The Clark Enersen Partners

Wayne State College

Carhart Science Building

Renovation/Addition Program Statement

April, 2004

Revised June, 2004

The Clark Enersen Partners

Table of Contents

Table of Contents

Table of Contents

I.A. Background and History

The Carhart Science Building was built in 1969-1970 to house the department of Life Science and the department of Physical Sciences and Math which are part of the School of Natural and Social Sciences. The 58,568 gross square foot (GSF) building has 37,294 NSF net assignable square feet (NASF). Named for Wayne businessman and member of the state college governing board (1945-57) Ralph M. Carhart, the building is the only "wet lab" facility (i.e. equipped with lab utilities, fume hoods, benches, and special building systems) on campus.

Since the building was constructed 35 years ago, higher education science curriculum, technologies, and teaching methods have evolved significantly. The use of computers and electronic instrumentation to conduct experiments is widespread, putting strain on building mechanical and electrical systems. Few fumehoods were installed (one per lab at most) and current life/safety codes, safety procedures, and air quality standards cannot be met in the existing building.

In addition, the building is in need of general upgrade to address building code and ADA deficiencies and to create a more comfortable, modern campus building that meets the expectations of faculty, students, and the citizens of the state. Many students enrolled in the department are preparing for future careers in science, medicine, and technology. They understand that their ability to excel in these complex and competitive fields requires state-of-the-art skills and experience. Wayne State College's ability to recruit quality faculty and students will be increasingly difficult if facilities are not in place that reflect these expectations.

I.B. Project Description

The proposed project involves complete renovation of the 58,568 GSF building and the construction of a new ~~10,737~~ 20,217 GSF addition to the Carhart Science Building. The building renovation will involve a complete gutting of demising walls, insulation of exterior walls and new drywall demising walls, new roof, replacement of windows, new HVAC system, replacement of all laboratory fixed equipment (i.e. lab benches, cabinets, fumehoods), and replacement of restrooms with ADA facilities. The project will zone the building for maximum energy efficiency, creating an office suite on each floor which is heated, cooled, and ventilated separately from the classroom/laboratory zone on each floor.

The addition will provide two ADA-accessible entrances to the building, an ADA-accessible elevator/stair tower, and new ADA restrooms. The addition will house the more public components of the program, providing a welcoming entrance for visitors to the Planetarium, Observatory, and Natural History Museum. The Student Commons will also be housed in the addition, providing much-needed space for students to study and interact informally.

I.C. Purpose and Objectives

Specific goals and objectives for the project expressed by the Wayne State College administration, faculty, and Carhart Steering Committee include the following:

- Create a state-of-the-art science education facility to recruit and retain faculty and students
- Improve building functionality in light of current teaching techniques, curriculum
- Increase laboratory safety
- Meet all fire, life/safety, ADA codes
- Transform a dated building into an impressive campus entry feature
- Promote faculty/student interaction
- Provide natural daylighting where possible

- Provide greenspace/plaza/drop-off areas for public at the south end and as a terminus to the future campus commons on the north.
- Design an environmentally sensitive building toward LEED standards as a teaching/PR/stewardship goal as long as long term pay-back can be demonstrated
- Provide classrooms for 30 -50 Students
- Provide space suitable for student research (science major research emphasis)
- Provide shared instrument space
- Provide additional storage
- Provide visibility into the classrooms/laboratories from the corridor where possible
- Increase offices to standard office size
- Provide space for adjunct, interim faculty (1-2 per floor if possible)
- Create tiered classroom for student presentations, similar to Connell (45 students), capable of adapting for distance learning
- Integrate planning with concurrent LB309 projects – elevator/stair addition, fire sprinkler, fire alarm
- Provide identifiable donor opportunities
- Create inviting, friendly atmosphere
- Accommodate hazardous materials storage and disposal as per campus standards
- Create public entry, lobby with bus drop off
- Upgrade planetarium appearance, furnishings
- Improve observatory access, exposure
- Facilitate faculty-to-faculty communication as well as allow for faculty supervision of students in labs

Programming Team

The following individuals generously contributed to the development of the Program Statement for the Carhart Science Building Addition/Renovation Program Statement

Steering Committee

Robert McCue, Dean of the School of Natural and Social Sciences
Carolyn Murphy, Vice President for Administration and Finance
Derby Johnson, Director of Facility Services
Shawn Pearcy, Chair Department of Life Sciences
Tamara Worner, Chair Department of Physical Sciences and Math
David Fuller, Vice President for Academic Affairs
Molly Schroeder, Office Assistant
Ruth Smith,
Nichole Franzluebbers, Student
Collette Donner, Custodian

Faculty

Jeffrey Bauer, Math
Doug Christensen, Biology
Buffany DeBoer, Biology
Mary Ettel, Chemistry
John Fuelberth, Math
Yahia Hamada, Chemistry
Mark Hammer, Biology
Sally Harms, Chemistry
Barbara Hayford, Biology
Marian Ingwersen, Biology
Paul Karr, Chemistry
Glenn Kietzmann, Biology
Rex Murray, Chemistry
James Paige, Math
David Peitz, Chemistry
Barbara Peitzmeier, Biology
Carl Rump, Earth Science
Todd Young, Physics
Barb Engebretsen, Health, Human Performance & Sport

The Clark Enersen Partners – Consultants

JoAnne Kissel, Planner, Principal and Project Manager
Greg Lattig, AIA, Senior Principal, Principal Architect and Laboratory Planner
TJ Schirmer, PE, Principal and Project Electrical Engineer
Robert Braden, PE, Project Mechanical Engineer
Andrew Stepp, Associate, Project Architect
Jeffre Chadwick, Associate, Architectural Designer

II.A. Data Supporting the Funding Request

The most compelling rationale behind the renovation and addition to Carhart Science Building is the need to address the physical and programmatic deficiencies inherent in a 35-year old science building. The building has not been significantly upgraded to address basic changes in curriculum offerings, building codes, safety practices, research methods, technology, and general appearance which are important factors in attracting students and faculty. These deficiencies are described in detail in Section V of this document.

ENROLLMENT TRENDS

In addition to the deficiencies associated with an aging facility, the need for the project is demonstrated by enrollment trends. In 2001, the number of students majoring in the two departments housed in Carhart Science Building has increased an average of 12% each year as illustrated in the table below. Life Sciences majors increased 39% from 2001 to 2003 and Physical Science and Math majors increased 18%.

MAJORS ENROLLMENT: 3 YEAR TREND	fall 2001	fall 2002	fall 2003	ave. annual change
Life Sciences Department	122	139	170	39%
Physical Sciences & Math Department	187	195	220	18%
Total	**309**	**334**	**390**	**26%**

The increased enrollment trend actually began earlier but data regarding pre-professional majors was tracked differently, skewing the trend analysis.

MAJORS ENROLLMENT: 5 YEAR TREND	fall 1999*	fall 2000*	fall 2001	fall 2002	fall 2003	ave. annual change
Life Sciences	217	182	122	139	170	-22%
Phys Sciences & Math	154	163	187	195	220	43%
Total	**371**	**345**	**309**	**334**	**390**	**5%**

Note: Years noted with asterisks (*) included all pre-professionals in life sciences.

This trend toward increased enrollments in the two departments housed in Carhart Science Building is significant when compared with a 7% decline in campus enrollment during the same time period as illustrated in the table below.

CAMPUS-WIDE ENROLLMENT	fall 1999	fall 2000	fall 2001	fall 2002	fall 2003	% increase
Undergrad headcount (1)	2,974	2,923	2,772	2,666	2,728	
Graduate headcount	642	608	562	571	623	
Total headcount	**3,616**	**3,531**	**3,334**	**3,237**	**3,351**	**-7%**
Undergrad FTE (2)	2,780	2,706	2,610	2,520	2,588	
Graduate FTE	213	206	209	220	261	
Total FTE	**2,993**	**2,912**	**2,819**	**2,740**	**2,849**	**-5%**

Notes: (1) headcount = individual student count. (2) FTE = full time equivalent students

Two popular health sciences programs offered at Wayne State College are aimed at recruiting and retaining rural Nebraska students who want a rural health practice. The Rural Health Opportunities Program (RHOP) offers training in dentistry, medicine, pharmacy, medical technology, and dental hygiene and a cooperative program between Wayne State College and the University of Nebraska Medical Center. The Mid-America Rural Health Opportunities Program (MARHOP) offers training in physical and occupational therapy and pharmacy and is a cooperative program between Wayne State College and Creighton University. As the table below indicates, together these two programs have increased 65% since 1999.

PROGRAM ENROLLMENT	fall 1999	fall 2000	fall 2001	fall 2002	fall 2003	% increase
Accepted students - MARHOP	9	5	9	6	18	**100%**
Accepted students - RHOP	12	11	18	14	15	**25%**
Total students enrolled	**43**	**56**	**50**	**52**	**71**	**65%**

Research

Students majoring in the departments of Life Sciences or Physical Sciences and Mathematics are now required to do a terminal project, thesis, or research. This has resulted in a marked increase in unscheduled class lab utilization. It also creates challenges in setting up and equipping labs for both instruction and research and makes it difficult to control the laboratory environment as required for ongoing research projects.

Biological Research Infrastructure Network, or BRIN, is a partnership between Wayne State College and the University of Nebraska Medical Center for the purpose of strengthening undergraduate research and enhancing faculty development through research. Through the program, Wayne State College is able to purchase new equipment and provide students with resources to gain research experience that will prepare them for further scientific study and employment.

Outreach

Wayne State College sponsors many outreach activities which bring visitors to the campus. For instance, the College hosts an annual gathering of the Junior Academy of Science which attracts visitors from around the region. The Natural History Museum is currently being improved and will re-open in the spring of 2004 for use as a teaching and outreach facility. The facility which attracts the greatest visitation is the Planetarium. In the past three years, attendance to shows at the Planetarium has increased 14% as illustrated below.

PLANETARIUM ATTENDENCE	2000-2001	2001-2002	2002-2003	increase
School Groups	27	52	36	33%
Non-school Groups	13	10	11	-15%
General Public	22	20	23	5%
Total Attendence	**2800**	**3700**	**3200**	**14%**

Grant Activity

The Math and Science Departments actively seek grant funding for programs and equipment, averaging a 68% success rate (dollars awarded to dollars requested) for the last five years. This indicates an aggressive department and the need for facilities that will recruit and retain faculty committed to grant-funded teaching and research activities.

year	# submitted	$ applied for	# awarded	$ awarded	# hit rate	$ hit rate
1999	2	$11,934	2	$ 13,000	100%	109%
2000	3	$ 80,022	0	$0	0%	0%
2201	3	$ 6,600	2	$ 4,400	67%	67%
2002	10	$ 290,262	10	$ 267,720	100%	92%
2003	12	$ 277,578	9	$ 170,945	75%	62%
5-Yr Average	**6**	**$ 133,279**	**5**	**$ 91,213**	**77%**	**68%**

II.B. Alternatives Considered

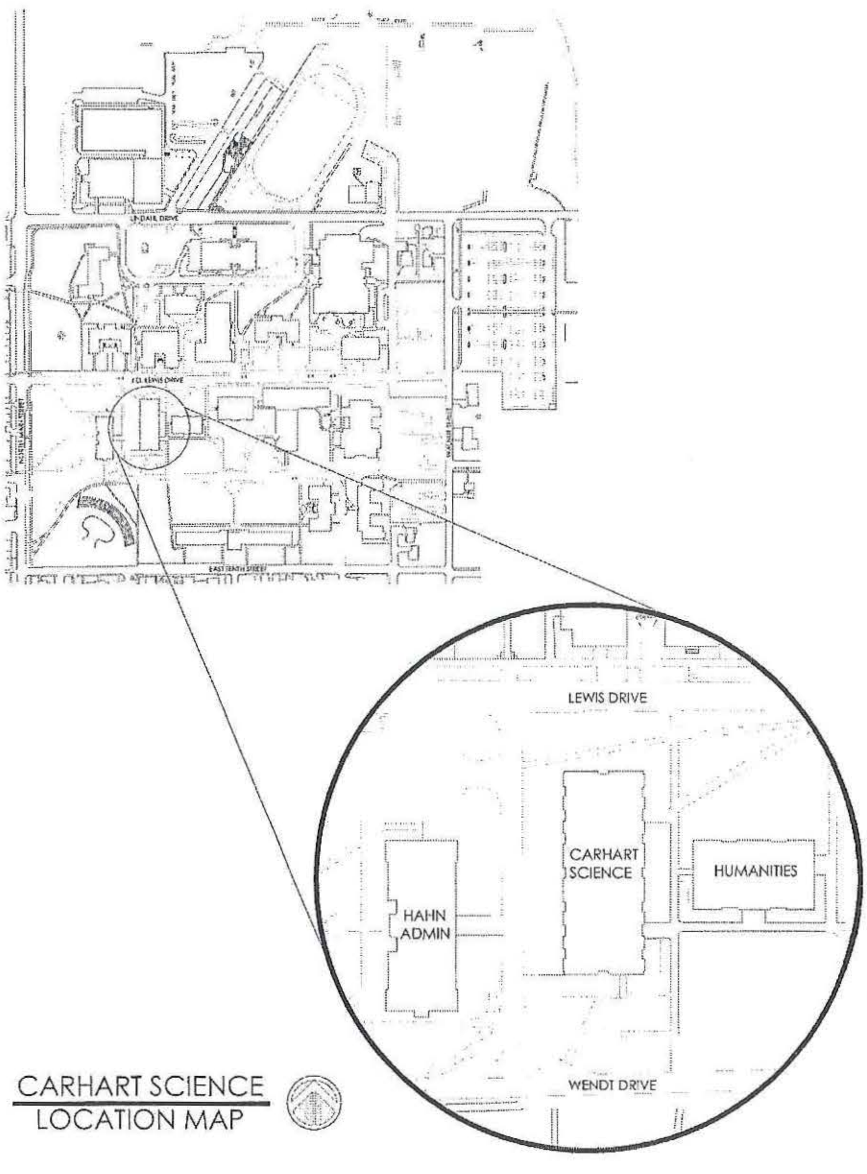
In the course of the current planning process, the project team and steering committee explored the replacement of Carhart Science Building with a new wet lab building and conversion of Carhart to non-laboratory functions. This alternative offered several advantages:

- The higher cost of construction associated with laboratory spaces and specialized systems is confined to a smaller building.
- Rather than retrofitting an old building with all its inherent limitations, the new building would be designed for maximum efficiency in lab layout, energy conservation, and environmental quality.
- The space vacated in Carhart can be renovated at a much lower cost for other campus needs such as general purpose classrooms, administrative and faculty offices, student services, campus technology, storage, and campus support.
- The construction of a new wet lab building facilitated a phasing plan that was less disruptive to the College.

Despite these benefits, this was not selected because the additional funding necessary to renovate Carhart for other campus uses (estimated at $7.8 million) was not currently available.

III.A. Location

The project is located in Wayne County, in Wayne, Nebraska, on the Wayne State College campus. See location map below.

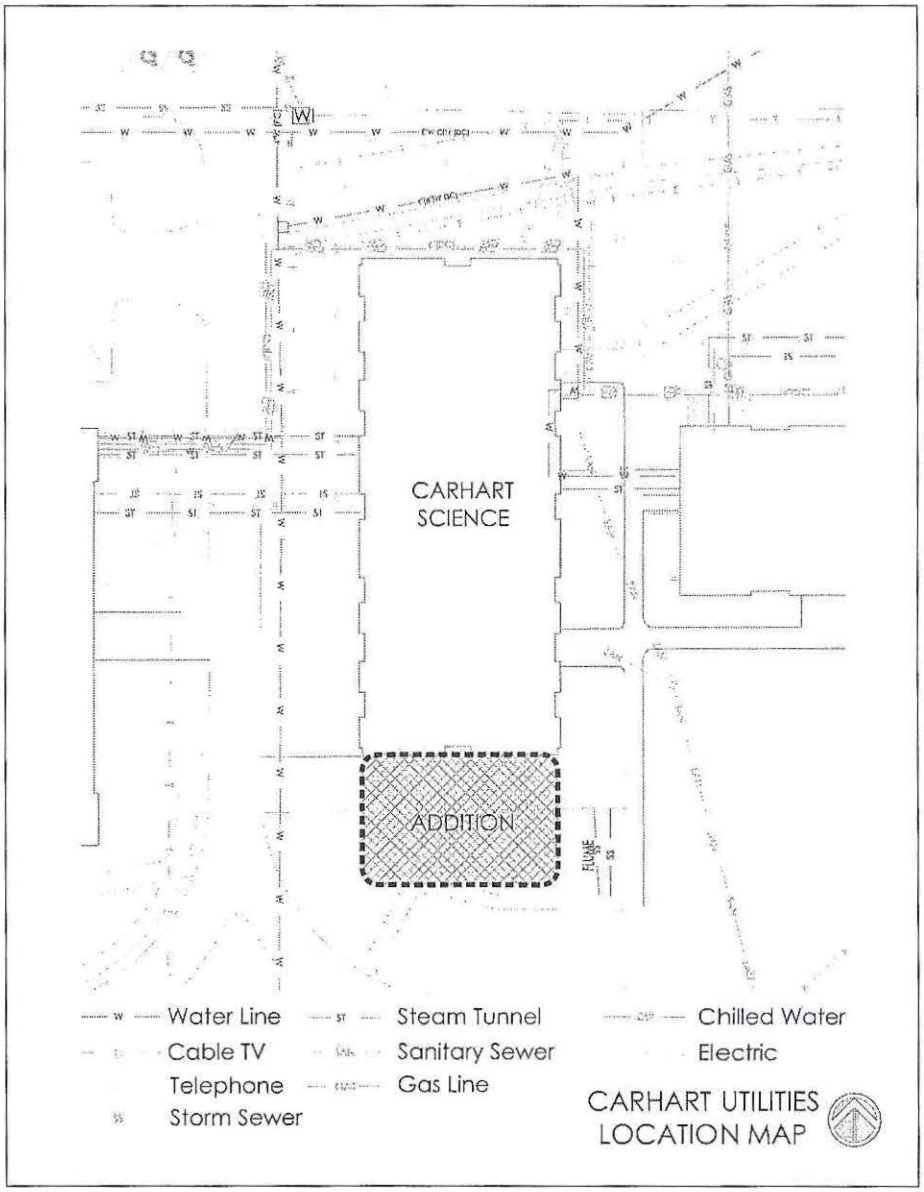


CARHART SCIENCE
LOCATION MAP

III.B. Proposed Site & Existing Utilities

Utilities available at Carhart Science Building include sanitary sewer, domestic water, central plant high pressure steam and condensate return, central plant chilled water, natural gas, electrical power and telecommunications. All of these utilities will be reused to serve the needs of the science building into the future.

