Purdue University College of Agriculture

Programming & Planning for ABE Building Addition and Renovation 2014

The S/L/A/M Collaborative

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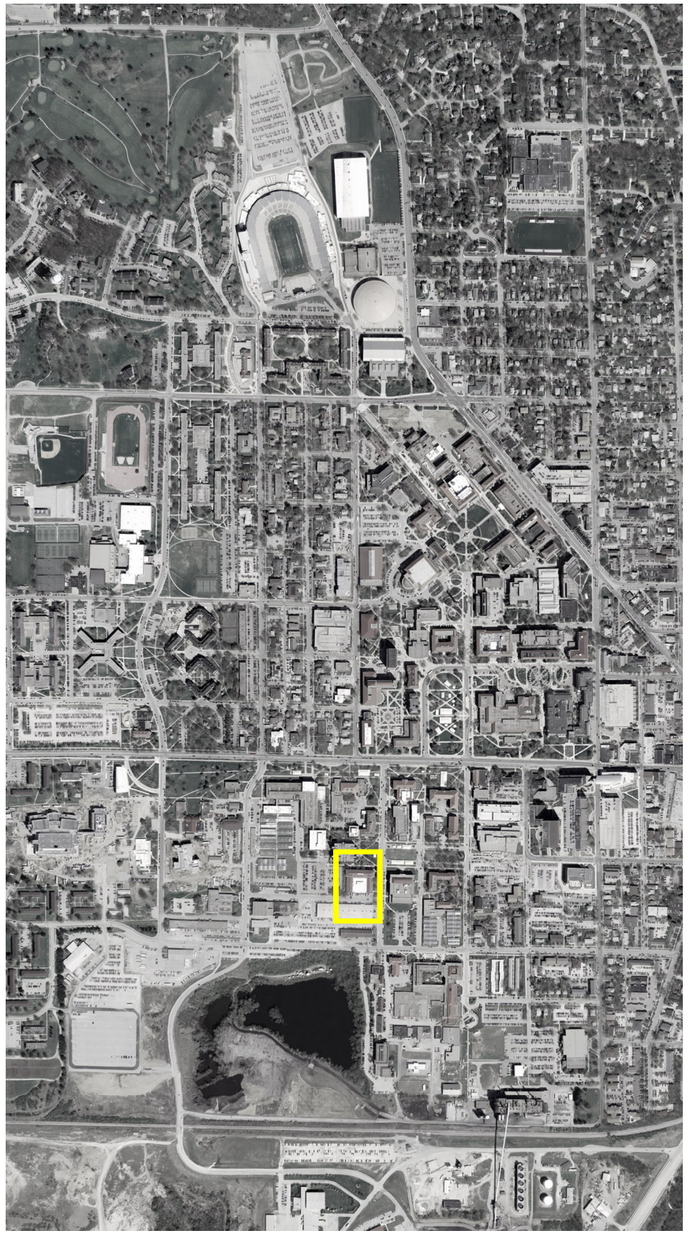

Aerial view of campus. The Department of Agricultural & Biological Engineering is located within the highlighted area.

Department Planning/Programming

In 2012 The S/L/A/M Collaborative began the process of gathering information on the Department of Agricultural & Biological Engineering (ABE) in the College of Agriculture at Purdue University in order to develop a comprehensive facility plan that meets the needs of the Department both today and in the future. An overall College of Agriculture Facility Master Plan document was produced in 2011 and as a result the Department of Agricultural & Biological Engineering elected to develop a detailed program and plan for its needs going forward. Both exercises have been conducted within the context of the University's Campus Master Plan.

Among the findings illustrated in the College of Agriculture Facility Master Plan is a recommendation for a new addition to the existing ABE Building. The Department of ABE is in need of a facility that will support cell and molecular biology, wet chemistry, bioprocess equipment, computing research and teaching spaces that are not well accommodated in the existing ABE Building. Biological engineering requires the integration of cells, biomaterials, and biomolecules with larger scale processes using informatics and computational modeling, each of which influence space design. The instructional and design labs require space that is suited for cell and molecular biology, wet chemistry, bioprocess equipment and computing. Traditionally teaching labs are designed to support a singular unique function. The planned labs will provide flexible layouts for instruction and design for the next generation of biological engineering.

This document will provide the Department with a solid planning tool in preparation for project approval and funding.

The planning team was created to help guide this process and includes representatives from The College, University and Planning team.

Building Design Task Force:

Department of Agricultural & Biological Engineering:
- Dr. Bernard Engel
- Dr. Vincent Bralts
- Dr. Dennis Buckmaster
- Dr. Osvaldo Campanella
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Agriculture Research at Purdue:
- Dr. Karen Plaut
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Planning Team:

The S/L/A/M Collaborative:
- Kent Brown, AIA, RA
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Department Overview

Purdue's Agricultural & Biological Engineering Department has been ranked #1 by US News and World Report for the past six consecutive years. The Department offers three degrees; Agricultural Systems Management granted by the College of Agriculture, Agricultural Engineering, and Biological Engineering granted by the College of Engineering. In 2013 there were 388 undergraduate students and 96 graduate students enrolled in the Department. Student enrollment has remained steady over the past few years; however, new University-wide initiatives to increase student enrollment are anticipated to impact the Department.

The Department is dispersed among nine buildings throughout campus and has many other off-campus facilities. For the purposes of this study, only the on-campus functions are addressed. The programs at the ADM Agricultural Innovation Center and Kepner Buildings will remain in their off-campus locations.

The Department's research has ties to many other Departments within the College of Agriculture as well as connections to the College of Engineering. Their research includes work in Food Engineering, Machinery, Bio-Processes, Environmental, and Biological Engineering and is inherently multidisciplinary due to this integration with both colleges.

Department Mission Statement

As identified at https://engineering.purdue.edu/ABE

"To prepare students, citizens, and industry for the future through innovative education and extension/outreach programs and the discovery of knowledge"

Aerial Photo of Site

Project Drivers

1. Provide appropriate office and office support space for the anticipated number of personnel
2. Create a state-of-the-art research environment that includes these characteristics:
   - Experiential teaching lab spaces
   - Large format teaching spaces
   - Opportunities for informal learning
   - Student project space
3. Create a state-of-the-art research environment that provides:
   - Appropriate heating, ventilation, air conditioning, electrical, and plumbing systems
   - Flexible research and support spaces to accommodate evolving research targets, group sizes, equipment and instrumentation
   - Appropriate bio-security
4. Create Collaborative and interactive spaces with:
   - Opportunities for spontaneous interactions
   - Space for student/faculty and student/post-doc engagement
   - Surge office and social space for visitors that is not isolated
5. Create a community with a sense of place that reinforces the stature of the Department of Agricultural and Biological Engineering that:
   - Provides compelling and exciting space
   - Enhances faculty and student recruitment
   - Provides clarity, wayfinding, and organization
   - Fosters transparency and accessibility
   - Creates density and buzz
   - Puts science and engineering on display

Goals and Objectives

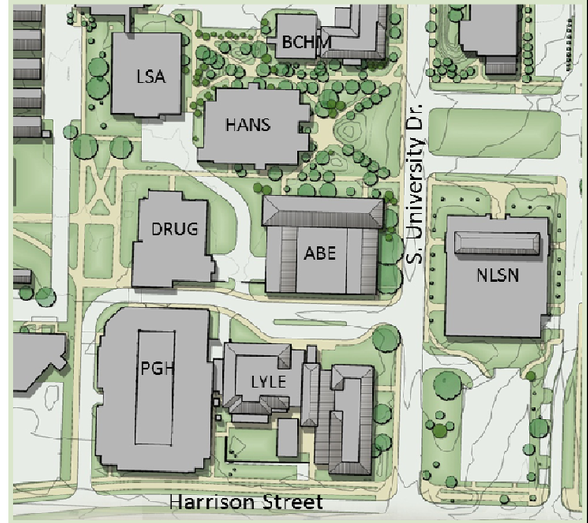
I. **Provide more space:** The need for more space is not only driven by the faculty and student growth, but also the need for improvement in the quality of space. The Department of Agricultural and Biological Engineering is anticipating growth in both undergraduate and graduate enrollment, requiring more space to provide:
   - Improved teaching and learning environments that are technology rich
   - Higher quality and quantity of student spaces
   - Additional collaboration space
   - Surge space for international collaborators
   - Research facilities that can support cell and molecular biology, wet chemistry, biological engineering, bioprocess equipment and computing

II. **Provide better organization:** The research units within the Department are spread throughout nine other campus buildings. Providing better organization will:
   - Consolidate all personnel, office, and research space into the ABE complex, with the exception of the personnel located off campus in the Kepner building
   - Include Engineering Personnel from LORRE in the building consolidation
   - Organize shared research facilities more centrally within the department; however, the Pilot Plant located in the Food Sciences Building will remain in the current location with plans for future expansion

II. **Create a physical Departmental identity:** The Department is currently dispersed among nine buildings across campus. Creating a physical departmental identity will:
   - Establish a space that celebrates the past, present, and future of its people and history of the Agricultural and Biological Engineering and its impact on the world
   - Create spaces to encourage interdepartmental, community, and international collaborations
   - Provide a place to put the Department's science and engineering on display

Process

The planning process consisted of a series of workshops and interviews with the Department to review the facility needs. In these workshops, information was gathered about the Department's mission and goals to better understand how the planning could facilitate these aspirations. During this process, S/L/A/M gathered and analyzed data about the Department, reviewed its current operations, and outlined its future needs in order to develop specific space program requirements and conceptual layouts.



Partial Plan of South Campus Showing Current ABE Building

View of ABE Building Looking South

Building Legend

ABE	Agricultural and Biological Engineering Building
BCHM	Biochemistry Building
DRUG	Drug Discovery Building
HANS	Arthur G. Hansen Life Sciences Res. Bldg. HGRH Horticulture Greenhouse Building
LSA	Life Science Annex
LYLE	Lyles-Porter Hall
NLSN	Philip E. Nelson Hall of Food Science
PGH	Harrison Street Parking Garage

Programming

Space Program Approach

The following is a summary of the program of space requirements that were developed to reflect the needs of the Department of Agricultural and Biological Engineering through the year 2027 as part of the College of Agriculture's Master Plan. The goal of the space program is to document the types, quantity, and quality of spaces that are required to accommodate the activities that will meet the strategic plan of the College and Department. A clear understanding of programmatic requirements was developed, refined, and confirmed through a series of meetings with representatives from the Department.

The resulting space program reflects a broad vision for facilities with the following key characteristics:

- Meets current and future needs and provide space for growth
- Consolidates the Department to promote a sense of community
- Creates collaborative facilities that catalyze people
- Accommodates the organization of space to support interdisciplinary endeavors and promote synergies

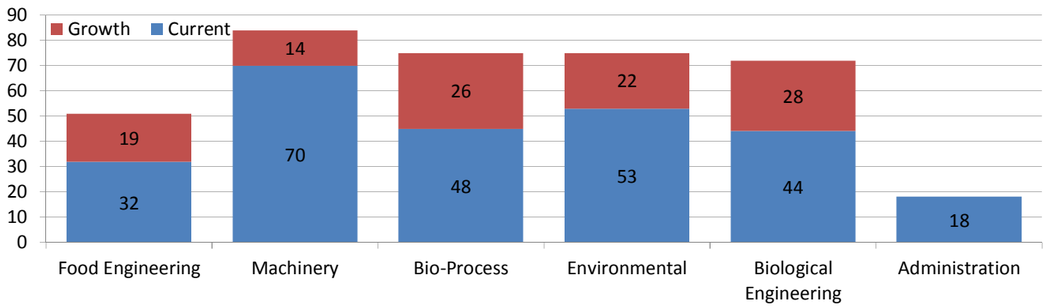
Personnel

The total number of existing Department of Agricultural and Biological Engineering personnel is 265. The chart on the right shows distribution by job position. Note that graduate students and tenured/tenure-track faculty account for the largest proportion of the total personnel, (exclusive of undergraduates).

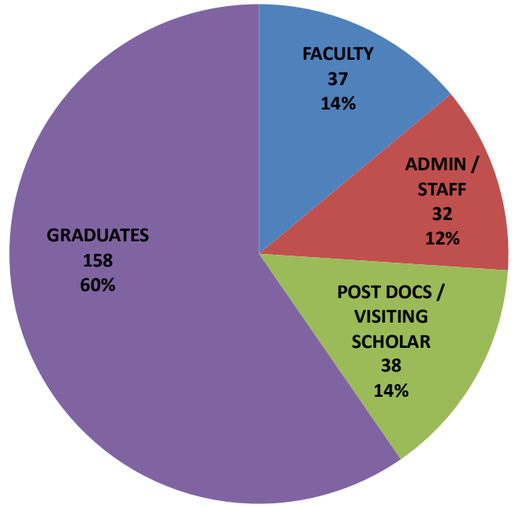
In order to meet its overarching goal of preparing students, citizens, and industry for the future through the discovery of knowledge, innovative learning opportunities and progressive engagement programs, the Department of Agricultural and Biological Engineering has determined that it must increase its faculty and graduate student population by 25%.

The renovation and addition will be planned to accommodate the total personnel with three exceptions; the personnel located off campus in Kepner, the Soils Building, and personnel housed in the Youth Development & Agricultural Education (YDAE) program. These programs will remain in their current locations which better meet their needs.

