SUSTAINABLE DESIGN GUIDELINES

Version 1.0

OAKVILLE

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The *Sustainable Design Guidelines* was developed as a joint effort between the Facilities and Construction Management department and the Environmental Policy department. It provides a holistic approach to the design, construction and preventative maintenance of the town's facilities with sustainability as the core principle. Knowledge and use of the *Sustainable Design Guidelines* is **mandatory** for all construction projects at town facilities including new construction, renovations, repairs or maintenance projects. In addition to meeting the requirements of the *Sustainable Design Guidelines*, all new facilities (over 500 m2) must be eligible to achieve Silver certification, at a minimum, under the LEED Canada-NC Version 1.0 Green Building Rating System administered by the Canada Green Building Council.

The *Sustainable Design Guidelines* focus on the appropriate and efficient use of resources — energy, water and materials — in order to reduce the building's environmental impact during its lifecycle. In addition to increased sustainability, a consistent approach to design and construction of the town's facilities will clarify direction and streamline project execution. Through the implementation and continued use of the guidelines the town will:

- Minimize it's ecological footprint
- Achieve sustainable building and community design
- Enhance the town's air and water quality
- Have increased operational efficiency
- Be able to establish and maintain an effective preventative maintenance program
- Achieve greater cost accountability

Section 1.0 of the *Sustainable Design Guidelines* lists general *Design Principles* that govern all decisions with respect to building and building systems. They consider the widespread impact of the building and include guidelines, recommended and required processes and building performance criteria that must be met.

Section 2.0 to 5.0 of the *Sustainable Design Guidelines* provides performance specifications and metrics to be achieved by all buildings – New and Existing – including:

- *Site* design with consideration to landscaping, stormwater management and exterior lighting
- *Building Components* with requirements for building envelope, mechanical and electrical systems, indoor air quality, furniture and fitments and access to daylight and views
- *Specialty Areas and Uses* with requirements for pools, arenas, commercial kitchens, seasonal use buildings, etc.
- And, *Commissioning*

In addition to the sections noted above, the guidelines include *General Instructions to Consultants*, a sample *LEED Scorecard*, the town's *CADD Standard* and the *Sustainable Design*

Guidelines Checklist. The use of the Checklist is **mandatory** and must be filled out be staff managing the project or consultants for all building related construction projects.

The *Sustainable Design Guidelines* supports the town's Green Building Design Procedure EN-GEN-001-003 and the Environmental Sustainability Policy (EN-GEN-001) and was approved by Council on July 12, 2010. A copy of the document is available through the Facilities and Construction Management department or through the town's website under the Links section at the Public Tenders, Bids and Contracts page at: http://www.oakville.ca/vendorinfo.htm

Introduction

The Town of Oakville's new official Plan - Livable Oakville - sets out clear objectives with respect to the environment and seeks to reduce the overall impact of the built environment on human health and the natural environment by:

a) Minimizing the Town's ecological footprint
b) Achieving sustainable building and community design
c) Enhancing the Town's air and water quality

The ***Sustainable Design Guidelines*** *(SDG)* extends this initiative is **mandatory** for the design, construction and preventative maintenance of the Town's facilities with a particular focus on the appropriate and efficient use of resources — energy, water and materials — in order to reduce the building's environmental impact during its lifecycle.

As well as outlining a framework that incorporates sustainability as one of the core principles, the guidelines provide a consistent approach to decision making based on clearly stated performance criteria to be met for various building systems, components and assemblies. Viewed through this lens, the processes involved with new construction, renovations and preventative maintenance are reviewed and implemented within a lifecycle framework resulting in increased reliability, serviceability, operational efficiency, maintainability, safety and cost.

The use of the guidelines by Facilities and Construction Management' staff, facility managers and operators, design consultants, contractors, and other stakeholders will clarify direction and streamline project execution, allowing town staff to deliver and manage construction projects in a more efficient and consistent manner. In general, the *Sustainable Design Guidelines* will be considered in conjunction with LEED requirements for all new construction. A certain degree of flexibility in interpretation will be required when using the SDG for renovations or maintenance projects to existing facilities as there are restrictions imposed by existing conditions and by available funding.

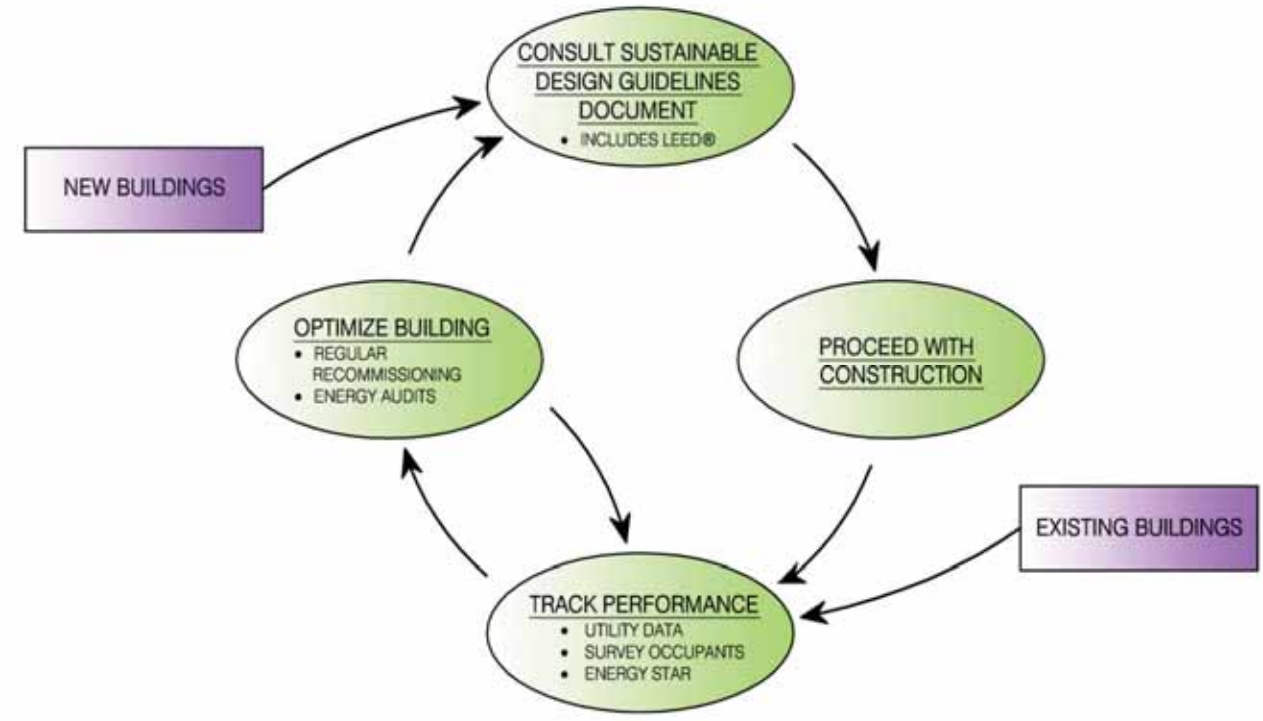
Design consultants must exercise professional judgement and expertise when using these documents. The SDG does not release the consultant from liability or the need for due diligence. When issues arise that are not part of this document, the consultant should consult with Facilities and Construction Management staff in order to determine appropriate measures.

If innovative design solutions are proposed, the consultant must do so in conjunction with the Facilities and Construction Management staff and with consideration of benefits and risks, costing and life cycle analysis.

Intent and Use of the Guidelines

The use of the *Sustainable Design Guidelines* encourages a holistic approach to the design, construction and preventative maintenance of town's facilities. All of a building's systems should be viewed together with consideration to life cycle costing and a pay back period of 5 to 7 years. Life cycle costing takes into account all of the costs associated with a building; including up front capital costs, operating and maintenance costs, and disposal of a building or building systems. As a result, we can compare different building systems that meet the same performance requirements, but which may differ in terms of initial capital cost and operating cost and evaluate them based on the net cost to the town.

The illustration below provides a diagrammatic understanding of the cyclical and holistic intent of the Sustainable Design Guidelines (SDG). Both maintenance and repair to existing buildings and new construction are considered in the model.



The model is predicated on two things: the use of **life cycle costing** as part of the design phase with the analysis of capital expenditure and potential operational savings becoming part of the decision making process and a **preventative maintenance program** that supports and maintains the sustainable intent of the building design by the timely anticipation of remediation work.

Within the model itself there are two key stages: **performance tracking** of the building systems and **optimizing** building systems - both play a key role in extending the life of the building and its systems and should be part of the preventative maintenance program. By including these procedures, remediation work can be accurately identified and performed in a timely manner. In general, a further definition of performance tracking and optimization are outside the scope of the Sustainable Design Standards and will be developed by the Facilities and Construction Management department in a separate document.

Tie into Town's Other Documents

As part of the development of the *Sustainable Design Guidelines*, the working group incorporated best practices from existing strategies developed by the Environmental Policy department. The strategies reviewed are listed below.

a) The *Environmental Sustainability Policy (EN-GEN-001)* was approved by Council in April 2009 and it states that:

   "The Corporation of the Town of Oakville shall promote environmental initiatives advancing Oakville as a sustainable community."

   As such, the Environmental Policy department has partnered with various other town departments to develop procedures to advance environmental sustainability encompassing the core sustainability elements of: living within the limits, understanding the interconnections among environment, culture, society and economy, and equitable distribution of resources and opportunities. The *Sustainable Design Guidelines* is one such initiative.

a) The *Corporate Energy Management Plan* – Provides energy actions and best practices, as well as energy efficiency targets.
b) The *Sustainable Purchasing Handbook* – To ensure compliance when purchasing materials, appliances and equipment.

The Town and LEED

In addition to defining sustainable goals for the Town, Livable Oakville requires that all new municipal buildings over 500 square meters be built to achieve LEED Silver certification under the Canada Green Building Council. Leadership in Energy and Environmental Design (LEED) is a Green Building Rating system developed by the US Green Building Council and adopted by the Canada Green Building Council, that offers a checklist of sustainable performances and targets. A sample scorecard is attached as *Appendix B – LEED Scorecard* with various targets identified as being either *Recommended or Site/Building Specific or Discussion Required* depending on cost-effectiveness, environmental benefit, applicability to various building types, and occupant benefit. The design of all new construction should use the LEED scorecard as a starting point for discussion and design development.

General Instructions to Consultants

As part of the Sustainable Design Guidelines there are specific tasks that a design consultant must consider and include in their scope of work. For a list of requirements, refer to *Appendix A - General Instructions to Consultants*.

Exemptions

All design and construction of Town facilities must comply with the guidelines set forth in the SDG. Exemptions may be appropriate for some project scenarios. Where such exemptions are deemed to be appropriate by the design consultant, he/she must substantiate the exemptions in a formal submission to the Town. The submission must include information as follows:

- Description of project
- Requested exemption and rationale
- Impact on building performance and sustainable design principles
- Impact on construction and operation of the building
- Impact on capital and operating costs

The submission will be reviewed by Facilities and Construction Management and a written acceptance/rejection decision will be provided.

Where an exemption has been granted, the documents of the exemption request and the acceptance must form part of the Project Record and be identified in the Project Close-Out binder under separate tab.

Sustainable Design Guidelines Checklist

Knowledge and use of the *Sustainable Design Guidelines* is **mandatory** for all construction projects at town facilities including new construction, renovations, repairs or maintenance projects. The *Sustainable Design Guidelines Checklist* is intended to assist staff and consultants with the application of the SDG and to ensure that each guideline has been applied as is appropriate. A copy of the Checklist must be completed by staff or consultant (where appropriate) and kept on file by town staff.

Maintaining the Guidelines

The *Sustainable Design Guidelines* will be maintained by the Facilities and Construction Management department in conjunction with the Environmental Policy department. The guidelines will continue to be updated on an as-need basis and be maintained as a living document. The date of issue and revision is noted in the footer.

As the construction industry continues to learn from its best practices in relation to the concept of sustainability, the guidelines will be reinforced through updates concerning lessons learned from these best practices. This will allow the guidelines to become an intrinsic part of the design and specification of buildings. In addition, the SDG will be reviewed every three years to ensure it continues to reflect the town's requirements.

Authorship

The *Sustainable Design Guidelines* was created jointly by the Facilities and Construction Management and Environmental Policy departments along with a working group comprised of representation from the following departments within the town:

- Facilities and Construction Management
- Environmental Policy
- Parks and Open Space
- Recreation and Culture
- Fire
- Engineering and Construction
- Roads and Works
- And, Planning

We thank the following consulting team members for their contribution to the Sustainable Design Guidelines: Betty Chee of Ng Chee Architects; Braden Kurczak and David Rekker of Enermodal Engineering; Paul DiProfio and John Richard of STLA Design Strategies.

1.0 Design Principles

The underlying principle of the *Sustainable Design Guidelines* is to approach building design with a broad concern for sustainability. The aim is to: a.) decrease energy consumption; b.) minimize the generation of pollutants that affect our air, water, and night sky; and c.) improve our co-habitation with the natural environment while leaving the smallest of ecological footprint.

As such, the design principles described in the following sections consider the widespread impact of a building and building systems with a focus on energy use, air quality for occupants, the local environment, and global impacts.

The section *Design Principles* describes eight areas to help project teams incorporate holistic and sustainable design principles:

1.1 General
1.2 Occupant Health and Comfort
1.3 Carbon Impact
1.4 Alternative Energy Sources
1.5 Material Impact
1.6 Waste Stream Impact
1.7 Building Performance
1.8 Performance Benchmarking

1.1 General

In addition to concerns with sustainability and the environmental impact of the town's buildings, there are **general** design principles that must also be adhered to and included in the design and construction of all of the town's facilities.

A. Accessibility

- All building projects must be designed for accessibility and ease of access as provided in the town's *Guidelines for the Design of Accessible Facilities* (GDAF) and following the principles of universal design. In addition, consideration must be given to all applicable laws and where a conflict arises between the GDAF and applicable law arises, the accommodation that is the most exacting should be followed.
- Knowledge, understanding and use of the GDAF is mandatory for all staff as well as consultants and contractors. Consultants are required to submit to the town project coordinators the *Accessibility Checklist* (GDAF - Appendix B) at the end of the design phase to ensure all relevant requirements are incorporated into the building design.
- If a conflict should arise between accessibility and sustainable design issues, staff and / or consultant to discuss all relevant concerns with the accessibility coordinator (Facilities and Construction Management) with final approval to be provided by the Facilities and Construction Management department.

B. Security

- In **Existing Buildings** where electronic security measures are in place, ensure level of integration for renovation projects is coordinated with town project manager.
- Ensure new outdoor ancillary areas such as bicycle storage or recycling areas are located in a safe and secure environment. Ensure coordination of surveillance equipment and proper illumination.

C. Safety

- In the design and construction of Town facilities, care must be taken to ensure the following:
    - Health and safety of the public
    - Health and safety of the occupants
    - During construction, that construction site safety standards are met
    - That all municipal, provincial and federal fire and life safety requirements are met
    - And, that all reasonable measures have been taken to limit the risk and liability of the Town.
- Consultant to ensure that construction documents adequately address each of the items listed above.

D. Durability

- Provide adequate clearances around equipment and workspaces to avoid unnecessary damage to equipment, fixtures, furniture and enclosing walls and ceilings during the course of everyday use.
- Configuration of interior spaces should allow for flexibility of use and occupancy for the life of the building.
- Ensure selection of appropriate materials and colours to avoid unnecessary replacement prior to material's end-of-life.
- Design structure, building envelope, and major building components for long term life expectancy.
- Provide sufficient access to building systems to ensure regular service and maintenance can be performed.
- In selecting exterior wall finish, ensure impact resistant and vandalism proof measures are in place from grade to 3.65m (12'-0") above grade.

E. Building Use

- While using the information provided in this document, keep in mind the use and program of each building, e.g. Theatre, Recreation Centre. The differences in their use will demand different types and levels of finish.
- Final building component selection will be dependent on the program requirement of the facility and must be approved by the Town's Project Manager.
- Material selection should be appropriate to the use.

F. Flexibility and Adaptability

- Where possible, design for reasonable expansion of building systems (electrical load, mechanical, controls, etc) in order to minimize future interruption of service.
- Where components and assemblies may require replacement or have a shorter service life than that of the building, ensure that the design of these components and assemblies can be readily replaced without significant modification and repair to the base building.

G. Heritage Concerns

- The Town of Oakville owns a number of buildings that have heritage designation. Prior to design, confirm possible heritage status and ensure that all heritage concerns are addressed in the design and approved by the Heritage Planning Committee.
- Additions or repairs to town buildings with historical and/or architectural significance must be designed with the view to preserve and enhance the distinctive nature and character of the building.
- Where conflict arises between heritage issues, sustainable approaches and/or accessibility issues, design consultant will provide the required expertise to resolve the

issues to the satisfaction of the Heritage Planning Committee and the Town. Similar to the exemptions process, application for review must be made to the Facilities and Construction Management department.

H. Communications and Data

- For all project telecommunication and data requirement, refer to the town's Information Systems and Solutions department (IS & S) for coordination and/or installation.
- Ensure that contract documents meet the requirements of the IS & S communications standards documents listed below:
  - Oakville Systemax Wiring Spec 2010- ver 3.
  - CCTV Standards for Town of Oakville
- Copies of these documents are available through the Facilities and Construction Management department.

1.2 Occupant Health and Comfort

This section focuses on providing a safe, comfortable, and healthy indoor environment for building occupants. In order to achieve the principle of occupant health and comfort, the following approaches are recommended.

1. Design building ventilation systems according to the ventilation rate procedure outlined in the most recent version of the ASHRAE 62.1 standard. (see section *3.4 Ventilation and Exhaust*)
2. Provide indoor spaces that are thermally comfortable i.e., meet human comfort conditions for temperature and humidity, as outlined by the most recent version of ASHRAE 55. (see sections *3.5 Heating and 3.6 Cooling*)
3. Locate building air intakes away from exhaust ports or areas where ventilation air contamination may occur (e.g. near idling cars, emergency generators, etc.).
4. Provide daylight to interior spaces:
    - **In New Buildings**, a 40% window to wall ratio will provide the optimum amount of daylight to the space, without compromising the building's energy performance. In the design, consider that floor to ceiling windows provide no more daylight to an area than do windows of a similar height with a 900 mm sill and that a window's daylight penetration is a roughly twice its height.
    - Apply 40% window to wall ratio to **Existing Buildings** where additions and renovations include significant change to exterior walls.
    - Ensure proper glare controls are included in the design and be aware that light coloured surfaces, below eye level (e.g. white desk tops) will reflect light upwards.
5. Provide views to the outdoors, at eye level:
    - Ensure views to landscaping.
    - Consider installing vegetated roofs in areas where people will be able to see or access roof-tops.
    - Consider occupant concerns when installing highly reflective roofing materials on areas where people may be forced to look for prolonged periods.
6. Select interior finishes that contain low levels of volatile organic compounds (VOCs). These include: paints, coatings, adhesives, sealants, carpet and furniture.

1.3 Carbon Impact

Buildings account for 25% of the total national greenhouse gas (GHG) emissions in Canada. The largest savings in energy use occur for new buildings, through designing and operating buildings as complete systems. Incorporating green and sustainable building design contributes to long-term reductions in GHG emissions and provides mitigation methods for carbon impacts. The *Sustainable Design Guidelines* aim to reduce the GHG produced by the construction and maintenance of the town's building portfolio through the application of green and sustainable design and construction.