An enlarged and colored version of the site utilities map to the right can be found in the Appendix of this document (Appendix 4).



III.D. Statewide building inventory

The Carhart Science Building is Building 1284 in the Department of Administrative Services Building Inventory.

III.E. Influence of project on existing site conditions

Relationship to Neighbors and Environment

The project is surrounded by three historic campus buildings – Hahn Administration Building (1926), Connell Hall (1923), and Humanities Building (1912). It is also within view of the campus' signature historic feature, the Willow Bowl. The design of Carhart Science Building (1969) is dramatically different in style and massing than any of these structures and lacks both physical and figurative connections with them. The proposed project offers opportunities to improve Carhart's relationship with its neighbors in several ways. The project will create new glass elements on both the north and south ends of the building to establish more building transparency. The addition will provide entry access on both the east and west sides of the building, improving pedestrian traffic flow. It will also create more visibly active space, creating views into the building and out toward the Commons on the north and Willow Bowl on the south.

The development of the site and the location of the addition on the south side of Carhart Science Building was an outgrowth of the following factors:

- The need to create an accessible entrance into the existing Planetarium.
- The desire to create a strong new entry feature on the southwest corner of the campus visible from Willow Bowl, as recommended in the 2002 Master Plan.
- The need to relocate the observatory to the south side of the building for optimal star gazing with an accessible route.
- The need for a new bus drop-off area that does not conflict with campus vehicular or pedestrian circulation
- The need to relocate the greenhouse to a location with southern exposure.

- The desire to minimize conflict with the proposed pedestrian commons on the north end of the building.

Parking and Circulation

Circulation around the project site will be altered as a result of the Commons and Street Improvements project. In addition to the primary changes identified above – creation of a bus drop-off area on the south and a new Commons on the north – the Carhart site will be altered with the creation of a modified service drive between Hahn and Carhart. Gulliver Drive will be closed to through traffic.

Limited parking including handicapped stalls will be provided along Wendt Drive and in a lot north of Hahn Administration Building.

IV. A. Current Campus Comprehensive Plan, Updates and Revisions

The Campus Master Plan for Wayne State College, dated February, 2002 (referred to as the Campus Facilities Master Plan) was received by the Board of Trustees of the Nebraska State Colleges. This Master Plan contains a recommendation to renovate and add on to Carhart. The Campus Facilities Master Plan also presents guidelines and offers recommendations for improvements to land use, landscaping, open space, circulation, utilities, and campus aesthetic issues. As design work proceeds, the Campus Facilities Master Plan should be consulted to insure that all future work complies with the Master Plan guidelines.

IV.B. Consistency with Agency's Comprehensive Capital Facilities Plan

The Campus Master Plan for Wayne State College, dated February, 2002 (referred to as the Campus Facilities Master Plan) also acts as the College's Comprehensive Capital Facilities Plan. The renovation is an important step in the overall campus facilities plan.

IV.C. Consistency with CCPE Project Review Criteria/Statewide Plan

The renovation of Carhart Science Building will meet criteria established by the Coordinating Commission for project review as follows:

1. Compliance and consistency with Comprehensive Statewide Plan. The Comprehensive Statewide Plan identifies the role and mission of the three State Colleges. Providing adequate, efficient and accessible facilities for science instruction at WSC is critical to support the role and mission of the College.

2. Compliance and consistency with the Statewide Facilities Plan. It is a goal of the Statewide Facilities Plan to create a physical environment at each of the state's postsecondary institutions that supports its role and mission; is well-utilized and effectively accommodates space needs; is safe, accessible, cost effective, and well-maintained; and is sufficiently flexible to adapt to future changes in programs and technologies. The proposed project is consistent with these goals.

3. Assess duplication of facilities. Carhart Science Building is the only wet lab facility on campus and involves some of the most specialized spaces on campus -- laboratories, planetarium, greenhouse, and natural history museum. These spaces require more intensive mechanical and ventilation systems which will be provided by zoning the building, thus avoiding duplication of systems and controlling costs.

4. Sufficient information to review the proposal. Every attempt has been made in this document to provide adequate information for review by Wayne State College representatives, the State College Board of Trustees, Coordinating Commission, and other agencies of the State of Nebraska.

V.A. Function and purpose of existing programs

The Carhart Science Building houses two departments of the College of Natural and Social Sciences – Life Sciences and Physical Science and Math. The following is an overview of the programs, majors, and courses associated with these two departments.

Life Sciences Department

The Biology/Life Sciences major provides students with career choices in biotechnology, organismal biology, environmental biology, and biology education. The Biology/ Life Sciences program also offers courses to students preparing for further study in Mortuary Science, Medical Technology, Respiratory Therapy, other health science fields. The department offers a BA or BS in Biology and concentrations in Food Science, Biology Education, Respiratory Therapy, Medical Technology, and Mortuary Science.

The department participates in two Health Sciences Programs -- Rural Health Opportunities Program (RHOP) and the Mid-America Rural Health Opportunities Program (MARHOP). RHOP is a cooperative program between Wayne State College and the University of Nebraska Medical Center with the purpose of educating students who want to practice in rural communities in the fields of dentistry, medicine, pharmacy, medical technology, and dental hygiene. MARHOP is a cooperative program between Wayne State College and Creighton University with the purpose of educating students who want to practice in rural communities in the field of pharmacy, physical therapy and occupational therapy.

Physical Sciences & Mathematics Department

The department of Physical Sciences and Mathematics offers majors in Chemistry and Math, a minor in Physics, and field endorsements in Physical Sciences and Natural Science.

The major in Chemistry (BA or BS) provides students with the scientific and professional knowledge basic to pre-professional tracks and careers in science. Subject concentrations are offered in Chemistry Education Concentration and Chemical Sciences Concentration. Student research projects involving an individual research project under the direction of a chosen instructor is required of majors. The department is also involved with the RHOP and MARHOP programs.

The major in Mathematics (BA or BS) is designed for those students who (1) plan to teach mathematics, (2) plan to pursue advanced work in the field of mathematics, (3) plan to apply mathematics in some technical field or (4) wish to derive pleasure and profit from the study of mathematics.

The courses in Physics are designed for those students who (1) plan to pursue further work in the field of physics, (2) plan to apply physics in the pre-professional program, (3) plan to teach physics in an academic setting, (4) have the intellectual curiosity to know and understand the physical world around them. Emphasis is placed upon the concepts of physical principles and how they interact with each other in the real world.

The field endorsement in Physical Sciences will qualify the student to teach courses in physical science, chemistry, physics and earth science for grades 7-12. The field endorsement in Natural Science will qualify the student to teach courses in General Science, Life Sciences, Physical Sciences, Chemistry, Physics, Biology and Earth Science for grades 7-12 in Nebraska.

The School of Natural and Social Sciences also offers pre-professional programs which are coordinated with fields of specialization at the University of Nebraska. Many of the courses required in these programs are offered in Carhart Science Building.

V.B. Square Footage of existing areas

The table below summarizes the existing space in Carhart Science Building by subject area.

1.0 Chemistry		Extg NASF	Subtotal	Totals
1.1 Teaching Laboratories				
301	General Chemistry	873		
306	Physical Chemistry	885		
307	General Chemistry	858		
310	General Chemistry	938		
311	Organic Chemistry	922		
314	Analytical/Bio Chemistry	961		
	Subtotal - Teaching Labs		**5,437**	
1.2 Research Laboratories				
317	Faculty Research Lab	296		
318	Faculty Research Lab	284		
323	Faculty Research Lab	286		
326	Faculty Research Lab	286		
	Subtotal – Research Labs		**1,152**	
1.3 Laboratory Support				
013	NMR Room	343		
030	Chemicals Storage	319		
029	General Chemical Storage	319		
302	Balance Room	116		
303	Oven	95		
304	Instrument Room	113		
305	Prep Room	140		
327	Chemical Storage	298		
308	Balance Room	114		
309	Prep Room	113		
312	Prep Room	129		
313	Prep Room/Glass Washing	91		
	Subtotal – Lab Support		**2,190**	

1.0 Chemistry (Cont.)		Extg NASF	Subtotal	Totals
1.4 Office and Office Support				
315	Faculty Office	119		
316	Faculty Office	105		
319	Faculty Office	112		
320	Faculty Office	105		
321	Faculty Office	108		
322	Faculty Office	108		
334	Faculty Office	111		
	Subtotal - Office		**768**	
	TOTAL CHEMISTRY			**9,547**

2.0 Life Sciences

2.1 Teaching Laboratories				
201	Zoology	959		
204	Botany	757		
205	General Biology	735		
209	Microbiology	767		
212	Anatomy & Phsiology	922		
215	Ecology	961		
	Subtotal - Teaching Labs		**5,101**	
2.2 Research Laboratories				
218	Faculty Research Lab	330		
221	Faculty Research Lab	309		
222	Faculty Research Lab	310		
227	Faculty Research Lab	301		
228	Faculty Research Lab	178		
	Subtotal - Research Labs		**1,428**	
2.3 Laboratory Support				
119	Prep Room	93		
202	Prep Room	132		
203	Biology Storage	188		
206	Incubator	137		
207	Cold Room	137		
208	Autoclaves	137		
210	Prep Room	160		
211	Prep Room	161		
214	Prep Room	111		
213	Prep Room	114		
	Subtotal - Lab Support		**1,370**	

2.0 Life Sciences		Extg NASF	Subtotal	Totals
2.4 Office and Office Support				
216	Faculty Office	102		
217	Faculty Office	99		
219	Faculty Office	95		
220	Faculty Office	100		
223	Faculty Office	93		
224	Faculty Office	96		
225	Faculty Office	102		
226	Faculty Office	99		
229	Faculty Office	99		
238	Faculty Office	111		
	Subtotal - Office		**996**	
	TOTAL LIFE SCIENCES			**8,895**

3.0 Math		Extg NASF	Subtotal	Totals
3.1 Teaching Laboratories				
	Subtotal - Teaching Labs	**0**		
3.2 Research Laboratories				
	Subtotal - Research Labs	**0**		
3.3 Laboratory Support				
	Subtotal - Lab Support	**0**		
3.4 Office and Office Support				
104	Faculty Office	116		
105	Faculty Office	160		
103	Faculty Office	115		
106	Faculty Office	110		
102	Faculty Office	105		
107	Faculty Office	127		
134	Faculty Office	119		
	Subtotal - Office		**852**	
	TOTAL MATH			**852**

4.0 Earth Sciences / Physics		Extg NASF	Subtotal	Totals
4.1 Teaching Laboratories				
124	Earth Science Lab	961		
007	General Physics	478		
009	General Physics	960		
011	Electronics Lab	402		
128	Faculty Research Lab	325		
135	Faculty Research Lab	396		
	Subtotal - Teaching Labs		**3,522**	
4.2 Resesarch Laboratories				
023	Faculty Research Lab	406		
	Subtotal – Research Labs		**406**	
4.3 Laboratory Support				
010	Electronics Storage	151		
012	Storage	345		
017	Dark Room	218		
016	Storage Room	163		
125	Prep Room	113		
	Subtotal – Lab Support		**990**	
4.4 Office and Office Support				
021	Faculty Office	104		
022	Faculty Office	100		
136	Faculty Office	118		
127	Faculty Office	137		
	Subtotal - Administrative		**459**	
	TOTAL EARTH SCIENCES/PHYSICS			**5,377**

5.0 Shared		Extg NASF	Subtotal	Totals
5.1 Teaching Laboratories				
118	General Education Biology	877		
006	Computer Lab	1,018		
	Subtotal – Teaching Labs		**1,895**	
5.2 Research Laboratories				
	Subtotal - Research Labs		**0**	

5.0 Shared (Cont.)		Extg NASF	Subtotal	Totals
5.3 Laboratory Support				
237	Animal Room	318		
236	Animal Room	178		
235	Animal Room	135		
121	Prep Room	86		
123	Faculty Prep	114		
	Subtotal – Lab Support		**831**	
5.4 Office and Office Support				
120	Faculty Lounge	438		
110	Science library	709		
115	Conference Room	251		
112	Copy Room	189		
111	Mail Room	92		
114	Reception	192		
	Subtotal - Office and Office Support		**1,871**	
5.5 Classrooms				
101	Lecture	488		
122	Lecture	922		
130	Lecture	617		
131	Lecture	617		
132	Lecture	617		
333	Lecture	650		
	Subtotal - Classrooms		**3,911**	
5.6 Specialized Shared				
019	Natural History Museum	755		
020	Museum Storage	335		
B1	Herbarium	352		
B2	Planetarium	1043		
001	Storage	329		
015	Museum Storage	650		
PH	Observatory	427		
	Subtotal - Specialized Shared		**3,891**	
5.7 Student Interactive Areas				
324	Tutor Room	224		
	Subtotal - Student Interactive		**224**	
	TOTAL SHARED			**12,623**

	TOTAL EXISTING NASF	**37,294**

V.C. Utilization of existing space

As the tables below indicate, classroom and class lab utilization in Carhart Science Building for the 2003 fall semester was approximately 75% and 55% respectively. Space utilization for the spring semester was approximately 48% for both classrooms and class labs which reflects the heavier scheduling of lecture-based instruction in the fall semester each year for incoming students. Calculations are based on a full-time use assumption of 30 hours for classrooms and 20 hours for class labs.

Carhart Science Building utilization is comparable to campus-wide space utilization rate which in the fall of 2003, was approximately 68% for classrooms and 57% for classlabs. Of the 27 classrooms and class labs on campus with 90% or greater utilization, four, or 15% are located in Carhart Science Building (rooms 118, 122, 215, 307). It should be noted that the data indicates that the utilization rates are highest for larger classrooms and class labs (e.g. 40-60 student stations) and lowest for small seminar rooms (e.g. 10- 20 student stations).

Classroom Utilization

FALL 2003 Rm #	NASF	student stations	sched hrs/wk	stations hrs/wk	available stations/wk	stations utilization	room use utilization
CS101	488	30	22	257	900	28.56%	73.33%
CS122	922	40	34	996	1,200	83.00%	113.33%
CS130	617	40	21	727	1,200	60.58%	70.00%
CS131	617	36	16	492	1,080	45.56%	53.33%
CS132	617	40	23	602	1,200	50.17%	76.67%
CS333	650	38	20	446	1,140	39.12%	66.67%
TOTALS	**3,911**	**224**	**136**	**3,520**	**6,720**	**52.38%**	**75.56%**

(6)

SPRING 2003 Rm #	NASF	student stations	sched hrs/wk	stations hrs/wk	available stations/wk	stations utilization	room use utilization
CS101	488	30	17	210	900	23.33%	56.67%
CS122	922	40	30	768	1,200	64.00%	100.00%
CS130	617	40	20	464	1,200	38.67%	66.67%
CS131	617	36	16	344	1,080	31.85%	53.33%
CS132	617	40	22	593	1,200	49.42%	73.33%
CS333	650	38	26	578	1,140	50.70%	86.67%
TOTALS	**3,911**	**224**	**131**	**2,957**	**6,720**	**44.00%**	**48.52%**

Class Lab Utilization

FALL 2003 Rm #	NASF	student stations	sched hrs/wk	stations hrs/wk	available stations/wk	stations utilization	room use utilization
006		25					
007		24					
CS009	960	18	15	183	360	50.83%	75.00%
CS118	877	32	24	400	640	62.50%	120.00%
CS124	961	30	10	181	600	30.17%	50.00%
CS201	959	24	6	87	480	18.13%	30.00%
CS204	757	32	16	297	640	46.41%	80.00%
CS205	735	23	12	226	460	49.13%	60.00%
CS209	767	20	6	108	400	27.00%	30.00%
CS212	922	21	6	108	420	25.71%	30.00%
CS215	961	23	18	354	460	76.96%	90.00%
CS301	873	25	3	30	500	6.00%	15.00%
CS306	885	18	3	24	360	6.67%	15.00%
CS307	858	21	18	318	420	75.71%	90.00%
CS310	938	21	12	220	420	52.38%	60.00%
CS311	922	20	9	171	400	42.75%	45.00%
CS314	961	20	6	105	400	26.25%	30.00%
TOTALS	**13,336**	**348**	**164**	**2,812**	**6,960**	**40.40%**	**54.67%**

+49
399

SPRING 2003 Rm #	NASF	student stations	sched hrs/wk	stations hrs/wk	available stations/wk	stations utilization	room use utilization
CS006	999	25	9	132	500	26.40%	45.00%
CS007	478	24	9	93	480	19.38%	45.00%
CS009	960	18	8	88	360	24.44%	40.00%
CS118	877	32	12	280	640	43.75%	60.00%
CS124	961	30	12	207	600	34.50%	60.00%
CS201	959	24	9	162	480	33.75%	45.00%
CS204	757	32	11	173	640	27.03%	55.00%
CS205	735	23	13	242	460	52.61%	65.00%
CS209	767	20	6	105	400	26.25%	30.00%
CS212	922	21	9	138	420	32.86%	45.00%
CS215	961	23	6	105	460	22.83%	30.00%
CS301	873	25	3	36	500	7.20%	15.00%
CS306	885	18	6	42	360	11.67%	30.00%
CS307	858	21	18	300	420	71.43%	90.00%
CS310	938	21	12	208	420	49.52%	60.00%
CS 314 → CS311	922	20	9	126	400	31.50%	45.00%
TOTALS	**13,852**	**377**	**152**	**2,437**	**7,540**	**32.32%**	**47.50%**

This program statement proposes seven classrooms in a different mix of sizes in Carhart Science Building. Rather than six classrooms in the 30-40 student station range, as exists currently, this program recommends four classroom/lecture halls in the 30-40 capacity range and two 50-station lecture halls. This mix helps meet the campus-wide need for larger lecture halls. A ten-person seminar room is also included to accommodate break-out discussion and small group study.

V.D. Physical deficiencies

Due largely to its age, the Carhart Science Building has many physical deficiencies which the proposed project seeks to correct. The deficiencies listed below can be found throughout the building.

Codes

- Lack of two exits in laboratories as required by code
- No ADA-accessible elevator

- No ADA-accessible restrooms
- Planetarium and Observatory are inaccessible
- Animal labs do not meet standards
- The building is not protected with a fire sprinkler system.

