UNIVERSITY of CALIFORNIA Riverside

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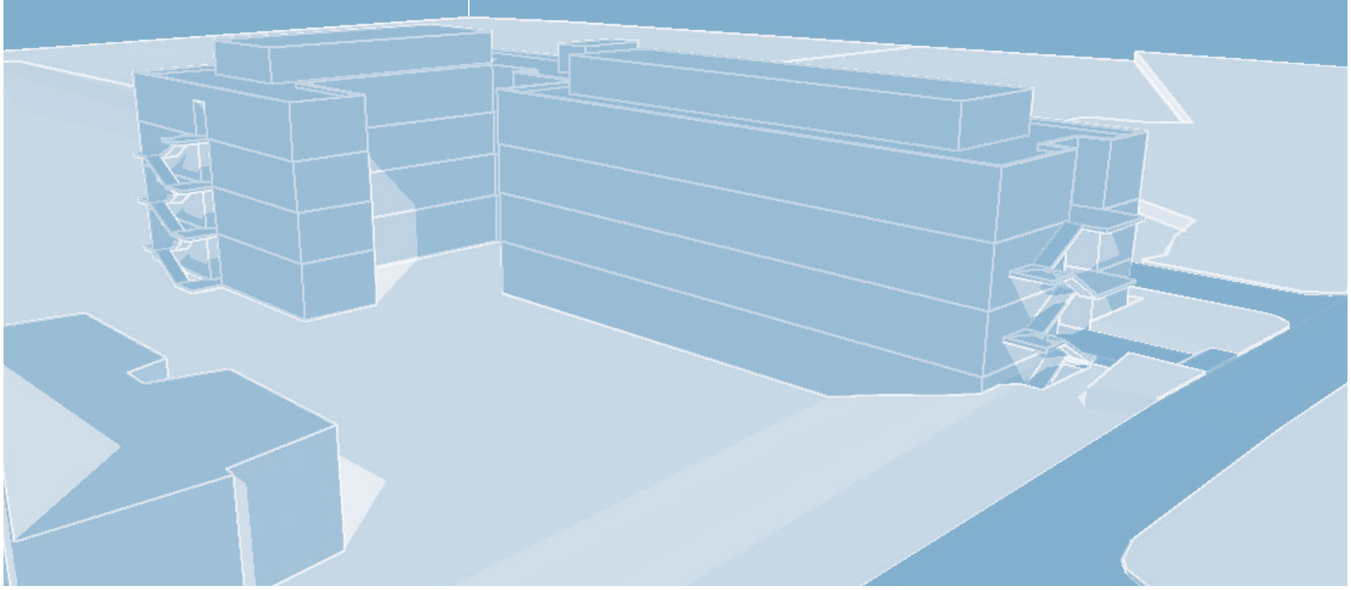
ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM
DPP

AUGUST 28, 2006 FINAL



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ACKNOWLEDGEMENTS

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ACKNOWLEDGEMENTS

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1.0
EXECUTIVE SUMMARY

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

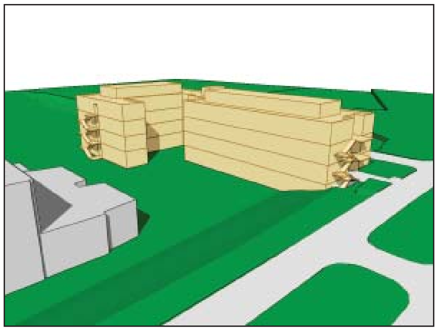
DPP

CO ARCHITECTS

1.1 OVERVIEW
1.2 PROGRAM
1.3 BUILDING
1.4 SITE
1.5 COST

1.0
EXECUTIVE SUMMARY

1.1 OVERVIEW



Massing Model of EBU3 looking northwest

The following Detailed Project Program (DPP) defines the project scope for the Engineering Building Unit 3 (EBU3) that will provide facilities for the Bourns College of Engineering (BCOE) at the University of California, Riverside (UCR). The purpose of the DPP is to establish the goals, parameters and constraints of the project in sufficient detail to provide conceptual guidance for the subsequent design phases of the project and to confirm the estimated construction cost. It is also the intent of the DPP to establish specific space requirements, determine internal and external functional relationships, define site design goals and develop laboratory and building technical design criteria. The proposed space program for the EBU3 is comprised of 54,000 assignable square feet (ASF) in several major program elements including: Instructional Space, Office Space, Research Space, Scholarly Activity Space and Core Facilities/Building Support Space. It is anticipated that building design will achieve an efficiency ratio of 59% thus resulting in a 91,525 gross square foot (GSF) facility. The facility as a whole will provide space for an integrated and interdisciplinary approach to education, research and development in the fields of Bioengineering, Chemical Engineering, Environmental Engineering, and Materials Science. The facility planning criteria contained herein will guide the development of facilities that will fulfill the curricular mission and academic goals of the BCOE for current programs as well as for the creation of a new Department of Bioengineering. EBU3 will meet or exceed regulatory requirements governing the construction of laboratory facilities. The facility will meet or exceed State of California code requirements for sustainability and energy efficiency specified in Title 24.

The building site for EBU3 is located in at the northeast corner of existing intramural playing fields in the East Campus north of the corner of Aberdeen Drive and North Campus Drive. The building site is positioned north of the future Materials Science and Engineering Building (MS&E) and forms the north edge of a planned campus open space designated as the University Arroyo. Program organization studies suggest that the building will consist of a four-story structure with research functions located on the first, third and fourth floor. Due to site topographic parameters, the second floor will serve as the primary public floor accessed directly from the adjacent Aberdeen Drive. As such, functions that require a greater degree of public access and student interface such as departmental administration, teaching laboratories and seminar spaces will occupy the second floor.

1.0
EXECUTIVE SUMMARY

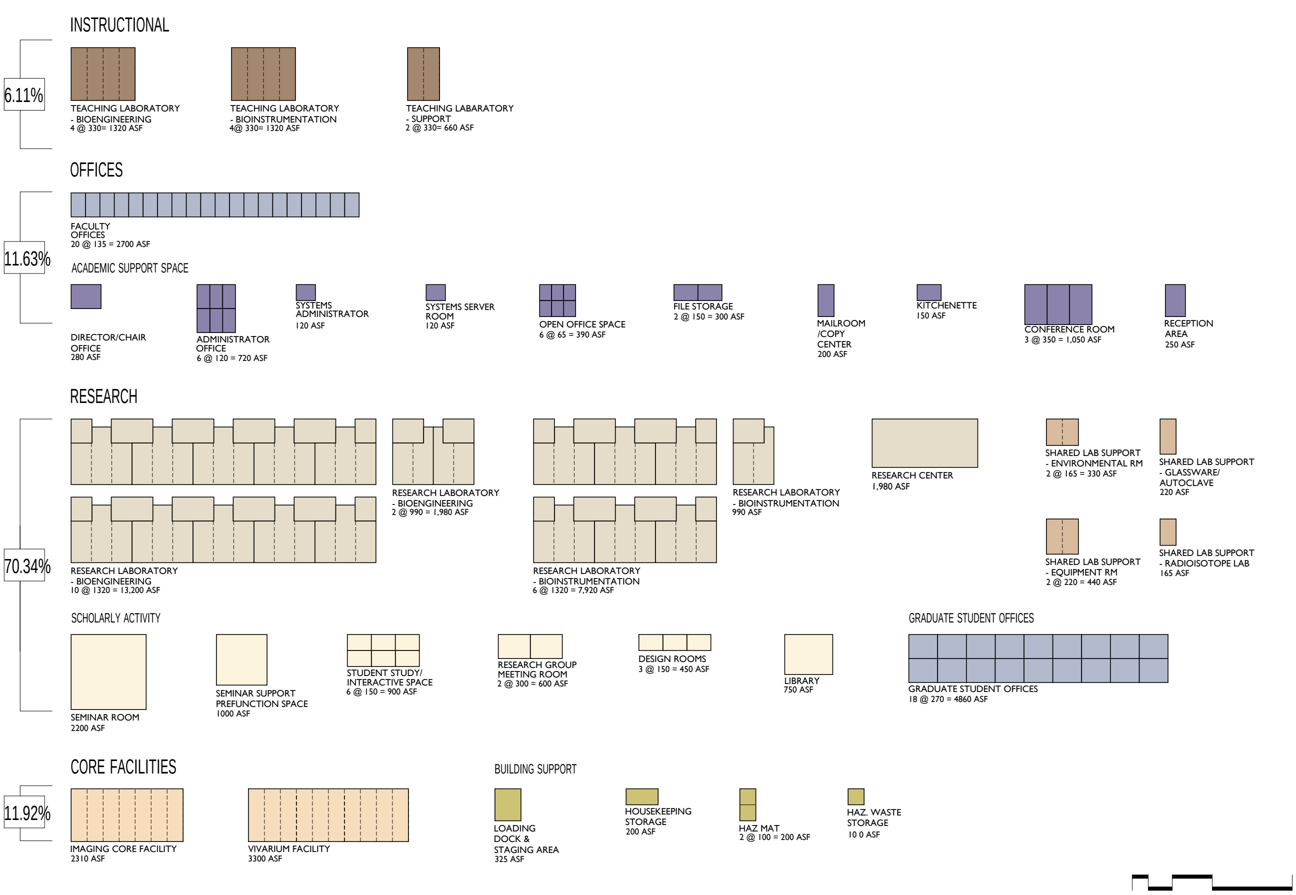
1.2 PROGRAM

The following table and graphic space program diagram summarizes the major categories and percentages of various space types included in the program:

- **Total GSF : 91,525 S.F.**
- **Total ASF : 54,000 S.F.**
- **Efficiency : 59%**

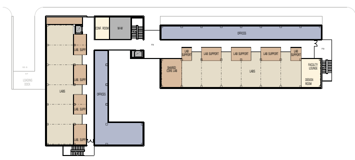
Instructional Labs	**3,300 SF**	**6 %**
Offices/ Academic Support	**6,280 SF**	**12 %**
Research Labs	**27,225 SF**	**50 %**
Scholarly Activity	**5,900 SF**	**11 %**
Graduate Student Offices	**4,860 SF**	**9 %**
Core Facilities/ Building Support	**6,435 SF**	**12 %**
		100 %

EBU3 : Program Synopsis

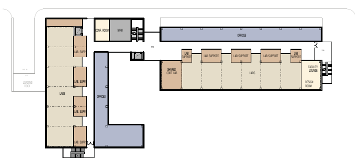


1.0
EXECUTIVE SUMMARY

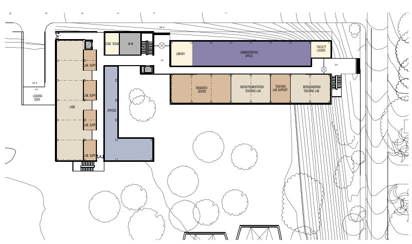
1.3 BUILDING



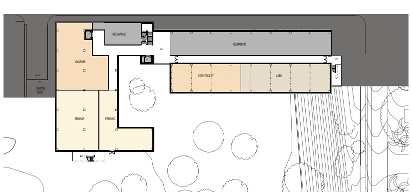
Fourth floor



Third floor



Second floor (Street level)



First floor (Arroyo level)

During the course of the programming effort, several approaches to accommodate the building elements were investigated. The final organizational concept locates the building's footprint per the guidelines of the East Campus Entrance Area Study; it will allow several future buildings to the west. Located about 30 feet west of Aberdeen Drive's western sidewalk, the proposed EBU3 will be pushed as far north as possible to maximize the width of the arroyo. At its narrowest, the arroyo's minimum dimension will be 100 feet in the north/south direction, however its width is significantly greater for most of the building's length.

The height of the new EBU3 building will be four stories tall plus a dimension of ten to twelve feet for rooftop mechanical equipment and roof screens. The vivarium and mechanical space are located at grade at the arroyo level. This level of the building is buried into the hill, acting as a retaining wall for the service road to the immediate north.

Most public spaces such as the seminar room and associated functional areas will be located at this level, opening onto the arroyo. A courtyard in line with the staircase at MS&E will be developed at the arroyo level.

The second floor will align with the level of the north service road and Aberdeen Drive. Major entrances will occur on both the north and east sides of the building. To allow for easy accessibility, teaching laboratories and the administrative suite will be located on this street level.

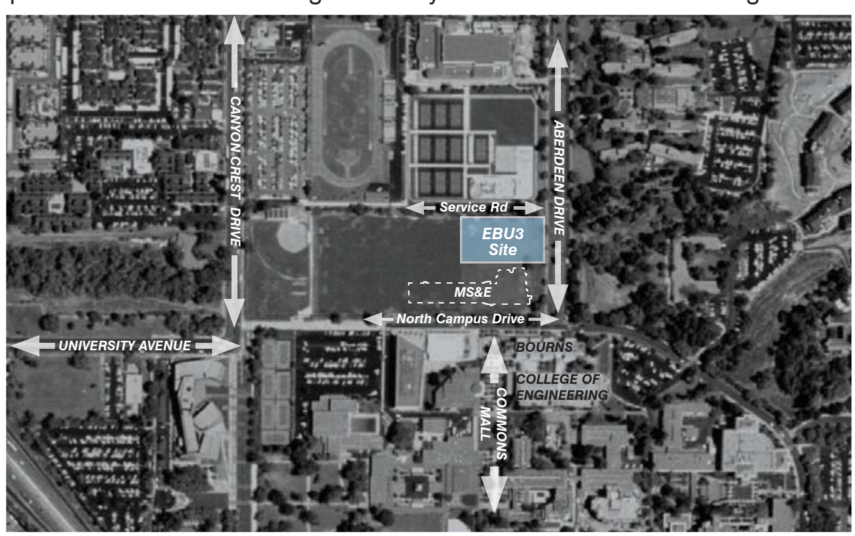
The third and fourth floor will contain research laboratories and associated support space and offices. The various blocking and stacking diagrams developed for the building included organizational concepts such as:

- Separate but contiguous blocks of labs and offices
- A full courtyard scheme
- A modified courtyard
- A configuration with offices across a circulation corridor to the lab space.

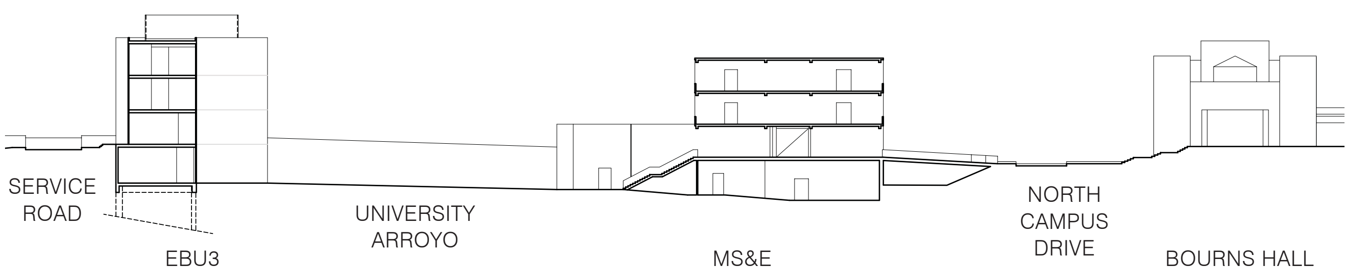
For the purposes of the DPP and costing model, it was assumed that the building will be clad in a combination of brick, plaster and glass. The building's ASF is 54,000 square feet and at an assumed efficiency of 59%, the gross square footage is 91,525 GSF.

1.4 SITE

The site selection for the EBU3 is defined in the East Campus Entrance Area Study. The site location is adjacent to the planned University Arroyo which forms a new east-west open space and pedestrian link that will connect student residential and recreational facilities to the network of malls and public space leading to the core of campus. The site is connected to related BCOE buildings via two significant pedestrian routes including pathways along Aberdeen Drive and along the north-south axis defined by the Commons Mall. EBU3 will benefit from its close proximity to the future MS&E building as it houses major core facilities as well as closely related research activities. It will also benefit in the future from the extension of the recreation mall south across the field to the student commons. Service access to the site will occur at the north edge of the site from a new service access road. This new access road is also conceived as a significant east-west pedestrian link to Parking Lot 24, the site of a future parking structure. As such it will be developed as a landscaped corridor extending from Aberdeen Drive to the east to Canyon Crest Drive to the west. The major building entry will occur at the street level interface at Aberdeen Drive. A secondary entry point will occur at the University Arroyo space in line with the established axis of the Commons Mall coming through the MS&E building. A third, limited access entry is needed on the north side of the building to serve building occupants and visitors accessing the facility from the direction of Parking Lot 24.



Aerial view of UCR Campus and EBU3 Building Site



N-S Site Section (View looking east)

2.0
INTRODUCTION AND PROJECT BACKGROUND

UNIVERSITY of CALIFORNIA Riverside

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM
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CO ARCHITECTS

2.1 UC RIVERSIDE
2.2 BOURNS COLLEGE OF ENGINEERING (BCOE)
2.3 DEPARTMENT OF BIOENGINEERING (BIOE)
2.4 EBU3 GOALS AND MISSION
2.5 DPP PROCESS

2.0
PROJECT BACKGROUND

2.1 UNIVERSITY OF CALIFORNIA RIVERSIDE

The University of California, Riverside was officially founded in 1951 as a small liberal arts college to be situated on 1,000 acres of land. The original planned capacity of 1,500 students grew to 5,000 in 1955. Graduate and professional education programs were added in 1959, greatly expanding UCR's academic mission. The 1964 Long Range Development Plan (LRDP) provided for an increase in enrollment to 10,000 students and corresponding increases in the numbers faculty and staff.

The University of California, Riverside is currently a 1,112-acre campus located three miles east of downtown Riverside, in southern California's rapidly growing "Inland Empire" region. This area has become one of the fastest growing areas of California. As the region's numbers have expanded, an increasingly diverse and multi-cultural population has incurred a growing need for education in support of business and industry development in the surrounding communities. UC Riverside serves as one of the most important major educational, economic and cultural resources for this area.

The UCR campus is currently in a period of rapid enrollment growth. Supporting its transformation into one of the premier public research university campuses in the United States, 16,622 students registered for classes during the Fall semester 2005 and enrollment is projected to grow to 25,000 students by 2015.

The agricultural programs integrate with the general campus programs in biological and physical sciences through the College of Natural and Agricultural Sciences (CNAS). The rest of the campus is organized into a College of Humanities, Arts and Social Sciences (CHASS); Bourns College of Engineering (BCOE); A. Gary Anderson Graduate School of Management (AGSM); a Graduate School of Education (GSOE); and a Biomedical Sciences Division.

The 2005 Long Range Development Plan (LRDP) anticipates that the campus and its surrounding community can accommodate an enrollment of 25,000 students, with a faculty increase (inclusive of all categories) to 1,184 FTE (full time equivalent) by 2015. The LRDP summarizes the ways in which the campus plans to manage future growth including key strategies to:

- Encourage the achievement of greater excellence in existing college, schools and programs, including the arts, humanities, social sciences, natural sciences, and agriculture.
- Develop additional professional schools.
- Initiate new graduate and undergraduate degree programs.
- Develop new areas of research specialization and community service.

2.2 BOURNS COLLEGE OF ENGINEERING (BCOE)

The BCOE strives to provide students with a diverse set of educational choices designed to support the development of creative thinking and engineering skills that will enable them to succeed in an expanding variety of engineering disciplines and careers. The College currently consists of four departments: Computer Science and Engineering, Electrical Engineering, Mechanical Engineering, and Chemical and Environmental Engineering. Within these four departments, instructional and research opportunities are available in the areas of air and water pollution control, biotechnology, automation and intelligent systems, smart materials, and communication networks. In all programs, design and implementation methods are emphasized in teaching. Interaction with leaders in related industries is encouraged.

The College places significant emphasis on laboratory instruction. The hands-on experience available in the laboratory setting gives students the capability to make cognitive connections with theories learned in the classroom and is considered essential to the learning process. The College aims to provide students with tools to increase knowledge in basic engineering research disciplines, as well as the applied sciences. In that regard, design is an integral part of the curricula for all programs

2.3 THE BIOENGINEERING PROGRAM

Bioengineering is the most recent major program to be developed in the College. Continuing advances in molecular and cellular biology and the engineering sciences have opened up new avenues of exploration requiring the integration of knowledge and technical skills from the fields of both biology and engineering. Designed to provide students with a broad education that will prepare them for careers in the biotechnology, biomedical devices and medical fields, the program's core curriculum will help students to develop knowledge in the biological areas of genomics, proteomics, inhibitory RNA technology, pharmacodynamics and regenerative medicine, as well as the engineering realms of microfabrication, advanced computer systems, novel materials, and automated manufacturing.

In addition to the program offering a BS in Bioengineering, a new interdepartmental Masters and PhD Bioengineering program will allow students to take advantage of the comprehensive expertise available on campus within the biomedical sciences, physical sciences and biological sciences disciplines.

2.4 EBU3 GOALS AND MISSION

EBU3 represents the latest expansion of the BCOE. The two most significant driving factors for EBU3 program planning include the projections for growth in BCOE faculty and student population and the creation of the new Department of Bioengineering which will be the major building occupant. The planning team conducted a space inventory analysis for the BCOE, which indicates that the College needs to increase the quantities of wet research and wet teaching laboratories. In addition to bioengineering, EBU3 will also provide space for research that is closely related to that of the bioengineers and includes chemical engineering, environmental engineering and materials science research.

Bioengineering is the newest major program at the BCOE. This new discipline develops processes and products made possible by the underlying basic scientific advances in biology and engineering. The field of Bioengineering promises to provide some of the most important technologies for the next few decades. Students enrolled in this program will have a broad preparation that will enable them to enter various fields such as biotechnology, biomedical engineering, and medicine. Biotechnology companies use modern knowledge of molecular and cellular biology to make a wide variety of products such as antibiotics, hormones (e.g. insulin), vitamins, detergent enzymes, vaccines, and drug delivery systems. Medical companies use current engineering advances to make pacemakers, imaging machines (e.g. MRI, ultrasound, CAT scans), diagnostic tools (gene chips, glucose meters) and tools for minimally invasive surgery. The curriculum also provides the core courses for entry into most health science based programs.

Wide ranging advances in fundamental molecular and cellular biology and the engineering sciences have led to discoveries that bridge the biological and engineering domains. In the biological sphere, genomics, proteomics, inhibitory RNA technology, pharmacodynamics and regenerative medicine are just a few examples. In the engineering sphere, microfabrication, advanced computer systems, novel materials, and automated manufacturing disciplines represent some of the rapidly emerging applications.

2.5 DPP PROCESS

The programming process was conducted through a series of workshops that addressed future space needs, internal space relationships and external building relationships. Five workshops were held to discuss the key aspects of vision, scope, budget and schedule. Participants included representatives from the UCR. An initial workshop reviewed the UCR participants' vision and goals for the EBU3, while subsequent meetings focused upon basic program assumptions then proceeded to investigate site planning considerations and the development of building organizational concepts. The significant issues addressed in the workshops included research operations, integration of lab support with research lab functions, teaching laboratory requirements, hazardous materials use, adaptable office planning, classroom planning, functional relationships and external relationships. Following these efforts, a comprehensive cost review was initiated in order to evaluate goals and expectations in terms of cost and balance them against the established University budget for the project.

The workshop format was typically structured in one or two-day sessions which involved meetings with groups of representatives for the University focusing on the specific requirements of the following types of space:

- Public Space
- Meeting and Conference Space
- Classrooms and Discussion Rooms
- Administration/Student Services
- Building Support
- Research Office and Support Space
- Research Laboratory Space
- Research Laboratory Support Space
- Instructional Laboratory Space
- Animal Facilities

Once site analyses, functional requirements and building organization were established, significant planning efforts went into addressing budget concerns. Performance criteria were developed for site, architectural, laboratory, structural and building engineering systems with the intent of utilizing the aggregate understanding of academic and research requirements to evaluate and select the materials and systems capable of providing the best value to the University.

Final completion of the pre-design phase includes adjustment to both the qualitative and quantitative aspects of the program in order to wholly define the detailed program requirements for the project and confirm the integration of scope, budget and schedule.

3.0
PROGRAM REQUIREMENTS

UNIVERSITY of CALIFORNIA Riverside

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

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3.1 SPACE PROGRAM LIST
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- 3.6.6 NOISE CONTROL
- 3.6.7 VIBRATION/STRUCTURAL CONSIDERATIONS

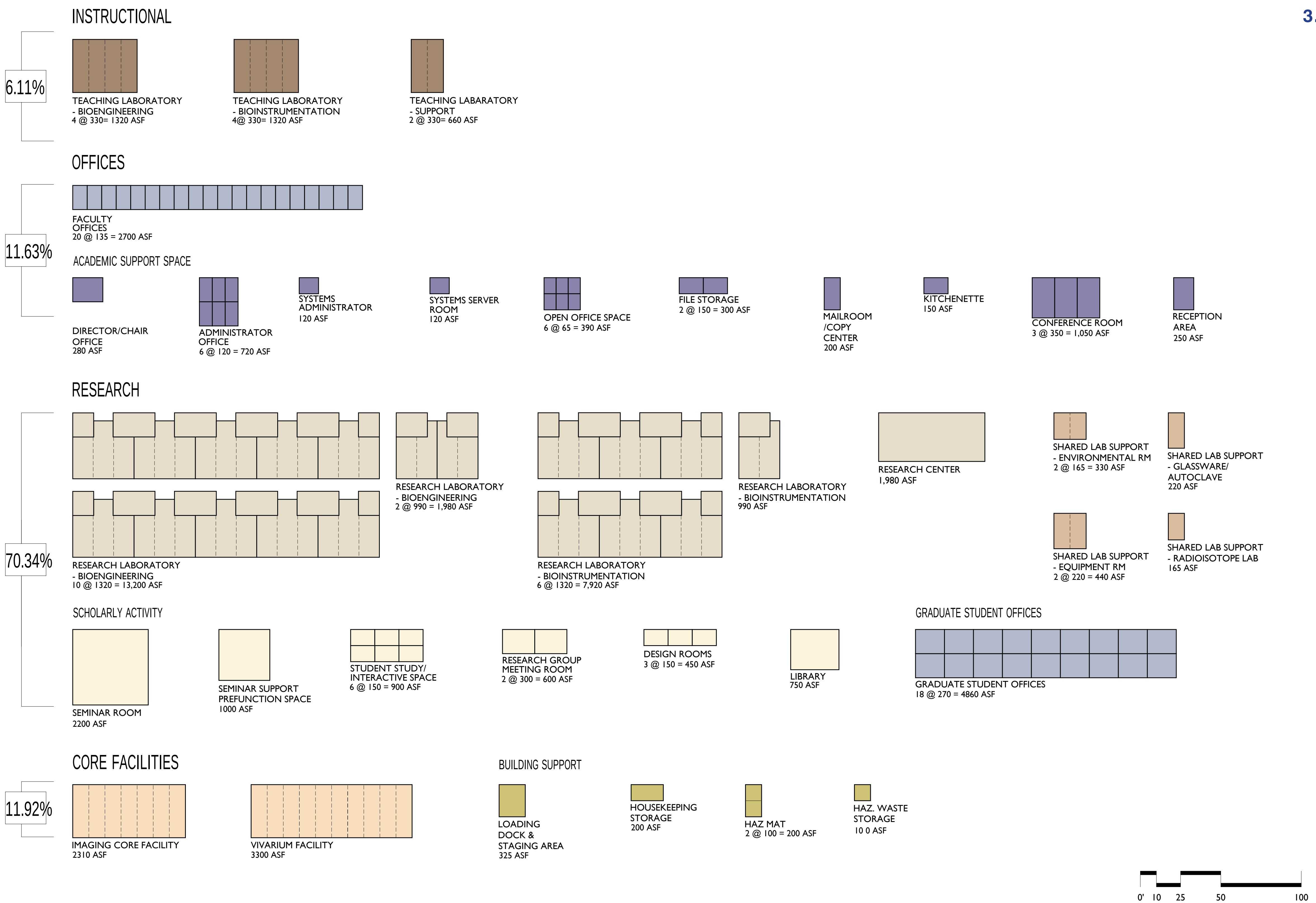
3.7 HVAC DESIGN PARAMETERS

3.1 SPACE PROGRAM LIST

Gross Square Feet: **91,525**
Assignable Square Feet: **54,000**
Assumed Efficiency: **59%**

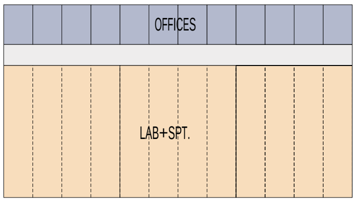
Room Code	Program Name / Space Type	Capacity	ASF/Ea.	Quantity	TOTALS
	Instructional				
A-1	Teaching Laboratory - Bioengineering	4	1,320	1	**1,320**
A-2	Teaching Laboratory - Bioinstrumentation	4	1,320	1	**1,320**
A-3	Teaching Laboratory Support	2	660	1	**660**
				Subtotal:	***3,300***
	Offices				
B-1	Faculty Offices	1	135	20	**2,700**
				Subtotal:	***2,700***
	Academic Support Space				
C-1	Director/Chair Office	1	280	1	**280**
C-2	Administrator Office	1	120	6	**720**
C-3	Systems Administrator	1	120	1	**120**
C-4	Systems Server Room	1	120	1	**120**
C-5	Open Office Space	1	65	6	**390**
C-6	File Storage	-	150	2	**300**
C-7	Mailroom/Copy Center	6	200	1	**200**
C-8	Kitchenette	4	150	1	**150**
C-9	Conference Room	25	350	3	**1,050**
C-10	Reception Area	10	250	1	**250**
				Subtotal:	***3,580***
	Research	# of Mod's			
D-1a	Research Laboratory - Bioengineering	4	1,320	10	**13,200**
D-1b	Research Laboratory - Bioengineering	3	990	2	**1,980**
D-2a	Research Laboratory - Bioinstrumentation	4	1,320	6	**7,920**
D-2b	Research Laboratory - Bioinstrumentation	3	990	1	**990**
D-3	Shared Lab Support - Environmental Room	0.5	165	2	**330**
D-4	Shared Lab Support - Glassware/Autoclave	1	220	1	**220**
D-5	Shared Lab Support - Equipment Room	1	220	2	**440**
D-6	Shared Lab Support - Radioisotope Lab	0.5	165	1	**165**
D-7	Research Center	6	1,980	1	**1,980**
D-8	Graduate Student Office	6	270	18	**4,860**
				Subtotal:	***32,085***
	Scholarly Activity				
E-1	Seminar Room	50	2,200	1	**2,200**
E-2	Seminar Support/Prefunction Space	-	1,000	1	**1,000**
E-3	Student Study/Interactive Space	8	150	6	**900**
E-4	Research Group Meeting Room	15	300	2	**600**
E-5	Design Rooms	9	150	3	**450**
E-6	Library	30	750	1	**750**
				Subtotal:	***5,900***
	Core Facilities/Building Support	# of Mod's			
F-1	Imaging/Instrumentation Core Facility	7	2,310	1	**2,310**
F-2	Vivarium Facility	10	3,300	1	**3,300**
F-3	Loading Dock	-	325	1	**325**
F-4	Housekeeping Storage	-	200	1	**200**
F-5	Hazardous Materials Storage	-	100	2	**200**
F-6	Hazardous Waste Storage	-	100	1	**100**
				Subtotal:	***6,435***
BUILDING TOTAL ASF					**54,000**
BUILDING TOTAL GSF (Assuming 59% Efficiency Ratio)					**91,525**

3.2 GRAPHIC SPACE PROGRAM



OFFICE TO LAB

1.



