FACILITIES & INFRASTRUCTURE

REPORT • JANUARY 2013

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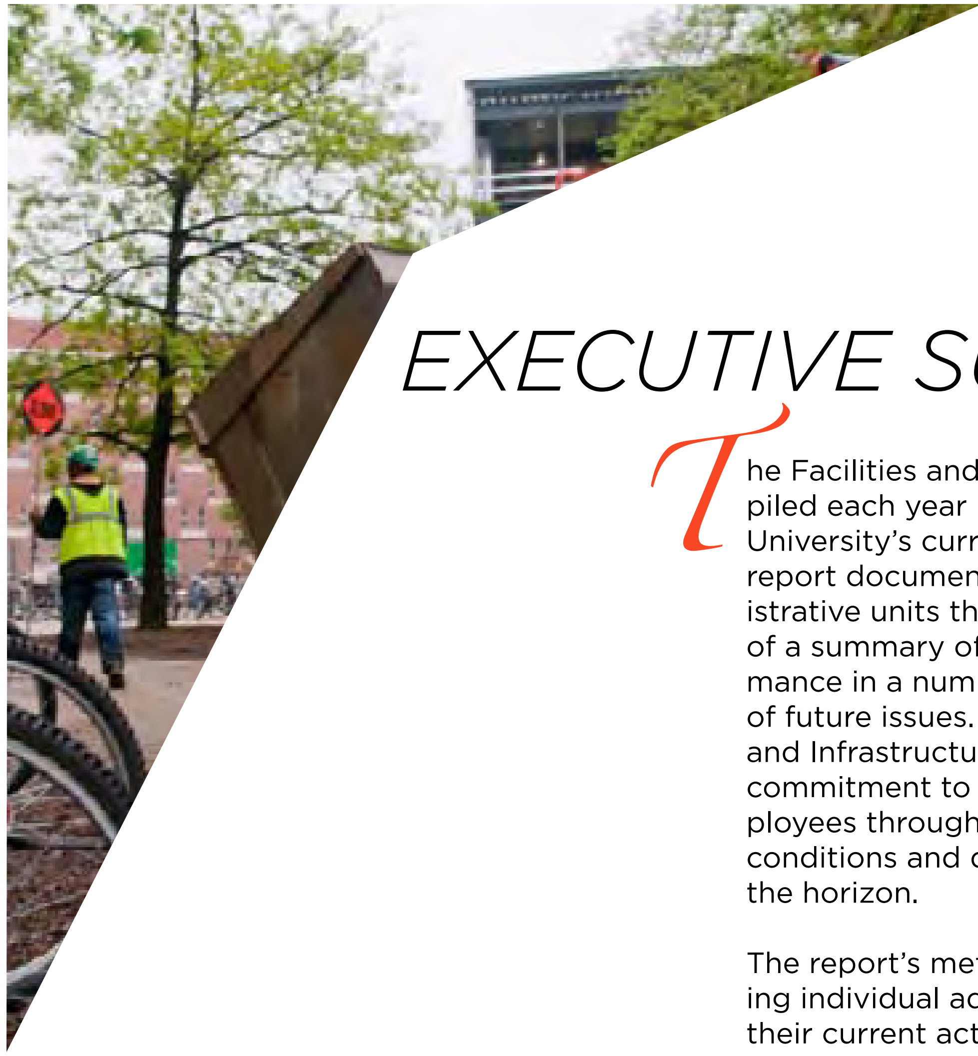


EXECUTIVE SUMMARY

The Facilities and Infrastructure Report is compiled each year in order to reflect Michigan State University's current campus state of affairs. This report documents the activities of several administrative units through the individual presentation of a summary of activity, an analysis of performance in a number of areas, and a consideration of future issues. Taken as a whole, the Facilities and Infrastructure Report demonstrates MSU's commitment to supporting its students and employees through responsive analysis of current conditions and detailed projections of issues on the horizon.

The report's methodology consisted of requesting individual administrative units to summarize their current activity, analyze these activities in depth, and identify key areas for future consideration. The report therefore not only represents MSU's current state of affairs through the lens of individual administrative units but also the outlook for future developments.

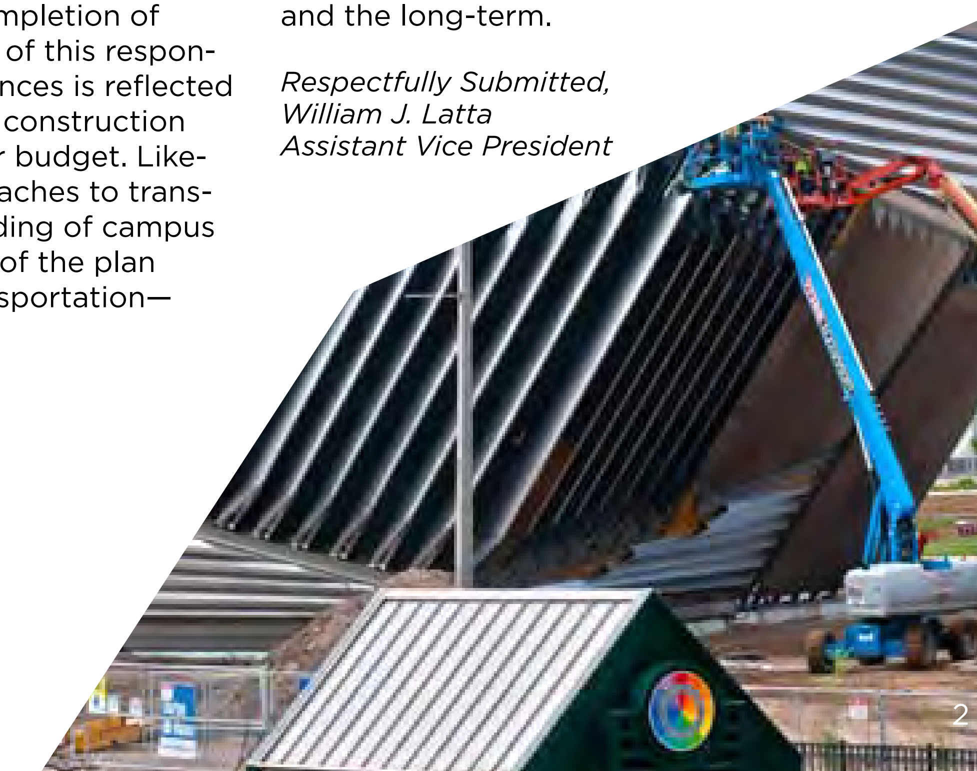
The report illustrates several overriding themes of university facilities and infrastructure in addition to providing an account of individual administrative units. As such, the report highlights several emerging trends in key areas of university development. For instance, the report documents a cross-unit concern for environmental stewardship. This vital area of consideration has become a cornerstone of many units maintaining and developing facilities and infrastructure on campus. One prominent development in this area is the university's Energy Transition Plan, which strongly promotes progress toward energy sustainability goals. Moreover, university safety's importance is reflected in several units, with one key development being the strong refinement of the Research Emergency Defense Information System (REDIS). Due to the efforts to overhaul REDIS in 2012, MSU is now better prepared to respond to safety threats in a manner that protects both the health of the university community and the university's strong investment in research.

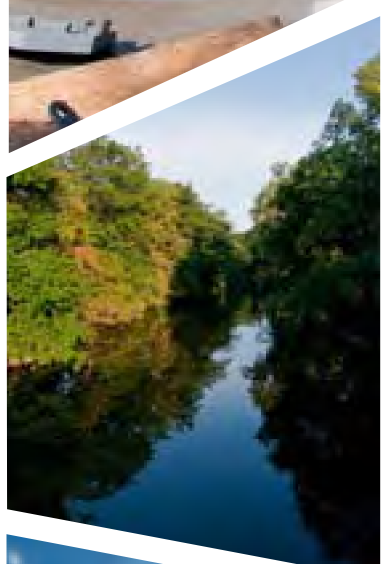
The university's responsiveness to changing conditions is also reflected in the report. Construction projects have been conceived and executed in the manner best suited to MSU's current needs. In this respect, projects have increasingly utilized methods of building congruent with the streamlined completion of construction. The effectiveness of this responsiveness to changing circumstances is reflected in the pronounced tendency of construction projects to be completed under budget. Likewise, a conscious shift in approaches to transportation—including the upgrading of campus intersections and the updating of the plan addressing non-motorized transportation—demonstrates the university's strong propensity for isolating current trends and making substantial adjustments that positively impact the campus community.

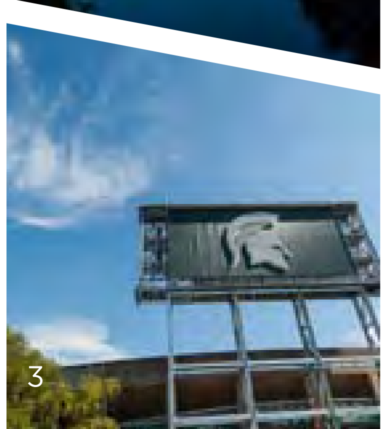
Current conditions are also constantly evaluated through the Just-in-Time (JIT) maintenance method. Through a new application of the Facilities Asset Management Information System (FAMIS), a more precise method of classifying the urgency of JIT projects has been developed. In this method, "critical" projects are identified for funding requests, which better suits the university's allotted funding for JIT maintenance.

The Facilities and Infrastructure Report thus represents MSU's dedication to recognizing current needs and isolating future areas of development. In this respect, MSU's administrative units remain committed to providing the most efficient and best support for its students, faculty, and staff both in the present and the long-term.

Respectfully Submitted,
William J. Latta
Assistant Vice President







INFRASTRUCTURE PLANNING

In the last year, Michigan State University has updated its methodology for planning projects in several areas. First, an independent review of the construction standards was completed to assure compliance with recent updates in the Americans with Disabilities Act (ADA). Coupled with the university's approach to planning for barrier free improvements, MSU remains committed to developing projects in accordance with the national accessibility and barrier-free standards as promulgated by the ADA. Second, the standards were evaluated for the direction they provide to planners to achieve greater levels of energy efficiency in new construction and renovation projects. Finally, a work group is working on an analysis of the process of estimating the cost of major Capital Projects (those $1 million and above). This group is examining ways to improve the initial estimate of projects to provide a more thorough and complete estimate that will yield a more reliable planning figure. The Geographic Information System (GIS) office in Campus Planning and Administration also assists planning efforts by utilizing GIS technology in order to better inform campus planning as well as helping the campus to work with its facilities; one primary example of this office's work in the last year is the further development of the Research Emergency Defense Information System (REDIS) to inform campus safety officials about research being conducted within existing facilities in the case of an emergency. Finally, the Post Occupancy Evaluations program allows for the timely analysis of the effectiveness of recently completed construction projects.

ADA Changes in Construction Standards

SUMMARY

In 2010, the U.S. Department of Justice passed regulations that updated various sections of the Americans with Disabilities Act (ADA), which was originally passed in 1990. Among the updates, the standards for accessible design were modified and implemented in March 2012. To assist with modifying the MSU construction standards and ensure for their compliance with the updated regulations, a third party consultant conducted an independent review. The review resulted in minor changes to the Construction Standards, mainly in the form of updating references to newer codes. The updated Construction Standards have been posted to the Engineering and Architectural Services web page for use by consultants, construction managers, and contractors that may be interested in doing business with MSU.

ANALYSIS

IMPACT ON CONSTRUCTION

The revised ADA regulations reaffirm that on every project involving new construction, additions, or alterations to existing facilities, persons with physical disabilities must be able independently to get to, enter, and use the site, facility, building, or element. In no way may a facility be restricted to handicap persons due to alterations or new construction that would normally be made accessible to non-handicap persons. Alternate routes for all new facilities or alterations to existing facilities must incorporate the latest federal, state, and local barrier-free standards and include temporary access accommodations for physically handicapped persons.

The planning, design, and construction phases of a project must include provisions for complying with the revised regulations. The requirement to maintain the existing or provide alternative accessible routes and facilities may impact the project budget depending on the extent of accessible facilities that are present and affected by the construction project. The construction schedule may be affected due to staging of work or additional work required to maintain access during the project.

CONSTRUCTION STANDARDS UPDATE

While the revised regulations affect construction activities, the new requirements have not resulted in material changes to the MSU Construction Standards in terms of how buildings are designed. The modifications made to the Construction Standards have rather been to add statements in each technical section to remind consultants and contractors to comply with current codes. The construction areas specifically cited for compliance with barrier free access standards are: the materials and methods of installation for elevators; toilet accessories; laboratory cabinet hardware; signage; door hardware; entrances and storefronts; flooring; stairway handrails; and wood post frame buildings.

FUTURE DIRECTIONS

An annual ADA Code review will be conducted to ensure compliance with the latest code changes. The Construction Standards will be updated with these changes to the Americans with Disabilities Act as required.

Planning for Barrier-Free Projects

SUMMARY

Michigan State University is committed to providing equal opportunity for full participation in all programs, services, and activities. As a part of this commitment, MSU has included in construction projects the evolving set of state and national accessibility/barrier-free standards (established by code requirements) to provide an increasingly accessible learning and work environment. Additionally and where possible, MSU will exceed the construction requirements striving towards the principles of an environment that is both accommodating and user-friendly. Each year the university sets aside funds for new projects that further the goal of maximizing access to all campus facilities.

ANALYSIS

Facilities Planning and Space Management is responsible for barrier-free planning on campus in conjunction with: the Resource Center for Persons with Disabilities; Residential and Hospitality Services (RHS); Parking; the Physical Plant Division; Campus Planning and Administration; and Athletics. Together these groups make up the Barrier-Free/Accessibility Planning Committee. The committee meets bi-annually to review current facility issues (submissions from the accessibility website and other communications from faculty/staff/students/visitors), as well as plan and prioritize future projects on campus. Accessibility issues with regard to site and roads are addressed in a similar fashion and will be reviewed in conjunction with the above. An annual allocation of over $350K is provided for accessibility improvements to general fund buildings. Self-supporting units, which include RHS, Athletics, and Parking, fund improvements internally.

The revised ADA regulations have not impacted the way in which the university plans for barrier-free facilities on campus. All facility renovation projects as well as new construction comply fully with, and in many cases go beyond, the construction codes for building accessibility. And wherever possible, Michigan State University strives to employ concepts of universal design, creating environments that are accessible to both people with and without disabilities. To integrate more fully accessibility features in new and existing structures thus facilitates comprehensive access.

FUTURE DIRECTIONS

Focusing on programmatic access rather than the built environment exclusively is a primary consideration in determining barrier removal project priorities. With the abundant amount of programs offered at Michigan State University, it is not uncommon for programs to be distributed and located in more than one facility. In some instances, one of the facilities may be inaccessible or only partially barrier-free while the other facility is accessible. In these cases, the building that is either not accessible or only partially accessible may not require immediate modification. As necessary, priorities will be guided by and adjusted for changes in the location of programs, programmatic demand, available funding, and urgent individual needs. New construction and renovations adhere to the ADA regulations as well as the universal design principles. When undertaking renovations of existing facilities, the Barrier-Free/Accessibility Committee, along with Faculty/Staff/Student/Visitor input, helps to identify these locations so the university can plan for a thoughtful solution to provide access. An annual planning process, convened by Facilities Planning and Space Management/Office of Planning and Budgets, updates priorities and recommends projects for facility access.

Construction Standards and Energy Efficiency

SUMMARY

A number of efforts are being taken to move the university towards increasing sustainability and help further progress towards the Energy Transition Plan goals. Among these initiatives, the energy efficiency components of the construction standards are being re-examined. Building systems are currently required to perform above national benchmarks for energy efficiency. However, efforts are underway to test increasing those levels while simultaneously being conscious of avoiding undue cost to the institution.

Capital investment in energy efficiency measures during the design and construction of a new facility or renovation has the potential to minimize environmental impacts and save in utility costs for the university. However, the cost of raising the standards must be evaluated within the context of energy saved (and lower utility costs) over a reasonable period of time, which is typically significantly less than the life of the building system. Using this approach, the utilization of energy efficient measures will be carefully analyzed on a project-by-project basis. The analysis will compare forecasted energy savings over time with the initial costs of the measures. This analysis will ensure that prior to implementing the measures, appropriate decisions can be made so that additional cost is not only recovered but, ultimately, will result in energy bills that are substantially lower over the total life of the facility.

ANALYSIS

CONSTRUCTION STANDARDS UPDATE

The following are examples of energy-related modifications that are being evaluated for inclusion in the MSU Construction Standards:

- The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has established minimum performance levels (ASHRAE 90.1) for energy efficiency of building systems. At MSU, the current standards require performance above this threshold at 18% for existing facilities and 22% for new buildings. Using the Integrated Energy Performance Model in conjunction with the expertise of MSU engineers, simulations have been run comparing the added cost for energy efficiency measures for various building types (ex. office, laboratory, residence hall, etc.) to the energy savings that result over time. Initial findings indicate that increasing the energy efficiency design requirements to achieve a minimum of 30% for renovations and new buildings with a goal of 45% is possible.

- All new building and major remodeling projects will include identification of energy-efficiency measures, with estimated savings and implementation costs, using a whole building project simulation.

- All new building and major remodeling projects will be evaluated to qualify for LEED™ Silver Certified rather than the minimum level of Certified.

- All projects will include provisions for ongoing measurement and verification of building energy consumption over time.

- All projects, where applicable, will reduce the potable water consumption for landscape irrigation by 50%.

- All projects, where applicable, will include on-site renewable energy that is a minimum of 1% of the building's annual energy cost.

IMPACT ON CONSTRUCTION

The design and construction of a new building, addition, or other modification to a building envelope (such as window replacement) will be based on the following goals:

- Reduce heat conduction through roofs and walls.

- Reduce infiltration.

- Control or reduce solar heat gains.

- Reduce heat conduction and long wave radiation.

Lighting systems for new buildings and major renovation projects will be designed and constructed to include reduced illumination levels, higher efficiency components, curtailed operating hours, and use of day-lighting. High efficiency motors will be evaluated to improve power system efficiency.

Heating, ventilating, and air conditioning systems will be designed and evaluated for reduced energy usage through improving equipment performance, reducing ventilation requirements to minimal levels without compromising safety, providing water-side economizers, optimizing the distribution system, and applying heat recovery systems.

Energy management control systems will be designed to optimize equipment operating times. Also, provisions will be made for detailed energy measurement and commissioning to maintain the designed energy savings over time.

Renewable energy sources, such as solar, wind, geothermal, and rainwater capture, will be evaluated for use where possible.

FUTURE DIRECTIONS

Engineering and Architectural Services will continue to review and update the Construction Standards to meet or exceed current minimum code requirements and achieve the highest level of energy efficiency possible. This will be done within the framework of striving to reduce the total cost of the facility (capital plus operating) over its useful life.

To maintain and keep Construction Standards updated, EAS will: continually seek out and evaluate a broad array of developing and new technologies in heating, ventilation, and air conditioning (HVAC) systems; identify high impact HVAC technology and concepts; and provide detailed analysis to determine applicability to MSU projects. Also, following installation, continuous commissioning of the building systems will be provided to create meaningful analysis and reports, actionable information, and verification that standards and goals are being met with resulting energy savings during ongoing operation of the building systems.

Capital Project Estimating Process

SUMMARY

A work group is reviewing the process for estimating the cost of a major ($1 million and above) Capital Project. This work group consists of members from the following offices: the Office of the Vice President for Finance and Operations; Facilities Planning and Space Management; Engineering and Architectural Services; and Campus Planning and Administration. The work group will ultimately recommend revisions in order to improve the reliability, consistency, and completeness of Capital Project estimates.

ANALYSIS

REVIEW OF HISTORICAL DATA AND CAMPUS INPUT

The work group reviewed projects constructed over the past five years to identify frequency of budget increases by, first, focusing on a comparison of the cost estimate when the project received authorization to plan from the Board of Trustees (BOT) and, second, the cost estimate when the project design was approximately two-thirds completed and prepared for submission to the BOT for authorization to proceed. This provided a basis for evaluating the existing estimating process and focusing on the constraints and opportunities for improvement. The work group discovered that over 50% of the projects had a budget increase related to deficiencies in the early scope definition for the project.

In addition to the individual project reviews, the work group also received input developed through the MSU Way/Excellence in Operations and Services (ECOS) initiative. This is a project jointly sponsored by the Physical Plant and Residential and Hospitality Services to enlist staff at all levels of the organization to evaluate and recommend process improvements in the delivery of construction projects. Involving a number of support units on the campus and obtaining information from academic and non-academic units that receive services, the input will help guide improvements to a number of service processes including project estimates.

RECOMMENDED PROJECT PLANNING PROCESS

The work group had considered recommending moving the in-depth feasibility analysis that occurs following Step 1. Authorization to Plan to occur before the request for planning authorization is taken. However, after additional review and considering the potential negative impacts this action could have on the transparency that exists currently in the process, it was decided to not move this component. Alternatively, the work group is looking at ways to increase the completeness and reliability of estimates by taking a more in-depth and early look at building codes, LEED requirements, infrastructure needs, environmental impacts, hazardous material remediation, and Just-In-Time maintenance items. Additionally, greater emphasis will be placed on program development and identification prior to Authorization to Plan. Also, consideration is being given to expressing the initial estimate as a range to help communicate that the review is preliminary and requires further refinement. Finally, including an inflation-planning factor that can be used for projects that will develop in the future is also under review. A high-level process map outlining the steps in developing an estimate and preparing a project for authorization to plan follows (Figure 1).

FUTURE DIRECTIONS

After the new process has been thoroughly examined and approval is received to proceed, the work group will develop training materials and a training program to set consistent expectations from project to project. A communication plan will be developed and implemented for all university staff involved with this aspect of Capital Projects.

The work group will be evaluating the effect the implemented change has on future projects by comparing the difference in budget as a major project progresses from a Preliminary Cost Assessment through the BOT steps. The thoroughness of project budgets measured by their accuracy using the new process will be compared to the accuracy of project budgets prior to implementation of the process change. In addition to reviewing individual projects, Campus Planning and Administration will review the effectiveness of the new process through selected post occupancy evaluations and an annual summary presented with the Infrastructure Report.

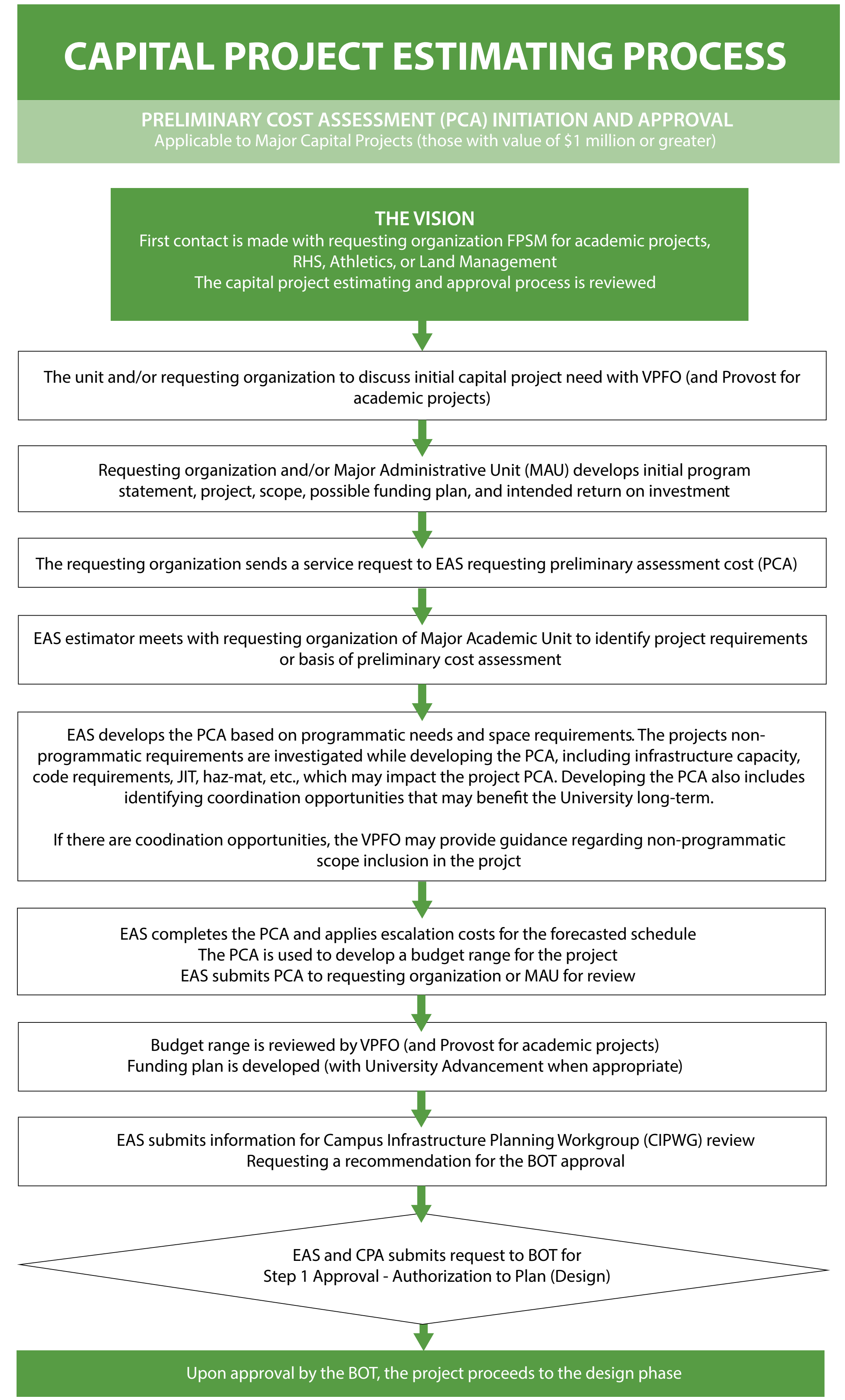


FIGURE 1
Capital Project Estimating Process

Geographic Information Systems

SUMMARY

The Geographic Information System (GIS) office in Campus Planning and Administration serves as a central repository point for a variety of information with respect to campus infrastructure and operations. Originally developed as a tool to analyze infrastructure deferred maintenance needs (now embodied in the Just-In-Time, or JIT, reporting system), it has been expanded to encompass a wide variety of topics.

Development of the GIS is continual and focuses on three primary areas: management of the complex data systems that feed into the GIS; maintenance of applications in hardware and software to remain compatible with end user technology; and development of new applications.

ANALYSIS

The Physical Plant supplies a significant amount of the data utilized by the GIS. In recent months, the Physical Plant has moved the source of JIT data to the Facilities Assessment module of the Facilities Asset Management Information System (FAMIS). The Physical Plant also recently implemented the Utility Billing System to record utility consumption. In 2012 the GIS was modified to use both of these improved data sources.

The GIS office has begun the conversion of the GIS from a Flash™ based web application to one utilizing the newly supported features of HTML 5. When work on this is complete (expected Spring 2013), the GIS will provide much greater support for users with accessibility needs, will offer a much simpler user experience (no plug-in required for maps), and will be available to a much wider range of client technologies (all modern browsers, including iOS and Android mobile devices).

Several new or improved applications have been deployed in 2012. The Campus Addressing project was supported in large measure by the development of GIS's addressing website. This website served to inform the campus community of the scheduled assignment of street addresses to their facilities and continues to be a resource where users can look up the address of their building. The addressing website is driven by the spatial database that GIS maintains to assign addresses to new facilities. This database and the associated grid map were developed by GIS in cooperation with all of the surrounding municipalities, MSU Police, University Services, and several other units and organizations.

The Research Emergency Defense Information System (REDIS) is an application developed by the GIS office in cooperation with MSU Police and several academic units to provide information about research activities within campus facilities. REDIS has two primary functions: first, to inform first responders about potential threats to health and safety within facilities to which they are responding, and second, to protect the university's research investment in the event of emergency response scenarios large and small. The system was first developed several years ago but has seen a major overhaul in 2012 based on feedback from all participants. The new application provides a significantly simpler interface for principal investigators (PIs), allowing for much more efficient input and maintenance of data. It also eliminates the need for PIs to make decisions regarding first responder threats and places that responsibility in the hands of representatives of the first responders. Additionally, the new system will ultimately integrate with the regional dispatch system, allowing key information to be provided to first responders at the time that they receive the call—both from dispatch verbally and on the in-vehicle terminals where so equipped.

GIS has provided 360° photography for some time. An effort to improve the quality of this photography began in full in 2012 via the usage of an advanced imaging system developed between Carnegie Mellon University and NASA called GigaPan. The GigaPan device produces extremely high-resolution panoramic photographs. Using the new system also allows for much better interior photography than the original parabolic lens used to capture the first generation photography. These images provide useful context in a wide range of infrastructure planning discussions.

Another imagery capability of the GIS that was published in 2012 is the historical imagery viewer. GIS digitized its collection of historic aerial photography of the campus dating back to 1938. The resultant application allows users to move backward in time to view the changes that have taken place on campus. This has been of particular use in analysis associated with maintenance of the campus arboretum.

A population analysis tool was developed to assist in decision-making by the MSU/CATA Cooperative Assessment Teams. The tool utilizes information from the Student Information System and the Enterprise Business Systems Data Warehouse to provide location demand information, which can then be used to help determine bus route demand. The application allows the user to generate choropleth (thematic) maps of campus facilities based upon arrivals and departures at facilities by day of week and time ranges. It provides data going back to Spring semester 2000 to help identify changes in demand.

FUTURE DIRECTIONS

A central area of focus in the coming months will be conversion of all existing applications to HTML 5 for the reasons stated previously. This effort will be completed in 2013.

The Entrance Accessibility application, which provides information helpful to users with special mobility needs, will undergo a major refresh in 2013 with the expectation that all facilities will receive a revised on-location analysis and incorporate the higher resolution panoramic photography.

The JIT reporting tool will also be significantly revised in 2013 to provide more comprehensive reporting to utilize fully the data now available in FAMIS' Facility Assessment Module.

Work has begun on a complete redesign of the environmental stewardship reporting application that will include the generation of a new report format for building stewards based on their feedback about the existing reports. The new reports are slated to have their first publication take place in January 2013, with the web application to be replaced by mid-year.

Post Occupancy Evaluations

SUMMARY

There was significant progress on the development and implementation of the Post Occupancy Program at MSU in 2011-12. Post occupancy evaluation (POE) refers to the evaluation of a completed project after it has been occupied for a period of time. A POE process can answer several significant questions including: did the constructed building meet the program needs it was designed to address? Is the facility functioning as planned? If not, what corrective measures are necessary? The main focus is to evaluate how building construction can be improved in the future to provide maximum value for the capital investment. During the past year, the POE process steering committee evaluated the results from the pilot POEs that were completed in years prior. The pilot studies that were completed earlier in the program's development were evaluated to identify the tools and methods of measurement that could provide the most benefit to projects performed at MSU. A formal process template was developed that will serve as a guideline for the POE program moving forward. The steering committee included members of: Engineering and Architectural Services (EAS); Residential and Hospitality Services (RHS); Design and Construction; Campus Planning and Administration (CPA); and the Construction Industry Research and Education Center (CIREC).

The new POE template outlines tools and methods that are available to the leaders of a POE study and provides guidelines for identifying the necessary participants and input requirements for each type of POE. There are a number of different methods outlined in the process template that can be used to evaluate a project's success. These methods can include interviews, surveys, direct observation, workshops, focus groups, cost and benchmarking analysis, measurement to quantifiable programmatic goals, and continuous energy and water consumption measurement. As illustrated in the construction section, MSU typically does a significant amount of construction on an annual basis; therefore, it is not feasible to do an in-depth POE on every project. The program specifies performing in-depth POEs on three to four major projects per year, as well as outlines the selection method for which programs will have POEs. Representatives from EAS and CPA, with input from FPSM, RHS, CIREC, and the office of the VPFO, select the projects that are identified as candidates for a POE. Generally, projects identified for a POE are intended to provide input to similar projects that are in the planning and design phase in order to identify desirable design features as well as feed forward lessons learned that may bring value to the new project. While in-depth POEs will not be performed on every project, many projects can have individual evaluation tools used to provide specific feedback when appropriate.

Project	Year Bldg. Comp.	POE Type
The Wharton Center	2009	In-depth
Owens Hall Renovation	2009	In-depth
The Surplus Store and Recycling Center	2010	In-depth
Spartan Stadium Expansion	2008	Survey only
The School of Planning, Design and Construction Renovation	2008	Survey only

TABLE 1
Completed Project Post Occupancy Evaluations

The three in-depth POEs that served as pilot studies for the program can be found in Table 1. In addition to the pilot studies, two other projects had also been evaluated through a less extensive POE survey. These projects, the Stadium Addition and the Human Ecology Renovation, were specifically studied to produce a standard survey template that can be used during all POE studies at MSU. Graduate students in CIREC performed the survey research and development for the survey, and the final thesis included a standard survey template that has been implemented in the MSU POE program.

At the time of this report, two POEs were in process. The first, the Molecular Plant Science Addition, is the first to follow the newly developed process template and is intended to document the project features or lessons learned so that they can be applied to the new Bio-Engineering facility that is currently in the early design phases. The second is the Brody Hall Dining Renovation. The Brody Hall POE was initiated to evaluate the specific sustainability design features for the facility. It is intended to provide information regarding the sustainability features that were incorporated into the building design and to measure if they provided the projected energy savings. At the conclusion of the sustainability POE for Brody, the project will be evaluated to determine whether additional POE methods should be used to evaluate other aspects of the project that may benefit MSU. In addition to these two projects, a number of project POEs are in the planning stages. They are the Case Hall Dining Renovation, the Emmons Hall Renovation, and, in the fall of 2013, the Bott Nursing Addition.

ANALYSIS

The project performance metrics found in a POE final report, such as change order and schedule data, are essential to the process; however, a POE also explores the functional performance and design quality of the building. There are many methods that can be used to evaluate a building's performance. They include: occupant surveys; occupant and project team interviews; direct observation; and design efficiency data.

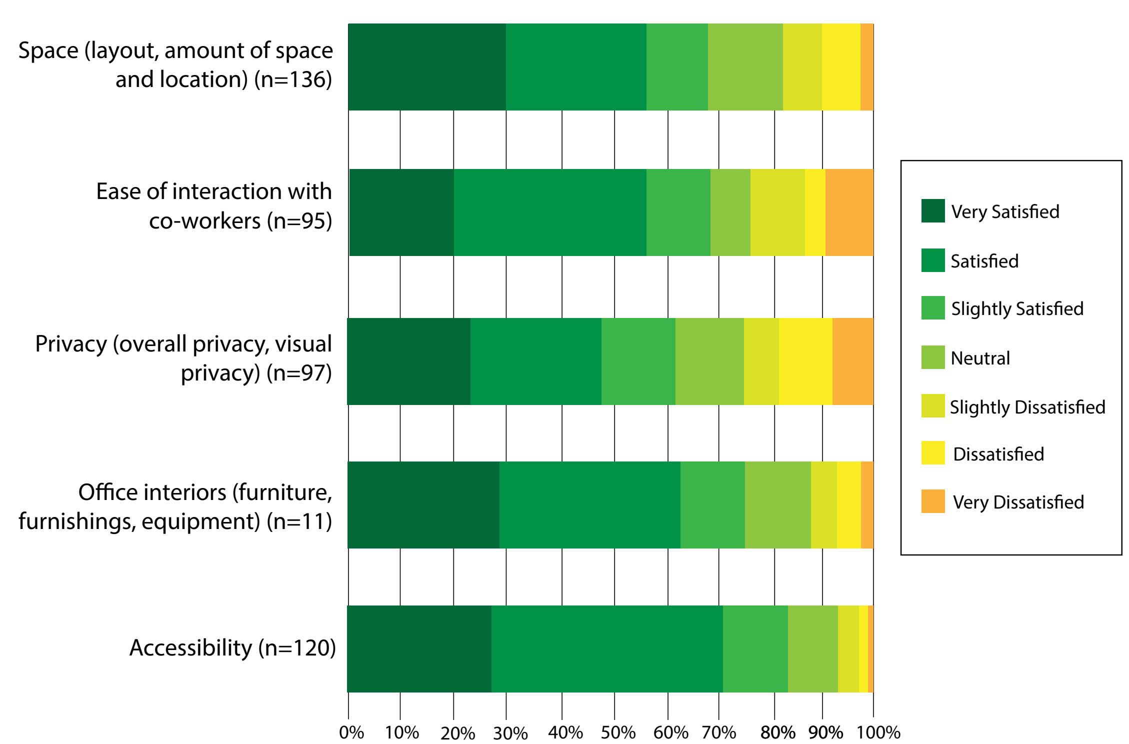
The focus of the survey results of post occupancy evaluations can be divided into two main categories: functional performance and indoor environment. Figure 1 is a consolidated summary of the functional performance results of the five POEs to date. The results of the surveys have indicated that privacy is the leading cause of dissatisfaction among building occupants after move in. The United States Green Building Council LEED standard suggests that any categories with a satisfaction rating of less than 80% should be addressed. The 80% threshold equates to achieving a rating of at least neutral or better. While the categories of space, ease of interaction, office interiors, and accessibility all achieved over 80%, the privacy category only achieved a 75% rating. It is not expected that the privacy rankings will improve in the short-term because of changing philosophies in the design of office environments in the higher education sector, which emphasize opportunities for interaction and collaboration. People coming from a traditional office environment typically need a period of adjustment to adapt to the new approach. The Wells Hall and Plant Sciences additions are examples of environments that feature an open office design not traditionally seen at MSU. As occupants move into these new buildings, there will be a learning phase in which there will be a higher level of dissatisfaction in regards to privacy until the building occupants adapt to these new environments.

Figure 3 is a consolidated summary of the indoor environment results of the five POEs conducted to date. The results indicate that thermal comfort, personal control, and acoustics are the leading causes of dissatisfaction among building occupants after move in. All three of the categories mentioned are below the 80% United States Green Building Council LEED standard satisfaction rating. The acoustics category may be the result of the increased level of open office environments that are being constructed today, as referenced in the functional performance analysis.

The university standard for thermal comfort is 76 degrees Fahrenheit during summer and 70 degrees Fahrenheit during winter. The standard has been created in accord with the intended energy savings and building operations costs for new projects on campus. There may be multiple causes for the higher level of dissatisfaction among build-

FIGURE 2
Functional Performance Results for Five Completed POEs

Functional Performance



Indoor Environment

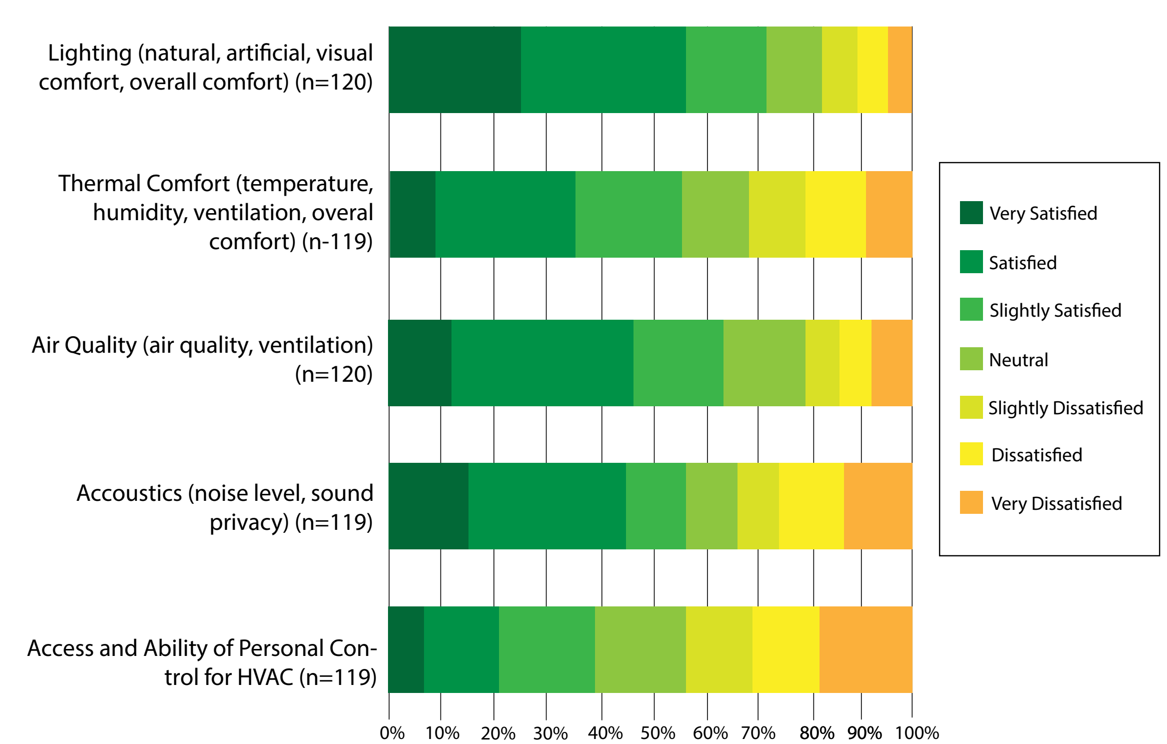


FIGURE 3
Functional Performance Results for Five Completed POEs

ing occupants. This dissatisfaction may be due to discontent with the standard thermal settings, or the facility may not be operating as designed.

The personal control standard is to provide an individual thermostat for every three individual spaces or in a common area. While it may be possible to increase the level of satisfaction by increasing the level of personal control, there are building maintenance, operating, and construction costs that would most likely be increased. The building also may not be performing as intended or designed. Both thermal comfort and personal control can be addressed through good commissioning and communication flow with the occupants during move in and the first year of operation of the new facility.

FUTURE DIRECTIONS

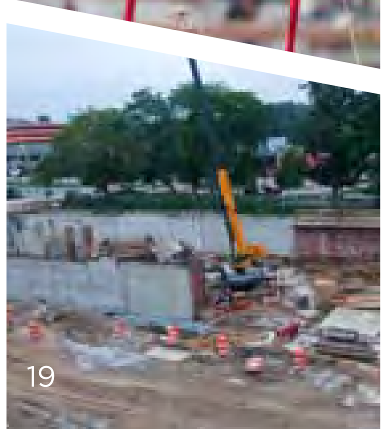
The POE is intended to be a quality control and value analysis tool that is used to improve continuously the delivery of projects. While the POE is used primarily for evaluating the constructed facility, it also serves to reveal process issues that may be improved to increase the value and provide more reliable project performance. There have been a number of process improvements that have been implemented to date such as earlier investigation of infrastructure requirements in design, earlier investigation of maintenance requirements of an existing building, and development of a standard protocol for document archiving.

The most important development resulting from the POE process is identifying the need for a lessons learned database. Historically, project lessons learned have been carried forward from project to project on an individual knowledge and experience basis. This has led to inconsistent performance improvement and project delivery results over time. A lessons learned database is currently in the development stages. This database will be used to provide information to project designers, consultants, construction representatives, and contractors to communicate lessons learned on individual projects that will have a positive impact on the delivery process.

In addition to the lessons learned database, there are a number of other process improvements that have been identified by the POE, and are a current area of focus. The following is a list of high priority areas that are currently being reviewed for improvement:

- Implementing a more in-depth and consistent estimating process
- Creating a published operational guideline for building occupants and construction users
- Creating a more formal building commissioning document earlier in the design process
- Creating a measurement and verification protocol to evaluate the impact of new construction on the existing campus infrastructure
- Measuring the return on investment of sustainability features incorporated into each project
- Requiring energy models and in-depth impact statements on all projects

All of the above mentioned initiatives are intended to provide better quality, cost reliability, and value for projects at MSU.



CONSTRUCTION

SUMMARY

Adequate facilities are vital for Michigan State University (MSU) to perform its missions of education, research, and outreach. The university continues to invest heavily in design and construction projects, and 2011-12 was an extraordinary year because Board of Trustees construction project actions more than doubled both in count and project value. Construction payments were more than 40% above the five-year average. Approximately $152 million, or 8%, of the university's $1.93 billion expenditures in 2011-12 were contracted design or construction.

MSU's construction performance and delivery of projects continues to improve in many areas. Ninety-three percent of projects were ready for university use by the scheduled dates during fiscal year 2011-2012.

The annual Construction Report reviews completed projects as part of a required reporting process for MSU's Board of Trustees. This report is included in Appendix A and lists 40 major and minor capital projects that were closed in fiscal year 2011-12, with a total value of nearly $52 million. Approximately 98% of all closed projects were within budget and further 7.6 % on average was returned to the original funding sources approximating $4 million.

ANALYSIS

CONSTRUCTION ACTIVITY AND SPENDING

Projects authorized for planning (step 1) are approved to begin the design process, including retaining design consultants. The costs are only an estimate at that point, pending validation of the scope and schedule. Projects authorized to proceed (step 2) have a defined scope, schedule, and project budget. If the project is using a construction manager or design-build delivery method, construction can proceed. If the project is design-bid-build, the project must return for bid and contract award (step 3).

There were a large number of projects focused on addressing infrastructure needs that were authorized to plan in 2011-12 (13 projects valued at over $70 million). Infrastructure projects include: Just-In-Time Maintenance (JIT); energy infrastructure and conservation measures; power plant and building services; and parking replacement. There was also one action of an authorization to plan for Athletics and one for Residential and Hospitality Services (RHS). The balance of the projects authorized for planning arose from academic units. Of the 20 projects authorized to plan in fiscal year 2011-12, six were under construction by June 30, with nine more anticipated to start in fiscal year 2012-13 and five remaining at least one year from commencing construction.

Projects authorized to proceed were more widely distributed, with six for infrastructure (principally JIT), five for RHS facilities, five for Academic space, two for Athletics, and one project support space. All of these projects will be substantially complete in fiscal year 2012-13. It is difficult to gauge whether the fiscal year 2011-12 board authorization activity is a trend or an aberration. While the funding for capital projects remains uncertain, there is ample demand for facilities additions, upgrades, and renewal. The value of projects authorized by the board for action also increased significantly in fiscal year 2011-12. Figure 1 shows the number of Board of Trustees' authorizations, by project step, for the past four fiscal years. Figure 2 shows the total value of those authorizations.

The value of Authorizations to Plan nearly tripled from the prior year but were consistent with the five-year average. Infrastructure projects (JIT, Energy Conservation Measures, Power Plant, and parking replacement) accounted for $70 million, or slightly more than half of the value of these projects. There were $52 million in academic projects authorized to plan, including the Bio-Engineering Facility, partially funded by Capital Outlay. Finally, auxiliary and support projects accounted for $11 million. Of the $133 million authorized to plan, $33 million was later authorized to begin construction by the end of the fiscal year, with $41 million more anticipated to begin in fiscal year 2012-13, as well as $59 million to begin in fiscal year 2013-14 or later. Projects Authorized to Proceed in fiscal year 2011-12 also increased significantly from the prior year to $157 million. This is relatively close, however, to the $144 million average

Number of Board of Trustes Construction Authorizations (Excludes FRIB Projects)

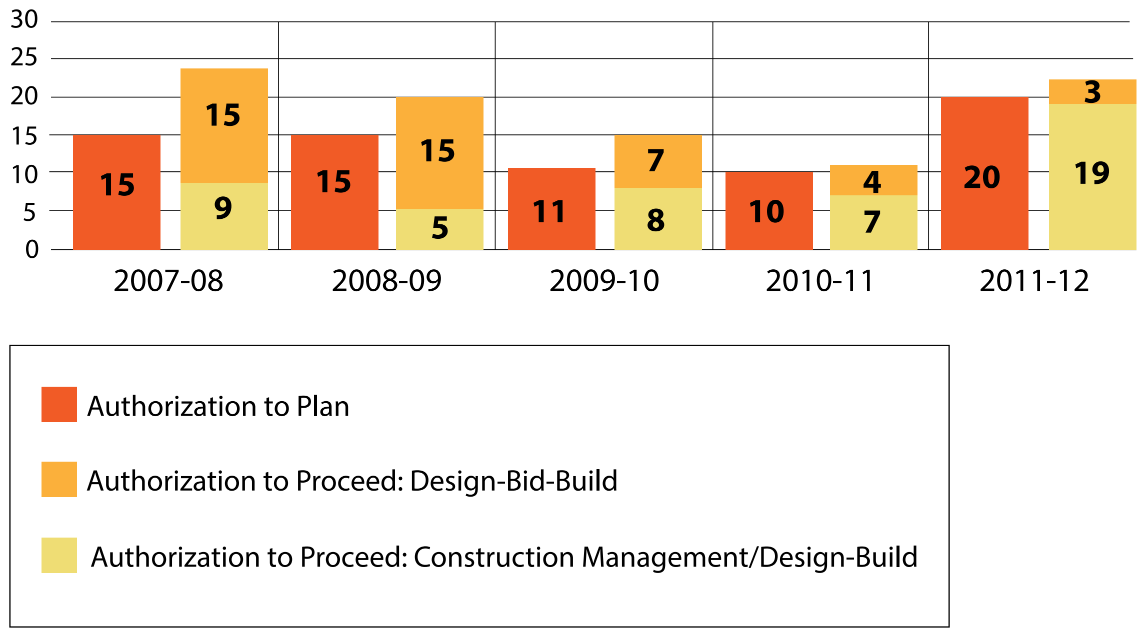


FIGURE 1
Number of Board Authorizations

Value of Board of Trustees Construction Authorizations (Excludes FRIB Projects)

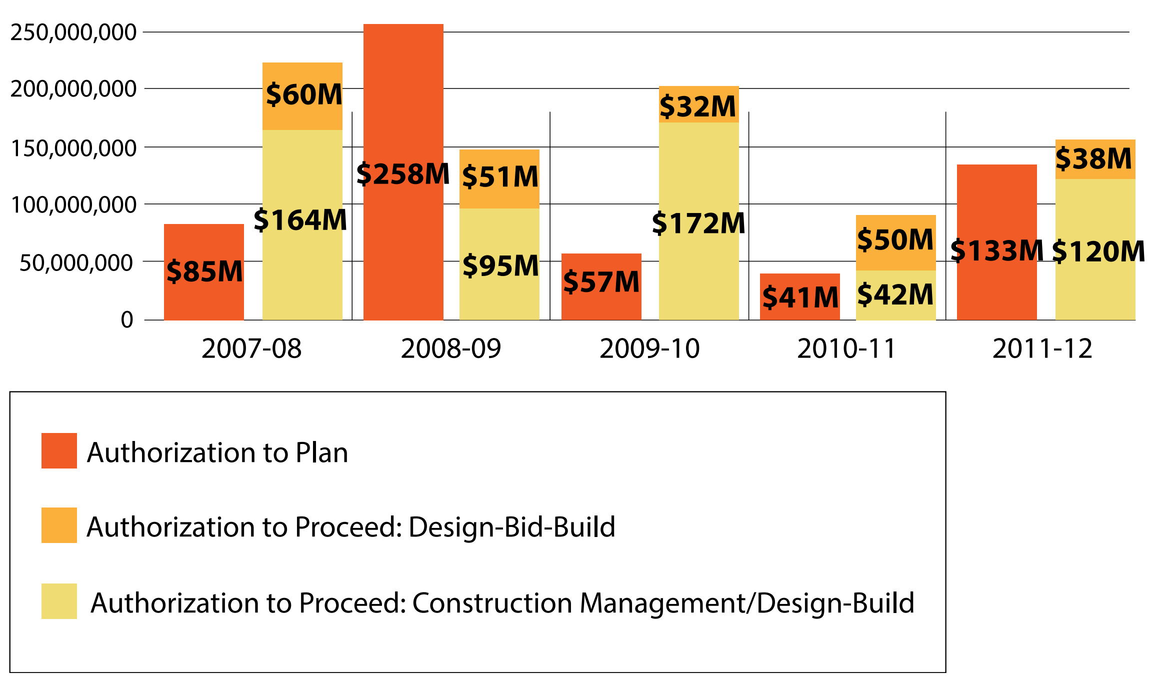


FIGURE 2
Value of Board Authorizations

Design Consultant Payments by Fiscal Year

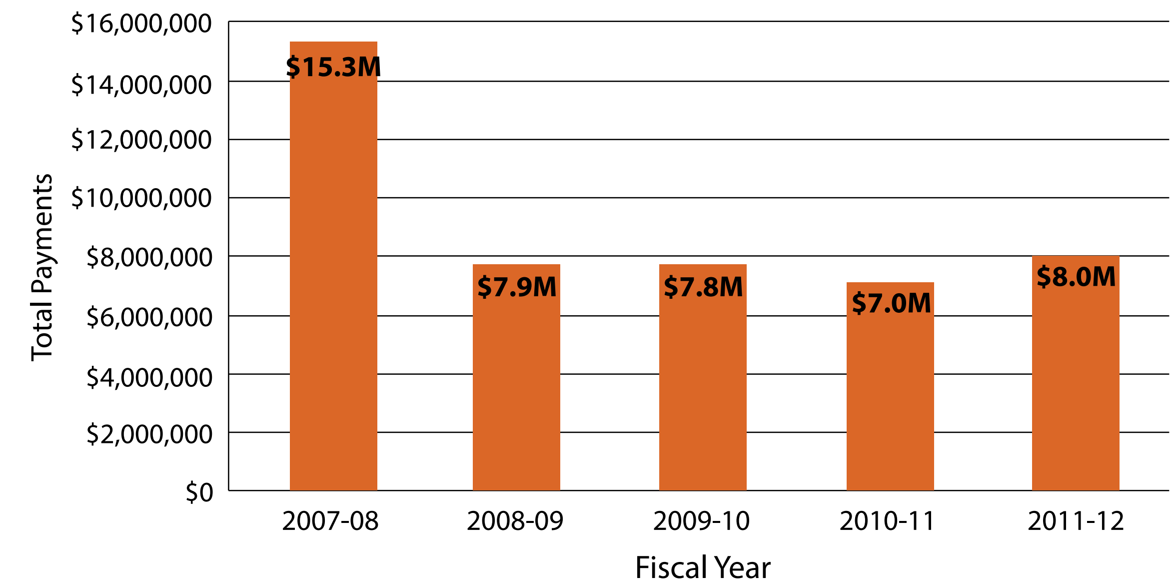


FIGURE 3
Design Consultant Payments by Fiscal Year

of the previous five years. RHS accounted for $55 million of this activity, or 35%. Other significant sources included $49 million for Academic space (34%), $34 million for infrastructure (22%), and $14 million for Athletics (9%). All projects authorized to proceed are scheduled to be substantially complete in fiscal year 2012-13.

Design consultant activity reached an extraordinary level in fiscal year 2007-08 due to the size and number of projects approved for construction (which included the Secchia [Medical College] Center, the Duffy Daugherty Addition, Mary Mayo Renovations, the Cyclotron Addition, the Recycling Center, and Holden Hall Renovations). In fiscal year 2011-12, design activity increased, though not as dramatically as construction. Projects such as Shaw Hall Dining, Armstrong/Bryan Hall Renovations, West Circle Steam Distribution, and Fairchild renovations account for nearly half of the activity. RHS projects accounted for 40% of design activity, with academic and infrastructure projects comprising 31% and 24% of design payments respectively. While the number and value of projects that are Authorized to Plan can fluctuate from year to year, design activity remains fairly stable due to the leveling out of design resources that are required to meet project design schedules over time. Figure 3 illustrates design payments to consultants for fiscal year 2011-12.

A number of significant projects were in the construction phase in fiscal year 2011-12. There were six projects with expenditures of over $10 million each: Bailey/Rather ($23.3 million), the Wells Hall Addition ($17.8 million), Plant Science ($17.2 million), the Broad Art Museum ($14.1 million), Case Hall ($13.5 million), and the Life Science Addition ($10.1 million). It should be noted that all of these projects will be substantially complete by the first quarter of fiscal year 2012-13. Academic projects comprised 44% of this activity, with RHS and infra-

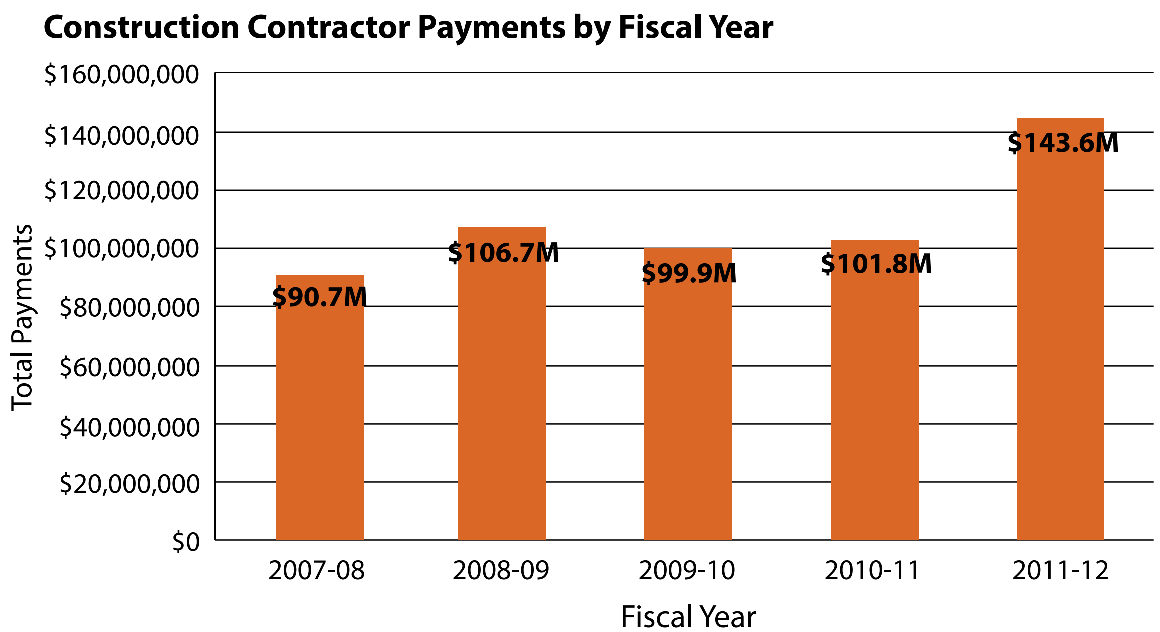


FIGURE 4
Construction Payments by Fiscal Year

structure projects accounting for 33% and 15% respectively. Figure 4 illustrates construction payments for fiscal year 2011-12.

A number of significant projects were in the construction phase in fiscal year 2011-12. There were six projects with expenditures of over $10 million each: Bailey/Rather ($23.3 million), the Wells Hall Addition ($17.8 million), Plant Science ($17.2 million), the Broad Art Museum ($14.1 million), Case Hall ($13.5 million), and the Life Science Addition ($10.1 million). It should be noted that all of these projects will be substantially complete by the first quarter of fiscal year 2012-13. Academic projects comprised 44% of this activity, with RHS and infrastructure projects accounting for 33% and 15% respectively. Figure 4 illustrates construction payments for fiscal year 2011-12.

PROJECT DELIVERY METHODS

MSU traditionally utilizes multiple types of delivery methods on projects. The four types of delivery methods most commonly used on campus are:

Design-Bid-Build (General Contractor, or GC) - The design-bid-build project delivery method is the traditional method of moving a project from conception to completion. The basis of this delivery method is that design is completed prior to bidding/pricing and construction.

Construction Management (CM) - Construction management is the application of professional management techniques to a construction project from conception to completion, in order to control project time, cost, and extent. A construction manager is an individual or an entity that is hired by the owner to supplement the owner's role in the project.

Design-Build (DB) - In the design-build delivery method, the owner contracts with a single entity for the complete design and construction of a project. Regardless of its composition, the design-builder provides complete design service and performs the construction under a single contract with the owner.

Owner-Build (OB) - In owner-build, the owner is involved in aspects of contracting for every portion of a construction project. Because the owner acts similarly to a contractor, the construction contracts are between the owner and the specialty contractors (subcontractors).

MSU has a long history of primarily using the traditional GC method of project delivery. However, within the last ten years, the CM method has increasingly been utilized. Due to the fast-track nature of an increasing number of projects, this method can be utilized to accelerate the project schedule and begin construction prior to having a completed design. The CM method has also been beneficial to supplement MSU personnel during recent construction volume peaks, in which the current staffing levels would not be ideal for the situation.

