DALHOUSIE UNIVERSITY

DALHOUSIE UNIVERSITY AGRICULTURALCAMPUS (DAC)

March 2017

# Framework Campus Development Plan: Transition, Sustainability and Growth

In association with

CBCL
TEAL Architects
Hanscomb Limited

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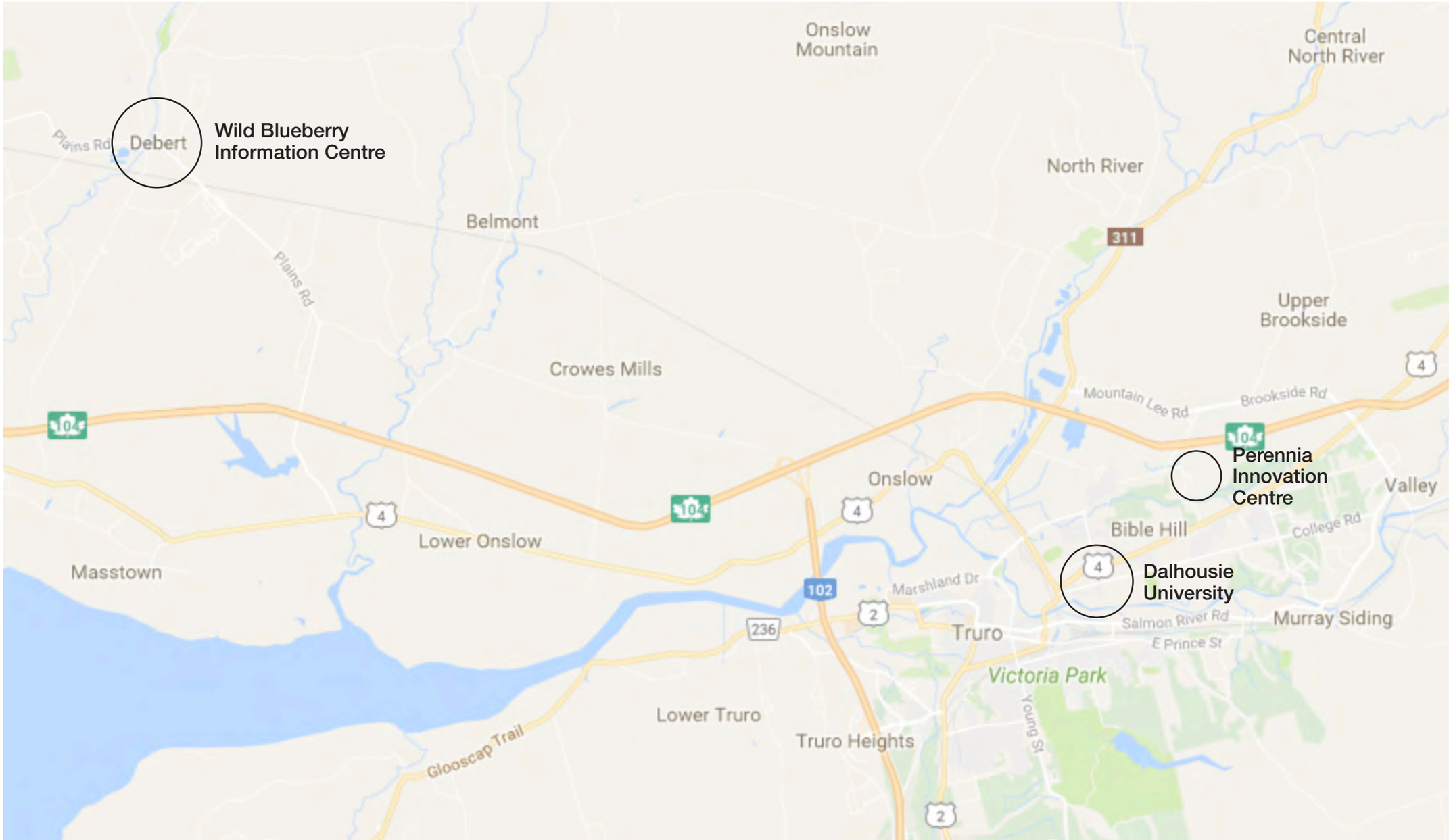

Wild Blueberry
Information Centre
Perennia
Innovation
Centre
Dalhousie
University
Onslow
Mountain
Central
North River
Debert
Plains Rd
North River
Belmont
311
Upper
Brookside
Crowes Mills
Mountain Lee Rd
Brookside Rd
104
4
Onslow
Valley
Bible Hill
College Rd
Lower Onslow
Masstown
102
Marshland Dr
2
236
Truro
Salmon River Rd
E Prince St
Murray Siding
Victoria Park
Young St
Lower Truro
Truro Heights
Glooscap Trail

# 1.0 Executive Summary

## Context

The Nova Scotia Agricultural College (NSAC) became the Dalhousie Agricultural Campus (DAC) in 2012. The DAC is located some 100 km from Halifax in the Village of Bible Hill, adjacent to the Town of Truro, in the County of Colchester, NS. The built campus comprises 40 academic, administrative and farm buildings on some 150 acres and in addition, the University manages some 440 acres of farm land owned and leased, that support its farming programs and supports the Wild Blueberry Network Information Centre in Debert, NS as well as the Perennia Innovation Centre in Bible Hill. The campus itself is characterized by its unique seasonal gardens and landscaped open spaces, a seasoned agricultural faculty, a functioning infrastructure of building types – albeit in various levels of condition and suitability - and a range of constituent external communities able to support and benefit from a university campus in the Truro-centered region.

## Importance of Agricultural Education and Research

Leading politicians and economists are now calling food production Canada's 'post-carbon' global boom. Large research grants are awarded to Canadian and international university consortiums focusing on food production. The recent Ivany Report by the Nova Scotia Commission on Building Our New Economy cites agriculture and university research as aiming to double both production (currently $230M) and research (currently $360M) by 2024. The current Federal Atlantic Growth Strategy aims to promote "traditional sectors such as agriculture, fisheries and forestry".

The addition of the DAC and its Faculty of Agriculture draws Dal into a dynamic academic and research arena that is already of global proportion. Dalhousie joins other major Canadian universities in this critical field such as:

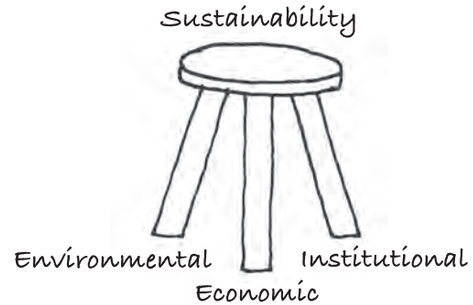
- UBC, Faculty of Land and Food Systems
- UAlberta, Faculty of Agriculture, Life and Environmental Sciences, and Department of Agriculture, Food and Nutritional Sciences
- UManitoba, Faculty of Agriculture and Food Sciences
- USaskatchewan, College of Agriculture and Bioresources
- UGuelph, Ontario Agricultural College
- McGill University, Faculty of Agricultural and Environmental Sciences

The merger presents Dal's Agricultural Faculty with expanded roles and academic resources, interface with related disciplines, greater recruitment potential, and opportunity for wider sources of public and private funding and research. The new Faculty of Agriculture can now draw from the full range of Dal's teaching and research disciplines to broaden its spectrum of programs, as well as now being potentially well positioned to attract the public and private funding required to expand its programs and grow its student enrollments and faculties. Dal's success and benefits can extend broadly to the surrounding urban and farming communities, the Province and the Atlantic region, the Nation and the world beyond.

## Essential Goal of Achieving Campus Sustainability

While opportunities abound, the DAC faces immediate and challenging issues such as uncertain enrollments, inadequate facilities and lack of necessary capital funding. Clearly, plan-making for DAC's future development must be undertaken with concern for ensuring 3-dimensional sustainability:

- institutional (how to achieve the University's strategic principles and goals),
- economic (how to earn and invest to sustain campus growth and change), and
- environmental (how to build and manage the campus environs).




These 3 factors are interdependent, for example

- How to balance capital funding between the DAC and other University demands, and how to allocate the DAC capital budget over time to achieve strategic priorities such as increasing enrollments, enhancing student life, attracting quality staff and research funding, renewing existing facilities and realizing carbon neutrality;
- How to attract increased monies by strategies for improving programs and facilities that grow enrollments and education/research reputation;
- How to reduce carbon footprints by initiatives affecting transportation, building design and operation, landscaping, and energy production and use;
- How to ensure that the entire campus environment becomes the classroom of learning, conserving, sharing, growing and socializing.

## Primary Plan Limitations and Objectives

As the title of this report suggests, this is an interim framework plan rather than a typical campus master plan due to the transition underway that needs time to fully define expectations of future academic programs, enrollment growth and the capital funds needed to accommodate such growth. This report is therefore intended as a framework to guide campus development decisions as the campus and its academic programs - both agricultural and other - evolve from periods of transition to sustainability and growth.

To realize Dal's long term opportunities, campus planning is initially focused on critical near term strategies to ensure the campus and its programs become economically, functionally and environmentally sustainable; the plans provide guidelines and strategies to secure significant capital funding, to accommodate the advancement of excellence in academics and research, and to reach and maintain highest possible environmental standards, all of which are required to attract student growth and future campus development.

## Planning Approach

The approach taken to formulating this Framework Plan is primarily informed by the President's Strategic Direction 2014-2018 from which planning concepts to achieve these objectives have been identified over three overlapping periods defined as:

- A Plan for Priority Projects,
- A Plan for Transition and Change, and
- A Plan for the Future Mature Campus.

Accordingly, this Report provides

- Overview of current planning issues together with promising resources and opportunities for achieving development over time;
- A preliminary estimate of future facilities and infrastructure requirements based on meeting enrollment growth thresholds;
- Physical plans for each of the three development periods;
- Design Guidelines to inform campus development decisions over time; and
- Implementation Strategies to inform managing, coordinating and financing campus development.

## Priority Projects

While functionally outmoded, the campus buildings and infrastructure are generally adequate until capital funds become available to invest in major renewals, with notable exceptions requiring priority attention:

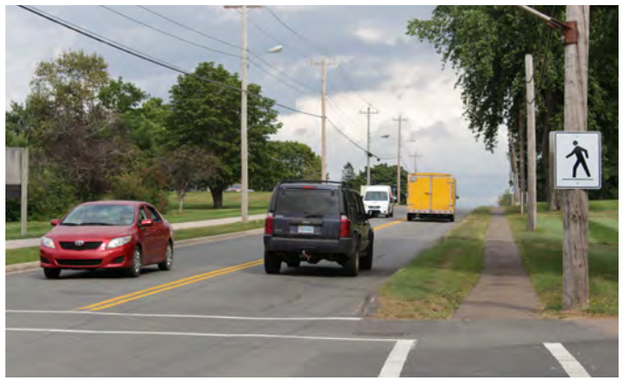
- University pressures the Province to improve pedestrian cross-walks in the College Road right-of-way to arterial standards, cited by students as dangerous and highest priority;
- $1M upgrade of the overall campus technology framework needed to support proper use of services such as personal and institutional computers, teleconferencing and internet connections;
- $2.5M renovation of the MacRae Library 3rd floor to provide temporary needed student study and lounge space, Student Association offices and meeting rooms in addition to Library service space;
- Selective renovations to outdated student residences including room and bathroom modernizations;
- Upgrades to a select number of class rooms in Cox and Haley to provide modern flexible furniture and improved technologies;
- Renovations and expansion of the Ruminant Animal Centre, due in part to a recent fire, for animal feed management and additional animal care facilities;
- Deferred maintenance currently budgeted annually at $2M.

## Transition Period Projects

These are projects that are expected to be needed during

the period of transition depending on progress in implementing plans for academic program mix and on attracting enrollment growth. Certain projects may be initiated early, even overlapping with the Priority period, others may be delayed.

- Transitional steps will be required to safeguard campus pedestrians crossing College Road as both the campus population and local traffic volumes grow over time. The anticipated Provincial area traffic study should include attention to these issues. As part of that public planning process the Framework Plan suggests an interim College Road design through the campus similar to other urban campuses whereby the road is resurfaced and multiple slightly raised crossing points are located at busy pathways to indicate to drivers that they are passing through an unusually busy pedestrian space, having a traffic calming effect. Ultimately, should local traffic be permanently re-routed and College Road be only used for campus access, this design would continue to effectively protect intersecting pedestrian and vehicular traffic.



College Road Crosswalk

Cox Institute

Haley Institute

- While the large lecture theatres in Cox and Haley are outdated, the recommendation is to phase in construction of fewer new contemporary lecture theatres designed to achieve greater flexibility, functionality and multi-use and thus higher utilization, while phasing out and repurposing existing theatre spaces;
- Major renovation of Alumni Theatre in Cumming Hall would fully equip it for multiple uses such as lectures, conferences, performances and cinema;
- It is also recommended that, to delay or possibly avoid massive renovation to existing student residences to comply with current standards, smaller additions be constructed at less cost at the corners, linking the three buildings, providing accessible elevators, modern bathrooms and additional bed rooms;
- A new Student Centre is proposed to be centrally located linked to MacRae Library, serving as a centerpiece to the renewed campus and providing students with a wide range of services and facilities such as cafes, retail services, student association and club offices, meeting rooms, study and exhibit space; the Centre can also be the opportunity for multi-cultural activity space celebrating the increasingly diverse student population including international students and First Nations, particularly the regional Mi'Kmaq community.
- Preliminary analysis suggest an additional 100 residence beds could be needed for every enrollment increase of 250 full-time equivalent students (about 30%), providing students with a broader range of unit choices as well as an adjacent conference centre located within the Student Life precinct and Cumming Hall;
- Potential repurposing, renovation and upgrading of Cox and Haley is envisioned as the initial way of modernizing teaching and learning facilities;
- The Plan also proposes a new flagship Research and Teaching Centre linked to Haley and the Poultry Research Institute, providing much needed expansion for the Aguaculture Research Labs;
- Construction of the new Combined Heat and Power facility is anticipated in the near future, adjacent to the Extension Engineering Building housing the existing central heating plant;
- A future enclosed botanical garden is proposed, linking Cox with Banting and potentially the Library and Student Centre, that would support plant life teaching and research and public visitations.

## Vision of the Mature Campus

While it is premature to precisely forecast future requirements for facilities, it is useful to present a vision of the mature campus to demonstrate potential development. This vision includes the possibility of the Province providing alternative traffic routes  to improve public traffic flow and allow College Road to be closed to through traffic, illustrating the potential for creating an uninterrupted pedestrian Campus Green.

## Plan Implementation

The Plan makes recommendations in various areas of implementation however funding development is most critical. Three strategy options are identified, of which the "kick-start" major grant option is most timely, potentially in response to the current federal Atlantic Growth Strategy that in part, calls for "…initiatives to attract and retain international students in Atlantic Canada (e.g., mission to Asia with University Presidents)". This initiative suggests opportunities for Dalhousie to collaborate with other Maritime universities and possibly rebrand its agricultural programs aimed at attracting more international students.


Truro Raceway
Agridome
Nova Scotia Provincial Exhibition...
Ryland Ave
Bible Hill Fire Brigade
Wayne's Saddlery Boot & Harness Ltd
Truro Recreation Products
Lloyd Ct
Greenhawk Harness & Equestrian
Kennedy's Variety
Main St
Century Hyundai
Subway Bottle Exchange
Century Honda
Subway
The Pond Classic Grill
Canadian Tire Gas+
Co-op Country Store
Tim Hortons
Riverside Ave
Holy Well Park
Salmon River
Cumming Dr
CIBC ATM
Langille Athletic Centre
Cox Rd
Banting upper parking
MacRae Library
Alumni Gardens
Alumni Gardens parking lot
Parking Lot
College Rd
Rock Garden
Rock garden parking
Dalhousie Agricultural Campus
Horseshoe Crescent
Cumming Hall rear parking
Cobequid Trail
Haley upper parking lot
Haley lower parking lot
Berlin Wall Sections
Sheep Hill Ln
Farm Ln
Sipu Awti
Farmstead Ct
Dixon Ct
Bible Hill Central Elementary School
Renu Water Center
Pictou Rd
Blanchard Ave
Hillside Ave
Hillcrest Ave
Allison Ave
Macintosh Ave
Bigney Ave
Charles Ct
4

# 2.0 Today's Campus: Resources, Needs and Opportunities

## 2.1 Campus in Transition

The transition from stand-alone college to university status is affecting academic programming and administrative procedures throughout the University operating system in the face of significant obstacles such as

- Inefficiencies of distance and communications between the DAC and Halifax campuses
- Delayed enrollment growth affecting revenues and academic programming
- A physical plant of scattered buildings and infrastructure in various states of adequacy and need of modernization
- Inadequate capital funding

Yet the transition is also providing opportunities benefiting both the DAC and the University as a whole, such as

- Teaching and Research programs are in the process of review and refinement and other faculties can over time bring a spectrum of courses to the region, and this in turn can influence future enrollment growth, space requirements and utilization and capital fund raising.
- Facilities will require dramatic improvement over time although there is some space underutilization now creating opportunities for repurposing space to provide modest up-grades to classrooms and labs, and in the future, a major renewal of the Cox Institute and Haley Institute, and construction of two proposed new 'flagship' facilities – a new Agricultural Teaching and Research Centre and a much needed new Student Centre. Such modernization and expansion will be of course driven by future prospects of enrollment growth, program change and increases in capital funding.
- Information and Communications Technologies are essential requirements at the DAC and in its connectivity with the Halifax campus and the world. The initial priority is a $1M up-grading of the campus wide ITS framework that is the critical backbone of campus IT services.
- Community Relations is also an essential part of the transition, ie Dal building strong positive relations with adjacent communities of Bible Hill and Truro, with the affiliated agricultural and alumni communities and with other communities with diverse interests including local First Nation peoples. This will naturally take time and commitment to engage and help these communities to increasingly appreciate the economic and social advantages of supporting and participating in the growth and development of the campus.
- Community Participation by the University in the planning and development of the surrounding environs is yet another important part of the transition, such as being an active participant in an anticipated area traffic study by the Provincial Department of Transportation and Infrastructure Renewal (TIR) that can reduce traffic volumes currently bisecting the campus along College Road that create serious cross-walk safety issues for Dal students.

## 2.2 Campus Landscape

A noteworthy asset of the physical campus is the quality and extent of its landscape, which becomes its most compelling physical "brand". Staff and students stress the concept of developing the overall campus as a "continuing learning experience" or "campus as the class room" of which the open space landscape plays a key role. The existing campus open space provides significant natural qualities upon which to build a dramatic landscape that celebrates local plant life and informs its occupants about growth, management, sustainability and natural relationships, eg between species, soils, climates, sun and shade, topography, use and methods of care and propagation. The long-term Campus Landscape Plan on page 27 identifies various areas for future planting and development described in the Landscape Design Guidelines included in Section 4 of this report.