General Deficiencies

- Severe structural deflection causing waving floors and cracked walls (appears to have occurred soon after construction and is now stabilized)
- Most of the major mechanical equipment is original late 1960's equipment and is near the end of its useful life

Electrical & Telecommunications Deficiencies

- Inadequate number of 110V and 220V outlets for equipment in labs
- Electrical service and distribution equipment was original to the building and is reaching the end of its expected lifetime
- The building does not contain an emergency generator
- Ductwork is located above the main electrical switchboard, thus creating a code violation
- Loads are tapped ahead of the main circuit breaker that are not permissible to be tapped per the National Electrical Code
- Telecommunications cabling is not supported adequately above the ceiling per EIA/TIA standards
- Lighting primarily consists of inefficient T-12 lamps with magnetic ballasts
- Some lighting throughout the building is provided with incandescent lamps which are not as efficient and do not provide the expected life that fluorescent lamps provide
- Most exit signs contain incandescent lamps that make them more expensive to maintain and less visible in a smoke filled environment than LED-type exit signs
- Fixture lenses are missing on some lighting fixtures
- Some fluorescent lighting fixture lenses are yellowing, thus reducing total light output
- Electrical panelboard covers located in custodial closets are rusting
- Electrical panelboards located in custodial closets are not provided with proper clearance per the National Electrical Code

- The motor control center in the penthouse does not have adequate clearance per the National Electrical Code
- According to facility personnel, some of the electrical feeder conductors in the building are aluminum which has created problems in the past due to loose terminations
- Some electrical panelboards do not contain any room for future capacity
- Several electrical panelboards rated at 225 amps are indicated to be protected by 300 amp fuses, creating a code violation
- Many electrical receptacle faceplates are rusting

Mechanical Deficiencies

- Uneven climate control throughout building
- Poor ventilation throughout building but especially in labs
- Mechanical system does not meet current State of Nebraska Energy Code or ASHRAE Standard 90.1. This includes but is not limited to: constant volume reheat, lab ventilation systems over 15,000 cfm shall utilize VAV and/or energy recovery system, insufficient pipe insulation, simultaneous heating and cooling, etc.
- Dampers are not of the low leakage type, thus resulting in poor temperature controllability during damper shut-off and higher than acceptable infiltration levels.

Indoor Air Quality

- HVAC system does not meet current Indoor Air Quality Standard as defined by ASHRAE 62. This includes but is not limited to: non sloped drain pans, evidence of mold growth in the drain pan, and inefficient filtration,
- Failure to provide 15 cfm of outside air per occupant in classrooms. (Lecture room design cfm is 940 cfm supply air, with thirty student and an instructor, 485 cfm of outside air would be required. For this room to be in compliance, over fifty percent of outside intake should be occurring. Based on a typical constant supply air temperature of 55°, the ventilation rate would be under the desired 50% whenever the outside air temperature is much below 40°F.)
- No existing means for humidifying the building to maintain a recommended minimum 30% relative humidity.

Lab Standards

- Lab exhaust system does meet the current ANSI /AIHA Standard Z9.5 for exhaust stack design, discharge velocity or stack height.
- The acid waste drainage system utilizes glass pipe which, while highly resistant to chemical deterioration, is difficult to repair and maintain. Replacement is advised.

- Not all the emergency safety eye washes and showers are properly supplied with tepid water per ANSI Standard Z358.1-1998.
- The heating system consists of only steam to heat water heat exchanger. Therefore if a major mechanical failure should occur to this piece of equipment, the entire building would be without heat.
- Fume hoods lack both safety controls and a face airflow velocity monitoring system.
- The planning team observed that almost all of the fume hood sashes were found nearly 100% open. The fume hood is a constant volume, variable capture face velocity hood. The only fume hood control is a switch that opens or closes a damper that is located in the fume hood exhaust duct. When the damper is in the open position, the fume hood exhaust airflow rate is approximately constant. Therefore, the capture face velocity changes as the sash is raised and lowered. With most of the fume hood sashes wide open, the fume hood capture face velocity is very slow. The fume hood sash must be approximately 1/3 open to deflect air flow sufficiently towards the interior of the fume hood.
- There are no lab room pressurization controls.
- The cold water and hot water to the lab plumbing fixtures are not isolated from the building cold water and hot water system with a backflow prevention device.
- The fume hood exhaust system consists of several independent exhaust fan systems that typically are serving two or more fume hoods. Each independent exhaust fan system has only one exhaust fan. There is no backup exhaust system in the event of exhaust fan failure or exhaust monitoring that would provide alarm to the building maintenance office personnel upon the loss of exhaust airflow.
- It is likely the operating condition of the existing fume hoods would not pass the minimum acceptable standards if tested in accordance with ASHRAE 110-Method of Testing Performance of Laboratory Fume Hoods.
- The acid neutralization system has not been functioning for some time and is no longer being maintained by maintenance staff
- The air handling unit systems are independent of each other without a backup system in the event of system failure.
- Return air from laboratories with fume hoods is re-circulated through the air handling units serving the other laboratories and non-laboratory areas. The industrial ventilation standards recommend "once-through" 100% outside air systems.
- Chemical corrosion has occurred on the exposed surfaces of several of the diffusers and grilles, especially in the lab areas, resulting in poor physical appearance.

- The use of low efficient roll air filters, typical 25% or lower, does not meet the current lab filtration standards where the minimum recommended filtration rate is 60% or the commonly recommended filtration rate of 90%-95% that is typically used.
- Emergency shut-off of the natural gas system in teaching lab do not exist.
- Lab vacuum pump discharge does not meet the current requirement to be a minimum 10'-0" from nearest door or window.

Heating, Ventilation, and Air Conditioning

- Portions of the temperature control system, including the air handling unit, have been converted to DDC controls. However the majority of the remaining control systems utilize the original pneumatic controls.
- The steam service from the plant was identified as insufficient in past years to allow the existing air handling system to operate as a 100% outside air system.
- The original coils were designed for 42° entering chilled water temperature from the plant. The chilled water temperature from the plant was reported to vary between 46° and 48°F. Therefore, it is highly likely that during days of severe hot weather or high humidity, the existing cooling coils struggle to meet the cooling demands of the building.
- The steam preheat coils inside the air handling units have been removed due to maintenance problems.
- The building relief air is indirectly discharged first into the penthouse mechanical room before exiting through the gravity relief dampers on the south side of the building.

Plumbing and Piping

- Mold and mildew growth has formed on some of the insulated pipes.
- Portions of the heating water pipes are missing insulation. Some of these exposed pipes are copper and show evidence of corrosion caused by chemicals used inside the building.
- Due to the uneven floor surfaces, the location the existing floor drains do not ensure that a liquid spills or overflow will be properly contained in the area that the spill or overflow condition occurred.
- In the past, water pipes have frozen during severe cold weather due to these piping being located in pipe chases that are located on the exterior wall of the building.
- Several drainage problems have occurred in the sanitary sewer system that serves the still.
- The pipe fittings contain asbestos.
- The plumbing system branch piping has insufficient shut-off valve, thus causing large portion or the entire building to be shut-off to make repairs or modifications.

- The still was upgraded recently. During the upgrade, the tank was cleaned with acid that resulted in over 70 holes that needed to be repaired on site because the size of the still prohibited its removal through a standard three foot door.

Finishes & Fixed Equipment

- Poor condition of lab casework; original millwork and benches are non-standard
- Stained ceiling tiles
- Corroded fume hoods, sinks, benches, lab fittings
- Dingy interior lighting and finishes
- Dated furnishings, window treatments
- Lab benches are too short, poorly arranged for instruction, and too close together
- Lab casework is in poor condition, has no knee-space
- Lack of shared equipment space for instruments, gas cylinders, glassware washing.
- Lab sinks are too shallow to wash equipment
- Library has outdated furnishings and materials
- Inadequate number and quality of safety showers

Other

- Inefficient building plan
- In efficient small, narrow offices that also function as lab vestibules
- Poor building entry and identity
- Leaky roof, windows, plumbing
- Configuration of some classrooms is not conducive to instruction (too linear)

V.E. Programmatic deficiencies

In addition to the physical deficiencies mentioned above, the building has the following programmatic deficiencies:

- Inadequate amount of conveniently located storage space for chemicals, supplies
- Unsafe conditions for storage of chemicals
- No computer modeling lab for physical science instruction
- Lack of informal gathering spaces
- Lack of planetarium control room
- Lack of museum prep space

- Lack of identifiable administrative space for two departments (Life Science and Physical Science/Math)
- Lack of workroom/copier room on each floor accessible to students and faculty
- Inadequate storage for departmental files, chemical storage, biology field equipment, specialized lab equipment, cabinet storage in labs
- No kitchenette facilities to serve faculty lounge
- No student lounge with convenient vending, microwave
- Need larger instrument lab
- Need larger prep rooms serving labs
- Study/peer tutoring room doubles as faculty conference room to meet demand
- No instruction-based computer lab (configured and equipped for teaching)

V.F. Replacement cost of existing building

The cost of replacing the existing 58,568 GSF Carhart Science Building in 2004 dollars is estimated to be approximately $13.2 million exclusive of soft (non-construction) costs. This does not include the proposed addition.

VI. A. Functions/Purpose of Proposed Program

Activity Identification & Analysis

No change of program or activity is associated with this project.

Projected Occupany/Use

The two departments housed in Carhart Science Building currently house 24 faculty and staff.

These include:

- 5 Chemistry faculty
- 8 Biology/Life Sciences faculty
- 4 Mathematics
- 1 Earth Sciences
- 2 Physics
- 1 Natural Science
- 4 adjunct
- 1 office administrator

26

Three additional adjunct faculty may be added in the future and are planned for in this program document for a total of 27 faculty and staff.

VI.B. Space Requirements

The Carhart Science Building Addition/Renovation utilizes a proven modular approach to laboratory planning which provides the organizational structure in which space is allocated. Based on an existing structural grid dictated by 10'-6" bay widths and room depths of 30' to 33', the planning module used to develop this program is 324 s.f. This module is adequate to assure that all proper functional working relationships and safety requirements are met. The laboratories resulting from the establishment of this module are easily adaptable as technology, faculty, research, or curriculum, changes in the future. Partitions can be relocated, doors moved, and areas of the building can be expanded or modified without requiring reconstruction of structural or mechanical building elements. The module also allows for the systematic delivery of piped services, HVAC ducts, power and data cabling, facilitating future retrofits with minimal disruption to adjacent spaces.

Peninsula benches should be 5'-6" deep and wall benches 2'-9" deep to accommodate the instrumentation. A 5'-0" wide aisle should be provided between benches with back-to-back student stations and a 4'-0" wide aisle adjacent to wall benches in order to minimize conflicts between personnel and reduce potential safety hazards.

The table below reflects the program needs for the occupants of Carhart Science Building. The column at the far right indicates the actual net assignable square feet (NASF) shown on the conceptual floor diagrams in the appendix of this document.

1.0 Chemistry		# spaces	NASF ea	Total NASF	NASF Provided
1.1 Teaching Laboratories					
1.1.1	General Chemistry (24)	2 48	972	1,944	1,932
1.1.2	Organic Chemistry (24)	1 24	972	972	896
1.1.3	Physical Chemistry ~~(24)~~ (12)	1 12	972	972	1,024
1.1.4	Analytical Chemistry (24)	1 24	972	972	953
1.1.5	Biochemistry (24)	1 24	972	972	950
	Subtotal Teaching Laboratories	(6) 132		**5,832**	**5,755**
1.2 Research Laboratories					
1.2.1	Instrument Laboratory	1	972	972	875 size?
1.2.2	Computer Modeling Laboratory	1	648	648	620
1.2.3	Research Laboratory	3	162	486	486
	Subtotal Research Laboratories			**2,106**	**1,981**
1.3 Laboratory Support					
1.3.1	Preparation Laboratory	4	108	432	502
1.3.2	Central Prep and Glassware Washing	1	324	324	330
1.3.3	Chemical Storage	1	208	208	233
	Subtotal Laboratory Support			**964**	**1,065**
1.4 Office and Office Support					
1.4.1	Faculty Offices	6	120	720	906
1.4.2	Copy / Workroom	1	80	80	78
1.4.3	Conference Room	1	162	162	152
1.4.4	Student Study Area	1	162	162	238
	Subtotal Office and Office Support			**1,124**	**1,374**
	Total Chemistry			**10,026**	**10,175**

2.0 Life Sciences		# spaces	NASF ea	Total NASF	NASF Provided
2.1 Teaching Laboratories					
2.1.1	General Biology / Zoology (24)	1	1,134	1,134	1,023
2.1.2	General Biology / Ecology (24)	1	1,134	1,134	1,093
2.1.3	Majors Biology (24)	1	1,134	1,134	1,069
2.1.4	Botony (24)	1	1,134	1,134	1,173
2.1.5	Anatomy and Physiology (24)	1	1,134	1,134	1,121
2.1.6	Microbiology (16)	1	972	972	903
2.1.7	Greenhouse	1	972	972	850
	Subtotal Teaching Laboratories			**7,614**	**7,232**
2.2 Research Laboratories					
2.2.1	Microbiology Research Laboratory	1	648	648	665
2.2.2	Research Laboratory	5	162	810	909
2.2.3	Tissue Culture	1	108	108	117
	Subtotal Research Laboratories			**1,566**	**1,691**
2.3 Laboratory Support					
2.3.1	Preparation Laboratory	5	108	540	521
2.3.2	Sterilization	1	162	162	142
2.3.3	Preparation / Potting	1	108	108	107
	Subtotal Laboratory Support			**810**	**770**
2.4 Office and Office Support					
2.4.1	Faculty Offices	8	120	960	1,140
2.4.2	Copy / Workroom	1	108	108	78
2.4.3	Conference Room	1	162	162	152
2.4.4	Student Study Area	1	162	162	238
	Subtotal Office and Office Support			**1,392**	**1,608**
	Total Life Sciences			**11,382**	**11,301**

3.0 Mathematics		# spaces	NASF ea	Total NASF	NASF Provided
3.1 Teaching Laboratories					
	Subtotal Teaching Laboratories			**0**	**0**
3.2 Research Laboratories					
	Subtotal Research Laboratories			**0**	**0**
3.3 Laboratory Support					
	Subtotal Laboratory Support			**0**	**0**

		# spaces	NASF ea	Total NASF	NASF Provided
3.4 Office and Office Support					
3.4.1	Faculty Offices	6	120	720	906
3.4.2	Copy / Workroom	1	80	80	78
3.4.3	Conference Room	1	162	162	152
3.4.4	Student Study Area	1	162	162	238
	Subtotal Office and Office Support			**1,124**	**1,374**
	Total Mathematics			**1,124**	**1,374**

4.0 Physics / Earth Sciences		**# spaces**	**NASF ea**	**Total NASF**	**NASF Provided**
4.1 Teaching Laboratories					
220? → 4.1.1	Rock and Mineral Laboratory (12)	1	486	486	458
4.1.2	Earth Sciences Laboratory (24)	1 24	972	972	903
4.1.3	Physics Laboratory (24)	(3) 1 24	972	972	948
4.1.4	Physics Laboratory (24)	1 24	972	972	934
	Subtotal Teaching Laboratories	72		**3,402**	**3,243**
4.2 Research Laboratories					
	Subtotal Research Laboratories			**0**	**0**
4.3 Laboratory Support					
4.3.1	Earth Science Prep and Stor	1	324	324	301
4.3.2	Physics and Preparation Storage	1	324	324	301
4.3.3	Physics Storage	1	216	216	264
	Subtotal Laboratory Support			**864**	**866**
4.4 Office and Office Support					
4.4.1	Faculty Offices	3	120	360	442
	Subtotal Office and Office Support			**360**	**442**
	Total Physics and Earth Sciences			**4,626**	**4,551**

5.0 Shared Spaces		**# spaces**	**NASF ea**	**Total NASF**	**NASF Provided**
5.1 Teaching Laboratories					
5.1.1	Science Education (36)	(2) 1 34	1,134	1,134	1,230
5.1.2	Computer Laboratory (40)	1 40	1,134	1,134	1,114
	Subtotal Teaching Laboratories	76		**2,268**	**2,344**
5.2 Research Laboratories					
	Subtotal Research Laboratories	(17) (416)		**0**	**0**

5.0 Shared Spaces (Cont.)

		# spaces	NASF ea	Total NASF	NASF Provided
5.3 Laboratory Support					
5.3.1	Science Education Preparation Room	1	162	162	260
5.3.2	Animal Facilities				
5.3.2.1	Centralized Preparation & Support	1	216	216	226
5.3.2.2	Holding Room	2	162	324	324
5.3.2.3	Procedure Room	1	108	108	108
5.3.3	Laboratory Storage	1	624	624	707
5.3.4	Mud Room / Field Storage	1	162	162	152
	Subtotal Laboratory Support			**1,596**	**1,777**

		# spaces	NASF ea	Total NASF	NASF Provided
5.4 Office and Office Support					
5.4.1	Administrative Area				
5.4.1.1	Reception / Waiting	1	216	216	204
5.4.1.2	Administrative Assistant	1	120	120	120
5.4.1.3	Workroom / Mailboxes	1	162	162	173
5.4.1.4	Department Chair Offices	2	175	350	248
5.4.1.5	Small Conference Room	1	108	108	108
5.4.1.6	Library	1	324	324	546
	Subtotal Office and Office Support			**1,280**	**1,399**

		# spaces	Stations	NASF ea	Total NASF	NASF Provided
5.5 Lecture Rooms						
5.5.1	Small Classroom (32)	3	96	648	1,944	1,904
5.5.2	Large Classroom (50)	2	100	972	1,944	1,828
5.5.3	Lecture Room (Table 32)	2	64	972	1,944	1,949
5.5.4	Seminar Room (10)	1	10	162	162	152
	Subtotal Lecture Rooms	8	270		**5,994**	**5,833**

		# spaces	NASF ea	Total NASF	NASF Provided
5.6 Specialized Shared Spaces					
5.6.1	Science Museum				
5.6.1.1	Exhibit Space	1	1,620	1,620	1,592
5.6.1.2	Museum Storage and Staging	1	972	972	1,024
5.6.1.3	Museum Preparation Room	1	162	162	164
5.6.1.4	Herbarium	1	648	648	889
5.6.2	Planetarium				
5.6.2.1	Planetarium Theatre	1	1,045	1,045	1,045
5.6.2.2	Planetarium Equipment & Storage	1	162	162	201
5.6.3	Observatory				
5.6.3.1	Observation Deck	1	972	972	1,297
5.6.3.2	Observatory Storage	1	108	108	224
	Subtotal Specialized Shared Spaces			**5,689**	**6,436**

5.0 Shared Spaces (Cont.)		# spaces	NASF ea	Total NASF	NASF Provided
5.7 Student and Interactive Areas					
5.7.1	Student Commons	1	1,296	1,296	1,323
5.7.2	Student Interactive Areas	2	108	216	224
	Subtotal Student and Interactive Areas			**1,512**	**1,547**
	Total Shared Spaces			**18,339**	**19,336**
	GRAND TOTAL			**45,497**	**46,737**

SPACE NEEDS SUMMARY		NASF Needed	NASF Provided
1.0	Chemistry	10,026	10,175
2.0	Life Sciences	11,382	11,301
3.0	Mathematics	1,124	1,374
4.0	Physics and Earth Sciences	4,626	4,551
5.0	Shared Teaching and Support Facilities	18,339	19,336
	TOTAL	**45,497**	**46,737**

Conceptual floor diagrams are included in the appendix of this document which illustrate how the space needs can be accommodated in the expanded building and meet the adjacency requirements expressed by the users.

