.63	88.50	88.50	89.00	2010
	Laboratory	100.00	86.00	87.00	90.00	2012
	Hospital	NA	85.50	88.00	90.00	2012
	Housing	100.00	99.00	99.00	99.00	2006

Figure 11
Asset Utilization Index Targets
(DOE Three-Year Rolling Timeline)

PART 5 **LONG TERM STEWARDSHIP**

Fermilab's Long Term Stewardship activities are identified in the Environmental Management System (EMS, available at http://www-esh.fnal.gov/FESHM/8000/8010.htm). The program is a defined and integrated system of managing activities, training and communication to achieve environmental goals/objectives and targets within the overall Integrated ES&H Management System (IESHMS) at Fermilab. It describes the Laboratory's program for integrated execution and evaluation of programs for protecting the environment, assuring compliance with applicable environmental standards, and avoiding adverse environmental impacts through an effort of continual improvement. Important program elements under the Fermilab EMS include:

8011	Monitoring Wells
8012	Sedimentation and Erosion Control Planning
8020	General Program Statement on Waste Management
8021	Chemical and Radioactive Waste Management
8022	Waste Minimization and Pollution Prevention Awareness Program
8023	Solid Waste Management
8025	Wastewater Discharge to Sanitary Sewers
8030	Spills and Releases
8040	Specific Chemical Hazards
8040.1	Polychlorinated Biphenyls
8040.2	Pesticides
8050	Drinking Water Protection
8051	Protection of Domestic Water Supplies Backflow Prevention: Cross-Connections
8060	National Environmental Policy Act Review
8070	Decontamination and Decommissioning
8080	Air Emissions Control Program

The underlying emphasis of the Fermilab EMS is continual improvement. The mechanism for establishing the framework to achieve this is the Environmental Management Program. This program requires that the aspects that are identified to be significant in their impact to the environment be examined and then ideas generated and tested to reduce that impact. These ideas should be realized through the establishment of goals/objectives and targets. To ensure its effectiveness, the environmental management program needs to define not only what the improvement is but also what means will be used to achieve it, who is responsible, and the time frame that will be used to monitor achievement. It is important, though, to realize that, although these elements are defined, they are also dynamic in nature. The process must allow for modification of any element along the path of implementation to ensure that the focus is on continual improvement.

All funding for Fermilab Long Term Stewardship activities are contained within the overall operating program (HEP) budget, and are not captured as unique, identifiable costs.

Figure 12
Fermilab prairie & Wilson Hall

PART 6 REPLACEMENT PLANT VALUE (RPV) ESTIMATES

Fermilab's Replacement Plant Values, updated annually, are typically based on the Capitalized Plant Values (CPV), which consider acquisition values, year & improvements. This method applies an ENR escalator based on construction year to original acquisition costs. As part of a QA review in FY04, Fermilab recognized that 16% of its assets (38% of its original acquisition buildings) had original acquisition values below $5k, resulting in low RPVs. Engineer's estimates, combined with square foot analyses, were used to improve the accuracy of these assets' RPVs.

The RPV projections included in this Ten Year Site Plan take account of the following proposed new assets:

- Advanced Materials Lab
- Grid Computing Center
- Site Security Facility
- MINU
- MI65 Addition
- New Muon Expansion (AARD)
- Illinois Accelerator Research Center
- Next Generation Computing Facility

In Figure 13 below, the RPV at start of FY08 is the February 2007 RPV, plus escalation and FY07 changes. This includes $445.2M for buildings and $152.8 for Other Structures and Facilities, plus the new assets proposed through FY07 (Grid Computing Center & SciBooNE) and escalation. The February 2007 RPV also includes the conventional portion of OSF3000 RPV, as detailed in Attachment 8, High RPV/Low Maintenance Facilities Review.

In addition, RPV is subtracted in FY10 for projected demolitions accomplished in conjunction with construction of an Advanced Manufacturing Lab and the Illinois Accelerator Research Center, as identified in Part 10 of this Facilities & Infrastructure section.

RPV figures have been escalated in each year in accordance with the TYSP guidance. In years FY14 through FY17, Conventional RPV estimates for the ILC, though *preliminary*, are included as follows:

ILC RPV

Tunnel	100
Service & support buildings	170
Utilities	500

Figure 13
RPV Estimates for the Planning Period

	A	B	C	D*
	RPV of existing facilities at beginning of FY	Estimated additions in FY	Total Estimated RPV at end of FY (A+B)	Escalation (1.023 * C)
FY04	$ 557,360,165			$ -
FY05	$ 598,364,040			$ -
FY06	$ 676,109,628		$ 676,109,628	$ 676,109,628
FY07	$ 676,109,628	$ 6,726,465	$ 682,836,093	$ 698,541,323
FY08	$ 698,541,323	$ 3,000,000	$ 701,541,323	$ 717,676,774
FY09	$ 717,676,774	$ 8,360,000	$ 726,036,774	$ 742,735,619
FY10	$ 742,735,619	$ 31,475,000	$ 774,210,619	$ 792,017,464
FY11	$ 792,017,464	$ 50,000,000	$ 842,017,464	$ 861,383,865
FY12	$ 861,383,865		$ 861,383,865	$ 881,195,694
FY13	$ 881,195,694		$ 881,195,694	$ 901,463,195
FY14	$ 901,463,195		$ 901,463,195	$ 922,196,849
FY15	$ 922,196,849	$ 40,000,000	$ 962,196,849	$ 984,327,376
FY16	$ 984,327,376		$ 984,327,376	$ 1,006,966,906
FY17	$ 1,006,966,906		$ 1,006,966,906	$ 1,030,127,145
FY18	$ 1,030,127,145		$ 1,030,127,145	$ 1,053,820,069

PART 7 **MAINTENANCE**

The Facilities Engineering Services Section provides preventive and corrective maintenance for Fermilab's conventional electrical and mechanical equipment. Occupant organizations identify, fund, and accomplish the remainder of facility sustainment requirements, including those activities accomplished in concert with other GPP or line item projects.

Additional discussion on maintenance performance is included in Part 12 of this Facilities & Infrastructure Section. Future maintenance expenditures, based on 2% of conventional replacement plant value (as detailed in Part 6, Figure 13 of this Facilities & Infrastructure Section) are planned as demonstrated in the chart below. Should actual replacement plant values differ from those currently projected, Fermilab's planned maintenance expenditures will be also adjusted. Further, these maintenance funding estimates are based on the RPV data presented in Figure 13, which differ from the laboratory's FY09 IFI crosscut budget submission (Attachment 4), which did not include escalation or allowances for new assets.

Figure 14
Site Maintenance Funding Plan

	A	B	C	D	E	F	G
	RPV	SC Goal (minimum 2% of RPV)	Planned Site direct-funded maintenance	Planned indirect funded maintenance	Total planned site maintenance funding (C+D)	MII calculation (E/A)	Explanation if funding plan does not meet goal or results in DM
FY07	$ 557,360,165	$ 11,147,203	$ 3,249,000	$ 8,166,000	$ 11,415,000	2.05%	
FY08	$ 598,364,040	$ 11,967,281	$ 3,410,675	$ 8,556,606	$ 11,967,281	2.00%	
FY09	$ 676,109,628	$ 13,522,193	$ 3,853,825	$ 9,668,368	$ 13,522,193	2.00%	
FY10	$ 698,541,323	$ 13,970,826	$ 3,981,686	$ 9,989,141	$ 13,970,826	2.00%	
FY11	$ 717,676,774	$ 14,353,535	$ 4,090,758	$ 10,262,778	$ 14,353,535	2.00%	
FY12	$ 742,735,619	$ 14,854,712	$ 4,233,593	$ 10,621,119	$ 14,854,712	2.00%	
FY13	$ 801,761,539	$ 16,035,231	$ 4,570,041	$ 11,465,190	$ 16,035,231	2.00%	
FY14	$ 871,352,054	$ 17,427,041	$ 4,966,707	$ 12,460,334	$ 17,427,041	2.00%	
FY15	$ 891,393,151	$ 17,827,863	$ 5,080,941	$ 12,746,922	$ 17,827,863	2.00%	
FY16	$ 911,895,194	$ 18,237,904	$ 5,197,803	$ 13,040,101	$ 18,237,904	2.00%	
FY17	$ 932,868,783	$ 18,657,376	$ 5,317,352	$ 13,340,024	$ 18,657,376	2.00%	
FY18	$ 995,244,765	$ 19,904,895	$ 5,672,895	$ 14,232,000	$ 19,904,895	2.00%	

PART 8 DEFERRED MAINTENANCE REDUCTION (DMR)

Fermilab's total deferred maintenance (DM) decreased $5.3M from $44.7M reported in FY05 to $39.4M for FY06. Seventy percent of Fermilab's DM rests with Mission Critical Other Structures and Facilities.

Routine maintenance responsibilities for OSFs are assigned to specific system owners, typically the Facilities Engineering Services Section. OSF assessments are periodically updated to represent their current operating condition. This is an ongoing process, factoring system or component age, efficiency, safety and environmental compliance, maintainability, failure history, locations and conditions found during repairs, current mission needs, and future requirements. Deferred maintenance on utility systems has increased dramatically over recent years due to more detailed assessments of the aging infrastructure systems. Utility system deferred maintenance is due in large part to ongoing inspections validating increased deterioration of these systems. The resource matrix included in the appendix identifies significant multi-million dollar GPP investments planned for the next several years that will reduce the high voltage electrical, domestic and industrial water systems backlog.

Requirements for deferred maintenance are identified and scoped by the system owner, and, if appropriate, prioritized for GPP funding by the Office of the Director. Prioritization of these projects is based on risk levels associated with safety, mission, and environment and the probability of operational impacts from a particular system.

Fermilab recognizes that continued additional reinvestment will be required to control deferred maintenance growth. Figure 15 reflects the current plans for this reinvestment to improve the overall condition of building components and infrastructure systems, specifically with respect to ACI.

Projected GPP investment reduces the existing DM and controls the forecasted growth through FY11 with a fair degree of confidence. As a single-program laboratory with a single source of funding, Fermilab's GPP infrastructure expenditures support general purpose assets. SC 31.2, in discussion with the Fermilab FIMS Administrator, agreed that Fermilab's GPP expenditures that reduce deferred maintenance *can* be counted as part of Fermilab's DMR efforts. These GPP contributions are reflected in Figure 15 in column F.

Fermilab's partnership with the neighboring City of Batavia will result in the replacement of Fermilab's aging Pi-poles in FY08. This DMR contribution is also included in column F of Figure 15.

Finally, significant amounts of ICW and high voltage electric deferred maintenance are eliminated through the SLI Modernization Initiative. These DMR contributions are also included in Figure 15's column F.

While Fermilab acknowledges the DMR targets set forth by the Office of Science, the laboratory posits that these investments duly reduce the deferred maintenance backlog and achieve the ACI target of 0.98 for mission critical assets by FY12. Fermilab's mission dependent assets currently meet the target ACI of 0.96. With projected growth of 5% and escalation, GPP investments on roofs (currently programmed in the FY09 IFI for years FY10 through FY13) maintain the target ACI through FY16.

Further, Figure 15 does not include any investment for mission dependent assets. Actual investments will likely exceed $0 and would prevent the represented ACI drop to 0.94.

Figure 15
Estimated DM & ACI based on Site DMR Funding (for Mission Critical and Mission Dependent Facilities)

MISSION CRITICAL FACILITIES* ACI goal = .98

	A	B	C	D	E	F	G	H	I	J
	FIMS DM or estimate	Estimate of DM Growth	SC DMR Funding Target (Table Sec.II,B.2)	Lab Planned DM Reduction Funding	Portion of Column D from IGPP or major repairs	DM Reduction: Other Contributions (Line Item, ESPC)	Expected DM at the end of the FY (A+B+D+F)	DM Escalation (G*1.023)	Estimated RPV	Estimated ACI (1-H/I)
FY07	$ 29,457,303	$ 1,000,000	$ (1,306,800)	$ (1,306,800)		$ (1,000,000)	$ 28,150,503	$ 28,797,965	$ 476,850,882	94%
FY08	$ 28,797,965	$ 1,000,000	$ (2,856,480)	$ (1,000,000)		$ (5,000,000)	$ 23,797,965	$ 24,345,318	$ 487,818,453	95%
FY09	$ 24,345,318	$ 1,000,000	$ (4,165,920)	$ (1,000,000)			$ 24,345,318	$ 24,905,260	$ 502,107,277	95%
FY10	$ 24,905,260	$ 1,000,000	$ (5,475,360)			$ (3,500,000)	$ 22,405,260	$ 22,920,581	$ 521,635,144	96%
FY11	$ 22,920,581	$ 1,000,000	$ (5,475,360)			$ (3,100,000)	$ 20,820,581	$ 21,299,454	$ 575,575,753	96%
FY12	$ 21,299,454	$ 1,000,000	$ (5,475,360)			$ (9,000,000)	$ 13,299,454	$ 13,605,342	$ 639,963,995	98%
FY13	$ 13,605,342	$ 1,000,000				$ (7,500,000)	$ 7,105,342	$ 7,268,765	$ 654,683,167	99%
FY14	$ 7,268,765	$ 1,000,000					$ 8,268,765	$ 8,458,946	$ 669,740,880	99%
FY15	$ 8,458,946	$ 1,000,000					$ 9,458,946	$ 9,676,502	$ 685,144,920	99%
FY16	$ 9,676,502	$ 1,000,000					$ 10,676,502	$ 10,922,062	$ 741,823,253	99%
FY17	$ 10,922,062	$ 1,000,000					$ 11,922,062	$ 12,196,269	$ 758,885,188	98%
FY18	$ 12,196,269	$ 1,000,000					$ 13,196,269	$ 13,499,783	$ 776,339,547	98%