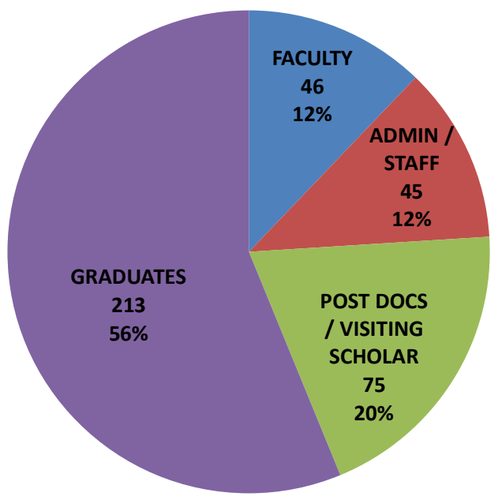
Agricultural and Biological Engineering Personnel Counts by Category



	Current ABE Personnel	Current CoE Personnel	Growth	Total Future Personnel	Located off campus	Future in ABE Building
Assist. Dean / Dept. Head	1	0	0	**1**	0	**1**
Director	1	0	0	**1**	0	**1**
T/T Faculty	32	0	9	**41**	3	**38**
Adjunct	1	0	0	**1**	0	**1**
Emeritas/ Emeritus	2	0	0	**2**	0	**2**
Visiting Scholars	30	0	16	**46**	9	**37**
Lab Mgr./ Lab Tech	6	2	4	**12**	1	**11**
Post-Docs	8	0	21	**29**	4	**25**
Grads - Paid	125	0	37	**162**	10	**152**
Grads - Unpaid	9	0	18	**27**	1	**26**
Non-ABE grads	24	0	0	**24**	13	**11**
Admin/ Professional	16	0	2	**18**	4	**14**
Admin Staff	4	2	1	**7**	0	**7**
Admin/ Clerical	6	1	1	**8**	3	**5**
Total Personnel	265	5	109	**379**	48	**331**

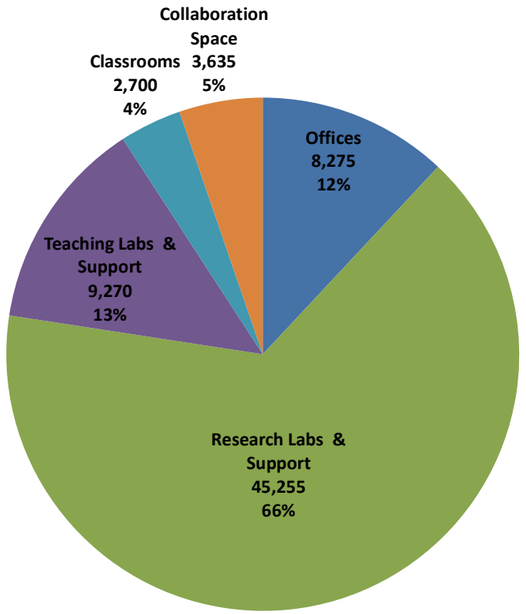


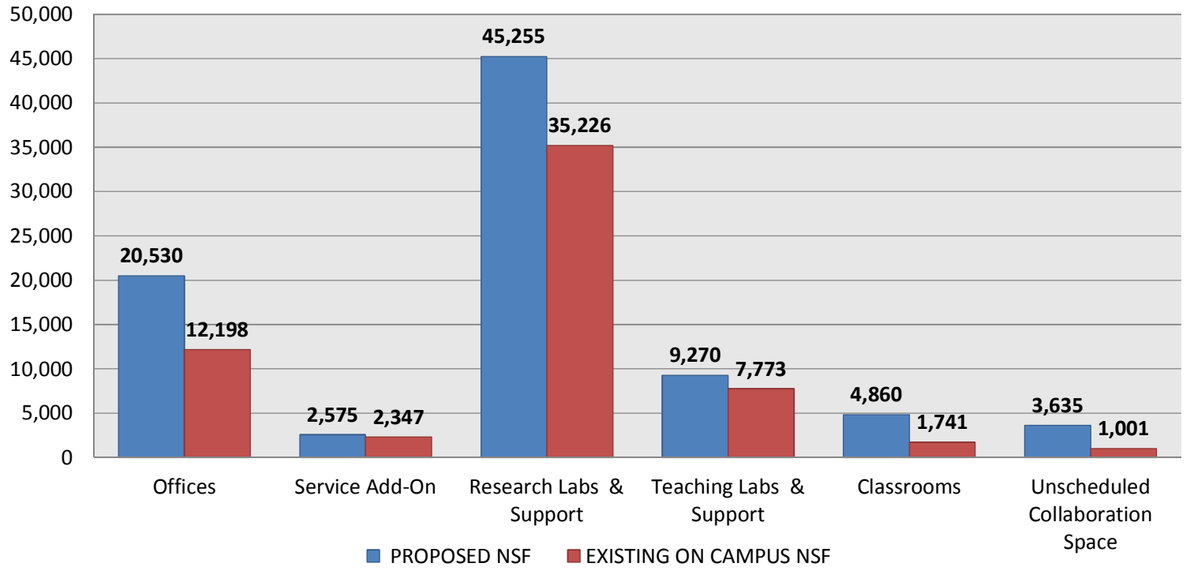
Agricultural and Biological Engineering Current Personnel by Position



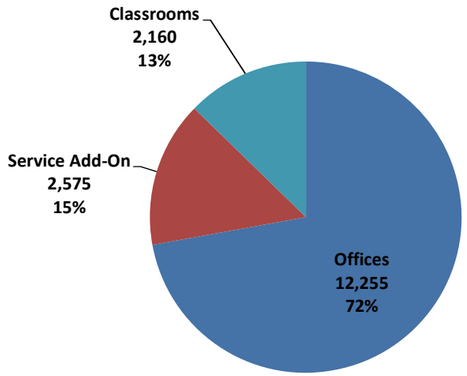
Agricultural and Biological Engineering Future Personnel by Position

Proposed New Addition to the ABE Building





Comparison of Existing Space Versus Proposed Departmental Space



Proposed Renovation to the ABE Building

Summary of Detailed Space Program by Space Type and Proposed Location

	SPACE TYPE	NEW ADDITION NSF	ABE RENOVATION NSF	PROPOSED NSF	EXISTING ON CAMPUS NSF	DELTA NSF
Offices	Offices	8,275	12,255	20,530	12,198	*8,332*
	Service Add-On		2,575	2,575	2,347	*228*
Research	Research Labs & Support	45,255		45,255	35,226	*10,029*
Teaching	Teaching Labs & Support	9,270		9,270	7,773	*1,497*
	Classrooms	2,700	2,160	4,860	1,741	*3,119*
Interaction	Unscheduled Collaboration Space	3,635		3,635	1,001	*2,634*
	SUBTOTAL MASTER PLAN NSF	**69,135**	**16,990**	**86,125**	**60,286**	***25,839***
	PROJECT VALUE	**$50,374,850**	**$8,018,692**	**$58,393,542**		

Detailed Space Program Summary

It is useful to look at each space type individually to understand the drivers for the increase in that space category.

- Office and Service Add-On: Existing allocations are mostly in alignment with Purdue space standards; however, the Department is located in nine buildings and much of their office support space is duplicated.
- Research Labs and Support: Currently, the Department of Agricultural and Biological Engineering is located in nine buildings and much of their research support space is duplicated.
- Teaching Labs: The increase is required to provide an appropriate molecular biology teaching lab for Agricultural and Biological Engineering as well as provide an experiential, hands-on, laboratory-rich environment for teaching and learning.
- Classrooms: The increase is needed to support the department's growing class sizes and is required to migrate the Department of Agricultural and Biological Engineering from tablet armchair classrooms to a classroom design that will promote and enable evolving pedagogies and experiential, hands-on learning.
- Unscheduled Collaboration: This space is necessary to enhance a sense of community and promote opportunities for collaboration within the Department.

The Department of Agricultural and Biological Engineering is proposed to be housed in the current ABE building with a new four story addition planned to be built to the south of the existing ABE building. The program includes the total programed space the department will require to consolidate faculty and research from all areas of the campus with the exception of the faculty and research located in the Soils, ADM, and Kepner Buildings. The majority of the specialized spaces will be located in the addition while the existing building will primarily house office space.

Conceptual Diagrams

Conceptual Diagramming Process

Following the definition of the space program, understanding the required adjacencies of each space and its optimum location within the building is the next critical step. There were a series of meetings to review layout options that involved reviewing both the location of space vertically throughout the building in conjunction with the lab layout concepts. During this process it was determined that the final option should incorporate:

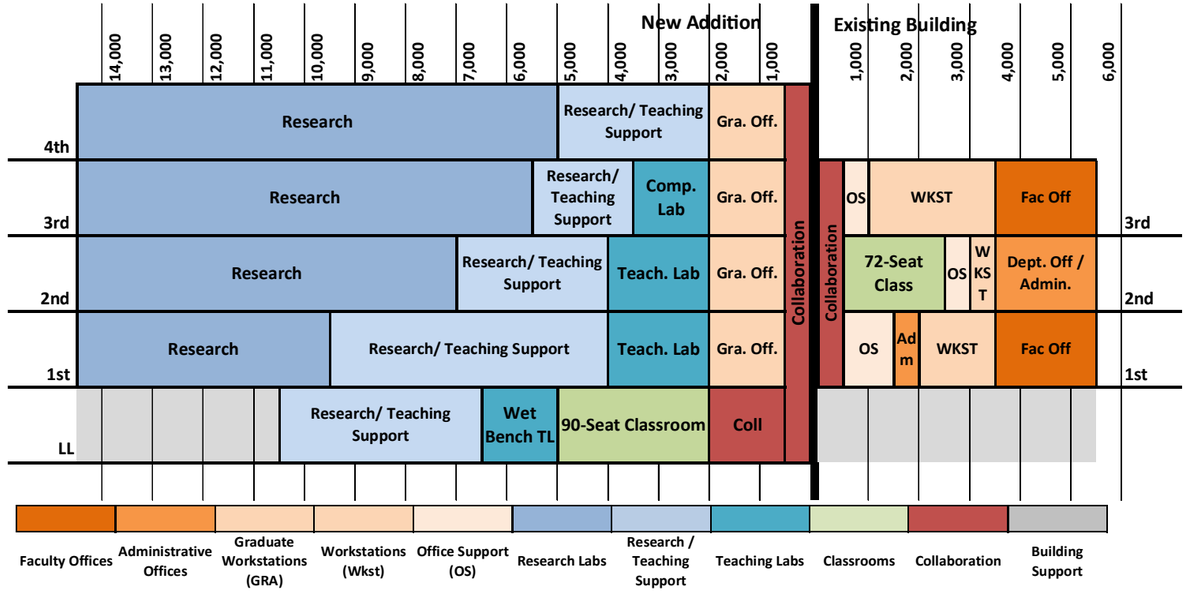
- Teaching functions on each level of the building to promote faculty/ student interaction
- Open labs that are not organized by area of research to allow for future flexibility
- Office space for graduate students located adjacent to research labs
- Faculty offices located together to promote community within the department

The Department of Agricultural & Biological Engineering's faculty and research are divided across nine buildings on campus plus other off-site facilities. Historically, the Department has had a great deal of interaction with other colleges and schools campus wide, which has contributed to this decentralization. Consequently, there has been limited opportunity for departmental interaction in the current configuration. It is assumed that some of the Department will remain in their current locations because of their strong connections to research in their host buildings. This approach provides the Department with the flexibility to move faculty and research back to ABE as needed as research and intercollege interaction evolves.

There are new facilities near campus that duplicate many of the functions located in the one-story south wing of the ABE Building. For example, the existing ABE building south wing is high-bay space that allowed large farm equipment to be brought to campus; however, with the new high-bay facility located nearby in ADM, this access will no longer be required.

The ABE Building is located near the Food Science Department in the Philip E. Nelson Hall of Food Science and benefits from their many synergies. The largest shared resource with the Department of Food Science is the Pilot Plant, which does not need to be duplicated because of its proximity to ABE.

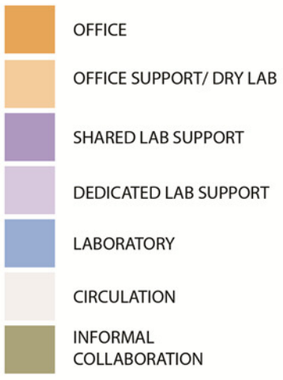
The site of the ABE Building has many constraints and will not accommodate expansion within the existing building. The most feasible approach to consolidate the Department at its current location is to demolish the one story south wing of the ABE Building and build a four-story addition for research on the same footprint, and use the existing building primarily for offices.

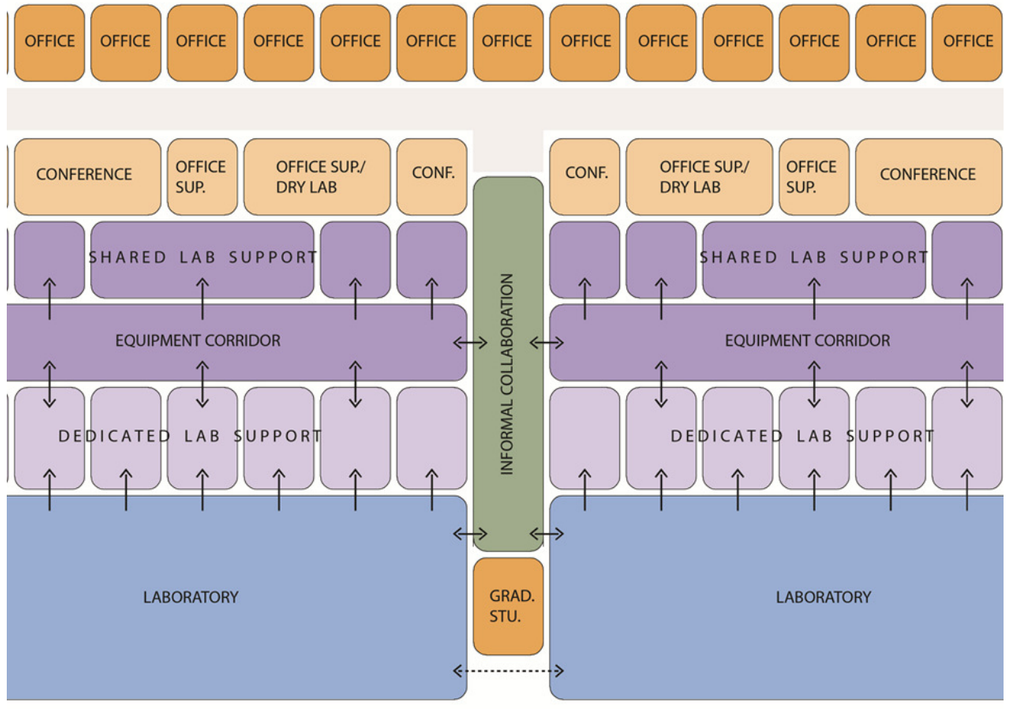


Final Blocking and Stacking Diagram

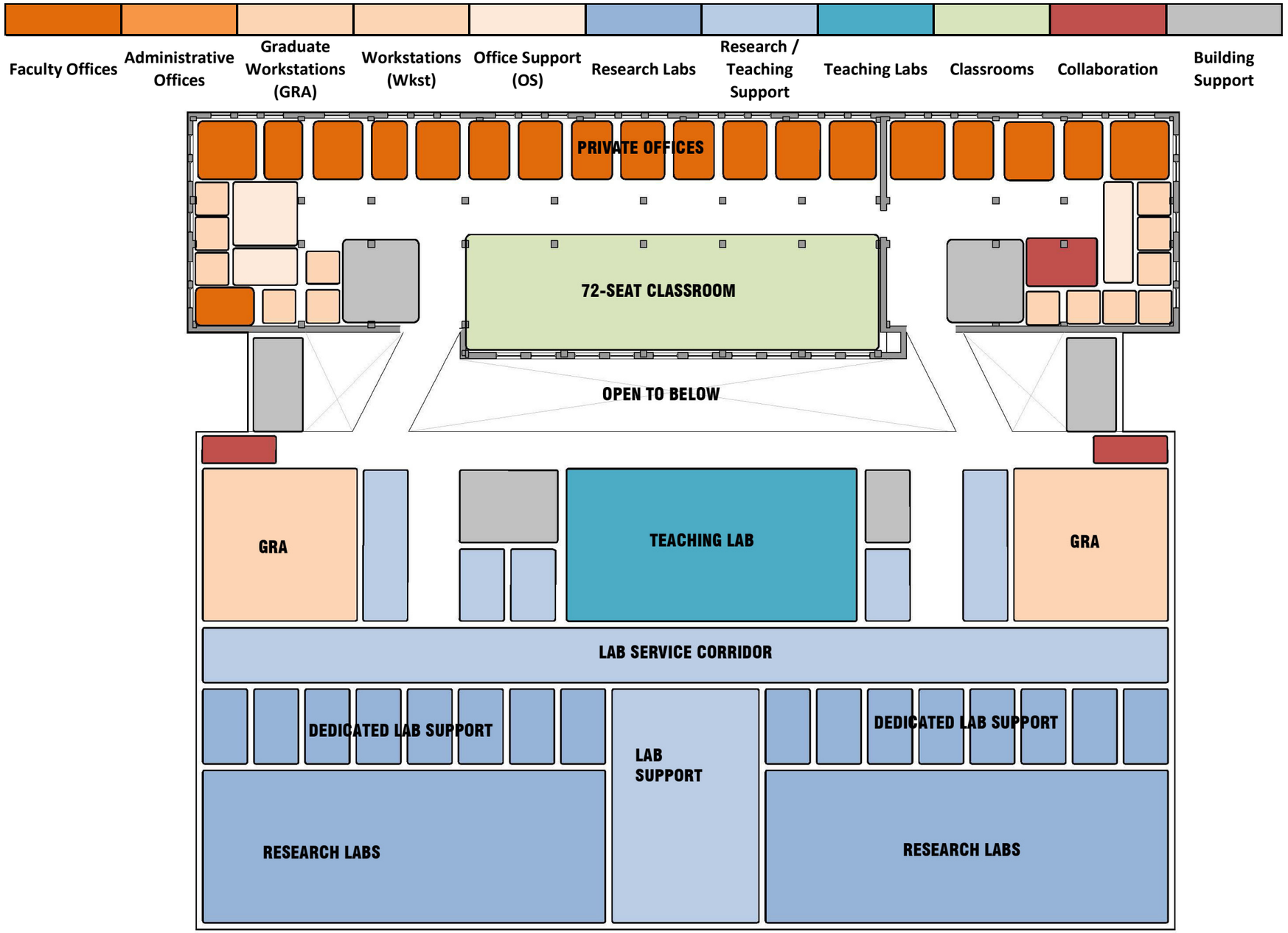
Final Blocking and Stacking Solution

- Dispersed teaching functions on multiple floors to promote student and faculty interaction
- Office space is distributed through the building to provide proximity to research
- Departmental Administrative functions are centrally located
- Lab support located so that it can be easily shared between research and teaching functions





Lab Diagram



Typical Floor Diagram

Building Legend

ABE	Agricultural & Biological Engineering Building
BCHM	Biochemistry Building
DRUG	Drug Discovery Building
HANS	Arthur G. Hansen Life Sciences Res. Bldg.
LYLE	Lyles-Porter Hall
NLSN	Philip E. Nelson Hall of Food Science
PGH	Harrison Street Parking Garage

Conclusion

Project Statistics

Phase One - Demolish the one-story south wing, and build a new four story research lab intensive addition on the same footprint. The building will have a basement and penthouse level in addition to the four stories.