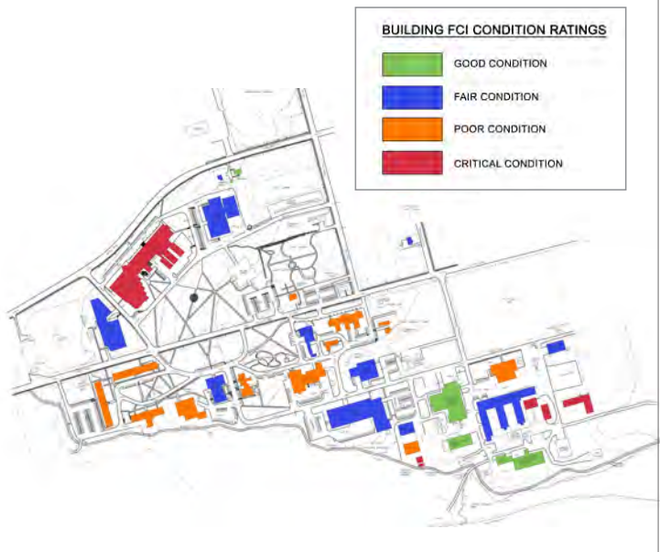
Alumni Garden

## 2.3 Facilities Renewal, Replacement and Expansion

For some 100 years this college campus survived without an overall development plan and in some cases adequate resources to upgrade and add to its building inventory. In accepting responsibility for the Agricultural Campus, Dalhousie has accepted the challenge of renewing as well as growing a campus that is known for its academic and research achievements but has serious facilities shortcomings, in many cases below common university standards. The University's current Facilities Condition Index (FCI) survey assessed and rated some 39 campus buildings:

- 22 rated in "poor" condition, of which only the old section of Cox Institute was rated in critical condition by an FCI exceeding 0.30,
- 12 rated in "fair" condition, and
- 5 rated in "good" condition

The FCI report calculates the "replacement value" and the "FCI cost" for correcting the deficiencies identified for each building. The table and map opposite indicate the locations, values and costs assigned to these buildings as reported in 2014.




| | Replacement Value | FCI Cost |
|---|---|---|
| 15 "Poor" Buildings | $163,678,000 | $41,220,000 |
| 8 "Fair" Buildings | $98,969,000 | $10,631,000 |
| 3 "Good" Buildings | $28,306,000 | $58,000 |
| Total for 26 Buildings | $290,953,000 | $52,009,000 |

Facilities Management currently estimates the total Replacement Value of the existing building inventory to be $299,209,449 and the total Deferred Maintenance to be $61.5M. The campus is currently budgeted to expend in the order of $2M annually for facilities up-grades and deferred maintenance expenditure, while staff estimates the annual requirement to be in the order of $5-6M.

While the University is undertaking deferred maintenance projects on a priority basis such as antiquated roof repairs and deteriorated window replacements, pressing needs exceed available budgets not only to address deferred maintenance costs but additionally to make other needed improvements to facilities serving curricular, student life and support functions such as:

- ITS local area network upgrade
- Upgrades and expansion of teaching and research facilities
- Improvements to student life facilities including residences and study and leisure spaces

## 2.4 Teaching and Research Facilities

Teaching and research practices are changing dramatically in response to pedagogy trends and user demands, with implications for class room and lab space design such as greater spatial flexibility and adaptability for multiple use, moveable partitioning and furnishings, variable lighting, and various technology applications.

**Class room** space requirements – both present and future – cannot be accurately forecast until academic planning has stabilized and enrollments can be reliably forecast. In the current transition period – during which the existing inventory of classroom space is adequate - the priority is to up-grade and increase utilization of selected class rooms in the 40-50-seat range with improved seating and technology supports.

**Lecture theatres** are in need of up-grades particularly in terms of antiquated seating, lighting and ventilation, however as trends in course delivery and utilization patterns are advancing, it is considered more cost/effective to make only modest up-grades to existing theatres now, and in time invest in fewer new modern lecture theatres located and designed for multiple use and higher utilization.

**Research and teaching labs**, although adequate in size and location, will also require modernization over time to reflect contemporary concepts of lab/class room flexibility and multiple-use.

Cox Classroom

Cox Lecture Theatre

Cox Labs

## 2.5 Student Life Facilities

Attracting and serving a growing body of competent and motivated students must be of primary objective in assuring a sustainable university campus. To address the present deficiencies, a priority plan of action should bridge into the transition period as capital funds become available. The priorities have been confirmed by student and staff comments throughout the planning, described as follows:

**Student safety** in having to cross College Road, the major thoroughfare that divides the campus, is the first and most critical issue often expressed by the students. Sightlines at both the bottom and the top of the road's grade are poor, traffic caution signs are lacking, and the cross-walks are poorly maintained and lighted. While this is a Provincial responsibility, it is incumbent upon the University to aggressively advocate for immediate improvements and to join with the Province and the community in considering alternatives and adopting a plan for reducing this hazard as the University population and traffic volumes grow. Such alternatives are discussed in the Design Guidelines dealing with Roads and Parking.

**Student service facilities** are seriously inadequate by common university standards, even as basic as comfortable social and study spaces and convenient snack facilities available over extended hours. The interim priority to provide relief space on the top floor of the MacRae Library as a "student learning commons" will improve service to students using the Library. A future Student Centre is contemplated that can provide the opportunity to consolidate student activities and services and dramatically demonstrate the University's commitment to improving future student life.

**Student Residences** require improvements to outdated rooms and common toilets and showers and as enrollment grows, additional campus residence spaces will be required, designed to reflect more diverse and contemporary student living preferences.

**Graduate student offices** are in need of improvement in terms of quality work space and furnishings and adjacent conference and lounge space, recognizing the intensive work hours typically undertaken by graduate students.

**Student and Health Services**, needing to be located for optimum access by students, are presently located in the Dairly Building; while geographically central, this facility lacks adequate space and exposure to student circulation and would be better located as part of the future Student Centre.

The need for adequate student life facilities - as well as services and activities – will be critical to sustaining a growing and increasingly diverse enrollment comprising higher proportions of mature and international students. With aggressive recruitment comes increased student expectation, and more students from afar will need greater social as well as academic engagement. The opportunity is to encourage a rich multi-cultural experience that will promote retention, advancement and reputation that will in turn, enhance further recruitment and enrollment growth. To this end, the University must give priority to enhancing not only academic but also student life facilities and promotion of related services and activities that provide a well-rounded campus experience.

## 2.6 Estimate of Future Space Requirements Based on Enrollment Growth

Recognizing that future academic program and enrollment information is currently unclear, a preliminary view of the potential requirement for additional space can be projected by assuming increments of total enrollment growth that might occur over time. These total enrollments can be applied to common space requirement norms (i.e. net assignable square meters per enrollment FTE) for various types of university space to produce a projection of space, that compared with existing space, produces a projection of potential space deficits or future requirements as illustrated in the table opposite. This analysis illustrates space that could be required as enrollment grows from the Registrar's reported Fall 2016-17 level of 797 FTE by increments of 10% to 200%, applying common university norms for various types of space. In reality, requirements for each space type must then be subjected to various factors unique to the actual DAC condition in deciding more specifically how and when future space need be provided, such as the following guidelines:

- The DAC inventory of existing class rooms noted in the table is misleading, since many (a detailed survey is needed) are unusable in terms of size or functionality and/or poorly located and must be considered for repurposing or renovation. In fact, the Faculty of Agriculture indicates that the useable inventory of class rooms is currently timetabled to capacity, suggesting that additional class rooms of useable sizes will be needed in the near future;

- Research labs are not generally required on the basis of student enrollment but rather by the nature of research undertaken. The particular nature of future agricultural research will determine the adequacy of the current inventory in this category;
- Academic offices are needed to meet growth in specific academic programs and should be accommodated accordingly;
- Administrative offices and student service units are more directly influenced by overall enrollment growth, yet vary by function, and therefore limited expansion can be planned incrementally, guided by this preliminary projection;
- Student residence expansion is subject to variables such as the availability of competing off-campus options (that could support a policy of prioritizing residence availability to, for example, first year and international students), the ratio of graduate to undergraduate students in residence and the percent of international students comprising the total enrollment, all of which could modify this projection. Assuming current policies and compared to the size of the existing three residences, this analysis suggests need for some 75 additional beds with 25% enrollment increase or 150 beds with 50% enrollment increase.

This preliminary overview has informed tentative locations of future academic buildings in the Framework Campus Plans as well as forecasting the infrastructure requirements to support them, however more detailed confirming space forecasting will be necessary as academic programming is stabilized.

**DALHOUSIE UNIVERSITY - AGRICULTURE CAMPUS**

**FRAMEWORK FOR PROJECTING SPACE DEMAND TO MATCH ENROLMENT GROWTH PROJECTIONS**

| GROWTH LEVEL SCENARIO | Present 2016/2017 | Present 2016/2017 | | 10% | 25% | 50% | 70% | 100% | 150% | 200% |
|---|---|---|---|---|---|---|---|---|---|---|
| STUDENT FTE's (Note 1) | 797 | 797 | | 877 | 997 | 1196 | 1355 | 1595 | 1993 | 2392 |
| *INCREASE* IN FTE's from PRESENT LEVEL | | | *Increase* | 80 | 199 | 399 | 558 | 797 | 1196 | 1595 |
| FACULTY & PDF FTE's | 95 | 95 | *Increase* | 10 | 24 | 48 | 67 | 95 | 143 | 190 |
| NON-ACADEMIC STAFF FTE's | 156 | 156 | *Increase* | 16 | 39 | 78 | 109 | 156 | 234 | 312 |
| *SPACE TYPE* | *EXISTING* SPACE ESTIMATES AS APPLICABLE (NASM) | SPACE BASED ON *INSTITUTIONAL AVERAGES PER STUDENT/OTHER FTE* (NASM) (Note 4) | *VARIANCE* BETWEEN EXISTING AND AVERAGE GENERATED SPACE (NASM) | *INCREMENTAL* SPACE NEEDED ON CAMPUS DUE TO *ENROLLMENT INCREASES* (Net Assignable Square Meters NASM) | | | | | | |
| Classroom Facilities | 1,888 | 732 | 1,156 | 73 | 183 | 366 | 512 | 732 | 1,098 | 1,464 |
| Class Labs (Note 2) | 11,527 | 4,305 | 7,222 | 69 | 172 | 344 | 482 | 688 | 1,032 | 1,377 |
| Research Labs (Note 2) | 10,222 | 3,508 | 6,714 | 101 | 253 | 507 | 709 | 1,013 | 1,520 | 2,027 |
| Academic Office & Related | 2,055 | 2,268 | -213 | 228 | 570 | 1,140 | 1,596 | 2,280 | 3,420 | 4,560 |
| Administrative Office & Related | 2,526 | 2,088 | 438 | 209 | 522 | 1,044 | 1,461 | 2,087 | 3,131 | 4,174 |
| Campus Study Space & Library Facilities | 2,236 | 741 | 1,495 | 74 | 185 | 370 | 518 | 741 | 1,111 | 1,481 |
| **1 - Sub-Total (NASM)** | | **13,642** | | **754** | **1,885** | **3,771** | **5,279** | **7,541** | **11,312** | **15,083** |
| **1 - Sub-Total (GROSS SM)** | | **20,767** | | **1,148** | **2,870** | **5,740** | **8,036** | **11,480** | **17,220** | **22,960** |
| Recreation/Athletic Space | 2,172 | 509 | 1,662 | 51 | 127 | 255 | 357 | 509 | 764 | 1,019 |
| Student & Central Services (Note 3) | 4,564 | 805 | 3,759 | 81 | 201 | 403 | 564 | 805 | 1,208 | 1,610 |
| **2 - Sub-Total (NASM)** | | **1,315** | | **131** | **329** | **657** | **920** | **1,315** | **1,972** | **2,629** |
| **2 - Sub-Total (GROSS SM)** | | **2,001** | | **200** | **500** | **1,001** | **1,401** | **2,001** | **3,002** | **4,002** |
| Residential Space | 5,048 | 2,402 | 2,645 | 240 | 601 | 1,201 | 1,682 | 2,402 | 3,604 | 4,805 |
| **3 - Sub-Total (NASM)** | | **2,402** | | **240** | **601** | **1,201** | **1,682** | **2,402** | **3,604** | **4,805** |
| **3 - Sub-Total (GROSS SM)** | | **3,657** | | **366** | **914** | **1,829** | **2,560** | **3,657** | **5,486** | **7,315** |
| Animal Space | | 43 | | 4 | 11 | 21 | 30 | 43 | 64 | 86 |
| Plant Maintenance | | 108 | | 11 | 27 | 54 | 76 | 108 | 162 | 216 |
| **4 - Sub-Total (NASM)** | | **151** | | **15** | **38** | **76** | **106** | **151** | **227** | **302** |
| **4 - Sub-Total (GROSS SM)** | | **230** | | **23** | **57** | **115** | **161** | **230** | **345** | **460** |
| **GRAND TOTAL NASM (1,2,3 & 4)** | | **17,510** | | **1,141** | **2,852** | **5,705** | **7,987** | **11,409** | **17,114** | **22,819** |
| **GRAND TOTAL GROSS SM (1,2,3 & 4)** | | **26,655** | | **1,737** | **4,342** | **8,684** | **12,158** | **17,368** | **26,053** | **34,737** |

**Note 1:** Student Enrolment expressed in Full-Time Equivalents (FTEs) based on Fall 2016/2017 Enrolment Statistics and as obtained from the Registrar's Office

**Note 2:** The sizeable variance in Lab Facilities is due to specailized lab space that varies from institutional averages based on each institution's specific requirements

**Note 3:** Includes Food Services, Bookstore & Merchandise, A/V TV facilities, Central Services, Health Services, Student Activity space, Assembly/Exhibition facilities

**Note 4:** Averages are based on Existing Ontario University facilities and the respective actual Enrolment and adjusted, as in the case for Lab Space, to reflect Agriculture Programs

95 (88.9 Faculty plus 5.60 FTE Post-docs) - Basis for Average Space Estimate

156 FTE Non-Academic Administrative Staff - Basis for Average Space Estimate

DATE: NOVEMBER 15, 2016

## 2.7 IT and Communications Systems Infrastructure

Information technology and communications systems serving the campus and connectivity with the Halifax campus are seriously outdated and inadequate such as the technology framework underpinning access to all campus ITS system and communications functions with the Halifax campus. The $1M project to update the campus local area network is seen as a priority capital improvement project. Over time, various extensions of the system will then be possible as described in more detail in Appendix B.

The University has invested in building level smart electrical meters and has plans for water and hot water meters. This meter data along with building systems points will be connected through an Energy Management Information System for operational and energy and water efficiency. Electrical meters are operational now. Water and hot water meters will be installed in future.

## 2.8 Surrounding Urban Development

The DAC campus is adjacent to the Bible Hill urban neighbourhoods and nearby commercial areas as well as farm land both owned and leased by the University in support of its agricultural programs.

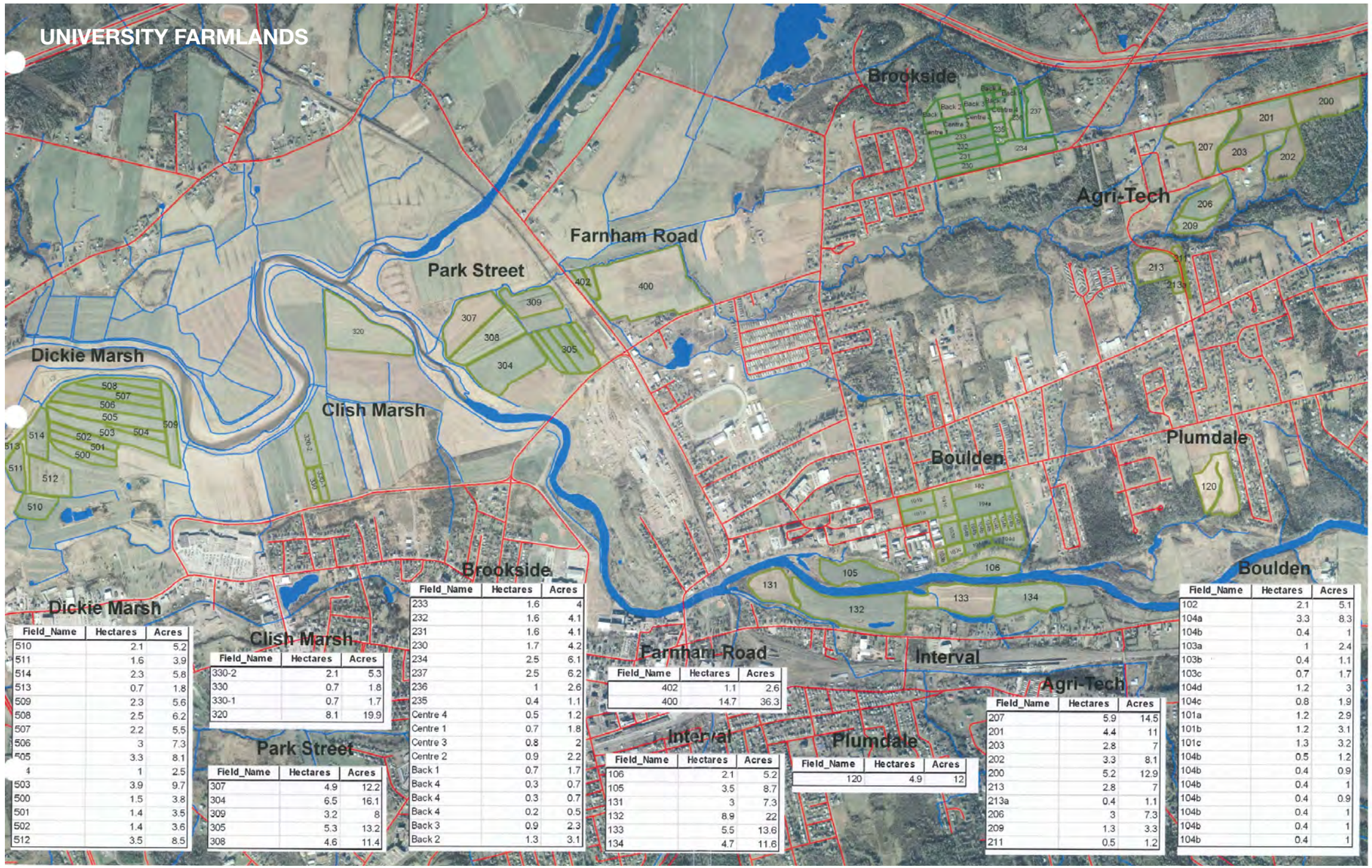
The presence of a growing university campus within the Truro-Bible Hill urban community promises new economic vitality as a growing university population seeks off-campus retail, social and residential benefits and as the surrounding populations take advantage of university-level education options. Increasingly, the community and the university will recognize these mutual benefits. The University will want to consciously take initiatives aimed at strengthening relations and contributing to the community in three ways:

- Encouraging community participation in campus facilities and services, for example, as course offerings, alumni relations, retaining local services; inviting the public to university events and offering space for public activities;
- Participation of senior Dal staff in County and Provincial land use and transportation planning issues where a University perspective can be useful to both itself and the community; for example, the anticipated Provincial traffic study affecting the campus and County land use planning near the campus;
- Strengthening teaching and research links between Dalhousie Faculties and other local institutions such Public Health, the Community College, Indigenous organizations, local farming organizations and agricultural industries.

## 2.9 University Farmlands and Facilities Beyond the Campus

The University presently manages some 440 acres of farmland in the area of the campus either through ownership or lease, as illustrated on the map and tables opposite provided by the University. Certain of these properties are ideal for supporting the Faculty's agricultural programs, however some are marginal primarily due to proximity to river flood risk and will require review and future replacement. Over time directed by the Faculty of Agriculture, these farm land holdings are expected to be rationalized and expanded.

The Faculty of Agriculture also conducts research in two facilities beyond the campus: the Dalhousie Wild Blueberry Research Centre located some 3.8 km from the campus in Debert and as research contributor with the Perennia Rural Research Centre (formerly Agritech Park) in Bible Hill.