MISSION DEPENDENT FACILITIES* ACI goal = .95

	A	B	C	D	E	F	G	H	I	J
	FIMS DM or estimate	Estimate of DM Growth	SC DMR Funding Target (Table Sec.II,B.2)	Lab Planned DM Reduction Funding	Portion of Column D from IGPP or major repairs	DM Reduction: Other Contributions (Line Item, ESPC)	Expected DM at the end of the FY (A+B+D+F)	DM Escalation (G*1.023)	Estimated RPV	Estimated ACI (1-H/I)
FY07	$ 9,906,761	$ 1,000,000	$ 673,200				$ 10,906,761	$ 11,157,617	$ 291,210,250	96%
FY08	$ 11,157,617	$ 1,000,000	$ 1,471,520				$ 12,157,617	$ 12,437,242	$ 297,908,085	96%
FY09	$ 12,437,242	$ 1,000,000	$ 2,146,080				$ 13,437,242	$ 13,746,298	$ 304,759,971	95%
FY10	$ 13,746,298	$ 1,000,000	$ 2,820,640				$ 14,746,298	$ 15,085,463	$ 312,342,331	95%
FY11	$ 15,085,463	$ 1,000,000	$ 2,820,640				$ 16,085,463	$ 16,455,429	$ 319,526,204	95%
FY12	$ 16,455,429	$ 1,000,000	$ 2,820,640				$ 17,455,429	$ 17,856,904	$ 326,875,307	95%
FY13	$ 17,856,904	$ 1,000,000					$ 18,856,904	$ 19,290,612	$ 334,393,439	94%
FY14	$ 19,290,612	$ 1,000,000					$ 20,290,612	$ 20,757,296	$ 342,084,488	94%
FY15	$ 20,757,296	$ 1,000,000					$ 21,757,296	$ 22,257,714	$ 349,952,431	94%
FY16	$ 22,257,714	$ 1,000,000					$ 23,257,714	$ 23,792,642	$ 358,001,337	93%
FY17	$ 23,792,642	$ 1,000,000					$ 24,792,642	$ 25,362,872	$ 366,235,368	93%
FY18	$ 25,362,872	$ 1,000,000					$ 26,362,872	$ 26,969,219	$ 374,658,781	93%

Notes:
Lab Planned DM Reduction funding includes DM eliminated by operating dollars
DM Reduction Other Contributions includes DM reductions via GPP, SLI and third-party projects.

PART 9 RECAPITALIZATION & MODERNIZATION

SLI Modernization Initiative
Three Fermilab projects are slated for funding as part of the Office of Science initiative to address infrastructure modernization needs at its laboratories. Each of these projects, summarized below, fulfills general infrastructure requirements and solidifies Fermilab's potential mission capabilities. Additional project detail is included in Attachment 5.

	Cost ($M)	FY Start	DMR (FY06)
ICW	20.8	11	8.3
HV Electrical	14.1	11	8.0
Ind Facilities	33.8	14	0.1

Figure 16
SLI Project Summary

Rehab & Improvement Costs
RIC for specific assets is included in FIMS and summarized in the table below.

Asset Name	RIC
Wilson Hall & Auditorium	$ 2,910,188
Feynman Computer Center	$ 2,650,000
Central Utility Building	$ 1,410,000
Switchyard Service Building	$ 10,330
HDCF - Grid Comp Ctr - WBL Ctg House	$ 6,700,000
NuMI Target Service Building	$ 4,890,000
Industrial Building #3	$ 4,600,000
Site 38 Barn	$ 80,000
Site 38 Fire Station	$ 4,030,000
Paved Roads	$ 2,154,654
Electrical Substations	$ 3,292,819
Electrical Distribution, 13.8kV Feeders	$ 1,692,570
Water System Potable Distribution (DWS)	$ 3,749,000
ICW Piping Distribution System	$ 4,084,000
Sewage System Pumped & Gravity	$ 923,220
Cooling Ponds & Reservoirs	$ 7,000,000
Fox River Pumping Station	$ 87,193
Secondary Roads	$ 2,500,600
Stormwater Piping Gravity & Pressure	$ 51,290

Figure 17
Rehab & Improvement Costs

Line Items
The proposed Illinois Accelerator Research Center would be located at Fermilab. The Illinois Governor's FY2007 Capital Budget request included a $3 million grant to fund the design of this Center, which would offer a national and international focal point for accelerator research and industrialization in Illinois, particularly as efforts to host the International Linear Collider in the US intensify. After design, the project would require additional investment from another funding source, potentially as a line item project.

GPP
The IFI crosscut represents the Laboratory's best understanding of outyear GPP funding levels based on information from the HEP program office and the laboratory's planning for infrastructure improvements.

In addition to mission requirements, infrastructure needs and plans, FY07 through FY12, are summarized in the FY09 IFI crosscut, Attachment 4. GPP investments are directed toward the utilities which present the highest vulnerability to the scientific operation as well as those in the greatest need of repair. Significant GPP investment is also directed toward expanded computing capacity.

The increased GPP values in the outyears represent both unconstrained needs as well as the potential GPP increase commensurate with the completion of UIP payments.

Future submissions will likely include additional projects as planning continues for future mission as described the TYSP.

PART 10 **SITE SPACE BANK ANALYSIS**

As Fermilab prepares to host the International Linear Collider, it acknowledges that it does not have the required offsetting square footage associated with this new mission. Though the International Linear Collider space requirements are preliminary, the laboratory will continue to assess its changing mission needs to determine whether current assets are excess to its mission.

Over the planning horizon addressed in this Plan, Fermilab exhibits a deficit of space associated with its mission requirements.

An initial review of this situation is presented below, including the space availability deficit in future years.

Figure 18
Space Bank Plan

	A		B	C	D
	Expected Additions		Expected Removals	Net Change (A-B)	Available offsetting space at the site
FY06	6,950	1	6,950		19,959
FY07	479	2	479	-	19,959
FY08	4,450	3	4,450	-	19,959
FY09	22,215	4	2,500	19,715	244
FY10	63,500	5	63,500	-	244
FY11	30,000	6		30,000	(29,756)
FY12				-	(29,756)
FY13	800,000	7		800,000	(829,756)
FY14	1,000,000	7		1,000,000	(1,829,756)
FY15	300,000	7		300,000	(2,129,756)
FY16				-	(2,129,756)
FY17				-	(2,129,756)
FY18				-	(2,129,756)

[1] Grid Computing Center
[2] SciBooNE
[3] MINU
[4] Site Security Facility,
MI65 Expansion,
New Muon Lab Expansion (AARD),
GCC Computer Room D
[5] Advanced Manufacturing Facility,
Illinois Accelerator Research Center
[6] Next Generation Computing Facility
[7] International Linear Collider

PART 11 PERFORMANCE INDICATORS & MEASURES

A. The FY07 contract performance measures in the area of infrastructure management are based on the following objective:

Establish and maintain a dependable facilities base from which particle physics and other Fermilab programs can be safely accomplished without interruption.

This objective identifies seven measures and associated metrics; one of these measures is a project management metric, rather than an infrastructure measure. As such, it is omitted from this discussion. FY07 measures and targets are described below:

1. Maintenance is performed as scheduled; the target is >80%.

   Measure 7.1.1: Effectiveness and efficiency of maintenance activities to maximize the operational life of facility systems, structures, and components: (**Scheduled hours vs. total hours, measured as a percentage)**

2. Maintenance investment (MII); the target is 1.5% for the 9-month contract period.

   Measure 7.1.2: Level of maintenance investment in real property assets. The MII is calculated by dividing the total annual contractor funded maintenance for active conventional facilities by the Replacement Plant Value (RPV) from FIMS for these same facilities. Multiplying this decimal number by 100 expresses the index as a percentage.

   MII = (Annual Contractor Maintenance / RPV) x 100

3. GPP, AIP and IHEM milestones achieved as planned in Directives; the target is 90%.

   Measure 7.1.3.1: Provide planning for and acquisition of facilities and infrastructure required to support future Laboratory programs.

4. GPP planning in the Ten Year Site Plan. This measure considers the integration and alignment of the Ten Year Site Plan to the Laboratory's comprehensive strategic plan, as well as the involvement of stakeholders and responsiveness to mission needs. The target is ≥80%.

   Measure 7.2.1: Percent of new GPP projects that were identified in the Ten Year Site Plan at least one year before the authorization was approved. This shall exclude programmatic projects that have arisen out of rapidly changing program requirements as described by the laboratory and agreed for exclusion by the Fermi Site Office.

5. The final two measures evaluate Tevatron Run Time lost due to the electrical infrastructure and the cooling water system. For each of these measures, the target is <5%. The performance on these measures is reflected in the Laboratory's luminosity achievements.

PART 12 ENERGY MANAGEMENT

Fermilab has aggressively pursued energy and water efficiency of its facilities. It is likely one of the most thoroughly investigated DOE laboratories in the nation, with two complete energy audits of the entire site completed in 2000 by competing utility companies. Through these and other similar efforts, over $58M in Utility Energy Service Contracts work was awarded through 2001 to rebuild critical infrastructure while improving energy and water conservation. In addition, other remaining life-cycle cost effective opportunities identified in these audits which were not implemented under UESC have been funded and completed recently as FEMP retrofit projects.

As a result, Fermilab is in an unusual position with regard to the new emphasis on an energy baseline of FY2003 under EPACT-2005. With consistently stellar efficiency improvements resulting in numerous awards year after year, Fermilab has improved Buildings efficiency by about 50% relative to baseline 1985, and has performed even better in the I&L category relative to baseline FY1990 under the Btu/Performance-Unit metric formerly allowed under Executive Order 13123. All of this early work will make it more challenging for Fermilab to increase efficiency improvements relative to the new FY2003 baseline.

Further complicating matters are the recent alterations in future of Fermilab programs, as reflected in changes to the planning horizon reported in the TYSP in the last few years. Many program initiatives have been suspended or cancelled, and the character of future operations on site remains in the balance. This makes it difficult to recommend further retrofit investment at this time in some of the site's most energy intensive facilities, leaving many potential energy projects in suspense until programmatic clarification is forthcoming.

- **DOE Order 430.2A Departmental Energy Utilities Management**

  Fermilab's energy management initiatives are managed consistent with its annually updated Comprehensive Energy Management Program and Plan (CEMP), which includes the minimum requirements of DOE Order 430.2A and elements of EPACT-2005. Last year Fermilab far exceeded expectations in its energy performance agreement for meeting the initiatives outlined in its CEMP.

Fermilab has traditionally scored very high in meeting its energy performance measures in the past. However, this may become increasingly difficult for the site to attain in the coming years for the reasons outlined above. The site's current plans to address some of the key actions required under the new Energy Policy Act are as follows:

Section 102 Energy Management Requirements

Benefits from recently implemented conservation measures should help efficiency in the short-term, but changes in building usage driven by programmatic shifts should likely also have an influence. Current plans to consolidate operations in some facilities and improve mechanical and electrical systems with modern equipment will likely play a role in the longer-term. However, the exact nature, timing and effect of such consolidations or usage changes being planned in these facilities continues to change, so the ability to predict how this will all play out under the year-by-year progress being stipulated under the performance agreements remains uncertain.

Section 103 Energy Use Measurement and Accountability

Fermilab is currently evaluating the applicability of cost-effective electric metering at facilities around the site in accordance with FEMP's *Guidance for Electric Metering in Federal Buildings*. While it will be difficult to effectively prioritize an implementation plan so long as the viability of many of its most energy intensive facilities remains in question beyond the FY2009 programmatic plans

Advanced Electric Meters

Building Name	FIMS#	Install Date (Scheduled)
Wilson Hall & Auditorium	001	30-Sep-2008
Industrial Center	806	30-Sep-2009
Meson Detector Building	408	30-Sep-2010
Industrial Building #1	801	30-Sep-2010
Industrial Building #2	800	30-Sep-2010
Industrial Building #3	805	30-Sep-2010
Industrial Building #4	805	30-Sep-2010
MI 60 Service Building	760	30-Sep-2011
A0 Lab Building	217	30-Sep-2011
Booster Tower Southwest	207	30-Sep-2011
Booster Tower Southeast	208	30-Sep-2011
MI 8 Service Building	708	30-Sep-2011
NuMI Target Service Building	765	30-Sep-2011
Neutrino Lab A	600	30-Sep-2012
Neutrino Lab B	602	30-Sep-2012
Lab A-B Bridge Building	601	30-Sep-2012
Neutrino Lab D	606	30-Sep-2012
Laboratory F	610	30-Sep-2012
Curia I - 34 Shabbona	141	30-Sep-2012

Figure 19
Metering Plan

to likely shutdown the Tevatron, an initial installation schedule has been developed (Figure 19). In Fermilab's response to the upcoming DOE call for a site metering implementation plan this will be a real challenge. With full implementation called for by 2012, it would seem prudent to minimize investment early-on until the programmatic picture becomes clearer.

Section 104 Procurement of Energy Efficient Products
Fermilab promotes the purchase of Energy Star products and other energy efficient products as designated by FEMP, to engineers, designers and buyers. Specific language to this effect is incorporated in the guide specifications for new construction and in product specifications. The Fermilab acquisition systems have also incorporated recommendations for low standby power products from FEMP's *Standby Power Data Center* into purchasing decisions as part of one of its recent energy performance measures.

Section 105 Energy Savings Performance Contracts
Although Fermilab has already covered most of its alternative financing energy initiatives under the UESC initiative, it continues to look for additional opportunities. Due to the programmatic uncertainties in the Laboratory's future, however, such initiatives are strictly limited. None the less, the Laboratory is currently pursuing possible infrastructure upgrades in exchange for a utility Right-Of-Way that could help make operations more efficient. In addition, Fermilab is currently looking into potential ESPC applications, including a BAMF generating plant.

