PROJECT PLANNING REPORT FOR THE RENOVATION OF CHEMISTRY UNDERGRADUATE TEACHING LABORATORIES AT UTM

REPORT

November 2012

Facilities Management & Planning, University of Toronto Mississauga

I. EXECUTIVE SUMMARY

In June 2011, the Ontario government announced capital funding estimated at $17.5 million for the Renovation of the Undergraduate Teaching Laboratories at the University of Toronto Mississauga (UTM). This funding will enable UTM to undertake a multi-year renewal program of its teaching laboratories.

UTM's first science laboratories were built almost 40 years ago and in many cases the facilities barely meet current regulatory standards. The renovation is essential to maximize the utilization of the existing infrastructure and will support increased numbers of undergraduate, research-based master's and doctoral graduate programs, and provide the updated infrastructure needed to support today's scientific teaching and research. The renovation process of the Chemistry teaching laboratories started in 2010 creating large teaching laboratories containing a significant number of fume hoods and accommodating large first and upper year chemistry courses (funded by the Knowledge and Infrastructure Program). This project will complete the CHM teaching laboratory renovation increasing the space allocation by 282nasm and allowing the entire 3rd floor of the W.G. Davis building D-block to be dedicated to CHM teaching and related research.

The Chemistry department is currently engaged in an academic and strategic planning process to support enrolment growth and expansion of lab-based courses. Chemistry is an experimental science and chemical education must involve exposure to and direct hands-on experience with chemistry experiments. Investment in the physical structure will allow the improvement of pedagogical techniques, as well as more efficient use of space to deliver an effective educational experience to UTM's students.

In addition, the space will provide for an expansion of the suite of analytical instruments used by senior undergraduate chemistry students in research-intensive fourth-year chemistry courses, by chemistry graduate students in their research projects, and by other researchers within CPS and throughout the science disciplines based at UTM.

The proposed schedule for this project is based on advanced planning to allow for construction to commence in April, 2013 immediately after classes finish. It is essential for construction to be completed by September 3, 2013.

The estimated Total Project Cost for the project is $ 3,956.738 and it will be funded from UTM's Operating Fund. Note, the North Bldg and the Teaching Laboratory Renovations will be funded by the province 70% and UTM 30%. However, due to cash flow from the province and the proposed timing of the projects involved, the proportion of the funding will vary significantly among the related projects.

It should be noted that the teaching laboratories have been designed for maximum flexibility and with a view to accommodate UTM growth, not only in Chemistry but in other possible programs that will be able to use the laboratories to ensure optimal utilization.

TABLE OF CONTENTS

II. PROJECT BACKGROUND

a) Membership

Peter Macdonald, Professor and Chair of CPS, UTM
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b) Terms of Reference

1. Review the space utilization of the chemistry undergraduate teaching laboratories and related support space and demonstrate that the proposed space program will be consistent with the Council of Ontario Universities' and the University's own space standard.
2. Make recommendations describing other models for undergraduate teaching laboratory layout and operation.
3. Review environmental and occupational health and safety processes and procedures, propose improvements to laboratory operation and implement new chemical and chemical waste management processes (i.e. purchasing and inventory management and control) for the undergraduate laboratories.
4. Identify equipment and moveable furnishings necessary to the project and their estimated costs.
5. Identify all data, networking, communication, security, and A/V requirements and their related costs.
6. Identify all environmental, occupational health and safety, life safety, security and accessibility requirements and their related costs.
7. Determine a total project cost estimate (TPC) for the capital project, operating costs including the cost of implementation in phases and identify all other resource costs to the University.
8. Identify all sources of funding for capital and operating costs.
9. Report in September 2012.

c) Background Information

Until recently, the existing chemistry undergraduate teaching laboratories at UTM, which have been in service since 1970, had undergone essentially no renovation or modernization in the ensuing 40 years. Originally designed to accommodate a total of ~600 students per 5-day week, the actual number has doubled to more than 1200 laboratory FCE's in the current academic year. To accommodate this growth, laboratory instructional hours for students, particularly first-year students, had to be severely cut back. Even so, it proved necessary to schedule laboratory classes during evenings and weekends. Moreover, in light of our increased knowledge of chemical toxicity and evolving health and safety regulations, the lack of sufficient fume hood capacity severely restricted the nature of the experiments that could be performed safely in the laboratory space.

The severe and debilitating inadequacies of the chemistry undergraduate teaching laboratories at UTM were brought to the attention of UTM's senior administration in reports from two independent external review groups. The first review, completed in the spring of 2008, was conducted by the Canadian Society for Chemistry (CSC), and concerned a renewal of the CSC Accreditation of UTM's undergraduate chemistry programs. As the quotes below from their report illustrate, the CSC review panel was unequivocal in highlighting the necessity for more laboratory space renovated to modern health and safety standards.

> "Much of the laboratory space in the department is in real need of renovation to bring it to modern standards…….In the case of the technical staff who are responsible for administering the laboratory program to a large degree, the combination of lack of space and small numbers appears to be leading to a situation which is, at least, not student-friendly and, at worst, a real health and safety issue……If this (renovation) does not come to pass as suggested, we feel the situation may become unmanageable. At present, as noted above, laboratory hours in the first year are restricted to two hours every second week. Chemistry is an experimental science and this limited exposure is damaging to the student experience of the science and also to the recruitment of good students into the program."

In their assessment, the CSC site visit team provided the following recommendation as their recommendation on highest priority.

