PLANNING & DESIGNING
Green School Grounds
# Table of Contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>Executive Summary</td>
</tr>
<tr>
<td>06</td>
<td>1.0 Intent of Guidelines</td>
</tr>
<tr>
<td></td>
<td>1.1 Toronto Green Standard</td>
</tr>
<tr>
<td></td>
<td>1.2 Evergreen Design Principles</td>
</tr>
<tr>
<td></td>
<td>1.3 Unique Aspects of School Ground Design</td>
</tr>
<tr>
<td>08</td>
<td>2.0 Guiding Principles</td>
</tr>
<tr>
<td></td>
<td>2.1 Set Green Standard Goals</td>
</tr>
<tr>
<td></td>
<td>2.2 Take a Child-Centred Approach</td>
</tr>
<tr>
<td></td>
<td>2.3 Use Natural Materials</td>
</tr>
<tr>
<td></td>
<td>2.4 Be Creative with Surfacing and Separations</td>
</tr>
<tr>
<td></td>
<td>2.5 Focus on Function</td>
</tr>
<tr>
<td></td>
<td>2.6 Be Cognizant of Safe-Schools Issues</td>
</tr>
<tr>
<td></td>
<td>2.7 Plan for Maintenance and Sustainability</td>
</tr>
<tr>
<td>14</td>
<td>3.0 The Building Addition</td>
</tr>
<tr>
<td></td>
<td>3.1 Assess Existing Conditions</td>
</tr>
<tr>
<td></td>
<td>3.2 Building Facades</td>
</tr>
<tr>
<td></td>
<td>3.3 Entrances and Exits</td>
</tr>
<tr>
<td></td>
<td>3.4 Building Addition Configuration: Courtyards</td>
</tr>
<tr>
<td></td>
<td>3.5 Clearances</td>
</tr>
<tr>
<td>18</td>
<td>4.0 Grading and Drainage</td>
</tr>
<tr>
<td></td>
<td>4.1 Treat Water as a Resource Not as Waste</td>
</tr>
<tr>
<td></td>
<td>4.2 Reduce the Amount of Impervious Cover</td>
</tr>
<tr>
<td></td>
<td>4.3 Stormwater Runoff</td>
</tr>
<tr>
<td></td>
<td>4.4 Link to Local Issues</td>
</tr>
<tr>
<td></td>
<td>4.5 Grading Specifics for School Grounds</td>
</tr>
<tr>
<td>26</td>
<td>5.0 Cycling, Pedestrian and Automobile Infrastructure</td>
</tr>
<tr>
<td></td>
<td>5.1 Circulation</td>
</tr>
<tr>
<td></td>
<td>5.2 Parking Lots</td>
</tr>
</tbody>
</table>
6.0 Construction Materials and Techniques
   6.1 Buy Local
   6.2 The Four R’s
   6.3 Balance Cut and Fill
   6.4 Reduce Emissions
   6.5 Control Erosion
   6.6 Choose Durable Materials

7.0 Shade: Urban Heat Island Reduction
   7.1 Protect Against Ultra Violet Radiation
   7.2 Invest in Trees
   7.3 Create Groves
   7.4 Deciduous Trees
   7.5 Coniferous Trees
   7.6 Shading Parking Lots
   7.7 Shade by Season
   7.8 Surface Colours

8.0 Trees: The Urban Forest
   8.1 Existing Trees
   8.2 New Tree Placement
   8.3 Tree Planting Specifics for School Grounds
   8.4 Warranty
   8.5 Maximize Trees

9.0 Lighting
   9.1 Dark-Sky Compliance
   9.2 Low-Energy Lamps
   9.3 Minimize Lighting

10.0 Site Amenities
   10.1 Seating
   10.2 Class-size Outdoor Seating Areas
   10.3 Nature Study Areas and Gardens
   10.4 Play Equipment
   10.5 Railings and Access Barriers (including bollards, fences and gates)

51 Recommended Construction Details and Plant Lists
The following guidelines, *Planning and Designing Green School Grounds*, were commissioned by the Toronto Catholic District School Board (TCDSB) in the fall of 2008. Evergreen, a not-for-profit organization that makes cities more livable by deepening the connection between people and nature, was asked to prepare both guidelines and standards to aid and guide the work of architects and landscape architects designing 16 new additions on TCDSB schools as their work pertained to the schools’ grounds. These guidelines bring together information from two primary sources. The first source is the *Toronto Green Standard*, developed by the City of Toronto; the second is the best practices for school ground greening that Evergreen has been developing with its network of landscape designers across Canada.

Together, these ideas represent a renewed vision for the TCDSB’s school grounds—one that is in line with current green design standards while at the same time focused on better serving students’ physical, intellectual, social and emotional needs, from shade and seating, to managing water on site, to class-sized gathering spaces and beyond. While the guidelines represent change to existing practices at the TCDSB, the content has been assembled based on designs and techniques that have proven to be successful in numerous school settings.

