Dalhousie Edible Garden Plan: Design Concepts for the Henry Street Plot

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Executive Summary

This report summarizes the findings of a research project undertaken by students at Dalhousie University to determine the key design elements necessary for the establishment of a food-producing garden on Dalhousie campus, with particular focus on the construction of raised garden beds, garden maintenance and equipment, aesthetics, soil and water concerns, weeds and pests, climate, sunlight availability, slope issues, and potential crops to be grown. Research methods included informal narrative interviews with Dalhousie staff and local gardening experts, a review of relevant literature, including previous research on the feasibility of gardens at Dalhousie, and a GIS analysis of the proposed garden plot. The results of this research allowed the authors to develop a preliminary site plan for the garden as well as a number of recommendations that may increase the garden's productivity as well as its appeal to the university's administration.

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Chapter 1 - Introduction

1.1 Project Definition

The initial purpose of this study was to produce a proposal and design key concepts for the implementation of a raised bed vegetable and herb garden on Dalhousie Campus that would work collaboratively with Dalhousie's food service provider.

This project was proposed by Rebecca Hoffer, a representative of the Loaded Ladle student society. The Loaded Ladle's goal is to provide students, staff and faculty with local, healthy and fairly-priced food. If a campus food garden is implemented then this goal will be easier to achieve because local, fresh produce will be more accessible. Recently, in the Dalhousie Student Union elections, "Dalhousie students overwhelming voted to fund [the Loaded Ladle] through a $2 student levy" (Sobowale, 2011). In addition to this levy, the proposed garden will allow the Loaded Ladle to provide fresh food on campus more frequently throughout the week, making them one of the main food service providers on campus.

The research question is: "What are the key design elements for an edible raised-bed garden on the Henry Street Plot?".

To ensure that the project will proceed, an early objective was to confirm that the Henry Street plot had been designated by Dalhousie University for horticulture use. Another initial goal was to determine the support and interest of food service providers in this edible garden initiative as one of them was to be a significant player in purchasing food from the garden for campus distribution.

A further objective was to design the layout for the vegetable garden. Finally, any concerns or requests from the administration were applied to the final garden design.

The research reported in the following pages is vital to the implementation of the campus garden project. Both qualitative and quantitative information was retrieved through interviews and literature review. The final plan used this information and more quantitative data from a Geographical Information System analysis of the Henry Street Plot.

This study can have an important role in greening Dalhousie's campus. By growing edible foods on campus it will cut down on transportation costs of shipping food from wholesalers and at the same time promote a variety of locally grown products. The garden would create more green space on campus and over time could cut down net costs by continually growing in-season crops that can be sold to the university food service provider. If the garden is implemented successfully it could serve as a model for future gardens on Dalhousie Campus and other university campuses.

1.2 Background

Providing local food to students on campus is a vital step in the Greening the Campus movement. Globally, agriculture is the leading cause of deforestation. Commercial farming dominates the agro-food system and causes a wide array of environmental damage. Large-scale monoculture, the most common type of commercial farming, uses vast amounts of water, degrades soil fertility, diminishes biodiversity, and pollutes air and water (Dalhousie Campus Green Guide, 2010). The proposed campus garden could be designed and operated in such a way as to avoid these undesirable outcomes.

Many universities across North America have been working to increase their expenditure on local foods and source their own produce from on-campus gardens. In fact, seventy percent of the schools that took part in the College of Sustainability Report Card own and maintain a garden or farm on campus. Dalhousie specifically "spends 34 percent of its annual food budget on local items, including vegetables, fruit, dairy, grains, meat, poultry, and eggs from 15 local farms through a distributor" (Sustainable Endowments Institute, 2010). While these numbers are a step in the right direction, Dalhousie could do much more in the way of food production to improve its sustainability grade of "B".

With the creation of a campus food garden, students and staff would have access to food grown on campus and decrease their adverse environmental impacts. Currently, food prices do not reflect their true costs, as Morgan explains: "Far from being concerned simply with the environment, the ecological world seeks to address one of the core principles of sustainable development - the need to render visible the costs neglected by conventional cost-benefit analysis, where many of the negative costs of the industrial agri-food system have been externalized" (Morgan, 2008). To reduce externalized costs and further environmental degradation, Morgan suggests that schools and caterers should look to local farmers and suppliers for their produce where possible. A campus food garden is an excellent initiative that would coincide with the need for locally produced food, decreasing energy consumption associated with the production and distribution of non-localized food products.

Published in 2010, the third edition of the Campus Green Guide produced by the College of Sustainability provides ten golden rules to live by on Dalhousie Campus. Two of these rules, to “eat mostly plants, locally produced, and minimally processed” and to “get involved: take action” can be addressed via the creation of a food garden on campus (Maguire, Omina, and Lynch, 2010). Students and faculty members could produce their own plants and vegetables using organic composted material instead of fertilizers and herbicides that have adverse environmental impacts. This would also foster a greater sense of community as many student societies and faculty members would be using the garden space and working together to harvest their own crop yields, lower their carbon footprint and increase the sustainability of Dalhousie campus.

It is important to explore the idea of a campus food garden because the garden may increase awareness of sustainable food production and consumption, encourage student involvement, provide hands-on learning opportunities and enhance green space on campus. Additionally, by collaborating with the on-campus food provider, the garden could provide fresh, local food to students and faculty. This supports sustainability initiatives on Dalhousie campus as outlined in Dalhousie’s Campus Green Guide which promotes the use of local and organic foods that are in season (Campus Green Guide, 2010). The garden would also offer students the opportunity to interact with new people, learn new skills and team up with sustainable student initiatives.

There have been a number of feasibility studies done by Dalhousie students and faculty regarding food gardens on campus. In 2010, students conducted a study for the implementation of a garden on campus entitled “Campus Food Gardens”, to “determine the feasibility, including the cost of and interest in, implementing and operating organic community food gardens on the Southwest corner of the Killam library” (Cantafio et al., 2010). The report concluded that a campus food garden was both environmentally and economically viable, and that there is adequate interest from students and faculty. However, the location of the garden does not fit with the university administration's plans, as renovations have been proposed for the given area. This study is very useful for our project as much of the feasibility work, including focus groups and surveys, has already been completed.

Other feasibility studies that have proven to be useful for this project include "Higher Learning- Greening the Kenneth Rowe Roof" created at Dalhousie in 2007 and "The Future of Rooftop Gardens on the University of Waterloo Campus" created in 2000. While these two proposals outline the feasibility of rooftop gardens in particular, they are still very useful in determining what goes into the creation of a garden on campus. Information that these proposals provide will be used as base knowledge for this study.

Chapter 2 - Material and Methods

2.1 Introduction

To clarify the methodological processes, this section has been divided into two parts; interviews and coding. The first section contains the steps under which the data and knowledge was collected and justified, while the second describes how the coding process was used to analyze the qualitative data.

2.2 Interviews

Qualitative research is that which involves "analyzing and interpreting texts and interviews in order to discover patterns descriptive of a particular phenomenon" (Auerback and Silverstein, 2003). Hypothesis generating research using the grounded theory method was chosen to analyze the interview data for its two basic principles. First, it uses questioning rather than measuring which allows the researchers to acknowledge that enough information was not known about the research question to formulate a significant hypothesis. Instead, the interview participants are used as a source of knowledge, and the information provided from their subjective experiences generates a hypothesis. The second principle of hypothesis generating research is that it uses theoretical coding to ground the hypothesis in what the research participants say.

Narrative interviewing is creating a series of questions that allow the research participants to explain their history with respect to the research concerns. (Auerback and Silverstein, 2003) Narrative interviews were conducted because current literature could not provide adequate answers to the research question. Interview participants were offered opportunities to bring up unanticipated topics to allow further discussion.

When the research project began, little was known about the design concepts of an on campus garden. Deciding which participants to investigate was determined through practical considerations. Dalhousie University staff and faculty were chosen for interviews as well as local gardening experts.

It is recommended that six general questions be asked when conducting narrative interviews (Auerback and Silverstein, 2003). Individual rather than group interviews were chosen because individual interviews were more appropriate for exploring each participant's personal experiences (Auerback and Silverstein, 2003). Each research participant in the study was asked five standardized questions and up to six specific questions that took them through their gardening experiences. See Appendix 2 and Appendix 3 for a complete list of questions. Following the questioning, the participants were invited to share any thoughts they had not yet voiced. During the interview process, notes were taken and then transcribed. The transcribed interviews formed the raw text for data analysis.

Informal narrative interviews were conducted with the following research participants:

- Megan Tardiff-Woolgar: Event Organizer for Seemore Green; a community garden currently located on Dalhousie property.
- Marjorie Willison: Executive Director of the Chebucto Connections community development agency. Ms. Willison had been suggested by Rochelle Owen as a community garden specialist in the HRM.

A formal e-mail interview was sent to the following research participant:

- Mike Wilkinson: the Grounds Supervisor in Facilities Management at Dalhousie University, who has information pertaining to the maintenance, necessary equipment and potential users of the campus garden. Support from the Facilities Management is essential to all new development on campus.

The following research participants were chosen for narrative interviews but declined the opportunity to participate, or were not able to respond before the submission of this report.