**Dickie Marsh**

| Field_Name | Hectares | Acres |
|---|---|---|
| 510 | 2.1 | 5.2 |
| 511 | 1.6 | 3.9 |
| 514 | 2.3 | 5.8 |
| 513 | 0.7 | 1.8 |
| 509 | 2.3 | 5.6 |
| 508 | 2.5 | 6.2 |
| 507 | 2.2 | 5.5 |
| 506 | 3 | 7.3 |
| 505 | 3.3 | 8.1 |
| 4 | 1 | 2.5 |
| 503 | 3.9 | 9.7 |
| 500 | 1.5 | 3.8 |
| 501 | 1.4 | 3.5 |
| 502 | 1.4 | 3.6 |
| 512 | 3.5 | 8.5 |

**Clish Marsh**

| Field_Name | Hectares | Acres |
|---|---|---|
| 330-2 | 2.1 | 5.3 |
| 330 | 0.7 | 1.8 |
| 330-1 | 0.7 | 1.7 |
| 320 | 8.1 | 19.9 |

**Park Street**

| Field_Name | Hectares | Acres |
|---|---|---|
| 307 | 4.9 | 12.2 |
| 304 | 6.5 | 16.1 |
| 309 | 3.2 | 8 |
| 305 | 5.3 | 13.2 |
| 308 | 4.6 | 11.4 |

**Brookside**

| Field_Name | Hectares | Acres |
|---|---|---|
| 233 | 1.6 | 4 |
| 232 | 1.6 | 4.1 |
| 231 | 1.6 | 4.1 |
| 230 | 1.7 | 4.2 |
| 234 | 2.5 | 6.1 |
| 237 | 2.5 | 6.2 |
| 236 | 1 | 2.6 |
| 235 | 0.4 | 1.1 |
| Centre 4 | 0.5 | 1.2 |
| Centre 1 | 0.7 | 1.8 |
| Centre 3 | 0.8 | 2 |
| Centre 2 | 0.9 | 2.2 |
| Back 1 | 0.7 | 1.7 |
| Back 4 | 0.3 | 0.7 |
| Back 4 | 0.3 | 0.7 |
| Back 4 | 0.2 | 0.5 |
| Back 3 | 0.9 | 2.3 |
| Back 2 | 1.3 | 3.1 |

**Farnham Road**

| Field_Name | Hectares | Acres |
|---|---|---|
| 402 | 1.1 | 2.6 |
| 400 | 14.7 | 36.3 |

**Interval**

| Field_Name | Hectares | Acres |
|---|---|---|
| 106 | 2.1 | 5.2 |
| 105 | 3.5 | 8.7 |
| 131 | 3 | 7.3 |
| 132 | 8.9 | 22 |
| 133 | 5.5 | 13.6 |
| 134 | 4.7 | 11.6 |

**Plumdale**

| Field_Name | Hectares | Acres |
|---|---|---|
| 120 | 4.9 | 12 |

**Agri-Tech**

| Field_Name | Hectares | Acres |
|---|---|---|
| 207 | 5.9 | 14.5 |
| 201 | 4.4 | 11 |
| 203 | 2.8 | 7 |
| 202 | 3.3 | 8.1 |
| 200 | 5.2 | 12.9 |
| 213 | 2.8 | 7 |
| 213a | 0.4 | 1.1 |
| 206 | 3 | 7.3 |
| 209 | 1.3 | 3.3 |
| 211 | 0.5 | 1.2 |

**Boulden**

| Field_Name | Hectares | Acres |
|---|---|---|
| 102 | 2.1 | 5.1 |
| 104a | 3.3 | 8.3 |
| 104b | 0.4 | 1 |
| 103a | 1 | 2.4 |
| 103b | 0.4 | 1.1 |
| 103c | 0.7 | 1.7 |
| 104d | 1.2 | 3 |
| 104c | 0.8 | 1.9 |
| 101a | 1.2 | 2.9 |
| 101b | 1.2 | 3.1 |
| 101c | 1.3 | 3.2 |
| 104b | 0.5 | 1.2 |
| 104b | 0.4 | 0.9 |
| 104b | 0.4 | 1 |
| 104b | 0.4 | 0.9 |
| 104b | 0.4 | 1 |
| 104b | 0.4 | 1 |
| 104b | 0.4 | 1 |

# 3.0 Campus Development Plans Informed by Dal's Strategic Directions

## 3.1 Approach to Planning for Transition and Growth

The University has cited four overriding principles, fully documented in Appendix A, that inform campus planning:

- Collective focus on learning, teaching and research
- Local, provincial and international community engagement
- Sustainability through life-cycle thinking
- Supportive physical and communications infrastructure

Within the above overriding principles, together with strategic directions provided by the Faculty of Agriculture, the campus development plans must reflect the realities of the complex transition underway and how it impacts the entire University from diverse perspectives, in particular:

- The significance of Dalhousie adopting a **new field of academics and research** has critical global as well as regional and national importance, suggesting a growing focus on cross-discipline programming and need for flexible/adaptable space together with accommodation for unpredictable pedagogies and growth;
- The **challenges of transitioning** a traditional college into a major multi-disciplinary university campus will raise facilities standards in compliance with overall Dal policy; and
- The **challenges of connecting** with a remote, and previously unplanned campus will demand improved inter-campus communications and over time, facilities improvements and expansion.

### Critical Variables

All these factors contribute to an understandable current situation of flux, requiring time, patience and deliberate decision-making that will move from having to deal with priority actions through a state of transition to a future mature campus. Currently – and perhaps for some reasonable time to come – four critical variables pose obstacles to providing accurate long range estimates of facilities requirements typically comprising a 'campus master plan':

- Academic programing undergoing refinement and change involving both the Agricultural Faculty and likely other program offerings in the future;
- Student Enrollment growth therefore cannot be accurately forecast into the foreseeable future upon which to base realistic demand estimates of future amounts and types of space and infrastructure;
- Funding requirements for development can presently only be projected for known needs;
- Timing, i.e. reasonable horizons needed to complete a reliable long term development plan.

### Strategic Context

The context for planning the future development of the campus is based upon examination of current issues and future trends potentially impacting the physical campus environment, having three critical dimensions:

- Principles and Directives, drawing specifically from the President's Strategic Direction 2014-2018.
- Time, three broad periods that overlap in terms of specific development initiatives: (1) Immediate Priority Actions, (2) Period of Transition and Growth, and (3) a vision of the future Mature Campus.
- 5 Key Perspectives: Academics/Research, Students, External Communities, Institutional Operations, and Facilities.

The Matrix opposite illustrates how these 3 dimensions form planning responses in terms of trends, change factors and future visions that can inform the physical planning. The President's Strategic Directions apply specifically to each perspective and consequently inform the development trends and goals extending over the three time periods.

This multi-dimensional Strategic Context Matrix opposite is meant as a "living" tool that can be modified by campus planners and executive policy makers as on-going campus development occurs through the three time periods. For example, examination of the Matrix suggests a variety of future development possibilities for consideration:

- Over time, a deliberate consolidation of campus academic and service activities in fewer, better buildings (by renovation, renewal and new construction) to optimize space functionality, utilization and operating efficiencies, while phasing out inefficient/outdated buildings. Major renovation of Cox and expansion of Haley are priorities.
- Various course delivery approaches will best be accommodated by investing in flexible, adaptable multi-purpose classroom/labs with rolling furniture and up-to-date technologies. This approach will also provide optimum utilization of these spaces.

- Collegial graduate student work areas to include flexible, well-appointed work stations and sharedlounge/work spaces, located near related research labs.
- Current campus trends suggest providing students with greater service and residence choices that will influence design of residence units, dining and retail facilities.
- Renovation of Alumni Theatre to serve multi-cultural activities and purposes such as lectures, conferencing, cinema and live theatre.
- A public reception and exhibit space in Cumming Hall.
- A DAC pilot project in "smart campus" design and implementation that could extend to the entire University.

The following three pages illustrate how the Context Matrix informs each plan, focusing on (1) Priority Projects, (2) Transition & Growth and (3) the Future Mature Campus.

| | STRATEGIC DIRECTIONS | PRIORITY ACTIONS | TRANSITION & GROWTH | MATURE CAMPUS |
|---|---|---|---|---|
| ACADEMIC / RESEARCH | "Innovation in research, teaching & pedagogy"<br>"... emerging research areas:<br>• Information Science and Communication<br>• Agriculture and Food Technologies<br>• Energ and the Environment"<br>"Atract and support excellent graduate students" | **Improve Lecture/Lab Delivery**<br>• Upgrade classrooms/labs<br>• Upgrade IT systems framework | **Active Learning**<br>• Multi-modal information sources<br>• Innovative problem-solving<br>• T&L support<br>**Multi-Disciplinary Research**<br>• Flexible lab redesign.renewal<br>• Partnerships with industry<br>• Expanded IT capacities<br>• Links with Perennia | **Flexible, Blended Academics Research Continuum**<br>• Undergraduate to graduate to post-graduate learning<br>**Multi-Disciplinary Networks**<br>• Information Science & Communication<br>• Health Science & Food Technologies<br>• Energy & the Environment<br>• Global Economics |
| STUDENTS | "Strengthen student experience" | **Reverse Declining Enrollments**<br>• Improve learning buildings<br>• Upgrade graduate student office<br>• Added options for student residence and dining<br>• New student centre | **Increasing % Graduate and Foreign Students + Focus on Personal Development**<br>• Integrated academic/research learning experience<br>• Flexible academic programming<br>• Diversified student services | **Campus as Safe Learning Environment**<br>**Services Tailored to Needs and Choices** |
| EXTERNAL COMMUNITIES | "Cultural and economic vitality"<br>"Partnerships and relationships"<br>"External investment" | **Build Relationships with Diverse Interests**<br>• Surrounding communities<br>• Farmers<br>• Agricultural Industry<br>• Alumni<br>• Institutions<br>• Government agencies | Diverse Programs<br>• Continuing education<br>• Advisory groups<br>• Local to global networks<br>• Focused fund raising<br>• Rural and industry outreach<br>• Participation in community development | **Culture of Engagement, Service and Partnership**<br>• Fundraising<br>• Capital projects<br>• Continuing Education<br>• Community Development |
| INSTITUTIONAL OPERATIONS | "Expect and track changes ... assess, track, inform, and continuously improve"<br>"Effectiveness and efficiency"<br>"Monitoring and evaluation' | **Harmonize AC-HALIFAX**<br>• Service delivery<br>• Communications<br>• Responsibilities<br>• Efficiencies | **"Smart Campus" Pilot**<br>**Adaptive Client-Focused Service Models** | **"Smart University" Responsive Administration**<br>**Multi-Fasceted Integrated Sustainability**<br>• Economic<br>• Social<br>• Environmental |
| FACILITES | "Improve ... quality and inventory"<br>"State-of-the-art (research) facilities | **Improve Classroom Utilization**<br>• Repurpose surplus space<br>• Select classroom upgrades<br>• Flexible and adaptable<br>• Multi-use design suitable for teaching, collaborative study and meetings | **Fewer Consolidated Buildings in Renewed and New Buildings**<br>• Phase out older, inefficient buildings | **Adaptable, Efficient, High Utilization Facilities**<br>**Continous Learning Campus Environment**<br>**Adaptive, Global IT Systems** |

## 3.2 Plan For Priority Projects

Priority actions are primarily limited by available funding. Some projects already have approved funding and are progressing. Others require final funding approvals that are anticipated in the near future. Many further projects needed in the near future are included in the subsequent plan for the transitional period.

The Strategic Context in the previous Matrix poses key guidelines for priority planning:

1. Priority investments in improvements important to students can strengthen student retention and growth;
2. Priority investments in a campus Teaching and Learning Centre can demonstrate support for faculty and encourage their attention to advances in course delivery methods that in turn, can strengthen efforts to attract enrollment growth need and promote optimum utilization of facilities;
3. Building community support will require involvement in public issues of shared importance such as public planning, continuous education, and partnerships with other local institutions; all such issues affect campus facilities and development planning;
4. Campus operations need priority infrastructure and facilities improvements to support streamlining administrative practices;
5. While priority facility improvements are needed, these institutional investments should be made with a view to meeting Dal's high standards and strategic directions affecting academics, student life and operational effectiveness and efficiency.

Such guidelines drive recommended priority actions focused on immediate needs and short-term opportunities and longer term results:

- Student safety crossing College Road represents the uppermost student comment offered to the planners. While student safety is a primary responsibility of the University, the actions required to improve the cross walks are the responsibility of the Provincial Department of Transportation and Infrastructure Renewal (TIR). The University is advised to press the TIR to provide these improvements as a matter of priority in the interests of student safety.

  In addition, campus pedestrian pathways leading to crossings of College Road that are not provided with standard cross walk facilities should be eliminated and pedestrians discouraged from crossing at such points.
- Campus intelligent information systems (ITS) cannot function adequately and serve the myriad of user demands (including adequate inter-campus communications) until its local area network is upgraded. This is a critical infrastructure project affecting utilization of most if not all campus facilities and is delaying other priority technology upgrades.
- With an upgraded campus ITS framework in place, strategic investment in a limited number of class room upgrades will be a priority in Cox and Haley. Initial improvements could be limited to improved lighting, new flexible furniture and upgraded teaching and learning technologies, resulting in increased space utilization and allowing other less utilized spaces to be repurposed. Candidate class rooms for the up-grading include Cox 260, 208, 262, 136, 209, 164, 138, 41, 261 and Haley 110, 114, 116.
- As a temporary student amenity, the top floor of the MacRae Library is to be renovated to accommodate a Student Commons including lounge and study space, Student Association offices and meeting rooms as well as space for Library services.
- While the present outdated student residences will require major investment in the future, limited upgrading of rooms and wash rooms will demonstrate response to student priority concerns.
- Current administrative operations concentrated in Cumming Hall have recently been fitted with modern office renovations and will likely need continued support as operational changes inevitably occur.
- Planning for renovations and additions to the Ruminant Animal Centre (RAC) are underway including replacement of feed facilities recently damaged by fire, addition of a new public entry and central interpretation and teaching space, and new animal care wing, cited by the Faculty as a priority need and opportunity to generally improve accommodation of both animal care and teaching. Minor alterations can also provide an improved classroom/lab and meeting space at the existing entrance area.

## PRIORITY PROJECTS


**Cox Institute**
- Repurpose surplus space
- Upgrade select classrooms/labs

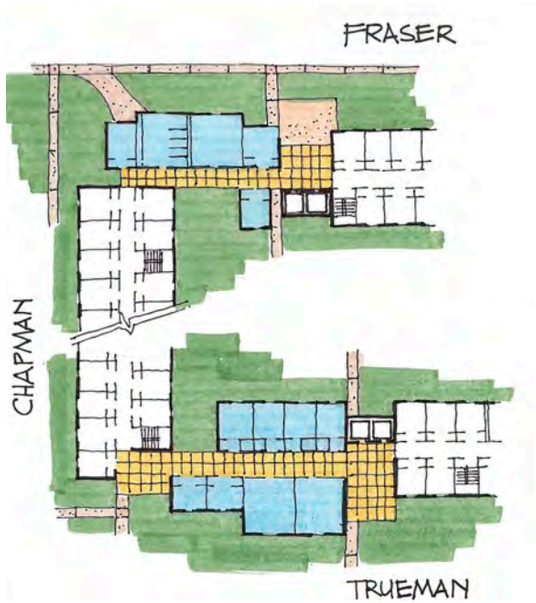
**MacRae Library**
- Renovate 3rd Floor to accomodate Student Commons

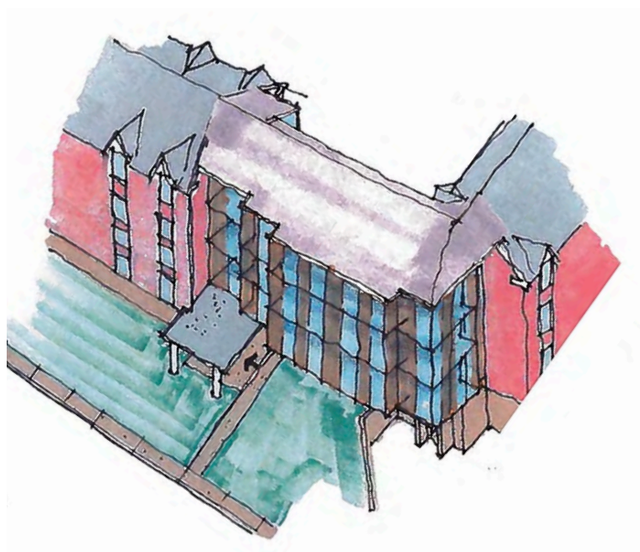
**Student Residences**
- Upgrade residential rooms and common bathroom and shower facilities

**College Road**
- Improve cross-walks to ensure pedestrian safety and traffic calming
- Eliminate pathways that encourage unprotected pedestrian crossings

**Haley Institute**
- Upgrade classrooms

**Ruminant Animal Centre (RAC)**
- Add new animal wing to increase capacity
- Expand existing lab/classroom to provide upgraded 25 seat instructional and meeting space



Proposed Residence Corner Additions

## 3.3 Plan For Transition and Growth

The period of campus transition is already well underway and overlaps with initiatives that both address immediate priorities and others that may not occur for some time. Yet this transition period is expected to address more challenges and opportunities in the near future, such as how agricultural programs may evolve, what academic program mix might be introduced at the campus in addition to Agriculture, what capital funding strategies might be adopted, what operational models might be invented, and what steps might be taken towards achieving the “smart campus” concept. The plan for this period optimistically focuses on growth and envisions projects intended to accommodate expansion as a guide to future decision making.

The Strategic Context in the previous Matrix poses key guidelines for formulating a plan for development during this period of transition and growth:

1. Continuing investments in the campus technologies infrastructure should be guided by a strategic long term IT systems plan and capital budget, of which a part might be examination of opportunities for implementing a “smart campus” pilot project on the DAC – discussed in Appendix B - with a view to future extensions to the University-wide system; a recommended modest first step would be to undertake an initial assessment of existing and potential benefits and costs involved and strategies for taking optimum advantage of existing ITS resources;

2. Likewise, continuing investments in achieving the University’s objectives of environmental sustainability such as carbon neutrality and facilities energy monitoring;

3. Investment in upgrading and expanding the campus inventory of facilities – including improvements to building systems efficiencies – while systematically eliminating existing buildings that are underused, functionally outdated and/or inefficient to operate and maintain, leading to a future inventory that is relatively less in size but greater in utilization, adaptability and life cycle cost efficiency;

4. Facilities design that ensures each capital project contributes to a renewed facilities inventory that is flexible and adaptable to changes in use as well as durable and sustainable in economic, functional and environmental terms;

5. Capital projects – be they renovations, additions or new buildings – that are planned to achieve overall campus development principles and design standards as well as specific functionalities; such principles are detailed in the Design Guidelines provided in the following section of this report;

6. Building Infrastructure and parking facilities will be added as required to accommodate future renovated and new building construction.

Accordingly, the plan for campus development in this transitional period contains specific project recommendations and in addition, points to potential sites for development and existing buildings to be considered for demolition over time. Included is a proposed option for avoiding more costly renovations to the existing residences by constructing new additions at the two corners linking the three buildings that would provide modern washroom facilities, elevators to the floors, and additional lounges and bed rooms.

## TRANSITION/GROWTH PROJECTS

### Future Enclosed Botanical Garden

- To provide year-round space to develop specialized gardens, botanical collections, and gene conservation programs.

### Langille Athletic Centre

- Future addition to accomodate expanded courts,change and fitness facilities and new multi-purpose rooms as well as mechanical and accessibility upgrades.