Prerequisites: Relocate any remaining functions in the one-story south wing of ABE building.

Design Duration:	18 months
Construction:	18 months
Net Square Feet:	69,135 NSF
Gross Square feet:	125,000 GSF
Project Cost :	$50.4 Million

Phase Two - Renovate existing ABE Building

Prerequisites: Temporarily vacate the existing three story Agricultural & Biological Engineering Building until the renovation is complete. Use the new addition to accommodate staff displaced by the renovation.

Design Duration:	12 months (overlap phase I)
Construction:	12 months
Net Square Feet:	16,990 NSF
Project Cost:	$8.0 Million

Proposed cost savings strategies:

Leave Food Engineering in the Food Sciences building

- Removes 7,835 NSF of office and research
- Savings of $6.2 Million

Delete 90-seat Classroom

- Savings of $1.7 Million
- Delete 72-seat Classroom
- Savings of $1.3 Million

Conceptual Rendering— Aerial View of ABE Building with Addition to the South

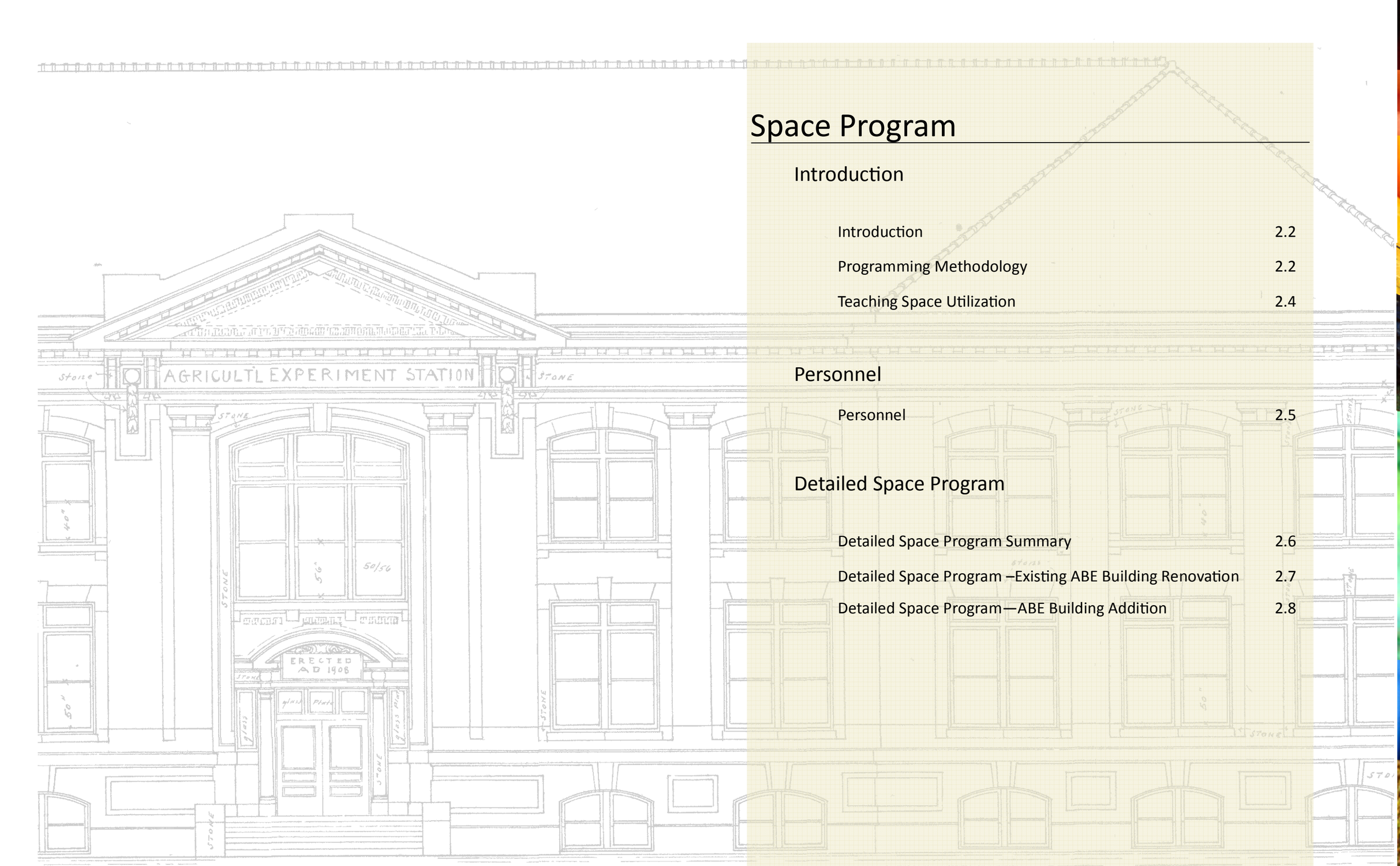
Conceptual Rendering—View of New Addition Looking Northwest

Space Program

Introduction

Personnel

Detailed Space Program



Introduction

Introduction

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The resulting space program reflects a broad vision for facilities with the following key characteristics:

- Meet current and future needs and provide space to grow
- Consolidate Department to promote a sense of community
- Create collaborative facilities that catalyze people
- Accommodate the organization of space to support interdisciplinary endeavors and encourage synergies

Space needs are both quantitative and qualitative. The quantitative space needs are easier to understand since they address anticipated growth and create spatial parity among all users to align with Purdue University space standards. Qualitative space recommendations address the need to create an integrated, collaborative, and at times, experimental learning and research environment that can have a significant impact on productivity and success in learning and research within the College of Agriculture, Department of Agricultural and Biological Engineering.

In response, the Department of Agricultural and Biological Engineering program has been developed to accomplish the following.

1. Provide appropriate office and office support space for the anticipated number of personnel
2. Create a state-of-the-art research environment that includes these features:
   - Experiential teaching lab spaces
   - Large format teaching spaces
   - Opportunities for informal learning
   - Student project space
3. Create a state-of-the-art research environment that provides:
   - Appropriate heating, ventilation, air conditioning, electrical, and plumbing systems
   - Flexible research and support spaces to accommodate evolving research targets, group sizes, equipment and instrumentation.
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4. Create collaborative and interactive spaces with:
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   - Provides compelling and exciting space
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   - Fosters transparency and accessibility
   - Creates density and buzz
   - Puts science and engineering on display

Purdue University Space Standards

Office	Assumed FTE per person	Space Standard	Service Add-On*
Department Head	1	180	30
Director	1	150	30
Tenured/TT Faculty - new bldg	1	130	30
Adjunct Faculty	0.5	65	15
Emeritus / Emeritas	0	0	0
Visiting Scholars		7%	7%
Research Associates /Lab Managers	1	130	30
Post-Docs. / Fellowships	1	65	5
Grads. - Paid	1	40	0
Grads. -TA	1	40	30
Grads. - Unpaid	1	40	0
Grads. - Non ABE	1	40	0
Admin. Management	1	130	30
Admin. Staff / Office	1	120	30
Clerical / Workstation	1	90	30

*Service Add-On includes reception, workrooms, storage, conference rooms, and kitchens

Conference Rooms	NSF per Station
Conference - 12	25
Conference - 36	25
Conference - 50	20

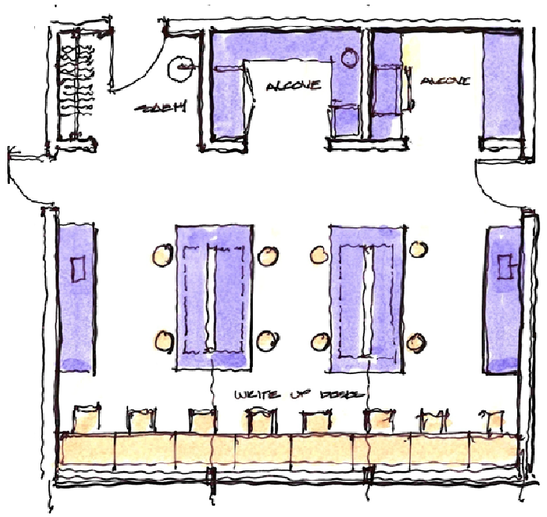
Research Labs- includes lab support	Assumed FTE per Person	Space Standard per Person in New Building	Space Standard per Person in Older Building
Wet	1	225	250
Engineering	1	325	350
Dry - Team Collaboration Space Allowance	1	15	15

Programming Methodology

The program was developed based on Purdue space standards, scientific requirements, utilization, and the desire to create community and enhance interaction. Purdue space standards delineate the amount of space allocated for offices for each category of personnel. Each position category is assigned a typical office size and a service add-on. The visiting scholar category has rapidly increased in recent years and is derived as a percentage of the faculty space allocation. The service add-on accommodates activities outside the office proper, such as reception, workroom, storage, conference rooms, shared office equipment, and lounge/ break rooms. Combining the service add-ons for each staff member into one pool provides sufficient shared space for these various activities. Each organizational unit has discretion in how the combined service add-on space is used. These space standards are designed to provide each organizational unit with a reasonable target for total office and office service space.

Research Laboratory

Research laboratories and dedicated research laboratory space are allocated based on the number of personnel performing research activities, including faculty, post-docs, graduate students, lab managers, and lab technicians. The space standards also acknowledge that different types of research activities including wet bench, dry computational, and engineering have differing requirements. If wet bench lab space, which supports microbiological and molecular biology, is the baseline then the engineering standard is larger due to multiple large pieces of equipment that need to be accommodated. The dry computational allocation is substantially less since most research takes place at each individual's desk or workstation included in the office allocation with an additional allowance for team collaboration space.



An example of a typical repetitive, modular layout of wet bench research laboratory in a new building

Teaching Lab

Classrooms	NSF per Station
Seminar - up to 20 seats	25
Classroom - 36 seats	30
Computer Classroom - 36 seats	30
Tiered or TEAL - 48 seats	30
Tiered or TEAL - 72 seats	30
Lecture Hall - 125 seats	20
Lecture Hall - 250 seats	15

Purdue University Space Standards

Teaching Laboratories

The program for teaching labs is based on the requirement to create opportunities for experiential, hands-on learning in a laboratory-rich environment. Space allocations per station are based on industry standards that enable an active learning environment with more emphasis on group activities and less emphasis on passive learning as well as enabling the incorporation of evolving pedagogies that take advantage of research regarding how students learn. As in research labs, teaching lab space standards acknowledge that space requirements vary among wet bench, engineering, and computer teaching labs, primarily due to the specific types of equipment and learning activities that take place in each. An appropriate amount of support space for preparation of experiments, storage of materials, etc. is also provided.

Classrooms

Classrooms are centrally held and scheduled at Purdue University; however, those with up to 125 seats are included in each Department's program to acknowledge the intensive use of these spaces by the College.

Similar to teaching labs, the design of classrooms has evolved to recognize the trend toward experiential learning. Most of Purdue's older, existing classrooms are formatted as tablet armchair classrooms that reflect a time when the instructor was the sage on the stage and students passively received information and instruction. With the evolution towards experiential learning, increased space per station must be allocated to enable group and individual work in a flexible, technology enriched active learning room (TEAL).

Research Lab

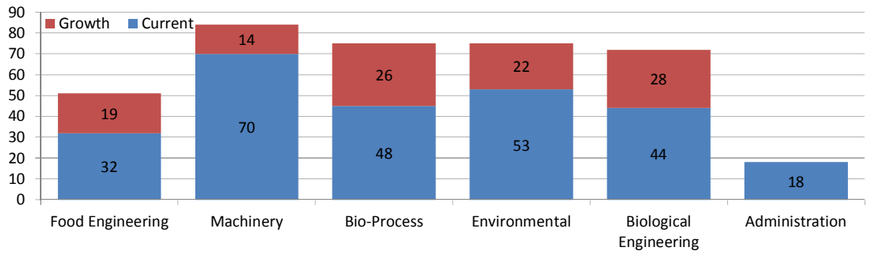
Purdue University Space Standards

Teaching Labs	NSF per Station	Support
Wet Bench	50	25%
Engineering	75	25%
Computer	30	10%

TEAL Classroom

	Current Personnel	LORRE Staff	Growth	Total Future Personnel	Located off campus	Future in ABE
Dept. Head	1	0	0	**1**	0	**1**
Director	1	0	0	**1**	0	**1**
T/T Faculty	32	0	9	**41**	3	**38**
Adjunct	1	0	0	**1**	0	**1**
Emeritas/ Emeritus	2	0	0	**2**	0	**2**
Visiting Scholars	30	0	16	**46**	9	**37**
Lab Mgr./ Lab Tech.	6	2	4	**12**	1	**11**
Post-Docs	8	0	21	**29**	4	**25**
Grads. - Paid	125	0	37	**162**	10	**152**
Grads. - Unpaid	9	0	18	**27**	1	**26**
Non-ABE Grads.	24	0	0	**24**	13	**11**
Admin./ Professional	16	0	2	**18**	4	**14**
Admin. Staff	4	2	1	**7**	0	**7**
Admin./ Clerical	6	1	1	**8**	3	**5**
Total Personnel	265	5	109	**379**	48	**331**

Agricultural and Biological Engineering Personnel Counts by Category



Personnel

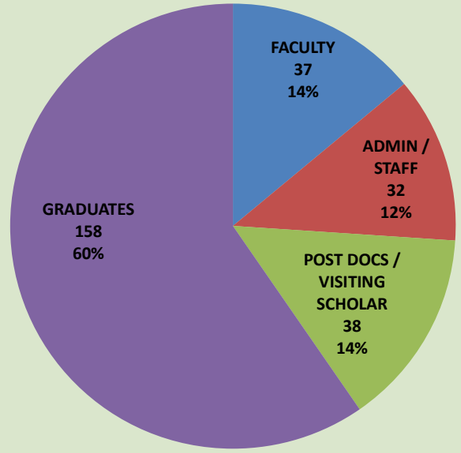
The total number of existing Department of Agricultural and Biological Engineering personnel is 265. The chart to the left shows distribution by job position. Graduate students and tenured/ tenure-track faculty account for the largest proportion of the total personnel, (exclusive of undergraduates).