- Deborah Buszard: the Associate Director of the College of Sustainability at Dalhousie University, who has expertise in studying the use of plants in the built environment, including gardens.
- Claudette Levy: the Area Recreation Coordinator for Halifax Regional Municipality (HRM). She has experience with the creation, implementation and function of local community gardens.
- Bonnie Neumann: The Vice-President of Student Services, Dalhousie University and would have been helpful in determining the necessary design elements that are required by the Dalhousie University administration.

Originally, all six participants were to be interviewed using individual narrative face-to-face interviews, however, due to time constraints, interview styles needed to be adjusted to include telephone and email as well.

The participants interviewed provided information specific to the Dalhousie University campus and the Henry Street plot. The knowledge gained from meeting with these experts is supplementary to research done in the literature review. This purposive, non-probabilistic, qualitative research method allows for the possibility of other methods such as snowball sampling. The questions asked were broad and pertain to many different fields of study, and are attached to this proposal as Appendix 2. These open–ended questions allow for researchers "in hearing respondents' opinions in their own words, particularly in exploratory research, where the researcher isn't entirely clear about what range of responses might be anticipated" (Palys and Atchinson, 2008).

2.3 Methods of Data Analysis

General gardening information and climate data was collected through the research review. The in-depth literature review focused on raised-bed construction, maintenance and equipment, aesthetics, soil, water, weed and pest control, plant species suitable to the local climate. The information was collected from books available at the Halifax Public Library and through Nova Scotia government publications. Keywords used in *Prowler,* Dalhousie Library's *Novanet* and the Halifax Regional Library's *Discover* database are included in Appendix 4. Peer reviewed journals and articles were not used as an exhaustive amount of information was not available. Table 1 in Appendix 4 depicts the seven topics researched through literature review, the key words and phrases entered into the search engine and the information expected to be retrieved.

2.4 Coding and Categorization

Coding was used to facilitate the interpretation of interviews. This is the conversion of qualitative data attained through interviews and open-ended questions into a form receptive to quantitative treatment (Guetzkow, 1950). Coding was used to analyze the responses to the narrative interviews so interpretations could be supported and allow other researchers to understand the analysis (Auerback and Silverstein, 2003). There were two operations to turn raw qualitative data into research concerns, separating the qualitative material into codable units and establishing category-sets into which the unitized material would be classified (Guetzkow, 1950). The reliability of the coding was dependent on the accuracy of the unitizing and classifying so a large degree of error was expected due to extremely limited interview responses. Unit size was dependent on the category set employed. Seven category sets were defined as classes into which the codable units of qualitative data could be placed.

The first step taken in the coding procedure was cutting down the text to manageable proportion sizes (Auerback and Silverstein, 2003). While reading through the transcripts, we kept our specific research concerns in mind. Text that was related to our specific research concern is called relevant text. Only the most relevant text was kept and the rest was discarded. After the relevant text was selected, repeating ideas, themes, similarities and dissimilarities of words that came up across research participant's interviews were documented and analyzed and applied to the final design plan (Wright, 2011). Due to limited raw data, themes could be not be identified in all categories.

2.5 Site Visit

The study site for the proposed garden is located in the Henry Street Plot, behind the Goldberg Computer Science Building, at Dalhousie University, Halifax, Nova Scotia. The site assessment was performed on March 21, 25 and 29, 2011. The study group gathered at the site both individually and as a team to quantify the measurements of the plot. The plot's perimeter was measured using a measuring tape. From the data collected, the area of the plot was calculated in meters (Appendix 5). This method was used to determine the number of raised beds and other features required within the garden dimensions.

Figure 1: Photo of the proposed garden plot

2.6 GIS Analysis

GIS was used to analyse the amount of slope, sunlight and climate available at the proposed garden site.

2.6.1 Sunlight

Geographic Information System was used to determine the amount of sunlight available for the proposed garden area, using the technique of a past garden study by Dalhousie students (Cantafio, et. al., 2010). The sun exposure to the garden was mapped out for four dates during the growing season; May 1st, June 15th, August 1st, and September 15th 2011, for three times, morning, noon, and afternoon. Many plants need a certain amount of sunlight for optimal growth. Therefore, having sunlight exposure mapped will allow for the proper placement of the plants throughout the garden.

To begin creating the sunlight analysis, Digital Elevation Model (DEM) information for Halifax, Nova Scotia was provided by the GIS Centre located at the Killam Library, Dalhousie University. The DEM, otherwise known as a topographic surface model was created by a Light Detection and Ranging (LIDAR) technology (Satellite Imaging Corporation, 2010). LIDAR is an optical remote sensing technology that measures the elevation of the ground by analysis of backscattered or reflected light from their surfaces (USGS, 2010). This information was then added to the program ArcMAP, which is the main component of ESRI's ArcGIS software suite of geospatial processing programs. Azimuths and altitudes for Halifax was retrieved from the United States Naval Observatory (USNO) website by specifying the object (sun), dates and location for Halifax at a latitude 44° 39' N and longitude 63° 35' W. The azimuth is important in determining the amount of shade because it is the angle at which the sunlight hits the Earth's surface on a horizontal plane (USNO, 2011). The azimuth and altitude data collected was entered individually into ArcMap to determine the hillshade for 12 different images, at a resolution of 1 by 1 meters. The times of the day were 9 AM, 12 PM, and 3PM, which covered a six hour period in order to obtain as much sunlight information needed to determine optimal growing times.

2.6.2 Slope

Geographic Information System was also used to determine the slope of the proposed garden area. Edible plants require a more even ground so as to avoid soil contamination and to maintain proper drainage levels. Therefore a slope analysis can determine the proper placement of the plants throughout the garden and whether the land must be reconfigured for growing plants. The slope was calculated in ArcMAP using the same Digital Elevation Model for Halifax, as the one used for sunlight analysis. The slope was measured in degrees and a resulting image was produced for the Henry Street plot. Slopes for buildings and tree covered land were also taken into account.

2.7 Climate

Climate data was collected by the National Climate Data and Information Archive (NCDIA) through Environment Canada's website. Daily temperatures and precipitations for the months of May to October were gathered for Halifax, Nova Scotia at Stanfield International Airport, as it was the closest station that comprised of both recent climate data and climate normals and averages. These records were based on the 2010 calendar year and 30 year climate average from 1971 to 2001.

2.8 Limitations

The time constraints of this research project may be a limitation. The growing season will be limited mainly to the spring and summer seasons, so environmental conditions at the time of this study will not be the same as normal growing conditions, as the study needed to be concluded and submitted on April 13.

The number of possible interviews was also limited by time constraints. Our group was only able to meet with one representative from each interested party because of the logistical difficulties of scheduling a large number of meetings in a short period of time. Although six experts were identified as interview participants, only three of them were able to provide appropriate responses to our standardized questions by the time this report was written. Nevertheless, the three experts' responses were considered credible and were included in the results section of this report.

Another limitation of this study is the potential use of the Henry Street plot by multiple community garden initiatives on campus. The Henry Street plot is limited in size, and each group may want to grow different types of produce for different purposes, so the proportion of space available for the production of food to be distributed by the Loaded Ladle is undetermined.

Research was further limited by a general lack of peer-reviewed documents related to community gardening in the Halifax area. As a result, most of the reviewed literature is in the form of published books, government documents, and previous student research studies.

2.9 Delimitations

This project's research also has a number of delimitations. Poor soil quality is an established concern in the Halifax region and therefore an assumption has been made that the Henry Street plot has poor soil and the garden must be raised and contained. Some other plots of land were considered but in most cases, proposed construction and renovation projects would have disrupted the garden soon after its implementation.

The study has also been delimited to factors involved in the construction and maintenance of the garden, environmental factors that will influence the garden's growing capacity, institutional factors (working with university administration to meet all guidelines and a future food provider to meet their expectations) and finally ensuring the garden will meet or exceed food and safety regulations. We will not be doing extensive research on funding sources, nor will we be recruiting staff or volunteers to operate and maintain the garden. However, any information we do gain on potential funding and staffing sources will be included in the final project report. A brief cost analysis of necessary materials is included in this proposal as Appendix 8.

2.10 Operationalized Terms

Design plan: The main deliverable for this project. This plan not only applies to the implementation, but also the long-term sustainability of the garden. The plan encompasses all aspects associated with an on-campus food garden, including structure, function, aesthetics, users, and action growing conditions.

Raised Bed Garden: A garden in which the main productive area consists of plots that are contained by small raised structures, isolated from the naturally-occurring soil upon which they are built.

Aesthetics: The appearance and odour of the garden and how these affect a person's perception of the garden.

Key design elements: The elements of a garden that are important to a successful edible garden on Dalhousie campus.

2.11 Research Budget

Due to the nature of the proposed research, a dedicated research budget was not required. All of the interviews were conducted at Dalhousie University, by email or over the phone, making travel expenses negligible. All of the documents necessary for the literature review are available free-of-charge, some to Dalhousie students specifically, the rest to the general public. Communication between group members and interested parties was conducted through email and other free online venues, and the communication of our results is not expected to generate any additional costs.

Chapter 3 - Results and Observations

3.1 Interviews

To facilitate analysis, interview responses were divided into the same categories as the literature review. All relevant text in the responses was categorized, and repeated responses and themes have been noted.