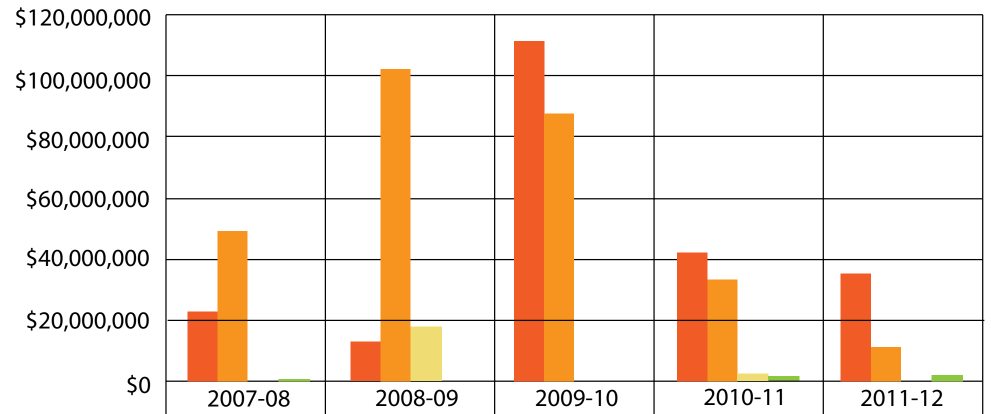
The DB method is used sparingly at MSU. Projects typically require a high level of programmatic control, and therefore design-build is not always appropriate. However, the Land Management Office has successfully used DB for agricultural or off-campus projects, including the KBS Pasture-Based Dairy Facility. DB has also been used on campus for unique campus projects such as the University Village Apartments and, more recently, the Spartan Stadium Scoreboard replacement. These projects were selected for DB due to the straightforward and clear program requirements for the project. The DB method allowed the projects to be constructed in an accelerated timeframe while not increasing the risk to the university through transferring the control of the design to the constructor.

The OB method is becoming more viable as a delivery option at MSU. While the OB method has had limited use on major projects over the last five years, more projects have recently utilized this method. OB is ideal as a potential cost savings alternative, as it eliminates the need for a GC or a CM while also giving MSU greater control over the schedule. Use of the OB method can also provide more flexibility in managing existing personnel resources by maintaining a sufficient work backlog for staff, despite fluctuations in the volume of campus construction. It should be noted, however, that projects delivered utilizing the OB method have been selected carefully, as this method brings greater risk to the university. Therefore, OB has been used on projects that could realize the benefits of the method while also being small enough to prevent the university from being exposed to significant risk. Figure 5 illustrates the project delivery method utilization for the last five years.

COMPLETED PROJECTS AND FUNDS RETURNED

There is a direct correlation between budget performance and schedule performance on most projects. A well-managed project generally meets the project goals for both.

Project Delivery Methods for Closed Projects



	2007-08	2008-09	2009-10	2010-11	2011-12
Construction Management	$22,933,271	$12,997,937	$111,585,162	$41,861,832	$35,218,423
General Contract	$49,348,448	$102,627,100	$87,729,142	$33,200,599	$11,203,131
Design Build	$0	$16,816,246	$0	$2,792,177	$0
Owner Build	$401,061	$0	$0	$1,771,412	$2,030,198

FIGURE 5
Project Delivery Methods for Closed Projects per Fiscal Year

Project Performance for Closed Capital Projects by Fiscal Year

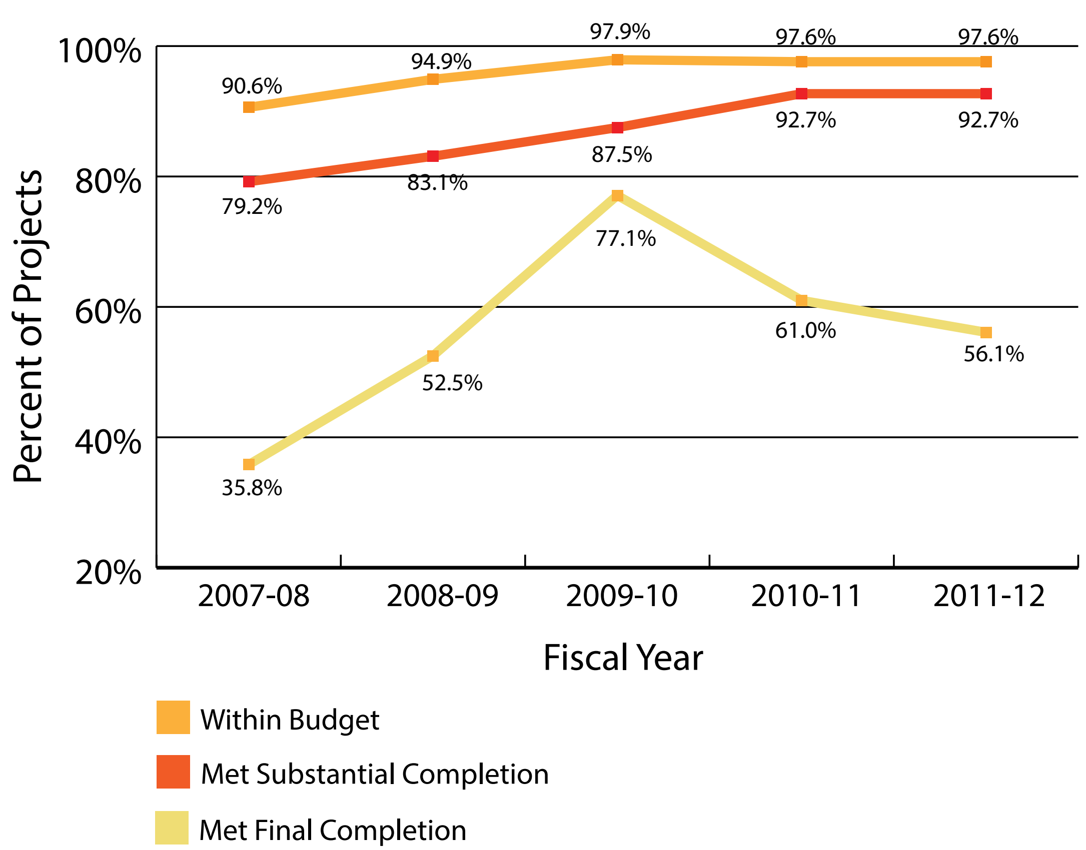


FIGURE 6
Schedule and Budget Performance (Consolidated graph of budget, substantial completion, final completion)

Figure 6 shows aggregate schedule and cost information, by fiscal year, on a single graph. It is meant to assess the overall project performance. Over 97% of projects were completed within budget and 92% met substantial completion. There was one individual project that was closed over budget by a negligible amount (the renovation to classroom W26A in Holmes Hall was over by $128), having no impact on construction activity. While final completion took a step backwards, it should be noted that this has little impact on campus operations. There are many factors that have contributed to the decrease in the number of projects that met final completion, but the most important was the volume of active construction projects ($143.6 million) during this period. Projects that are in the construction phase inherently demand a higher priority from the limited number of project management staff than projects that have already met substantial completion.

Table 1 summarizes the budget performance for projects that have been completed and closed in fiscal year 2011-12. The number of projects closed remained constant from the year prior; however, the value of closed projects was significantly lower in fiscal year 2011-12. Projects that were closed returned 7.6% of funding to the source, slightly higher than the 5.5% average over the past five years.

Table 2 illustrates the funding returned for projects when separated by project size. The chart represents three divisions: projects over $1 million; between $500,000 and $1 million; and from $250,000 to $500,000. The percentage of funds returned tends to be higher on the smaller projects. There is a need to carry a higher percentage of contingency when performing smaller jobs. A single change order or multiple change orders can have a much larger impact on a project that is small in size, depending on the magnitude of the change. By contrast, a single change order on larger projects tends to not commit contingency funding to a level that it would require a budget adjustment to cover the costs of the change or changes.

Table 3 illustrates the contingency usage by budget group. The construction contract, work by owner,

Budget for Closed Projects	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12
Authorized Budget:	$77,483,334	$206,398,900	$139,244,363	$84,843,838	$52,410,475
Final Cost:	$75,836,038	$198,930,659	$132,931,212	$80,362,824	$48,451,752
Total Returned:	$1,647,296	$14,890,367	$6,313,151	$4,481,014	$3,958,723
Percent Returned:	2.1%	7.2%	4.5%	5.3%	7.6%
Actual Cost of Construction Contract:	$59,658,023	$164,066,096	$109,341,206	$59,054,199	$33,789,257
Number of Projects Closed:	**53**	**59**	**48**	**41**	**41**

TABLE 1
Budget for Major and Minor Closed Capital Projects, by Fiscal Year

Major Projects (>$1million)	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12
Authorized Budget:	$53,557,235	$186,600,978	$121,962,000	$69,550,000	$36,330,000
Final Cost:	$51,926,466	$178,613,769	$117,009,199	$66,975,836	$34,321,351
Total Returned:	$1,594,796	$7,987,209	$4,862,801	$2,5724,164	$2,008,649
Percent Returned:	3.0%	4.3%	4.0%	3.7%	5.5%
Number of Projects Closed:	13	21	13	11	8

Projects $500K to $1million	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12
Authorized Budget:	$15,965,599	$13,154,000	$9,326,363	$8,105,838	$7,485,500
Final Cost:	$14,581,544	$12,427,400	$18,743,434	$7,630,527	$6,614,698
Total Returned:	$1,384,055	$726,600	$582,929	$475,311	$870,802
Percent Returned:	8.7%	5.5%	6.3%	5.9%	11.6%
Number of Projects Closed:	20	18	13	11	10

Projects $250K to $500K	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12
Authorized Budget:	$7,960,500	$7,559,079	$7,956,000	$7,188,000	$8,594,975
Final Cost:	$7,335,889	$7,046,400	$7,088,579	$5,756,426	$7,515,703
Total Returned:	$624,611	$512,679	$867,421	$1,431,538	$1,079,272
Percent Returned:	7.8%	6.8%	10.9%	19.9%	12.6%
Number of Projects Closed:	20	20	22	20	23

TABLE 2
Summary of Funds Returned for Projects Closed in FY11-12, by Project Size

Description	Authorized Budget	Total Cost	Dollars (Over)/Under Budget	Percent (Over)/Under Budget	Percent Contingency Used
Contract	$29,840,502	$33,789,257	($3,948,755)	(13.2%)	48.0%
Design	$4,143,440	$4,534,545	($391,105)	(9.4%)	4.7%
Project Administration	$1,837,593	$1,851,660	($14,067)	(0.8%)	0.2%
Project Development Costs	$181,301	$206,596	($25,295)	(14.0%)	0.3%
Construction by Owner	$6,228,117	$5,920,907	$307,210	4.9%	-3.7%
Moveable Furnishings and Equipment	$1,944,524	$2,148,786	($204,262)	(10.5%)	2.5%
Contingency	$8,234,998		$4,276,275		
Total Projects: 41	**$52,410,475**	**$48,451,752**	**$3,958,723**	**7.6%**	**51.9%**

TABLE 3
Contingency Use Summary (Budget by Budget)

and the design costs have the largest impact on project contingency, with the contract category consuming the largest share. Contingency usage in this category was roughly proportionate with the contract share of the budget. Campus Planning and Administration and Engineering and Architectural Services continue to refine the budgeting process to provide better value and more reliability to the campus. As an aggregate, projects returned over one half of the budgeted contingency to the university. It is important to have an effective, timely closeout process in order to release the remaining project contingency funds to the source in order to be repurposed. An analysis of closeout times is reviewed later in the construction section of this report.

PROJECT CHANGE ORDER ANALYSIS

As Campus Planning and Administration (CPA) and Engineering and Architectural Services (EAS) strive to make improvements, one of the earliest focus areas has been reducing the number of construction change orders. Though often necessary, changes can lead to delays in construction and disputes with contractors. Often these disputes are not from a single change but rather from numerous small changes. These small changes may result in a contractor claiming that the volume of changes delayed the project or impacted their productivity, and subsequently demanding substantial additional compensation. Change orders are inevitable the construction process for a number of reasons:

1) Undocumented field conditions, such as bad soils and concealed asbestos. It is important to perform as much investigative research of the existing conditions as possible in order to minimize the impact of field conditions on a project.

2) Document discrepancies in which the work specified either cannot be built or does not meet the intent of the project. It is important to identify and correct recurring mistakes in order to reduce change orders and thereby limiting university exposure.

3) Scope changes requiring additional work at the discretion of the university. Scope changes modify the function or capacity of a facility. These may include changes to the quality of finishes and furnishings or to the size of the building or program to be included in the project. These are the most easily controlled sources of changes but can also increase the value gained by the project.

MSU tracks change order rates by calculating the dollar value of change orders divided by construction payments. The change order rate has generally trended downward since fiscal year 2003-04, when the change order rate was 9.1%. Following the spike in fiscal year 2010-11, the 2011-12 period shows a reduction to 7.2% attributable primary to a combination of less project complexity, timing (i.e. projects closer to substantial completion), and improved construction documents.

Figure 7 represents the change order rate by reason code as a percentage of total construction payments for active and closed projects

Change Order Rate vs Construction Payments for Active and Closed Capital Projects
by Fiscal Year of the Issue Date

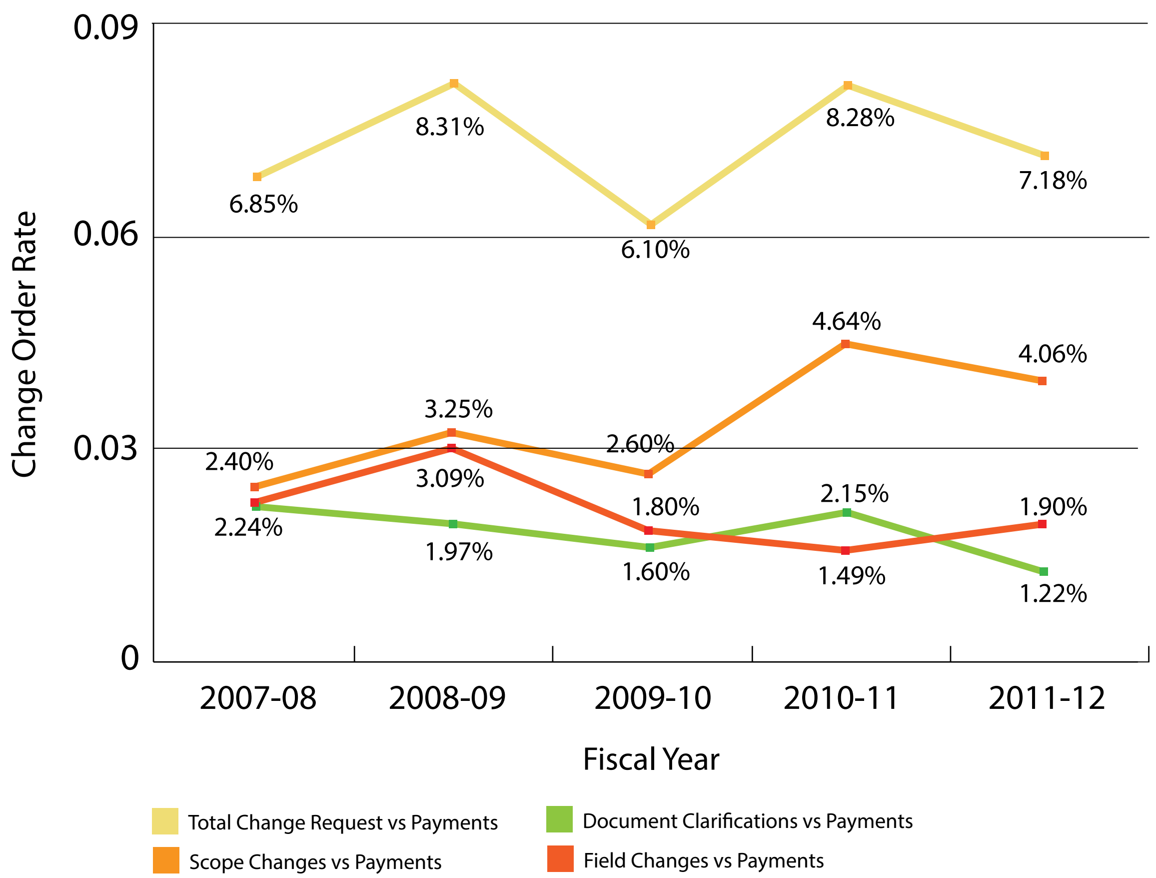


FIGURE 7
Change Order Rates by Reason Code

by fiscal year. Each percentage point of change order rate represents a $1 increase per $100 of the construction bid price. For example, for every $100,000 in construction paid during fiscal year 2011-12, the university identified $7,200 in change orders.

In fiscal year 2011-12, the overall change order rate decreased to 7.2% from the year prior of 8.3%, which was slightly below the five-year average of 7.4%. The rather large decrease in spending year over year is chiefly attributed to the reduction in document changes from 2.2% to 1.2%. This is a positive result, as document changes are the most controllable source of changes and indicates that MSU's design and construction process is providing more value to the campus community. Compared to five-year averages, the 1.2% document changes reflect a drop of approximately 33%, while field condition changes nearly match the average and scope changes at 4.1% are slightly above the average of 3.7%. This indicates that while the overall change rate remains nearly constant, there is more value being added to jobs through scope additions and less money being spent on document changes.

Figure 7 illustrates that document changes fell below the lowest rate in the prior four years by 25%. While the rate increased in the year prior, the current year continues the downward trend. This can most likely be attributed to the use of Building Information Modeling (BIM) becoming more commonplace. BIM helps to minimize design errors that are most often identified in the field through the use of clash detection. In the past five years, the use of BIM has increased significantly to the point that it is uncommon for a major project not to utilize BIM on some level. This has significantly helped to minimize document changes. Moreover, as the tool is used more often, the design consultants become more proficient with it and continue to increase its effectiveness.

Although the scope change rate decreased in fiscal year 2011-12, there was a significant increase in the overall value of scope changes due to the high volume of construction payments. Nearly 15% of the scope changes (over $1.4 million in value) are related to the Eli and Edythe Broad Art Museum, which, as mentioned earlier, may be attributed to the challenges of dealing with signature architecture. Other projects that had significant scope changes are the Bailey and Rather Hall Renovation at $893,000, the Case Hall Renovation at $724,000, and the Cyclotron Phase II office addition at $547,000. Scope changes on these four projects contributed to over 50% of all scope changes for 2011-12.

Field changes increased significantly in fiscal year 2011-12 by nearly 27%. Field changes can sometimes be minimized by more thorough investigation of existing conditions; however, this is not always possible without significant disruption of building operations or student living conditions. The Bailey, Rather, and Emmons Hall renovations made up over 25% of the field changes for fiscal year 2011-12. This percentage may be attributed to the projects' accelerated schedules and student occupancy of the building minimizing the amount of existing condition investigation that could be completed during the design phase. There has been a significant effort to increase the investigation of existing building conditions earlier in the design phase, and this should have a positive impact on the number of field condition changes required on future projects.

MSU works continuously to improve the methods and metrics used to assess project performance. A breakdown of change order rates by delivery method has been developed for this report. As discussed earlier in this section, there are strengths and risks associated with each type of project delivery method. Figure 8 illustrates the change order rates by delivery method.

The two delivery methods most commonly used at MSU, the CM and GC delivery methods, show a significant difference in the amount of scope changes, which is the highest volume cause for changes. The CM method provides more flexibility for scope change due to the construction manager's role as an agent of the university, thus allowing MSU to add value to a project as it progresses and the risk of unforeseen conditions diminishes. In this situation, the contingency held to mitigate risk becomes available to add programmatic elements to the project, thus providing more value to the universi-

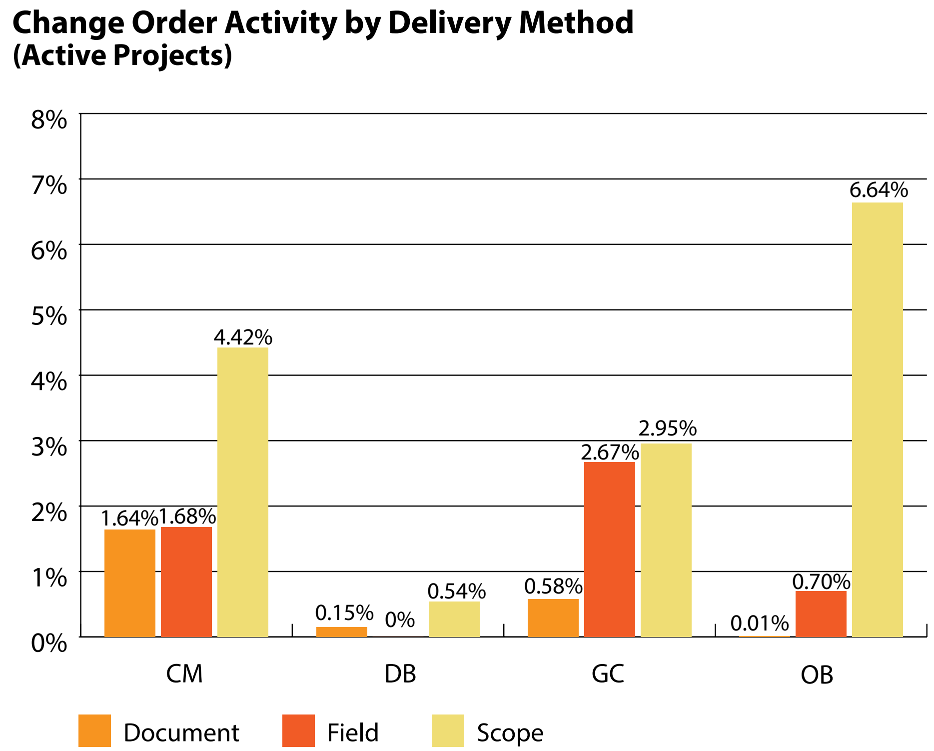


FIGURE 8
Change Order Rates by Delivery Method

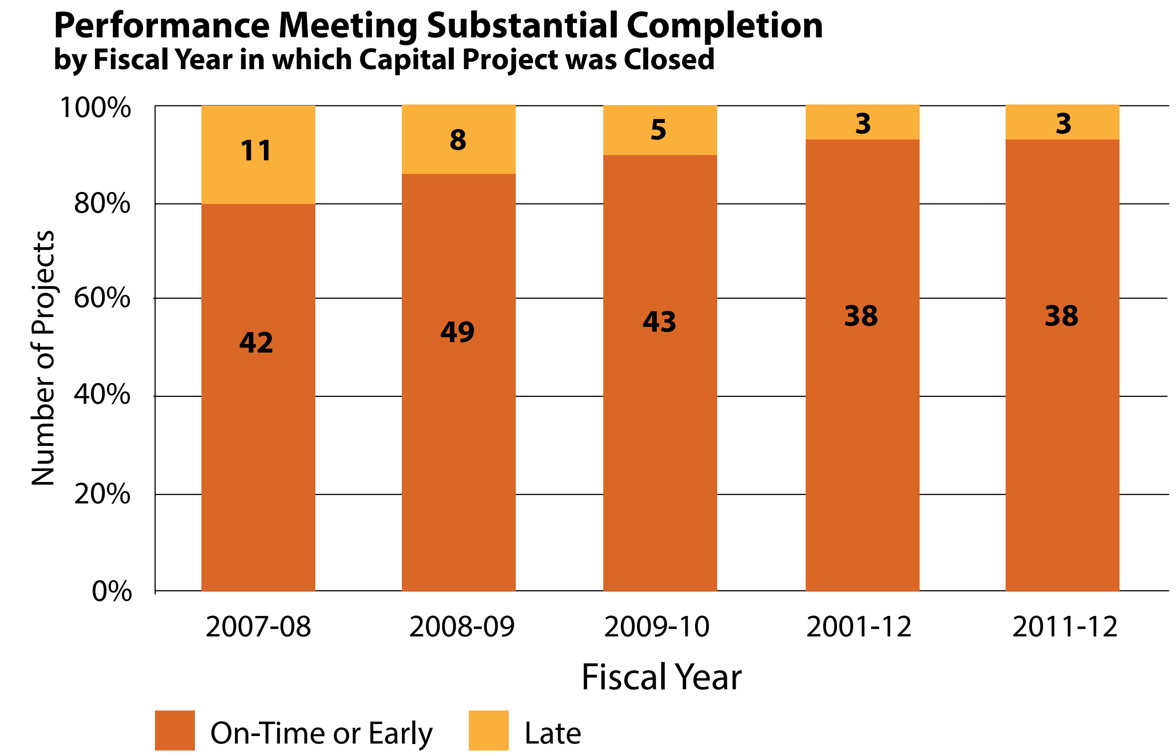


FIGURE 9
Schedule Performance for Meeting Substantial Completion

ty. The OB method also has a significantly higher scope change rate. OB provides the highest level of flexibility but is used selectively so as to control the risk to the university.

The field change rate is the highest for jobs delivered using the GC delivery method. This is typical as this is the only delivery method that precludes pre-inspection or existing facility investigation.

The document change rate is significantly higher for CM compared to the other methods. This is predictable because the CM method tends to be used on the most complex projects that inherently pose the most risk to the university. Document changes can be reduced by incorporating a CM in the project planning process as early as possible on larger projects. This provides estimating expertise and assists the design consultant in the quality control and constructability of the project documents.

As data becomes available in future years, it will be possible to identify trends and build on the metrics that assist in measuring project performance at MSU.

SCHEDULE PERFORMANCE ANALYSIS AND FINAL COMPLETION TREND

MSU emphasizes schedule requirements by setting realistic substantial completion dates with clients, specifying those requirements clearly in the bid documents and then holding contractors to a high standard of compliance. Engineering and Architectural Services has made an effort to emphasize schedule compliance beyond project specifications and has highlighted schedule importance at contractor and consultant forums.

Substantial completion requires that a project is usable for its intended purpose (e.g., a laboratory allows for classes or research, a road intersection is open, or an elevator is permitted to carry passengers). Figure 9 shows that 38 of 41 projects (93%) met substantial completion on time or ahead of schedule, matching the fiscal year 2010-11 performance and exceeding the success rate of the three years prior to that. University operations were not impacted by any of the projects that missed the substantial completion date.

Final completion is the final task of closing out a project. It requires that all work be completed, no more unpaid expenses remain, and any unused funds be returned. There are a number of factors that hinder timely final completion. The university performs many work functions on a construction project, including: landscaping; procurement of furnishings and equipment; and computer and telecommunication networking. These functions tend to occur toward the end of a project. While strides have been made in recent years to improve the accuracy of budgets for these activities, MSU is still refining the scheduling of these functions to deliver them efficiently to individual projects. In many ways, the closeout process is controlled by the inputs at the beginning of the project, including realistic schedules and budgets, along with a clear understanding of the entire scope of MSU-performed work.

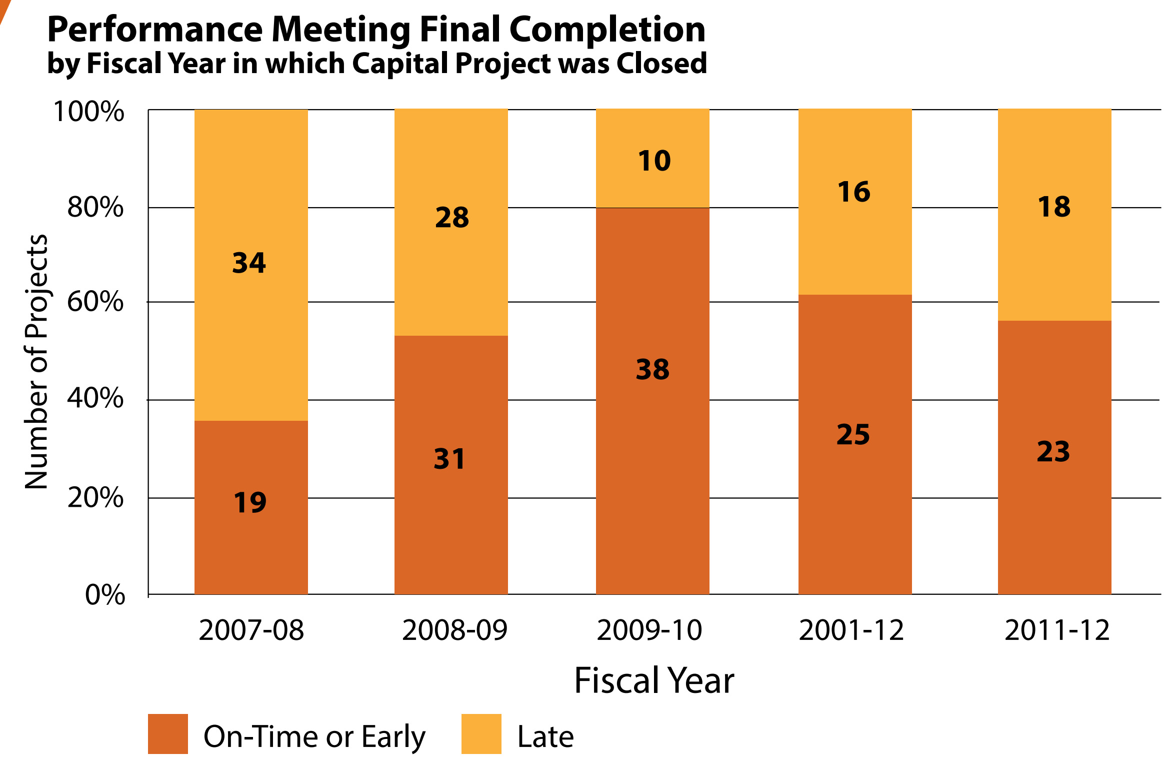


FIGURE 10
Schedule Performance for Meeting Final Completion

In order to be successful in timely final completion of a project, university-performed work must be fully integrated into the planning schedule. The university is putting forth greater efforts to accurately identify and perform MSU work on schedule. Planning is done in advance of construction activities and with consideration of MSU-performed tasks rather than waiting for the completion of all other field activities. Campus Planning and Administration and EAS meet regularly to review the status of projects that are substantially complete and to communicate the status with customers and stakeholders.

The percent of projects that met the planned final completion continuously improved prior to fiscal year 2010-11. In fiscal year 2009-10, nearly 80% of all projects met the required final completion date. While the trend indicated continuous improvement in this area, there was a decrease in the number of projects that met the planned final completion date in fiscal year 2010-11 and again in fiscal year 2011-12. Figure 10 displays the results of the last five fiscal years. Having a newly constructed building or addition functioning as designed prior to final completion is a higher priority than closing out a project. This sometimes requires that a project continue past the planned final completion date. The focus is to close projects in an appropriate timeframe, resulting in the release of unused funding so that it can be repurposed for other university needs. While it is important to emphasize the timely closeout of a project, if it remains open beyond the planned final completion date, there is usually minimal impact on campus operations.

In April 2008, the School of Planning, Design, and Construction (SPDC) completed a study evaluating the MSU project closeout process. Timelier project closeout was found to benefit all project stakeholders, including the MSU user, the project implementation team, contractors, and designers. One recommendation was to track the project closeout process in two segments: 1) T1, which is the time period from substantial completion to final payment to the contractor, and 2) T2, which is the period from final payment to final closeout of the project. Figure 11 displays the average closeout duration for capital projects by the T1 and T2 categories for the last five fiscal years. Closeout time significantly increased in fiscal year 2010-11. This is principally a product of the five projects averaging 975 days to close, many of which had extenuating circumstances. For instance, the Engineering Research Complex had HVAC system problems caused by faulty work by the contractor, and the Spartan Stadium east upper stands repair project also missed the final completion due to contractor error. Moreover, the Duffy Daugherty Football Complex had continuous construction scope additions that kept the project open past its planned final completion date. Likewise, the Wilson road project missed the final completion date due to seasonal limitations on site work and landscaping being performed by MSU Landscape Services. If these projects are excluded, the closeout duration would have been an average of 450 days, which is consistent with the five year average. In 2011-12, the duration for closeout when included these projects was 480 days, slightly above the five-year average. There were four projects that remained open over two years, well beyond the average closeout timeframe, and these projects raised the number significantly. The Chemistry addition was partially state funded and remained open in order to maintain funding availability, the Brody Utility Improvements Phase I and Recycling Center Public Drop Off remained open to identify possible opportunities for improvements within the project scope, and the Giltner Hall Rooms 31 and 32 renovation was held open to ensure the lab space was functioning as intended.

Capital improvements at MSU are defined in two categories: major and minor. A major capital project is any project that is likely to cost over $1 million, that would change the height or footprint of an existing building (other than temporary buildings), or that would make a material long-term change to the campus landscape. Minor capital projects are between $250,000 and $1 million, and do not require a building height or footprint change. Figures 12-14 represent the average closeout durations for all major and minor projects, separated by project size. It is logical to assume that most projects that are larger and more complicated would take more time to closeout. The timeframe to bring projects to final contractor payment (T1), and then to closeout (T2), increases incrementally with the size of the project.

FUTURE DIRECTIONS

Construction payments were extraordinarily high for fiscal year 2011-12, but payments for fiscal year 2012-13 should be somewhat lower

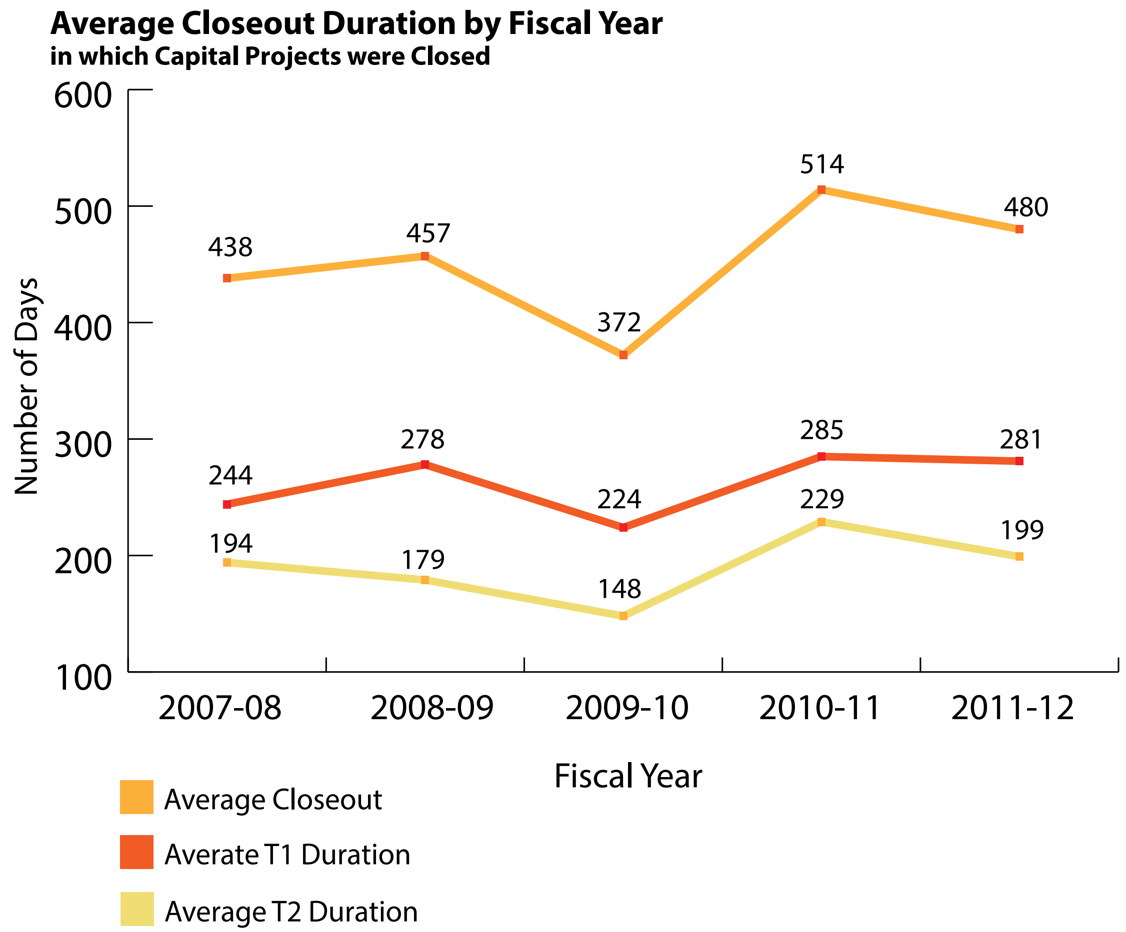


FIGURE 11
Substantial and Final Completion Performance (Closeout Duration)

(though still above the five-year of average of $100 million). Many of the new projects are not expected to start construction until late in the fiscal year.

THE MSU WAY – EXCELLENCE IN CAMPUS OPERATIONS AND SERVICES (ECOS) INITIATIVE

There are a number of campus organizations that are involved in construction projects at MSU. Several of those key organizations, such as the Physical Plant, Residential and Hospitality Services, Information Technology Services, Recycling/Surplus/Waste Management, MSU Police, Land Management, Campus Planning and Administration, Facilities Planning and Space Management, Environmental Safety and Health, and MSU Purchasing, are partnering to develop and deploy an initiative that is presently called "The MSU Way: Excellence in Campus Operations and Services (ECOS)."

The focus of the effort is on all construction and maintenance operations or services that units provide to campus clients. "The MSU Way" is the method of delivery all partners would agree to follow consistently in order to collaboratively exceed the campus customers' expectations while using MSU's resources as efficiently as possible.

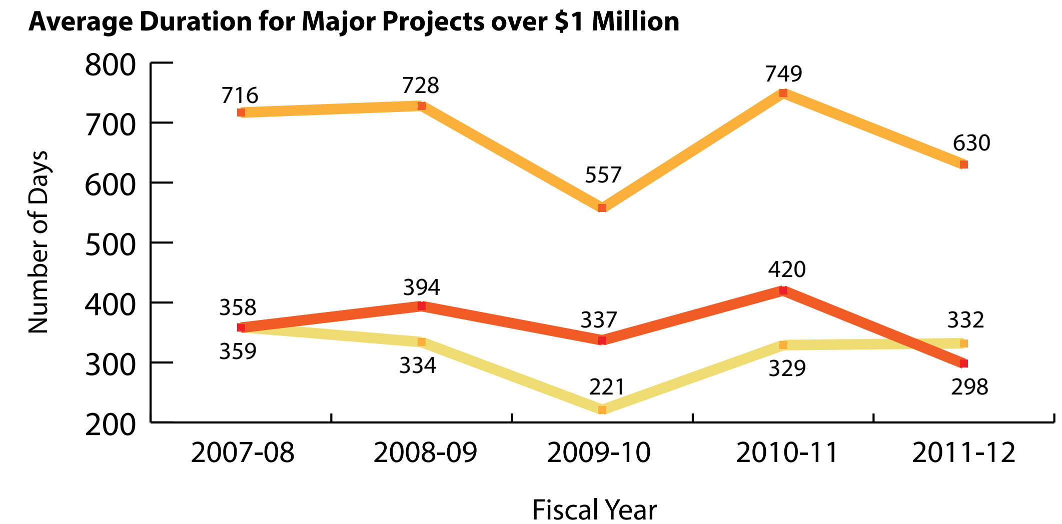


FIGURE 12
Substantial and Final Completion Performance – Major Projects (Closeout Duration)

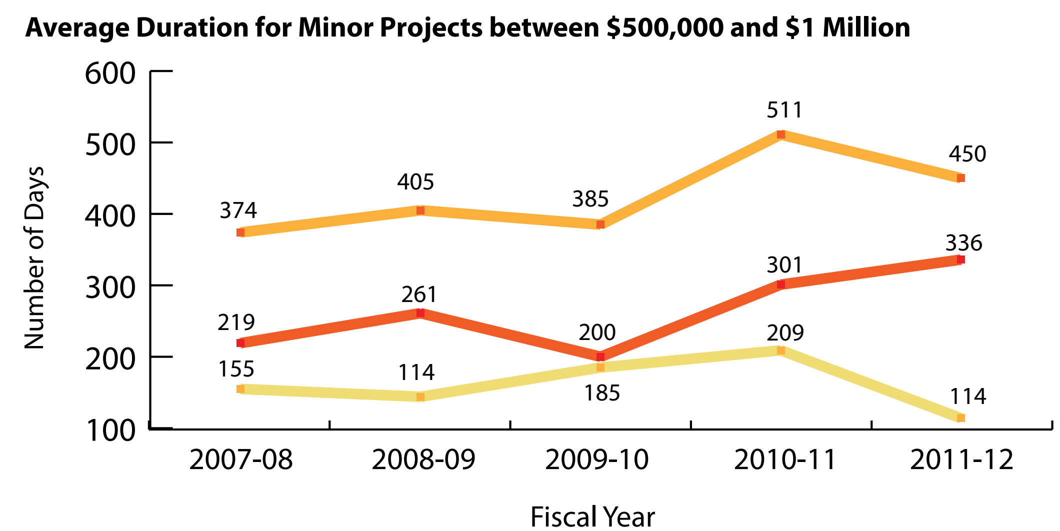


FIGURE 13
Substantial and Final Completion Performance – Minor Projects (Closeout Duration)

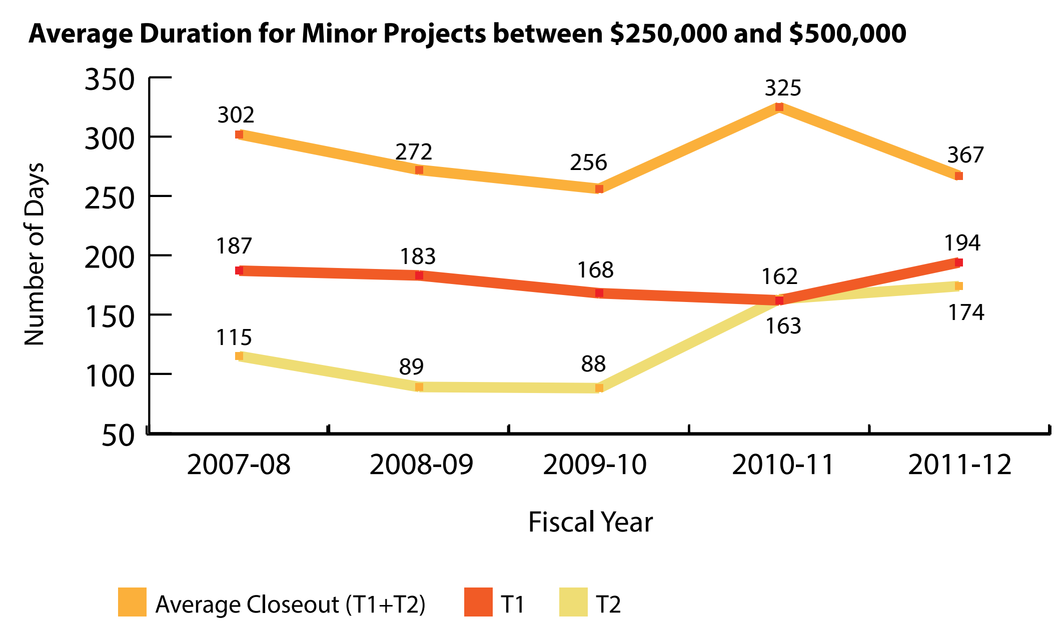


FIGURE 14
Substantial and Final Completion Performance – Minor Projects (Closeout Duration)

Broadly defined, the goals of The MSU Way: ECOS project are as follows:

- Focus on investigating opportunities for improvement in how the Physical Plant interacts with other divisions on campus.
- Identify and eliminate duplications in operations and service processes.
- Streamline existing operations and service processes and develop new ones if needed.
- Proactively look at MSU operations and suggest improvements from within the organization.

The initiative is being led by a steering committee, with three separate work groups. Each individual work group is tasked with identifying and piloting opportunities for improvement in its focus topic. The focus topics are:

1) Major capital projects, defined as projects that are $1 million and above or require Board of Trustees approval.

2) Minor projects from $250,000 to less than $1 million.

3) All other service requests, maintenance operations, shops, or PO projects are those less than $250,000 or performed by the Physical Plant.

There are numerous inputs to identify areas of improvement. Work groups focus on their own individual project areas, with a goal on identifying synergies that will produce the best results or provide the best value to MSU. The focus area inputs include:

- Suggestions made by the committee members
- Surveying staff perceptions of process engagement levels
- Focus group feedback from campus customers
- Results from Post Occupancy Evaluations (POE)
- Process mapping and analysis
- Feedback from participatory management meetings

The ECOS initiative is designed to utilize the Plan, Do, Check, Act (PDCA) cycle, or the Deming Cycle, to guide the initiative. The PDCA cycle is a never-ending cycle, repeated again and again for continuous improvement. Given the multiple sources of data that the ECOS initiative will collect and accumulate, the following strategy is being used to process suggestions through the committee structure established for the initiative: see Figure 3.

There are three phases to the process; the validation and cohesion phase; the scoping and development phase; and the implementation phase. The project is currently midway through the scoping and development phase. There will be incremental changes to the processes that are implemented over time. The focus of the effort will be to measure the effectiveness of that which has been modified while also identifying new ways to improve the system.

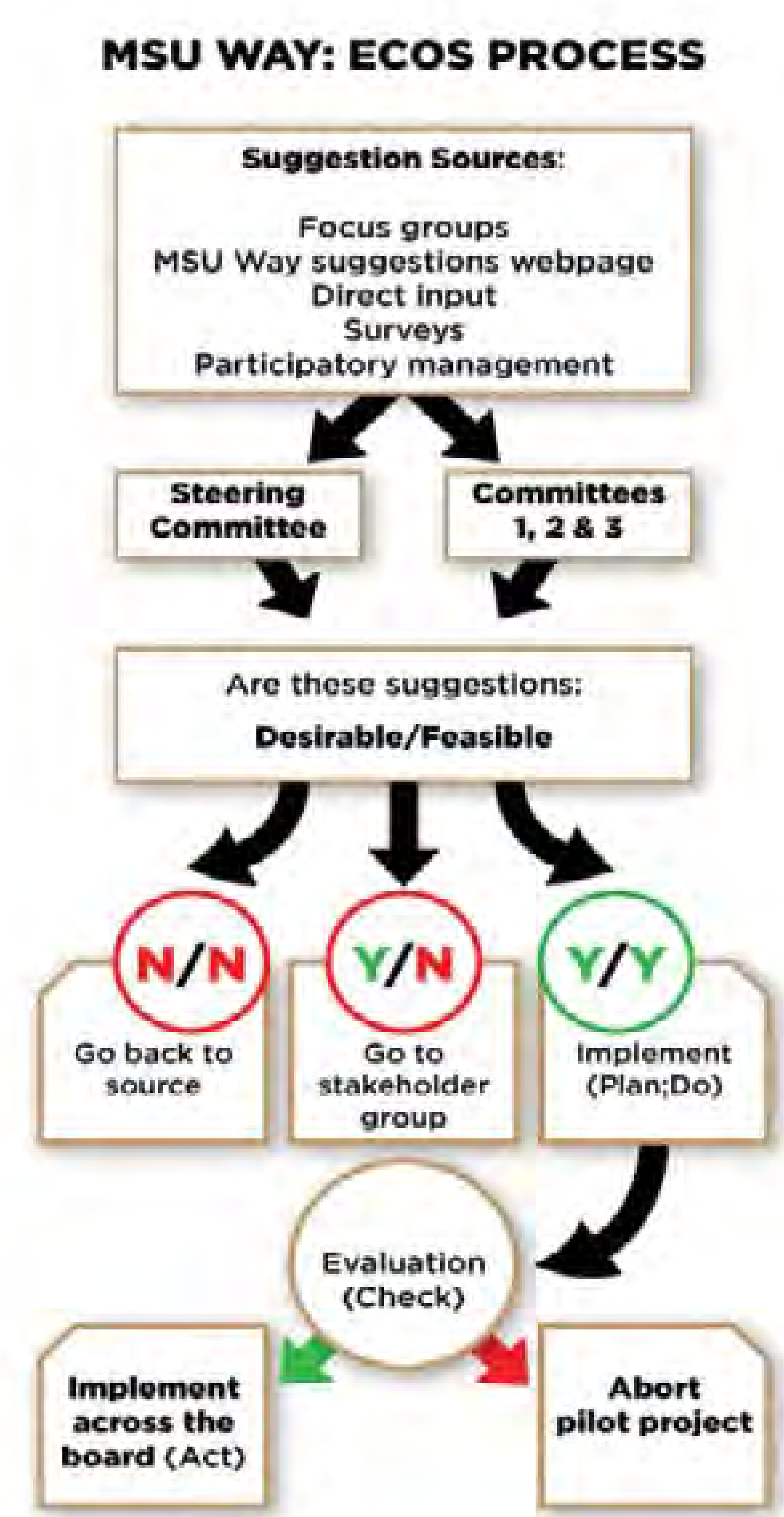
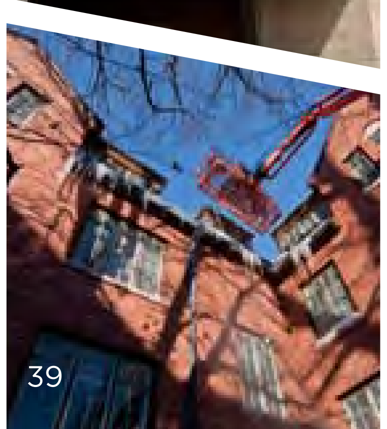


FIGURE 15
The MSU Way: ECOS Process



JUST-IN-TIME MAINTENANCE

SUMMARY

The Just-In-Time (JIT) facilities condition database represents a comprehensive assessment of all campus infrastructure components. The rating process used to develop the database assesses the condition of a particular component and estimates the expected failure date based on the assessment. This information is analyzed, and then a priority list and schedule of repair, replacement, and maintenance needs is developed. The industry-predicted life cycle of infrastructure systems (average number of years before a replacement is normally needed) is used as the starting point for projecting the timing of required work. This method is commonly referred to as deferred maintenance. At MSU, however, this estimated replacement year is adjusted based on observations made in the field by preventative maintenance and repair crews. As a result of these observations, the time for replacement or repair of a particular piece of equipment or utility segment is adjusted so that funding resources can be used most efficiently, effectively, and closest to a predicted failure. The JIT annual maintenance and replacement costs are then projected over a 10-year period.

Just-In-Time needs are broken down into two time frames: the next five years and six to ten years. The JIT data provides opportunities to coordinate JIT projects with other construction and renovation projects.

ANALYSIS

Early in 2012, Physical Plant migrated all JIT data to the previously purchased FAMIS Facilities Assessment module. Now JIT projects are able to connect to, and utilize, the entire set of project tracking information included in the other FAMIS modules used by Physical Plant. At the same time, the Physical Plant Building Retro-Commissioning team is adding building system commissioning data into the Facilities Assessment module, so that age and condition information (JIT) and energy efficiency data (Retro-Commissioning) can be viewed together for the most comprehensive understanding of each building. Moving to the Facilities Assessment Module afforded the opportunity to re-classify the identified JIT projects in a manner better suited to the current funding climate. Now the priority of a JIT project, "Critical," "High Risk," or "Low Risk," is determined with five criteria:

- Imminence of system failure.
- Potential for human or research safety to be jeopardized.
- Potential for disruption of university and personnel, and the impact of the disruption.
- Probability of escalating damage to other systems or property.
- Near-term programmatic planning affecting JIT projects already identified; opportunities for coordination and cost savings.

Critical projects are considered the highest risk to the university, and generally funding is requested for this set of needs before high-risk projects are considered. The 10-year JIT forecast for the general fund identifies $460 million of work that should be performed in order to preserve the safety and reliability of the university's infrastructure.
Figure 1 shows the JIT needs for the next 10 fiscal years.

The projects that comprise the first five fiscal years of JIT needs are evaluated annually to determine which items present the most critical and highest risk to the institution, should a particular item fail. This "risk-based" approach for managing JIT reviews each item in light of the degree to which a failure would cause an interruption of normal university business and adversely impact the people and equipment that provide for the university's mission. For example, a steam tunnel failure would be deemed a higher risk than a window failure because it could force the closure of one or more buildings.

In Figure 1, the greatest requirement for funding of JIT needs occurs in fiscal year 2013-14. This is the effect of each year's needs outpacing the funds and sources available and being carried forward to the next. Additionally, a major funding source for JIT, the Endowment Trust, has contracted significantly. This source of funds was generating as much as $21,000,000 in annual proceeds until the market downturn. For fiscal year 2011, there was just $4,000,000 available, fiscal year 2012 provided $2,000,000, and fiscal year 2013 is

Total General Fund JIT Needs

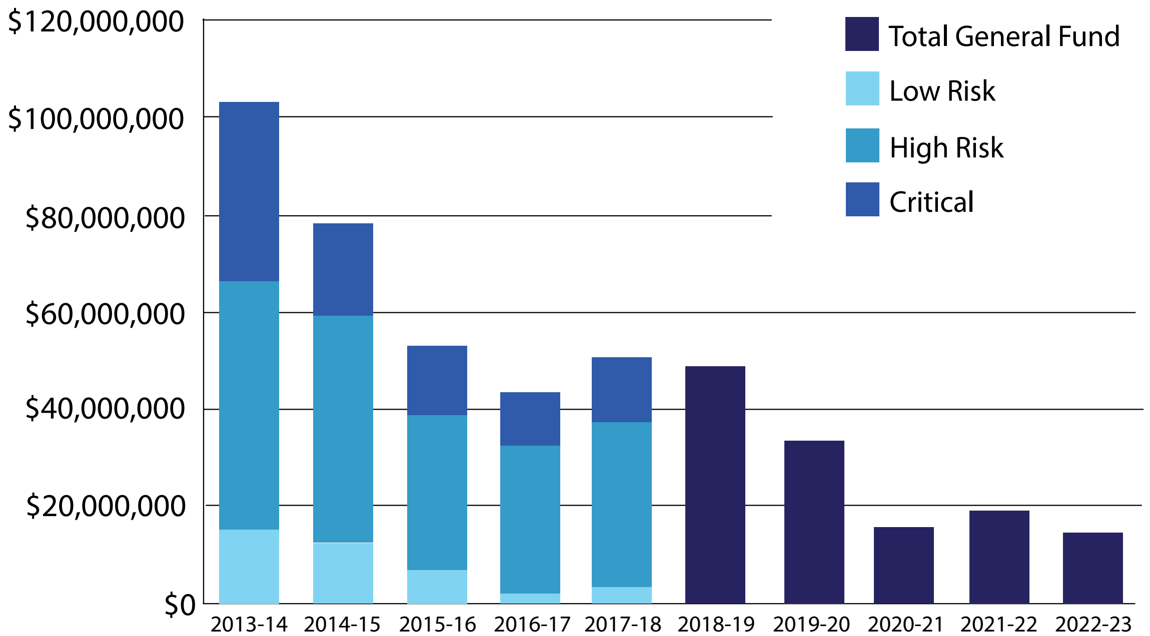


FIGURE 1
Annual General Fund JIT Needs for Next 10 Fiscal Years

General Fund JIT by Catagory

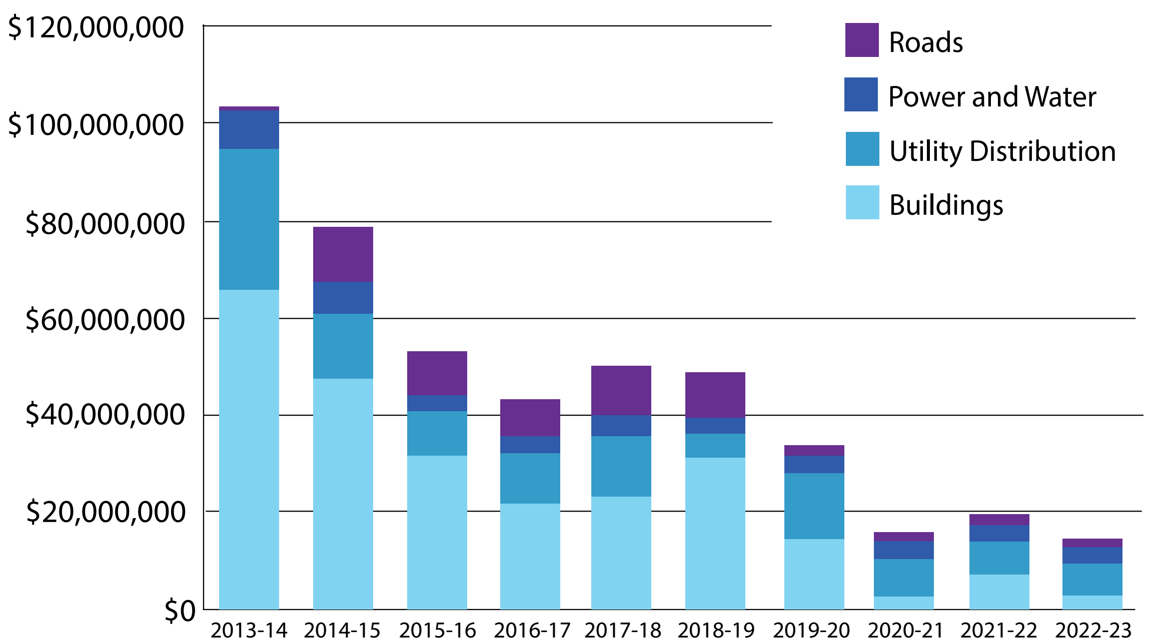


FIGURE 2
Annual General Fund JIT Needs for 2013-14 through 2022-23 for Buildings, Utility Distribution, Power and Water, and Roads

projected at $0. There are "no proceeds" also predicted for fiscal year 2014.

The JIT infrastructure needs for the general fund facilities are grouped into four main categories: buildings, utility distribution systems, power and water systems, and roads. Figure 2, which sorts the JIT information into those four categories, provides more detail of the JIT needs facing the general fund in the next 10 fiscal years.

The total ten-year general fund JIT needs by the four main categories are as follows:

Buildings:	$246,581,222
Utility Distribution:	$114,287,894
Power and Water:	$41,952,792
Roads:	$56,754,604
10 Year Total	$495,576,512

Table 1 shows the funding trend for JIT over the past five years with the four main JIT categories being analyzed more in depth by sub-sections. Each sub-section is color coded.

Evaluation of funding trends over the past five years reveals the most frequently funded type of JIT project to be mechanical and electrical systems within buildings. About one quarter of funded projects were

JIT Projects	# of Projects	$ Amount Funded	% of Projects	% of $ Amount of Projects
Building Envelope	115	$13,610,000	23%	8%
Building Interior	26	$1,156,000	5%	1%
Building Systems	200	$38,543,000	40%	21%
Utility Distribution	90	$85,489,000	18%	48%
Power Plant	51	$20,700,000	10%	12%
Wells	5	$2,750,000	1%	1%
Roads	15	$17,187,000	3%	9%
Bridges	2	$205,000	0%	0%
Total	504	$179,640,000	100%	100%

TABLE 1
Funding Trend over the Past Five Fiscal Years

for building envelope and just 5% have been for building interiors. In the earliest years of the increased funding levels for JIT, the Physical Plant concentrated on the backlog of deteriorated building exteriors (roofs, masonry repairs, doors, and windows). Currently, with the exception of windows in numerous older buildings, the building envelope backlog of campus buildings has been relieved, and the Physical Plant is keeping pace with funding at the expected life cycle of remaining buildings. Within the last five years, emphasis has now been placed on the backlog of old and failing equipment inside buildings, most related to heating and cooling for occupants and research.

Approximately 40% of the projects funded were for building systems, amounting to about 21% of the total funding. In comparison, utility distribution projects in the last five years comprised about 18% of the types of JIT projects but amounted to about 48% of the funding total. Correction of damage or deficiencies in the steam system have most often been the primary motivation for these projects; however, the scope of the work includes other infrastructure upgrades such as water lines, communication or power duct-lines, sewers, roadways, bike paths, and walkways. This approach minimizes longer-range costs and the disruption of repeated tearing up and reconstructing roadways and landscape.