In order to meet its overarching goals of preparing students, citizens, and industry for the future through the discovery of knowledge, innovative learning opportunities, and progressive engagement programs, the Department of Agricultural and Biological Engineering has determined that it must increase its faculty and graduate student population by 25%.

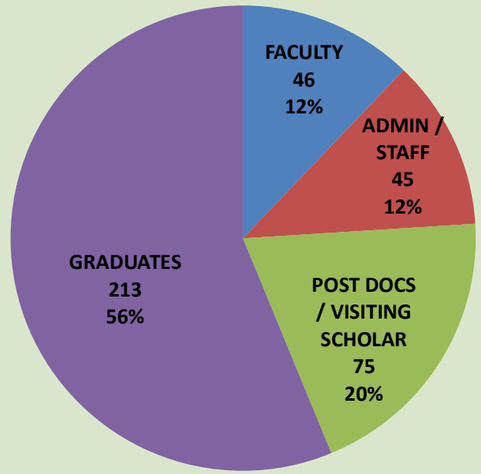
Historically, the Department enrollment has fluctuated. The current undergraduate enrollment is anticipated to steadily increase as university research programs in general are strengthening and growing; therefore, graduate student growth is expected to continue.

The current personnel counts plus the projected growth have set the basis for space allocation for the Department. These totals shown to the left represent the personnel that are accounted for in the following detailed Department of Agricultural and Biological Engineering program outlined below and on the following pages.

The renovation and addition will be planned to accommodate the total personnel with a few exceptions. The personnel located off campus in Kepner, the Soils Building and personnel housed in the Youth Development & Agricultural Education (YDAE) program will remain at their current locations. These programs are better served in their current locations.



Agricultural and Biological Engineering Current Personnel by Position



Agricultural and Biological Engineering Future Personnel by Position

Agricultural and Biological Engineering Personnel Counts by Research Group

	Food Engineering			Machinery					Bio-Process						Environmental					Biological Engineering			Administration		
	Current	Growth	Future Total	Current	Kepner	Current total	Growth	Future Total	ABE Current	POTR Current	LORRE Staff	Current total	Growth no LORRE	Future Total	Current	Soils/ YDAE	Current total	Growth	Future Total	Current	Growth	Future Total	Current	Growth	Future Total
Dept. Head		0													1		1	0	**1**		0			0	
Director										1		1		**1**											
T/T Faculty	4	1	**5**	6	2	8	2	**10**	3	3		6	2	**8**	9	1	10	1	**11**	4	3	**7**		0	
Adjunct										1		1		**1**			0	0			0			0	
Emeritas/ Emeritus										2		2		**2**			0	0			0			0	
Visiting Scholars	4	4	**8**	4	9	13		**13**	4	2		6	3	**9**	4		4	4	**8**	3	5	**8**		0	
Lab Mgr./ Lab Tech.	1		**1**	1	1	2	1	**3**			2		1	**3**	1		1	1	**2**	1	1	**2**	1	0	**1**
Post-Docs	2	4	**6**	1	4	5	5	**10**	1			1	5	**6**			0	2	**2**		5	**5**		0	
Grads. - Paid	17	6	**23**	12	10	22	3	**25**	6	17		23	8	**31**	30		30	10	**40**	33	10	**43**		0	
Grads. - Unpaid	1	4	**5**	1	1	2	3	**5**	1	3		4	3	**7**	1		1	4	**5**	1	4	**5**		0	
Non-ABE Grads.	2		**2**	2	13	15		**15**	2	1		3		**3**	2		2	0	**2**	2	0	**2**	0	0	
Admin./ Professional	1		**1**		1	1		**1**		1		1	2	**3**		3	3	0	**3**		0		10	0	**10**
Admin. Staff											2		1	**3**			0	0			0		4	0	**4**
Admin./ Clerical					2	2		**2**			1		1	**2**		1	1	0	**1**		0		3	0	**3**
Total Personnel	32	19	**51**	27	43	70	14	**84**	17	31	5	48	26	**79**	48	5	53	22	**75**	44	28	**72**	18	0	**18**

Introduction

Teaching Space Utilization

A key factor that impacts the quantity of teaching labs and classrooms, is room utilization which is expressed as a percentage of the total number of hours that a room is available for use per week. The Purdue classroom utilization target is 70% to 75% or 37.5 to 40 hours per week based on a 54 hour week. Additional concepts to consider are room capacity and seat utilization. Room capacity refers to the number of seats that a teaching space is configured to accommodate. Purdue prefers to build classrooms with a minimum of 36 seats; however, smaller seminar-type classrooms are considered to accommodate specific needs of an organizational unit. Seat utilization refers to the number of seats per room that are occupied expressed as a percentage of the total number of seats available during the total number of hours that a room is available for use per week. Purdue determines the number of classrooms required across campus based on a seat utilization target of 70% - 75%.

The actual utilization for teaching labs are usually less than the targets noted above and therefore more teaching labs will be required for the following reasons:

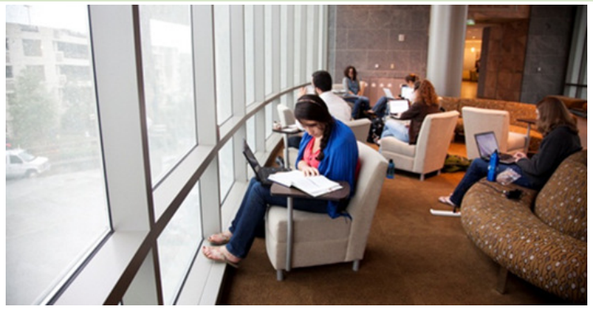
- The unique resources required for courses taught in a given teaching lab often mean that a specific course has to take place in a specific room and cannot be scheduled in another space.
- Teaching labs are often designed around unique equipment and thus cannot be shared to increase utilization.
- Teaching labs often require scheduled set-up time before the lab section meets and break-down time after the lab section resulting in decreased utilization.
- Students often require access to the teaching lab facilities outside of class hours to work on assignments.
- Teaching labs are taught in longer sessions of 2-4 hours, which makes it more difficult to fit classes into all available hours.
- Teaching labs are often linked to classes that meet in a classroom in a different time slot and thus lab times must be coordinated with class times and not just available lab slots.

Teaching Labs

The design team analyzed the number of hours per week required for the Department of Agricultural and Biological Engineering Teaching Labs based on course schedules available on-line for Fall 2011 and 2013 and Spring 2012 and 2013; however, other factors influenced the quantity of labs included in the program. It was acknowledged that the Department of Agricultural and Biological Engineering lacks adequate space to teach molecular biology courses and would like to offer these courses in a dedicated lab which they currently do not have. The utilization table below does not accurately reflect how teaching space is utilized by this department. Many courses are scheduled in classrooms that then move into research labs and other teaching labs throughout the semester. There are currently two engineering teaching labs that are highly utilized and are expected to be highly utilized in the future. The trend shows an increase in laboratory courses and a reduction in classroom instruction. The utilization shown below is low for each lab type; however, the nature of the science dictates that these functions be located in two separate spaces.

Classrooms

The design team analyzed the number of hours per week required for Department of Agricultural and Biological Engineering classrooms based on course schedules available on-line for Fall 2011 and 2013 and Spring 2012 and 2013. The Department noted that their class offerings are constrained by the quantity and quality of classrooms available for use. The number of classrooms was increased to reflect their targeted class offerings. Classrooms will remain centrally scheduled and managed; however, the majority of the classrooms listed for the Department will be located within their designated space. The Department has determined that past classroom usage is not an accurate representation of the future needs. The school has determined that larger classrooms will be required to accommodate growth, to increase class enrollment, and to reduce the number of sections.



Informal collaboration space

Collaboration Space

As education and research are increasingly integrated collaborative enterprises, it is crucial to recognize the need for unscheduled collaboration space. Purdue has responded to this need by recognizing such space types as Open Labs, Group Study, and Informal Break-Out.

Table showing Teaching Space Room and Seat Utilization by Instruction Type

	Fall 2011 & Spring 2012 Utilization						Fall & Spring 2013 Utilization					
	Teaching Labs		Computer Labs		Classrooms		Teaching Labs		Computer Labs		Classrooms	
Use not including time at Kepner and ADM	Hours per Week	Seats per Week	Hours per Week	Seats per Week	Hours per Week	Seats per Week	Hours per Week	Seats per Week	Hours per Week	Seats per Week	Hours per Week	Seats per Week
Spring	16	362	42	653	70	1955	43	754	18	428	59	1717
Fall	48	725	23	634	70	2445	38	1044	18	564	61.5	2091
Peak Load	48	725	23	653	70	2445	38	1044	18	564	61.5	2091
Scheduled hours/seats per week	20	400	20	720	40	2880	20	400	20	720	40	2880
Number of rooms	2.40	1.81	1.15	0.91	1.75	0.85	1.90	2.61	0.90	0.78	1.54	0.73

Teaching labs and Computer labs serve dual uses and provide space for student project work in addition to instructional space. In order to achieve this, the labs are required to remain unscheduled for 26 hours a week which helps reduce duplication of expensive spaces within the program. The trend shows increased lab class sizes which is not desired by the department. It was determined that lab class sizes should not exceed 24 seats.

Teaching labs require prep time between classes. This prep time accounts for 8 hours a week assuming the courses are only scheduled for 20 hours a week. Teaching labs seats assumes an average of 20 seats per lab per course hour.

The quantity of Computer lab seats assumes an average of 36 seats per course hour.

The number of classroom seats assumes an average of 72 seats per class. Note that the classroom usage has decreased over the semesters shown, and lab usage has increased.

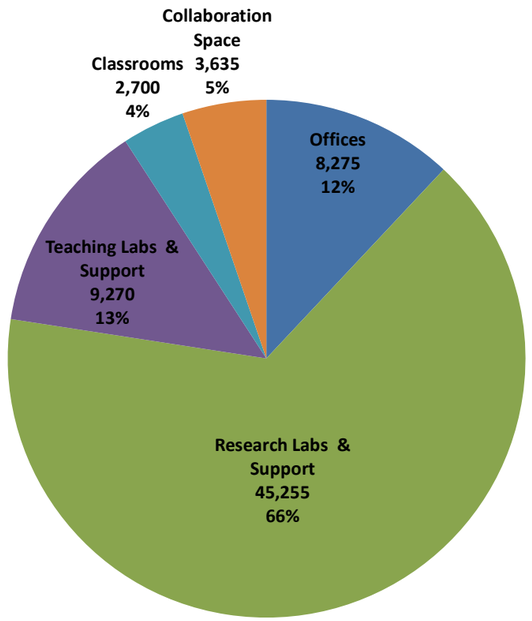
Purdue University Space Standards

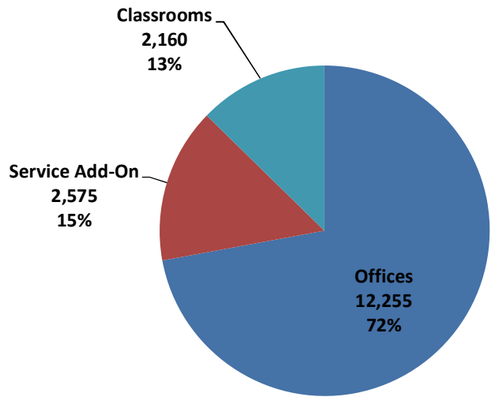
Unscheduled Collaboration Space	NSF per Station
Open Lab - Computer	25
Open Lab - Project	50
Group Study (quiet)	25
Informal Research Collaboration	25
Informal Collaboration	25

Classroom

Detailed Space Program

Proposed New Addition to the ABE Building





Proposed Renovation to the ABE Building

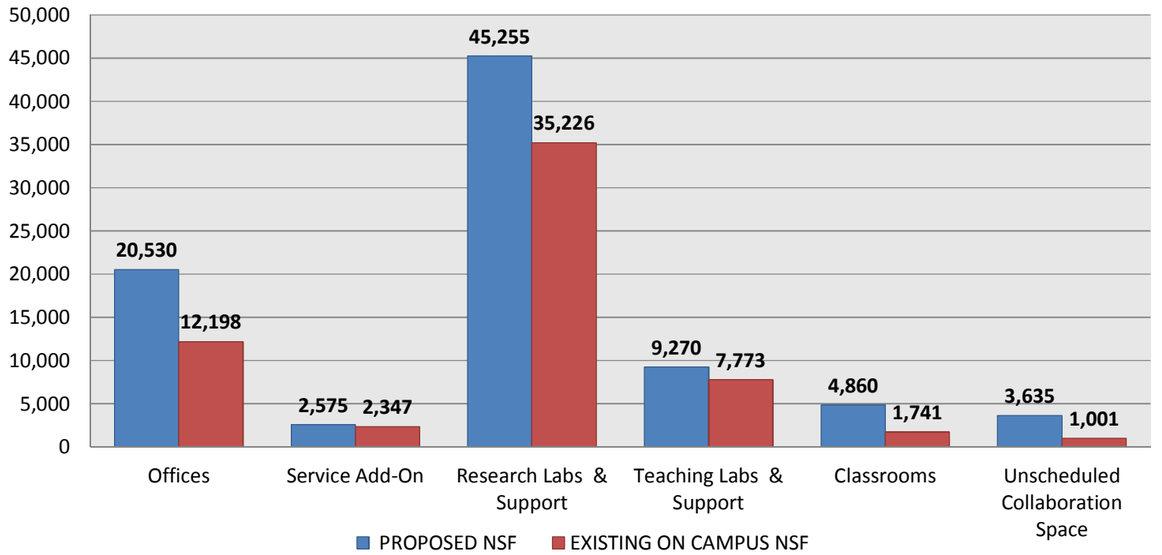
Detailed Space Program Summary

It is useful to look at each space type individually to understand the drivers for the increase in that space type.

- Office and Service Add-On: Existing allocations are mostly in alignment with Purdue space standards; however, the Department is located in nine buildings and much of their office support space is duplicated.
- Research Labs and Support: Currently the Department of Agricultural and Biological Engineering is located in nine buildings and much of their research support space is duplicated.
- Teaching Labs: The increase is required to provide an appropriate molecular biology teaching lab for Agricultural and Biological Engineering as well as provide an experiential, hands-on, laboratory-rich environment for teaching and learning.
- Classrooms: The increase is needed to support the departments growing class sizes and is required to migrate the Department of Agricultural and Biological Engineering from tablet armchair classrooms to a classroom design that will promote and enable evolving pedagogies and experiential, hands-on learning.
- Unscheduled Collaboration: This space is necessary to enhance a sense of community and promote opportunities for collaboration within the Department.

The Department of Agricultural and Biological Engineering is proposed to be housed in the current ABE building with a future four story addition to the south of the existing ABE building. The program includes the amount of programed space the department will require to consolidate faculty and research from all areas of the campus with the exception of the faculty and research located in the Soils, ADM, and Kepner buildings. The majority of the technical spaces will be located in the addition while the existing building will primarily house office space.

The following pages define in detail the proposed program required to support the Department of Agricultural and Biological Engineering in this location.