The scope of work that is undertaken on school grounds is larger than these guidelines attempt to cover. This represents one step towards an expanding vision of the potential role that school grounds can play in improving the lives of students, teachers, staff, administration and each school community. In an age of climate change and with the current generation of children spending dramatically increasing amounts of time indoors and inactive, the efforts to improve and green our school grounds is timely and important. It deserves attention, priority and our best efforts.
1.0 Intent of Guidelines

1.1 Toronto Green Standard

These guidelines reflect the Toronto Green Standard by promoting better environmental sustainability in the siting and design of outdoor spaces associated with school building additions and the creation of new schools. The Toronto Green Standard (a set of performance measures for sustainable development that responds to the City’s environmental concerns) was adopted by Toronto City Council in December 2008; it will be fully implemented September 2009. These guidelines promote the adoption of the Toronto Green Standard right away with the expectation that it will help improve air and water quality, reduce greenhouse gas emissions and enhance the natural environment. For more information on the Toronto Green Standard, see www.toronto.ca/planning/greendev.htm.

1.2 Evergreen Design Principles

These guidelines are also intended to reflect Evergreen design principles:

- Design to meet children’s developmental needs
- Respond to local ecology and community
- Incorporate green design principles
- Use the participatory design process
- Facilitate outdoor learning opportunities
1.3 Unique Aspects of School Ground Design

In addition, these guidelines are intended to highlight the unique aspects of the design and maintenance of school grounds, which include:

- Specific strategies for the detailed design of outdoor spaces associated with school additions and new schools.

- Challenges related to intensive use:
  - Children spend as much as a quarter of their day at school outdoors in the school grounds, making these pivotal places that play an important role in shaping future generations—in communicating and instilling values. Children easily “read” the school ground landscape (consciously and subconsciously) and perceive the values the adult world places on them and the natural environment. School grounds are outdoor classrooms with learning opportunities everywhere; the school ground is a classroom whether we intend it or not.

  - Virtually all school grounds are challenged by intensive use by large numbers of children. Even more significantly, all school grounds are subject to intensive and heavy use in all seasons and all weather conditions. This is different from other landscapes that tend to be used mostly, if not exclusively, in favourable weather conditions. Related to this point is the limited (if any) amount of time available after construction for establishment of new landscapes, especially sod and seed. As a result, design solutions that are successful for parks, commercial sites, gardens, institutional and residential properties are rarely transferable to schools.

Like nearly all public spaces, school grounds are invariably open to the public for use after hours: after school, weekends and summer holidays, as well as during the night. School ground design presents an opportunity to foster community development and trigger positive change while at the same time it presents challenges related to public safety (real and perceived), vandalism and abuse. As a designer it is important to bear in mind that a connection between use and safety has been well established: where people use spaces in a positive way and in substantial numbers, all people feel more secure.
2.0 Guiding Principles

2.1 Set Green Standard Goals

Use the Toronto Green Standard to inform all design decisions to ensure a positive impact on the environment:

- Better air quality and reduced greenhouse gas emissions
- Reduced urban heat island effects
- Greater energy efficiency
- Improved water quality and water efficiency
- Reduced solid waste
- Protection of the urban forest and wildlife habitat
- Reduced light pollution (controlling intensity and direction of light: light spill, glare, reflected light, dark-sky issues, source brightness)

2.2 Take a Child-Centred Approach

Make design decisions with an understanding of children, children’s play, and the importance of play in learning and development. Take the following into account:

- **Flexibility**: Design spaces that are suggestive, not prescriptive. Ensure flexibility in use is possible when designing spaces for children’s play and learning.

- **Playfulness**: Build in a sense of playfulness, aesthetics and creativity. Express this through both the overall design and in detail through the use of colour, pattern and texture.

- **Scale**: Scale spaces to be child-oriented and aim for a sense of intimacy. When determining locations of play areas, take advantage of the spatial quality, sense of place and shade created by existing trees.

- **Diversity**: Encourage diversity by creating different spaces and distinct places within the school ground. Create landmarks that function as distinct meeting and playing places for children. Avoid mass repetition of the same feature.
2.3 Use Natural Materials

Whenever possible, use natural materials for their unique and interesting qualities and potential for learning (e.g. use stone rather than precast concrete). Children benefit in many ways from contact with nature and may exhibit behavioural problems (sometimes referred to as “Nature Deficit Disorder”) if deprived of free, unorganized play in natural outdoor environments.

2.4 Be Creative with Surfacing and Separations

Although asphalt and chain-link have conventionally been the materials of choice for surfacing and separations, there are many other possibilities, such as mulch, permeable paving or vegetation. Feel free to be creative with your choices.