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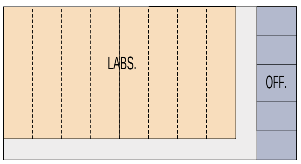

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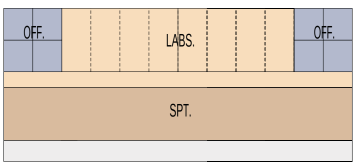

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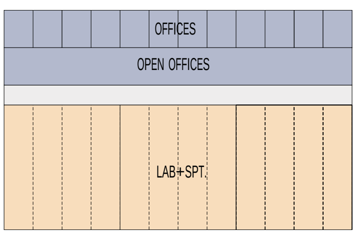

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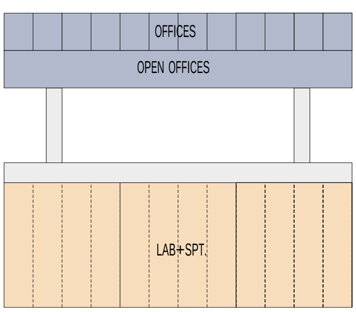


Abbreviation: OFF (Offices)
SPT (Lab Support)

3.3 PROGRAM RELATIONSHIP DIAGRAMS

Office to Lab:
Four options were presented and discussed:

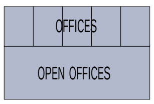
- Offices embedded in the labs
- Clustered offices adjacent to a lab cluster
- Offices across a circulation corridor from the laboratories
- Combinations and variations of the above

It was agreed that embedded offices were less flexible and the need for such close proximity was not necessary. Clustered offices are the pre-dominant arrangement to date at the BCOE. The functional preference for the Bioengineering department, however, was for a somewhat closer proximity of offices to the labs. As such, the preferred arrangement was for offices across a corridor from the laboratories.

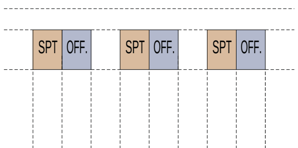
OFFICES

1. FACULTIES OFFICES CLUSTERD

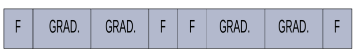
2. ALL OFFICES CLUSTERD. GRAD STUDENTS OPEN OFFICES



3. FACULTY REMOTE OFFICES. GRAD STUDENTS IN LABS

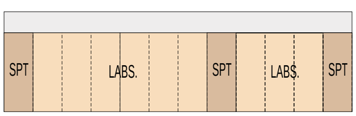


4. ALL OFFICES CLUSTERED AND ENCLOSED



LAB TO LAB SUPPORT

1.



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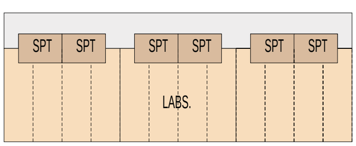

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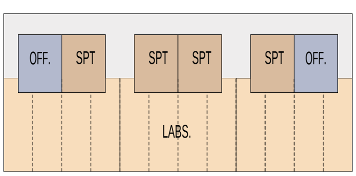

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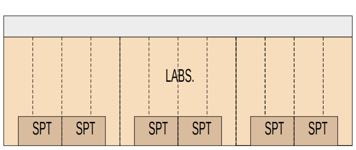


Abbreviations: F (Faculty)
GRAD (Graduate Student)
OFF (Office)
SPT (Lab Support)

Faculty Offices and Graduate Student Offices

Faculty offices are to be individual; they should be co-located with other faculty offices. Graduate student offices can be grouped; they can be located adjacent to faculty offices. Faculty offices should have direct access to circulation, without having to pass through an open graduate student office zone.

Lab-to-Lab Support

The unique character of Lab Support spaces and their relationship to the primary research laboratory space can often provide the key to understanding both the pragmatic methodologies as well as the unique philosophical pursuit of a particular research discipline. The interdisciplinary nature of research in Bioengineering of the other related disciplines that will occupy EBU3 require a tailored yet versatile solution in planning spaces for laboratory support.

Two distinct types of support functions were identified in the programming workshop and meetings with focus groups:

Shared Lab Support Spaces:

The need for these types of spaces is typical for all researchers in the building. These include common wet biology lab support facilities such as equipment rooms, environmentally controlled cold rooms, constant temperature rooms and more specialized spaces for work with radioisotopes. It was determined that in order to best serve the needs of all occupants of the building that these shared functions should be grouped together in an accessible, central location on each research lab floor to form a secure and efficient core facility of shared research support.

Dedicated Research Lab Support:

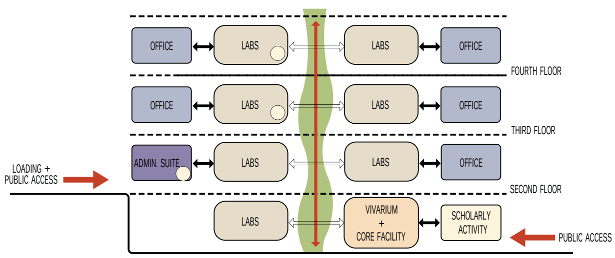
The diverse range of scientific disciplines and methodologies must be facilitated in Bioengineering and other interdisciplinary research. Such diversity demands versatility of the physical facility and can result in a great deal of customization to accommodate research that varies greatly from one lab to the next. A planning strategy was developed for EBU3 that will accommodate a diverse range of lab support functions while minimizing the need for customization in individual labs. EBU3 will provide dedicated support lab zones between the laboratories and the corridor. The space should be subdividable to allow each researcher to create and access more than one specialized support lab. This also allows the support space to be used as a single larger space that can accommodate larger equipment that cannot fit within the typical wide lab planning module width. The ideal dimensions for this dedicated support lab space is determined to be 22' wide by 15' deep.

3.4 PROGRAM ORGANIZATION CONCEPTS

Program organization concepts were developed to align key academic objectives with the interdisciplinary research in EBU3. The program organization concepts are driven largely by arrangement of the programmatic elements for a typical research laboratory floor. To achieve maximum flexibility, lab and lab support are assumed to be repeating modules with specific dimensional and adjacency characteristics.

The program is organized vertically into three distinct zones that respond to both internal functional requirements as well as specific site and contextual constraints:

Typical Vertical Organization Diagram

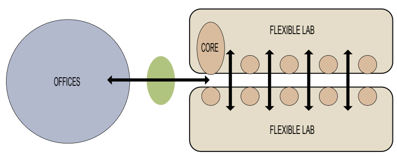


1. TYPICAL RESEARCH FLOORS (THIRD AND FOURTH FLOORS): these floors house research laboratories and associated lab support spaces, shared research support core facilities, research offices for faculty and students as well as shared conference rooms, research group meeting spaces and student interaction spaces.
2. THE SECOND FLOOR is the most public floor as it provides the main public entry from the elevated street level of Aberdeen Drive. As such it is best suited for the most public functions of the program such as the administrative offices and the teaching labs. Service access is provided at this level.
3. THE GROUND FLOOR provides space for specialized core facilities such as the vivarium and the imaging core facility addressing requirements for privacy, security or vibration control. Other spaces that may be appropriate for the first floor are research labs that require close proximity to the core facilities. Some public functions such as the seminar room and its associated pre-function space may be appropriately located on the first floor in order to take advantage of and enhance public interaction with the open green space of the university arroyo.

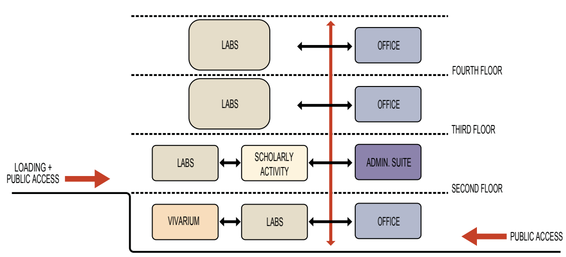
3.4 PROGRAM ORGANIZATION CONCEPTS

PROGRAM ORGANIZATION CONCEPT A

Third & Fourth Floor Organizational Diagram



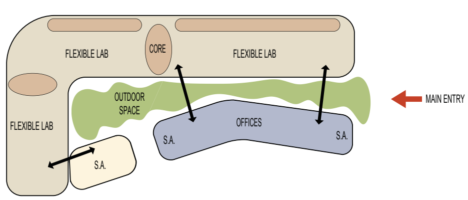
Vertical Organizational Diagram



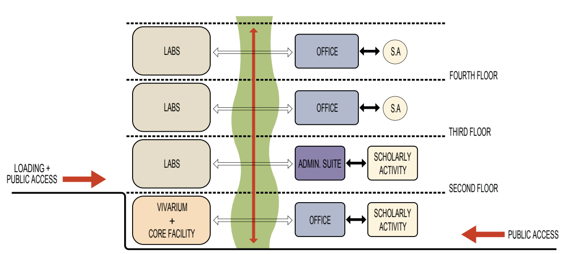
PROGRAM ORGANIZATION CONCEPT A represents the simplest and most efficient organization of the program elements for the typical research floor. Laboratories are grouped together along a double-loaded corridor with zoned areas for dedicated support labs located between the corridor and the labs. A Shared Research Lab Support Core is located near to the center of the building to allow proximity to labs and easy access from vertical transportation. Non-laboratory spaces are all grouped together into a separate block of space. Program elements will be ideally arranged to promote interaction between faculty and students. This building element will also provide shared space such as office support functions, conference space, design rooms and research group meeting spaces. This organizational concept, while highly effective in terms of construction cost and building engineering system efficiency, does not fulfill the functional goal of locating offices, interaction space or lounge areas in close proximity to labs. Public functions such as the Administrative Offices and Seminar Room are grouped together on the second floor to take advantage of the street level main entry that is possible from Aberdeen Drive

PROGRAM ORGANIZATION CONCEPT B

Third & Fourth Floor Organizational Diagram



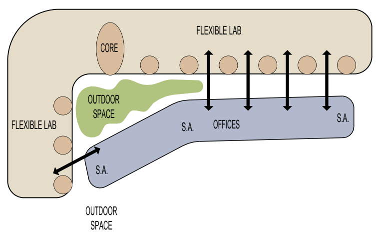
Vertical Organizational Diagram



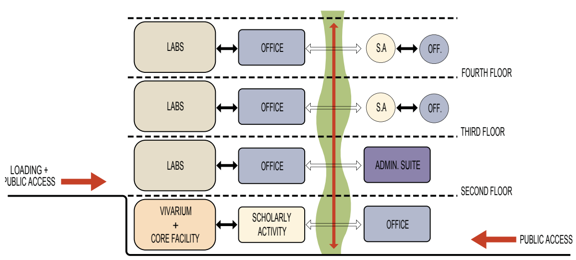
PROGRAM ORGANIZATION CONCEPT B provides a highly integrated approach to the disposition of program elements. Laboratories are arrayed in an 'L' shaped block that forms two edges of an open courtyard space. Offices are located in a linear block directly across the courtyard space from the labs. Conference rooms and other shared public functions form a third block of space that is positioned between the offices and the labs to allow adjacency to both program elements. This also allows stacking of similar functions. The Seminar Room and Prefunction spaces are located on the first floor adjacent to the courtyard and the open campus space thus taking advantage of the opportunity to enliven the courtyard and to form a public interface with the campus open space. This concept fulfills the departmental and cultural goals defined for EBU3 programs, but also carries a significant cost burden due to the relatively inefficient organization of space and an increased percentage of exterior wall area. Another disadvantage of this approach is that access to research labs occurs via exterior walkways, thus presenting challenges for mechanical system design.

PROGRAM ORGANIZATION CONCEPT C

Third & Fourth Floor Organizational Diagram



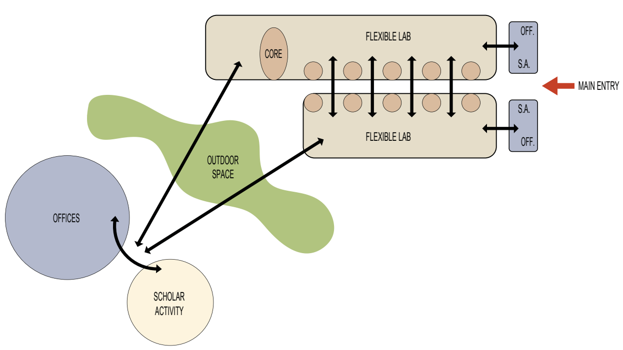
Vertical Organizational Diagram



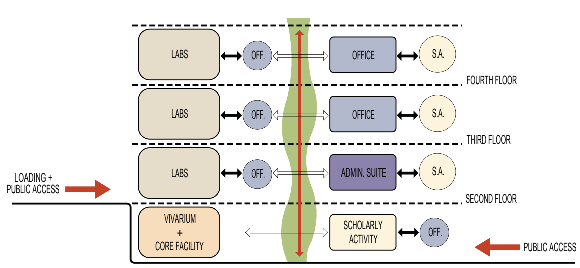
PROGRAM ORGANIZATION CONCEPT C reflects many of the organizational mechanisms included in Concept B, but reduces the quantity of courtyard space and allows offices and labs to be joined together in a double-loaded corridor for the majority of space. The open courtyard in this concept is enclosed by vertical building elements and is thus less open to the adjacent campus public spaces. The space therefore provides a more private, and inwardly focused exterior public space for EBU3 occupants. The scheme improves space adjacency goals for offices and labs, yet still allows them to be serviced separately by building engineering systems.

PROGRAM ORGANIZATION CONCEPT D

Third & Fourth Floor Organizational Diagram



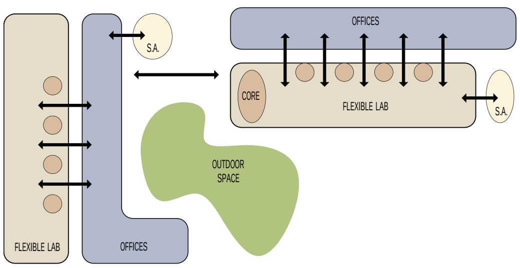
Vertical Organizational Diagram



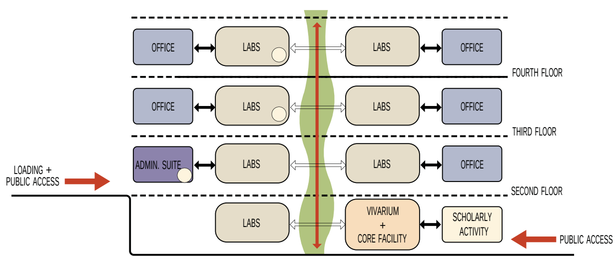
PROGRAM ORGANIZATION CONCEPT D also forms an exterior courtyard space but incorporates organizational principles similar to Concept A. In this scheme, student offices are again grouped together along with public and shared non-lab space in a separate block. Faculty offices, however, are distributed and located directly adjacent to the labs. While the scheme provides a more efficient way of organizing lab space it does not fulfill the goal of student proximity to labs.

PROGRAM ORGANIZATION CONCEPT E

Third & Fourth Floor Organizational Diagram



Vertical Organizational Diagram

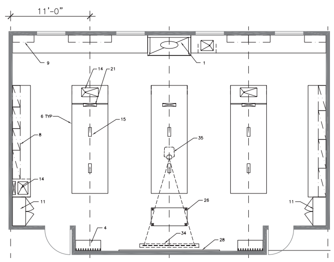


PROGRAM ORGANIZATION CONCEPT E represents the optimal compromise between building efficiency and the fulfillment of program adjacency goals and ideal organizational concepts. It was developed following input from all programming participants. The scheme incorporates a significant outdoor courtyard space that both provides a central public focus for the building and also acts as an effective buffer zone to interface with the campus scaled open spaces adjacent to the site. The diagram reflects an organization into two wings. Labs and offices are located together in each wing and are organized along either side of double-loaded corridors. The connecting element between the wings provides a central zone in which shared laboratory and non-laboratory functions can be grouped.

3.5 SPACE TYPES

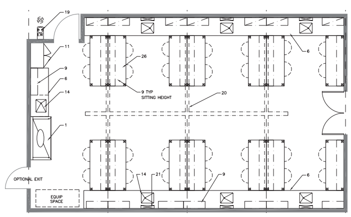
A general overview of space types included in the EBU3 Space Program is described below in the five major categories: Instructional Space, Offices, Research, Scholarly Activity and Core Facilities/Building Support. The overview provides a brief description of the primary function of spaces, requirements for functional adjacencies and the basic planning criteria for each category.

Instructional Space:
Two Teaching Laboratories are provided in the program including associated Teaching Laboratory Support space. Two basic teaching lab types are required including a 24-student, 4-module wet Bioengineering Teaching Lab and 24-student, 4-module Bioinstrumentation Teaching Lab.



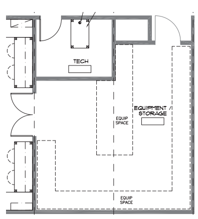
Teaching Laboratory - Bioengineering

- THE WET BIOENGINEERING TEACHING LAB includes fixed island benches with cup sinks and lab service pipe drops as well as perimeter wall benches with lab storage casework above and below the benches. The lab contains one chemical fume hood, a marker board, a ceiling-mounted digital projector and manual projection screen for instructional purposes.



Teaching Laboratory - Bioinstrumentation

- THE BIOINSTRUMENTATION TEACHING LAB includes movable lab tables that can be reconfigured for different instructional methods. Fixed benches with lab sinks and storage casework above are located at the perimeter walls. The room is provided with lab piped services from overhead service carriers to allow flexibility in locating equipment and instrumentation for instruction. The lab includes one chemical fume hood.



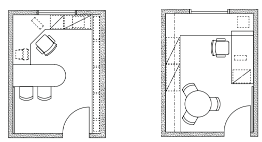
Teaching Laboratory - Support

- TEACHING LABORATORY SUPPORT (two modules) provide space for equipment, instrumentation and prep area for the class labs. Support space will be ideally located between and directly adjacent to the teaching labs thus providing direct access for class preparation activities and ease of access for the storage of specialized equipment.

Provisions should be made for accommodation of specialized teaching needs (e.g. spectroscopy). The Teaching Labs will be used primarily for instruction, but should also be designed to accommodate student projects as well as research activities when classes are not in session. Teaching Labs should be located in order to be easily accessible from the main building entry and should be easily identifiable to students. Adjacency relationships should recognize the probability of heavy student traffic patterns into and out the spaces.

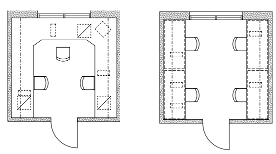
Office Space:

Office space for EBU3 is included in the Space Program in three major categories: Faculty Offices, Academic Support Space and Graduate Student Offices (included in the Space Program in the "Research" category). Offices follow University of California System guidelines for assignable square foot (ASF) sizes.



Faculty Offices options

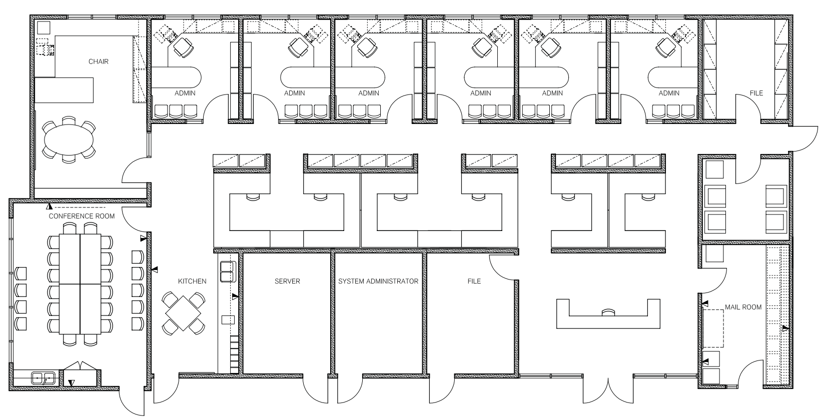
- FACULTY OFFICES (20) are programmed at 135 ASF each and should be located in relative proximity to the research that they serve; however they should also be easily accessible to students. Faculty Offices should be grouped together where possible to promote interaction and collaboration amongst researchers.



Graduate Student Offices options

- GRADUATE STUDENT OFFICES are provided to accommodate a maximum of (108) occupants. The offices are programmed at 270 ASF each and should follow modular planning based on the size and configuration of the Faculty Offices. This will allow maximum flexibility for change over time such that the spaces can be subdivided into two smaller offices in the future. These spaces should also be located in relatively close proximity to the labs and the faculty office blocks. They do not require co-location with faculty offices.

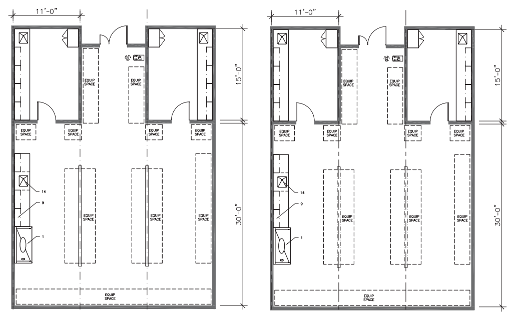
- ACADEMIC SUPPORT SPACE provides space for administrative functions for the building, but primarily for the Department of Bioengineering. Also included in this category of space are conference rooms that should be distributed within the building to serve localized areas on each research floor. The administrative office functions should be organized into an office suite with areas of public interface such as reception, mail room and student academic advisor spaces located so that they are visible and easily accessible from the main building entry. Other office spaces require a greater level of privacy and should be grouped together around open office support spaces to create an internally interactive environment.



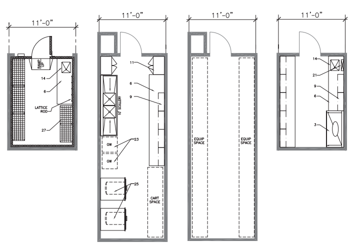
Administrative Suite

Research Space:

Research Laboratories and Shared Laboratory Support comprise the majority of laboratory space in the EBU3 Space Program, totalling 27,225 ASF. Two basic research lab types are required including 3-module and 4-module Bioengineering Research Labs and 3-module and 4-module Bioinstrumentation Research Labs. The research lab planning approach includes pre-planned and dedicated support spaces that can be modified to suit the needs of individual research groups. Research labs in general will be served by shared facilities that provide space for typical, non-specialized research support functions.



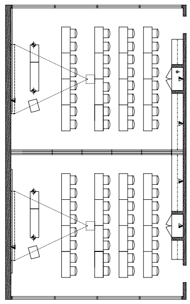
(l -r) Research Laboratory - Bioengineering
Research Laboratory - Bioinstrumentation



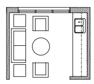
(l -r) Shared Lab Support - Environmental Room
Shared Lab Support - Glassware/Autoclave Room
Shared Lab Support - Equipment Room
Shared Lab Support - Radioisotope Room

- THE BIOENGINEERING RESEARCH LABORATORY spaces reflect the primary design goals of providing a flexible and adaptable environment for an interdisciplinary and varied research program. The functional engineering criteria are identical for the Bioinstrumentation Research Laboratories as it is anticipated that overlap will occur as programs, occupancies, and instrumentation requirements evolve. The primary differences between the two types of research laboratories are in casework, sink and Fume Hood density. Bioengineering Labs are provided with a greater degree of fixed casework and require, on average, one fume hood per two modules of space whereas the Bioinstrumentation Labs are provided with primarily movable casework and are serviced by overhead service carriers.

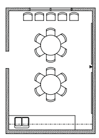
- SHARED LABORATORY SUPPORT CORE functions such as environmental rooms, a glassware/autoclave room, equipment rooms and a radioisotope room are included in the space program and will serve all research lab areas. Ideally these shared support functions will be grouped together on each research lab floor and serve as a centralized shared core support facility.



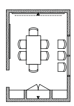
Seminar Room



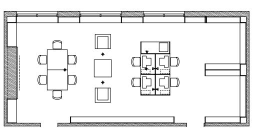
Student Study/Interactive Space



Research Group Meeting Room



Design Room



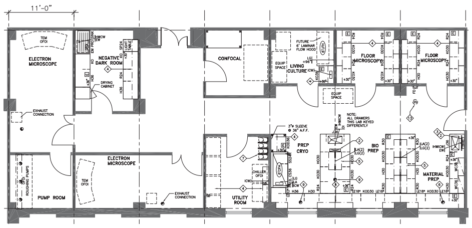
Library

Scholarly Activity Space:
Various types of meeting, training, resource and interaction spaces are provided within the program to support the research and instructional goals of EBU3. They include a Seminar Room with associated support and pre-function space. This space should be located centrally to allow easy access from within the building as well as for visitors to the building. It is planned as a large room that can be subdivided by a movable wall to allow maximum flexibility for different functions. The space is provided with high technology A/V systems for training and instruction purposes.

The space program also includes spaces for interaction and collegial activities reflecting the need for a variety of scales and levels of formality and privacy necessary to act as a catalyst in the collaborative environment. Spaces include student interaction spaces which are informal open spaces that should be distributed throughout the building in strategic locations adjacent to primary circulation patterns and central to shared research and instructional functions. Research Group Meeting spaces will provide tables and chairs for informal gatherings of graduate student and faculty as well as counter space for simple food preparation, coffee makers, microwave ovens, etc. The two Research Group Meeting spaces should be located where easily accessible to the main research laboratories. Design rooms are intended for slightly more formal meetings that occur outside of the laboratory and are intended to accommodate the members of an individual research group. The Library/Workroom space is intended as a collegial gathering place for faculty and will be located near to the administrative office suite.

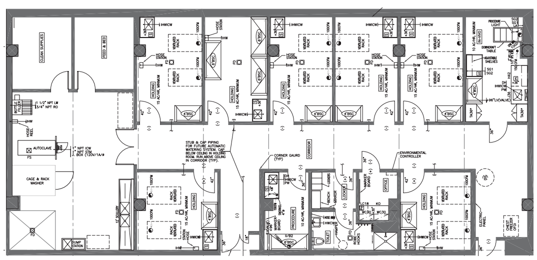
Core Facilities Space:

Core Facilities are included in the Space Program to provide space and infrastructure for specialized research activities necessary to support the unique range of scientific disciplines that are represented in the building.



Imaging Instrumentation

- THE IMAGING/INSTRUMENTATION CORE FACILITY is programmed as space for three to five scanning electron microscopes, transmission electron microscopes or for confocal microscope use. There is also space for fluorescent microscopy with a prep area for use by personnel working with this instrumentation. Users identified a potential need for a small NMR for animal imaging; no provision for this function is currently included in the program



Vivarium

- THE VIVARIUM CORE FACILITY planning approach is to provide a "stand alone" entity and does not rely on other campus animal facilities to provide rack and cage washing functions. The animal facility is designed for rodents (mice & rats) as well as rabbits. No large animal use is anticipated, nor has any transgenic, barrier or BSL-3 use been identified. The facility includes six animal holding rooms, a procedure room and an in-vivo surgery room.

3.6 SPECIAL DESIGN REQUIREMENTS

3.6.1 LABORATORY DESIGN CRITERIA

Initial meetings with the Dean and faculty of the College underscored the need for “wet” laboratory research space for EBU3. Although the actual occupants are not known at this time, the overall program of the building was broken down into the following major focus groups:

Research Laboratories and Research Support Laboratories
Teaching Laboratories
Animal Core Facility
Imaging Core Facility

Subsequent focus group meetings were held to develop enough detail to generate functional requirements which then could be documented as diagrams and data sheets. During the focus group meetings it was agreed that the building would have roughly 70% Chem-Bio type research laboratories and 30% Instrumentation type research laboratories. For future flexibility and to fulfill the requirement for as many “wet” type research laboratories as possible, it was decided to supply all the research laboratories with 100% fresh air. The diagrams and data sheets included in this document clearly illustrate this programming approach. A description of the these major focus areas follows. See the Functional Criteria Section, Systems Criteria, data sheets and diagrams for additional programming level definition of these spaces.

Research Laboratories. The ChemBio laboratories comprise the majority of laboratory space in the building, approximately 16,000 ASF. These laboratories reflect the primary design goals of providing a flexible and adaptable environment for an interdisciplinary and varied research program. The functional engineering criteria is identical to the Instrumentation Research Laboratories because it is anticipated that overlap will occur as programs, occupancies, and instrumentation requirements evolve. The main differences between the two types of research laboratories are in casework, sink and Fume Hood density.

To this end, potentially fixed benchwork in the instrumentation research laboratories is concentrated in the vicinity of fume hoods and along the perimeter of the space. The center of the labs are kept free for movable tables and freestanding instrumentation. Overhead service carriers are provided. This does not preclude the addition of fixed benchwork in the future should it be needed. It is recommended that the utilities be distributed on the walls independently of the benchwork and movable tables to allow for future additions or removal of the benchwork.

With the proper utilities distribution concept as described above, conventional benchwork with cabinetry that is floor supported can be effectively utilized. However, it is recommended that other types which are more easily relocated be investigated during the schematic design phase.

While the main research laboratories described above are intentionally generic in design, assigned support spaces such as Tissue Culture Rooms, Fluorescent Assigned Support spaces including Microscopy, Laser Labs, Small Machine Shop, and Computation Rooms are expected to take up to 30% of the main research lab space. Detailed requirements are anticipated to be identified in the design phases. These areas will be designed to specifically accommodate their unique needs and should also be co-located with the main research laboratories. The cost for these areas is anticipated to equal the room layouts shown on the research diagrams and room data sheets. The extra walls and doors have been shown to cover the condition that might require maximum separation between spaces.

Research Center. The 1,980 ASF identified will accommodate research related to the interaction with industry and also possible “spin-off” efforts of the College. The laboratories need to be highly flexible in order to adapt to rapidly evolving and often times unpredictable programmatic directions. This lab space will be supplied with 100% fresh air, and mobile workstations will largely supplant fixed benchwork.

Shared Support Labs. Small shared laboratory support rooms have been identified during the programming phase, such as environmental rooms, radioisotope room, autoclave/glass wash room and equipment rooms. These support spaces are envisioned to be located in a cluster near the research laboratory space.

Teaching Laboratories. Two 24 station teaching laboratories for the BCOE are included in this program along with a 660 ASF support/storage room.

THE BIOENGINEERING TEACHING LABORATORY is set up similar to a biology class lab with one fume hood and fixed benching with sinks along the perimeter. The 24 student stations are located at movable tables in the center of the space for clear sight lines to the teaching wall at the front of the space.

THE BIOINSTRUMENTATION TEACHING LABORATORY is similar to the Bioengineering space with its one fume hood and movable table student stations and fixed perimeter benching with sink access. This space is arranged in such a way to facilitate physiology and robotic student projects. With the possibility of setting up the student stations so they have easy access to piped services at the perimeter while leaving a large open floor space needed for the student projects to be tested.

There is a need for the ability to switch out apparatus for instruction fairly quickly which is the reason for the teaching laboratory support space to be located near the teaching laboratories, if not immediately adjacent. This space will also house the tech support personnel required for these spaces.

Vivarium Core Facility. The programming phase involved discussion concerning this vivarium space and its relationship to the campus animal care program as a whole. It was determined that this animal facility should be a “stand alone” entity and not try to rely on another campus animal facilities to provide rack and cage washing functions.

The animal facility is designed for rodents (mice & rats) as well as rabbits. No large animal use is anticipated, nor was any transgenic, barrier or BSL-3 use identified.

The animal facility is designed for double-sided micro isolator racks which can hold up to 560 mice/rack for a total of 7,800 mice. The cage wash area is designed for a cage washer, rack wash down area, autoclave, bottle filler and a bedding dump station.

Imaging Core Facility. The imaging facility is programmed as space for three to five scanning electron microscopes, transmission electron microscopes or confocal microscope use. There is also space for fluorescent microscopy with a prep area for use by personnel working with this instrumentation. This area also includes a dark room for film processing and pump rooms to house noise and heat producing ancillary equipment for the scopes.