Section 109 Federal Building Performance Standards
Sustainability principles and standards have been increasingly integrated into the Laboratory's design practices, and several Laboratory personnel have received professional accreditation in this area. All projects are analyzed at the conceptual design review stage and the Laboratory routinely incorporates elements for water efficient landscaping, use of low-emitting materials, alternate transportation, and reduced site disturbance in it designs. The routine use of DDC technology on site also lends itself to measurement and verification. Where life-cycle cost effective, efficiencies 30% beyond ASHRAE standards are targeted for new construction.

Section 203 Federal Purchase Requirement
Fermilab is working with DESC to procure green power as scheduled under the annual DOE requirements.

Other initiatives that Fermilab continues to implement toward meeting the goals of EPACT-2005 include participation in voluntary electric curtailment programs with both our local utility company and retail electric supplier, introducing the use of dollar-cost-averaging strategies into its electric procurement process to reduce risk from price extremes, procurement of efficient vehicles and use of alternative transportation, on-going use of life-cycle cost analysis in project evaluations, on-going inspections for energy and water opportunities under the Condition Assessment Survey system that covers 20% of the facilities on site every year, and continued participation in the FEMP energy retrofit funding program although the current programmatic uncertainties have interfered at this time.

The Department's Three Year Rolling Timeline identifies targets and goals for energy-related operating costs. The following table (Figure 20) summarizes Fermilab's plan to meet these targets for Buildings and Lab/Industrial facilities (excluding "metered process" facilities).

Figure 20
Energy Consumption Targets

	Baseline	Actual	Target				Achieve
Performance Measures	FY2005	FY2006	FY2007	FY2008	FY2009	Long Term	Target
Operating Costs - Energy Consumption (BTU/SF). 2005 Energy Policy Act. 20% reduction from 2003 baseline by 2015	FY2003 Baseline 107,350	104,190	103,056	100,909	98,762	85,880	2015
Operating Costs - Energy Consumption (BTU/SF). EO 13423 3% annual reduction or 30% reduction by 2015	FY2003 Baseline 107,350	104,190	103,056	100,909	98,762	75,145	2015

PART 13 LEASING & THIRD PARTY / NON-FEDERAL FUNDED CONSTRUCTION OF NEW BUILDINGS

N/A

PART 14 OPERATING COSTS FOR SUSTAINMENT & OPERATIONS

DOE's Office of Engineering and Construction Management has established targets and goals for operating costs for buildings, as presented in Figure 21 below. Fermilab's recent performance is also reflected in this summary. While the operations portion of the operating costs are above the DOE FY05 baseline and FY06 actual, these expenditures contribute to the close alignment of the Fermilab Actual FY06 Operating Cost Sustainment and Deferred Maintenance Reduction ($/SF) and the DOE Actual FY06 figure. In addition, compared to other large DOE sites (more than 100 buildings, more than 4000 acres), Fermilab has one of the lowest operating costs per square foot. As Fermilab continues to increase its maintenance investment (to align with the 2% target), sustainment costs per square foot will increase.

	Fermilab Baseline FY05	DOE Baseline FY05	Fermilab Actual FY06	DOE Actual FY06	Target FY07	Target FY08	Target FY09	Target Long Term	Achieve Target
Operating Costs: Sustainment and DM Reduction ($/SF)	5.33	6.89	6.52	6.50	7.00	7.25	7.50	9.00	2014
Operating Costs: Operations ($/SF)	2.15	1.10	2.32	1.24	1.30	1.35	1.35	1.35	2009

Figure 21
Operating Cost Targets & Summary

Notes on the chart:

- *Fermilab Operating Costs: Sustainment and DM Reduction includes building portion of DMR reported on FY05 4th quarter maintenance report.*
- *Fermilab Operating Costs exclude OSF 3000 accelerator electrical consumption.*

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Attachment 2 Building Inventory & Maps

FIMS#	Building Name
001	Wilson Hall & Auditorium
002	Main Ring Gazebo
003	Feynman Computer Center
005	Science Education Center
019	11 Sauk Circle - Anderson Barn
020	1 Sauk Circle - Residence
021	3 Sauk Circle - Residence
022	4 Sauk Circle - Residence
023	5 Sauk Circle - Residence
024	6 Sauk Circle - Residence
025	7 Sauk Circle - Residence
026	8 Sauk Circle - Residence
027	9 Sauk Circle - Residence
028	10 Sauk Circle - Residence
029	12 Sauk Circle - Residence
030	13 Sauk Circle - Residence
031	14 Sauk Circle - Residence
032	15 Sauk Circle - Residence
033	17 Sauk Circle - Residence
034	18 Sauk Circle - Residence
035	19 Sauk Circle - Residence
036	1 Sauk Blvd - Aspen East
040	14 Sauk Blvd - Residence
041	16 Sauk Blvd - Residence
042	18 Sauk Blvd - Vending/Laundry
043	20 Sauk Blvd - Residence
044	1 Shabbona - Dorm 3
045	22 Sauk Blvd - Residence
046	24 Sauk Blvd - Residence
047	24a Sauk Blvd - Garage
048	26 Sauk Blvd - Residence
049	28 Sauk Blvd - Residence
050	28a Sauk Blvd - Garage
051	28b Sauk Blvd - Greenhouse
052	28c Sauk Blvd - R&G Equip Shed
053	29 Sauk Blvd - Residence
054	30 Sauk Blvd - Maid Hdqtrs
055	30a Sauk Blvd - Pole Building
056	31 Sauk Blvd - Pump House

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
057	32 Sauk Blvd - Dorm 1
058	33 Sauk Blvd - Residence
059	34 Sauk Blvd - Residence
060	36 Sauk Blvd - Metals Dev. Lab
061	Village FIRUS Hut
062	Village Water Facility
069	2 Che Che Pinqua-Users Center
070	1 Che Che Pinqua - Kuhn Barn
077	13 Neuqua - Residence
078	16 Neuqua - Residence
079	18 Neuqua - Residence
080	19 Neuqua - Residence
081	20 Neuqua - Lab 7 House
082	22 Neuqua - Lab 7 House
083	23 Neuqua - Residence
084	25 Neuqua - Residence
085	14 Neuqua - Residence
086	26a Neuqua-Lab 6-Garage
087	28 Neuqua - Lab 6 House
088	30 Neuqua - Lab 6 House
089	28a Neuqua-Lab 6 Pole Building
090	32 Neuqua - Lab 6 House
091	34 Neuqua - Lab 5 House
092	36 Neuqua - Lab 5 House
093	36a Neuqua - Lab 5 Pole Bldg.
094	38 Neuqua - Lab 5 House
095	36 Shabbona - Lab 5 House
096	26 Neuqua - Scintillator R&D
102	27a Winnebago - Lab 1 House
103	27b Winnebago - Lab 1 House
104	27c Winnebago - Lab 1 House
105	29 Winnebago - Machine Repair
106	32 Winnebago - Lab 4 House
107	35a Winnebago-Lab 2 Compressor
108	40 Shabbona-Lab 4 House/Office
109	30 Winnebago - Machine Repair
116	22 Blackhawk - Residence
117	24 Blackhawk - Residence

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
118	25 Blackhawk - Lab 8 House
119	25a Blackhawk - Lab 8 South
120	27 Blackhawk - Lab 8 House
121	29 Blackhawk
122	31 Blackhawk - Lab 8 House
123	31a Blackhawk - Lab 8 North
124	33 Blackhawk - Lab 8 House
125	35 Blackhawk - Residence
131	2 Shabbona - Dorm 2
132	8 Shabbona - Residence
133	8a Shabbona Garage
134	10 Shabbona - Residence
135	12 Shabbona - Residence
136	14 Shabbona - Residence
137	14a Shabbona - Garage
138	19 Shabbona - Residence
139	20 Shabbona Shelter
140	21 Shabbona - House
141	Curia I-34 Shabbona, Day Care, Dorms 5,6
142	33 Shabbona - Residence
143	35a Shabbona - Lab 3 House
148	37a Shabbona-Material Dev. Lab
149	37 Shabbona-Material Dev. Lab
150	39 Shabbona-Material Dev. Lab
156	11 Potawatomi - Residence
157	12 Potawatomi - Residence
158	13 Potawatomi - Residence
159	14 Potawatomi - Residence
160	15 Potawatomi - Residence
161	15a Potawatomi Garage
162	16 Potawatomi - Shower Rooms
163	16a Potawatomi - Exercise Rms
164	16b Potawatomi - Gymnasium
165	17 Potawatomi - Residence
166	17a Potawatomi Garage
167	18 Potawatomi - Residence
168	20 Potawatomi - Dorm 4
169	20a Potawatomi Dorm 4
170	22 Potawatomi - Residence

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
171	24 Potawatomi - Residence
179	27 Winnebago - Lab 1
180	35 Winnebago-Lab 2 Butler Bldg
181	35 Winnebago - Lab 3
182	38 Shabbona - Lab 4
183	36a Shabbona-Lab 5 Butler Bldg
184	32a Neuqua- Lab 6 Butler Bldg.
185	22a Neuqua-Lab 7 Butler Bldg.
186	27a Blackhawk-Lab 8 Butler Bld
201	AP30 Service Building
202	AP10 Service Building
203	AP50 Service Building
204	AP-0 Target Hall
205	AP50 Gas Storage Building
206	Booster Gallery East & West
207	Booster Tower Southwest
208	Booster Tower Southeast
210	MuCool Service Building
212	Linac, X-Gallery, Transfer Gallery
214	Central Utility Building
216	A0 Kicker Building
217	A0 Lab Building
218	A-0 Service Bldg./Vehicle
220	A-1 Service Building
221	A-2 Service Building
222	A-3 Service Building
223	A-4 Service Building
224	B-0 Service Building
225	B-1 Service Building
226	B-2 Service Building
227	B-3 Service Building
228	B-4 Service Building
229	B-48 Kicker Building
230	C-0 Service Building
231	C-1 Service Building
232	C-17 Kicker Building
233	C-2 Service Building
234	C-3 Service Building

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
235	C-4 Service Building
236	C-4 Pump House
237	C-48 Kicker Building
238	D-0 Service Building
239	D-0 Vehicle Access Building
240	D-1 Service Building
241	D-2 Service Building
242	D-3 Service Building
243	D-4 Service Building
244	D-48 Kicker Building
245	E-0 Service Building
246	E-1 Service Building
247	E-17 Kicker Building
248	E-2 Service Building
249	E-3 Service Building
250	E-4 Service Building
251	F-0 (Rf) Service Building
252	F-1 Service Building
253	F-2 Service Building
254	F-23 Power Supply Building
255	F-27 Power Supply Building
256	F-3 Service Building
257	F-4 Service Building
258	D0 Gas Shed
259	B12 Gas Shed
267	F-17 Service Building
283	Switchyard Service Building
299	A-1 Refrigeration Building
300	A-2 Refrigeration Building
301	A-3 Refrigeration Building
302	A-4 Refrigeration Building
303	B-1 Refrigeration Building
304	B-2 Refrigeration Building
305	B-3 Refrigeration Building
306	B-4 Refrigeration Building
307	C-1 Refrigeration Building
308	C-2 Refrigeration Building

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
309	C-3 Refrigeration Building
310	C-4 Refrigeration Building
311	D-1 Refrigeration Building
312	D-2 Refrigeration Building
313	D-3 Refrigeration Building
314	D-4 Refrigeration Building
315	E-1 Refrigeration Building
316	E-2 Refrigeration Building
317	E-3 Refrigeration Building
318	E-4 Refrig Bldg & Test Facility
319	F-1 Refrigeration Building
320	F-2 Refrigeration Building
321	F-3 Refrigeration Building
322	F-4 Refrigeration Building
323	Collider Detector Facility CDF
324	G2 Service Building
325	D-0 Assembly Building
326	PPD Office Building at D-0
327	PPD Office Building at CDF
330	C0 Experimental Hall
400	Meson Wonder Enclosure
402	Ms-1 Meson Service Building
404	Ms-2 Meson Service Building
406	Ms-3 Meson Service Building
408	Meson Detector Building
410	Meson Central Cryogenics
412	Meson Assembly Building
413	Shield Block Storage Shed
414	Meson Service #4
416	Polarized Proton Lab - Mp
418	Meson Service Ms7
420	Meson West Lab -- MW9
422	BD Cryogenic Engineering Office
500	Proton Pagoda
502	Proton Assembly
504	Proton Tagged Photon Lab
506	High Intensity Laboratory

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
508	Proton Service #1
510	Proton Service #2
512	Proton Service #3
514	Proton Service #4
516	Proton Service #5
518	Proton Service #6
520	Proton Pole Building - Site 50
522	Exp Area Operations Ctr
600	Neutrino Lab A
601	Lab AB Bridge Bldg
602	Neutrino Lab B
603	Rd T&M Shop
604	Neutrino Lab C
605	Lab CD Cross Connect Building
606	Neutrino Lab D
608	Neutrino Lab E
609	Lab BEG Connection
610	Laboratory F
612	Laboratory G
613	Neutrino Service Building #E
614	Neutrino Lab Nwa
615	Neutrino Service #0
616	Neutrino Service #1
618	Neutrino Service #2
620	Neutrino Service #3
621	NS8 Service Building
622	Neutrino Service #4
623	Neutrino Service Building #7
624	Neutrino Target Service
626	Pb6/Pb7 Wide Band
628	HDCF - Grid Comp Ctr - WBL Ctg House
630	KTeV / NM4
700	Muon Laboratory
708	MI 8 Service Building
710	MI 10 Service Building
712	Mini BooNE Target Hall & Serv Bldg MI 12
713	MI 13A Counting House
720	MI 20 Service Building