Sturdy wood rail fences, armour stone and coloured concrete are viable options for school grounds (see Fig. 1 Wood Rail Fence, p. 52).
2.5 Focus on Function

Aim to create a healthy, functional play space for children. Avoid an ornamental approach to the design of the landscape by considering the following points:

- **Put trees first:** Prioritize trees over ornamental shrub plantings and gardens. Channel the landscaping budget toward well-placed trees best suited to ensure the following:
  - Sun safety and wind protection for children.
  - Urban heat island reduction.
  - Energy conservation.
• **Create sustainable gardens**: Create gardens that benefit children and will last long-term. (see Section 10.3).
  
  - Locate gardens in low-traffic areas (i.e. well away from meet-and-greet spaces, active play spaces, sports fields, student entrances/exits, line-up zones) and preferably in locations that are accessible to students at recess.
  
  - Avoid ornamental flower gardens and shrub plantings intended to beautify the building or provide visual screening adjacent to parking lots and boundary fence lines as they are not sustainable.

Gardens do not work in high-traffic meet-and-greet and line-up areas. Shrub plantings intended merely as beautification are not sustainable. Trees should take priority over ornamental shrub plantings and gardens.
• **Be bold:** Create and shape spaces using bold gestures. Walls, ceilings, doors, windows and floors shape outdoor spaces just as they shape spaces within a building. There are various landscape elements that can be used as "walls" and "ceilings" and that can create doors and windows. Generally, ceilings are very important in space-shaping in school grounds, and walls, particularly those within the school grounds, should be transparent wherever possible; solid walls are spatially/visually confining and create potential safety/security/surveillance problems. Canopy trees are ideal ceilings as they shape spaces and at the same time create shade.

*Top left:* Trees planted 7m from the building foundation help to shade hard surface areas and cool classrooms.
*Top right:* Trees planted between a play space and a roadway offer a green veil to soften the urban environment and buffer street noise.
*Bottom:* Highway sound barriers create a feeling of enclosure but can be overbearing, making a space feel cold and isolating.
2.6 Be Cognizant of Safe-Schools Issues

Ensure the school ground design contributes to a safe space by considering the following points:

- **Design predictable layouts**: Enhance site legibility so the layout can be easily understood.

- **Keep sight-lines open**: Do not plant trees in locations that would compromise safety by blocking sight-lines, security cameras and/or night lighting.
  - Avoid planting low-growing shrubs and other dense plantings next to building walls and along the edges of walkways. It is important for people to be able to see ahead along pathways.
  - Similarly, do not locate waste and recycling dumpsters and/or precast concrete storage sheds (bunkers) near walkways.

- **Space out seating**: Do not place benches or seating stones right at the edge of walkways. Path users may feel uncomfortable or unsafe to be forced to walk close to people sitting on or gathering at the bench.

- **Two ways out**: Make sure there are two ways in and out of fenced areas. Avoid dead-end entrapment zones.

2.7 Plan for Maintenance and Sustainability

Choose durable, high quality materials whenever possible and consider maintenance, long-term sustainability and site-management issues in all design decisions.
3.1 Assess Existing Conditions

At the outset obtain a current topographic survey (and other documents as necessary) that shows existing features. Among other things, the documents should indicate the following elements (marked as either “to remain” or “to be removed”). These should be marked accordingly on the Site Plan and Landscape Plans:

- **Trees:** Mark caliper, species, extent of drip-line, elevation at base of trunk, spot elevations at several points within drip-line and the drip-line of neighbouring trees overhanging school property including City trees on adjacent boulevards and parks.

- **Soil:** Have existing soils tested for permeability (infiltration) and height (elevation) of water table at same time as bearing capacity testing.

- **Grading:** Mark spot elevations at regular intervals, grading break points (top and bottom of slope, centre lines of swales/ditches), contour lines at 0.25m intervals and benchmark.

- **Water sources:** Mark location of ground hydrants and hose bibs on existing building, field irrigation, etc.

- **Utilities:** Mark underground services/utilities, overhead wires, catch basins and storm sewers including inverts and pipe sizes.

- **Existing building and site features:** Mark fences including height, gates, flagpoles, benches, light standards, surfaces, boulders, stones, curbs, play equipment including wall-mounted equipment and pavement markings including line games.

Note: All plans should also include property lines, scale and a north arrow.

3.2 Building Facades

- **Facing play areas:** Children spend a great deal of time playing close to the building. Be sensitive to the design and the aesthetics of the facades facing the playing area.

- **Playable walls:** Keep in mind the play-ability of the walls facing the play area. These walls are potential play surfaces for wall ball, basketball and others. These games are impacted by fenestration, surface texture, wall angles etc.
3.3 Entrances and Exits

- **Lining up:** Allow space for “lining up” outside building entrances. This activity takes place at the end of recess and may also be associated with dismissal time and bus line-ups.