Detailed summary in Appendix D

- Future pedestrian bridge to Cox

### Residential Link Buildings

- To provide both horizontal and vertical circulation and inprove accessibility of the existing residences and provide modern washrooms and additional rooms

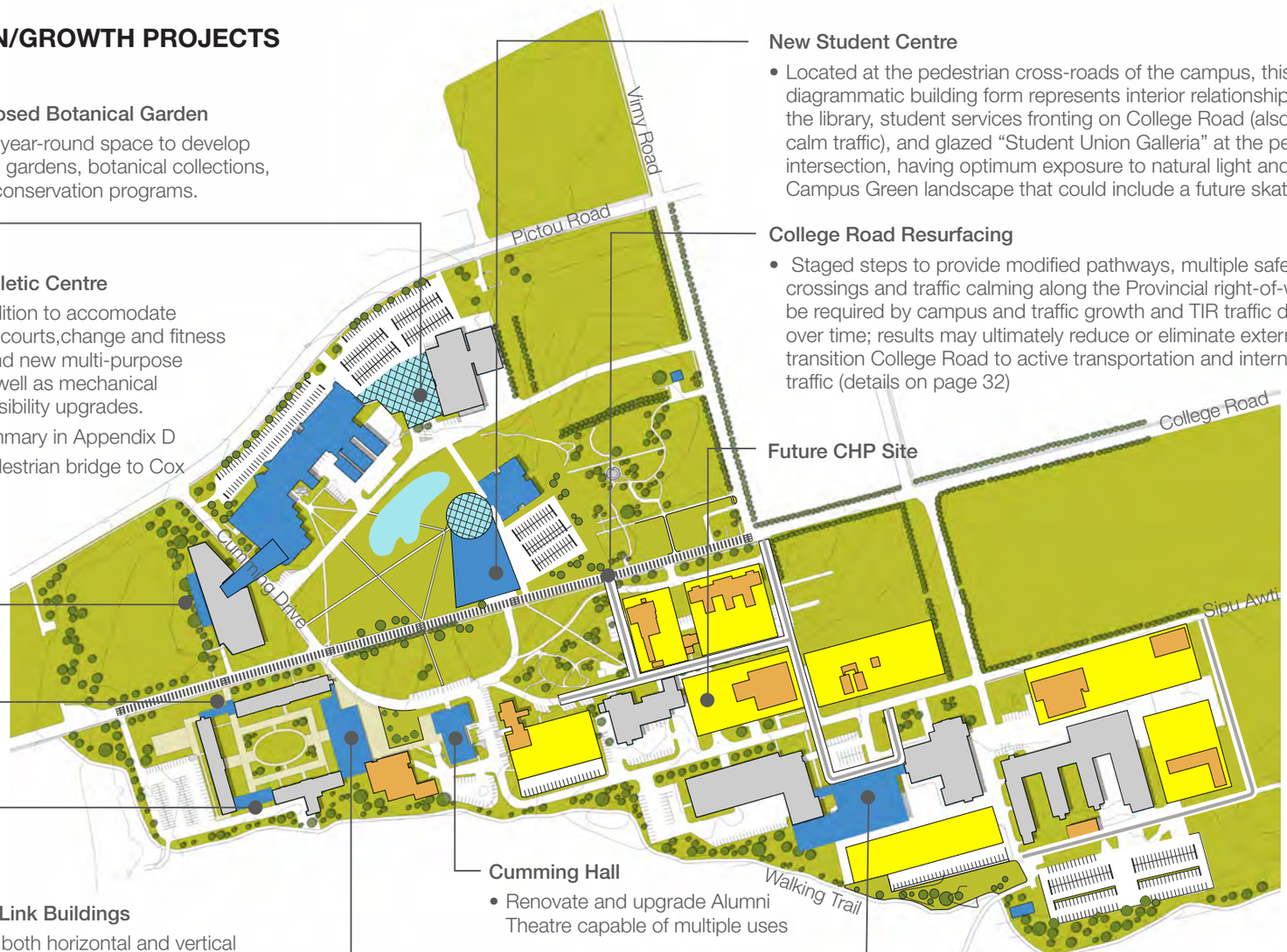
### New Student Centre

- Located at the pedestrian cross-roads of the campus, this diagrammatic building form represents interior relationships between the library, student services fronting on College Road (also serving to calm traffic), and glazed “Student Union Galleria” at the pedestrian intersection, having optimum exposure to natural light and the Campus Green landscape that could include a future skating pond.

### College Road Resurfacing

- Staged steps to provide modified pathways, multiple safe pedestrian crossings and traffic calming along the Provincial right-of-way as may be required by campus and traffic growth and TIR traffic diversion plans over time; results may ultimately reduce or eliminate external traffic and transition College Road to active transportation and internal vehicular traffic (details on page 32)

### Future CHP Site




### Cumming Hall

- Renovate and upgrade Alumni Theatre capable of multiple uses

### Future Residential Mixed-Use Building

- To provide future additional residential spaces as enrollment grows, renewed dining facilities and Conference Centre

### Future Research and Teaching Centre

- The new building would provide a sheltered link between the Haley Institute and the Atlantic Poultry Research Institute and include expansion of Agriculture Ressearch Facilities.

EXISTING BUILDING

FUTURE BUILDING SITE

PROPOSED BUILDING

NEW CAMPUS ROADS

PATTERNED ROADWAY AND CROSS-WALK PAVING

## 3.4 Plan For The Mature Campus

A vision of the potential mature campus follows from the planning that forms the priority and transitional plans. While it is clearly premature to forecast the extent and institutional nature of the campus as it evolves into maturity, it is possible to envision how the physical structure of the campus can be expected to develop over time based on the information presently know.

The Strategic Context in the previous Matrix poses key guidelines for forming a plan that envisions development of the mature campus:

1. An operational vision for the mature campus would be full implementation of the “smart campus” concept that would focus on student, teaching and research services in addition to serving a streamlined model of campus operations;

2. The mature campus is envisioned as strengthening the (5) activity precincts with facilities within each that provide the flexibilities, adaptabilities and choices to meet changing user needs and preferences over time;

3. The built form of the mature campus – providing a capacity of space far exceeding anticipated near-term requirements – is envisioned as expansion on development sites indicated on the transition plan for potential future development if required, simultaneously replacing existing under-performing buildings;

4. The landscape plan for the campus illustrated on Page 27 envisions mature gardens and plantings as well as an enclosed botanical garden used for teaching, research and public visitations;

5. The vehicular and pedestrian circulation patterns – also accommodating other forms of ‘active transportation’ such as bike paths – envisioned in the mature campus plan are presented with the awareness that future roadway elements will depend upon future functional requirements and external decisions including:

- Should vehicular traffic to the campus increase significantly, formal entry ‘gateways’ as indicated on the plan would be advantages, as information and security measures; likewise, such traffic growth would require completing the staged parking plan outlined in the transition plan and fully indicated in this plan;
- The results of TIR traffic planning may better serve the travelling public by diverting traffic to improved intersections at Main Street via Picton Road. A comprehensive area traffic plan may be supported by the public and implemented by the Province in the future, in which case, it should be also supported by the University in favour of modifying or closing College Road to through traffic. Since this matter is not with the University’s authority, the plan simply demonstrates the advantages to campus enhancement of such modifications.

## MATURE CAMPUS PLAN

# 4.0 Design Guidelines

## 4.1 Campus Planning Concepts

### Campus Structure

The overall physical structure of the campus is defined by three essential elements: its networks of pedestrian and vehicular **circulation**, its **open spaces** and its pattern of **built form**. Existing patterns of the campus have apparently evolved over the past 100 years on the basis of ad hoc practicalities. The goal of the Campus Framework Plan is to prescribe modifications to current patterns as they evolve in an orderly manner to meet the needs of future generations.

### Campus Activity Pattern

The plans envision strengthening the identity and character of **five generalized precincts of campus activity** expected to develop as the campus grows and matures:

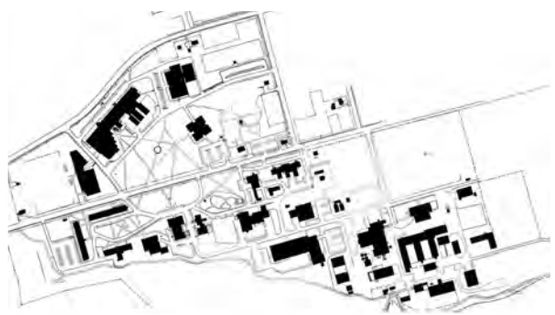
1. The central **Campus Green** and network of gardens
2. The proposed **Student Centre**, forming the student focused activity hub of the campus;
3. The North and South **Teaching and Research** complexes;
4. The campus **Administrative and Conference Centre** focusing on Cumming Hall and its Alumni Theatre; and
5. The **Student Living** complexes, comprising the residences, dining and athletic facilities.

Existing Campus Circulation

Future Campus Circulation

Existing Campus Open Space

Future Campus Open Space



Existing Campus Built Form

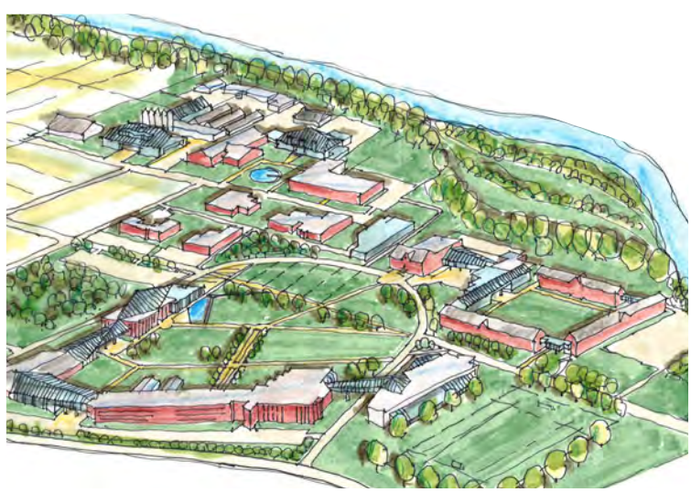

Future Campus Activity Pattern

Concept Framework Axonometric Sketch

### Campus Connectivity

The goal of connecting campus buildings should be achieved over time when renewing older buildings and adding new. Each project should add to the ability for pedestrians to have weather-protected options for moving from one building to another. Each project should feature major connecting pedestrian routes that feature social gathering spaces and form a consistent network of interior movement. Enclosed pedestrian bridges are appropriate where the pedestrian route intersects with vehicular circulation, for example connecting the proposed Student Centre to Banting and bridging street traffic between Cox and the Athletic Centre. Advantages to such weather protected pedestrian connections are:

- contributing to defining campus built form and outdoor defining spaces
- encouraging pedestrian-oriented social interaction



- discouraging driving between buildings, thereby reducing demand for parking spaces and improving air qualityConnectivity between the DAC and Halifax campuses will become increasingly critical as academic programs, research projects and student involvement in university-wide activities expand. This connectivity will occur in many forms including:
- joint campus electronic information screens placed in high occupancy facilities such as the new Student Centre,
- effective two-way tele-conferencing and project hook-ups,
- regular two-way University bus service between the campuses and short term residence facilities on both campuses to accommodate joint intra-campus participation.

Likewise, investments in maintaining up-graded global electronic connectivity will be essential to the campus' expanding international academic and research roles.

### Campus as Continuous Learning Experience

Just as the University is devoted to learning so should the campus be planned and its buildings designed to achieve the environment of a "living classroom and laboratory", ie a continuum of learning experiences as one moves through and experiences the campus. Implementation of this principle takes many forms, for example:

- outdoor artwork that stimulates imagination, and plant and tree species that change form in response to the climates and seasons;
- transparency by windows from corridors into active spaces such as labs, demonstration lecture rooms, learning workshops and studios, galleries and exhibit areas, leisure and exercise areas, animal and plant working areas, electronic news and information screens;
- Corridors equipped with white board walls and niches where groups can pause to study and socialize, as well as views to the outdoors.

## 4.2 Architectural Vocabulary

The architecture of the first buildings on campus such as Cumming Hall shared a common material and style typical among similar agricultural collegiate institutions at the time such as Macdonald and Guelph. They were distinctive and reflective of their time in terms of design and technology and used quality, durable materials. Generally, the campus buildings built since are not as inspired, do not reflect the unique programme that an agricultural campus might express and utilize a wider range of architectural styles and materials.

The design of future buildings on Campus should :

- Be planned with maximum spatial flexibility and adaptability so that interiors can easily be modified to suit changing program needs as well as being capable of expansion; architectural proposals should be required to include explanations of how such flexibility and expansion can be readily achieved;
- Demonstrate ease of pedestrian movement between them to facilitate protected all season circulation and connectivity; such linkages should be designed to accommodate social interaction and learning experience;
- Have an accentuated indoor/outdoor relationship;
- Utilize the open space of the campus as formalized teaching spaces in the landscape design and integrated with the architecture by enclosing / or interacting with the natural landscape;
- Comply with University policies regarding environmental sustainability;

- Reflect attention to the natural features of the site including sun orientation and natural daylight, wind, topography, vegetation and views;
- Contribute to principles fostering continual learning experience by optimizing internal transparencies between spaces, for example glass separations between corridors and laboratories and other group activity spaces;
- Utilize quality, durable materials that foster effective life-cycle principles and reflect the needs of long-term institutions.

Investment must be made over time in transforming the entire campus to comply with accessibility standards, including not only new and existing buildings but also outdoor drop-off and parking areas, pathways, curbs and seating areas. This will be increasingly essential as the campus grows and becomes frequented by more students, staff, visitors and the general public.

## 4.3 Environmental Sustainability

### Carbon Neutrality

Providing the energy requirements for operations (heating, cooling, lighting, cleaning) and maintenance of buildings as well as the powering of equipment required to carry out all of the campus activities are the main sources of the carbon footprint generated by the campus.

A well-known and widely stated aspirational goal of Dalhousie is to achieve carbon neutrality for the Agricultural Campus (DAC). A 2014 Campus Renewable Energy Plan by CBCL identified the total scope 1 and scope 2 carbon emissions on campus to be 10,447 tonnes. These were comprised of emissions attributed to electricity purchased from Nova Scotia Power Incorporated (NSPI) and consumption of fossil fuels for heating at the time. The plan identified 12 renewable energy projects that, if implemented, would result in net carbon emission reductions of 11,900 tonnes per year.

The University has multiple plans that support the concept of carbon neutrality including the University Climate Change Plan and annual Greenhouse Gas (GHG) reporting. Version Two of the University Climate Plan will be released in 2017 and will include the details of the carbon neutral planning elements that build and expand on the initial 2014 study. Annual GHG reports and targets have been adjusted to include all Dalhousie campuses including the AC.

The university has already embarked on a series of programs and developed plans that are intended to reduce the campus carbon footprint towards the carbon neutrality goal. Strategies include energy efficiency, green building development, fleet upgrades, and renewable energy. Example of projects completed or underway include campus-wide lighting upgrades, fume hood upgrades, controls improvements, solar pv, house insulation and heating upgrades including heat pumps, and biomass co-generation.

The biomass co-generation project ($24.2 million) is a major energy efficiency and renewable energy initiative scheduled to be completed in June 2018. The project scope includes replacing campus's aging steam lines with hot water lines, replacing the old wood boiler, adding appropriate and required air quality controls, and adding a turbine to create electricity. The 1 megawatt biomass co-generation plant project focuses on energy efficiency and securing local sustainable supply. Waste heat from electricity production is used for heating the campus. The plant design will allow flexibility for future products like willow. The electricity from the project is sold to NSPI through the Community Feed in Tariff Program (COMFIT). Under this program NSPI keeps the carbon attributes for the electricity portion.

Other strategies in the carbon neutrality plan include more energy efficiency projects from whole building energy performance projects, equipment upgrades, controls and energy optimization strategies, fleet enhancements, and thermal envelope improvements. Future renewable energy projects include the addition of solar PV and other solar technologies (6000 kWh –50 MWh), purchase and/or development of local wind energy (10,000–11,000 MWh), and using anaerobic or aerobic digestion in farm uses. A combination of these strategies will yield a carbon neutral campus.

## Environmental Full-Cost Accounting

Beyond carbon neutrality, developing a lifecycle environmental full-cost accounting approach is a complete assessment of environmental costs and benefits of any major projects at the Agricultural Campus. This would require the identification of current base lines for the environmental, social and economic costs and benefits of all relevant systems. The Agricultural Campus is highly suitable in terms of scale and activities to provide an academic as well as a practical model for the Dalhousie Community for such a holistic accounting approach.

If environmental full-cost accounting proves difficult to put into practice at this time, the focus should continue to be on carbon neutrality for energy systems and building projects as outlined above, including continuous performance assessment of the primary infrastructure systems:

- Potable Water Distribution
- Storm Water
- Sanitary Waste
- Solid Waste
- Electrical Power
- Steam Distribution

## Water Quality Management

- **Storm Water Infrastructure**

The load on Municipal Storm Water Management system capturing run-off from hard surfaces on the campus (mainly roofs and asphalt-paved parking areas) should be gradually reduced as opportunities arise. This would reduce the carbon footprint of storm water management as well as the risk of flooding and run-offs harmful to human-made and natural environments which is especially true in the case of the Salmon River, flooding the Truro area on a regular basis. Additional benefits of this approach are the treatment of stormwater run-off and recharge of the groundwater table. The primary elements of this strategy are:

- For new buildings, connect roof drains to infiltration galleries or pervious surfaces, or implement other stormwater runoff attenuation measures for new buildings such as green roofs;
- As impervious parking surfaces and walking paths reach the end of their service lives and are scheduled for replacement , replace the impervious surface with a new porous paving surface or design the parking area so impervious surfaced areas are drained to infiltration trenches, permeable strips, rain garden or other infiltration system; (Fig. 1)
- Ensure that any new car parking areas and walking pathways are surfaced with appropriate porous paving materials or is drained to infiltration trenches, permeable strips, rain garden or other infiltration system; (fig. 2)
- Stormwater detention basins are not considered a suitable means of controlling stormwater flows: they are only effective a short distance downstream, and will not reduce flooding in the Salmon River;
- Stormwater Drainage Pipes: as existing storm sewer piping reaches the end of its service life and requires replacement, replace with perforated pipe in clearstone bedding. This ensures that a portion of the water carried in the pipe is absorbed by the surrounding ground thus reducing the load on the receiving storm sewer or watercourse;
- Introduce storm water management infiltration swales into the landscape where appropriate (fig.3)
- As existing storm sewer piping reaches the end of its service life and requires replacement, replace with perforated pipe. This ensures that a portion of the water carried in the pipe is absorbed by the surrounding ground thus reducing the load on the receiving storm sewer or watercourse.

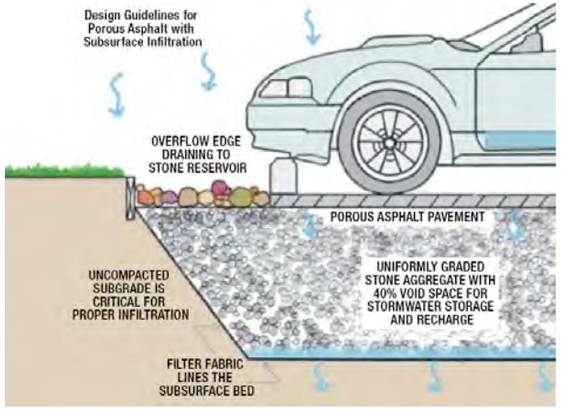



Fig. 1 Permeable Strip Drainage Detail

Fig.2 Permeable Paving Example on Hawthorne Street, Yarmouth NS

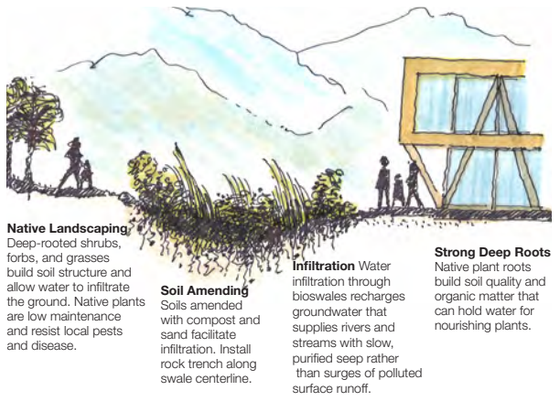



Fig. 3 – Bioswale in a Built Setting

## Sanitary Waste Infrastructure

New developments, which may increase the strength and/or volume of the sanitary sewer flows, should be reviewed with the Municipality to confirm the treatment plant can accept the additional flows. Capacities of the trunk sanitary sewers on Pictou and College Roads should also be confirmed.

A system condition assessment and flow monitoring study is recommended to determine the structural condition of the pipes and manholes, etc., remaining service life (progress of deterioration), hydraulic capacity, and daily flows including inflow and infiltration. The work scope would include gathering pipe invert elevations and confirmation of pipe sizes and flow gauging at key points along the trunk sewers, typically over a period of months that cover a good sample of wet weather and dry weather periods. The gathered information will be used to compare measured flows with calculated pipeline capacities.

## Solid Waste

Dalhousie University's solid waste management strategy has been implemented at the Agricultural Campus and is reportedly working well.

## Energy Conservation

- **Steam Distribution Infrastructure**

  The existing steam distribution network is being replaced with a new hot water distribution network as part of the new combined heat and power plant project currently under development. With the installation of the Combined Heat and Power Plant, hot water lines will replace the existing steam lines. The new hot water piping will offer improved insulation levels and reduced thermal losses compared with the existing steam distribution infrastructure.

- **Outdoor Lighting Systems**

  Upgrades of outdoor lighting to LED is underway and the programme is ongoing.

- **Buildings**

  Improving environmental performance for buildings falls into four categories:

- Upgrades to indoor lighting systems: grades from incandescent and fluorescent to LED lighting within several buildings are underway and the programme is ongoing.
- Lightly used buildings with poor energy performance yet heated through the winter: All such buildings should be identified. The activities within these buildings should be reviewed for possible relocation to more energy efficient buildings that have sufficient space.

  Once current activities are relocated, these buildings may be suitable for repurposing for uses that do not require heating, for example storage.

  Exceptions to this strategy would be made for buildings that have been conditionally bequeathed to the former Nova Scotia Agricultural College.