1.4 Alternative Energy Sources

As addition to employing sustainable and green construction practices during the design and construction of town facilities, the use of alternative energy sources can also reduce the building's carbon footprint.

For New Construction,
Consider the use of alternative energy sources where such opportunities are available. Discuss with Facilities and Construction Management department and the town's design team at the early stages of the project.

For Existing Building,
Where energy efficiency strategies have been employed, discuss with project team whether the use of alternate energy sources is an option for the project.

1. Purchase green power offsets for building energy use. This increases the amount of available green energy on the grid (thereby displacing the need for high-emitting energy sources).
2. Install a Renewable Energy Technology System (RETs) on-site to produce green power.
    - Photovoltaic power produces electric energy from the sun. This can be sold back to the power grid (currently at a significant premium). Photovoltaic panels require an unobstructed southerly exposure.
    - Wind power produces electric energy from the wind. This power can be sold back to the grid. Wind energy systems require a constant wind at a minimum speed to be effective. Be cognisant of the optics, or the risk of "greenwash", for building mounted wind energy systems.
    - Solar Thermal systems can be used to heat water or air to supplement, or replace, traditional heating systems.
        - Solar hot water systems realize acceptable paybacks when hot water loads are significant (e.g., pools, residential buildings).
        - Solar air heating systems can provide significant benefits to industrial style buildings and processes.

1.5 Material Impact

This section focuses on reducing the impact of building materials and the construction process on the natural environment. The following approaches should be used:

1. Re-use existing buildings and building structures whenever feasible. In all cases, consider re-cladding to bring building's energy use up to high performance standards as detailed in section *1.7 Building Performance*
2. Where possible, specify locally sourced (extracted and manufactured) materials to reduce the carbon impact of materials transportation.
3. Specify building components that contain high levels of recycled content to eliminate the need to extract raw materials from the natural environment.
4. Where possible, specify building materials certified under a 3rd party system that promotes sustainable harvesting or manufacturing practices (e.g. Forest Stewardship Council).
5. Design and construct buildings that are intended to last 50 years, or more.
    - Ensure building components provide sufficient service lives to support a long building life.
    - Ensure building enclosures are air and water tight through good design controls, as well as on-site inspections and reviews.

1.6 Waste-Stream Impact

This section focuses on minimizing the impact a building has on the waste stream, both during construction as well as during its operation. The following approaches should be adopted.

1. In design, include sufficient and designated area in each building for the collection of:
   - Recyclable materials (cans, bottles, paper, etc.)
   - Compostable / organic materials (with the exception of Parks buildings due to concerns with pests)
   - General waste

2. During construction, divert construction waste from landfill. Tender documents must clearly state the responsibilities of the contractor to:

   For New Construction:
   1. Identify non-landfill receiving facilities for various types of waste:
      - Concrete
      - Asphalt
      - Drywall
      - Masonry
      - Wood
      - Carpet
   2. Separate waste on-site and send it to specific receiving facilities (e.g. concrete and wood in separate bins)
   3. If necessary, contract a waste hauler who is able to provide off-site sorting of waste products from construction.
   4. Contractor to target a diversion rate of 100% and take responsibility for tracking and documenting diversion rates. If 100% is not possible, contractor to notify Town and provide reason to the satisfaction of the Town.

   For Existing Buildings contractor is to:
   1. Separate waste on-site and send it to specific receiving facilities (e.g. concrete and wood in separate bins)
   2. If necessary, contract a waste hauler who is able to provide off-site sorting of waste products from construction.
   3. Maximize waste diversion rate based on the requirements above. Contractor to take responsibility for tracking and documenting diversion rates.
   4. Prior to demolition, contractor to investigate sale of existing structure to building salvager and relocation companies.

1.7 Building Performance

In order to achieve the goals targeted in the *Sustainable Design Guidelines*, new and existing building stock must be designed and maintained to reduce their impact on the environment. As such, establishing clear building performance and benchmarking criteria is a requirement.

Guideline:

For New Buildings: Achieve a building energy consumption intensity – measured in kwh/m2 and m3/m2 – that is at least 40% below the average for that building type (as established through EnergyStar™).

For Existing Buildings: Where possible, reduce building energy consumption measured in kwh/m2 and m3/m2 after each renovation or retrofit compared against the EnergyStar™ rating for that facility and within the Town's own building stock. (See section *1.8 Performance Benchmarking* below.)

Approach:

For New Buildings

1. Utilize an energy model to develop a design strategy that will achieve a 30% energy consumption savings, relative to current codes (most recent version of ASHRAE 90.1). This is a targeted estimate, based on an energy model which includes a number of assumptions related to building operation and components. A building designed to code typically performs 15% better than the average building. Therefore, by designing a building to be 30% more efficient than a code building, a 40% savings over an average building should be achieved. (A 40% "real life" savings can only be ascertained by comparing real-life building data (i.e., utility bills), to standardized data sets.)
2. Design projects to achieve a minimum certification of Silver under the most recent version of LEED® Canada for that project type.
3. Engage a building energy specialist and building commissioning agent from early design stages to provide enhanced services geared toward optimizing building energy use.
4. Include energy end-use monitoring, measurement and analysis in each building to help optimize building operations including the capability to measure and track building performance and occupant comfort.

For Existing Buildings

1. Analyze building performance data collected by town staff regarding building energy consumption to determine if building is performing as intended, and expected.(Refer to *1.8 Performance Benchmarking* section below)
2. Where possible, improve building performance with every planned renovation giving consideration to energy management goals described in the Design Principles.

1.8 Performance Benchmarking

Although the measures described below are not strictly part of the *Sustainable Design Guidelines*, they are highlighted in this section in order to ensure that designers are aware of the measures that are currently undertaken by staff, or that will be implemented shortly through the Facilities and Construction Management and Environmental Policy departments, in order to ensure that the Town's buildings are working at optimal conditions. All designs should make use of this data in order to improve building performance with every planned renovation.

Guideline:
Ensure Town's buildings are operating within their optimal range and as expected.

Note: The approach described below is intended for Town staff and is part of the corporate Energy Management Plan.

Approach:

For Existing Buildings

1. Analyze building performance data contained in the Building Worksheets as administered by the Facilities and Construction Management department. See *Appendix C – Building Worksheets.*
2. Incorporate regularly scheduled occupant surveys and re-commissioning into the standard maintenance schedule.
3. Establish performance benchmarking of each building as compared against EnergyStar™ and within the Town's own building stock.
4. Obtain an EnergyStar™ rating[1] for all buildings that have been operating for more than 1 year. Use this information to ascertain which buildings will afford the greatest opportunity for operational savings.

[1] https://natural-resources.canada.ca/energy-efficiency/energy-star/buildings/energy-star-scores

2.0 Site

In order to effectively reduce the overall impact of the built environment on the natural environment, it is necessary to first consider a building's siting, both in terms of its location as well as on the site itself. Within a broader context, sustainable development looks to maintain as much open space as possible within communities through the selection of previously developed land, the re-use of brownfield sites, and retrofitting of existing buildings as well as locating buildings in areas of existing development where infrastructure already exists. For a detailed list of requirements regarding site choice refer to *Appendix B – LEED Score Card.*

Within the microclimate of the site, the placement of a building affects a wide range of environmental factors: energy consumption, daylighting, views, landscaping requirements (both hard and soft), reduction of heat island effect, stormwater management, erosion and sediment control and habitat preservation. For a detailed list of requirements regarding building siting, refer to section *3.1 Building Massing and Orientation.*

In addition to site specific criteria, site selection and building siting should incorporate transportation solutions that consider the need for bicycle parking, carpool staging, and the proximity to public transit.

The section *Site* describes four areas to help project teams incorporate holistic and sustainable design principles:

2.1 Landscaping – Hard
2.2 Landscaping – Soft
2.3 Exterior Lighting
2.4 Stormwater Management

2.1 Landscaping - Hard

Guideline:
Balance the functional requirements of vehicular and pedestrian circulation with accessibility, maintenance and aesthetic criteria / issues.

Approach:

1. **Parking in general**
    1. Size parking facilities to meet but not exceed town's zoning requirements. Ensure appropriate accessibility standards are followed for parking in accordance with the town's 2008 *Guidelines for Design of Accessible Facilities*. As well, consider use and type of building when determining number of parking spaces required.
    2. As an alternate to surface parking, consider underground / covered parking / parking integrated into built form as it:
        - Reduces the exterior paved surface area used by parking lots.
        - Minimizes the negative visual affect of surface parking facilities as the defining element of the site.
        - Can elevate the design of the parking facility to better integrate with the surrounding context through appropriate architectural treatment.
        - Enables more comfortable (weather protection) and secure environments for users.
    3. When designing parking areas consider the inclusion of reserved or dedicated parking spaces for carpooling and hybrid/alternative fuel vehicles.

2. **Parking siting and layout considerations**
    1. Locate surface parking to the rear of buildings , away from primary street frontages and intersections. Parking along the sides of buildings may be considered if appropriate buffering is integrated along primary streets.
    2. Parking should not be situated between the street edge and the building façade.
    3. Where possible, consider on-street parking in order to reduce parking lot capacity requirements.
    4. If possible, avoid expansive parking lots by dividing into smaller parking areas, allowing for consolidated planting areas, greater pedestrian comfort and safety, and minimizing the visual impact of the facility.
    5. Minimize the length of continuous parking rows by including breaks (planted islands). Ensure proper tree canopy coverage while maintaining safe pedestrian connections.
    6. Ensure adequate soil conditions and volumes are available to support proposed vegetation.
    7. In accordance with the *2008 Guidelines for Design of Accessible Facilities*, locate and provide accessible parking spaces. Ensure a clear and accessible path of travel from

parking to front entrance and any other accessible entrances. Maximum distance for path of travel to be 30 meters.

8. Integrate bicycle parking elements into the design and layout of the parking facility. Ensure these elements are sited as primary components of the design with convenient access to adjacent building entrances, within well lit areas that have options for weather protection. Allow for both short and long term bike parking. See section *4.5 Bikes and Showers.*
9. Ensure adequate areas for snow storage are integrated into the parking lot layout. Note that planted areas are discouraged for use as snow storage due to the potentially damaging impacts to vegetation caused by salt content.
10. A French drain or river rock/granular system integrated with the parking layout may be considered within constrained sites to accommodate snow storage and melt water infiltration.

3. Surface paving considerations

1. Provide permeable or porous paving materials (open joint pavers, porous concrete or asphalt and/or pre-cast turf-grid products) where appropriate and as approved by the town's Landscape department. Ensure proper sub-base is specified for permeable paving to allow adequate infiltration/drainage and avoid frost heave situations.
2. The installation of perforated sub-drains below permeable paving may be required to store, filter or direct water to bio-retention areas, vegetated spaces or other stormwater facilities. Refer to section *2.4 B Quantity and Quality Controls* for additional guidelines on drainage technologies.
3. Provide permeable or porous paving materials at snow storage areas in order to absorb snow melt on site.
4. Specify surface materials that contain recycled or sustainable materials, such as higher percentages of recycled asphalt pavement (RAP) in asphalt mixes or supplementary cementing materials (SCM) in concrete mixes.
5. Specify high albedo surface materials, such as concrete, light coloured asphalt or unit pavers, to decrease heat absorption and ambient surface temperatures (urban heat island effect). Light coloured surface paving should have an SRI of at least 29 and/or a USEPA Energy Star labelling requirement.
6. All paving materials and installation to be selected and designed to withstand traffic impacts and maintenance requirements.
7. Changes in paving colour and texture may be considered to delineate pedestrian crossings, entrance areas, loading areas, dedicated parking areas (accessible, carpool), bike storage, etc.

4. Walkways

1. Establish direct, continuous pedestrian linkages that are comfortable, safe and convenient, with connections to building entrances, adjacent sidewalks, transit

stops, parking spaces and outlying local services, including shops, parks, schools, etc. Width of walkways as follows:
    - General walkways - minimum 5' (1.5 metres)
    - Walkways providing maintenance access to site – minimum 10' (3 metres)
2. Provide a direct and accessible pedestrian path of travel between building entrance and sidewalk that is uninterrupted by driveways, parking or other impediments.
3. Ensure a clear and accessible path of travel from the street with appropriate crosswalk and curb cuts.
4. As with paving materials related to surface parking, specify light coloured paving materials, the use of sustainable or recycled materials (RAP in asphalt mixes / SCM's in concrete mixes) and permeable materials, as appropriate.
5. Walkways intended to be the accessible path of travel must adhere to the finishes required by the *2008 Guideline for Design of Accessible Facilities* with respect to colour, glare, texture and opening. Include wayfinding by incorporating colour contrast and different types of surface finish.
6. Walkways should be emphasized as the priority designation within any setting that combines vehicular use with pedestrians to ensure the safety and comfort of users.
7. Where possible, shade trees should be installed along walkways to enhance pedestrian comfort, reduce surface temperatures and help buffer walkways from vehicular travel.
8. Accessibility and universal design principles should be considered when designing walkways. Should a conflict occurs between sustainability and accessibility, consult with the Facilities and Construction Management department for direction.

5. Community Spaces

1. Community spaces should be designed and landscaped to provide wind protection and shade or sun as the season requires.
2. Landscape features such as berms, tree and shrub groupings, green walls should be considered to screen noise and views to adjacent or nearby uses (traffic, trains, buildings) and on-site service areas (loading docks).
3. For lighting considerations, see section *2.3 Exterior Lighting*.
4. Design should emphasize comfortable, secure pedestrian use and connections with consideration to both safety and accessibility concerns.

2.2 Landscaping – Soft

Guideline:
Achieve a balance with regards to preserving and enhancing the vegetated environment through ecological sustainability and urban tree canopy while meeting aesthetic requirements with regards to the appearance and function of place and with consideration for maintenance.

Approach:

1. General Landscape Design Considerations

1. Plant trees an appropriate distance from hard surface treatments (driveways, sidewalks, curbs, retaining walls, etc.) to allow for adequate root growth and buffering from snow piling, salt, compact soils and impermeable surfaces.
3. If possible, expand the rooting zone for trees under adjacent paved surfaces such as sidewalks through the use of techniques that may include structural soils, soil cells, continuous soil trenching, etc.
4. Introduced planting should be contiguous with existing green space where possible and appropriate.
5. Landscape planting strategy should work with the site's micro-climate and form to reduce the building's HVAC requirements:
    - Plant and strategically place deciduous trees to let sunlight and warmth into buildings and public open spaces during winter. In the summer create a canopy that shields people and buildings from sun, glare and heat, while also allowing breezes to flow through. This decreases the requirement for air conditioning and energy use.
    - Green screens and other landscape features should be situated on and near building facades to reduce ambient heat and reduce the amount of air conditioning required.
    - To mitigate the impact of wind on a site, evergreens can be used as a windscreen for undesirable wind exposures.

2. Plant Selection

1. Provide a suitable minimum soil volume, such as 30 cu.m. for each tree, to ensure long-term tree growth and survival. Topsoil/planting soil should be of good quality suitable to the growth of selected trees and vegetation, with a minimum depth of:
    - 0.9m for tree planting areas
    - 0.750m depth for non-tree planting areas (shrub)
    - 0.300m depth for basic topsoil depth for all park areas
    - Consideration for trees with tap roots may require greater depths of soil.

   This is applicable to grass boulevard street tree planting, as well. Refer to *Appendix G – Topsoil Requirement Matrix* for more detail.

2. The planting of native species should be emphasized, particularly adjacent to natural heritage systems (valleylands, woodlots, wetlands). A list of native plant species can be referenced from the Halton region website (www.halton.ca) including trees, shrubs, grasses and groundcover. The website also provides recommendations regarding context and growing conditions (suitability for parking lots, grass boulevards, tree grates, bio-swales, etc.)
3. Planting (trees and shrubs) shall comprise hardy species tolerant of urban conditions (pollution/salt/drought tolerant, compacted soils).
4. No planting of invasive species on properties or streets adjacent to a natural heritage system (valleylands, woodlands, wetlands) or parks. A list of potential invasive species is referenced on the Halton region website.
5. Consult with the town's Landscape department and adhere to size recommendations and minimums established by the town with respect to trees, shrubs and groundcover.
6. Avoid planting monocultures which can be vulnerable to diseases.
7. Integrate a variety of deciduous and coniferous trees and shrubs for year round interest, seasonal variation, texture and shape.
8. Use only organic or biological fertilizers and weed and pest control products without potentially toxic contaminants as per current Ontario legislation.

3. Irrigation

1. Where possible utilize xeriscape planting techniques, selecting drought-tolerant plant species to conserve water. The first preference is to avoid the requirement for irrigation systems.
2. Consider landscape alternatives to large expanses of turf (sod) requiring intensive maintenance and watering.
3. If irrigation is required (general planting), consider using non-potable sources (roof, parking lot, grey water).
4. If landscape irrigation is desired or required, consider using an efficient drip irrigation system connected to a non-potable source (roof, parking lot, grey-water) in combination with existing centralized irrigation control systems.
5. Prior to design and implementation, items 3 and 4 will need to be discussed in detail with the Landscape and Facilities and Construction Management departments.

4. Canopy

1. One of Livable Oakville's goal is to achieve a sustainable tree canopy coverage of 40%, through the protection of existing trees and the proper planting of new trees.
2. Native tree species shall comprise a substantial component of the new urban forest canopy.
3. All street trees located on municipally owned property are protected by the by-laws below:

- By-law 2009-025 - authorizes and regulates the planting, care, maintenance and removal of trees on town property and ensuring the sustainability of the urban forest.
- By-law 2003-021 - regulates site alterations within the town of Oakville. (Amendment 2008-124)
- By-law 1999-159 - prescribes rules and regulations for parks within the town of Oakville. (Amendment 2005-197)

4. Reference and follow the requirements of the town policy and procedure regarding tree protection:
   - Tree Protection Policy EN-TRE-001
   - Tree Protection During Construction Procedure EN-TRE-001-001

5. Existing Vegetation

1. Preserve, protect and enhance the urban forest by protecting trees within natural areas (ravines), parks and street right-of-ways.
2. Adhere to all town of Oakville tree retention and protection guidelines during construction and demolition stages.
3. Where possible, protect and integrate significant or sensitive existing vegetated areas, particularly within valley or slope environments to retain soil structure.
4. Retain good quality native soil on site and enhance, if required, with locally sourced soil of equal or better quality.

6. Land & Habitat Conservation

1. Restore and enhance components of the natural heritage system where adjacent to development sites.
2. Plant selection strategies should synergize with habitat conservation.
3. Generally prohibit development that will adversely affect designated parkland, natural open space areas and sensitive environments associated with the natural heritage system.

2.3 Exterior Lighting

Guideline:
Achieve a balance between sustainability, safety, security, aesthetics and achieve an overall reduction in energy consumption in exterior lighting.