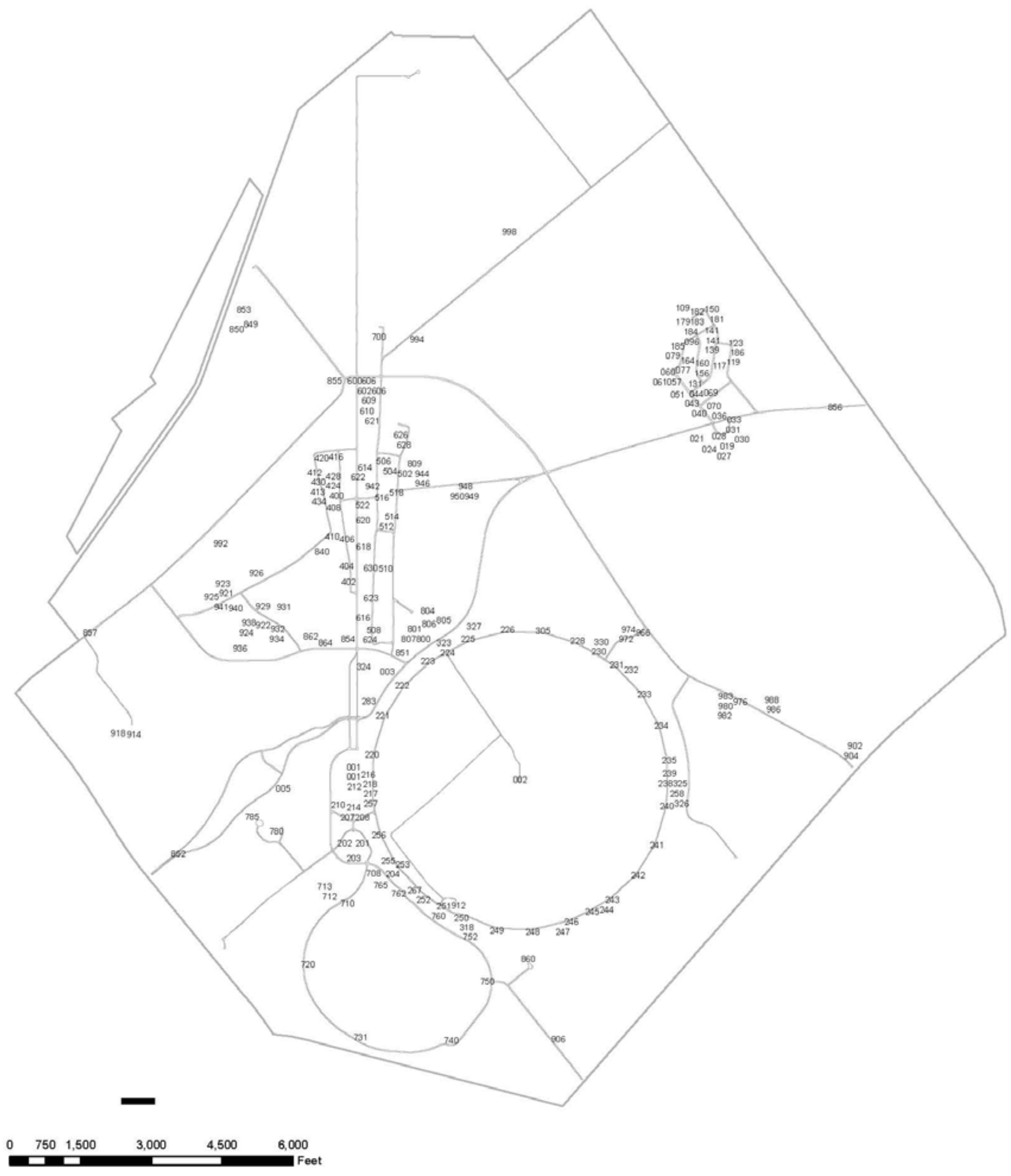
Attachment 2 Building Inventory & Maps

FIMS#	Building Name
730	MI 30 Service Building
731	MI 31 Service Bldg. E-Cool
740	MI 40 Service Building
750	MI 50 Service Building
752	MI 52 Service Building
760	MI 60 Service Building
762	MI 62 Service Building
765	NuMI Target Service Building
780	Mini BooNE Detector Building
785	MINOS Service Building
800	Industrial Building #1
801	Industrial Building #2
803	Industrial Shed #2A
804	Industrial Building #3
805	Industrial Building #4
806	Industrial Center Building
807	Industrial Compressor Building
809	Magnet Storage
840	Low Level Waste Handling Bldg.
849	Nevis Barn
850	Super Shed/Lundy Barn
851	Central Helium Liquefier
852	Pine Street Guard House
853	Railsiding Storage Shed
854	Master Sub-Station
855	Caseys Pond Pump House
856	Batavia Road Guard House
857	Wilson Rd Guardhouse
860	Kautz Road Sub-Station
902	Site 3 Barn
904	Site 3 Shed
906	Site 12 Barn
911	Site 17 Barn
912	Site 17 Shed
914	Site 29 House
916	Site 29 Garage
917	Site 29 Wellhouse
918	Site 29 Shed 1
919	Site 29 Shed 3

Attachment 2 Building Inventory & Maps

FIMS#	Building Name
920	Site 29 Shed 2
921	Site 37 Shop
922	Site 38 Maintenance
923	Roads/Grounds Equip Stge
924	Site 38 Equipment Building
925	Salt Storage Facility
926	Site 39
928	Site 38 HUS Building
929	Fuel Service Center
930	Site 38 Barn
931	Radiation Physics Calibration
932	Site 38 Fire Station
934	Site 38 Extinguisher Bldg
936	Site 38 Hazardous Storage
938	Receiving Warehouse #1
940	Receiving Warehouse #2
941	Scale House
942	Site 49 Barn
943	Site 50, Building A
944	Site 50 Barn
946	Site 50 House
948	Site 52 House
949	Site 52 Barn
950	Site 52 Shed
964	Site 55 House
966	Site 55 Storage
968	Site 55 Garage
970	Site 55 WS-3 Waste Storage
972	Site 55 WS-2 Waste Storage
974	Site 55 WS-1 Waste Storage
976	Site 56 Residence
978	Site 56 Barn 1
980	Site 56 Barn 2
982	Site 56 Shed 1
983	Site 56 Storage Building
984	Site 56 Shed 2
986	Site 58 Residence
988	Site 58 Barn
992	Site 65 Barn
994	Site 67 Barn
998	Site 70 Barn

Attachment 2 Building Inventory & Maps

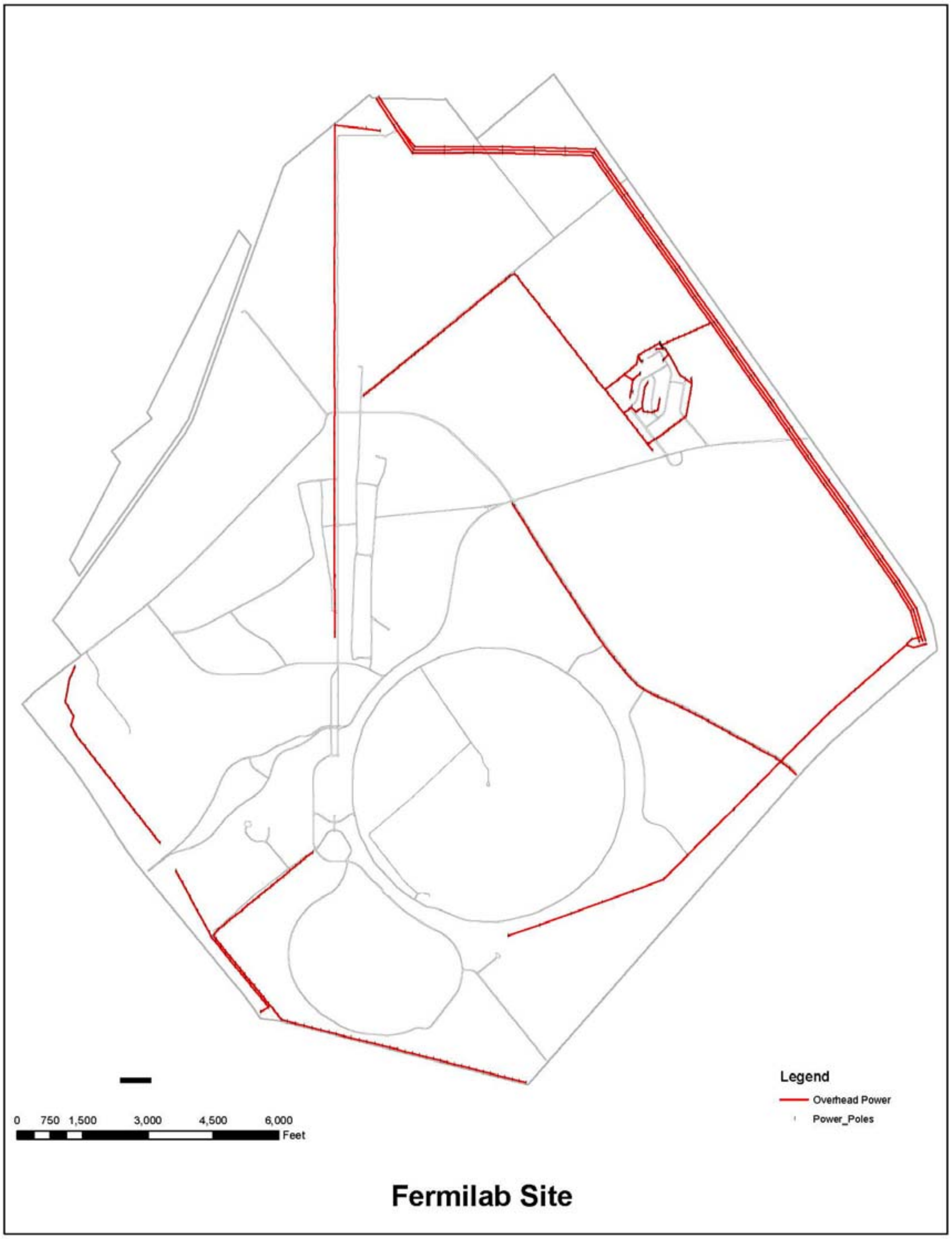


Fermilab Site

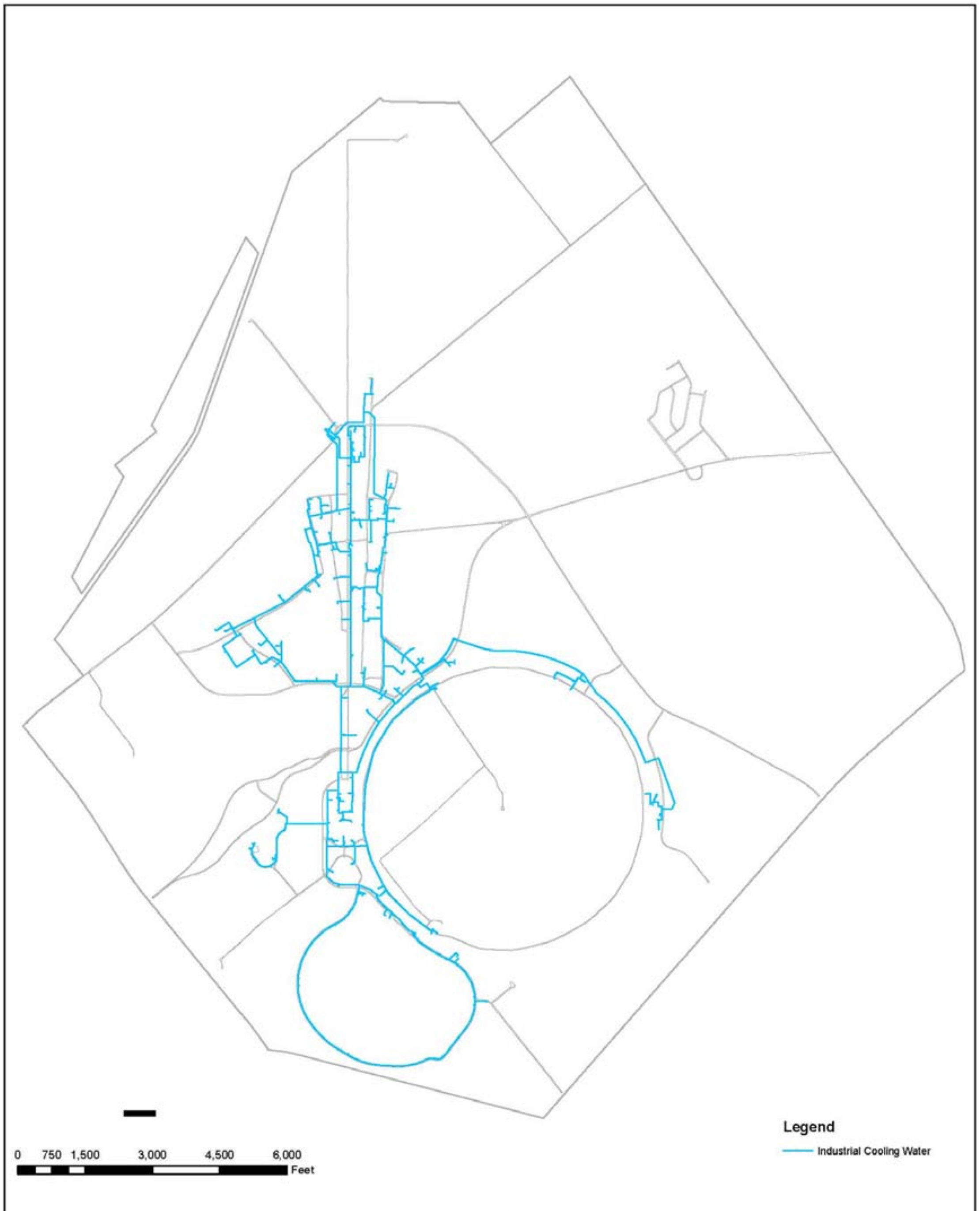
Attachment 3 Infrastructure / Utility Inventory & Maps