3.1.1 Raised-Bed Construction

Use of natural and recycled materials was recommended by two research participants, with wood being the preferred material. A plot width of 4 feet and a variable plot length were recommended by two respondents.

3.1.2 Maintenance and Equipment

Cold frames (clear plastic or glass containers placed over garden plots to preserve heat), a storage shed, and a warm place to start seedlings were all identified as important pieces of infrastructure by two research participants, and one also recommended a greenhouse.

There was no clear consensus on who should be involved in the garden's establishment and upkeep; two of the respondents recommended that the garden be accessible to the wider community as well as Dalhousie students, while another respondent was emphatic that the garden should be used by students exclusively. Both Seemore Green and the Urban Farm Museum expressed a willingness to provide help in the form of information and advice, while Mike Wilkinson offered the use of his tools. Two of the research participants suggested that all tools should be shared, and one suggested that plots should be shared as well.

3.1.3 Aesthetics

Dissimilarities existed between aesthetic priorities within a garden plot. Functionality and neatness were both identified as priorities by different research participants. The incorporation of 3-dimensional structures such as archways and poles or netting to support climbing vines was also suggested. All respondents agreed that compost, if incorporated, should not pose a problem aesthetically as long as it is properly maintained and is free of meat and dairy products.

3.1.4 Soil

No themes were identified amongst research participants responses as they all varied. Proper soil maintenance was identified as a means of minimizing the risk of weed and pest infestation and plant diseases. Soil should be kept warm, humid but well-drained, and should be sheltered from the wind. Compost increases soil fertility but care should be taken to ensure that there are no residual seeds left in compost.

3.1.5 Water

The local climate requires that some water be available during the summer months because precipitation is not reliable enough, therefore two respondents recommended incorporating water barrels into the design.

3.1.6 Plants

In response to plants species in a garden, two research participants had similar answers being a good diversity of plants and the use of plants with natural pest-repellent properties as effective pest-control methods. Further answers included, collection of seeds at harvest was identified by one respondent as a means of reducing operating costs. One respondent also indicated that some plants, such as tomatoes, eggplants, and peppers may require a dedicated, heated space to start seedlings.

3.1.7 Weed and Pest Control

Two research participants had similar views on maintaining biodiversity as an effective means of discouraging weed and pest infestations. Regular maintenance/weeding of the garden should be performed. The presence of certain insects such as bees and ladybugs tend to discourage pest infestations. The area surrounding the garden should be considered when dealing with weeds and pests. Dissimilar views included one respondent noting that pests have not been a problem in other gardens around the Dalhousie area, therefore they are not a concern.

3.2 Findings of Literature Review

3.2.1 Raised-Bed Construction

Constructing a raised bed garden needs planning to ensure that the garden is as efficient as possible, especially when growing vegetables. Raised bed gardens are better for climates like Nova Scotia's that have shorter growing seasons because raised bed gardens warm up faster and cool down slower, which slightly prolongs the growing season for the gardener (Brandt, 2010). This is because the warm air can move faster throughout the soil (Bartholomew, 1982, as cited by Brandt, 2010). They also provide better drainage for the plants and provide better aesthetics for the garden by keeping gardens contained and therefore making them appear more organized (Brandt, 2010). The gardener has control over the content of the soil and can allow for more intensive farming, where plants can be planted closer together which increases efficient usage of the garden space (Taylor, 2011). Furthermore, intensive planting can block out sunlight so it is harder for weeds to grow, and the looser soil of the raised beds allows for easier weeding (Taylor, 2011). According to *The Small Garden Handbook*, the best way to plant on slopes is through terracing with raised bed plots (Abbeyvale Press, 2000).

When constructing the garden there are many factors to take into account, including materials to contain the raised beds, drainage, and the depth and width of garden beds.

(i) Materials:

The materials used to construct the raised beds depend on the budget of the garden and the kind of garden planted. Treated wood, railroad ties or stained landscaping timbers can leach chemicals into the soil (Taylor, 2011). However, treated wood would be preferential for aesthetic and maintenance purposes because it is less likely to rot. Most wooden boxes need to be replaced after five years, and need repairs after three (Taylor, 2011). The alternatives would be to use either rot-resistant wood such as Cedar, Oak or Cyprus, or to use non-biodegradable materials such as concrete, cinder blocks or brick (Taylor, 2011). Joining materials such as nails or mortar are also necessary. In order to further prevent contamination of the garden bed soil, it is beneficial to lay landscape cloth between the soil and the contaminated ground (Johnson, 2010). This would also cut down on labour by eliminating sod removal from the construction process.

(ii) Drainage:

It is important that the garden be able to drain properly to prevent the soil from becoming saturated. Raised beds do drain better than gardens planted directly into the ground. However, if it is decided that brick, cinder blocks or cement should be used there must be a drainage mechanism incorporated in the structure. Abbeyvale Press gives a good description of what this process would entail (Abbeyvale, 2000).

(iii) Depth and Width:

The size of the gardens is a very important factor because it determines the amount of materials needed and the budget for the project. Adversely, the budget of the project can determine the size of the garden. Lisa Taylor's *Urban Dweller's Guide to Growing Food* advises that raised beds be no shorter than 12 in (30.5 cm). The key to a raised bed garden is that the entire garden should be accessible without actually standing on or in it. Therefore the ideal width is 4 ft (1.2 m) (Pray, 2010). If the garden needs to be more accessible for physically handicapped persons then it should be a minimum of 18 in (45.72 cm) while 3 ft (0.9 m) for those who need to sit in chair while gardening. When building for physically handicapped person, again, one must be able to reach across the garden, so the width must be adjusted to 2 ft (0.6 m).

3.2.2 Maintenance and Equipment

Lisa Taylor's *Urban Dweller's Guide to Growing Food and Raising Animals* lists the basic tools necessary for starting a garden. For the complete list see Appendix 8. Some tools from Taylor's list were not included because they were deemed unnecessary for the plants planned for this garden.

It is important that the tools are properly cared for so that they last longer and work more efficiently. Wooden tool handles can be maintained by sealing the handle with oil. Judy Pray's book recommends using tung oil instead of the traditional linseed oil because linseed oil takes a long time to dry and does not last as long as tung oil (Pray, 2010). Tools should also be kept sharp using either a flat file for a flat-faced garden spade and a half-round file for a curved shovel (Pray, 2010). To prevent the loss of tools, tools should be painted bright colours (Pray, 2010). To keep tools in good condition, it might be beneficial to have a monthly tool maintenance get-together. To avoid tool deterioration and for accessing convenience there should be a shed on-site.

3.2.3 Aesthetics

(i) Water

Water adds aesthetic value to gardens (Willison, 2005). Water containments can vary in size from small bowls to ponds and bring users a sense of tranquility. Advantages include the feeling of being cooler, attraction of wildlife and the opportunity to grow certain plants. However, disadvantages include a danger to toddlers and young children.

(ii) Specimen Plants

Specimen plants are plants used as features to highlight areas of a garden (Willison, 2005). They can vary in size from huge trees to smaller contained herbs in pots. If too many specimen plants are added to the garden design, it can become distracting and cause major drawbacks for the overall aesthetic.

(iii) Rockeries

Rockeries are natural or man-made rock outcroppings that are used in conjunction with shrubs to provide a sense of nature to gardens (Willison, 2005). Natural rockeries can be easy to maintain and add beauty to any garden however man-made rockeries are labour intensive, require heavy work to build and hours of maintenance.

(iv) Seating and Furniture

Furniture is designed to provide a tranquil oasis where users are invited to visit, wander and sit down (Willison, 2005). The best spots for furniture include areas that are open to the sun but provide shelter. Seating that faces activity centres is beneficial. Wood or iron seats placed strategically in a garden can attract the eye (Bird, 1998; Willison, 2005). Unpainted wood and logs that have been carved into furniture are excellent additions to match the garden’s natural surroundings (Willison, 2005). Difficulties when using furniture include obtaining products that will withstand harsh weather and placing it out of the wind.

(v) Ornaments

Ornaments can come in a variety of shapes and sizes and can add charm to any garden (Willison, 2005). Ornaments can include any item that appeals to sense of beauty or humour such as sundials, clay animals or attractive pots. Ornaments act as transition elements that can bring features from indoors into the garden.

(vi) Unwanted Features

Unwanted features are any features that contribute to unsightly, but sometimes necessary, attributes of a garden (Willison, 2005). Common solutions to unwanted features are disguising them or getting rid of them (Bird, 1998; Willison). Utilities such as a shed or compost can be hidden by fences or partially covered in vegetation such as climbing plants. When objects cannot be removed, garden designers attempt to draw the eye away from the object or paint it (Bird, 1998). Getting rid of an object completely is a radical solution, but can be beneficial to the appearance of the garden.

(vii) Garden Deceits/ Subtleties

Deceits are "tricks employed to make gardens appear to be something they are not" (Bird, 1998). Tricks of the eye include longer and curving paths or techniques such as mirages that increase the aesthetics of a garden by making it appear something it is not. Other subtleties are aspects of a garden that increase features in a positive way such as shape, color and texture of plants. The shape of a plant adds interest to otherwise flat, dull designs (Willison, 2005). Furthermore, shape can adds function, height or accents to a plot, or serves as a windbreak. Too many contrasting shapes can detract focus from a garden and add disarray to the unity of design. Plants with varying textures add interest and can create illusions of depth. Color is the final subtlety that can unite a garden. Colors add a sense of design, balance and alter perceptions of distance (Bird, 1998; Willison, 2005).