Approach:

1. Select lighting poles, luminaires and levels that are appropriate to the site and function to avoid over lighting and light pollution.
2. Use energy efficient luminaires and bulbs.
3. Encourage 'night sky' compliance as a component of sustainable design.
4. Prevent or eliminate light trespass from buildings and sites onto adjoining properties by selecting fixtures that are full cut-off (e.g. "Dark Sky Compliant") to eliminate up-lighting and spillage onto neighbouring properties.
5. Design to requirements of the *New Sports Field Lighting Standard By-law 2010-070.*
6. Design site Lighting Power Density to meet LEED standards for Light Pollution Reduction (based on the most current version of ASHRAE 90.1). IESNA studies show that security concerns exist most often on sites with high contrast lighting, as opposed to uniform low levels of lighting.
    - 80% of ASHRAE for Tradable Spaces (e.g. Parking Lots)
    - 50% of ASHRAE for Non-Tradable Spaces (e.g. Building Facades)
7. Provide automated controls (e.g. timer, photo-cell, BAS) to shut off exterior fixtures when building is not in use, while balancing issues of security and safety.
8. Accessibility and universal design principles should be considered when designing site lighting. Refer to *2008 Guideline for Design of Accessible Facilities*. When a conflict occurs between sustainability and accessibility, consult with the Facilities and Construction Management department for direction.
9. Consider minimum security requirements. For example, a building facade may require some lighting, but a parking lot might not. This needs to be discussed with the facility manager as well as the Facilities and Construction Management department as part of the design phase.

2.4 Stormwater Management

The intention of on-site stormwater management is to minimize the amount of stormwater that leaves the site as an "end of pipe" solution through rainwater harvesting, quantity and quality controls and erosion and sediment control measures.

A. Rainwater Harvesting

Guideline:

Where possible, divert rainwater away from a previously connected sewer line. These techniques allow the water to be used for planting and groundwater recharge and reduces outflow to overcharged sewage and storm system.

Approach:

1. Roof

1. Where appropriate, disconnect roof downspout from the sewer system in order that water is managed on site, whether through a storage device, permeable surface or infiltrations system. Ensure water is properly managed on site as to prevent standing water at the base of wall, at trafficable surfaces such as walkway and driveway and to prevent possible damage to building foundations. In all cases, water must be directed away from building face. This option must be discussed and reviewed in detail with the Facilities and Construction Management department.
2. Where appropriate, consideration should be given to soakaway pits, whereby the roof downspout is connected to an underground pit lined with gravel or coarse aggregate, temporarily storing the water until it is absorbed into the surrounding ground.
3. Similar to soakaway pits, infiltration trenches directs water to an at-grade trench filled with aggregate material, where it is held until it infiltrates into the ground.
4. Depending on the built form type, rain barrels, cysterns or underground storage may also be considered to manage roof run-off.

2. Parking Lots and Expansive Paved Areas (Bio-retention Swales)

1. Where applicable, consideration should be given to integrating bio-retention swales.
2. Bio-retention swales are one of the most common and effective techniques for managing stormwater within expansive areas of runoff. These include swales, vegetated islands, rain gardens.
3. Only planting species tolerant of extreme conditions such as flooding, salt and other contaminants should be selected for bio-retention swale applications.
4. Planting of trees should be above grade from ponding limit and clear of stormwater flow.

5. Composition of swale components should be designed to ensure surface water is fully drained within 48 hours of the end of any rainfall event.
6. A french drain or river rock/granular system integrated with the parking layout may be considered to accommodate snow storage and melt water infiltration within constrained sites where swales are not feasible.

B. Quantity and Quality Controls

Guideline:
Manage rainwater and snowmelt on site with measures that encourage infiltration, evapotranspiration and water re-use.

Approach:

1. Except for parking areas, use permeable paving for hard surface areas, particularly in locations that experience high runoff volumes. This must be discussed with town staff for approval.
2. Utilize soft landscape areas, including the planting of trees, shrubs and groundcover, adjacent to overland flow areas to provide opportunities for water uptake and evapotranspiration.
3. Undertake soil amendments by increasing topsoil depths and restructuring compacted soils for improved infiltration.
4. Decrease the rate and quantity of stormwater runoff with consideration for implementing a stormwater management plan that meets or exceeds LEED standards.
5. Where possible, retain the equivalent annual volume of overland runoff allowable under pre-development conditions for small design rainfall events through rainwater storage/re-use, infiltration and evapotranspiration.

C. Erosion and Sedimentation Control

Guideline:
Provide measures to prevent erosion, both during the construction phase and in the long-term after construction is completed.

Approach:

1. **Temporary Erosion Measures (During Construction):**
    1. Develop a temporary **Erosion and Sedimentation Control Plan** to be implemented by general contractor. Plan to address the following measures (as applicable):
        - A statement of erosion control and stormwater management objectives.
        - Contain exterior area required for construction access

- Contain and minimize air borne dust and pollutants created by construction activities.
- Preserve and protect vegetation associated with potential erosion prone areas.
- Include the necessary technologies for controlling erosion and sedimentation depending on soil composition and site issues.
- Provide other measures as required for LEED Silver certification.

2. Requirement is typical for all construction projects that include a site development component.

2. Permanent Erosion Measures:

1. Avoid extensive grading and earth works in areas prone to erosion issues.
2. If drainage regime will alter an otherwise stable slope environment, enact an aggressive planting program that will provide the necessary stabilization with native, non-invasive species suitable for erosion control.
3. The Erosion and Sedimentation Control Plan should also include the type and frequency of maintenance activities required for the types of erosion control facilities employed on the site.

2. Technologies

1. Listed below are some methods and technologies used to control erosion and sedimentation. For more detail reference the current LEED manual:
   - Provide temporary seeding where fast growing grasses are planted to temporarily stabilize soils.
   - Provide permanent seeding where grasses along with trees and shrubs are planted to permanently stabilize soils.
   - Add mulching of slopes with hay, grass, woodchips, straw or gravel to cover and stabilize soils.
   - Provide earth dike construction consisting of mounds of stabilized soil to divert surface runoff volumes from disturbed areas or into sediment basins / sediment traps.
   - Provide silt fencing where filter fabric is used to remove sediment from stormwater volumes flowing through the fence.
   - Include sediment traps in which excavated ponds or earthen embankments are constructed to collect sediment from stormwater volumes.
   - Include sediment basins or ponds with a controlled water release system to allow for settling of sediment from stormwater volumes.

3.0 Building Components

Sustainable building design is an integrated synergistic approach that considers all phases of the facility's life cycle. The performance of all building components are considered to be connected and looked at holistically with a view to improving energy conservation while achieving a balance in cost and environmental benefits. The section *3.0 Building Components* provides performance specifications to ensure that building performance is optimized from cradle to grave with consideration to the following principles:

- Optimize building siting within microclimate of site as well as within the broader context of the community/ecosystem.
- Optimize building envelope performance to reduce heating and cooling loads.
- Optimize and reduce energy use through the separation of Heating, Ventilation, and Air Conditioning (HVAC) systems.
- Protect and conserve water by minimizing the demand and use of potable water.
- Optimize operations and maintenance through the use of controls and monitoring.
- Optimize access to daylight and views for the most number of building occupants
- Consider material selections with respect to environmental impacts (e.g. sustainably harvested, recycled content, etc.).
- Choose materials and building systems with consideration to indoor air quality.

In addition to concerns with respect to sustainability, building components should address issues of durability, accessibility, flexibility, and suitability for the intended building use.

The section *Building Components* describes thirteen areas to help project teams incorporate holistic and sustainable design principles:

3.1 Building Orientation and Massing
3.2 Building Envelope
3.3 Interior Lighting
3.4 Ventilation and Exhaust
3.5 Heating
3.6 Cooling
3.7 Water
3.8 Controls
3.9 Control Simplification
3.10 Monitoring
3.11 Indoor Air Quality
3.12 Interior Fit-Up
3.13 Daylight, Views and Glare Control

3.1 Building Orientation and Massing

Guideline:
Optimize building orientation and form with consideration of site layout, exposure, building shape and site micro-climate.

Approach:

1. Maximize north and south exposures:
    - North provides diffuse daylighting
    - South provides passive solar heating
2. North or couth facing clerestories and dormers are preferable to horizontal or sloping glazed skylights.
3. Thin profile buildings allow for increased daylighting and views.
4. Optimize window to wall ratios in buildings: maximum 40% glazing in terms of heating/cooling equipment sizing.
5. Include exterior shade structures/blinds on south, east and west facades to limit glare and prevent excessive solar heat gain in warmer seasons.
6. Proposed site layout and grading should be integrated as much as possible with existing grading conditions while balancing the functional needs of servicing and stormwater management.
7. Site design and building siting should minimize the amount of cut and fill required on the site.
8. Landscape features should be situated to help buffer adjoining properties from potentially negative impacts such as HVAC noise, property lighting, vehicle noise and headlights, etc.
9. Accessibility and universal design principles should be considered when placing building on site.
10. Building placement should consider the natural grading of the site as well as orientation for sun and wind.

3.2 Building Envelope

Guideline:
In order to maximize energy savings, exceed OBC minimum requirements for building envelope and minimize thermal bridging and air leakages.

A. Approach for Exterior Walls:

1. Performance

1. Provide minimum RSI-3.52 /R-20 (including thermal bridging). Calculate R-value for all wall, window, and roof conditions as part of the design.
2. Include a continuous layer of insulation. Ensure that batt insulation is not compressed. *See Appendix D – Detail 4*.
3. Minimize thermal bridging through steel studs, tracks, and Z-girts. (Note that batt insulation between steel members provides little thermal performance as thermal bridging happens at each steel stud location.)
4. Ensure the air barrier is continuous and all interruptions (mechanical, electrical, etc.) are thoroughly sealed.
5. If there is more than one vapour barrier, ensure water cannot penetrate into the wall system. Ensure that vapour barrier is properly located (above dew point) taking into account the thermal gradient through the wall
    - For example, 6-mil polyethylene is a common air barrier installed behind interior drywall, and also serves as a vapour barrier. Exterior plywood sheathing or foil-faced board insulation can also form an unintended air barrier. If moisture makes its way between these two vapour barriers, mould issues or component failure may result.

2. Material

For New Construction:

1. Specify wood for sheathing and studs from FSC-certified wood from an FSC supplier holding a valid Chain-of-Custody certificate to ensure the use of sustainably harvested wood products.
2. Use exterior grade plywood as it contains no added urea-formaldehyde.
3. Use steel studs that contain at least 25% post-consumer recycled content.

For Existing Buildings:

1. Consider specifying requirement of FSC certified wood and steel studs with at least 25% post consumer recycled content. This must be discussed with Facilities and Construction Management department and town's project manager and will be dependant on scope of work.

2. In all cases, ensure proper sealing to prevent air leakage at wall interruptions (windows, doors, vents, etc.)
3. If increasing the thermal performance of an existing exterior wall, insulation should be added to the exterior of the building. Provide calculations indicating location of dew point within wall assembly and ensure that design follows best practice methods.
4. If exterior insulation is not possible, interior systems can be considered. Provide calculations indicating location of dew point within wall assembly and ensure that design follows best practice methods. See *Appendix D – Details 2 and 3*.
3. For buildings with brick facades, be conscious of the building science implications of adding insulation to the interior of a building enclosure:
    1. A detailed review of the thermal and moisture impacts of these upgrades should be undertaken.
    2. Discuss implications with project team.

3. Cladding

1. Depending on building type, use and location, there is a requirement for different types of cladding with respect to durability, function and appearance. This should be discussed in detail with the Facilities and Construction Management department as part of the design development.

B. Approach for Roofs:

1. Performance

1. Provide minimum RSI-5.28/R-30. From an environmental standpoint, all roofs should be constructed with the most insulation possible.
2. Ensure flashing provides redundancy within building envelope to prevent water penetration. In all cases, do not rely on caulking as primary measure against water infiltration into building envelope. Refer to *Appendix D - Detail 4.*
3. Where appropriate, collect rain water from roof to a cistern to use for non-potable water supply (irrigation; toilet flushing). This must be discussed in detail with the Facilities and Construction Management department during design phase with consideration to both capital and life cycle costing.

Sloped Roofs:

1. The top layer of the roofing system should have a high SRI value to reduce surface temperatures and to reduce the cooling load in the summer.
    - Low sloped roof (≤2:12) SRI ≥ 78
    - Steep sloped roof (>2:12) SRI ≥ 29

Flat Roofs :

1. When using tapered insulation, ensure it is installed on top of the base layer of RSI-5.28/R-30 (i.e., the minimum amount of insulation will achieve the desired performance; tapered insulation affords additional insulation).
2. Where possible, provide positive slope to drain by sloping of structural components.
3. Ensure a continuous layer of insulation is maintained around parapets, connecting roof and wall assemblies completely. Refer to *Appendix D - Detail 5*.
4. Design mechanical systems to minimize roof traffic. Provide membrane protection where such traffic is unavoidable.

2. Materials

Sloped Roofs:

1. Water shedding materials include, but are not limited to:
    - Steel / Composite roofing is cost effective when expected life-span of the building is considered. Specify at least 25% post-consumer recycled content.
    - For traditional asphalt shingles, specify a life-span rating of >35 years.
2. Consider using framing products that are:
    - Engineered wood trusses: specify FSC-certified wood from an FSC supplier holding a valid Chain-of-Custody certificate to ensure the use of sustainably harvested wood products.
    - Engineered steel trusses: specify at least 25% post-consumer recycled content

Flat Roofs:

1. Flat roof water-proofing systems include:
    - 80 mil white PVC membrane
    - White TPO membrane (The use of this product must be discussed with the Facilities and Construction Management department due to concerns with durability. Include for a 25 year warrantee period.)
    - 2 ply mod bit roof system with light coloured cap sheets
    - 4-ply built up roof system with light coloured aggregate. Consider use of white reflective aggregate. (Do not specify 2 ply due to concerns with durability.)
2. 4-ply built up roofing system is the most cost effective and durable of the flat roof systems available and should be used in all cases where there is the expectation of traffic for maintenance of roof top units. If an alternate is proposed, discuss with the Facilities and Construction Management department.
3. If specifying a PVC or TPO membrane roof, ensure pavers from roof access to all mechanical units. In addition, include pavers to all four sides of mechanical unit for access and maintenance.
4. Specify a minimum 5 year contractor warrantee on labour and materials.
5. Specify tapered insulation to be the same material as the base insulation for added performance.

6. When installing insulation, multiple over-lapping layers should be specified to prevent thermal breaks.
7. Insulation must be mechanically fastened.

3. Green Roofs:

1. Limit the use of green roofs to those projects exhibiting one or more of the following scenarios:
    - The roof is regularly accessible and usable by the building's occupants.
    - A small area of green roof is required for educational purposes.
    - The roof is visible to building occupants or to neighbouring buildings
    - The green roof is required as an architectural feature.
2. Provide roof hatches or exterior roof access ladders in order to maintain green roof.
3. Provide structural anchoring devices for tying off fall arrest harness as required.
4. Ensure leak test is done to existing or new roof prior to installation of green roof to ensure watertightness.
5. Include for a permanent leak detection system such as electric field vector mapping (EFVM).

For Existing Buildings:

1. Green roof retrofits may be considered for those projects meeting the above criteria.
2. Structural loads must be taken into consideration when replacing a typical roof with a green roof.

C. Approach for Windows:

1. More glass results in more heat being lost from the building resulting in a larger heating system.
    - The recommended maximum window-to-wall ratio is 40%.
    - Use punched windows as opposed to curtain-wall systems.
    - Windows allow daylight penetration of almost 2x their height.
2. To decrease the amount of heat loss through glazing while maintaining economic and functional feasibility, the following performance specifications are recommended:
    1. Target Performance:
        - U-value: ≤ 1.94
        - SHGC: ≤ 0.3
    2. Assembly:
        - Double glazed
        - Soft low-e coating
        - Non-aluminum edge spacer
        - Argon gas fill
    3. Avoid dark reflective coatings

4. Window Frames:
    - Aluminum frames should have thermal breaks (min 9mm)
    - Curtainwall should have a similar thermal break or be 2-sided structural silicon glazing (SSG)

3. To improve occupant comfort, operable windows should be installed where feasible (offices, meeting rooms).
4. To achieve maximum daylight benefit, window height should be no more than half the interior wall height.
5. Consider the use of light shelves to reflect daylight and mitigate glare.
6. Ensure insulation and air sealing are complete between window and the wall structure.

D. Approach for Exterior Doors:

1. For doors to the exterior that are opened frequently, energy implications may be less of a concern.
2. For glass doors, performance should be equal to the recommendations in the window section above.
3. Opaque doors must be insulated assemblies with a thermal break at wall.
4. All doors should have functional and long-wearing weather-stripping to prevent air leakage.
5. Specify door assemblies to suit type of use:
    - Typically, provide insulated metal door.
    - For principle entrance or as part of a glazed assembly, provide aluminium entrance doors.
    - Warehouse/receiving areas, provide rapid roll up insulated doors to reduce loss of conditioned air.
6. Entrance and exit door sills to be flush to grade for accessibility.
7. When considering sliding entrance doors, ensure vestibule is large enough to allow proper timing of the exterior doors and interior doors to avoid both sets of doors being opened at the same time.
8. Consider off-setting the two sets of sliding doors to minimize wind tunnelling.
9. There are numerous accessibility requirements to be considered for exterior doors. Refer to the *2008 Guideline for Design of Accessible Facilities*.

E. Approach for Slabs and Foundations:

1. Performance

1. Slabs and perimeter foundation walls should have continuous insulation on exterior surfaces. Ensure continuity of insulation and waterproofing from foundation to slab to wall.
2. Insulation should achieve a minimum RSI-1.76/R-10 (e.g. 2" XPS).
3. For slabs incorporating radiant floor heating, under-slab insulation should be increased to prevent heat-loss into the ground.
4. Provide frost slab at all entrances and required exits with door sill flush to grade. For all other doors provide minimum 6" step down to grade.

2. Materials

1. As per mix designed by structural engineer, 25 – 50% of the Portland cement should be replaced by SCMs. (Supplementary Cementitious Materials (SCM) replace virgin Portland cement in concrete mixes. SCMs are waste by-products from a number of different industrial processes. While their inclusion can increase the curing time of the concrete (a consideration for winter pours), SCMs increase the strength and the corrosion resistance of concrete.
2. During winter pours, concrete should be insulated while curing.
3. Provide min. 2' of perimeter below grade insulation (horizontal and vertical) for slab on grade and extend full height of basement wall. Protect insulation against damage at grade.
4. SCMs that are by-products of industrial processes include:
    - Fly Ash – Types F, CI, or CH
    - Slag – Type S
    - Silica Fume – Type SF

3.3 Interior Lighting

Guideline:
Provide lighting levels suitable to task requirements with consideration to energy conservation.

Approach

1. Select lamp types based on the space programming. For example:
    - T8HO and T5HO fluorescents for high-bay and arena applications
    - LED lamps for spot-lighting
    - T8 fluorescents for general purpose dropped ceilings
    - T5 fluorescents for thin profile lighting fixtures
    - Type of lamps
2. Select efficient light fixtures (measured in lumens/watt).
3. Design for the number of lux required to perform tasks occurring in the space:
    - Consult IESNA for current recommended values (IESNA Lighting Handbook)
    - Take into account direct and reflected light from daylight
4. Design at or below the most current version of ASHRAE 90.1 power density requirements:
    - Designing lighting power 20%, or more, below ASHRAE is a common target in "green" building design (e.g. office: <10W/m2)
5. In general, do not use lighting control systems unless area has a fixed long term occupancy schedule.
1. Provide occupancy/vacancy controls to allow lighting to be shut off when not needed.
6. Where corridor and stairwells are not part of the accessible path of travel, limit lighting power density to the minimum allowed by Ontario Building Code:
    - Shut stairwell lights off, when unoccupied; activate lighting by way of occupancy or manual controls.
    - Ensure emergency lighting can provide minimum light levels when activated.
7. In all cases, the accessible path of travel (typically corridors, access and exiting, washrooms, etc) will require enhanced lighting power density. Confirm requirement with the town's *Guideline for Design of Accessible Facilities* and provincial accessibility legislation.
8. Provide daylight sensors/controls and dimmable fixtures to allow for additional energy savings when adequate daylight is available.
9. Use direct/indirect lighting fixtures to provide lighting levels with minimal contrast.
10. Coordinate lighting design with architectural design to benefit from light shelves or daylight harvesting opportunities.
11. Provide task lighting where appropriate and reduce general light levels.