FIMS#	Asset Name
401030123	Storage Water Tanks
406030124	Railsiding Storage
701030125	Research Acc Ring/Tunnel
7111030126	Electrical Substations
7112030127	Electrical 345kV Transmission Lines
7113030128	Electrical Distribution, 13.8kV Feeders
7113030129	Electrical Distribution Lines, Tertiary
7115030130	Electrical Generators
7131030131	Water System Potable Distribution (DWS)
7132030132	ICW Piping Distribution System
7134030134	Water Wells - Nonpotable
7136030135	Pumping Station - Nonpotable
7142030136	Natural Gas Piping
7155030139	Sewage System Pumped & Gravity
7156030140	Sewage & Storm Septic Tanks
7163030141	Chilled Water Distribution Lines
7164030142	Cooling Ponds & Reservoirs
724030143	Communication System
761030144	Paved Roads
762030145	Unpaved Roads
801030146	Sidewalk
802030147	Fences
803030148	Parking Areas
808030149	Street Lighting
811030150	Site Prep., Grading/Landscapg
DAMS	Dams, MI, Lake Law, AE Sea
FUEL PUMPS	Fuel Pumps
LATERALS	Laterals, Ditches & Culverts
LIFT STATION	Sewage Lift Stations
NUMI BEAMLINE	NuMI Beamline
NUMI TUNNEL	NuMI Tunnel
OIL TANKS	Oil Tanks
PUMP STATION	Fox River Pumping Station
SECONDARY ROADS	Secondary Roads
STORMWATER	Stormwater Piping Gravity & Pressure
TRUCK SCALE	Truck Scale

Attachment 3 Infrastructure / Utility Inventory & Maps

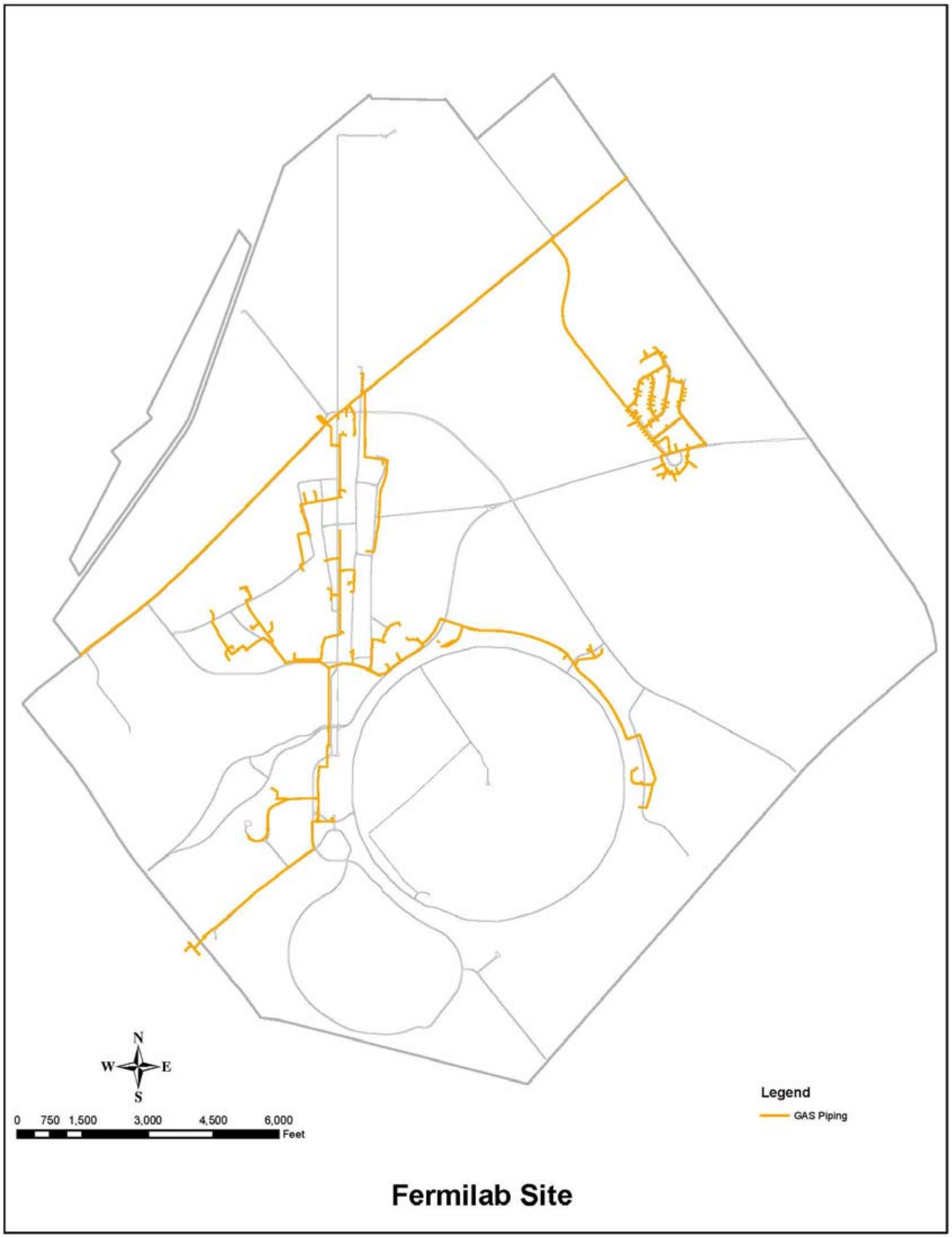


Attachment 3 Infrastructure / Utility Inventory & Maps



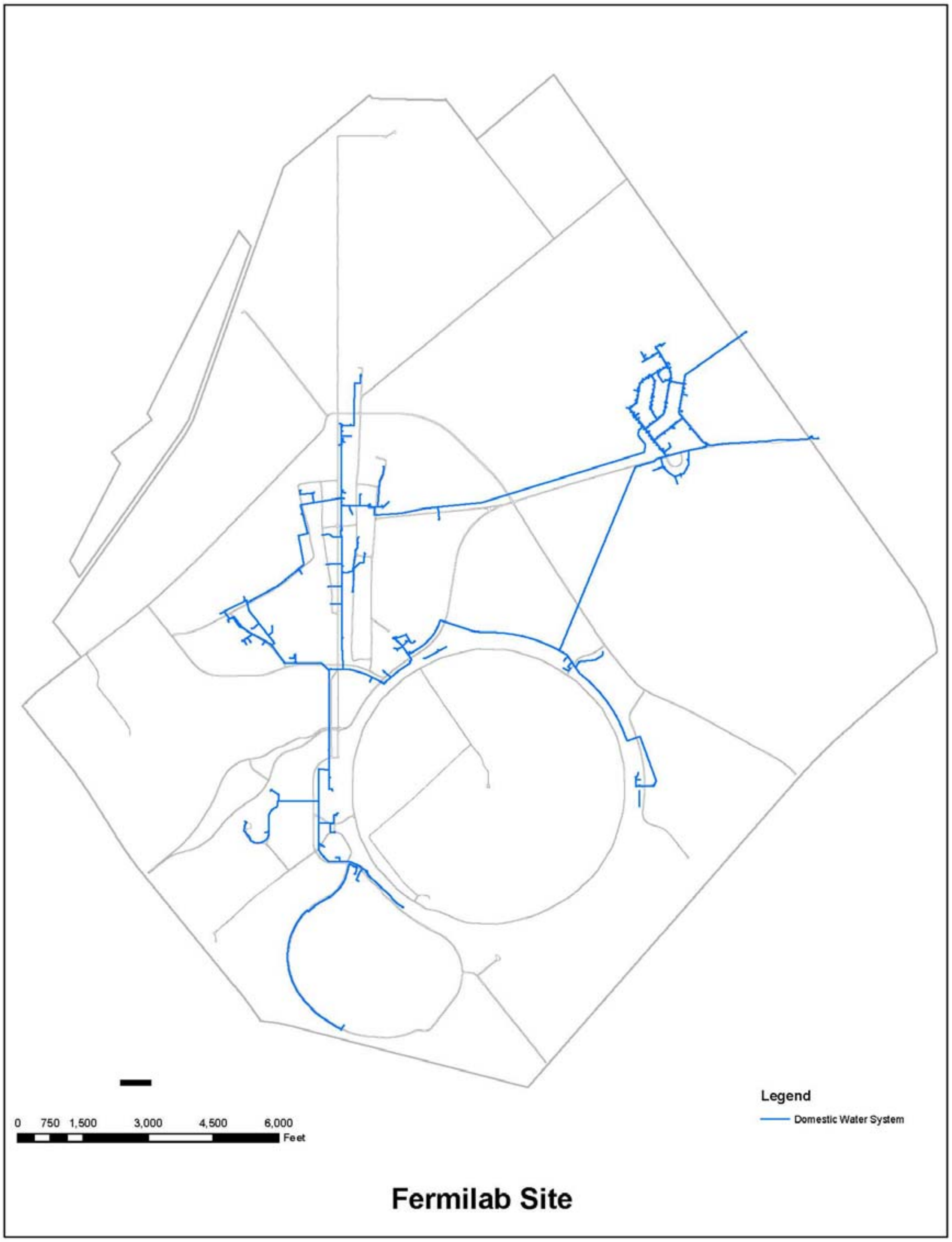
Fermilab Site

Attachment 3 Infrastructure / Utility Inventory & Maps

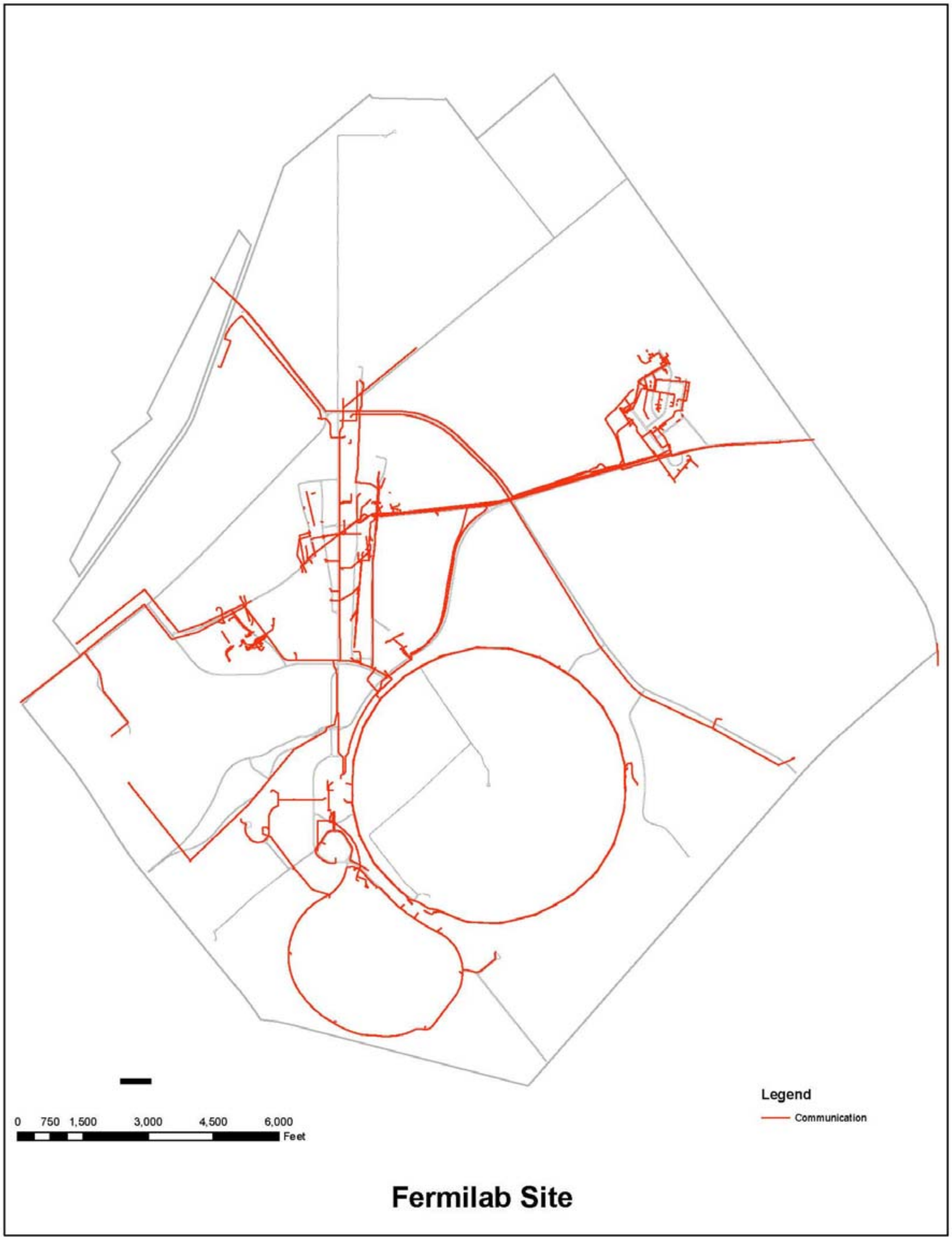


Attachment 3 Infrastructure / Utility Inventory & Maps

Attachment 3 Infrastructure / Utility Inventory & Maps



Attachment 3 Infrastructure / Utility Inventory & Maps



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Attachment 4 FY09 Integrated Facilities & Infrastructure (IFI) Crosscut Budget Submission