- **Well-used buildings that require renovation:**

  This applies particularly to Cox Institute. Others should be assessed to provide a baseline environmental performance.

  Wherever possible, minor renovations to such buildings should focus on improvements in the energy efficiency and reduction of the carbon footprint of upgraded envelopes and systems.

  Major renovations of or additions to these buildings should follow Dalhousie University's current strategy of targeting LEED Gold rating with a focus on maximising the points for energy use.

- **New buildings:**

  Some new buildings are justified, primarily to attract and retain students by enhancing student life, as well as to attract staff and research support.

  These projects should follow Dalhousie University's current strategy of targeting LEED Gold rating with a focus on maximising the points for energy use.

## Resilience

The resilience of the campus as a whole to address catastrophic events is in three main categories: Fire at the new Central Heating Plant (CHP), Flooding and Security of Electrical Power.

- **Fire at the new CHP**

  A fire that would incapacitate the energy system for the campus during an academic term may prove to be a catastrophic event. The new CHP will include a new wood fired organic Rankine cycle unit to produce electrical and thermal energy. The existing oil fired thermal backup boilers could continue to provide campus heating in the event of a fire in the new CHP unit. All electrical energy produced from the CHP is sent to the grid and all campus power is supplied from the grid. Improved fire resilience in the central plant could involve the addition of fire separations between the CHP and backup boiler areas as well as from electrical distribution and distribution pump locations.

- **Flooding**

  Resilience with regard to flooding should be addressed through the gradual elimination of hard surfaces (refer to storm water infrastructure above) Storm water infrastructure upgrades should include capacities to address more frequent extreme storm events.

- **Electrical Power – Security of Service**

  The onsite emergency power system consists of a single 332 kva generator at the central heating plant and sized to sustain only the central plant operations during a power outage. Whilst the reliability of the electrical utility services is very high there are potentially a number of weaknesses throughout the system. Both utility services are fed from same distribution line:  a weather related or motor vehicle accident could take the line out of service. These outages tend to be of a short duration – hours, rather than days.

  The two services are not interconnected so even though either one might be able to carry the total campus load that option is not available.  Consideration should be given reviewing the feasibility of interconnection.

  The main substations are 40 years old and located outdoors in enclosures where they are subject to weather and some local water pooling.  Landscape at substations to resolve water pooling.  Conduct regular testing on switchgear to monitor condition and forecast possible failures.  Begin budgeting and planning to replace equipment as part of planned maintenance rather than unanticipated equipment failure.

  The on-site emergency power system cannot sustain the college activities other than at a minimum service level. The CHP generator output cannot not be used directly to feed the campus: Comfit requires that the electricity be delivered to the utility grid.  Review overall emergency power requirements for site including for heating plant; administration services; data and communications; student services and residences; livestock services etc.

### Landscape Design and Management

- **Storm Water Management**

  Per the Storm Water Management Section above and the following Landscape section, the campus landscape should have a major role in reducing the load on the municipal storm water management infrastructure. Consideration is to be given to further storm water management swales.

- **Edible Landscape**

  The concept that this campus could grow all of the food to feed itself has been raised through this assignment. Such a strategy would have academic, research and environmental benefits and further detailed consideration is recommended.

- **Botanical Gardens**

  The concept that the campus plan incorporates a botanical gardens as strategy supporting academic, research and environmental benefits, further detailed in the following landscape design guidelines.

- **Satellite Campuses**

  The long-term sustainability strategies identified in this report are to be considered for application to satellite farm facilities such as Perennia Research Centre in Bible Hill and the Wild Blueberry Research Centre in Debert.

## 4.4 Campus Landscape and Open Space

The DAC has the unique opportunity to combine a rural landscape, an arboretum and an outdoor laboratory into one agricultural campus that celebrates all three. The Landscape and Open Space Plan opposite, as part of the overall Framework Plan for DAC is intended to guide the future development of the campus. It is intended to build upon the existing cultural landscape, and to provide direction for how incremental growth will occur as funding is available for either building specific projects, or for larger campus-wide initiatives. Further, as funds become available, it is intended to guide the overall direction and logic of the DAC, with the overall goal of creating a more coherent and cohesive landscape and open space system, that helps tie together the overall look and feel for the DAC.

### Landscape Design Objectives

The University aspires to create a campus that can be characterized as a “living class room and laboratory” for continuous learning, ie one that stimulates and informs people passing through and enjoying its multitude of natural and built features. A number of elements of outdoor campus design can contribute to this objective:

**Placemaking**  The Landscape and Open Space system should be treated as a campus-wide initiative. In each section below, we have expanded on the characteristics of what is unique to those areas, but the overall feel should be recognized as a system of elements that reinforce the vision of one strong campus – the furniture, the lighting, the materials, the wayfinding are all components that should be seen as a system of element. Their role is to provide continuity and consistency.

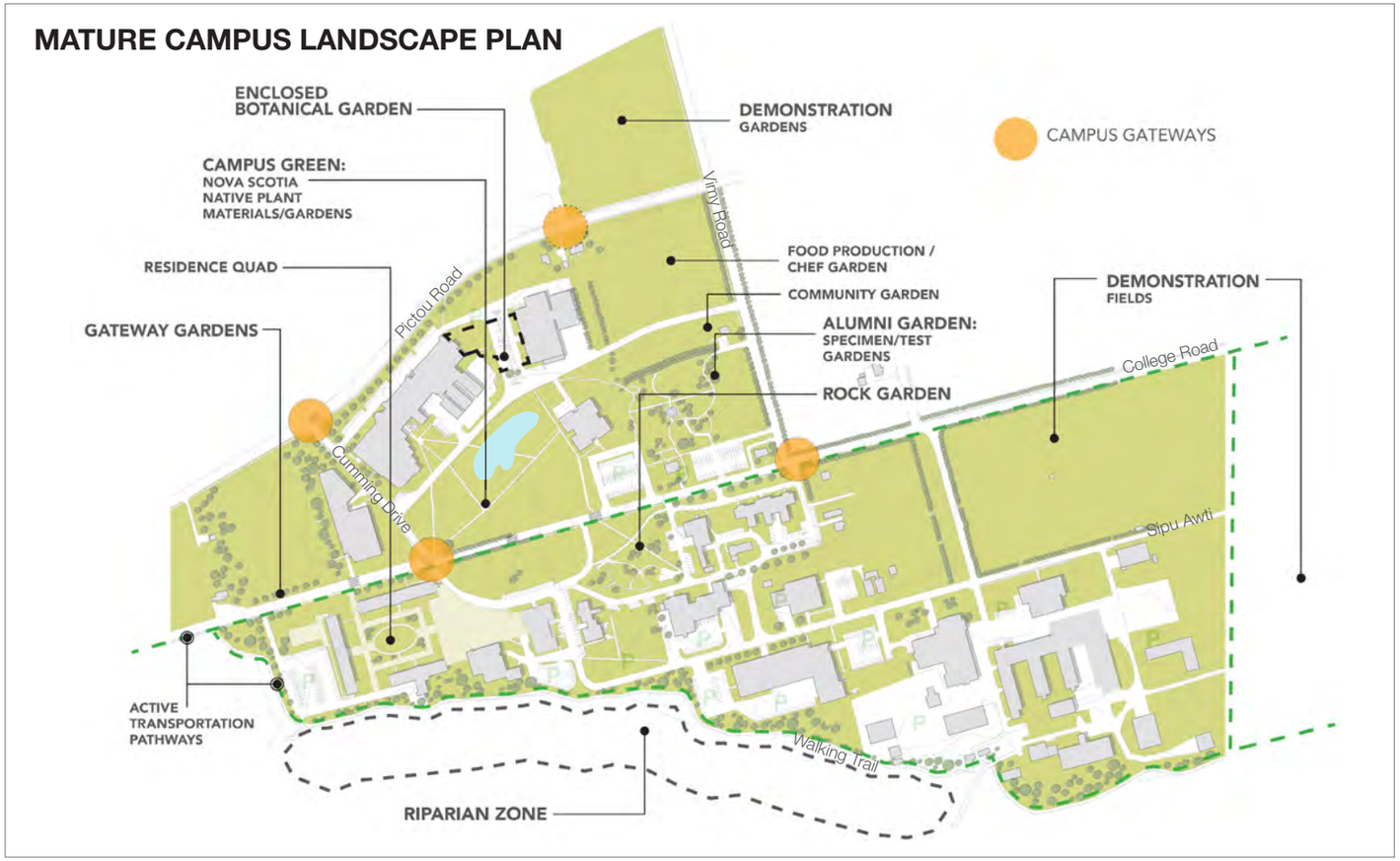
**Planting** Campus wide, planting is an opportunity for diversity and variability, depending on the specific area of the DAC and the role it is to contribute. The common theme, however, is that the DAC can be seen as a form of Arboretum and that the living landscape becomes something that can be shared by all that work or live or visit the campus. The individual planting objectives are described further below.

**Wayfinding** Wayfinding is another campus-wide element and all signage and wayfinding should reflect the continuity and consistency of signage across the campus. It should also be consistent with the Dalhousie brand expressed throughout the Halifax campus.

The pathways transecting the Campus Green should be designed with consideration to the overall hierarchy of traffic and circulation on the site. The major desire lines to Cox, the Library, the Recreation Centre and the student residences should be of a generous width, not less than three meters, and with benches and trash receptacles located at building entrances and intersections of major paths so as to encourage use and discourage littering.

They should be well lit, with pedestrian scale lighting, and a coordinated wayfinding and signage system that ties into the overall campus wayfinding and is intuitive and easy to understand. A campus wide wayfinding and signage program should be developed as a separate detailed exercise that builds upon the Halifax campus signage and yet includes a further family of signs that is specific to the DAC and to identification of plant material, significance and any associated research.

**Public Art** Public art is important in celebrating the values of the cultural landscape and how art can be integrated into the landscape. Public art may vary throughout the DAC and is described below in the context of the unique areas.




The public art objectives across the campus should be tied closely to the development of the Landscape program and integration of art into the landscape. Garden walls, sculpture, kinetic sculpture and environmental art should all be encouraged to help generate interest across the DAC. The heart of this program should be explained and tied into the trail and walkway system and should physically tie back to a major location on the Campus Green.

**Environmental Sustainability** A logical and connected green landscape and open space system will help support the University's overall sustainability objectives. Linked green spaces, connected walkways, clear desire lines for pedestrian movement and generous sidewalks with seating opportunities will all encourage more walkability on the campus. Stormwater management systems that may include ponds, bioswales, rain gardens and LID technology will all support creation of a greener and more sustainable campus. Opportunities for solar

integration in demonstration gardens to help power irrigation systems will reduce use of groundwater and research in areas and types of bioswales adjacent to the Salmon River and other catchment areas will further the improvement of recharging the watertable.

## Campus Green

The Campus Green is a envisioned as the centrally located common space that will serve as the campus-wide “front lawn” of the University Campus. Although the space is currently bisected by College Road, the long term vision is that the entire green space will serve a multitude of uses from major gatherings to passive strolling and informal recreation. It is a space that should reflect the landscape values of the University and its relationship with the outside world. The grade changes that occur across the site present design opportunities to celebrate the rural landscape but also to create vistas and views across the lawn.

One does not have to look far to find precedents for University Commons that serve the same role as the Campus Green is intended to serve for DAC. With respect to other agricultural universities, the University of Guelph has Johnson Green (verify the name) and the University of Saskatchewan has the great lawn. Other historic precedents include University of Virginia.

The Campus Green should be designed to be as one grand space with a rural and pastoral character that reflects the cultural landscape of Nova Scotia, while celebrating the institutional values of DAC. Within the broader space, there are programmatic opportunities for helping animate the space – including a water feature that would serve for stormwater management, and would connect to a reflecting pond or artificial ice rink. The multitude of pathways that transect the site are critical to giving form and access to the overall design of the space but should respect the major desire lines between primary buildings.

The planting of the Campus Green should reflect the hierarchy of roles that the Campus Green plays in terms of the overall campus. First and foremost, it is the central university gathering space and organizational space for the campus. The planting structure should include a ring of broad canopy indigenous trees that define the perimeter of the space. The smaller spaces that form to make up the Campus Green will include spaces for academic gathering, for recreation, for passive recreation or for contemplation and study. These spaces should be designed along with adjacent building programs but should respect the role and the order of the larger space. Plantings should use indigenous plant material to reflect the cultural landscape of rural Nova Scotia, and should take into consideration seasonal colour, texture and variety of form, as well as climatic conditions – hedgerows to protect from the dominant winter winds and sun-pockets to celebrate the shoulder seasons.

University of Saskatchewan

## Alumni Garden

The Alumni Garden is already a space that has been defined to recognize the contributions and donations coming from alumni and a collection of plant material including trees, ornamental plant materials and gardens have been started. This is a significant opportunity to expand the garden into a well-defined space with an organized collection of ornamental plant material, and circuit walkways designed as looping trails, along with both recognition signage and informative plant material identification signage. As part of the campus-wide arboretum collection, the Alumni Garden would be a place to present exotic and non-indigenous plant material for the interest of the students, staff and campus visitors.


Alumni Garden

An advantage in achieving place-making objectives would be to work closely with the newly formed Landscape Architecture program students and faculty to house a design competition for how to best “build upon” the planting structure that exists but to create a true Alumni Garden with a design that complements the Campus Green, but is unique in that it celebrates the diversity of plant material, garden design, and in a sense “formalizes” the structure of these gardens into a showcase for the future.

Planting diversity is recommended, in terms of form, colour, texture and seasonal variety.

The wayfinding design of the Alumni Garden should take into account the fact that this space will be frequented by all ages and types of users, from school children to aging alumni with mobility issues. The wayfinding should be clear and simple to understand, should be informative with respect to plant material and facts. Relevance to research carried out by the DAC should be reflected in the signage and any recognition for donors should be tasteful and discrete and should not dominate the wayfinding message.

There are opportunities for public art within the Alumni Gardens and these opportunities should be considered in the structural design of the Alumni Garden.

The Alumni Garden is a common way to acknowledge the alumni in one central space. This is not to suggest that alumni contributions are limited to this space,  indeed donor programs should be encouraged across the campus including major tree planting programs in areas such as the Campus Green.

## Chef's Garden

This 1-acre plot is a subject of great pride to the campus and community, maintained by staff, students and community members for growing food varieties that go to Dal dining halls including the DAC and to the local community. Last year for example, the Chef's Garden provided some 17,000 lbs of produce to Dal kitchens comprising 29 vegetable varieties, demonstrating its value as a learning experience under staff supervision as well as a useful method of engaging the local community.

## Botanical Gardens

## Agriculture Demonstration Spaces

One of the most unique opportunities that DAC has is to celebrate a diverse cultural landscape with related academic programs. This is rare for most universities and has the potential to become one of DAC's biggest assets. The space outside and between buildings, particularly towards the east side of the campus, can be developed into Demonstration Spaces – plots, gardens, fields and laboratories. Visitors to the campus can be exposed to a changing landscape, which is actively used and tested for the betterment of research and for visual diversity. The UBC Farm, University of Guelph and University of Saskatchewan farmstead all are examples of where the campus research areas reach into the community and expose parts of the research to the public.

The Demonstration Spaces will need to be designed in a flexible manner that allow fencing, secure access, limited public access with viewing and informative signage. The idea is to create a "living landscape" which will become an important component in the DAC.

Planting will depend on the research and development programs and can include varieties of food production, orchards, gardens, edible landscapes, vertical agriculture and turf management.

The wayfinding objectives will be to encourage visitation to key areas where public is allowed to access and to limit access in areas based on maintaining high standards for research and public safety.

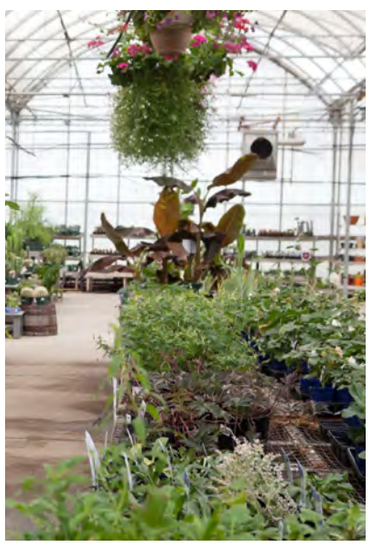
University of British Columbia Farm

## Botanical Garden Opportunities

The DAC offers opportunity to combine rural landscape, an arboretum and an outdoor laboratory into one "agricultural campus" environment that exhibits for pleasure and study a diversity of plant materials. Whereas an arboretum tends to focus on trees, a botanical garden is dedicated to the collection, study, cultivation and display of a much broader range of plant material that includes exotics, vines, groundcovers, and a wide range of plant material.

The DAC has such a unique diversity already, that with the newly founded Landscape Architectural program can become an unprecedented opportunity to celebrate the diversity of microclimates that exist on the campus in an open environment available to students, scientists and the general public. Some of the feature areas could include an East Coast Indigenous plant material area, a more exotic collection of specimens within the Alumni Garden, the Rock Garden species near Cumming Hall and the Riparian Zone plantings along the river bed.

Further, the Framework Plan contemplates the future introduction of an interior atrium or winter-garden linking Banting and Cox. This enclosed botanical garden could be a year-round space where faculty and students – as well as the visiting public - can study rearch plant material in an inspirational setting – essentially a green learning hub for study and enjoyment.



Enclosed Botanical Garden

## Riparian Zone

Usually a riparian zone is a wetland area with setbacks from 10m to 30m, yet from a botanical perspective, the DAC Riparian Zone is also an opportunity to become a demonstration garden that shows what plant material thrive under water or with temporary flooding. The areas along the south edge of the DAC, including the Cobequid Trail and the Salmon River are one of the most unique and diverse landscapes on the DAC. There are opportunities to enhance the existing trail, provide better linkages and to formalize the connections to the DAC.

The design of this area should respect the fact that seasonal flooding may occur and that this is a unique opportunity for providing a riparian landscape. Opportunities for trail connections, for informal seating, for contemplation and relaxation should reflect the natural and rugged landscape.

Plant material should be selected to reflect the seasonal flooding and drought that may occur and should be indigenous material selected for its hardiness and diversity.

The Cobequid Trail should be connected at key points of access to the DAC circulation system, and the trail heads should have signage, informal seating and trash receptacles. There are opportunities for some interpretive signage communicating the diversity of local plant material and the fluctuation of the water level of the Salmon River. The ecological diversity and environmental management message should also be conveyed through the signage in this area.

Any public art in this area should respect the diversity of the areas, the natural landscape and have a focus on the environmental attributes or messages. A good example would be the sculpture garden located along the South Saskatchewan River at the edge of the U of S campus.

## Recreational Fields

The area west of the Recreation Centre adjacent to the residences is a good location for recreational sports fields.

## Special Spaces

There are many Special Spaces within the DAC, and there will be many others to come as the campus grows. Sometimes these will be associated with building entrances, with junctions in the pathway and circulation system, with sun-pockets in the natural landscape or with special trees that have significant landscape and placemaking values on the campus. An example is the Rock Garden landscape where this space has been developed over time and has become a favorite spot for informal gathering, for a stroll or a coffee break. These Special Spaces are critical to the success of the larger Master Plan initiatives and should always be encouraged with a focus on design excellence, use of high quality materials and consideration for the contribution to the overall campus.

Rock Garden

## Pedestrian Pathway Circulation

One of the richest and most rewarding experiences should be the pedestrian experience as the campus develops. The pathway system can unify the campus experience through the consistent use of standard materials, the quality of the materials, the path dimensions and the accessibility of this system during all seasons. The following guidelines should form a DAC-wide campus treatment which can be developed over time, and should be followed for all repairs, improvements and new construction.