3.6.2 FUNCTIONAL DESIGN CRITERIA

Table 1 below, indicates the program level estimates of required centralized utilities to the various laboratory types. The requirements are expressed on a modular basis (see Modular Planning). It is anticipated that some refinement of these requirements will occur during further design phases. It is recommended that the HVAC system be designed to anticipate an expansion of the fume hood exhaust system by 15-20% over the life of the building. For distribution of data outlets, refer to the Electrical section (6.2).

Laboratory Type	Central Utilities									
	Water			Lab Compressed Air	Lab Natural Gas	Electrical		Cooling		
	Industrial IHW/ICW	Potable for Safety stations	Pure Water PW	A (scfm)	LG (scfm)	120/208v	480 v	CEWS/R	Fume Exhaust (cfm/mod)	Heat Load (BTUh/mod)
Bioengineering Research & Support (NSFL = 15,180)	1 sink/ 2 mod	Incidental use, 20 gpm/ station	1 sink/ 2 mod	3/mod	0.5/mod	30 - 40w/sf	0	1 gpm/ mod	500	10,000
Bioinstrumentation Research & Support (NSFL = 8,910)	1 sink/ 3 mod	Incidental use, 20 gpm/ station	1 sink/ 3 mod	3/mod	0.5/mod	35- 45w/sf	0	2 gpm/ mod	250	12,000
Teaching (NSFL = 3,300)	1 sink/ 1 mod	Incidental use, 20 gpm/ station	1 sink/ 2 mod	6/mod	6/mod	25- 35w/sf	0	0	250	12,000
Imaging Core (NSFL = 2,310)	0.7 sink/1 mod	Incidental use, 20 gpm/ station	0.25 sink/ 1 mod	3/mod	0.25/mod	40- 50w/sf	50 amps	6 gpm/ mod	250	15,000
Vivarium Core (NSFL = 3,300)	5 sink/ 1 mod - incl. cage washer	Incidental use, 20 gpm/ station	0	3/mod	0.2/mod	40w/sf	50 amps	0	250	18,000

Note: All loads are connected without applied diversities.

Abbreviations: mod = Laboratory module (330sf)
NSFL = Net Square Foot of Laboratory

3.6.3 SUSTAINABILITY

The development of an effective sustainability strategy for the laboratory portions of the EBU3 will require a constant investigation and evaluation of potential measures. The most effective measures will fall into four major categories: Sustainable Site Design, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality.

Suggestions for further investigation include:

(1) Materials Processing

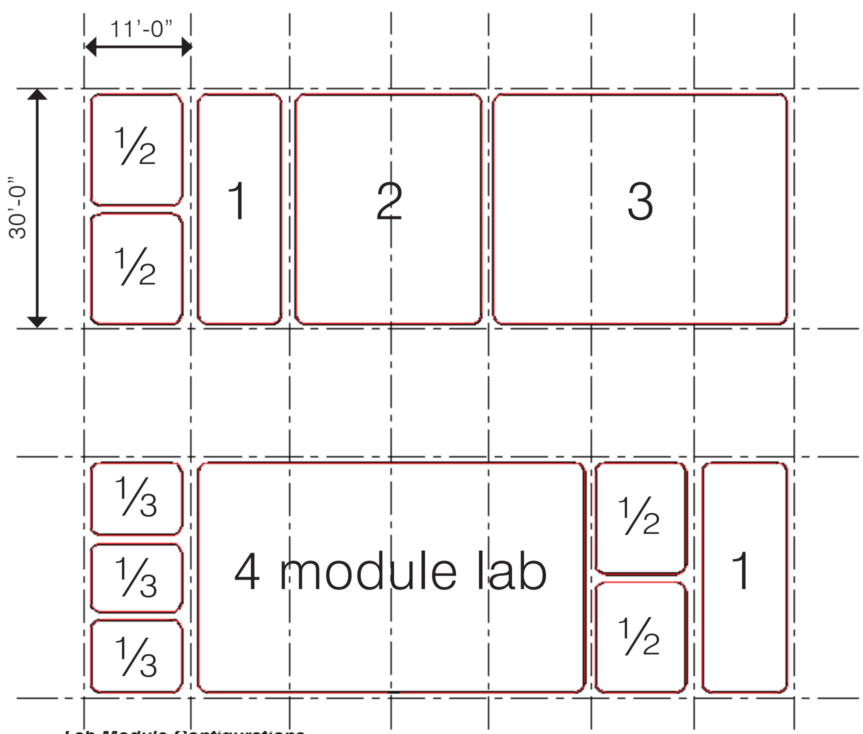
- Wood from “Certified Sustainability Managed Forests”
- Minimum requirements for recycled steel content
- Use of environmentally ‘friendly’ finishes:
- Water-borne application for wood
- Finishes applied with ‘near-zero’ VOC emissions

- No 'off-gassing' of wood products after curing
- Dry coating process for steel casework finishes

(2) Energy Conservation
- Variable Air Volume (VAV) control systems on fume hoods
- Sash-limiting devices on fume hoods to reduce air flow
- Occupancy sensor for fume hoods and or room lighting
- Heat recovery system for fume hood exhaust

Another potential measure that can contribute to a reasonable sustainability strategy for the laboratory design is the minimization of base cabinetry and simplification of base cabinetry configurations. During the design phase it will be important to work with the faculty and university to find the appropriate casework system that can both satisfy the laboratory storage requirements with the minimum use of materials and energy investment in their processing.

3.6.4 FLEXIBILITY AND ADAPTABILITY



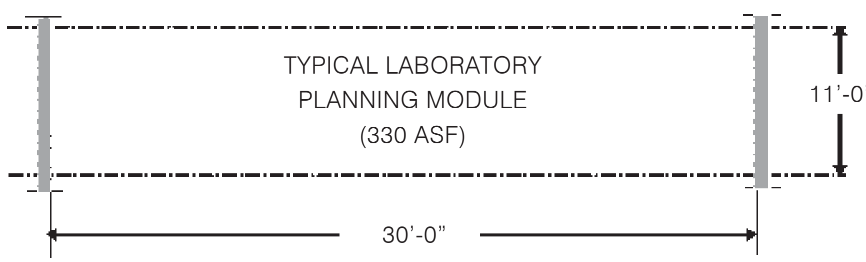
Lab Module Configurations

Laboratories should be organized around modular planning principles so they are constructed with standardized units or dimensions for flexibility and to enable a variety of uses. Modular planning is used as an organizational tool to allocate space within a building. The module establishes a grid by which walls and partitions are located. As modifications are required because of changes in laboratory use, instrumentation, or departmental organization, partitions can be relocated, doors moved, and laboratories expanded into larger laboratory units or contracted into smaller laboratory units without requiring reconstruction of structural or mechanical building elements.

The planning modules may be combined to produce large, open laboratories or subdivided to produce small instrument or special-use laboratories.

The above description of the planning module also allows for the organized and systematic delivery of laboratory piped services, HVAC, fume hood exhaust ducts, power and signal cables. If these services are delivered to each laboratory unit in a consistent manner, then changes in laboratory use requiring addition or deletion of services will be easy to accomplish because of the constant nature of the infrastructure.

The proposed laboratory planning module for the EBU3 was derived by analyzing the laboratory bench, equipment, and circulation space required for the project specific laboratory functions. The module is based on the bench space (width and length) required for technical work stations, instruments, and procedures. The space required between benches is designed to allow people to work back-to-back at adjacent benches, to allow for accessibility for disabled and still allow for movement of people and laboratory carts in the aisle.



A planning module approximately 11’-0” wide by 30’-0” deep is recommended for the laboratory spaces. This module will provide adequate bench space plus space for floor standing equipment and fume hoods, and can be divided for smaller support spaces such as equipment and instrument rooms. The recommended module size will be tested against the column spacing and exterior wall locations of the proposed relocation site during the design phases, and may be adjusted accordingly.

Island benches which are 5’-6” deep and wall benches 2’-9”deep are recommended to accommodate the anticipated instruments to be used in the EBU3.

A 5’-0” minimum aisle between benches will minimize circulation conflicts and reduce potential safety hazards. It is critical in all laboratory spaces that carts be able to maneuver without conflict in all aisles.

The proposed module width will accommodate the above requirements and will provide sufficient space in laboratories when movable computer stations or equipment racks are used near laboratory benches.

3.6.5 ACCESSIBILITY

Providing accessibility for persons with disabilities requires special design considerations. The facility must conform to applicable local, state and federal regulations. Early design consideration should be given to the following accessibility aspects:

- All parts of the building should be accessible by persons with disabilities.
- Accessible work stations and fume hoods should be provided in the laboratories based on code requirements.
- Location of accessible work stations as close as possible to eyewash and safety showers.
- An 18” clearance on the pull side and 12” clearance on the push side of doors opposite the hinged side is required.

Some general criteria and guidelines for accessible work stations in laboratories are as follows:

Work surfaces should be located 30” to 34” above the floor with wheelchair clearance below. Adjustable work surfaces can provide a range of possible height adjustments.

Laboratory service controls, equipment, and equipment controls should be located within easy reach for persons with limited mobility. Controls require have single-action levers or blade handles for easy operation.

Aisle widths and clearances should be adequate for maneuvers of wheelchair bound individuals. Aisles 5’-0” wide are recommended with turnaround areas.

3.6.6 NOISE CONTROL

Noise control requires specific attention to design and construction details. The following features should be addressed in the design of the mechanical and electrical systems:

- Fan noise transmitted to spaces through the duct system or through the building structure. This noise is characterized by a low-frequency rumble and often includes annoying pure tones.
- Noise generated by the excitation of duct wall resonance produced by fan noise, by pressure fluctuations caused by fan instability, and by high turbulence caused by discontinuance in the duct system.

- Noise generated by air flowing past dampers, turning vanes, terminal device louvers, and comprising mid-to-high frequency energy.
- Water circulation system noise caused by high velocities or abrupt pressure changes that is generally transmitted through structural connections.
- Noise and vibration caused by out-of-balance forces generated by the operation of fans, pumps, compressors, etc.
- Magnetostrictive hum associated with the operation of fluorescent lighting ballasts, transformers, or electric motors.
- Elevator equipment noise from motor generators, hoist gear, and counterweight movement; or from hydraulic pump systems.

Other design precautions include:

- Conduits should not directly link noise-sensitive spaces, nor should they mechanically bridge vibrationally-isolated building elements using a rigid connection.
- Flexible conduit must be used for connections to isolated floor slabs, walls, and vibrationally isolated mechanical/electrical devices.
- Duct silencers will be considered when duct distance is not sufficient to provide adequate acoustical separation.

3.6.7 VIBRATION/STRUCTURAL CONSIDERATIONS

The nature of research activity being conducted in EBU3 requires consideration of structural dynamics.

Footfall-induced vibrations on above-grade floors, should be reduced by:

- Confining heavily traveled areas to regions near column lines,
- Placing sensitive equipment near columns,
- Placing the equipment away from heavily traveled areas,
- Minimizing the length of spans.

Increasing the stiffness of the floor slab alleviates vibration. Providing a combination of mass and/or depth for above grade slabs increases structural stiffness. Cast-in-place concrete has natural characteristics and mass advantages for vibration reduction; a concrete frame structural system is anticipated in this building. For vibration considerations. laboratory areas should be designed for 125 psf live load.

Air handling equipment and ductwork shall be designed to minimize vibration. Supply and exhaust air fans, compressors, pumps, and other noise and vibration producing equipment should be located in mechanical rooms with protective wall construction. Equipment should be isolated from supporting structure with resilient mounts. Vibration isolators should be selected based on floor stiffness, span extension, equipment power and operating speed.

Instruments that are extremely sensitive to vibration (scanning electron microscope or transmission electron microscope, STM / ATM, NMR, etc.) should ideally be located on slab-on-grade construction to minimize transient structure-borne vibration. Provisions of an isolated slab should be analyzed.

Pneumatic and piezoelectric isolations should be used, as required, on specified highly sensitive equipment.

Vibration criteria for areas intended to accommodate sensitive equipment are based on rms Velocity Level as measured in one-third octave bands of frequency over the range of 8-100 Hz. Generic Vibration Criterion (VC) curves have been developed for different types of equipment. The results are shown in Table 1.

Criterion curves VC-A through VC-E are applicable to research facilities. International Standards Organization (ISO) criteria for human exposure to vibration are also shown.

It is recommended that the structural floor system be designed to meet the VC-A criterion on upper floors, and the VC-D on grade level. The design should follow the AISC Guidelines of Design for Sensitive Equipment.

Seismic stabilization of the structure should be addressed. Natural frequency of floor and building structure should be determined in function of the Seismic Zone of construction site. A minimum building natural frequency of 12Hz is recommended for optimum operation of vibration isolating equipment unless seismic or other criteria may impose a lower frequency.

DESIGN CRITERIA FOR SENSITIVE INSTRUMENTATION AND EQUIPMENT NOT OTHERWISE VIBRATION-ISOLATED

Criterion Curve	V_{rms} Velocity Level		Detail Size (μm)	Description of Use
	(μin/s)	(dB) Ref:1μin/s		
Workshop (ISO)	32,000	90	N/A	Distinctly felt vibration. Appropriate to workshops and non-sensitive areas.
Office (ISO)	16,000	84	N/A	Felt vibration. Appropriate to offices and non-sensitive areas.
Residential Day (ISO)	8,000	78	75	Barely felt vibration. Sleep areas in most instances. Probably adequate for computer equipment, probe test equipment and low-power microscopes (to 20X).
Op.Theatre (ISO)	4,000	72	25	Vibration not felt. Suitable for sensitive sleeping areas. Suitable in most instances for microscopes to l00X and for other equipment of low sensitivity.
VC-A	2,000	66	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	1,000	60	3	Optical microscopes to l000X, inspection and lithography equipment (including steppers) to 3 micron-meter line widths.
VC-C	500	54	1	A good standard for most inspection equipment and lithography to 1 micron micron-meter detail size.
VC-D	250	48	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs, SEMs, AFMs) and E-Beam systems, operation to the limits of their capacity.
VC-E	125	42	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems.

Note: Detail Size column expresses the minimum width of fabrication details or size of research particles that could be handled at a specific criterion value.

3.7 HVAC DESIGN PARAMETERS

Safety

The laboratory HVAC system should promote the safe operation of the building and the health and comfort of the occupants. The laboratory environment may contain harmful chemical vapors, particulates and biological aerosols. These hazardous substances must be continuously removed from the breathing zone of the laboratory users. In addition, a safe environment should be maintained around the building.

The HVAC design will be based on regulatory requirements and guidelines along with good engineering practices. Code requirements are a minimum standard.

Primary Containment

The primary containment in laboratory ventilation consists of chemical fume hoods and other ventilated enclosures which operate under negative pressurization with respect to the laboratory. They are designed for preventing personnel exposure to hazardous materials.

Hoods should be located more than 10 feet from any door or doorway, with the exception of secondary exits, and should not be located on a main traffic aisle.

With the view of energy and capital savings, the hood should be normally operated at 18” vertical sash opening. Sash stops shall be provided and the normal operating sash position shall be labeled. The sash will be fully open only during set-up or take-down operations. Horizontal sashes or combination of vertical-horizontal sashes can be used.

All chemical fume hoods should maintain an average face velocity of 100 feet per minute $\pm$10%. The constant volume hoods designed to operate at 18 inch vertical sash opening will develop lower face velocities when the sash is raised above this limit. Under no circumstances shall face velocities drop below 60 fpm. Lower velocities of 60 to 80 feet per minute can be employed in variable air fume hoods by using presence sensors providing adaptive face velocity control. In some applications the average face velocity might exceed 100 feet per minute.

Each fume hood shall be equipped with a flow-measuring device and should be monitored locally to allow convenient confirmation of adequate hood performance. All laboratory fume hoods must be equipped with visual and audible alarms warning of unsafe airflow.

Any fume hood which is designated by the Environmental Health and Safety Authority as especially hazardous shall have a dedicated duct, fan, and if required, treatment system. Fume hoods in this category will include radioisotope hoods.

Secondary Containment

Secondary containment is provided by the negative pressure of the laboratory space relative to corridors and surrounding non-laboratory spaces. To effectively maintain the negative pressure in the laboratory the use of operable windows or doors to the exterior should be avoided. Doors to laboratories should be equipped with closers, must remain closed as much as possible and should not be held open. If the direction of airflow is deemed critical, monitoring devices shall be used to signal or alarm the inadequate pressure relationship of adjacent spaces.

The laboratory spaces will be continuously ventilated 24 hours per day.

Supply air shall be effectively distributed into all portions of the laboratory space by ceiling diffusers or perforated ceiling panels, without creating drafts at exhaust hoods. The maximum supply air velocity in the vicinity of fume hoods and biological safety cabinets shall be 50 feet per minute at 6 feet above the floor.

Air from laboratories and other spaces which might contain hazardous materials shall be exhausted outdoors and not recirculated.

Air from offices and other clean areas may be recirculated or directed toward negative pressure laboratories.

Other Exhaust Devices

Canopy Hoods: Hoods over work areas or equipment used to capture heat or steam. The recommended design flow rate is 75 cfm per linear foot of open perimeter.

Snorkels: Small capturing cones attached to an adjustable exhaust arm, suspended from the wall or ceiling, to capture heat or fumes from equipment or processes. Typical flow rates are 100-200 cfm.

Vented Cabinets: Vented Cabinets used to store hazardous, corrosive, toxic and other health hazard storage cabinets may be connected to an exhaust system, providing a negative pressurization inside the cabinets. Venting of flammable liquid storage cabinets should be reviewed with the authority having jurisdiction.

Equipment Exhaust Connections: Exhaust ports will be provided for equipment requiring direct exhaust connection. Some equipment may have a separate exhaust system.

UNIVERSITY of CALIFORNIA Riverside

4.0
SITE DESIGN REQUIREMENTS

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

CO ARCHITECTS

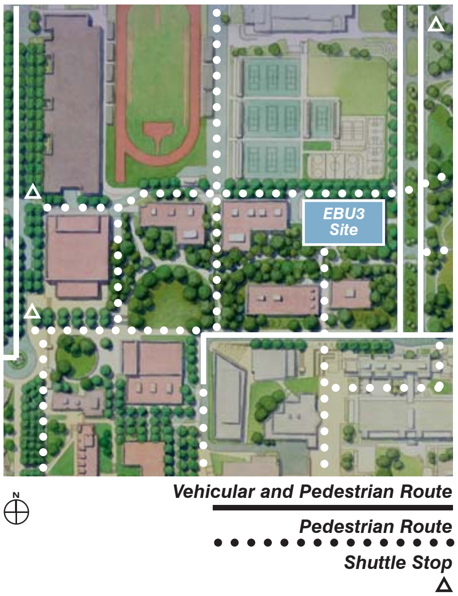
4.1 CAMPUS PLANNING ISSUES
- 4.1.1 PEDESTRIAN CIRCULATION PATTERNS
- 4.1.2 PUBLIC TRANSPORTATION
- 4.1.3 VEHICULAR, SERVICE AND PARKING ACCESS
- 4.1.4 OPEN SPACE PLANNING

4.2 EBU3 SITE PLANNING ISSUES
- 4.2.1 SITE DESIGN OPTIONS
- 4.2.2 PEDESTRIAN LINKS
- 4.2.3 SERVICE AND LOADING ACCESS
- 4.2.4 SITE UTILIZATION ANALYSIS
- 4.2.5 SOLAR ORIENTATION
- 4.2.6 LANDSCAPE

4.0
SITE DESIGN REQUIREMENTS

4.1 CAMPUS PLANNING ISSUES

4.1.1 PEDESTRIAN AND BICYCLE CIRCULATION PATTERNS

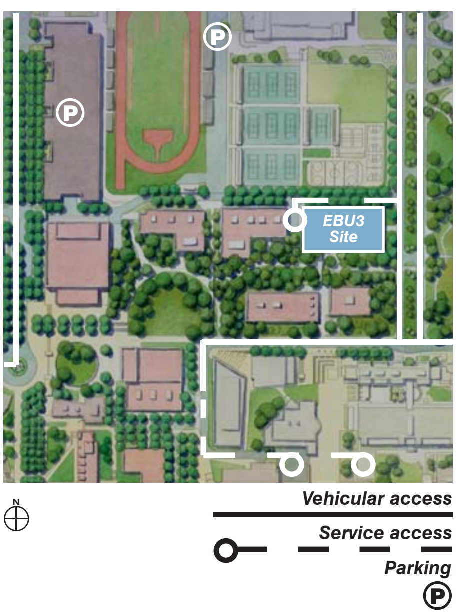


In response to long range campus growth projections, the 2005 LRDP identified the need to enhance physical connections across the entire campus by promoting walking and bicycling as attractive alternatives to driving. Among key issues recognized was the need to strengthen links between the East and West campus by adding and widening walkways and bike paths. Pedestrian access on the East Campus will be improved by limiting vehicular circulation to this area. The system of pedestrian malls will be extended through the academic core on the East Campus and will be connected to recreational and residential areas on the north and northeast. In proximity to the EBU3 site, bicycle access will be available along University Avenue, Aberdeen Drive and Big Springs Road.

4.1.2 PUBLIC TRANSPORTATION

As the campus grows, the University plans to expand its campus shuttle system in order to mitigate traffic congestion along key internal core routes and to offer greater frequency of service. From the site of the new EBU3, future shuttle transit routes have been designated along the local access circulation road, Canyon Crest Drive and Aberdeen Drive.

4.1.3 VEHICULAR, SERVICE AND PARKING ACCESS



Vehicular circulation around campus will be provided by a two-tiered system composed of the primary large radius loop connecting the campus east and west of the freeway, and a secondary system providing access to parking and accessible drop-off destinations for passenger and service vehicles along University Avenue east of Chicago Avenue, Canyon Crest Drive between Blaine and University Avenues and Iowa Avenue. Within the secondary system, a network of local vehicular routes will provide intra-campus mobility accommodating vehicles for service, disabled access, deliveries and emergency access. Controlled access zones have been established within the core academic campus areas. These routes will generally remain closed in support of enhanced bicycle and pedestrian traffic, but will be actively managed to allow access for special events. Controlled access roadways supporting the new EBU3 site include Aberdeen Drive south of the Aberdeen-Inverness residence hall, and Linden Street from Canyon Crest Drive to Aberdeen Drive.
A majority of students currently commute to campus, although the 2005 LRDP anticipates that the percentage will decrease to 50 % by 2015 with the expansion of residential development at UCR. Parking structures and surface parking lots are planned at key sites at the campus perimeter and adjacent to freeway off-ramps. Two parking sites having close proximity

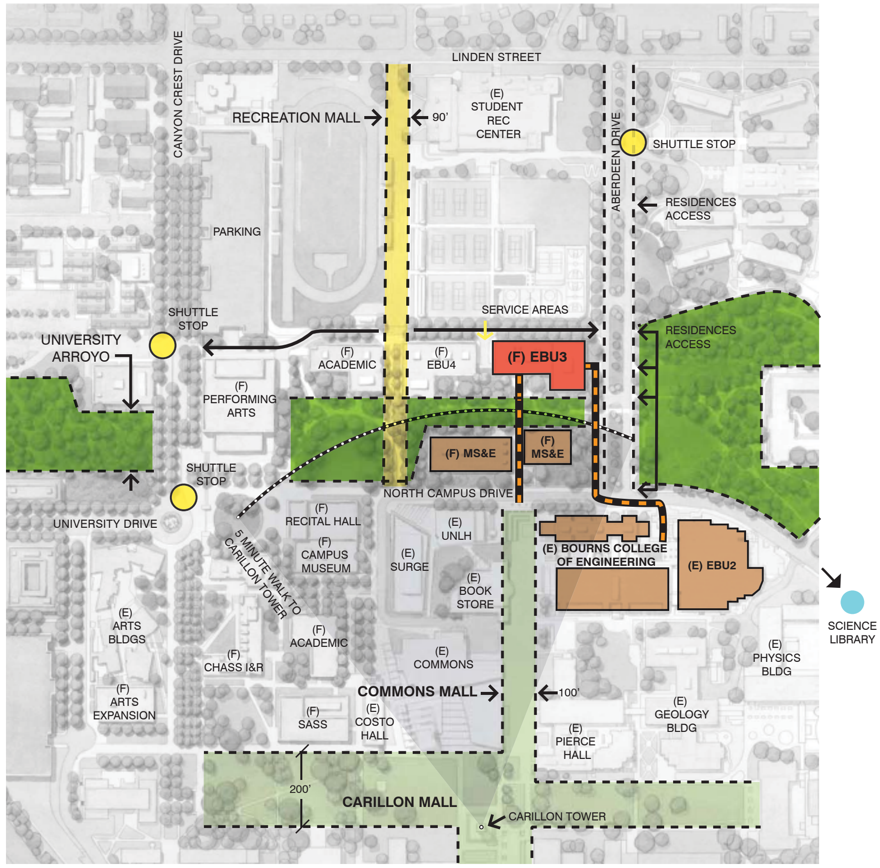
to the EBU3 site will occur along Canyon Crest Drive, (1) to the northwest and (2) to the southwest of the academic core.

4.1.4 OPEN SPACE PLANNING

UCR recognizes that open space in combination with a strong pedestrian and bicycle circulation system affords an opportunity to communicate and strengthen the character and image of the University campus. The 2005 LDRP envisions these elements creating “a fabric of outdoor rooms, spaces and pathways that connect all areas of the campus.” The open space planning framework developed for the campus distinguishes several important elements – Natural Open Spaces to be preserved from development, Naturalistic Open Spaces to be developed in a manner consistent with the natural habitat, and Campus Landmark Open Spaces to be respected for their dominant existing character and emulated in future development particularly in the East Campus academic core.

The open arroyo space area immediately south of the EBU3 site will be developed as a Naturalistic Open Space. With the goal of extending the natural riparian drainage system environment along the building footprint, plant materials and exterior hardscape will be selected using design criteria that link them to the historic natural arroyo that originally crossed through the site.

4.2 EBU3 SITE PLANNING ISSUES



Site Diagram ***Key:*** (E) Existing, (F) Future

4.2.1 SITE DESIGN OPTIONS

The following represent important site design considerations to be addressed when schematic design begins:

- The building shall comply with the campus design guidelines.
- The building should be close to Aberdeen Drive to accommodate future buildings to the west.
- The building and north service road should be pushed northwards as far as possible, while maintaining the running track and permitting a relatively straight service road. This will maximize the width of the arroyo green zone.
- The building's entrance off the arroyo and any semi-public courtyard space must align with the massing break and circulation stairs of the MS&E building to the south.
- The building should take advantage of the grade differential between the north service road and the new arroyo.

- A major entrance and address should be located off Aberdeen Drive. Another entrance from the north service road should be provided.
- Offices should face either north or east to minimize solar exposure.
- The building configuration must respond to the East Campus Entrance Area Plan; it will provide definition to the new University Arroyo. At its narrowest point, the arroyo open space can reduce to a minimum width of 100 feet but the priority should be to retain as much open space as possible.
- The building form must be sensitive to its impact on scale and physical definition of the arroyo.

4.2.2 PEDESTRIAN LINKS

It is likely that faculty and students from the College of Engineering will access this building either through the MS&E building or along Aberdeen Drive, coming from Bourns Hall and EBU2. With a new parking structure on Lot 24, and existing transit stops along Canyon Crest Drive, the north service road is likely to become a well used east-west pedestrian circulation route. Students from the residence halls will likely approach EBU3 along Aberdeen Drive.

4.2.3 SERVICE AND LOADING ACCESS

Several studies examined two different solutions. The first was to integrate a loading dock into the building mass. While this provided the most screening it presented the most expensive scenario.

A second and recommended solution is to place a service dock off the north service road just to the west of EBU3. Some retaining wall will be required to allow this to sit above the arroyo at the higher street elevation. This dock will then service EBU3 and a future building to the west. Adequate screening will be required and sensitive architectural treatment needed to reduce visual impact on the arroyo.

4.2.4 SITE UTILIZATION ANALYSIS

The site for EBU3 is designated in the East Campus Entrance Area Study as the northeast corner of the existing Intramural fields that are master planned collectively as the new University Arroyo open space. The Arroyo will recreate a naturalistic landscaped open space and serve as an east-west pedestrian linkage for the East Campus Entry area of the campus. The specific site area for EBU3 is bounded by Aberdeen Drive to the east and a planned service drive and east-west pedestrian link to the north. The southern limits of buildable area are defined by the siting of the future MS&E and the University Arroyo design criteria for open space that specifies a minimum 100' wide open space. The western site limits are set only by the need to leave sufficient space for future buildings and the need for a shared loading facility to serve EBU3 and the next building to be located west of EBU3.

Other site utilization influences include the need to respond to a north-south axis established by the Commons Mall and reinforced by the positioning of the MS&E building entry. Also, it has been established through analysis of likely pedestrian access paths from BCOE and from student residence areas that the Aberdeen Drive frontage will serve as the primary public building entrance.

Given the limited availability of new development sites for the BCOE, the greatest pressure on planning decisions for EBU3 may be the need to maximize the floor area ratio (FAR) of the site. As such, the Programming Team analyzed various scenarios for three, four and five-story buildings on the site assuming a fixed program ASF and GSF quantities. Ultimately it was determined that a four-story building located as far north and east optimizes site utilization in light of other planning constraints. Three-story planning diagrams resulted in the need for excessive site area to accommodate the elongated footprint. Five-story planning diagrams resulted in a building organization that left research floors lacking a critical mass of laboratories and research offices.

4.2.5 SOLAR ORIENTATION

The building's orientation is east-west; this is a very favorable situation in that it is relatively easy to mitigate the deleterious effects of solar radiation.

The south can be screened by horizontal overhangs and sunshades. Investigation into the possibilities of using an overhang to screen roof top mechanical equipment should be undertaken.

There is a long north façade; faculty have indicated a preference for this orientation as it also affords excellent mountain views. It also makes sense to place more cellular offices to the north as they would tend to overheat more quickly with southern exposure than larger more open laboratory spaces that have an inherently higher air change requirement per hour.

To the west, a future building will ultimately screen low afternoon sun; however until that is built, consideration to mitigating this condition needs to be given, to the extent feasible, in light of budgetary constraints.

4.2.6 LANDSCAPE

Existing landscape Conditions
The existing Athletic Fields project site is approximately twenty feet below the grade of the adjacent streets. The arroyo, a significant landscape

feature on this part of campus, continues through the site. The north part of the site is bounded by existing recreational facilities. Aberdeen Drive, a unique divided roadway, borders the east side of the site and separates the site from a heavily landscaped area with a mix of Pepper, Ash, and a variety of native trees and shrubs. Aberdeen Drive establishes the semi-rural character of the Campus and recalls the agricultural past of the region.

The concept for the project needs to respond to the overarching motif of creating a "naturalistic" arroyo. It should recognize the MS&E landscape plan as well as species guidelines for the arroyo. Plant material should aid in providing solar shading of the building's southern exposure. The landscape plan should provide places for people to gather under shade. This is also true for any semi-public courtyard spaces.

Consideration of screening the loading dock with landscaping is important. EBU3 should provide street trees along the northern service road and Aberdeen Drive, in concert with the University's designated plants for these important public walkways. To the greatest extent possible, the landscape should visually link with major trees in The College's Quads to figuratively make a connection with these adjacent parts of the campus. The landscape shall comply with the campus landscape guidelines contained within the campus design guidelines.

Irrigation

The irrigation system shall provide the most effective method for providing complete ground place coverage and efficient watering for the new planting. Deep water irrigation shall be provided at the trees. The irrigation system shall be compatible with UCR requirements and utilize a automatic central controller.