The table below provides a comparison between existing and proposed square feet by space use.

SPACE USE COMPARISON	Existing NASF	Proposed	Difference
Teaching Labs	15,955	19,116	3,161
Research Labs	2,986	AR – 3,672	686
Lab Support	5,381	4,234	(1,147)
Office	4,946	5,280	334
Lecture/Classroom	3,911	5,994	2,083
Specialized Shared	3,891	PS – 5,689	1,798
Student Interaction/Commons	224	1,512	1,288
GRAND TOTAL	**37,294**	**45,497**	**8,203**

VI.C. Impact of Project on Existing Space

All existing space in Carhart Science Building is reutilized as a result of this project.

VII.A. Available Equipment

Much of the furnishings and equipment in use in Carhart Science Building will be replaced in this project with the exception of new equipment purchased recent years, much of it purchased with NIH funding to the Life Sciences.

VII.B. Additional Equipment

The equipment budget for the project was developed by applying comparable cost data from other similar projects. Office furnishings typically run \$3000 (faculty) to \$5000 (chair) per room and laboratories can be furnished with special/technical equipment for approximately 2.5% of the construction budget.

VIII.A. Construction Type

The building shall be classified as Type I or Type II construction as determined by the International Building Code.

VIII.B. Heating, Ventilation and Cooling Systems

The HVAC systems should be designed to address the following criteria, not listed in any specific order:

- Reliability
- Redundancy
- Maintainability
- Simplicity in operation
- Energy Efficient – meets ASHRAE Standard 90.1, The Building Energy Efficiency Standard.
- Indoor Air Quality – meets the intent of ASHRAE Standard 62, The Building Indoor Air Quality Standard.
- Cost Effective
- Flexibility – able to accommodate change.
- Low noise and vibration – meets ASHRAE guidelines on acceptable noise criteria

The design and installation of all mechanical systems will be in accordance with relevant portions of the following codes, standards, and publications:

- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbooks and Standards
- American National Standards Institute (ANSI) Standards
- Building Officials and Code Administrators (BOCA) Codes
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- National Fire Protection Association (NFPA) Codes
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- All codes and standards as established by Wayne State College

The following temperature, ventilation, and noise parameters will be used as the basis for the design of the building HVAC systems:

Outdoor Design Conditions

ASHRAE 0.4% mean coincidence weather data:

- Winter Dry Bulb Temperature: -11°F
- Summer Design Dry Bulb Temperature: 95°F
- Summer Coincident Wet Bulb Temperature: 74°F
- Summer Design Wet Bulb Temperature: 76°F
- Summer Coincident Dry Bulb Temperature: 90°F

ASHRAE extreme annual weather data:

- Winter Dry Bulb Temperature: -18°F
- Summer Dry Bulb Temperature: 101°F

Indoor Design Conditions

- Winter Dry Bulb Temperature - Lab and support areas: 73.5°F
- All other areas: 72°F
- Summer Dry Bulb Temperature: Lab and support areas: 73.5°F
- All other areas: 75°F

Relative Humidity:

- Summer – Glassware areas: 55-65% RH
- Summer – All other areas: 45-55% RH
- Winter – All areas: 30-50% RH

Minimum Ventilation Rates:

- Laboratory and support areas: 8 air changes/hr (ACH)
- All other areas: as per ASHRAE requirements

Noise Criteria Conditions:

- Laboratory and support areas: NC<40
- All other areas: NC<30

Heating Systems

The building heat should be provided by the existing high pressure steam that is supplied off the existing central steam plant steam distribution piping system. The existing high pressure reducing valve assembly should be replaced with a new pressure reducing station.

The steam should be converted to heating water through two steam-to-water shell and heat exchangers. Each shell and tube heat exchanger should be sized for 100% of the heating load so that 100% redundancy is provided. To minimize the freezing potential in the heating water system, it should be protected with 60% water and 40% food grade propylene glycol solution. The heating water should be distributed throughout the building to the heating coils in the air handling units, reheat coils in variable air volume boxes, terminal heating units located in circulation and toilet areas. The heating water should be circulated by two base-mounted centrifugal pumps. Each pump should be sized for 100% of the water flow rate. To minimize pumping energy cost, the heating water pumps should be controlled with variable frequency drives. Steam condensate from the heat exchangers should be piped to a duplex condensate pump unit that returns the steam condensate back to the central steam plant. Heating water specialty items including safety relief valves, glycol feeder, coalescing air separator, etc. should be provided.

Air Conditioning

The building's air conditioning will be provided by the central chilled water system from the central chilled water plant. The chilled water and supply and return will reconnect to the existing 6" chilled water supply and return piping that currently serves the building. The chilled water will be circulated to cooling coils located in the air handling units. Two based-mounted centrifugal pumps should be piped as a tertiary pumping system to boost the chilled water pressure inside the building. Each chilled water pump should be sized for 100% of the chilled water flow rate. To minimize pumping energy cost, the chilled water pumps should be controlled with variable frequency drives.

Humidification

The supply air should be humidified by steam humidifier grids that are installed inside the air handling units. The humidification system should be sized to maintain a minimum 30% relative humidity inside the building. The humidifier grids should be supplied with steam that is produced in a steam-to-steam humidifier generator. The steam supply to the steam-to-steam humidifier generators will be provided from the high pressure distribution system that is supplied by the central steam plant. The steam supply will branch off the low pressure steam that will supply the heating system heat exchangers. To minimize maintenance that results from scaling due to minerals that are dissolved in Wayne State College water supply, the make-up water for the humidifier generators should be pretreated by an ion-exchange water softener (softened domestic hot water) and reverse osmosis (RO) system. The RO system shall be independent system serving only the humidification system. The RO system shall be sized to meet the instantaneous water demand of the humidification system and shall be provided with a storage tank that will compensate for the time period that the RO system is regenerating. The steam condensate from the humidifier generator should be piped to the duplex condensate pump unit that serves the heating water system.

Air Handling Unit System

Three air handling units (AHU) are recommended. AHU-1 will primarily serve the basement, ground and first floors and the office areas on second and third floor of the building. AHU-1 will primarily serve classrooms and offices. AHU-1 will be a variable-air-volume-reheat system. A double solid wall insulated air handling casing is recommend in each section. Double sloped drain pans are recommended for the heating coil, humidifier and cooling coil sections. Vibration isolation base is recommended for AHU-1 supply fan. AHU-1 shall have a 0-100% outside air economizer with 100%-0% return air. AHU-1 relief air will discharge into a common exhaust air system that serves building relief, general building exhaust, lab general exhaust, fume hood exhaust and biological safety cabinet exhaust. AHU-1 minimum outside intake controls should be based on real time multi-space ventilation calculations that are in compliance with ASHRAE 62. Note that the multi-space will take into account only the zones that have constant occupancy level, i.e. offices.

AHU-2 and AHU-3 will serve primarily the second and third floors and will provide the conditioned outside air that is used for the dual path dedicated outside air zones located in the basement, ground and first floors. AHU-2 and AHU-3 will primarily serve biology labs, chemistry lab and the conditioned outside air system. AHU-2 and AHU-3 will be a combination of variable-air-volume-reheat system. A double solid wall insulated air handling casing is recommend in each section. Double sloped drain pans are recommended for the heating coil, humidifier and cooling coil sections. Vibration isolation base is recommended for AHU-2 and AHU-3 supply fans.

AHU-2 and AHU-3 supply air discharge will connect into a common supply air duct. Therefore if one of the air handling units should fail, the other air handling unit will provide some backup to the supply air system. Each AHU will be sized for approximately 50% of the supply airflow rate. AHU-2 and AHU-3 will be primarily 100% outside air systems. However, some return air will be utilized from the labs, primarily from the second floor biology classrooms, whose return air was identified during programming as returnable to the air handling unit system. The amount of return air flow rate will proportionally be significantly less than the outside air airflow rate. Therefore, AHU-1 and AHU-3 supply air can serve a dual function as conditioned outside air. Because of the proportionally high percentage of outside air, compliance with ASHRAE standard 62 should be met in room served exclusively by AHU-2 and AHU-3.

To reduce the energy consumption to pre-heat and pre-cool the large quantities of outside air that will be brought into the building by AHU-2 and AHU-3, it is proposed that the energy/heat recovery system be utilized to pre-treat the outside air before the outside air enters AHU-2 and AHU-3. Prior to final selection of the type of energy/heat recovery device, a study should be conducted that identifies and evaluates the performance f or the different types of energy/heat recovery systems that are available. The study should include evaluation on first cost, annual energy savings, annual operation and maintenance cost, projected useful life, life cycle cost, potential for cross contamination, and compatibility of materials used in the construction of the energy/heat recovery unit to the chemicals that will be present in the exhaust air streams.

Lab and General Exhaust Systems

A common exhaust system is proposed for laboratory ventilation, fume hoods, general building exhaust and general building relief air. The exhaust fan system will likely consist of six direct-drive mixed-flow vertical-discharge induction type fans that will be mounted on the roof of the penthouse. Each exhaust fan will be provided with a variable frequency drive and the exhaust fans will be staged on to meet the total building exhaust airflow rate. The exhaust fan stacks would be a minimum of ten feet above the highest roof point of the building to comply with the ANSI/AIHA Z9.5 standards. Staging of the exhaust fans and an outside air by-pass damper will be provided between the common exhaust air plenum and the outside air plenum will allow the exhaust fan to comply with ANSI/AIHA Z9.5 minimum recommended stack velocity of 3,000 feet per minimum. By using a common plenum exhaust system, the total exhaust airflow rate will closely follow the outside air flow rate. This arrangement will provide a high overall operating efficiency of the energy/heat recovery system.

When the outside air conditions are mild and full capacity of the energy recovery system is not required to adequately precondition the outside air, some form of energy/heat recovery modulation should be used. This could include a variable frequency drive controlling the energy recovery wheel speed should an energy recovery wheel system be selected, or variable flow pumping system should a heat recovery coil run-around system is selected. In addition to modulating the capacity of the energy recovery system, by-pass dampers should be provided across the energy/heat recovery device to reduce the pressure drop of the exhaust system when no energy/heat recovery is required, thus reducing exhaust fan horsepower.

Exhaust air systems should be ducted to the exhaust fan through galvanized steel and discharged to outside the building. Most likely a combination of independent exhaust systems and common exhaust system serving two or more ones will need to be utilized.

Lab Ventilation and Lab Control Systems

The laboratory ventilation control system should incorporate a variable-air-volume volumetric-tracking system that provides a constant airflow offset scheme to control laboratory pressurization. Volumetric airflow offset should be achieved by using a supply air control valve for each the lab, a general exhaust/return control valve for each lab, and a exhaust control valve for fume hood. The lab control system will monitor the air flow through each valve to maintain a predetermined design offset for each lab. Each fume hood will be provided with a fume hood flow indication design that should provide as a minimum, the hood sash face velocity, hood control status, fume hood air flow alarm and emergency exhaust alarm. Consideration should be given to providing a shut-off damper in the organic chemistry teaching lab which is programmed to have twelve eight foot hoods. The design airflow rate for these twelve fume hood with the sash fully open is over 21,000 cfm. Even with all the fume hood sashes closed, the minimum recommended fume hood airflow rate is over 4,200 cfm. To significantly reduce the energy consumption in this lab, and because of the type and usage of this lab, a shut-off damper to completely shut-off all but one or more fume hood should be considered. Manual controls in the lab should be provided to allow the users of this lab to manually control when the fume hoods are not completely shut-off.

Temperature Control System

The entire temperature control system should be upgraded to direct digital control energy management system. Currently the Campus utilizes Johnson Controls Metasys control system.

Distributed controllers should be used where possible. Air handlers should have dedicated distributed controllers. VAV boxes should have electronic damper and valve actuators and

Supply Air Duct Distribution System

AHU-1 supply air duct should be a common riser system with a branch duct take-off at each floor level. AHU-1 shall supply air to variable-air-volume terminal units with heating water reheat coils. The room temperature sensor shall control the airflow rate and heating coil to maintain the room temperature set point. AHU-1 supply air duct should be a galvanized steel duct that is thermally insulated. Zones with a high density highly variable occupancy load, i.e. classrooms and conference rooms, should be provided with a dual path dedicated outside air supply air duct that will supply conditioned outside air from the common AHU-2 and AHU-3 supply air duct. The conditioned outside air ducts shall be insulated galvanized ducts. A second variable-air-volume terminal unit should be provided to control the conditioned outside airflow rate that is supplied into the zone. This conditioned outside air terminal unit should be connected downstream of the supply air terminal unit and upstream of the reheat coil. A carbon dioxide sensor located in the zone shall vary the conditioned airflow rate based on the carbon dioxide level in the zone. The dual path conditioned outside air duct will provide significant energy savings while providing the outside air ventilation rates required by ASHRAE Standard 62.

Return Air, General Ventilation and Exhaust Duct System

AHU-1 return air duct system should consist of a ducted main riser with a branch take-off located on each floor level. The return air should be extended into the office areas on the upper two floor levels where the laboratories are primarily located. The return air ducts will terminate at a return air opening in the duct above the ceiling plenum. The supply air delivered into occupied zone will return through transfer grilles located in the ceiling where the return air can them flow through the ceiling plenum to the return air openings. The return air ducts should be galvanized steel.

should be controlled via a DDC box controller. All controllers should be networked and a front end computer with graphics should be provided for the building. The front end should also provide access to equipment technical information.

Air-side control valves for laboratory spaces should utilize a microprocessor based control system provided by the valve manufacturer. This control system should interface with the building DDC system so all points can be monitored from the building system. Larger control valves and dampers should have pneumatic actuators. Controls schemes should be in compliance with ASHRAE Standard 90.1.

Building Storm Drainage Systems

The storm drainage system from the roofs on the proposed addition and the proposed penthouse mechanical room shall comply with the current plumbing codes, including provisions for the second overflow roof drainage system. The existing roof drains that are not affected by the proposed building changes should remain active with no modifications anticipated except where the existing storm drainage system interferes with the proposed building modifications.

Mechanical Insulation Systems

The supply air ducts, supply air/conditioned outside air ducts, outside air, common exhaust fan plenum systems should be insulated to prevent condensation and to reduce heat transfer between the ducts and the surrounding environment. The amount of duct insulation should conform to the minimum recommendations of ASHRAE Standard 90.1.

All ductwork upstream of supply air terminal units should be provided with wrapped insulation. Whether duct liner or duct wrap should be utilized downstream of supply air terminal units should be evaluated to determine if the acoustical benefits of duct liner offset the potential disadvantages of duct liner. If duct liner is utilized, the liner should be coated to prevent the growth of mold, bacteria and fungus, and to prevent erosion of the liner surface to due to high air velocities.

The piping systems should be insulated to prevent condensation and to reduce the heat transfer between the ducts and the surrounding environment. The amount of pipe insulation should conform to the minimum recommendations of ASHRAE Standard 90.1. Consideration should be given to using pipe insulation in the chilled water piping system that manages moisture by wicking it away so that insulation can dry out naturally.

Indoor Air Quality

Humidification of the supply air to maintain a minimum 30% relative humidity inside the building is recommended. High final filtration rates are recommended for all the air handling unit systems. Dual sloped drain pans are recommended in the heating coil, humidifier and cooling coil sections of the air handling units.

Installation of the cooling coil upstream of the supply fan is recommended to allow the heat generated by the supply fan to heat the saturated cooled air leaving the cooling coil, preventing dampness and reducing the potential of mold growth on the final filter surfaces. Use of self wicking pipe insulation should be considered to minimize the potential for mold growth in the pipe insulation.

The use of carbon dioxide sensors with a dual path conditioned outside air path system is recommended to meet ASHRAE Standard 62 in high density highly variable occupied zones, i.e. classrooms and conference rooms.

VIII. C. Life Safety/ADA

Fire Alarm System

The fire alarm system in Carhart Science Building was recently upgraded. The existing fire alarm control panel is adequate to meet the needs of the building. New fire alarm notification and initiation devices shall be provided throughout the building as required by National Fire Protection Association and Americans with Disabilities Act standards. These devices shall be connected to the existing fire alarm system.

Fire Protection System

The entire building shall be protected with an automatic wet pipe sprinkler system that complies with the requirements of NFPA 13. Additionally to protect rooms with highly sensitive and expensive electronic equipment, single or double interlock pre-action sprinkler systems should be evaluated to determine if the additional cost of these systems for these rooms is warranted.

Handicapped Accessibility

All portions of the Carhart Science Building shall be accessible to the physically handicapped as required by the International Building Code 2003 (IBC 2003) and the Americans with Disabilities Act Accessibility Guidelines (ADA-AG). At least one primary entrance to the building must be accessible and usable by the physically handicapped. This primary entrance must be on a level that would provide accessibility to the building elevators. Additional accessible exits shall be provided as required to meet the existing standards of the IBC 2003 and ADA-AG.

All parts of the building including all laboratory and support spaces should be handicapped accessible. Accessible work stations, classrooms, seating, meeting areas and laboratory fixtures should be provided. In schematic design, some of the specific accessibility issues and alternatives to be considered include the following:

- Adjustable work stations and fume hoods.