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	Deferred Maintenance Reduction	Gross Building Area Added	Gross Building Area Removed	FY 07 Approp. ($000)	FY 08 to Congress ($000)	FY 09 ($000)	FY 10 ($000)	FY 11 ($000)	FY 12 ($000)	FY 13 ($000)
SITE NAME: Fermilab										
PROGRAM: High Energy Physics										
1.0 Capital Line Item										
1.1 New Infrastructure Construction (facilities and additions)										
Subtotal 1.1										
1.2 All Other Infrastructure Projects (recap)										
Subtotal 1.2										
Total Infrastructure Line Items (1.1 + 1.2)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1.3 Programmatic Line Items that Add Space										
Next Generation Computing Facility		**30000**					25000	25000		
Advanced Materials Lab		**13500**	**13500**					3000	3000	
Subtotal 1.3										
Subtotal Line Item Projects (1.1 +1.2+1.3)		**43500**	**13500**	**0**	**0**	**0**	**25000**	**28000**	**3000**	**0**
2.0 General Plant Project (GPP) (Include project number & identify Funding Program)										
2.1 New Construction (facilities and additions)										
MI65 Expansion		**7000**	**7000**			4200				
New Muon Lab Expansion (AARD)		**7865**	**7865**			3600				
GCC Computer Room D		**4850**	**4850**			2500				
Site Security Facility		**2500**	**2500**				560			
Subtotal 2.1 New Construction GPP		**22215**	**22215**	**0**	**0**	**10300**	**560**	**0**	**0**	**0**
2.2 All Other GPP Projects (recap including alterations and improvements)										
Electrical Feeder System Upgrade				100						
Footprint & WH DWS Improvements				550						
Site 50/52 Sanitary				450						
GCC Computer Room C				1400	2800					
WH Generator Replacement					500					
A1 to CDF Paving					350					
FCC Sanitary					500					
ICW Upgrade & Controls					450		1175	1200	1200	800
High Availability Computing Center						4500				
Road Repaving & drainage Improvements						500				
WH West Parking Lot Upgrade							330			
Booster Tower HVAC Improvements							1300			
Computing Improvements							2300	2300	2300	2300
Emergency Services Building Improvements							3335	135		
Road Rehabilitiation							655	840	570	
CUB System Upgrades							225	585	600	
Domestic Water System							1315	1200	1200	
Pond Water Systems							225	600	600	400
Sanitary System Rehabilitation							1140	570	1260	1500
Steel Roofing Upgrades							250	250	250	250
Site Fire Protection Detection Improvements							190	85	200	200
Site HVAC Upgrades							195	85	200	200
FCC Office Improvements								350	1800	
High Voltage Electrical Upgrade								2350	1200	1200
High Voltage Electrical Oil Switches								2250	2035	
Surface Water Systems								290	900	
Parking Lot Rehabilitation								110	110	
Natural Gas Systems								290	900	
Elevator Improvements								175	225	
FCC Condenser Water Upgrade								500		
FCC Precast Concrete Infiltration Study & Recoating									330	
CD WH Office Improvements									840	
Master Substation Rehabilitation										4200
MINOS Dewatering Upgrade										3000
Wilson Hall Miscellaneous Improvements										2300
Road Repaving & drainage Improvements										135
Subtotal 2.2 All Other (recap) GPP				2500	4600	5000	12635	14165	16720	16485
Subtotal GPP (2.1 + 2.2)		22215	22215	2500	4600	15300	13195	14165	16720	16485

Attachment 4 FY09 Integrated Facilities & Infrastructure (IFI) Crosscut Budget Submission

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	Gross Sq Ft.	FY 07 Approp. ($000)	FY 08 to Congress ($000)	FY 09 ($000)	FY 10 ($000)	FY 11 ($000)	FY 12 ($000)	FY 13 ($000)
SITE NAME: Fermilab								
PROGRAM: High Energy Physics								

3.0 Institutional General Plant Project (IGPP)										
Subtotal IGPP Projects										
4.0 Operating/Expense for Excess Elimination and Other										
4.1 Excess Elimination (demolition, sale, lease, transfer) Show area eliminated in Gross Area column										
4.1 Subtotal										
4.2 All Other (List direct O&E maintenance under 5.1)										
Provide project level detail										
4.2 Subtotal										
Subtotal 4.0 Operating/Expense Projects (4.1 + 4.2)										
TOTAL Capital & Operating Investment:		65715	35715	2500	4600	15300	38195	42165	19720	16485
TOTAL Overhead Investments (IGPP)		0	0	0	0	0	0	0	0	0

	Gross Sq Ft.	FY 07 Approp. ($000)	FY 08 to Congress ($000)	FY 09 ($000)	FY 10 ($000)	FY 11 ($000)	FY 12 ($000)	FY 13 ($000)
5.0 Maintenance & Repair								
5.1 Direct Funded (by HQ or Site Program)		3249	3351	3786	3831	3919	4007	4097
List direct O/E maintenance projects >$500,000								
Subtotal 5.1 Total Direct Maintenance & Repair		3249	3351	3786	3831	3919	4007	4097
5.2 Indirect (from Overhead or Space Charges)		8166	8616	9736	9851	10078	10304	10536
Include indirect O/E maintenance projects > $500,000								
Subtotal 5.2 Total Indirect Maintenance & Repair		8166	8616	9736	9851	10078	10304	10536
Subtotal Total Maintenance & Repair (5.1 + 5.2)		11415	11967	13522	13682	13997	14311	14633
5.3 Hqs Direct Funded Deferred Maintenance Reduction								
Subtotal 5.3 Total Direct Deferred Maintenance								
5.4 Indirect Funded Deferred Maintenance Reduction (from Overhead or Space Charges)								
Include indirect O/E maintenance projects > $500,000								
Deferred Maintenance Reduction Allocation		1980	4328	6312	8296	8296	8296	
Subtotal 5.4 Total Indirect Deferred Maintenance								
Total Deferred Maintenance (5.3 + 5.4)		1980	4328	6312	8296	8296	8296	0
Total Maintenance (5.1 + 5.2 +5.3 +5.4)		13395	16295	19834	21978	22293	22607	14633
6.0 Indirect O&E								
6.1 Excess Elimination (demolition, sale, lease, transfer) funded from indirect funds. Show area eliminated in Gross Area column								
Decommissioning post-Tevatron Operations					250	250	260	270
6.1 Total Indirect Excess Elimination	0	0	0	0	250	250	260	270
6.2 Other Indirect Funded (includes modifications, additions, improvements, etc. that does not qualify as GPP or maintenance)								
Utility Incentive Program (UIP)		5400	5400	5400	5400	2700		
6.2 Total Other Indirect O&E								
6.0 Total Indirect O&E		5400	5400	5400	5650	2950	260	270

Attachment 4 FY09 Integrated Facilities & Infrastructure (IFI) Crosscut Budget Submission

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)

SITE NAME: Fermilab

PROGRAM: High Energy Physics

7.0 Summary of Area Added & Eliminated by Year

7.1 Total Area to be Eliminated Each Year (List of projects, by type of funding, with project number, and AREA eliminated by fiscal year accomplished).	Project Number	Gross SF Removed	FY 06 Sq Ft	FY 07 Sq Ft	FY 08 Sq Ft	FY 09 Sq Ft	FY 10 Sq Ft	FY 11 Sq Ft	FY 12 Sq Ft	FY 13 Sq Ft
Line Item from Block 1 (show each that removes space)										
Subtotal Line Items		13500							13500	
GPP from Block 2 (show each that removes space)										
Subtotal GPP		22215				19715	2500			
IGPP from Block 3 (show each that removes space)										
Subtotal IGPP		0								
Operations/Expense from Block 4.1 (show each that removes space)										
Subtotal Block 4.1		0								
Indirect Operations/ Expense from Block 6.1 (show each that removes space)										
Subtotal Block 6.1		0								
Transfer by sale or lease, or transfer to an outside federal agency										
Provide detail										
Subtotal Transfer or Lease		0								
Subtotal 7.1 Space Removed		35715.0								
7.2 Total Area to be Added by GPP, IGPP, and LI Construction (List of projects, by type of funding, with project number, and AREA add by fiscal year accomplished).		Gross SF Added	FY 06 Sq Ft	FY 07 Sq Ft	FY 08 Sq Ft	FY 09 Sq Ft	FY 10 Sq Ft	FY 11 Sq Ft	FY 12 Sq Ft	FY 13 Sq Ft
Line Item (list)										
Subtotal Line Items		43500						30000	13500	
GPP (List)										
Subtotal GPP		22215				19715	2500			
IGPP (List)										
Subtotal IGPP		0								
Subtotal 7.2 Area Added		65715	0	0	0	19715	2500	30000	13500	0

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Attachment 5 Detail Information for SLI Line Item Projects

SLI Project #1: ICW

Laboratory:	FNAL
Project Title:	Industrial Cooling Water System Upgrades
Project Number*:	FNAL-001
Estimated Cost	$20,800
Near, Mid or Far-term:	N

Project Description /Justification:

Description:
- -Network analysis & redesign
- -Installation/replacement of piping, valves & sectional metering
- -Replace pump houses (Casey's & C4)
- -Required offsetting demolition

Justification:
- -Reliable supply required for fire safety
- -Optimization of distribution system to current loads & usage
- -Portions of the existing network are at end-of-life
- -Sectionalization is needed to promote redundancy & serviceability

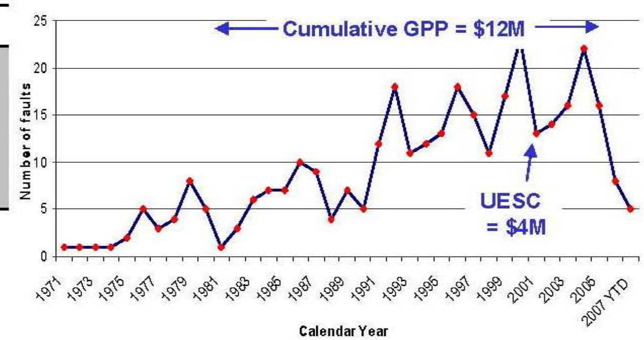
Funding Profile:	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**
Expenditure ($K)			$800	$10,000	$10,000					

Gross Sq Ft	**Added:**	2,000	**Removed:**	2,000	**Rehabbed:**	0
Def. Maint. Reduc.	8300					
CAMP Score	44.0	**Principle Driver:**		MI AS		

Attachment 5 Detail Information for SLI Line Item Projects

SLI Project #2: HV Electrical

Laboratory:	FNAL
Project Title:	High Voltage Electrical System Upgrades
Project Number*:	FNAL-003
Estimated Cost	$14,100
Near, Mid or Far-term:	N



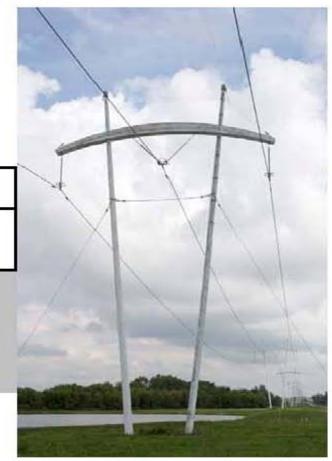
Project Description /Justification:

Description:
-Replace original oil switches with air switches
-Upgrades to Master Substation
- switchgear
- distribution
- disconnect switches
-Installation of 345kV main site circuit breaker

Justification:
-Oil switch replacement mitigates environmental liability
-Oil switches and substation components at end-of-life; parts obsolete

Funding Profile:	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Expenditure ($K)			$500	$6,800	$6,800		

Gross Sq Ft	**Added:**	0	**Removed:**	0	**Rehabbed:**	0
Def. Maint. Reduc.	8000					
CAMP Score	42.0	**Principle Driver:**	MI AS			



Attachment 5 Detail Information for SLI Line Item Projects

SLI Project #3: Ind Facilities

Laboratory:	FNAL
Project Title:	Industrial Facilities Consolidation
Project Number*:	FNAL-004
Estimated Cost	$33,750
Near, Mid or Far-term:	N

Project Description /Justification:

Description:
- Additions to existing buildings
- Adaptive re-use of existing experimental building
- Required offsetting demolition

Justification:
- Increased efficiency through functional consolidation
- Replace inappropriate facilities with state-of-the-art R&D and assembly accommodations

Funding Profile:	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Expenditure ($K)						$1,050	$6,720	$16,720	$9,260	

Gross Sq Ft	**Added:**	27,000	**Removed:**	31,600	**Rehabbed:**	40,000
Def. Maint. Reduc.	18k					
CAMP Score	39.0	**Principle Driver:**	MI CC			

Attachments

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Attachment 8

Fermilab High RPV/Low Maintenance Facilities Review

Background

On April 25 and April 26th, 2006, Max Rosenquist and Steve Neus, representing DOE CH, completed an on-site assessment of the Fermilab Low Maintenance, High RPV facilities. They were escorted by Kent Collins and Al Flowers, from the Fermilab Facilities Engineering Site Services organization. The purpose of the visit was to tour several sample areas of tunnel structures, and validate the Fermilab generated list of components that are conventional in nature. For this purpose, conventional components are those providing general functionality to a facility, and are usually maintained by the site facilities group as part of the basic service provided to the facility tenant. Programmatic equipment is excluded, as well as unique program support equipment that would not generally be reusable by another program, and would be removed.

The areas toured included the F sector of the Tevatron Main Ring tunnel, the MI60 interchange region of the Main Injector, and the MINOS, or downstream end of the NuMI tunnel system.

After completing the tours, the group developed an understanding on the means and methods to define the CFI indicator values for Fermilab's OSF 3000 tunnel facilities.