> "The University's plan to complete the renovations to the first year labs, and just as important to expand the lab space for undergraduate instruction, is crucial and failure to do this in the announced time frame may jeopardize the accreditation of the programs. In view of the expanding enrollment and the potential for shifting undergraduate students from the St. George campus to the suburban ones, increased space is an absolute necessity. The expansion/renovations must allow a minimum of three hours laboratories for first year students at least on a biweekly basis and preferably on a weekly basis. A failure to do so in a timely fashion will leave UTM's programs uncompetitive with others at the other UT campuses and across Canada. It will inhibit recruitment into higher years of the programs, and ultimately affect the UTM graduate student population."

The second review, conducted in February of 2009, was a formal external review of the Department of Chemical and Physical Sciences by a panel of senior university scientists from across North America. As the quotations below from their report demonstrates, it was immediately recognized that renovation of CPS's undergraduate chemistry teaching laboratories must be a top priority, from a health and safety perspective, and also with regards to concerns over the quality of undergraduate chemistry education.

> "The crowded undergraduate laboratories are not adequately vented and students and staff are being exposed to noxious chemicals. The students commented strongly about inadequate safety in the laboratories: insufficient hood space, and air quality issues. Based on our own ours of the laboratories, it is in fact clear that this is an issue that needs to be dealt with very quickly."
>
> "If these conditions existed at a university in the U.S. the laboratory courses would be shut down and not re-opened until the safety conditions had been corrected."

Prompted by these two independent assessments, planning exercises were initiated in Summer 2009 for renovations of the UTM undergraduate chemistry teaching laboratories. Because of the extent, complexity and expense of the required renovations, a multi-phase, multi-year plan was developed.

Phase 1 addressed the need for relocation and consolidation of the preparation space for technical staff. The multiple benefits of this plan included an enhanced ability to manage and control inventory, storage of chemicals, chemical and hazardous waste disposal and energy consumption. Furthermore, by relocation and consolidation of the preparation space, the teaching laboratories could be made larger and better suited for teaching of large classes. Phase 1 was completed during Summer 2010.

Phase 2 consisted of complete renovations to two substantial undergraduate chemistry teaching laboratories: one large laboratory for first and second year chemistry courses (600 nasm) and one smaller laboratory for upper year courses (300 nasm). The configuration of the large laboratory allowed scheduling of large first year and second year classes with enhanced laboratory hours per course, while eliminating the need for evening and weekend classes (although some evening sessions were retained to accommodate the scheduling needs of part-time students). The upper year chemistry laboratory was configured to permit sufficiently serviced space to safely accommodate their experiments while providing access to sophisticated instrumentation and computers. Both laboratories were provided with fume hoods integrated with the bench space, with one 4-ft fume hood being shared by two students. This allowed for incorporation of more sophisticated experiments in undergraduate chemistry laboratories, such as the inclusion of more organic chemistry in the first year curriculum, a growing trend at Canadian universities, while providing for strict adherence to best practices in chemical health and safety standards. The increased air-handling capacity demanded by the addition of these numerous new fume hoods required a complete re-engineering of the air-handling of the Davis Building undergraduate teaching wing. Phase 2 was completed in Fall 2011 and has literally transformed the student undergraduate chemistry laboratory experience by exposing the students to modern chemistry facilities, infrastructure, equipment and experiments, and through incorporating instructional zones or "pods" with white board and projection capabilities, allowing teaching assistants to focus on small groups of 20 students with targeted content specific to the needs of a given course.

Phase 3 will be undertaken during Summer 2013 and will consist of an expansion of the upper year chemistry laboratory started in Phase 2. The existing upper year chemistry laboratory space permits for only limited enrolments in laboratory-intensive advanced courses, despite the increasing demand. Furthermore, this laboratory space would be better configured if biochemical-oriented courses were completely segregated from synthetic chemistry-oriented courses, as the teaching materials used in these respective courses are mutually incompatible. Moreover, advanced instrument-intensive courses place their own particular demands on infrastructure and equipment. The final configuration of the upper year chemistry undergraduate teaching laboratory is designed to permit radically increased enrolments in these courses, as expected to arise due to overall enrolment increases at UTM, but also through increased "catchment" in CPS chemistry programs overall resulting from the enhanced chemistry education experienced by students in the recently renovated first and second year undergraduate chemistry teaching laboratories. The advance chemistry undergraduate laboratory configuration will

accommodate the various diverse advanced, and sometimes incompatible, experimental requirements, sophisticated instrumentation and computers demanded by these courses, while providing flexibility in scheduling and efficient usage of space, with due consideration to modern health and safety standards and practices.

d) Space Utilization Analysis

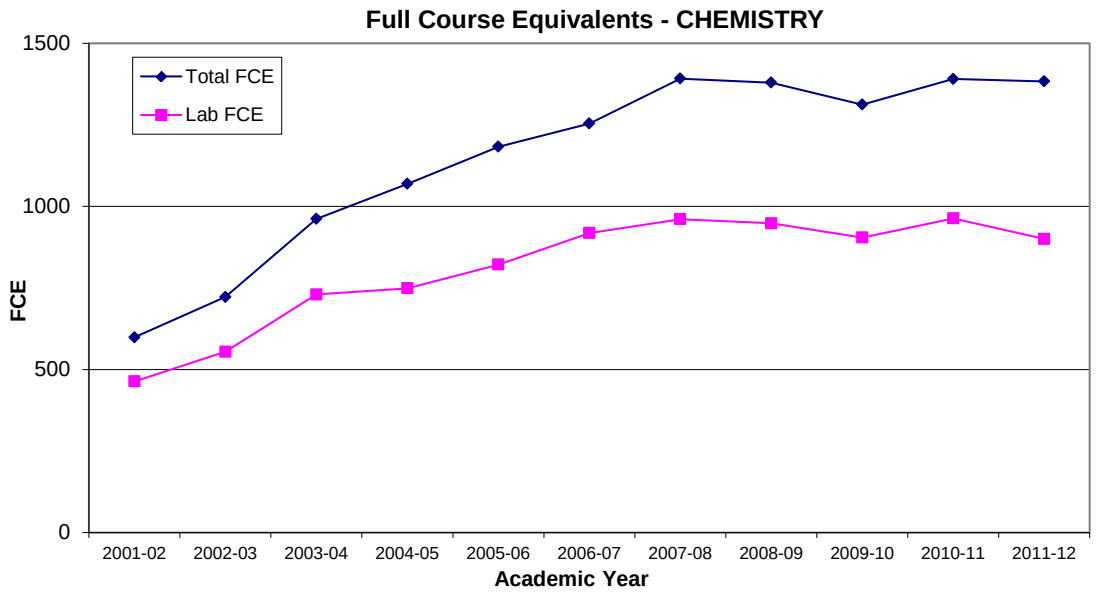
The utilization level of the chemistry teaching laboratories was evaluated using three indicators:

- Full course equivalents
- Weekly student contact hours
- Laboratory schedules

Full Course Equivalents

Full Course Equivalents (FCEs) are calculated as the sums of all course weights multiplied by the number of enrolled students. The FCE calculation differentiates between full and half courses: a full Y course has a weight of 1.0 and a half course H has a weight of 0.5.

The following chart shows the Total FCE and Laboratory FCEs for Chemistry over the last few years.



From the period 2001 to 2008, Chemistry FCEs roughly doubled, from on the order of 600-700 to between1300-1400. Chemistry Laboratory FCEs followed a parallel trend. Over the past three years Chemistry FCE growth has slowed; contributing to this slower growth was the introduction of higher standards for acceptance into first year chemistry (now 70% in high school chemistry versus the earlier 50% requirement prior to 2008).

Note, the FCE numbers in the table above include all CHM courses and as well as joint physics courses taught in chemistry teaching laboratories.

Weekly Student Contact Hours

The Council of Ontario Universities (COU) space guidelines provide a quantitative guide to the space required to accommodate undergraduate teaching laboratories and their support space (COU category 2). The amount of space is based on the number of Weekly Student Laboratory Contact Hours (WSCH) and the nature of the discipline.

The table below shows that the generated (theoretically required) space 1402nasm exceeds the existing space of 1028nasm.

UTM Chemistry Course Information (2012-2013)**

COURSE	Practical Lab Hours/Week	Course Enrollment	Contact Hours/Course	COU Space Factor	Generated NASM
CHM110	1.5	800	1200	0.6	720
CHM120***	1.5	0	0	0.6	0
CHM211H	4	120	480	0.6	288
CHM231H	2	120	240	0.6	144
CHM243H***	4	0	0	0.6	0
CHM371H	4	40	160	0.6	96
CHM391H	4	32	128	0.6	76.8
CHM393H	4	32	128	0.6	76.8
JCP221H***	1.5	0	0	0.6	0

TOTAL	contact hours	2336
	generated NASM	1401.6
	existing NASM	1028.5

** enrollments as of July 20th, 2012 - pre-requisite checking is completed

*** spring term courses are excluded from this table, per previous PPR

The renovation of 2010 increased teaching laboratory space from 792nasm to 1029nasm greatly improving the laboratory teaching facilities for the department.

A portion of the upper year teaching laboratory is shared with research, so the area was prorated to 889nasm in undergraduate teaching laboratories and 140nasm in instrumentation research laboratories (instrumentation lab) to more accurately reflect the space use. Updated space inventory is included in Appendix A.

The proposed renovation will add the last quadrant of the 3rd floor of the D-block of the W.G. Davis building to chemistry wet laboratories further increasing the area by 283nasm: 236nasm for teaching purposes and 47nasm for research. This new allocation greatly improves COU allocation of Chemistry undergraduate teaching laboratories (COU Category 2) to 80% of COU generated space.

The anticipated enrolment growth for UTM is approximately 25%. This increase will translate to approximately 1751nasm of generated space for CHM teaching laboratories (equivalent to 64% of COU space allocation).

Laboratory Schedules – Upper year lab

This laboratory is intended for courses with small enrollment, courses that utilize research equipment located as part of the laboratory and research-based courses that require large numbers of unscheduled, practical hours. The Laboratory for 3rd year is arranged in two sections: fume hood intensive and instrumentation sections. This setup accommodates courses that

require extensive use of fume hoods while providing access to sophisticated research laboratory equipment.

The proposed renovation will be similar to the existing upper year laboratory:

- island benches with fume hoods for teaching
- heavily serviced space
- flexible serviced benches with “snorkel “fume hoods
- flexible setup for AIR Lab (Advanced Interdisciplinary Research Laboratory)
- fixed island bench without fume hoods for analytical instrumentation

Chemistry -Laboratory Schedule (Fall/Winter) 2012-2013

DV3065-2012-2013	Course	Section size	M	T	W	R	F	Total/Course
FALL/WINTER SESSION(Y COURSES)	CHM371	20	4	4				8
	CHM391	16	4				4	8
	CHM393	16			4	4	4	12
TOTAL WEEKLY HOURS								28

Laboratory Schedules – First year lab

This laboratory is arranged to accommodate large first-year courses, large upper-year courses and courses that do not require time-consuming experimental setup. The Laboratory for 1st and 2nd year is arranged in 6 pods of 20 students each allowing for teaching and learning the content and methods of the discipline in an integrated format, and providing great flexibility in scheduling the laboratory use.

No changes to this laboratory are planned during the proposed renovation.