- A portion of the work surfaces 30" above floor with wheelchair clearance below. Adjustable work surfaces can provide a range of possible height adjustments.
- Laboratory service controls, equipment, and equipment controls within easy reach for persons with limited mobility. Controls should have single-action levers or blade handles for easy operation.
- Aisle widths and clearances adequate for maneuvers of wheelchair bound individuals. Aisles 5'-0" wide are recommended with turnaround areas as required by ADAAG.
- Location of handicap work stations as close as possible to laboratories and safety showers. Drench hoses should be located at each work station.
- An 18" clearance is required at entrance doors opposite the hinged side.

Some other ADA requirements include the following:

- Each floor of the building shall be provided with at least one restroom that is handicap accessible to each sex with doorway openings of not less than 32 inches.
- Provide at least one handicap accessible water fountain per floor.
- All signage shall meet tactile requirements found in ADAAG.
- Any ramps required for accessibility to the building shall not exceed the slope of 1 inch in 12 inches, and shall not exceed 2-1/2 feet in vertical change without a 5'-0" level landing being provided. Continuous handrails shall be provided on both sides of all ramps and landings.
- Clear floor space requirements shall be followed adjacent to all fixtures and adjacent to all door openings.

VIII.D. Historic or architectural significance

While the Carhart Science Building is not considered one of the campus's historic or architectural landmarks, it is surrounded by historical campus buildings. The development of the addition should take care not to detract from the adjacent historic structures including Humanities, Hahn, and Connell Hall.

VIII.E. Artwork

The project budget includes 1% for artwork as required by the State of Nebraska. The addition will be an excellent location for art because it acts as a major public entry to the campus for visitors coming to the Planetarium, Observatory, and Natural History Museum. The addition also houses the bulk of student interaction space which would be an excellent location for art that reflects the sciences housed in the building.

VIII.F. Phasing

The project will be implemented in two separately funded phases. The second phase will be constructed in three sequences as described below.

Phase I – Elevator/Stair addition

With funding from the Task Force for Building Renewal (also known as 309 funding), the elevator/stair addition will address the immediate pressing need for ADA accessibility into and through the building. It is anticipated that funding for this phase may be imminent.

Phase II – Addition completion and building renovation

When funding for the rest of the project is available, the addition and renovation should be sequenced as follows:

- Step 1: Construction of new restrooms in addition.
- Step 2: Renovation of south ½ of Carhart and completion of addition.
- Step 3: Renovation of north ½ of Carhart.

It should be noted that if 309 funding is available for both the elevator stair addition and construction of new restrooms, the sequencing of Phase II is simplified and a significant savings to the project is resulted.

VIII.G. Future Expansion

There are no further plans for expanding Carhart Science Building after this addition/renovation is completed.

VIII. H. Electrical Design Considerations

The electrical design for this project shall include the following:

- Modifications to the existing primary underground service, as required.
- Modifications to electrical service entrance.
- Interior electrical distribution systems.
- Emergency electrical distribution systems.
- Interior lighting systems.
- Fire and life safety systems
- Telecommunications cabling and distribution

The design and installation of all electrical systems and devices shall be in accordance with relative portions of the following Codes and publications:

- National Electrical Code (NEC)
- National Fire Protection Association (NFPA) Standards
- National Electrical Safety Code (NESC)
- Uniform Building Code (UBC)
- ASHRAE 90.1
- Uniform Fire Code (UFC)
- American National Standards Institute (ANSI) Standards
- National Electrical Manufacturers Association (NEMA) Standards
- Underwriter's Laboratories, Inc. (UL)
- Illuminating Engineering Society Handbook
- All governing local Codes and Standards

Modifications to Primary Underground Service

Existing underground primary service to Carhart Science Building is routed to a pad mounted service transformer located on the north side of the building. The size of the existing service transformer will need to be evaluated during design and increased in size if necessary.

Electrical Service Entrance

The existing building is served by a switchboard located on the ground floor. This switchboard shall be replaced. A new 480Y/277 volt, 3 phase 4 wire, circuit breaker type service entrance switchboard shall be provided to serve the facility. Transient voltage surge suppression (TVSS) equipment and digital customer metering shall be provided at the service entrance panel. The switchboard shall be located on the ground floor and served by underground conduit from the service transformer.

Interior Electrical Distribution Systems

Existing electrical distribution system equipment within the facility shall be replaced as part of this project. A 480Y/277 Volt, 3 phase, 4 wire bus duct, fed by the main switchboard shall be routed through the stacked electrical rooms located on each floor. This bus duct shall feed a 480Y/277 Volt, 3 phase, 4 wire lighting and appliance panelboard on each floor that shall be used to serve lighting circuits. The bus duct shall also feed a 208Y/120 Volt, 3 phase, 4 wire distribution panel on each floor via a 480-208Y/120 Volt, 3 phase, 4 wire transformer. The 208Y/120 volt distribution panel shall serve branch circuit panelboards located outside each laboratory and elsewhere on the floor as necessary to serve receptacle and general purpose branch circuit loads. A 480Y/277 Volt, 3 phase, 4 wire distribution panel shall be located in the penthouse to serve mechanical loads in the penthouse and on the roof. Mechanical loads on the ground floor shall be served by the main switchboard. All new electrical distribution equipment shall be provided with copper busses, and shall have a minimum of 20 percent spare/space capacity.

A natural-gas driven emergency generator shall be provided to serve life safety loads and essential lab equipment loads. The generator shall serve an emergency distribution panel, via an automatic transfer switch, located on the ground floor. The emergency distribution panel shall serve 480Y/277 Volt, 3 phase, 4 wire and 208Y/120 Volt, 3 phase, 4 wire emergency panels throughout the building. Loads to be fed by the emergency power system shall be coordinated with college personnel.

In general, air conditioning, heating and ventilation system loads, as well as elevators and other large motor driven equipment shall be served by circuit breakers in the main switchboard or penthouse distribution panel at 480 volts, 3 phase. In general, lighting loads shall be served at 277 Volts. Receptacle circuits shall be separated from lighting circuits. Each computer workstation location shall be provided with a double duplex receptacle to support equipment loads. A maximum of three computer workstation receptacles shall be connected to a single, dedicated, 20 amp, 120 volt branch circuit. General-purpose duplex receptacles shall be provided throughout the facility to ensure maximum flexibility. General-purpose receptacles shall be provided in restrooms, corridors, storage rooms, janitor closets, mechanical and electrical rooms, etc. A maximum of six (6) general purpose receptacles shall be connected to a single 20 amp, 120 volt branch circuit. Ground fault interrupting type devices shall be provided as required to satisfy current Codes.

Laboratories shall be provided with surface metal raceway or pedestals so that every workstation shall be provided with 120 Volt power and telecommunications outlets. Surface metal raceway shall be two-section (one section for power, the other for telecommunications) and shall be constructed so that the two sections have covers that can be removed independently.

Interior Lighting Systems

Existing interior lighting systems within the facility are in need of replacement. New lighting systems shall be designed to provide appropriate illumination levels within each space, in accordance with IES criteria and recommendations for the spaces served. In addition, lighting systems shall be designed to minimize the impact due to direct and indirect glare and veiling reflections.

Fluorescent lighting systems shall be used throughout most of the facility. Recessed lensed fluorescent lighting fixtures shall be used in laboratories.

Classrooms and offices shall be provided with 2' x 4' lay-in fluorescent fixtures with parabolic louvers. Fixtures shall be switched by lamp and by row to provide multiple levels of illumination. Dimmable lighting shall be provided in spaces in order to support instructional programs. Industrial type fluorescent fixtures shall be used to light mechanical and electrical equipment rooms, janitor and telecommunication closets, etc. Office spaces shall be provided with 2' x 4' lay-in fluorescent fixtures with parabolic louvers. Restrooms shall be lighted with fluorescent strip fixtures mounted in architectural soffits. Recessed, fluorescent downlight fixtures, lensed fluorescent fixtures and decorative fixtures shall light public circulation areas.

Emergency and exit lighting fixtures shall be served by the emergency power distribution system as required to meet current Life Safety Codes.

Fluorescent lamps shall be of the compact, biax or T8 type. Ballasts for fluorescent fixtures shall be of the high frequency, solid state, electronic type. Dimming type, electronic ballasts shall be provided as required.

Telecommunications Systems

Stacked telecommunications rooms shall be located on each floor of the building. Each room shall contain a data rack(s) to accommodate voice and data patch panels and Owner furnished equipment. The telecommunications rooms shall contain cable tray for distribution of cable.

A new cable tray system shall be provided above accessible corridor ceilings to support the distribution of telecommunication system cabling. Conduit sleeves and horizontal and vertical chases shall be provided, as required to allow for the horizontal and vertical distribution of cabling systems.

Telecommunications outlets shall be provided throughout the facility in accordance with direction provided by college personnel. A 1" conduit shall be routed from each telecommunications outlet location to a new corridor cable tray system to support the installation of telecommunications system cabling. Telecommunications outlets at lab benches shall be located in the surface metal raceway or lab bench pedestals.

Avaya/Lucent category 6 (or highest recognized EIA/TIA category at the time of design) cable, patch panels, modular jacks and other associated telecommunications cabling equipment shall be provided for each telecommunications outlet provided. Cabling from telecommunications outlets shall be terminated on patch panels on the same floor. Backbone cabling shall be coordinated with college personnel.

VIII. I. Laboratory Utilities

Laboratory Air Distribution Systems

Laboratories should be designed with variable volume control valves controlling airflow to fume hoods, supply, and general exhaust. The valves should be controlled to maintain proper face velocity at the hood, and to control the specific pressure relationship required by maintaining a fixed offset either into or out of the lab. Generally speaking, labs should be negative relative to adjacent spaces.

The complete laboratory supply, fume hood exhaust, general exhaust and return air systems shall be fully ducted systems. Laboratory exhaust main ductwork serving fume hoods should be rectangular stainless steel ducts with welded longitudinal joints and mechanical flanged and gasketed transverse joints. Branch exhaust ducts to fume hoods should be round or oval stainless steel with mechanical flanged and gasketed transverse joints. All duct fittings should have weld seams. Laboratory supply, general exhaust and return air ducts should be constructed from galvanized sheet metal. The laboratory supply air ducts should be insulated.

Domestic Cold Water and Hot Water Systems

A code compliant water system should be installed. The domestic water supply should continue to be supplied by the potable water service located on the campus. The building's water supply should be protected with a double check back flow preventer. Cold water and hot water should be distributed throughout the building to plumbing fixtures, and will be tapped off to provide industrial cold water and industrial hot water that will serve the labs. The cold water make-up to the water heater should be treated with ion-exchange water softener. The water heater should be replaced with an instantaneous water heater that uses high pressure steam from the central plant to generate domestic hot water. Instantaneous water heaters reduce virtually reduce the stand-by losses of the large storage tanks and minimize the potential for water borne pathogens that typically are found in larger water storage tanks. The steam condensate should be piped to drain into the duplex condensate pump system serving the heating water system. A hot water circulating system should be provided to compensate for the pipe heat losses during inactive and low usage periods.

Lab Faucets, Outlets, and Inlets

Lab grade faucets, gas outlets and vacuum inlets should be provided. The lab fixtures shall be in compliance with ANSI/ASME A112.18.1M. The quality of the lab fixtures should be consistent with type of gas service and usage of the lab fixture. The finish of the lab fixture shall be selected based on both chemical resistant requirements, and the particular look and feel desired for the laboratory installation. Lab sinks should be acid resistant type sinks that are integral in the lab countertops. Faucets shall be provided with vacuum breakers as required.

Lab Waste and Vent Systems

The glass lab waste and vent piping system should be replaced with either an acid-resistant PVC piping system that uses conventional solvent welded joints, or an acid resistant polypropylene piping system that uses an electrical fusion weld joints. Both have a significantly lower first cost than the existing glass waste and vent system, have acceptable life expectancy, and are significantly easier to maintain. A new acid neutralization system should be provided. The acid neutralization system should be installed to allow better access for inspection, maintenance and replacement of lime stone media.

Lab Industrial Cold Water and Hot Water Systems

Labs shall be provided with industrial cold water and hot water that is supplied from the potable domestic cold and hot water services. To protect the potable water services from possible contamination, reduced pressure backflow preventer should be installed where the industrial cold water and hot water systems connect to the potable water system. To maintain a suitable industrial hot water temperature and relatively constant water temperature during inactive or low water usage periods, an industrial hot water circulating system should be provided. An electric water heater shall be provided to provide supplement heat to compensate for heat loss.

Lab Pure Water System

A central deionized (DI) water system should be installed. A National Committee for Clinical Laboratory Standards Type III general laboratory-grade water is recommended. If a higher grade water is required, independent high pure water systems should be provided. To achieve this grade of water, at a minimum an ion-exchange water softener, carbon filter, reverse osmosis system, ultraviolet light, and deionizer will be required. A study should be completed to evaluate and recommend the most appropriate water treatment system for Carhart Science Building. The study should compare different types of water treatment systems, such as mixed bed and dual bed deionizers and should evaluate first cost, annual operating cost and regeneration cost, and life cycle cost.

The DI water will be distributed throughout the building to DI water outlets that are identified in the program. The use of a re-circulating and continuous flow system without branch piping should be evaluated based on the user ultimate needs. It is recommended that a pure grade virgin polypropylene piping system be used to pipe the DI water.

Lab Natural Gas System

A lab natural gas system will use gas from the existing on-site local gas utility system that enters the building in the basement. The gas will be distributed from the gas service through to the gas outlets identified in the program for each lab. Gas supplied into each teaching lab shall each be provided with a means to shut-off all the gas outlets located in that teaching lab from one location. An electrical solenoid valve with key operated switch is highly recommended.

Lab Process Steam System

Lab process steam will be provided by the existing high pressure steam that is supplied off the existing central steam plant steam distribution piping system. The lab process steam will tap of the steam branch that supplies the steam-to-steam humidifiers and be piped to each steam outlet that is identified it the program for each lab. To minimize the condensate that will form in the distribution piping the steam piping from collecting in the steam outlet pipe riser, all the lab steam outlet piping shall be located in the ceiling plenum on the floor below the steam outlet and all steam outlets are to be tapped off the top of the steam branch main and the steam outlet branch shall slope back to the branch main. End-of main-drips shall be provided on the steam branch mains. The condensate formed in this piping shall be piping to a condensate main that drain to the duplex condensate pump that serves the heating water system.

Lab Vacuum System

Lab vacuum shall be supplied by a new central dual compressor vacuum pump mounted on a common receiver tank. The vacuum shall be piped to the central vacuum pump to the lab vacuum inlets identified in the program. The vacuum pump discharge vent shall be piped to be a minimum 10'-0" from the nearest window, door, air intake or any other opening in the building and shall be installed at a different level than the HVAC air intakes. Most likely the vacuum discharge should be piped to discharge through the penthouse roof.

Lab Compressed Air System

Lab compressed air shall be supplied by a new central dual compressor air compressor mounted on a common storage tank. The lab compressed air shall be processed through a refrigerant air dryer, moisture coalescing air filter and pressure reducing station. The compressed air shall be distributed from the central compressor to the lab compressed air outlets identified in the program. A separate compressor will be provided for temperature controls and laboratory air.

Specialty Lab Gases

Specialty gases such as nitrogen and carbon dioxide will be required in some of the laboratories. Individual bottle gas cylinders should be provided for those labs. During the design phase, the gas usage requirements should be evaluated to determine if gas bottles should be manifolded together and/or distributed to multiple gas outlets in one or more labs.

Processed Chilled Water

Process cooling system will be required. During the design phase the process cooling loads should be determined to properly size the process cooling system. The process cooling system shall be an independent self-contained re-circulating chilled water process cooling system. Chilled water supply and return outlet locations and location of the process chiller should be identified during detailed design.

Lab Emergency Shower and Eyewash Systems

Placement of emergency eye wash and showers shall comply with OSHA requirements, ANSI Standard Z358.1-1998, the safety and operational procedures may have been adopted by either the State or Wayne State College safety committees. The emergency showers and eyewashes shall be provided with tepid water to comply with ANSI Standard Z358.1-1998. Whether one common tepid water system is provided or separate individual tepid systems are provided should be evaluated on requirement to monitor the usage of the emergency devices verse the frequency that the emergency devices will be tested and their associated initial cost.

Plumbing Waste and Vent System

A code compliant plumbing waste and vent system should be installed. The plumbing waste system should continue to drain into the existing building sanitary sewer system that currently serves the building. The underground waste piping system should be in satisfactory condition to continue to serve the building. The above floor plumbing waste and vent piping systems should be modified to accommodate the proposed building modifications.

VIII.J. Energy Conservation

In order to conserve energy, the following are recommendations to be considered in design:

- Variable speed pumping for the heating water and tertiary chilled water systems.
- 100% outside economizer and variable-air-volume system for AHU-1.
- Variable-air-volume systems for AHU-2 and AHU-3.
- Energy recovery/heat recovery system for AHU-2 and AHU-3.
- Common exhaust plenum system to allow a higher overall operating efficiency by closely matching the exhaust airflow rate with the outside airflow rate.
- A staged variable-air-volume exhaust fan system.
- Modulation of the energy/recovery equipment and a means to by-pass the energy/heat recovery device.
- Duct insulation and pipe insulation systems compliance with ASHRAE Standard 90.1.
- Replacement of the domestic hot water heater and storage tank with energy efficient instantaneous steam water heaters.
- A complete upgrade of the temperature control system to DDC in compliance with ASHRAE Standard 90.1.

VIII. K. Structural Considerations

It appears that serious structural deflection occurred many years ago, probably soon after the building was constructed, causing wavy floors and cracked masonry walls. While the deflection seems to have ceased, the situation should be monitored by facilities staff between now and the commencement of construction to make certain no additional shifting is occurring. The floors should be leveled with self-leveling epoxy grout.

IX.A. Cost Estimates Criteria

The project budget was prepared in April 2004. A 4% annual inflation rate was used to formulate the budget in accordance with the proposed timeline shown in Section XI of this document. The assumed number of years to mid-point of construction is 1.25 years for phase I and 3.25 for phase II.

The budget was developed using comparable cost data from similar recent projects in the region.

The table below provides a cost overview for the project.

COST FACTORS	phase 1 (elev/stair)	phase 2 (renov/add)	total
Total Construction Cost	$ 897,909	$14,104,007	$15,001,916
Total Project Costs	$1,025,940	$17,706,011	$18,731,951
Project NSF	0	45,497	45,497
Project GSF	4,270	74,515	78,785
Project Cost/GSF	$240	$238	$238
Construction Cost/ GSF	$210	$189	$190

IX.B. Total Project Cost

The table on the following page summarizes the project costs for the Carhart Science Building Project.