- **Meet and greet:** Be aware of the “meet and greet” activity that takes place outside of kindergarten and primary exits at dismissal time. With sensitive design, these spaces can be animated to encourage positive social interaction and community building. These waiting/gathering spaces for parents and caregivers are used during all seasons and all weather conditions. They should be designed to be comfortable with shade, wind protection, lots of seating and room for strollers and wagons. Caregivers tend to set themselves apart/alone in a location visible to/from the exit doors. There is a great deal of spill-over onto surrounding surfaces; these spaces should have hard surfacing or be mulched and/or have specific edges. In general, meet and greet spaces need to be spacious, but this must be balanced with an intimacy of scale. Note that meet and greet areas for older students are usually located at school ground entrances rather than building entrances.
3.4 Building Addition Configuration: Courtyards

- Although enclosed courtyards provide secure, sheltered and intimate outdoor spaces for play and learning, they present many challenges from a site-management perspective as they are difficult to access with equipment and materials. Be cognizant of these issues if proposing a building addition layout that results in or includes a courtyard.

- Partially enclosed courtyards offer many of the advantages of a fully enclosed courtyard without the associated site-management difficulties. However, unless such courtyards are open to public view (i.e. facing an active street) ensuring safety and security in these areas can be extremely challenging as there is potential for increased vandalism.

3.5 Clearances

Provide clearances around the building for circulation and site management. Consider the following common uses:

- Building maintenance and construction: walls, windows, roofs
- Building-related deliveries: furniture, supplies
- Site-related deliveries: sand, mulch, topsoil
- Playing-field management: top-dressing, grading, aeration, mowing
- Snow removal and storage: giant piles, snow ploughs, trucks
- Portables: installation and removal
- Emergency access: police vehicles after-hours
- Garbage and recycling pick-up: dumpsters, trucks

Align truck access gates from public roads through parking lots and into the school grounds. Curb cuts (ramped curbs) should be provided where necessary. Width of emergency and site management access routes should take into consideration winter conditions and the probable location of snow piles.
4.0 Grading & Drainage

The *Toronto Green Standard* (Water Quality, Quantity and Efficiency)

Manage, clean and minimize the amount of stormwater that leaves the site.

**Do the following:**

- Follow the Erosion and Sediment Control Guidelines for Urban Construction (Greater Golden Horseshoe Conservation Authorities, December 2006) during construction and demolition activities.

- Retain stormwater onsite to the same level of annual volume of the overland runoff allowable under pre-development conditions.

- Retain at least the first 5mm from each rainfall through rainwater reuse, on-site infiltration, and evapotranspiration.

**OR**

- Ensure that the maximum allowable annual runoff volume from the development site is no more than 50% of the total average annual rainfall depth.

- Remove 80% of total suspended solids (on an annual loading basis) from all runoff leaving the site based on the post-development level of imperviousness.

4.1 Treat Water as a Resource Not as Waste

Take a *water balance* (hydrologic cycle) approach that links each school property to its watershed. Understand that positive action at the site level realizes watershed-scale benefits. The goal is to reduce the quantity and to improve the quality of stormwater runoff through source control rather than conveyance of surface runoff to end-of-pipe solutions. This has become particularly important due to the increased frequency and intensity of rainfall events.

A *water balance* approach represents a fundamental shift in water management.

<table>
<thead>
<tr>
<th>Drainage systems</th>
<th>&gt;</th>
<th>Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive (solving)</td>
<td>&gt;</td>
<td>Proactive (preventing)</td>
</tr>
<tr>
<td>Engineer driven</td>
<td>&gt;</td>
<td>Interdisciplinary</td>
</tr>
<tr>
<td>Pipe and convey</td>
<td>&gt;</td>
<td>Model natural systems</td>
</tr>
<tr>
<td>Peak flow thinking</td>
<td>&gt;</td>
<td>Volume-based thinking</td>
</tr>
</tbody>
</table>
4.2 Reduce the Amount of Impervious Cover

- **Drop-off and pick-up zones:** Consider and facilitate use of the existing street as a drop-off and pick-up zone rather than creating one on site.

- **Parking lots:** Provide only the minimum required parking ratio for building use, particularly where public transit is available.
  - Provide compact car spaces, minimum stall dimensions and efficient parking lanes.
  - Prior to extending/adding additional parking stalls, re-evaluate and reconfigure the existing parking lot layout. Use this same criteria (compact car spaces, minimum stall dimensions and efficient parking lanes) to maximize parking in the existing parking lot(s).

- **Play areas:** Consider options and provide alternatives to impervious hard surface (asphalt) play areas. Depending on the site, turf and/or a suitable mulch soft surface play area may be a viable option. At the very least, take measures to avoid or reduce large unbroken expanses of hard surface play area.
4.3 Stormwater Runoff

Reduce the rate and volume of stormwater runoff. Keep rainwater on site: store it, delay runoff and make use of it to achieve other goals (e.g. watering trees, gardens, etc.). This can be achieved through the following absorbent landscaping solutions:

- **Bio-retention swales:** These are vegetated swales, grass swales with minimal slopes and/or rain gardens that offer the following functionality:
  - Immediate above-ground and, in the case of bio-retention swales and rain gardens, below-ground storage capacity.
  - Possible infiltration areas for groundwater recharge depending on the underlying soil type.
  - When planted with wetland shrubs and trees (rain gardens) these “natural” drainage systems/riparian zones slow down water and act as a sponge to soak up water and promote evapotranspiration.
  - Improved water quality.
  - Act as learning gardens for students.
  - Produce shade to reduce the urban heat island.