The laboratory schedule for 2012-13 shows utilization below COU standards, yet the total space allocation is below 85%. This discrepancy is due to small station size allocated for each student. This decision was made in 2009 when the main renovation of the CHM teaching laboratories was planned. At that time, there was no possibility to vacate and no funding to renovate additional space for the CHM teaching laboratories.

At the present time, the spare capacity in the laboratory schedule will allow UTM to accommodate additional growth of 25%-30% which is expected to fully realised by 2016. At that time the labs will be used 19 hours per week in the fall and 22 hours per week in the spring.

Chemistry - Laboratory Schedule(Fall/Spring)2012-2013

DV3075 - 2012-2013			M	T	W	R	F	Average weekly use/pod*
FALL	CHM110F	Pod 1*	6	6	3	6		21
		Pod 2	6	6	3	6		21
		Pod 3	3	3	3	1.5		10.5
	CHM211F	Pod 4		4	4	4		12
		Pod 5		4	4			8
	CHM231F	Pod 6		4	4	4	2**	14
			(ARE PER POD)TOTAL WEEKLY HOURS, FALL TERM					14.42
SPRING	CHM120S	Pod 1	6	6	3	6		21
		Pod 2	6	6	3	6		21
		Pod 3	3	3				6
	JCP221S	Pod 4	3	3	3	3		12
	CHM243S	Pod 5	4	8	4	4		20
		Pod 6	4	8	4	4		20
			(ARE PER POD)TOTAL WEEKLY HOURS, SPRING TERM					16.67

*20 students/pod

**FSC300

JCP includes join courses between CHMand PHY

The scheduling of teaching laboratories in chemistry will allow not only the anticipated enrollment growth in the department, but it will also allow teaching multidisciplinary courses and courses that require fume hood facilities. This practice was introduced in 2011-2012 when Forensic Science and Biology started sharing the teaching laboratories.

III. Project Description

a) Vision Statement: Advanced Chemistry Undergraduate Laboratories

Chemistry is the study of molecules: their structures, their reactions, their properties, and their applications. Chemistry is a central science, of importance in physics, biology, medicine, engineering, agriculture, environmental and multiple other fields. Thus, chemistry impacts our daily lives in innumerable ways.

Chemistry is an experimental science and chemical education must involve exposure to and direct hands-on experience with chemistry experiments. At an advanced level, this involves more than following pre-ordained “recipes”. Instead, the budding chemist must learn to formulate the hypothesis to be tested, properly design experiments to address the question at hand, interpret the results, evaluate the experiment’s success or failure, and repeat the process with appropriate modifications. In this fashion, the critical thinking skills required of practicing chemists can be fostered.

The particular laboratory-intensive chemistry courses to be accommodated in the newly renovated chemistry laboratories are:

CHM371H5Y “Techniques in Biological Chemistry”

JBC487Y5Y “Advanced Interdisciplinary Research Laboratory”

CHM391H5Y “Instrumental Laboratory”

In addition, the space will provide for an expansion of the suite of analytical instruments used by senior undergraduate chemistry students in research-intensive fourth-year chemistry courses, by chemistry graduate students in their research projects, and by other researchers within CPS and throughout the science disciplines based at UTM.

In order that an advanced chemistry laboratory facility is capable of providing such possibilities it must combine access to up-to-date instrumentation with flexibility of use to permit incorporation of future pedagogical developments. Furthermore, safety is a prime consideration in the design of laboratory space in which potentially hazardous materials / procedures are to be used / conducted. The key elements of the laboratory infrastructure necessary to achieve these principles in the context of the particular courses allocated to the newly renovated laboratory space are as follows:

- Island benches with fume hoods, benches to afford storage space for small equipment, electrical outlets, adjustable shelving.
- Fume hoods on island benches to be equipped with requisite services, including cold water, vacuum compressed air, nitrogen gas, chilled water for condensers, retort stands, etc.
- Perimeter benches with maximum counter space and storage.
- Fume hoods at perimeter equipped as above for general use.
- Flexible island benches, with “snorkel” fume hoods, permitting multiple possible arrangements.
- Fixed island benches without fume hoods, for analytical instrumentation.
- Biosafety cabinets for storage of potentially hazardous biological materials.
- Hazardous waste (glass, chemicals, general waste) disposal considerations.
- Sinks, constructed of durable material, to be located appropriately throughout.
- Requisite services (electrical, plumbing, gas, etc.) to be provided with a view to maximum flexibility for future changes in dispersal.
- Secure access to the facility without unduly restricting off-hours access.
- Teaching station equipped for digital audio-video plus no-digital presentations.
- General visual blend / continuity of finishes with previously renovated chemistry undergraduate laboratory space.
- Student lockers in outside hallways to avoid congestion around work benches.