3.4 Ventilation and Exhaust

Guideline:
When considering the controllability of Heating, Ventilation, and Air Conditioning (HVAC) systems, the best performance can be achieved through the separation of these into their basic components. The following section addresses Ventilation design challenges.

Approach:

1. Design

1. Decouple ventilation from space heating and cooling.
2. Design the ventilation system to meet the standards set forth in the most recent version of ASHRAE 62.1, according to the Ventilation Rate Procedure. The standard requires the calculation of rates for the occupants (to provide fresh air for breathing) and the area (to replace stale air and contaminants).
    - To prevent over-sizing of equipment, ensure occupancy numbers are based on actual expected occupancies, not Fire Code calculations.
    - Take into account System Efficiency and Ventilation Effectiveness as described in ASHRAE 62.1 Ventilation Rate Procedure.
3. Allow for natural ventilation to provide the required OA when exterior conditions permit.
4. Ensure Outdoor Air (OA) calculations are shown on the design drawings as a resource for installers, balancing contractors, commissioning agents, and building operators.
5. Ensure ventilation system is balanced (i.e. Total OA ≈ Total Exhaust)
6. Size the ventilation system to provide some level of cooling.
7. Design system to control relative humidity within a range appropriate for the building type:
    - Ensure the design meets the requirements of the most recent version of ASHRAE 55.

2. Equipment

1. Specify equipment meeting the minimum efficiency ratings as prescribed in the most recent version of ASHRAE 90.1.
2. Use heat recovery units (e.g. an enthalpy wheel (“ERV”), heat pipe or plate (“HRV”)) to temper ventilation air with reclaimed heat from exhaust air. Applicable to units that are providing 100% fresh air and 100% exhaust air.
3. Utilize variable speed pumps and fans: variable frequency drives (VFDs) or electronically commutated motors (ECMs) can provide variable, efficient control.
4. Minimize parasitic loads (e.g. small distributed fans and pumps can add up to large energy use). If small distributed fans are required, specify ECMs.
5. Ensure exhaust and supply ducting is insulated to prevent condensation (e.g. cool air passing through warm spaces).

3. Delivery and Control

1. Maximize the effectiveness (≥1.0) of providing OA to the occupants. Refer to Table 6-2 in the most recent version of ASHRAE 62.1 (excerpt of 2004 below):

Air Distribution Configuration	E_z
Ceiling supply of cool air	1
Ceiling supply of warm air and floor return	1
Ceiling supply of warm air 15°F (8°C) or more above space temperature and ceiling return.	0.8
Floor supply of cool air and ceiling return, provided low-velocity displacement ventilation achieves unidirectional flow and thermal stratification	1.2

2. Supply air through ducts at 150m/minute to limit pressure drop across ducting.
3. Use occupancy sensors/CO_2 controls to reduce ventilation provided, when it is not needed.
    - Set-points (in parts per million) for CO_2 sensors should be specified based on space type and occupancy loads per the most recent version of ASHRAE 62.1.
    - Ensure CO_2 sensors are re-calibrated per manufacturer's recommendations.

3.5 Heating

Guideline:
When considering the controllability of Heating, Ventilation, and Air Conditioning (HVAC) systems, the best performance can be achieved through the separation of these into their basic components. The following section addresses Heating design challenges.

Approach:

1. Design

Decouple ventilation from space heating.

1. Design the heating system to meet the space requirements taking into account all heat gains and losses.
    - Ensure calculations are shown on drawings to enable coordination between designers.
    - In a high performance building, heating systems should be sized to provide ~50W/m^2.
2. Utilize variable speed pumps and fans: variable frequency drives (VFDs) or electronically commutated motors (ECMs) can provide variable, efficient control.
3. When specifying condensing boilers, ensure that the return water temperature is low enough to achieve maximum thermal efficiency.
4. Specify insulation on ducts and pipes to prevent condensation and losses.
5. Provide heat traps in supply pipes running from heating equipment.
6. Ensure the design complies with the most recent version of ASHRAE 55 for thermal comfort of occupants.
7. Where feasible, use heat pumps internally to move excess heat to areas where it is needed.
8. Where feasible, use a ground coupled heat pump system as a “battery” system to store excess energy seasonally for use in another season.

2. Equipment

1. Specify equipment meeting the minimum efficiency ratings as prescribed in the most recent version of ASHRAE 90.1.
2. Select heating equipment with a high degree of controllability. For example, specify boilers with:
    - Variable frequency drive (VFD) pumps
    - Consider how large a turndown ratio is required for the system
    - Install differential pressure sensors near the end of the loop (as opposed to across the pump) to allow for proper sensing of loads.
    - Specify 2-way valves (as opposed to 3-way) to allow VFDs to work as designed.
3. Heat pump systems (e.g. water-loop or variable refrigerant flow) can simultaneously provide heat to one zone while cooling another.

4. Minimize parasitic loads (e.g. small distributed fans and pumps can add up to large energy use). If small distributed fans are required, specify ECMs.
5. Use enthalpy wheel heat recovery units to help maintain desired humidity levels, while recovering heating and cooling losses.

3. Delivery and Control

1. When possible, move heating energy via water, rather than air.
2. Minimize parasitic loads (e.g. additional small distributed fans and pumps).
3. Use low-grade (temp) heat coupled with a condensing boiler to produce building heat (condensing boilers require a low return-water temperature).
4. Supply air through ducts at 150m/minute to limit pressure drop across ducting.
5. Control heating demand via occupancy as opposed to schedules.
6. Occupancy-controlled heating systems can be integrated with other occupant controls (e.g. lighting).

3.6 Cooling

Guideline:
When considering the controllability of Heating, Ventilation, and Air Conditioning (HVAC) systems, the best performance can be achieved through the separation of these into their basic components. The following section addresses Cooling design challenges.

Approach:

1. Design

1. Decouple ventilation from space cooling.
2. Design the cooling system to meet the space requirements taking into account all heat gains and losses.
    - Ensure calculations are shown on drawings to enable coordination between designers.
    - In a high performance building, cooling systems should handle 50m^2 per ton of cooling.
3. Utilize variable speed pumps and fans: variable frequency drives (VFDs) or electronically commutated motors (ECMs) can provide variable, efficient control.
4. Ensure design complies with the most recent version of ASHRAE 55 for thermal comfort of occupants.
5. Size the ventilation system to provide some level of cooling.
6. Where feasible, use a ground coupled heat pump system as a "battery" system to store excess energy seasonally for use in another season.

2. Equipment

1. Specify equipment meeting the minimum efficiency ratings as prescribed in the most recent version of ASHRAE 90.1.
2. Multi-split heat pump systems can provide heat to one zone while cooling another.
3. If roof top units must be used, select those with an EER of greater than 11. (SEER 14 for this equipment is supportable but there may be cost increases)
4. Include air-side economizer to allow for free cooling (no compressor use) when conditions are favourable.
5. Consider the pros and cons of air-cooled vs. water-cooled chillers.
6. Specify two-speed or variable speed fans in cooling towers.
7. Include water-side economizer to allow for free cooling by the cooling tower (no chiller use) when outdoor conditions are favourable.
8. Minimize parasitic loads (e.g. small distributed fans and pumps can add up to large energy use).
9. If small distributed fans are required, specify ECMs.

10. Insulate ducts and pipes to prevent condensation and losses.
11. Select HFC (not HCFC) refrigerants for cooling equipment.

3. Delivery and Control

1. Supply air through ducts at 150m/minute to limit pressure drop across ducting.
2. Minimize parasitic loads (e.g. additional small distributed fans and pumps).
3. Control cooling demand via occupancy as opposed to schedules.
    - Occupancy-controlled cooling systems can be integrated with other occupant controls.

3.7 Water

Guideline:
Where possible, reduce the amount of potable water used in building operations and maintenance through water conservation technologies and the use of cisterns.

Approach:

1. Outdoor Water Use

1. Select native/adaptive and drought tolerant plants to minimize irrigation requirements.
2. Where possible, harvest and utilize rainwater for irrigation.

2. Indoor Water Use

1. Install low-consumption plumbing fixtures as per table below:

FIXTURE TYPE	RECOMMENDED	
Water Closet	Dual-Flush	
	3.0/6.0 L/flush	0.8/1.6 gal/flush
	Pressure Assist Low-Flow	
	4.0 L/flush	1.1 gal/flush
Urinals	0.5 L/flush	0.13 gal/min
Lavatory Faucets	1.9 L/min	0.5 gal/min
Metered Faucets	0.5 L/cycle	0.13 gal/cycle
Water Closet	4.0 L/flush	1.1 gal/flush
Showers	5.7 L/min	1.5 gal/min
Non-Commercial Kitchen Faucets	5.7 L/min	1.5 gal/min

2. Consider usage requirements when combining 1.9lpm faucets with tankless water heaters.
    - Some tankless water heaters may need a higher flow rate to trigger the heating cycle.
    - If hot water requirements are sporadic and frequency of use is low, it may be better to use a 5.7lpm faucet with a tankless water heater to achieve energy savings instead of water savings.

- Use low water/energy consuming appliances (e.g. washing machines, dishwashers).

3. Consider the use of zero-water consuming devices for remote building locations.
    1. Consider maintenance requirements of these technologies
    2. Waterless urinals
    3. Composting toilets
4. Capture waste heat from drains (e.g. PowerPipe™).
5. Collect and use non-potable water generated from building operations.
    - Air conditioner condensate
    - Grey-water from lavatories
6. Provide automatic flush water closets, faucets and faucets in all accessible washroom facilities.

3. Wastewater

1. Use low-consumption sanitary plumbing fixtures.
2. Use captured and filtered grey-water (e.g. water from lavatory faucets) for sanitary conveyance.
3. Use captured and filtered rain-water (e.g. water from roof and/or parking surfaces) for sanitary conveyance.
4. Elect to use an on-site water treatment system (e.g. Waterloo Biofilter) where sanitary infrastructure is not available. Treat water to tertiary quality prior to discharge in a shallow pressure trench, rather than a typical septic bed system.

4. Cistern Design

1. Where feasible, install a cistern to be used for non-potable requirements.
2. Calculate the size of cistern required to meet the non-potable water needs of the building
    - Obtain annual average rainfall data
    - Calculate the area of all surfaces rainwater is to be captured from
    - Calculate the amount of water required by the system served by the cistern (e.g. number of uses for plumbing fixtures; amount of water required for irrigation)
3. Consider whether the cistern will require potable water make-up.
4. Include a strainer and settling portion in the cistern to minimize system contamination
5. Provide space in the mechanical room for a future tie-in for future filtration equipment in the event that problems with colour or odour arise.
6. The use of a cistern must be discussed with the Facilities and Construction Management department as part of the design stage phase with an analysis presented as to usefulness, life cycle cost and capital and maintenance cost.

5. Process Water Use

1. Where possible, use captured and filtered rainwater for non-potable applications:
    - Floor cleaning
    - Cooling tower make-up
    - Landscape irrigation
    - Vehicle washing
    - Steam humidifiers

3.8 Controls

Guideline:

Through the implementation of building systems controls, ensure the primary users of energy in a building are functioning at peak efficiency and only when required.

Approach:

1. Building controls

1. Specify controls for each major system according to occupant needs, building use frequency, etc. Buildings in Canada must comply with energy codes which require certain automatic control, including:
    - Thermostat control for each zone
    - Setback controls - automatically adjust heating and cooling system set points on a programmed occupancy schedule
    - Automatic shutdown: provide time-of-day start/stop controls for heating/cooling/ ventilation systems.
    - Shut-off dampers: close motorized dampers when ventilation systems stop
    - Domestic hot water recirculation heating - automatically disable temperature maintenance in hot water pipes when heating is not required

2. Building Automation Systems (BAS)

1. A building automation system can provide central control to the majority of the building's systems and is able to process multiple inputs and apply complex logic to optimize the operation of the building's mechanical equipment.
2. A BAS requires a building operator to have training specific to the system.
3. A BAS uses low voltage wiring and can easily be reconfigured to accommodate changes in space layouts.
4. Centralized control systems allow operators to monitor the building from one location, but they are more expensive to install than non-centralized controls.
5. Different parameters of control are available, including:
    - Time of Day scheduling of ventilation equipment, lighting, etc.

- Load shedding (reducing electrical loads based on high energy prices in order to lower demand)

6. BAS to be specified as Open Protocol:
   - Controllers in this type of system can use an external standard of communication meaning equipment from various manufacturers can be used.
   - This system can achieve a higher degree of controllability due to its custom nature, but it also requires more skill and coordination on the part of the design, installation, and commissioning team.
   - Having an Open Protocol system allows for competitive bidding on the service contract.
7. BAS to be specified as Open Protocol Ready:
   - This system is installed as a closed protocol system but includes a gateway to an open protocol controller capable of communicating in an open protocol.
   - This system can optimize initial performance, while allowing future competitive bidding on maintenance.
8. Review manufacturer and specifications with Facility and Construction Management department prior to tender to ensure contract documents meet all requirements.

3.9 Control Simplification

Buildings with highly variable occupancy or low frequency of use may not benefit from the added expense of a BAS. In these cases, simplicity can eliminate the need for programming and save the building operator many hours of responding to complaints.

Guideline:

Move systems between occupied and unoccupied modes in the simplest manner possible.

Approach:

1. Integrated occupancy control of HVAC and lighting can ensure that the space is being conditioned only when it is being used and eliminates the need for multiple sensors.
2. Ensure building occupants are educated regarding system controls that may include occupant-override capabilities.
3. In buildings with simple layouts and known scheduling, programmable thermostats in the various zones can be more cost-effective and easier to maintain than a BAS.
4. Buildings with a BAS may have isolated or specialized systems that could benefit from simplified controls.
5. Examples of simpler controls include:

Occupancy-based Controls:

- Use passive infrared (PIR) sensors to control lighting in areas where line-of-sight is not an issue.
- Use ultrasonic sensors to control lighting in areas with many partitions or corners.
- Can be combined with daylighting controls or a BAS to combine the savings of local control with those achieved through having central control.

Daylighting Controls:

- Specify photo sensors to read the light level in the space and switch off or dim perimeter lights.

Demand Control Ventilation:

- CO_2 sensors located in the space and connected to air handling units can control the amount of ventilation required based on the number of occupants in the space.

3.10 Monitoring

Guideline:
Measure and monitor building energy use to verify building energy performance and use the monitoring data to improve system efficiency.

Approach:

1. Metering and Archiving

1. Determine which building systems will be large consumers of energy (e.g. lighting, ventilation, heating, cooling, etc.).
2. Meter building systems which are large energy consumers and whose energy consumption will change with occupancy, weather, etc.
3. Include metering equipment in design documents. Clearly indicate meter locations on mechanical and electrical drawings. Tie into BAS system for monitoring purposes only.
4. Specify a data collection system to collect and store the metered data (e.g. digital metering system or building automation system).
5. If included in building design, use the building automation system to monitor building system performance. Set up archives for building automation system points that will track the performance of major systems (e.g. runtimes or status indicators on major pumps and fans) and provide data on trending.

2. Data Analysis and Reporting

For New Buildings:

1. As part of commissioning and 1 year warrantee, ensure building is performing to optimum level as clearly specified in contract documents. If not, provide recommendations to contractor to improve.
    - Determine building energy consumption and energy consumption for each major building system (e.g. lighting, ventilation, heating, cooling, etc.).
    - Calibrate the energy model created during the design of the building to as-built conditions, including updating occupancy and weather data.
    - Compare the actual building energy consumption (as determined by utility bills, metered data, BAS data, etc.) to the predicted energy consumption as determined by the calibrated model. Compare on both total energy and on energy end-uses.
    - In the case of significant discrepancy between the actual and predicted energy consumption, investigate building system operation.

3.11 Indoor Air Quality

Guideline:

Ensure all design decisions affecting indoor air quality consider impact, short and long term, on occupant health.

Approach:

1. Conduct all indoor construction in a way that is compliant with the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) IAQ Guidelines for Buildings under Construction during Occupancy.
    1. HVAC Protection
    2. Source Control
    3. Pathway Interruption
    4. Housekeeping
    5. Scheduling

3.12 Interior Fit-up

Building materials for interior fit-up can impact the environment from both a raw materials and end-of-life perspective. Consideration must be given to the environmental impact of re-using existing (where possible), or with new products; the manufacturing process, the recycled content and the supply and installation of the product. Once installed or in use, the product will also have an environmental impact with respect to VOC content, indoor air quality and method of disposal.

A. Materials

Guideline:

When choosing materials, consider indoor air quality as well as lifecycle cost and appropriateness of use.

Approach:

1. General

1. On renovation projects, prior to demolition, evaluate what can be reused, refinished, recycled, and salvaged.
2. Select materials high in recycled content:
    - Drywall
    - Acoustic Ceiling Tile
    - Steel studs
    - Carpet
    - Some paints
3. Select interior building systems that are easy to deconstruct and re-use:
    - Systems favouring screws over nails or adhesives
    - Where walls are frequently relocated use demountable partitions
4. Select materials that can be recycled at the end of their useful life:
    - Interface Carpet recycling program
    - Drywall collection through New West Gypsum
    - Acoustical ceiling tile recycling
    - Steel studs and ceiling grids are accepted by scrap metal dealers
5. Select wood products certified under the Forest Stewardship Council (FSC). Request Chain-of-Custody certificates from suppliers for all FSC wood products.
    - Doors
    - Trim
    - Millwork
    - Plywood backing (electrical panels, backer board, etc.)
6. Select materials fabricated from rapidly renewable sources, such as:

- Wheat board
- Agrifibre core in wood doors

7. Where possible, re-use products taken from other demolition projects.
8. For further requirements, refer to section *3.12 C. Material Emissions.*

2. Wall

1. Gypsum board:
   - Avoid use of gypsum in community centers/arenas or facilities with high use. If required, specify impact resistant gypsum board.
   - In service areas and high traffic areas, provide wall protection and corner guard to a height of 1200 mm from finish floor level.
   - Provide continuous blocking or reinforcement for wall mounted millwork and fixtures.
2. Masonry block:
   - Ensure non-load bearing lightweight concrete masonry units are not located in area exposed to the weather or have contact with earth.
   - Where openings or exposed corners are finished in masonry units use bull-nosed type, do not use field cut stretcher units.
   - Provide block walls for community centers, arenas or facilities with expected high use.
   - Block walls to have paint finish or other solid surfacing. For paint finish, refer to OPCA paint formulations and section *3.12 B Finishes.*
3. See *Guideline for Design of Accessible Facilities* for requirements with respect to colours and finishes.

3. Doors

1. Interior non-service doors to have windows. Service doors may require glazing for visual safety where necessary, ensure compliance with OBC.
2. Where windows are set in doors ensure a minimum bottom rail/sill and mid-rail height of 150 mm.
3. Doors and frames to be painted a contrasting colour to adjacent wall and floor. See *Guideline for Design of Accessible Facilities* for requirements with respect to colours and finishes.
3. Specify door assemblies to suit type of use:
   - Arenas and community centers – typically hollow metal doors
   - Arenas at rink area – phenolic or p.lam. doors for Players' Change Rooms and any washrooms
   - Administrative areas – wood doors or hollow metal

Hollow Metal Doors

- Carbon, cold-rolled commercial grade sheet steel – conform to ASTM A366/A366M

- Zinc-coated (Galvanized) commercial grade sheet steel - confirm to ASTM A653/A653M
- Doors to be steel-stiffened type using spot welding or adhesive method to attach face sheets to rib stiffeners.
- Frames to be of the welded type.