A bio-retention swale provides a naturalized green corridor through the landscape consisting of a wide variety of plants ideally suited for the infiltration of stormwater, offering a rich context for teaching and learning.
• **Storage/Infiltration trench:** Runoff from both impervious surfaces and surfaces with low infiltration capacities can be intercepted by an infiltration trench (see Fig. 2, Bio-Retention/Infiltration Trench, p. 53). The temporary storage and eventual percolation of stormwater runoff into the soil is the primary purpose of an infiltration trench. The desired dimensions will depend upon the volume of direct runoff for which control is needed and the characteristics of the watershed and soils.

• **Parking lot stormwater runoff:**
  - Wherever possible, use storage/infiltration trenches to address parking lot stormwater runoff. At the same time, slow the runoff down across the asphalt, keep it dispersed and flowing in a “sheet” allowing the water to enter the perimeter trench or bio-retention swale from several points avoiding a single entry point. Be mindful of icing issues on asphalt pavement as sheet flow can create icy patches in shaded areas and where the slope is less than 2%.
  - Provide “breaks” in curbs between “hard” paved surfaces and soft surfaces. Allow water to run from hard surfaces onto soft surfaces. Bio-retention swales, rain gardens or simply open mulched areas with tree plantings are very effective at intercepting runoff from areas of impervious paving.
  - Avoid directing water from soft surfaces onto and over hard surfaces that need to be kept clear of snow/ice in winter.

A newly constructed outdoor classroom is also a large bio-retention area capturing sub-surface seepage from the adjacent park as well as a portion of the parking lot runoff. Sub-surface filter-cloth wrapped drainage pits full of clear stone lie beneath these mulched areas and capture runoff from the asphalt play area.
• **Permeable surfacing:** Permeable concrete pavers, pervious concrete, limestone screenings and porous poured-in-place rubber playground surfacing should be considered for school grounds. Porous asphalt is also available but as of yet, is not generally recommended for school parking lots or play surfaces as its porosity is impermanent in these situations (see Fig. 3, Limestone Screenings Walkway, p. 54).

The following are examples of the environmental benefits of permeable surfaces:

- Provides immediate below-ground storage capacity
- May function as an infiltration area for groundwater recharge (depending on the underlying soil type)
- Research indicates that permeable surfaces can improve water quality by trapping/filtering most pollutants* (avoid intersection of granular base and water table) and reduce thermal pollution by reducing warmed surface runoff

* Except chloride (salt). However, infiltration technologies distribute (release) chloride more evenly over the seasons than do impervious pavements. Asphalt paving results in high seasonal concentrations in the surrounding environment.

Permeable concrete paving used for the parking stalls on the downhill portion of this parking lot captures and retains a portion of the runoff before it enters the adjacent swale. This school also was able to manage a ‘first in–last out’ double row of parking to maximize the stall/aisle ratio.
Currently, most permeable paving is significantly more expensive than standard asphalt paving. In some instances it may be a viable option for parking lot expansion or considered for use in combination with other types of paving. It becomes economically viable (in the short term) when its use precludes the necessity of constructing storm sewers and/or stormwater management ponds and structures. For example, existing roof drains should ideally be separated from existing combined sewers; consider using permeable paving in parking lot reconstruction to partially balance (reduce) roof water currently being directed to storm sewers.

The following are ways to intercept and/or capture water that would otherwise be directed to storm sewers:

- **GSPP systems**: Grass Swale and Perforated (leaky) Pipe systems in place of curbs and conventional storm sewers.

- **Tree canopy**: Canopies intercept rainwater which alters the timing and distribution of precipitation.

- **No-mow areas**: Often called learning gardens, these areas are more absorbent (have lower runoff rates and volumes) than areas of turf.

- **External downspouts**: Downspouts, in combination with rain barrels and/or cisterns for rainwater storage, can provide an immediate and accessible water resource on site to help with the watering needs of natural school grounds.

- **Green roofs**: Green roofs reduce the amount of stormwater runoff and also delay the time at which runoff occurs, resulting in decreased stress on sewer systems at peak flow periods.

### 4.4 Link to Local Issues

Use the project as an opportunity to raise awareness of local watershed issues and as an example or educational tool of applied solutions to issues involving environment, watershed, climate change, urban planning etc. Make the solution visible. For example, a drainage pit with a standard catch basin frame and grate appears on the surface to be no different from a conventional catch basin drain inlet to a storm sewer. Children, like the community in general, are not aware that this solution is different or that there is a problem in the first place. This is lost learning potential. Use the solution as an opportunity for direct experience.
4.5 Grading Specifics for School Grounds

Good grading and positive drainage are arguably the most critical site-management components of sustainable school grounds due to the intensive use they are subject to in all seasons and all weather conditions.