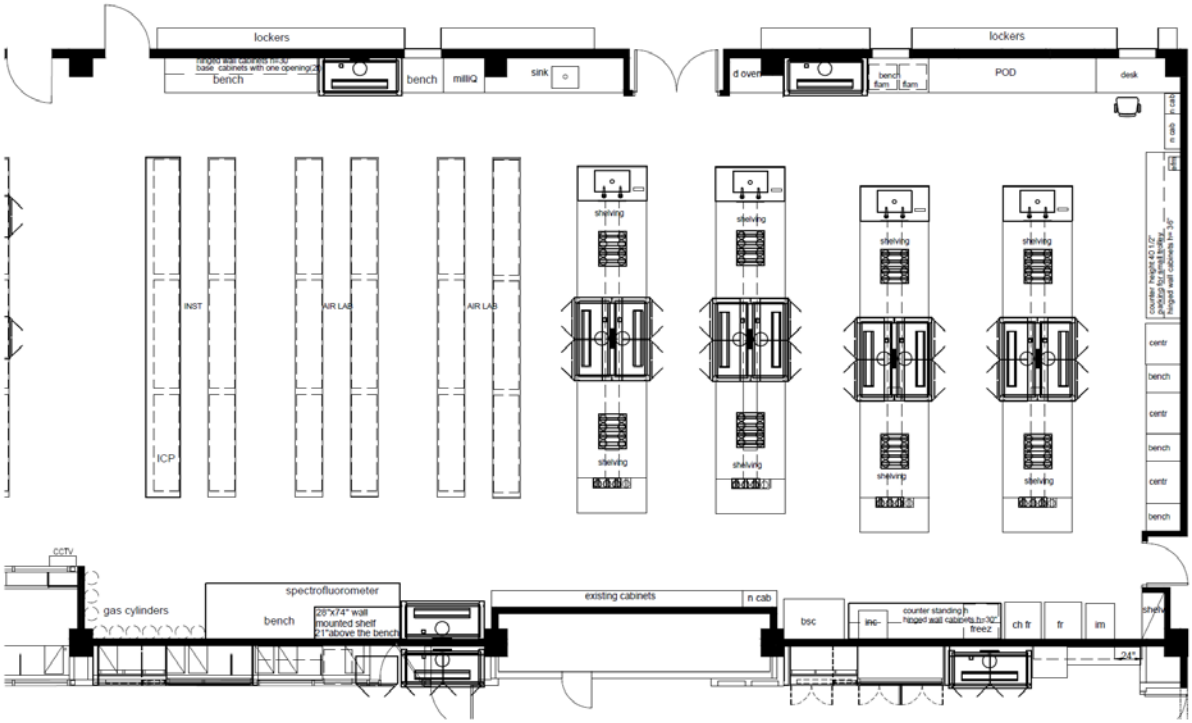
b) Space Program & Functional Plan

The area to be renovated DV3069/3070/3071 is vacant and used on a temporary basis for research needs of the Department of Biology. This space will be fully vacant in March 2013.

The proposed renovation will combine the existing teaching laboratories into one large teaching laboratory which will support both teaching and research purposes.

The large open concept will allow for separation of incompatible courses in organic/inorganic chemistry, biochemistry and synthesis while providing flexible environment for teaching courses with various enrollments. The large open concept will also improve efficiency in equipment utilization and chemical management among the different courses.

Proposed Layout



The largest improvement from teaching point of view is the large number of fume hoods allowing all students to work in fume hoods or a lab bench as required.

The renovated laboratory will include: four double-side island benches with fume hoods, each island bench will accommodate eight students; two flexible double-sided island benches with “snorkel “fume hoods, each flexible island bench will accommodate several students during the Advanced Interdisciplinary Research Laboratory sessions, and one double-sided island bench without fume hoods, this island bench will accommodate several students and various instruments.

c) Building Considerations

Accessibility
The University of Toronto is committed to ensuring that its buildings and services are accessible to persons with disabilities, and it requires that all consultants adhere to the University’s Barrier Free Design Standards.

The laboratory will include an accessible layout (min 5ft wide isles), no dead end corridors, door operators on main entry doors, access to a barrier-free student station in the teaching laboratory, and electronic teaching podium with voice and data integration.

Safety and Security
Access to the upper year teaching laboratory will be controlled by electronic card access and a CCTV camera. This system will allow safe access to the laboratory during and after hours, but it

will also provide security for expensive laboratory equipment in the instrumentation section of the laboratory.

Note, the new system has to be designed to provide seamless integration with the existing security system in DV3065.

Computing
Computing and communications will utilize the network already available in the Davis Building. The laboratory will have several data ports for presentation areas in addition to wireless environment throughout the laboratories.

d) Site Considerations

UTM accommodates its academic activities in several buildings across campus. The W.G. Davis Building provides space required for teaching and research activities of all physical and life sciences. The North Building Reconstruction and Kaneff Building Expansion, both recently approved, will open in September 2014 and provide urgently needed office, classroom, and dry laboratory type research academic space. At the present time, there is no funded plan to create significant science expansion, so maximization and modernization of the existing serviced space in the W.G. Davis building for research and teaching laboratories is more important than ever.

e) Campus Infrastructure Considerations

All services required by the operation of the renovated laboratories are available within the existing W.G. Davis Building.

All chemistry teaching laboratories require the use of RO or distilled water. The W.G. Davis building currently has an extensive but outdated gravity RO system which will be used to supply the chemistry teaching laboratories.

f) Environmental Impact – Construction/Renovation changes

Design and construction will be in accordance with all applicable environmental, health and safety legislation, and University of Toronto policies and standards.

The current lighting, fluorescent lighting ballasts may contain PCB's which are substances that are heavily regulated under the Canadian Environmental Protection Act. The benefits of the lighting retrofit to new T-8 lighting ballasts include removal of PCB's and replacing them with ballasts that do not include PCB's or other highly regulated materials. In addition, through the lighting retrofit, the laboratory will reduce energy consumption, reduce the generation of waste from lamp replacement, due to the much longer lifetime of the proposed lighting retrofits.

g) Environmental Impact – Laboratory Operation

The proposed renovation addresses this recommendation and the following specific objectives as outlined in the University of Toronto Environmental Protection Policy:

- Meet and where possible exceed environmental standards, regulation, and guidelines.
- Minimize energy use, through efficient management and practices

h) Environmental Impact – Waste Management

The renovation (i.e., increased fume hoods) will allow for changes in the nature, type, and scope of laboratory operations (e.g., inclusion of more organic chemistry in first year curriculum). As well, the renovation combined with refined chemical management systems will enable the University to meet the requirements of applicable environmental, health and safety regulations and standards.