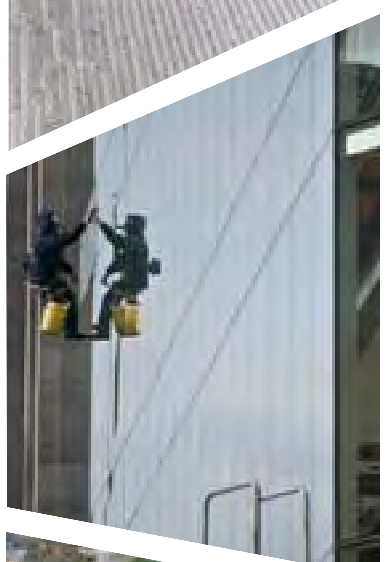
FUTURE DIRECTIONS

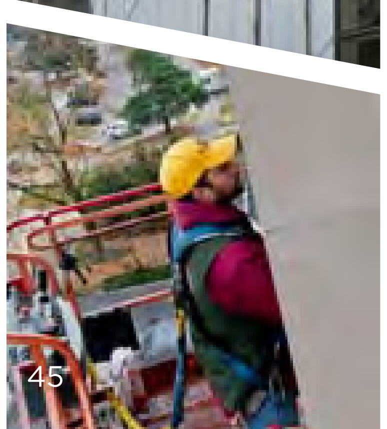
Building-wide window replacements for Student Services, Linton Hall, the MSU Museum, Central Services, Giltner Hall, Old Botany, and others have been deferred repeatedly over the last five high years as more critical projects have competed for the limited funding. The scale and cost of these projects are large and the disruption to occupants is potentially significant. Yet leaving them for the future puts them in competition with other high priced needs that are looming in the near future. Within the next five years, 12 buildings will have major HVAC equipment come to the end of its life expectancy. At the same time, five science buildings are under review for substantial funding to renew laboratory ventilation equipment to help meet Energy Transition Plan goals. With the continued under-funding of JIT needs, decisions based on risk of failure will likely favor those buildings with the oldest equipment. This circumstance will have to be balanced with the opportunities for enhanced energy efficiency found in the newer science buildings.

During the past year, a significantly more coordinated effort has been underway to share information related to planning the upkeep of campus buildings. The departments of Facilities Planning and Space Management and Energy Management have been added to the JIT monthly planning sessions to maximize coordination of building maintenance, programmatic needs, and energy efficiency. One inevitable outcome of this coordination is identification of more comprehensive, and potentially more expensive, changes needed. For example, more and

more frequently, a component of an HVAC system is identified as old and failing, but funding just the replacement of that component (as JIT is defined) makes little sense when the entire system has major energy losses or the use of the space is changing in the near future. So what starts as a $600,000 multiple exhaust fan replacement needed at the MSU Museum, for example, should most prudently become a multi-million dollar upgrade for energy efficient variable air volume and cooling systems. The past and current rates of JIT funding cannot keep pace with comprehensive building needs. Identifying energy efficient upgrades in conjunction with old equipment replacement, however, provides a long-range plan for the sustainability of each building.

The summary of JIT requirements shows the financial challenges that must be met to preserve the university's infrastructure framework. Although many infrastructure components may continue to operate, the likelihood of a disruptive failure grows yearly due to their age and deteriorating condition. There is a critical concern for JIT funding needs occurring in the next five fiscal years. During these years, the components of many buildings and systems that were constructed in the 1950s and 60s will reach the end of their adjusted life cycle and will require just-in-time replacement. An ongoing challenge will be to maintain and keep these systems operating until funding can be identified to address the full extent of these needs.





	% Greenhouse Gas Emission Reduction	% Campus Renewable Energy
2015	30%	15%
2020	45%	20%
2025	55%	25%
2030	65%	40%

TABLE 1
Energy Transition Plan Goals to Improve the Environment

ENERGY MANAGEMENT

SUMMARY

MSU has a 100-year history of demonstrated energy conservation using co-generation (also known as combined heat and power), which is an efficient energy supply system for campus. Since the energy crisis of the 1970s, the university has continued to reduce consumption using a central building energy management system along with enhanced construction standards. These standards incorporate the United States Green Building Council Leadership in Energy and Environmental Design requirements for sustainability. The recent adoption of the Energy Transition Plan by the MSU Board of Trustees has set the stage to continue improvement in the area of energy supply and demand for campus by moving the university towards a sustainable energy future.

ANALYSIS

ENERGY PLANNING

The Energy Transition Plan, adopted by the Board of Trustees in April 2012, is the first and most important step toward a sustainable energy future at MSU.

Calling on MSU to make a complete transition to renewable energy across campus, the Energy Transition Plan sets the standards that will guide future energy decisions (in a manner similar to how the Master Plan guides the university's growth). By design, this plan sets high-level goals and recommends strategies to meet the energy needs of the campus, reduce carbon emissions, and implement renewable energy infrastructure. This will be a university-wide effort with far-reaching benefits to improve the world for many generations.

The Energy Transition Plan utilizes solid data and research from MSU faculty, students, and staff, as well as outside experts, and addresses critical variables – reliability, cost, health, environment and capacity – that impact MSU's many stakeholders in the proximate community, across the state, and throughout the world.

The Energy Transition Plan Steering Committee identified three goals for sustainability that will move MSU toward its vision of 100% renewable energy: improve the physical environment, invest in sustainable energy research and development, and be an educational leader in sustainable energy. Similar to the Master Plan, the Energy Transition Plan will undergo a thorough review every five years to assess assumptions and strategies, as well as to set additional goals.

ENERGY OPERATIONS

The first goal, to improve the physical environment, recommends a schedule (shown in Table 1) to increase the percentage of campus renewable energy and decrease the percentage of greenhouse gas emissions (GHGs).

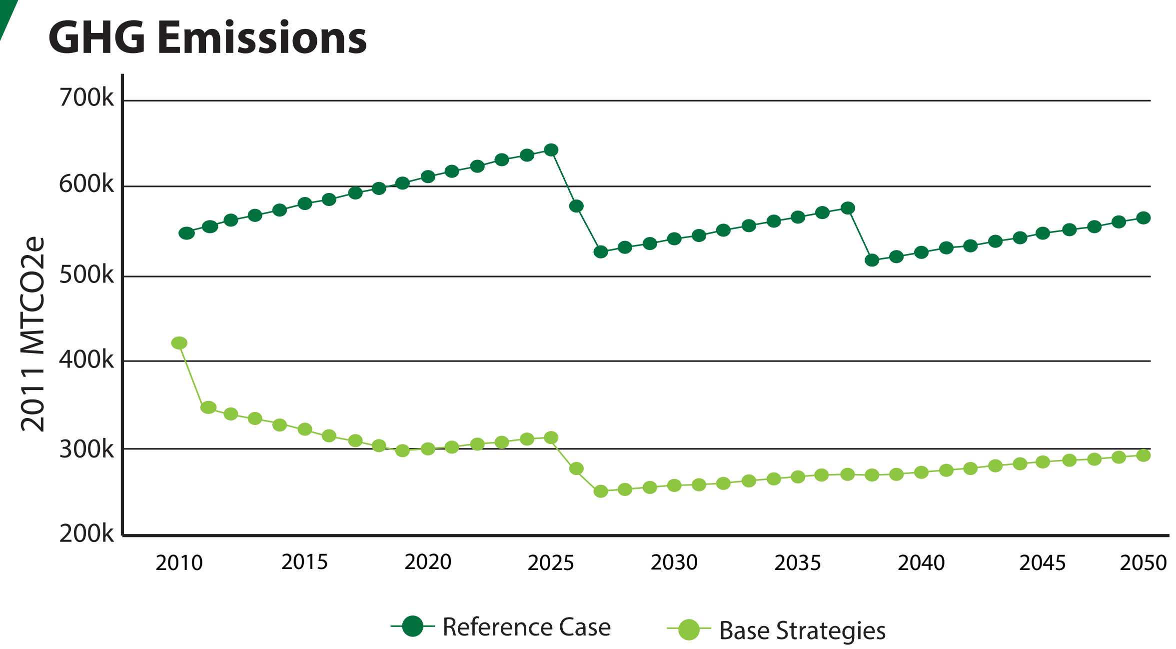


FIGURE 1
Scenario Comparison for GHG Emissions

An Energy Operations Group was formed to ensure that these targets will be met. The group is comprised of administrators and key staff from the following departments: the Office of the Vice President for Finance and Operations; the Physical Plant; Planning and Budgets; and Campus Sustainability. This group meets regularly to evaluate and recommend strategies for GHG and renewable energy targets while balancing factors such as energy reliability, cost, capacity needs, and health considerations.

INTEGRATED ENERGY PLANNING MODEL

One of the primary tools of the Energy Operations Group for evaluating energy options is the Integrated Energy Management Planning Model (IEPM).

The relationships between energy demand and supply variables are complex. The model takes what is known about MSU's energy system to forecast decision outcomes. The long-range integrated energy-planning model provides the tools necessary for almost any campus or community member to test different solutions to the challenges posed by the Energy Transition Plan.

The energy-planning model has the ability to forecast the impact of alternate planning strategies on key performance indicators such as cost of utilities, greenhouse gas emissions, tuition, energy capacity, and renewable energy percentages to meet reduction goals over the next 40 years (Figure 1).

The graph above shows an example of how two scenarios might be compared using the IEPM. This particular example shows the difference between two scenarios in terms of greenhouse gas emissions. The IEPM does not dictate what option is best, but it does provide a way to view the impact of multiple and complex scenarios.

ENERGY ANALYSIS, MONITORING AND REPORTING

Campus continues to expand and grow with an average of two million square feet in the most recent 10 years. This is part of the energy challenge: to meet the demand of new growth while minimizing the impact to the environment. Sustainable measures such as designs that include Leadership in Energy and Environmental Design (LEED) guidelines, energy efficiency goals, and renewable energy are a key part of the MSU Construction Standards. The MSU Design and Construction team has a minimum standard of LEED silver level for all new buildings and major renovations. The MSU Construction Standards have been written to achieve: quality structures of maximum utility; minimum maintenance and operation expenses; prudent use of energy and water; and minimum environmental impact during the construction process.

The MSU Construction Standards are continuously reviewed and updated as experience or construction innovations dictate. As referenced earlier in the this report as part of the section that addressed changes in planning, prior to August 2012, the construction standards required a 22% energy improvement for new buildings over typical building design efficiency standard as outlined by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). A thorough analysis was conducted using the IEPM and MSU engineers to determine the added cost and energy savings by pursuing more aggressive construction standards. The analysis showed MSU could pursue more aggressive building energy standards that would save the university in utility costs annually and that a minimum of a 30% energy efficiency requirement with a goal of 45 percent was possible. MSU Engineering and Architectural Services will continue to evaluate this in the context of the cost of increasing the efficiency level relative to the energy saved and the overall reduction in utility costs. Analysis shows typical industry building costs (maintenance and utilities) are six times more than the initial capital cost over the life of the building; by contrast, MSU maintenance and utility costs are three times the initial capital costs. Again, as noted earlier in this report, capital investment in energy efficiency measures during the design and construction of a new facility will minimize environmental impact and save in utility costs for the university in the long run but will be evaluated carefully on an individual project basis.

The IEPM has incorporated the increased efficiency requirements in new construction as it applies to space growth on campus and major renovations. The model also includes an existing building profile section that identifies energy efficient measures that are opportunities for capital investment to reduce annual energy costs in over 150 existing buildings on campus. Examples of energy conservation measures that could be applied to existing buildings include: installation of motion sensors to control lighting; upgrades to ventilation and air conditioning; replacement of constant speed fans with variable speed fans to respond to reduced demand; and the installation of air quality sensors in laboratories to improve safety while at the same time reducing the amount energy required to heat and cool laboratory buildings. The existing building profile module, along with energy audits being conducted in over 100 existing buildings, will help guide the investment decisions necessary to achieve further reductions in energy, which will result in minimizing the impact to the environment and avoiding increased operating costs.

CAMPUS ENERGY USE

MSU continues to have the lowest electrical consumption per square foot of building space among the Big Ten universities (see Figure 2). This is a reflection of the university's commitment to energy efficiency and continued improvement in operations of the Physical Plant.

The average total annual energy consumption per capita of the MSU East Lansing Campus community has dropped despite the growing population (see Figure 3). Consumption per capita is calculated using the total population of the area served by the T.B. Simon Power Plant and the total British Thermal Units (BTUs) generated by the T.B. Simon Power Plant. The reduction in energy per person results from a combination of the following: efficiencies gained at the power plant; energy conservation measures implemented in campus facilities, such as lighting upgrades, motion sensor installations, commissioning buildings, etc.; and an increase in the population on campus. The co-generation feature of the T.B. Simon Power Plant includes providing heating, cooling, and electricity for close to 20 million square feet of building space on the main campus. Co-generation is recognized as a very efficient method of providing energy to campus environments and provides MSU with a flexible and reliable energy supply.

ENERGY MONITORING AND REDUCTION STRATEGIES

MSU implemented a central building energy management system in the early 1970s and has required each new facility constructed to be connected to the Central Control energy management system. Central Control is housed in Physical Plant and is a computerized energy management system networked over campus ethernet. Central Control manages building heating, ventilating, air conditioning equipment, HVAC, and lighting control. Building equipment is scheduled based on occupancy, class schedules, and events, and it can be turned off or temperatures can be set back when the building is not in use. Operational strategies are programmed in buildings through central control to minimize energy use and alarm for maintenance when necessary.

Physical Plant Central Control partnered with the Registrar's Office, IT Services, and Residential and Hospitality Services to develop a policy for scheduling of heating, ventilating, and air conditioning equipment. In addition, the team recommended a classroom consolidation approach

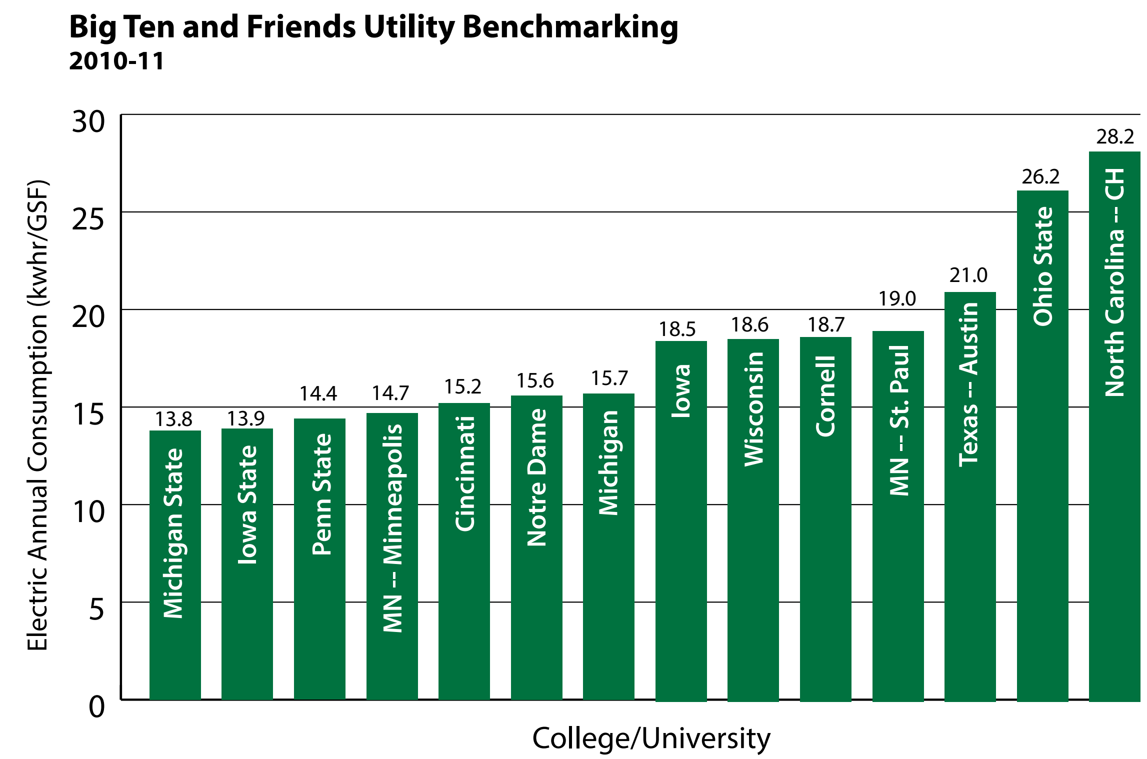


FIGURE 2
Big Ten and Friends Utility Benchmarking

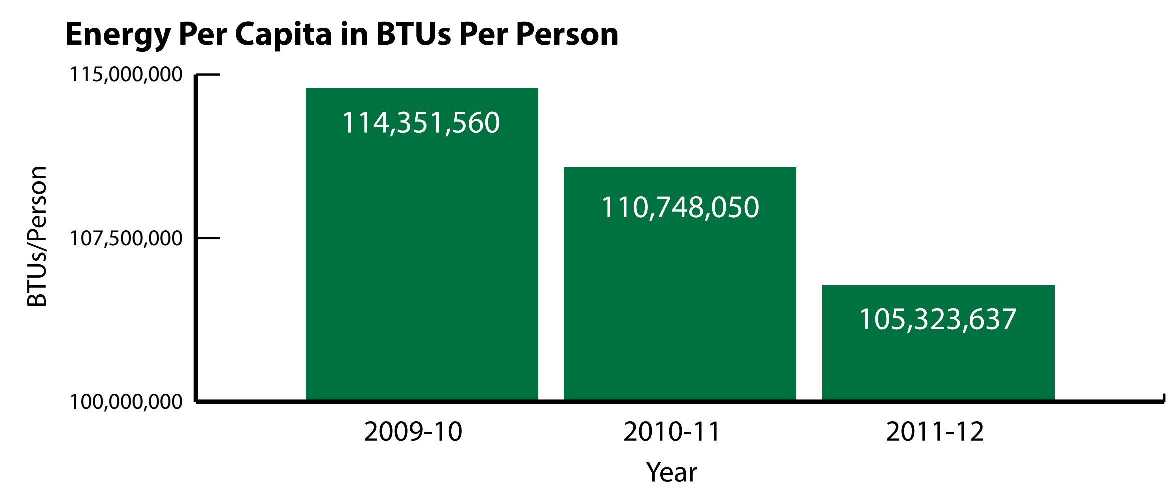


FIGURE 3
Energy Per Capita

FIGURE 4
Emmons Hall Energy Display for Smart Metering

to scheduling which allowed a reduction of HVAC equipment use in several buildings. The team recognized an opportunity to move scheduled classes to buildings that were more highly utilized with equipment already in operation, and, in turn, other buildings were shut down earlier in the evening. The results were as high as a 20% energy reduction in some facilities. The team continues to work on and prioritize scheduling and a software approach that will help to automate the scheduling process across units.

METERING

The efforts to reduce energy consumption on campus include connecting energy use with the campus community. All major buildings on campus have smart electrical metering for viewing real time data on the Internet at http://meters.msu.edu. In addition, an interactive energy dashboard (http://energydashboard.msu.edu) is available in Emmons Hall and Brody Hall to raise student awareness of consumption (see Figure 4). Online access to monthly and annual reports on energy consumption is also available at http://gis.msu.edu. Access to this data is part of the university's effort to educate the campus community about its consumption and encourage conservation.

Utility metering at the building level is essential for ongoing monitoring, measurement, and verification of energy savings for campus. Over the past three years, a smart electrical meter upgrade project has focused on ensuring all main campus buildings served by the T. B. Simon Power Plant have real time electrical meters that can be viewed by the various interfaces including the energy dashboard (Figure 4), the geographic web based mapping system, and the utility billing system. The smart meters provide minute-by-minute data

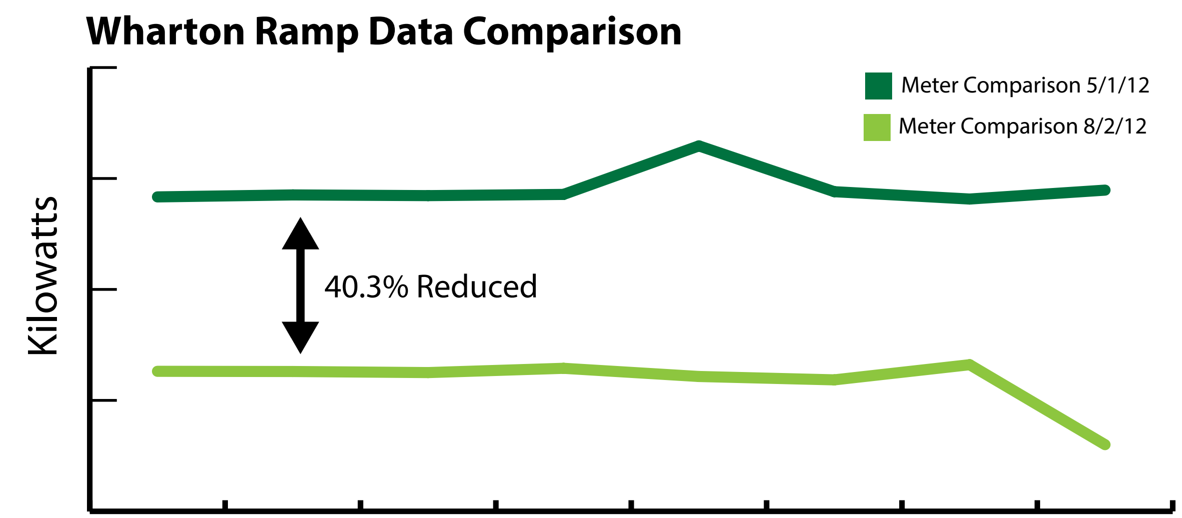


FIGURE 5
Wharton Parking Ramp Lighting Upgrade

that will improve efficiency of operations, identify waste, and ascertain opportunities for energy demand reductions.

Metering is an important aspect of validating the return on investment of capital costs with regard to implementation of energy efficiency measures in our existing fleet of buildings. A recent upgrade of lighting in the Wharton Parking Ramp reduced energy consumption by 40%, which was validated by the data from the metering program (see Figure 5). The upgrade included: new light fixtures; motion sensors for two-level lighting which reduces the light output during unoccupied times in the late evening; and day lighting control to reduce the perimeter lighting when there is enough daylight entering the ramp.

The results for the electrical meter upgrade project can be seen on the campus map in Figure 6. The MSU smart electrical meters are highlighted in dark green while the local utility meters are shown in purple. There is one remaining manually read meter in Morrill Hall that will be removed when the building is razed. Meter upgrades are currently underway for steam and chilled water.

The steam meter map (see Figure 7) shows the number of buildings with smart steam meters in light green, buildings with manually read meters in red, and buildings with no steam meters, or buildings that are not fed with steam, in grey. Chilled water metering for 10 buildings has been funded and is now in the design phase. A water meter study completed in 2012 estimated that it would cost the university $4 million to upgrade to smart water meters in 80% of campus buildings fed by the university's water system. A few buildings on campus, such as the Brody Complex and Kellogg Center, are fed from the local utility, Board

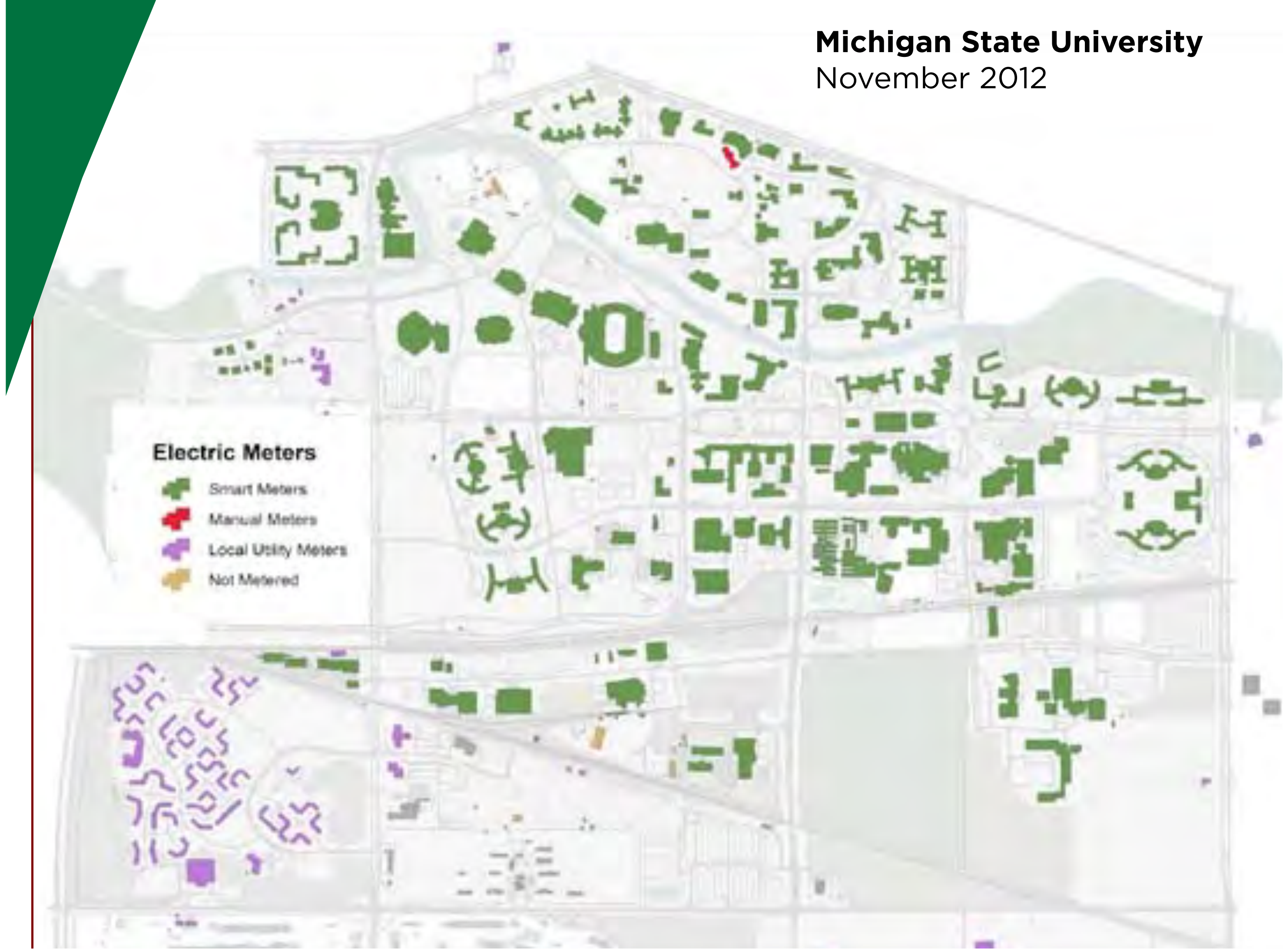


FIGURE 6
Electric Meter Map

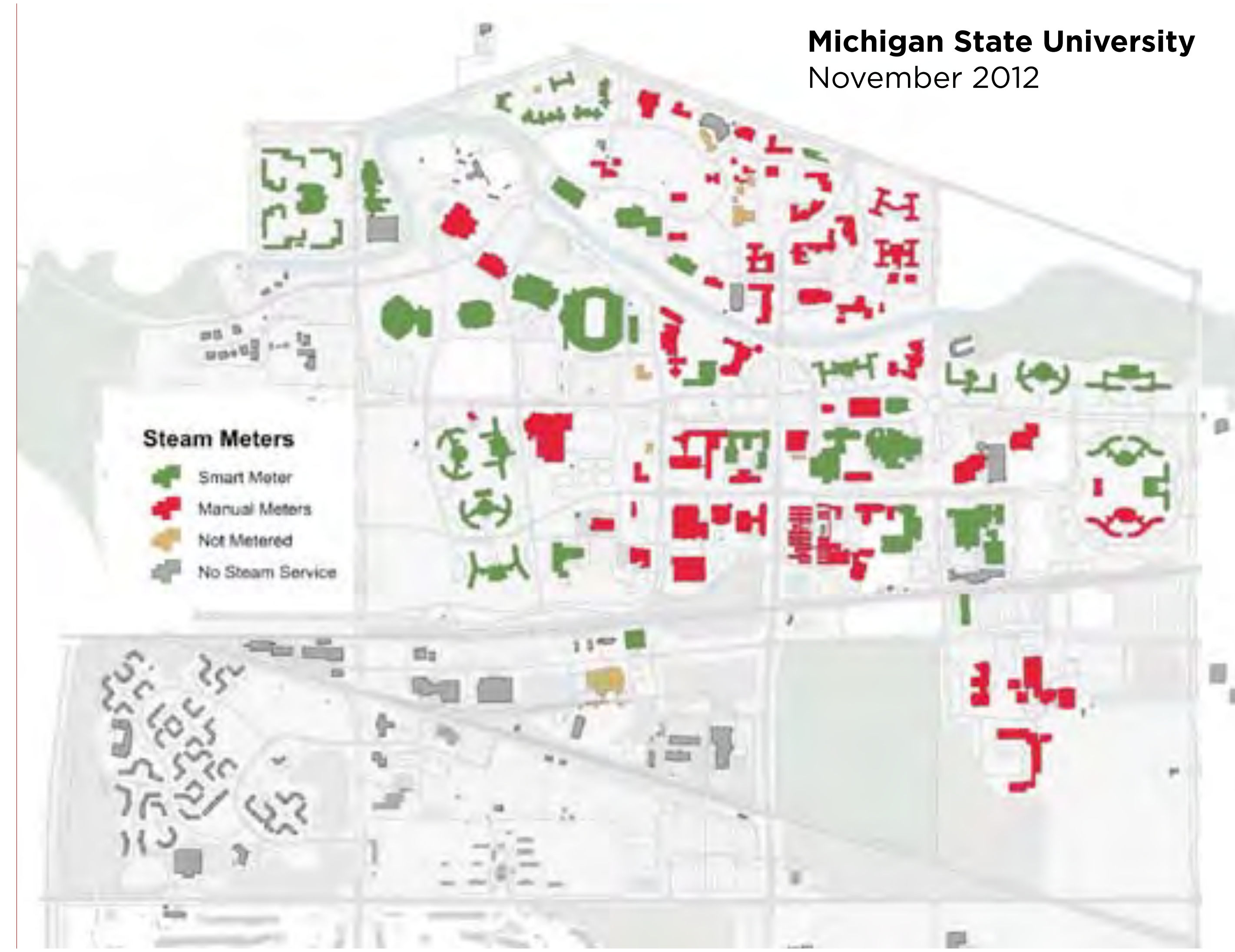


FIGURE 7
Steam Meter Map

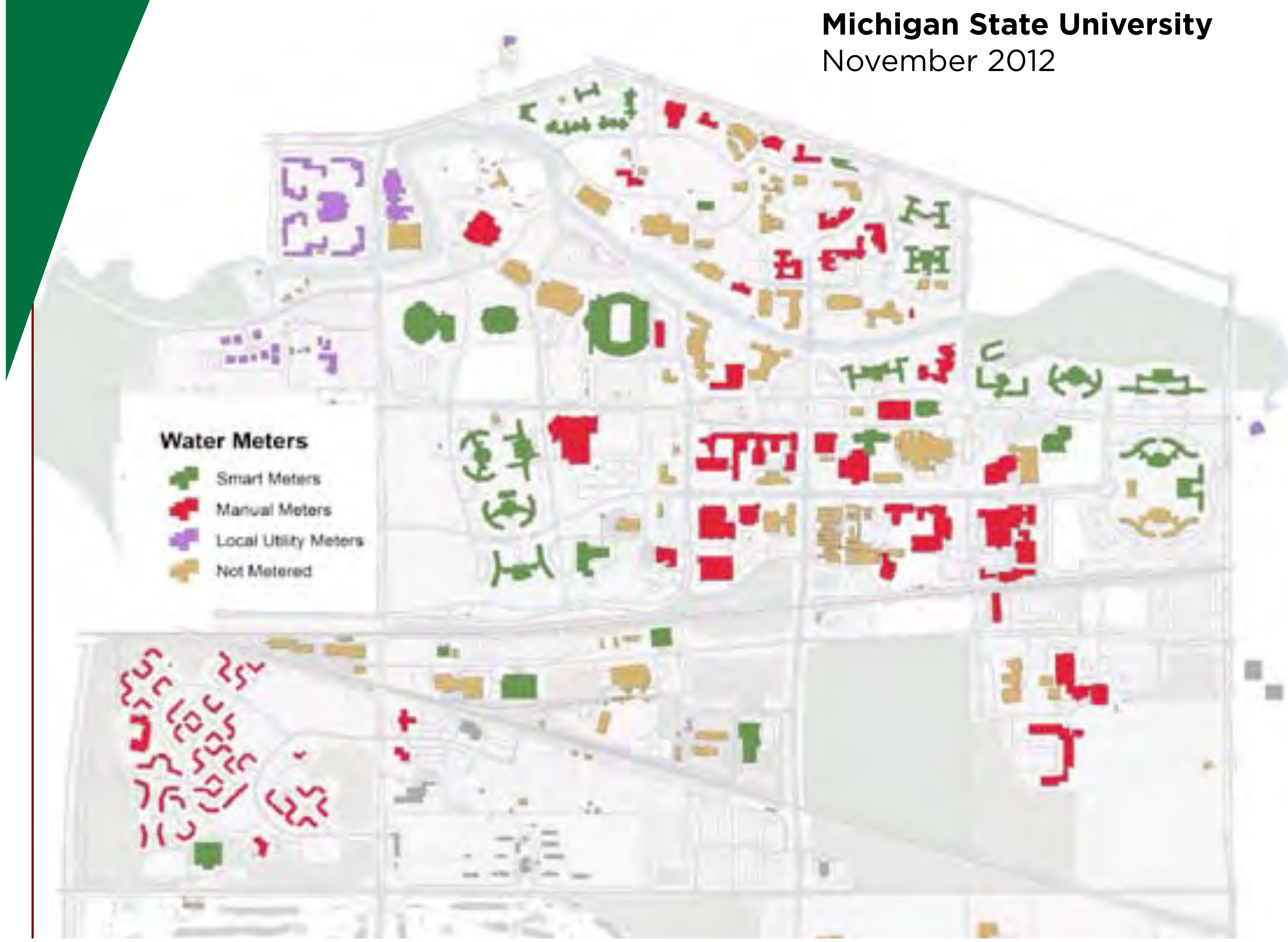


FIGURE 8
Water Meter Map

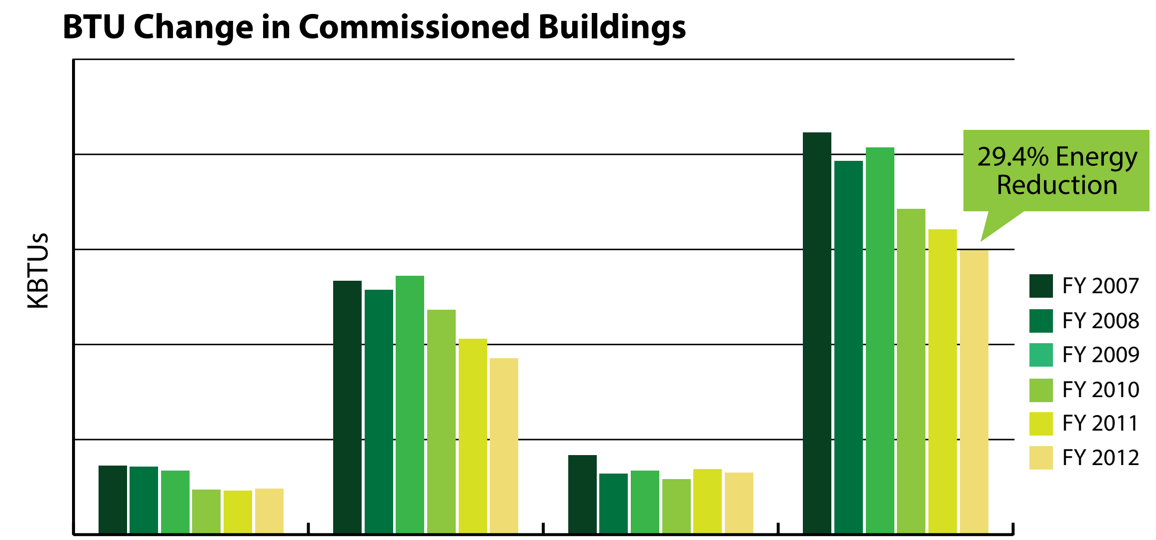


FIGURE 9
Energy (BTU) Change in Commissioned Buildings

of Water and Light, or from the City of East Lansing. Further sub-metering at the department level may be necessary in the future to connect utility costs directly to departments within a building.

The university joined the Department of Energy's Better Building Challenge (BBC) and committed to reduce energy by 20% in close to 20 million square feet of campus by 2020. The BBC is a national program in which partners agree to share best practices, innovations, and implementation models via demonstration or "showcase" projects for others to learn from and apply in their own facilities. Anthony Hall was chosen as the first showcase project for the BBC and information on energy conservation measures can be found at http://www4.eere.energy.gov/challenge.

A five-year plan to retro-commission 115 major buildings, including energy audits of all mechanical systems, is currently being implemented in over 16 million square feet of existing space across campus. The commissioning team reports close to a 30% average reduction in energy consumption in the first buildings that have completed the entire retro-commissioning process, including implementation of energy conservation measures in the building (see Figure 9). The retro-commissioning and energy audit process is expected to be instrumental in meeting the BBC and campus goals with regard to energy conservation.

As part of the existing building commissioning process, the recommendation to upgrade laboratory facilities to state of the art "smart" labs has proven to improve safety, reduce environmental impacts, and avoid increased utility costs. Implementation of smart labs includes: improved ventilation controls; installation of air quality sensors; and displaying the information in an easy to view format for the faculty, students, and staff using a dashboard type of display (see Figure

FIGURE 10
Laboratory Air Quality Dashboard

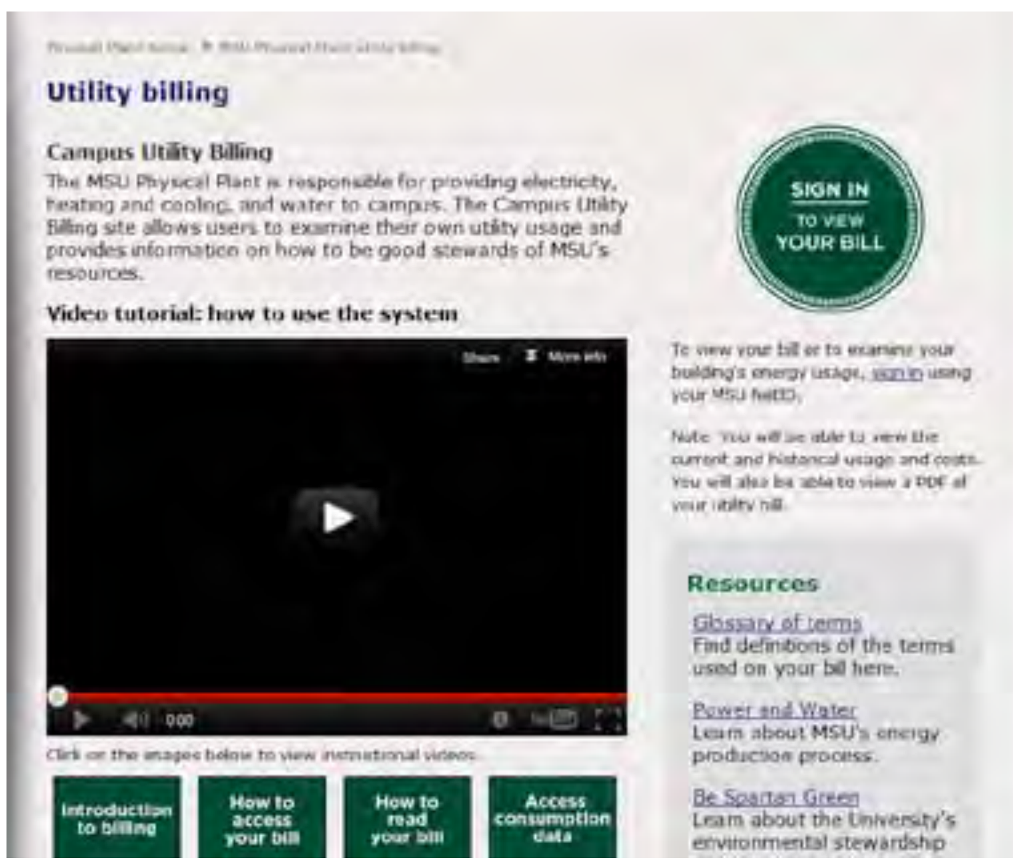


FIGURE 11
Physical Plant Utility Billing Website

10). Environmental Health and Safety can monitor the display for anomalies and to ensure proper lab safety practices are being followed. Principal Investigators can use the air quality dashboard to monitor the fume hood sash management of personnel in the labs. Energy Educators can view the dashboard to target areas where intervention is needed to explain how lab practices can impact energy use.

An Environmental Stewardship program dedicated to increasing awareness in the community has been established that includes over 500 staff across campus. Energy Educators work with the Environmental Stewards in the buildings to identify best practices, educate the campus community on how buildings work, target areas for energy conservation by human intervention, and improve the overall energy conservation knowledge on campus. Tools such as the Air Quality Dashboard and the Energy Dashboard will help make the efforts on campus more visible to the community. The Environmental Stewards program includes green certification for departments and, along with energy education, will assist in achieving the Energy Transition goals. Building upon the culture of energy conservation and stewardship will be key to a sustainable future at MSU.

UTILITY BILLING PROJECT

The Utility Billing System (UBS) is one of the strategies in the MSU Energy Transition Plan. Implementation of a real time utility billing system with data readily available on the web is expected to provide incentives to reduce consumption based on users' understanding of the amount of energy used and actual monthly cost of energy.

The first phase of the system culminated in the issuance of utility bills for fiscal year 2012-13 from the new system to Residential and Hospitality Services utility customers that currently pay for their utilities. The billing system meter and cost data is maintained by the Physical Plant Power & Water Department. Resulting transactions in the Kuali Financial System automatically charge departmental accounts for utility costs associated with actual consumption. Campus staff is able to view a current Utility Bill and historical energy consumption by following a link from a Physical Plant website (see Figure 11). The system will be expanded to the Department of Intercollegiate Athletics, the Cyclotron, and Olin Health Center as of January 2013. A longer-range goal is to use the billing system data to inform campus departments that do not currently pay for their utilities of the amount of energy being utilized by their operations.

RATE DESIGN

As part of the multi-year energy transition plan and related reporting of utility costs, there is a need to analyze the full cost of utilities across the university. Building upon existing internal analyses, MSU is partnering with external energy consultants to design a repeatable algorithm that will encompass all costs related to creating and delivering utilities to campus customers. The process will also assist with identifying the cost and use differences that may exist among different types of users expressed as rate classes.

This new rate design will allow the university to articulate the various components of the utility costs. This can be done at a micro or macro level as needed or desired. As MSU moves into future years of the energy transition plan, the details of the rates used will be determined. The configuration of the financial system will also be modified to better accommodate the model used to arrive at utility rates.

FUTURE DIRECTIONS

The MSU Energy Transition Plan approved by the Board of Trustees defines goals and sets the direction for a sustainable energy future. The aggressive and yet achievable goals will drive research into: energy storage technologies; renewable energy; methods to reduce emissions including carbon capture and sequestration; and smart grid technologies to reduce energy demand. Recognizing the impact of shifting regulations, developments such as electric vehicles, along with the interdependence of water and energy consumption, will require a new approach for the university to achieve the vision of sustainability and 100% renewable energy. The Energy Operations Team will review various options for campus, including: large scale wind and solar generation; bio-fuels including torrefied wood; geothermal energy; thermal energy storage; demand reduction by implementing energy conservation measures; and green power purchases using the Integrated Energy Planning model. Likely there will not be a single solution that optimizes reliability, cost, and capacity, while at the same time reduces the impact to the environment and achieves a higher renewable standard. An energy portfolio will be needed that will move the campus in the direction to meet the goals of the Energy Transition Plan. The plan will be reviewed every five years to evaluate new energy technologies as they are developed and as campus continues to grow to meet the teaching and research needs. Operations will strengthen partnerships with research to meet the energy demands on campus to create the sustainable vision set forth in the Energy Transition Plan.

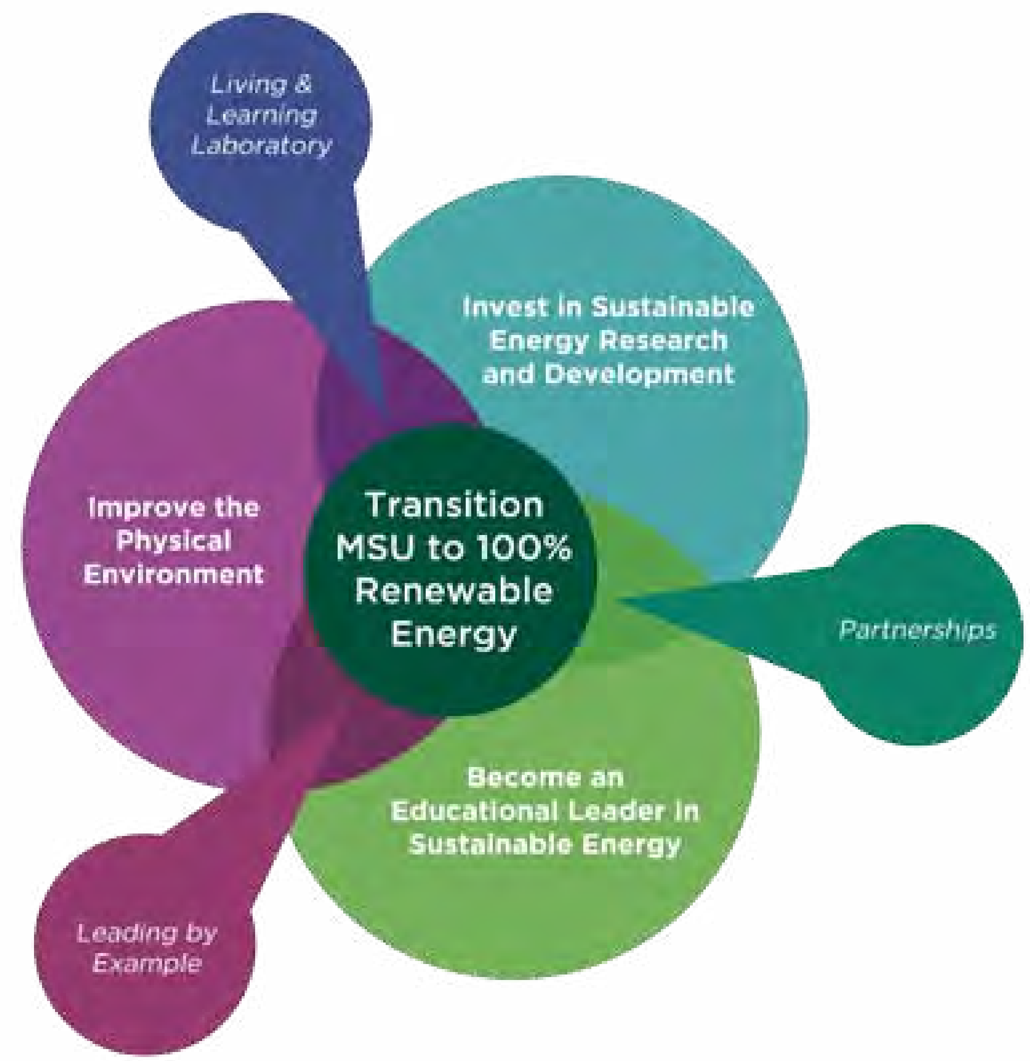
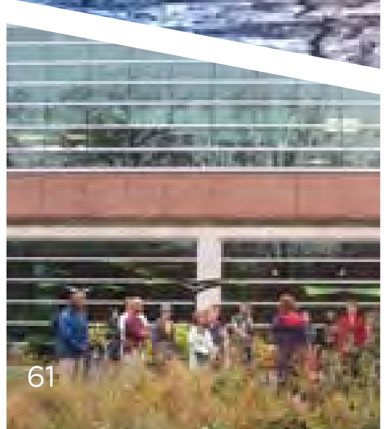


FIGURE 12
MSU's Energy Transition Plan goals



STORMWATER MANAGEMENT

SUMMARY

Michigan State University is nearing the end of its second five-year stormwater permit cycle. Mandated under the federal Clean Water Act, the stormwater regulations include specific requirements for urbanized communities throughout Michigan, including MSU. Working across multiple service units, colleges and departments, as well as in cooperation with jurisdictions throughout the Greater Lansing area, the university has implemented a variety of actions to manage stormwater proactively. Regulations pertaining to stormwater runoff controls that address both water quantity and quality issues from new development sites have become increasingly stringent. The university has addressed these new requirements by developing a process for implementing and tracking stormwater controls. Future permit activities will build upon the foundation that has been established as part of this process.

ANALYSIS

Stormwater regulations address a variety of elements, including: public participation and education; illicit discharge detection and elimination; good housekeeping practices; construction site runoff control; and post-construction runoff control. As part of its current permit requirements, in 2010 MSU submitted a Stormwater Pollution Prevention Initiative (SWPPI) to the Michigan Department of Environmental Quality (MDEQ), the state primacy agency that administers the stormwater permits. Implementation of the SWPPI commenced upon submittal.

POST-CONSTRUCTION STORMWATER CONTROLS

Of particular concern in the permit have been the more stringent requirements for post-construction controls. Under the current permit, post-construction stormwater runoff from all new and redevelopment projects that disturb one acre or more must meet the following stormwater discharge criteria:

- Treatment methods shall be designed on a site-specific basis to achieve discharge concentrations of total suspended solids (TSS) not to exceed 80 milligrams per liter (mg/l) resulting from up to a 0.91 inch rainfall.
- The channel protection criteria shall maintain post development site runoff volume and peak flow rate at or below existing levels for all storms up to the two-year, 24-hour event (2.42 inches).

Much of the campus has been developed or urbanized, and soils generally have limited infiltration capacity. Meeting these stormwater requirements on an individual project basis in the developed part of campus would be very difficult since there is inadequate land area to create Low Impact Design (LID) techniques for volume control or to store stormwater for rate control. In 2010, the MDEQ approved the University's SWPPI, which included an alternative approach to meeting post-construction stormwater controls.

The alternative approach for MSU views the campus as one parcel, with the Red Cedar River as its outlet. Each individual development or redevelopment project is required to evaluate a method of complying with the stormwater requirements at the site and prepare a cost estimate for construction, following the procedures in the MSU Stormwater Design Standards. The proposed stormwater controls and cost estimate are then submitted to a campus Stormwater Committee, which is chaired by the University Engineer and includes representatives from a variety of campus service units and departments.

Under the alternative approach, projects that may alter the stormwater volume or peak-rate characteristics are tracked on a campus wide basis. A stormwater credit system has been established for the university whereby all projects with impervious changes are documented in a yearly change log and monitored as part of the permit compliance activities. Projects contributing to the bank include demolition activities and stormwater improvement projects such as porous pavement parking lots, green roofs, and bioretention areas.

FIGURE 1
Wells Hall Addition Green Roof

Recognizing that new projects located in highly developed zones of campus will have difficulty meeting the stormwater permit standards without incurring excessive costs or without resorting to impractical solutions such as stormwater pumping, the Stormwater Committee may recommend that a project use credits from the campus bank to meet its stormwater requirements. If a project applies for bank credits, the project may be charged a proportionate cost to help pay the capital costs associated with a larger regional project that would be implemented to maintain the stormwater bank. Under the alternative approach, regional projects would have to demonstrate effectiveness of a 1.2 multiplier for all permit parameters over a site-specific solution. The Physical Plant Division is responsible for maintaining the log and ensuring accurate record keeping regarding the post-construction controls for each development project.

As the university has moved forward with implementation of the SWPPI, capital projects are now including a variety of best management practices (BMPs) to address the post-construction controls. These include various LID techniques that are both structural (e.g., porous pavement and cisterns) as well as nonstructural or vegetative practices (e.g., green roofs and bioretention areas). The Wells Hall Addition green roof is shown in Figure 1.

Since 2010, more than 15 acres of impervious surface have been removed through various demolition projects, and runoff from nearly 17 acres is now directed to stormwater treatment devices to address water quality requirements. Table 1 summarizes stormwater BMPs by development project for the period 2007-2012.

BEST MANAGEMENT PRACTICES (BMPs) MAINTENANCE AND RECORD KEEPING

Ongoing operation and maintenance of the stormwater BMPs is a critical component of the SWPPI. To ensure timely inspection and maintenance of the BMPs, MSU's Stormwater Management Interactive Map has been developed. This is a web-based map of the campus that is integrated with the campus GIS system (MUNSYS) and the preventative maintenance system (FAMIS). When a BMP is added to the system, the attributes are added to the campus GIS system and the BMP is categorized and given an equipment number. A maintenance and inspection checklist is then included in the database along with a required schedule for periodic inspections. When the inspec-

TABLE 1
Stormwater Best Management Practices 2007-2012

Year	Building Name	Watershed District	Net Impervious Footprint (SF)	Net Impervious Area Increase (AC)	Area Treated for 80% TSS (AC)	Comments
Future	Morrill Hall - Demolition	RC		-0.40	0.40	Building demolition - area returned to greenspace
Future	Cyclotron (FRIB addition)	RC				Building, parking lot and removal of Bogue Street- Off-site treatment
2012	West Circle Steam - Phase I	RC	0	0.00	12.00	Bay Saver
2012	West Circle Steam - Phase I	RC	0	0.00	0.30	Porous Pavement
2012	Chestnut Road Reconstruction	RC	0	0.00	0.30	Porous Pavement
2012	Michigan State Police - Demolition	RC	-196,000	-4.50	0.00	Building and parking lot removal
2012	Wells Hall Addition	RC	5,100	0.12	0.15	Green Roof
2011	Brody Hall Addition	RC	5,500	0.13	0.13	Significant LID, including rain garden
2011	Cherry Lane/Faculty Bricks	RC	-450,000	-10.33		Building and parking lot removal
2011	Life Science Addition	RC	15,000	0.34	10.00	bay saver for entire sub-district installed in 2011
2010	Campus Police	RC	N/A	-1.20	1.20	Porous pavement parking lot
2010	Grounds Maintenance	RC	N/A	-0.15	0.15	Roof water re-routed to rain garden
	Sub Total - completed projects 2010-2012			-15.59	29.23	
Projects Completed in Previous Permit Cycle						
2009	Farm Lane Underpass	RC	139,830	3.21	3.21	Significant LID, including bioretention
2009	Shooting Center	HC	42,000	0.96	0.96	Significant LID, including bio-swales
2008	Recycle and Surplus Center	RC	216,000	4.95	4.95	Significant LID, including porous pavement, detention and rain garden
2008	Wharton Center Addition	RC	6,000	0.14		
2008	Cyclotron Addition	RC	5,000	0.11		
2009	Forest Akers East Driving Range	RC	14,000	0.32		No direct storm sewer connection
2009	Old College Field - Press box	RC	1,400	0.03		Net increase (existing building removed)
2009	Birch/Wilson Steam Tunnel	RC	16,000	0.37	26.90	Nutrient box installation for entire sub-district
2008	North Campus - Bike Pad Removal	RC	13,715	0.33		Bike lanes/pads removed
2008	Case Hall - Add. 2 - Loading Dock	RC	1,840	0.04		
2008	Duffy Daugherty Football - Add. 4	RC	12,200	0.28		
2008	Chemistry - Add. 2	RC	4,880	0.11		
2008	Misc Minor Bldg Projects	--	883	0.02		
2008	Spartan Village	RC	-630,000	-14.46		Buildings and parking lots removed
2007	Snyder and Phillips Hall - Add 1	RC	4,000	0.09		Net increase (built over existing building)
2007	Phys Plant Storage Bldg No. 1 - Add. 1	RC	23,650	0.54		
2007	Engineering Research Complex Add. 2	RC	15,100	0.35		Energy & Automotive
2007	Grounds Maint. Nursery - Pole Barn 2	RC	3,399	0.08		
2007	Grounds Maint. Nursery - Pole Barn 3	RC	3,399	0.08		
2007	Endocrine Res. - Animal Air Quality	RC	5,378	0.12		
2007	Old College Field - Batting Facility	RC	9,872	0.23		
2007	University Village	RC	-479,160	-11.00		East complex removed and rebuilt in same footprint, similar density. West complex removed and restored to park space. Numbers indicated are net green space after construction
2007	East Circle Drive Reconstruction	RC	-61,883	-1.42		
2007	Misc Minor Bldg Projects	--	3,516	0.08		

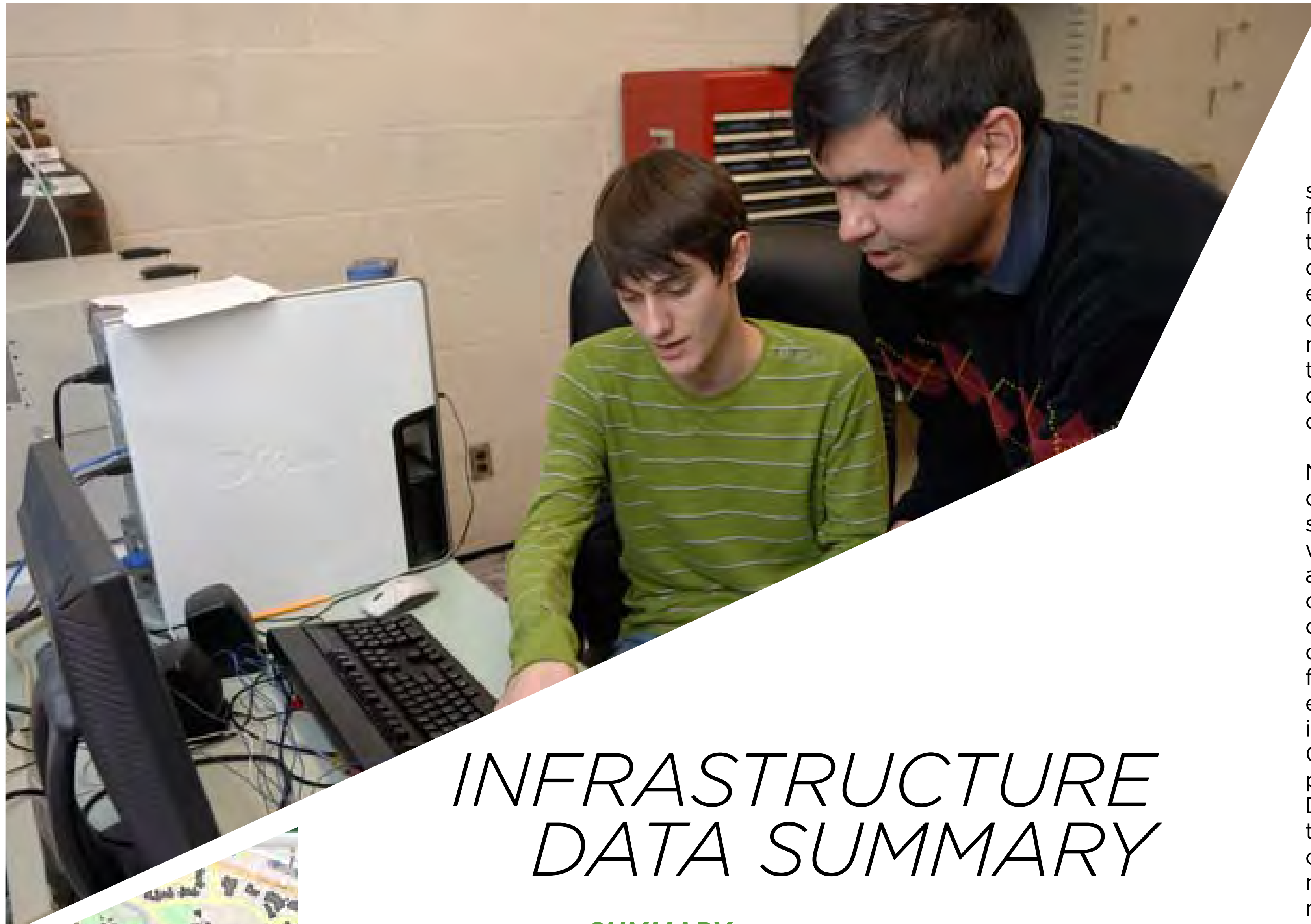
FIGURE 2
MSU Stormwater
BMP Locations

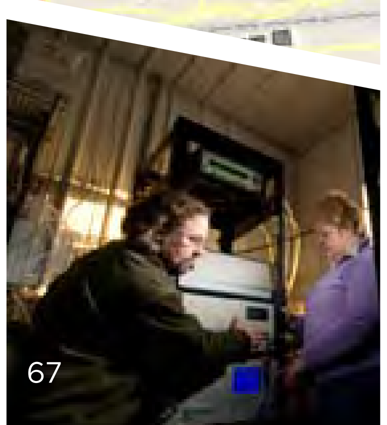
tion is complete the information is entered in FAMIS, which the website then gathers and displays. A map of the stormwater BMP locations as it appears in the web-based system is shown in Figure 2.