IX.C. Fiscal Impact

The table below reflects the projected annual additional costs associated with the project.

FISCAL IMPACT	Add'l O&M costs	Add'l Program-matic costs	Building Renewal assessment
Phase I – LB309 stair/elevator addition	$9,500	n/a	$20,519
Phases II and III – addition/renovation	$67,000	n/a	$374,229

IX. Project Budget & Fiscal Impact

PROJECT BUDGET	Current Costs	Subtotal	Inflated Costs
1) PROGRAMMING			
Programming Consultants	65,000		
Programming Costs Subtotal		**65,000**	**65,000**
2) PROFESSIONAL FEES			
Design Fees	1,200,153		
Additional Services	75,000		
Other Consultants	0		
Professional Fees Subtotal		**1,275,153**	**1,275,153**
3) CONSTRUCTION			
Site Work	79,600		
General	5,249,264		
Mechanical	4,917,356		
Electrical	1,889,800		
Conveying	78,000		
Fixed Equipment	1,057,000		
Construction Subtotal		**13,271,020**	**15,001,916**
EQUIPMENT			
4) Moveable Equipment	204,900		
5) Special/Technical Equipment	331,800		
Equipment Subtotal		**536,700**	**536,700**
LAND & ART			
6) Land Acquisition	0		
7) Artwork	140,000		
Land & Art Subtotal		**140,000**	**140,000**
8) OTHER COSTS			
Printing/Publication	5,000		
Moving/relocation	140,000		
Testing	15,000		
Surveys	5,000		
Legal fees	2,500		
Insurance	20,000		
Other Costs Subtotal		**187,500**	**212,990**
9) PROJECT CONTINGENCY	**1,327,102**	**1,327,102**	**1,500,192**
TOTAL PROJECT COST		**$ 16,802,475**	**$ 18,731,951 ***

* NOTE: If the Task Force for Building Renewal elects to fund a Phase I project that includes both the stair/elevator and new restroom addition, a savings of over $175,000 for construction plus at least $200,000 in inflation can be gained.

X.A. Total Funds Required

The total funds required for the project are **$18,731,951.**

X.B. Project Funding Sources

The table below reflects the anticipated sources of funding for the project.

FUNDING SOURCE	Description	% of Funds	Amount
State funds		82%	$15,360,901
Cash funds		0%	$ 0
Federal funds	research suite	1%	$184,800
LB309 funds	elevator/stair	4%	$786,250
Revenue Bonds		0%	$ 0
Private Donations	addition	13%	$ 2,400,000
Other Sources		0%	$ 0
TOTAL		**100%**	**$18,731,951**

X.C. Fiscal Year Expenditures for Project Duration

FISCAL YEAR	Amount	% of Funds	Amount
2003-2004	programming	0.3%	$ 65,000
2004-2005	phase I	5.5%	$1,025,940
2005-2006	phase II design	8.2%	$1,542,253
2006-2007	phase II construction	38.7%	$7,244,441
2007-2008	phase II construction	38.7%	$7,244,441
2008-2009	phase II construction	8.6%	$1,609,876
	TOTAL	**100%**	**$18,731,951**

XI.A. Timeline

MILESTONE	All phases	Phase I	Phase II
Need statement	n/a		
Program statement	April 2004		
Funding		July 2004	July 2005
Consultants Selection		July 2004	September 2005
Design Development Documents		September 2004	January 2006
Receive Bids for Construction		January 2005	March 2006
Contract Award		March 2005	July 2006
Mid-Point Construction		June 2005	August 2007
Construction Complete		September 2005	September 2008

XII.A. CCPE Review

Review by the Coordinating Commission for Post-Secondary Education is required for this project.

XII.B. Method of Contracting

The project will be conventional design/bid/build. This method is preferred because the complexities involved in project phasing and specialized building systems warrant the traditional design process. There appear to be no advantages to design/build delivery method. However, CM-at-Risk may be desirable if the bidding climate warrants it at the time of construction.

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APPENDIX 1
Carhart Science Building
View looking east

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APPENDIX 1
Carhart Science Building
View looking west

The drawings on the following pages illustrate the proposed phasing plan.

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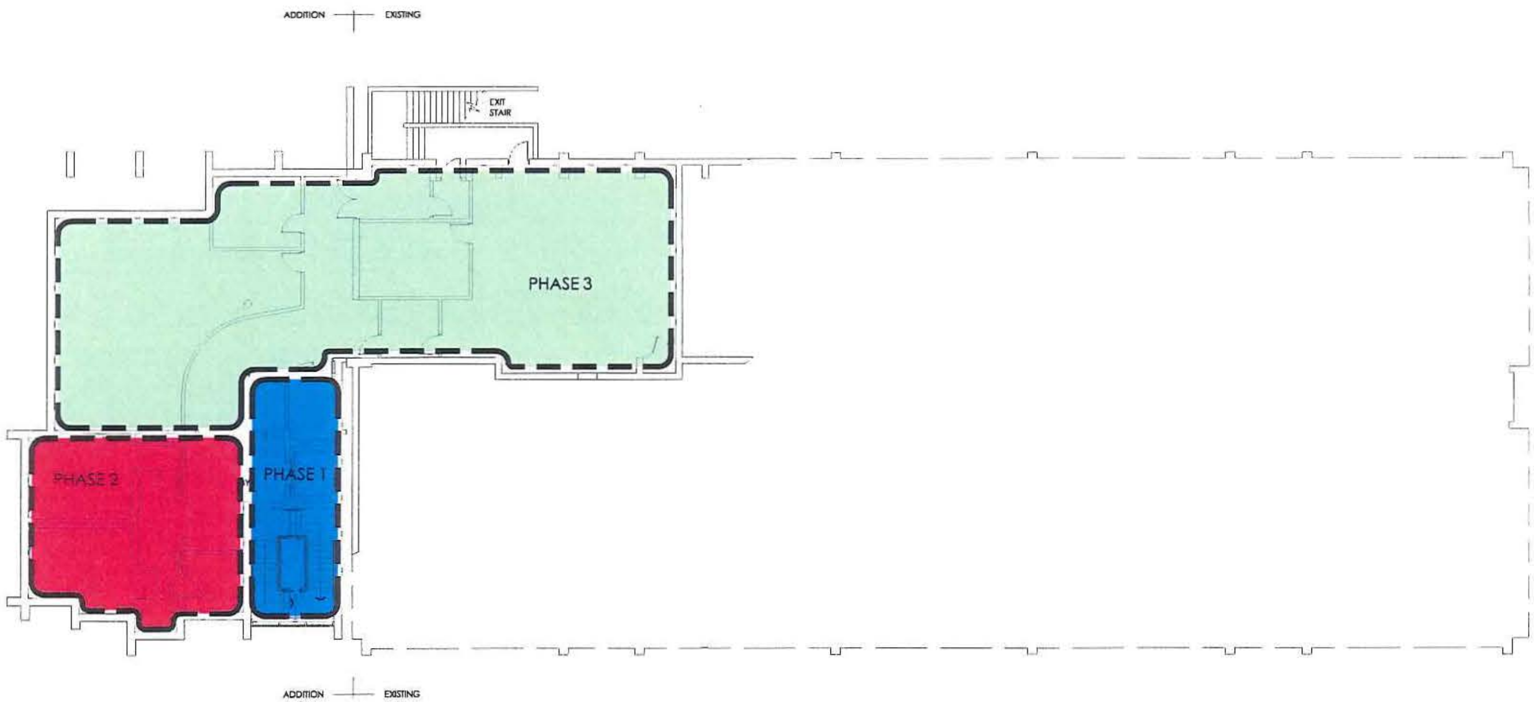
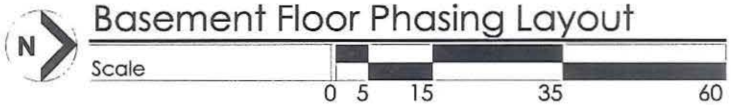
APPENDIX 2

Carhart Science Building Construction Phasing Plans



Basement Floor Phasing Layout



Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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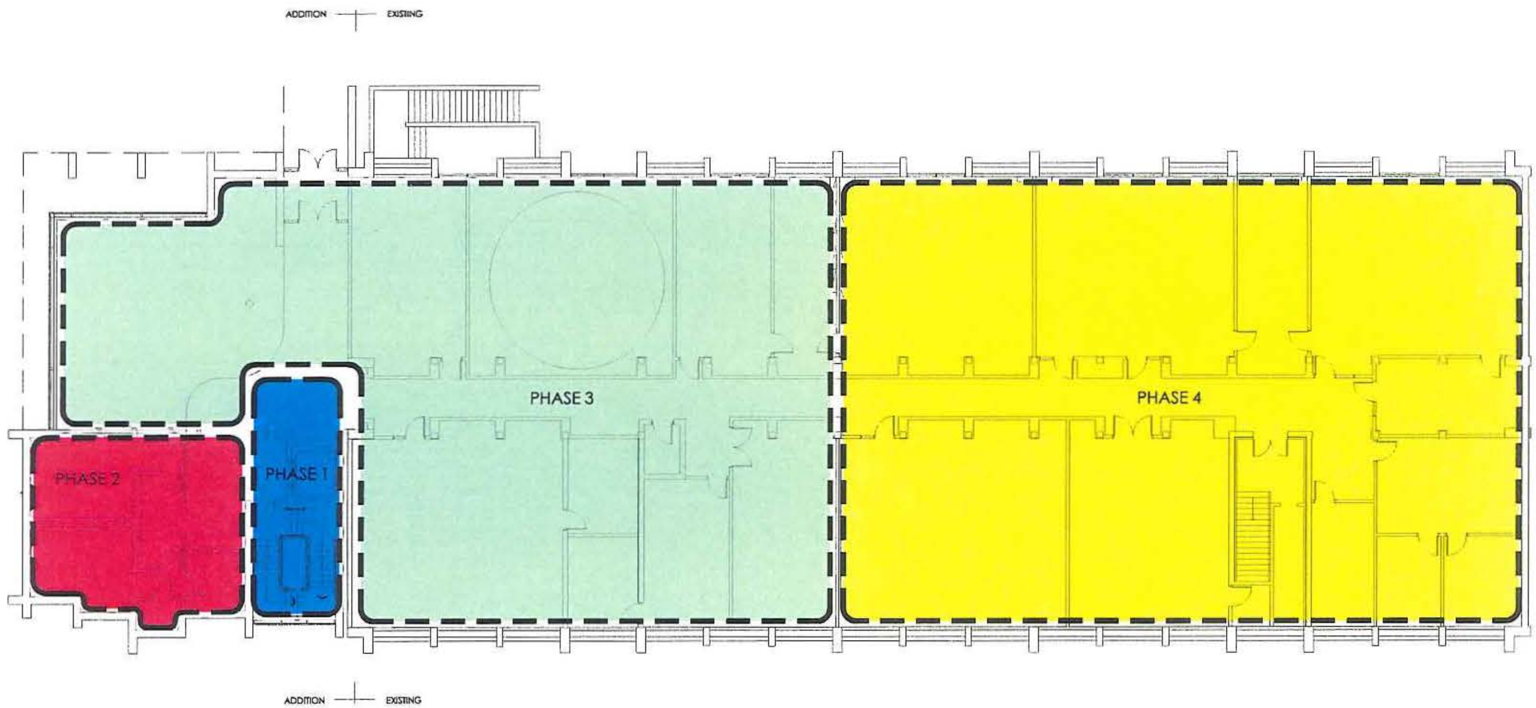

Ground Floor Phasing Layout

N

Scale

0 5 15 35 60

Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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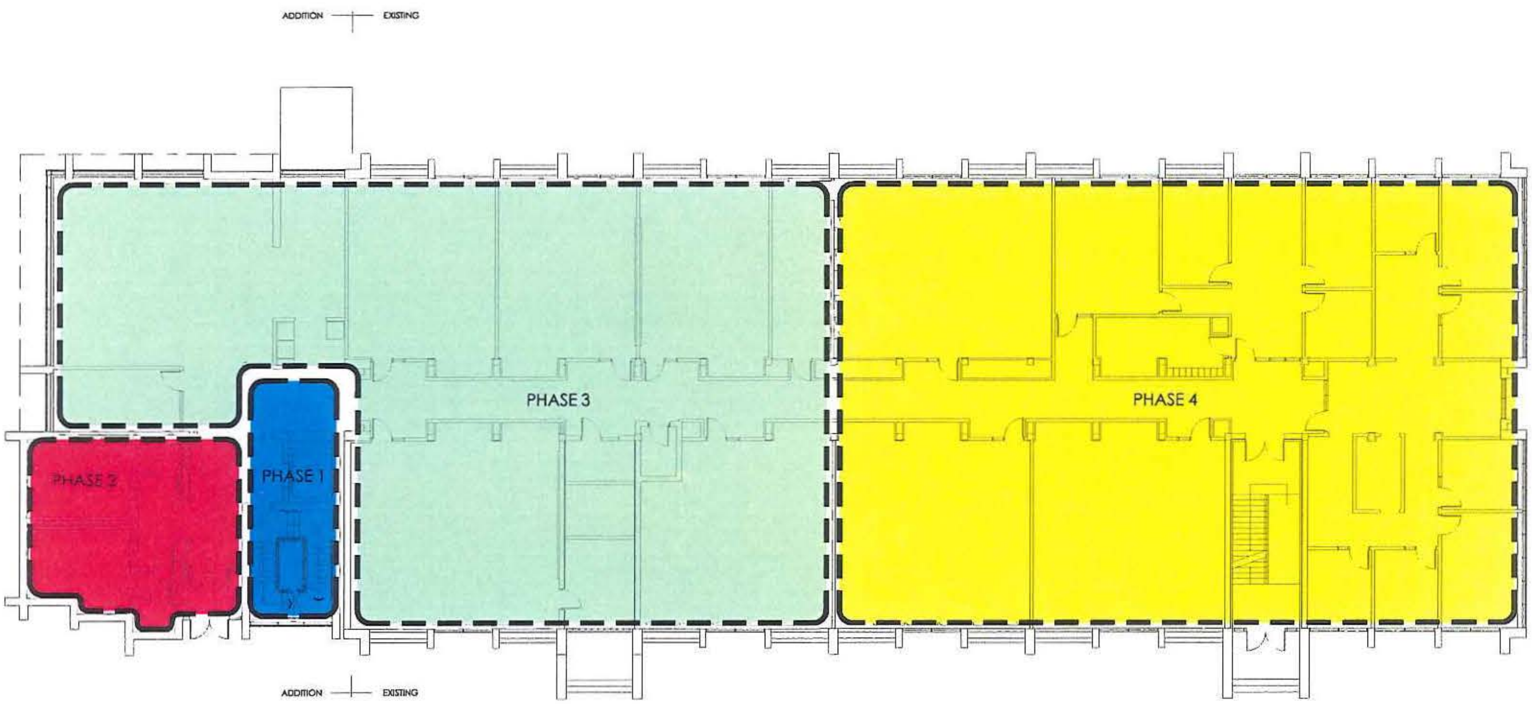

First Floor Phasing Layout

N

Scale

0 5 15 35 60

Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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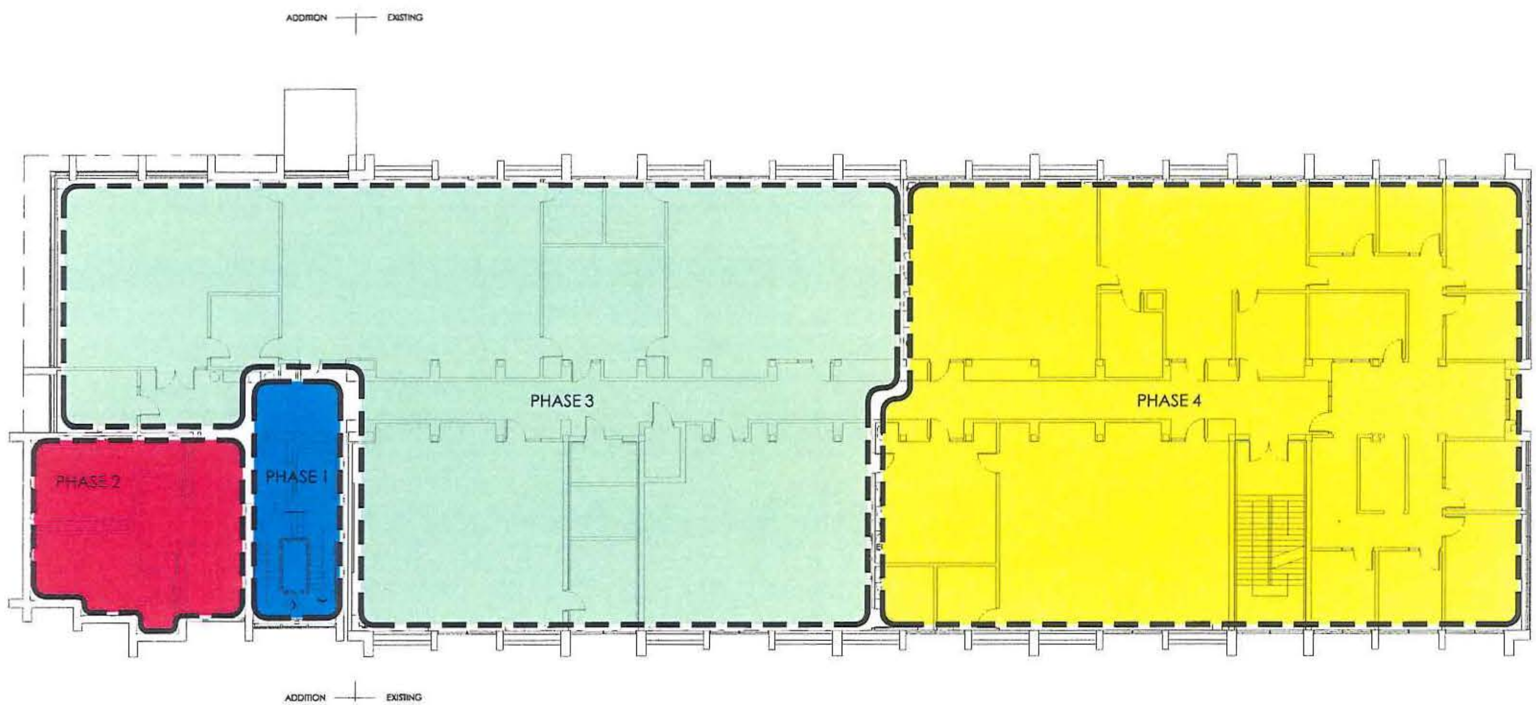