(viii) Arches and Trellises

Adding a third dimension can improve the aesthetics of a garden (Bird, 1998). Shrubs and trees eventually provide this stimulating atmosphere but because they take time to grow, man-made structures can be used to create an immediate effect. Internal screens, boundary screens, arches, pergolas and walkways are all different concepts that can be applied to a garden to supply it with height and screens. Trellises can be designed out of plastic or wood while arches can be made out of wood, metal, plastic, brick or hedges.

(ix) Pathways

Paths are a significant part of garden design and aesthetics (Bird, 1998). Paths provide a strong visual importance as well as the primary route from place to place in the garden. The materials available for paths are diverse and are dependent on use of the site. According to Lisa Taylor's *An Urban Dweller's Guide to Growing Food and Raising Animals,* pathways should 40 inches (about 1 m) wide to accommodate for wheelchair users carrying gardening tools or harvest baskets (Taylor, 2011).

3.2.4 Soil

(i) Soil Composition

Soil composition on the Halifax Peninsula creates many barriers to urban gardening. Some soils tested by the Ecology Action Centre "have shown higher than recommended concentrations of lead, arsenic and zinc" which can be very harmful if ingested (EAC, 2010). These metals have leached into the soil from both natural sources, such as arsenic from slate, and human sources like lead-based paint flakes and zinc-coated galvanized fencing (EAC, 2010).

Some suggestions to improve soil quality include adding compost, mulch, leaves and other organic matter to the soil, to reduce the bioavailability of lead (EAC, 2010). Adding limestone is another alternative since lime "reduces the pH of the soil, decreasing metal solubility" (EAC, 2010). If metal contamination is too high, raised beds or container gardens are highly recommended.

As such, using alternate sources of soil in raised-bed gardens will be beneficial. “Ideal garden soil will contain at least 20% organic matter to improve aeration and drainage as well as to hold nutrient until plants can use them” (Smith, 2011). Before planting seeds in the newly purchased soil, amendments should be added to the garden. These can include an inch of sandy loam and two or three inches of compost, depending on the soil composition within the raised beds.

(ii) Pathways

Pathways are a necessary addition to the garden structure to prevent the soil from being compacted. “Acidification of the soil can increase when it has been compacted, resulting in the degeneration of the garden. It is important that the soil has good drainage to ensure proper balance of water in the soil for the plants and avoid excess build up” (Dam et al, 2000).

(iii) Sod Removal

The existing sod on the Henry Street plot may need to be removed prior to the construction of the raised bed gardens. To do this, a straight blade shovel will be used to cut a perimeter into the grass to mark the area to be worked on, sod will then be removed from the area and shaken out by hand to remove excess soil. (Brandt, 2010) Alternatively, the raised beds could be placed over top of the sod instead of removing it first. Newspapers or landscaping cloth must be placed on the sod prior to the construction of the raised beds.

(iv) Composting

Composting is “the practise of creating humus-like organic materials outside of the soil by mixing, piling or otherwise storing organic materials under conditions conducive to aerobic decompositions and nutrient conservation” (Brady and Weil, 1996). Applying composted organic materials to the soil provides valuable nutrients for crop growth, such as nitrogen. (MacDonald, 2002) In Halifax, it is important to incorporate organic matter to the soil decrease the bioavailability of lead in the soil (EAC, 2010).

Backyard composting is the process of using a vessel or bin which holds food waste and yard scraps to reduce them to compost. This method of composting requires high levels of maintenance as "materials must be turned over on a regular basis to keep the process advancing at a steady pace" (EcoEfficiency, 2008). There is a low start-up cost associated with this form of composting, though the maintenance requirements are high.

The addition of worms to the compost bin can help hasten the composting process. This is known as vermi-composting or vermiculture. "Vermiculture uses a specific kind of earthworm, the red wiggler, because of its ability to survive and adapt to sudden changes to its surroundings" (EcoEfficiency, 2008).

To reduce concerns about the smell of compost, a good mix of yard waste, food waster, moisture and exposure to air should be upheld. There should also be good air circulation within the compost bin to deter odours. Adding meat or dairy products to the compost bins should also be avoided. 'Brown waste' such as leaves, straw, hay, or boxboard should be added whenever food waste is present in the compost.

3.2.5 Water

(i) Precipitation

The climate data that was collected throughout the course of this research project shows the irregular precipitation in the Halifax area. This information is further detailed in Section 3.10 of this report. Within this data set, precipitation charts show that the monthly precipitation levels are drastically different.

(ii) Irrigation

There are two main types of irrigation systems that would be feasible in a raised bed vegetable garden; spray and drip irrigation. Spray irrigation has traditionally been the method of irrigation chosen by municipal homeowners for their lawns and gardens. Using fixed or moving sprinkler devices, water is distributed quickly over a large area (LearnAbout, 2010). Fine mist spray devices can also be used as they create a moist environment around a larger area, but use less water than a conventional spray irrigation system of jet sprinklers.

Drip irrigation is a more efficient alternative of irrigation as the water is delivered slowly and directly to the plant roots using a hose that if full of tiny holes. Because drip irrigation systems deliver moisture directly to the roots of the pants, there is far less water lost to evaporation and wind drift than with traditional spray irrigation systems (LearnAbout, 2010). Drip irrigation wastes less water due to runoff, and possesses less of a risk for plant disease developing as water does not pool in the soil. It is also more cost-effective and aesthetically pleasing since the irrigation lines can be buried beneath the soil within the raised bed containers.

Some studies have also examined the use of domestic greywater for the irrigation of food crops. The use of greywater produced on Dalhousie campus could be a new development in the "Greening the Campus" movement. No significant difference was observed between plants watered with treated municipal water and domestic greywater. "Plant growth and productivity were unaffected by water quality… These results reinforce the potential of domestic greywater as an alternative irrigation source" (Finley, 2009).

(iii) Watering techniques

There are also alternatives to installing an irrigation system. Hand watering is the cheapest and most effective way to water a vegetable garden. This method ensures that each plant will receive an adequate water supply and that water does not pool at the base of the plants. Watering should be conducted in the morning when temperatures are cooler to minimize evaporation.

(iv) Rain Barrels

Rain barrels provide a source of water that is free from chemicals like lime, calcium and chlorine which can be found in treated municipal water. Rain barrels are also an effective way to conserve rain water that would otherwise form runoff and drain into the municipal storm sewers, and allow the garden to operate without having to route municipal water directly to the site. To be most effective, rain barrels should be placed beneath downspouts so the rain collection is more concentrated.

(i) Vegetables

Nova Scotia's 4-H Gardening Resource manual identifies several vegetables that are suitable for gardens in Nova Scotia. The manual separates the annual vegetables into cool-season and warm-season crops, with the cool-season vegetables growing in the late spring to early summer, and the warm-season crops growing over the course of the summer and into the fall. Cool-season crops are generally planted and harvested earlier than warm-season crops. Perennial crops do not need to be replanted each year and their primary growing and harvest times vary. Some perennial crops must grow for a year or longer before they can be harvested. The list of potential vegetable crops is not exhaustive but provides a sense of the types of crops that can be grown in the local climate.

Table 1: Vegetables suited to Nova Scotia Climate

Cool season crops	Warm season crops	Perennial crops
Beets	Cucumbers	Rhubarb
Carrots	Melons	Asparagus
Lettuce	Zucchini	
Peas	Pumpkin	
Rutabaga	Beans	
Turnip	Squash	
Spinach	Corn	
	Tomatoes	

The 4-H manual recommends alternating rows of cool and warm season crops to maximize garden productivity. It also recommends keeping perennial crops separate from annuals to facilitate garden management, especially during the planting season.

(ii) Herbs

Herbs mentioned in the manual include savoury, parsley, mint, dill, chives, basil, marjoram, balm, fennel, lovage, sorrel, and tarragon, with particular focus on savoury, dill, parsley, mint, and chives. Most of these herbs require well-drained, sandy soil, although mint and parsley also require soil that can retain moisture. The manual suggests *not* using highly fertile soil, since low soil fertility generally results in smaller leaves, with a better concentration of flavour. Higher soil fertility will result in larger, but less flavourful herbs (Province of Nova Scotia, 2007).

3.2.7 Weed and Pest Control

(i) Weeds

Weeds are unwanted plants that compete with crop plants for water, nutrients, air, and sunlight. Like other plants, weeds can be classified as annuals or perennials. Weeds can be controlled without the use of herbicides by removing them from the garden as they appear. Soil preparation is an important first step, and any manure that is applied to the soil should be composted to destroy any residual seeds. Weeds should be removed early in their growth cycle to minimize their immediate effects on the garden and to prevent them from spreading by seed or by root. Weeding should be performed at least once a week during crop growth.

(ii) Diseases

Different plant diseases require different treatment measures. However, most diseases can be prevented by providing a healthy growing condition for the crops. Use of fertile, well-drained soil, elimination of weeds, use of disease-resistant seeds and/or plants, crop diversity, crop rotation, removal of damaged plants, and destruction of dead plant material (either by burning or thorough composting) can all help to prevent diseases.