Wood Doors

- All wood doors to conform to Quality Standards for Architectural Woodwork published by Architectural Woodwork Manufacturers Association of Canada (AWMAC) for Architectural Grade Doors
- Veneer faces to be uniform, clean, of the specified species, without open defects, or natural characteristics which are detrimental to appearance.
- Provide reinforcing blocking required for surface applied hardware.
- Composite wood door faces or cores to contain no added urea-formaldehyde resins.
- Completely seal top, bottom and edges and edges of cut-outs, before units are shipped.

Plastic Laminated Doors

- Ensure plastic laminate is applied to both sides of door panel to prevent warping. Plastic laminate should be applied to all other exposed surfaces.
- VOC content in laminate adhesives to not exceed limits specified in SCAQMD Rule #1168.

4. Ceiling

1. Design ceiling type to fit building use. Discuss requirements with town's project team.
2. Design ceilings in large spaces such as pools, arena, and gymnasia with a view to ease of maintenance and replacement. Access to these ceilings, especially over pool areas, is difficult and requires closure of the facility and interruption to public usage.

B. Finishes

Guideline:

Finishes should consider impact on indoor air quality as well as appropriateness of use, maintenance requirements and replacement implications. In some buildings, issues of vandalism must be considered.

Approach:

1. Floor

1. In entry area, service area, pool deck, washrooms, change rooms, stairs, and ramps, use non-slip flooring material.
2. Where flooring change occurs ensure inclusion of proper transition strip or levelling detail to eliminate tripping hazard. Transition strip must meet GDAF requirements.
3. Where flooring change occurs at threshold of doorways specify flooring termination at the centre line of door.
4. Specify appropriate flooring system for different occupancy and usage:
   - High impact and high traffic area – acid-resistant, rubber, or epoxy flooring
   - Entry, pool deck, washrooms, and change rooms to be porcelain tile with epoxy grout.
   - Water resistant and/or bacterial infection control – resilient vinyl sheet flooring with proper details for cove-base and floor drain. For wet areas, select non-slip finish.
   - Acoustical consideration – carpet, carpet tile, rubber, or vinyl flooring, sheet vinyl flooring.
   - Office / administrative areas – carpet tile. See section *3.12 C Material Emissions* for further requirements.
   - Design discussion with the town's project team is required in selecting the appropriate solution for different building types.
5. For ESD protection of electronic devises and equipment, install flooring material that keeps static generation consistently lower than 10 V (ESD STM 97.2).
6. If specifying vinyl composite tile (VCT): minimum 3mm thick with through colour or through pattern.
7. Use porcelain tile instead of ceramic or natural stone for durability.
8. For further requirements, refer to section *3.12 C. Material Emissions.*

2. Wall

A. Painting

1. Paint formulations and methods to be as per the Ontario Painting Contractors Association (OPCA) Architectural Specification Manual – latest edition.

2. Specify an OPCA 2 year Guarantee or a 100% 2 year Maintenance Bond on completion of the work. The Guarantee or the Maintenance Bond shall warrant that the work has been performed with respect to the standards and requirements incorporated in the OPCA specification manual.
3. If painting scope is extensive, consider using inspection services from the OPCA. (Cash Allowance)
4. Paint exposed conduits and electrical equipment occurring in finished areas.
5. Specify the appropriate paint system including primer and surface preparation for different applications and surfaces:

Exterior paint

- Steel and Metal (ungalvanized) – Alkyd
- Wood – Water based, solid colour stain
- Galvanized Metal – Alkyd over cementitious primer
- Hot dipped Galvanized surface – Alkyd over polyamine epoxy tie-coat (in place of cementitious primer)

Interior paint

- Concrete – Latex
- Concrete Masonry Unit – High performance architectural latex
- Steel and Metal – Alkyd
- Galvanized Metal – Alkyd over cementitious primer
- Hot dipped Galvanized surface – Alkyd over polyamine epoxy tie-coat (in place of cementitious primer)
- Wood Veneer – Polyurethane varnish
- Drywall – High performance architectural latex
- Piping and Conduit – Alkyd (caution: Natural gas piping – paint all surfaces in accordance with the requirements of Ontario Gas Utilization Code.)

B. Other wall finishes

1. Do not use vinyl applied finish due to concerns with mould.

C. Acoustical Requirements

1. Ensure acoustics resulting from room configuration and choice of material is suitable for room use.
2. Engage acoustical consultant to review any spaces / areas that might have concerns. This is typical for lobbies, pool areas, meeting rooms, theatre spaces, etc.

3. Ceiling

1. Pool ceiling material and finish to be resistant to mould, rusting and water / vapour damage.

2. Where light fixtures are mounted to a suspended ceiling system, ensure that the fixtures are mounted at the main T's.
3. Typical ceiling material to be acoustical ceiling (t-bar). Provide alternate type of ceiling in significant spaces.
4. Provide acoustical treatment as required depending on use of room or area.

4. Stairs

1. Stair design must meet the *Town of Oakville 2008 Guidelines for Design of Accessible Facilities (GDAF).*
2. Where stair is a designated exit ensure clear visible sightlines to the exterior exit door, minimize alcove and concealed corners.
3. Light level must meet OBC and GDAF requirements, or whichever is more stringent.
4. Finish for tread and riser must be slip resistant and of high impact and durable material.
5. If rubber, tread should be one-piece homogeneous material with integral nosing of contrasting colour.

C. Material Emissions

Guideline:

Building materials for interior fit-up can impact the occupant indoor environment. Select materials with consideration to low VOC content and indoor air quality.

Approach:

1. Select paints having VOC contents below the limits outlined in Green Seal Standards GS-11 and GC-03, and in South Coast Air Quality Management District (SCAQMD) Rule #1113.
2. Select adhesives and sealants having VOC contents below the limits outlined in SCAQMD Rule #1168.
3. Select low-emitting systems for:
    - Carpet systems compliant with the Carpet and Rug Institute's Green Label program
    - Resilient flooring systems certified under FloorScore
    - Floor coatings compliant with SCAQMD Rule #1113
    - Ceramic tile adhesives compliant with SCAQMD Rule #1168
    - Select wood products and laminating adhesives containing no added urea-formaldehyde (NAUF):
    - Doors
    - Millwork
    - Plywood backing (electrical panels, backer board, etc.)

D. Furniture

Guideline:

Choose furniture and fixtures with consideration to impact on the environment with respect to the use of raw materials, end-of-life disposal and indoor environment.

Approach:

1. Refer to the *Appendix F - Accommodation and Furniture Standard* for design guidelines for the design of administrative space. An electronic copy of the *Standard* is available on Portico under the Facilities and Construction Management department tab and a hard copy can be provided by the department upon request.
2. *Herman Miller Workplace Resource* has been awarded the contract for furniture supply and installation for all town facilities. For detailed specifications and furniture layouts, contact the Facilities and Construction Management department.
3. For furniture not included in the *Accommodation and Furniture Standard*, the following are general intents as they apply to sustainable design:
    - Select products with a high recycled content.
    - Select products that can be recycled at the end of their useful life.
    - Select low-emitting products
    - Select furniture certified under GreenGuard standards, or equivalent

E. Fixtures and Fitments

Guideline:

Choose fixtures with consideration to impact on the environment from both a raw materials and end-of-life perspective and on occupant indoor environment. Selection of fixtures should be in keeping with the class of building and for the type of use.

Approach:

1. Toilet Partitions

1. Select toilet partitions and urinal screens that would best suit the building type and condition:
    - Heavy traffic condition – High density polyethylene (HDPE) partitions
    - Vandalism problems – Colour-thru phenolic partitions
    - Appearance and durability – Stainless steel with satin finish partitions
    - Affordability – Plastic laminate partitions. Ensure such partitions meet specifications as described in section *2.10 C Materials Emissions.*
2. Toilet partitions must be properly braced whether they are ceiling hung or floor mounted. Ensure doors are hung and aligned to supporting panels with piano hinge or 2 heavy duty hinges.
3. Fixtures with shop-applied coatings (no on-site applications necessary).
4. Where possible install flush mounted or semi-recessed fitments.

2. Miscellaneous washroom fixtures

1. Install automatic soap dispensers and ensure, at most, one soap dispenser for every two adjacent lavatories. Soap dispensers should be mounted beside counter to eliminate the need to reach across the counter to meet GDAF requirements.
2. Select automatic paper towel dispenser, use recycled paper product.
3. Alternately, select high efficiency hand dryer.
4. Refer to the town's *2008 Guidelines for Design of Accessible Facilities* for installation location and heights for washroom accessories.

F. Millwork

Guideline: Similar to furniture and fitments, design millwork to have as minimal an environmental impact as is feasible while maintaining durability, appearance and

Approach:

1. Specify qualification for millwork manufacturer:
    - no less than 5 years experience in institutional millwork
    - member of AWMAC
2. Depending on the scope of work required, include for a maintenance bond: two (2) year AWMAC Guarantee Certificate or an equivalent maintenance bond for the full value of the contract. This requirement should be discussed with the Facilities and Construction Management department prior to tender.
3. All wood and wood veneer products to have a waterborne finishing process to reduce emission of VOC's (Volatile Organic Components).
4. All paint & powder coat finishes to be VOC free.
5. All wood and wood veneer products to come from FSC (Forest Stewardship Council) Certified Forests and have a Chain of Custody Certificate.
6. Countertops to be made from quartz or solid surface material. Avoid solid colours.
7. Provide solid 3mm edging around doors and all exposed gable edges. Edging to be PVC or wood.

3.13 Daylight, Views and Glare Control

Access to daylight and views is considered important for occupant well being . Daylight is important for its quality, spectral composition and variability while views provide for a connection to the outdoors.

A. Daylight

Guideline:

In areas where a building is regularly occupied, provide exposure to daylight for building occupants and create the potential for energy savings from lowered lighting loads.

Approach:

1. Consult the *Appendix F - Accommodation and Furniture Standard* for the design of any administrative space.
2. Use the following principles when designing layout of space:
    - Allow daylight from windows and skylights to penetrate deeply into the regularly occupied space. This is achieved by ensuring full height partitions are not erected along the window/perimeter zone of the space and by ensuring skylights are serving more than one enclosed space.
    - For windows, where vision glazing is higher than 2.3m (7'-6") from finish floor install interior light shelf to help direct daylight further into the space.
    - For skylights, north facing vertical clerestory windows/skylights are more effective for redirecting daylight than horizontal or angled skylights.
    - Where perimeter private offices or meeting rooms are unavoidable, install vision glazing in the corridor wall of these rooms.
    - Install light sensors to operate ambient light level and provide task lighting throughout (also see section *3.3 Interior Lighting*).

B. Views

Guideline:
Views to the exterior from regularly occupied areas of the building provide building occupants with a connection to the outdoors.

Approach:

1. Assign occupancy of perimeter zone to open space plan with low height partitions between staff work areas.
2. Where window sills are more than 0.75m (2'-6") from finished floor level, and where such windows are scheduled for replacement, consider lowering the sill.
3. For interior full height offices, install vision glazing along the corridor wall to allow view to the exterior.
4. Maximize the number of staff with access to daylight and views from their workstations.

C. Glare Control

Guideline:
Glare control is required on windows facing the directions of the sun. Glare is distracting in the work environment and can be a source for safety concern..

Approach:

1. In all windows facing the directions of the sun, install adjustable blinds.
2. Interior light shelf used in directing daylight penetration is also a good glare control device.
3. Consider use of exterior shading device such as operable louvers, or fixed translucent panels where solar heat gain is also a factor.
4. As indicated in approaches 1 to 3 above, the following glare control solutions are acceptable when designed to meet specific glare problems:
    - Fixed exterior shading device
    - Light shelf, exterior or interior
    - Interior blinds
    - Pull-down shades
    - Fritted glazing – silk screened ceramic frit on glass reduces solar heat gain and depending on density can either control glare or diffuse light
    - Drapes
    - Electronic black-out glazing

4.0 Specialty Areas and Uses

Given the variety of building types and use in the Town's portfolio, consideration must be given to speciality areas and use when specifying equipment and materials. For every building, a high performance building envelope is a key to energy efficiency, refer to Section *3.0 Building Components* for more detail.

The section *Specialty Areas and Uses* describes six areas to help project teams incorporate holistic and sustainable design principles:

4.1 Pools
4.2 Arenas
4.3 Commercial Kitchens
4.4 Bikes and Showers
4.5 Seasonal Buildings
4.6 Specialty Surfaces

4.1 Pools

A. Water use

Guideline:
Reduce potable water use.

Approach:

1. Monitor float valves regularly. Faulty valves can mean unnecessary makeup water is being used.
2. Install sub-meters to track water use and analyze data to find leaks.
3. Capture and reuse water displaced during make-up water cycles
    - Toilet and urinal flushing
    - Fire protection storage systems
    - If water is being transported off-site, consider filling non-potable cisterns at other facilities, especially during months of low precipitation.

B. Air Handling System

Guideline:
Optimize the performance of the air handling system.

Approach:

1. Use heat energy from the dehumidification process to reheat conditioned air:
    - If there is excess heat gain, consider using it to heat the domestic hot water system.
    - It may not be cost-effective to implement a system to transfer waste heat to the pool water. Keeping the heat in the air above the pool would reduce the amount of heat lost by the pool.
2. As an alternative to the typical dehumidification system, consider using a heat recovery ventilator (HRV) to take advantage of dry outdoor air.
    - During most of the year, outdoor air will be dryer than the indoor air.
    - The HRV will require the capacity to supply more than the ventilation rate in order to dehumidify effectively.
    - This system eliminates the requirement of a separate ventilation system for the space.
    - This strategy reduces heating/cooling loads by transferring heat between the supply and exhaust airstreams.

3. Consider combining this system with an active desiccant system to dry and heat the outdoor air before it reaches the HRV.

C. Energy Use

Guideline:
Reduce energy required to heat and move water.

Approach:

1. Keep the temperature as low as possible for swimmer comfort.
2. Use a pool cover system to reduce heat loss during unoccupied periods:
   - Traditional pool covers (automatic or manual)
   - Liquid pool covers (e.g. Heatsavr™)
3. Use waste heat from other processes within the building:
   - If feasible, integrate the dehumidification system with the water heating system.
   - If an arena is present on site, use the heat rejected by the ice plant.
4. Use properly sized, high efficiency pumps to move water required for turnover rates.
5. Monitor float valves regularly. Faulty valves can mean unnecessary makeup water is being used.
6. Design of system to be kept simple and easy to maintain. The town prefers to use Dectron humidifiers. Consult with Facilities and Construction Management department regarding choice.

D. Finishes

Guideline:
Provide low VOC finishes while considering highly corrosive nature of pool areas.

Approach:

1. Pool floor, wall and ceiling material and finish to be resistant to mould, rusting and water / vapour damage.
2. All fasteners (including for mechanical and electrical fitments) to be resistant to rusting and water damage.
3. Use stainless steel sprinkler heads throughout pool area.

4.2 Arenas

A. Refrigeration Loads

Guideline:
Reduce refrigeration loads.

Approach:

1. Install low-emissivity materials on the ceiling of the arena to prevent radiant heating from entering through the roof.
2. Based on technology currently available, specify T8HO lamps in the arena or T5HO (if room temperature is kept above freezing). T8HO lamps:
    - Produce less heat than metal halide lamps
    - Have lower input wattages than metal halide lamps
    - Have a shorter re-strike time meaning lights can be turned off between uses. (i.e. they don't have to be left on for the entire day)

B. Heat Loads

Guideline:
Reuse heat rejected by the ice plant.

Approach:

1. Recover heat:
    - Specify a desuperheater to produce high temperature water
2. Recover condensing heat:
    - Specify heat exchangers with high thermodynamic efficiency (>75%) to remove heat from the condenser
    - Recovering this heat can reduce the load on the condenser
3. Using heat pump networks, supply recovered heat to identified heat sinks:
    - Radiant floor heating in seating areas
    - Radiant floor heating in change rooms
    - Hot water required for ice re-surfacing
    - Domestic hot water requirements
    - Snow melting pits
4. Install cold storage system to enable load shedding and off-peak power usage.

C. Energy Use

Guideline:
Reduce energy required by the refrigeration system.

Approach:

1. Specify systems that can reduce loads according to occupancy or temperature such as variable speed motors controlled by the brine temperature differential change; or, two-speed motors running at full speed during occupied and low speed during unoccupied hours.
2. Multi-pass (>2) brine circuits can reduce flow rate required to cool the ice surface.
3. Turn off brine pumps and refrigeration systems during unoccupied hours. Use sensors to restart the system if ice temperature increases past a maximum set point.
4. Using combinations of the above measures, adjust ice temperature set points according to the season and type of activities.

4.3 Commercial Kitchens

Much of the energy used by commercial kitchens can be attributed to the conditioning and movement of ventilation and make-up air. Large volumes of air are exhausted by typical range hoods, and the air brought in to replace this needs to be conditioned for occupant comfort. The back-of-house system needs to address these challenges while not adversely affecting the dining or cafeteria spaces.

A. Exhaust Air

Guideline:
Reduce the amount of exhaust and make-up air while ensuring comfortable and safe working conditions.

Approach:

1. Specify range hoods that are constructed for optimal capture and containment of heat and combustion by-products:
    - Use UL listed proximity type hoods
    - Custom hood construction can reduce exhaust air volume requirements by up to 50%.
2. Specify Demand Control Ventilation (DCV) on kitchen exhaust systems:
    - Commercial kitchen DCV systems use heat and combustion sensors to switch on exhaust hoods only when required.
    - Exhaust hood operation should be linked to make-up air systems
    - Specify variable speed kitchen exhaust / make-up systems that can increase exhaust requirements as demand is increased.
3. Use make-up air from the dining area:
    - Maximize transfer air and minimize direct make-up air
    - This prevents kitchen smells and exhaust from entering the dining area
4. Reference the California Energy Commission's Design Guides for Commercial Kitchen Ventilation for additional recommendations.

B. Energy Use

Guideline:
Reduce the amount of heating energy required in the building.

Approach:

1. Specify glycol loop heat recovery systems that take heat from the kitchen exhaust and transfer it to other areas of the building. Be aware of additional maintenance requirements of kitchen exhaust heat recovery systems; filter changes are required more frequently.
    - Hot water heaters
    - Fan coils for dining area heating
    - Condition make-up air for the kitchen

C. Water Use

Guideline:

Reduce the amount of water required by kitchen operations.

Approach:

1. Specify Energy Star equipment:
    - Dishwashers
    - Ice machines (air cooled as opposed to water cooled)
    - Steamers
2. Specify high performance, low flow rinse nozzles.
3. Use water brooms instead of spray-down systems for floor cleaning

4.4 Seasonal Use Buildings

Guideline:
While these buildings represent a small energy impact, there are opportunities for operational savings through creative design.