Comparison of Existing Space versus Proposed Departmental Space

Summary of Detailed Space Program by Space Type and Proposed Location

	SPACE TYPE	NEW ADDITION NSF	ABE RENOVATION NSF	PROPOSED NSF	EXISTING ON CAMPUS NSF	DELTA NSF
Offices	Offices	8,275	12,255	20,530	12,198	*8,332*
	Service Add-On		2,575	2,575	2,347	*228*
Research	Research Labs & Support	45,255		45,255	35,226	*10,029*
Teaching	Teaching Labs & Support	9,270		9,270	7,773	*1,497*
	Classrooms	2,700	2,160	4,860	1,741	*3,119*
Interaction	Unscheduled Collaboration Space	3,635		3,635	1,001	*2,634*
	SUBTOTAL MASTER PLAN NSF	**69,135**	**16,990**	**86,125**	**60,286**	***25,839***
	PROJECT VALUE	**$50,374,850**	**$8,018,692**	**$58,393,542**		

Summary of Detailed Space Program - Existing ABE Building Renovation

		Current			Detailed Program						
					cap.	*per room*		TOTALS			
Space Type		Area Offsite (Kepner + ADM)	Area on campus (ABE + POTR)	Total Personnel	Seats per room	NSF / Seat	*NSF / station or Room*	No. of stations or Rooms	**Total Area (NSF)**	Service Add-On Allowance	Notes
Existing Building Renovation											
Offices & Service Add-On											
	Offices	**806**	**12,198**	**104**					**12,255**		
	Dept. Head			1			180	1	180	*30*	
	Director			1			150	1	150	*30*	
	T/T Faculty			32			130	38	4,940	*1,140*	
	Adjunct			1			65	1	65	*15*	
	Emeritas/ Emeritus			2			65	2	130	*30*	
	Visiting Scholars			30			65	37	2,405	*0*	
	Post-Docs.			8			65	25	1,625	*0*	
	Admin./ Professional			16			120	14	1,680	*420*	
	Admin. Staff			6			90	7	630	*210*	
	Admin/ Clerical			7			90	5	450	*150*	
	Service Add-On	**29**	**2,347**						**2,575**	2,025	
	Department Reception				6	25	150	1	150		
	Files/Storage						180	1	180		
	Admin Workroom						160	1	160		
	Business Workroom						120	1	120		
	Informal Collaboration				6	20	120	2	240		
	Conference				25	25	625	1	625		
	Conference				12	25	300	3	900		sub dividable 12/24
	Kitchen				8	25	200	1	200		
Offices & Support Total		**835**	**14,545**						**14,830**		
Classrooms											
110	Classroom 72-Seat				72	30	2,160	1	2,160		
Total Classrooms		**0**	**865**						**2,160**		
ABE RENOVATION TOTAL		**835**	**15,410**						**16,990**		

Detailed Space Program –Existing Building Renovation

The existing ABE 3-story building is 29,800 gross square feet.

The building can support approximately 17,500 net square feet of programmed space. The detailed space program for the proposed renovation shown to the left is predominately office and office support space to serve as a home for the Department faculty and students. It is the desire of the Department to consolidate faculty and administration since historically they have been decentralized throughout campus. This has limited collaboration opportunities within the department, and has required duplicate spaces that can be reduced when faculty is consolidated. In particular office support space has not been increased in conjunction with the office growth because their colocation provides an economy in the amount of service add-on space required.

The existing building will also house one of the required classrooms. Due to the long narrow configuration of the existing space, it best accommodates a 72– student, technology enriched active learning (TEAL) room.

The three 12-seat conferences rooms will be located adjacent one another with an operable partition between each room to provide flexible use.

Existing ABE Building Looking South

Detail Space Program

Detailed Space Program—ABE Building Addition

The office space that will be located in the addition will support the research component of the program which includes lab manager offices and grad student office space.

The majority of space in the addition will house research laboratories. The research space allocation in the College of Agriculture Facilities Master Plan was originally determined by a factor of the number of personnel and Purdue University space standards. In meetings with the research groups it was determined that much of the research support space could also support teaching functions and be shared between the different research areas to allow a reduction in required space. The research areas are Food Engineering, Machinery, Bio-Process, Environmental, and Biological Engineering. Within each of these research areas the research group sizes vary.

Food Engineering is currently located in the Food Science Building. The Food Sciences program is expanding and will absorb the space that is currently occupied by ABE. ABE will not duplicate the pilot plant in their building across the street but rather share the use of this facility. The pilot plant is currently undersized for their need, but future plans call for addition to the Food Sciences Building, which will include expanding this function. The planned average research group for Food Engineering includes: 1 faculty, 1 post doctorate, and 6 graduate assistants.

Machinery research is presently located in both the ABE building and the new ADM building. The ADM building provides shared large bay space for specialized work and will remain at this location. Research space will also be located in the ABE building for small machinery research. This average research group size is smaller: 1 faculty, 1 post doc., and 2.5 graduate assistants.

Summary of Detailed Space Program - ABE Building Addition

Space Type	Current: Area Offsite (Kepner + ADM)	Current: Area on campus (ABE + POTR)	Current: Total Personnel	Detailed Program: Seats per room (cap.)	Detailed Program: NSF / Seat (per room)	Detailed Program: NSF / station or Room (per room)	Detailed Program: No. of stations or Rooms (TOTALS)	Detailed Program: **Total Area (NSF)** (TOTALS)	Detailed Program: Service Add-On Allowance	Notes
New Building Addition										
Offices & Service Add-On										
Lab Mgr./ Lab Tech.			8			65	11	715	*55*	
Grads. - Paid	1,128	2,903	125			40	152	6,080	*0*	
Grads. - Unpaid			9			40	26	1,040	*0*	
Non-ABE grads.			24			40	11	440	*330*	
Offices & Support Total	**1,128**	**2,903**	**166**					**8,275**		
Research Labs & Support										
Food Engineering -5		4,999							5,420	
Open Lab				8	80	640	5	3,200		
Fume Hood Alcoves						120	2	240		
Dedicated Lab Support						120	5	600		
Large Equipment Corridor						120	5	600		
Shared Lab Support						240	2	480		
Cold Room						120	1	120		
Glasswash						180	1	180		
Pilot Plant						4,500	1	0		in FS Expansion
Machinery -8	19,903								8,600	
Open Labs				8	80	640	8	5,120		
Tool Room						240	1	240		supports teaching
Parts Room						240	1	240		supports teaching
Machinery Floor						3,000	1	3,000		supports teaching

Research Space as Calculated by Purdue Standards

Research Group Lab & Support Space Type	Total FTE	SF / FTE	SF of Space
Food Engineering -5	35	225	7,875
Machinery -8	30.5	325	9,913
Bio-Process-8	46.5	225	10,463
Environmental-11	45.5	225	10,238
Biological Engineering-7	47	225	10,575
Total Research & Support			49,063

Summary of Detailed Space Program - ABE Building Addition—Continued

Space Type	Area Offsite (Kepner + ADM)	Area on campus (ABE + POTR)	Total Personnel	Detailed Program: cap. Seats per room	per room: NSF / Seat	per room: *NSF / station or Room*	TOTALS: No. of stations or Rooms	TOTALS: **Total Area (NSF)**	Service Add-On Allowance	Notes
New Building Addition										
Bio-Process-8		8,684							8,540	
Open Labs				8	80	640	8	5,120		
Fume Hood Alcoves						120	4	480		
Dedicated Lab Support						120	8	960		
Large Equipment Corridor						120	8	960		
Shared Lab Support						240	3	720		
Cold Room						120	1	120		
Glasswash						180	1	180		
Environmental-11									11,660	
Open Labs				8	80	640	11	7,040		
Fume Hood Alcoves						120	6	720		
Dedicated Lab Support						120	11	1,320		
Large Equipment Corridor						120	11	1,320		
Shared Lab Support						240	4	960		
Cold Room						120	1	120		
Glasswash						180	1	180		
Biological Engineering-7									7,420	
Open Labs				8	80	640	7	4,480		
Fume Hood Alcoves						120	3	360		
Dedicated Lab Support						120	7	840		
Large Equipment Corridor						120	7	840		
Shared Lab Support						240	2	480		
Cold Room						120	1	120		
Warm Room						120	1	120		
Glasswash						180	1	180		
Central Lab Support									3,615	
Fermentation Lab						1,500	1	1,500		supports teaching
Field Sample prep - grinding						240	1	240		
Field Electronics shop						240	1	240		
Field Electronics storage						240	1	240		
Equipment room						480	1	480		supports teaching
Field Storage				9	75	675	1	675		supports teaching
Field Loading						240	1	240		w/ loading dock
Research Labs & Support Total	**19,903**	**35,226**						**45,255**		

Bio-Process research takes place in Potter Hall, the ABE building, and Lilly Hall. This research group will be consolidated in the new ABE complex. Also included in the consolidation is the staff from Lorre which is identified as College of Engineering Staff. The planned average research group size is: 1 faculty, 1 post doc., and 4 graduate assistants.

Environmental research is located in the ABE building and Lilly Hall. This research group is planned to be consolidated in the new ABE complex. The planned average research group size is: 1 faculty and 4 graduate assistants.

Biological Engineering research is located in the ABE building and Bindley Biosciences Center. This research group will be consolidated in the new ABE complex. The planned average research group size is: 1 faculty and 4 graduate assistants.

Much of these research activities overlap and by locating all faculty and their research in one building will provide opportunities to strengthen intradepartmental research.

Detail Space Program

Detailed Space Program—ABE Building Addition

Teaching spaces will serve a dual purpose for both open student project space and teaching. There are two types of flex teaching labs proposed. The first type is an engineering lab, that will replace the two existing labs located in the one-story wing that is to be torn down. There will be two new engineering labs with associated support space in the new building addition to provide storage for equipment that will allow different courses to be taught in the lab. The second type of lab is a molecular biology lab that the Department currently lacks. Most of these courses are taught within the research labs; however, this lab will serve as a flexible teaching lab with different equipment located nearby to support a variety of biological engineering and molecular engineering courses.

Flexible Biological Engineering and Molecular Engineering Teaching Lab

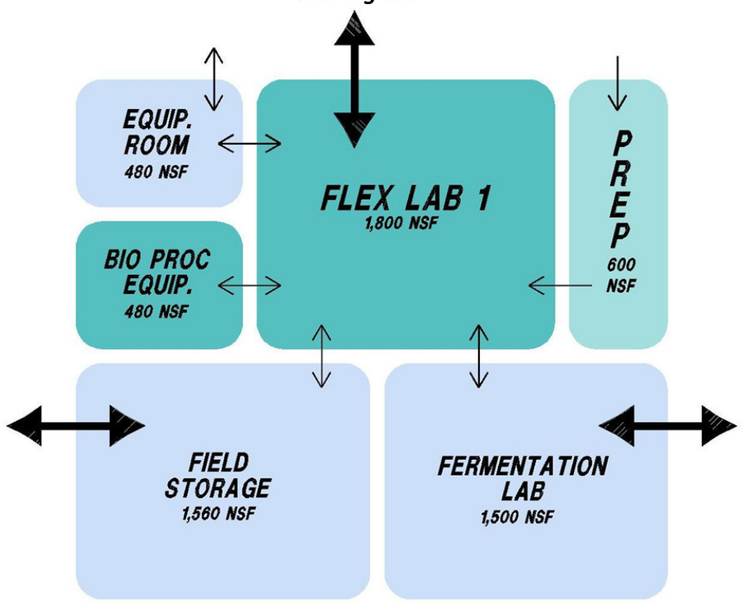
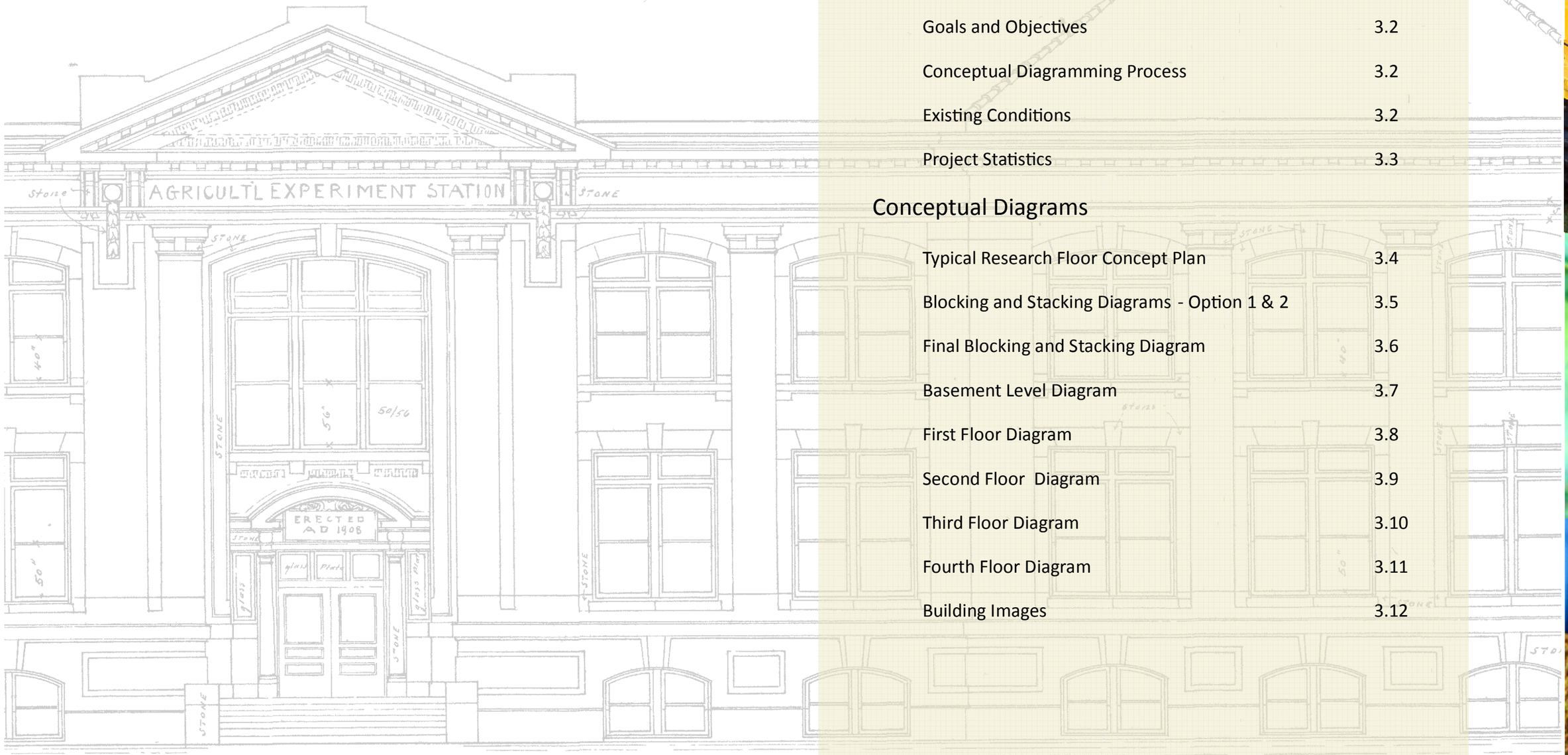