Although, the University is committed to being a positive and creative force in the protection of the local and global environment through its teaching, research, and administrative environments, it also recognizes that it and all members of the University community have the responsibility to act in ways consistent with its fundamental principles of minimizing negative impacts on the environment and the conservation and wise use of natural resources.

To this end, the renovations, in particular the space program and functional layout as outlined in Section 5 of this report, combined with refined chemical management systems offer opportunities to explore various waste minimization techniques, such as the following:

1. Process Modification

To the extent that it does not affect vital teaching, modifying experiments to decrease the quantity of chemicals used and waste generated (e.g., micro analysis techniques or small scale chemistry experiments have become a presence on the educational scene). The renovation will accommodate such process modifications made in the future. The benefits of small-scale chemistry include:

- Reduced the amounts of chemicals being purchased
- Promotion of waste reduction at the sources
- Improved laboratory safety and risk to fire and explosion
- Minimized storage space requirements
- Reduces preparation and clean up time
- Sharply reduced laboratory costs associated with purchasing and disposal costs.
- Teaching of excellent laboratory techniques without sacrificing content, sound pedagogy, or student interest.

2. Segregation and Characterization

Segregation and characterization allows waste to be redistributed for reuse if someone else in the University system can use the chemicals; if the waste cannot be redistributed, segregation simplifies chemical recycling, such as distillation or reclamation, and minimizes costs.

3. Reclamation

The University reclaims some precious metals and valuable chemicals to reduce waste treatment costs.

4. Purchasing and Inventory Management and Control

The Department of Chemistry & Physical Sciences will be purchasing software that will have the capacity to provide a client server Data Management Program designed for users of Controlled Substances and Hazardous Chemicals. The software program will also provide for improved documentation of purchasing, receipt, use, waste disposal, real time inventory and instrument inventory. This software will be used as a tool to assist in the management of chemicals and chemical waste.

5. Chemical Exchange Programs

Through the use of the client server data management program described above in item 4, the opportunity to develop a chemical exchange programs within the Department exists.

i) Secondary Effects

Some modifications to the recently renovated DV3065 laboratory will be required to allow for better sharing/separation between biochemistry and organic/inorganic synthesis. Major changes include the following:

- The addition of two fume hoods (6' each) on the north east wall of the existing laboratory.
- The removal of a full sized floor oven on the west wall of DV3065 and replacing that area with bench space (counter, base and wall cabinets to match existing).
- The relocation of a muffle furnace to the newly renovated laboratory including new enclosure and ventilation required for its operation.
- Demolition of wall between DV3065 and DV3070 and relocation gas cylinders currently located along the wall.

j) Staging

The space to be renovated is a new allocation to the department of Chemical Physical Sciences and the staging requirements are therefore minimal.

The following considerations need to be included to allow for the instrumentation laboratory to operate during the summer:

- Removal of wall between the existing and new laboratory to minimize disruption to the existing facility.
- Essential and sensitive equipment might have to be relocated out of DV3065 to another research space within CPS.

k) Phasing

The proposed renovations of the undergraduate laboratories in the W.G. Davis Building will take place over the next four years in order to take advantage of the summer semester construction window and allow for coordination with other capital projects that are planned for the UTM campus:

- Phase 1 –Biology teaching laboratory renovation (completed in Summer 2012)
- Phase 2 - Anthropology teaching laboratory renovation (completed in Summer 2012)
- **Phase 3 - Chemistry teaching laboratory renovation 3rd floor (this project -Summer 2013)**
- Phase 4 - Main floor teaching laboratory renovations East side (Summer 2014)
- Phase 5 - Main floor teaching laboratory renovations West side (Summer 2015)
- Phase 6 - Physics teaching laboratory renovation (Summer 2013)
- Phase 7 - Research laboratory renovations - secondary effects (Fall 2015)

l) Schedule

The Renovation of the Chemistry teaching laboratories will be done in the Spring and Summer of 2013.

Consultant Selection Approval CaPS Exec	November 2012
Consultant Selection and Design	December 2012
Executive Committee of Governing Council	February 15, 2013
Lab Bench Tender	February 2013
Permit Application	February 2013
General Tender	March 2013
Construction	April-August 2013
Occupancy	September 2013

The proposed schedule is based on advanced planning to allow for construction to commence in April, 2013 immediately after classes finish.

IV. RESOURCE IMPLICATIONS

a) Total Project Cost Estimate

The total estimated cost of the project is $3,956.738 million dollars which include estimates or allowances for the following items:

- construction cost
- Contingencies
- taxes
- hazardous waste removal
- secondary effects
- demolition
- permits and insurance
- professional fees
- moving, staging
- furniture and equipment
- computer and telephone terminations
- security
- commissioning

Equipment and Furniture Cost
The proposed renovation will include some new equipment to allow for fit up of new space and accommodate new experiments and changes in course curriculum. Appendix B, Room Specification Sheets (available on request), include a full list of existing and new equipment and furniture.

The details of the cost estimate are included in Appendix C (available on request)

b) Operating Costs

The cost for utilities in the renovated area will be higher than the existing utility costs due to the substantial increase in exhaust air requirements. The changes to equipment and infrastructure will result in a greater energy efficient design, monitoring and tracking of energy consumption.

Increased building engineer man-hours to maintain the lab and demands on external contractor skill sets will result in increased operating costs. This is the direct effect of increasingly complex lab design and higher standard of research / teaching occupancy requirements

With expanded cleaning requirements, due to increased course activity, the total costs (electricity, operation and maintenance) for Chemistry 3rd floor teaching laboratory space are anticipated to increase by $18.800 per annum.

c) Funding Sources

Phase 3 was estimated to cost $3,956.738 million dollars and it will be funded from the UTM Operating Fund.