Second Floor Phasing Layout

Scale 0 5 15 35 60

Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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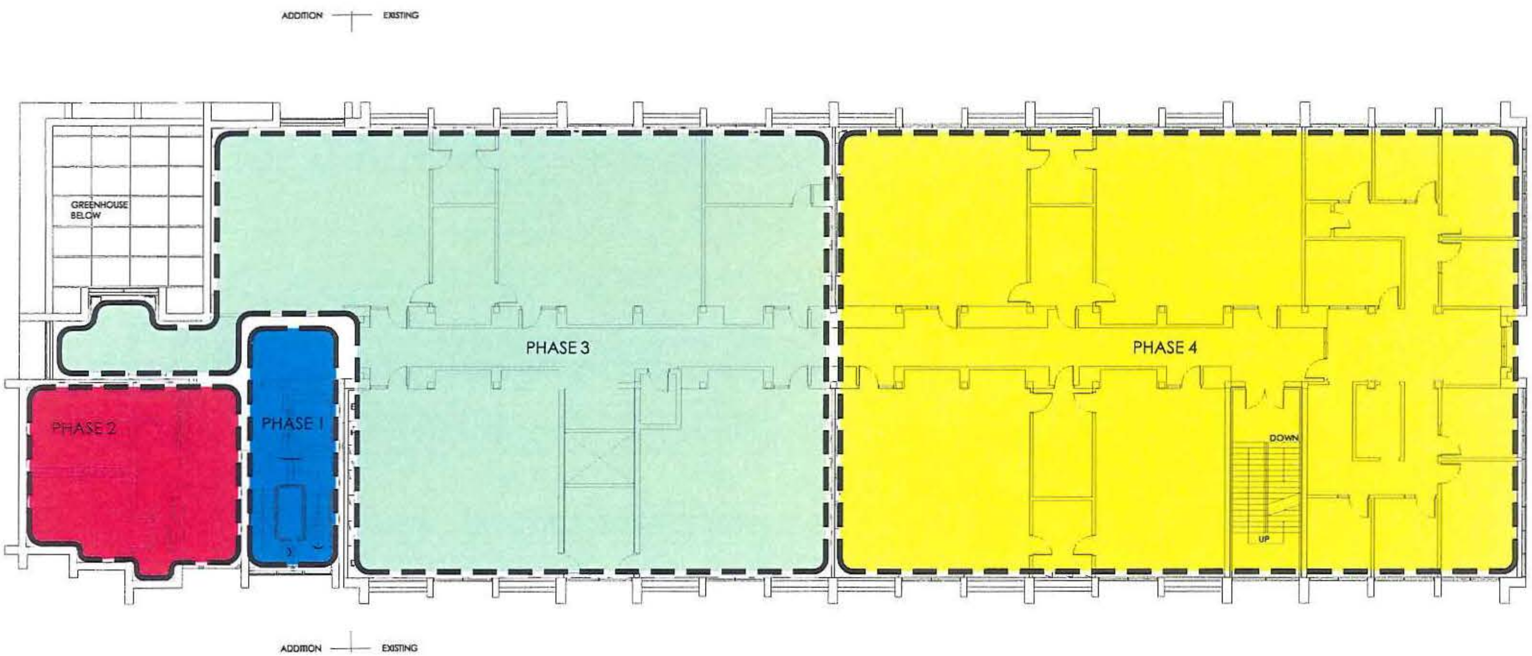

Third Floor Phasing Layout

Scale

0 5 15 35 60

Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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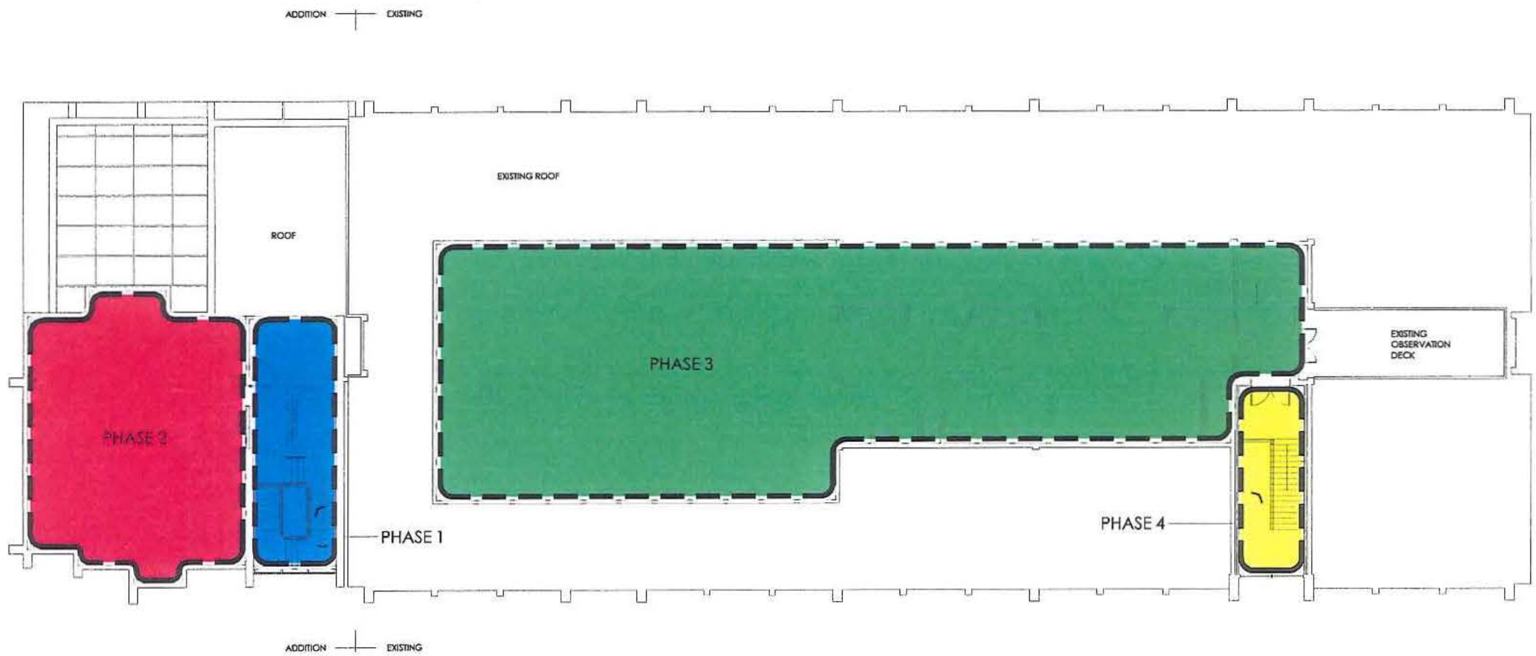

Penthouse Floor Phasing Layout

Scale: 0 5 15 35 60

Key

- Phase 1
- Phase 2
- Phase 3
- Phase 4

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The following are proposed conceptual layouts of the expanded Carhart Science Building.

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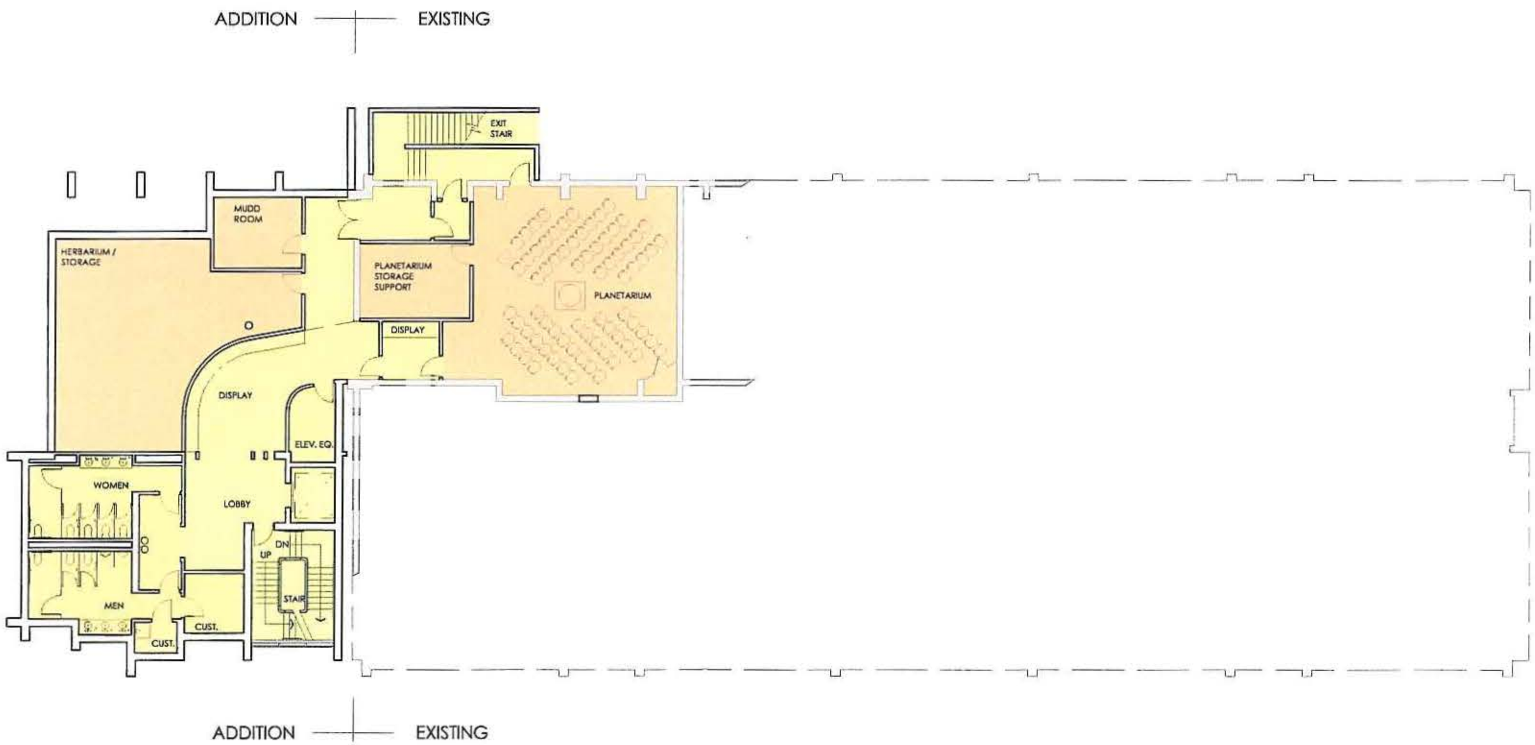
APPENDIX 3
Carhart Science Building
Conceptual Floor Layouts



Basement Floor Conceptual Layout

N

Scale

0 5 15 35 60

Key

- Chemistry
- Life Sciences
- Mathematics
- Physics and Earth Sciences
- Shared Teaching and Support
- Circulation
- Service

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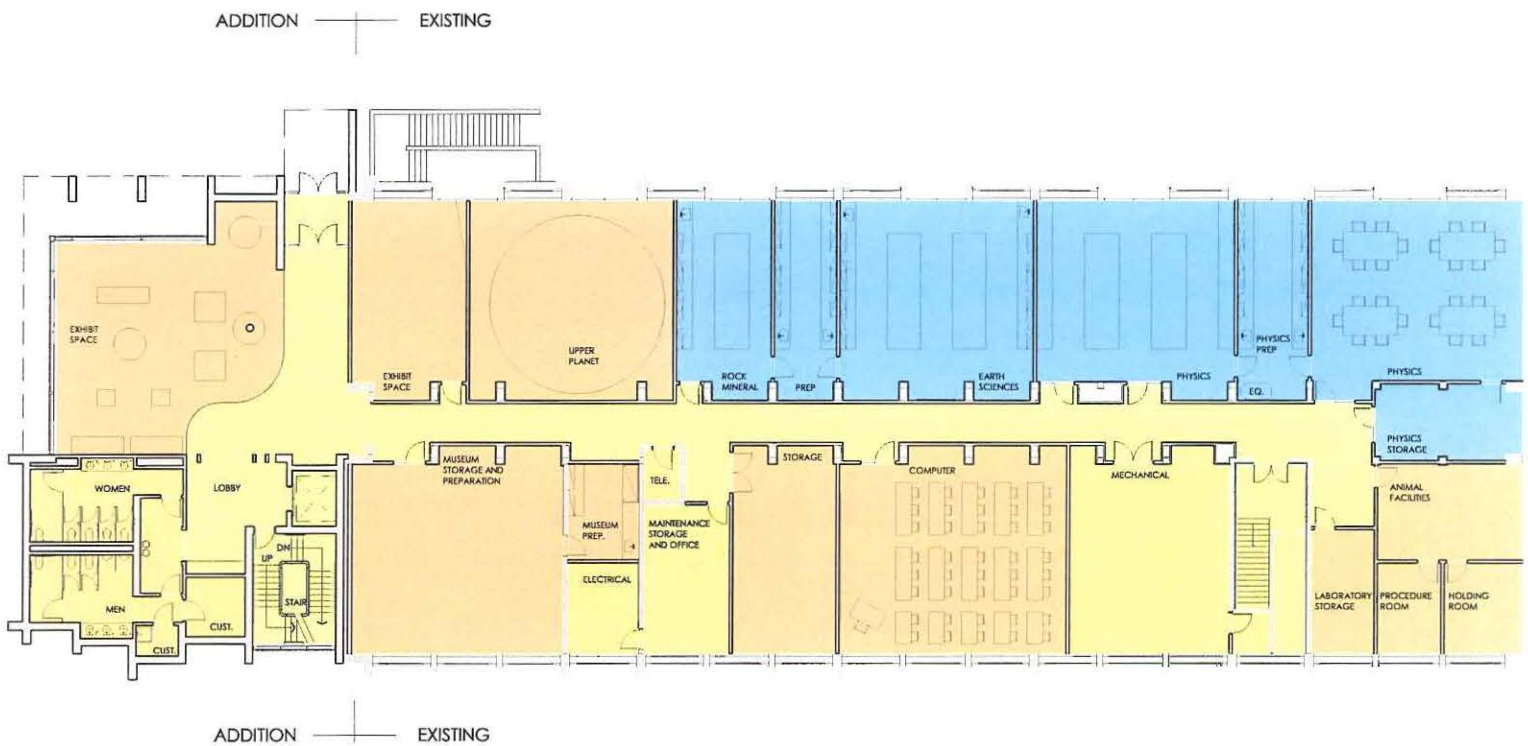

Ground Floor Conceptual Layout

Key

Chemistry	Shared Teaching and Support
Life Sciences	
Mathematics	Circulation
Physics and Earth Sciences	Service

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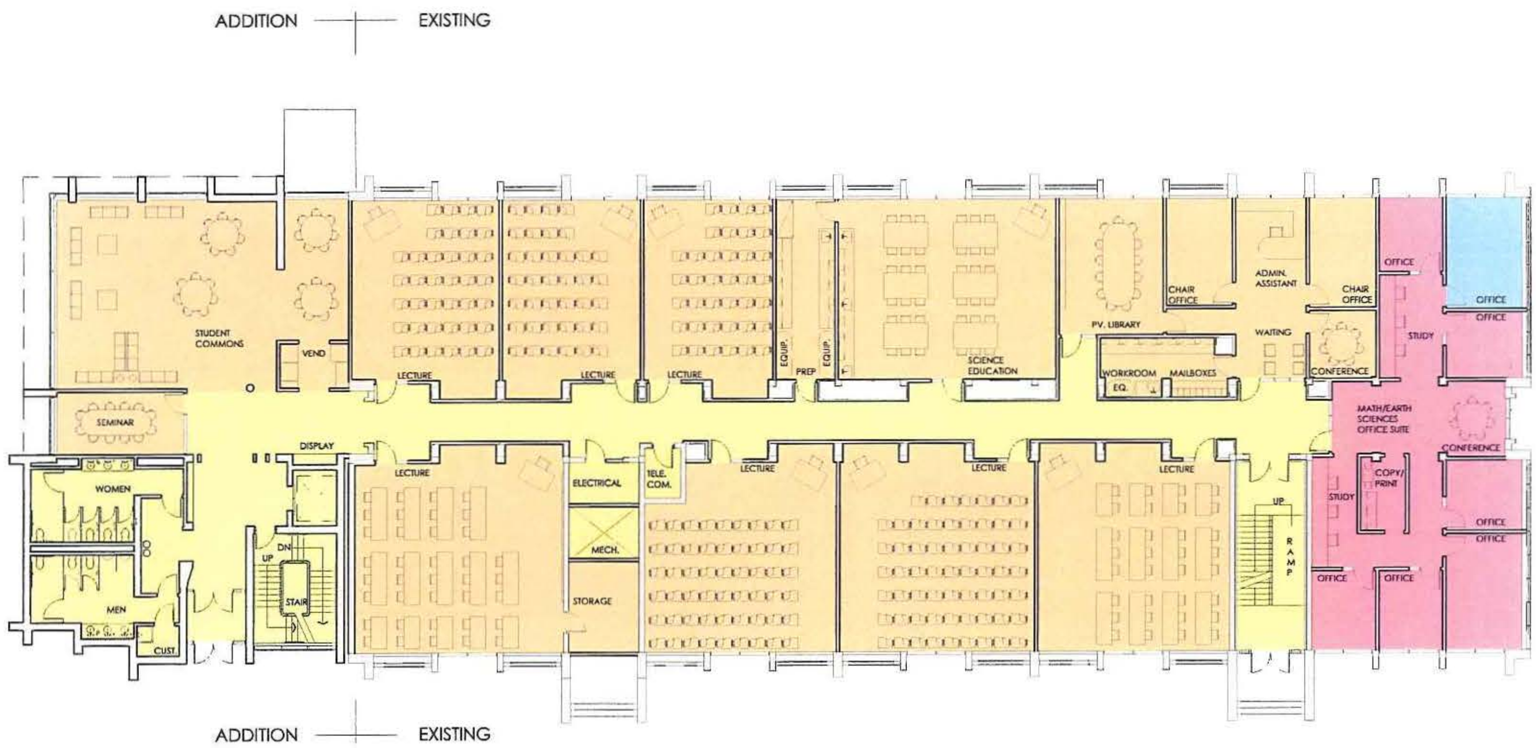