UNIVERSITY of CALIFORNIA Riverside

5.0
BUILDING ORGANIZATION

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

CO ARCHITECTS

5.1 ARCHITECTURAL DESIGN CRITERIA
5.2 BUILDING CONCEPTS

- BUILDING ORGANIZATION CONCEPT A
- BUILDING ORGANIZATION CONCEPT B
- BUILDING ORGANIZATION CONCEPT C
- BUILDING ORGANIZATION CONCEPT D
- BUILDING ORGANIZATION CONCEPT E

5.0
BUILDING ORGANIZATION

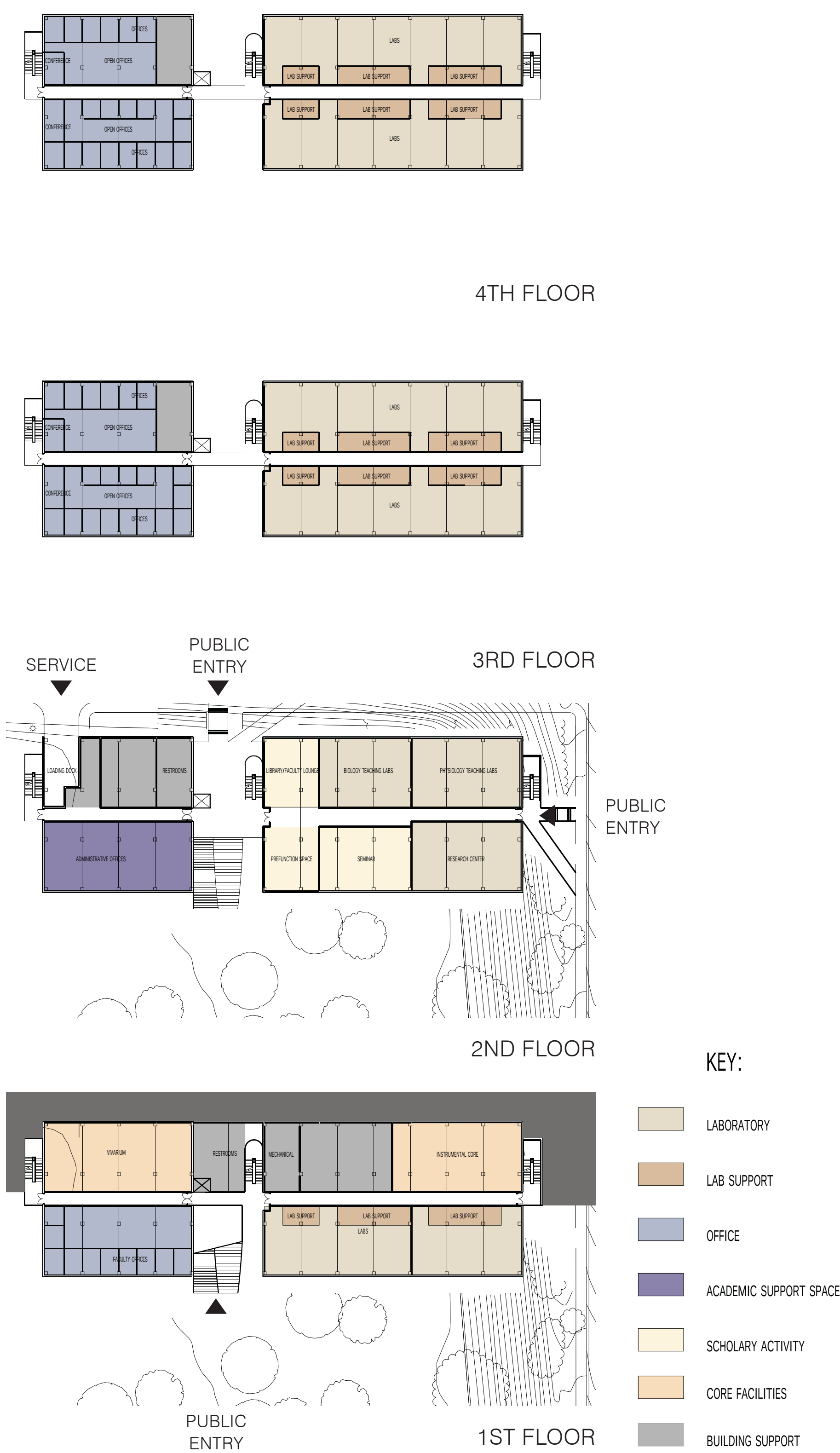
5.1 ARCHITECTURAL DESIGN CRITERIA

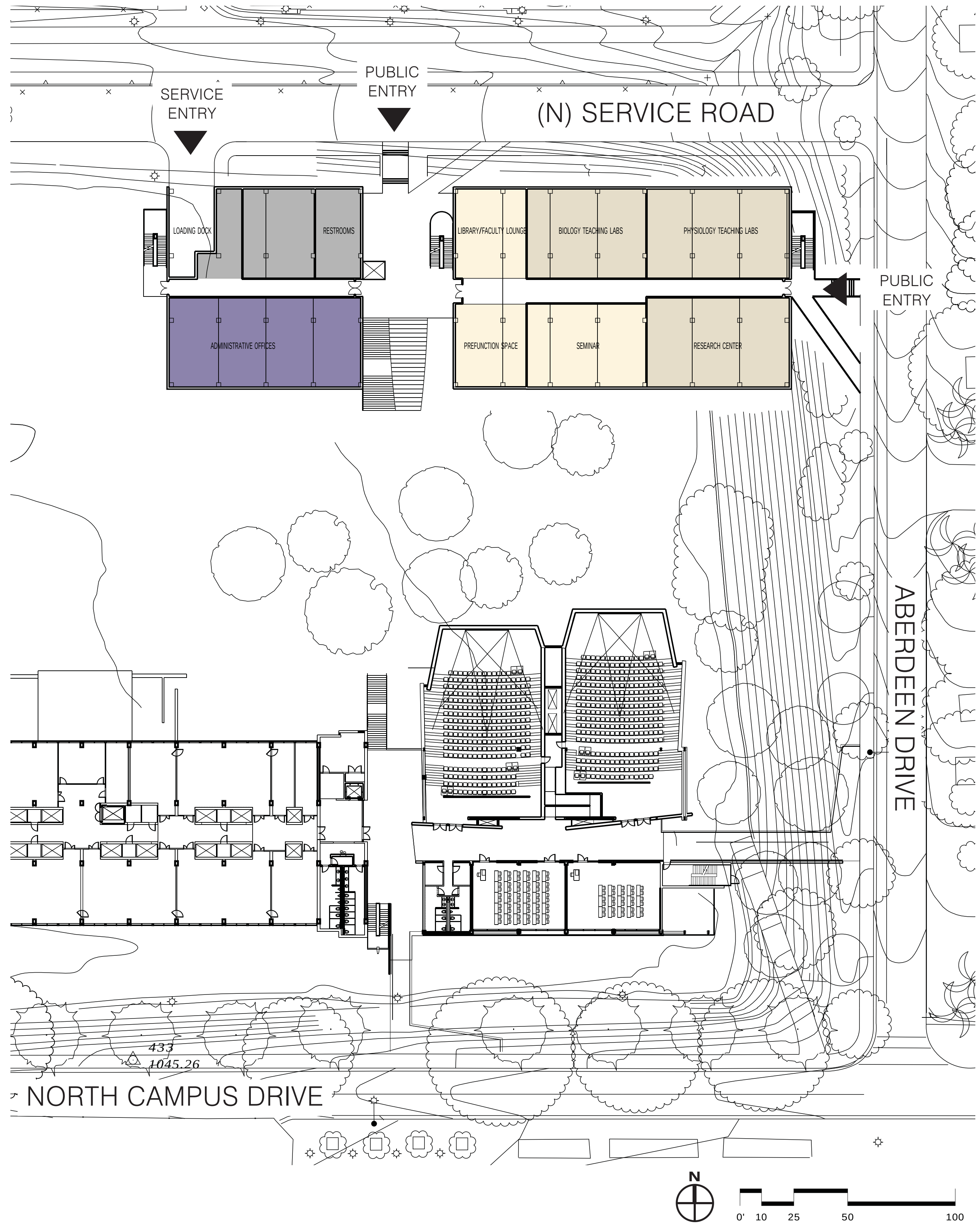
Several concepts were studied through the pre-design process to organize and accommodate the program on the project site. These organizational concepts are illustrated in building diagrams A through E. Each concept has benefits and concerns, most notably cost considerations.

Each organizational concept can be adjusted to address issues of entrance, building permeability and transparency. The idea of building transparency has two conflicting elements – the first is the desire to provide memorable places for the campus population, to enliven pedestrian experiences and to educate the population by exposing passerby to work done on campus. An opposing perspective is that of work security and noise and privacy concerns throughout the facility.

The following diagrams show the range of physical configurations studied. In a sense, these are independent from the building organization concepts and further work on the concepts can accommodate a desired approach.

The range illustrated show a full open courtyard not unlike Bourns and EBU2, through which students can pass and the college inhabit. This activates the arroyo, and the building and extends the useful space for occupants. It provides more daylight at the cost of increasing exterior building skin. Other options show smaller courtyards which provide similar benefits with less cost premium. Some of the building organization concepts show building massing similar to MS&E in that it has adjacent wings of office and laboratories. Other concepts look at opening the building and integrating the office zones with the laboratory areas.





5.2 BUILDING CONCEPTS

Concept A

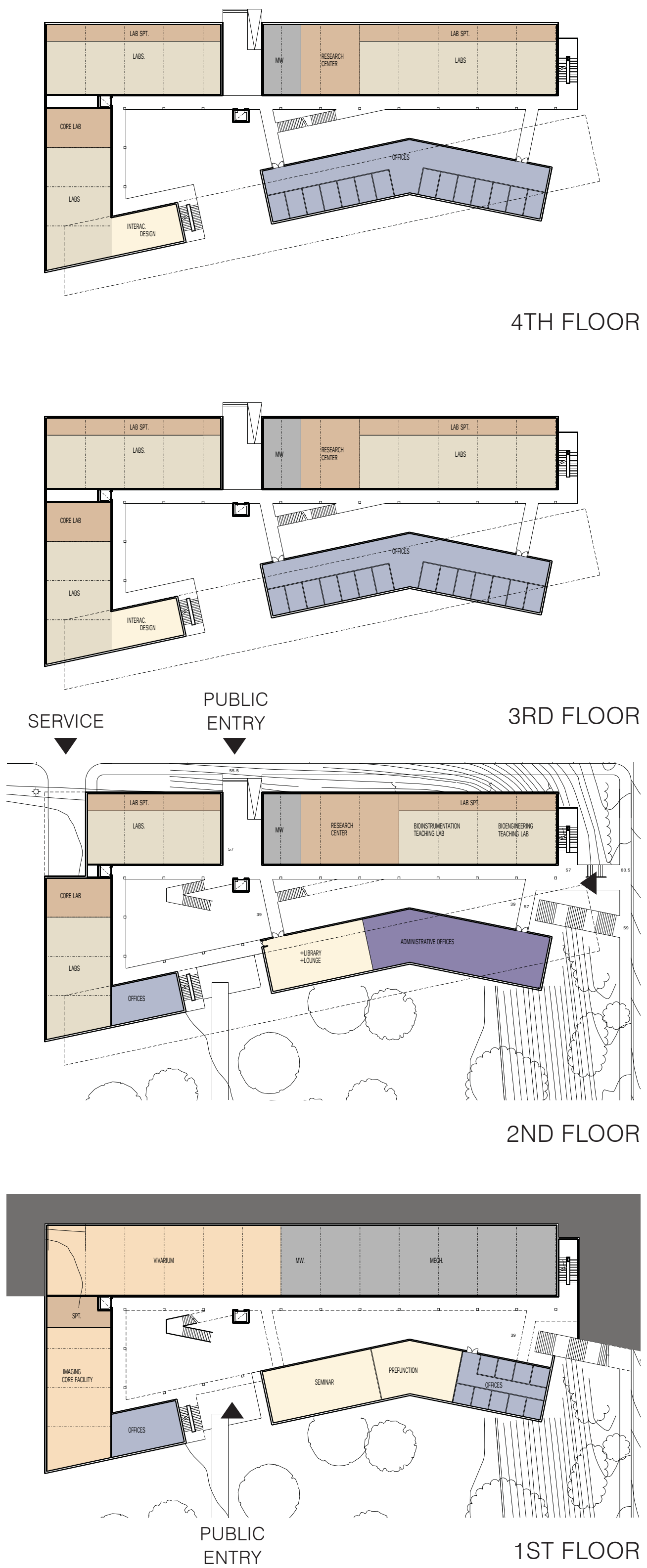
Building organization concept A consists of a westerly office wing and a lab wing to the east. These wings are connected by bridges at the third and fourth levels and by a corridor at the ground (arroyo) level. At the second floor, which is at street level, the connection between wings is broken allowing for pedestrians to pass from the arroyo northward to the recreational zone beyond the north service road. Street entrance can occur either from the service road or from Aberdeen Drive. The first floor contains the vivarium, the imaging core facilities and mechanical spaces set into the hillside with the front spaces, consisting of offices and laboratories, looking onto the arroyo. The second floor has teaching labs and administrative offices.

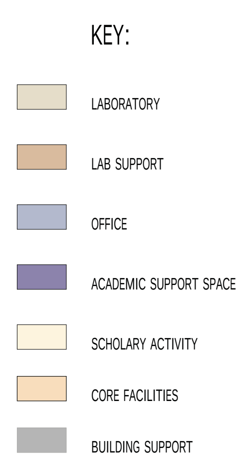
Pros:

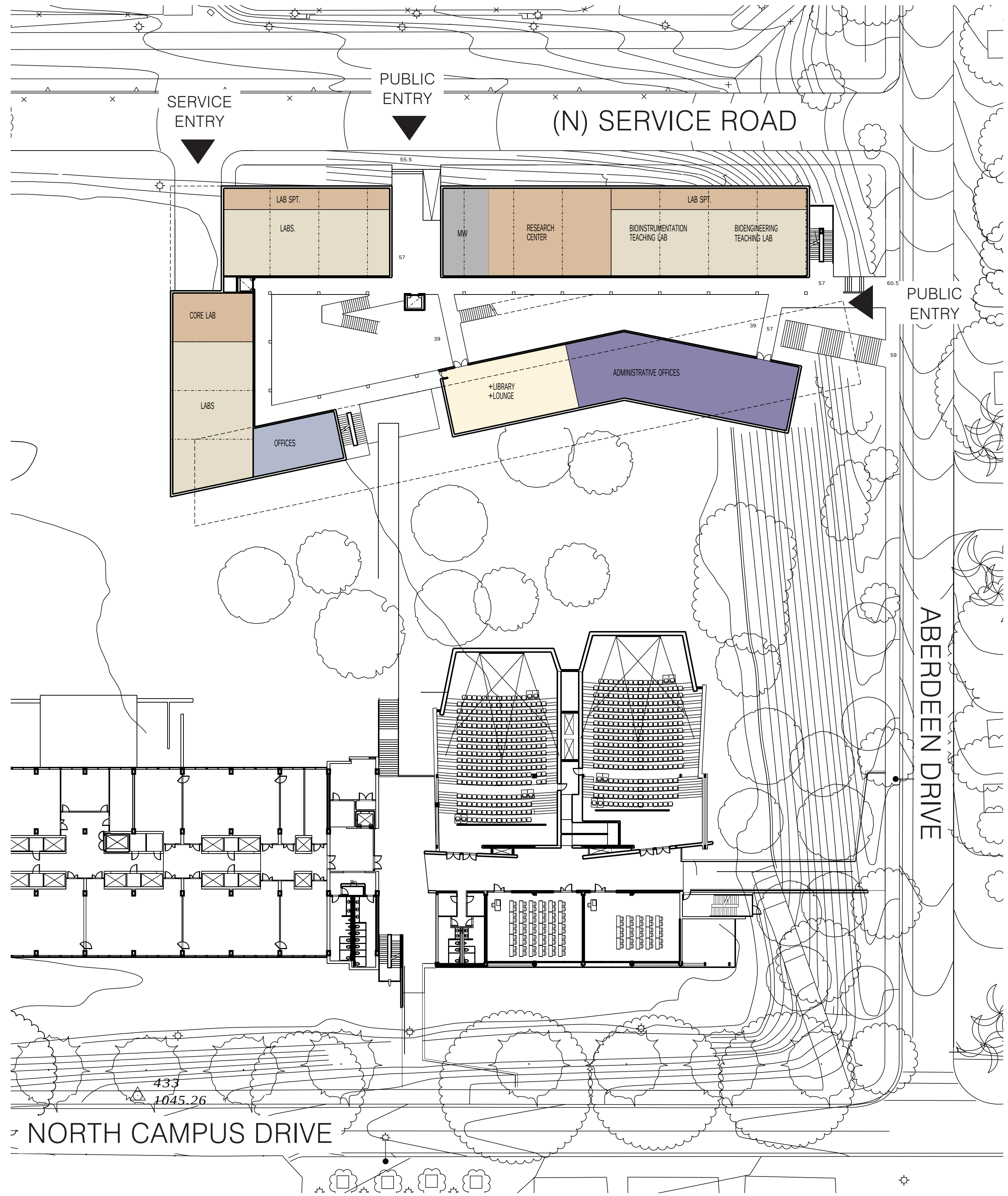
- Least expensive
- Most efficient
- Optimizes engineering systems

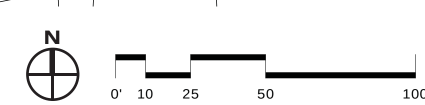
Cons:

- Offices are remote from labs
- Fewer opportunities for architectural distinction
- No semi private outdoor space
- Building organization does not promote user interaction









5.2 BUILDING CONCEPTS

Concept B

Building organization concept B utilizes an office wing connected by open walkways to form an open courtyard. The courtyard strategically opens to create a major entrance off of Aberdeen Drive with a large opening to the court located to align with the access stairs to the new MS&E building. From the first floor (arroyo) level one can enter the building or access stairs and elevators to travel to the street and upper building levels. The first floor houses seminar rooms opening into the courtyard. In addition, the core facilites and mechanical spaces are located on this level. The second floor (street level) contains teaching labs and the administration suite. Upper levels, the third and fourth floors, consist of offices and laboratories. Concept B places the support space towards the north of the lab block allowing windows into the labs from the courtyard for light and views. This scheme produces the greatest opportunity for collegiality, but at a financial cost due to the extended footprint.

Pros:

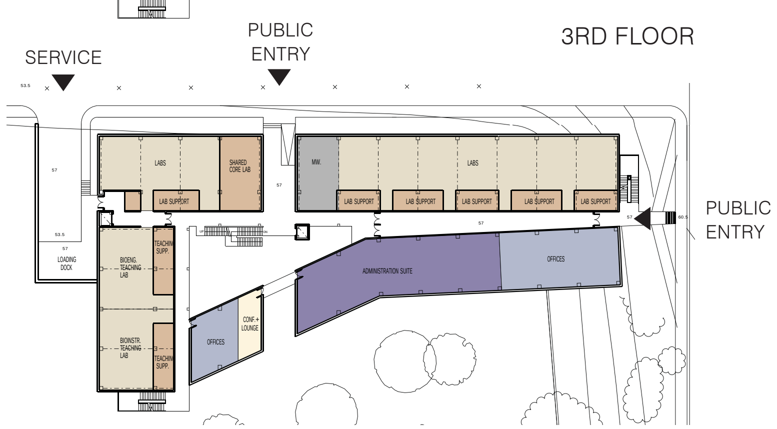
- Creates unique identity
- Most natural light penetration
- Semi-private outdoor space
- Highly collaborative and interactive environment
- Program elements are easily visible and identifiable from public spaces
- Offices grouped and in close proximity to labs

Cons:

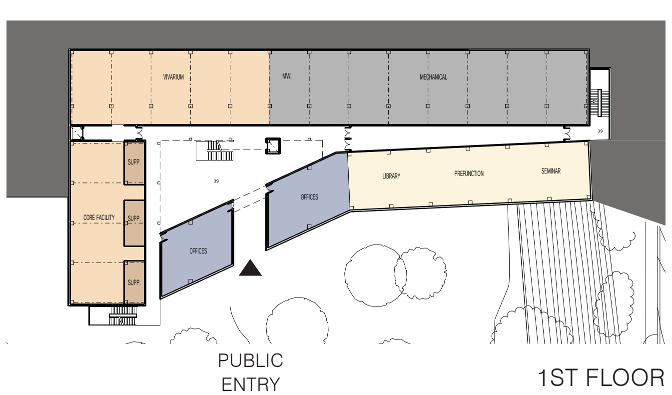
- Most expensive
- Less efficient building
- Exterior balcony access required for some labs

4TH FLOOR

3RD FLOOR



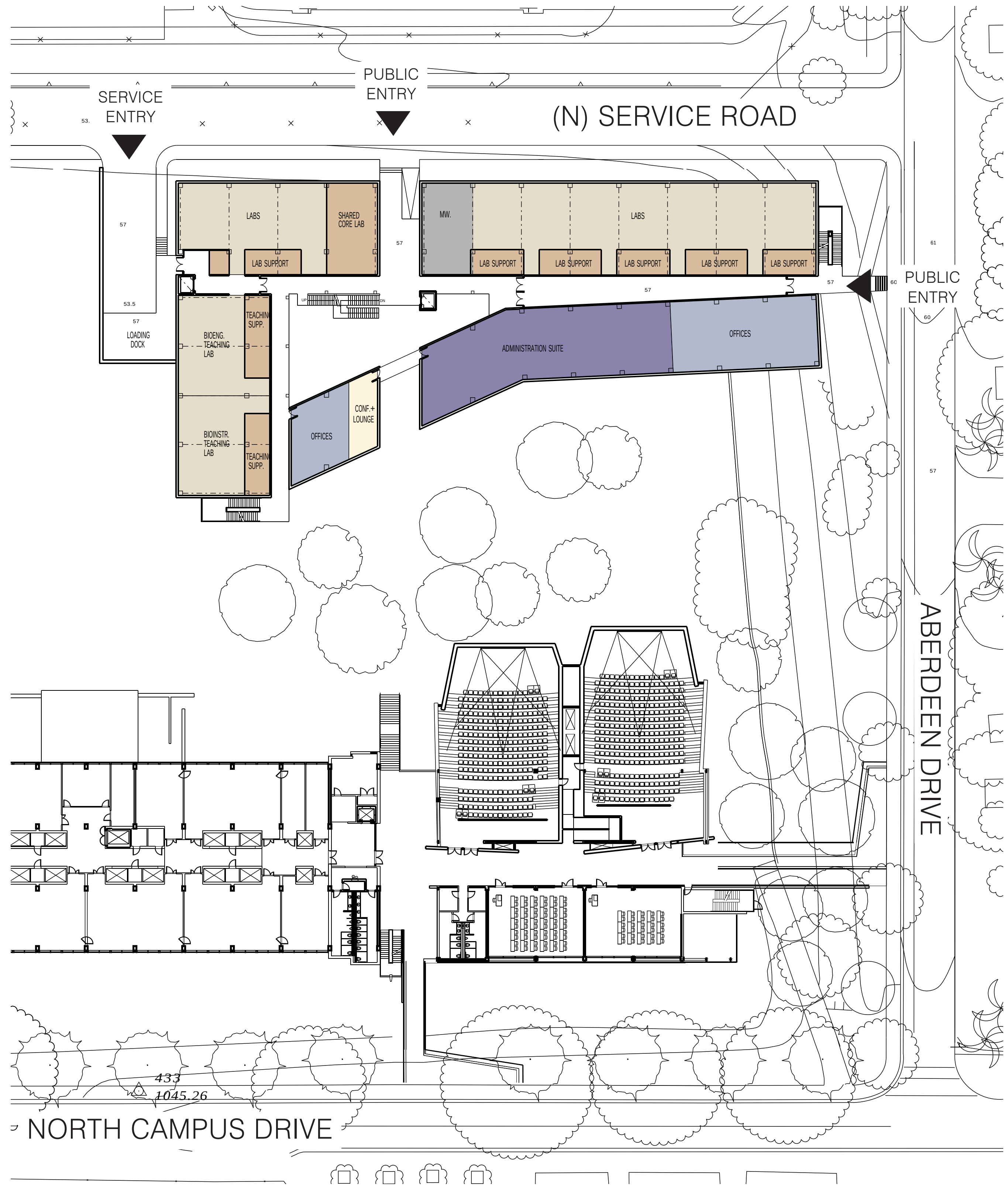
2ND FLOOR

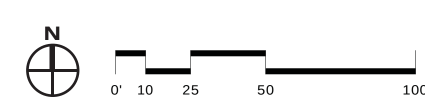


1ST FLOOR

KEY:

- LABORATORY
- LAB SUPPORT
- OFFICE
- ACADEMIC SUPPORT SPACE
- SCHOLARY ACTIVITY
- CORE FACILITIES
- BUILDING SUPPORT





5.2 BUILDING CONCEPTS

Concept C

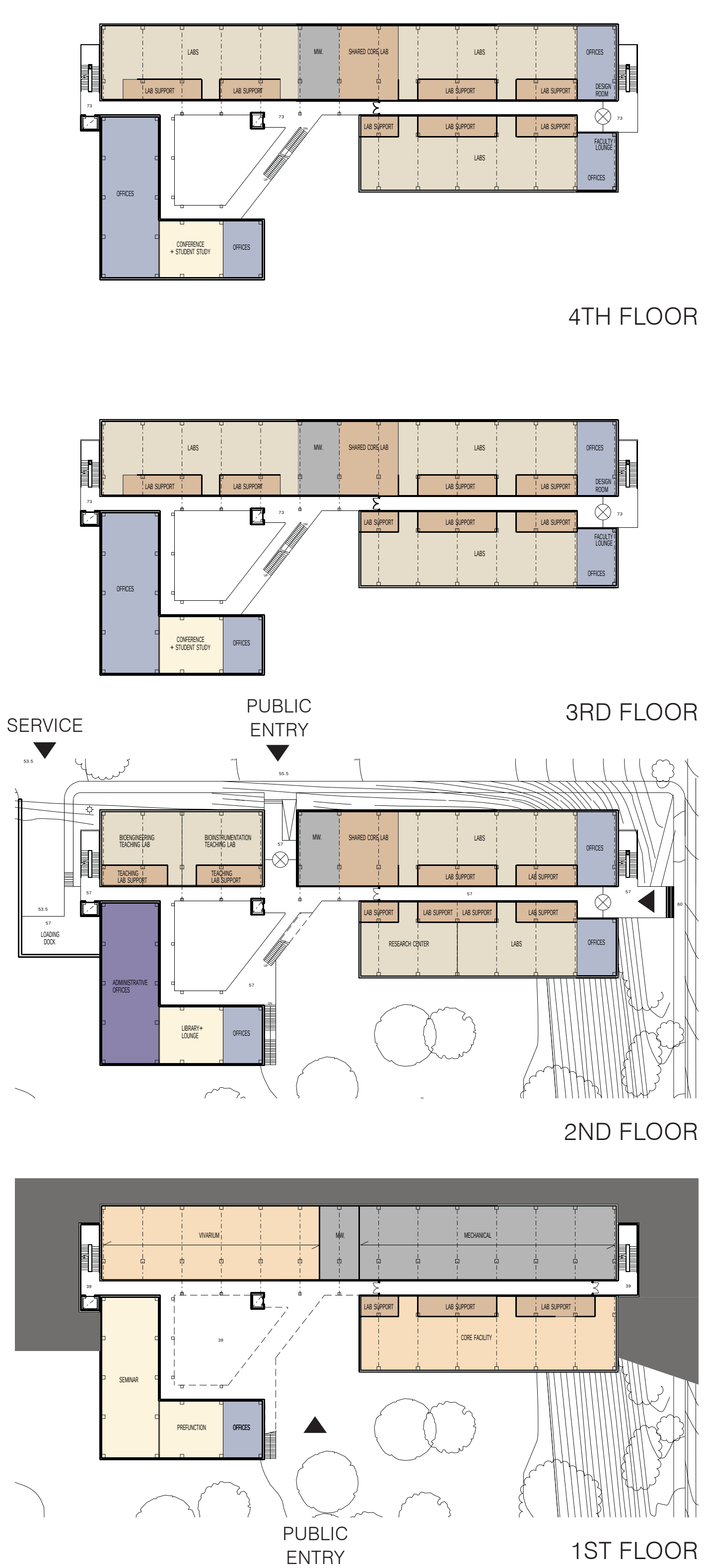
Building organization concept C creates a smaller courtyard aligned with the MS&E building access path. The eastern end of the building is a single block with offices across a corridor from the laboratories. Vertically, the spaces are distributed according to the logic of previous schemes. Circulation around the western part of the building occurs at the courtyard perimeter. This scheme seeks to balance interconnectedness and the potential for collegial interaction with cost considerations.

Pros:

- Balances need for interactive environment with cost / efficiency
- Better relationship of labs to offices
- Creates unique identity
- Semi-private outdoor space
- Highly collaborative and interactive environment
- Program elements are easily visible and identifiable from public space

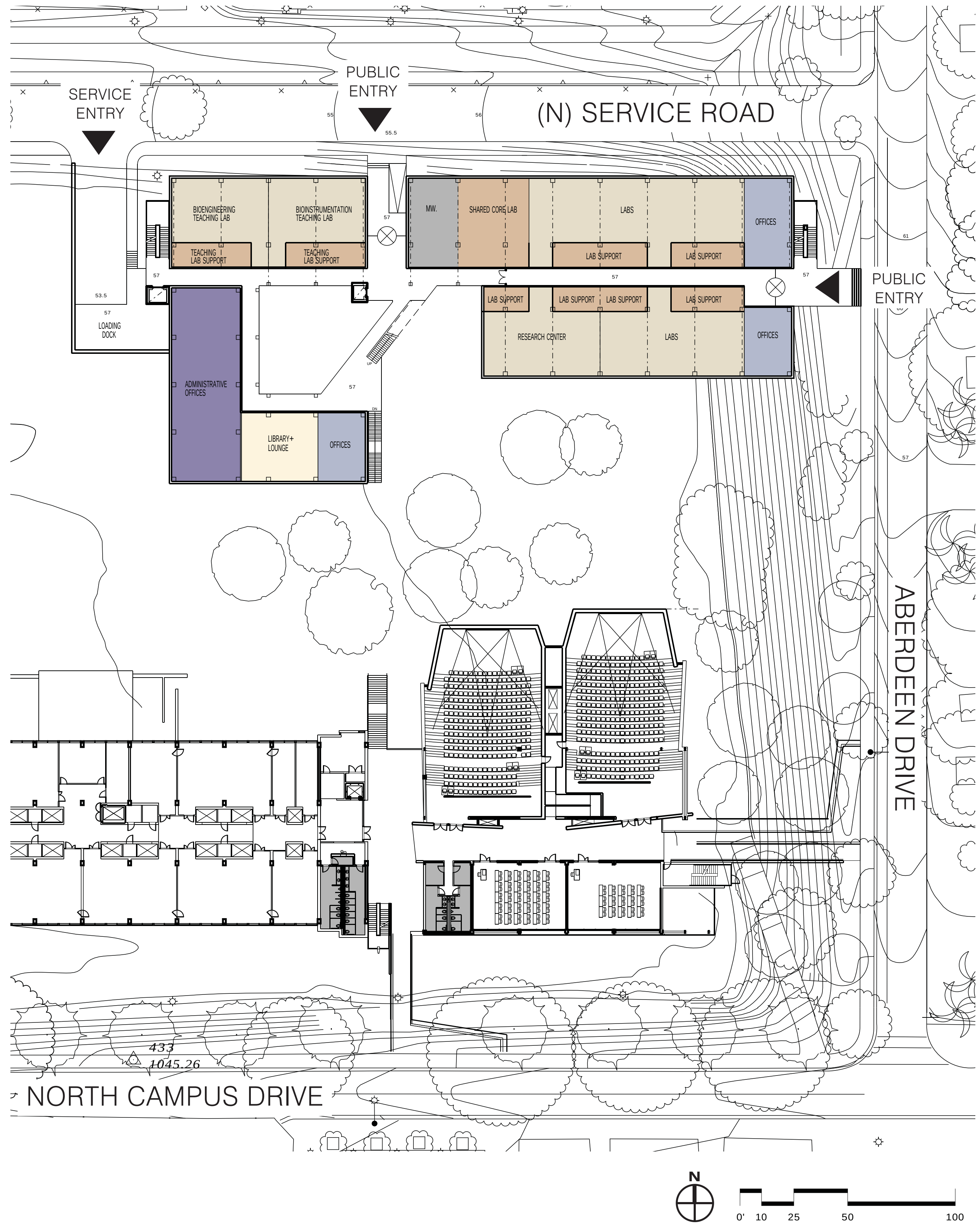
Cons:

- Engineering systems are not optimized
- Interior offices do not have direct access to natural light



KEY:

- LABORATORY
- LAB SUPPORT
- OFFICE
- ACADEMIC SUPPORT SPACE
- SCHOLARY ACTIVITY
- CORE FACILITIES
- BUILDING SUPPORT



5.2 BUILDING CONCEPTS

Concept D

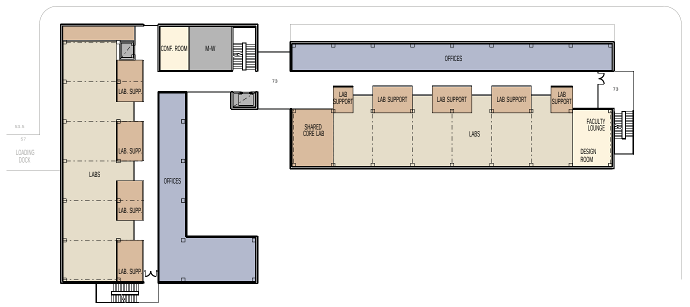
Building organization concept D is a variant of concept C. It has an enclosed eastern wing combined with an open access western zone with exterior corridors. The vertical disposition of spaces remains consistent; the physical form of the wings create a courtyard aligned with the MS&E access way.