(iii) Pests

Pests are animals that feed on or otherwise damage the garden's plants. Government documents identify common garden pests in Nova Scotia. The most common garden pests are insects and other invertebrates such as slugs and snails, which damage the plants' leaves and in some cases, their root systems. These pests can be controlled by using traps, by encouraging a diversity of plants including aromatic herbs, and by encouraging the presence of other species that eat them. Birds and rodents can also be damaging to a garden; birds can be deterred by scarecrows or human presence, and care should be taken while designing the garden to make sure that there are no hiding places for mice or rats in the garden (Province of Nova Scotia, 2007; 2010).

3.3 GIS Analysis

3.3.1 Sunlight

Figures 2 to 5 show the sunlight analysis for four months, May 1st, June 15th, August 1st and September 15th 2011. By analyzing the images, it is apparent that the Henry Street plot receives more than six hours of sunlight each day for these months. Sunlight for Figures 2 to 5 is greatest at noon for the months of May to September. It is also apparent from observing these figures that the north-east corner of the plot receives the most amount of sunlight within a day.

9 AM

12 PM

3 PM

Figure 2: GIS shadow map of Henry Street plot for May 1, 2011

9 AM

12 PM

3 PM

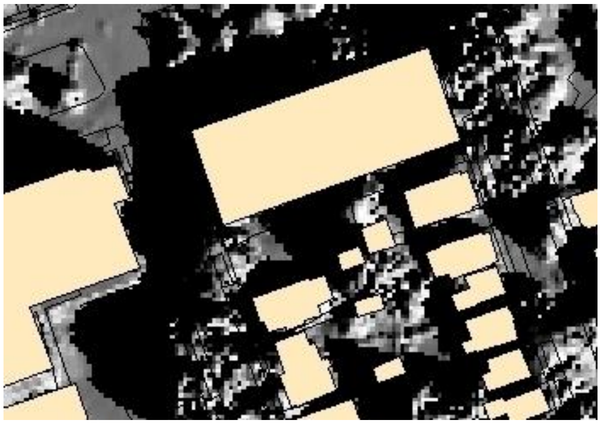
Figure 3: GIS shadow map of Henry Street plot for June 15, 2011

9AM

12 PM

3 PM

Figure 4: GIS shadow map of Henry Street plot for August 1, 2011



9 AM

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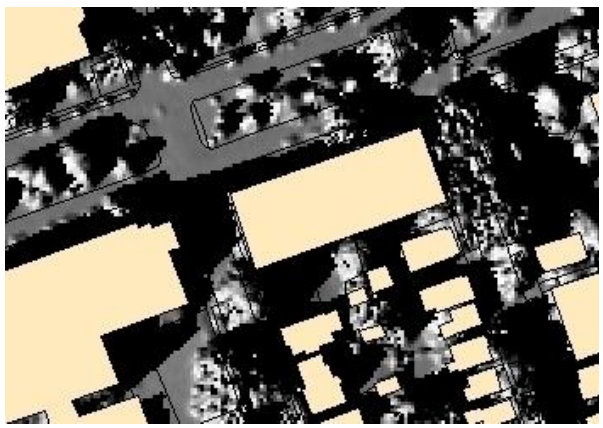


3 PM

Figure 5: GIS shadow map of Henry Street plot for September 15, 2011

3.3.2 Slope

Figure 6 shows the slope for the Henry Street plot. The land is predominantly flat with some areas higher in degrees of slope. These areas generally run the perimeter of the plot; however the main area also slopes downhill. To the left of the plot is the tree, which is represented by a steep gradient.

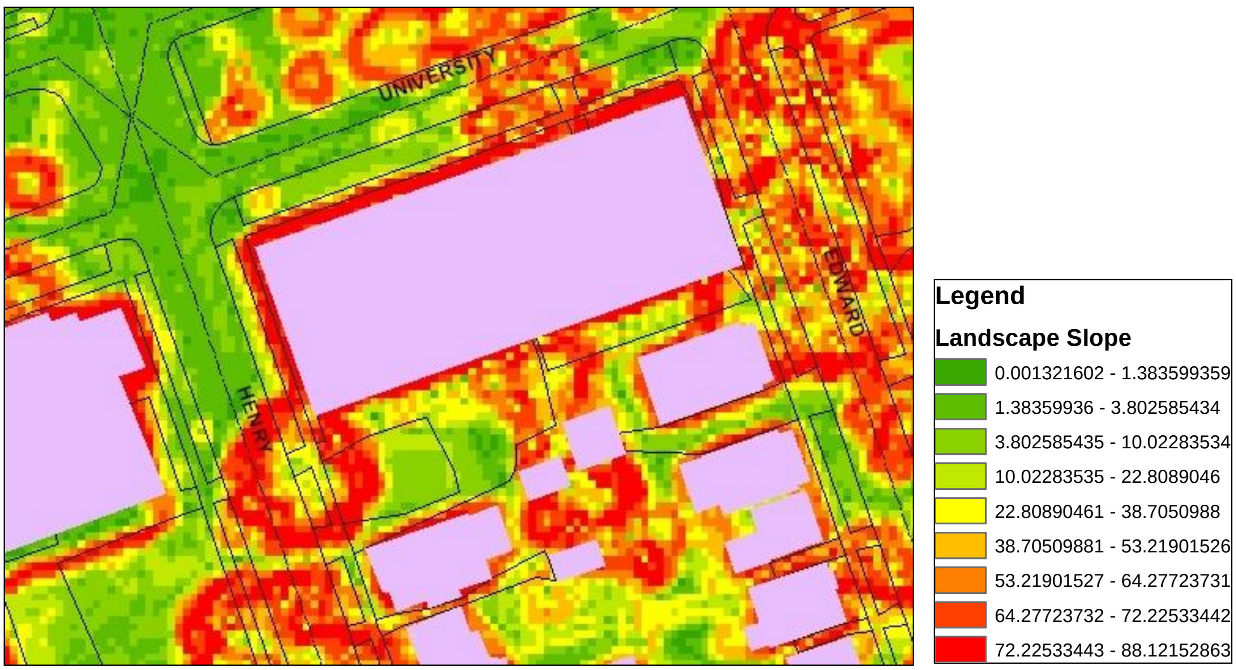


Figure 6: GIS Slope Analysis for the Henry Street plot

3.4 Climate Data

Figure 7 shows the minimum and maximum daily temperatures for May to October 2010. Maximum daily temperatures for May were greater than 10 degrees. Temperatures increased predominantly following June 3rd, with daily maximum temperatures falling to no less than 15.8 degrees. The average daily temperatures were relatively cool before becoming more consistent midway through June. Daily temperatures are noticeably higher for the month of July, however the highest daily maximum was observed for September at 34.2 degrees Celsius (Figure 7). September also had more temperature fluctuations than previous months and October reached daily minimum temperatures below freezing point.

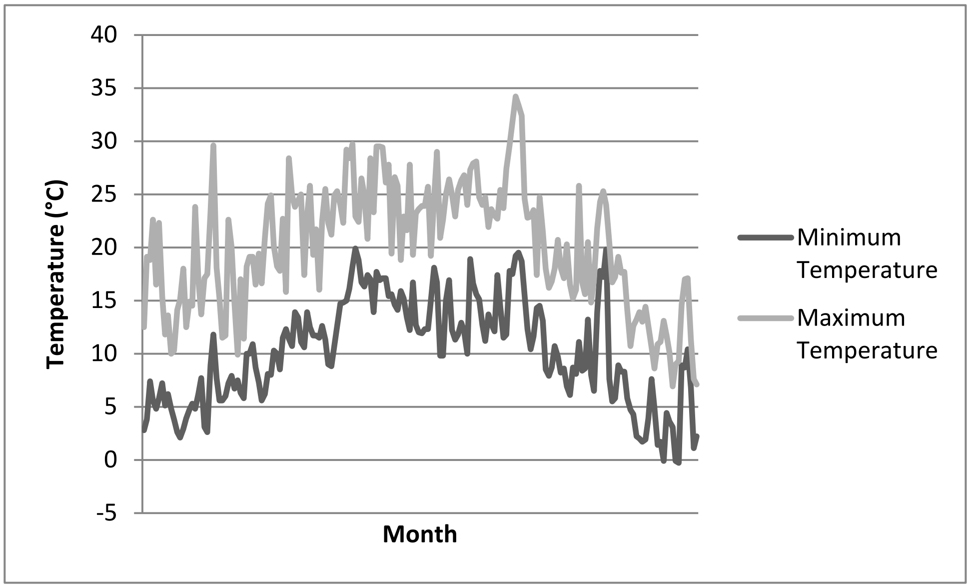


Figure 7: Minimum and maximum daily temperatures by month, based on data collected by Environment Canada at Stanfield International Airport, in Halifax, NS, during 2010.

Figure 8 compares the daily average temperature for 2010 and the thirty year period 1971 to 2001. Generally, records for the year 2010 and thirty year average were relatively comparable for the months of May to October. However, average temperatures for May, July, August and October were slightly higher, while September 2010 showed a more pronounced increase in average temperature.