First Floor Conceptual Layout

N

Scale

0 5 15 35 60

Key

- Chemistry
- Life Sciences
- Mathematics
- Physics and Earth Sciences
- Shared Teaching and Support
- Circulation
- Service

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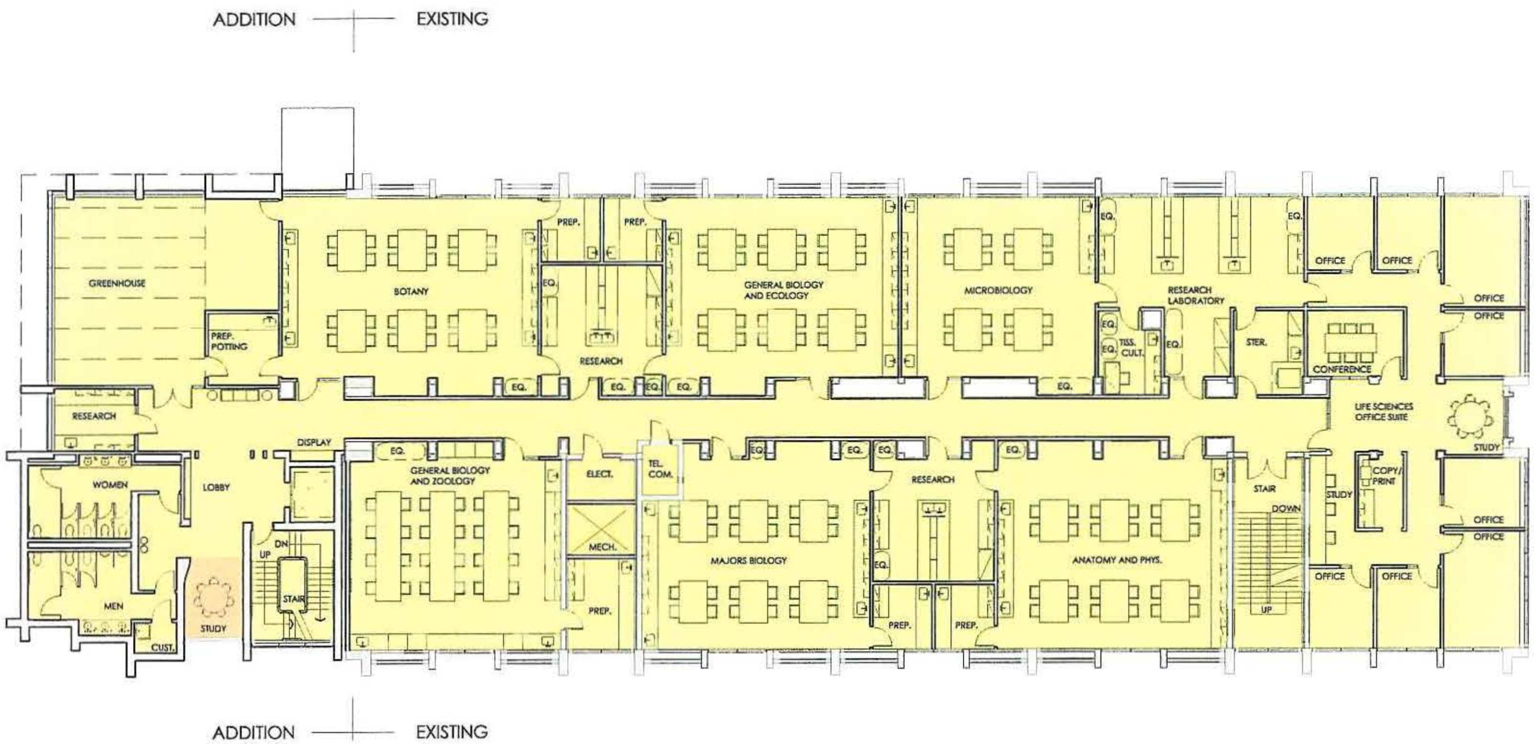

Second Floor Conceptual Layout

N

Scale

0 5 15 35 60

Key

- Chemistry
- Life Sciences
- Mathematics
- Physics and Earth Sciences
- Shared Teaching and Support
- Circulation
- Service

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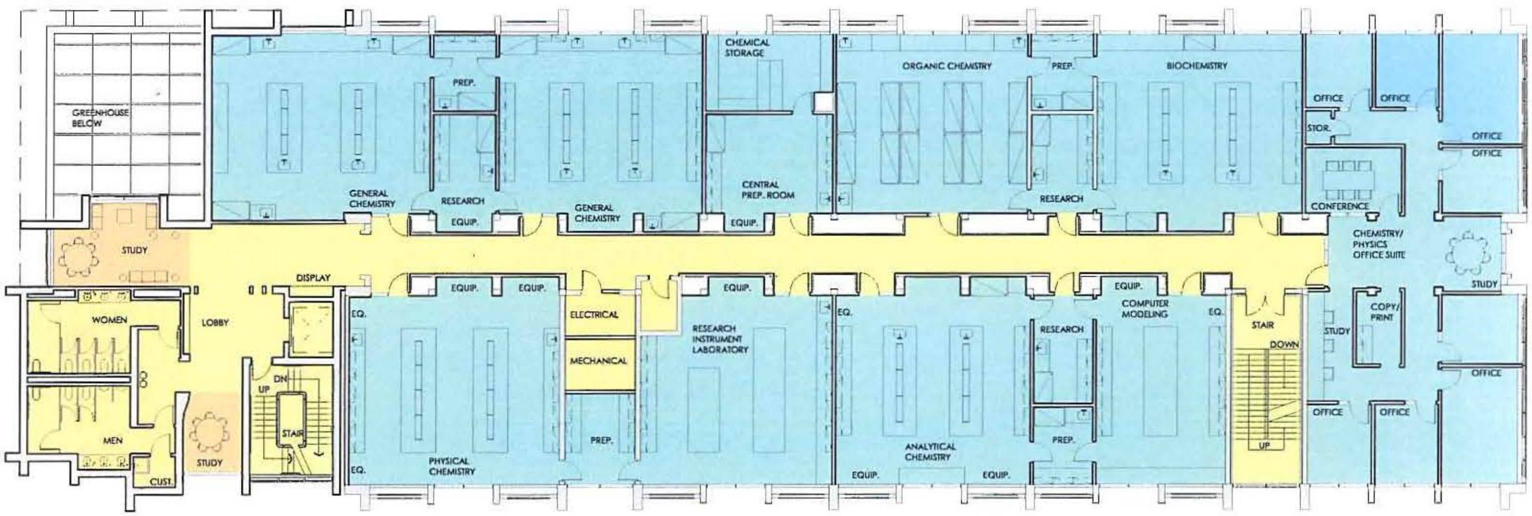
ADDITION — EXISTING



ADDITION — EXISTING

Third Floor Conceptual Layout

N

Scale

0 5 15 35 60

Key

Chemistry	Shared Teaching and Support
Life Sciences	
Mathematics	Circulation
Physics and Earth Sciences	Service

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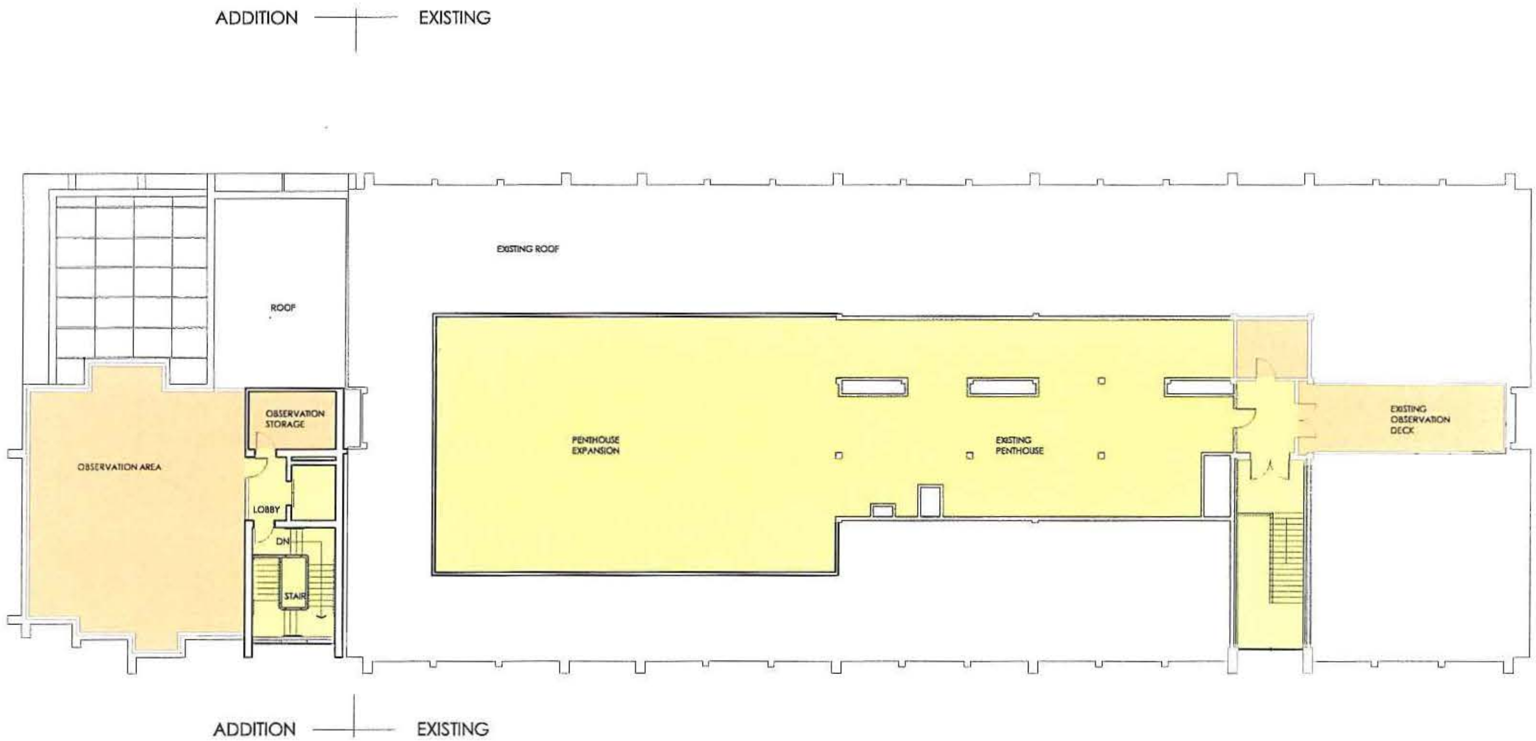

Penthouse Floor Conceptual Layout

N

Scale

0 5 15 35 60

Key

- Chemistry
- Life Sciences
- Mathematics
- Physics and Earth Sciences
- Shared Teaching and Support
- Circulation
- Service

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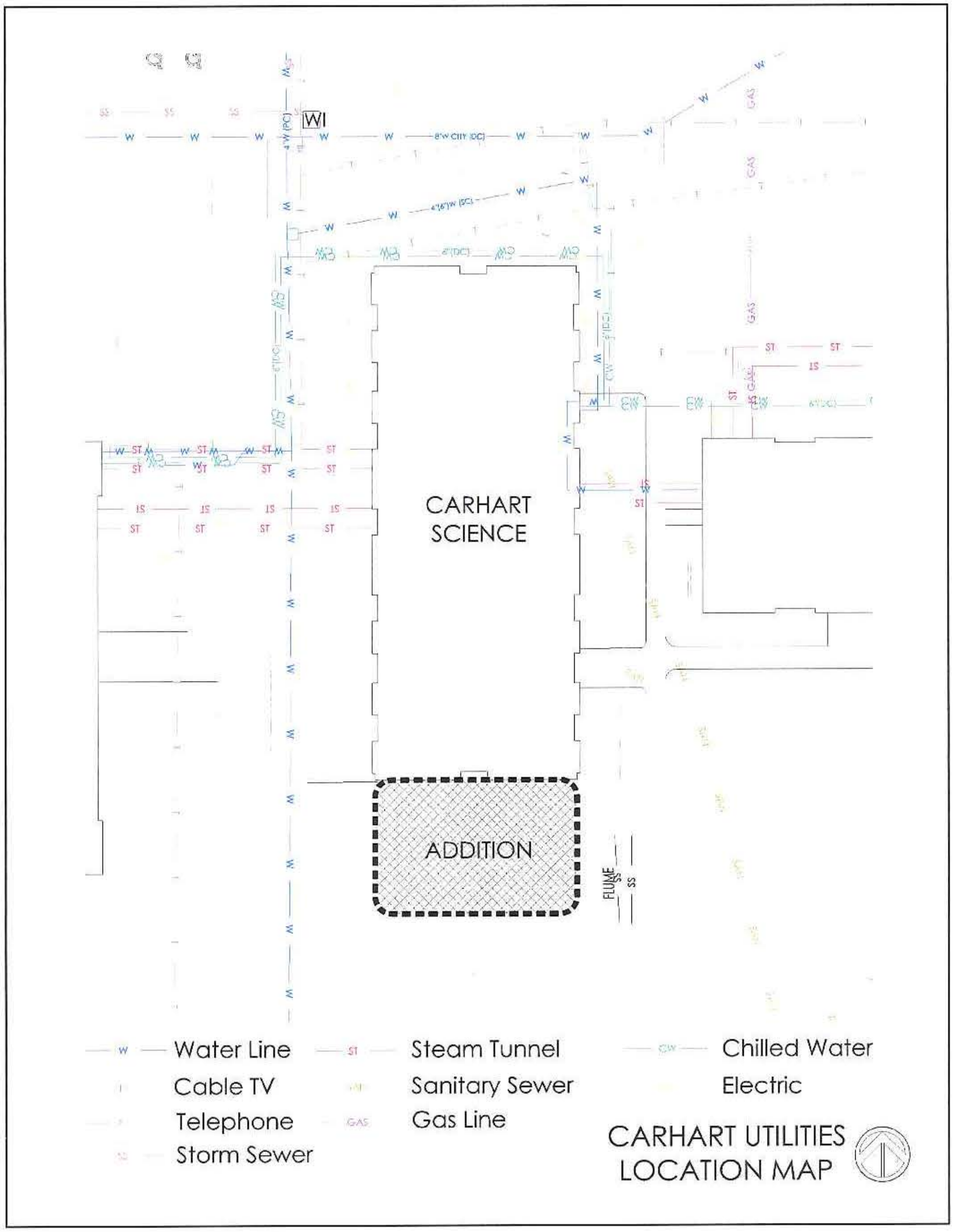

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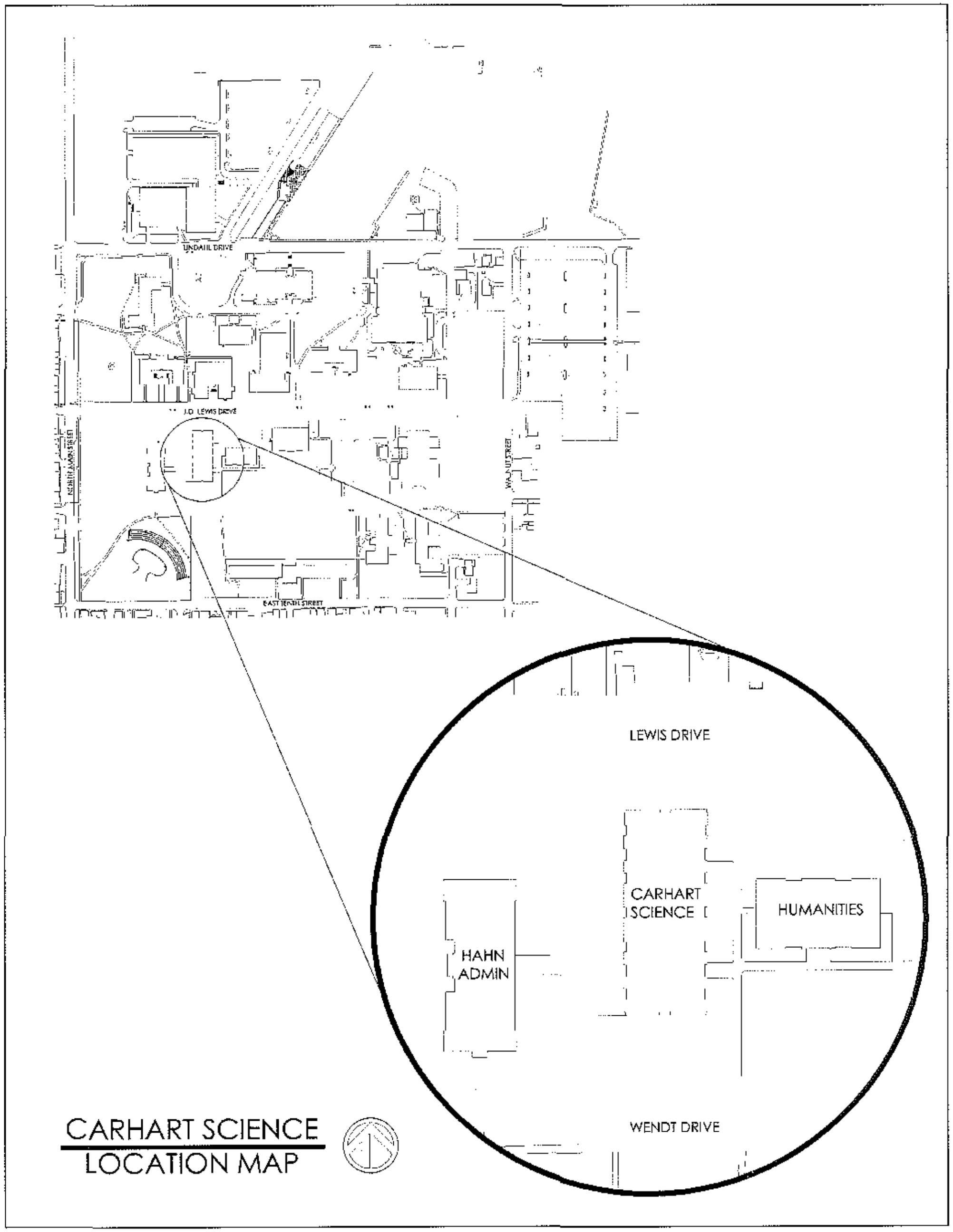
APPENDIX 5

Carhart Science Building
Existing Site Utilities Map



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Carhart Science Building
Existing Site Utilities Map