A finite list of conventional components and ancillary support materials, equipment, or structures has been developed. Equivalent RPV values were based on Whitestone, Means, or site specific construction cost data. Table 1 provides data for all of the tunnel facilities except the recently constructed NuMI facility. Table 2 provides data for the NuMI facilities.

Summary

The conventional equipment in the primary Fermilab OSF3000 asset (tunnels) has an RPV of $24,264,460. Repairs are occasionally required to the underground enclosure to control water infiltration, and a value for a conventional roof equivalent can be determined based on the average cost of these repairs over time. The OSF3000 (tunnel) conventional roof equivalent RPV value is $3,330,000 as shown in the table of section 9. The RPV in FIMS for the complete asset, including conventional and programmatic components, is $745,748,925. Therefore, the Conventional Facilities Indicator (CFI) is 3.70%. (CFI = (Conventional RPV + "roof" RPV Adjustment)/ FIMS RPV)

The conventional equipment in the NuMI tunnel OSF3000 asset has a RPV of $4,341,734. The roof equivalent value is $370,000 shown in the table of section 9. The total RPV in FIMS is $57,787,446. Therefore, the Conventional Facilities Indicator (CFI) is 8.15%, which is much higher than the CFI of Fermilab's primary OSF3000 asset, Research Accelerator Ring/Tunnel because the NuMI Tunnel includes only the conventional portion of the split asset. The CFI of the NuMI Beamline, in fact, is zero, as it is the exclusive programmatic portion of this split asset, represented as two records in FIMS. The table below summarizes the current FIMS RPV for each subject asset, as well as the new total equivalent RPV and CFI.

FIMS Current RPV	FIMS Asset	Total Equivalent RPV for MII	CFI
$57,787,446	NUMI TUNNEL	$4,711,734	8.15%
$745,748,925	701030125 Accel Tunnel	$27,594,460	3.70%
$847,880,069	Total:	$52,000,870	

Attachment 8

The following table shows three scenarios for the FY2006 MII, based on Fermilab's actual reported expenditures, and three different RPV denominators. It compares the MII based on the current total RPV, the proposed new RPV utilizing an adjustment for the conventional equipment through application of the CFI multiplier, and the MII associated with the base RPV used for 2006 SC MII goals. All values in the table are based on a proposed CFI of 0.0% for the Fermilab site preparation and grading asset, which will be classified as a "High RPV / Zero Maintenance Asset."

MII with 2006 Actual	Comparison RPV	Explanation	2006 Actual Maintenance 4th Quarter Report
0.86%	1,430,301,664	Total current RPV in FIMS (Early Feb. 2007 before 2007 Up-date) (Buildings, OSF & Real Property Trailers), excluding Site Prep. previously approved, including OSF series 3000	12,282,000
1.94%	634,422,465	Total Conventional current RPV after Proposed CFI's are Applied to all series 3000 assets, excluding site prep.,	12,282,000
2.19%	560,000,000	Base RPV used for SC 2006 MII M&O contract goals – FY06 Maintenance Plan in FY07 IFI to Congress, (excludes series 3000 and all assets with status codes other than 1, 2 & 6, includes site prep.) Per Yates email 1-11-06 3:56 PM & 1-10-06 11:32 AM .	12,282,000

The 2006 maintenance funding goal based on 2% MII goal would have been $12,688,449 instead of $11,200,000 if the base RPV would have been based on Total Conventional RPV after proposed CFI's are applied (2nd Row above), instead of the base RPV used for 2006 MII goals (3rd Row above).

Notes for the Table above: The current RPV for the site prep asset is $6,130,311. The table in section 9 below shows the RPV reduction $795,879,199 associated with the CFI being applied to OSF series 3000 assets.

Issues

When Fermilab originally populated the RPIS database it was decided that all service buildings or above-ground structures that have a distinct non-earthen roof would be classified as buildings, and all underground beam transmission facilities would be classified as tunnels. Because all of the tunnels were by Fermilab's definition programmatic, condition assessments were not completed. Starting in 2004, conventional equipment such as unit heaters and lighting that resided in tunnels was reassigned in the computerized maintenance management system (CMMS) to the appropriate tunnel sector. This effort was completed by the end of FY05, and the inventory in the CMMS has been used to identify the conventional components in the Fermilab tunnels. In the future, condition assessments will also include this equipment.

The only deferred maintenance noted during the on-site review was painting for one of the Tevatron fan housings. Because the tunnels and their supporting systems house the most important and most critical equipment at Fermilab, future condition assessments are expected to result in similarly insignificant DM amounts.

While no significant other issues were found on the tours, many specific issues were discussed to help determine an appropriate definition of conventional equipment in tunnels. The following summarizes each issue and provides some of the rationale for the final determinations. Table 1 and Table 2 summarize the data used to calculate the replacement RPV, and the associated CFI Indicators. Because the NuMI system was recently capitalized, and was constructed quite differently than any of the other Fermilab shallow tunnels, it was treated separately in Table 2.

Attachment 8

1. Components and operating protocols for ventilating the Tevatron tunnel

The Tevatron tunnel was originally designed to be positively pressurized with inflow fans located at 12 even numbered service buildings, with a total capacity of 156,000 cfm, and exhaust fans located at the 12 odd numbered service buildings. The exhaust units were capable of removing 10% less than the inflow amount. The design provided over 2 air changes per hour.

It is not known if the fans were ever used in accordance with the original design philosophy. The current ventilation plan does not rely on any of these original fan units. Half of the units have been removed, and the chases are sealed. The remaining fans have been occasionally used for short duration, localized exhausting after welding or when other fume or odor generating work occurs in the tunnel during a shutdown. Fresh make-up air is provided by a combination of thermally induced natural convection through the remaining fan chases, or pressure gradients due to surface winds over the openings. Air within the tunnel is circulated in a clockwise direction with small disposable propeller fans hung from the ceiling, preventing concentrated pockets of humid air. Nineteen dehumidifiers are located around the Tevatron tunnel.

Only the propeller fans and dehumidifiers are considered conventional HVAC equipment.

2. Managing water infiltration into different tunnel systems

Water entry into beam transmission tunnel systems can represent a considerable liability. Disposal of large volumes of tritiated water can be expensive. Water allowed to leak onto machine components while operating can cause failure of those components. Fermilab mitigates these risks by being very proactive in managing ground water intrusion. Epoxy injection is typically used in the shallow tunnels to keep water out, and water is managed in deeper tunnels with defined flow paths to a pumped discharge sump. Planned future annual expenditures for subcontracted injection sealing of tunnel walls and maintenance of diverters or gutters are expected to be similar to the recent four year average of $35,000 per year. With the site factor of 1.903 and the geographic factor of 11%, the annual expected burdened maintenance cost is $74,000. Dividing the annual maintenance by the currently required maintenance investment index of 2% yields an equivalent "roof" RPV of $3,700,000. Approximately 10% of this "roof" is at NuMI ($370,000).

Historic tunnel waterproofing (usually epoxy injection) costs:

FY03	$ 13,877
FY04	$ 37,751
FY05	$ 37,589
FY06	$ 52,627
Average:	$ 35,461

4. Accelerator LCW system and subcomponents in tunnels

Fermilab's Tevatron accelerator primarily resides in the 4 mile ring tunnel system. The ring is divided into six different sections, and each section contains four above ground service buildings. Each service building has a tap into the LCW supply and return loop, connected through a 75 Hp circulating pump. Heat introduced into the loop from magnets, power supplies, and other electrical loads is rejected to the pond water system through heat exchangers in each service building. The LCW supply and return headers are located in the Tevatron tunnel, and are actually large loops. This has the effect of connecting each section via the continuous header, and allows for the movement of water between sections in the event a pump fails.

The only components in the tunnel are the piping headers. The pumps and heat exchangers are contained in and considered part of each of the service buildings. The valves, pumps, and deionization columns in the Central Utility building are considered components of that building.

Attachment 8

LCW distribution headers are maintained by the accelerator mechanics. They do not differentiate their work activity or costs between the various components of the LCW systems. They maintain pumps, piping, valves, point of service isolators for cooling electrical loads, and regeneration facilities, as well as perform system operating functions such as servicing the regeneration columns and locating piping prior to excavations. The LCW distribution system in the tunnels is an integral part of the accelerator that would be removed if accelerator operations ceased.

The piping headers in the tunnel are programmatic equipment located and sized to specifically and only service the accelerator equipment. Accordingly, no components of the LCW system are included in the OSF3000 list of conventional equipment.

5. Tunnel painting

Records are not available for any painting projects in the Tevatron tunnel within the past five years. It is believed that less than two man days of effort was dedicated to touching up graffiti about 3-5 years ago. The five year average cost of this effort would be in the range of $300 per year. Tunnel walls are usually painted or at least sealed before occupancy to help reduce the generation of dust from the surface as it cures. There is no requirement or plan to recoat these surfaces. No walls, wall coverings, or wall coatings are included in the OSF3000 list of conventional equipment.

6. Exit lights and emergency lights

The power supplies for the tunnel emergency lights are in the service buildings. Fermilab cannot tell which are for tunnels only, but because the asset numbers and work orders represent all effort for the lamps, fixtures, batteries, chargers, and power supplies, the maintenance costs are captured as part of the service building.

Tunnel exit signs are LED units without back-up batteries. Defective units are replaced by the accelerator technicians during major shutdowns. No specific records or costs are available for this activity, and the associated costs are insignificant.

No exit lights or emergency lights are included in the OSF3000 list of conventional equipment.

7. Dedicated warning systems in tunnels (ODH and start-up warnings)

Defective units are replaced by the accelerator technicians during major shutdowns. No specific records or costs are available for this activity. The start-up warning system is part of the safety envelope required to operate the accelerator chain, providing an aural and visible warning that the machine will be energized, and that all personnel are to vacate the area immediately. The ODH horns and lights are also a component of the safety envelope, alarming whenever atmospheric oxygen levels in the tunnel fall to a danger level. Both are integral parts of the accelerator that would be removed if accelerator operations ceased.

No warning system components are included in the OSF3000 list of conventional equipment.

8. Fermilab's practices for development of conventional equipment RPV's

The Fermilab cost estimates utilize the current Fermilab geographic factor and the newly developed site factor for tunnel assets. The base costs are from recent construction experience, Means data, or Whitestone Research data.

Attachment 8

9. Clarification of current capitalization status (RPV) of NuMI and other OSF3000 tunnel assets in FIMS, and the proposed revised RPV values expected after approval of the conventional equipment list.

The table below shows the breakdown for the capitalization of the Tevatron and older Fermilab tunnels and the newly adopted method used for capitalizing the NuMI buildings and tunnels separately from the NuMI programmatic beamline. It also shows the equivalent RPV and associated CFI value used for development of the MII metric.

FIMS Current RPV		Annual "roof" infiltration cost	Equivalent "roof" RPV	Conventional Equipment RPV	New Total Equivalent RPV for MII	CFI
$24,649,022	NUMI BEAMLINE			$0	$0	0%
$57,787,446	NUMI TUNNEL	$7,400	$370,000	$4,341,734	$4,711,734	8.15%
$11,289,112	#765 NuMI Target Service Building			$11,289,112	$11,289,112	100%
$8,405,564	#785 MINOS Service Building			$8,405,564	$8,405,564	100%
$745,748,925	701030125 Accel Tunnel	$66,600	$3,330,000	$24,264,460	$27,594,460	3.70%
$847,880,069	Total:	$74,000	$3,700,000	$48,300,870	$52,000,870	

Notes on the Table *(above)*: The difference between Total Current RPV and New Equivalent RPV is $795,879,199. The total Equivalent RPV (the conventional equipment RPV after the CFI's are applied) for the three OSF series 3000 assets (NUMI TUNNEL, NUMI BEAMLINE and 701030122 Accel Tunnel) is $32,306,194 (excludes the two building assets #765 & #785 listed as buildings in FIMS).

The CFI for the NUMI BEAMLINE is zero because it is exclusively the programmatic component of the split asset, or the actual beam conveyance and/or experimental target/interaction equipment located in the NUMI TUNNEL. The discrepancy in CFI percentage between Fermilab's other shallow tunnels and the deep NuMI tunnels is normal. Design considerations such as fire protection and dehumidification are more challenging, and considerably more expensive at NuMI. It is also a split asset, so the conventional percentage of the civil construction portion is higher than in the other Fermilab tunnels, which include the programmatic component in their CFI denominator's RPV. If it were not a split asset, the NUMI TUNNEL CFI would be 5.664%.

The new OSF3000 reduced RPV to be used for the purpose of calculating MII will be the sum of the $4,711,734 (NuMI tunnel conventional equipment) and $27,594,460 (all other tunnel conventional equipment), reducing the total $803,536,371 OSF3000 RPV by $771,230,177 to a new value of $32,306,194.

10. Historical actual maintenance performed on the conventional equipment.

Individual items of equipment were originally assigned to the closest building for tracking purposes in the Fermilab computerized maintenance management system. Between FY03 and FY04, equipment that was physically located in tunnel enclosures was reassigned in the CMMS system to the facility in which it primarily resides. The average cost of maintenance performed shown on Table 1 below represents the FY04/05 average for preventive maintenance and minor repair, as shown in the CMMS.

Several other changes were being made to the CMMS system at the same time, which affect the quality of this data. Shop labor rates were changed from a standard to various rates that more accurately represented the true direct cost. Shop overhead costs were later included in these rates. The multiples for geographic factor, site factor, and G&A burden were not applied. In spite of the data quality problems, there is a clear indication that the ongoing required maintenance investment is minimal relative to the construction cost of the entire tunnel system, but is relatively in line with a 2% metric applied to the RPV of the conventional type equipment identified in this analysis.

Attachment 8

Major repair and equipment replacement costs were not historically captured through either the CMMS or accounting systems. Fermilab has recently started to capture theses costs and they are included in the quarterly and annual maintenance reports to the Department of Energy. When replacement program costs are factored in, it is expected the average annual maintenance investment may exceed 2%.