- Realignment of major pathways as noted on the Framework Plans reflect intended ‘desire’ lines of pedestrian circulation to/from existing and future buildings;
- A standard pathway width of 2.1m is generally recommended to accommodate diverse use including walking, bikes and disability motorized vehicles;
- A standard palette of materials (concrete is generally recommended for durability) should be used, with priority to quality of materials closest to building entrances and major pedestrian walkways. In other words, stone, unit pavers and higher quality concrete finishes are appropriate near entrances and on significant connectors across the Campus Green;
- Asphalt trails can be used throughout the DAC in lower priority zones to reduce capital and maintenance costs and to allow small equipment used for campus maintenance and research to move on the campus;

- Areas of environmental sensitivity or areas where groundwater recharge is critical for root zones, or adjacent riparian zones, pervious paving should be used;
- Trails in areas with sensitive root zones or along running trains can include wood chip trails;
- Wherever possible, steps should be avoided unless used in conjunction with complementary ramp systems, and ramp systems should be less than 5% slope, or 1 in 20, to avoid extensive railing systems and landings;
- Site specific trail connections should take in account micro climatic conditions, dominant wind and snow drifts, and avoid low lying areas of wetlands;
- Walkway systems should provide seating, of a formal and informal nature, for people to pause, reflect and socialize;
- Pathways and trails should be cross drained at a minimum slope of .5%, but 1-2% is encouraged to promote runoff;
- Sustainability should be considered to be paramount in all circulation design;  bioswales are encouraged in all areas;
- Major pedestrian pathways must be designed to also be used by a variety of other active transportation means including bicycles, tricycles, carriages and both manual and motorized vehicles. Regard for path widenings, lay-bys, maximum slopes, and proper drainage are design factors requiring attention.

## Lighting

With the addition of sidewalks and pathways throughout the DAC, it is timely for the University to carry out a comprehensive lighting strategy that not only standardizes the road and pedestrian scale lighting poles, but also the fixtures. From the perspective of sustainability and with new technology of LED fixtures, this review will reduce maintenance and operation costs significantly, and should include the following family of elements:

- Roadway lighting, which is critical for driver and pedestrian safety;
- Parking lot lighting, designed to have no spill over to adjacent property or to the residences;
- Pathway lighting to be themed to complement the roadway lighting but at a pedestrian scale to encourage walking and cycling between buildings;
- Pedestrian scale lighting for the open spaces adjacent to buildings and in courtyards that are encouraged to be hubs for social and other student gatherings;
- Dramatic lighting to feature areas of design excellence in the architecture and the open space including building facades and entry courts.

## Dedicated Bikeways

Two particular bikeways with dedicated lanes for fast moving and high volumes of bicyclists will be that portion of the regional bike trail that crosses the campus along the College Road right-of-way and potentially along the Cobequid Trail.

## Bike Racks

Design of bike racks can be both functional and sculptural to achieve security and durability; a consistent design is preferred so as to be readily identified throughout the campus. They need to be conveniently located at points along high bike traffic routes and where parking is desirable, particularly at building entrances.

## Outdoor Furniture

Campus outdoor furniture should be durable and natural, using wood and stone in areas of high priority but can include high quality composites, which are durable and suitable for harsh weather. A common family of elements should be selected by DAC and encouraged through replacement, new construction and potential donor programs.

## Outdoor Artwork

Artistic expression can occur using both natural and built features; the intention is not so much to enhance the environment but rather to stimulate learning and thoughtfulness. Pieces of art sculpture can best be placed near pedestrian traffic routes and changed from time to time just as natural features change with age and season and should be fully integrated through landscape design.

## Signage and Way-Finding

Campus gateway locations are indicated on the Framework Plans where highly visible welcoming signs and campus map standards should be located as well as provisions for information staff to be available either in person or electronically to assist newcomers in routing to their destination.

- Lighted campus map standards should also be located at all major points of pedestrian intersection; these standards should be durable and designed for future electronic plotting of public parking, building locations, open space descriptors, and other useful information;
- Standard Dalhousie University building signs should be provided at all major points of entry to campus buildings and should be well lighted and upgraded as needed;
- Ensure standardization of each building room numbering system, eg “Cox 110” (ground level) and “Cox 010” (basement level);
- Name and sign all campus roads, pathways and bikeways and reflect these identifiers on the campus map standards;
- Clearly label all significant outdoor natural and built campus features.


Dalhousie Building Signage Way-Finding

## 4.5 Roads and Parking

The result of some 100 years of incremental growth has resulted in a patchwork pattern of campus roadways and parking lots. As the campus grows in population and traffic it will be important to rationalize internal campus circulation and parking.

The Agricultural Campus was initially concentrated on the south side of College Road, but over time buildings were added and the campus now straddles both sides of College Road, becoming increasingly a heavily travelled thoroughfare dividing the campus and creating a pathway system that effectively criss-crosses this traffic corridor.

College Road is paralleled by Pictou Road along the northern boundary of the campus (Highway 4) which serves longer distance traffic and provides connections to provincial highways 102 and 104. Proximity of the intersection of College Road with Main Street and Pictou Road is particularly problematic, backing up College Road traffic seeking left turns into Truro.

The key challenge for campus development is to ensure that the College Road corridor becomes an integral part of the campus as the University grows as opposed to becoming a greater barrier and pedestrian safety concern, and that this occurs in harmony with community traffic interests. Five key strategies should guide future roadway planning to improve internal circulation, campus access and public traffic:

1. **Pedestrian safety** is paramount; College Road cross-walks are routinely cited by students as a major concern, noting poor design and insufficient number of secure crossings to meet needs. Increasing car and truck traffic can be problematic due to speed, weather conditions, inadequate cross-walk lighting and warning, and visibility due to the critical slope of the roadway. Considering the increasing distraction of personal communications devices, weather conditions and the slope of the road, it is essential that measures be taken to reduce and perhaps in the future, eliminate pedestrian-vehicle conflicts on College Road. Options for this are discussed below.

2. **Pictou Road** should be the main route for through traffic; Pictou Road is designed to accommodate higher traffic volumes than College Road and should be promoted as the main street for through traffic. Since all uses along College Road, including the Campus, have access to Pictou Road it is possible to implement design changes to College Road that reinforce this road hierarchy.

3. **College Road** should prioritize pedestrians and cyclists: Given the above two principles, it should be the policy of the University to promote public transportation plans making it possible over time for College Road to revert to serving campus access and service traffic with a focus on pedestrians and cyclists. This could be extended to serving a future transit route as well. Changing the function of College Road will also facilitate improvements to intersections at Main Street that currently concern the travelling public and Provincial transportation authorities.

4. **Vehicular access** and parking from the campus perimeters: Related principles are to minimize internal campus traffic and roadways, favouring emergency and service vehicles, and prioritize the campus core on pedestrian and active transportation purposes.

5. **Concentrate major parking lots** Expand parking facilities accessible directly from major arterials limited to specific user permits, eg faculty, students, staff and visitors, which in turn will support future parking fee programs and rationalize smaller dedicated lots internal to the campus.

University of Toronto Raised Cross-Walk

There are a number of potential alternatives for reducing the speed and volume on College Road while prioritizing its function as a local campus access road:

- Traffic Calming and Reduction Measures could include modifying the surface of the roadway to signify its change in character as it penetrates the campus, and providing wide raised pedestrian walkways at intersections with pathways (common to many urban universities), curb extensions, lane narrowings or traffic circles, and diverting truck traffic to Pictou Road via Vimy Road;
- Future partial closure would limit access for through vehicles including truck traffic. Access would remain for campus traffic. A variation on this would be to change the alignment of the road to effectively severe the straight section of College Road, but allowing for local campus access via Cumming Drive;
- Campus Gateway Features such as roundabouts or traffic circles, signage and sculpture, and information and security kiosks that indicate to approaching drivers that they are entering the campus environment.

Potential future options for modifying and adding to campus roadways are indicated in Framework Plans. These options may in the future be considered of advantage by the University depending upon variables such as future changes in community traffic patterns,  campus growth affecting internal traffic volumes and service access requirements. In the case of a potential intersection at Pictou Road across from the Fire Station, Provincial requirements and property ownerships would be among the deciding factors.

## Parking

Recommended objectives for developing a functional pattern of campus parking lots over time include:

- Required parking by category permits, eg staff, students, visitors, temporary service vehicles, etc, and phased in parking fees, to give drivers a predictable and stable parking solution, that in turn discourages driving between campus destinations; an essential element of parking management is to adopt an efficient and accurate data system to track behaviour and demand;
- Concentrated larger parking lots immediately accessible from arterial streets and concentrated smaller internal lots near key destinations that are limited by the permit system;
- While adding parking supply to accommodate campus growth, conserve campus open space by adopting a permit system that makes securing a space as efficient as possible and discourages drivers using multiple spaces by driving between campus buildings.

# 5.0 Implementation Strategies

## 5.1 Periodic Plan Review

The Framework Plan anticipates a future of dynamic campus development generally defined over three overlapping time periods: first a period of addressing immediate priorities, overlapping with a second period of addressing transitional and growth issues, finally leading to a period of mature campus development; individual projects may occur in any of these general periods as need and opportunities arise. The Framework Plans are meant to serve as a guide to decisions taken through these time periods that are driven by various change factors, enrollment growth, academic program development and the availability of capital resources. In addition to these factors, unpredictable opportunities may arise, requiring periodic, comprehensive review of the Plans to document change in policy direction that impacts on-going development decision-making.

It is recommended that such change factors be systematically monitored – for example, by an Oversight Campus Planning Committee – that would retain professional assistance to carry out this plan review, initially in three year periods and later in five year periods.

## 5.2 Facilities Renewal and Utilization

An underlying campus development strategy behind the Framework Plan is to gradually (a) improve the utilization of the most effective existing buildings by up-grading and repurposing spaces, (b) consolidate academic and student service functions to improve efficiencies and accessibility, (c) eliminate older inefficient and disparate buildings to increase efficient space use and provide future development sites where needed, and (d) build new in-fill facilities that reinforce the above three objectives, where needed and affordable. Strategies for implementing this strategy over time is best considered in six categories:

- Staged facilities renewal and up-grades, initially focusing on improving teaching spaces, student residences and study/lounge spaces, and graduate student offices;
- Information technology and ‘smart campus’ scan/study potentially leading to future applications of a ‘Smart Campus’ pilot project at the DAC;
- Major new capital projects, initially the RAC expansion, a new Student Centre, renewal of Cox and Haley institutes, and a proposed new teaching and research building;
- Staged open space renewal and up-grades including landscaping, roads and paths, lighting, furnishing, signage and artwork;
- Staged elimination of inefficient and obsolete buildings to concentrate functions and reduce energy consumption;
- Adjacent land management and land banking, both west to Main Street for future campus expansion and east for farm land.

**Facilities renewal** will be a staged process over a considerable time period, and will require a decisive coordinating function, for example Campus Planning and Capital Allocation Committee, representing all of the many and often conflicting interests and needs, to ensure that limited annual funds are allocated to projects on a campus-wide priority basis. This is necessary in order to address the various needs for up-grading and developing the campus and optimizing the resources and information available, and avoiding the inefficiencies of relying on potentially competing interests to decide on capital spending priorities. The Framework Plan and its references to the President’s Strategic Directions can serve as guidelines in setting priorities and determining budget expenditures.

The Plan envisions four major **new capital building projects** to address needs of the current academic programs and student population:

- the RAC project currently underway to replace the recently damaged feed facility and add a fourth farm animal wing to improve and expand animal management;
- a new Student Centre to accommodate a range of needed student facilities and needs and provide a dramatic new focus to student life on campus;
- major renewal and modernization of the Cox Institute and selected renovations of the Haley Institute to meet advancing university standards, increase capacities for teaching and research and accommodate the new Landscape Planning curriculum that has already been instituted on the campus in temporary labs;
- a proposed new Teaching and Research Centre building in the farm complex to reinforce the University’s commitment to local and global food production and allow concentration of program units needing improved or expanded space such as the Aquaculture labs.

Each of these four building projects will have a significant impact on improving the campus image and functional efficiencies, and the potential for replacing older, less efficient spaces or freeing them for repurposing. Each project will have unique and complex functional programs requiring **pre-design research and programming** that will support the targeted fund raising strategies. Such research should include thorough review of state-of-the-art and best practice insights since each project type is currently undergoing significant functional and design advances; there are numerous North American examples of functional innovation, shared space and increased utilization, environmental efficiencies and enhanced user satisfaction. Based on the defined program of space requirements, each project can be the subject of a focused

fund raising strategy targeting different types of potential funders associated with the project's purpose and intent. The caution is to ensure that the project's requirements set the fundraising target rather than the target determining the extent of requirements that can be provided.

**Campus open space** should develop and be improved over a period of time, supported by a variety of funding sources, some as part of building projects, others as part of parking and road improvements, others through specific donations for artwork and landscaping by donors with specific interests, and still others out of annual campus improvement budgets. The recommendation of an overall coordinated approach to making annual capital allocations will ensure that consideration of open space improvements will be included in the process, hopefully following a multi-year investment program that continues to progress towards realizing an intentional improvement plan.

**Buildings to be eliminated** over time should be subject to criteria such as inefficient operating costs, conditions that will require unwarranted deferred maintenance investment, locations unrelated to concentrations of activity, and purposes or capacities that are no longer required.

**Adjacent land management and banking** implies acting to secure the longer range institutional benefits and needs affecting the campus, likewise implying the need for constant institutional stewardship capable of understanding future as well as immediate priorities. Initially the University is wise to review the value of its owned and leased farm lands – some of which are inferior due to seasonal flooding - and adopt a program of making strategic land acquisitions and disposals as the Agricultural Faculty expands its farming operations and research activities. Likewise, vacant and underused land west of the campus should be considered for acquisition over time, both for expansion and to support future improvements in the quality of urban development in the area.

## 5.3 Funding Strategies

Financing development of the Agricultural Campus is an overriding challenge facing the University. To renew the campus and ensure its future economic sustainability will require capital funding far exceeding sources that are typically available, considering (a) the pressure of competing University priorities for its limited capital funds, (b) present limited Provincial capacities, and (c) the difficulty of attracting major private funders without a compelling vision and record of achieving sustainable campus growth and prosperity.

Three strategy options for funding future campus development are identified for Executive and Board consideration:

1. **Incremental fund-raising**, matching the interests of the potential funder with the type of project, for example, student services, research, campus landscape, IT and utilities infrastructure, and as well, ranging in amount of capital needed, from entire building projects to specific spaces within a project to a unique species of campus vegetation or type of furnishing. This approach is essentially underway and the Plan allows for a broad spectrum of potential future contributors from individuals to community groups to major foundations and government agencies to support the campus developing in increments over time as priorities are addressed and funding opportunities occur.

2. **Non-Traditional Development Approaches**, such as "P3" partnerships, land leases or sale of redundant property with developers capable of financing, constructing and often operating facilities using institutional land and guaranteed revenues are recommended for consideration. These initiatives are more obvious for the additional and new forms of student residential including married and family units that will be required in the future but it could also be considered for joint industry/ university research facilities (that may include instructional spaces) where Dalhousie already has experience including at the Perennia facility in Bible Hill.

3. **Major 'kick-start' grant**, for example, aimed at attracting and retaining international students as called for in the current federal Atlantic Growth Strategy. Dal has a unique opportunity to respond, potentially initiating collaboration with other Maritime universities, Perennia and agricultural industries, to offer a creative approach to achieving the objective of strengthening enrollments and revenues, expanding programs, facilities and strengthening regional jobs and economies.

## 5.4 Cost Estimates for Initial Projects

| Stage One: Priority Projects | GSF | Constr.Cost (2015 M$) | Total Cost (+35%) |
|---|---|---|---|
| College Road Cross-walk Up-Grades | TIR Funding | TIR Funding | |
| ITS Campus Network Up-Grade | Budgeted | Budgeted | 1.0 |
| ITS Smart Campus Scan/Study | | | 0.25 |
| RAC Renewal and Addition | | | 15.0 |
| MacRae Library 3rd Floor Renovation | 15,000 | Budgeted | 2.5 |
| Class Room Up-Grades | | 0.5 Budget/Year | |
| Grad Student Office Up-Grades | | Facility Funding | |
| Student Residence Up-Grades | 111,500 | Department Funding | |
| Annual Deferred Maintenance | | $2.0M Budgeted/ Year | |

| Stage Two/Three: Transitional Projects | GSF | Cost (2015 M$) | Cost (+35%) |
|---|---|---|---|
| Farm modernization | | Faculty Budgeted | 7.5 |
| New Student Centre | 60,000 | 22.7 | 30.6 |
| New Research Centre | 100,000 | 31.5 | 42.5 |
| Cox Institute Building Renewal | 162,000 | 32.4 | 43.7 |
| MacRae-Banting Link Building | 5,400 | 1.6 | 2.2 |
| Alumni Theatre Renovation | | 2.0 | 2.7 |
| Student Residence Corner Buildings | 13,500 | 4.7 | 6.3 |
| Poultry Centre Class Room | | 0.3 | 0.4 |
| Fur Animal Research Centre Entry | 1,600 | 0.4 | 0.5 |
| Athletic Centre Addition and Link to Cox | 7,000 | 2.2 | 2.9 |
| New Student Residence/ Conference Centre | 85,000 | 28.9 | 39.0 |
| New Arboretum /Building | 19,400 | 6.3 | 8.5 |

## 5.5 Campus Infrastructure

### Initial Priorities

The heating distribution system is being converted from steam to hot water and is planned for implementation over the next two years to coincide with developing the new Central Heating Plant (CHP). A phased replacement and upgrade program based on age, condition and capacity of the campus infrastructure should be developed over time through a program of inspection and capacity metering.

The other priority project to update the campus ITS Framework must occur as the backbone for providing all other campus technology services.

### Future Infrastructure Services

While the infrastructure serving existing facilities are deemed adequate, as new capital projects are planned they will require detailed infrastructure assessments associated with their scale and location.

### Steps to the Future ‘Smart Campus’

Initially, modest steps are needed towards ultimately achieving ‘smart campus’ objectives described in Appendix B; universities world-wide are doing so in a variety of ways. The Framework Plan suggests DAC as a pilot project given its manageable scale and need for upgrading, potentially leading to University-wide applications. The Plan further recommends as a first step, a preliminary technical study to scan the present IT system conditions and capacities, identify priorities and benefit/costs of future development, and define a staged longer term strategy for investing in upgrades and expansions over time; the estimated cost of this assessment is $25,000.

## 5.6 Summary of Recommended Implementing Policies

1. Advocate for increasing **pedestrian cross-walk safety and traffic calming** on College Road by such means as: improving cross-walks to urban standards; adding a mid-campus cross-walk to Cumming Hall; diverting truck traffic to Vimy Road; supporting TIR intersection plans at Main Street that attract traffic from Pictou Road and discourage traffic from College Road; edging College Road through the campus with landscaping, parking and buildings; promoting community support for these University interests;

2. Expedite the essential upgrading of the campus **local area technology network**, and undertake a preliminary assessment of strategies for future technology investments;

3. Establish a definitive **strategic academic plan** for developing future campus programming and enrollment growth that addresses both agricultural and other programs and can serve as the basis for detailed facilities planning;

4. Establish a definitive **strategic student services plan** for providing an enriched experience for an increasingly diverse and international student population;

5. Adopt the **3-pronged funding strategy** outlined above to ensure campus development is adequately resourced;

6. Undertake **review and update** of this Campus Framework Plan within 3-5 year increments as a means of tracking and guiding progress.

# Appendices

## A. Planning Principles for Plan Formulation

The Dalhousie Agricultural Campus Plan will provide ongoing guidance and a framework for the development of facilities and infrastructure located on the Agricultural Campus (DAC). In addition to the overarching principle that development on the Agricultural Campus will support the Strategic Direction of the University, guiding principles within which the Plan has been developed have been provided by the Project Development Committee (PDC) as follows:

1. **Collective Focus on Learning, Teaching and Research:** Development will consistently support agriculture as the significant anchor to the teaching, learning and research approaches and the unique campus culture created. The characterization of the campus as a living classroom and laboratory will influence all planning and development.

2. **Local, Provincial and International Community Engagement:** Campus Development will build upon the Campus welcoming and accessible culture of engagement with students, faculty, staff, and with local and distant communities. Development must demonstrate the leveraging of common interests to create a shared vision for the Agricultural Campus.

3. **Sustainability Through Life-Cycle Thinking:** Campus development will consistently and broadly reflect sustainability and be exemplified in all development that supports teaching, research and external relationships.

4. **Supportive Physical and Communications Infrastructure** The Campus Plan will frame 'smart campus' technologies to support pedagogical and research and to facilitate delivery of efficient administrative services. Impact on and facilitation of physical connections to other Dalhousie campuses and partners in geographically distinct locations will be considered.