Pros:

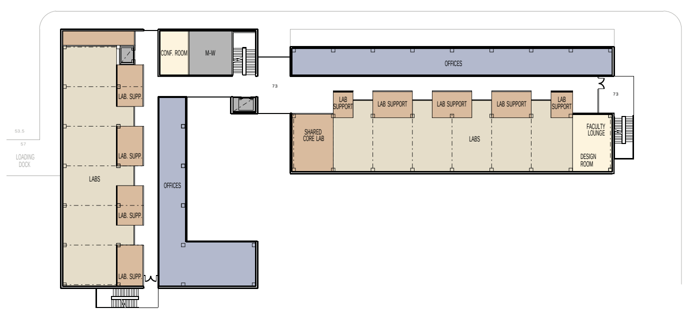
- Balances need for interactive environment with cost / efficiency
- Better optimization of engineering systems
- A courtyard helps to create unique identity
- Maximizes natural light penetration
- Semi-private outdoor space
- Creates collaborative and interactive environment
- Program elements are easily visible and identifiable from public space

Cons:

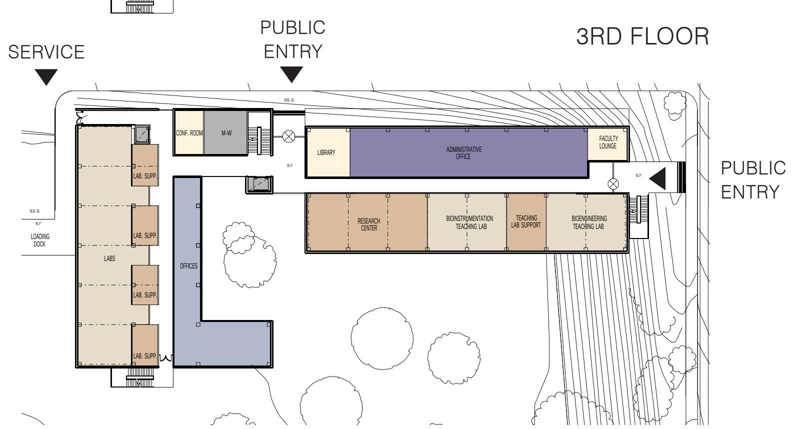
- Offices are remote from labs
- More expensive
- Less efficient building
- Exterior balcony access to some labs



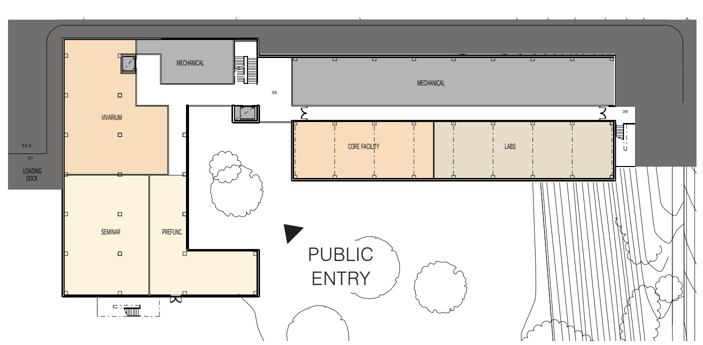
4TH FLOOR



3RD FLOOR



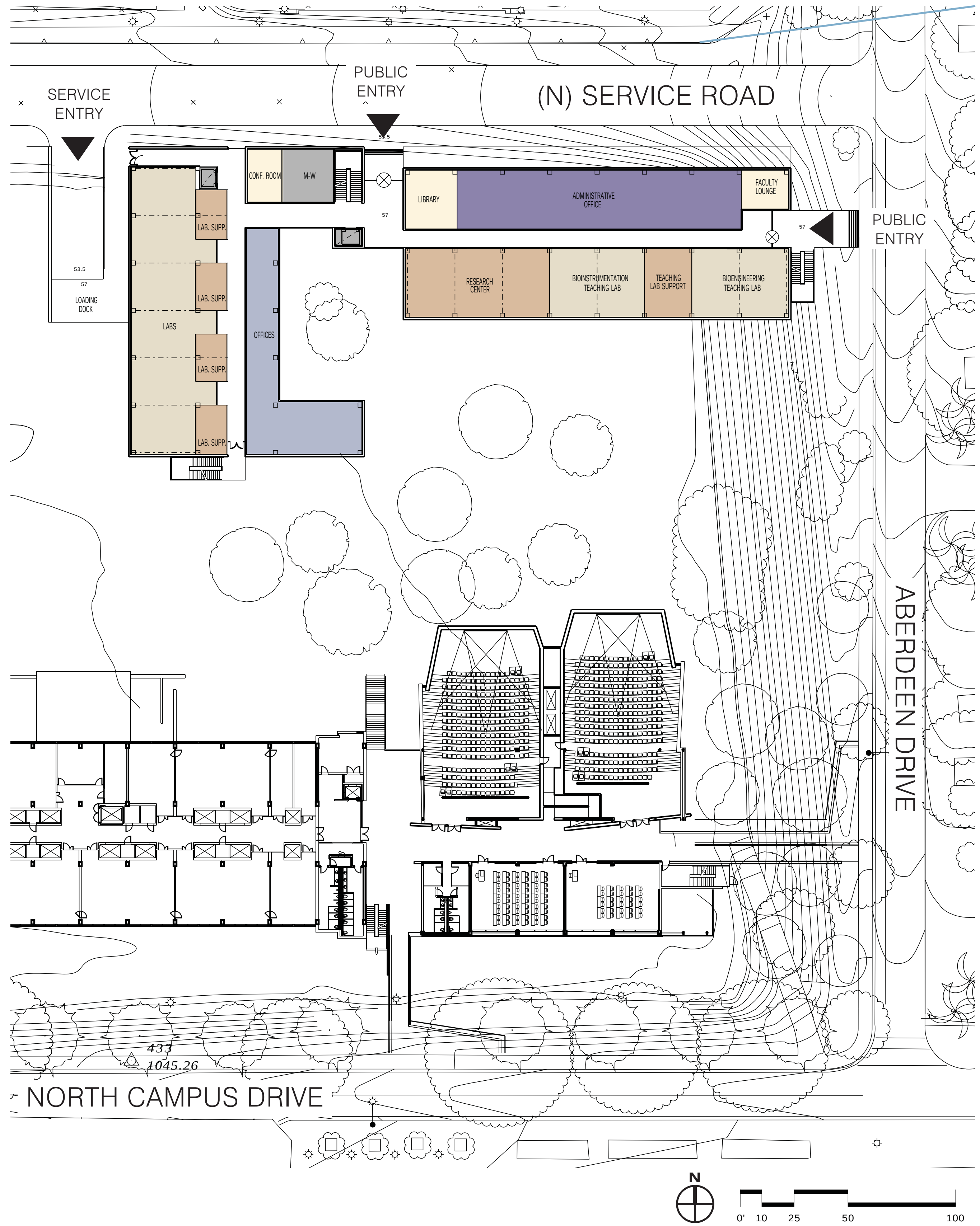
2ND FLOOR



1ST FLOOR

KEY:

- LABORATORY
- LAB SUPPORT
- OFFICE
- ACADEMIC SUPPORT SPACE
- SCHOLARY ACTIVITY
- CORE FACILITIES
- BUILDING SUPPORT



5.2 BUILDING CONCEPTS

Concept E

The final scheme, this diagram represents the culmination of discussions concerning the advantages and disadvantages of building organization concepts A through D. Street access is from the second floor off of Aberdeen Drive and the north service road. All the circulation is internal and the form of the building is shaped to create a courtyard at the arroyo level aligned with the MS&E stairway. Entry to the building is located at the first floor (arroyo) level. Offices are located across a corridor from the laboratories. Lab support space can be accessed either from the corridor or directly from the labs. The offices are positioned so as to take advantage of northern and eastern exposures. The first floor (arroyo) level contains the vivarium and mechanical spaces buried into the hillside with some laboratories and the seminar room facing the arroyo. The second floor consists of teaching labs and administrative offices. The service/loading dock is located at this level, but external to the west, to be shared with a future facility that will be built west of EBU3. The third and fourth floors house research labs and their associated principal investigator and graduate student offices. Shared laboratory support facilities will be located centrally.

Pros:

- Balances need for close office to lab adjacency with efficient plan organization
- Allows optimal zoning of HVAC systems
- Exterior courtyard creates unique building identity
- Offices oriented toward views
- Public and high traffic functions located at main building entry and Aberdeen Drive
- Narrow plan allows maximum use of natural light
- Creates interactive research environment
- Allows optimal arrangement of program elements

Cons:

- Offices require less efficient HVAC distribution
- Increased exterior building surface
- Engineering systems/distribution is less efficient

6.0
TECHNICAL DESIGN CRITERIA

UNIVERSITY of CALIFORNIA Riverside

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

CO ARCHITECTS

6.1 MECHANICAL
6.2 ELECTRICAL SYSTEMS
6.3 PLUMBING SYSTEMS
6.4 TELECOMMUNICATIONS SYSTEMS
6.5 SECURITY
6.6 A/V TECHNOLOGY
6.7 STRUCTURAL
6.8 CIVIL AND SITE UTILITIES
6.9 BUILDING MATERIALS
6.10 APPLICABLE CODES AND REGULATIONS

6.1 MECHANICAL

HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS

Design Philosophy:
The intent of this section is to promote the implementation of cost effective and energy efficient strategies for systems design and arrangements, equipment selection, distribution, and overall systems integration. These strategies will be undertaken during subsequent design phases.

HVAC system components and distribution layouts will have the following characteristics:

- Modular approach
- Energy responsiveness
- Flexibility for future changes
- Durability
- Ease of maintenance
- Reliability
- Redundancy of critical components

Every effort will be made to design, layout and install equipment in locations which will tend to encourage routine preventative maintenance by providing easy access for maintenance personnel.

Systems and equipment will be designed in accordance with the applicable Code summary sections of this manual and UCR standards.

Sustainability:
During design, the team will explore various opportunities to incorporate sustainable design principals within the building. While some concepts can prove to be fairly costly, many are not, and these will be integrated into the base design. Proposed concepts will be prioritized and, with input from UCR, the team will select the appropriate elements that fit within the confines of the project's budgetary allocations. Although LEED certification is not mandated for this project, our goal will be to exceed California's updated Title 24 Energy Standards by at least 10 percent, or as defined by UCR sustainable design polices currently under development.

Some of the elements specified within the MEP systems that will be incorporated into the base design are as follows:

- Variable volume systems
- Utilization of variable frequency motor controllers
- Premium efficiency motors

- Carbon dioxide and / or VOC monitoring sensors to control outside air ventilation rates
- Economizer provisions for air handling units
- Fan wall technology
- Enhanced minimum pipe and duct insulation thicknesses.
- Reduced coil and duct velocities for lower air pressure drops.
- Direct Digital Controls for the HVAC system
- High-efficiency light fixtures, lamps and ballasts
- Occupancy sensors
- Occupied / unoccupied HVAC control system to reduce air quantities during unoccupied modes
- High efficiency transformers
- Low flow plumbing fixtures
- Optimized system efficiencies
- Video-taped system commissioning for the operators

Other concepts that will be explored during design are:

- Use of conditioned relief air to cool equipment rooms
- Utilizing steam condensate for pre-heating domestic hot water
- Lower systems velocities
- Displacement ventilation
- Operable windows in office areas integrated into the HVAC Building Automation System.
- Humidity control within the wet labs and office spaces
- Day lighting with separate lighting controls
- Task lighting
- Water free urinals
- Green power sources (photovoltaic)
- Fuel cells
- Heat Recovery
- Enhanced system commissioning
- New chemical / particle sampling technology

UCR, as well as the Builder / Contractor will also play a major role in achieving the sustainable goals for this project. Equipment and appliances purchased for use in this building should be efficient and labeled with the Energy Star emblem. Reuse of resources by the Contractor will enhance the sustainable effort. Finally, good operations and maintenance of the systems and equipment will also conserve resources.

Building Envelope:

The building envelope should exceed the requirements of the new October 1, 2005 California Energy Code for minimum thickness of roof and wall insulation. As a basis of design the glazing should be double pane, Low-E, type. External shading should be considered where it will minimize the effects of solar radiation on the building interior.

6.0
TECHNICAL DESIGN CRITERIA

Applicable Codes, References and Standards:
Refer to the Applicable Codes and Regulations Section 6.10 of the report for applicable codes, references and standards.

Office/Conference/Academic Space Design Criteria:
The HVAC system will be a separate variable volume type with supply / return ductwork and fans, complete with air side economizer cycle of operation. Air distribution will utilize conventional boxes with reheat coils.

Laboratory Design Criteria:
One hundred percent of the air supplied to the wet laboratory areas will be exhausted. There will be no recirculating of laboratory air. Supply air quantities will be based upon heat loads, minimum dilution/ventilation requirements, and/or required make-up air for exhaust systems; whichever is greatest.

A minimum of 6-12 (per RFD room data sheets BR+A to coordinate/verify) Air Changes per Hour (ACPH) for dilution and removal of odors in laboratories will be provided. Actual ACPH requirements will be based on exhaust device requirements and heat loads generated by equipment, people, lighting, and solar heat gain. Unoccupied labs can have the ventilation rate set back to 6 ACPH for energy conservation.

All laboratories will be negative with respect to the corridor or adjacent spaces, unless otherwise noted.

The Air Handling Units (AHU) serving the laboratory spaces, will be designed as variable volume systems with twin fans/tunnels divided by a septum wall, for redundancy and ease of maintenance. Each fan/tunnel will be designed for 70% of the peak system load. This will allow for one side of the AHU to be taken off line for maintenance with minimum impact to the operations of the space.

All laboratory systems will operate 24 hours, 7 days a week, with varying degrees of occupancy in a 24-hour period.

Air distribution systems will utilize linear valves with reheat coils and will be designed to afford flexibility for future redesign, primarily by providing accessibility to the duct systems throughout the facility and, where feasible, by applying a modular layout of air distribution devices and by providing symmetry and uniformity to the branch duct layouts. This will also aid in the constructability and cost efficiency of the air distribution systems.

Ambient noise levels from the HVAC system will be maintained at NC 40-45 with noise levels 3 feet from the hoods maintained at a level no higher than NC 55.

Biological Safety Cabinets Class II, Type A, (30% exhaust) will be fitted with internal HEPA filter and will be exhausting air directly into the room.

Biological Safety Cabinets Class II, Type A will not require connection to the building exhaust system.

Biological Safety Cabinets Class II, Type B2 (100% exhaust) will be connected to the dedicated exhaust fan system and will include integral HEPA filtration.

Vivarium Design Criteria:
The HVAC system shall be pressure-independent, variable air volume (VAV) type.

Potential to reduce air changes per hour (ACPH), change to unoccupied setback in a particular room (or rooms) or change pressurization shall be accommodated. ACPH reduction, unoccupied setback or pressurization change shall be controlled by the building management system (BMS).

Supply and exhaust in all animal holding rooms and convertible Procedure/AHR, if applicable, shall be designed to accommodate ventilated racks. Ventilated racks will be equipped with a supply air blower pulling air from the room and a 4" diameter exhaust equipped with a local filter to prevent animal dander build-up on the exhaust equipment. The racks will discharge into two (2) thimble exhaust ducts connected to the building's dedicated vivarium exhaust system. Cage/Rack manufacturer will provide exhaust load simulators for each point exhaust. (This will be verified with UCR Animal Resources in the next design phase.)

Temperature and humidity probes shall be located within the ducts.

One hundred percent of the air supplied to the animal facility shall be outside air, and all air shall be exhausted. There will be no recirculation. Supply air quantities shall be based upon heat loads, minimum dilution/ventilation requirements, and/or required make-up air for exhaust systems, whichever is greater.

Ventilation of animal holding rooms shall be a minimum of eight (8) and a maximum of twenty (20) outside air changes per hour (ACPH). Final room air quantity calculations will confirm the minimum and maximum ACPH requirements required for the haul design. Heat generated from animals shall be calculated using the average-total-heat-gain formula published by ASHRAE.

Design of the HVAC system shall accommodate potential to adjust the initial air pressurization. For room-by-room environmental criteria, refer to the Matrix included hereinafter.

All Vivarium systems shall operate 24 hours, 7 days a week, with varying degrees of occupancy in a 24-hour period.

Air distribution systems will utilize linear valves with reheat coils and will be designed to afford flexibility for future redesign, primarily by providing accessibility to duct systems throughout the facility and, where feasible, by applying a modular layout of air distribution devices and by providing symmetry and uniformity to branch duct layouts.

Redundant and parallel systems for supply, exhaust, reheating and cooling will be provided so that environmental conditions can be maintained in animal holding rooms with one subsystem out of service.

Commercially available, standard size, exposed, disposable 1” thick filters will be provided in animal holding rooms at each exhaust grille and point exhaust. Filters shall be easily removable and replaceable without tools.

Fume hood and biological safety cabinet requirements will be same as described for this equipment under the Laboratory Design Criteria.

Sequencing, Server and Computer Rooms Design Criteria:
Sequencing, server and computer rooms shall be designed for a heat load density of 200 watts/SF. Separate computer room grade air conditioning units within the space will be provided.

Humidity Control:
Humidifiers and humidity control will be provided only for the Vivarium. A humidifier will be provided in the vivarium AHU along with units at each holding and quarantine room zone for trim control.

Humidity in the labs and offices will be unregulated.

Outside Design Conditions:
Summer: 110°F db/75°F wb (per UCR’ STD’s)
Winter: 34°F

SPACE DESIGN CONDITIONS:

Space Type	Minimum O.A. Ventilation Rate	Summer Design		Winter Design		Pressurization	Minimum Supply Air Filtration	Remarks
		Max. Temperature (F)	Max. Relative Humidity (%rh)	Min. Temperature (F)	Min. Relative Humidity (%rh)			
Public Spaces and Office Areas								
Common Areas	Note 1	75	55%	71	--	Note 3	90%	-
Lobby	Note 1	75	55%	71	--	Note 3	90%	-
Large Classrooms/Auditorium	Note 1	75	55%	71	--	None	90%	-
Offices	Note 1	75	55%	71	--	Note 3	90%	-
Conference Rooms	Note 1	75	55%	71	--	Note 3	90%	-
Laboratory Spaces								
Open Lab	100%	75	55%	71	--	(--)	90%	-
Alcove (open)	100%	75	55%	71	--	(--)	90%	-
Tissue Culture	100%	75	55%	71	--	(+)	90%	-
Procedure Room	100%	75	55%	71	--	(--)	90%	-
Glasswash	100%	75	60%	71	--	(---)	90%	-
Glasswash Equipment Space	100%	78	70%	71	--	(---)	90%	-
Darkroom	100%	75	55%	71	--	(---)	90%	-
Environmental Room	0.5 cfm / sq.ft.	-	-	-	-	None	90%	Note 2
Animal Facility Spaces								
Animal Holding Rooms	100%	Note 4	70%	Note 5	45%	Note 5	HEPA	-
Animal Testing Rooms	100%	Note 4	70%	Note 5	45%	Note 5	HEPA	-
Animal Procedure Rooms	100%	Note 4	70%	Note 5	45%	Note 5	HEPA	-
Animal Bedding	100%	75	70%	71	45%	(-)	HEPA	-
Dirty Cagewash	100%	78	70%	71	45%	(--)	HEPA	-
Clean Cagewash	100%	78	70%	71	45%	(+)	HEPA	-
Sterile Cagewash	100%	78	70%	71	45%	(+)	HEPA	-
Cagewash Equipment Space	100%	80	80%	71	45%	(---)	HEPA	-
Miscellaneous Spaces								
Sequencing, Server and Computer Rooms	--	75	55%	71	--	None	90%	-
Mech. / Elec. Rooms	100% Exhaust	95	-	65	-	None	80%	-
Tel/Data Rooms	--	78	60%	71	-	None	80%	-
Elevator Machine Rooms	--	95	85%	65	-	None	80%	-
General Storage	--	78	-	71	-	None	80%	-
Hazardous Storage	100% Exhaust	78	-	71	-	None	80%	-
Toilet / Locker Rooms	100% Exhaust	78	-	71	-	None	80%	-
Housekeeping Closets	100% Exhaust	78	-	71	-	None	80%	-
Loading Dock Receiving	100%Exhaust	85	-	65	-	(-)	20%	Note 7

Note 1: Public spaces and office areas will have CO_2 monitoring for ventilation control. Ventilation rate will be sized based on 20 cfm/person

Note 2: Environmental room temperature control will be by Division 11.

Note 3: Space pressurization will be positive relative to adjacent labs and otherwise neutral.

Note 4: Animal holding and procedure spaces will have temperatures adjustable between 68°F and 80°F.

Note 5: Animal holding and procedure room pressurization will be adjustable from positive to negative.

Note 6: Humidification will be provided to Vivarium spaces via clean steam generator.

Note 7: Loading dock receiving area will have CO_2 monitoring and purge exhaust system.

Note 8: The office and lab humidity levels in the winter will be uncontrolled. Only the Vivarium will be provided with humidity control.

INTERNAL LOAD DESIGN CRITERIA:

Space Type	People Load	Lighting Load	Equipment Load	Remarks
Public Spaces and Office Areas				
Common Areas	250 gsf/person	1.5 W/gsf	0.5 W/gsf	-
Lobby	250 gsf/person	1.5 W/gsf	0.5 W/gsf	-
Large Classrooms/ Auditoriums	25 gsf/person	1.5 W/gsf	0.5 W/gsf	-
Offices	100 gsf/person	1.5 W/gsf	4 W/gsf	-
Conference Rooms	25 gsf/person	1.5 W/gsf	2 W/gsf	-
Laboratory Spaces				
Open Lab		1.5 W/gsf	8 W/gsf	-
Alcove (open)	100 gsf/person	1.5 W/gsf	16 W/gsf	-
Tissue Culture	100 gsf/person	1.5 W/gsf	16 W/gsf	-
Procedure Room	100 gsf/person	1.5 W/gsf	16 W/gsf	-
Glasswash	200 gsf/person	1.5 W/gsf	Note 2	
Glasswash Equipment Space	-	1.5 W/gsf	Note 2	-
Darkroom	100 gsf/person	1.5 W/gsf	8 W/gsf	-
Environmental Room	-	-	4kw/Room	-
Animal Facility Spaces				
Animal Holding Rooms	Note 1	1.5 W/gsf	Note 2	-
Animal Testing Rooms	Note 1	1.5 W/gsf	Note 2	-
Animal Procedure Rooms	Note 1	1.5 W/gsf	Note 2	-
Animal Bedding	200gsf/person	1.5 W/gsf	Note 2	-
Dirty Cagewash	200gsf/person	1.5 W/gsf	Note 2	-
Clean Cagewash	200gsf/person	1.5 W/gsf	Note 2	-
Sterile Cagewash	200gsf/person	1.5 W/gsf	Note 2	-
Cagewash Equipment Space	200gsf/person	1.5 W/gsf	Note 2	-
Miscellaneous Spaces				
Sequencing, Server and Computer Rooms	100 gsf/person	1.25 W/gsf	200 W/gsf	-
Mech. / Elec. Rooms	-	-	-	Note 3

INTERNAL LOAD DESIGN CRITERIA (CONTINUED)

Tel/Data Rooms	-	1 W/gsf	Note 2	-
Elevator Machine Rooms	-	1 W/gsf	Note 2	-
General Storage	200 gsf/person	1 W/gsf	1.5 W/gsf	-
Hazardous Storage	200 gsf/person	1 W/gsf	1.5 W/gsf	-
Toilet / Locker Rooms	-	-	-	Note 4
Housekeeping Closets	-	-	-	Note 4

Note 1: People/animal loads will be based on actual count of people animals.

Note 2: Equipment loads will be based on actual equipment heat gains as published by the manufacturers.

Note 3: Space loads based on estimated equipment heat gain.

Note 4: Exhaust requirements will dictate air flow quantity (minimal cooling load).

The final design criteria will be developed during the detailed design phase.

Campus Steam:

High-pressure 100 psi steam (HPS) is distributed throughout the campus. A new 8" high-pressure steam line will be connected to the existing distribution system. Steam will be reduced to medium and low pressures within the building. The condensate will be collected in the building and pumped back to the central plant.

The new piping from the central plant will be connected to the campus system via direct buried lines from the new building foundation wall and will include anchors, guides, and expansion loops. Multiple-pressure reducing stations will reduce the HP steam to medium and low pressures.

A piping distribution (steam/condensate) system will be provided, complete with all required steam traps and other accessories for a complete system.

Medium-pressure steam will be utilized within the building for process loads to various process equipment and clean steam generator. Low-pressure steam will serve the heating hot water heat exchangers, domestic water heaters and humidifiers in the Vivarium unit.

The incoming campus steam will be metered and integrated into the campus BMS system.

Clean Steam:

Clean-steam generator utilizing campus steam as the heating source and distribution system will be provided to produce clean steam from soft cold water for vivarium humidification.

Building Heat:
Perimeter heating will be via the hot water reheat coils, relying on the heated supply air to offset the building heat losses. The hot water reheat system will be generated via two (2) steam-to-hot water heat exchangers, each sized for 50% of the load with one standby. Three pumps (two active/one stand-by) with VFD's will distribute water to all reheat coils, AHU preheat coils and other heating elements. A complete hot water supply/ return piping system will be provided.

Reheat will be provided in each vivarium zone.

Steam Distribution:
Process steam will be reduced to 70 psig and delivered to the process equipment and to the steam-to-steam heat exchange dedicated to the clean steam generation.

Steam will be reduced to 15 psig service for heating hot water and domestic hot water heat exchangers.

Chilled Water:
The campus is served by an existing Thermal Energy Storage (TES) system and chilled water is distributed throughout. New chilled water lines will be installed under a separate project to the new building. This project will tap these new lines and extend 12" chilled water (supply/return) lines, to/from the mechanical room. The pipes will be direct buried.

Chilled water temperature available from the central plant is 38°F to 42°F. However, 46°F will be utilized for design. The minimum return water delta T should be 20°F, with 60°F being the preferred return water temperature.

The chilled water system serving the building loads will connect to the distribution loop with a thermal bridge to meet UCR standards. The building pumping system will consist of two chilled water pumps (one standby). A two-way control valve will be provided at each point of chilled water use. Variable frequency drives will vary the speed of the chilled water pumps to maintain a preset minimum pressure differential in the most remote system point.

Two sources of cooling is proposed for the animal quarters. In addition to the campus chilled water interconnection, a separate air-cooled chiller on the roof of the building will be provided. The changeover between the two systems will be manual and alarmed via the DDC system for primary system failure.

Chilled water will serve the following HVAC and lab process equipment:

- Vivarium AHU Cooling coils
- Lab AHU cooling coils
- Office AHU cooling coils
- Elevator machine room fan coil units
- Electrical rooms fan coil units
- Telecom room computer type fan coil units
- Future lab process equipment
- Sequencing, server and computer rooms

Environmental room condensing units will be remote mounted on the roof and served with emergency power.

Process Cooling Water:
A dedicated closed loop (plate and frame) system with associated pumps will be provided to serve process equipment.

Secondary chilled water temperatures will be 60°F supply with an anticipated 15°F temperature rise. The system pressure differential will be designed for 50 psi. Pumps will be equipped with variable speed drives.

Process cooling water will be distributed to scientific water cooled equipment through insulated copper piping.

Supply Air Handling Unit Descriptions:
Supply air handling unit system components and design criteria will be in accordance with the following table:

Supply Air (AHU) System	COMPONENTS																		
	Prefilters (30%)	After Filters (90%)	Hot Water Preheat Coil	Cooling Coils (Draw-Thru)	Sound Attenuator (Fan Inlet)	Supply Fans (Quantity Active)	Sound Attenuator (Fan Discharge)	Humidifier (Trimming)	Cooling Coil (Blow-Thru)	HEPA Final Filters	Humidifier	% Outside Air (Minimum)	Volume Control	Fan Heat Gain Allowance (F)	Unit Discharge Temp (F db)	Duct Heat Gain Allowance (F)	Space Discharge Temp (F)	Emergency Power	Remarks
Laboratory	•	•	•	•	•	2	•					100	•	3	52	1	53	No	Note 1&2
Vivarium	•	•	•		•	2	•	•	•	•		100	•	3	52	1	53	Yes	Note 3, 4 & 5
Office	•	•		•	•	1	•					30	•	3	54	1	55	No	

Note 1: Air handling unit consists of two supply fan/tunnels. Each supply fan/tunnel is designed for 70% of the peak load.

Note 2: Emergency power will be provided for one supply fan/tunnel only.

Note 3: The Variable Volume drives are provided to compensate for filter loading only.

Note 4: Air handling unit consist of two supply fans/tunnels. Each supply fan/tunnel is designed for 100% capacity.

Note 5: Emergency power will be provided for both fans/tunnels.

Ductwork Classifications:
Ductwork will be sized in accordance with the following:

Duct Class		Risers	Submains	Branches	Air Distribution Device Neck Velocity (FPM)
Medium Pressure	Max. Velocity	2,000 fpm	1,500 fpm	----	----
	Max. P.D.	0.4"/100'	0.3"/100'	---	---
Low Pressure (except Auditorium)	Max. Velocity	1,600 fpm	1,400 fpm	800 fpm	450 fpm
	Max P.D.	0.1"/100'	0.1"/100'	0.08"/100'	
Low Pressure (Auditorium)	Max. Velocity	1,200 fpm	800 fpm	400 fpm	250 fpm
	Max P.D.	0.08"/100'	0.07"/100'	0.05"/100'	---

Exhaust Systems:
The laboratory exhaust (general lab / fume hoods) will be manifolded and exhausted via multiple fans, located at roof level, to provide for 50% stand-by capability. Each fan capacity is based on 50% of total lab exhaust capacity.