V. RECOMMENDATIONS

Be It Recommended to the Academic Board:

a) THAT the Project Planning Report for the Renovation of the Chemistry Teaching Laboratories in the W.G. Davis Building at the University of Toronto Mississauga, dated November 2012, be approved.

b) THAT the project scope with a total project cost of $ 3.9 million to be funded from the UTM Operating Fund be approved in principle.

APPENDICES

Appendix A: Existing Space Inventory
Appendix B: Room Specification Sheets (on request)
Appendix C: Equipment List (on request)
Appendix D: Total Project Cost (on request)

APPENDIX A:

EXISTING SPACE INVENTORY

The following table summarizes the space inventory affected by the proposed renovation.

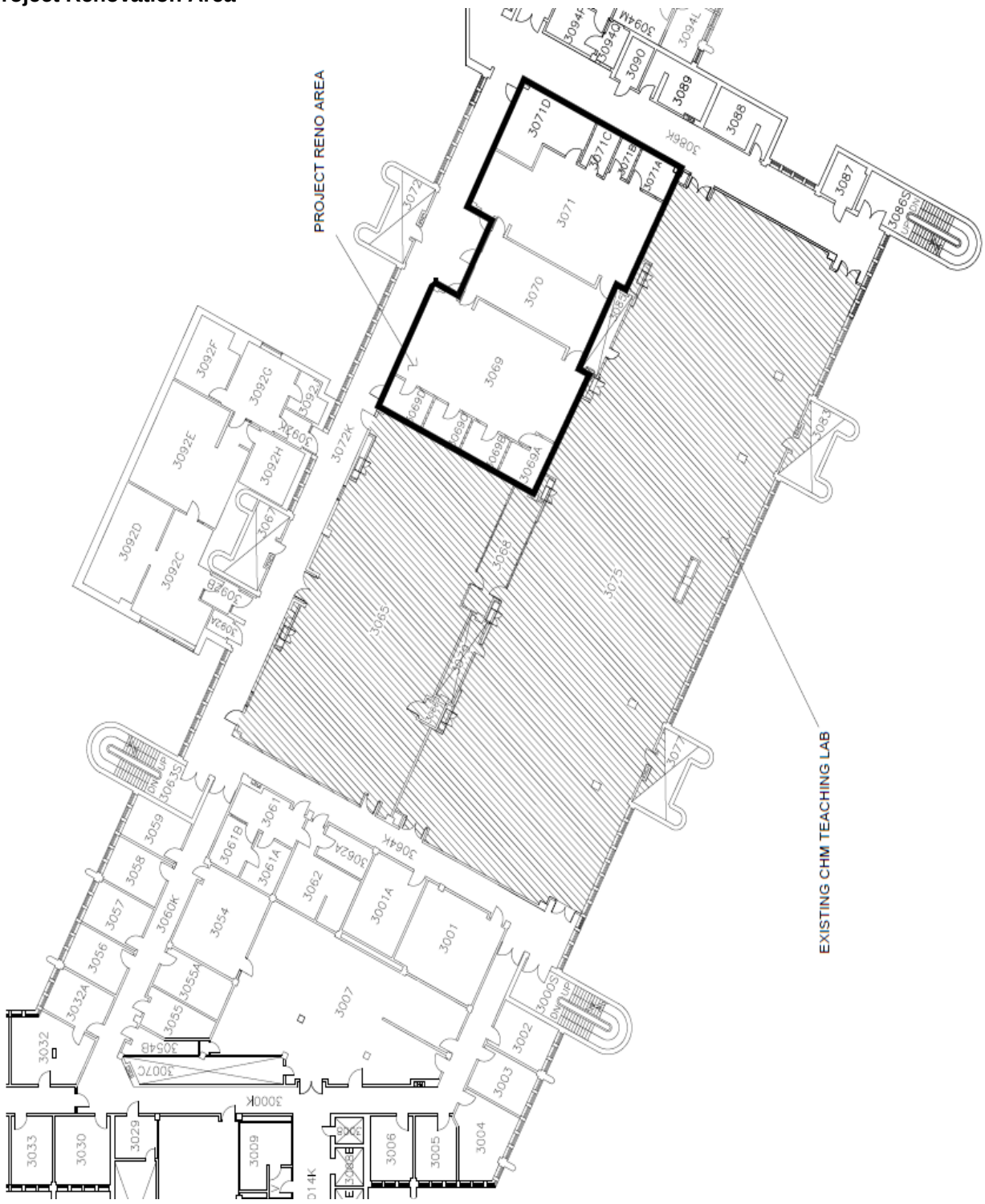
Existing UTM Chemistry Teaching Laboratory Space Inventory

Building Name	Room No. Sfx.	Department Name	COU Category Code	Proration Type %	Room Details Stns	Room Alloc Comments	Area
W. G. Davis Building	3007	UTM- ChemPhysScien	02.3	100	0	Lab Prep	67.83
W. G. Davis Building	3007A	UTM- ChemPhysScien	02.3	100		Lab Prep	53.87
W. G. Davis Building	3007B	UTM- ChemPhysScien	02.3	100	0	Lab Prep	18.42
W. G. Davis Building	3065	UTM- ChemPhysScien	02.1	100	16+	Wet Lab	280.69
W. G. Davis Building	3066	UTM- ChemPhysScien	02.3	100	0	Gas room	2.32
W. G. Davis Building	3068	UTM- ChemPhysScien	02.3	100	4	Lab Office	20.18
W. G. Davis Building	3075	UTM- ChemPhysScien	02.1	100	120	Wet Lab	717.48
W. G. Davis Building	3087	UTM- ChemPhysScien	02.3	100	0	Lab Storage and Supply	7.83