- **Hard surface areas:**
  - Minimum slope 2% on impervious surfaces. This reduces the need for salt in high traffic areas, an obvious environmental benefit.

- **Soft surface areas:**
  - Minimum slope 1.5% on turf—otherwise they are at times wet and unusable and/or become worn and muddy in high traffic areas.
  - Specify fill and topsoil that is low in clay and high in sand content.
  - Create deliberate “soft” (not engineered) infiltration basins/trenches (constructed wetlands) in areas that are poorly drained (low points, wet areas). Plant appropriate trees (e.g. Acer rubrum) adjacent to aid water take-up. Consider making this a feature (learning garden).
  - Use utility mulch (relatively inexpensive tub-grinder mulch) in heavily shaded, poorly drained and/or heavy-use areas where turf is not sustainable. Note that tub-grinder mulch is not the same as forestry chipper mulch, which has long strands of wood that plug up catch basins and are a safety concern with children.
  - Be aware that mulch migrates downhill: placing it on a berm next to a hard-surface area is difficult to manage/maintain.
  - Place mulch or other loose fill material away from drain inlets (catch basins).
  - Finished grade of mulch areas should be flush with finished grade of hard surfaces.
• **New or renovated sports fields:** Add sand and/or composted amendments to sports fields when aerating, over-seeding, top-dressing, rototilling or regrading, and/or re-sodding to improve water infiltration.

• **Low points:** Place drainage low points (e.g. swales, catch basins) away from high pedestrian traffic areas (walkways, play areas, line-up areas) and conversely, locate gates and openings in fences away from low points.

• **Slopes, hills and berms:**
  - Contrasting topography is a powerful invitation to play. Where not already existing, it may be possible to shape hills and berms and other playful ground configurations. However, grassy berms are a major site-management challenge and are generally not sustainable in areas of active play as they pose mowing problems and become worn and bare from high use within a few years.
  - If berms are being considered they should not be higher than about 600mm and side slopes should not exceed 3:1 (33%). These types of low berms, if mulched with tub-grinder mulch (that tends to knit together) or paved with poured-in-place rubber surfacing, have proven to be sustainable at schools.
  - Consider existing slopes as opportunities for increased play potential within a play space; it may not be necessary to build retaining walls or to make them “level,” even around new building additions. This could result in cost savings as well as a more interesting and natural school ground.
5.0 Cycling, Pedestrian and 

The *Toronto Green Standard* 
(Air Quality)

Do the following:

Discourage single-occupancy automobile use

- Provide the minimum number of parking spaces allowed under the Zoning Bylaw.
- Dedicate priority parking space for carpool ride sharing.
- Dedicate priority parking spaces for ultra low-emission vehicles.
- All additional spaces must provide or have access to electrical outlets for plug-in electric vehicles.

Encourage cycling as a clean air alternative

- In the Downtown, Central Waterfront and Centers, provide at least 0.2 bicycle parking spaces/100m² of non-residential GFA; for buildings in the rest of the City provide at least 0.13 bicycle parking spaces/100m² of non-residential GFA.

  OR

- In the Downtown, Central Waterfront and Centers, provide the greater 0.3 spaces/100m² of non-residential GFA or 6 spaces, for sites with non-residential GFA greater than 1000m², for buildings in the rest of the City provide at least 0.25 spaces/100m² of non-residential GFA or 6 spaces, for sites with non-residential GFA greater than 1000m².

Encourage walking as a clean air alternative

- Connect buildings on the site to off-site pedestrian paths, transit stops and parking areas (car and bike).
- Design sidewalks and walkways to be continuous, universally accessible, barrier free and clearly designated.
- Cover main entrances and outdoor waiting areas for protection from sun and inclement weather.
- Use only energy-efficient, pedestrian specific lighting directed onto sidewalks, pathways, entrances and outdoor waiting areas.
- Locate air exhaust systems away from pedestrian routes and amenity areas.
- No air-intake grates along pedestrian routes.

5.1 Circulation

Pay attention to circulation, particularly pedestrian circulation. Use design to encourage flow of children around the whole site.
• **Facilitate walking:** Design to encourage walking and cycling to school rather than driving and drop-off.
  
  ° Provide linking hard surface walkways between the school and City sidewalks at all school ground access points.
  ° Provide bicycle “parking” in a convenient, secure and visible location.
  ° Provide comfortable and attractive meet and greet areas at the likely waiting, gathering and congregating places.
  ° Resist requests to design new or modify existing parking lots to create internal looping aisles so they can readily double as vehicular drop-off zones. Parking lots with dead-end aisles subject to congestion problems are more easily justified and regulated as “off-limits” at arrival and dismissal times, thereby discouraging vehicular drop-off/pick-up.