Chemical fume hoods shall be bench type, with constant volume controls. Fume hoods shall have an average face velocity of 100 feet per minute, with the sash positioned at 18-inch opening height.

Point Exhaust: 100 - 150 CFM
Canopy Hood: 100 FPM/ square feet depending upon application

The Vivarium exhaust will be separately routed to the roof. A common manifold with multiple fans and 100% redundancy will be provided.

Radioisotope exhaust will be manifolded and exhausted by a dedicated fan system. The system will be a full stainless steel welded construction. Upstream of the fan, stainless steel bag-in/bag-out filter banks with

HEPA /Carbon filters will be provided. The system will be on emergency power and equipped with 100% redundant fan and filter bank.

Biological Safety Cabinets Class II, Type B2 (100% exhaust) will be connected to the manifold and exhausted with the laboratory exhaust fan system. Each Biological Safety Cabinet will be provided with a constant volume linear control valve to maintain constant Cabinet exhaust flow. The system will be equipped with 100% redundancy.

In addition to the above major exhaust systems; the following systems will also be dedicated:

- Wet exhaust
- Toilet exhaust
- Loading Dock
- Penthouse ventilation (if the roof equipment is enclosed)
- *NO* BL3 Labs

Mechanical and electrical spaces will be provided with ventilation systems off the "house" systems and/or will be conditioned with fan coil units or "wasted" return air.

All exhausts will discharge a safe distance above the roof to prevent recirculation through proper dispersion of the air stream into the atmosphere. Discharge stacks will be designed to release the exhaust air at a minimum level higher than any human working on the roof and at a sufficiently high velocity to enable the exhaust air to disperse. The final height, location and discharge velocities will be in accordance with the Wind Consultant's recommendations.

In addition to all other dedicated exhausts, two (2) dedicated future exhaust risers in each shaft will be provided, for separate dedicated exhaust requirements. Space for future fans will be provided on the roof to serve possible future requirements.

Imaging/Instrumentation Core Facility:
Spaces will be cooled/ventilated and exhausted via the Lab air handling systems. Materials utilized in the rooms will be non-ferrous where required. An oxygen monitoring and alarm system will be provided.

It is assumed that a dedicated purge system will not be required due to the high air changes provided in the rooms (to be verified with equipment vendor).

High heat load producing equipment will be cooled via the building chilled water system. Chilled water fed fan coils units will be provided to cool the equipment loads.

Ductwork Distribution:
Supply air ductwork from the AHU's to the inlet of the supply air terminal boxes or control valves will be "medium pressure" constructed of G90 galvanized single wall sheet metal with exterior foil faced wrapped insulation. Ductwork downstream of the supply air terminal boxes or control valves will be constructed of G90 galvanized single wall sheet metal with exterior foil faced wrapped insulation. No internal duct insulation/lining will be permitted. Connections to supply diffusers/grilles may be made with up to 5 feet of flexible duct.

Lab and Vivarium exhaust ductwork will be constructed of G90 galvanized steel per SMACNA. Wet exhaust will be all welded stainless steel. Toilet exhaust and other non-lab exhaust systems will be G90 galvanized steel.

Ductwork from the fume hoods to the linear exhaust valves will be stainless steel.

Laboratory / Vivarium supply and exhaust control air devices will be Phoenix linear type air valves, with downstream sound attenuators and reheat coils.

Non-laboratory / Vivarium spaces will be served via conventional supply terminal boxes with reheat coils and integral, fiber free, sound attenuators. Return boxes with integral attenuators will also be provided to allow supply/return tracking and pressurization control.

Laboratory Pressurization Control System (LPCS):
The laboratory design will incorporate supply, general exhaust and fume hood exhaust into a total comprehensive control system that maintains pressure relationships and temperature in each laboratory based upon airflow measurements.

Each fume hood (constant volume/bypass type) will be provided with a constant volume linear control valve to maintain constant hood exhaust. Hood exhaust will be ducted to the manifold/general lab variable volume exhaust system.

Vivarium Environmental Monitoring and Control System:
Monitoring and control of temperature, humidity, pressurization, and lighting in each Vivarium space will be provided. Separate monitoring with dedicated computer front end will also be provided and be located in the Vivarium Manager's office.

Automatic Temperature Control:
The building will be served via a combination pneumatic and Direct Digital Control (DDC) Automatic Temperature Control (ATC) system as manufactured by Johnson Controls. The ATC system will be connected and

interfaced with the existing campus Energy Management System. The new DDC system shall be comprised of local area networks that communicate with each other to share information. All networks shall be scanned on a regular basis by the CPU to download information such as alarms, energy usage, temperatures, etc.

The ATC system shall accomplish all sensing and control via electronics with pneumatic activation for large valves/dampers and electronic activation for small terminal unit valves/dampers. All air handling units, chilled water loops, heat exchangers, pumps, fans and other central infrastructure systems shall be controlled via DDC controllers.

CONCEPTUAL (PRELIMINARY) MAJOR HVAC EQUIPMENT LIST:

Air Handling Units (Custom Made and Package)						
Supply Unit #	**Service**	**CFM**	**OA (%)**	**HP**	**Emergency Power**	**Remarks**
AHU-1	Lab / Imaging Unit	80,000	100	2 Fans at 125	No	VFD
AHU-2A & 2B	Vivarium	11,000	100	2 Fans at 20	Yes	VFD
AHU-3	Office	25,000	30	1 Fan at 50	No	VFD

CONCEPTUAL (PRELIMINARY) MAJOR HVAC EQUIPMENT LIST (CONTINUED)

Return and Exhaust Fans					
Fan #	**Service**	**CFM**	**HP**	**Emergency Power**	**Remarks**
EX-1a	Lab Exhaust	20,000	30	Yes	25% of Lab Exhaust - Bleed Damper
EX-1b	Lab Exhaust	20,000	30	No	25% of Lab Exhaust - Bleed Damper
EX-1c	Lab Exhaust	20,000	30	No	25% of Lab Exhaust - Bleed Damper
EX-1d	Lab Exhaust	20,000	30	No	25% of Lab Exhaust – Bleed Damper
EX-2a	Vivarium Exhaust	11,000	15	Yes	VFD
EX-2b	Vivarium Exhaust	11,000	15	Yes	VFD
EX-3	Toilet Exhaust	2,500	2.0	No	
EX-4a	Radioisotope Exhaust	1,600	5	Yes	VFD
EX-4b	Radioisotope Exhaust	1,600	5	No	VFD
EX-5	Loading Dock Exhaust	1,000	0.75	No	
EX-6	Hazardous Exhaust	1,000	0.75	Yes	
EX-7a	BSC Hoods	7,000	7.5	Yes	Bag-in/Bag-out Filtration

CONCEPTUAL (PRELIMINARY) MAJOR HVAC EQUIPMENT LIST (CONTINUED)

EX-7b	BSC Hoods	7,000	7.5	Yes	Bag-in/Bag-out Filtration
RAF-1	Office	25,000	30	No	VFD

Heat Exchangers					
Unit #	**Service**	**GPM Output**	**Steam Input, lbs/Hr.**	**Chilled Water Input, GPM**	**Remarks**
HE-1	Heating Hot Water	310	4,700	---	Shell & Tube
HE-2	Heating Hot Water	310	4,700	---	Shell & Tube
HE-3	Clean Steam	--	4,200	---	Steam Generator
HE-4	Clean Steam	--	4,200	---	Steam Generator
HE-5	Process Chilled Water	100	NA	70	Plate & Frame
HE-6	Process Chilled Water	100	NA	70	Plate & Frame

Condensate Pumps					
Unit #	**Service**	**Lbs/Hr**	**HP**	**Emergency Power**	**Remarks**
CP-1	Condensate Return to Plant	TBD	2 at 3	Yes	Duplex Pumps
CP-2	Condensate Return to Plant	TBD	2 at 3	Yes	Duplex Pumps

CONCEPTUAL (PRELIMINARY) MAJOR HVAC EQUIPMENT LIST (CONTINUED)

Water Pumps					
Unit #	**Service**	**GPM**	**HP**	**Emergency Power**	**Remarks**
HWP-1	Heating Hot Water	310	7.5	Yes	VFD
HWP-2	Heating Hot Water	310	7.5	Yes	VFD
CHP-1	Chilled Water	1130	30	Yes	VFD
CHP-2	Chilled Water	1130	30	Yes	VFD
CHP-3	Chilled Water-CH-1	120	5.0	Yes	No
CHP-4	Chilled Water-CH-1	120	5.0	Yes	No
PCHP-1	Process Chilled Water	100	5	Yes	No
PCHP-2	Process Chilled Water	100	5	Yes	No

Chillers						
Unit #	**Service**	**Capacity (Tons)**	**Electric (KW)**	**Steam Lbs./Hr.**	**Emergency Power**	**Remarks**
ACCH-1	AHR Rooms	60	83.5	NA	Yes	Air Cooled

Steam Pressure Reducing Stations			
Unit #	**Capacity (Lbs/Hr)**	**PSI**	**Remarks**
PRV-1	TBD	100 to 50	1/3-2/3 valve arrangement
PRV-2	TBD	50 to 15	1/3-2/3 valve arrangement

Control Air Compressor			
Unit #	**Type**	**HP**	**Emergency Power**
CAC-1	Duplex	2 at 10	Yes

6.2 ELECTRICAL SYSTEMS

Design Philosophy:
The intent of this section is to promote the implementation of cost effective and energy efficient strategies for systems design and arrangements, equipment selection, distribution, and overall systems integration. These strategies will be undertaken during subsequent design phases.

Electrical system components and distribution layouts will have the following characteristics:

- Modular approach
- Energy responsiveness
- Flexibility for future changes
- Durability
- Ease of maintenance
- Reliability
- Redundancy of critical components

Every effort will be made to design, layout and install equipment in locations which will tend to encourage routine preventative maintenance by providing easy access for maintenance personnel.

Systems and equipment will be designed in accordance with the applicable Code summary sections of this manual and UCR standards.

Sustainability:
During design, the team will explore various opportunities to incorporate sustainable design principals within the building. While some concepts can prove to be fairly costly, many are not, and these will be integrated into the base design. Proposed concepts will be prioritized and, with input from UCR, the team will select the appropriate elements that fit within the confines of the project's budgetary allocations. Although LEED certification is not mandated for this project, our goal will be to exceed California's updated Title 24 Energy Standards by at least 10 percent, or as defined by UCR sustainable design polices currently under development.

Some of the elements specified within the Electrical systems that will be incorporated into the base design are as follows:

- Utilization of variable frequency motor controllers
- Premium efficiency motors
- High-efficiency light fixtures, lamps and ballasts
- Occupancy sensors
- High efficiency transformers

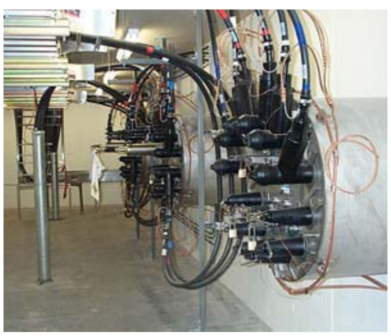
- Optimized system efficiencies
- Video-taped system commissioning for the operators

Other concepts that will be explored during design are:

- Day lighting with separate lighting controls
- Task lighting
- Green power sources (photovoltaic)
- Fuel cells
- Enhanced system commissioning

UCR, as well as the Builder / Contractor will also play a major role in achieving the sustainable goals for this project. Equipment and appliances purchased for use in this building should be efficient and labeled with the Energy Star emblem. Reuse of resources by the Contractor will enhance the sustainable effort. Finally, good operations and maintenance of the systems and equipment will also conserve resources.

Applicable Codes, References and Standards
Refer to the Regulatory and Certification Criteria Sections of this Document for applicable Codes, References and Standards.



Utilization Voltages:

Primary:	12,470V, 3-phase, 3-wire
Secondary:	480Y/ 277V, 3-phase, 4-wire
	208Y/ 120V, 3-phase, 4-wire

Branch Circuits:

General Use Receptacles:	120V
Special Purpose Recept:	208V, 1-phase
Fluorescent Lighting:	277V
Incandescent Lighting:	120V
Motors 1/3 HP and smaller:	120V
Motors 1/2 HP and larger:	480V, 3-phase.

Design and Demand Loads:
Laboratory spaces will be designed for the following *peak* power capacities:

Laboratory Panels	40 VA/ Square Foot
Floor Distribution	20 VA/ Square Foot
Main Distribution	10-15 VA/ Square Foot

Overall space *demand* loads (which will also be used for the floor equipment sizing criteria) are as follows:

6.0
TECHNICAL DESIGN CRITERIA

Administration/ Office/ Open Workstations
- Lighting 1.2 VA/ square foot
- Receptacles 5.0 VA/ square foot

Workrooms
- Lighting 1.2 VA/ square foot
- Receptacles 10.0 VA/ square foot

Circulation/ Lounges/ and Restrooms
- Lighting 0.6 VA/ square foot
- Receptacles 1.5 VA/ square foot

Storage/ Support Rooms
- Lighting 0.6 VA/ square foot
- Receptacles 1.5 VA/ square foot

Dry and Wet Research Labs
- Lighting 1.5 VA/ square foot
- Equip/ Receptacles 8 VA/ square foot

Lab Equipment and Support Rooms
- Lighting 1.5 VA/ square foot
- Power 16 VA/ square foot

Sequencing, Server and Computer Rooms
- Lighting 1.0 VA/ square foot
- Power 200 VA/ square foot

Mechanical/ Plumbing/ Elect. Equipment Rooms
- Lighting 0.75 VA/ square foot
- Power Actual Motor Hp

The following demand factors will be applied to the service entrance equipment (NEC 220-34):

First 3VA/ square foot	100% Demand
Over 3 to 20 VA/ square foot	75% Demand
Reminder over 20 VA/ square foot	25% Demand

PRELIMINARY BUILDING POWER LOADS (ORDER-OF-MAGNITUDE):

Service	Estimated Loads
Normal Power *(Demand Load)*	2000 KVA
Emergency Power *(Design Load)*	1000 KVA

Note 1: The actual building areas have not been finalized. The values above are order-of magnitude only for the representative areas indicated. Actual requirements will be refined as the project progresses.

Incoming Power Services (Normal Power):
This quadrant of the campus is served by the 12 kV distribution system. Power is distributed on 15 kV, 500 kcmil, EPR, copper cables, through a series of manholes (vaults) and concrete encased ducts.

A forth coming project will bring two 12 kV circuits down North Campus Drive to new manholes within approximately 50 feet of MSE. From these manholes the 12 kV circuits shall be tapped with 600A elbow connectors and extended to the building's electrical substation. (A sectionalizing switch may be required - this will require further study.)

Two separate electrical circuits shall be brought to the building for redundancy and reliability. The 12 kV service shall be arranged so that if one primary feeder is out of service, the remaining feeder has sufficient capacity to carry the total load.

The building's distribution system shall be configured in a primary/ secondary selective arrangement with one indoor, double-ended unit substation.

Concrete encased duct banks will be provided to extend the medium voltage circuits from the existing vaults to the Building.

Alternate: The design team will explore the alternate design of pad mounted exterior transformers (in lieu of substation style interior transformers) located exterior to the building adjacent to the weatherproof emergency generator.

15 kV Feeders:
15 kV feeders will have 133 percent insulation, 220 mil, single-conductor, solid-dielectric Ethylene Propylene Rubber (EPR) insulated, shielded, jacketed power cable rated for 105C for continuous service and 140C for emergency service. Fault trip indicators will be provided on each phase. Cables will be manufactured by Okonite or Southwire.

A #4/0 bare copper ground wire will be installed with every primary 15 kV feeder.

Power Distribution Equipment:
All power distribution equipment will be fabricated with copper bussing and conductors.

Vertical busways, fed from the substations, will be provided to distribute power to each floor. At each floor plug in circuit breakers will be provided on the busway to tap power for the floor distribution equipment.

Lighting panel(s) will be provided on each floor that are fed from the busway plug-in circuit breaker(s) which will be equipped with ground fault protection.

Step down transformers will service 208/120V distribution panels that will in turn, service local receptacle panels, laboratory panels, and light fixture dimming panels. Transformers shall have 115°C insulation and sound levels that are 3db below NEMA standards.

Each laboratory module will have an individual branch circuit breaker panel for the lab loads.

Lab panelboards will be equipped with main breakers and may be located within equipment entry and equipment alcoves or the corridors.

Branch circuit panelboards will be trimmed with door-in-door type covers. All panels will have at least 25% spare breaker capacity above initial requirements.

Branch circuit panelboards within the vivarium spaces shall be semi-flush mounted, stainless steel, NEMA 4X construction.

Motor control centers and power panels will be provided in mechanical equipment rooms for pumps, fans, packaged equipment, etc. Major equipment may be fed directly from the substations.

All starters shall be drawout type minimum size NEMA 1. Starters NEMA 3 and above will be solid state soft start type. All starters shall utilize motor circuit protectors. Each starter shall be equipped with ground fault protection, applicable control power transformer, indicating lights, H-O-A switch and contacts.

Short Circuit Ratings:
All electrical power distribution components will have a short circuit withstand rating that exceeds the available fault duty at that point in the system. Components will be fully rated, no series ratings will be allowed.

Branch Circuitry:
The following criteria will be used in designing the branch circuitry:

- Typical convenience receptacles will be arranged for four (4) duplex or quad outlets per 20A, 1 pole circuit, 120V.
- All duplex and special purpose receptacles indicated for specific equipment will typically be on a separate dedicated circuit.
- Work Stations and Offices will be designed with one (1) duplex receptacle on each of the three walls and (1) double duplex receptacle at the wall adjacent to the desk.

- Conference rooms and common areas will be equipped with at least one (1) duplex per wall. Typically receptacles will be spaced on 12-foot centers.
- Corridors will be designed with a receptacle spacing of approximately 40 feet.
- Building support (equipment rooms, storage) will be designed with one (1) duplex receptacle per wall or one (1) per every 150 square feet, whichever is greater.
- Receptacles within the Labs will be coordinated with the equipment layout.
- Laboratories and equipment rooms will be designed with dual channel pre-wired aluminum raceways installed on perimeter walls and island benches. 120V, 20A duplex receptacles will be mounted in the bottom compartment of the raceway, typically at 12 inches on center, interconnected to alternating circuits. The top compartment of the raceway will house communications outlets. Two (2) 120V, 20 amp circuits will be provided for each pre-wired raceway. Circuits will be confined to one side of the bench to facilitate identification if the Laboratory is subdivided or enlarged in the future. Circuits will be confined to one side of the bench to facilitate identification if the laboratory is subdivided or enlarged in the future. In addition, at each lab bench (2) 208V, 1-phase, 30 amp receptacles will be provided. A minimum of (2) 208V, 1-phase, 30 amp receptacles will be provided on each wall of the lab and within each lab support space and equipment room. (Optional standby power receptacles will not be installed within the same raceway. These will be flush mounted in the wall above the raceway or in the lab umbilical chases.)

Conductors:
Branch circuit conductors will be single-conductors 600V rated with THHN-2/ THWN insulation with continuous color-coding.

Branch circuit conductors will be designed to utilize the advantage of multi-wire distribution, however, no more than 5 conductors (3-phase, 1 neutral and 1 ground) will be installed in a common conduit.

Wiring Devices:
Wiring devices will be specification grade, complete with all accessories.

Device cover plates will be stainless steel. All receptacle nameplates will be permanently engraved with panel name and circuit number.

Isolated ground type receptacles with dedicated insulated/isolated grounding conductors will be utilized only in server and telecom rooms.

Ground fault protection will be provided for outlets within 6’-0” of a sink edge, and other wet locations. Electrical outlets will be individually ground fault interrupted (GFCI) protected (not at the circuit breaker or first outlet on the circuit).

All duplex and special purpose receptacles indicated for specific equipment will be on separate dedicated circuits.

Raceways:
Raceways for feeders and branch circuits will be metallic, Rigid Steel Conduit (RSC), or Electrical Metallic Tubing (EMT) subject to the restrictions of the California Electrical Code, minimum size 3/4". EMT will not be used in concrete construction or where subjected to mechanical damage.

Exterior ductbanks will be comprised of PVC Schedule 40 conduit encased in concrete. Where ductbanks penetrate foundation walls or manholes, rigid galvanized steel (RGS) conduit will be used.

Raceways will not be allowed in concrete floor slabs.

Special Wiring In Hazardous Areas:
Lighting fixture and wiring devices within the chemical storage rooms and other hazardous areas will conform to the class 1, Division 2, Hazardous location requirement.

Emergency Power Systems:
One standby emergency diesel engine-generator set, preliminarily sized at 1000 kW (standby), will be provided to supply electrical power in the event of loss of normal power. The capacity of the generator will need to be validated in the next phase.

The standby emergency engine-generator set shall utilize diesel fuel. The unit shall be capable of picking up their rated capacity in one step and provide a transition time for the emergency system within then (10) seconds for the Life Safety Loads and within (60) seconds for the legally required and optional standby loads from failure of the normal power source. As the Life Safety Loads are served by the campus system the code requirement for a (10) second transition time is not applicable to this installation.

The proposed location for the engine-generator set is in exterior to the building in a weatherproof enclosure with a skid mounted, double wall, integral fuel storage tank. The unit will be equipped with a factory constructed sound attenuating enclosure.

The following equipment is proposed to be provided with emergency power in the event of normal power failure.

Life Safety Systems:

- Egress lighting (0.4 VA/ square foot)
- Exit signs
- Fire alarm equipment (0.25 VA/ square foot)
- Fire and Jockey Pumps (if required)
- Building Management System (BMS) and accessories

Legally Required Standby System Power:

- BSL3 exhaust

Optional Systems Proposed to be connected to the Standby System Power (UCR Selected Systems):

- One elevator per elevator bank
- Sewage ejectors
- Lab Waste ejectors
- Underground de-watering system (if required)
- Fume hood exhaust system
- Animal Holding Room environmental parameters
- Animal automatic watering system
- Selected lab equipment
- Backup chiller and associated peripherals for the vivarium
- Vivarium Biosafety Cabinets
- Selected vivarium equipment
- In each lab (per 21' O.C.; combined total for both walls) provide one 120V, 20 amp duplex receptacle and one 208V, 1-phase, 30 amp receptacle for the selected freezers and incubators
- Freezers and incubators as follow:
  - Alcoves: (2) @ 120V, 20 amp, duplex receptacles.
  - Procedure Rooms: (4) @120V, 20 amp duplex receptacles.
  - Equipment Rooms (per 21' on center); combined total for both walls: (3) @ 120V, 20 amp, duplex receptacles and (5) @ 208V, 1Φ, 30 amp receptacles.
- Fume hood airflow monitor/audible–visual alarm
- Limited laboratory supply and exhaust systems to maintain environmental conditions, relative negative pressure of labs, exhaust from fume hoods (sash will be completely closed in a power outage) and vented base cabinets (acid and flammable) under the hood.
- Dedicated exhaust for the radioisotope fume hoods
- Environmental rooms (warm & cold)
- Point supply (PS) HEPA filtration systems
- Designated sequencing, server and computer rooms
- Selected hydronic pumps
- Additional lighting in selected areas
- Lab waste systems
- Sump pumps
- Water booster pumps
- Hot water circulating pumps

- Security systems
- Telecommunication systems

The emergency power system will be capable of picking up their rated capacity in one step and provide a transition time for the emergency systems within ten (10) seconds for the Life Safety Loads and within (60) seconds for the legally required and optional standby loads from failure of the normal power source.

Load Bank:
A resistive load bank will *NOT* be provided. Portable load banks for testing will be provided by the University.

Automatic Transfer Switches:
Each automatic transfer switch will be 4-pole and provided with a bypass isolation switch. The bypass isolation switch will provide a safe and convenient means of manually bypassing and isolating the automatic transfer switch regardless of the condition or position of the switch.

The transfer switches will be capable of sensing loss of normal power, automatically starting the remote engine-generator plant, and will transfer the emergency loads to the emergency source.

The ATS equipment will be manufactured by Russelectric or ASCo.

Emergency Equipment Rooms:
The emergency switchgear, and transfer switches will be located in dedicated (2) hour fire rated rooms independent of one another and other electrical equipment such as the substation.

UPS Equipment:
A central UPS system is not anticipated.

Variable Speed Controllers:
Variable Speed Controllers (VSC) or drives will be provided on selected fans and pumps. Controllers will be microprocessor based, IGBT, pulse width modulating type-1, with bypass contactor, and 18 pulse when over 25 hp.

The controllers will be equipped with integral communications for direct communications with the Siemens BMS system.

Grounding System Description:
A complete equipment grounding system will be provided such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames and all other conductive items operate continu-

ously at ground potential and provide a low impedance path to ground for possible fault currents. Ground system resistance will be 5 ohms or less.

A separate insulated green grounding conductor will be provided for each single and 3-phase feeder and branch circuit. The grounding conductor will be run with the related phase and neutral conductors. Panel feeders installed in more than (1) raceway will have individual, full sized, green grounding conductor in each raceway. The equipment grounding system will not rely on the metallic raceways for grounding continuity.

Transient Voltage Surge Suppression:
Transient voltage surge suppression (TVSS) will be provided on both the normal and emergency power distribution systems.

TVSS will be provided on multiple levels (substations and distribution and distribution equipment) and coordinated for a cascading system.

Lightning Protection System:
A lightning protection system will *NOT* be provided for this building.

CONCEPTUAL (PRELIMINARY) MAJOR ELECTRICAL DISTRIBUTION EQUIPMENT LIST

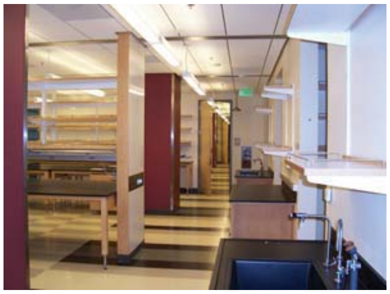
Unit Designation	Size (Each)	Total Quantity	Description
Double-Ended Unit Substation		1	
Duplex Primary Switch	15 kV, 600 Amps	2	Surge arrestors on the load side of the current limiting fuses
Substation Transformers	1,000 kVA, 12 kV Primary-480Y / 277V, 3 ph, 4-wire Secondary	2/substation	115ºC VPI type with fan assisted cooling and temperature monitoring
Secondary Switchgear	2,500A, 480Y/277V, 3 ph, 4-wire	2/substation	Draw-out power main, feeder and tie circuit breakers with a minimum 65KAIC withstand rating
Full Function Electronic Metering	N/A	2	Interface with Campus system

CONCEPTUAL (PRELIMINARY) MAJOR ELECTRICAL DISTRIBUTION EQUIPMENT LIST (CONTINUED)

Unit Designation	Size (Each)	Total Quantity	Description
Normal Power Distribution Equipment			
Distribution Switchboards	1200A 480/277V, 3-ph, 4-wire with main breaker	TBD	
Vertical Distribution Busways & Busplugs	800 A, 480/277V, 3 ph, 4-wire	2	(3) Bus plugs / floor; one for the lighting panel (with GFI), one for the lab dist panel xfr, and one for the office dist panel xfr
Lighting Panels	225A, 480/277V, 3-ph, 4-wire, 42 circuit panel with main lugs only.	1/Floor	
Lab Distribution Step Down Transformers	225 kVA, 480V, primary, 208Y/120V 3 ph, 4-wire Secondary	1/Floor	Dry Type, K-6 rated, 115ºC rise
Lab Distribution Power Panels	800A, 208/120V, 3-ph, 4-wire panel with main breaker	1/Floor	
Lab Panels	225A, 208/120V, 3ph, 4-wire, 42 circuits panel with a main breaker	1 / 3 Lab Modules	Size for 40W/SF
Office Distribution Step Down Transformers	75 kVA, 480V, primary, 208Y/120V 3 ph, 4-wire Secondary	1/Floor	Dry Type, K-6 rated, 115ºC rise
Office Receptacle Panels	225A, 208/120V, 3ph, 4-wire, 42 circuits panel with a main breaker	1/5,000 ASF	Also provide one additional panel for each sequencing, server and computer room
Mechanical / Plumbing Equipment			
Motor Control Centers	800A, 480V, 3 ph, 4-wire, NEMA class II-B	TBD	A minimum of 1 on the roof and 1 in the basement mechanical room for; 1) the normal power system, 2) the Life Safety power system, and 3) the legally required and optional standby power systems
Variable Frequency Drives	18-pulse, IGBT drives	TBD	In compliance with IEEE 519

CONCEPTUAL (PRELIMINARY) MAJOR ELECTRICAL DISTRIBUTION EQUIPMENT LIST (CONTINUED)

Unit Designation	Size (Each)	Total Quantity	Description
<u>Emergency Power Distribution Equipment</u>			
Emergency Switchgear	1600A, 480/277V, 3-ph, 4-wire with main breaker	1	
Automatic Transfer Switches	400-800A, 277/48V, 3-ph, 4-pole	3	With bypass isolation feature
Emergency Distribution Power Panels	400-800A main lugs, 3-ph, 4-wire	TBD	A minimum of 1/Floor
Vertical Distribution Busways & Busplugs	400-600 A, 480/277V, 3 ph, 4-wire	1/Floor	(4) Bus plugs / floor; two for the lighting panel and 480V equipment panels (with GFI), and two for the power panel transformers
Emergency Lighting Panels	30 circuit, 100A main lugs, 3 ph, 4-wire	1/Floor	
Distribution Step Down Transformers	112.5 kVA 480V primary, 208Y/120V 3 ph, 4-wire Secondary	1/Floor	Dry Type, K-6 rated, 115ºC rise
Emergency Receptacles Panels	225A, 208/120V, 3ph, 4-wire, 42 circuits panel with a main breaker.	1/Floor	One panel for the Life Safety System and one panel for the legally required and optional standby power system.
Emergency Lab Equipment Panels	225A, 208/120V, 3ph, 4-wire, 42 circuits panel with a main breaker.	1 / 6 Lab Modules	
Elevator Distribution Panelboard	600A, 480V, 3 ph, 4-wire, NEMA class II-B	1	Located near the elevator machine rooms.



Description of Lighting Systems:
A complete lighting system for all indoor and site illumination will be provided. The indoor lighting system will consist of energy efficient fluorescent fixtures. Incandescent fixtures may be provided in selected areas with specific dimming requirements (auditoriums, large conference rooms, etc.).

UCR standard pole-mounted, metal halide lighting fixtures and poles will be used along pathways and sidewalks.

Exit signs will be State Fire Marshall approved LED type, located in all paths of egress.

Emergency/night lighting will be provided by unswitched branch circuits. These unswitched branch circuits will be fed from emergency lighting panel.

Lighting Levels:
Lighting levels will conform to the Illuminating Engineering Society's recommendations. The targeted lighting levels are as follows:

Area or Space	Light Level
Administration/ Office/ Open Workstations	50-70 fc
Workrooms	40-60 fc
Circulation/ Lounges/ and Restrooms	15-25 fc
Storage/ Support Rooms	15-25 fc
Laboratories and Lab Equipment Rooms	75-100 fc
Vivarium	varies
Sequencing, Server and Computer Rooms	50-75 fc
Mechanical/ Plumbing/ Electrical Equipment Rooms	25-40 fc
Exterior	1-5 fc

Lighting Fixtures:

The following lighting fixtures and descriptions are general in nature and will be validated and further refined in the following phases of work.

All lighting will be hung from the building structure independently of the ceiling support system.