### Background Supporting the above Principles:

The purpose of the Agricultural Campus Plan is to provide ongoing, relevant guidance on the development of the Agricultural Campus (AC) facilities and infrastructure required to support the Strategic Direction of Dalhousie University.

### Collective Focus on Learning, Teaching and Research

With a focus on enhancing the transformative power of learning, teaching & research, the Campus Plan will emphasize the DAC as a living classroom and laboratory with continuous learning experiences, teaching resources and emerging research areas. There already exists a substantial agricultural culture at the DAC emanating from physical teaching resources like the working farm and greenhouses that create a distinct sense of place on the campus and which must be reinforced. The future DAC environment, however, should also include improved interior study spaces, learning commons and opportunities for other faculties to develop appropriate programs on the DAC. As part of Dalhousie University, the development of the DAC will be done in the context of the Strategic Research Plan, International Strategy and other institutional planning documents.

**Engaging with the Local, Provincial and International Communities** To promote a culture of engagement with students, faculty, staff, neighbouring communities of Bible Hill/Truro and beyond, the Campus Plan will seek to catalyze common interests in a shared future vision for the DAC.

**Sustainability Through Life-Cycle Thinking** Following nature's cycles and systems is second nature to the agriculture community. In keeping with this life-cycle thinking, the Campus Plan will outline design that promotes hands-on learning for the on- and off-campus community through connection to operations and research. Design will:

- reduce energy and water use and harness renewable energy with a goal of not using more carbon than what we are offsetting;
- optimize elegant design that uses passive systems such as siting, natural light, and efficient and durable building envelopes to reduce life cycle energy and operating costs and to create desirable spaces for people and animals;
- use waste as a resource, such as for fertilizer and energy; and,
- integrate and support natural environment and transportation spaces that promote biodiversity, social cohesion and active living.

**Supportive Physical and Communications Infrastructure** Building capacity at the DAC requires connectivity between the campus, its rural and urban surroundings, the Halifax campus and the world by both physical and electronic means. The Campus Plan will frame 'Smart Campus' technologies that support advanced pedagogical and research methods as well as human and administrative services. The Plan will also recognize and take account of:

- use of and connection to other satellite locations such as Nappan, Debert and Kentville
- aspirations for the campus to be recognized as a botanical garden;
- integration with the Capital Campaign and,
- facility renewal requirements of the campus that need to be integrated into the overall planning model.

**Planning for Implementation** To address existing challenges at the DAC, the Campus Plan will outline interventions that could be achieved within the first five years, 10 years, and beyond. Quantity and functionality of all types of space on campus need to be predicated on a predicted growth model which is to be developed in the next phase of planning. This includes not only classrooms, labs and study spaces, but also support facilities such as residences, food services, and recreation areas.

## B. Information Technology and Opportunities for the 'Network-Enabled' Campus

IBI technology specialists have met with senior Dal technology staff and with DAC Faculty and students to provide an overview of future requirements and opportunities for IT systems advances over time.

### Essential Network Up-Grade

Up-grading the overall campus network is the primary initial requirement since without an adequate network, no other systems improvements can be accommodated. Accordingly, the network upgrade is understood to be of critical priority as part of this campus plan.

### Campus IT Systems

Based on our consultations and observations of information technology requirements, the overview for future development considers five categories:

- Technology and systems infrastructure
- Distance/e-learning
- Agro informatics
- Energy monitoring
- Campus systems

### Technology and systems infrastructure

Information technology and specifically reliable and fast access to internal files and data and to the public internet is an essential part of campus life.

Anecdotal evidence suggests that there are gaps in wifi coverage at certain locations on the campus and that internet access can be slow. It would be useful to carry out a more structured review of the quality of the existing IT services so that the existence / extent of the issue can be properly quantified and mapped. Once better understood, an assessment could be undertaken of the extent to which such connectivity issues are impeding learning and recreational opportunities.

Such a survey would help to inform considerations of the best approach to improve the situation. This could include improvements in the underlying IT infrastructure as well at policies aimed at controlling (or charging for) bandwidth hungry internet usage by students.

Improved availability of video conferencing is very important to the AC. At present, a significant amount of senior staff time is being spent travelling back and forth to Halifax for meetings. This is highly inefficient and should be treated as a priority item. The solution lies in a combination of higher end video conferencing solutions that could be installed in selected rooms, providing a high end experience in terms picture quality and most importantly voice. These rooms would then be used for larger or more critical meetings. Other rooms could be equipped with a lower grade solution that relies on consumer grade cameras and microphones. To the greatest extent possible, off-the-shelf software should be used, ideally from one of the handful of leading vendors in this space.

Beyond the technology itself, there are important commercial considerations about how IT services are provided and specifically the demarcation between internal IT department responsibilities and outsourcing options.

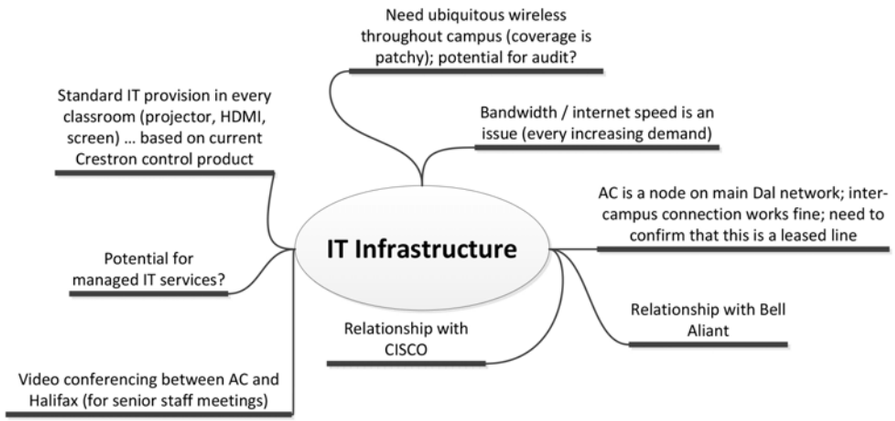
### Distance / e-Learning

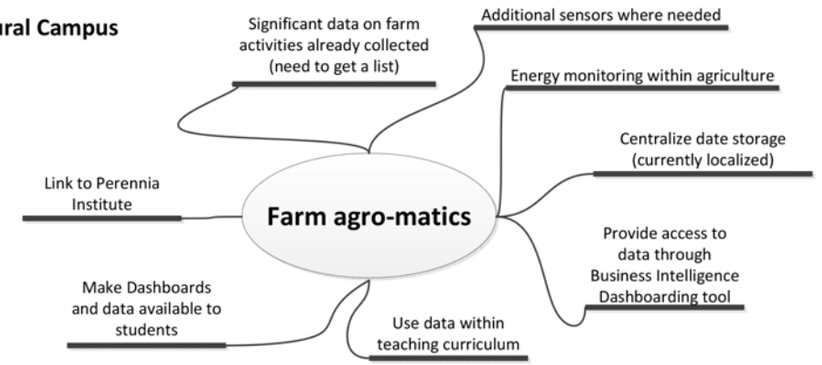
We understand that the AC has aspirations to deliver courses through a distance learning and online course model. Within this context, it is important to note that the AC is the pilot site for the deployment of the Desire2Learn on-line software package at the University.

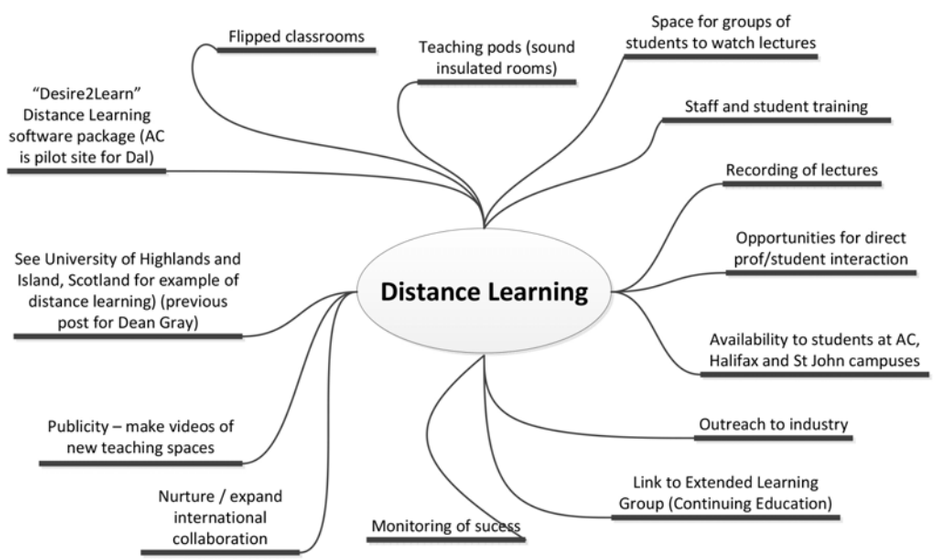
This approach offers the potential to significantly expand the number of students that the AC could reach. It can also make it more convenient for students from Halifax to take courses at the AC (and vice versa ), without the inconvenience of physical travel between the campuses. The distance/e-learning approach would also help the AC nurture and build upon its relationships with international academic institutions, notably in China.

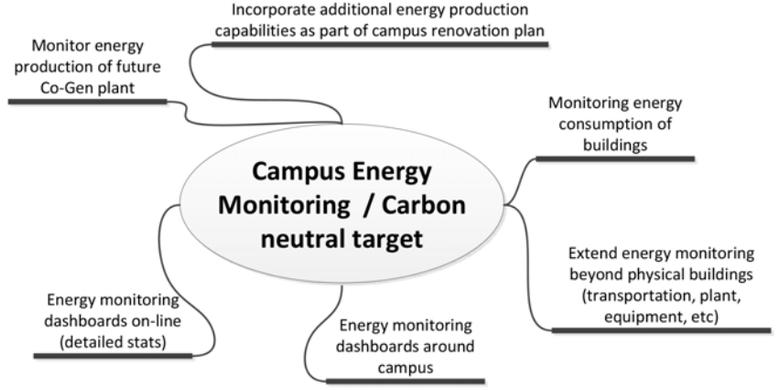
A sustained venture by the AC into on-line or distance learning would require investments in e-learning software (D2L + other packages), the creation of physical spaces from which to record/delivery lectures electronically (e.g., teaching pods) and flipped classrooms and other areas to encourage collaboration amongst students that is consistent with this alternative approach to education delivery. Based on our review, such facilities do not currently exist on campus.

**Figure 1: Information Technology Systems - Potential Applications at the Dalhousie Agricultural Campus**




E-learning also has important implications in terms of training of professions, IT support services and marketing and communications, particular if the University wishes to offer the distance on-line courses to students beyond the physical campus.

## Agro Informatics

The need for additional instruction in agro-informatics was a strong theme in students interviews carried out to date. In fact, many students see this area as an essential to preparing them for a career in agriculture.

Whilst commenting on the academic curriculum is beyond the scope of Master Plan, a shift in focus towards agro informatics would have various implications on IT systems. These include provisions for a data warehouse to store the significant data volumes that this activity would create and associated data analytics software. Depending on the extent of data usage and querying, this activity could also put pressure on bandwidth in part of the AC's IT network.

## Energy Monitoring

The Agricultural College is interested in establishing a program of centralized monitoring of energy usage across the campus. This would allow the AC to better understand its patterns of energy consumption and identify opportunities for energy savings.

The monitoring results could be displayed at prominent locations around campus and be made available through a series of on-line dashboards. This would raise awareness of energy usage with students and enhance the AC's reputation in terms of environmental stewardship. This latter point would help the AC attract students. Once proven, the AC could look to extend the concept to the usage of water and other resources.

The AC is currently developing plans for an energy co-generation plant that could meet up to 80% of the campus's electricity needs. The resulting energy would be sold at the provincially mandated feed in tariffs, creating a significant off-set to the use and cost of electricity on the campus. Translating energy monitoring to energy reduction would help the AC to close the remaining gap and achieve its target of carbon neutrality.  The campus and on-line display boards could therefore include information on energy production and consumption and any resulting gap.

## Campus Systems

There are a variety of IT systems applications that could be used to improve the quality and efficiency of campus life. These include building monitoring, access control, security, intelligent lighting, and transportation. Many of these systems come in the form of commercial products, the need for which would need to be assessed on a case by case basis.

Applications in transportation require additional thought.  The interview phase of the master plan identified the lack of transit services to Truro and Bible Hill as well as to Halifax as major issues. Funding a limited transit service would be one way to address this issue. However, modern technology is opening up less expensive and more flexible ways to meet these requirements. Car and sharing services would be top of this list.

Under this model, the University could conceivably facilitate a commercial service whereby to make car sharing available to students. For example, instead of purchasing vehicles for its own exclusive use, the University could contract with a car sharing company (e.g., Autoshare, Zip car, etc) whereby the University would make use of the shared vehicles when needed, allowing students to rent the vehicles on an hourly basis at other times. Such a model could be based on the University simply reserving vehicles like any other member or by the University have exclusive use of certain vehicles at certain times of the day. Regardless, the different patterns of demand for vehicles between the University (office hours) and students (evenings and weekends) provide a good basis for such a model to work. Clearly, further work is necessary to determine the costs and level of uptake but such a solution would appear to offer a creative solution to a need that has clearly been expressed by the student body.

Beyond cars, a similar model could be applied to bike sharing, helping to address the need for travel within the campus for which car usage is inappropriate.

## Near-term Campus Technology Requirements

Technology Up-Grades

- Campus Network
- Smart classrooms, labs, Library

Connectivity with Halifax Campus

- Conferencing
- On-line courses
- Scheduling meetings
- Car-pooling/couriers
- Administrative services

Campus Systems

- Scheduling meetings
- Campus security
- Information
- Facilities inventory/performance
- Energy
- Academic programming
- Space scheduling
- Local transit

Agro-informatics

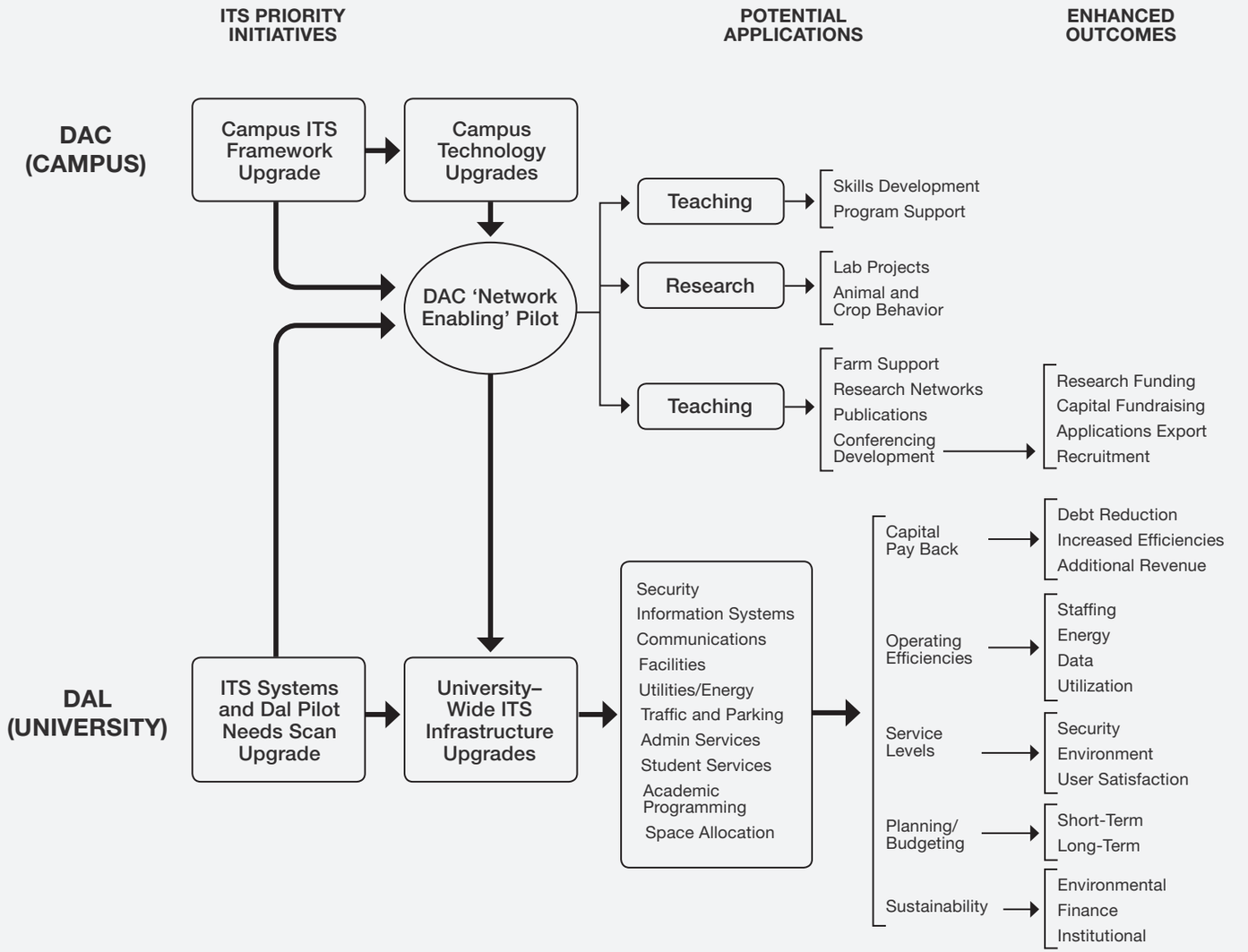
- Data management
- Hardware & space
- Software
- Staff & Programs (teaching, research and outreach)

## ‘Network-Enabling’ Opportunities

World-wide PSE settings are increasingly discovering innovative applications of the information technologies to their education sectors, the management of their physical environments and their administrative operations. These institutions place value on research ventures and technology advantages with industry– a collaboration of academics and industry that is giving evidence to significant long-term benefits.

The ‘Network-Enabling’ or ‘Smart Concept’ uses digital technologies to enhance performance and well-being, reduce costs and resource consumption, and engages more effectively and actively with its constituents. The technologies help achieve these results by collecting, managing and acting on real-time information that reflect on constituent needs and preferences, allowing administrators to provide the required supports with greater accuracy and efficiency. Ultimately, the purpose of the ‘smart campus’ concept is ultimately to enhance user satisfaction and effectiveness.

‘Network-Enabling’ is typically implemented over time as functional elements are designed, initiated and refined to fit the unique characteristics and requirements of each campus. Numerous PSE institutions world-wide are by now known for their advancements in ‘smart campus’ systems, such as University of Calgary,  UBC, Ryerson, University of Illinois, Prince Sultan University, University College Dublin, University of Glasgow, Indonesia University, Gunadarma University, and Hamdan Bin Mohammed Smart University.



Elements of the 'Network-Enabling' concept tend to fall into three general categories:

- Cloud-Based Education
- Smart Building Technologies
- Cloud-Based Campus Operations

Cloud-Based Education is a dynamic way to educate that aligns with the way we think, share, learn and collaborate in and outside the classroom, in which there is unparalleled access to various information, programs and resources.

Cloud Classroom Technology fosters opportunities for teaching and learning by integrating learning technology, such as computers, specialized software, audience response technology, assistive listening devices, networking and audio/visual capabilities.

Remote Lecturing gives the ability to deliver interactive course material, administer tutorials, assignments and assessment tasks and communicate with students regardless of physical location.

- Cloud Classrooms
- Education Technologies
- Remote Lecturing
- Group Project Assistance
- Storage
- Time and Resources

Education Technologies streamline the education process and allows university administrators to efficiently handle admissions, financial aid, human resources, internal communications and course content such as:

- Student registration
- Course homepages
- Online quiz and test modules
- Computer marking tools and grade maintenance/distribution
- Teleconference, video conferencing and application sharing
- Classroom and student management
- Statistical information re: system usage
- Technical administration tools

Education technologies allow multiple users, for example group study and project teams, to work on the same project simultaneously from various locations, provide instant access to numerous documents, photos, eBooks, lectures, etc, and saves administrator time and staff resources which would otherwise be allocated to data entry, organizing and managing data.