FUTURE DIRECTIONS

Federal permit requirements continue to evolve, and the university must be ready to respond to new mandates. A new stormwater permit will be issued by the MDEQ in the fall of 2013. Although not yet finalized, the new permit application will require a transition from the SWPPI to a Stormwater Management Program. The program will encompass many of the elements that are included in the current SWPPI, including watershed-wide components that will be conducted in cooperation with the Greater Lansing area communities as well as individual jurisdictional activities such as the continued implementation of the post-construction stormwater controls. In addition, in future permit cycles, permittees will be required to address bacterial loading to the Red Cedar River. This will necessitate cooperative work with communities throughout the Red Cedar River Watershed, including those located outside the urbanized boundaries.

The university is well positioned as it approaches its new, five-year permit cycle. Work is currently underway to develop a watershed management plan for portions of the Red Cedar River Watershed, with an emphasis on E. coli bacteria. MSU Faculty, students and staff members are working with numerous local partners in this effort. Along with those broader, watershed-wide efforts, strong working relationships have developed among the members of the Greater Lansing Regional Committee for Stormwater Management (GLRC), and MSU will continue to be a full partner with these communities in the urbanized portion of the watershed as a member of this organization. In addition, the campus Stormwater Committee, comprised of staff members from multiple service units and departments, continues to emphasize an integrated approach to managing stormwater on campus.





INFRASTRUCTURE DATA SUMMARY

SUMMARY

The safety and security of the campus community remains an utmost priority, and MSU strives to be proactive in its efforts through the development of data support that allows for more responsive courses of action. In this respect, MSU has particularly focused on areas such as campus evacuation procedures, emergency response, and availability of information to first responders. To better address these areas, MSU has developed data systems, such as the Geographic Information System (GIS), to protect research interests, communicate in the case of an emergency, and map shelters.

University-wide bomb threats have occurred at universities in North Dakota and Texas, prompting them to evacuate an entire campus. These events provided MSU with the impetus to identify a way to conduct a massive and far-reaching evacuation of the campus that may involve moving large populations to temporary shelter locations. In addition, the threat of active violence striking MSU continues to be at the forefront of our planning for mitigation, response, and recovery. Work continues in planning, training, and exercising our ability to manage a catastrophic event and provide the needed resources and programs that advance the safety and security on campus, as well as enhance our overall emergency preparedness.

MSU has also taken on an address change project to insure that responders and visitors can find their way around. This project was initiated through a recent process to change existing addressing protocols in order to meet federal standards for “locatable addresses” that first responders could locate in an emergency. This project was started in January 2011 and completed in October 2012 through a multi-disciplinary team lead by the MSU Police Department. The team coordinated the creation, implementation, and changes needed in university business systems to accommodate a new addressing format. Included in that team were: University Services for U.S. Postal Systems coordination; Residential and Hospitality Services; Geographical Information System (GIS); Telecommunications; the Physical Plant, 911 Dispatch Center; Enterprise Business System (EBS); Landscape Services; Communications and Brand Strategy; and other associated units that are involved in postal or business needs for the university.

MSU has also continued to develop and implement the Research Emergency Defense Information System (REDIS). This system solicits critical response and long-term recovery information from within research facilities and makes it available to first responders and emergency preparedness personnel in order to manage incidents occurring within critical research areas. That system is managed using GIS technology to provide the information when it is needed for response or recovery. New systems have been implemented using technology and partnerships with local 911 Emergency Dispatch Centers in order to get that data to responders using existing infrastructure and technology.

Emergency preparedness, emergency messaging, and emergency evacuation/shelter-in-place mapping has always been important to the university to provide a safe and secure environment. Key activities in these areas include planning, training, exercising, and evaluating plans, systems and programs.

ANALYSIS

ADDRESSING PROJECT

MSU recognized that emergency response, coordination, mail delivery, and ease of map reading using Global Positioning Systems (GPS) were all complicated by the lack of locatable addresses. In 2011, the MSU Police Department embarked on a mission to review requirements and seek better solutions for the ability to report locations in the same manner that municipal entities use addressing. The MSU Police Department partnered with University Services to manage this issue in combination with the problems associated with mail or package delivery on campus. The result was the creation of a Campus Addressing Project Workgroup led by the Vice President for Finance and Operations with implementation details delegated to the MSU Police Department.

The work group gathered information on what changes were needed and developed an addressing grid design that would meet with local planning in the area. Discussions were held with surrounding jurisdictions and a design was finalized in early 2011. Once the design was completed, the GIS office worked to generate new addresses for every facility identified in the Physical Plant's FAMIS system (the system of record for approved facilities). This information was used to finalize addresses based on emergency response needs and mail system delivery. As address formats were explored, the leaders of the team met with key stakeholders from across the university to discuss the implications of these changes and to solicit feedback on the process.

Two pilot phases were conducted in November 2011 to test the sequencing needed for launches of new addresses. Communication to the U.S. Postal Service and 911 phone systems was completed prior to actual address changes. Following those key aspects, signage was changed to assist with the identification of new addresses. A broad media blitz was prepared after the initial pilots were completed and automated messaging provided situational information for businesses, residents, faculty, staff, and students. The launching of the new address changes was completed in October 2012 with minimal disruption to the campus. This process received accolades from the community and insures our ability to meet the needs of those seeking help or locating resources.

REDIS

The Research Emergency Defense Information System (REDIS) that has been in place for over eight years was revamped to provide easier access to first responders. This system provides for first responders and researchers critical information about what is housed within facilities that could cause harm or result in loss of research. A collaborative partnership with researchers has allowed for user input of chemicals, equipment, hazards, and high-level research in order to better manage these areas in a large disaster or emergency. The platform for this system resides in GIS technology. After software changes, there is a way to transmit to police and fire response vehicles information that is critical in response. The pilot phases of these software changes were completed in October 2012. The police and fire department personnel are currently evaluating this software for any necessary changes before full implementation.

EMERGENCY PREPAREDNESS

MSU leads the nation in its ability to prepare for, respond to, and recover from emergency situations. To achieve the best possible response to an emergency, MSU is proactive in its preparedness planning within all units and departments. Moreover, MSU involves the help of many people to write unit level specific plans for addressing common emergencies. This process was tested this year through a full-scale simulated active violence scenario on July 18, 2012. Police, Fire, EMS, and hospital personnel were deployed to the simulated scene of a shooting incident in Conrad Hall. Those personnel were to engage the threat, rescue persons injured, treat those victimized, and coordinate that care with hospitals and responders. The Emergency Operations Center (EOC) was also opened where almost 50 key decision-makers from university units and departments met to assist with this response and recovery.

The Emergency Operations Plan (EOP) and multiple Unit Level planning documents were tested and improved. An after action report concluded that MSU is well prepared to manage such a disaster, as well as ready to make technical changes in technology that would enhance responsiveness capabilities. Those recommendations are currently being implemented and future exercises will test their ability to help.

EMERGENCY MESSAGING

In the full-scale exercise conducted in July 2012, the university was able to test many of its platforms for communicating to faculty, staff, students, and visitors. MSU's Blackboard ConnectED Alert and Notification system that can deliver messaging using SMS Text, telephone, cellular phone, and email was successful at reaching our simulated target audience. In addition, there were media representatives that joined Communications and Brand Strategy (CABS) professionals to conduct on-scene media announcements. Those relationships are important in an emergency and well coordinated by the MSU Police Public Information Officer and CABS.

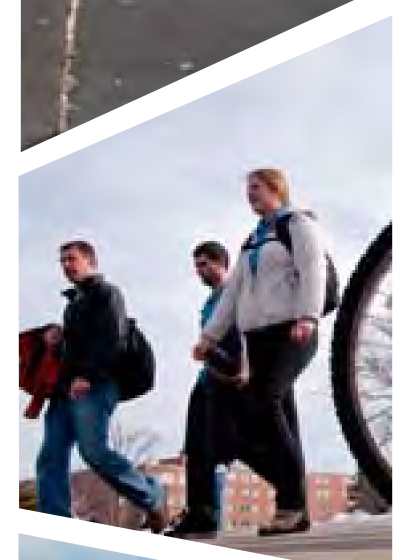
MSU Police were also able to secure access to cable television systems in order to launch "scrolling messages" on campus televisions and capture monitors within Neighborhood Engagement Centers in residence hall facilities to launch critical emergency messaging. This is another platform that can provide timely information to a broad range of community members in a visible format.

EMERGENCY EVACUATION/ SHELTER-IN-PLACE MAPPING

The Michigan Occupational Safety and Health Act (MIOSHA) specifies that the employer needs to have plans for emergency situations and to train workers to guide the actions of others. Every building/unit on the MSU Campus has a written emergency action plan that identifies the actions that students, staff, and visitors should take in the event of an emergency or disaster. These emergency actions are guided by placement of emergency evacuation/shelter-in-place maps located strategically within campus buildings and facilities. Those maps inform the public and members of the Emergency Action Team in each building where to go for safety. Team members are trained to guide evacuations and sheltering in the event of a fire, a weather sheltering event, a hazardous atmosphere shelter event, and any building specific hazards that has been identified. The current maps within the facilities do not follow a common format or display, and the MSU Police Department approached the University Safety and Security Committee to seek funding to replace those maps in each facility with a common looking map in a safe and visible holder. That funding began in August 2012 and the first buildings identified using a prioritization schedule will receive mapping in March 2013. This is a comprehensive effort to manage safety of faculty, staff, students, and visitors through critical information displays.

FUTURE DIRECTIONS

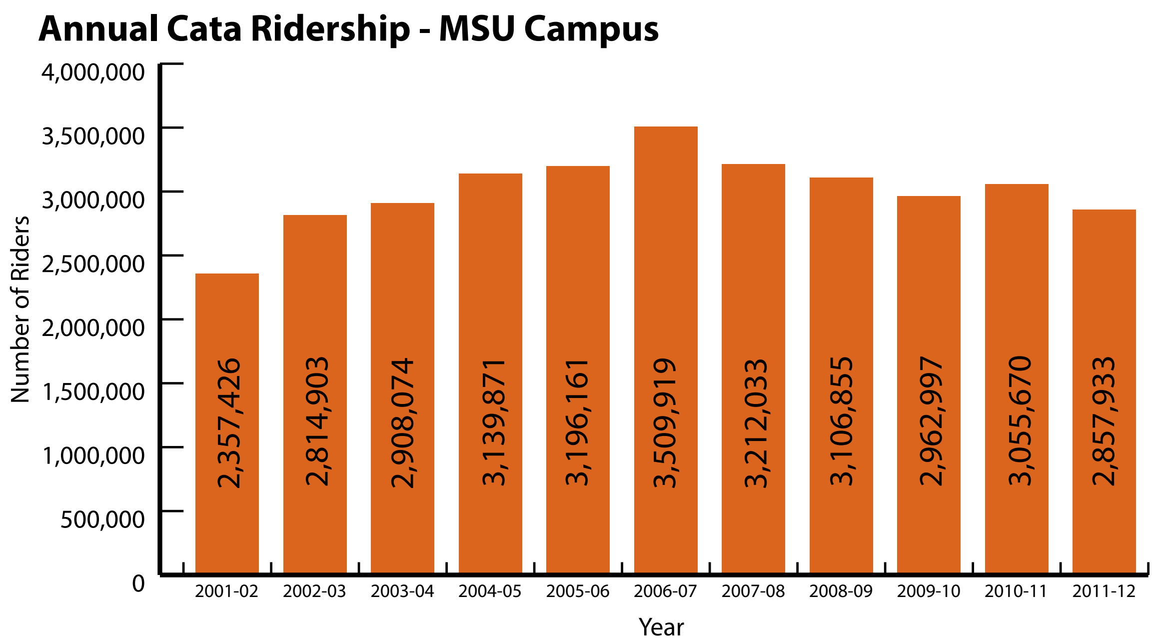
MSU Police will continue to partner with many departments across campus in safety and security initiatives. They currently serve as a subject matter expert to assist units and departments in creating emergency planning for a variety of incidents or events that could occur on campus. A partnership has been formed with the Resource Center for Persons with Disabilities to review and update the EOP to take into consideration special needs our faculty, staff, and students have in a disaster and to be better prepared to manage those situations.



TRANSPORTATION & SAFETY

Transportation remains a crucial consideration at MSU due to the high volume of students and employees traveling on campus each day. The breadth of transportation is reflected in the subsequent sections analyzing campus ridership via the Capital Area Transportation Authority and private vehicles. The issues surrounding the usage of these vehicles are reflected in analyses of parking, ticketing, and accidents. Additionally, the usage of non-motorized vehicles is significant, and a plan for future developments in this area has been compiled. In each of these areas, MSU remains committed to providing students and employees with safety and ease of travel.

FIGURE 1
Annual CATA Ridership by Fiscal Year



Capital Area Transportation Authority

SUMMARY

The Capital Area Transportation Authority (CATA) has been providing bus service on the MSU campus since Fiscal Year 1999. Ridership quickly grew from 829,000 rides that first year to more than 3 million rides by fiscal year 2005. Aside from a spike to 3.5 million in fiscal year 2007, the number of campus rides has held relatively steady to within 7% of the 3 million rides per year plateau. It should be noted, however, that ridership has been trending slowly downward (see Figure 1). Causes for the reduction in ridership are being explored.

MSU continues to work with CATA to find ways to improve efficiency and enhance the transit service on campus, while at the same time containing the cost of the operation. Input from the campus community and information supplied from CATA have been used effectively to adjust the system annually to meet the needs of bus riders.

ANALYSIS

Operational data from CATA is the key to exploring opportunities for service improvement and cost savings. In response to the requirements outlined in the latest CATA/MSU Transportation Services Agreement (which began in July of 2011), CATA has implemented an Automatic Vehicle Locater (AVL) system on all of its buses. In addition to providing real-time information about bus locations, the system includes Automatic Passenger Counters (APCs) that track the number of riders boarding a bus by route, location, and time of day. The robustness of this data greatly enhances the ability to assess the performance of existing bus service and explore new opportunities for improvement.

FUTURE DIRECTIONS

A current area of technological focus being explored for future changes is the student bus pass. The original goal was to be able to activate a CATA student pass on the student's MSU identification card. After serious examination, this was determined to be unachievable with CATA's present fare box technology. The current plan is to sell unique bar-coded passes to MSU students, which will be linked to the student ID number at the time of sale. CATA has a contract requirement to have this system operational by May 1, 2013, with full implementation expected for fall semester of 2013.

Vehicles

SUMMARY

Trend data gathered from MSU Police crash reports and parking registrations can be used to monitor transportation safety issues for vehicles on campus. Vehicle permit sales for faculty and staff have remained relatively consistent over a 10-year period; however, student vehicle permit sales (both on campus residents and commuters) have declined. Therefore, due to the reduction in overall campus traffic, as well as better management in handling visitor traffic and parking, there has been a significant reduction in crashes. The redesign and construction of major campus intersections is also recognized as a significant factor for successfully lowering the number of accidents and improving transportation safety.

ANALYSIS

10-YEAR TREND ON FACULTY STAFF PARKING PASSES

Faculty/Staff Vehicle Registration data in Figure 1 depicts the sales of permits to MSU Faculty and Staff Employees. The ebb and flow of each year represents the two-year expiration cycle on standard employee permits.

COMMUTER PARKING PASSES

Commuter student vehicle registration trends have been on the decline over a 10-year period. Anecdotal information indicates that the overall cost of maintaining a motor vehicle has had a significant impact on student driving behavior.

STUDENT PARKING PASSES

On campus student vehicle registration trends, as depicted in Figure 3, have increased slightly between 2002 and 2008, in relation to increases in student enrollment. However, the decline in registrations since 2008 is likely attributed to a combination of higher gasoline prices and CATA bus service on campus.

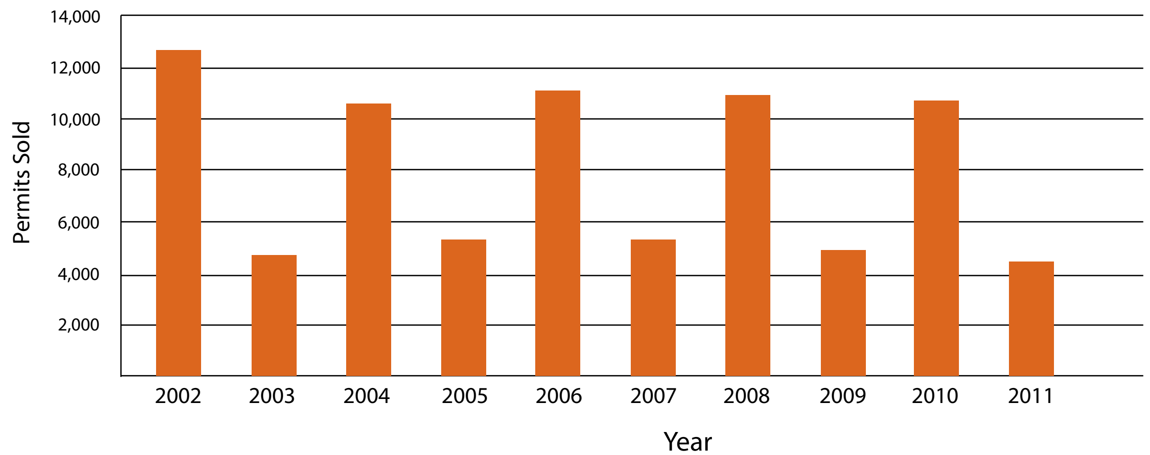
PARKING VIOLATIONS

While parking violations are generally consistent over a 10-year period, the shifts in the number of violations issued within certain periods are typically attributed to the experience of the parking enforcement staff. Parking enforcers are student employees and as they become more proficient in the job, the violation issue count increases. However, after they graduate and leave the university, the cycle starts over.

TRAFFIC ACCIDENTS

Traffic accidents have substantially decreased over a 10-year period. The general decline in roadway accidents

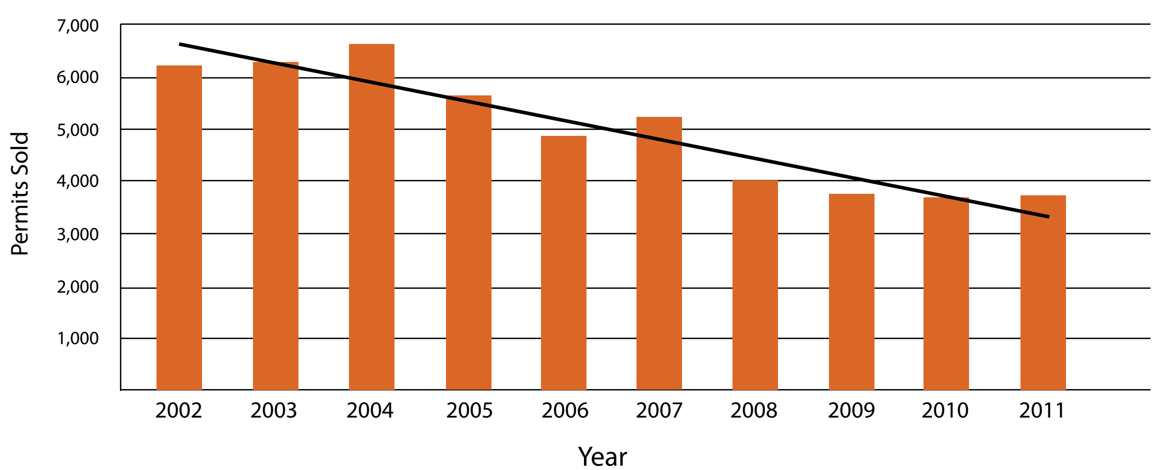
Faculty/Staff Vehicle Registration
Michigan State University Police



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Permits Sold	12,677	4,702	10,610	5,278	11,106	5,358	10,969	4,890	10,716	4,474

FIGURE 2
Employee Parking Permits Sold

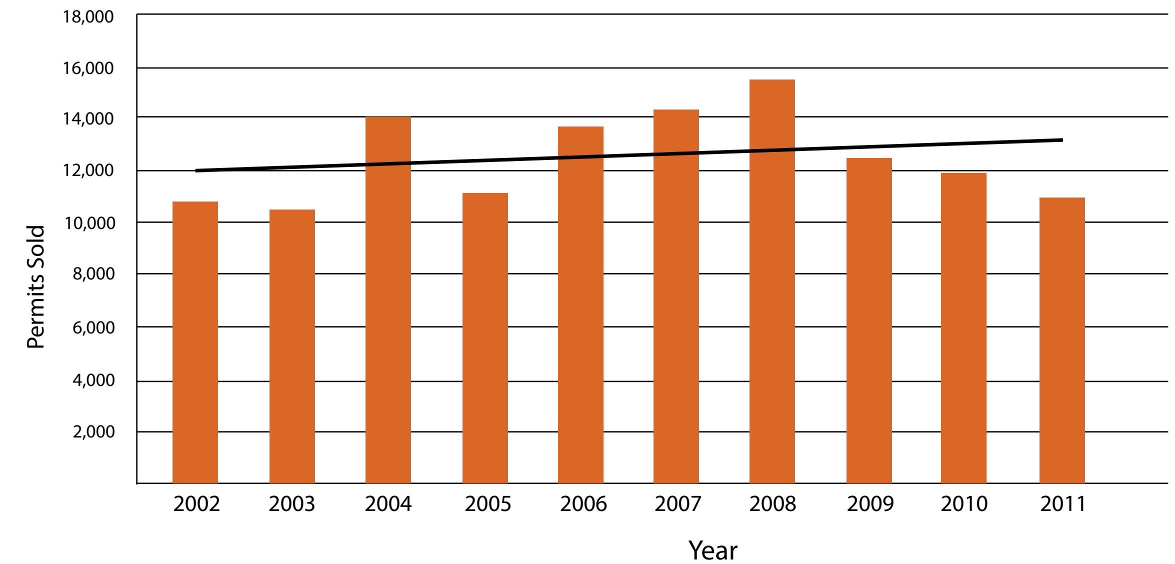
Commuter Vehicle Registrations
Michigan State University Police



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Permits Sold	6,185	6,236	6,590	5,603	4,835	5,194	3,964	3,730	3,694	3,717

FIGURE 3
Commuter Parking Permits Sold

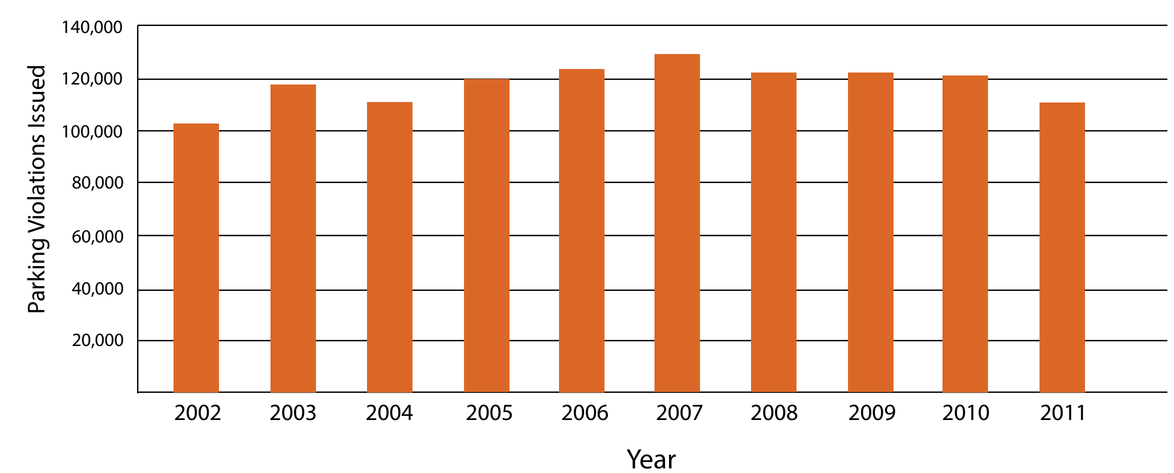
Student Vehicle Registrations
Michigan State University Police



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Permits Sold	10,788	10,468	13,935	11,133	13,766	14,418	15,580	12,436	11,935	11,036

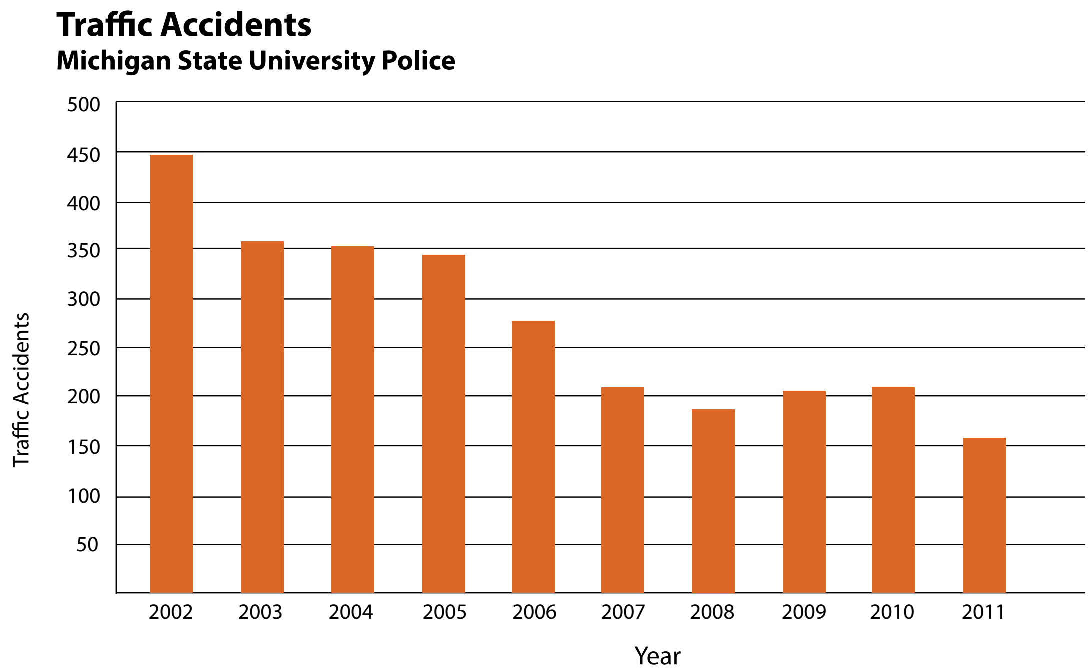
FIGURE 4
Student Parking Permits Sold

Parking Violations Issued
Michigan State University Police



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Violations	103,296	118,572	111,493	120,135	124,072	129,611	122,929	122,288	121,785	111,585

FIGURE 5
Parking Violations Issued



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Accidents	447	359	353	345	278	209	188	206	210	158

FIGURE 6
Accidents on campus

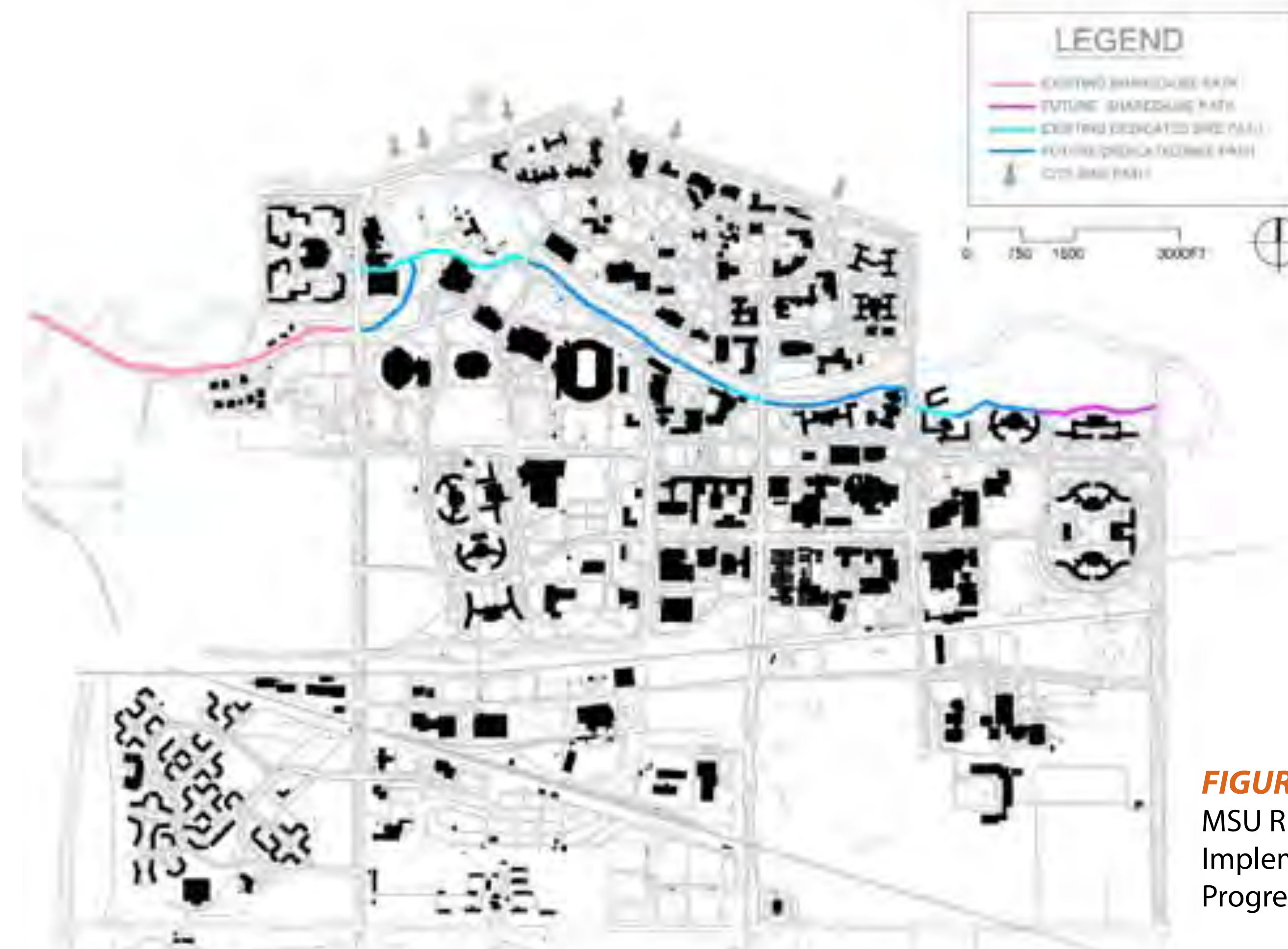


FIGURE 7
MSU River Trail Implementation Progress

is the result of an intense accident reduction program including redesigned intersections, targeted enforcement, and pedestrian crosswalk caution signs. MSU has reduced traffic injuries on campus by 90% in the last 10 years, earning the Governor's Traffic Safety Advisory Commission Richard H. Austin 2006 Outstanding Contributions to Traffic Safety Award.

FUTURE DIRECTIONS

In following with the Campus 20/20 Master Plan, the future direction for transportation safety is to create more opportunities for perimeter parking. This will shift the trend for faculty/staff vehicle registrations downward therefore increasing commuter registrations. At the same time, due to a decrease in vehicular traffic across campus, vehicle crashes should continue to diminish. The Traffic Engineer reviews traffic safety on campus on a daily basis. Traffic safety data reports are generated every day based on crash reports and monitored points of interest in order to guide recommendations for safety improvements and traffic advancements.

Non-Motorized Planning

SUMMARY

Planning for a safer non-motorized system is a critical component of the Campus Master Plan – Update 2011. In the spring of 2011, the Vice President for Finance and Operations (VPFO) requested that a working group be convened by Campus Planning and Administration (CPA) to compile, assess, and prioritize proposed enhancements to the non-motorized system emanating from various campus committees and annual planning efforts. The effort resulted in a prioritized listing of enhancements that will improve non-motorized circulation and safety across the Michigan State University campus over a five-year planning horizon as funding becomes available.

The assessment process included:

1) Reviewing existing planning documents including the AUTTC (All University Traffic and Transportation Committee) Annual Report recommendations (dated May 2010), the Campus Master Plan (dated January 2007), the MSU Bicycle Facilities Plan (dated December 2007), the Red Cedar Greenway Master Plan (dated May 2002), the Women's Advisory Committee for Finance and Operations (WACFO), the City of East Lansing's Non-motorized Plan, and the Physical Plant's 2001 - 2012 Annual Plan Funding Request.

2) Coordinating with the Crosswalk Safety Committee.

3) Coordinating with the university's Resource Center for Persons with Disabilities.

4) Investigating best practices used by other institutions and communities for potential utilization on campus.

5) Identifying and prioritizing non-motorized enhancement projects over a five-year planning horizon.

6) Providing input on the Campus Master Plan's non-motorized recommendations.

Recommendations are categorized and summarized below:

1) Communication and Education - One of the highest priorities is the need for improved communication and education programs centered on safety, getting around MSU, and promoting environmentally sustainable alternatives through a suite of transportation options.

2) Planning and Study – Numerous issues were identified for further study including roadway/intersection geometry, speed table locations, and updating construction standards.

3) Construction - The following construction projects were funded and completed during the summer of 2012: 1) the first phase of the MSU River Trail, a dedicated pedestrian and bicycle pathway system following the Red Cedar River from Harrison to Hagadorn Roads, 2) Abbot Road entrance modifications, 3) share the road pavement symbols on Stadium Drive, Recycling Road and Green Way, 4) new steps along Michigan Avenue where a dirt trail existed, 5) a new crosswalk from Parking Ramp #5 to the MSU Police facility, 6) a new walkway and accessible ramp from Wilson Road to the West Range Greenhouses at Farm Lane, and 7) modifications to a pedestrian crosswalk near the Akers Hall service court. Figure 7 identifies the portions of the MSU River Trail that are complete or pending future implementation.

4) Infrastructure Enhancements and Maintenance – More resources will be required on an annual basis to maintain the motorized- and non-motorized transportation infrastructure including lighting, pavement markings, signs, and parking.

5) ADA Transition Planning - Numerous pedestrian crosswalk ramps were brought up to current Americans with Disability Act (ADA) guidelines as part of ongoing roadway reconstruction projects across campus. These upgrades are being tracked by the Physical Plant as part of an ongoing ADA Transition Plan.

The university constructs all roadways as complete streets compliant with Public Acts 134 and 135 of 2010. The acts identify that roadways be designed for all legal users. To this end, every new or reconstructed roadway incorporates bike lanes, crosswalk ramps, and signalization as deemed appropriate by the University Traffic Engineer. Figure 8 illustrates where bike lanes exist on university-owned roadways. Currently, over 55% of campus roadways have bike lanes.

FIGURE 8
Existing Campus Bike Lanes

FUTURE DIRECTIONS

The non-motorized plan will be updated during the first half of 2013. Priority projects will include continuing to build the MSU River Trail, crosswalk enhancements per ADA guidelines, and expansion of the bike lane system. Funding is being sequestered by VPFO for the second segment of the MSU River Trail extending from Kalamazoo Street to Farm Lane. This funding will be supplemented by a grant received by Dr. Kutay in the College of Engineering to study the use of crumb rubber to enhance asphalt pavement performance.

Appendix A: Construction Project Data Summary

The Annual Construction Report, as requested by the Board of Trustees, includes construction projects that have been completed and project accounts that have been closed.

Major capital projects are those that are $1 million or greater and require Board approval. Minor capital projects are those that are greater than $250,000 and less than $1 million. The Board requests a listing of these projects on an annual basis. In addition to the annual report, the Board receives quarterly construction reports reflecting current construction projects. The Closed Major Capital Projects Report highlights three areas for the 10 major capital projects that were closed during fiscal year 2011-12. These areas include authorized budget, final cost of the project, contingency use, schedule adherence, and change order management. The reports are utilized to provide timely and accurate project information, as well as to report on project performance in the aggregate, analyzing strengths and weaknesses, and improving processes. The Closed Minor Capital Projects Report highlights final cost for the 31 minor capital projects that were closed during the fiscal year.

Of the 41 closed projects, 10 are major capital projects and 31 are minor capital projects. The approved budgets for the projects totaled $52,410,475. The final cost of these projects was $48,451,752, a difference of $3,958,723 (7.6%), which was returned to the appropriate unit.

CP04240 - CHEMISTRY - OFFICE ADDITION #1 & RENOVATIONS

Authorized Budget:	21,540,000	**Final Cost:**	21,368,520	**Classification:**	Office
Construction:	14,725,547	**Returned:**	171,480	**Delivery Method:**	Construction Manager
Professional Services:	2,229,927			**Contractor:**	GRANGER CONSTRUCTION COMPANY
Owner Work and Material:	595,523			**A/E (Consultant):**	FTC&H
Contingency:	3,989,003			**Funds returned to:**	FPSM/Reserve-Facilities Projs

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	1,794,539	12.2%	45.0%	**Substantial Completion:**	1/30/2010	12/6/2008	(420)
Document:	1,177,246	8.0%	29.5%	**Close Out:**	12/30/2010	8/24/2011	237
Field:	369,158	2.5%	9.3%				
Total:	3,340,943	22.7%	83.8%				

CP06387 - KRESGE ART CENTER - REPLACE ELECTRICAL SUBSTATION

Authorized Budget:	1,250,000	**Final Cost:**	1,044,063	**Classification:**	Undefined
Construction:	323,588	**Returned:**	205,937	**Delivery Method:**	Construction Manager
Professional Services:	167,496			**Contractor:**	PP - PROJECT SERVICES
Owner Work and Material:	758,916			**A/E (Consultant):**	ORION
Contingency:	0			**Funds returned to:**	JIT

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	0	0.0%	NA	**Substantial Completion:**	9/1/2011	9/1/2011	0
Document:	0	0.0%	NA	**Close Out:**	12/30/2011	1/9/2012	10
Field:	0	0.0%	NA				
Total:	0	0.0%	NA				

CP07074 - BRODY COMPLEX - UTILITY INFRASTRUCTURE IMPROVEMENTS - PHASE 1

Authorized Budget:	2,400,000	**Final Cost:**	1,642,859	**Classification:**	Site
Construction:	1,650,000	**Returned:**	757,141	**Delivery Method:**	Construction Manager
Professional Services:	400,505			**Contractor:**	CLARK CONSTRUCTION
Owner Work and Material:	75,000			**A/E (Consultant):**	FTC&H
Contingency:	274,495			**Funds returned to:**	JIT

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	5,386	0.3%	2.0%	**Substantial Completion:**	8/1/2009	8/1/2009	0
Document:	10,117	0.6%	3.7%	**Close Out:**	6/30/2012	3/27/2012	(95)
Field:	170,279	10.3%	62.0%				
Total:	185,782	11.3%	67.7%				

CP07082 - BRODY COMPLEX - UTILITY INFRASTRUCTURE IMPROVEMENTS - PHASE 2

Authorized Budget:	1,690,000	Final Cost:	1,516,943	Classification:	Mechanical & Electrical
Construction:	1,021,000	Returned:	173,057	Delivery Method:	Design Bid Build
Professional Services:	391,552			Contractor:	GRANGER CONSTRUCTION CO
Owner Work and Material:	124,610			A/E (Consultant):	FTC&H
Contingency:	152,838			Funds returned to:	IFM

Change Orders		% of Contract	% of Contingency	Schedule	Planned	Actual	Days (Under)/Over
Scope:	21,440	2.1%	14.0%	Substantial Completion:	8/13/2010	8/13/2010	0
Document:	0	0.0%	0.0%	Close Out:	5/30/2011	12/8/2011	192
Field:	133,787	13.1%	87.5%				
Total:	155,227	15.2%	101.6%				

CP08111 - ENGINEERING RESEARCH COMPLEX - ADDITION 3 OFFICE

Authorized Budget:	998,500	Final Cost:	980,302	Classification:	Site
Construction:	736,198	Returned:	18,198	Delivery Method:	Construction Manager
Professional Services:	163,302			Contractor:	ROCKFORD CONSTRUCTION
Owner Work and Material:	18,000			A/E (Consultant):	DICLEMENTE SIEGEL
Contingency:	81,000			Funds returned to:	

Change Orders		% of Contract	% of Contingency	Schedule	Planned	Actual	Days (Under)/Over
Scope:	2,653	0.4%	3.3%	Substantial Completion:	8/20/2010	8/20/2010	0
Document:	31,414	4.3%	38.8%	Close Out:	3/30/2012	5/4/2012	35
Field:	7,723	1.0%	9.5%				
Total:	41,790	5.7%	51.6%				

CP08202 - HOLMES HALL - ELEVATOR REPLACEMENT

Authorized Budget:	1,300,000	**Final Cost:**	1,215,088	**Classification:**	Elevator
Construction:	1,096,000	**Returned:**	84,912	**Delivery Method:**	Design Bid Build
Professional Services:	80,896			**Contractor:**	HBC CONTRACTING
Owner Work and Material:	24,580			**A/E (Consultant):**	BERNATH-COAKLEY
Contingency:	98,524			**Funds returned to:**	RHS

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	1,983	0.2%	2.0%	**Substantial Completion:**	8/20/2010	8/20/2010	0
Document:	9,650	0.9%	9.8%	**Close Out:**	7/30/2011	7/20/2011	(10)
Field:	3,197	0.3%	3.2%				
Total:	14,830	1.4%	15.1%				

CP08203 - WILSON HALL - ELEVATOR REPLACEMENTS

Authorized Budget:	1,200,000	**Final Cost:**	1,125,022	**Classification:**	Elevator
Construction:	1,019,800	**Returned:**	74,978	**Delivery Method:**	Design Bid Build
Professional Services:	63,100			**Contractor:**	HBC CONTRACTING
Owner Work and Material:	29,000			**A/E (Consultant):**	EAS
Contingency:	88,100			**Funds returned to:**	RHS

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	0	0.0%	0.0%	**Substantial Completion:**	1/17/2011	1/17/2011	0
Document:	8,404	0.8%	9.5%	**Close Out:**	5/31/2012	4/10/2012	(51)
Field:	20,447	2.0%	23.2%				
Total:	28,851	2.8%	32.7%				

CP09231 - HUBBARD HALL - RENOVATIONS TO FIRST FLOOR COMMON AREA

Authorized Budget:	4,050,000	**Final Cost:**	3,931,630	**Classification:**	Site
Construction:	2,788,045	**Returned:**	118,370	**Delivery Method:**	Construction Manager
Professional Services:	473,910			**Contractor:**	TRIANGLE ASSOCIATES
Owner Work and Material:	445,530			**A/E (Consultant):**	IDS
Contingency:	342,515			**Funds returned to:**	

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	103,473	3.7%	30.2%	**Substantial Completion:**	8/13/2010	8/4/2010	(9)
Document:	48,881	1.8%	14.3%	**Close Out:**	7/30/2012	4/27/2012	(94)
Field:	107,164	3.8%	31.3%				
Total:	259,517	9.3%	75.8%				

CP09301 - BIOMEDICAL PHYSICAL SCIENCE - ALTERATIONS TO SUITE 1440 (ICER/BEACON)

Authorized Budget:	2,900,000	**Final Cost:**	2,477,226	**Classification:**	Laboratory
Construction:	453,375	**Returned:**	422,774	**Delivery Method:**	Construction Manager
Professional Services:	204,607			**Contractor:**	SKANSKA
Owner Work and Material:	1,866,215			**A/E (Consultant):**	BERNATH COAKLEY
Contingency:	375,803			**Funds returned to:**	Provost

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	5,577	1.2%	1.5%	**Substantial Completion:**	9/1/2010	5/28/2010	(96)
Document:	5,387	1.2%	1.4%	**Close Out:**	8/1/2011	12/2/2011	123
Field:	-9,191	-2.0%	-2.4%				
Total:	1,773	0.4%	0.5%				

CP09370 - SHAW LANE POWER PLANT - DEMOLISH STACK

Authorized Budget:	700,000	**Final Cost:**	505,682	**Classification:**	Building Exterior
Construction:	431,008	**Returned:**	194,318	**Delivery Method:**	Construction Manager
Professional Services:	71,003			**Contractor:**	BARTON MALOW
Owner Work and Material:	41,873			**A/E (Consultant):**	EAS
Contingency:	156,116			**Funds returned to:**	Physical Plant

Change Orders		**% of Contract**	**% of Contingency**	**Schedule**	**Planned**	**Actual**	**Days (Under)/Over**
Scope:	0	0.0%	0.0%	**Substantial Completion:**	8/31/2011	8/12/2011	(19)
Document:	0	0.0%	0.0%	**Close Out:**	3/31/2012	3/9/2012	(22)
Field:	0	0.0%	0.0%				
Total:	0	0.0%	0.0%				

Closed Minor Capital Projects for Fiscal Year 2011 – 2012

CP Number	Project Description	Budget	Final Costs	Returned
CP05080	ANTHONY HALL-CAMPUS SECURITY SYSTEMS WITH EXTERIOR DOOR ACCESS CONTROL (SICPAC)	315,000	314,934	66
CP06299	AUDITORIUM - WINDOW REPLACEMENT	550,000	488,835	61,165
CP06510	T.B. SIMON POWER PLANT - CAUSTIC STORAGE CONTAINMENT SYSTEM	850,000	504,153	345,847
CP07016	OLDS HALL - FIRE ALARM UPGRADE	260,000	221,687	38,313
CP07104	LAUNDRY BUILDING - EXTERIOR RESTORATION	256,000	253,678	2,322
CP07271	BUSINESS COLLEGE COMPLEX - REPAIR HYDRAULIC ELEVATORS	450,000	446,229	3,771
CP07500	PHYSICAL PLANT - INTERIOR OFFICE RENOVATIONS	300,000	299,721	279
CP08055	GILTNER HALL - RENOVATIONS TO ROOMS 31 AND 32	987,000	972,619	14,381
CP08066	RECYCLING CENTER - PUBLIC DROP OFF	455,000	388,871	66,129
CP08114	ENGINEERING RESEARCH COMPLEX - C10A-C10D LAB RENOVATION	750,000	684,915	65,085
CP08243	NATURAL SCIENCE BUILDING - REPLACE ELEVATORS	700,000	586,042	113,958
CP08244	ERICKSON, ADMININSTRATION AND LIBRARY - REPLACE FOULED AHU CHILLED WATER COOLING COILS	500,000	357,373	142,627
CP08284	ENGINEERING RESEARCH COMPLEX - ALTERATIONS TO ROOM E172	775,000	694,284	80,716
CP08302	LIBRARY - COMPLETE REPLACEMENT OF TWO TRACTION ELEVATORS ON WEST SIDE	600,000	475,589	124,411
CP09015	WONDERS HALL - SECURITY / ACCESS CONTROL UPGRADES	300,000	212,052	87,948
CP09016	WILSON HALL - NEW CARD READERS ON INTERIOR, EXTERIOR AND MECH ROOM DOORS	325,000	299,110	25,890
CP09018	CASE HALL - SECURITY / ACCESS CONTROL UPGRADES	380,000	336,778	43,222
CP09027	SHAW HALL - NEW CARD READERS ON INTERIOR, EXTERIOR AND MECH ROOM DOORS	350,000	349,208	792
CP09034	HOLMES HALL - NEW CARD READERS ON INTERIOR, EXTERIOR, AND MECH ROOM DOORS	465,000	386,834	78,166
CP09117	COMMUNICATION DISTRIBUTION - REPAIR COMM AND ELECTRICAL BANK UNDER INT'L CTR SIGN	600,000	599,705	295
CP09190	HOLMES HALL - ALTERATIONS TO ROOM W26A	280,675	280,803	-128
CP09254	ERICKSON HALL - REPLACE ROOFS	575,000	571,701	3,299
CP09289	PHYSICAL PLANT - ROOM 102 EXPANSION	500,000	445,605	54,395

CP Number	Project Description	Budget	Final Costs	Returned
CP09357	SPARTAN STADIUM - U2 CONCERT	277,000	252,717	24,283
CP10027	WONDERS HALL - REPLACE ROOF SECTIONS 1, 2, 3, 5, 6, 9, 14, AND 15	350,000	336,086	13,914
CP10046	STUDENT SERVICES - BARRIER FREE ACCESS AT NORTH ENTRY	550,000	515,296	34,704
CP10141	SPARTAN VILLAGE - UNITS 1451 E&F AND 1569 A&B - BARRIER FREE RENOVATIONS	300,000	292,522	7,478
CP10241	INTERNATIONAL CENTER - RENOVATE ROOMS 117 & 117A	296,300	242,075	54,225
CP10313	PLANT BIOLOGY - SOUTH WING HVAC UPGRADES	475,000	373,106	101,894
CP11017	BERKEY HALL - STRUCTURAL REPAIR	300,000	198,648	101,352
CP11059	PARKING RAMPS 3 (WHARTON CENTER) AND 6 (GRAND RIVER) - RESTORATION AND TESTING	310,000	263,244	46,756
Total Projects: 31		**14,381,975**	**12,644,417**	**1,737,558**

John A. Hannah, MSU's 12th President

Prepared by:

Land Management Office

Real Property Holdings - Table of Contents

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

Real Property Holdings - Real Estate Facts

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

Summary of Acres

- Michigan State University (MSU) lands comprise 25,490.240 acres.
- Main campus lands (North of Mt. Hope) comprise 2,045.617 acres.
- Research, education, and outreach lands (South of Mt. Hope) comprise 2,737.492 acres.
- The golf course is 325 acres.
- Campus lands leased to others include 74.116 acres.
- Off-campus properties include 20,295.015 acres.
- Property for sale comprise 7.831 acres (included in off-campus total).

Acreage Changes

- MSU traded approximately 4.04 acres of the Forest Biomass Innovation Center for approximately 12.18 acres; a net gain of 8.14 acres
- MSU purchased approximately 5 acres of land in Thompsonville to be used for chestnut research.
- Approximately 2.7 acres of non-income generating Morris Property were sold.

Long-Term Leases

- Leases of a term of ten years or greater require Board of Trustee approval. There were no new long-term leases for the period July 1, 2011 - June 30, 2012.

  The long-term lease with the State Police terminated on March 31, 2012.

State Building Authority Projects

- MSU has four State Building Authority bond-financed projects. The project site is deeded to the State Building Authority and leased back to MSU. Current projects are: Anthony Hall Dairy Plant and Meat Lab (to be repaid 2032); Biomedical and Physical Sciences Building (to be repaid 2037); Diagnostic Center for Population and Animal Health (to be repaid 2040); and the Chemistry Building renovation project (to be repaid 2043). State Building Authority bonds are typically issued for 35 years but the State may retire them before their maturity date.

Agreement to Restore Title

- A 50-year lease between MSU and the State of Michigan was entered into February 1956 for approximately six acres on Harrison Road. The Department of Agriculture constructed a lab on the parcel known as the Geagley Laboratory. In 2002, the parcel was deeded to the State of Michigan in order for the State to convey the property to the State Building Authority to obtain bond financing for needed improvements. An "Agreement to Restore Title" requires the State to deed the parcel to MSU at the time the property is conveyed back to the State from the State Building Authority. At that time, a lease will be entered into between MSU (landlord) and the State (tenant) in order for the State to continue occupancy at the Geagley Laboratory. The "Agreement to Restore Title" is on file in the MSU Office of General Counsel and the Land Management Office.

Notice fo Federal Intent

- The National Institutes of Health awarded MSU a grant for the Life Sciences Complex: Nursing Research Addition. The award terms and conditions include resctrictions on property usage for 10 years (anticipated to be December 2022). The property may not be (1) used for any purposes inconsistent with the authorized grant program, (2) mortgaged, or (3) sold or transferred to another party. The entire Notice of Federal Intent is on file in the Land Management Office.

Real Property Holdings - Summary

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

PROPERTY		**ACRES**
East Lansing Campus		
North of Mt. Hope		2,058.617
Golf Course		325.000
Research, Education, and Outreach south of Mt. Hope		2,737.492
Campus Property Leased to Others		74.116
	Total Campus Acres	**5,195.225**
Off-Campus		20,295.015
	Total Deeded Acres	**25,490.240**
Property Leased to MSU Long-Term		264.000
	Total Leased and Deeded Acres	**25,754.240**

Real Property Holdings - Acquisitions and Properties Sold

MICHIGAN STATE UNIVERSITY

July 1, 2011 - June 30, 2012

ACQUISITIONS		**ACRES**
Property:	Rau Property 0 North Manistee Line Road Thompsonville, Michigan 49683 Benzie County	5.000
Acquisition Date:	8/5/2011	
Purchase Price:	$25,000.00	
How Acquired:	Purchase	

Property:	Judson Property Vacant Land Wells Tonwship, Michigan Delta County	12.180
Acquisition Date:	3/26/2012	
Purchase Price:	$0.00	
How Acquired:	Trade	

PROPERTY SOLD		**ACRES**
Property:	Morris Property Vacant Land Eagle Township, Michigan Clinton County	2.700
Sale Date:	8/4/2011	
Sale Price:	$8,000.00	

PROPERTY TRANSFERRED		**ACRES**
Property:	Forest Biomass Innovation Center 6005 J Road Escanaba, Michigan 49829 Delta County	4.040
Transfer Date:	3/26/2012	

Real Property Holdings - Acquisitions and Properties Sold

MICHIGAN STATE UNIVERSITY

July 1, 2011 - June 30, 2012

PROPERTY FOR SALE		ACRES
Property:	Hulett Road Engineering	5.691
Property:	Gantos Property	2.140

Real Property Holdings - Active Mineral Leases

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

MSU owns the Martin Property, the Management Education Center, and Hidden Lake Gardens. The Mancelona Property, Homer Nowlin Property, and Merillat Property were sold; MSU retained the mineral rights on those properties.

PROPERTY	ACRES
Mancelona Property (MSU owns mineral rights) Section 16, Mancelona Township, Antrim County Leased to Mercury Exploration Co. Lease is continued with producing well	31.400
Martin Property (Rose-Dell Seed Orchard, MSU owns surface and mineral rights) Sections 23 and 24, Albion Township, Calhoun County Leased to West Bay Exploration Three-year lease (commenced December 2007)	160.000
Homer Nowlin Property (MSU owns mineral rights) Sections 28 and 23, Rich Township, Lapeer County Leased to Total Petroleum, Inc. Lease is continued with producing well	313.000
Management Education Center (MSU owns surface and mineral rights) Section 9, Troy Township, Oakland County Leased to West Bay Exploration Company Lease is continued with producing well	24.320
Hidden Lake Gardens (MSU owns 750.265 surface acres and 712.655 mineral acres) Sections 17, 18, 19, and 20, Liberty Township, Lenawee County Leased to West Bay Exploration Company Three-year lease (commenced August 2009 - lease extended for an additional three years)	712.256
Merillat Property (MSU owns mineral rights) Section 29, Adrian Township, Lenawee County Leased to Savoy Energy, L.P. Three-year lease (commenced August 2010)	80.000
Total Acres Under Mineral Leases	**1,320.976**

Real Property Holdings - Mineral Rights Reserved on Sold Properties

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

PROPERTY	ACRES
Allegan County	
Section 21, Saugatuck Township	53.275
Antrim County	
Section 16, Mancelona Township	29.900
Clinton County	
Section 22, Eagle Township	24.000
Sections 22 & 27, Eagle Township	61.300
Section 34, Eagle Township	2.700
Delta County	4.040
Section 17, Wells Township	
Ingham County	20.369
Section 1, Delhi Township	
Lapeer County	
Section 28, Rich Township	10.000
Section 33, Rich Township	303.000
Lenawee County	
Section 29, Adrian Township	80.000
Monroe County	
Section 21, Milan Township	80.000
Oakland County	
Sections 2, 11, 12, Avon Township	234.434
Section 32, Bloomfield Township	5.000
Ontonagon County	
Section 6, Bohemia Township; Section 12, Greenland Township	78.000
Section 23, Bohemia Township	40.000

Real Property Holdings - Mineral Rights Reserved on Sold Properties - continued

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

VanBuren County	
Section 6, Geneva Township	29.000
Section 23, South Haven Township	53.230
Total Mineral Acres Reserved:	**1,108.248**

Real Property Holdings - Gas and Oil Royalty Income

MICHIGAN STATE UNIVERSITY

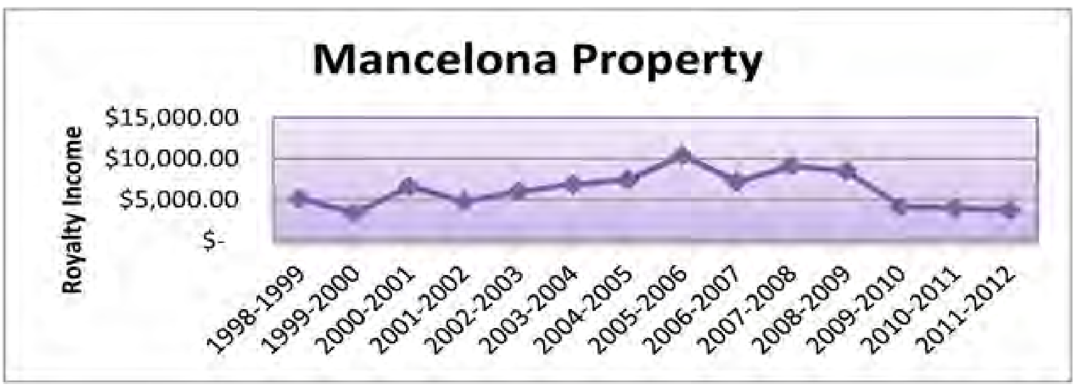
As of July 1, 2012

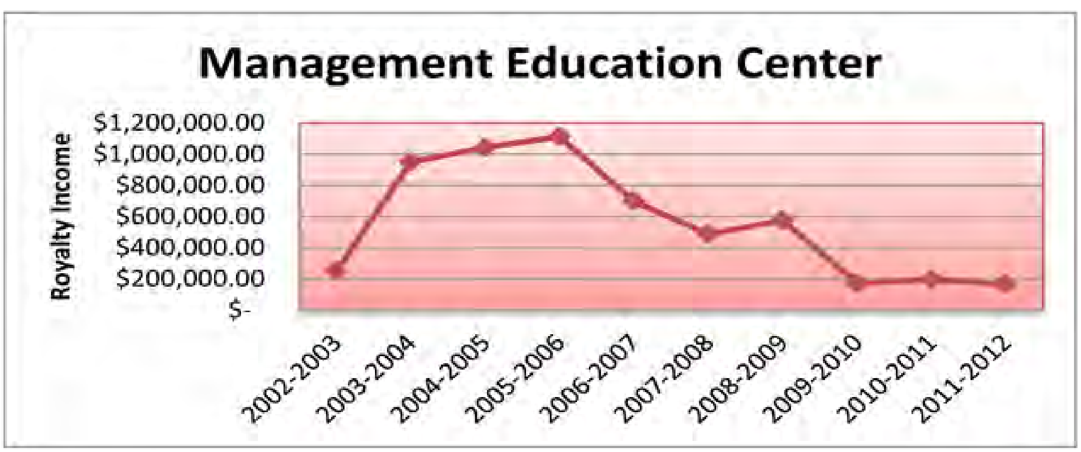
Mancelona Property
(Income funds the Land Fund Account)

1998-1999	$ 5,068.62
1999-2000	$ 3,390.42
2000-2001	$ 6,547.95
2001-2002	$ 4,789.45
2002-2003	$ 5,958.69
2003-2004	$ 6,833.60
2004-2005	$ 7,415.27
2005-2006	$ 10,337.62
2006-2007	$ 7,192.83
2007-2008	$ 9,082.79
2008-2009	$ 8,484.09
2009-2010	$ 4,114.23
2010-2011	$ 3,941.64
2011-2012	$ 3,691.88

Management Education Center
(Income funds Eli Broad College of Business Programs)

2002-2003	$ 248,679.62
2003-2004	$ 949,191.09
2004-2005	$ 1,041,242.41
2005-2006	$ 1,111,581.83
2006-2007	$ 695,627.95
2007-2008	$ 486,734.28
2008-2009	$ 573,939.94
2009-2010	$ 169,303.36
2010-2011	$ 195,046.47
2011-2012	$ 164,242.13





Real Property Holdings - Gas and Oil Royalty Income

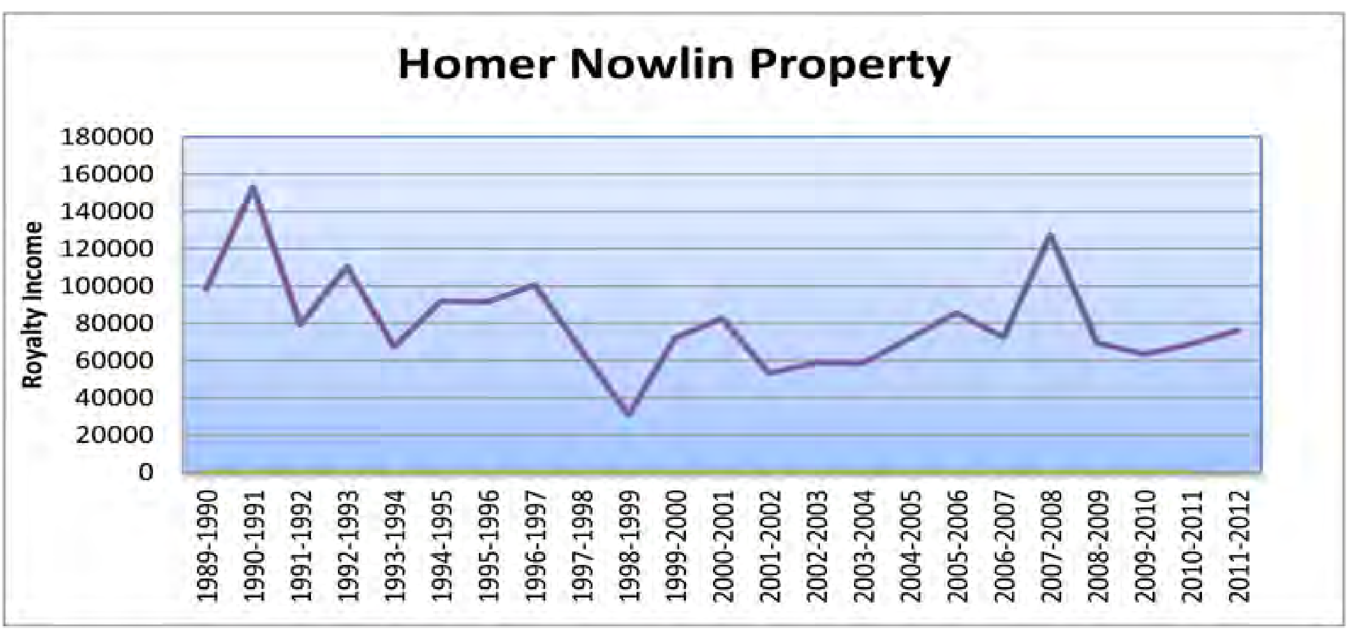
MICHIGAN STATE UNIVERSITY

As of July 1, 2012

Homer Nowlin Property

(Income funds endowed chair in the College of Agriculture and Natural Resources)

1989-1990	$	98,404.78
1990-1991	$	153,008.72
1991-1992	$	79,323.99
1992-1993	$	110,311.26
1993-1994	$	67,355.68
1994-1995	$	91,965.81
1995-1996	$	91,421.59
1996-1997	$	100,641.83
1997-1998	$	65,468.04
1998-1999	$	30,788.53
1999-2000	$	72,118.88
2000-2001	$	82,535.99
2001-2002	$	53,000.00
2002-2003	$	58,819.50
2003-2004	$	58,386.86
2004-2005	$	71,997.24
2005-2006	$	85,676.23
2006-2007	$	72,534.18
2007-2008	$	127,494.63
2008-2009	$	69,521.30
2009-2010	$	63,304.32
2010-2011	$	68,704.58
2011-2012	$	76,248.53



Real Property Holdings - Leased/Licensed Properties

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

Leases of 10 years or longer require MSU Board of Trustee approval. The following leases meet that criteria. Only real property leases are included in the Real Property Holdings annual report.