• **Walkway specifications:** Walkways should be functional, follow natural pedestrian flow lines and have generously curved radii and gradual slopes.

  ° Longitudinal slope: 5% maximum is ideal; 8% maximum for short distances where unavoidable.
  ° Cross slope: 2% minimum; 2.5% maximum.
  ° Respond to existing and predicted desire lines.
  ° Be barrier-free (without steps or barrier curbs) for strollers, wagons, bikes, wheelchairs, roller-blades, snow removal, etc.
  ° Be wide enough to allow for snow removal.

### 5.2 Parking Lots

• **Minimize allocated parking area:** Provide only the minimum number of parking spaces allowed under the Zoning By-law. Consider shared use of parking with adjacent developments (e.g. churches) that have different peak parking time characteristics. Dedicate priority parking spaces for carpool ride sharing and/or ultra-low emission vehicles.

• **Curbs:** In addition to the above and the considerations outlined in Section 4.0 Grading and Drainage, take into account the following when designing parking lots:

  ° All parking lots should have poured-in-place curbs or precast concrete curbs firmly anchored to the paving.
  ° The front of all curbs should be 1m minimum from any surrounding fence to prevent fence damage.

• **Waste removal:** Provide accessible handling and storage facilities for solid waste and recyclable materials (dumpsters) in locations that can be easily and safely approached and emptied by large waste-management trucks.
6.0 Construction Materials

The *Toronto Green Standard*  
*Water Quality, Quantity and Efficiency and Solid Waste*

Ensure protection of water quality during construction and demolition.

Facilitate waste reduction and efficient processing.

**Do the following:**

- Follow the *Erosion and Sediment Control Guidelines for Urban Construction* (Greater Golden Horseshoe Conservation Authorities, December 2006) during construction and demolition activities.

- Provide user-friendly and accessible handling and storage facilities for organic waste and recyclable materials.

6.1 Buy Local

Avoid long-distance shipping of construction materials by specifying locally available materials.

6.2 The Four R’s

Reduce, recycle, reuse... and *rethink* construction methods and details. Wherever possible, reuse existing topsoil, granular bases and asphalt paving on site (i.e. grind up and mix with granular base as first course in new paving bases) to reduce trucking materials away from the site and/or filling landfills.

6.3 Balance Cut and Fill

Make every attempt to balance cut and fill on site.

6.4 Reduce Emissions

Identify demolition and construction methods for minimizing air emissions and dust. For example, design layout of areas of precast concrete unit paving (e.g. permeable paving) in response to the size of the paving units so that the need to saw-cut pavers is reduced if not eliminated.
6.5 Control Erosion

Adhere to Ministry of the Environment and Conservation Authorities’ on-site *Erosion and Sediment Control Guidelines* during demolition and all construction activities.

6.6 Choose Durable Materials

Specify durable materials (e.g. precast concrete paving rather than asphalt paving) to minimize the need to replace, reconstruct and rebuild in the future.
7.0 Shade: Urban Heat Island

The *Toronto Green Standard* (Air Quality)
Reduce ambient surface temperatures, and provide shade for human health and comfort.

Do one of the following:

- Use high-albedo surface materials for at least 50% of the site’s non-roof hardscape. *OR*
- Use open grid pavement for at least 50% of the site’s non-roof hardscape. *OR*
- Shade at least 50% of hardscape, including surface parking areas, walkways and other hard surfaces.
- Plant large growing shade trees at the equivalent of 6–8m intervals starting from the property line along all street frontages, open space frontages and public walkways, excluding driveways and easements.
- If surface parking is permitted and provided, plant internal shade trees at a minimum ratio of one tree planted for every five parking spaces supplied, in accordance with the specifications found in the Design Guidelines for “Greening” Surface Parking Lots.

* Light coloured materials must have a reflectance of 0.3

7.1 Protect Against Ultra Violet Radiation

Ensure that, in addition to meeting or exceeding the *Toronto Green Standard* for air quality, outdoor sites are as healthy (“sun-safe”) as possible by reducing children’s exposure to UV radiation and lowering summer temperatures.

- Plan shade with careful regard to patterns of site usage.
- Provide effective solar protection, not just the impression of protection.

7.2 Invest in Trees

Trees are a long-term investment while structures are a short-term investment. Generally, create shade using trees rather than shade structures or gazebos. Trees are less expensive at the outset, improve and enlarge as they age (rather than deteriorate), provide many environmental benefits and are a natural solution that will help connect children with nature.
7.3 Create Groves

Plan for groves comprised of diverse species of native canopy trees to create natural gazebos. Ensure trees are located (See Fig. 11, Recommended Plant Lists, p. 63):

- Close to the school building (rather than lining the far edges of the school ground)
- Near sports field spectators
- In areas between and around active play spaces.