Approach:

1. Design buildings with a minimal electrical load:
    - Specify lamps with a high lumens/watt ratio (e.g. linear fluorescent or CFLs) or low wattage (eg. LED)
    - Keep receptacle loads to the minimum required.
2. Design buildings with minimal HVAC requirements:
    - Use natural ventilation systems (e.g. operable windows, high/low openings and grilled) or small fans where air movement is necessary
    - Incorporate shading, improved thermal performance, and/or reflective materials to decrease heat gain.
3. Perform a cost-benefit analysis of providing the required electricity via photovoltaic panels rather than installing a typical electrical service.
    - Installation of batteries for electrical storage would be required.

4.5 Bikes and Showers

Guideline:
Provide suitable accommodation to employees who commute to work via alternative transportation.

Approach:

1. Establish a suitable bicycle space target as a ratio of per units or floor space area for buildings.
2. Provide appropriate bike lock and storage facilities with options for weather protected storage.
3. Provide adequate shower and change facilities for cyclists within workplaces.
4. Ensure a safe and secure environment for bike storage (through proper illumination and consideration for security cameras where system exists).
5. Accommodating bike storage and related vehicles is mandatory and should adhere to town of Oakville provision standards. Consideration may also be given to incorporating LEED standards (if more stringent than Town of Oakville's).

4.6 Specialty Surfaces

A Entry Way Grates

Guideline:
Minimize exposure of building occupants to particulates.

Approach:

1. Install permanent entryway systems in the primary direction of travel to capture dirt:
   - Grill
   - Grate
   - Roll out carpet
2. Ensure grill/grate is installed flush to the level of the finish floor material. Depressed substrate such as concrete should be considered.
3. Provide floor drain with filter for solids under grill/grate for regular cleaning.

5.0 Commissioning

Commissioning is the process which takes the owner's vision, the design team's interpretation, and the contractors' work, then verifies that the final building delivers the expected performance. As building requirements, design expectations, HVAC and controls equipment, and construction methods have all exponentially increased in complexity, commissioning has become a critical, if not indispensable, step in any construction project.

The section *Commissioning* describes four areas to help project teams incorporate holistic and sustainable design principles:

5.1 Proper Commissioning Protocols
5.2 Design and Site Review
5.3 Thermal Imaging
5.4 Air Tightness Testing

5.1 Proper Commissioning Protocols

Guideline:

Perform quality control checks for given systems for proper and complete installation, and test to verify proper functioning of individual components and total systems.

Approach:

1. Ensure that owner's intent for the building's design, performance features and uses are clearly documented.
2. Review the Architectural, Mechanical and Electrical designs to ensure they are aligned with the owner's intent for the building.
3. Review design documents throughout the design and construction process.
4. Perform testing of all sequences of operation developed for the building systems and components to ensure building operates as it is intended.
5. Ensure building owner/operator is trained to properly operate and maintain the building efficiently.

5.2 Design and Site Reviews

Guideline:

Contract a 3rd party Commissioning Agent to work for the best interests of the town to conduct a peer review of the design development early in the construction documents phase. Recommendations on any alternatives that might be considered for cost, performance, control or maintenance improvements to the systems on a system by system level are documented in this review. During construction, site visits are necessary to confirm design items are installed and constructed to optimize building performance.

Approach:

1. Conduct design document reviews at 50% and 90% design stages. This review will focus on ensuring the concept design incorporates the systems and strategies proposed in the Design Intent and Basis of Design.
2. Issue all comments to designers and copy owner.
3. Follow up with comments to ensure they are properly understood and incorporated where appropriate.
4. Review shop drawings and all site notifications to ensure current knowledge of project is maintained and issue comments where appropriate.
5. Visit site at various times throughout the construction process to inspect building envelope components and sealing and verify proper installation of mechanical and electrical components. Include above ceiling inspections prior to ceiling installation.
6. Hold regular commissioning meetings which will include status of equipment start-up, BAS verification, and training. This will ensure all issues identified during construction are properly addressed before construction is complete.

5.3 Thermal Imaging

Guideline:

Thermal imaging requires the use of a camera which calculates surface temperature differences. A thermographer then interprets the results and can then provide an analysis of the building component. Common uses for this service include:

- Locating causes of air leaks.
- Identifying areas with poor insulation performance.
- Identifying poor sealant or insulation installations.
- Checking condition of electrical components and connections while under load.
- Checking condition of HVAC components, duct leaks, air distribution patterns.

Approach:

1. Contract a thermographer to check for deficiencies during and after construction.
2. Ensure contracted thermographers have substantial analysis experience. While no official certification exists, there are extensive courses available. It is recommended that contracted thermographers can prove completion of intermediate level training.
3. ***For Existing Buildings***, use a thermographer to aid in trouble-shooting areas that are exhibiting problems or where there are occupant comfort complaints.

5.4 Air Tightness Testing

Air leakage through building envelopes can cause increased energy use, mould problems, and occupant comfort issues. While air barriers may be noted on construction drawings, smaller details at building envelope transitions can be missed. Air tightness testing requires the use of equipment that can depressurize the building or compartments within the building (e.g. blower door).

Guideline:

Air tightness testing can be used on new buildings to assess the performance of the air barrier, or in existing buildings, to locate areas that require remediation.

Approach:

There are a number of strategies that can be used to ensure an airtight building:

1. Include detailed air barrier specification in construction documents outlining the following requirements (taken from the National Building Code of Canada, 5.4.1.2):
    - Airtightness
    - Continuity
    - Structural Integrity
    - Durability
2. Contract an Envelope Commissioning Agent to review the building envelope design and construction.
3. Contract an Envelope Commissioning Agent to perform an airtightness test once building is complete, but before the contractor has been released. Test procedures should follow methods described in one of the following standards:
    - CGSB 149.10 “Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method”.
    - CGSB 149.15 “Determination of the Overall Envelope Airtightness of Office Buildings by the Fan Depressurization Method Using the Buildings’ Air Handling System”.
4. Depressurization can also be used in combination with Thermal Imaging to discover sources of air leakage.

*Note: *Consultant refers to consultant team and includes prime consultant and all subconsultants.*

1. The consultant must ensure that all town guidelines / standards are followed in the design. In particular, care must be taken to meet:

    - the accessibility requirements of the *Guidelines for the Design of Accessible Facilities* (See the town's website).
    - Further to meeting the accessibility guidelines, consultants are required to submit to the town project coordinators the *Accessibility Checklist* (GDAF - Appendix B) at the end of the design phase to ensure all relevant requirements are incorporated into the building design.
    - the communications and data requirements of the town's IS & S department (See section *1.1 H Communications and Data*)
    - the requirements of the *Sustainable Purchasing Procedure* (see the town's website)

2. Project drawings (including as-built and record drawings) must be created using the town's *CADD Standard* as per attached *Appendix E*.

3. Contract documents developed by the consultant must include Construction Process Objectives which will have, at a minimum, the following sections:
    - Temporary Erosion and Sediment Control Plan (see section *2.4 Stormwater Management*)
    - Temporary Indoor Air Quality Control (see section *3.11 Indoor Air Quality*)
    - Topsoil Conservation Plan
    - Tree Inventory and Tree Preservation Plan
    - Construction Waste Management and Disposal (*see Section 1.6 Waste Stream Impact*)
    - Commissioning Plan (see section *5.0. Commissioning*)
    - ***for New Buildings*** over 500 m^2 must include *Section 01352 Special Project Procedures* for LEED Certification
    - Tree Protection During Construction Procedure EN-TRE-001-001 (*see town of Oakville website*)

4. Project Specifications must include, at a minimum, the following sections under General Conditions. Unless it is indicated otherwise, all requirements are common to both existing and new building projects.

    - Detailed project close – out requirements including list of all required warrantees, O & M manuals, as built drawings, review process and schedule.
    - Contractor to complete a Building Worksheet including data on building systems to be used as part of the Town's preventative maintenance program. Building

Worksheet to be filled in by the respective sub-trades and checked by the architect/engineer. (*See Appendix C*)
- Requirements for Chain of Custody for FSC wood used in the project
- Commissioning Certifications
- List of Warrantees
- List of required Testing and Inspections to be performed by contractor
- Site Safety Procedure
- Shut Down Notification. Ensure advance notice, of 72 hours, is given where construction project interrupts utility service to the building or impacts facility shut-down.
- After hours work – based on discussions with town staff clarify when after hours work will be required. In all cases minimize impact on facility operations and facility staff.
- Tracking of deficiencies – consultant to track deficiencies using an excel spreadsheet that includes item, remediation required, date of completion and cost to remediate. If item deficiency recurs, this should also be noted. Unless otherwise indicated in the consultant contract, it is the consultant's responsibility to track all deficiencies and ensure a satisfactory resolution for the town.
- 1 year Warranty - Provide electronic log book (using excel spreadsheet) of problems encountered throughout the warranty period. Tracking should include such items as date, time, description of problems (including location), resolution of problems, etc. If deficiency recurs, this should also be noted

5. Include wording in contract documents addressing the contractor's requirement to fill in Building Condition Assessment for work done as part of the contract. Contractor required to populate the first 9 columns of spreadsheet for **all** building components and provide expected service life and replacement cost. Column headings that are the contractor responsibility include:
    - Asset Tag (physical tag to be provided by town)
    - Uniformat Code (list to be provided by town)
    - Item Name
    - Location and/or Area
    - Component Description
    - Manufacturer (if applicable)
    - Model No. (If applicable)
    - Serial No. (If Applicable)
    - Normal Life Expectancy
    - Replacement Value

The sample LEED scorecard included below identifies various targets as either *Recommended* or *Site / Building Specific* or *Discussion Required* depending on cost-effectiveness, environmental benefit, applicability to various building types, and occupant benefit. The points scored under the recommended column are the town of Oakville target LEED points and the design of all new construction should use the scorecard as a starting point for discussion and design development. An Excel version of the LEED Scorecard is available on Portico under Design Standards tab at the Facilities and Construction Management department portal.

Recommended	Site/Bldg Specific	Discussion Req'd	LEED Canada NC 2009 Scorecard* Oakville Sustainable Design Guidelines
51	22	37	**Certified:** 40 to 49 pts **Silver:** 50 to 59 pts **Gold:** 60 to 79 pts **Platinum:** 80+ pts
6	16	4	**Sustainable Sites**
.			**SSp1 Construction Activity Pollution Prevention:** Design and implement an erosion and sedimentation control (ESC) plan that conforms to the requirements of the 2003 U.S. EPA Construction General Permit OR local standards, whichever is more stringent.
	1		**SSc1 Site Selection:** Site must not meet certain prohibited criteria (e.g. wetland, ecologically sensitive, etc.)
	5		**SSc2 Development Density and Community Connectivity (3 or 5 pts):** Site and building must meet certain location and building density requirements.
	1		**SSc3 Brownfield Redevelopment:** Site must be previously contaminated, and be fully remediated to accommodate the new project.
	6		**SSc4.1 Public Transportation Access (3 or 6 pts):** Site must be located close to multiple and frequent mass transit options. A Transportation Demand Management Plan strategy can be used if the site is not near public transit.
1			**SSc4.2 Bicycle Storage & Changing Rooms:** Provide the required number of secure, covered bike storage and showering facilities for occupants. Bike storage must also be provided for visitors.
		3	**SSc4.3 Low Emitting and Fuel Efficient Vehicles (3 pts):** Project must provide the required number of low-emitting/fuel efficient vehicles, as well as preferred parking, for the occupants, OR provide alternative-fuel refuelling stations.
2			**SSc4.4 Limit Parking Capacity (2 pts):** Limit parking to the minimum required by zoning, and no more than 3.5 spaces per 93 m2 GFA. Or, provide preferred parking for car/vanpools for projects that provide parking for less than 5% of full-time equivalent building occupants.

	1		**SSc5.1 Site Development: Protect or Restore Habitat:** Limit site disturbance during construction, or restore/protect the required amount (dependant on site type) of open space with native/adaptive vegetation.
	1		**SSc5.2 Site Development: Maximize Open Space:** Design site to reduce the development footprint and achieve the required amount of vegetated open space.
	1		**SSc6.1 Stormwater Design: Quantity Control:** Implement a stormwater management plan addressing rate and quantity of runoff. Credit requirements depend on existing site imperviousness.
1			**SSc6.2 Stormwater Design: Quality Control:** Implement a stormwater management plan that treats 90% of rainfall and removes 80% TSS; also implement a nitrogen and phosphorous reduction plan.
		1	**SSc7.1 Heat Island Effect: Non-Roof:** Provide shade (trees or solar panel structures), use reflective materials, and/or use open grid pavement for 50% of non-roof surfaces. Or, put 50% of parking under cover.
1			**SSc7.2 Heat Island Effect: Roof:** Use highly reflective roofing materials, or install a green roof.
1			**SSc8 Light Pollution Reduction:** Design outdoor lighting not to exceed 80% and 50% of exterior areas and building facades respectively as defined in ASHRAE 90.1-2007. Use full cut-off luminaires, and control light spillage at property lines. Interior lighting shall be shielded or automatically shut off between 11pm and 5am.

4	0	6	**Water Efficiency**
.			**WEp1 Water Use Reduction: 20%:** Plumbing fixtures shall achieve 20% water savings relative to the baseline. Install permanent water meter(s) measuring all potable water use for the project.
2		2	**WEc1 Landscape Irrigation (2 or 4 pts):** Reduce potable water consumption by 50% (2 pts) or 100% (4 pts) relative to baseline, OR, design a drought resistant landscape plan.
		2	**WEc2 Wastewater (2 pts):** Reduce usage of potable water for sewage conveyance by 50%, OR treat 50% of wastewater on-site to tertiary standards.
2		2	**WEc3 Water Use Reduction (2-4 pts):** Reduce potable water use by 30% (2 pts), 35% (3 pts), or 40% (4 pts) relative to baseline.

19	0	16	Energy & Atmosphere
.			**EAp1 Fundamental Commissioning of Building Energy Systems:** Engage a Commissioning Authority (CxA - cannot be part of the design or construction team) to design, implement, and document a commissioning plan for the Owner. CxA shall have documented Cx experience in at least two building projects.
.			**EAp2 Minimum Energy Performance:** Demonstrate a designed 23% or 10% energy cost improvement compared to an MNECB 1997 or ASHRAE 90.1-2007 reference building respectively, including *all* energy costs associated with the building (including process). All "Mandatory Provisions" of MNECB 1997 or ASHRAE 90.1-2007 would need to be documented by designers to confirm this prerequisite. OR, comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide appropriate to the project scope.
.			**EAp3 Fundamental Refrigerant Management:** Use no CFCs in HVAC&R equipment.
10		9	**EAc1 Optimize Energy Performance (1-19 pts):** Demonstrate a percentage cost improvement in the design compared to a MNECB 1997 of ASHRAE 90.1-2007 reference building, taking into account all energy uses.
		7	**EAc2 On-Site Renewable Energy (1-7 pts):** Supply a percentage of total annual energy use, by cost, from on-site renewable energy sources.
2			**EAc3 Enhanced Commissioning (2 pts):** Engage an independent CxA (3rd party) to design, implement, and document a Cx plan and provide peer review of design and construction documents with additional tasks as specified.
2			**EAc4 Enhanced Refrigerant Management (2 pts):** Use no CFCs, HCFCs or Halons in fire suppression equipment. Use no refrigerants, OR select refrigerants that are calculated to emit minimal compounds that contribute to ozone depletion and global warming.
3			**EAc5 Measurement & Verification (3 pts):** Develop a long-term continuous performance measurement and verification plan following IPMVP requirements. Provide a process for corrective action to ensure energy savings are realized.
2			**EAc6 Green Power (2 pts):** Engage in a minimum 2-year contract to purchase energy certified by a green power producer for at least 35% of the building's total electricity use (determined by EAc1 calculations).

7	4	3	Materials & Resources
.			**MRp1 Storage & Collection of Recyclables:** Provide a dedicated area for the collection, separation, and storage of the buildings glass, paper, metal, cardboard, and plastic recyclables, as well as organic waste.
	3		**MRc1 Building Reuse: Maintain Existing Walls, Floors, and Roof (1-3 pts):** Maintain 55% (1 pt), 75% (2 pts) or 95% (3 pts) of existing building structure and shell.
	1		**MRc1 Building Reuse: Maintain Interior Non-Structural Elements:** Maintain 50% of non-structural elements.
2			**MRc2 Construction Waste Management (1-2 pts):** Develop and implement a waste management plan. Divert 50% (1 pt) or 75% (2 pts) of construction waste to recycling/reuse facilities.
		2	**MRc3 Materials Reuse (1-2 pts):** Specify 5% (1 pt) or 10% (2 pts) of building materials used (by cost) to be salvaged or refurbished.
2			**MRc4 Recycled Content (1-2 pts):** Specify 10% (1 pt) or 20% (2 pts) of building materials (by cost) to be recycled content.
2			**MRc5 Regional Materials (1-2 pts):** Specify 20% (1 pt) or 30% (2 pts) of building materials be extracted within 800km of the final manufacturing site, and manufactured within 800km of the project.
		1	**MRc6 Rapidly Renewable Materials:** Specify 2.5% of building materials to be rapidly renewable.
1			**MRc7 Certified Wood:** Specify 50% of all wood components to be sourced from FSC-certified harvesters, manufacturers and suppliers.

9	2	4	Indoor Environmental Quality
.			**EQp1 Minimum IAQ Performance:** Comply with ASHRAE 62.1-2007.
.			**EQp2 Environmental Tobacco Smoke (ETS) Control:** Prohibit smoking in and around the building.
1			**EQc1 Outdoor Air Delivery Monitoring:** Install CO2 monitoring sensors, and equipment to measure outdoor air intake flow.
		1	**EQc2 Increased Ventilation:** Increase outdoor air ventilation rates by at least 30% above minimum rates required by ASHRAE 62.1-2007.

1			**EQc3.1 Construction IAQ Management Plan, During Construction:** Design and implement an IAQ management plan to SMACNA standards. Inspect building and HVAC systems for deficiencies (moisture, dust), and make provision for remediation.
1			**EQc3.2 Construction IAQ Management Plan, Before Occupancy:** Provide building flush-out or conduct IAQ testing before occupancy.
1			**EQc4.1 Low-Emitting Adhesives & Sealants:** Specify products that have VOC content compliant with SCAQMD #1168.
1			**EQc4.2 Low-Emitting Paints & Coatings:** Specify products that have VOC content compliant with Green Seal or SCAQMD #1113.
1			**EQc4.3 Low-Emitting Flooring Systems:** Specify CRI Green Label Plus carpet systems, Floorscore certified hard surface flooring systems, floor finishes compliant with SCAQMD #1113, and tile adhesives compliant with SCAQMD #1168.
		1	**EQc4.4 Low-Emitting Composite Wood and Agrifibre:** Specify composite wood, agrifibre, and laminate adhesive assemblies that contain no added urea formaldehyde.
		1	**EQc5 Indoor Chemical & Pollutant Source Control:** Design to minimize chemical pollution cross contamination of regularly occupied areas.
1			**EQc6.1 Controllability of Systems: Lighting:** Provided lighting controls to 90% of building occupants, and controllability for multi-occupant spaces that complies with ASHRAE 90.1-2007.
		1	**EQc6.2 Controllability of Systems: Thermal Comfort:** Provide individual comfort controls for 50% of occupants, and controls for all shared multi-occupant spaces.
1			**EQc7.1 Thermal Comfort: Design:** Comply with ASHRAE 55-2004.
1			**EQc7.2 Thermal Comfort: Verification**: Provide temperature and humidity monitoring and control to ensure parameters of EQc7.1 are met. In addition, an ongoing survey of occupants is required to enable adjustments.
	1		**EQc8.1 Daylight 75% of Spaces:** Provide required daylight factor to 75% of regularly occupied spaces.
	1		**EQc8.2 Views for 90% of Spaces:** Provide direct line of sight for 90% of regularly occupied spaces.