MSU as TENANT	**ACRES**
Northwest Michigan Horticultural Research Center Administrative Unit: College of Agriculture and Natural Resources Department of Horticulture MSU Extension	100.000
Tollgate Education Center Administrative Unit: College of Agriculture and Natural Resources Land Management Office MSU Extension	100.000
MSU Forest Biomass Innovation Center Administrative Unit: College of Agriculture and Natural Resources Department of Forestry	9.000
MSU Forest Biomass Innovation Center Administrative Unit: College of Agriculture and Natural Resources Department of Forestry	10.000
Total Leased Acres:	**219.000**

Real Property Holdings - Leased/Licensed Properties

MICHIGAN STATE UNIVERSITY

As of July 10, 2012

Leases of 10 years or longer require MSU Board of Trustee approval. The following leases meet that criteria. Only real property leases are included in the Real Property Holdings annual report.

TENANT	MSU PROPERTY	ACRES
Prairieville Township	Lux Arbor Reserve	0.800
Berrien County Extension Service	Southwest Michigan Research & Extension Center	1.380
Cass County Historical Commission	Russ Forest	1.800
Cass County Park & Recreation Commission	Russ Forest	14.000
Marcellus Community School	Russ Forest	21.450
Department of Natural Resources	Dunbar Forest	9.400
MSU Federal Credit Union	Campus	4.711
MSU Federal Credit Union	Campus	3.960
Sewage Plant	Campus	16.500
Consumers Energy	Campus	0.100
Northstar Cooperative, Inc.	Campus	9.710
University Rehabilitation Alliance	Campus	35.000
Candlewood/Vista I, LLC	Campus	3.235
LBWL/METC	Campus	0.900
Gull Lake Bible Conference	Kellogg Biological Station	10.000
Sheridan Lake YMCA (License)	Brook Lodge	415.000
Sheridan Lake YMCA (Lease)	Brook Lodge	40.000
Leland Township	Leland Property	0.700
Avon Players	VanHoosen Jones	1.793
Pete Clark	Morris Property	1,385.000
	Total Acres Leased/Licensed to Others:	**1,975.439**

BioEconomy Research and Development Center
Holland, Ottawa County

Purpose	Status	Acres
Research	Active Land use or resource use restrictions	6.300

Administrator	Comment
Vice President for Research and Graduate Studies	None

Brook Lodge
Augusta, Kalamazoo County

Purpose	Status	Acres
Conference center, teaching, research, and outreach	Inactive	633.240

Administrator	Comment
Kellogg Center Land Management Office	Long term lease on 40 acres to Sherman Lake YMCA

Clarksville Research Center
Clarksville, Ionia County

Purpose	Status	Acres
Horticulture research on small fruit and tree fruit	Active	440.000

Administrator	Comment
Department of Horticulture Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. Doug Buhler Farm Manager: Gerald Skeltis

Dobie Road
Okemos, Ingham County

Purpose	Status	Acres
WKAR Broadcasting Site	Active	114.431

Administrator	Comment
Land Management Office	Location of WKAR tower T-Mobile tower

Dunbar Forest
Sault Ste. Marie, Chippewa County

Purpose	Status	Acres
Forest research and demonstration	Active Title restricted on 4,668.84 acres Land reverts to State if not used solely for forestry purposes	5,759.815

Administrator	Comment
Department of Forestry Land Management Office	AgBioResearch Field Research Center

Forest Biomass Innovation Center
Escanaba, Delta County

Purpose	Status	Acres
Research and demonstration in forestry and crops	Active	1,745.400

Administrator	Comment
Department of Forestry Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. David McFarlane Resident Forester: Dr. Ray Miller

Gantos Property
City of Kentwood, Kent County

Purpose	Status	Acres
Donation for resale	Property is for sale	2.140

Administrator	Comment
Land Management Office	None

Hidden Lake Gardens
Tipton, Lenawee County

Purpose	Status	Acres
Arboretum and plant conservatory	Active	756.618

Administrator	Comment
Land Management Office	Manager: Steven Courtney

Hulett Road Engineering
Okemos, Ingham County

Purpose	Status	Acres
Former facilities and site for College of Engineering research	Property is for sale Building vacant	5.691

Administrator	Comment
Land Management Office	None

Human Medicine, College of
Grand Rapids, Kent County

Purpose	Status	Acres
Medical School	Active	1.735

Administrator	Comment
College of Human Medicine	Includes Condominium #5 Includes Condominium #29 (Parking Spots) .005 acres sold to MDOT

Jolly Road Engineering
Okemos, Ingham County

Purpose	Status	Acres
Facilities and site for College of Engineering research	Active	3.260

Administrator	Comment
College of Engineering Land Management Office	None

Kellogg, W.K. Biological Station
(Including Farm and Bird Sanctuary)
Hickory Corners, Kalamazoo County

Purpose	Status	Acres
Teaching, research, and extension activities in the environmental sciences focusing on the interdependence of natural and managed landscapes. The programs treat integrated study of biology, wildlife, and production agriculture, including animal input.	Active Title on original gift restricted. Property needs to be maintained and operated for educational purposes.	1,690.850

Administrator	Comment
Director, Biological Station College of Agriculture & Natural Resources College of Natural Science Land Management Office	AgBioResearch Field Research Center Director: Dr. Katherine Gross Farm Manager: Jim Bronson Bird Sanctuary Coordinator: Tracey Kast Farm Acreage: 944.674 Bird Sanctuary Acreage: 746.176 4.92 acres acquired in 2009

Kellogg, W.K. Biological Station
Lux Arbor Reserve
Delton, Barry County

Purpose	Status	Acres
Research and education in the agricultural, biological, botanical, and horticulture sciences	Active	1,323.000

Administrator	Comment
Same as Kellogg Biological Station	Included with Kellogg Biological Station as an Agricultural Research Station Farm Manager: Steve Norris

Kellogg, W.K. Experimental Forest
Augusta, Kalamazoo County

Purpose	Status	Acres
Forestry research, teaching, demonstration, and public use	Active Title restricted on 280 acres. To be used for reforestation, education, and experimental purposes	715.995

Administrator	Comment
Department of Forestry Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. David McFarlane Resident Forester: Greg Kowalewski

Lake City Research Center
Lake City, Missaukee County

Purpose	Status	Acres
Research in beef cattle, forages, and potatoes	Active	810.010

Administrator	Comment
Department of Animal Science Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. Jason Rountree Farm Manager: Doug Carmichael

Leland Property
Leland, Leelanau County

Purpose	Status	Acres
Long-term lease to Leland Township	Active	0.700

Administrator	Comment
Land Management Office	None

MacCready Forest and Wildlife Reserve
Clark Lake, Jackson County

Purpose	Status	Acres
Wildlife and forestry demonstration	Active	408.000

Administrator	Comment
Department of Forestry Department of Fisheries & Wildlife Land Management Office	None

Management Education Center
Troy, Oakland County

Purpose	Status	Acres
Advanced management training center	Active	24.327

Administrator	Comment
College of Business	Manager: Tom Freed

Martin Property (Rose-Dell Seed Orchard)
Calhoun County

Purpose	Status	Acres
Tree seed orchard and demonstration site	Active Proceeds from leases and timber sales to be used for farm maintenance and scholarships	160.000

Administrator	Comment
Department of Forestry Land Management Office	None

Mason Research Farm
Mason, Ingham County

Purpose	Status	Acres
Cereal grains and soybean research	Active	117.000

Administrator	Comment
Plant, Soil and Microbial Sciences Land Management Office	None

Michigan State University Campus
East Lansing, Ingham County

Purpose	Status	Acres
Research, education, and outreach	Active	5,195.225

Montcalm Research Center
Lakeview, Montcalm County

Purpose	Status	Acres
Potato production research and cash crops	Active	57.250

Administrator	Comment
Plant, Soil and Microbial Sciences Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. Dave Douches Farm Manager: Bruce Sackett

Morris Property
Grand Ledge, Clinton and Eaton Counties

Purpose	Status	Acres
Income generating property to fund endowments established by David and Betty Morris	Active	1,528.300

Administrator	Comment
Land Management Office	Long-term crop lease restricts near-term sale of property; includes eight residential leased properties, cell tower lease, research crop lease, billboard lease, and option to the Grand Ledge School District

MSU Sailing Club
Haslett, Ingham County

Purpose	Status	Acres
Sailing and wind surfing lessons	Active	0.760

Administrator	Comment
Intramural Sports and Recreative Services	None

Muck Soils Research Center
Laingsburg, Clinton County

Purpose	Status	Acres
Organic soil vegetable and crops research	Active	447.048

Administrator	Comment
Plant, Soil and Microbial Sciences	AgBioResearch Field Research Center
Land Management Office	Coordinator: Dr. Doug Buhler
	Farm Manager: Mitch Fabis

Rau Property
Thompsonville, Benzie County

Purpose	Status	Acres
Chestnut research	Active	5.000

Administrator	Comment
Land Management Office	None

River Terrace Property
East Lansing, Ingham County

Purpose	Status	Acres
Investment	Active	1.210

Administrator	Comment
Land Management Office	None

Rogers Reserve
Jackson, Jackson County

Purpose	Status	Acres
Botantical and horticultural sciences research and teaching	Active	115.850

Administrator	Comment
Department of Plant Pathology	Coordinator: Dr. Dennis Fulbright
Land Management Office	

Russ (Fred) Forest
Decatur, Cass County

Purpose	Status	Acres
Forestry plantings and genetics research	Active	938.750
Demonstration and public use	Title restricted on 269 acres	
	Land to be used for educational purposes	

Administrator	Comment
Department of Forestry	AgBioResearch Field Research Center
Land Management Office	Coordinator: Dr. David MacFarlane
	Non-Resident Forester: Greg Kowalewski

Saginaw Valley Research and Extension Center
Frankenmuth, Saginaw and Tuscola Counties

Purpose	Status	Acres
Dry bean, sugar beet, and crop research Research, outreach, and teaching	Active	310.040

Administrator	Comment
Plant, Soil and Microbial Sciences Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. James Kelly Farm Manager: Paul Horny

Southwest Michigan Research and Extension Center
Benton Harbor, Berrien County

Purpose	Status	Acres
Horticultural research and extension center	Active	350.000

Administrator	Comment
Department of Horticulture Cooperative Extension Service Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. Thomas Zabadal Farm Manager: Dave Francis

Stranahan-Bell (WaWaSum)
Grayling, Crawford County

Purpose	Status	Acres
Inland stream and reforestation research Small conference center	Active	251.000

Administrator	Comment
Land Management Office	None

Stuckman Property
St. Johns, Clinton County

Purpose	Status	Acres
Educational and/or research	Active	40.000

Administrator	Comment
Land Management Office	MOU on file in Land Management Office

Sycamore Creek
Holt, Ingham County

Purpose	Status	Acres
Support campus water management plan; controlled access to Sycamore Creek flood plain	Active Title restricted on 52 acres Deed covenants restrict use	54.500

Administrator	Comment
Land Management Office	None

Tollgate Education Center
Novi, Oakland County

Purpose	Status	Acres
Agricultural and environmental education and leadership training	Active	56.675

Administrator	Comment
Cooperative Extension Service Land Management Office	Farm Manager: Roy Prentice

Trevor Nichols Research Center
Fennville, Allegan County

Purpose	Status	Acres
Fruit pest research	Active	156.100

Administrator	Comment
Department of Entomology Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. John Wise Farm Manager: Jason Seward

Upper Peninsula Research Center
Chatham, Alger County

Purpose	Status	Acres
Dairy, forestry, and crops research	Active	1,262.227

Administrator	Comment
Department of Animal Science Land Management Office	AgBioResearch Field Research Center Coordinator: Dr. Dan Buskirk Farm Manager: Paul Naasz

VanHoosen Property
Rochester, Oakland County

Purpose	Status	Acres
Long-term lease to Avon Players	Active	1.793

Administrator	Comment
Vice President for Finance and Operations Land Management Office	Remaining land of Sarah Van Hoosen gift acquired in 1956

Total Acres: 25,490.240

Real Property Holdings - AgBioResearch Centers

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

AgBioResearch Centers owned by MSU

Clarksville Research Center
9302 Portland Road
Clarksville, MI 48815

MSU Forest Bomass Innovation Center
6005 J. Road
Escanaba, MI 49829

Kellogg, W.K. Experimental Forest
7060 N. 42nd Street
Augusta, MI 49012

Montcalm Research Center
4747 McBride Road
Lakeview, MI 48850

Fred Russ Forest
20673 Marcellus Highway
Decatur, MI 49045

Southwest Michigan Research and
Extension Center
1781 Hillandale Road
Benton Harbor, MI 49022

Upper Peninsula Research Center
E3774 University Drive
P.O. Box 168
Chatham, MI 49816

Dunbar Forest
12839 S. Scenic Drive
Sault Ste. Marie, MI 49783

Kellogg, W.K. Biological Station
3700 E. Gull Lake Drive
Hickory Corners, MI 49060

Lake City Research Center
5401 W. Jennings Road
Lake City, MI 49651

Muck Soils Research Center
Route 3
9370 E. Herbison Road
Laingsburg, MI 48848

Saginaw Valley Research and
Extension Center
9923 Krueger Road
Frankenmuth, MI 48734

Trevor Nichols Research Center
6237 124th Avenue
Fennville, MI 49408

AgBioResearch Centers leased by MSU

Northwest Michigan Horticultural
Research Center
6686 S. Center Highway
Traverse City, MI 49684

Real Property Holdings - Land Acquisition by Decade

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

	Acres	
	Campus	Off-Campus
Prior to 1920	1,026.380	1,060.327
1920's	564.350	2,007.112
1930's	284.614	795.026
1940's	1,605.236	6,281.322
1950's	1,266.862	862.190
1960's	767.850	2,417.390
1970's	188.747	861.049
1980's	13.943	3,265.245
1990's	66.338	1,775.765
2000's	1.069	1,566.310
2010's	0.000	1,652.320

Real Property Holdings - Land Available for Agricultural and Natural Resources Research

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

Off-Campus	**Acres**
13 Outlying Stations (owned)	16,006.485
1 Outlying Station (leased)	100.000
Dobie Road Property, Okemos	114.431
Off-Campus owned land used for agricultural research (Not designated as a research station)	1,151.350
Off-Campus leased land used for agricultural research	264.000
Campus	
Land used for agricultural research - south of Mt. Hope	2,737.492
Total Acres:	**20,373.758**

Real Property Holdings - Warranty Deeds to State Building Authority

MICHIGAN STATE UNIVERSITY

As of July 1, 2012

The following parcels have been or will be deeded to and leased back from the State Building Authority, for financing pursuant to earlier Board of Trustees approval.

- Anthony Hall Dairy Plant and Meats Lab
- Biomedical and Physical Sciences Building
- Diagnostic Center for Population and Animal Health
- Chemistry Building Renovation Project

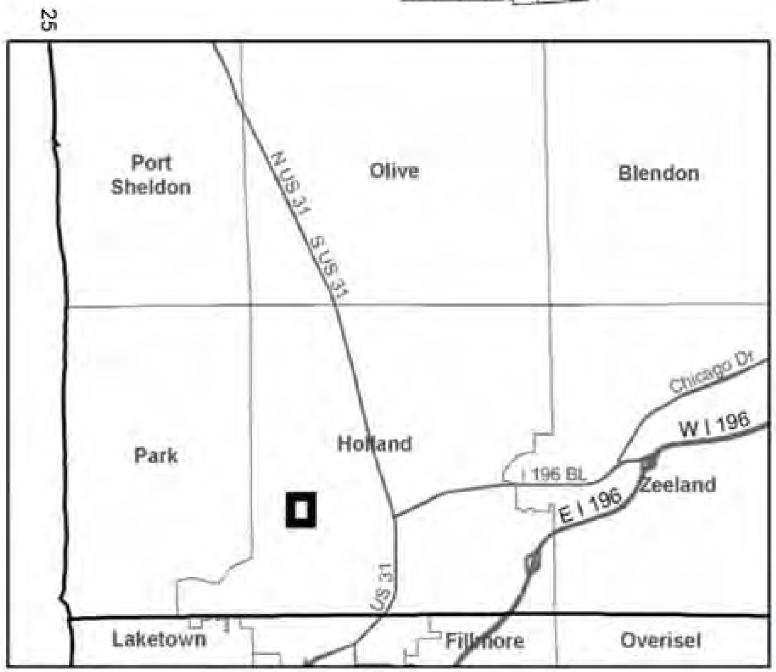
The following parcels have been deeded to the State of Michigan, pursuant to Board of Trustees approval, in connection with a State of Michigan financing of improvements. A written agreement obligates the State to deed the property back to MSU at a later date.

- The Geagley Laboratory

Location Maps
of
Michigan State University Properties
Alphabetical by County

BioEconomy Research and Development Center

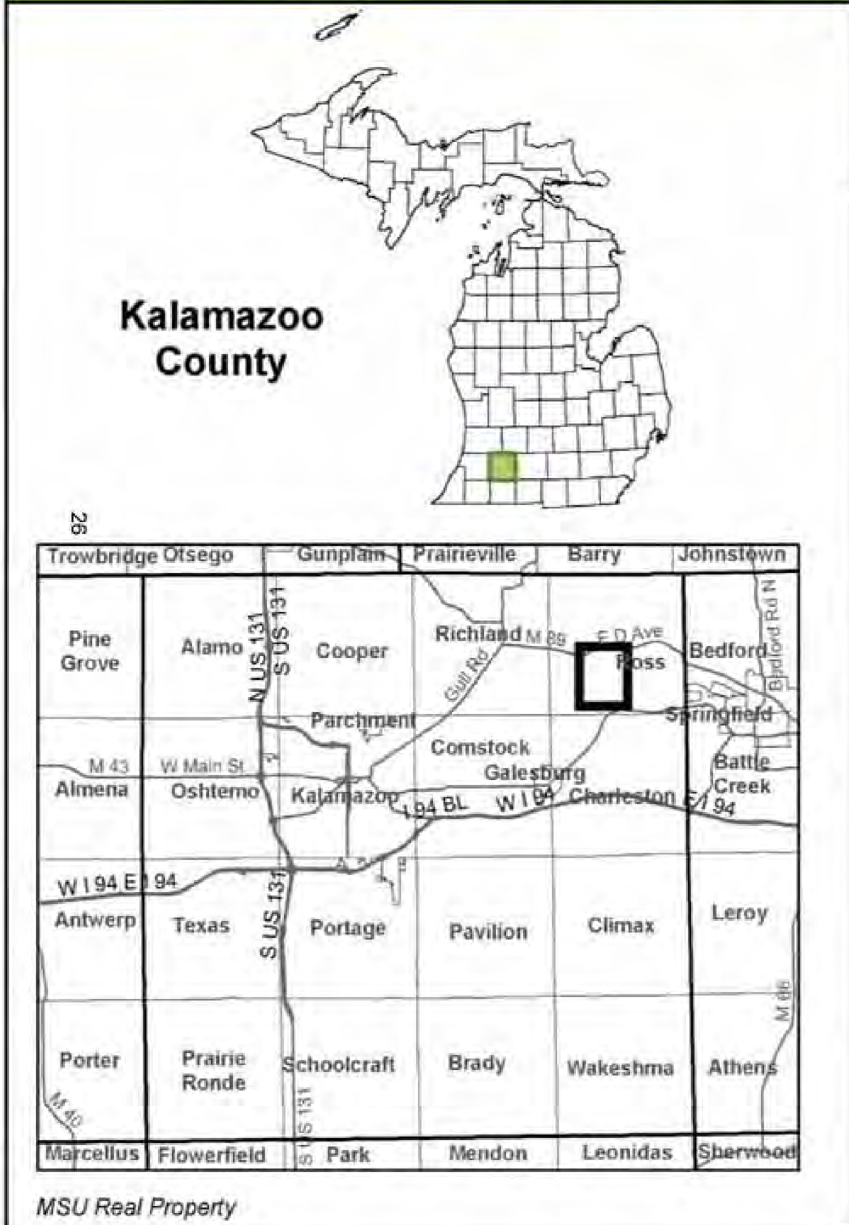
Holland Township, Section 19



MSU Real Property

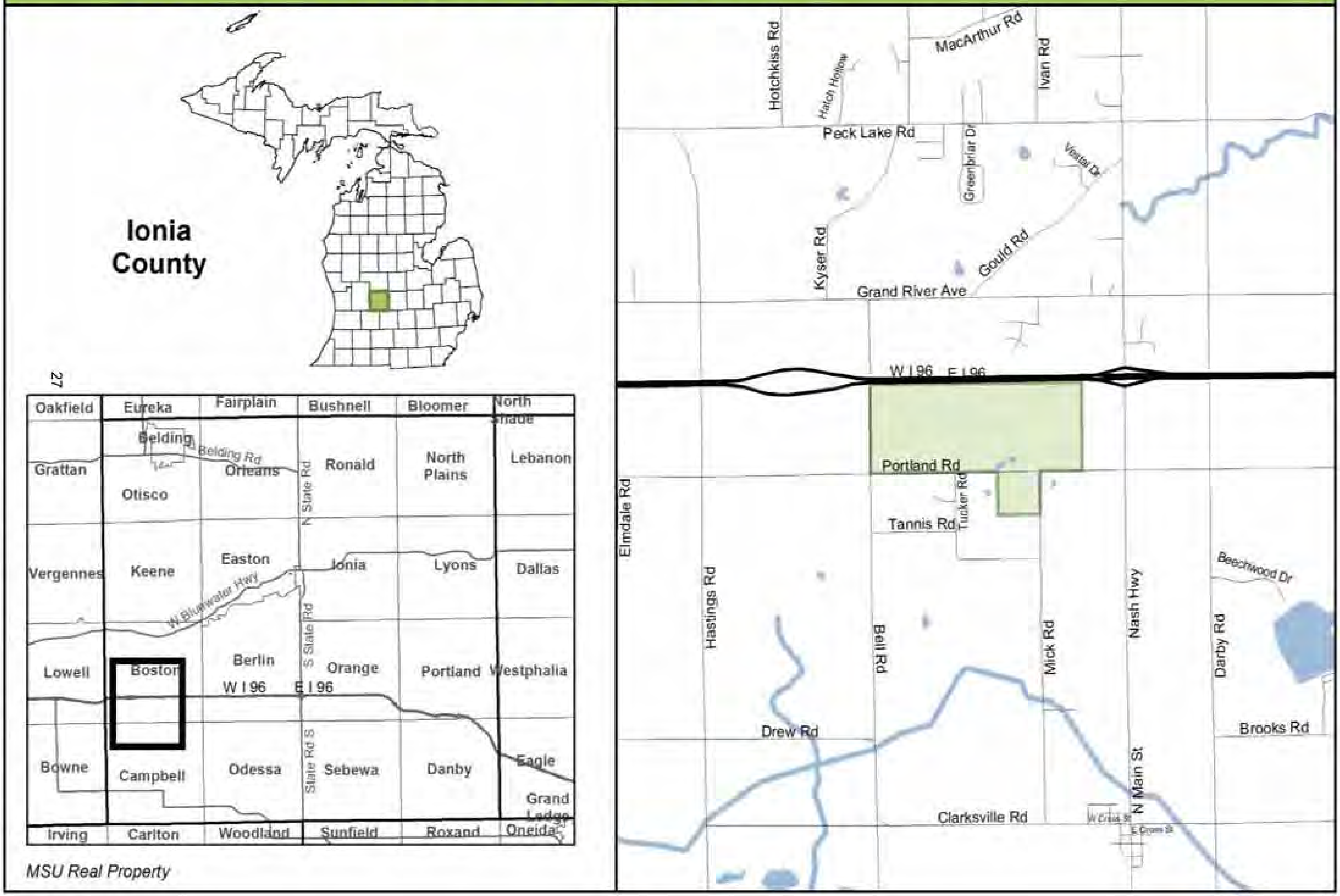
Brook Lodge

Ross Township, Section 21, 27, 28, and 29



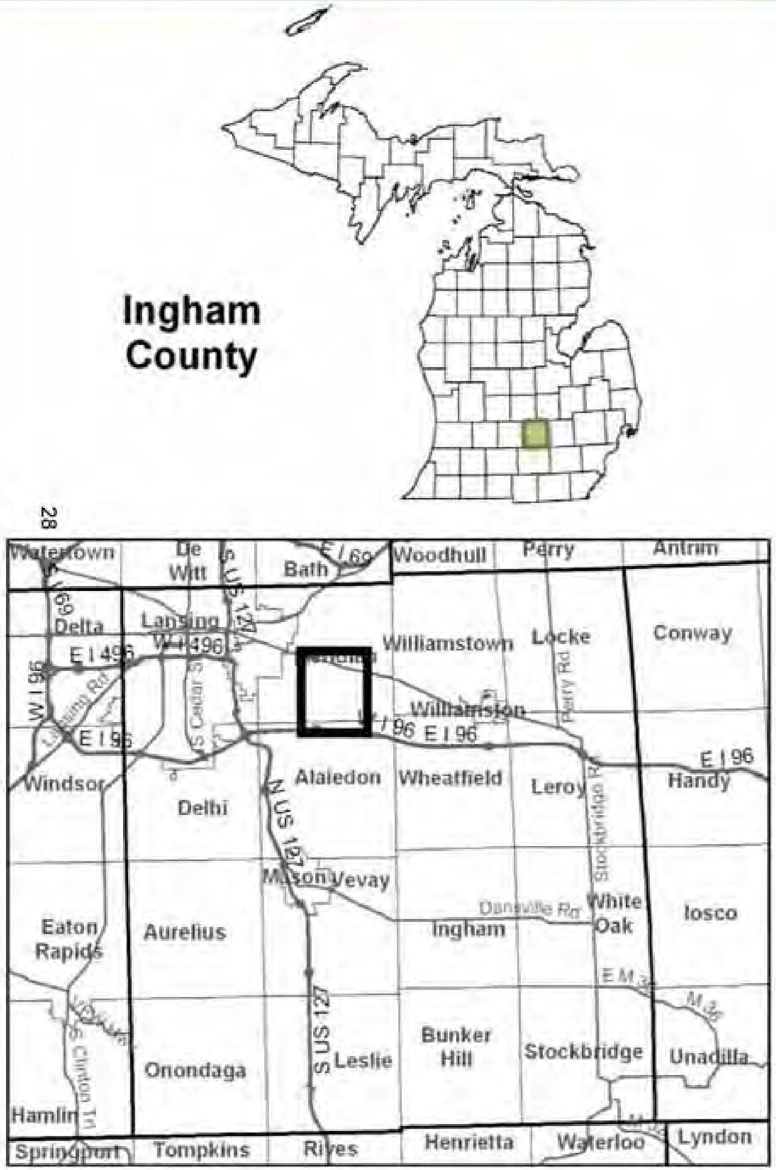
Clarksville Research Center

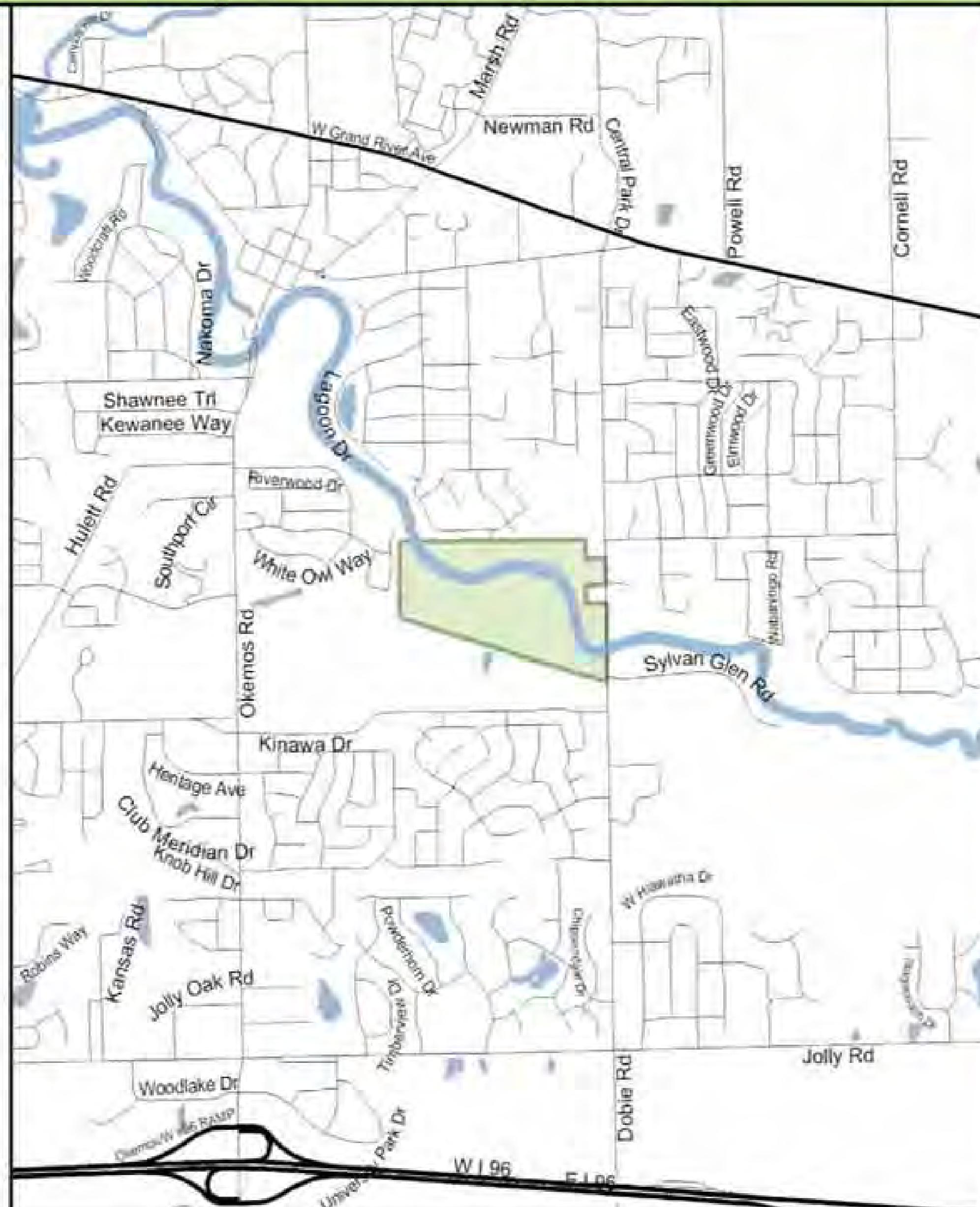
Boston Township, Sections 27, 28, and 33



Dobie Road Property

Meridian Township, Section 27

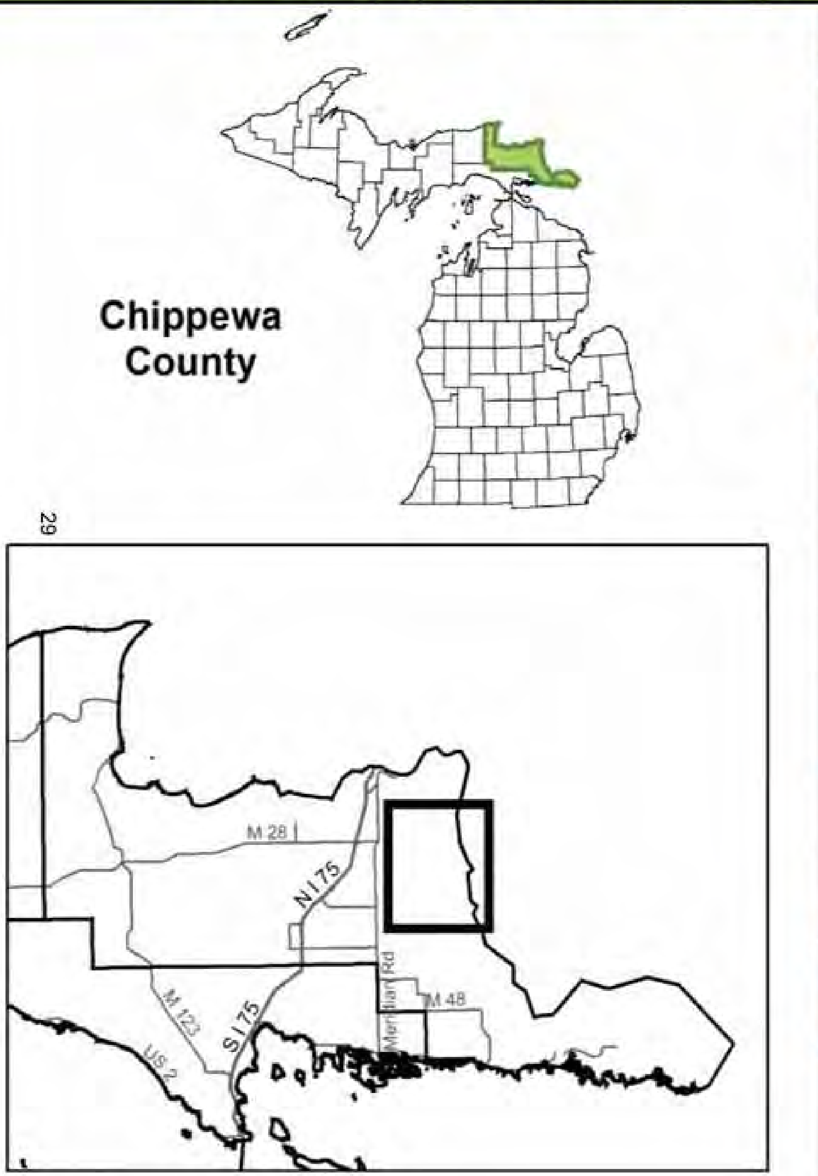




MSU Real Property

Dunbar Forest

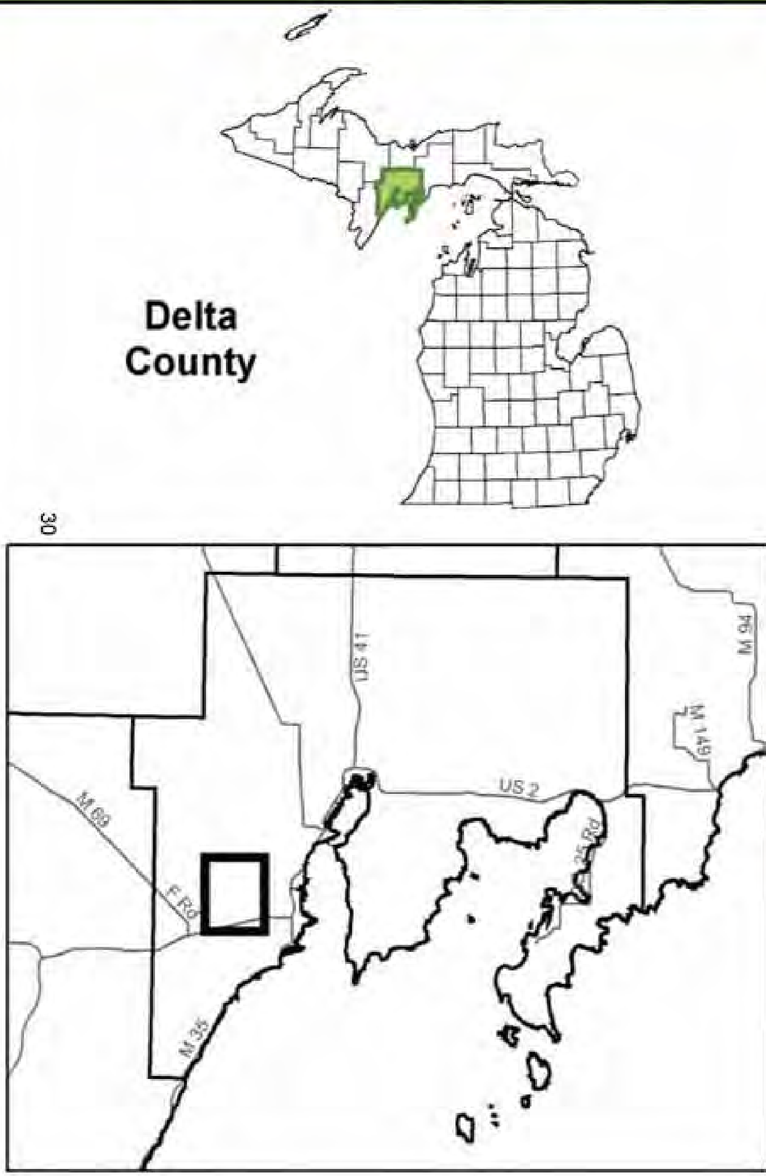
Soo Township, Sections 3, 4, 5, 8, 9, 10, 11, 14, 15, and 16; Bruce Township, Sections 1, 6, 7, 12, 13, 24, 25, 30, 31, and 36



MSU Real Property

Forest Biomass Innovation Center

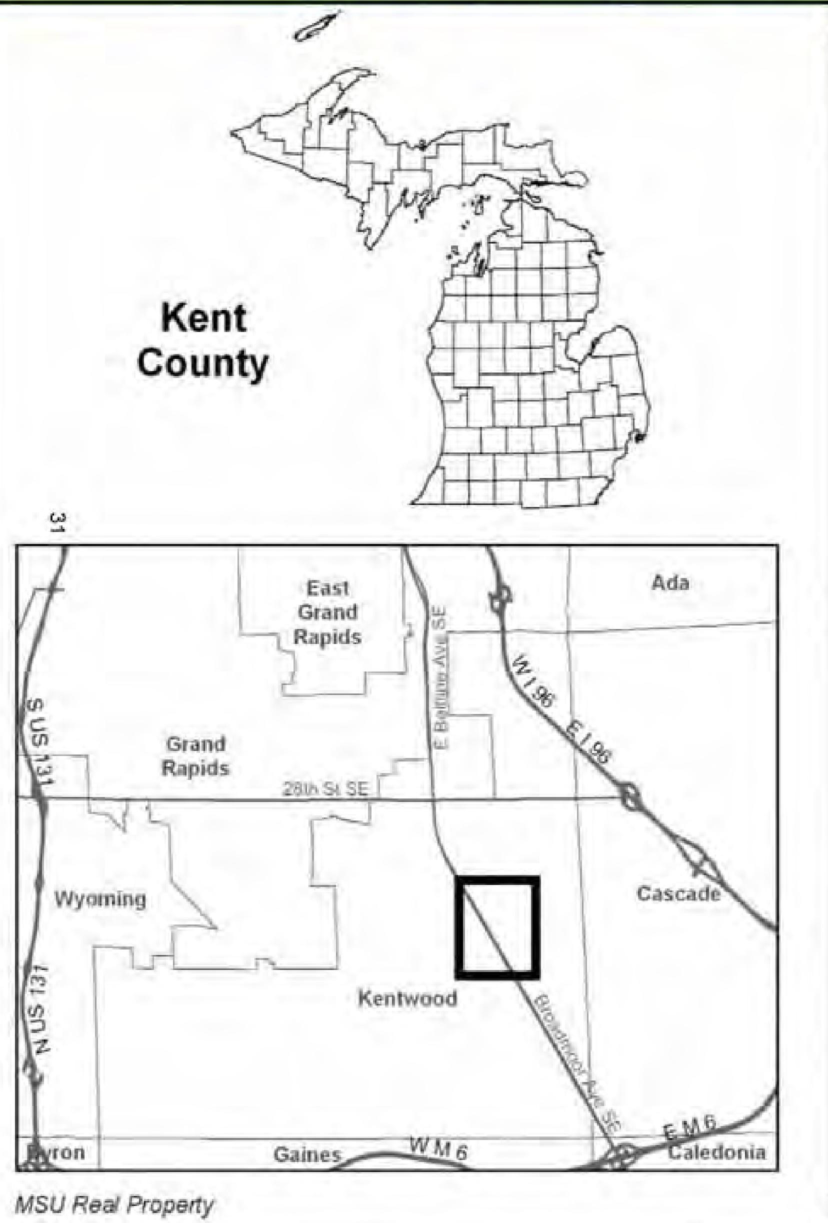
Wells Township, Sections 8, 17, 18, 19, and 20



MSU Real Property

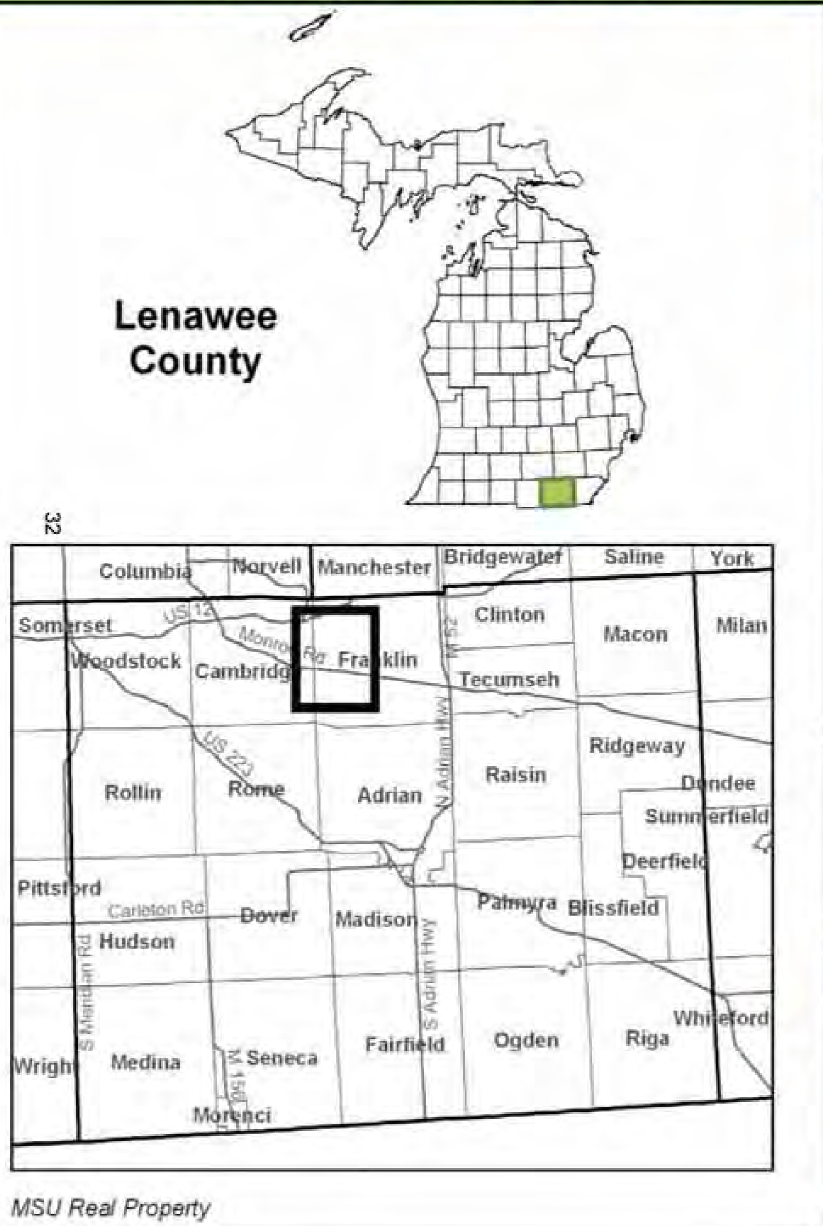
Gantos Property

Kentwood Township, Section 23



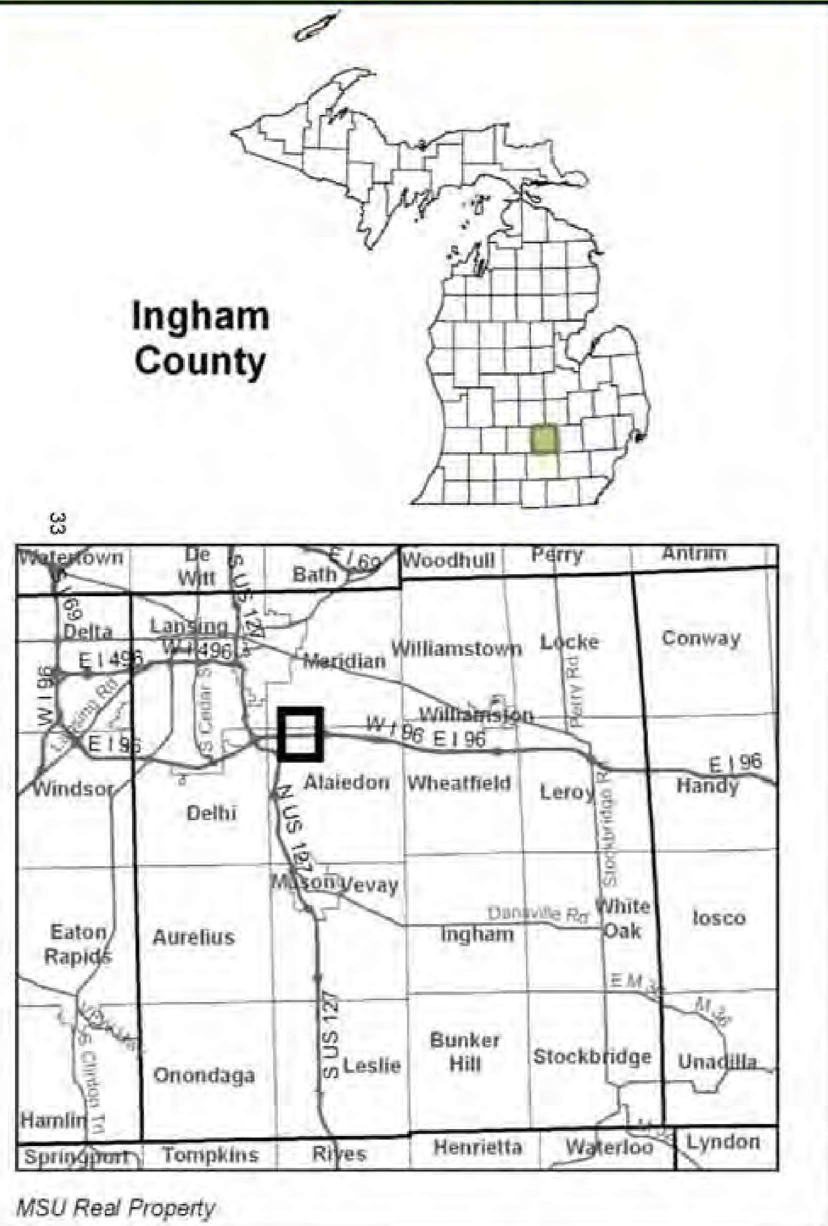
Hidden Lake Gardens

Franklin Township, Sections 17, 18, 19, and 20



Hulett Road Engineering

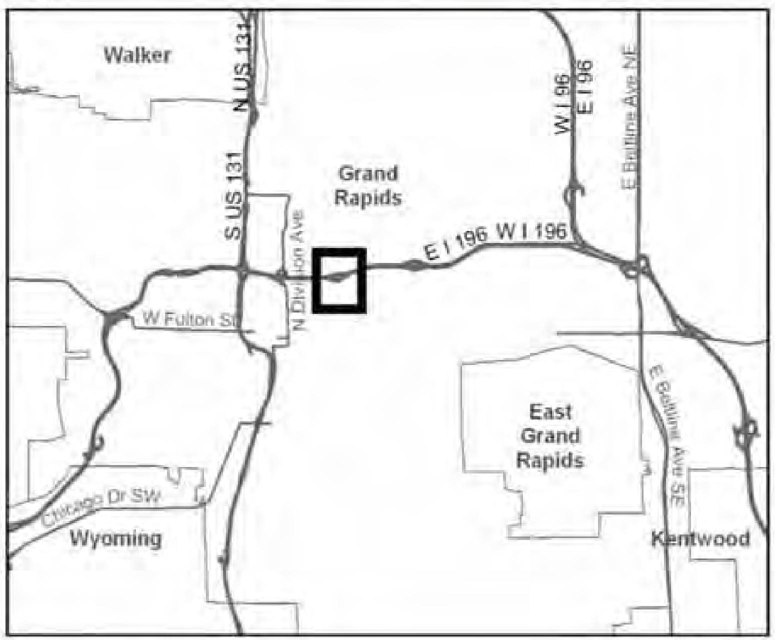
Alaiedon Township, Section 5



College of Human Medicine

Grand Rapids Township, Section 19

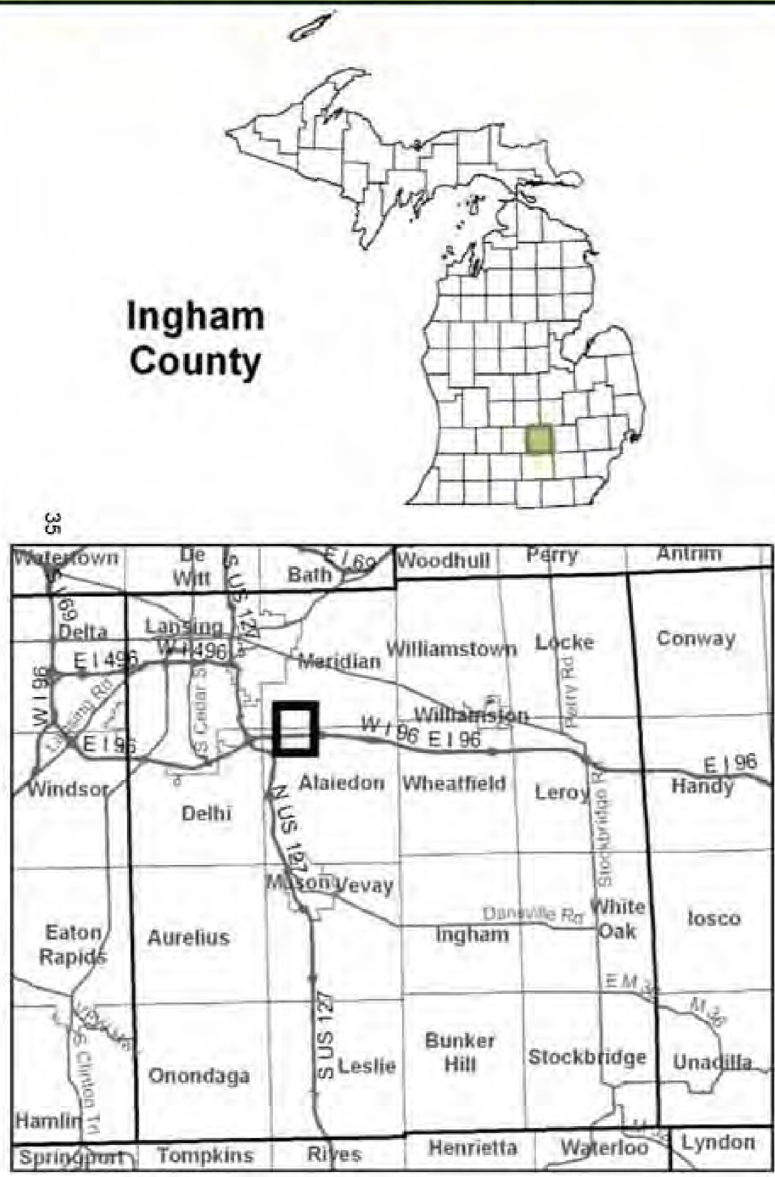
Kent County



MSU Real Property

Jolly Road Engineering and Civil Infrastructure Lab

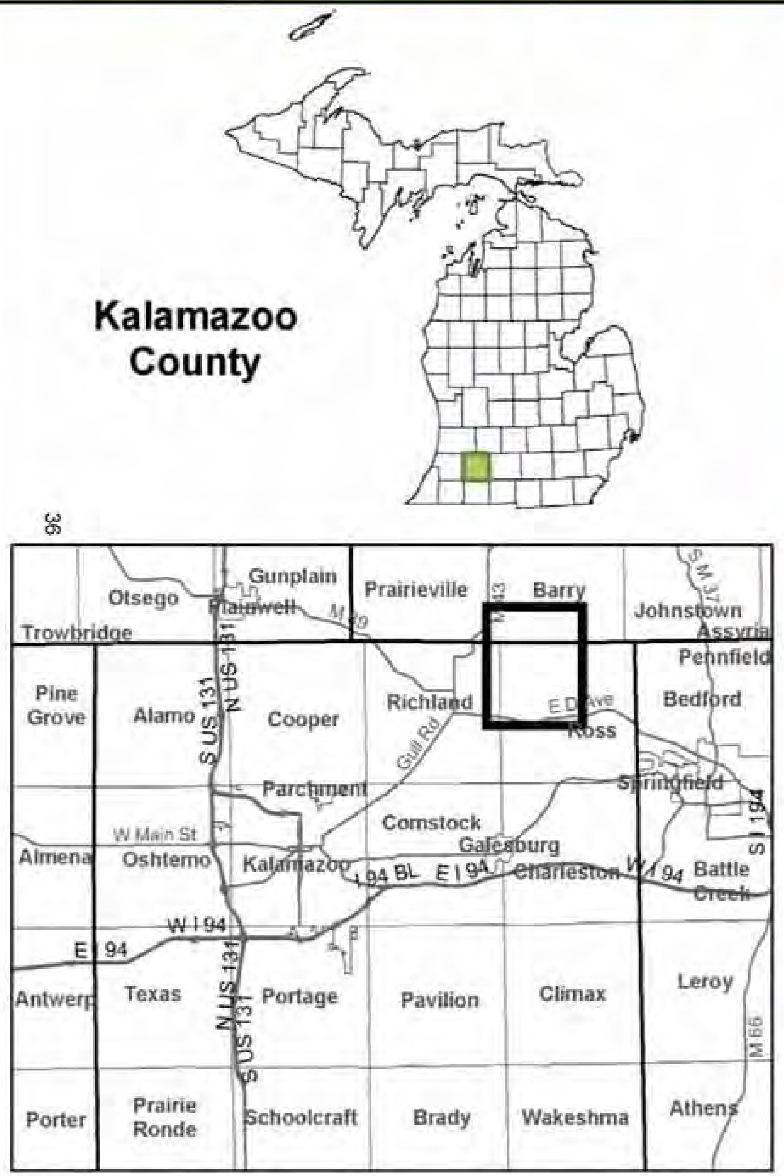
Alaiedon Township, Section 5



MSU Real Property

W.K. Kellogg Biological Station, Bird Sanctuary, and Farm

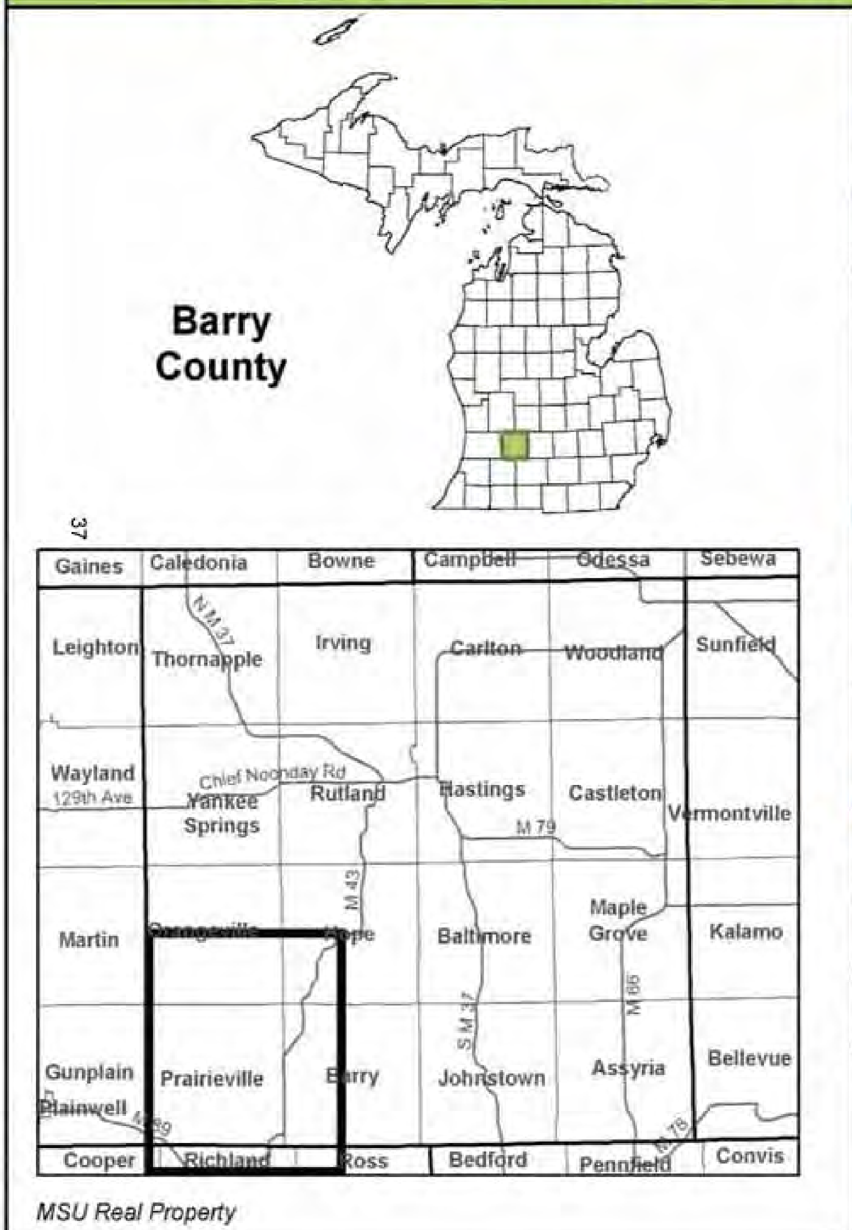
City of South Gull Lake and Ross Township, Sections 4, 5, 6, 8, and 9