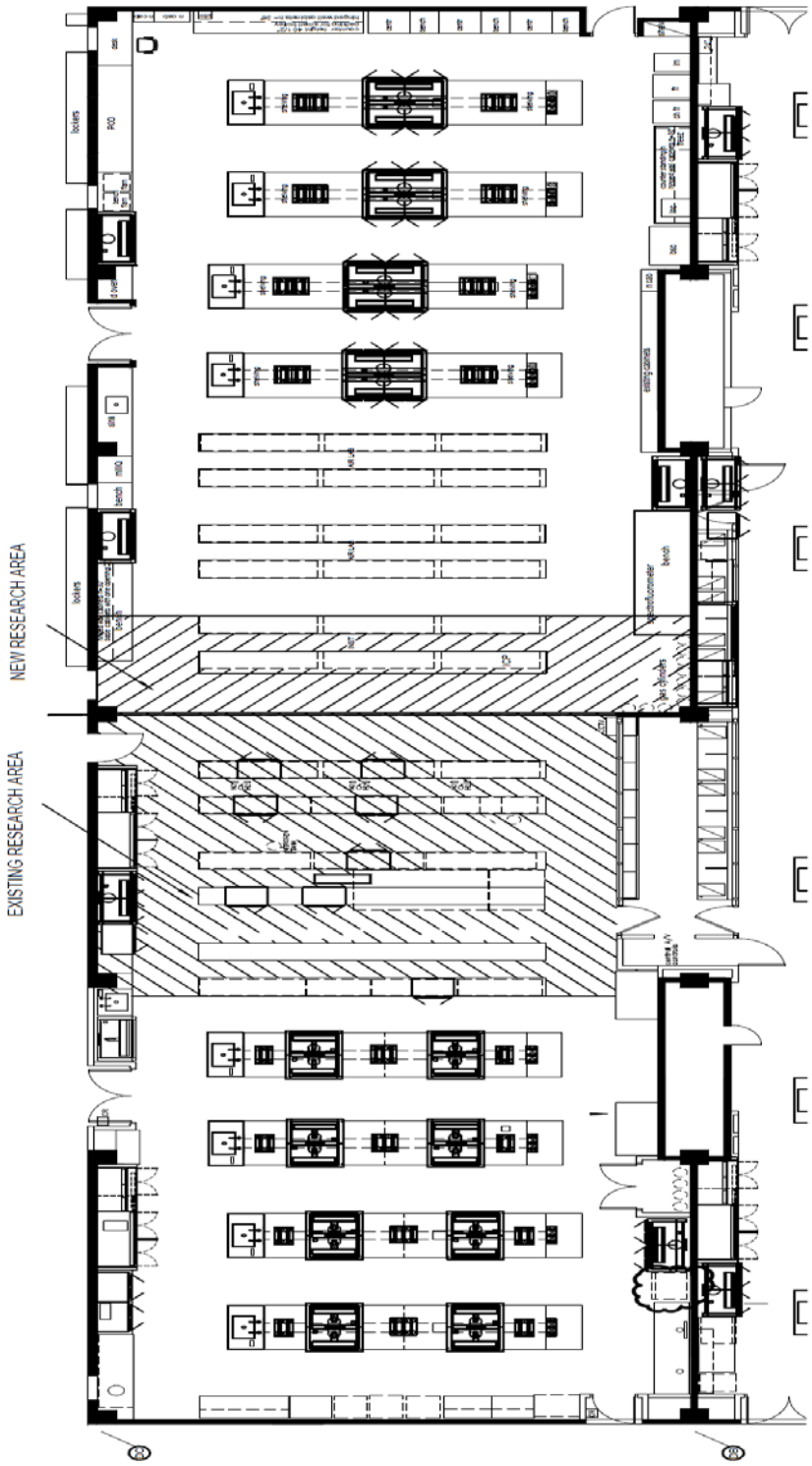
Existing UTM Biology Research Laboratory Space Inventory to be Renovated

Building Name	Room No. Sfx.	Department Name	COU Category Code	Proration Type %	Room Details Stns	Room Alloc Comments	Area
W. G. Davis Building	3069	UTM-Biology - Mississ	03.1	100		Research Lab	86.69
W. G. Davis Building	3069A	UTM-Biology - Mississ	03.2	100		Darkroom	9.24
W. G. Davis Building	3069B	UTM-Biology - Mississ	03.1	100		Research Lab	7.43
W. G. Davis Building	3069C	UTM-Biology - Mississ	03.1	100		Research Lab	7.43
W. G. Davis Building	3069D	UTM-Biology - Mississ	04.3	100		Graduate Office Multi	7.95
W. G. Davis Building	3070	UTM-Biology - Mississ	03.2	100		Lab Equipment Room	45.63
W. G. Davis Building	3071	UTM-Biology - Mississ	03.1	100		Research Lab	78.23
W. G. Davis Building	3071A	UTM-Biology - Mississ	03.2	100		Lab Storage	7.17
W. G. Davis Building	3071B	UTM-Biology - Mississ	03.2	100		Controlled Environment	3.73
W. G. Davis Building	3071C	UTM-Biology - Mississ	03.2	100		Controlled Environment	5.85
W. G. Davis Building	3071D	UTM-Biology - Mississ	04.3	100		Graduate Office Multi	23.41

Project Renovation Area



Existing and New Research Area



Secondary Effects Area