6	0	0	Innovation and Design
1			**IDc1.1 Innovation in Design:** A maximum of 3 IDc1 credits can be based on exemplary performance.
1			**IDc1.2 New Innovation Credit**
1			**IDc1.3 New Innovation Credit**
1			**IDc1.4 New Innovation Credit**
1			**IDc1.5 New Innovation Credit**
1			**IDc2 LEED® Accredited Professional:** A member of the project team must be a LEED® Accredited Professional.

0	0	4	Regional Priority
		1	**RPc1 Durable Building** Develop and implement a Building Durability Plan in accordance with the principles in CSA S478-95 (R2007) - Guideline on Durability in Buildings for construction and preoccupancy phases.
		1	**RPc2.1 New Regional Priority Credit** RP credits allow adding point emphasis to recognize one or more issues that have additional regional environmental importance.
		1	**RPc2.2 New Regional Priority Credit**
		1	**RPc2.3 New Regional Priority Credit**

** This Scorecard is intended to serve as a guideline to target a Silver level of performance under LEED Canada NC 2009. It neither confirms a LEED rating with the CaGBC, nor guarantees credit compliance. Credit descriptions are general and it is recommended that the Town of Oakville consult the most recent LEED Canada NC Reference Guide as not all credits are applicable to all projects.*

*** Scorecard provided by Enermodal Engineering.#*

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Building Worksheet provides a data collection opportunity for comparing current energy efficiency design benchmarks with the building's actual mechanical and electrical designs. This applies to new construction and to existing buildings. This worksheet will be administered by the Facilities and Construction Management department and developed for all town buildings. An excel version of the Building Worksheet is available on the towns' website.

Building Worksheet
Strategy Checklist for Energy Efficiency

Building Name:
Location:
Floor Area:

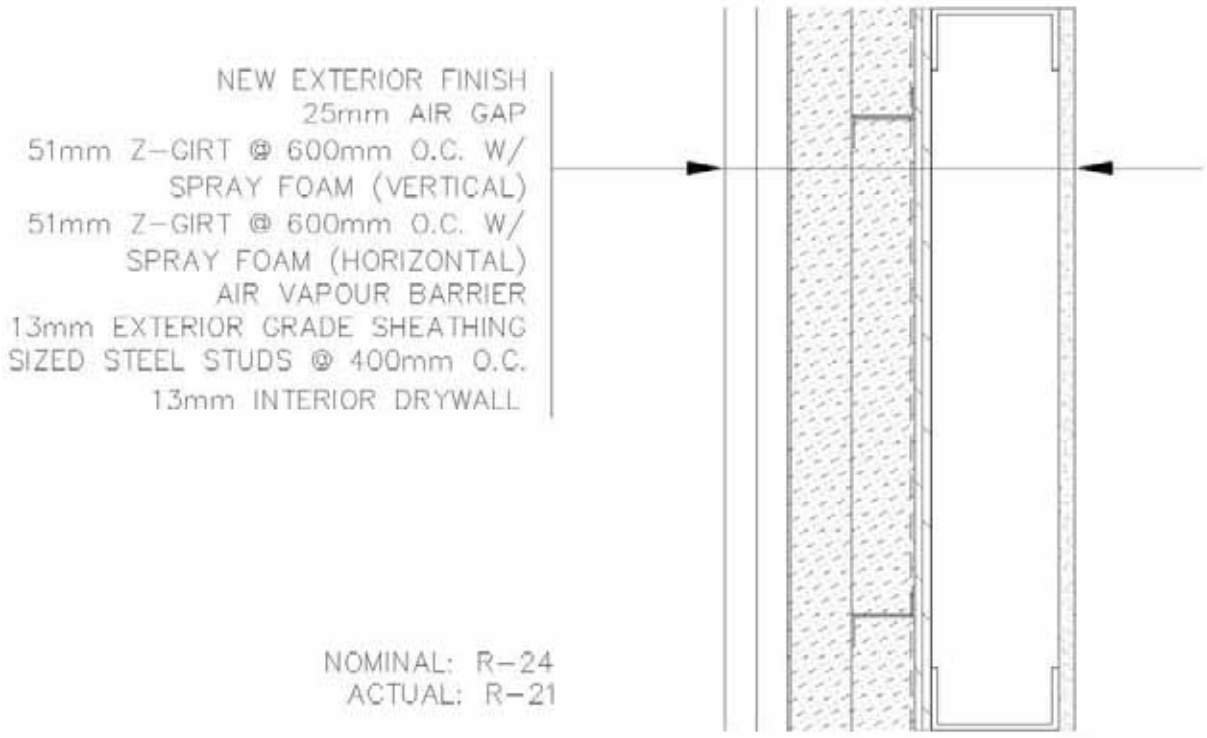
EE Measure	Information to Source	Benchmark	Actual	Notes and Comments
Minimize Loads	Window-to-Wall Ratio	< 50%		
	Actual occupancy	A number not based on a default or fire code maximum. (e.g. 1 person/200ft^2 for office)		
	Plug Loads	1 W/ft^2		
	Lighting Power Density	OBC 2006, SB-10 / ASHRAE 90.1		
	Wall and Roof R-Values	Minimum R-20 and R30 (accounting for effects of thermal bridging)		
	Window Features	Double glazed; Soft low-e coating; thermal break; gas-filled		
	Window U-Value	≤ 0.35 Btu/h.ft^2.^{o}F		
	Window SHGC	0.25 - 0.35		
Ventilation Rates	Total Flow Rate (all flow rates ÷ floor area)	< 0.75 cfm/ft^2		
	Flow rates for office	OA rate ÷ Cooling rate ≈ 20%		
	Flow rates for meeting	OA rate ÷ Cooling rate ≈ 67%		
	Balanced Ventilation System	Total OA = Total Exhaust		

EE Measure	Information to Source	Benchmark	Actual	Notes and Comments
Correctly Sized Systems	Ventilation Rate (accounting for **V**entilation **E**ffectiveness and **S**ystem **E**fficiency)	ASHRAE 62-2004; Table 6-1 e.g. 0.1 - 0.14 cfm/ft^2 for offices; 0.44 cfm/ft^2 for meeting rooms VE: Table 6-2 SE: Table 6-3		
	Exhaust Rate	ASHRAE 62-2004; Table 6-4 e.g. 50 cfm per restroom fixture		
	Heating Loads	Conduction Losses = 2.3W/ft^2 Ventilation Losses = 0.8W/ft^2 (taking into account HRV) Total ~4.7 W/ft^2		
	Cooling Loads	Conduction Gains = 0.9W/ft^2 Solar Gain = 1.1W/ft^2 Lights/Plugs = 2W/ft^2 Ventilation = .4W/ft^2 (taking into account HRV) Total >500 ft^2/ton		
System Controllability	Ventilation Control	CO2 sensors @ 1/5000ft^2		
		CO2 ctrl for each meeting room		
	Equipment Control	VFDs on pumps and fans		
		VAV boxes set to the greater of OA value or 30%		
High Performance / Efficiency Equipment	Condensing Boilers	>90% Efficiency		
		Supply Temperature ~160^{o}F		
		Return Temperature <130^{o}F		
	Fan Power	< 0.5 W/ft^2 (CV)		
		< 0.7 W/ft^2 (VAV)		
	Small Fans and Pumps	Use ECMs, or reduce number		

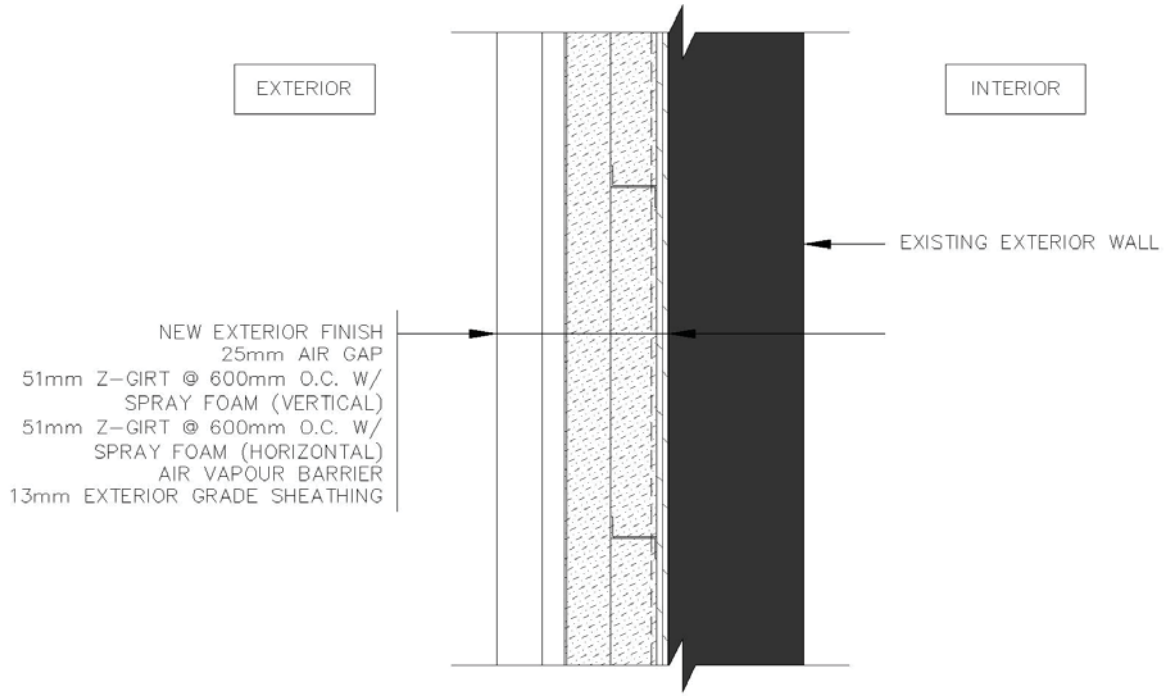
	Heat Recovery Units	> 65% Effectiveness Eff = (T2 - T1)/(T3 - T1); where: T1 - Entering supply temp (DB) T2 - Leaving sup temp (DB) T3 - Entering ex temp (DB)		
	Roof Top Units	EER > 11		
	Hot Water Heaters	Consider frequency of use: Tank heater for high frequency use showers and lavatories; Small tank heater for ultra low flow lavatories; Tankless water heater for low frequency use showers and lavatories (with >5lpm flow rate)		
	Water Loop Heat System	COP > 4		
	Process Exhaust	Duct through heat recovery unit		

Conversion Rates

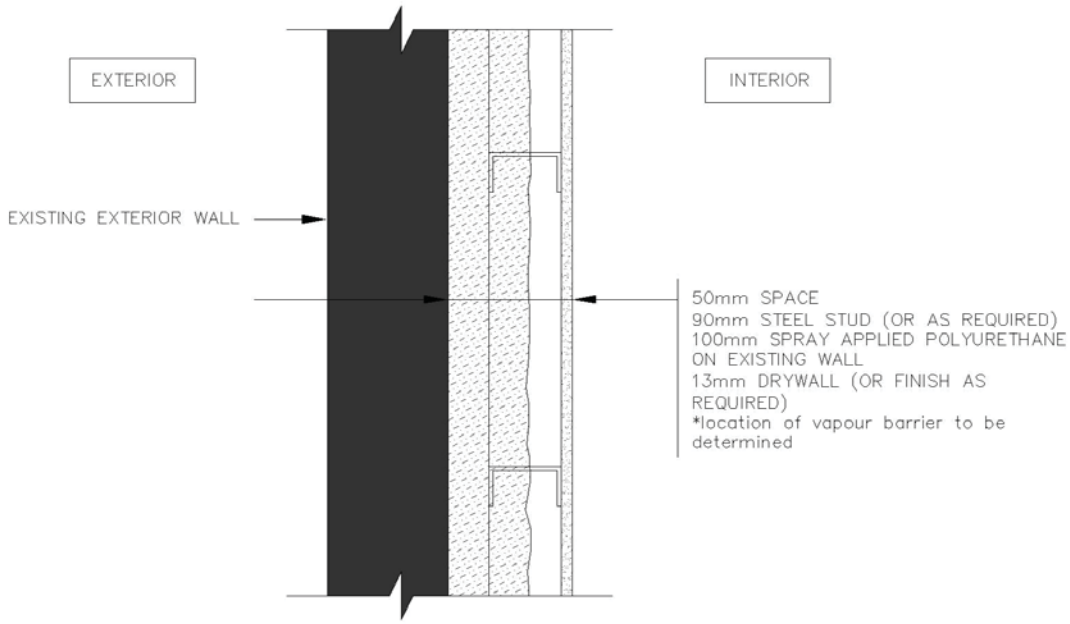
	1 m2 = 10.764 ft^2			
	1kW = 3.41 MBH			
	1 cfm = 0.47 l/s			



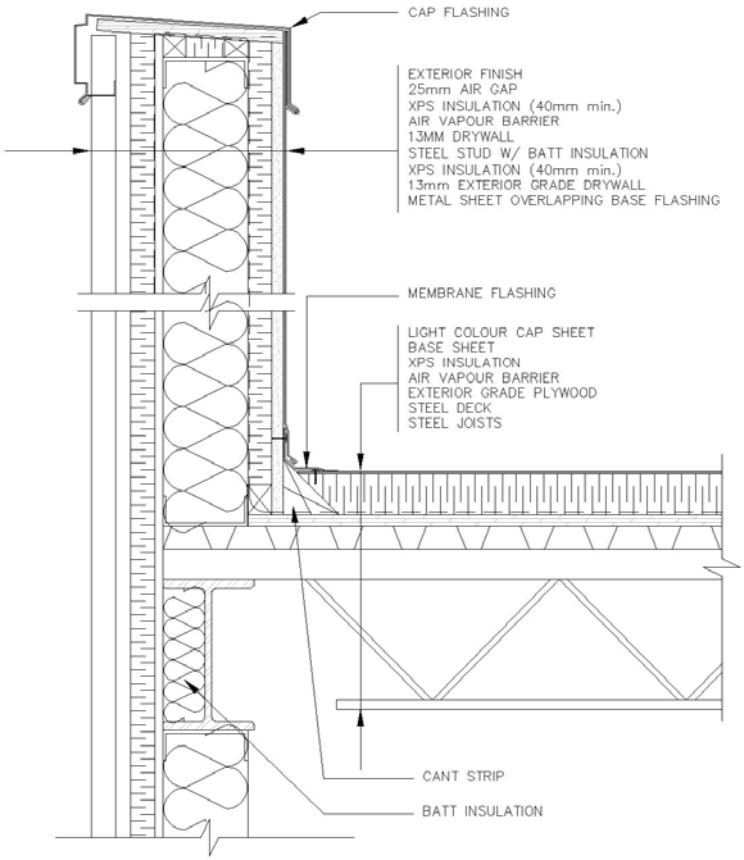
Detail 1 – Continuous Layer of Insulation



Detail 2 – Exterior insulation



Detail 3 – Interior insulation



Detail 4 - Parapet

1. Procedure

The Town requires that consultants use the following CADD standard in producing project drawings. Standardization of drawings will allow organized access to the information contained in these files and will become an important part of considering future construction projects. It will also be information required for maintenance and operations of the existing facilities.

A. File Submission

- By e-mail – the preference for drawing files submission is by e-mail. Files should not be protected by password; should not contain hyperlinks or electronic signature. Where file size exceeds Oakville's e-mail limit or sender's limit, files can be submitted by CD/DVD or via ftp sites.
- By CD or DVD – files must be delivered to the designated town contact of each project. Condition of files to be similar to those sent by e-mail.
- Via FTP sites – sensitive files must be protected by password using a file compression utility, i.e. WinZip, or similar utility program. Designated town contact must be notified by e-mail. Notification should include such information as:
    1. Municipal Building Name and Project Identification
    2. Project Number
    3. URL/File Name
    4. Zip File Password
    5. Date of File Deletion

B. Coordination and Quality Assurance

In the interest of ensuring consultant's design drawings conform to the CADD standard throughout the drawing phases of the work, the consultant will first submit drawing template for review prior to start of CADD. CADD standard must be met prior to design approval.

C. Mark-ups

For design review, hard copies of digital files will be marked-up in red by town staff. Marked-up copies will be returned to author for revision. All marked-up items to be addressed prior to acceptance of work. Depending on the project, additional comments may be provided in the form of a table/worksheet. In that case, the consultant will be required to respond back in writing advising how each comment will be dealt with.

2. Digital File

A. CADD drawing format

CADD drawing format should be AutoCAD native format DWG file.

B. AutoCAD version

AutoCAD version must be supported by software developer, i.e. Autodesk. Currently the town is using *AutoCAD 2010).*

C. Compatibility

All files must be compatible with Microsoft Operating Systems.

D. Drawing Sheet Size

Drawing Sheet Size – Unless otherwise approved, all drawings are to conform to the following sheet sizes:

1. A0 (841x1189)
2. A1 (594x841)
3. A2 (420x594)
4. A3 (297x420)
5. A4 (210x297) – landscape and portrait

E. General Condition of File

- Drawings files submitted for approval must be purged of all unused definitions such as layer names, line type, blocks, text style, etc.
- Layers 0 and DEFPOINTs must not contain any pertaining objects. Layer 0 is for use in block definition and dimensions.
- All errors in a drawing must be remedied prior to submission.

3. Layering Standard

A. Layers Naming Convention

Note: Layer naming convention based on AIA CAD Layer Guidelines / United States National CAD Standards- Version 4.

O AA BBBB CCCC
1 2 3

O – Optional = Status Code
AA (Position 1) = Discipline (one or two character)
BBBB (Position 2) = Major Group
CCCC (Position 3) = Minor Layer

Optional - Status Field:
This is an optional one-character identifies work status or construction phase. New construction from existing or phases may be differentiated by this field. For example use N for New work, E for existing to remain, D for existing to demolish, F Future work, T temporary work, and so on. Phases could be named by numbers 0-9. If used the status field is always placed as the first field of the layer name.

Layer names may be as short as six characters (discipline code+ major group) or as long as fourteen characters (discipline code+ major group+ minor group+ status). For example

Layer Name Formatting example		
1	A-WALL	A-BBBB
2	A-WALL-FULL	A-BBBB-CCCC
3	A-WALL-FULL-D	A-BBBB-CCCC-D
4	A-WALL-D	A-BBBB-D

Discipline Code (AA, position 1):
The Discipline Code is a two character field that identifies the discipline responsible for the layer content.

A = Architecture
C = Civil
E = Electrical
F = Fire Protection
G = General Information
I = Interiors
L = Landscape
LS = Legal Survey
M = Mechanical
P = Plumbing
Q= Equipment
S = Structural
T = Telecommunication
SS = Site Service
FS = Fire Suppression
O = the Town of Oakville Space Management
Z = Contractor shop drawings

Major Group (BBBB, position 2):
The Major Group designation identifies the building system and is a 4 character field. For example, WALL, DOOR, CEIL, FLOR, etc. In addition, the major group designation should be used for Annotation - text, dimensions, and sheet borders. Detail references, and other elements on CAD drawings that do not represent physical aspects of a building.

Annotation can be placed in both paper and model space.