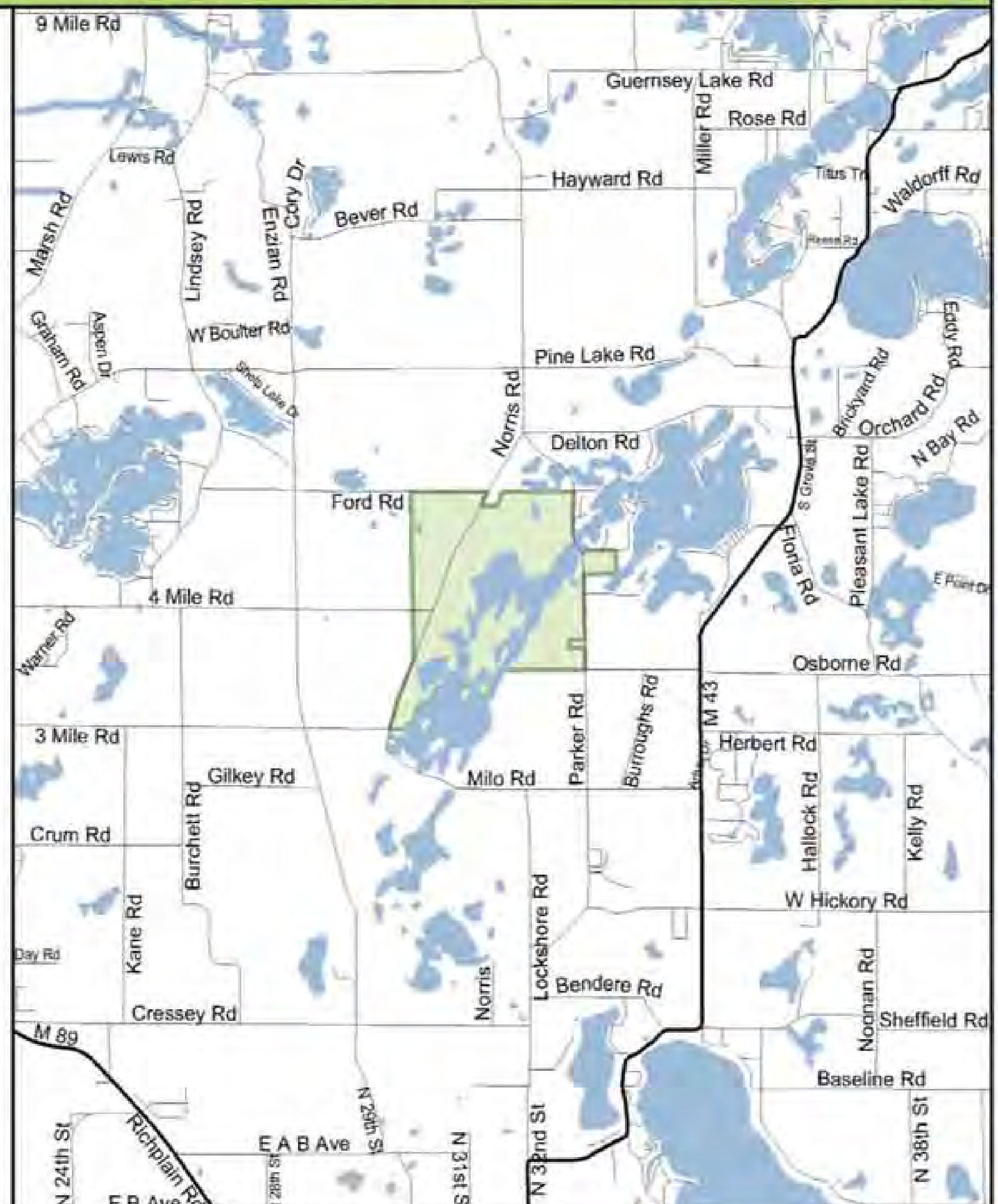


MSU Real Property

W.K. Kellogg Biological Station (Lux Arbor Reserve)

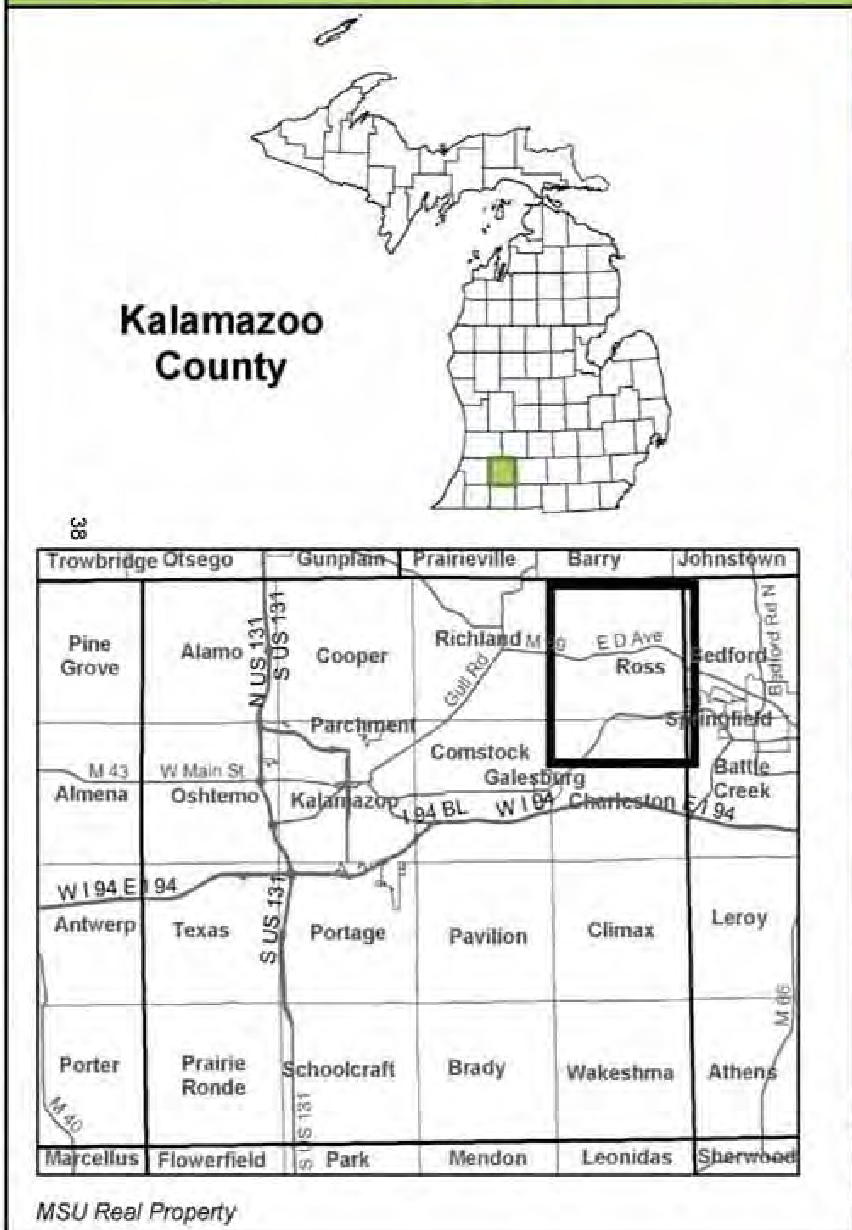
Prairieville Township, Sections 10, 11, 14, and 15





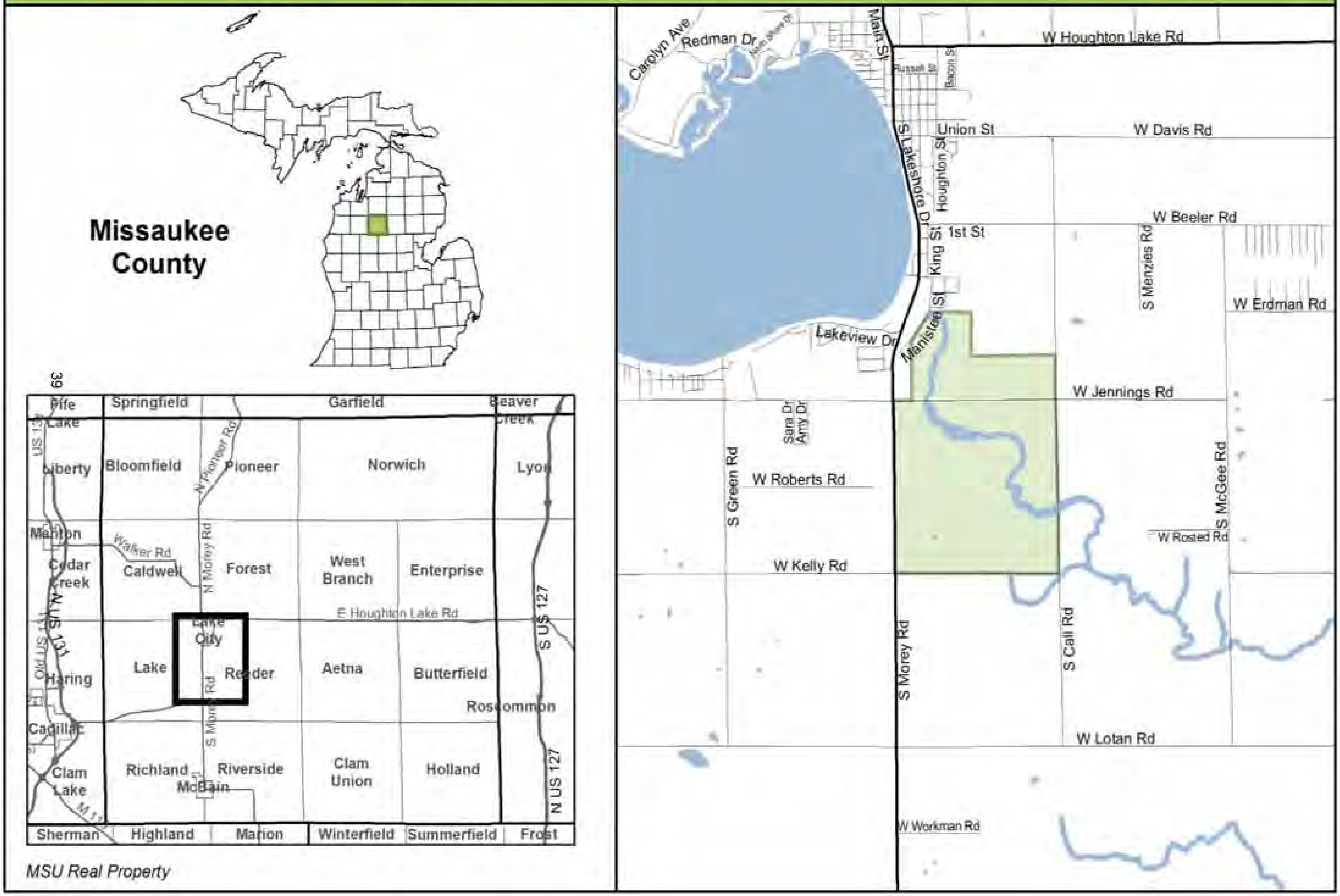
W.K. Kellogg Experimental Forest

Ross Township, Sections 21, 22, 27, and 28



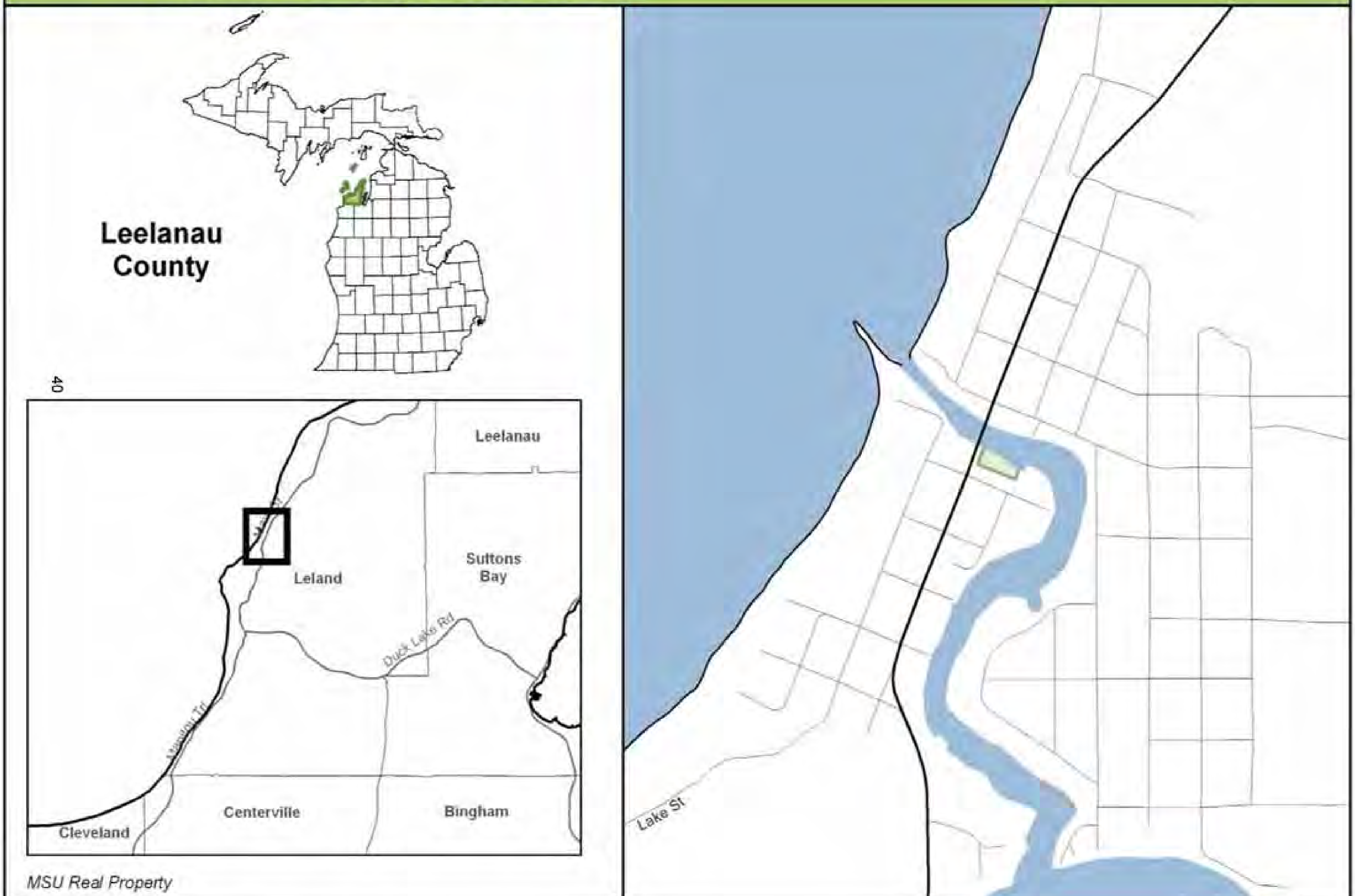
Lake City Research Center

Reeder Township, Sections 7 and 18



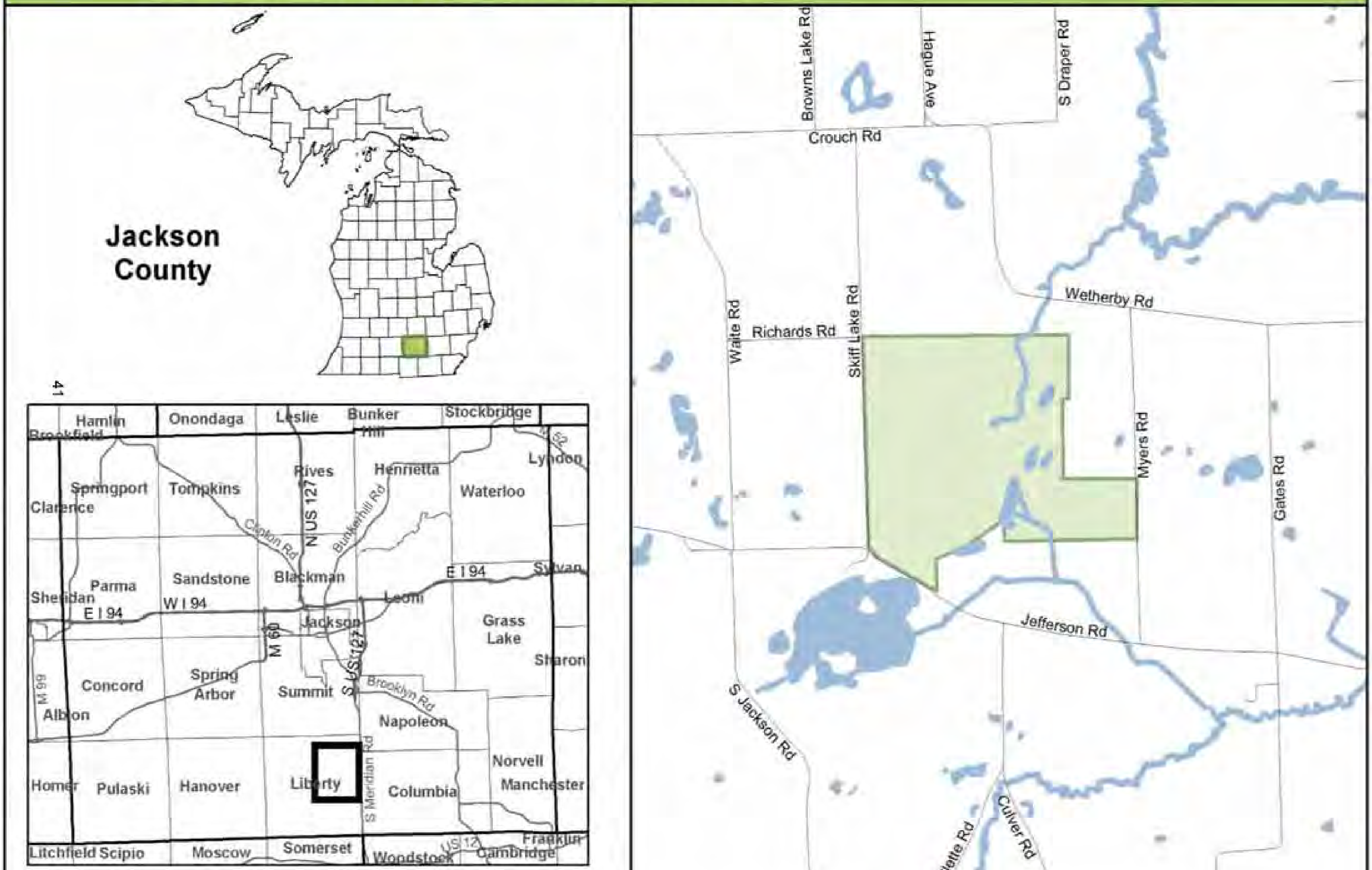
Leland Property

Leland Township, Section 9



MacCready Forest and Wildlife Reserve

Liberty Township, Sections 11 and 14



MSU Real Property

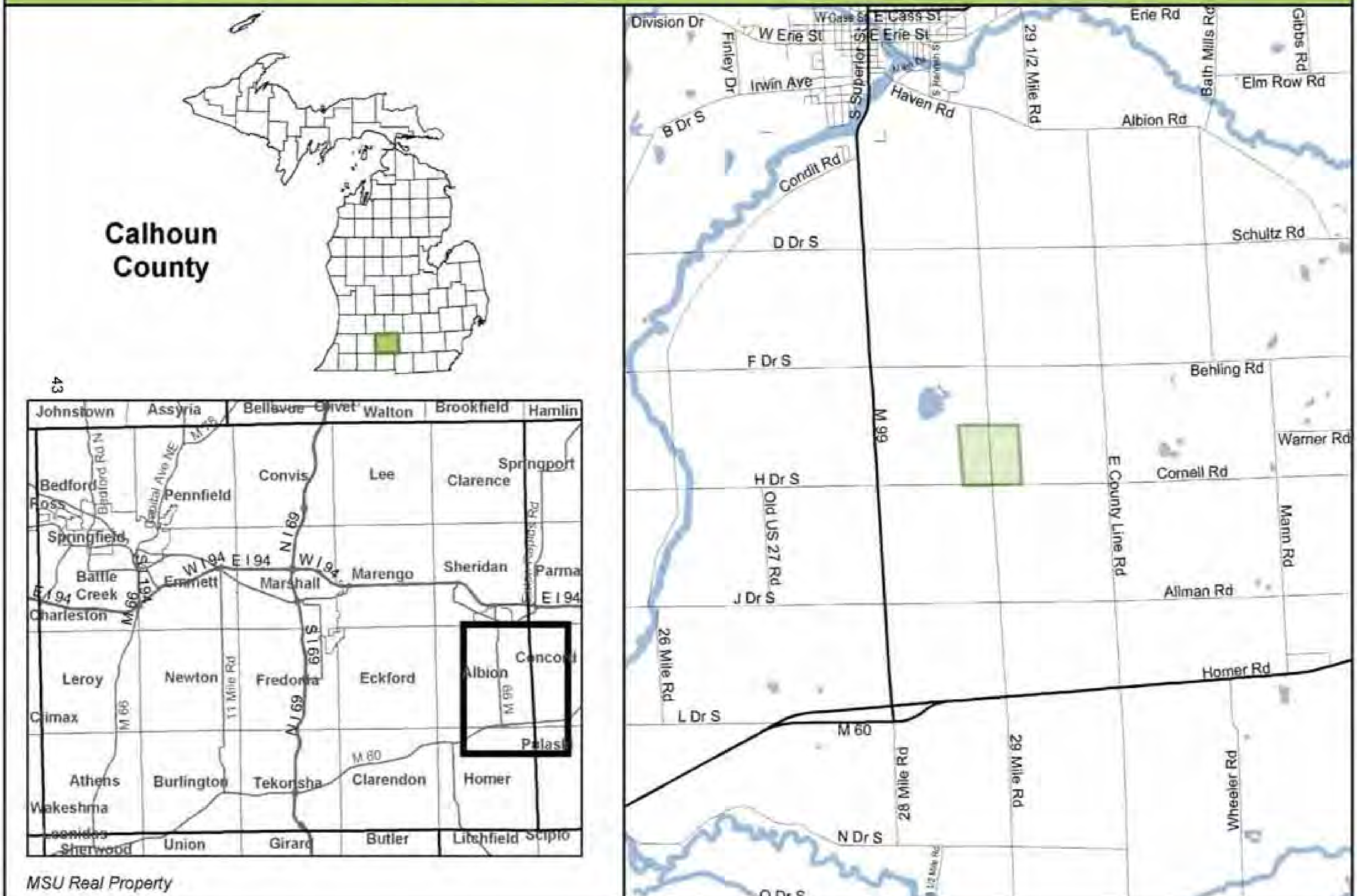
Management Education Center, Troy

City of Troy, Section 9

MSU Real Property

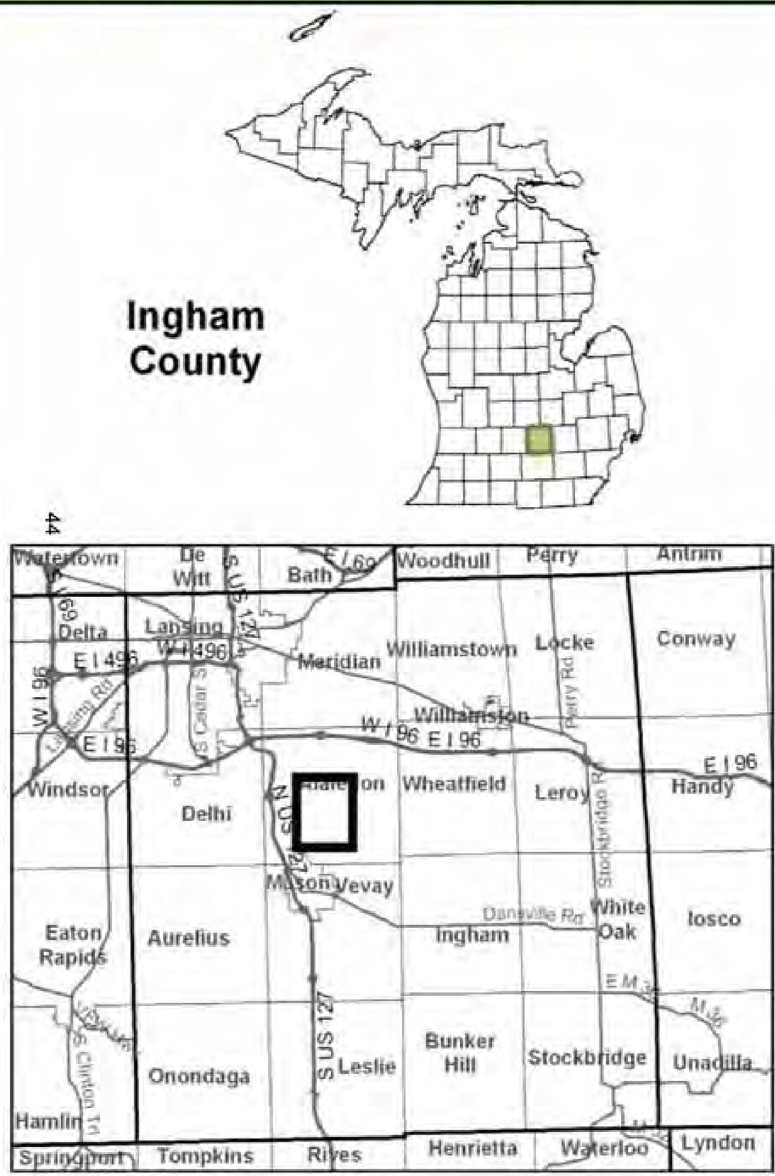
Martin Property (Rose-Dell Seed Orchard)

Albion Township, Sections 23 and 24



Mason Research Farm

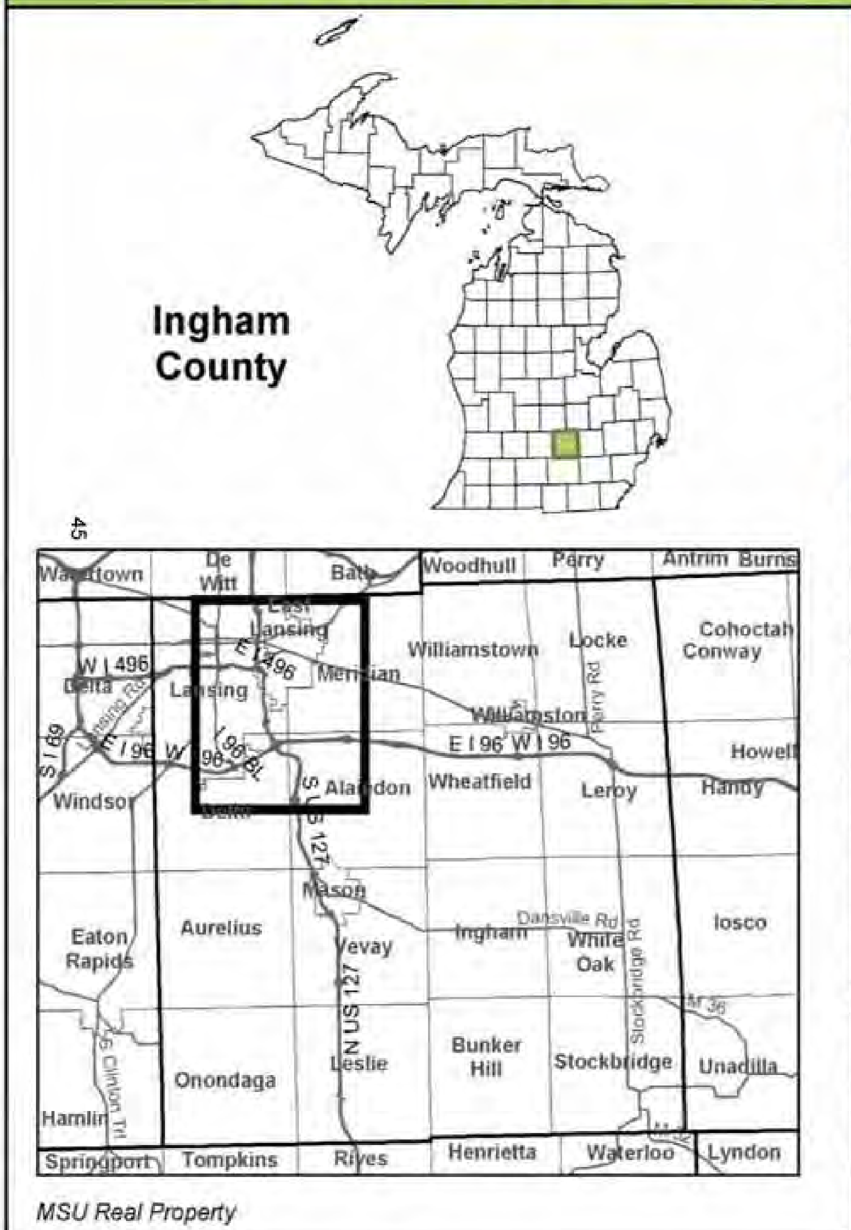
Alaiedon Township, Section 21

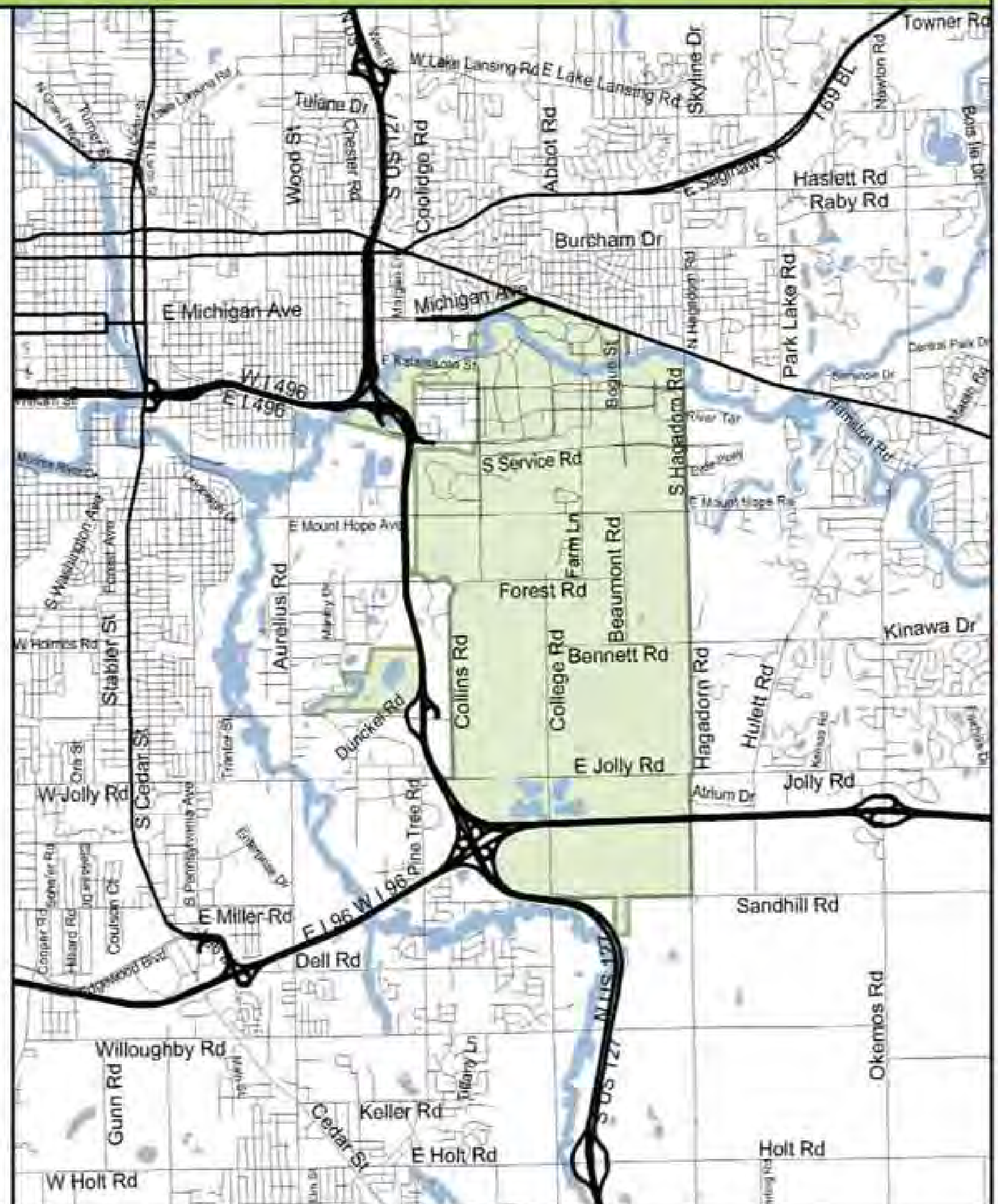


MSU Real Property

Michigan State University Campus, East Lansing

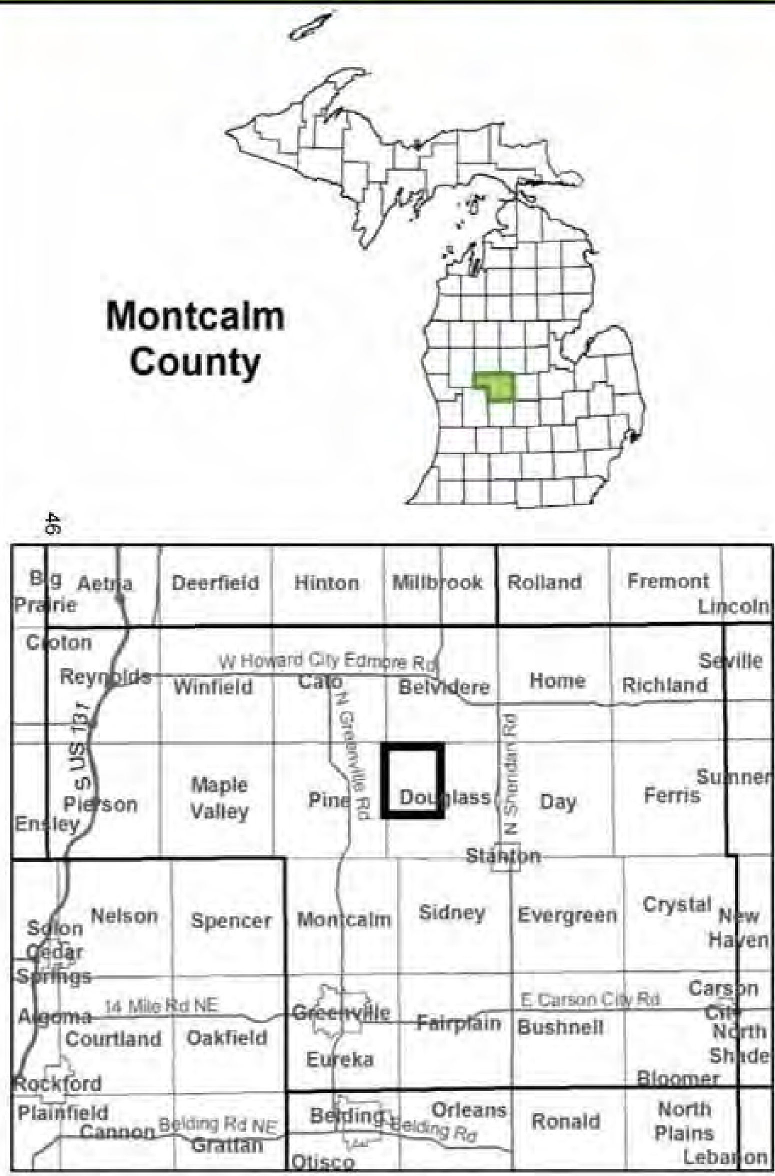
Alaiedon, Delhi, Lansing, and Meridian Townships





Montcalm Research Center

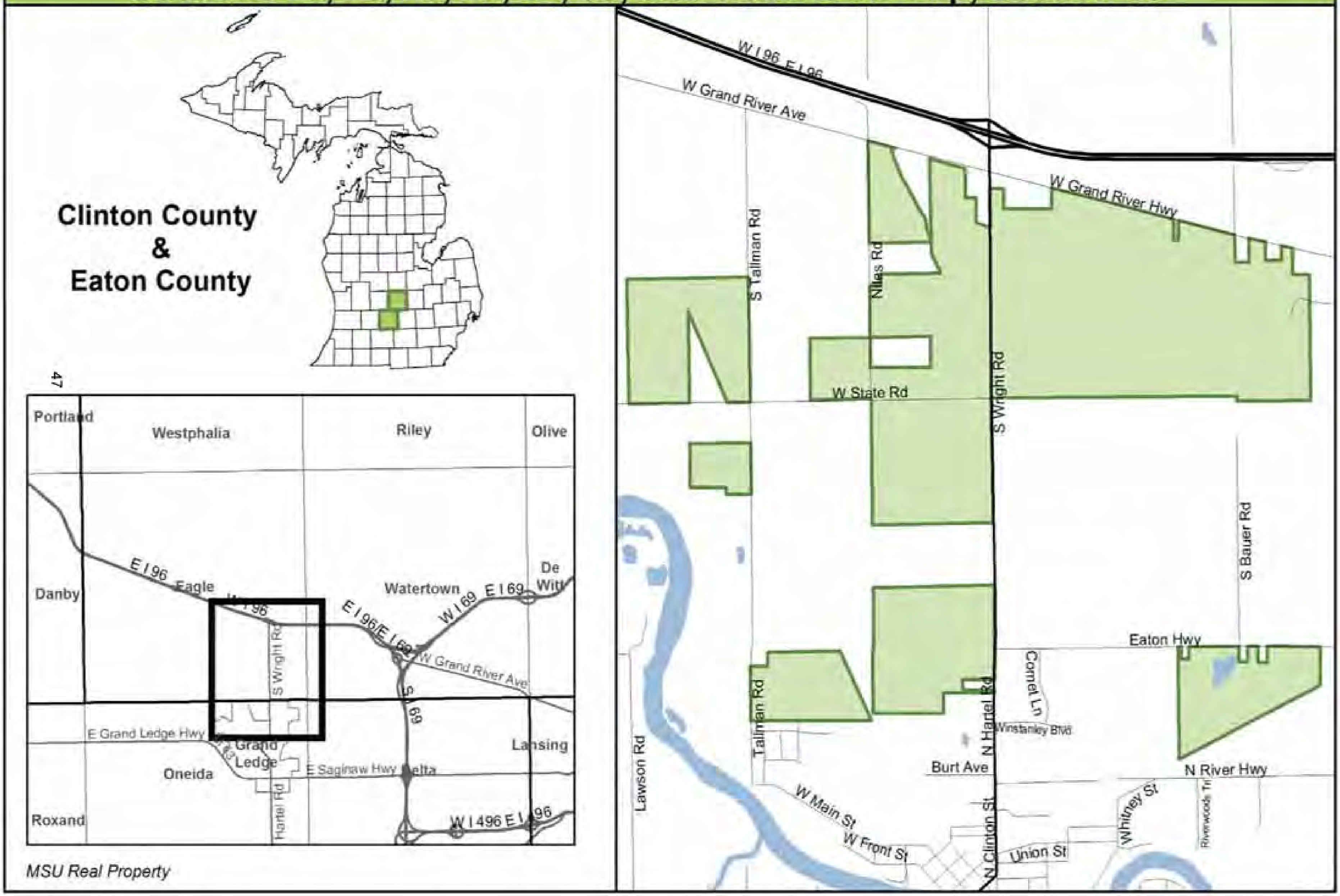
Douglass Township, Sections 8 and 17



MSU Real Property

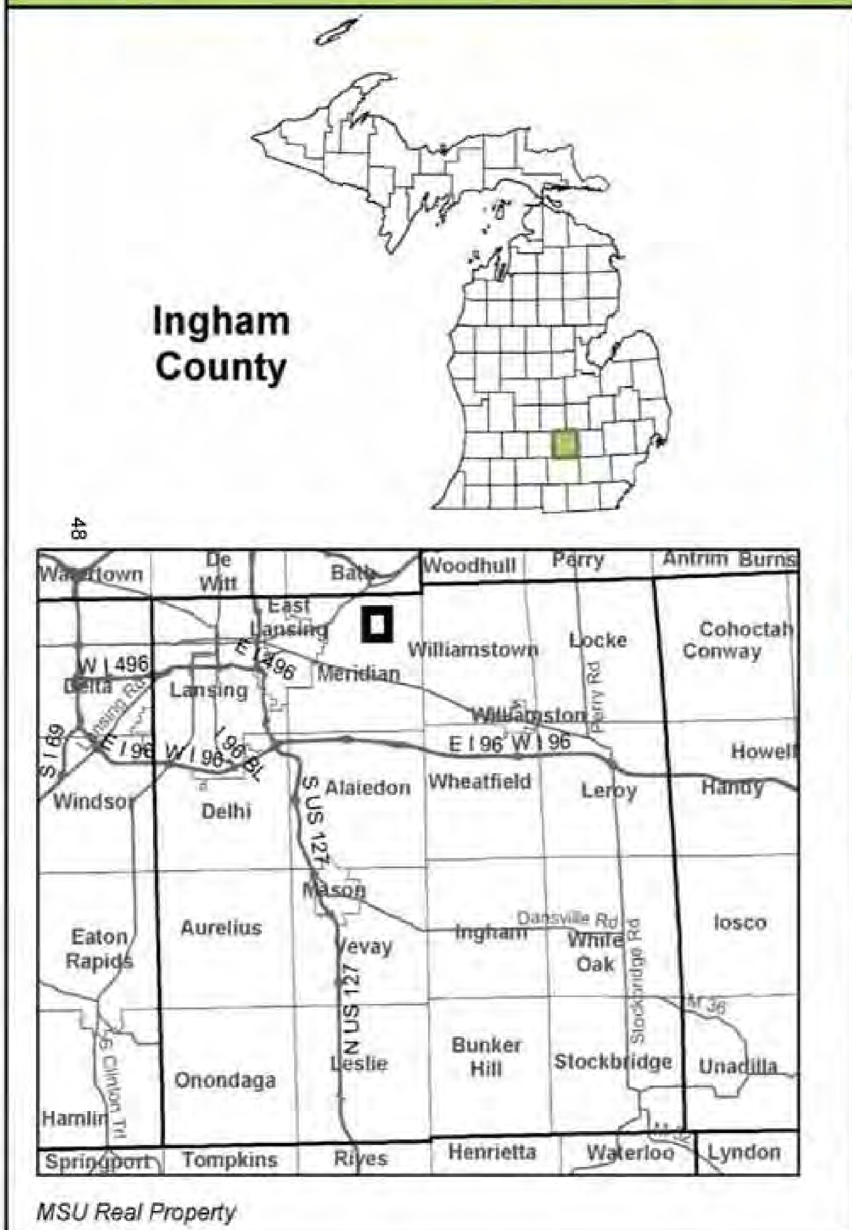
Morris Property

Oneida Twp, Sections 1 and 2; Delta Twp, Section 6; Eagle Twp, Sections 23, 25, 26, 27, 34, 35; and Watertown Twp, Section 30



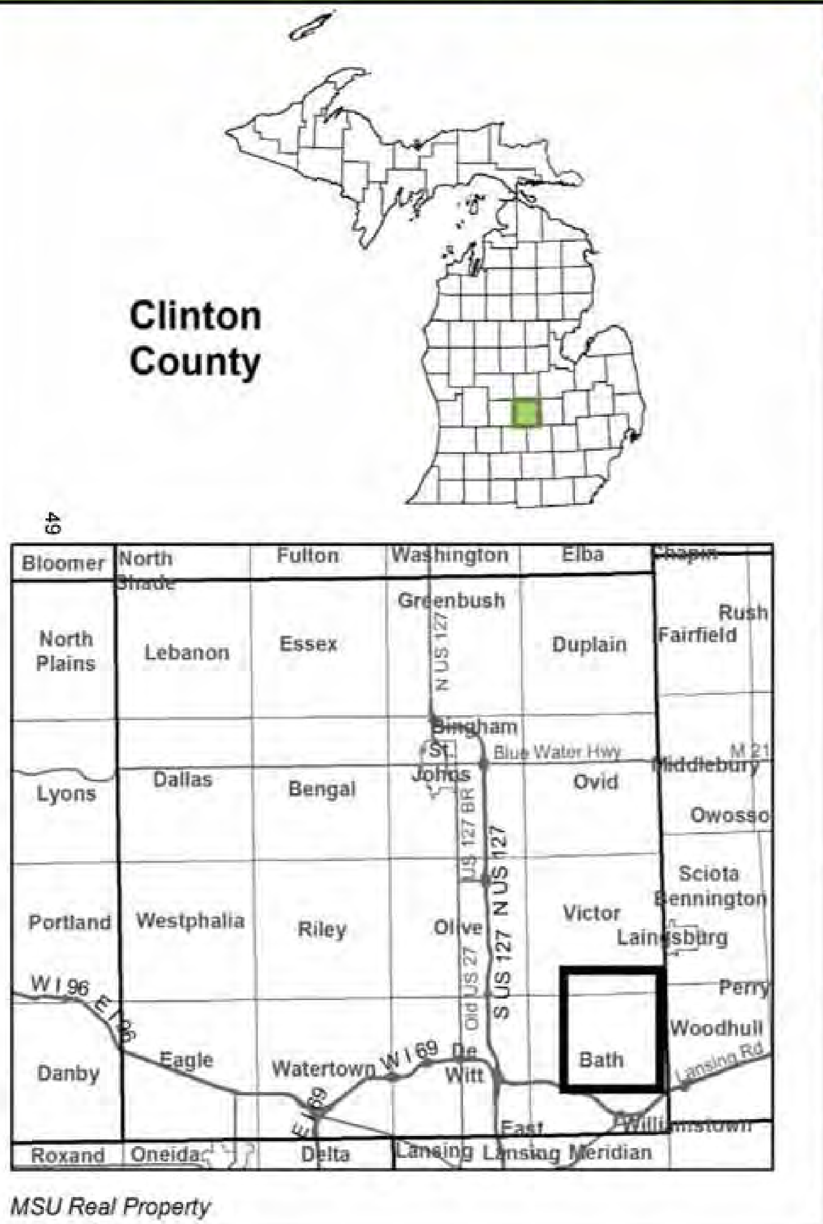
MSU Sailing Club

Meridian Township, Section 11



Muck Soils Research Center

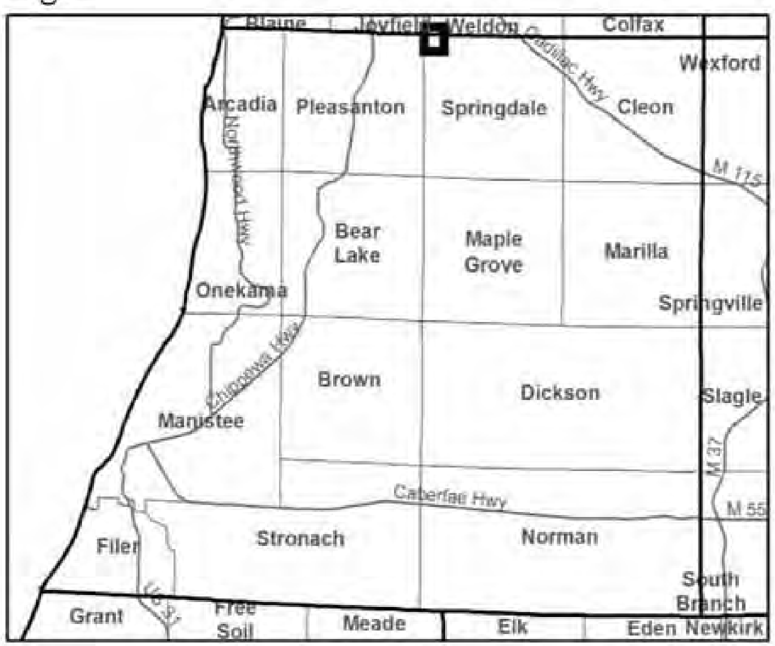
Bath Township, Sections 4, 5, 11, 12, 13, and 14



Rau Property

Springdale Township, Section 6

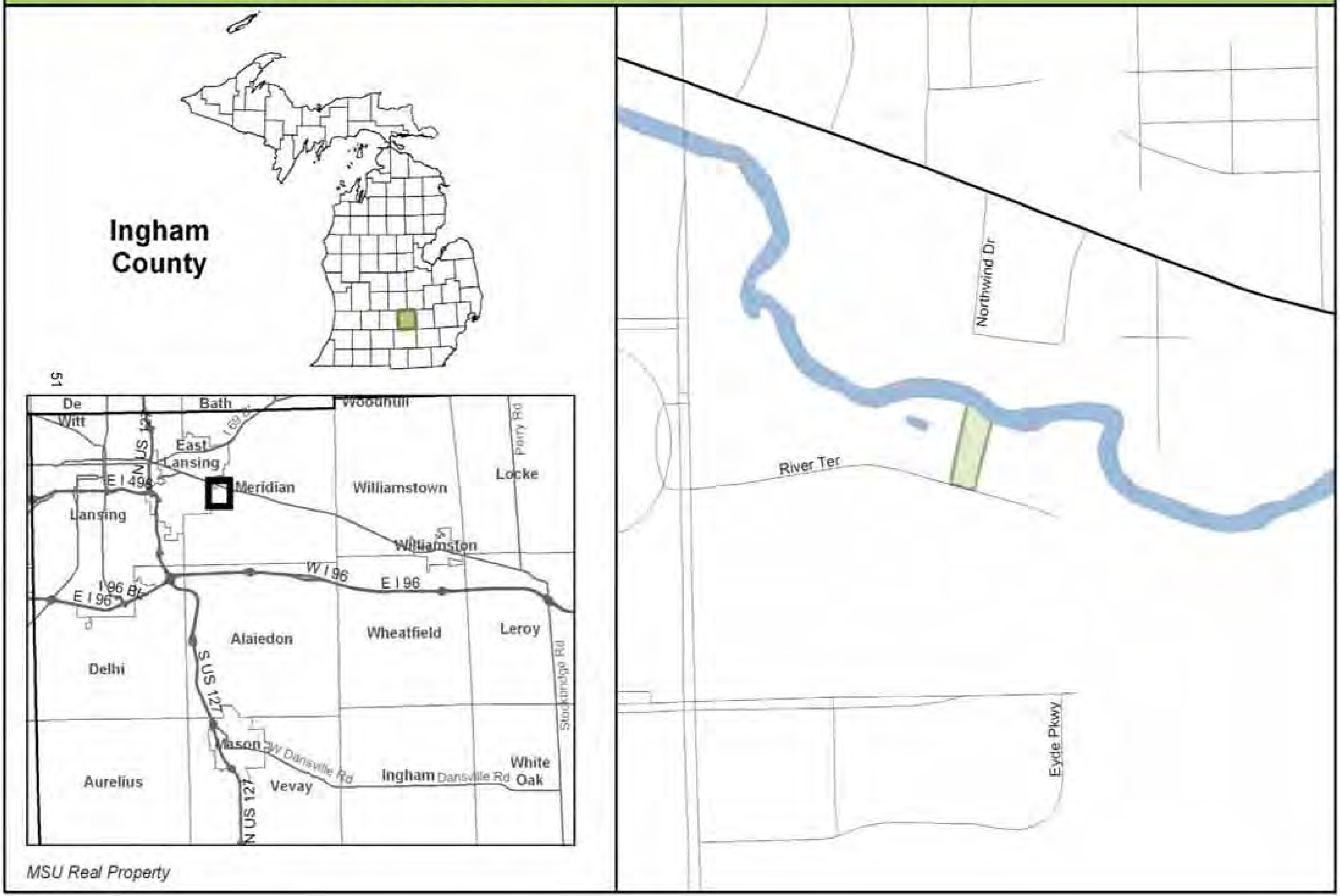
Manistee County



MSU Real Property

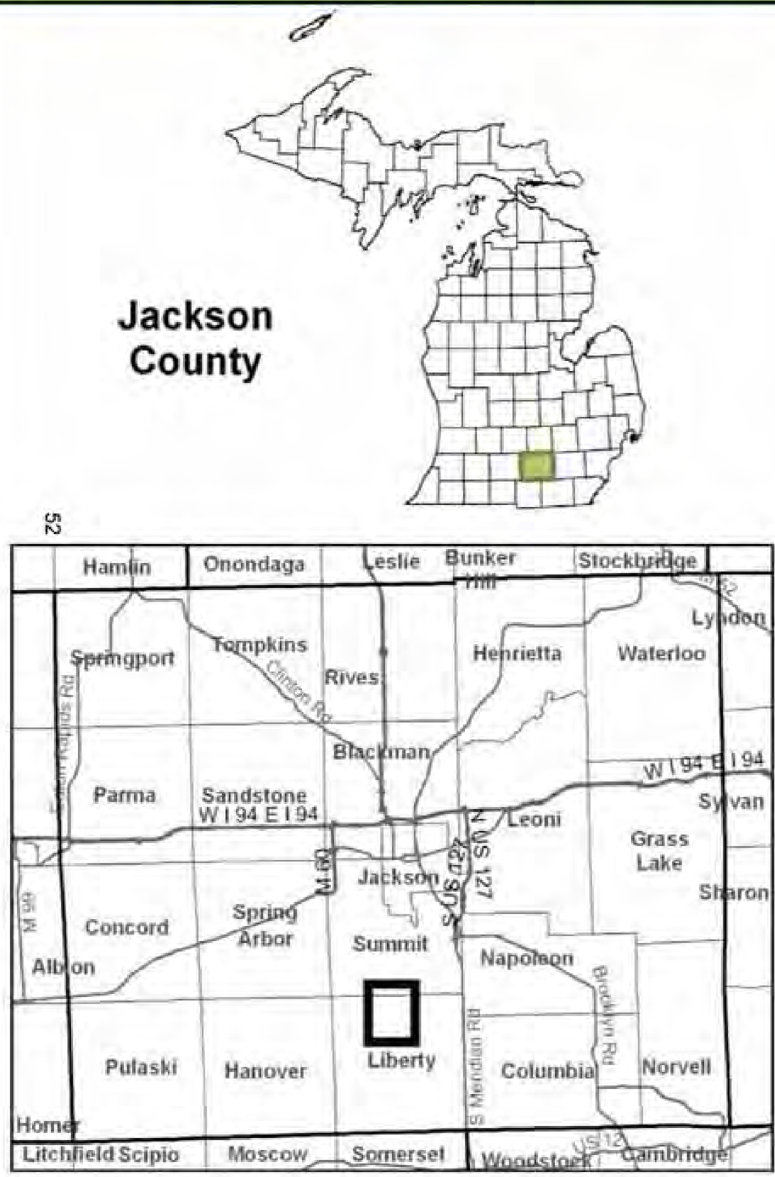
River Terrace Property

Meridian Township, Section 20



Rogers Reserve

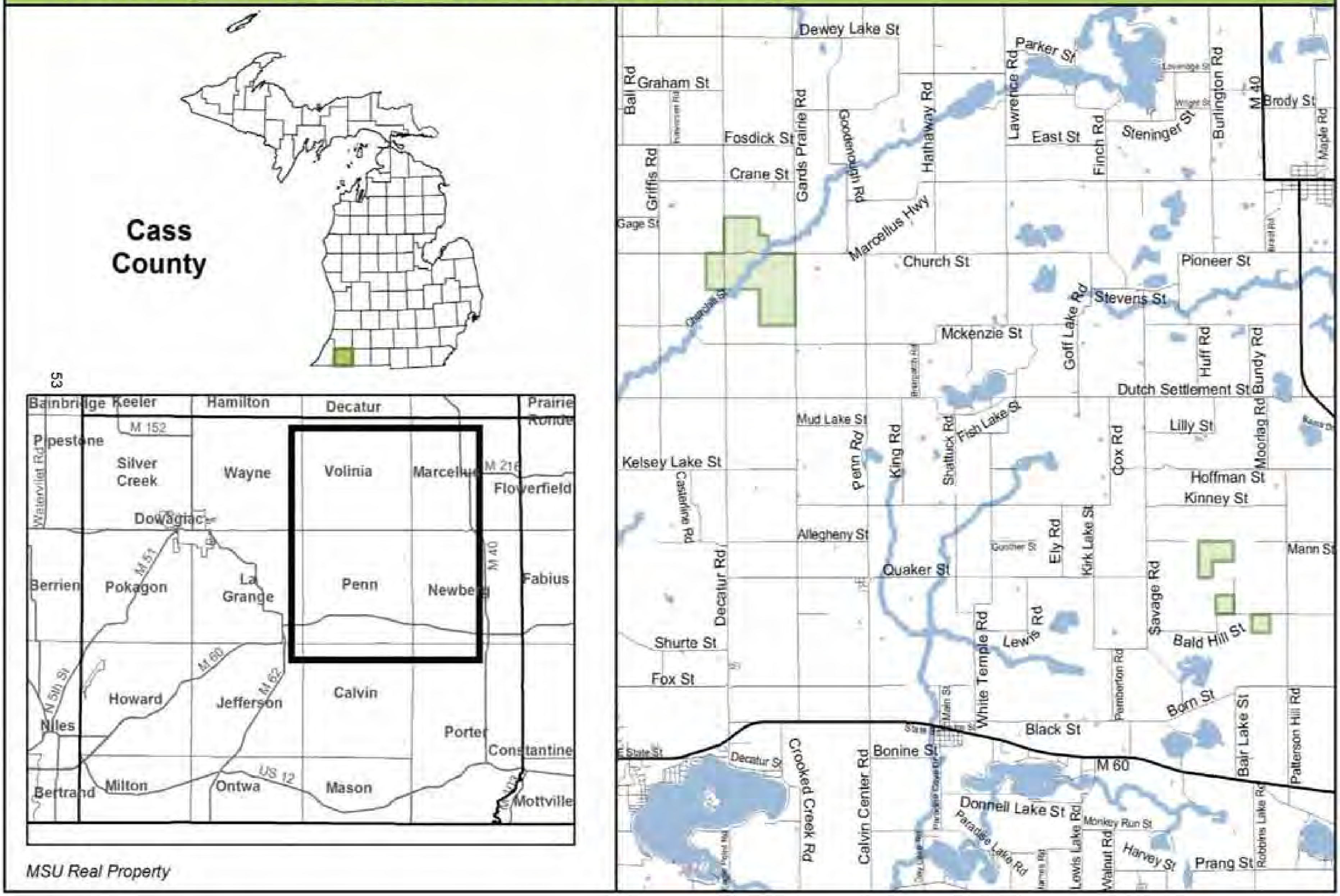
Liberty Township, Section 4



MSU Real Property

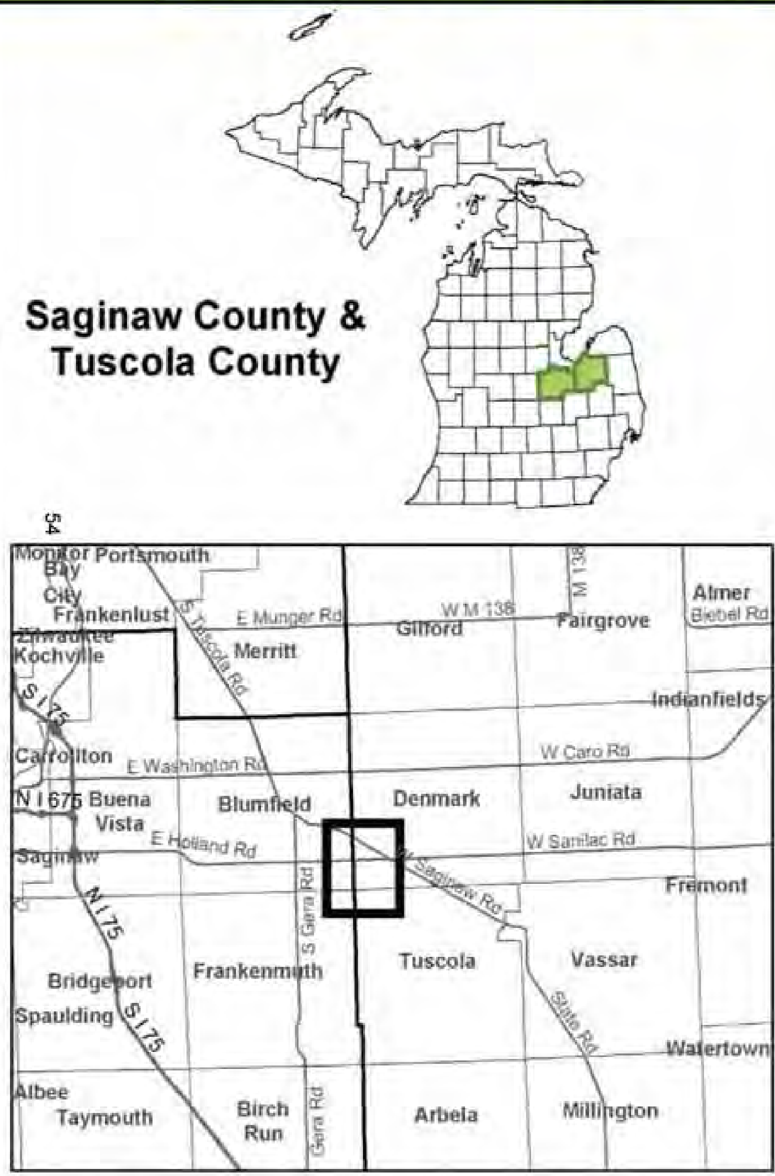
Russ Forest

Cass County, Volinia Township, Sections 20, 29 and 30; Newberg Township, Sections 16, 17, and 21