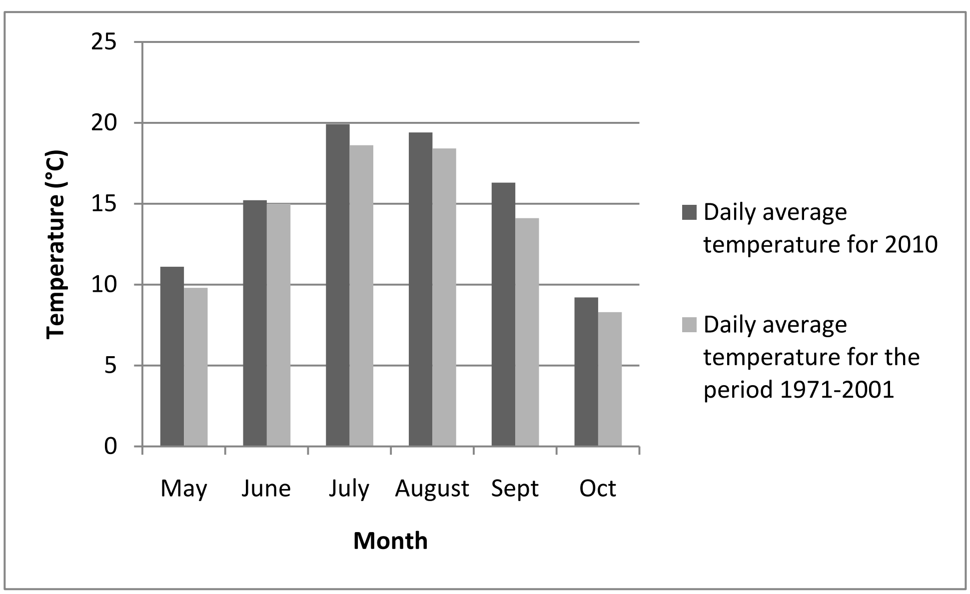


Figure 8: Comparison of the daily average temperature by month, based on data collected by Environment Canada at Stanfield International Airport in Halifax, NS.

Figure 9 depicts the daily precipitation for Halifax, for the months of May to October. May receives the least precipitation at 48 millimetres. Total precipitation is highest for July, yet it receives very little precipitation on a daily basis. Total precipitation for August is comparable to records for May. September has noticeably higher precipitation for the 4th and the 17th; these are attributable to the overwhelming rain brought on by Hurricane Earl and Igor, respectively (Figure 9). October receives the most amount of rain, however it is also the most variable.

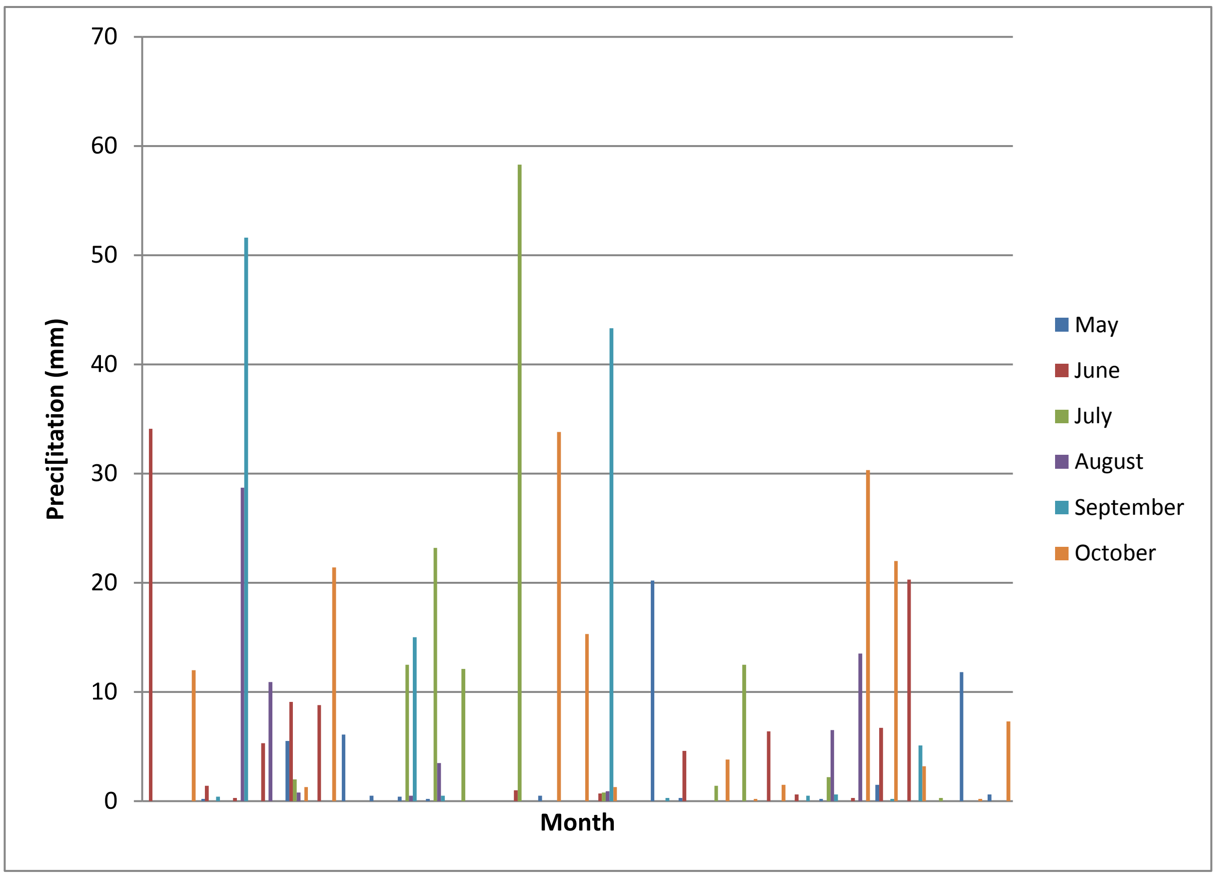


Figure 9: Daily precipitation by month, based on data collected by Environment Canada at Stanfield International Airport, in Halifax, NS, during 2010. Note: The two spikes in precipitation for September 2010 are due to Hurricane Earl and Hurricane Igor.

Figure 10 shows the monthly average precipitation for 2010 and the period 1971 to 2001. Precipitation levels are drastically different for the monthly precipitation averages. In 2010, dramatically lower precipitation was observed for May and August, while July, September and October received much more rain than the thirty year average. The amount of precipitation that fell in June 2010 was also slightly higher than the thirty year average. The precipitation level for September 2010 is higher than the climatic average due to the two storms that occured on the 4th and 17th (Hurricane Earl and Igor, respectively).

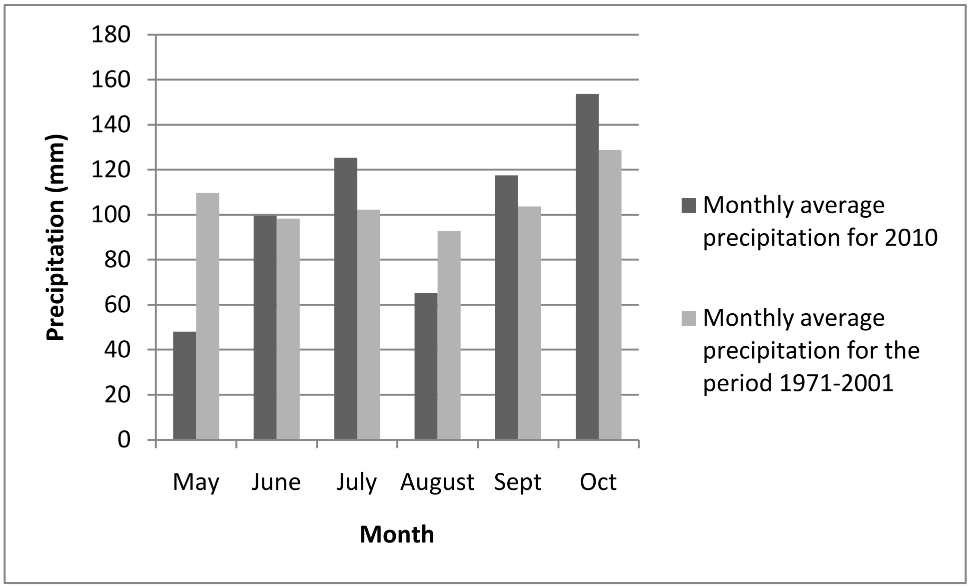


Figure 10: Comparison of the monthly average precipitation, based on data collected by Environment Canada at Stanfield International Airport in Halifax, NS.

3.5 Garden Dimensions

The total area measured was 347.89m2; further length and width measurements of the plot can be found in Appendix 5.

Chapter 4 - Discussion

The literature review uncovered many elements that were important to consider when designing a garden. However, only some of these elements applied to an edible garden in the Halifax climate. The interviews questions and answers were specific to the campus food garden but some of the answers did not apply to the design plan and were therefore not taken into account.

The raised beds will be well suited for the sloped area of the plot. Another advantage to raised bed gardens, specifically in the Dalhousie Campus Garden, is the separation of the garden soil from the possible contaminated soil of the gardening site. It is unclear as to whether or not the soil is contaminated on the site because a soil sample was not taken. Due to the fact that this will be an edible garden, raised beds will prevent the food from possibly becoming contaminated with the toxins found in much of the Halifax Peninsula's soil (EAC, 2010). New soil will have to be purchased and placed inside the raised beds. This soil will contain at least 20% organic material and compost will be added occasionally both to reduce the bio-availability of contaminants and to provide added nutrients to the crops.