Diagram of a Flex Teaching lab

Summary of Detailed Space Program - ABE Building Addition—Continued

	Space Type	Current: Area Offsite (Kepner + ADM)	Current: Area on campus (ABE + POTR)	Current: Total Personnel	Detailed Program: cap. Seats per room	per room: NSF / Seat	per room: NSF / station or Room	TOTALS: No. of stations or Rooms	TOTALS: **Total Area (NSF)**	Service Add-On Allowance	Notes
	New Building Addition										
	Research Labs & Support Total	**19,903**	**35,226**						**45,255**		
	Teaching Labs & Support										
	Flex Teaching Lab 1										
	Wet Bench Lab				24	50	1,200	1	1,200		
	Biological Processing Equip						480	1	480		
	Food Engineering Equip										in Food Science
	Fermentation Equipment										in Research Space
	Prep Lab						600	1	600		
	Flex Teaching Lab 2										
	Dry Bench Lab				24	75	1,800	2	3,600		
	Electronics & Instrumentation						360	1	360		
	Hydraulics equipment						480	1	480		
	Machinery equipment						0	0	0		in Research Space
	Equipment Support						1,110	1	1,110		
	Computational Lab				48	30	1,440	1	1,440		Dividable 24/24
	Total Teaching Labs & Support	**0**	**7,773**						**9,270**		
	Classrooms										
110	Classroom 90-Seat				90	30	2,700	1	2,700		
	Total Classrooms	**0**	**876**						**2,700**		
	Unscheduled Collaboration Space										
	Open Lab - Senior Capstone				7	40	280	1	280		
	Student Organizations				5	25	125	3	375		3 groups to room
	TA meeting Room				3	40	120	4	480		
	Student Resource Room				20	25	500	1	500		8 Comp. Stations
	Faculty & Grad Collaboration				20	25	500	1	500		
	Group Study (quiet)				5	25	125	4	500		
	Informal Coll (noisy)				20	25	500	2	1,000		
	Total Collaboration Space	**274**	**1,001**						**3,635**		
	ABE ADDITION TOTAL	**21,305**	**47,779**						**69,135**		



Concept Plans

Introduction

Conceptual Diagrams

Introduction

Goals and Objectives

I. **Provide more space:** The need for more space is not only driven by the faculty and student growth, but also the need for improved quality of space. The Department of Agricultural and Biological Engineering is anticipating growth in both undergraduate and graduate enrollment, requiring more space to provide:

- Improved teaching and learning environments that are technology rich
- Higher quality and quantity of student spaces
- Additional collaboration space
- Surge space for international collaborators
- Research facilities that can support cell and molecular biology, wet chemistry, biological engineering, bioprocess equipment and computing

II. **Provide better organization:** The research units within the Department are spread throughout nine other campus buildings. Providing better organization will:

- Consolidate personnel office and research space into the ABE complex, with the exception of the personnel located off campus in the Kepner building
- Include Engineering Personnel from LORRE in building consolidation
- Organize shared research facilities more centrally within the department; however, the Pilot Plant located in Food Sciences Building will remain in the current location with plans for future expansion

II. **Create a physical Departmental identity:** The Department is currently dispersed among nine buildings across campus. Creating a physical departmental identity will:

- Establish a space that celebrates the past, present, and future people and history of the Agricultural and Biological Engineering and its impact on the world
- Create spaces to encourage interdepartmental, community, and international collaborations
- Provide a place to put the Department's science and engineering on display

Conceptual Diagramming Process

Once the space program is determined, understanding the required adjacencies of each space and its desired location within the building is the subsequent step. There were a series of meetings to review layout options, that involved reviewing both the location of space vertically throughout the building and the lab layout concepts. During this process it was determined that the final option should incorporate:

- Teaching functions on each level of the building to promote faculty student interaction
- Open labs that are not organized by area of research to allow for future flexibility
- Office space for graduate students located adjacent to research labs
- Faculty offices located together to promote community within the department

This Department of Agricultural & Biological Engineering's faculty and research are divided across nine buildings on campus in addition to other off site facilities. Historically the Department has had a great deal of interaction with other colleges and schools campus wide, which has contributed to this decentralization. Consequently, there has been limited opportunity for departmental interaction in the current configuration. It is assumed that some of the Department will remain in their current locations because of their strong connections to research in their host buildings. This allows them the flexibility to move faculty and research back to the department as needed, and as research and intercollege interaction evolves.

New facilities near campus have been recently completed that duplicate some of the functions located in the one-story south wing of the ABE Building. For example, the existing south wing is a high bay space which allowed large farm equipment to be brought to campus; however, with the new ADM high bay facility located nearby, this access will no longer be required.

The Department is currently located near the Food Science Department in the Philip E. Nelson Hall of Food Science Building and benefits from their many synergies. The largest shared resource with the Department of Food Science is the Pilot Plant, which does not need to be duplicated due to its proximity to ABE.

The existing ABE Building is land locked and does not allow for expansion. The most feasible way to consolidate the Department at its current location is to demolish the one story south wing of the ABE Building and build a four-story addition for research on the same building footprint, and use the existing building primarily for offices.

The new addition is planned to be four stories above grade with a basement level, and a penthouse level above.

The schedule for the addition is planned to be an 18-month design and 18-month construction duration and will provide swing space to allow for an overall renovation of the existing ABE building. The design of the renovation portion of the project can be completed simultaneously with the design of the new addition or it can be deferred to occur during the construction of the addition. The design of the renovation is anticipated to take one year, and the construction will be completed in one year after the completion of the addition. There are benefits to completing both the addition and renovation as one project thus shortening the construction time and reducing the project cost. This will require the entire building to be vacated and other temporary housing to be provided. Regardless of the phasing, Lilly Hall of Life Sciences could provide the Department temporary housing of both office and lab space during the construction. In light of recent construction projects located adjacent the ABE building, the Department felt it would be too disruptive to remain in the building during the construction of the addition.

View of ABE Building Looking South

Existing Conditions

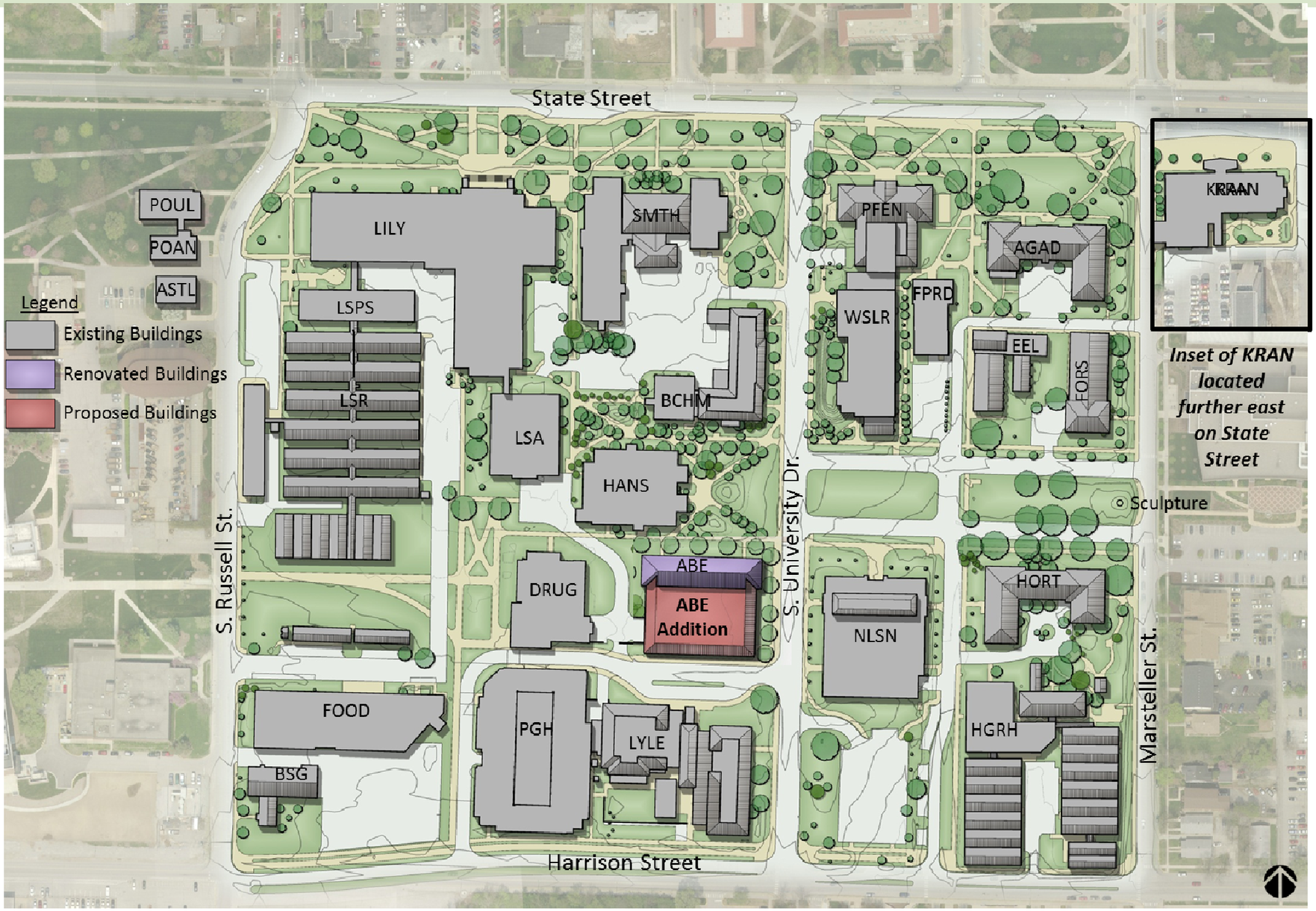
ABE - Agricultural and Biological Engineering Building

The ABE Building is home to the Department of Agricultural & Biological Engineering. It was built in two phases: the original building is 11,000 NSF and was built in 1928, with the addition of 30,000 NSF in 1940. The building is a concrete structure with a brick veneer and concrete masonry unit interior partitions. The two upper floors of the northern three story wing have average floor to floor heights, which makes it difficult to support laboratory functions. These areas would be best renovated and used for offices and classrooms. The one story high bay space to the south is not fully utilized since most of these functions have moved off campus to the new ADM Center to minimize tractor traffic on campus. There is a $2.5 million backlog of deferred repair and rehabilitation of which $1.5 million is electrical, mechanical, and infrastructure upgrades. Existing windows have been recently replaced and will not be done as part of the building renovation. All HVAC, plumbing, and electrical systems will be completely upgraded as part of the renovation of the ABE building.

Purdue University Physical Facilities Summary Report Showing Repair and Rehabilitation Cost by Building dated 11/30/2011, as provided by the University

Bldg	Category		Total Deferred Repair and Rehabilitation
ABE	Bldg Cost:	$28,051,329	FCI: 0.09
	Electrical		$367,500
	HVAC/Mechanical		$220,000
	Infrastructure		$1,050,000
	Interior		$65,300
	Roofing/Siding		$5,000
	Struc/Masonry		$285,000
	Windows/Doors		$420,000
		ABE Total:	$2,412,800

Site plan showing Department of Agricultural & Biological Engineering Proposed Addition and Renovation



Building Legend

ABE	Agricultural and Biological Engineering Building	FORS	Forestry Building	LILY	Lilly Hall of Life Sciences	PFEN	Pfendler Hall
AGAD	Agricultural Administration Building	FPRD	Forest Products Building	LSA	Life Sciences Annex	PGH	Harrison Street Parking Garage
BCHM	Biochemistry Building	HANS	Arthur G. Hansen Life Sciences Res. Bldg.	LSPS	Life Sciences Plant and Soils Laboratory	POAN	Poultry Science Annex
DRUG	Drug Discovery Building	HGRH	Horticulture Greenhouse Building	LSR	Life Science Ranges	POUL	Poultry Science Building
EEL	Entomology Environmental Laboratory	HORT	Horticulture Building	LYLE	Lyles-Porter Hall	SMTH	Smith Hall
		KRAN	Krannert Building	NLSN	Philip E. Nelson Hall of Food Science	WSLR	Whistler Agricultural Research Building

Project Statistics

Phase One - Demolish the one story south wing, and build a new four-story research lab-intensive addition on the same footprint. The building will have a basement and penthouse level in addition to the four-stories.

Prerequisites: Relocate any remaining functions in the one-story south wing of the Agricultural & Biological Engineering building.

Design Duration:	18 months
Construction Duration:	18 months
Net Square Feet:	69,135 NSF
Gross Square feet:	125,000 GSF
Project Cost :	$50.4 Million

Phase Two - Renovate existing Agricultural & Biological Engineering Building

Prerequisites: Temporarily vacate the existing three story Agricultural & Biological Engineering Building until the renovation is complete. Use the new addition to accommodate staff displaced by the renovation.

Design Duration:	12 months (overlap phase I)
Construction Duration:	12 months
Net Square Feet:	16,990 NSF
Project Cost:	$8.0 Million

Proposed cost savings strategies:

Leave Food Engineering in the Food Sciences building

- Removes 7,835 NSF of office and research
- Savings of $6.2 Million

Delete 90-seat Classroom

- Savings of $1.7 Million

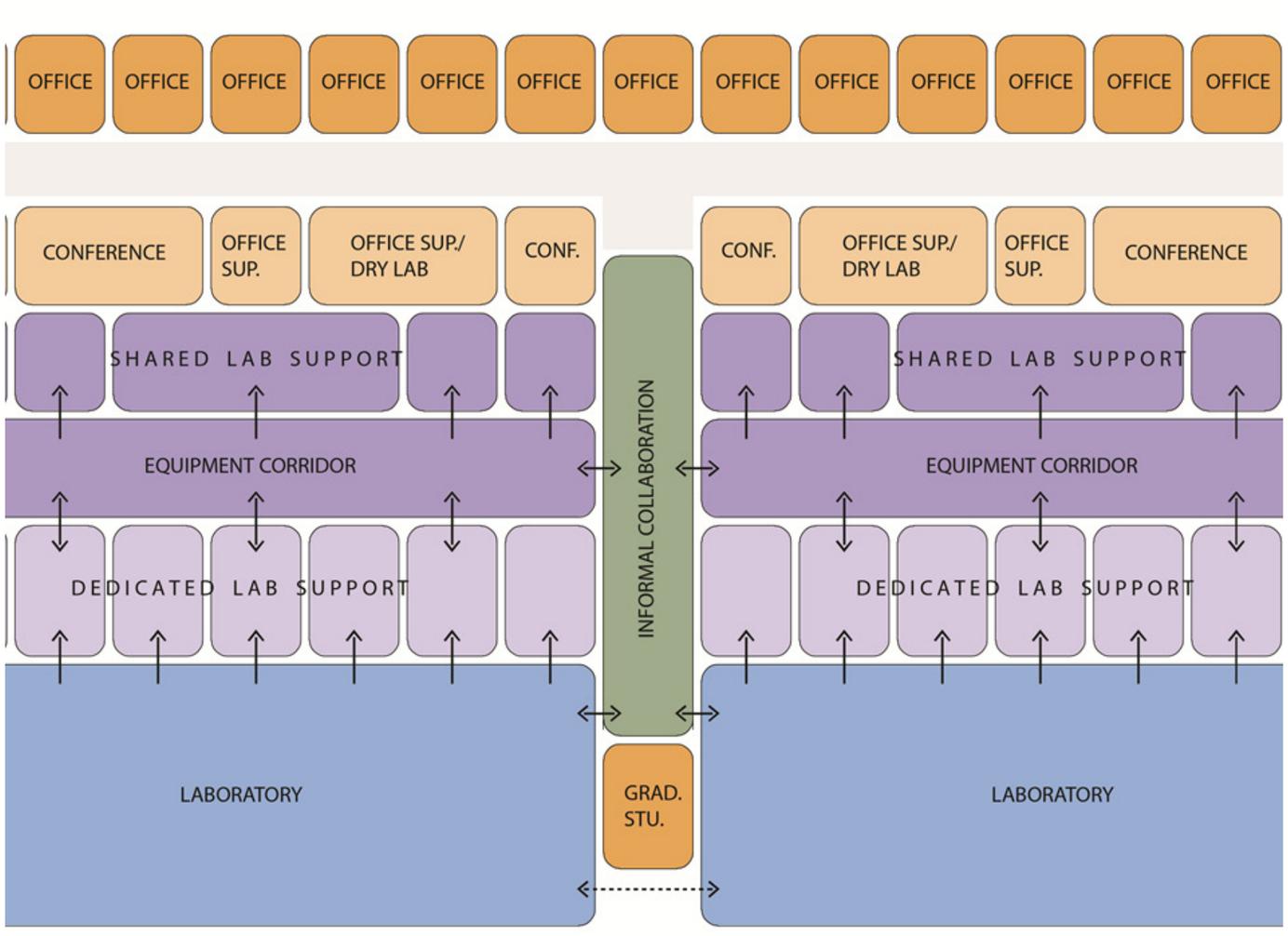
Delete 72-seat Classroom

- Savings of $1.3 Million

Conceptual Diagrams

Typical Research Floor Concept Plan

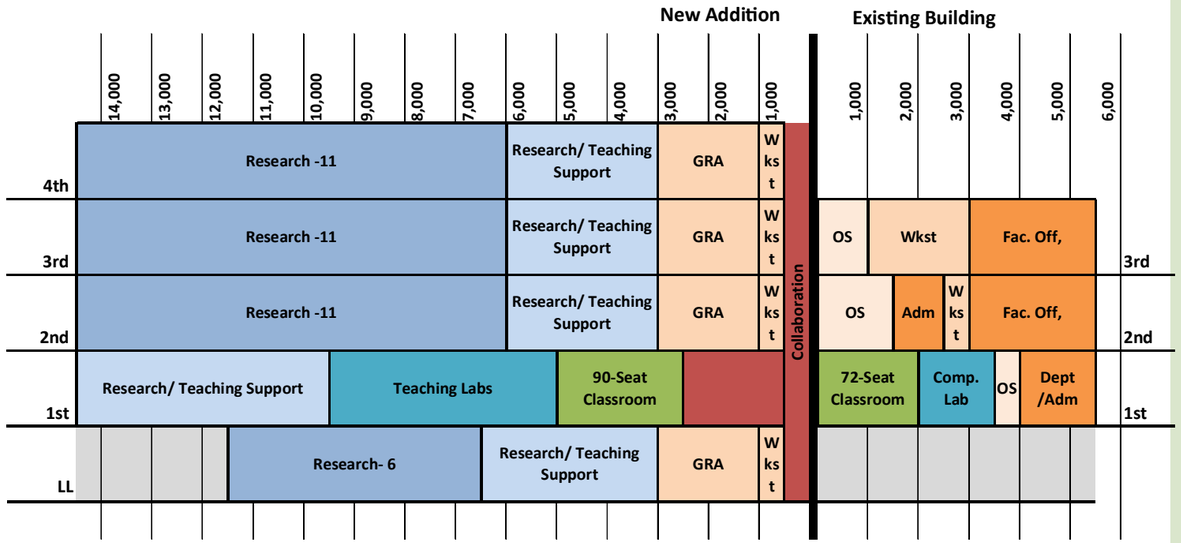
The typical research floor shall be organized with three primary laboratory suites, each with six bays of open-plan main lab and an equal amount (1:1 ratio) of support lab space. The support lab space shall be balanced between dedicated support labs and shared lab support and equipment spaces. The office zone shall arrange faculty offices on the exterior wall of the existing building with office support functions, conferencing space, and dry research space spread throughout the office zone. Informal meeting and interaction spaces shall serve as connections between office and lab spaces. Graduate student shared spaces shall be arranged between, and proximal to, the primary laboratories. This plan is organized to promote higher utilization through shared spaces, efficient space management with flexible and modular open-plan labs, and a highly collaborative environment with generous informal interaction spaces located throughout.



Lab Diagram

Option One Blocking and Stacking

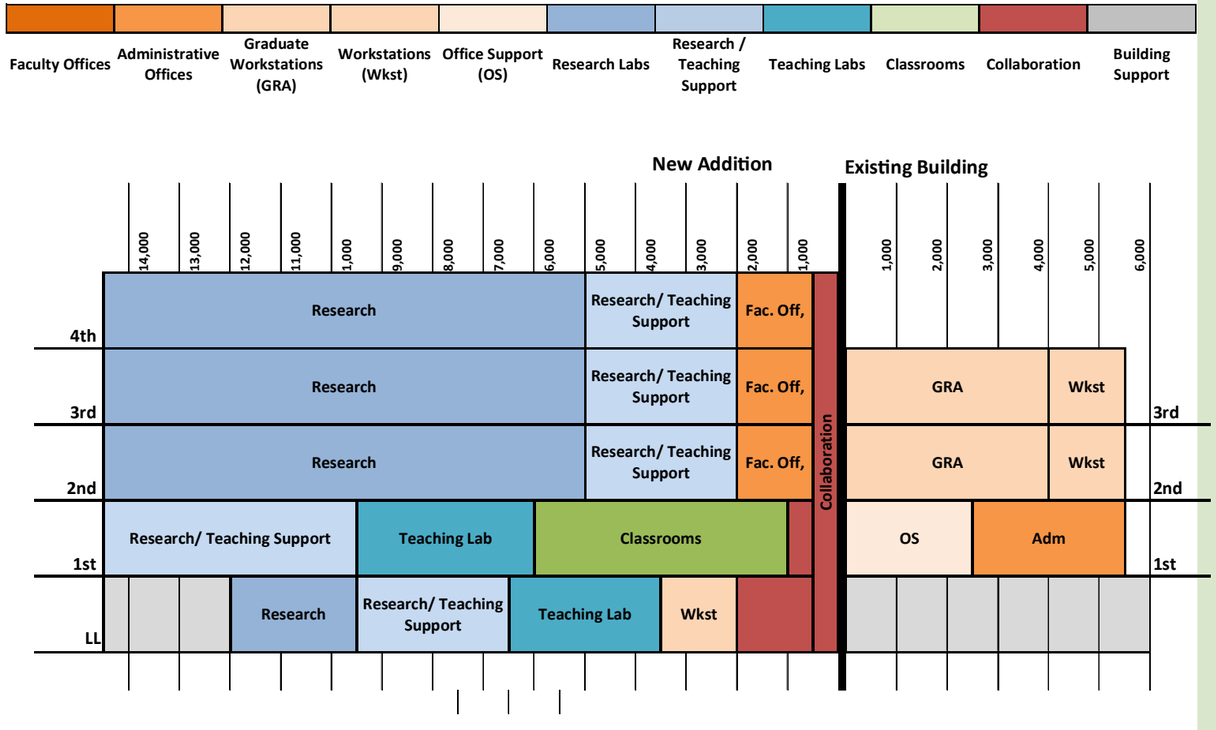
- Research labs are located on upper three floors and lower level
- Teaching labs and classrooms are located on the first floor to minimize student traffic through building
- Locates Machine Research off the first floor, separate from the Machine Shop, which is located adjacent the teaching labs
- Office functions located on the lower level to support research



Option One—Blocking and Stacking

Option Two Blocking and Stacking

- Research labs are located on upper three floors and lower level
- Teaching labs and classrooms are located on the first floor and lower level to minimize student traffic through building
- Locates Machine Research off the first floor, separate from the Machine Shop, which is located adjacent the teaching labs
- Office functions located on the lower level to support research
- Locates faculty offices with research labs



Option Two—Blocking and Stacking

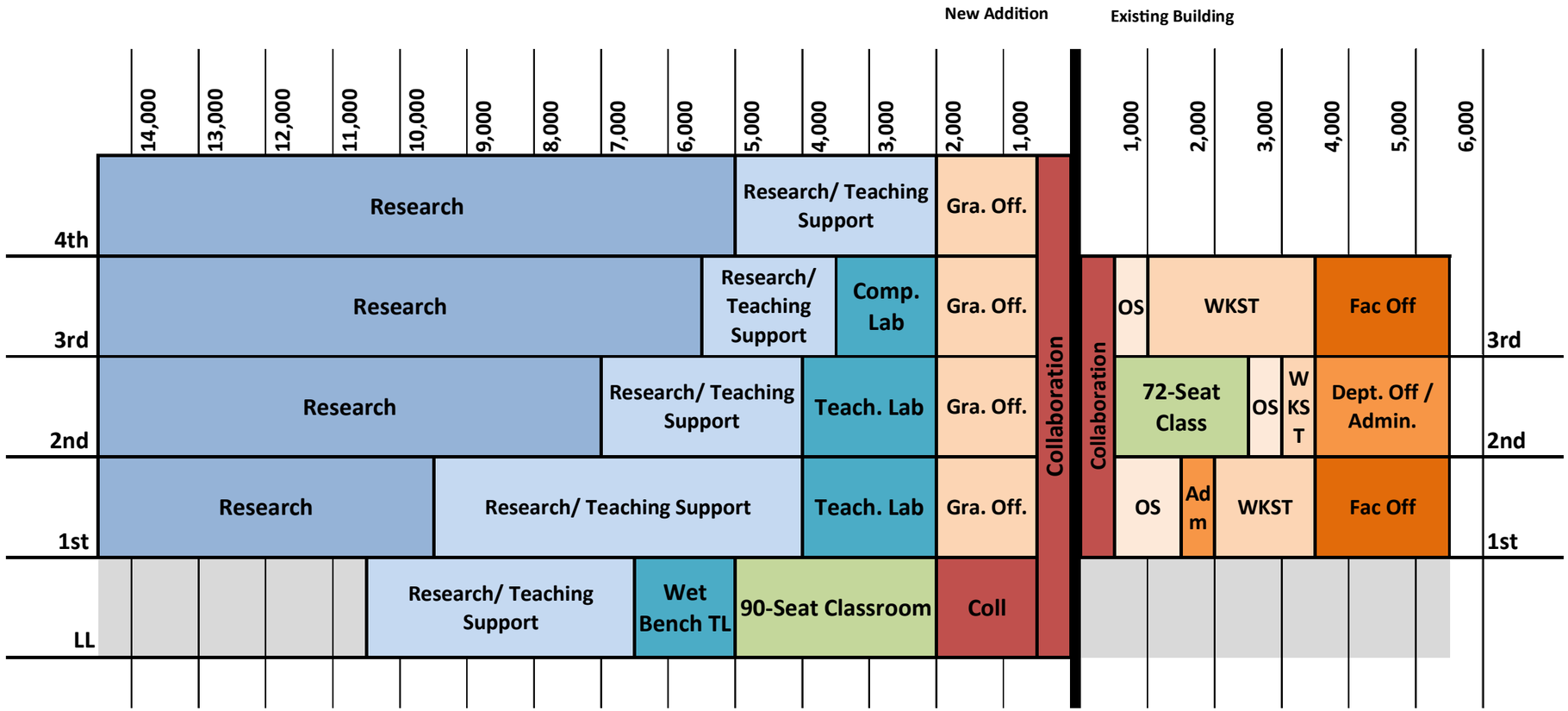
Blocking and Stacking Diagrams

The blocking and stacking diagrams to the right are illustrations of the building in sections showing the adjacencies of the primary functions of space on each floor as well as by building. Using the overall footprint of the proposed structure we overlay blocks of program net square feet of each group and /or function. These two diagrams show options that were studied; however, it was determined that the lack of adjacency of the teaching functions to the faculty, research, and office space is not desirable.

Conceptual Diagrams

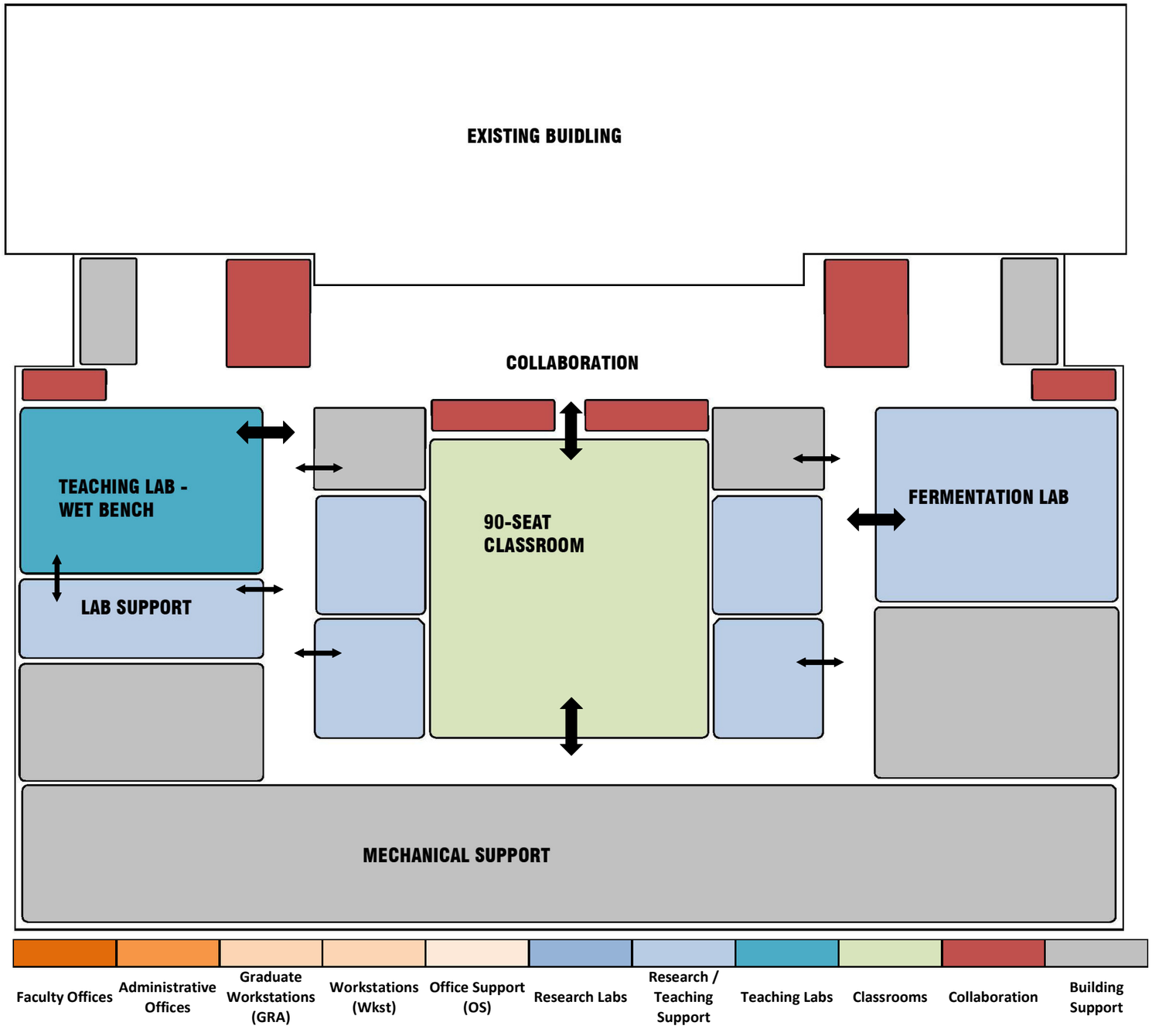
Final Blocking and Stacking Solution

- Dispersed teaching functions on multiple floors to promote student and faculty interaction
- Office space is distributed through the building to provide proximity to research
- Departmental Administrative functions are centrally located
- Lab support located so that it can be easily shared between research and teaching functions