Saginaw Valley Research and Extension Center

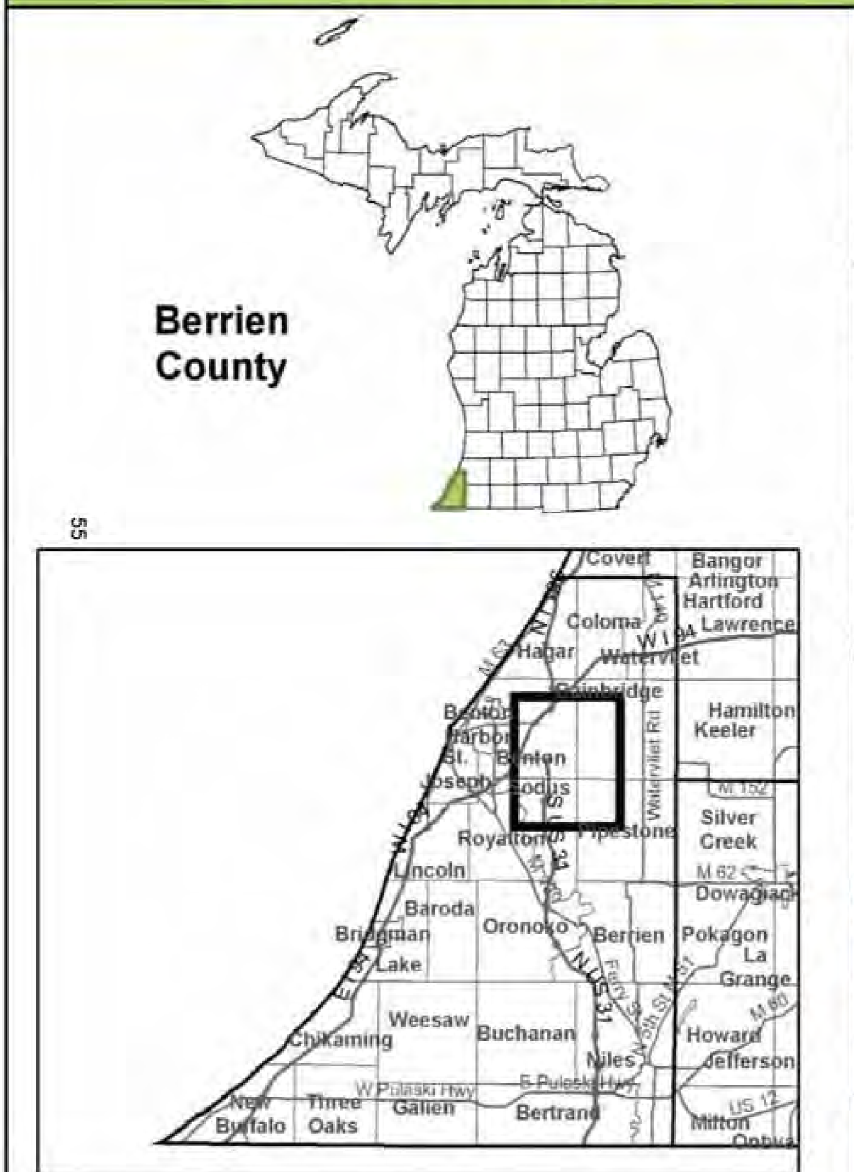
Blumfield Township, Section 25; Denmark Township, Section 31



MSU Real Property

Southwest Michigan Research and Extension Center

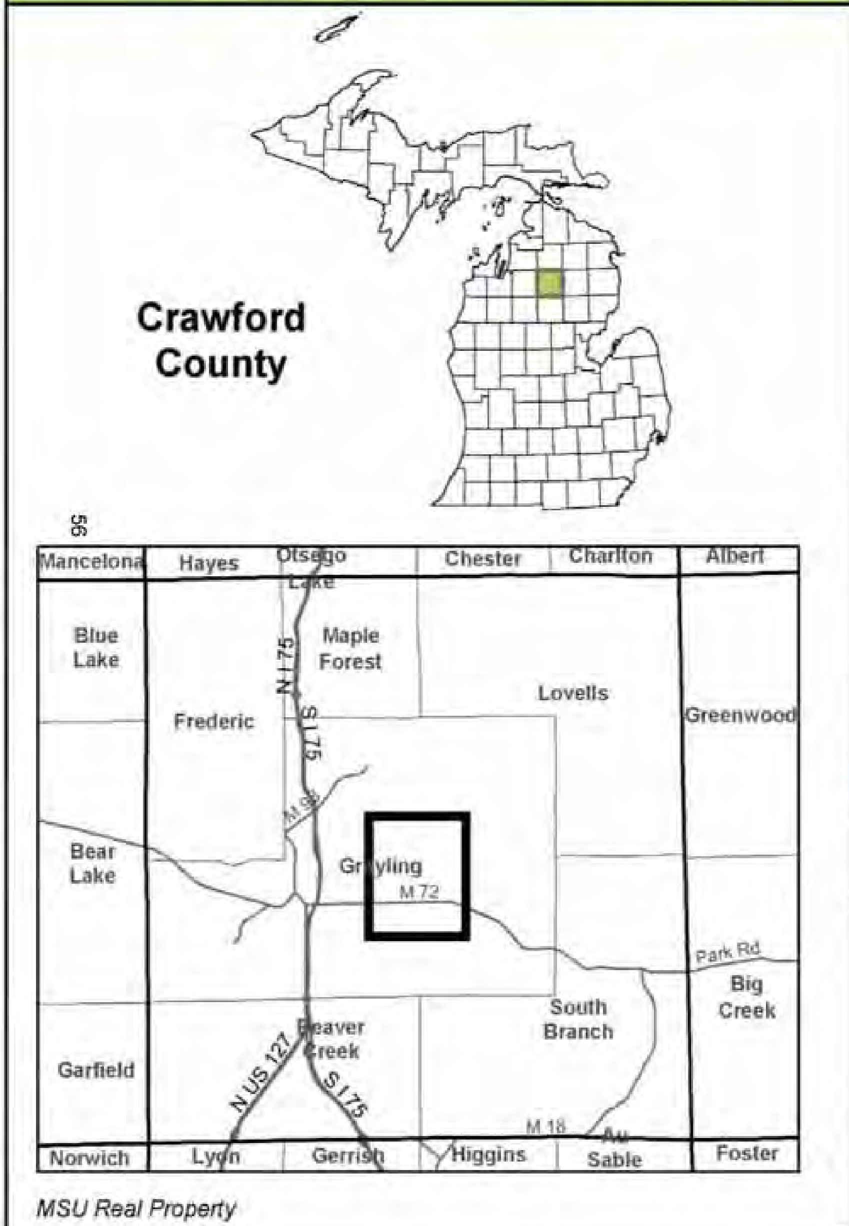
Benton Township, Sections 25 and 36

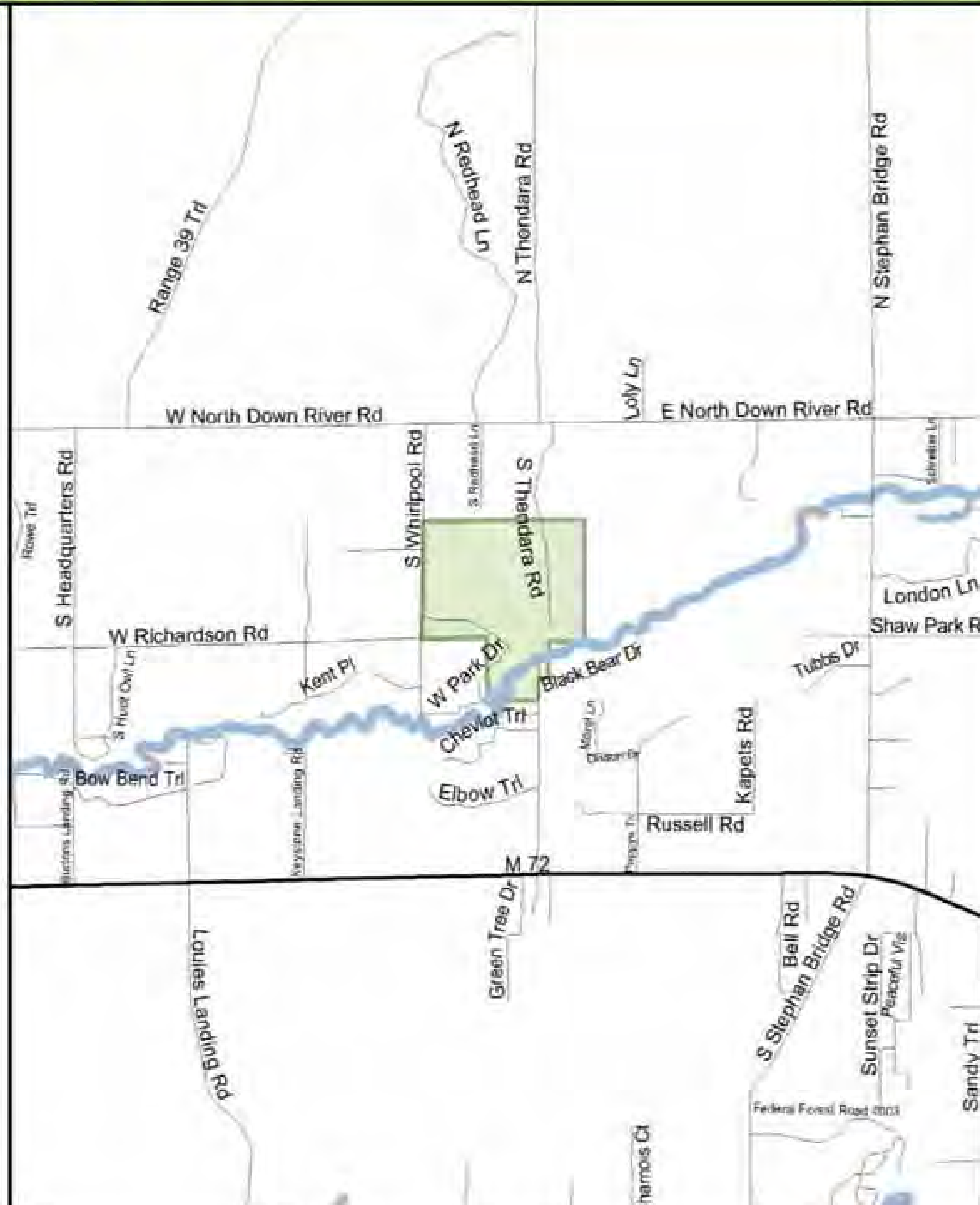


MSU Real Property

Stranahan-Bell Property (Wa Wa Sum)

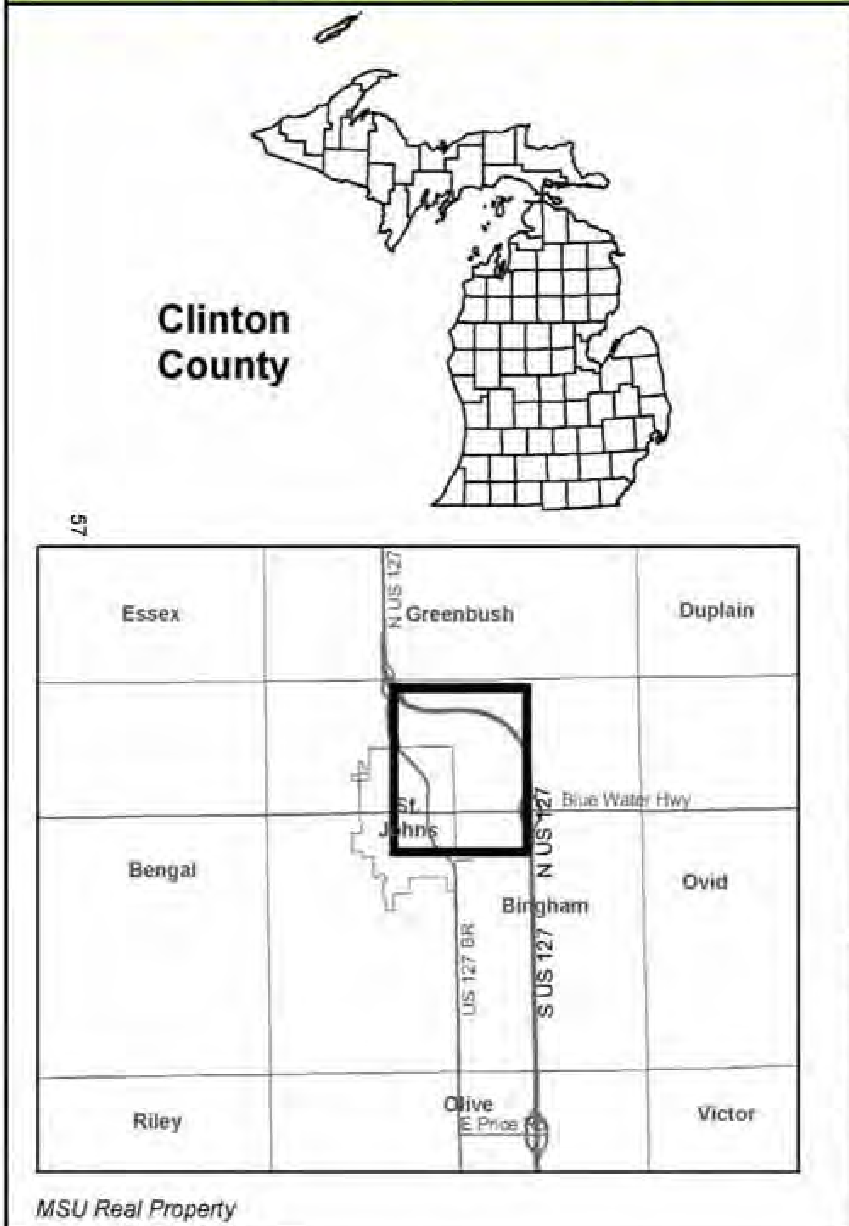
Grayling Township, Sections 1, 6, and 12



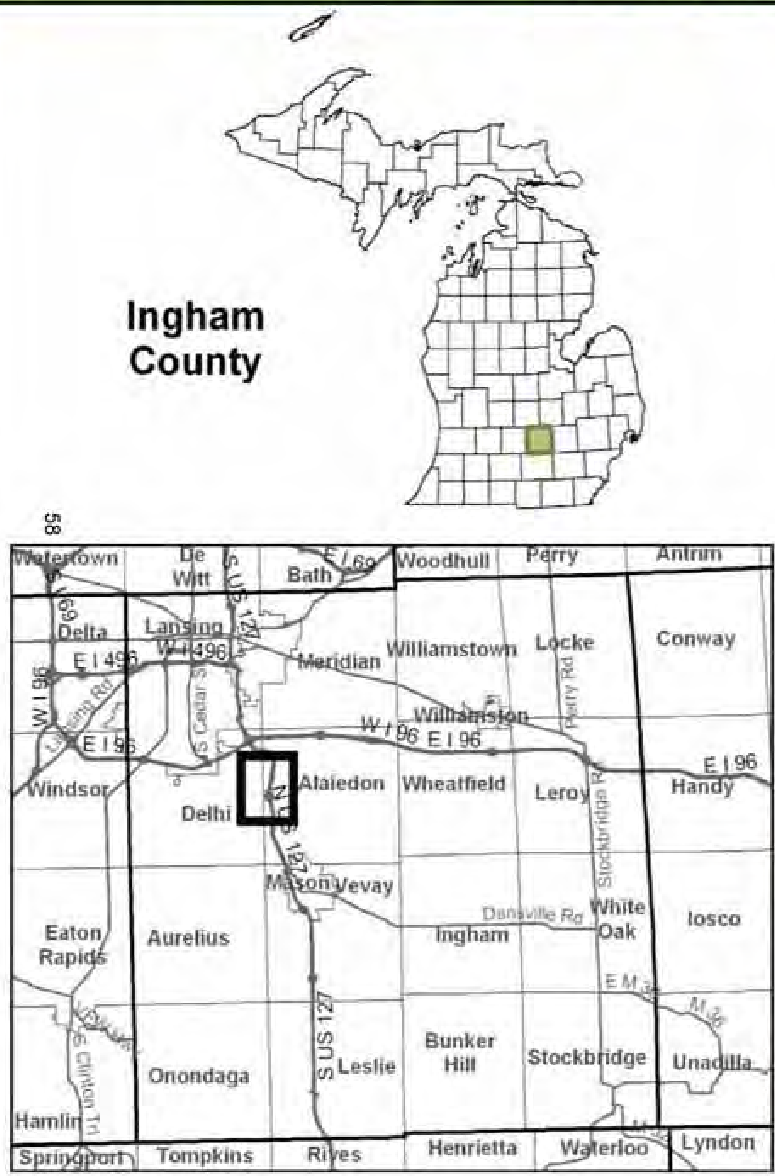


Stuckman Property

Bingham Township, Section 10



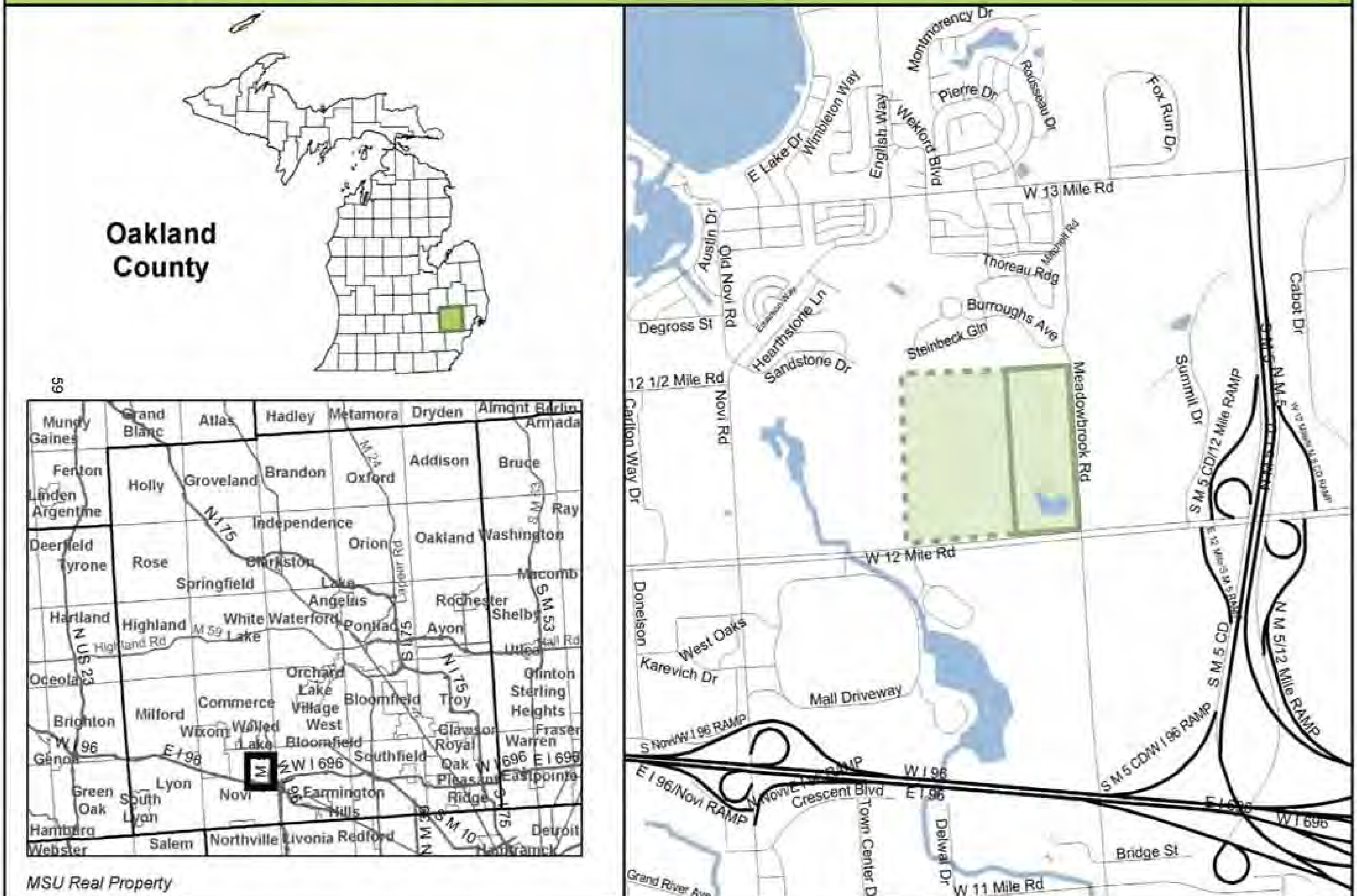
Sycamore Creek Property
Alaiedon Township, Section 18



MSU Real Property

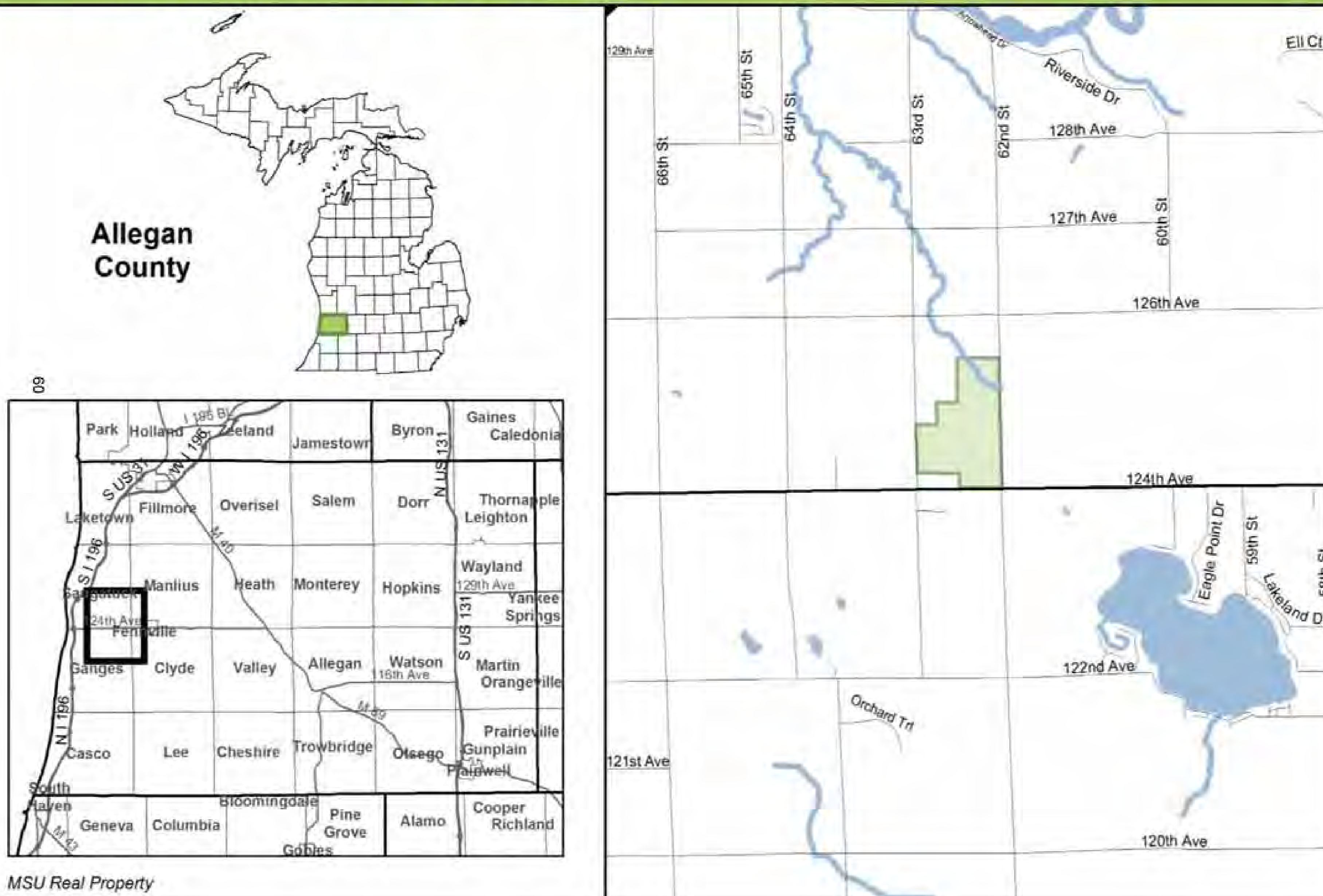
Tollgate Education Center and Americana Foundation Property

City of Novi, Section 11



Trevor Nichols Research Center

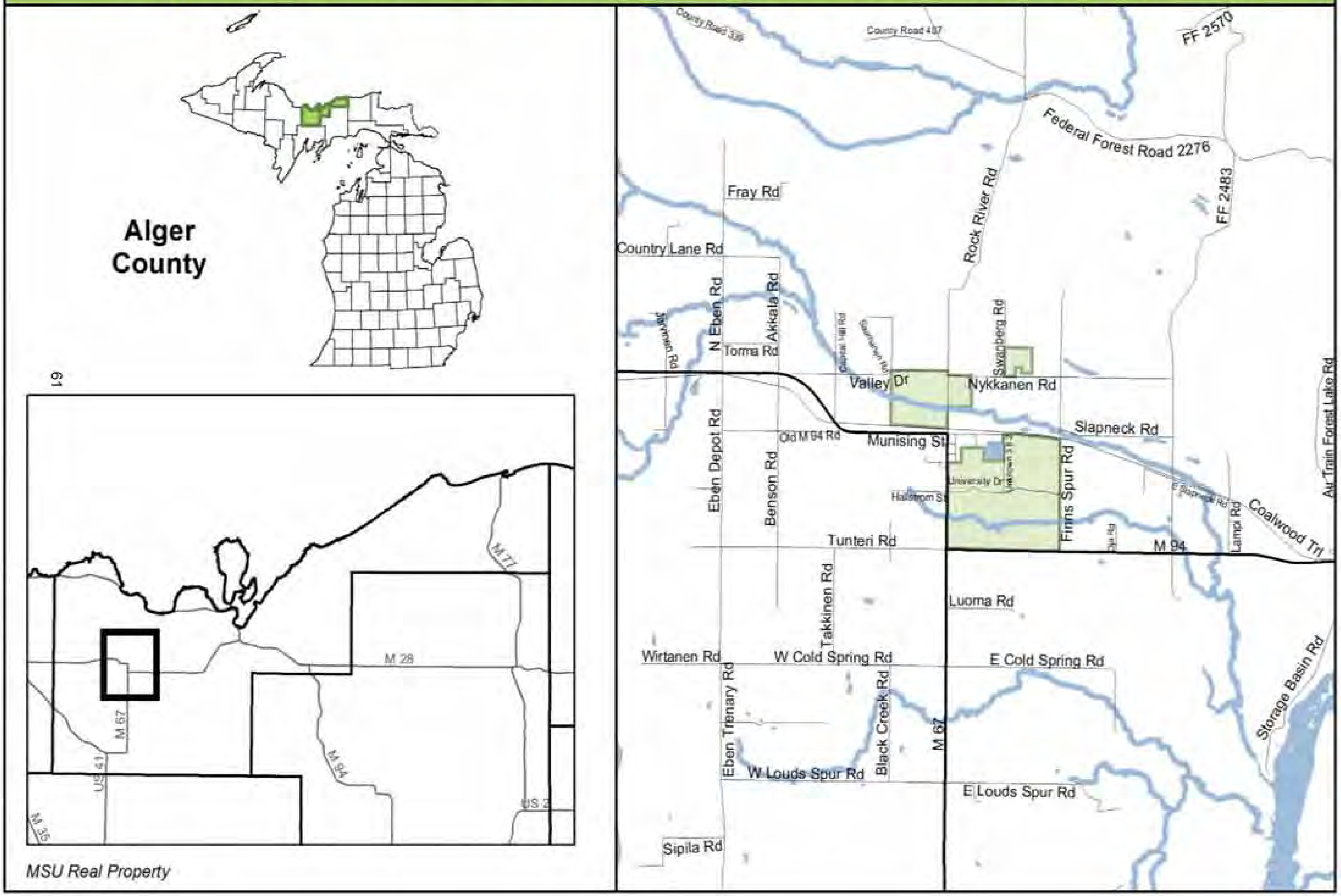
Saugatuck Township, Section 35



MSU Real Property

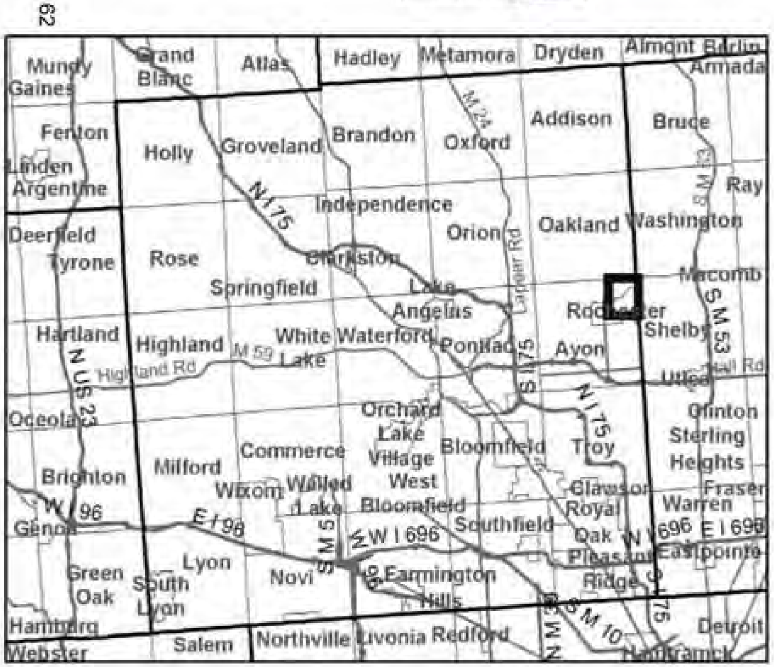
Upper Peninsula Research Center

City of Chatham and Rock River Township, Sections 24, 25, 27, 28, and 34



Van Hoosen Property

Avon Township, Section 1



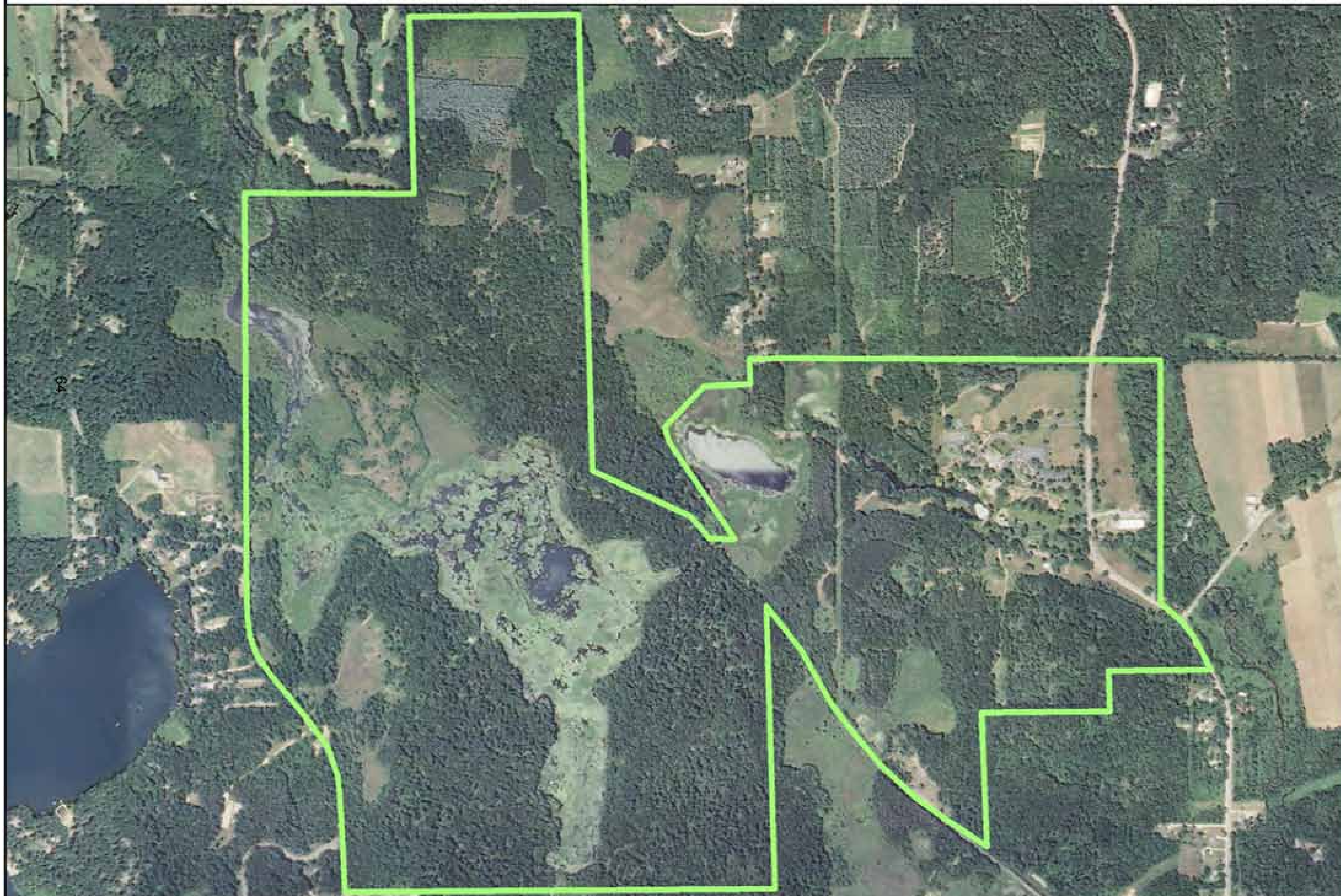
MSU Real Property


BioEconomy Research and Development Center
Ottawa County, Holland Township, Section 19
Image Year: 2009
63

Brook Lodge

Kalamazoo County, Ross Township, Section 21, 27, 28, and 29

Image Year: 2009



Clarksville Research Center

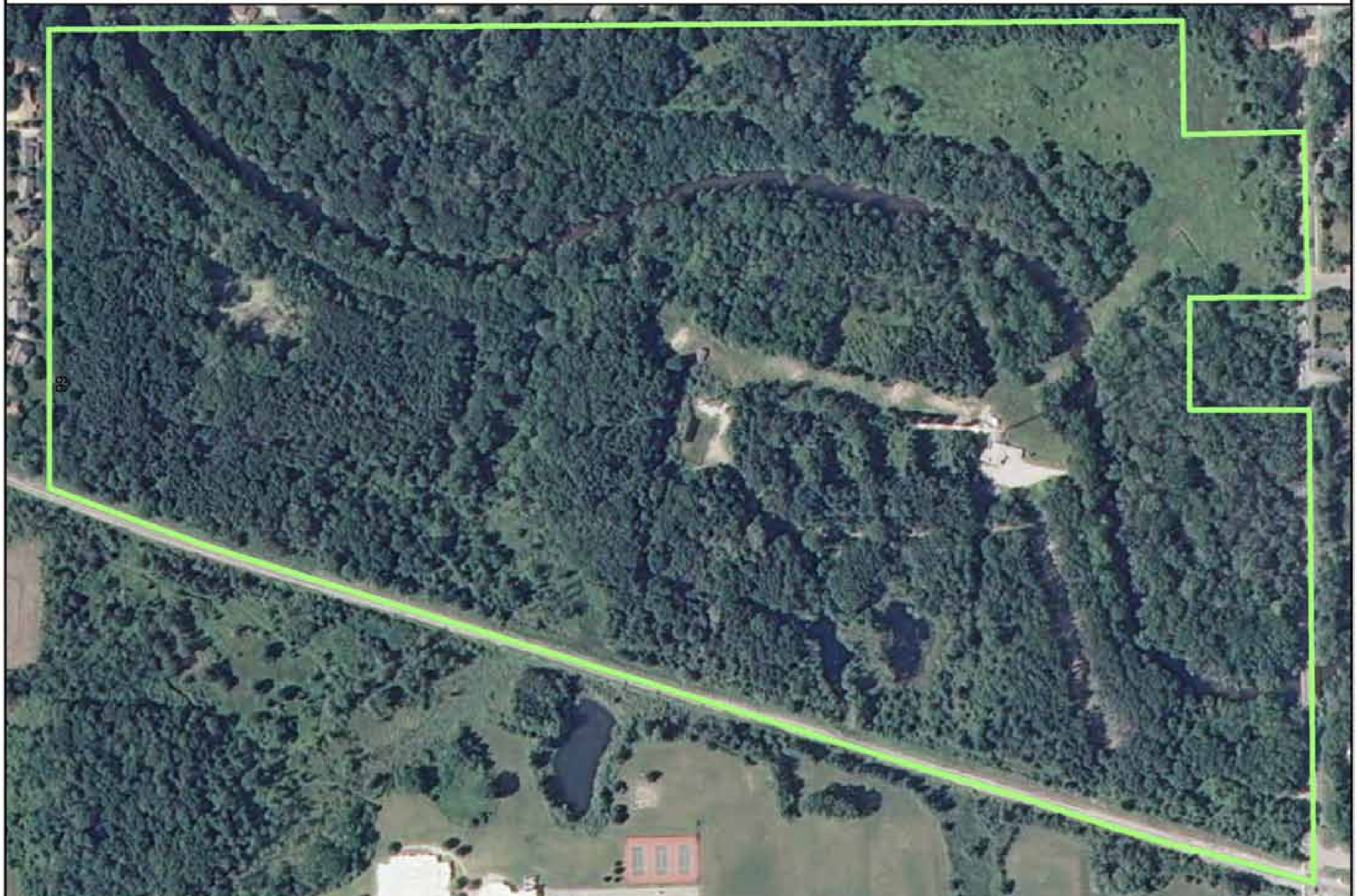
Ionia County, Boston Township, Sections 27, 28, and 33

Image Year: 2010

Dobie Road Property

Ingham County, Meridian Township, Section 27

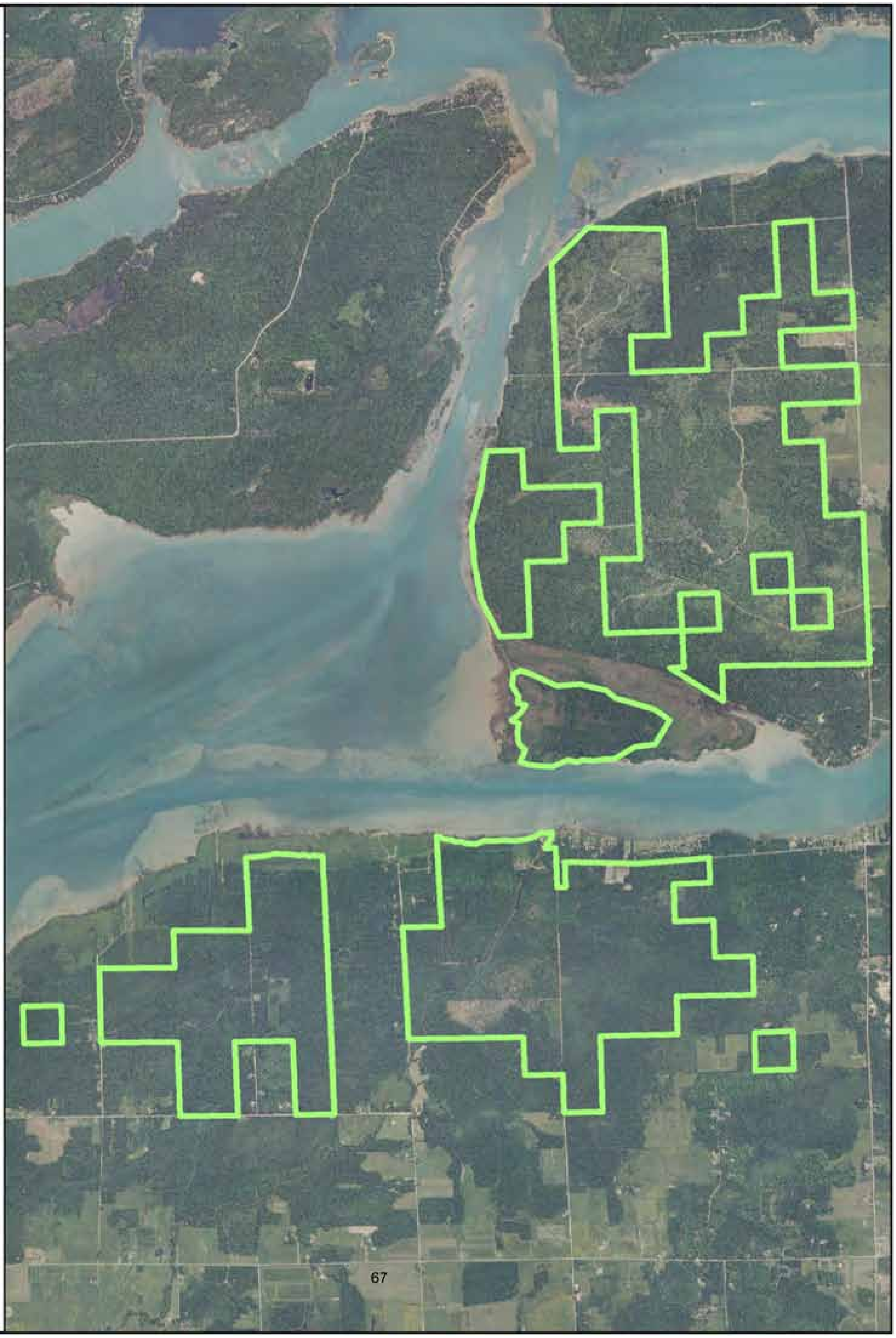
Image Year: 2009



Dunbar Forest

Chippewa County, Soo Township, Sections 3, 4, 5, 8, 9, 10, 11, 14, 15, and 16; Bruce Township, Sections 1, 6, 7, 12, 13, 24, 25, 30, 31, and 36

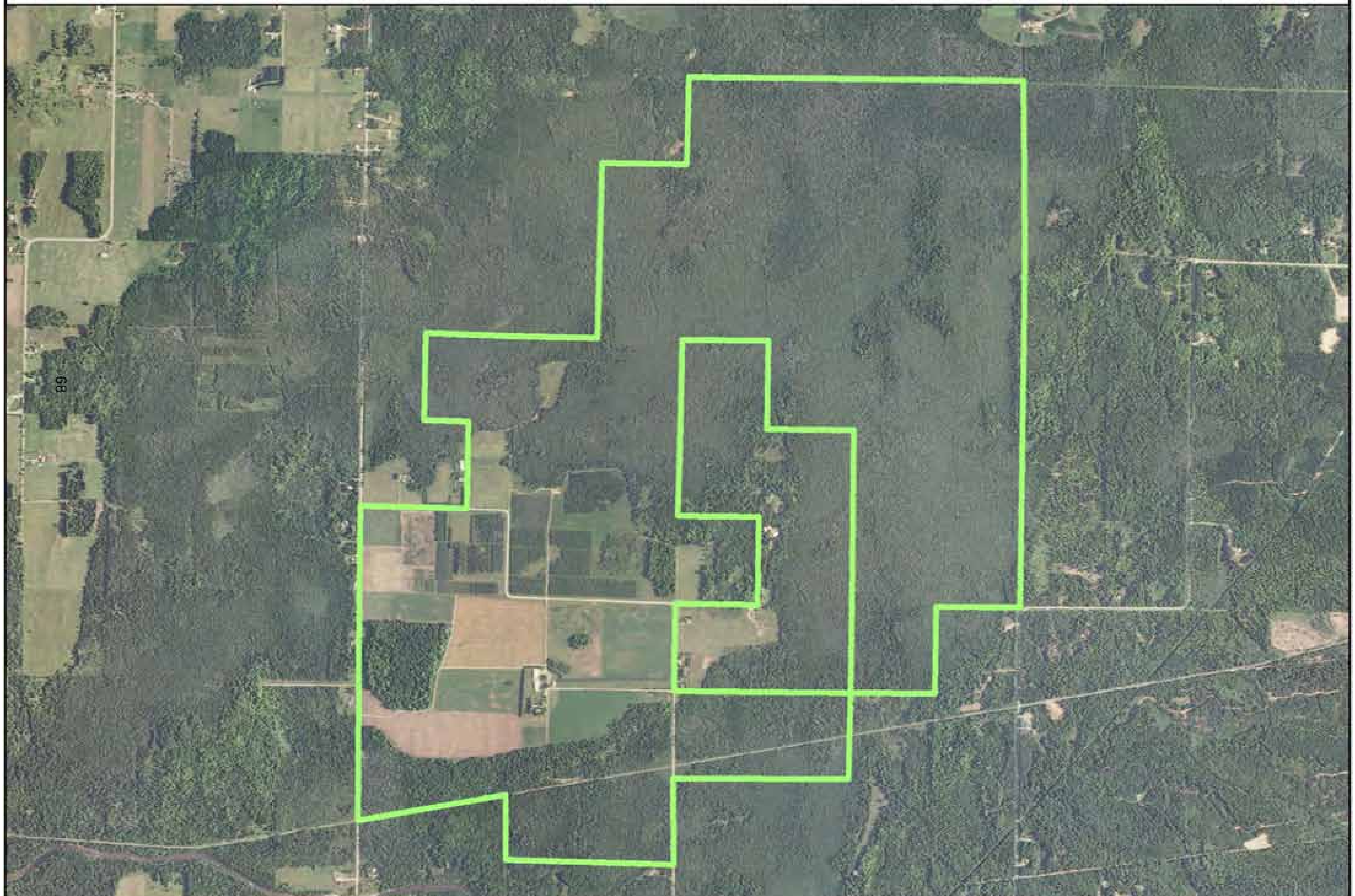
Image Year: 2010



Forest Biomass Innovation Center

Delta County, Wells Township, Sections 8, 17, 18, 19, and 20

Image Year: 2009




Gantos Property
Kent County, Kentwood Township, Section 23
Image Year: 2009
69

Hidden Lake Gardens

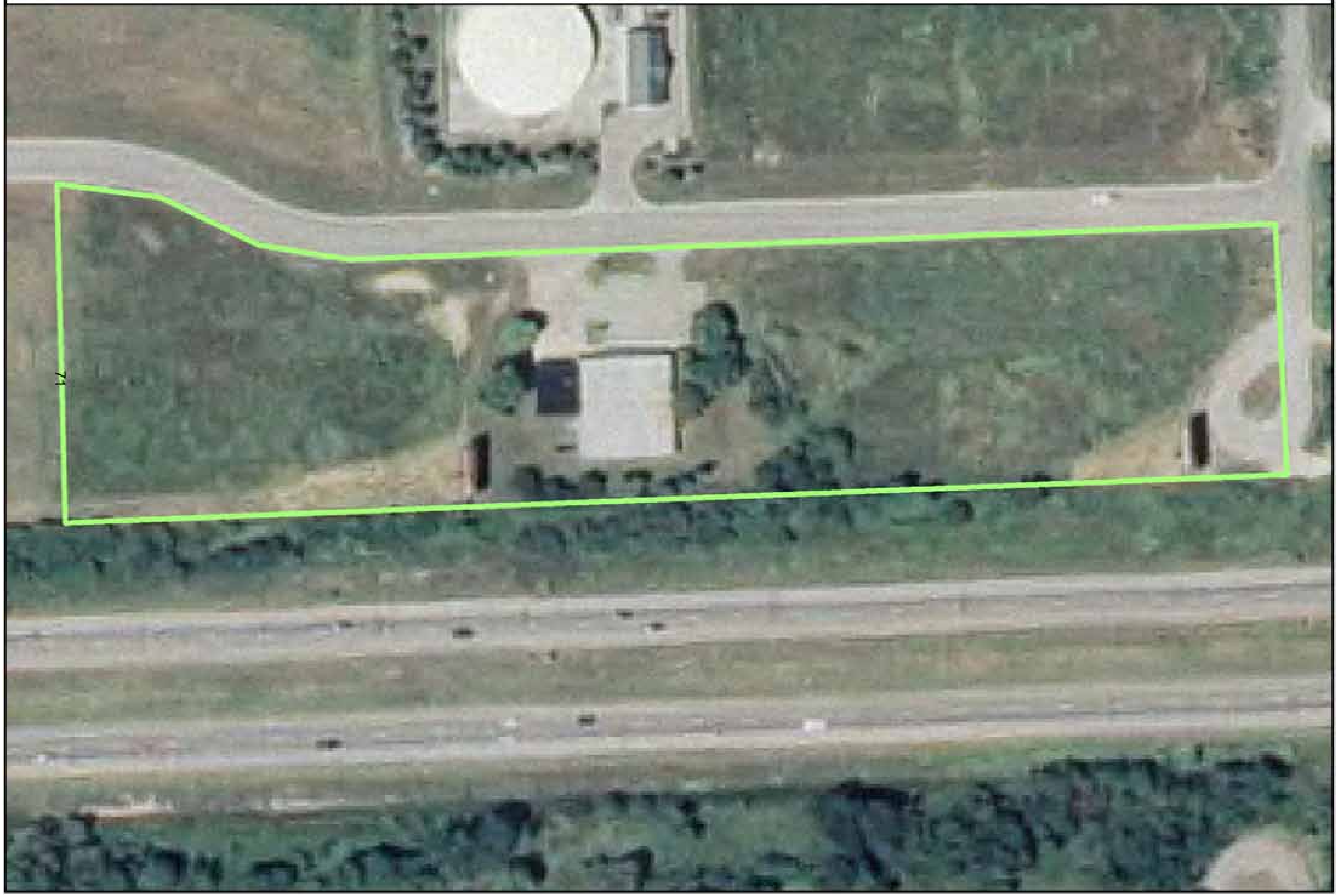
Lenawee County, Franklin Township, Sections 17, 18, 19, and 20

Image Year: 2009

Hulett Road Engineering

Ingham County, Alaiedon Township, Section 5

Image Year: 2009



College of Human Medicine

Kent County, Grand Rapids Township, Section 19

Image Year: 2009

Jolly Road Engineering and Civil Infrastructure Lab

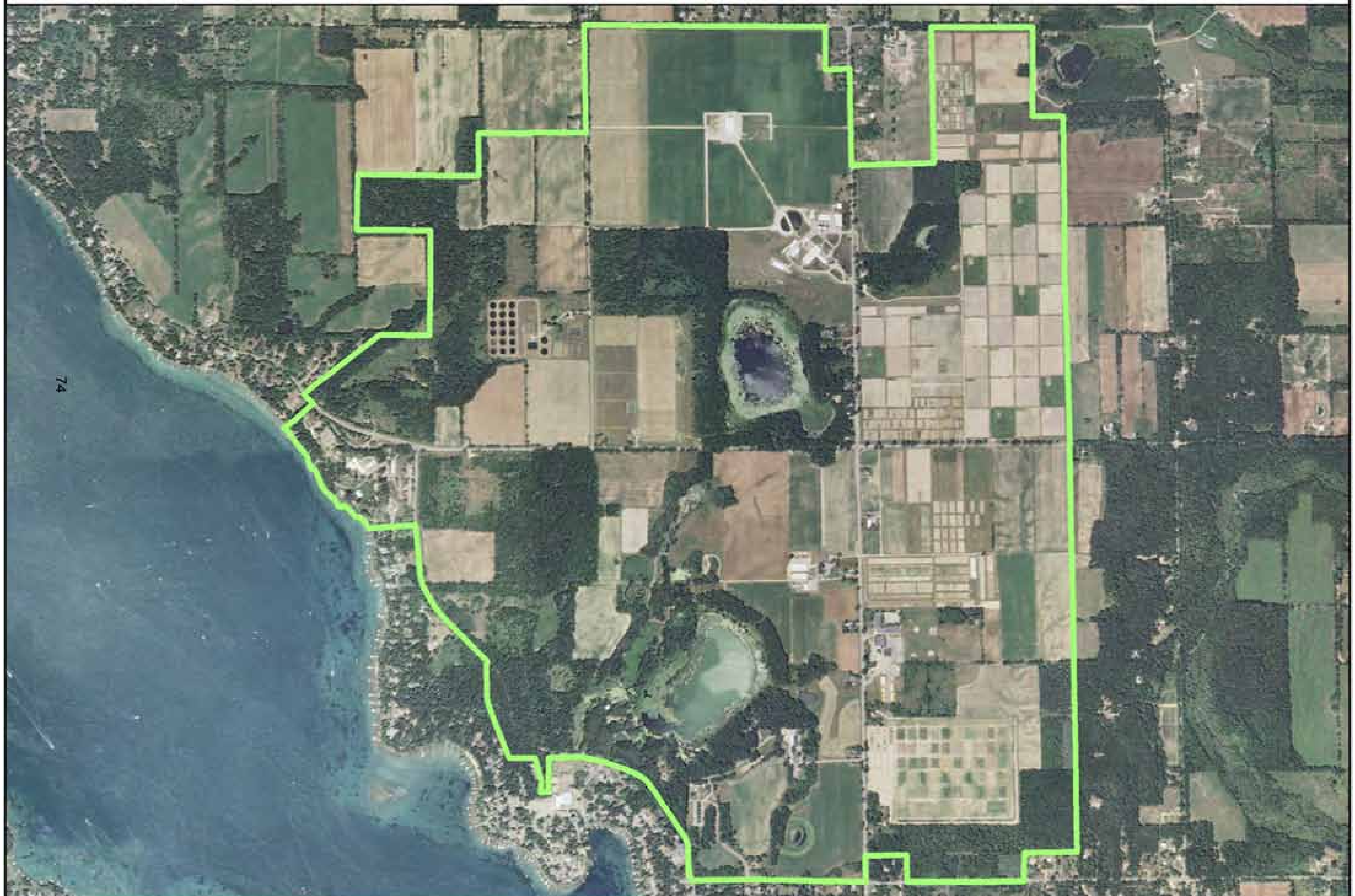
Ingham County, Alaiedon Township, Section 5

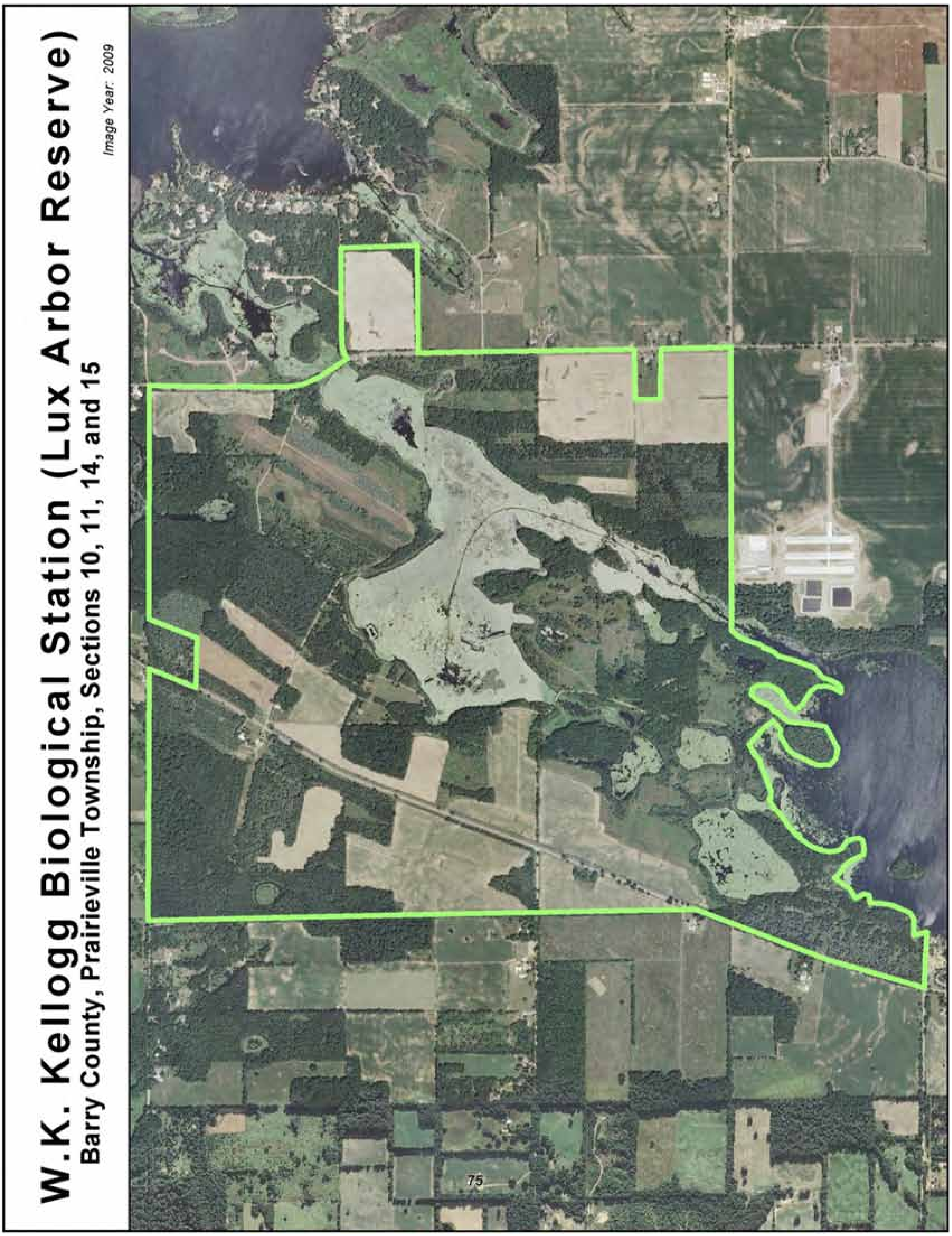
Image Year: 2009

W.K. Kellogg Biological Station, Bird Sanctuary, and Farm

Kalamazoo County, City of South Gull Lake and Ross Township,
Sections 4, 5, 6, 8, and 9