As this will be an edible garden, materials that may contaminate the plants must be avoided. Landscape cloth should be laid on the ground and below the soil and the garden walls should be constructed of non-treated wood or other materials such as stone, cinder blocks, or brick. Though the stonewalls would initially be more expensive they would not need to be replaced as frequently as wooden walls so they may cost less in the long-term.

The garden was designed with accessibility for everyone in mind. Therefore the garden beds were designed to be only 4 ft (1.2 m) wide. This also influences the width of the walking paths as they were designed to be wide enough for a person in a wheelchair while carrying tools.

The design plan accounted for a number of advantageous aesthetics. Curved pathways were used to unite the garden and give the appearance of a larger space. Gravel was chosen as the pathway material as it would be economically viable and easy to maintain. Specimen plants such as aromatic herbs were chosen to highlight specific areas of the garden and deter pests. Two picnic tables and a bench were chosen as seating in the garden design. This would offer visitors a place for relaxation and allow them to fully enjoy the benefits of the garden. Furniture was placed strategically in areas that would receive little sunlight to avoid wasting valuable growing space.

The largest aesthetic obstacle to overcome was determining the placement of the shed and the compost because they are deemed both necessary for the garden but not aesthetically pleasing. Both the shed and compost were placed at the back corner of the garden so they would be out of sight and less noticeable to visitors. The opening of the shed would be to the side of the garden so that a blank wall would be facing the garden's entrance. This would allow for the use of a mural to be painted on the wall that would not only make the shed more appealing but would again give the appearance of a larger garden.

After reviewing different types of irrigation, it was decided that drip irrigation was both the most cost-effective and aesthetically pleasing. Drip irrigation has a higher rate of water conservation and would be more suitable for the raised bed gardens. If there were a substantial number of volunteers who would be willing to water the plants daily, then hand watering would be a cheap and efficient alternative to installing an irrigation system. Further studies on the availability of garden volunteers would need to be conducted to assess hand watering as a feasible alternative.

Rain barrels were deemed to be a feasible water source for the garden. Because rain barrels work most effectively when placed underneath downspouts or gutters, the rain barrel was placed next to the shed in our garden design as the shed's downspouts can be used for rain water collection. A rain barrel is already present on the site and is available for future use.

A list of appropriate plant species based on the local climate was created. These plants were broken up into warm season, cold season and perennial crops to encourage well-planned gardening seasons. Some plants, especially aromatic herbs, can be used as a form of pest control so that pesticides are unnecessary. However, it was determined in the interviews that pests have not been a common problem in the vicinity of Dalhousie campus so no specific pest or weed control measures were incorporated into the final garden design.

Most of the Henry Street plot receives adequate sunlight during the growing season. The areas that do not receive as much sun were designated for use as a seating area, and storage for a shed and a compost bin.

While Aramark expressed interest in purchasing the garden's produce for distribution within the Dalhousie food system, a number of obstacles were encountered. First, the Henry Street plot had been designated for use by all interested gardening groups on campus, restricting the amount of space that could be dedicated to growing food for Aramark. Another major obstacle was the fact that Aramark's contract with Dalhousie was to expire shortly after the completion of this report, making it impossible to determine, at the time of this study, who would be in charge of food services at Dalhousie in the future. Since the Loaded Ladle has recently gained official recognition as a food provider on campus, and is one of the parties interested in operating the garden, it is expected that they will take over the responsibility of distributing their share of produce within the student community.

Chapter 5 - Conclusion

This thorough report details the necessary steps that must be taken when implementing a garden on the Henry Street plot on Dalhousie campus. While this information was generated specifically for this plot, it can be applied to many other urban and campus gardening projects in similar climates. The seven categories that were researched in the literature review clearly outline the necessary aspects that must be taken into consideration prior to the creation of a garden. Raised-bed construction, maintenance and equipment, aesthetics, soil, water, plants, weed and pest control were all examined with regards to the Henry Street plot and recommendations for the implementation of suitable features within these categories were suggested. Further, narrative interviews were conducted with various garden experts whose knowledge aided in forming a better garden design that was more specifically tailored to the Henry Street plot. All pertinent information that was generated within this study was presented in the final design or as recommendations for future studies. This report can be used as a vital resource for future student initiatives who wish to create a garden on the Henry Street plot on Dalhousie campus. Using this report as an example, it is evident that a lot of planning must be done prior to implementation to ensure the long-term success and sustainability of an on-campus food garden.

1. Soil Recommendation

   Soil sampling only costs $40-60 and is provided by the ALS Laboratories in Dartmouth, Nova Scotia (EAC, 2010). Contact information is provided in the Appendix 9.

2. Soil Recommendation
   Landscaping cloth (or a similar material) should be placed between the raised beds and the existing sod on the Henry St. site to avoid having to remove the existing sod.

3. Aesthetic Recommendation

   Ornamental water should be incorporated as it could increase biodiversity and add serenity.

4. Aesthetic Recommendation

   Ornaments would help increase aesthetic beauty.

5. Aesthetic Recommendation

   Arches and trellises should be used, especially since trees and shrubs have yet to be established. This would provide a third dimension to the garden.

6. Cost-benefit analysis

   A cost-benefit analysis would allow for a better understanding of the economic value of the garden.

7. Crop Recommendation

   A diversity of plants should be encouraged to minimize the negative effects of pests and diseases.

8. Volunteer Interest

   Volunteer interest should be assessed to determine whether or not an irrigation system is needed.

Acknowledgements

The authors wish to acknowledge the Environmental Problem Solving team at Dalhousie University: Tarah Wright, Associate Professor for the Environmental Science Program, for her guidance and support throughout this project; Rochelle Owen, Director of the Office of Sustainability, for helping us create our research question for this report; and Rebecca McNeil, graduate student from the School for Resource and Environmental Studies, for her continual encouragement and direction and without her this project would not have been successful.

We give many thanks to our client Rebecca Hoffer, member of the Loaded Ladle at Dalhousie University, for her warm and positive attitude throughout the completion of this report.

The authors gratefully acknowledge Deborah Buszard, Bonnie Neumann, Megan Tardiff-Woolgar, Mike Wilkinson, and Marjorie Wililson who partook in our interviews and provided us with invaluable information in the preparation of this report.

The research for this report would not have been possible without the generosity and GIS data provided by Raymond Jahncke, GIS Analyst at the Geographic Information Systems (GIS) Centre located in the Killam Library at Dalhousie University. We would like to thank our colleague, David Verbeek, for his contributions in the Garden Design of this report. Finally, we thank the Writing Centre at the Killam Libary, for taking the time to edit and provide helpful comments for our final report.

Appendices

Appendix 1 - Written consent form used for interview participants

Written consent form used for interview participants

I, ________________________________, hereby give my consent to be interviewed by the Food Gardens group from the ENVS/SUST 3502 class throughout the duration of this group study. I understand that my participation is entirely voluntary and that I may decline or discontinue at any time before or during the group study. I understand that all information I disclose will be used solely as a reference for this ENVS 3502 group project, and perhaps used as reference for the final group report.

Signature of group study member

____

Date

____

Appendix 2 - Standardized Questions for Participants

1) What is important to keep in mind with regards to aesthetics on Dalhousie University Campus?

   Aesthetics are vital to gaining approval from the University Administration to meet standards of green spaces on campus. Learning about the different specialists' opinions and suggestions with regards to aesthetics will give us a wide variety of options to choose from and we will be able to determine which elements are best for the Henry Street plot.

2) Who do you think should be the actors, supportive actors and should-be actors involved with the campus garden?

   This question exhausts all participants who will have a role in both the development and long term sustainability of the garden. Asking a wide variety of experts will generate an extensive list of possible people that can be involved with the implementation of the campus garden.

3) What are potential functional barriers (ie. Availability of equipment, support from the community, etc.) associated with the Henry Street plot?

   Asking about potential barriers will address and potentially overcome functional issues prior to the implementation of campus garden.

4) Would you be interested in providing any additional support for our project? (ie. volunteering time, providing detailed information, financial aid etc)

   This question allows us to ask for professional assistance in a variety of fields as we can include any possible services or information that the experts provide in our design plan.

5) Can you provide any suggestions for the structures implemented on the campus garden at the Henry Street plot?

   Our research question examines the structural complexities associated with the implementation of a long-term garden on campus. There is no information about the Henry Street plot in literary reviews therefore the knowledge from the interviewees may be more specific to the location.

Appendix 3: Individualized Interview Questions

Appendix 3.1 - Deborah Buszard

Deborah Buszard will not have additional questions.

Appendix 3.2 - Claudette Levy

1) What kind of equipment should be shared throughout the garden and what equipment the individual gardeners themselves should supply?
2) Will 4x4 ft plots be a good size for the needs of the gardeners? (Assuming that this is the most ideal size for plots not alongside a fence)
3) If so, what kind of activities? Do we need to take social functions and spaces into consideration when designing this garden (ie. Walkways, covered socially conducive spaces etc.)
4) Are there any particular structures you think would aid in making the garden more/less appealing?
5) Are there any plants or aesthetic devices that you can recommend to reduce expenses in the future?