**'Smart' building technologies** deliver useful building services that make occupants productive (i.e. illumination, thermal comfort, air quality, security, etc.) at the lowest cost and environmental impact over the building lifecycle. Smart building technologies fall into two broad categories:

- '**Smart' grid technology** is a modernized electrical grid that uses analog or digital information and communications technology to gather and act on information in an automated fashion to improve efficiency, reliability and sustainability of the production and distribution of electricity;
- **Green building technologies** are intended to mitigate or reverse the effects of human activity on the environment by applying advanced approaches to cool roofs, green insulation, biodegradable materials, stormwater management, geothermal heating, solar power, electrochromic smart glass and smart appliances.

  **Cloud-Based Campus Operations** The 'Network-Enabled' concept applies technology tools to centralize and coordinate student service data as well as ultimately redesign of approaches to learning, security and interactions among faculty, students, researchers and university administrators. Integration of these functions can allow the university in the future to utilize real-time data to respond to student and staff needs, making policy and operating decisions to be made on a timely and well informed basis.

## C. Engineer's Review of Existing Campus Utilities Infrastructure

The following comments are provided by CBCL Engineers as an update to their 2014 survey of existing campus' utilities infrastructure:

### Water Distribution System

Currently the campus has its own water supply and distribution system. Water is sourced from several groundwater wells located on campus. The distribution system consist of 200 mm diameter pipe and smaller. Record drawings of an expansion of the water system in 1966 indicate the pipe installed at that time was cast iron. The age and material of the pipe prior to the 1966 expansion is not known.

The majority of the water distribution pipe in the system is at least 50 years old. Although the condition of the pipe is not known at this time, cast iron pipe, installed under ideal conditions, has a life expectancy of 75–100 years.

Recent work to connect the campus distribution system to the Town of Truro's system has been carried out, however, the changeover has not yet been implemented, and the campus has continued to operate on its own system. The changeover is expected to be completed when a source of non-chlorinated water can be provided to several campus buildings and green houses, where chlorinated water is not desired.

There is an elevated steel water storage tank located next to the Harlow Institute building, along College Road, which provides equalization, and emergency storage for the campus. The tank, constructed in the 1950's or earlier, does not meet current seismic code requirements and is expected to be decommissioned when the campus makes the changeover to the Truro system.

For the purposes of our report, we have assumed that the connection to the Truro system has been made and the storage tank removed from the system.

A previous CBCL report, "Upgrade Existing Water System to Municipal Water", February 2007, identified the Agricultural College water demands. The average day demand was estimated to be 240 USgpm. A maximum day multiplication factor of 1.6 was used to derive maximum day demands of 384 USgpm. We are assuming that these demands have not changed since that time, and understand that the student population is not expected to increase significantly in the future.

Prior analysis has shown that the existing Truro water distribution system is capable of supporting the estimated maximum day demands of the campus, with little impact on the Bible Hill portion of the distribution system.

Our previous study of the Bible Hill portion of the distribution system shows that there is a limited fire flow capacity in the system. Fire flow design guidelines typically require that a minimum residual pressure of 22 psi is maintained in the distribution system. Because this standard can be extremely difficult to achieve in existing systems, a minimum residual pressure of 15 psi was used. CBCL estimated that the current distribution system is capable of providing approximately 1,250 USgpm total flow before pressures become too low in the eastern high ground of Bible Hill. The Town of Truro advised that they are prepared to support up to, but not exceed 750 USgpm fire flows to the campus under the current system. Fire hydrants on campus are sized for typical flow rates of 500 USgpm so the maximum fire flow offered by the town system could only partial flow to two fire hydrants simultaneously. This is inadequate to combat a major structural fire on campus , particularly when in building sprinkler systems or standpipes are included.

If the available fire flow needs to be increased the following options may be considered:

1. Construction of a fire flow reservoir and fire booster pump system located on the Agricultural College campus.

2. Construction of a reservoir in Bible Hill, east of the campus to service all of Bible Hill, including the campus.

We understand that current development plans do not expect significant growth in the campus student population. New building developments and upgrades are encouraged to install high efficiency, low flow plumbing fixtures, which will reduce the water consumption on a per capita basis. With little or no increase in student population the actual water demands could see an overall reduction.

The planned installation of water meters on each building, in addition to the metered connection to the town system, will allow for estimating the amount of water loss from distribution system leaks as well as provide a more accurate determination of the per capita water consumption.

Moving forward, a leak detection program is recommended, starting with sections of the water distribution system known to be 75 years or older. Priority for replacement of sections of pipe should be based on the number and size of leaks and age of the pipe. Sections of cast iron pipe that need to be replaced should be replaced with either ductile iron or PVC pipe. A typical installation detail for new piping is shown in Fig. 4.

Presently the Campus is supplied water by a number of wells and an elevated water storage tank. Recent work has been carried out to provide water to the campus from the Town of Truro water supply system. The changeover will not be completed until a supply of non-chlorinated water is obtained for several buildings and the greenhouses.

General comments on the water system:

- Service pressures ok and will be maintained when the Campus is switched over to the Town of Truro water system;
- Number of watermain breaks about normal, a few breaks near the Banting building; and
- The copper water lines (domestic hot water) in the service tunnels between Cummins Hall and the resident buildings have corrosive problems.

Future Considerations:

- The supply from the Town of Truro has sufficient pressure capacity for future growth because presently the supply to Bible Hill (and eventually to the Campus) is reduced at the Salmon River Bridge crossing in order to avoid high pressures at low lying areas within Bible Hill. Therefore, to service future growth, the pressure reduction can be adjusted in proportion to the magnitude of growth.
- The increase in flows from future growth most likely will have an upset limitation based on the capacity of the Town of Truro water source, treatment facilities and distribution system. Therefore, it is recommended that the maximum allowable water demand for the Campus be confirmed with the Town of Truro.

## Sanitary Sewer System

The sanitary sewer collection system consists of three main trunk lines, one on campus along River Road and the other two along College Road and Pictou Road, which are both maintained and operated by the County of Colchester. There is also a small pump station, located next to the fur unit.

The trunk lines direct flows to the west and eventually to a new wastewater treatment plant.  CBCL designed the plant and confirms it has a reasonable amount of reserve capacity.

The actual reserve capacity of the existing sanitary trunk sewers on College Road and Pictou Road is unknown. Recent conversations with the County of Colchester, which owns and maintains the sewers, confirms this. Design or as-built drawings of the sewer system are not available.

Record drawings for the section of sewer installed along River Road from the Machine shop to the Haley institute building are the only ones available. These drawings, dated 1966, show this section of sewer being 200 mm diameter with slopes ranging from 1.6% to 0.5%. The pipe material is not known.

The section of pipe running from the northwest corner of the Haley Institute building west to the last manhole on River Road was used as the limiting section of sanitary sewer. This section of sewer was selected considering that it  is the flattest section at 0.5% slope, and the farthest section downstream that we have records on. The calculated capacity of this section of pipe, assuming concrete pipe with a Manning's roughness coefficient of 0.012, is 400 USgpm.

Using water consumption information to estimate sanitary flows we examined the capability of the existing sanitary sewer to handle the estimated peak sanitary flows. From the CBCL water model, the total maximum day water demand, for the buildings connected upstream of this section of the sanitary sewer, is 116 USgpm. Using a peak hour demand multiplication factor of 3 on the average day demand, the estimated peak hour flow for this section of sewer is 218 USgpm, which is only 55% of the pipe capacity of 400 USgpm. Note that Inflow and infiltration contributions are not accounted for in our analysis and could be several times larger than the sanitary sewer flows.

It has been noted that the sanitary sewer in front of the Chapman house has been a maintenance problem in the past. Results of a site inspection suggests the sewer line most likely is relatively flat, reducing effective pipe capacity and typically causing build-up of material in the pipe. Fig. 1 below shows a typical installation detail for new or replacement pipe.

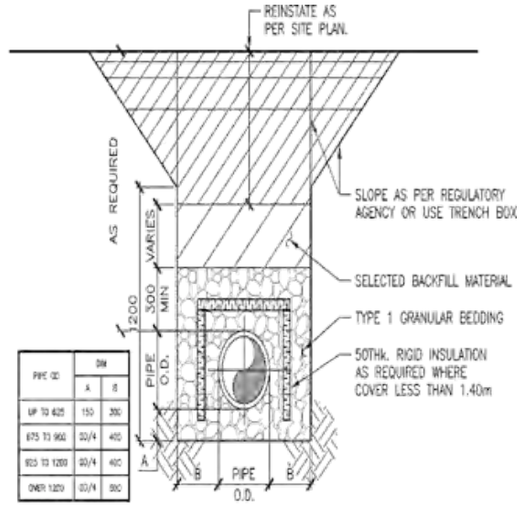



Figure 1 Typical Pipe Installation Detail

## Stormwater System

The existing storm water sewer system consist of catch basins and collection sewers on Campus with five storm water outfalls directing flows to the Salmon River watershed.  The Salmon River floods often.  Therefore, all new development must include storm water runoff systems that results in flows no greater than these existing prior to development.

General comments on the storm water sewer systems:

- Generally no problems with the piped system. No flooding experienced.  One catch basin near the Cox Institute requires some maintenance.
- The Salmon River, located along the south boundary of the campus, floods periodically. The Campus ground elevation is higher than the limits of the Salmon River flood plain and therefore does not experience flooding.

Future Considerations:

The design of stormwater retention facilities for future development could include collecting existing stormwater flows and outfalls the presently direct water runoff to the Salmon River.

## Steam Distribution Infrastructure

The existing steam distribution network is being replaced with a new hot water distribution network as part of the new combined heat and powerplant project currently under development. The new hot water piping will offer improved insulation levels and reduced thermal losses compared with the existing steam distribution infrastructure. Elimination of the need for steam converters and steam traps in each building will also reduce the potential for losses. A small low pressure steam distribution system in the Cox building that services existing autoclaves will require installation of a small electric steam generator to continue operation of the autoclaves.

Much of the existing steam tunnels are small with very little room to manoeuvre. Some consist of a small concrete U-shape structure with creosote wood covers, others allow maintenance access.

General comments on the steam tunnels:

- Operation concerns with the tunnel to the Cox and Banting Buildings;
- The steam pipes are in good condition but there are problems with corrosion at fittings;
- Most of the valves need to be replaced;
- Operation concerns with the tunnel to the Cox and Banting Buildings; and
- Some of the pipe insulation is in poor shape and require replacement.

Future Considerations:

- Future upgrades and extensions to the steam tunnels should be evaluated following completion of studies currently being undertaking regarding central heating strategies.

## Electrical Power

Campus receives power from utility through two 25kV to 5kV 2.5 MVA substations. One substation supplies power to area of campus north of College Road; the other serves south of the road.

Several smaller and remote buildings take power directly from the electrical utility secondary services. These include: Baron's Pride Stable; International House; Daycare Centre; Banting Annexe; AC Research Building.

To date, there have not been any issues with the capacity of these systems, however, the substation at the Harlow Building is at or near capacity. Based on utility billing demand charges, the two main utility service are each experiencing approximately 1200 kW of demand or close to 50 % of their nominal capacities.

Power is distributed at 5kV via underground cabling tolocal substations where the voltage is reduced to utilisation voltages of 120/208V or 347/600 V. Most local unit substations comprise outdoor equipment and dry type transformers in weatherproof enclosures however Fraser House has a vault in the building which contains open equipment and oil filled transformers.

The campus distribution system is 40-60 years old. Staff report that they are unaware of any issues with the high voltage side of the distribution equipment. The electrical components are industrial grade and are in good condition, although some of the enclosures are showing rust and need to be treated and repainted to prevent further deterioration.

The grading around the substations needs to be reviewed and appropriately adjusted as surface water at some locations tends to run towards the equipment rather than away from it (Truman and Hancock Buildings).

Staff report numerous issues with low voltage distribution equipment. This equipment is typically commercial grade and, unlike the high voltage equipment, is subject to rework and revisions over its life. The Banting Building 120/208 V switchboard needs to be replaced as does the incoming mineral insulated (MI) feeder which is damaged adjacent to the switchboard.

The duct banks running between substations are reported to be in good condition and contain spare ducts. Water has been observed in some ducts but this is believed to be mostly due to condensation. Manholes are dry all year.

There have been some underground cable failures in recent years in feeders to Jenkins Hall and Hancock Building. Repair and replacement of the HV cables is contracted to the electric utility.

The emergency system has experienced problems with the generator control panel and the automatic transfer switch (ATS) controls. The system includes only one ATS so life safety and none life safety loads cannot be segregated as per present requirements.

## Site and Roadway Lighting:

Existing lighting uses various types and ratings of HID fixtures. There is a proposed program to replace the fixtures with LED type. Staff indicated that they have concerns with the condition of the underground wiring to the lighting standards as in is installed at a shallow depth and over the years has been damaged by excavation for other services.

## Telephone, IT and Other Services

Installation and maintenance of these systems is often sub-contracted to service providers. Cabling for building management systems, fire alarm and telecom, including fibre, is mostly run through the service tunnels used for steam and other mechanical services. Mechanical failures and maintenance work within the tunnels can compromise the cabling systems.

## Next Steps

- Determine adequacy and spare capacity of existing feeders and equipment serving individual buildings by reviewing, where available, details of power feeders and equipment against electrical loading of building. This will require monitoring of circuits to determine the loads. Some buildings already have in-house metering and some others are being added.
- Gather any additional data on cross-sections of underground duct banks and identify quantity and size of ducts, and usage; how many spares?
- Review capacity of local generator installations. Identify whether they are intended for emergency or standby use. Identify whether or not the installations meet the requirements of their intended use.
- Identify adequacy of present telecom, data, building management (BMS) backbone cabling systems installations to meet current campus requirements for reliability, bandwidth etc. Need to get input from Dal IT and BMS personnel.

## Central Plant

The central heating plant is comprised of four medium pressure steam boilers. The main boiler is a woodchip fired unit originally rated at 12,000 lbs/hr but with upgrades to controls and combustion air fans it is now capable of operating at approximately 15,000 lbs/hr. The other 3 boilers are fired on No. 2 oil and are used primarily for peaking and backup. These boilers range in age from 5–40 years of age.

Total annual plant steam production has remained relatively flat for the past 10 years, operating within a range of +/- 5% depending upon the severity of each winter. Average instantaneous plant load has been between 8000 – 9000 lbs/hr since 2000 after having declined from an average of 10,000 lbs/hr in the early 1990's. Peak plant load is reported to reach 30,000 lbs/hr for brief periods. Peak plant capacity is currently over 40,000 lbs/hr with 3 of the 4 boilers in operation.

The current wood fired boiler is 27 years old and near the end of its service life based upon an assessment conducted by the manufacturer, KMW Ltd. This assessment was conducted as part of a CBCL led study to determine the feasibility of replacing the current wood fired boiler with a wood fired combined heat and power (CHP) unit. The current boiler required emergency repairs during the previous heating season, confirming the KMW opinion regarding the need to replace the boiler in the near future.

The proposed CHP unit would have a rated steam production capacity of 27,000 lbs/hr. While most of the increased capacity is required to generate electricity, the new boiler would be able to provide additional heating steam compared to the existing boiler. The increased capacity is primarily to reduce reliance on the oil boilers for peaking and backup along with the correspondingly higher operating costs. The total increase in plant capacity associated with the installation of the new CHP is approximately 10%. Based on the steam consumption and peak load figures for the plant for the past several years, the heating plant with the new CHP will have sufficient capacity to meet the campus heating load for the foreseeable future.

The existing stormwater sewer system consists of catch basins and collection sewers on Campus. Catch basins on the upper campus are collected and connect to a storm sewer main along Pictou Road. The lower campus catch basins are collected into drains terminating with five stormwater outfalls directing flows to the Salmon River watershed. The Salmon River floods on a frequent basis. Therefore, all new development should include stormwater runoff attenuation systems that result in peak flows that contribute no more to the stormwater system than runoff from a treed site of the same size. The location of the attenuation systems can be outside of the development site, as long as they are on campus and produce the required amount of flow attenuation. Unless the new development sites are currently covered in trees, attenuation system associated with each new development should help to reduce the overall campus stormwater runoff, and gradually help return the campus hydrologic characteristics towards pre-development conditions.

General comments on the stormwater sewer systems:

- Generally no reported problems with the current piped system. No flooding experienced. One catch basin near the Cox Institute requires some maintenance.
- The Salmon River, located along the south boundary of the campus, floods periodically. The Campus ground elevation is higher than the limits of the Salmon River flood plain and therefore does not experience flooding.

Future Considerations:

- The design of stormwater infiltration facilities for future development could include consolidating existing stormwater outfalls that presently direct water runoff to the Salmon River and instead direct it to a infiltration pond with a permanent volume that could supply irrigation water during dry periods. Overflow from this collection system would be directed to the river.
- All new stormwater piping should be perforated and laid in a clearstone bedding.

## D. Langille Athletic Centre Future Requirements for Up-Grades and Additions

The Following is a summary of observations by IBI staff touring the Centre and comments by students and staff as to inadequacies. It appears that since the Centre opened in 1977 to serve an enrollment of some 500 students significant changes have occurred requiring renewal of the facility; these change factors include facilities standards, expectations for fitness programming and equipment, delivery methods for services and student life style choices. Enrollment has nearly doubled since the Centre was planned and constructed and is expected to continue its growth as a University campus and as athletic facility standards and codes become more demanding.

Not only will advances in teaching and research methods influence the campus' plans for future development, so will advances in concepts of student experience shape the Plan. Over the past 20 some years an active lifestyle has increasingly been shown to improve mental health, physical health and the ability to cope with academic and other life challenges. There is evidence that on university campuses where mental health issues have been on the rise for the past 10+ years, managing mental health issues is being linked to physical activity. Mental health professionals believe that activity, fitness and group classes can assist students in managing their mental health concerns. Dalhousie Agricultural students are typically subject to a range of work and environmental stresses that can be mitigated by exercise and recreation. As well, active lifestyles have become more important for students, staff and the community members, fitness equipment has become more sophisticated and athletics/recreation activities have changed, with implications for up-grading the Centre:

- Provisions for programming of multiple activities to occur at the same time (prime time is the same for everyone) so that all students' sport and fitness needs can be addressed, eg, students and community members with conflicting needs of sport teams (to represent the institution and meet the needs of talented student-athletes) and the needs of all students in a variety of recreational options.
- Provisions to accommodate students having cultural or religious reasons for exercising solely with the same gender;
- Convenient, weather protected pedestrian over-pass to Cox Institute.

Facility renewal of the Athletic Centre may be undertaken in increments over time as enrollment grows and capital funds become available:

- Multi-purpose spaces are needed to accommodate group activities (eg, Zumba, Group Fitness, Yoga, Tai Chi etc), ie large enough for group classes and with sufficient equipment to accommodate special needs groups;
- Space and equipment for weight training, cardio work and cross training has not kept pace with changing standards and should be up-graded;
- The Centre presently has the only racquetball and squash courts in the region; however the squash courts are not competition size, have inadequate ventilation, no viewing and are considered unsafe and unusable in the June-September period because of humidity. The up-grade would allow an expansion of the courts to encourage provincial competition, provide a small viewing area and allow student instruction;
- The Centre's locker and change rooms – presently designed to a high school format – need up-grading to better serve students, teams, officials and community members to be active;
- And inevitably, additional storage space is needed for equipment to serve the expanded range and diversity of activities that include webcasting ACAA games, special events, group rentals and efficient changes in multi-use spaces;

The multi-level Centre is not presently served by handicapped elevators; physical access and mobility for all participants is functionally essential and required by current code and must be provided if all students, staff and the public are to be adequately served. The existing Centre building is reported to comprise some 39,600 gross sq ft which translates to approximately 27,000 net assignable sq ft  It is not realistic to compare this floor area to other institutions having higher enrollments, on a per student basis, since athletic spaces are in many cases sized by their function, eg athletic playing courts must have dimensions to suit their use regardless of the number of people they serve. The actual space program for this up-grade project will be determined by a detailed functional program and design.

An essential element of the Campus Master Plan will focus on the Student Experience. The Campus Renewal Plan will therefore include up-grading and expanding the Langille Athletic Centre as a priority capital project aimed at enhancing recruitment and better serving the campus population and the surrounding community.