Attachment 8

11. Methods used for calculating typical replacement unit cost for various types of conventional equipment.

Conventional equipment was grouped into systems, generally following the guidelines used by Whitestone Research in parametric modeling for building maintenance. For example, pumping systems include the drive motor, transmission system (coupling, belts, gears, guards, mounting, and alignment), electrical service and controls, and source and discharge piping, as well as the actual pump itself. Typical ancillary devices included in each system are identified below. The primary cost reference was Whitestone's data, and Means data was used for systems not available from Whitestone. The Whitestone data is based on and updated annually using Means data. Both Whitestone and Means costs are adjusted with a geographic, or location factor.

Quantities for ancillary devices were based on site experience. For example, electrical panels in tunnels are typically spaced approximately 800 feet apart. Utilization equipment such as sump pumps or compressors is typically located in close proximity to the panels, with lighting and convenience outlets spread out between panels. The quantity of conduit, cable, pull boxes, mounting hardware, etc is based on this arrangement. It is the same estimating method used for construction estimates when the Main Injector tunnel system was built in the late 90's. Unit prices for ancillary equipment are typically based on Means data.

The following panelboard example is typical of the methodology used to develop equivalent replacement pricing:

$ 6,651 – Means; NEHB panelboard, 4 wire, 277/480 volts w/ 400 amp main, 42 circuits
$ 7,000 – Site experience ancillary devices: conduit, wire, disconnect/protection, and terminal devices, based on $10k ea @ MI, MR, $3k elsewhere, for weighted average of $7k ea
$13,651 - Subtotal
______ x 2.1123 – default site factor (1.903), multiplied by geo factor (1.11) =
$28,835 Subtotal #1

Plus
20 hrs – labor based on site experience in new construction
x $60.12/hr which is $48.10/hr – electrician rate + $4.09 WorkComp + $7.93 benefits - from Whitestone
x 2.1123 – which is the site factor (1.903), multiplied by geo factor (1.11) =
$ 2,539 Subtotal #2
$31,374 Grand Total

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Attachment 8

Several specific questions were raised in Max Rosenquist's June Email. The following responses address these questions:

1. There should be an asterisk or a note explaining that the unit cost includes both the geo factor and the site factor. Done

2. Instead of "Revised Subtotal 6/2006," use "RPV Total," or "Conv. RPV Total." Done

3. It would be good to add columns for "Whitestone Sustainment" and "MII (2% of RPV)." The Whitestone models and the application of the 2% MII are known to not be accurate methods to predict budgets and/or cost comparisons for individual equipment. They are excellent tools for analyzing entire groups of data. Presentation of the component data in this case does not seem appropriate, because it may lead to inaccurate conclusions about any single category of items.

4. The tables designed to be printed landscape. It would be good to have the columns repeated on page two. It would be good to use a page break between tables. These can be formatted as required for your final report.

5. For NuMi some of the cells under "Whitestone MARS Component Name" are blank. Presumably they should be filled with "Means" or better yet with the Means reference number. It would be good to add, "or Means" to the column name. There is no Whitestone equivalent for these items. Costs are based on actual construction experience.

6. For DEHUDID046 the component name for NuMi is blank. Presumably this should be the same as listed for the other table. The NuMI desiccant dehumidifiers are unique, and are not represented in MARS. Costs are based on actual experience.

7. Why is an exterior light pole with two fixtures included? Does the cost for the light pole mean "not applicable" or "not available?" Its inclusion was an error.

8. What does the asterisk mean after 2 for the dehumidifier row? The refrigerant based dehumidifiers are similar in construction, complexity, and maintenance requirements to small packaged rooftop air conditioners. The acquisition and installation costs are approximately twice that of the air conditioners. The "* 2" represents a multiple of 2.

Some of the Ave. Annual Maintenance Costs seem to be questionable.

We agree there is variability in the actual maintenance data. This is the nature of maintenance. For example, at NuMI the annual unit cost for maintaining 5 transformers is greatly skewed by one significant repair. With a denominator of 145 for the rest of the site, one repair doesn't have a large impact on the unit cost.

All of the equipment in NuMI is new. Without a failure at NuMI, the $19 unit cost for preventive maintenance (inspect, blow out dust, confirm operation) is logically smaller than throughout the rest of the site where the average age of heaters is over 20 years, and failures are more commonplace.

NuMI does have some unique conditions that affect equipment operation. The electronic controls for the cranes in the NuMI tunnel are in close proximity to intense beam conditions and require removal prior to beam operation. When beam is turned off and the cranes need to be returned to service, the maintenance contractor re commissions the controls. Fermilab classifies the work as maintenance because the re commissioning includes work such as completing the annual inspection.

Attachment 8

Table 1: Fermilab tunnels without NuMI:

FAMIS (CMMS) Keyword	FAMIS Description	Whitestone MARS Component Name	Quantity	Unit Cost w/ Site & Geo factor	RPV Total	Avg. Annual Burdened Maintenance Cost	Ancillary devices' comments
GRAND TOTAL:					**$24,264,460**	**$382,246**	
TRANS071	LOW VOLTAGE TRANSFORMER	Secondary Transformer, Dry, 50 KVA	145	12,677	**1,838,199**	**1,672**	Typ 45KVA Tr. incl breakers/disconnect, conduit & conductors, & specialized mounting.
MOTOR 098	MOTOR, ELEC (Means)	MEANS	56	9,692	**542,743**	**5,194**	Typ 5HP w/ comb. starter, conduit, cable, mounting, and coupling or drive system.
HEATER015	HEATER, UNIT, ELEC	Electric Unit Heater	182	7,569	**1,377,594**	**29,634**	Typ 30KW w/ safety sw., conduit, cable, Tstat, and specialized mounting.
SWITCH052	SWITCHBOARD	Switchboard, 2000 Amp.	6	54,250	**325,500**	**286**	w/ disconnect/breaker, conduit and cable to swichbd, & specialilized mounting
PANEL 054	PANELBOARD	Distribution Panel Board 225A.	259	31,374	**8,125,870**	**15,958**	Conduit, wire, disconnect/protection, breakers, & terminal devices
No FAMIS equivalent	LIGHTING, STREET AND EXTERIOR	Light Pole, Exterior, 2 Fixtures	1	10,422	**10,422**	**N/A**	Means cost
No FAMIS equivalent	LIGHTING, INTERIOR	Fluorescent Lighting Fixture, 80 w	82	388	**2,705,359**	**16,952**	Includes average 85 2-lamp fixtures per lamping zone
BATTERY096	BATTERY	Exit Lighting Fixture, w/ Battery	6	1,459	**8,754**	**22,730**	Incl conduit, cable, and mounting.
FPDETP	FIRE DETECTION SYSTEM	Conventional Fire Alarm Control Panel	4	55,277	**221,106**	**2,440**	Based on detailed estimates of 4 systems

Attachments

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FAMIS (CMMS) Keyword	FAMIS Description	Whitestone MARS Component Name	Quantity	Unit Cost w/ Site & Geo factor	RPV Total	Avg. Annual Burdened Maintenance Cost	Ancillary devices' comments
AC 008	AC PKG UNIT, COOL ONLY W/COMPR	Air Conditioner, Rooftop or Split Condenser/Evap, 10 Ton	3	36,312	**108,937**	**13,586**	Duct work, mounting, condensate, flashing , power & misc. details.
AC 010	AC, REMOTE COMPRESS (SPLIT SYSTEM)	Condenser, Air-Cooled, 7.5 Ton	8	13,061	**104,486**	**11,068**	Mounting, condensate, flashing, power & misc. details.
PUMP 003	PUMP UTILITY SEWAGE/SUMP SUBMERS	Sump Pump, 20 HP	185	25,957	**4,801,980**	**143,796**	Discharge piping, sump, power & Means adjustment.kcollins: Means estimate for 25 HP pump is $2500 higher than MARS 20 HP
PUMP 002	PUMP UTILITY CENTRIFUGAL	Circulation Pump 25 HP, Hot Water	4	22,865	**91,459**	**792**	Piping, power, mounting, and misc. details.
FAN 015	EXHAUST FAN	Exhaust Fan, Centrifugal, 5,000 Cfm	113	11,070	**1,250,877**	**30,182**	Duct work and power. Starter.
VENT 040	VENT WITH DAMPERS	Steel Damper w/ Motor	8	3,455	**27,644**	**1,148**	Penetration & power.
HVAC 011C	SUPPLY AIR FAN	Air Handler, Single Zone, 6,500 Cfm	6	26,460	**158,757**	**2,172**	Ductwork, mounting, power & misc. details.
FAN 014	HVAC, SPLIT SYS/ELEC HEAT	Air Conditioner, Rooftop, Single Zone, 3 Ton	3	14,903	**44,709**	**3,292**	Mounting, condensate, flashing, power & misc. details.
HV 012	HEATING, VENTILATING UNIT	Air Handler, Single Zone, 6,500 Cfm	18	26,460	**476,271**	**17,912**	Ductwork, mounting, power & misc. details.
AC 084	AC PKG UNIT, WATER COOLED COOL ONLY	Air Conditioner, Rooftop, Single Zone, 7.5 Ton	4	23,000	**91,998**	**3,708**	Mounting, condensate, flashing, power & misc. details.
CRANE 030	CRANE AND/OR HOIST, LESS THAN 10 TON	Crane Jib Electric, 1 Ton	12	27,145	**325,739**	**1,912**	Includes controls, power, disconnect/breaker

Attachment 8

FAMIS (CMMS) Keyword	FAMIS Description	Whitestone MARS Component Name	Quantity	Unit Cost w/ Site & Geo factor	RPV Total	Avg. Annual Burdened Maintenance Cost	Ancillary devices' comments
CRANE 031	CRANE AND/OR HOIST, 10 TON AND OVER	Crane - 15 -30 ton, < 40 foot span	9	105,861	**952,746**	**38,126**	Includes controls, power, disconnect/breaker
HV 063A	FURNACE, GAS FIRED	House Furnace, Gas/Oil, 100 Mbh	3	25,649	**76,947**	**2,480**	Duct work, mounting, condensate, flashing , power & misc. details.
DEHUMID046	DEHUMIDIFIER	2* Air Conditioner, Rooftop, Multizone, 5 Ton	33	18,072	**596,362**	**17,206**	Includes condensate line, power, mounting

Attachment 8

Table 2: NuMI tunnels at Fermilab:

FAMIS (CMMS) Keyword	FAMIS Description	Whitestone MARS Component Name	Quantity	Unit Cost w/ Site & Geo factor	RPV Total	Avg. Annual Burdened Maintenance Cost	Ancillary devices' comments
GRAND TOTAL:					**$4,341,734**	**$33,549**	
HEATER015	HEATER, UNIT, ELEC	Electric Unit Heater	25	7,569	**189,230**	**491**	Typ 30KW w/ safety sw., conduit, cable, Tstat, and specialized mounting.
DRIVE068	VARIABLE SPEED MOTOR DRIVE	Variable Frequency Drive < 600v	3	9,059	**27,176**	**459**	Incl mounting, conduit, cable, and disconnect/breaker
PANEL 054	PANELBOARD	Distribution Panel Board 225A.	26	31,374	**815,724**	**1,164**	Conduit, wire, disconnect/protection, breakers, & terminal devices
FPDETP	FIRE DETECTION SYSTEM	No MARS Equivalent	1	2,216,468	**2,216,468**	**7,110**	Based on construction estimates, incl all annunc or warning devices, sprinkers, pipe, pumps, valves, power, conduit, wire
TRANS071	LOW VOLTAGE TRANSFORMER	Secondary Transformer, Dry, 50 KVA	11	12,677	**139,450**	**731**	Typ 45KVA Tr. incl breakers/disconnect, conduit & conductors, & specialized mounting.
DEHUMID046	DEHUMIDIFIER	No MARS Equivalent	2	60,213	**120,425**	**35**	Includes condensate line, power, mounting
HVAC 011C	EXHAUST FAN	Exhaust Fan, Centrifugal, 5,000 Cfm	5	11,086	**55,429**	**347**	Ductwork, mounting, power & misc. details.
FCOIL 044A	FAN COIL, CHW/ELEC HEAT	Fan Coil Unit, 30 Ton	6	15,073	**90,436**	**2,547**	Ductwork, mounting, power & misc. details.
PUMP 003	PUMP UTILITY SEWAGE/SUMP SUBMERSIBLE	Sump Pump, 20 HP	8	25,957	**207,653**	**2,923**	Discharge piping, sump, power & Means adjustment.kcollins: Means estimate for 25 HP pump is $2500 higher than MARS 20 HP
HVAC 011C	SUPPLY AIR FAN	Air Handler, Single Zone, 6,500 Cfm	5	26,460	**132,298**	**2,895**	Ductwork, mounting, power & misc. details.

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FAMIS (CMMS) Keyword	FAMIS Description	Whitestone MARS Component Name	Quantity	Unit Cost w/ Site & Geo factor	RPV Total	Avg. Annual Burdened Maintenance Cost	Ancillary devices' comments
CRANE 030	CRANE AND/OR HOIST, LESS THAN 10 TON	Crane Jib Electric, 1 Ton	5	27,145	**135,724**		Includes controls, power, disconnect/breaker
CRANE 031	CRANE AND/OR HOIST, 10 TON AND OVER	Crane - 15 -30 ton, < 40 foot span	2	105,861	**211,721**	**14,848**	Includes controls, power, disconnect/breaker
No FAMIS equivalent	LIGHTING, INTERIOR	Fluorescent Lighting Fixture, 80 w	3	388	**98,977**	**0**	Includes average 85 2-lamp fixtures per lamping zone