Image Year: 2009

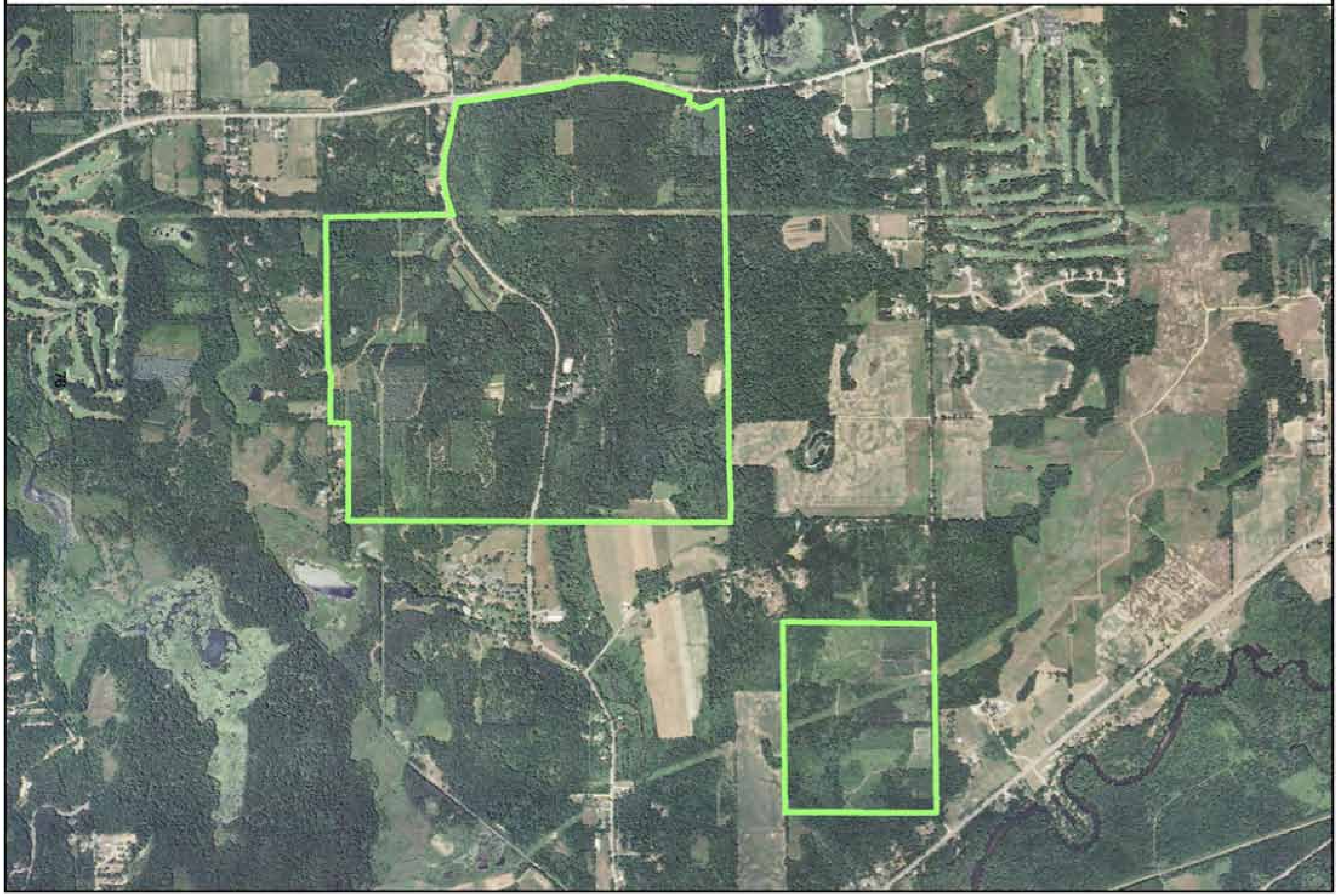


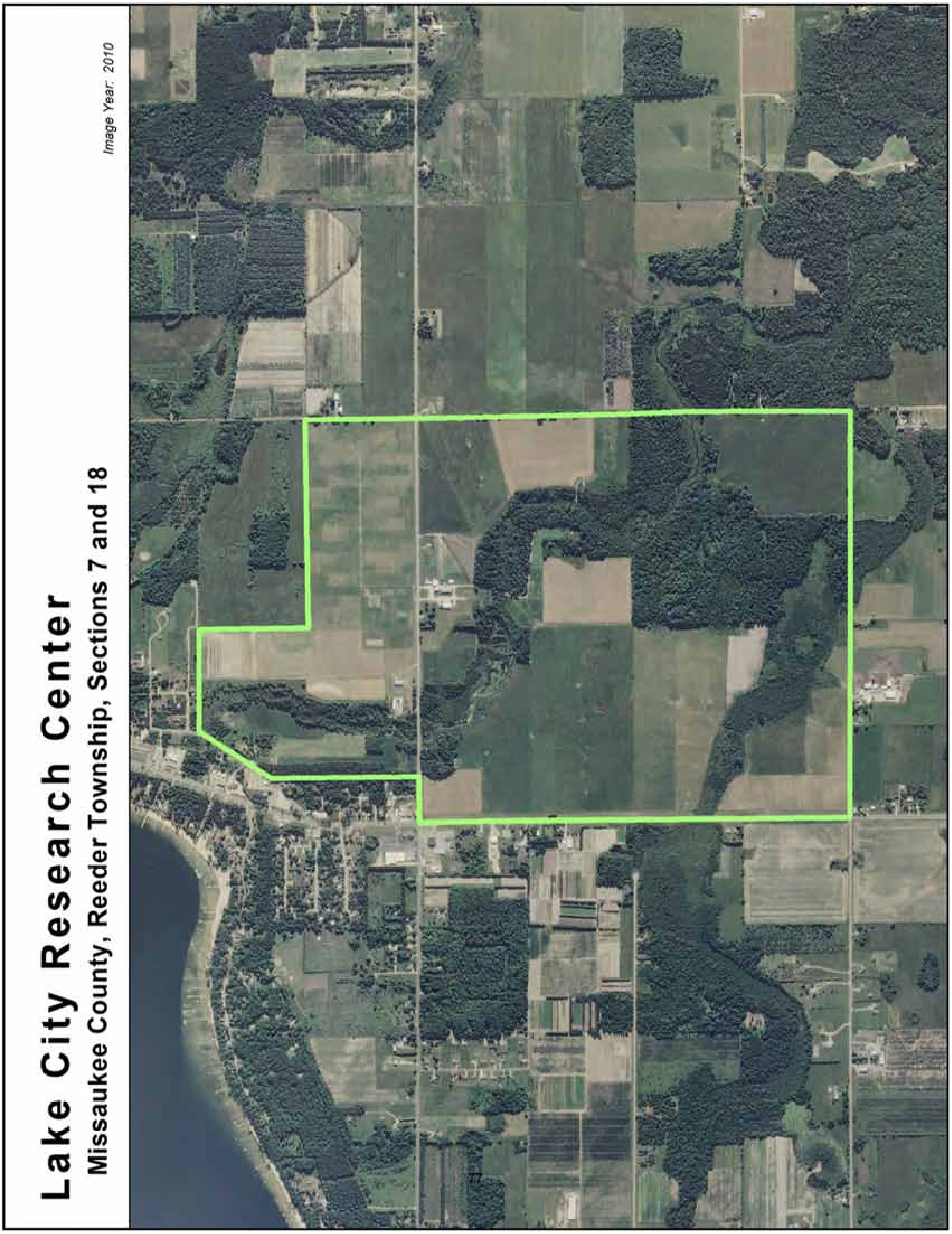

W.K. Kellogg Biological Station (Lux Arbor Reserve)
Barry County, Prairieville Township, Sections 10, 11, 14, and 15
Image Year: 2009
75

W.K. Kellogg Experimental Forest

Kalamazoo County, Ross Township, Sections 21, 22, 27, and 28

Image Year: 2009

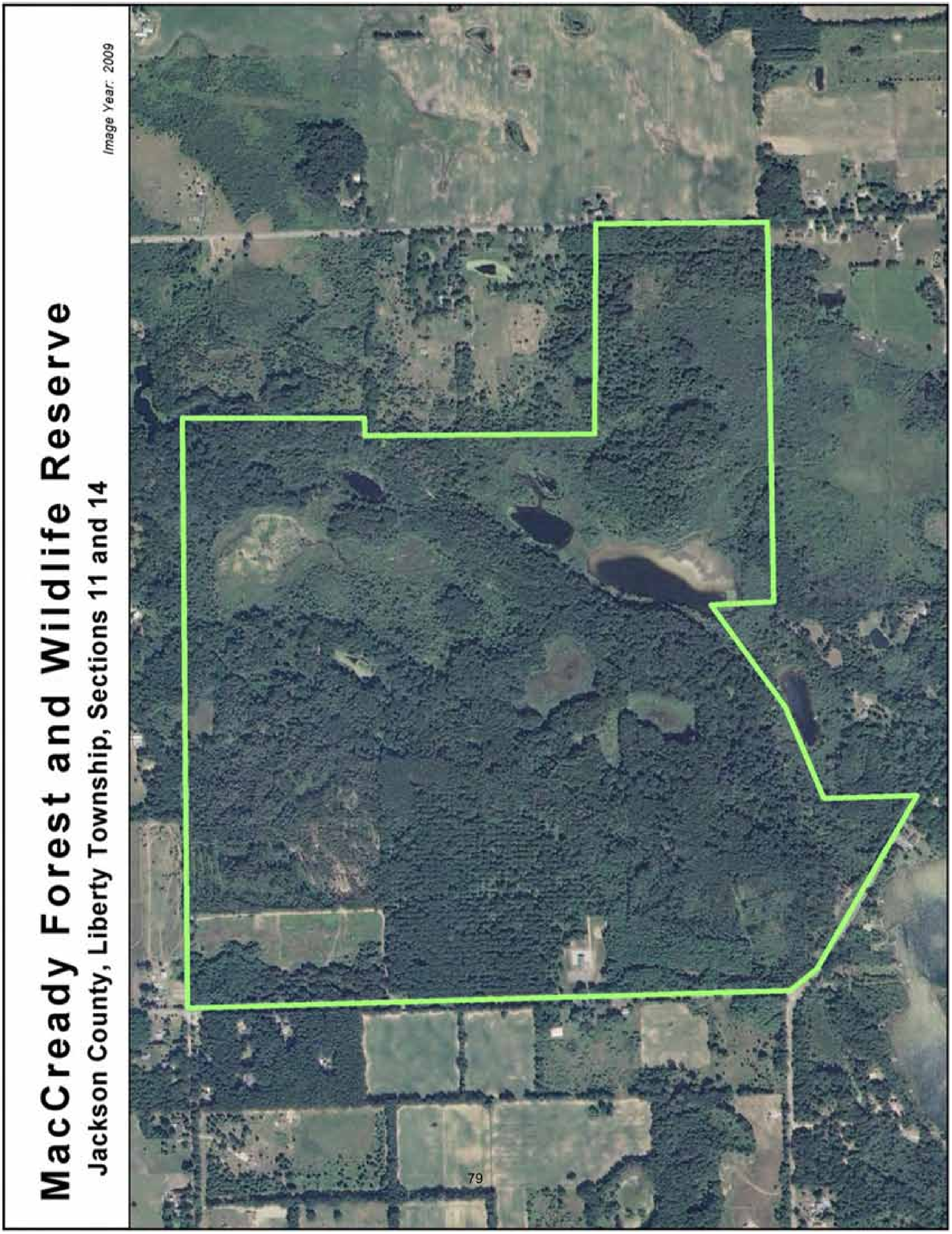



Lake City Research Center
Missaukee County, Reeder Township, Sections 7 and 18
Image Year: 2010

Leland Property

Leelanau County, Leland Township, Section 9

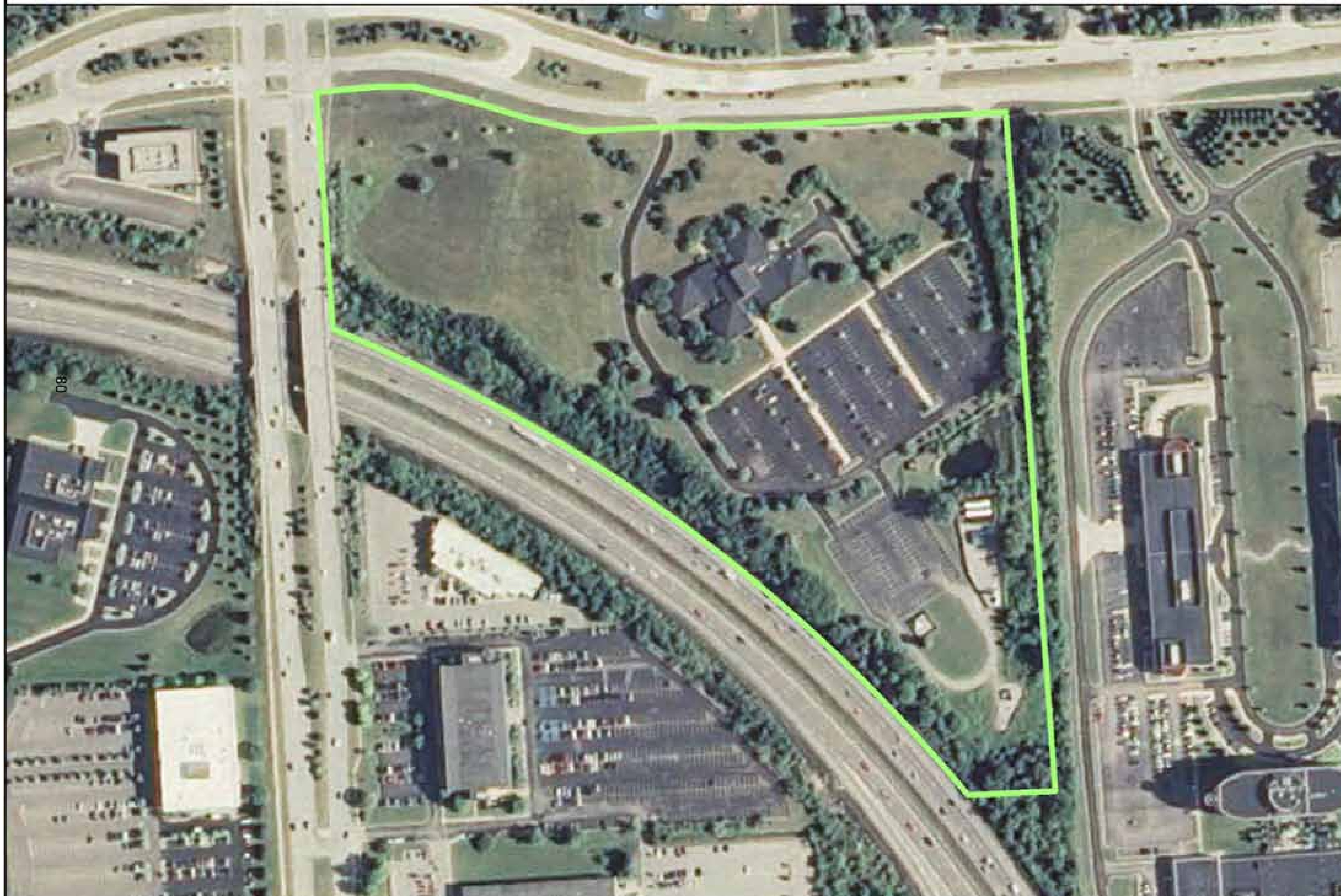
Image Year: 2009


MacCready Forest and Wildlife Reserve
Jackson County, Liberty Township, Sections 11 and 14
Image Year: 2009
79

Management Education Center, Troy

Oakland County, City of Troy, Section 9

Image Year: 2009

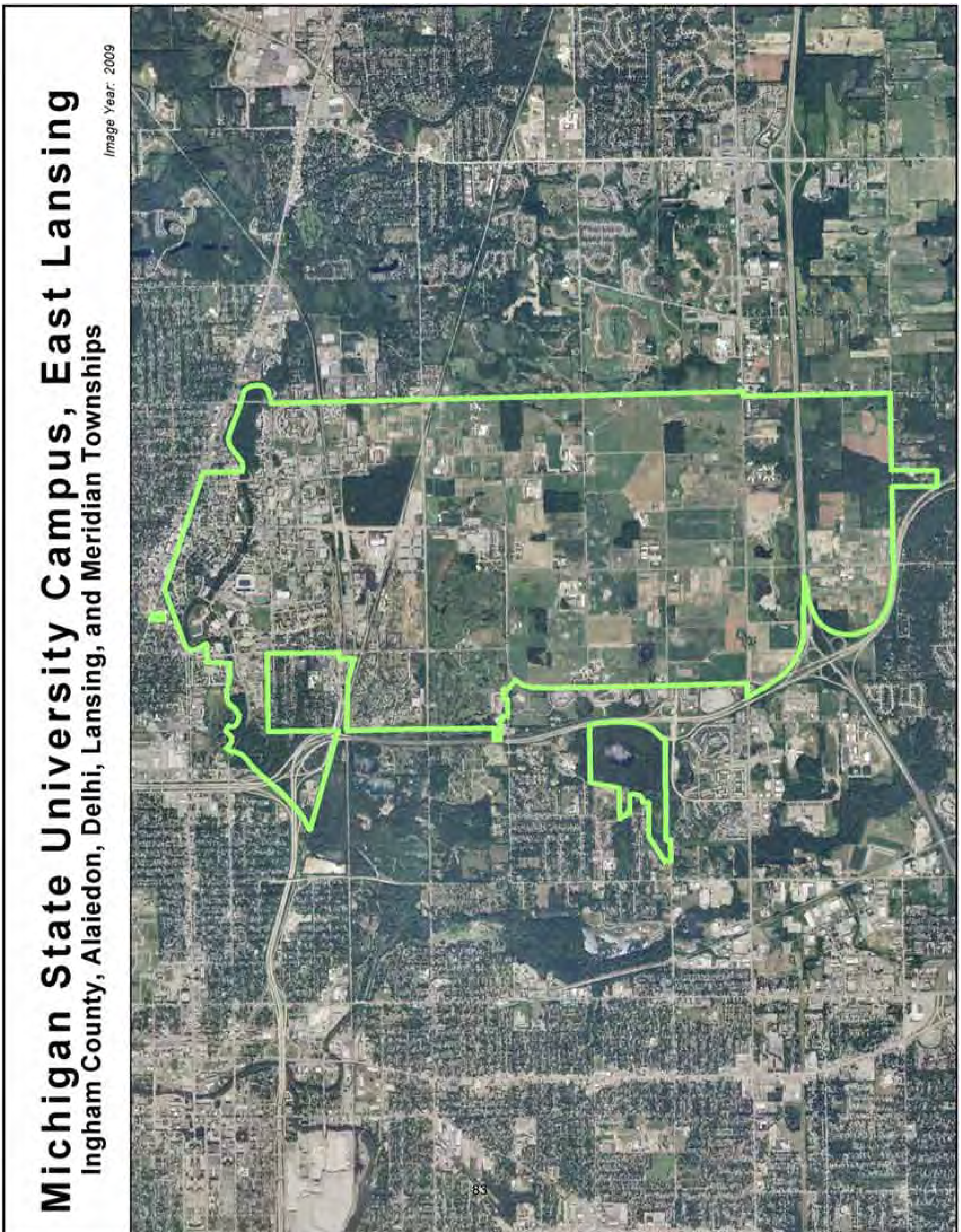



Martin Property (Rose-Dell Seed Orchard)
Calhoun County, Albion Township, Sections 23 and 24
Image Year: 2009
81

Mason Research Farm

Ingham County, Alaiedon Township, Section 21

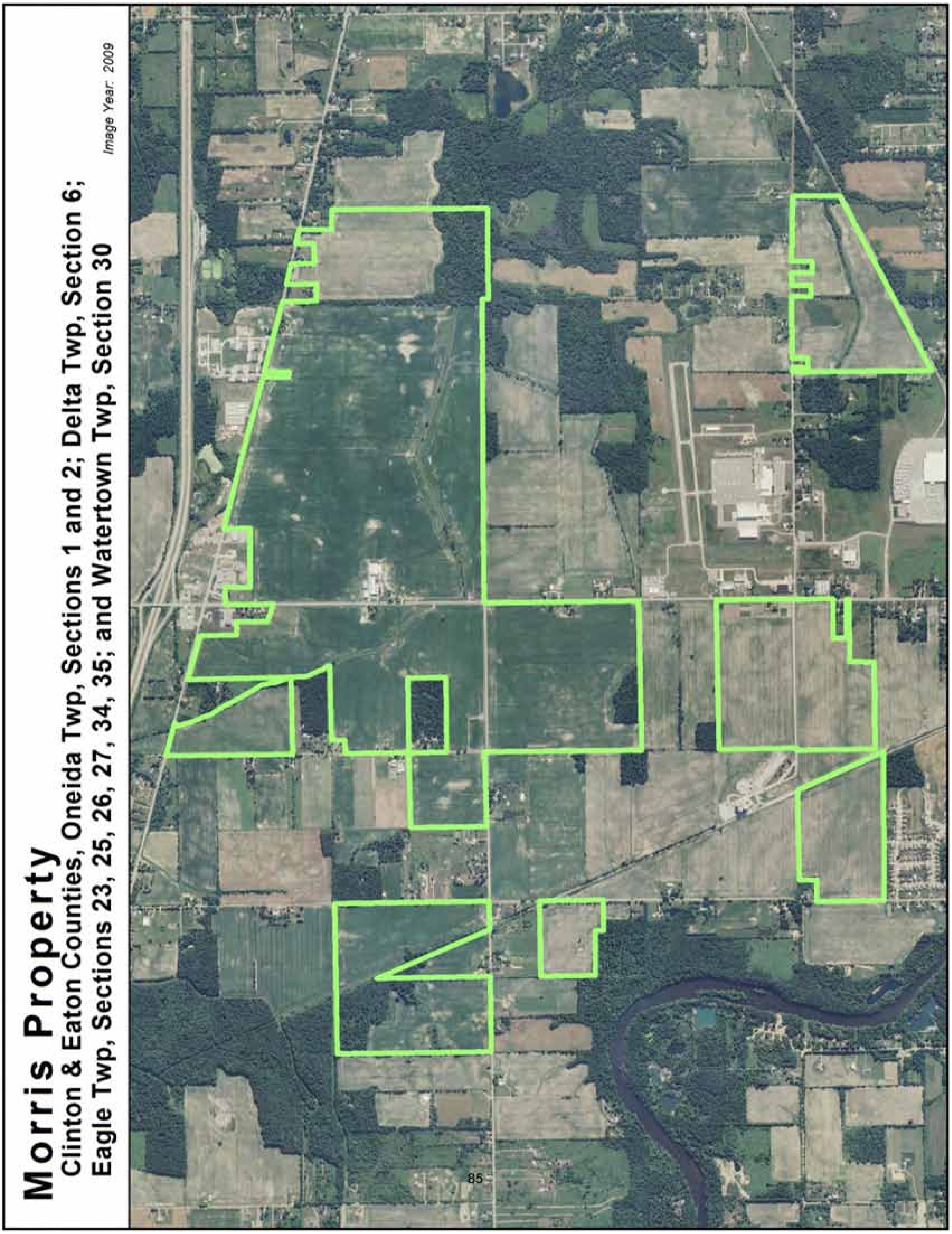
Image Year: 2009


Michigan State University Campus, East Lansing
Ingham County, Alaiedon, Delhi, Lansing, and Meridian Townships
Image Year: 2009
83

Montcalm Research Center

Montcalm County, Douglass Township, Sections 8 and 17

Image Year: 2010


Morris Property
Clinton & Eaton Counties, Oneida Twp, Sections 1 and 2; Delta Twp, Section 6;
Eagle Twp, Sections 23, 25, 26, 27, 34, 35; and Watertown Twp, Section 30
Image Year: 2009
85

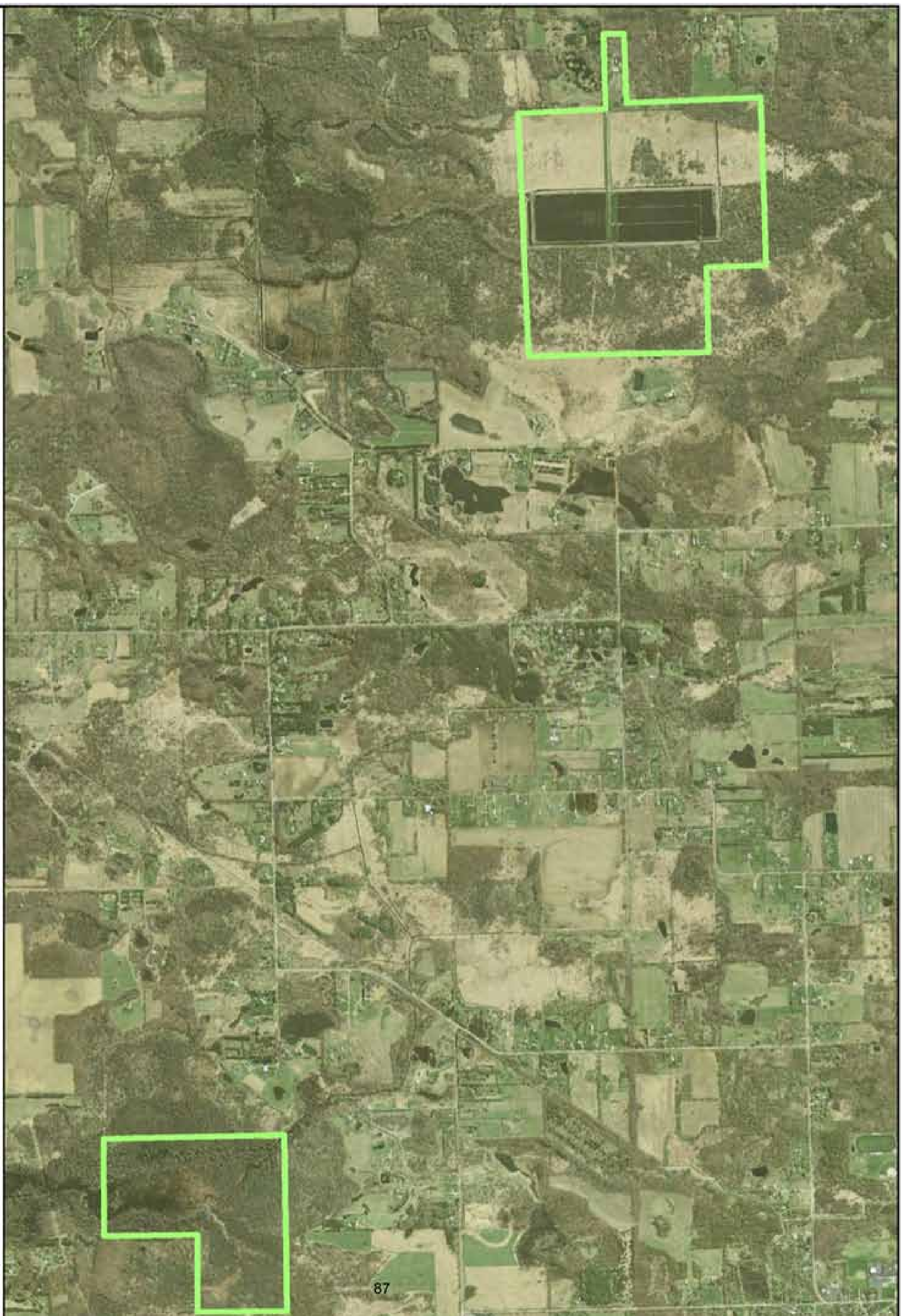
MSU Sailing Club
Ingham County, Meridian Township, Section 11

Image Year: 2009

Muck Soils Research Center

Clinton County, Bath Township, Sections 4, 5, 11, 12, 13, and 14

Image Year: 2010



Rau Property

Manistee County, Springdale Township, Section 6

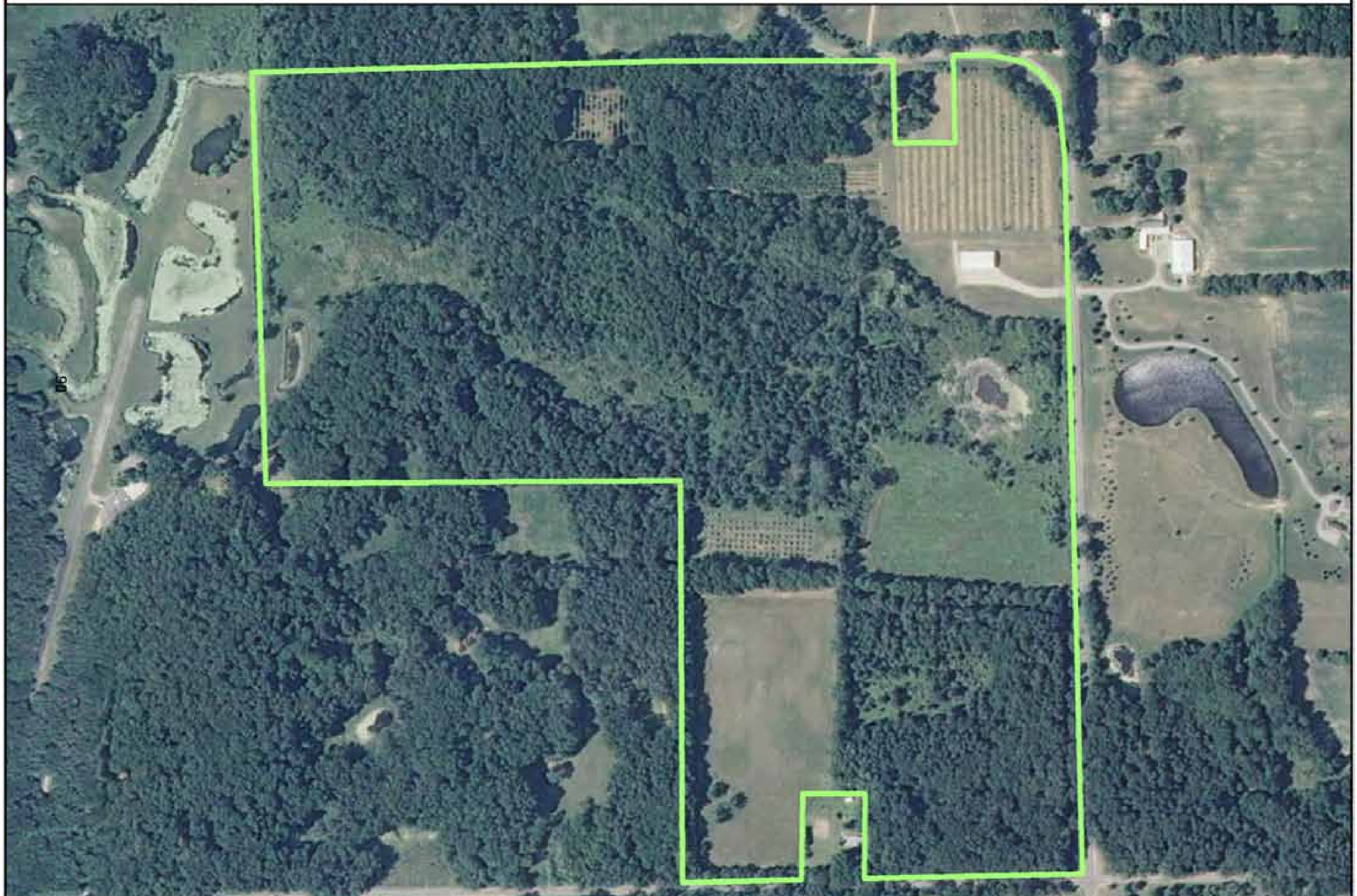
Image Year: 2009

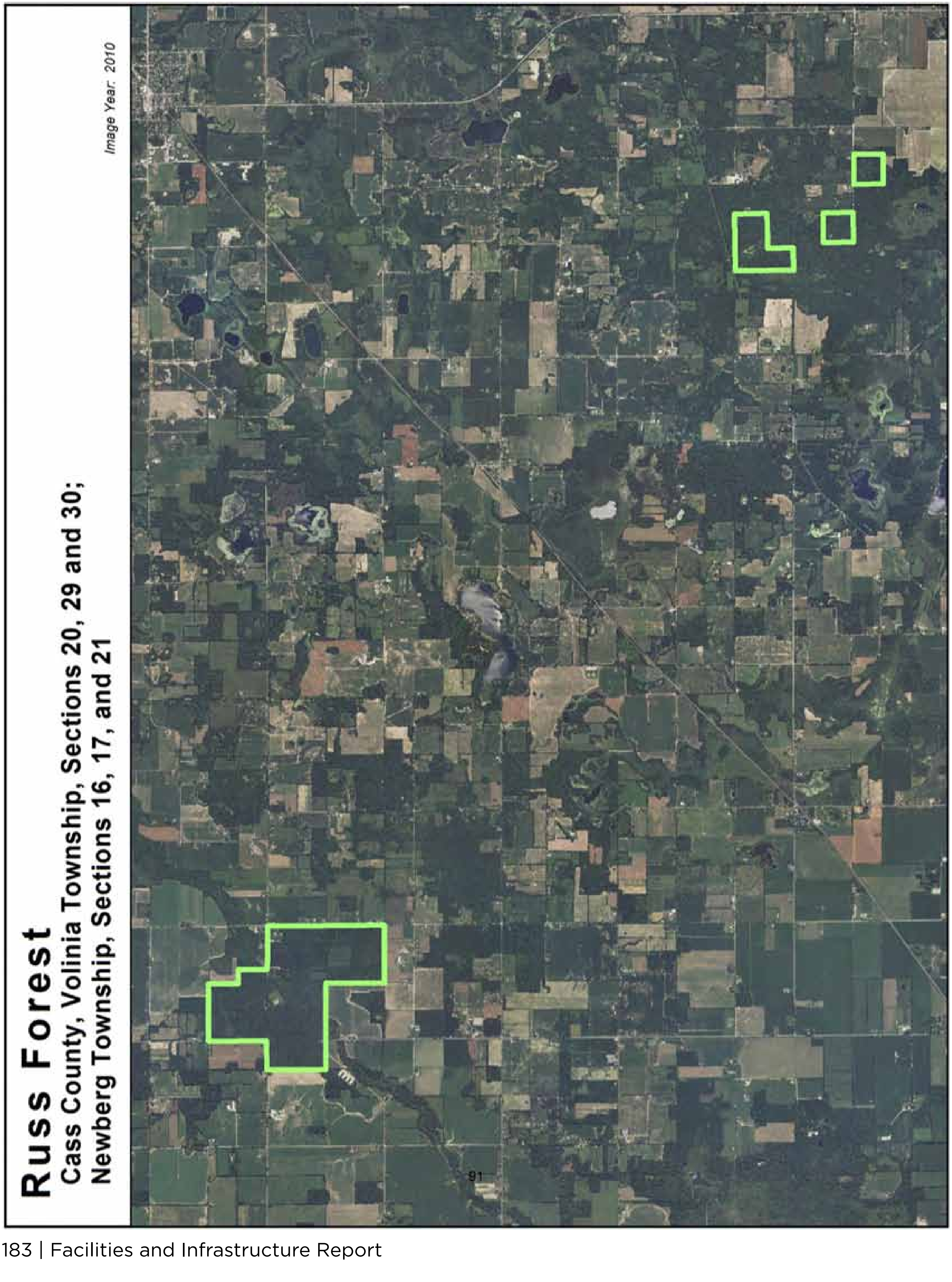

River Terrace Property
Ingham County, Meridian Township, Section 20
Image Year: 2009
89

Rogers Reserve

Jackson County, Liberty Township, Section 4

Image Year: 2009



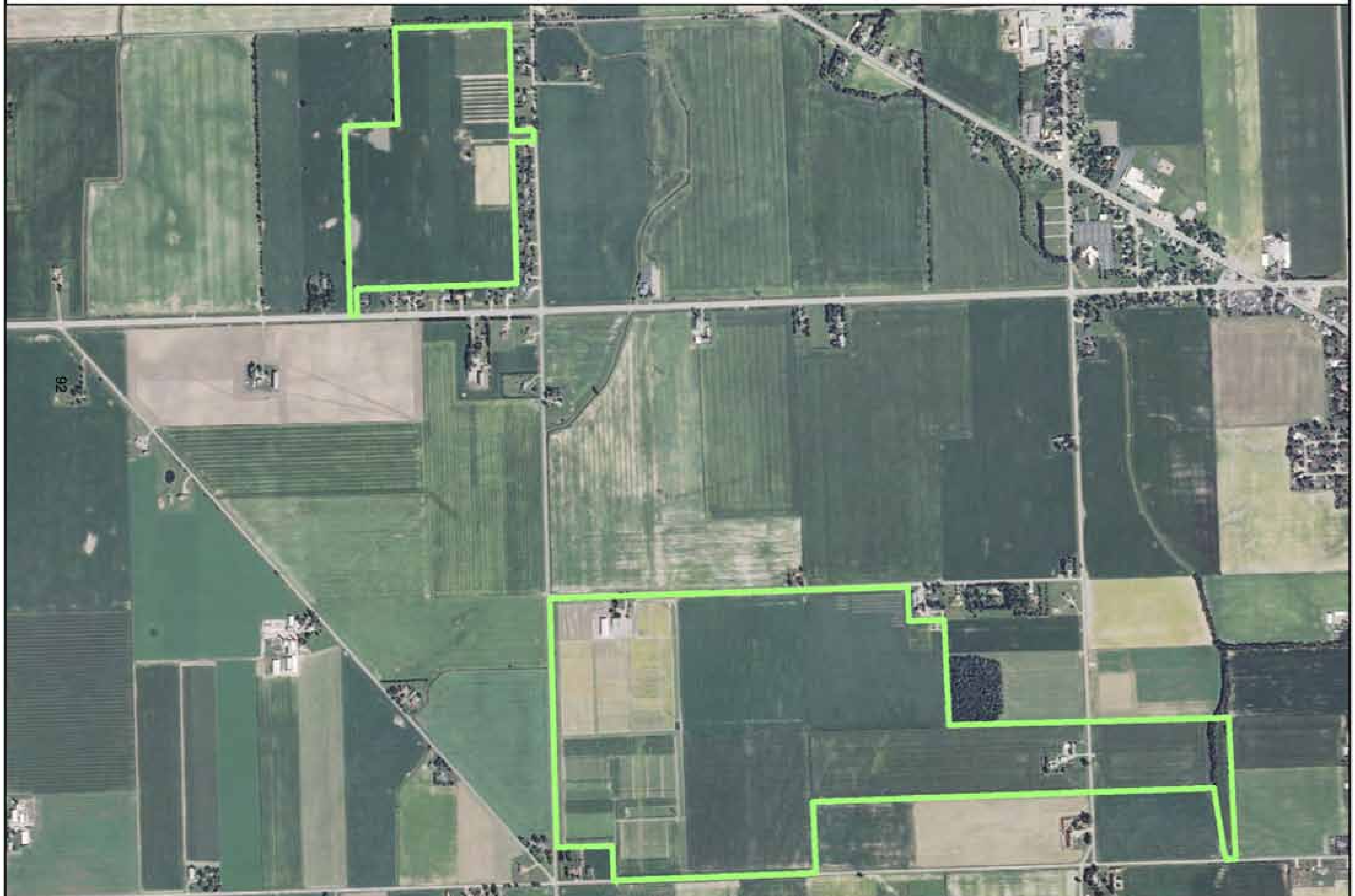


Russ Forest
Cass County, Volinia Township, Sections 20, 29 and 30;
Newberg Township, Sections 16, 17, and 21
Image Year: 2010
91

Saginaw Valley Research and Extension Center

Saginaw County, Blumfield Township, Section 25; Tuscola County, Denmark Township, Section 31

Image Year: 2009

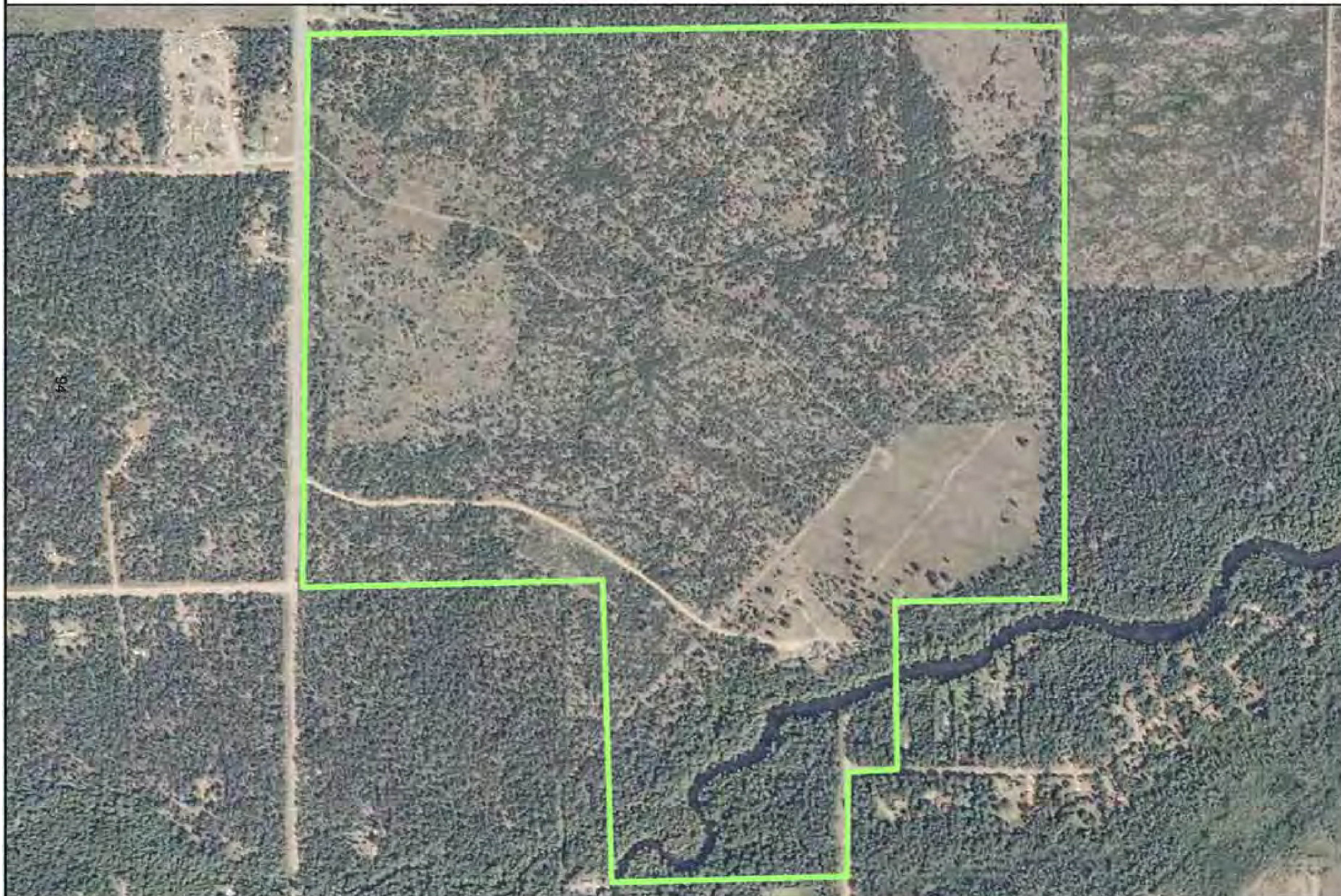



Southwest Michigan Research and Extension Center
Berrien County, Benton Township, Sections 25 and 36
Image Year: 2009
93

Stranahan-Bell Property (Wa Wa Sum)

Crawford County, Grayling Township, Sections 1, 6, and 12

Image Year: 2009



Stuckman Property

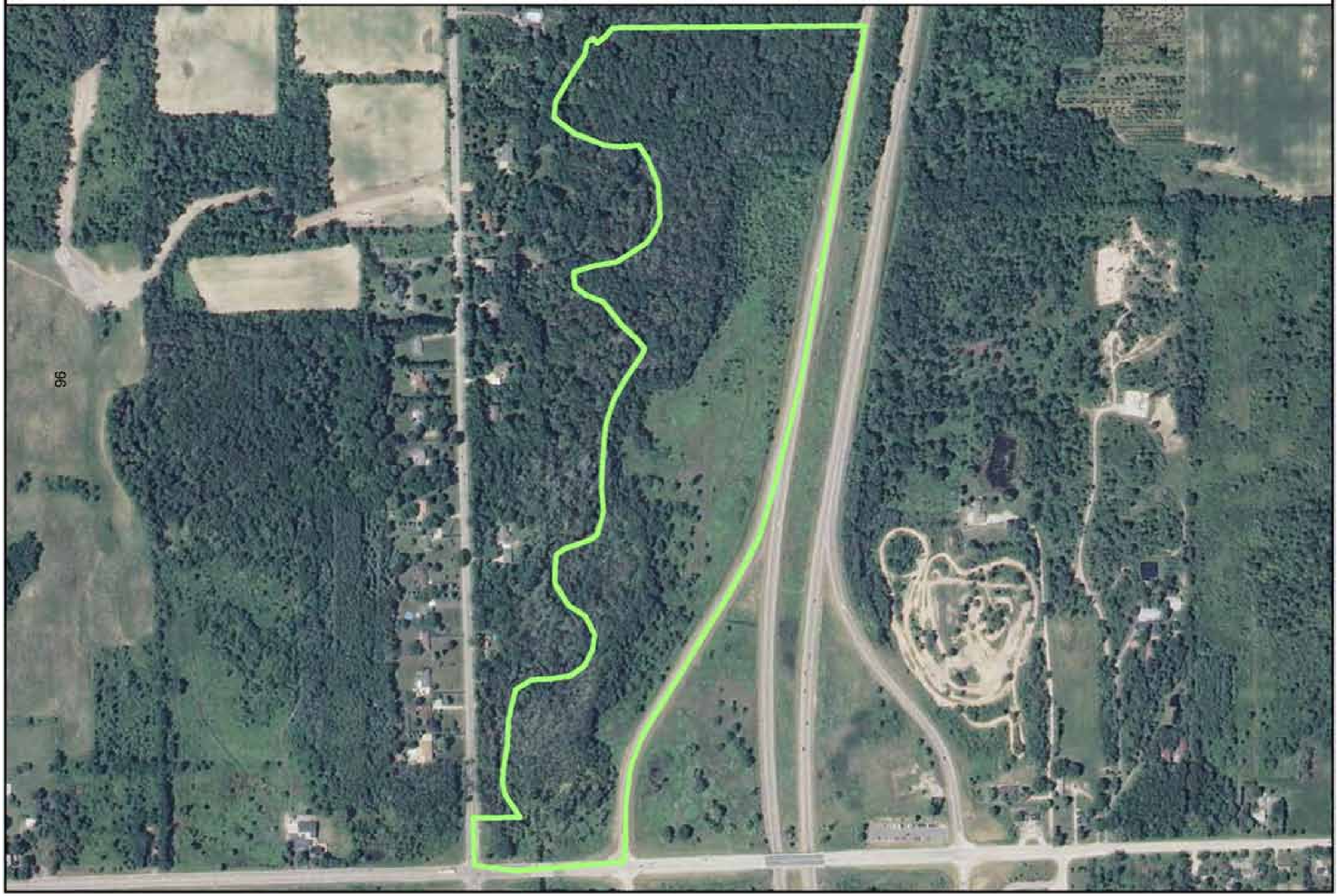
Clinton County, Bingham Township, Section 10

Image Year: 2009

Sycamore Creek Property

Ingham County, Alaiedon Township, Section 18

Image Year: 2009

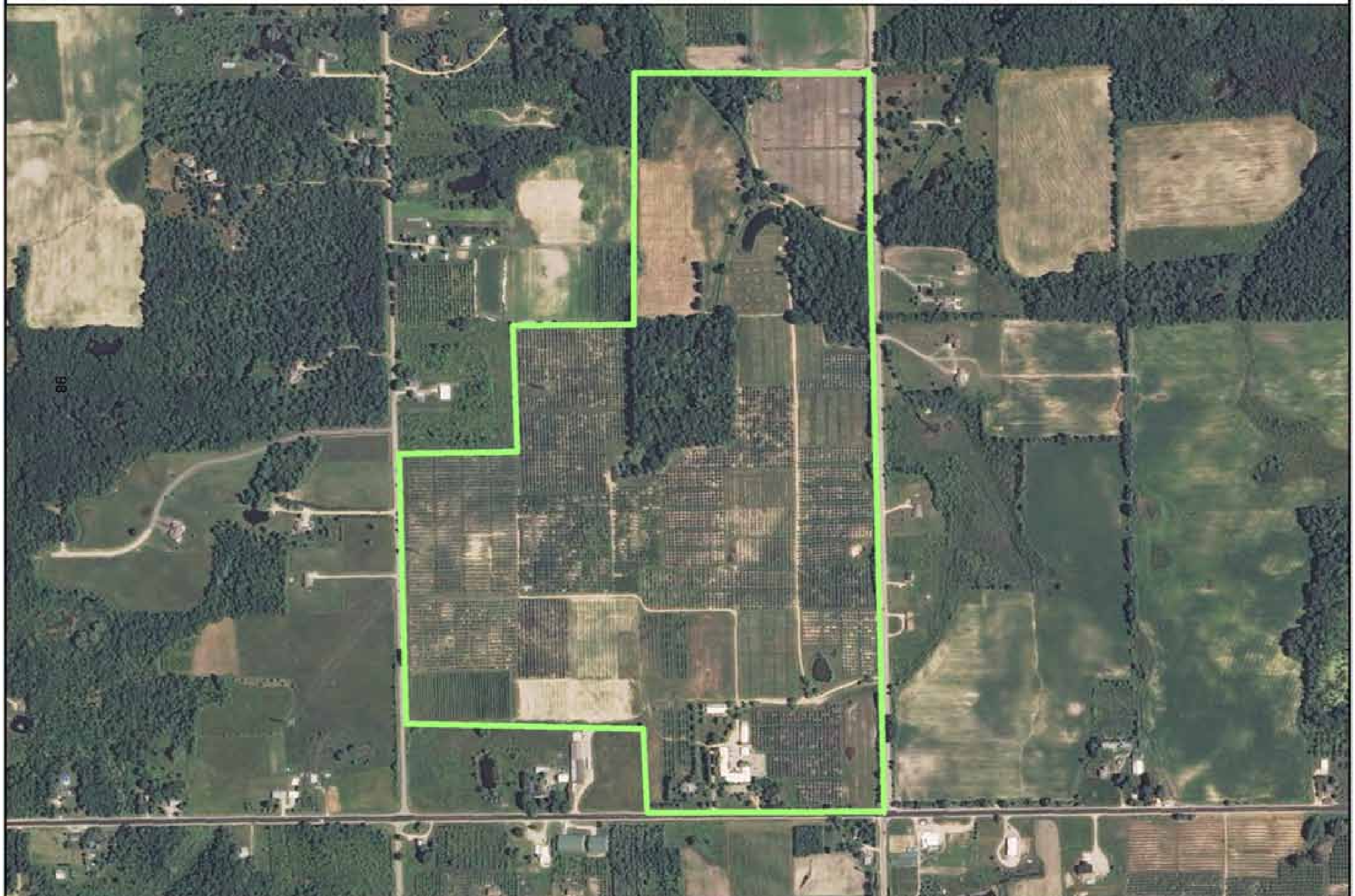


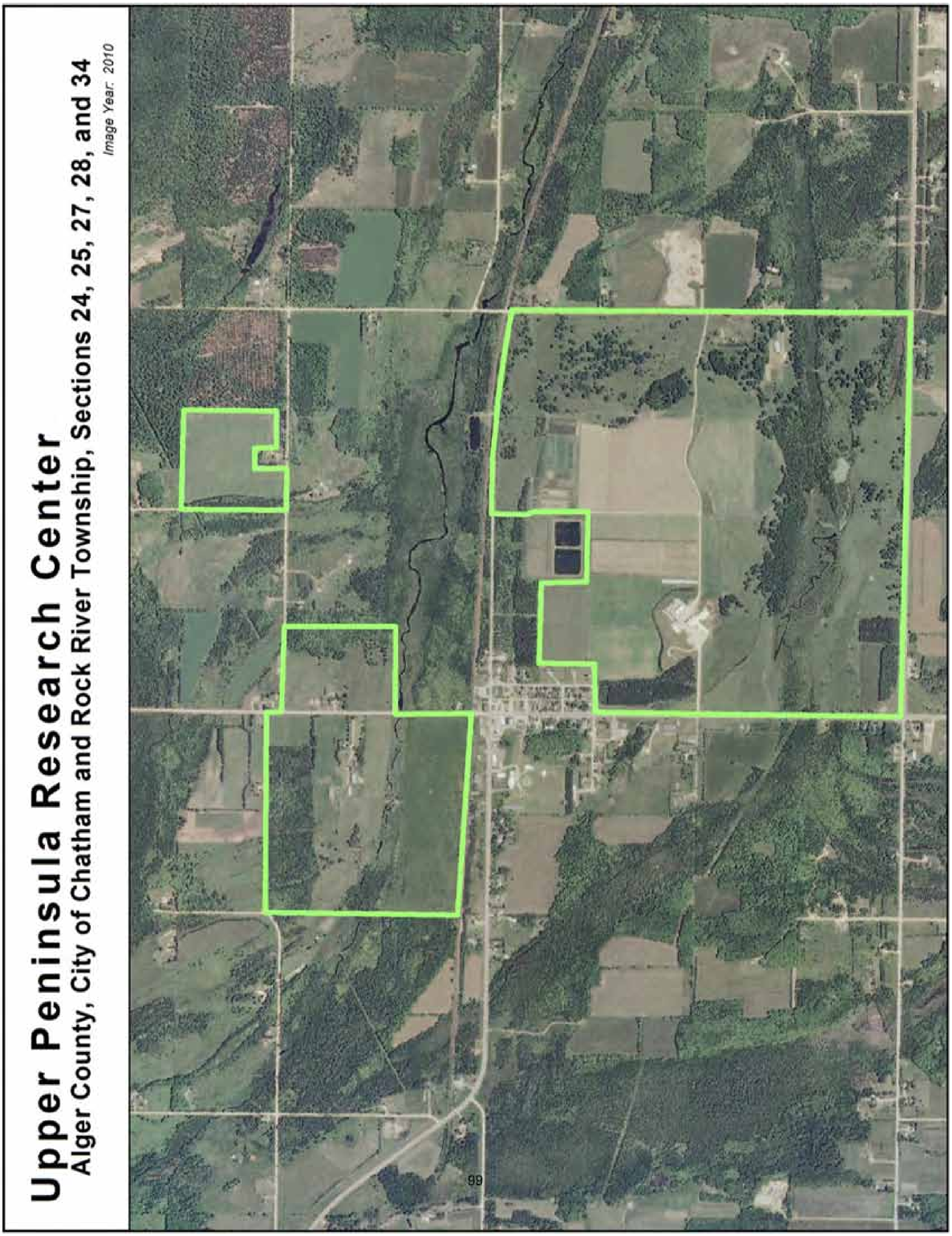

Tollgate Education Center and Americana Foundation Property
Oakland County, City of Novi, Section 11
Image Year: 2009
97

Trevor Nichols Research Center

Allegan County, Saugatuck Township, Section 35

Image Year: 2010

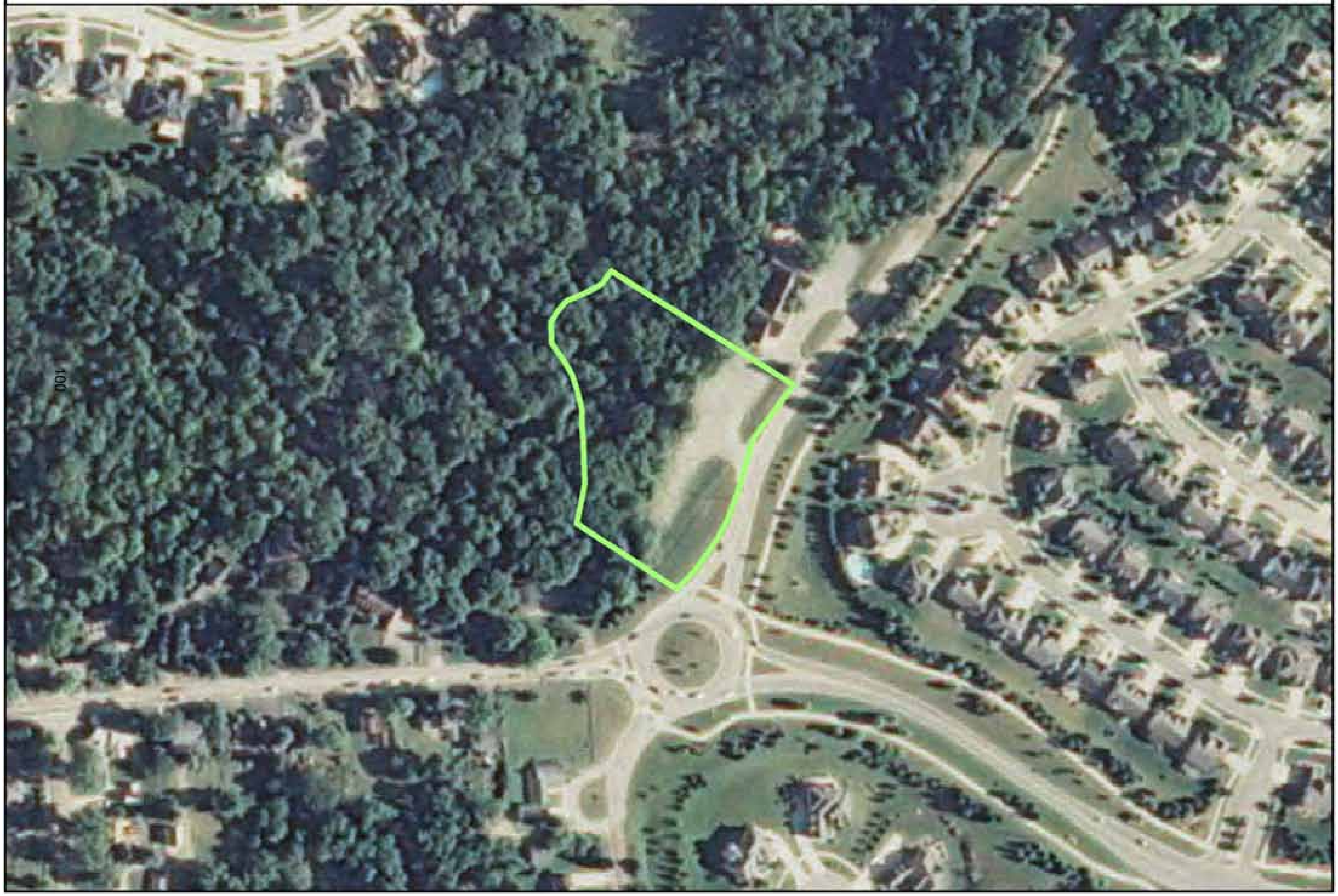



Upper Peninsula Research Center
Alger County, City of Chatham and Rock River Township, Sections 24, 25, 27, 28, and 34
Image Year: 2010

Van Hoosen Property

Oakland County, Avon Township, Section 1

Image Year: 2009



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Facilities and Infrastructure Report
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