Lighting levels shall conform to the Illuminating Engineering Society's recommendations. The targeted lighting levels are as follows:

Administration/ Office/ Open Workstations	50-70	fc
Workrooms	40-60	fc
Circulation/ Lounges/ and Restrooms	15-25	fc
Storage/ Support Rooms	15-25	fc
Laboratories and Lab Equipment Rooms	60-75	fc
Vivarium	Varies	
Sequencing, Server and Computer Rooms	50-75	fc
Mechanical/ Plumbing/ Electrical Equipment Rooms	25-40	fc
Exterior	1	fc

Lamps and Ballasts:

Generally, fluorescent lamps will be 4 foot rapid start with a 3500°K color temperature, with a minimum color rendering index of 82. Lamps shall be the T8 Xtreme series manufactured by Sylvania.

Incandescent lamps shall be the energy savings type, long life, rated for 130 volts.

Ballast shall meet State of California standards, be UL listed, high-frequency solid state, high power factor, class A with auto-resetting built-in thermal protection. Electronic ballasts shall have a maximum total harmonic distortion of 10 percent. T8 fluorescent ballasts shall be the Sylvania Xtreme series to coordinate with the lamps.

Description of Lighting Systems:

A complete lighting system for all indoor and site illumination will be provided. The indoor lighting system will consist of energy efficient fluorescent fixtures. Incandescent fixtures may be provided in selected areas with specific dimming requirements (auditoriums, large conference rooms, etc.).

UCR standard pole-mounted, metal halide lighting fixtures and poles shall be used along pathways and sidewalks.

Exit signs shall be State Fire Marshall approved LED type, located in all paths of egress.

Description of Lighting Systems (continued)

Area or Space	Description
Administration/ Office/ Open Workstations	*Ceilings under 10 ft:* Recessed, parabolic, static, fluorescent troffers. *Ceilings 10 ft. and higher:* Suspended, linear, direct/ indirect, extruded aluminum, fluorescent luminaries.
Labs	*Ceilings under 10 ft:* Recessed, parabolic, static, fluorescent troffers. *Ceilings 10 ft. and higher:* Suspended, linear, direct/ indirect, extruded aluminum, fluorescent luminaries.
Vivarium	Recessed flush mounted, clean room grade, UL listed for wet locations with an IP65 rating at 85 psi. Fixture trims shall be sealed to prevent the passage of vermin.
Workrooms	*Ceilings under 10 ft:* Recessed, parabolic, static, fluorescent troffers. *Ceilings 10 ft. and higher:* Suspended, linear, direct/ indirect, extruded aluminum, fluorescent luminaries.
Imaging Suites	Incandescent lighting constructed from non-ferrous materials with dimming controls.
Dark Rooms	Flush mounted incandescent lighting fixtures with chromatic filters and exterior mounted, illuminated, “DARK ROOM IN USE” signage.
Chemical Storage Rooms	Surfaces mounted fluorescent lighting with Class 1, Division 2, hazardous rating.
Lab Benches and Workstations	Under cabinet fluorescent task lighting with acrylic diffuser and local on-off rocker switch.
Circulation/ Lounges/ and Restrooms	Premium quality architectural ceiling and wall mounted fluorescent luminaires.
Storage/ Support Rooms	Surface mounted wraparound fluorescent fixtures.
Mechanical/ Plumbing/ Electrical Equipment Rooms	Suspended, open, industrial type, strip fluorescent fixtures with wire guards.

Lighting Control Systems:
All lighting will be controlled to meet or exceed the requirements of California Title 24. In general, the spaces will be designed with occupancy sensors and dual level (override off) switching. Core elements such as circulation corridors and restrooms along with the exterior lighting will be controlled by a networked, programmable, low voltage relay panel system.

Separate control of the fixtures in the day lighting zones will be provided.

Occupancy sensors in offices with exterior windows will be equipped with photocell detectors to prevent the lights from being activated when sufficient ambient lighting is available.

The typical lab lighting control will consist of combination, microprocessor based, ultrasonic and infrared sensors; photocells; switch-pack relays; and local switching. The perimeter lights will be controlled through the occupancy sensors and the photocells to prevent the perimeter fixtures from being energized when sufficient ambient day lighting is present. A separate auxiliary relay will be provided to annunciate lab occupancy status to the ATC for nighttime ventilation set-back.

Lutron dimming systems will be provided in all auditoriums and conference rooms.

Animal Facilities:
Within the vivarium each animal holding room and convertible Procedure/AHR and internal suite corridor shall be equipped with 3 independently controlled lighting systems, 1 for animals and 2 for humans. The 3 systems are as follows:

a. Animal White (T8 full spectrum fluorescent). Animal lighting system shall provide a programmable, automatic day/night cycle on an adjustable time and duration schedule with photocell confirmation of cycle controlled and monitored by the Building Management System. Lights shall flicker five minutes before shut-off. Animal lighting system shall provide 30-40 FC at 3’ AFF. Suite corridors shall be controlled by this system as well.
b. Human White (T8 full spectrum fluorescent). Human fluorescent lighting system shall be manually controlled by an integral light switch/one-hour timer mounted inside animal room near door. Lights shall flicker five minutes before shut-off. Human lighting system shall provide 60-70 FC at 3’ AFF. Human and animal lighting systems can be accommodated in same multi-bulb fixture. Human light level cannot override animal night cycle (no white light during nigh cycles).

c. Human Red (T8 full spectrum fluorescent). Human red light system shall be manually controlled by an integral light switch/one-hour timer mounted inside animal room near door. Lights shall flicker five minutes before shut-off. Human lighting system shall provide 15 FC at 3' AFF. Human and animal lighting systems can be accommodated in same multi-bulb fixture.

Fire Alarm System Description:
The fire alarm system will utilize addressable, microprocessor-based system, with cabinets, power supplies, micro controller, keyboard display, LED display, batteries, peripheral devices, voice evacuation system, etc. The system will be manufactured by Siemens, the campus standard.

Control Panel:

The main control panel will be a solid-state, microprocessor-based, modular fire alarm control panel. The control panel will communicate with all peripheral initiating devices and each initiating device will report to the control panel with an individual device point number and message.

The control panel will receive all alarms from peripheral devices and remote data gathering panels, initiate a pre-recorded voice message throughout the facility, and indicate alarm on the floor of incident and the floor above.

Remote Data Gathering Panels (DGP):
Remote data gathering panels will be located on each level for fire alarm service termination in the floor on which it's located. DGP's will communicate directly with the main fire alarm control panel and fire command center. Each remote DGP will be a fully functional self-contained and self-sufficient unit such that, if the connection to the control processor is severed, (a trouble indication will sound) the panel will continue to function and sound appropriate alarms based on the last set of programming instructions received.

Manual Pull Stations:

Manual pull stations will be provided at each floor egress and will be spaced, such that the travel distance to any pull station is less than 200'-0". Pull stations will be double-action of the non-coded type with a key reset switch.

Smoke Detectors:
Smoke detectors will also be located within stairwells, elevator vestibules, electric rooms, telecom rooms, janitors closets, equipment rooms, and other locations as required by code. Duct smoke detectors will be located at each air-handling unit and combination fire smoke damper. Smoke detectors will be photoelectric type.

Smoke detectors will be the analog type to differentiate between a dirty head (requiring service) and detection of smoke.

VESDA:
Early warning VESDA smoke detection will be provided within the auditoriums and Atrium.

Heat Detectors:
Heat detectors will be provided in elevator machine rooms, mechanical spaces venting steam, and emergency generator rooms.

Elevator Recall:
Alarm initiation will signal all elevators to recall to a designated floor.

Alarm Indicating Appliances:
Visual strobe units will meet the requirements of ADA, UL and NFPA. A strobe unit will be provided at locations dictated by code.

Audible units in public spaces will be speakers with a peak output of 96 dB at 10' 0".

Audible units in mechanical areas or other areas with high ambient noise will be trumpet type suitable for such locations.

Remote Annunciation:
The building's fire alarm system will report back to the campus central station located in the Amado Building. The reporting interconnection will utilize the wiring contained within the campus telecommunications systems.

Wiring:
All fire alarm wiring will be Style 6 (Class "A") and supervised. All wire and cable will be suitable for fire alarm use and will be installed in conduit.

6.3 PLUMBING SYSTEMS

Design Philosophy:
The intent of this section is to promote the implementation of cost effective and energy efficient strategies for systems design and arrangements, equipment selection, distribution, and overall systems integration. These strategies will be undertaken during subsequent design phases.

Plumbing system components and distribution layouts will have the following characteristics:

- Protection of the public water supply.
- Modular approach
- Energy responsiveness
- Flexibility for future changes
- Durability
- Ease of maintenance
- Reliability
- Redundancy of critical components

Every effort will be made to design, lay out and install equipment in locations which will tend to encourage routine preventative maintenance by providing easy access for maintenance personnel.

Systems and equipment will be designed in accordance with the applicable Code summary sections of this manual and UCR standards.

Sustainability:
During design, the team will explore various opportunities to incorporate sustainable design principals within the building. While some concepts can prove to be fairly costly, many are not, and these will be integrated into the base design. Proposed concepts will be prioritized and, with input from UCR, the team will select the appropriate elements that fit within the confines of the project's budgetary allocations. Although LEED certification is not mandated for this project, our goal will be to exceed California's Title 24 Standards by at least 10 percent, or as defined by UCR sustainable design polices currently under development.

Some of the elements specified within the Plumbing systems that will be incorporated into the base design are as follows:

- Enhanced minimum pipe and insulation thicknesses.
- Low flow plumbing fixtures
- Optimized system efficiencies
- Video-taped system commissioning for the operators

Other concepts that will be explored during design are:

- Waterless Urinals
- Reuse of RO/DI water discharge
- Reuse of Condensate waste water from the cooling units
- Enhanced system commissioning

UCR, as well as the Builder / Contractor will also play a major role in achieving the sustainable goals for this project. Equipment and appliances purchased for use in this building should be efficient and labeled with the Energy Star emblem. Reuse of resources by the Contractor will enhance the sustainable effort. Finally, good operations and maintenance of the systems and equipment will also conserve resources.

Applicable Codes, References and Standards:
Refer to the Regulatory and Certification Criteria Sections of this Document for applicable Codes, References and Standards.

Water Service:
A water meter assembly for the building will be provided per the local water company requirements.

Water supply pressure within the system will be maintained between 35 psi minimum and 80 psi maximum at all points. Multiple pressure reducing valve assemblies will be provided to reduce the incoming service pressure to not exceed 80 psi.

Reduced pressure principle backflow preventers will be installed on the building's incoming service in parallel for building containment and to protect the municipal water main. The following additional backflow preventers will be provided in parallel for in-plant protection and to protect the building's domestic water system:

- Non-potable (Industrial) water system for laboratory equipment
- RODI system
- Mechanical make-up systems.

Cold Water Systems:
Two (2) cold water systems to serve the building will be provided, including two (2) separate, fully recirculating, hot water supply systems. One is for the potable hot water system and the other for the non potable (industrialized) hot water system.

Hot Water Systems:
Two (2) hot water systems to serve the building will be provided, including two (3) separate, fully recirculating, hot water supply systems. One is

for the potable hot water system and the other for the non potable (120°F industrialized) hot water and (140°F industrialized) hot water system.

Domestic hot water will be generated centrally by duplex steam-to-water semi-instantaneous heat exchanger with a storage tank and a master thermostatic mixing valve.

This system will provide hot water to all domestic fixtures. Hot water will be distributed at a temperature of 120°F. A hot water return system will be provided to maintain the hot water supply temperature.

Non potable hot water will be protected and generated centrally by duplex semi-instantaneous steam-to-water heat exchangers with a storage tank and a master thermostatic mixing valve. This system will provide hot water to most laboratory equipment and other non-domestic facilities. Hot water will be distribution at a temperature of 120°F. A hot water return system will be provided to maintain the hot water supply temperature.

A separate 140°F nonpotable hot water system with its own supply and return will be provided for vivarium equipment such as the cage and tunnel washers.

Sanitary Waste and Vent System:
A complete sanitary waste and vent system will be provided throughout the building serving the toilet rooms, mechanical equipment, and floor drains. Systems will run by gravity flow wherever possible. Building drains which cannot be discharged by gravity flow will be collected into a sewage ejector pit with duplex ejectors. The effluent will be lifted and discharged into the gravity drainage system.

Laboratory Waste and Vent System:
A complete laboratory waste and vent (acid resistant) system will be provided throughout the laboratory areas in the building.

Laboratory sinks, cup sinks and laboratory equipment will be connected by gravity to the laboratory waste system that will exit the building independent of the sanitary waste system. Laboratory vent piping will run through the roof independent of the sanitary vent system.

The laboratory waste collection system will connect to a central limestone chip neutralization system before connecting to the building's sanitary system exterior to the building. Piping arrangements and space for a future active treatment system will be provided.

Floors well below grade with laboratory fixtures will be connected to a duplex lab waste ejector with duplex pumps discharging into the neutralizing tank.

Storm Drainage:
Multiple parallel roof and overflow storm drainage system will discharge by gravity. Roof storm drainage system will connect to site storm drains. Overflow storm drainage system will discharge through exterior wall and spill onto grade.

The system will be sized based on 2 inches of rainfall per hour per the County of Riverside codes. Storm drains which cannot flow by gravity will be collected in a sump pit with duplex sump pump system. The effluent from the ejectors will connect to the gravity system in the building to the site storm drainage system.

Natural Gas:
The natural gas system shall be an extension of the municipal distribution system to the building through a meter and regulator. The building distribution system shall be supplied from the meter through the foundation wall and then is distributed to the laboratories.

Natural gas system shall be designed to provide 5 cfh per laboratory outlet with a maximum system pressure drop of 0.5 inches water column.

Compressed Air System:
Laboratory compressed air will be centrally generated via a complete factory packaged, duplex, oil free air 125 psi compressor system with duplex desiccant dryers, receiver, and final coalescing filters located in the basement wet mechanical room.

The system will provide 1 cfm per laboratory equipment with a minimum 50 psig at the furthest equipment and a maximum system pressure drop of 5 psi.

100 psi system will be provided in the main supply with pressure reducing valves at the outlets. Lab outlets will be designed to provide 1 cfm per outlet at 30 psi of pressure. Localized pressure regulators will be provided to ensure the required pressures are satisfied.

The air compressor intake will be located on the roof away from all HVAC exhaust, plumbing vents, vacuum exhaust or any other equipment exhausts.

Vacuum System:
At this time a centralized and distributed vacuum system is *NOT* anticipated for this project and will not be provided.

Specialty Gas Systems:
Complete specialty gas systems for the laboratories including manifolds, regulators, all piping, valves and connections to lab benches and other

areas will be provided, as indicated in the Lab Room Data Sheets located in other sections of this document. These systems will be supplied locally and will be furnished and installed by others.

CO_2 for Laboratory use will be from cylinders supplied with manifolds. The systems will be supplied from local cylinder on the floor and will include manifolds, regulators and all piping and valves. A separate manifold assembly is assumed per floor. This will be further defined in the subsequent phases of work.

Softened and Reverse Osmosis/Deionized (RO/DI) Water Systems:

A complete soft water and RO/DI system will be provided. A continuous loop will throughout the laboratories will be designed to maintain the purity of the water. The system is intended to provide CAP Type II (2-4 megohm-cm) grade water to each lab sink and to specific laboratory equipment (glassware washer, etc). This system will include a mixing valve duplex, multi-media filters, duplex water softeners, carbon filters, carbon recirculation skid, skid mounted RO system, storage tanks, mixed bed deionizers, controls, PLC control panel and all piping, valves and filters to make a complete system. The system will include socket fused PVDF or stainless steel piping with diaphragm valves. Piping layout will be looped to eliminate dead legs including equipment drops down into walls.

Point of use local use polishers will be provided at selected sinks within the labs, as specified in the lab equipment and furnishings section of this report.

Soft cold water supply will be supplied from the central system to supply laboratory equipment requiring soft water, clean steam humidifiers, and other designated equipment.

Tempered Water System:

Tempered water supply system for emergency safety equipment will be provided. Distribution will supply all emergency showers and eye washers with ±70°F water. The tempered water will be supplied from the domestic water system through mixing valves located in the basement wet mechanical room. The system will be recirculating using an inline pump controlled by an aquastat. Local alarms and remote ATC annunciation will be provided on all emergency safety equipment for notification of activation of the emergency equipment.

Laboratory Equipment:

All countertops, sinks, cabinet work, shelves and other equipment or furnishings will be furnished and installed by the laboratory equipment Contractor. The Plumbing Contractor will install and provide all connections for faucets, gas, vacuum and compressed air outlets. In general, all sinks will be integral with countertop and set in place complete with waste outlet. The Plumbing Contractor will be responsible for final installation of lab trim and the waste and vent lines from the sink and outlets.

All hoods will be furnished and installed by the laboratory equipment Contractor, and will be erected in place, complete with all integral piping, ready for service connections, including waste, by the Plumbing Contractor.

Sinks located in the laboratory and Vivarium will be provided with wrist blades.

Laboratory equipment which disposes toxic, radioactive or high concentration waste will be locally contained "in-lab" safety containers without the use of piped system.

The following are the anticipated services to the specified lab equipment:

- Autoclaves: Soft water
- Steam Generator: Soft water
- Humidifiers: Soft cold water
- Glass Wash: Both Soft and RO/DI water
- Specified Lab Sinks: RO/DI water
- Specified Lab Sinks: Both Soft and RO/DI water

Vivarium Equipment:
A non-potable hot and cold water piping system supplied from the Laboratory system shall be provided to all of the Vivarium area sinks and equipment except handwashing sinks which will be supplied from the domestic system.

An automatic animal watering system shall be provided in all of the animal holding rooms. The system shall be supplied from the central RO system and provided with a central chlorinization *system*.

Safety Equipment:
Emergency showers/eye washers will be provided at laboratory exits.

Laboratory sinks will be provided with eyewash units.

Emergency showers will be provided in the mechanical equipment rooms and on the roof adjacent to mechanical equipment. Supply piping will be from the potable water system.

System piping shall be from the dedicated potable tempered water system. The system design will be based on ANSI Guidelines.

Floor drains at the shower/eyewash stations are *not* anticipated to be required.

Dewatering System:
Provide allowance for complete perimeter and subsurface dewatering system complete with ejectors and duplex sump pumps. (The requirement for this system is TBD.)

Water Consumption of Plumbing Fixtures:

Water Closets:	1.6 gallons per flush
Public Lavatories:	0.5 gpm
Sinks:	1.5 gpm
Urinal:	1 gallon per flush

CONCEPTUAL (PRELIMINARY) MAJOR PLUMBING EQUIPMENT LIST:

Unit Designation	Location/Service	Description
Domestic Hot Water Heaters	Basement wet mechanical room	Duplex Arrangement. Steam-to-water heat exchanger with hot water recirculating system, 140°F. Main thermostatic mixing valve set at 120°F. 18 gpm, 600 lbs/hr.
Non-Domestic Hot Water Heaters	Basement wet mechanical room	Duplex Arrangement. Steam-to-water heat exchanger with hot water recirculating system, 140°F. Main thermostatic mixing valve set at 120°F. 50 gpm, 1600 lbs/hr.

CONCEPTUAL (PRELIMINARY) MAJOR PLUMBING EQUIPMENT LIST (CONTINUED)

Unit Designation	Location/Service	Description
RO/DI System	Basement wet mechanical room	• Complete pre-treatment system including duplex 30" dia. multi-media, duplex 24" dia. water softener and 36" dia. carbon filters. • 1000 gal storage tank, tightly covered, polypropylene with sterile vent filter and level switch. • Stainless steel sanitary recirculation pump rated for 50 gpm at 80 psig boost. • Ultra violet sterilizer. • 0.2 micron final filters. • Continuously circulated, polypropylene, building piping system. • Duplex RO unit rated for 5 gpm product flow. • Mixed bed regenerable deionization tanks. • Multi-media, water softener and pipe sizing will include the additional load for soft water requirements
Laboratory Compressed Air System	Basement wet mechanical room	Duplex, oil free, permanently lubricated, scroll type, capable of 112 cfm at 125 psi, with a 240 gallon vertical receiver and 30HP compressor motors. Duplex desiccant dryers with dew point monitor, final coalescing filters and duplex reducing valves will be provided.
Neutralizing Tank	Basement wet mechanical room	One (1) 500 gallon polyethylene neutralizing tank with limestone chips. Space allowance will be provided for future active treatment system.
Animal Watering System	Basement mechanical room	Animal watering system complete with chlorination/repressurization, automatic room flushing systems, central monitoring, recoil hose flush stations, portable sanitizer, bottle filling station, PRV stations, stainless steel distribution piping.
Sewage Ejector	Basement mechanical room	Duplex vertical sewage ejector 125 gpm, 50 ft head, 10 hp each. Complete with concrete pit, float switches, alternator, alarm and control panel.

CONCEPTUAL (PRELIMINARY) MAJOR PLUMBING EQUIPMENT LIST (CONTINUED)

Unit Designation	Location/Service	Description
Lab Waste Ejector	Basement mechanical room	Duplex vertical, stainless steel, lab waste ejector, 100 gpm, 50 ft head, 7.5hp each. Complete with concrete pit lined with fiberglass basin, float switches, alternator, alarm and control panel.
Sump Pump	Basement mechanical room	Duplex vertical sump pump, 60 gpm, 50 ft head, 2 hp each. Complete with concrete pit, float switches, alternator, alarm and control panel.
Domestic Water Booster Pump	Basement mechanical room	Duplex pump, package complete unit, 132 gallon hydrocumulator tank, pre-piped, pre-wired, 200 gpm, 40 psi boost, 7.5 hp each.

FIRE PROTECTION

Applicable Codes, References and Standards:

Refer to the Regulatory and Certification Criteria Sections of this Document for applicable Codes, References and Standards.

Laboratory Design Criteria:

A complete "wet", combination sprinkler/standpipe fire protection system will be provided throughout the Building. The system will include a fire pump to pressurize the standpipes and a complete wet sprinkler system. Cold rooms will be provided with dry pendent heads off of the wet system. High temperature sprinkler heads will be provided in the cagewash and glasswash areas, near large autoclaves, and in the steam entrance room.

Standpipes:

The combination standpipe/sprinkler system will have 2 1/2" Fire Department Valves (FDVs), located such that each floor is covered with 100'-0" of hose and 30'-0" of stream attached to the valve. In general, all 2 1/2" valves will be inside stairways to allow Fire Department personnel to access a fire from the stairway. All valves will have the same hose thread as per the local Fire Department requirements. At the ceiling and within the stairwell of each floor, each riser will be provided with a floor zone control valve, complete with vane type flow alarm, test station, etc. to serve the sprinkler system.

Fire department connections, pumper connections and roof outlets will be provided as required for a complete system.

Sprinklers:

The sprinklers system will be hydraulically designed to meet the following densities:

Light Hazard:	0.1 gpm per square foot over the most remote 1500 square feet.
Ordinary Hazard:	0.2 gpm per square feet over the most remote 1500 square feet

Protection area per sprinkler head will be:

Light Hazard:	200 square feet - smooth ceiling 168 square feet other types of construction
Ordinary Hazard:	130 square feet

Application:

Light Hazard:	Classrooms and offices
Ordinary Hazard:	Mechanical rooms, storage rooms and laboratories

PRELIMINARY MAJOR FIRE PROTECTION EQUIPMENT LIST:

Unit Designation	Location/Service	Description
Fire Pump	Basement Fire Pump Room/Fire Sprinklers	The fire pump (if required) will be sized to provide 100 psi at the top of the most remote standpipe with 500 gpm flowing, 100 hp. The pump will be supplied from the city water service and provided with a double check valve on the inlet of the pump. The need for a fire pump will be determined in the next phase of work after the building height and available pressures at the adjacent hydrants are determined.
Jockey Pump	Basement Fire Pump Room/Fire Sprinklers	Jockey pump (if required) will be sized to provide 110 psi at 15 gpm, 5hp.

6.4 TELECOMMUNICATIONS SYSTEMS

A complete empty raceway system shall be provided for pulling in Telecommunications wiring. The system shall meet the EIA/TIA-569 standards.

Network hubs and switching will be provided.

Incoming Telecommunications Service:
Four (4) 4" PVC Schedule 40 conduits and (1) 7-cell, air blown, fiber duct encased in concrete shall be run from designated vault 12 on the site to the main Communications Service Entrance Room (CSER). The CSER shall be a minimum of 150 square feet.

Multiple Communications Service Distribution Closets (CSDC) shall be provided on each floor and shall be a minimum of 100 sq. ft. The rooms shall be located so that the cabling length from the farthest outlet will not exceed 250 feet.

CSER and CSDC rooms shall be stacked for the convenience of running wiring and cables from one floor *(see Fig. 01)* to the next through sleeves. Each CSDC shall have a minimum of three 4" sleeves/conduits from the main telecommunications room.

The CSER and CSDC rooms shall be provisioned with individual control of 24hr HCAC, emergency power receptacles, a convenient connection to the building grounding electrode system, fire retardant plywood material on the walls, lighting, and access control.

All rooms and closets shall have adequate space, ventilation and cooling to handle active networking equipment in standard 19" racks.

Distribution:
From each satellite closet on each floor, a system of cable tray and conduit shall be utilized for the distribution of telecommunications wiring to the end use equipment.

Cable Trays:
A system of cable trays shall be provided consisting of ladder type tray run in the central corridors. Cable tray shall be sized sufficient to handle the weight of all cables and wires to be installed.

Where cable tray penetrates fire or smoke partitions the tray shall terminate into 4" conduit sleeves, quantity to be equal in areas as the cable tray.

Telecommunications Outlets:
Each telecommunication outlet shall consist of a 4-11/16 inch square outlet box 2½” deep with single gang mud ring. A 1-1/2” conduit shall run from the outlet to over the edge of the cable tray and be mechanically grounded to the tray and terminated with a bushing. Provide 2 data jacks and 1 voice jack at each device location. Telecommunications wiring will be provided per University Standard.

Outlets shall be provided in the following locations:

Offices & Administration
1. One (1) combination telephone/data outlet at each work station or (1) per 40 square feet.

Dry Laboratories
1. One (1) combination telephone/data outlet at each work station or (1) per 25 square feet.

Wet Laboratories
1. One (1) combination telephone/data outlet at each technician desk.
2. One (1) data outlet at each laboratory bench on service column or in surface duct.
3. One (1) telephone outlet at laboratory entrance.

Clean Room
1. A minimum of one (1) combination telephone/data outlet per 50 square feet within both the clean and service aisles.

Telecommunications Backboards:
Telecommunications backboards shall consist of the appropriate number of 8’ by 4’ by 3/4” plywood backboards.

6.5 SECURITY

The need for security in research laboratory buildings is three-fold. Privacy and protection of research laboratory space is required to ensure physical protection of expensive and sensitive lab equipment and ongoing experimental research operations. In addition it is necessary to protect the public from exposure to hazardous materials and procedures that occur within research space. Lastly, it is important to protect intellectual property developed during the course of research investigations. Such protection is necessary not only for the laboratory spaces but also for research office space. Security provisions for EBU3 will include not only the physical provision of card-key access or combination door latch/lock entries to sensitive spaces such as research labs, research offices, and core facilities but also provisions for zoned organizational strategies that ensure separation of sensitive building areas form high traffic, public zones.

Special access control provisions are required for the Vivarium Core Facility due to the sensitive nature of the research. It is recommended the vivarium facility be protected by a zoned multiple entry protection that requires passing through at least two security protected entries before gaining access to the facility. In addition secure lockout capability is required for the service elevator access when animal transfer occurs. All building entry and service entry doors shall be controlled by card-key access.

6.6 A/V TECHNOLOGY

The design of the building will include the complete integration of a comprehensive network of pathways for audio/visual and information technology. Audio visual projectors and manual screens will be provided in instructional spaces and large meeting rooms. Data connections will be available in research labs, teaching labs, conference rooms and offices.

6.7 STRUCTURAL

Structural Criteria

The structural system shall be designed based on the following criteria:

1. Governing Building Code: 2001 California Building Code, or latest State of California Title 24 Building Code in use at the time of design.

2. Design Live Loading:

Dry and Wet Laboratories:	100 psf, fully reducible
Offices:	100 psf, fully reducible
General Storage:	125 psf, non-reducible
Circulation Areas:	100 psf, non-reducible
Assembly Areas:	100 psf, non-reducible

3. Vertical Vibration Criteria:
   Dry and Wet Laboratories: 2000 micro-inches per second.
   Other Program Areas:
   We understand that the building is generally to be designed to a criteria of 2000 micro-inches per second. However, it has been our experience that this level of vibration imperceptibility may not be needed in areas other than the labs. We are not aware of any specific vibration sensitive equipment planned for other portions of the building. As such, for human perception, we suggest that a vibration velocity not to exceed 8000 micro inches per second. This criteria should be confirmed with the University during the design phase when the usage and equipment is finalized.

4. Seismic Design: (Per latest governing code) I=1, Seismic Zone 4

Structural Systems Descriptions Concepts

The structural design for the building should provide a building system that will integrate the program and functional requirements for the space layout. The design should also provide for an integration of building services, and allow for the desired architecture while meeting current building code requirements.

The building is currently planned as a Type I structure, and as such, consideration should be given to either a structural steel or reinforced concrete structural system. Both systems could be configured to meet the functional and vibration requirements for the program. Final selection of the system may be driven by current market conditions, architectural considerations, or cost evaluation.

The preliminary geotechnical report indicates that there are unsuitable fill soils on the site, and as such, pile foundations and a structurally support-ed slab on grade will need to be utilized. Please note that the geotechnical report utilized as the basis for the DPP will require an update as the design process begins, as it appears that the report was prepared relative to an adjacent building.

Reinforced concrete systems and structural steel systems could be configured which would satisfy the project program goals. The following should be considered when assessing the viability of each system:

Reinforced Concrete Systems

Advantages:

- Additional mass assists in vibration control
- System is sufficiently stiff to mitigate vibrations
- Minimal lead time for obtaining materials
- Possibility of reducing the floor to floor heights required

Disadvantages:

- Added mass adds load to the lateral force resisting system
- Speed of construction
- Potentially less flexibility in renovations/future penetrations/future concentrated loading

Structural Steel Systems

Advantages:

- Speed of erection
- Flexibility for future renovations/penetrations/concentrated loading

Disadvantages:

- More difficult to configure a system with a mass and stiffness which will meet vibration requirements
- Mill ordering structural steel is potentially a long-lead item
- Possible increase in required floor to floor heights

The lateral force resisting system should balance the need for maximizing seismic safety, and layout integrates functional and architectural considerations, and economy. Lateral force resisting systems that should be considered include reinforced concrete shear walls, ductile concrete frames, steel concentric and eccentric braced frames, and steel moment-resisting frames. Some advantages and disadvantages to these systems are summarized in the following table:

Lateral Force Resisting System	Program Flexibility	Architectural Flexibility	Relative Cost	Structural Performance
Reinforced Concrete Shear Walls	Low	Low	Low	Adequate
Ductile Concrete Frames	High	High	High	Adequate
Concentric Steel Braced Frames	Medium	Medium	Low	Adequate
Eccentric Steel Braced Frames	Medium-High	Medium-High	Medium	Adequate
Steel Moment Resisting Frames	High	High	Medium	Adequate

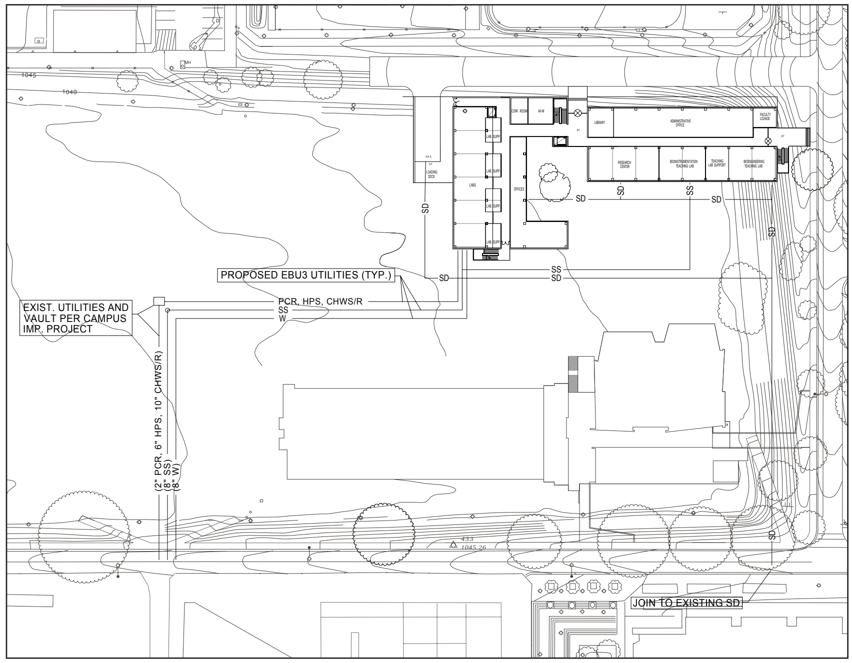
Architectural and program flexibility, which is desirable for this building, can be achieved in all of the systems by configuring the lateral force resisting systems around the perimeter of the building.