Appendix 3.3 – Bonnie Neuman

1) Will this area be used for social activities besides gardening?
2) If so, what kind of activities? Do we need to take social functions and spaces into consideration when designing this garden (ie. Walkways, covered socially conducive spaces etc.)
3) (only if not addresses already) Will having a compost bin at the garden site cause any aesthetic problems that concern the university? How would you suggest dealing with those problems?
4) Are there any particular structures you think would aid in making the garden more/less appealing?

Appendix 3.4 - Mike Wilkinson

1) What kind of equipment should be shared throughout the garden and what equipment the individual gardeners themselves should supply?
2) Should there be hired help to ensure the garden is maintained?

Appendix 3.5 – Marjorie Wilson

1) What kind of equipment should be shared throughout the garden and what equipment the individual gardeners themselves should supply?
2) Will 4x4 ft plots be a good size for the needs of the gardeners? (Assuming that this is the most ideal size for plots not alongside a fence)
3) How would you suggest dealing with the aesthetic problems caused by a compost bin/heap?
4) Are there any particular structures you think would aid in making the garden more/less appealing?

5) What have kind of pest-aversion technology have you found to be the most useful? (ie. A certain kind of pesticide, integrated-pest-management, home-made pesticides)
6) Are there any plants or aesthetic devices that you can recommend to reduce expenses in the future?

Appendix 3.6 – Megan Tardiff-Woolgar

1) What kind of equipment should be shared throughout the garden and what equipment the individual gardeners themselves should supply?
2) Will 4x4 ft plots be a good size for the needs of the gardeners? (Assuming that this is the most ideal size for plots not alongside a fence)
3) Will this area be used for social activities besides gardening?
4) (only if not addresses already) Will having a compost bin at the garden site cause any aesthetic problems that concern the university? How would you suggest dealing with those problems?
5) What have kind of pest-aversion technology have you found to be the most useful? (ie. A certain kind of pesticide, integrated-pest-management, home-made pesticides)
6) Are there any plants or aesthetic devices that you can recommend to reduce expenses in the future?

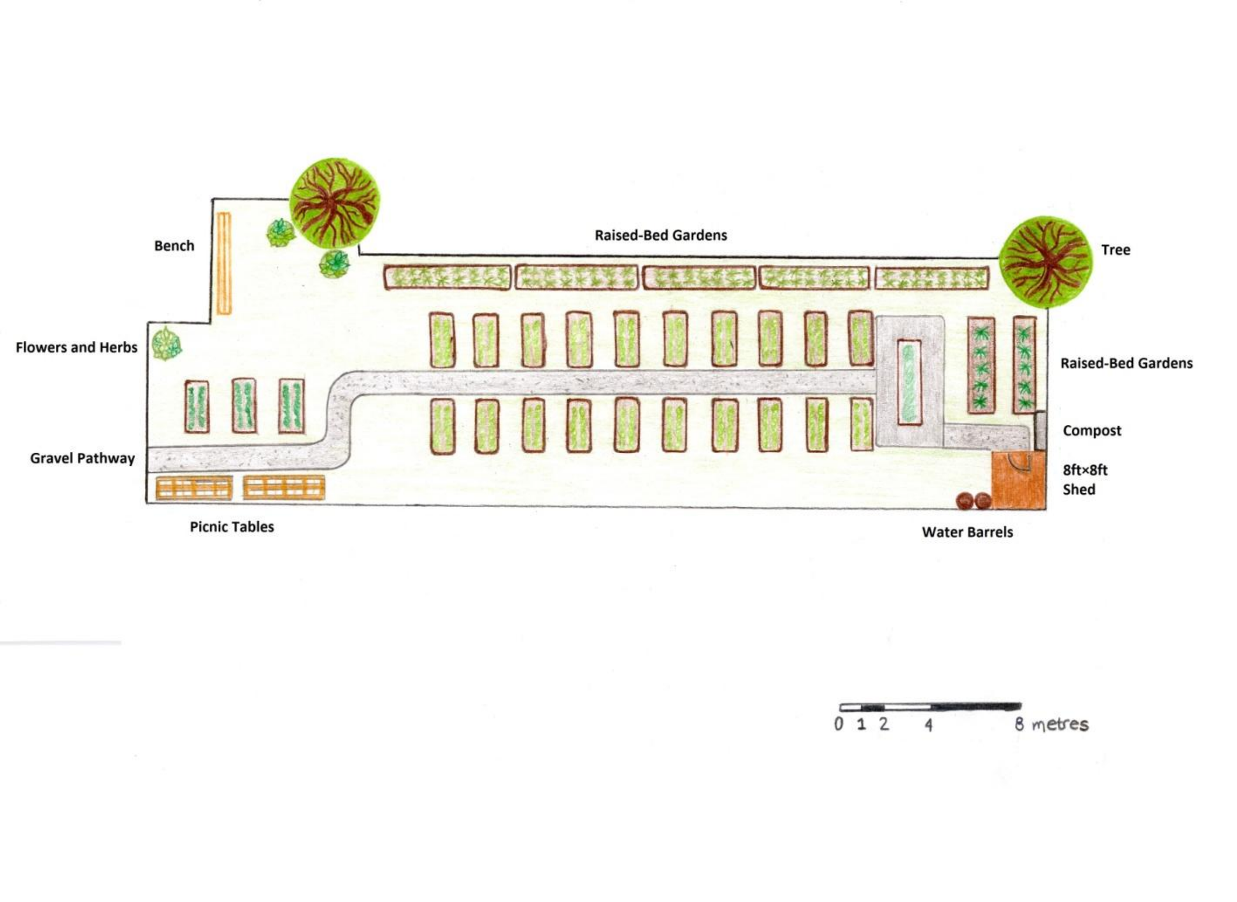
Appendix 4 – Garden Planning Codes and Categories

Raised Bed Construction	1. Raised bed garden 2. Gardening in small spaces 3. Gardening for beginners 4. Raised bed garden construction	Directions and materials needed for construction.
Maintenance and equipment	1. Community garden maintenance 2. Gardening tools 3. Community garden success 4. Community garden failure 5. Raised bed maintenance	Tools, equipment and labour needed for maintenance and associated costs.
Aesthetics	1. Garden design 2. Public garden design	Structures and concepts integral to creating an aesthetically appealing garden
Weed and pest control	1. Nova Scotia garden pests 2. Nova Scotia pest control 3. Pest control 4. Integrated pest management	Species of pests, the impact of these pests and suggestions for pest prevention
Soil	1. Halifax, Nova Scotia soil 2. Raised bed soil 3. Container garden soil 4. Composting	Soil composition necessary for raised bed gardens, amount of soil needed and costs.
Water	1) Irrigation techniques 2) Container garden Irrigation	Possible irrigation structures and viable plants.
Plants	1) Nova Scotia vegetables 2) Nova Scotia herbs 3) Raised bed vegetables 4) Raised bed herbs	Appropriate plant species for the garden

Appendix 5 – Garden Dimensions

Length (m)	Width (m)	Area (m2)
21.07	11.22	236.41
9.31	8.1	75.41
6.5	5.55	36.08
Total Area		347.89

Appendix 6 – Garden Design Plan



Appendix 7 – Tools and Uses

1. Digging fork: helps to get into soil and break it up
2. Digging Spade: digging a garden bed and creating straight edges
3. American shovel: digging holes and piling stuff up
4. Hori Hori: all purpose tool for weeding or creating furrows for planting
5. Hand Trowel: a little shovel for your hand
6. Steel rake: smoothing out the soil before you plant the seeds and for raking out rocks from the garden bed.
7. Leaf rake
8. Hand pruners: cutting stems
9. Scissors: snipping everything from lettuce to twine
10. Scuffle hoe: cuts annual weeds at or just under soil surface when you "scuffle" it back and forth.
11. Scoop shovel: will help you pick up large amounts of loose material such as woodchips or potting soil
12. Wheelbarrow or garden cart: moving around large amounts of soil
13. Soil thermometer: helping to plan when to plant

Soil	Brand	Price
	Davis Specialty Soil and Compost (70% compost and 30% topsoil)	$414.71 (7.65m3)
	Kynock Resources (40% Organic Gardeneing Soil)	$20.30 (per m3) $102.00 delivery
	Kel-Ann Organics (40% Organic Gardening Soil; Peat Moss, Compost and Manure)	$18.73 (per m3) $82.00 delivery
Lumber	Brand	Price
	Kent (Spruce)	2×6= $0.49 (per ft) $55.00 delivery
	Home Depot (Spruce)	2×6= $0.27 (per ft) $55.00 delivery
	Lumber Mart Ltd. (Hemlock)	2×6= $0.58 (per ft) $56.35 delivery
Equipment	Brand	
	Canadian Tire(Suncast Shed with Power Package)	$1199.99 (8ft by 8ft)
	Canadian Tire (Bow Rake)	$10.99
	Canadian Tire (Long-handle Shovel)	$13.99
	Canadian Tire (Home Basics Garden Hoe)	$16.99

Appendix 9 – The Soil Testing Contact Information

ALS Laboratories in Dartmouth, Nova Scotia
(902) 481-0017
(Toll-free) 1- 800-668-9878

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