Minor Group (CCCC, position 3):
This is an optional, four-character naming for further differentiation.
For example A-WALL-EXTR, M-HVAC-DUCT, M-HVAC-EQPM, C-ANNO-TEXT

Combining fields - Layers for Elevations, Details, Sections, and Vertical Drawings:
Special group of layers within each discipline are defined for elevations, sections, details, and three-dimensional views. The Minor group of four characters such as ELEV, SECT, and DETL can be added to any Major Group layer.For example:

A-DOOR-ELEV	Elevations
A-DOOR-ELEV-IDEN	Component identification numbers
A-WALL-SECT	Sections
A-WALL-DETL	Details
A-WALL-DETL-IDEN	Component Identification Numbers

Additional layer names:
Whenever additional names are needed, please refer to the AIA CAD Layer guidelines. If the list provided is still not sufficient, a new layer name may be added using the standards explained in the above.

B. Layer Colours and Pen Weights

- Layers must each be assigned a colour and entities should be created with colour “bylayer” where possible.
- Colour is to be used as a method of defining line weight to the plotter.
- Suggested Line Weight Settings – Consultant to submit pen weight.

4. Block Standards

- Creating blocks comprised of a group of entities is acceptable when these blocks represent simple objects or symbols. Nested blocks are not acceptable but the use of groups is preferred when a number of simple blocks or symbols are combined to represent a more complex object.
- Simple blocks must be created on layer “0” and inserted on the proper layer.

5. Text Style Standards

- The preferred text styles must be created using Standard AutoCAD SHX or TTF font files. Text style usage must be consistent and uniform throughout drawing set of the project.

- Text style height must be set to 0 (zero) allowing changes to suit scaling requirements.
- Text style names should contain, at a minimum, such information as use and font name.
- Standard height of text for:
    - Notes, dimensions, annotations = 2.5mm
    - Sub headings = 3.5mm
    - Major headings = 5.0mm

6. Dimension Style Standards

- Dimensioning must appear in model space created on entities and be associative. Use architectural ticks for dimension terminators.
- Dimension style usage must be uniform throughout drawing set of project. Dimension styles are created by specifying values for a number of dimension variables and saving that setting with a unique style name.
- Dimension style name must reflect the following:
    1. The discipline abbreviation
    2. The scale or height appropriate to the drawing scale

    Example:

A_50mm	Normal Architectural dimension for floor plans
E_1000mm	Normal Engineering dimension for site plans with metres as base unit

7. Linetype Standards

The following system variables affect the appearance of linetypes in the drawing:

1. The **Measurement** variable determines which linetype description file to use for linetype loading:
    - "1" sets the default to the metric unit file **acadiso.lin**.
    - "0" sets the default to the imperial unit file **acad.lin** and must not be used unless approved by the Town's project technologist.
2. The LTSCALE variable sets the global linetype scale factor.
3. The PSLTSCALE controls linetype appearance in paper space.

For consistent linetype appearance and plotting results, the required values for the variables are as follows:

1. Final Drawings: Title sheet in Paper Space with multiple, variously scaled, **VIEWPORTS**
    - Measurement = 1

- LTSCALE = 1 (should be 1 while printing in paper space but could be slightly lower or higher if the linetypes are too large or too small.)
- PSLTSCALE = 1 (On)

2. In Progress: Work from Model Space (not to be used for final Drawing Submission)
   - Measurement = 1
   - LTSCALE = Plot scale value for final drawing (should be equal to the plot scale while working in model space but it could be slightly lower or higher if the linetypes are too large or too small.)
   - PSLTSCALE = 0 (Off)

8. Title Block

A. Title Block Set-up

- Title Block sheets must always be inserted in a Layout (paper space) at 0,0,0 with scale factor of 1 and rotation angle of 0.
- Model Space graphics must appear in the layout in correctly scaled VIEWPORTS.
- Only one Title Block per Layout.
- Titleblock is not to be exploded. The titleblock information is entered as prompted through the attribute dialog box or prompts.

B. Information in Title Blocks

- All project drawings must be on standard sheets (see 3) and must carry the Town of Oakville corporate identity. Coordination with the town must be done at the start of a project with regards to sheet size, standard title block and content of the fields in the title block.
- Each title block must contain the information below:
  - Firm name
  - Project name
  - Project number
  - Address
  - Drawing name
  - Drawing number
  - Drawn by and date
  - Approved by and date
  - Revision chart
  - Drawing scale
  - North arrow (on plans)

9. Systems of Measurement and Drawing Scales

A. Units

- The International System of Units (S.I.) must be used to prepare drawings.
- The unit of linear dimensioning is the millimetre.
- If a site plan requires the use of metres then a decimal number with three decimal places shall indicate metres.

B. Scale

- A completed drawing sheet shall have, in addition to the text scale e.g. 1:100, a graphic scale.

10. Drawing File Naming Conventions

All CADD files must be arranged in a logical format for easy access, retrieval, and reference. The file naming convention follows the sheet Identification Section of the United States National CAD Standards- Version-4 and is similar to that used for layer names:

AA (Position 1) = Discipline (one or two character)
BBBB (Position 2) = Drawing type
CCCC (Position 3) = Sheet Number

Discipline designator: Same as Discipline code in Layer naming convention above. The code consists of one or two alphabetical characters. It indicates the category of the drawing.

Sheet type:

Sheet Type Designators*	
General	Symbols, legends, notes, etc
Plans	Horizontal views
Elevations	Vertical views
Sections	Sectional views and wall sections
Large scale views	Plans, elevation, stairs sections, or sections that are not details
Details	
Schedule and Diagrams	
User Defined	
User defined	
3D representation	Isometric, perspectives, photographs

Sheet number: At the discretion of the consultant, and dependant on complexity of drawing set.

Below is the Executive Summary of the town's *Accommodation and Furniture Standards*. A full copy of the standard is available through the Facilities and Construction Management department or on Portico under the department heading.

Developed and administered by the Facilities and Construction Management department, the *Accommodation and Furniture Standard* provides a consistent approach to cost, quality, and health and safety issues in the design and construction of administrative space throughout the Town's facilities. The standard applies to offices and work settings only and does not include special purpose space requirements specific to a department or a facility (e.g., Council Chambers, Service Desks, etc.)

The Accommodation and Furniture Standard establishes three key principles:

1. The use of a universal space standard of **150 square feet per person** for the design of all administrative space. This benchmark will be used for high level planning and includes offices and workstations of varying sizes, as well as adequate corridor width, centralized filing areas within departments, small copier/print areas, kitchenette, and small meeting rooms.
2. The use of a **centralized core** which will include all private offices, formal meeting spaces, storage and printing areas and an **open office plan** for workstations along the perimeter of the floor footprint. In keeping with sustainable design principles, this will allow for all workstations and collaborative work settings to have access to views and natural light.
3. A recommended **square foot allotment** for eight job classifications based on the specific function performed rather than job title. Although the list of job titles considered in the development of the standard did not include all departments, the definition of the job classifications can be extrapolated and applied across the Town's facilities.

Both the *Guidelines for Design of Accessible Facilities* (GDAF) and the *Environmental Sustainability Policy EN-GEN-001* were considered in the development of the Standard. As such, the layout of the offices and workstations must be fully accessible, and the supply and installation of furniture systems must contribute to the attainment of the appropriate LEED point(s) or be in "the spirit of LEED".

Typically, the use of this Standard will result in an overall smaller footprint per person and the resulting floor plan layout will provide for an open plan including collaborative team spaces, access to daylight and views to the exterior throughout the floor plan and more effective building utilization. The consistent use of space allocation guidelines is an important component in continuing to create an efficient and functional workplace, both for strategic planning and detailed space design.

Topsoil Requirements Matrix

	Private Property Developer via Subdivision Agreement	**Public Boulevards** Developer via Subdivisions Agreement or Town Road Construction Contract	**Parks General** Developer via Subdivisions Agreement or Town Park Development Contract
Depth requirement	▪ 6 inches 150mm) throughout private property lands	▪ For Sodded areas: minimum 6 inches (150 mm) throughout public boulevards; and ▪ For Boulevard Tree Planting areas: 30 inches (750 mm) in designated tree planting trench	▪ 12 Inches (300 mm) throughout park except for those areas designed for sports fields ▪ 30 inches (750 mm) for designated shrub or tree planting beds
Topsoil specification	▪ Native stockpile on site as directed by the Town; ▪ Native topsoil mixture screened, fertile, friable, containing 4% minimum organic mater fro clay loams and 2% minimum organic matter for sandy loams. Acidity of topsoil shall range from 6 to 7.5 pH (levels of NPK and Mg are to be noted). ▪ Free of subsoil, stones, roots over 2 inches (50 mm) in diameter as well as free foreign objects. ▪ Imported topsoil to match above noted specifications where there is insufficient topsoil on site and shall be tested at source.	▪ Native stockpile on site as directed by the Town; ▪ Native topsoil mixture screened, fertile, friable, containing 5% minimum organic mater fro clay loams and 2% minimum organic matter for sandy loams. ▪ Acidity of topsoil shall range from 6 to 7.5 pH Soil nutrients shall be present in the following rations: Nitrogen (N): 20-40 micrograms of available N/gram of topsoil, Phosphorous (P): 10-20 micrograms of phosphate/gram of topsoil, Potassium (K): 70-120 micrograms of potash/gram of topsoil ▪ Free of subsoil, stones, roots over 1 inch (25 mm) in diameter as well as free foreign objects. ▪ Imported topsoil to match above noted specifications where there is insufficient topsoil on site and shall be tested at source ▪ Drainage for tree trench to be provided as part of tree planting specifications. ▪	▪ Native stockpile on site as directed by the Town; ▪ Native topsoil mixture screened, fertile, friable, containing 5% minimum organic mater fro clay loams and 2% minimum organic matter for sandy loams. ▪ Acidity of topsoil shall range from 6 to 7.5 pH Soil nutrients shall be present in the following rations: Nitrogen (N): 20-40 micrograms of available N/gram of topsoil, Phosphorous (P): 10-20 micrograms of phosphate/gram of topsoil, Potassium (K): 70-120 micrograms of potash/gram of topsoil ▪ Free of subsoil, stones, roots over 1 inch (25 mm) in diameter as well as free foreign objects. ▪ Imported topsoil to match above noted specifications where there is insufficient topsoil on site and shall be tested at source.

	Private Property Developer via Subdivision Agreement	**Public Boulevards** Developer via Subdivisions Agreement or Town Road Construction Contract	**Parks General** Developer via Subdivisions Agreement or Town Park Development Contract
Testing requirements for Topsoil	▪ Test topsoil from stockpile source by providing 0.5 kg samples to an approved testing lab (as approved by the Town) and indicate present use, type of subsoil and quality of drainage; ▪ Prepare and ship samples in accordance with Provincial regulations and testing lab requirements; ▪ Testing must identify if the following elements are present in harmful levels: atrazene, salts, pre-emergent herbicides growth inhibitors or soil sterilants and heavy metals; ▪ Should the test results indicate the topsoil is not satisfactory, the report shall include recommendations to improve the soil; ▪ No other topsoil sources shall be used unless approved by the Town; ▪ The Town reserves the right to reject topsoil that does not meet the standard.	▪ Under supervision of Town Consultant or in-house inspectors test topsoil from stockpile source by providing 0.5 kg samples to an approved testing lab (as approved by the Town) and indicate present use, type of subsoil and quality of drainage; ▪ Prepare and ship samples in accordance with Provincial regulations and testing lab requirements; ▪ Testing must identify if the following elements are present in harmful levels: atrazene, salts, pre-emergent herbicides growth inhibitors or soil sterilants and heavy metals; ▪ Should the test results indicate the topsoil is not satisfactory, the report shall include recommendations to improve the soil; ▪ No other topsoil sources shall be used unless approved by the Town; ▪ The Town reserves the right to reject topsoil that does not meet the standard.	▪ Under supervision of Town Consultant or in-house inspectors test topsoil from stockpile source by providing 0.5 kg samples to an approved testing lab (as approved by the Town) and indicate present use, type of subsoil and quality of drainage; ▪ Prepare and ship samples in accordance with Provincial regulations and testing lab requirements; ▪ Testing must identify if the following elements are present in harmful levels: atrazene, salts, pre-emergent herbicides growth inhibitors or soil sterilants and heavy metals; ▪ Should the test results indicate the topsoil is not satisfactory, the report shall include recommendations to improve the soil; ▪ No other topsoil sources shall be used unless approved by the Town; ▪ The Town reserves the right to reject topsoil that does not meet the standard.
Responsibility for installation of Topsoil	▪ Developer, as a condition of Subdivision Agreement	▪ Subdivision Agreement: Developer, as a condition of Subdivision Agreement ▪ Town Tender: Contractor as a requirement of tender documents	▪ Subdivision Agreement: Developer, as a condition of Subdivision Agreement ▪ Town Tender: Contractor as a requirement of tender documents

	Private Property Developer via Subdivision Agreement	**Public Boulevards** Developer via Subdivisions Agreement or Town Road Construction Contract	**Parks General** Developer via Subdivisions Agreement or Town Park Development Contract
Tree Planting soil installation and Tree Planting requirement	▪ No requirement for developer to plant trees or plant trees on private property unless otherwise specified in the subdivision agreement, homeowner is generally responsible for private landscaping;	▪ Subdivision Agreement: Developer shall be responsible for boulevard tree planting and maintenance; Developer responsible for preparing planting plans to coordinate with utilities and other boulevard features. Planting plans to be approved by Town ▪ Town Tenders: Town contractor responsible for planting trees in Town Construction tender issued by the Town. ▪ Developer or Town contractor to provide warranty	▪ Subdivision Agreement: Developer responsible for planting trees to Town specifications for park development contracts within subdivision agreements; ▪ Town Tenders: Town Contractor responsible for park tree planting in park development contract tendered by the Town. ▪ Developer or Town contractor to provide warranty

* Topsoil Matrix Requirement developed by the Landscape department of the Town of Oakville.

Sustainable Design Guidelines Checklist

Knowledge and use of the Sustainable Design Guidelines is **mandatory** for all construction projects at town facilities including new construction, renovations, repairs or maintenance projects. In addition to meeting the requirements of the Sustainable Design Guidelines, all new facilities (over 500 m2) must be eligible to achieve Silver certification, at a minimum, under the LEED Canada-NC Version 1.0 Green Building Rating System administered by the Canada Green Building Council. The Checklist is intended to assist staff and consultants with the application of the SDG and to ensure that each guideline has been applied as is appropriate.

Facility Name:					**Date** (day-mth-yr)	
Project manager / Town staff responsible for project:						
New Construction			SF		**Maintenance** (**A**rchitectural, **S**tructural, **M**echanical or **E**lectrical)	
Addition			SF		**Repair / replacement** (**A**rchitectural, **S**tructural, **M**echanical or **E**lectrical)	
Renovation			SF		**Other** (**A**rchitectural, **S**tructural, **M**echanical or **E**lectrical)	
Project Description:						

	Guideline	N/A	YES	NO	How do you meet / not meet the SDG requirements?
1	**Design Principles**				
1.1A	Accessibility - As per GDAF				
1.1G	Heritage property				
1.1H	Communications & Data - as per IS&S				
1.4	Alternative Energy Sources				
2	**Site**				
2.1	Landscaping – Hard				
2.2	Landscaping – Soft				
2.3	Exterior Lighting				
2.4	Stormwater Management				
	A) Rainwater Harvesting				
	B) Quantity and Quality Controls				
	C) Erosion and Sedimentation Control				
3	**Building Components**				
3.1	Building Orientation and Massing				
3.2	Building Envelope				
	A) Approach for Exterior Walls				
	B) Approach for Roofs				
	C) Approach for Windows				
	D) Approach for Exterior Doors				
	E) Approach for Slabs and Foundations				
3.3	Interior Lighting				
3.4	Ventilation and Exhaust				
3.5	Heating				
3.6	Cooling				
3.7	Water				
3.8	Controls				
3.9	Control Simplification				
3.1	Monitoring				
3.11	Indoor Air Quality				
3.12	Interior Fit-Up				
	A) Materials				
	B) Finishes				
	C) Material Emissions				
	D) Furniture				
	E) Fixtures and Fitments				
	F) Millwork				
3.13	Daylight, Views and Glare Control				
	A) Daylight				
	B) Views				
	C) Glare Control				
4	**Specialty Areas and Uses**				
4.1	Pools				
4.2	Arenas				
4.3	Commercial Kitchens				
4.4	Seasonal Buildings				
4.5	Bikes and Showers				
4.6	Specialty Surfaces				
5	**Commissioning**				
5.1	Proper Commissioning Protocols				
5.2	Design and Site Review				
5.3	Thermal Imaging				
5.4	Air Tightness Testing				
	Appendices				
A-B	LEED Scorecard - Completed				
A-C	Building Worksheet - Completed				
A-E	Project drawings meet town's CADD				
	Contract Documents include:				
	Temporary Erosion and Sediment Control				
	Temporary Indoor Air Control Plan				
	Tree Inventory and Tree Preservation Plan				
	Tree Protection during Construction				
	Waste Management Plan				
	Requirements for Chain of Custody for FSC				
	Commissioning Plan				

ANSI – American National Standards Institute
ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM – American Society for Testing and Materials
BAAQMD – Bay Area Air Quality Management District
BAS – Building Automation System
BTU – British Thermal Unit
CaGBC – Canada Green Building Council
CFC – Chlorofluorocarbon
CFIA – Canadian Food Inspection Agency
CFL – Compact Fluorescent Lamp
CFM – Cubic Feet per Minute
CIBSE – Chartered Institution of Building Services Engineers
CLTA – Canadian Land Trust Alliance
COP – Coefficient of Performance
CSA – Canadian Standards Association
ECM – Electronically Commutated Motor
EER – Energy Efficiency Ratio
EPA – Environmental Protection Agency
EPEAT – Electronic Product Environmental Assessment Tools
ETS – Environmental Tobacco Smoke
FSC – Forest Stewardship Council
GDAF – The Town of Oakville 2008 Guidelines for Design of Accessible Facilities
GHG – Green house gases
HEPA – High Efficiency Particulate Air (filter)
HMA – Hot-mix asphalt
HRV – Heat Recovery Ventilator
IAQ – Indoor Air Quality
I-BEAM – Indoor Air Quality Building Education and Assessment Model
IESNA – Illuminating Engineering Society of North America
IS&S – Town of Oakville Information Systems and Solutions Department
LEED – Leadership in Energy and Environmental Design
LEED Canada NC – LEED Canada New Construction
LEED Canada EB & OM – LEED Canada Existing Buildings Operations and Maintenance
MBH – Mega BTU/hour
MERV – Minimum Efficiency Reporting Value
MNECB – Model National Energy Code for Buildings
MOE – Ministry of the Environment
NEMA – National Electrical Manufacturers Association
OBC – Ontario Building Code
OPA – Ontario Power Authority
OPCA – Ontario Petroleum Contractors Association
PVC – Polyvinyl Chloride

RAP – Reclaimed Asphalt Pavement
REC – Renewable Energy Certificate
SCAQMD – South Coast Air Quality Management District
SCM – Supplementary Cementing Material
SHGC – Solar Heat Gain Coefficient
SMACNA – Sheet Metal and Air Conditioning National Contractors Association
SOP – Standard Operating Procedure
SRI – Solar Reflectance Index
TPO – Thermo Plastic Olefin
USGBC – United States Green Building Council
VLT – Visible Light Transmittance
VOC – Volatile Organic Compound
WFR – Wall to Floor Area Ratio
XPS – Extruded Polystyrene