Based on our understanding of the program and functional requirements for the building, a reinforced concrete system appears to be the most viable, and as such, was the basis for the cost estimate contained in this DPP. The system could be configured with flat slabs with or without drop panels spanning to interior concrete columns and perimeter concrete shear walls. This system can be configured easily to meet vertical vibration requirements. It also possesses a smaller structural depth, which enables the interstitial space to be free of structure and well-suited to the building systems distribution which is such a critical component of this building type. Perimeter concrete shear walls would enable a flexible interior program space, and would provide a sub-structure for any exterior cladding planned on the façade. These issues should be studied in detail in schematic design.

For preliminary budgeting purposes, the structural system has been assumed to be a 16 inch thick flat slab system supported by 26 inch square reinforced concrete columns. The lateral force resisting system has been assumed to be a reinforced concrete shear wall system. Wall placement has not been determined, but an assumption of approximately 100 lineal feet of 16 inch thick shear walls has been assumed to be required. Foundation systems would consist of drilled, cast-in-place concrete piles supporting concrete pile caps, and interconnected by concrete tie beams. The slab on grade has been assumed to be structurally supported.

Alternate vertical and lateral force-resisting systems that are responsive to architectural and functional needs should be studied and estimated in the schematic design phase.

6.8 CIVIL AND SITE UTILITIES



Proposed Site Utilities Plan

The proposed Engineering Building Unit 3 is located on a 2-acre site currently occupied by the Lower Athletic Fields: west of Aberdeen Drive, north of North Campus Drive, and south of the Recreation Complex.

The site grades drop 20 feet from a high elevation of approximately 1058 feet at the Recreation Complex to a low elevation of 1038 feet within the Lower Athletic Fields. A majority of the existing grade differential is supported by an existing sideslope defining the northern edge of the site.

The required utility services will include sewer, storm drain, potable water, fire protection, power, telephone and data communication, chilled water, natural gas, steam and steam condensate.

The sanitary sewer, storm drain and water service systems shall be designed in accordance with current engineering practices and all applicable Codes, Standards and Authorities having jurisdiction, including but not limited to the Uniform Plumbing Code, Riverside County Fire Department Standards, State Marshal Standards, Campus Fire Marshal, and the UCR Office of Design and Construction practice.

All buildings in the vicinity, such as Bourns Hall, and the future Materials Science and Engineering, shall remain operational during demolition, removal, relocation and installation of all proposed site utilities.

The construction of tie-ins shall be closely coordinated with UCR Capital and Physical Planning and the office of Design and Construction.

Site Sanitary Sewer System

There is an existing 15-inch sewer located in North Campus Drive. As part of a separate campus improvement project, the University has plans to extend an 8-inch sewer lateral from North Campus Drive to the northeast and terminate at a manhole. The EBU3 project will be required to extend a sanitary sewer lateral approximately 200 feet to the southwest and join with the sewer manhole. Piping material for the new laterals shall be PVC SDR 35, consistent with Campus Design and Construction practice.

Site Storm Drainage

The project site is located within the Federal Emergency Management Agency (FEMA) 100-year flood plain. As part of the future Arroyo Restoration Project, drainage improvements will increase the buildable area with the existing athletic field by removing the site from the 100-year flood plain.

The discharge of storm water shall employ sustainable design techniques where possible to minimize storm water runoff, increase on-site infiltration and reducing runoff contaminants from discharging into the storm drain system. Design storm water treatment systems to reduce the average annual post development total suspended solids and pollutants by installing natural treatment systems such as subsurface infiltration chambers, vegetated filter strips, and bioswales.

There is a 72-inch and a 39-inch storm drain aligned parallel and sloping to the west along North Campus Drive. Runoff from roof drains on the proposed building shall be conveyed to this piping system. Runoff from the site shall be directed by sheet flow and collected in areas drain and discharged into the Arroyo to the south. Storm drain piping material shall be PVC SDR 35 consistent with Campus Design and Construction practice.

Domestic and Fire Water

There is an existing combined domestic and firewater loop on campus that includes an 8-inch water main North Campus Drive. As part of a separate campus improvement project, the University has plans to extend an 8-inch combined water line from North Campus Drive to the northeast. The EBU3 project will be required to extend a lateral approximately 200 feet to the southwest and the domestic and fire water supply for the proposed building will come from this 8-inch line. The domestic and fire water service laterals will each require backflow protection, in accordance with the UCR list of approved backflow prevention devices. The fire service line will require a fire department connection and post-indicator valve, as specified. All site water shall be PVC C900, consistent with Campus Design and Construction practice.

6.9 BUILDING MATERIALS

To the extent that the budget allows, it would be desirable to make this a predominately brick concrete and glass building in order to harmonize with other adjacent campus buildings. The structural frame will be concrete, which can be expressed. Brick and a combination of glass, metal panels and glass shadow box should be the predominate pallet for the exterior. If costs are an issue some plaster panels could be incorporated to reduce the overall cost for exterior skin. The plaster should have a smooth-troweled finish. Roof top equipment must be screened and integrated visually with the main building facades becoming an element of the entire architectural composition.

6.10 APPLICABLE CODES AND REGULATIONS

The following Codes and Standards are provided for general reference as the basis for the DPP document. At the time of design, the most recently adopted versions of all applicable codes as well as the then-current University standards will need to be utilized as the basis for design. The design team will need to make the final determination as to the relevance and application of these codes as well as others that may apply but not be included in the list below.

Building Codes

- California Building Standards Code, Title 24 of the California Code of Regulations. 2001 Edition
- Uniform Building Code, 1997 edition, and 1998 California Amendments
- Uniform Building Code Standards, 1997 edition
- Uniform Mechanical Code, 1998 edition, and 1998 California Amendments
- Uniform Plumbing Code, 1998 edition, and 1998 California Amendments
- Uniform Fire Code, 2000 edition
- National Electric Code, 1999 edition, and 1998 California Amendments
- California Code of Regulations, California Administrative Code Title 24, 1998 edition
- California Code of Regulations, Title 8, Industrial Relations
- California Code of Regulations, Title 19 - Public Safety
- California Code of Regulations, Title 21 - Public Works
- California Health and Safety Code, current regulations
- California Administrative Code Title 8 - Industrial Relations
- California Administrative Code Title 19 - Public Safety
- State of California Fire Code, 2001 Edition
- NFPA 10, National Fire Protection Association Standard for Portable Fire Extinguishers, 2000 edition
- NFPA 13, National Fire Protection Association Installation of Sprinkler Systems, 2000 edition
- NFPA 14, National Fire Protection Association Installation of Standpipe and Hose systems, 2000 edition
- NFPA 24, National Fire Protection Association Installation of Private Fire Service Mains and Their Apparatus, 1995 edition
- NFPA 30, National Fire Protection Association Flammable and Combustible Liquids Code, 2000 edition
- NFPA 45, National Fire Protection Association Standard on Fire Protection for Laboratories Using Chemicals, 2000 edition
- NFPA 72, National Fire Protection Association National Fire Alarm Code, 1993 edition
- NFPA 101, National Fire Protection Association Code for Safety to Life from Fire in Buildings and Structures, 2000 edition

Reference Standards and Regulations

- University of California, Riverside Campus Standards and Design Criteria.
- Americans with Disabilities Act (ADA), 1991, Title 3 and ADA P.L. 101-336
- Federal Standard 29 CFR Part 1910.1450 Occupational exposures to hazardous chemicals in laboratories
- American National Standards Institute 2358.1: Emergency Eyewash and Shower Equipment, 1990
- American National Standards Institute/American Industrial Hygienists Association 29.5 Standard for Laboratory Ventilation, 1992
- National Institutes of Health NIH 76-900 Safety Standards for Research Involving Chemical Carcinogens, Office of Research Safety
- National Institutes of Health NIH 81-2385 Guidelines for the Laboratory Use of Chemical Carcinogens, 1981
- Cast Iron Soil Pipe Institute (CISPI)
- Manufacturers Standardization Society (MSS)
- National Bureau of Standards
- Plumbing & Drainage Institute (PDI)
- South Coast Air Quality Management District (SCAQMD)
- Underwriters Laboratory (U.L.)
- Illuminating Engineering Society of North America (IES)
- Sheet Metal and Air Conditioning Contractors National Affiliation (SMACMA)
- Institute of Electrical & Electronics Engineers (IEEE)
- National Electrical Manufacturers Affiliation (NEMA)
- Occupational Safety and Health Administration (OSHA)
- American National Standards Institute (ANSI)
- American Society of Testing Materials (ASTM)
- American Welding Society Code (AWSC)
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- Standard 62
- Standard 90 A, B, C Energy Conservation in New Building Design
- Standard 100 Energy Conservation in Existing Buildings
- ASHRAE Fundamentals
- ASHRAE Systems and Applications
- ASHRAE Equipment

All of the above codes, standards and requirements should be reviewed as to the currently adopted version at the time of the design.

Occupancy Designation

The occupancy group designation within the California Building Code for laboratory buildings is governed by the type, quantity and storage methods for hazardous materials and chemicals used for research within the building. Common occupancy designations for laboratory buildings include "B" and "H-8". The program for the building includes offices, research laboratories (wet and dry), teaching laboratories and university classrooms. The University General Assignment Classrooms will fall within the assembly occupancy classification Group "A" which is defined as; "Any building or portion of a building having an assembly room with an occupant load of less than 300 or more than 300 without a legitimate stage, including such buildings used for educational purposes and not classified as a group E or Group B Occupancy". Each of these designations presents implications regarding specific standards for construction materials, allowable floor area, building height, fire-ratings for construction separations between spaces, the protection of penetrations between spaces and exiting requirements.

The likely occupancy for the Engineering Building Unit 3 is "H-8". A hazardous material inventory will be required during the design phase in order to confirm this occupancy designation assumption (this is a requirement for building occupancy).

B-2 Occupancy Summary

There are limits on quantities of hazardous materials, which can be used and stored in laboratories under B-2 occupancy classification. These limits are described in Tables 3-I and 3-E of the California Building Code (CBC) (see appendix) as "Exempt Amounts of Hazardous Materials Presenting a Physical [or Health] Hazard, Maximum Quantities per Control Area". The Department understands these limitations and will manage the chemical inventory as required to stay within the guidelines.

The amounts shown are the maximum allowed per laboratory control area. Control areas are limited to 10,000 square feet in size and must be separated by a one-hour fire resistive occupancy separation. In Type I buildings, which do not exceed three (3) stories in height, the two-hour floor separation is often a convenient way of separating control areas.

Fire Sprinklers: 100% Sprinklered Building, Ordinary Hazard

Fire Fighting Access: The University will coordinate with the City of Riverside Fire Department to provide suitable access for fire fighting. The Executive Architect will need to work closely with the Campus Fire Marshal to confirm access requirements for this building. This access will need to be integrated with access requirement for adjacent structures.

The current interpretation of “B-2” is to require individual ductwork from each fume hood and not have the ductwork manifolded which is more costly.

H-8 Laboratory Occupancy Summary

An “H-8” occupancy is required by the University for lab uses. This occupancy (in the California Building Standards Code) is intended for laboratories and similar areas used for scientific experimentation or research having quantities of materials not in excess of those listed in CBC Table 3-D.1 and 3-I and not otherwise classified as Group B occupancies. Maximum suite size must be 10,000 square feet.

For the purposes of the DPP, it is assumed that the exempt material storage amounts will not be exceeded, based upon current University experience. However, a chemical inventory for the proposed laboratories should be compiled as early as possible in the schematic design phase of this project so that it can be confirmed whether the needs of those laboratories will be able to be met.

The design team must utilize and apply the current code and code interpretations in force at the time of the design. For purposes of the DPP the following summary of the Group “H-8” major requirements are being considered:

1. Occupant load factor: 100 square feet/occupant (Table 10A)
2. Laboratory suite: 10,000-sf maximum, no limit on number of suites in building (Table 3-D, 1, 3-1)
3. Continuous 1-hour occupancy separation between lab suites of up to 10,000 sq. ft. each. (307.2.12)
4. Labs, shops and similar areas shall not require an occupancy separation when the use of the area is determined to be compatible. Classrooms and offices directly related to the use shall not require an occupancy separation. (307.2.12)
5. One-hour separation between fume hood exhaust ducts and fire-resistive exit corridors (307.2.13)
6. One-hour separation between lab interstitial space and corridor (307.2.13)
7. 1-hour rated slab-to-slab or tunnel, rated floor/ceiling assembly. Three-quarter hour rated corridor doors with smoke gasketing (1007.4.3)
8. Each portion of floor area 200 square feet or more requires two exits (1007.4.1)
9. Each portion of the floor area must be within 75 feet of an exit door (1007.4.2)
10. For buildings of four floors or more, each floor requires two-hour fire resistive horizontal exit. Each side of horizontal exit shall be provided with separate mechanical exhaust system, without interconnection.

No side less than 30% of total floor area. At least one elevator required to serve each side of horizontal exit (1007.4.7).

11. Rooms with cumulative occupant load of 10 or less may exit through more than one intervening room (1003.5)
12. Fire dampers prohibited in fume hood exhaust ducts (307.5.5)
13. Floor penetrations to maintain fire-resistive and liquid tight characteristics of 4 inches above floor (307.2.13)
14. Emergency power to supply all required electrical equipment when normal supply is interrupted (307.2.8)
15. Exhaust from each unit ducted separately to outside the building, mechanical space or shaft (307.5.5)
16. Spill emergency-response equipment room on each floor (307.2.12)
17. Ducts conveying explosives or flammable vapors, fumes, or dust shall extend directly to the exterior of the building without entering other spaces. Exhaust ducts shall not extend into or through ducts or plenums (1202.2.3). The exception to this is "ducts conveying vapor or fumes have flammable constituents less than 25% of their lower flammable limit."
18. Ventilation manual emergency shut-off located outside the room adjacent to principle access door. (1202.2.3)
19. Hazardous Material Management Plan (HMMP) required (307.1.6)
20. Spill control: Liquid tight floor and sill; 20 minute sprinkler drainage; secondary containment for spills and fire protection water (307.2.3)
21. Panic hardware required for latching or locking doors (1018)
22. Automatic or self-closing doors required (1018)
23. Automatic sprinkler system required, minimum Ordinary Hazard Group 3 over 3,000 square feet (904.2.6.4)
24. Class I standpipe is required for occupancies four stories or more, but less than 150 feet in height (Table 9 A)

NFPA 30: Flammable and Combustible Liquids Code

Liquid Classification: Combustible liquids have a flash point at or above 100° (37.8°C) and are classified as follows:

- i. Class II: Liquids with a flash point at or above 100°F (37.8°C) and below 140°F (60°C)
- ii. Class III A: Liquids with a flash point at or above 140°F (60°C) and below 200°F (93°C)
- iii. Class III B: Liquids with a flash point at or above 200°F (93°C)

Flammable liquids have a flash point below 100°F (37.8°C) and a vapor pressure not greater than 40 pounds per square inch (absolute) (2,068 mm Hg) at 100°F (37.8C). Flammable liquids are classified as follows:

- i. Class I A: Liquids with flash point below 73°F (22.8C) and a boiling point below 100°F (37.8°C)

ii. Class I B: Liquids with flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C)

iii. Class I C: Liquids with flash points at or above 73°F (22.8°C) and below 100°F (37.8°C)

Storage Cabinets: Not more than 120 gallons (454 L) of Class I, Class II, and Class III, a liquid may be stored in a storage cabinet. Of this total, not more than 60 gallons (227 L) may be of Class I and Class II liquids and not more than three (3) such cabinets may be located in a single Fire Area, except that, in an industrial occupancy, additional cabinets may be located in the same Fire Area if the additional cabinets (not more than a group of three (3) are separated from other cabinets or group of cabinets by at least 100 feet (30m).

In addition to the above standards it will be necessary during the design phases of the project to work closely with the representatives. The project team may need to incorporate additional requirements as laboratory and support spaces are more definitively outlined.

NFPA 45: Fire Protection For Laboratories Using Chemicals

Means of Egress: The means of egress for laboratory units and laboratory work areas shall comply with NFPA 101.

Access to Exits: A second means of access to an exit shall be provided from a laboratory work area if any of the following situations exist:

i. A laboratory work area contains an explosion hazard so located that an incident would block escape from or access to the laboratory work area.
ii. A fume hood in a laboratory work area is located adjacent to the primary means of exit access.
iii. A compressed gas cylinder in use which is larger than lecture bottle size, and contains a gas which is flammable or has a hazard rating of 3 or 4 and would prevent safe egress in event of accidental release of cylinder contents.
iv. The required exit doors of all laboratory work areas within Class A or Class B laboratory units shall swing in the direction of exit travel.

Furniture and Equipment: Furniture and equipment in laboratory work areas will be arranged so that means of access to an exit may be reached easily from any point.

Explosion Hazard: Explosion hazard is considered to exist if materials with a reactivity rating of 4 are stored or used, or if highly exothermic reactions or procedures without established properties are planned, or if high pressure reactions are planned.

Program information does not indicate that explosion hazards, as described above, exist in this project.

NFPA 101: Life Safety Code

Means of Egress: Where exits are not immediately accessible from an open floor area, safe and continuous passageways, aisles, or corridors will be maintained leading directly to every exit and will be arranged as to provide convenient access for each occupant to at least two exists by separate ways of travel.

Exit access will be so arranged that it will not be necessary to pass through any area identified under protection from hazards in Chapter 28.

Corridor Width: The minimum width of any corridor or passageway serving as a required exit, exit access, or exit discharge will be 44 inches.

Construction Type

The following tables present the maximum allowable height and floor areas for the Engineering Building Unit 3 for each allowable California Building Code construction types and occupancies. Table 6-A of the California Building Code provides additional information regarding the specific fire resistive requirements of building components for each construction type. The maximum allowable area for this site assumes increases in basic allowable area for multi-story buildings, 100% increase for a fully sprinkled building (except "H-8" area since sprinklers are mandated by code for "H-8" occupancy per the Fire Marshal), and a 100% increase for due to side yard separations.

Based on California Building Code Chapter 5 and Table 5-B

B or H-8 Occupancy

Construction Type	Allowable Height	Basic Allowable Area	Maximum Allowable Area
I	Unlimited	Unlimited	Unlimited (1)
II FR	160 ft, 12 stories	39,900	159,600
II One Hour	65 ft, 4 stories (2)	18,000	144,000 (1)(3)

(1) Includes allowable increase for multiple floor (x2), sprinkled (x2)
(2) Design exceeds allowable height
(3) Includes allowable increase for 40 ft. sideyards (x2)

A Occupancy
Allowable Area Tables

Construction Type	Allowable Height	Basic Allowable Area
I	Unlimited	Unlimited
II FR	160 ft, 4 stories	299,000
II One Hour	65 ft, 2 stories	13,500

The assumption for the purposes of this DPP is that the Engineering Building Unit 3 is of Type I construction.

When a building houses more than one occupancy, the area of the building shall be such that the sum of the ratios of the actual area for each separate occupancy divided by the total allowable area for each separate occupancy shall not exceed one.

High Rise Requirements
Group B occupancies having floors used for human occupancy more than 75 feet above the lowest level of the fire department vehicle access are classified as high-rise buildings. High-rise buildings are required to be Type I or Type II-FR construction, to have automatic sprinkler protection and required to meet all the requirements of California Building Code Section 403. These requirements include smoke detection, smoke control, pressurized exit stairs with vestibules, fire alarm and communication system, a central control station for fire department operations, elevator lobbies, and stand-by-power, light and emergency systems.

For the purpose of this DPP it is assumed that the Engineering Building Unit 3 is *not* of high rise construction.

Campus Requirements
The project will be subject to campus requirements, including:

- UCR Campus Standards and Design Criteria
- Environmental, Health and Safety Regulatories
- Environmental Impact Report (EIR)
- Seismic policy

Reviewing Authorities
UCR Capital Planning staff will review the final project planning documents. The UCR Campus Architect serves as the local Building Official. In addition to the building Official, design and construction documents will also be reviewed, approved, and stamped by the Division of the State Architect (DSA) for accessibility compliance, and the state Fire Marshal (SFM), for Fire/Life Safety compliance. Documents may be reviewed with various campus agencies for compliance with the campus requirements.

UNIVERSITY of CALIFORNIA Riverside

7.0
SUSTAINABLE DESIGN

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

CO ARCHITECTS

7.1 OVERVIEW
7.2 LEED™ ANALYSIS

7.0
SUSTAINABLE DESIGN

7.1 OVERVIEW

UCR has committed to a sustainable design approach in its new building projects. It has further established minimum standards for such efforts as specified in the UCR "Campus Green Building Baseline Substantiation" document dated October 3, 2005, and in the "UC Policy on Green Building Design and Clean Energy Standards." The EBU3 project will easily exceed these minimum requirements. Based on the following preliminary analysis, the facility can achieve a LEED™ certified rating with at least 31 points and may be able to achieve a silver rating if additional measures are deemed possible in the design phases of the project.

All LEED™ prerequisite conditions are achievable. The analysis indicates the status of possible points for each category and recommends the likelihood of achieving points for that category as "Yes," "Possible" and "No." It is important that further investigations be carried out early in the design phases of the project.

7.2 LEED™ ANALYSIS

LEED-NC

LEED-NC Version 2.1 Registered Project Checklist

UCR Engineering Building Unit 3
University of California, Riverside

			Yes	Possible	No
Sustainable Sites		**Possible 14** Points	7	2	5
Prereq 1	**Construction Activity Pollution Prevention**	Required	Y		
Credit 1	**Site Selection**	1	1		
Credit 2	**Development Density & Community Connectivity**	1		1	
Credit 3	**Brownfield Redevelopment**	1			1
Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	1		
Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1		1	
Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1			1
Credit 4.4	**Alternative Transportation**, Parking Capacity	1	1		
Credit 5.1	**Site Development,** Protect or Restore Habitat	1			1
Credit 5.2	**Site Development,** Maximize Open Space	1	1		
Credit 6.1	**Stormwater Design,** Quantity Control	1			
Credit 6.2	**Stormwater Design,** Quality Control	1			
Credit 7.1	**Heat Island Effect,** Non-Roof	1	1		1
Credit 7.2	**Heat Island Effect,** Roof	1	1		
Credit 8	**Light Pollution Reduction**	1	1		1

			Yes	?	No
Water Efficiency		**Possible 5** Points	2	1	2
Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	1		
Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1		1	
Credit 2	**Innovative Wastewater Technologies**	1			1
Credit 3.1	**Water Use Reduction**, 20% Reduction	1	1		
Credit 3.2	**Water Use Reduction**, 30% Reduction	1			1

			Yes	?	No
Energy & Atmosphere		**Possible 7** Points	6	1	2
Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required	Y		
Prereq 2	**Minimum Energy Performance**	Required	Y		
Prereq 3	**Fundamental Refrigerant Management**	Required	Y		
Credit 1	**Optimize Energy Performance**	1 to 10	4		
Credit 2	**On-Site Renewable Energy**	1 to 3			1
Credit 3	**Enhanced Commissioning**	1		1	
Credit 4	**Enhanced Refrigerant Management**	1	1		
Credit 5	**Measurement & Verification**	1	1		
Credit 6	**Green Power**	1			1

			Yes	?	No
Materials & Resources		**Possible 13** Points	4		9
Prereq 1	**Storage & Collection of Recyclables**	Required	Y		
Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1			1
Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1			1
Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1			1
Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1	1		
Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1			1
Credit 3.1	**Materials Reuse**, 5%	1			1
Credit 3.2	**Materials Reuse**,10%	1			1
Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1	1		
Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1			1
Credit 5.1	**Regional Materials**, 20% Extracted, Processed & Manufactured Regio	1	1		
Credit 5.2	**Regional Materials**, 50% Extracted, Processed & Manufactured Regio	1			1
Credit 6	**Rapidly Renewable Materials**	1			1
Credit 7	**Certified Wood**	1	1		

			Yes	?	No
Indoor Environmental Quality		**Possible 15** Points	10	3	2
Prereq 1	**Minimum IAQ Performance**	Required	Y		
Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required	Y		
Credit 1	**Outdoor Air Delivery Monitoring**	1	1		
Credit 2	**Increased Ventilation**	1	1		
Credit 3.1	**Construction IAQ Management Plan**, During Construction	1	1		
Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1	1		
Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1	1		
Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1	1		
Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1	1		
Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1		1	
Credit 5	**Indoor Chemical & Pollutant Source Control**	1	1		
Credit 6.1	**Controllability of Systems**, Lighting	1		1	
Credit 6.2	**Controllability of Systems**, Thermal Comfort	1	1		
Credit 7.1	**Thermal Comfort**, Design	1	1		
Credit 7.2	**Thermal Comfort**, Verification	1		1	
Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1			1
Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1			1

			Yes	?	No
Innovation & Design Process		**Possible 5** Points	2		
Credit 1.1	**Innovation in Design**: To be Determined - HVAC Improvements	1	1		
Credit 2	**LEED® Accredited Professional**	1	1		

		Yes	?	No
Project Totals (pre-certification estimates)	**Possible 9** Points	31	7	20

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

UNIVERSITY of CALIFORNIA Riverside

8.0
BUDGET AND COST ANALYSIS

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM

DPP

CO ARCHITECTS

CONSTRUCTION COST SUMMARY

Section						
Building and Site Work March 2006						
		DPP Cost Plan		**Budget**		
Main Building		$430.28	$39,381,026		
Sitework		$30.92	$2,830,014		
		$461.20	**$42,211,040**	$421.74	**$38,600,000**
Escalation from March 2006 to July 2009					
April 2006 - January 2007	4.0%	$18.67	$1,708,650		
January 2007 - January 2008	7.0%	$33.59	$3,074,378		
January 2008 - January 2009	7.0%	$35.94	$3,289,585		
Janaury 2009 - July 2009 **(Start of Construction)**	4.0%	$21.98	$2,011,346		
TOTAL ESTIMATED BUILDING & SITEWORK CONSTRUCTION COST ESCALATED TO CONSTRUCTION START DATE		**$571.37**	**$52,295,000**		

MAIN BUILDING COMPONENT SUMMARY

Element		Subtotal	Total	Cost / SF	Cost / SF
A) Shell (1-5)			**$11,964,644**		**$130.73**
1 Foundations		$1,595,976		$17.44	
2 Vertical Structure		$1,719,830		$18.79	
3 Floor & Roof Structures		$3,744,416		$40.91	
4 Exterior Cladding		$4,333,688		$47.35	
5 Roofing & Waterproofing		$570,734		$6.24	
B) Interiors (6-7)			**$3,273,948**		**$35.77**
6 Interior Partitions, Doors & Glazing		$1,940,330		$21.20	
7 Floor, Wall & Ceiling Finishes		$1,333,618		$14.57	
C) Equipment and Vertical Transportation (8-9)			**$2,362,135**		**$25.81**
8 Function Equipment & Specialties		$1,898,279		$20.74	
9 Stairs & Vertical Transportation		$463,856		$5.07	
D) Mechanical and Electrical (10-13)			**$13,671,926**		**$149.38**
10 Plumbing Systems		$1,550,852		$16.94	
11 Heating, Ventilating & Air Conditioning		$8,247,548		$90.11	
12 Electric Lighting, Power & Communications		$3,451,606		$37.71	
13 Fire Protection Systems		$421,920		$4.61	
E) Site Construction (14-16)			**$0**		**$0.00**
14 Site Preparation & Demolition		$0		$0.00	
15 Site Paving, Structures & Landscaping		$0		$0.00	
16 Utilities on Site		$0		$0.00	
Subtotal			**$31,272,653**		$341.68
Gen'l Cond, Bonds and Insurance	8.00%		**$2,501,812**		$27.33
Subtotal			**$33,774,465**		$369.02
General Contractor's Fee	6.00%		**$2,026,468**		$22.14
Subtotal			**$35,800,933**		$391.16
Design Contingency	10.00%		**$3,580,093**		$39.12
Subtotal			**$39,381,026**		$430.28
Escalation to Start Date (July 2009)	23.89%		**$9,408,127**		$102.79
TOTAL ESTIMATED CONSTRUCTION COST			**$48,789,153**		**$533.07**

Total Area: 91,525 SF

SITEWORK COMPONENT SUMMARY

Element			Subtotal	Total	Cost / SF	Cost / SF
E) Site Construction (14-16)				**$2,247,327**		**$30.37**
14	Site Preparation & Demolition		$435,565		$5.89	
15	Site Paving, Structures & Landscaping		$1,109,513		$14.99	
16	Utilities on Site		$702,250		$9.49	
	Subtotal			**$2,247,327**		$30.37
	Gen'l Cond, Bonds and Insurance	8.00%		**$179,786**		$2.43
	Subtotal			**$2,427,113**		$32.80
	General Contractor's Fee	6.00%		**$145,627**		$1.97
	Subtotal			**$2,572,740**		$34.77
	Design Contingency	10.00%		**$257,274**		$3.48
	Subtotal			**$2,830,014**		$38.24
	Escalation to Start Date (July 2009)	23.89%		**$676,090**		$9.14
	TOTAL ESTIMATED CONSTRUCTION COST			**$3,506,105**		**$47.38**

Total Area: 74,000 SF

UNIVERSITY of CALIFORNIA Riverside

9.0
PROJECT SCHEDULE

ENGINEERING BUILDING UNIT 3
DETAILED PROJECT PROGRAM
DPP

CO ARCHITECTS

9.0
PROJECT SCHEDULE

The Project Schedule outlines the four phases for the Engineering Building Unit 3 project including the Detailed Project Program, Project Planning Guide (PPG), Design Phases, and Construction.

Detailed Project Program

The purpose of the Detailed Project Program Phase is to prepare a program, concept, cost model, and schedule to aid in preparation of the Project Planning Guide. The DPP phase began in November 2005 with the selection of CO Architects as the programming and planning consultant. The final DPP completion date is March 31, 2006.

Project Planning Guide (PPG)

The purpose of the Project Planning Guide is to provide specific project justification to the Office of the President based on information provided in the DPP. The PPG phase will be complete by March 2007 for allocation of funds by July 2007.

Design Phases

Following approval of funding for design, the University of California Riverside will proceed with selection of an Architect. The design process will begin with schematic design and continue through design development and preparation of construction documents. This process is anticipated to take approximately 15 months and include agency reviews and final revisions to bid documents.

Construction

The Construction process will begin with competitive bidding, followed by award of the construction contract and construction. Construction is anticipated to take approximately 27 months including award of the construction contract.