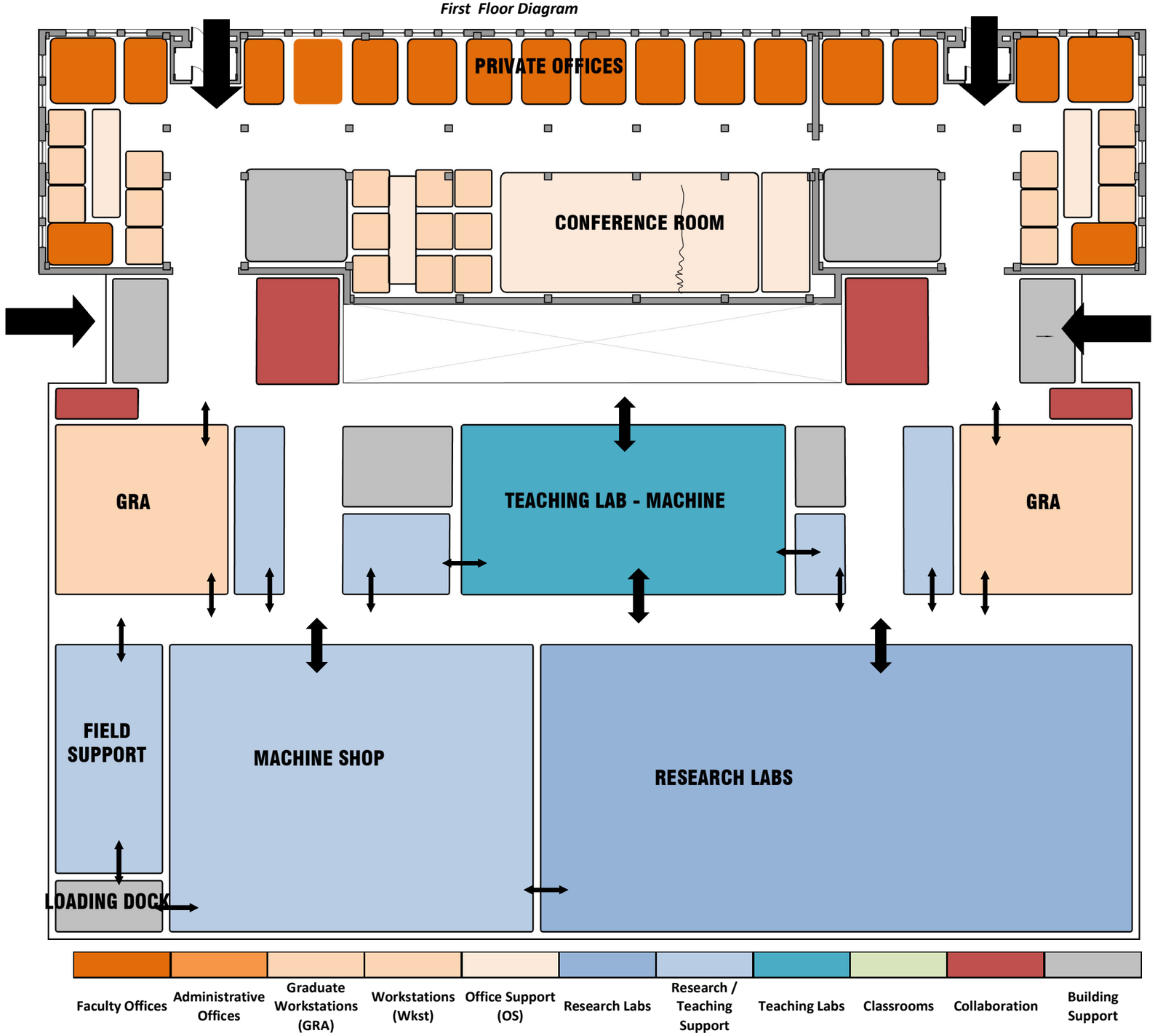
Option Three— Desired Blocking and Stacking Diagram

Basement Level Diagram

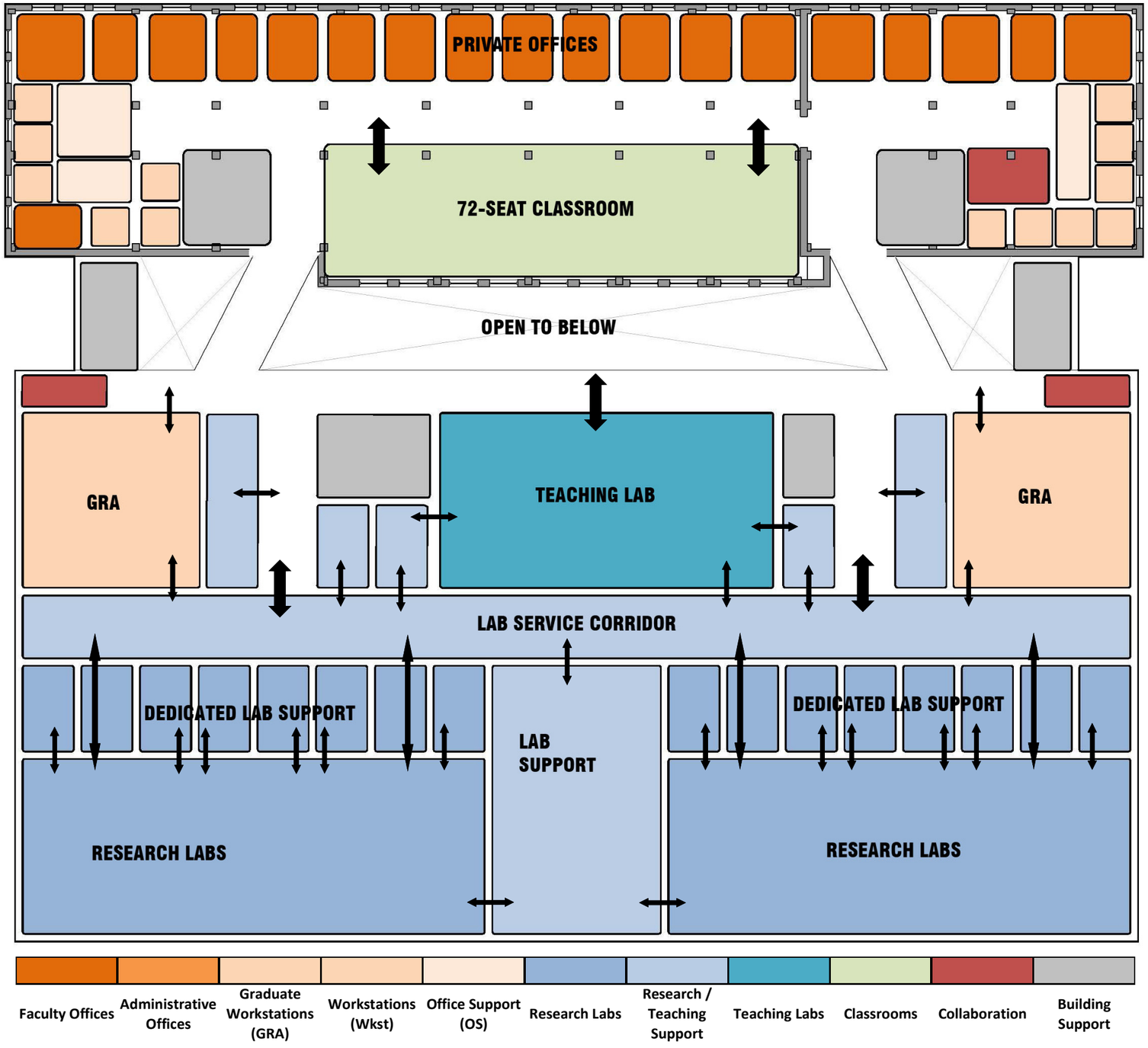


Conceptual Diagrams

First Floor Diagram

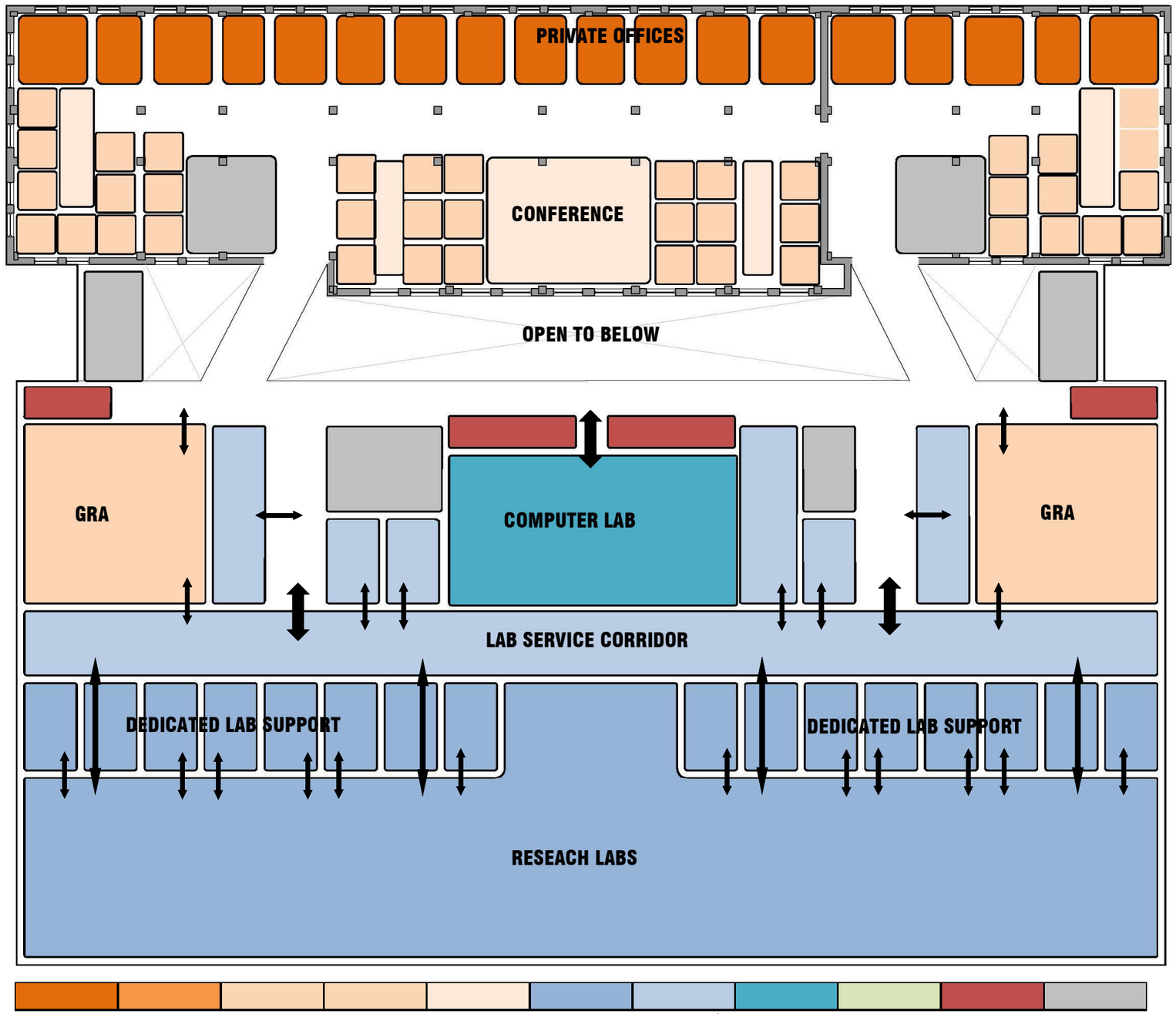


Second Floor Diagram

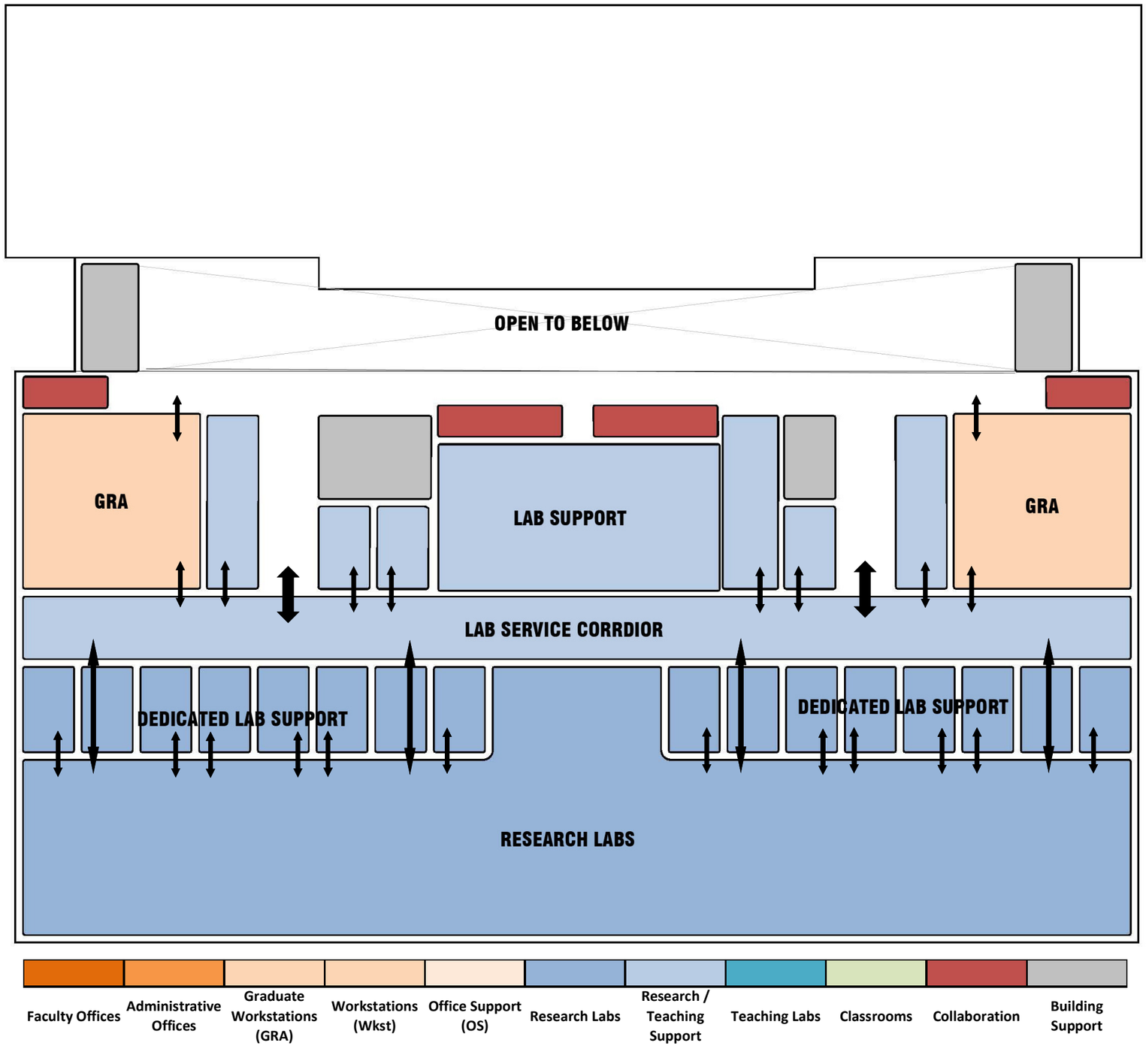


Conceptual Diagrams

Third Floor Diagram



Fourth Floor Diagram



Conceptual Diagrams

Conceptual Rendering—Aerial View of ABE Building with Addition to the South

Conceptual Rendering—View of ABE Addition Looking Northwest

The SLAM Collaborative