An example of a planting layout plan where groves of trees are strategically placed to provide shade without limiting active use of the school ground.
7.4 Deciduous Trees

Use deciduous trees on the south and west sides to shade the building and portables and to reduce reflectivity of paved surfaces and building walls. Plant trees in paved play areas to provide shade to reduce the urban heat island effect. If a choice is necessary (i.e. where funds are limited), priority should be given to shading paved play areas rather than parking lots (see Fig. 4, Deciduous Tree in Hard Surface, p. 55 and Fig. 5, Deciduous Tree Planted in Soft Surface, p. 56)
7.5 Coniferous Trees

Use coniferous trees to provide effective shade, wind protection and winter interest.

7.6 Shading Parking Lots

Trees used to shade parking lots should be located around the perimeter (be mindful of snow storage areas), rather than in islands within the parking lot. Where possible, do not design large multi-aisle parking lots with large expanses of paving.

7.7 Shade by Season

Care needs to be taken to ensure that new shade initiatives do not intensify winter conditions at the site. Summer shade provision should minimise UVR levels as well as reduce heat and light. Winter shade provision should minimise UVR levels, while allowing for transmission of sufficient levels of heat and light.

7.8 Surface Colours

Consider using lighter surface paving colours to achieve the Toronto Green Standard in parking areas and darker paving materials where children play. This strategy reduces the amount of glare for children and makes use of winter solar radiation to warm the asphalt and melt snow and ice more quickly, which helps reduce the need for salt. Deciduous trees can be planted to shade these areas of darker paving in the summer without significantly impacting the amount of winter sunlight reaching the paving.
8.0 Trees: The Urban Forest

The *Toronto Green Standard* (Ecology, Air Quality, Water Quality, Quantity and Efficiency)

Preserve and enhance the urban forest.

Protect, restore and enhance the natural heritage system. Protect and increase biodiversity.

Provide growing conditions to support long-term plant survival and growth.

Provide shade for human health and comfort.

Reduce demand for potable water through greater efficiencies.

**Do the following on the development site and adjacent boulevard:**

- Retain all healthy trees that are 30cm or more DBH (diameter at breast height).
- Adhere to the minimum protection distances and standards for tree protection barriers during construction (according to *The City of Toronto Tree Protection Policy and Specifications for Construction Near Trees*).

- **Trees in hardscaping:** For street trees and other trees planted in groups of two or more in primarily hardscaped areas, provide a minimum volume of 15m³ of high quality soil per tree. A single tree planted in hardscape requires 30m³ of soil.

- **Trees in softscaping:** Provide trees planted in softscaping with a minimum volume of 30m³ of high quality soil. Plant a minimum of one tree on site for every 30m² soft landscaping (e.g. for 60m² plant two trees).

- Provide a watering program for trees for the first three years after planting.

- Ensure that at least 50% of vegetation species planted are native.

- Do not plant any invasive species on properties or streets abutting ravines and natural area parks.

- Where a setback from top-of-bank is required, all plants must be native species.

- Retain and reuse uncontaminated on-site soil in all areas not covered by the building footprint or required hard surfaces, or adjust or replace with soil of equal or better quality.

- Plant large growing shade trees at the equivalent of 6–8m intervals starting from the property line along all street frontage, open-space frontages and public walkways, excluding driveways and easements.

- Use water-efficient plant material for at least 50% of landscaped area.
8.1 Existing Trees

Throughout design and construction, take every measure to protect existing natural areas and/or significant and healthy existing trees. Damage can occur during site servicing/utilities trenching, parking lot expansion and the creation of access lanes, drainage systems, hard surface play areas, etc.

- **Evaluate**: Evaluate existing trees based on their species, size, form, location, integrity, age and health against their and the building’s probable lifespan (2 years, 20 years, 50 years). Healthy and vigorous medium-sized and large existing trees are valuable assets for many reasons and are functionally irreplaceable in a generation. The design process should respect and place a high value on existing trees.

- **Transplant**: Consider transplanting trees that are in the way of construction rather than cutting them down.

- **Removal**: Where removal of existing trees is unavoidable, have the trees appraised by a certified arborist and obtain the necessary tree removal permit(s) from the City. Replace the removed tree(s) with trees of equal value; that is, the assessed value of the replacement trees must equal the assessed value of the removed tree(s).

- **Tree Protection**: Protect all existing trees within or adjacent to the construction area before construction starts by creating a Tree Protection Zone (TPZ) with a Tree Protection Barrier (TPB) erected around its perimeter. At minimum, erect the TPB at the drip-line* of the tree. Comply with The City of Toronto Specifications for Construction Near Trees, Sections 2 and 3, in all other respects.

* The drip-line is a “line” on the ground corresponding to the outermost reaches of the branch tips and generally corresponds to the root zone of most trees. Pyramidal and columnar form trees have root zones larger than their drip-line and the TPZ and TPB should be adjusted outward accordingly.
• **Roots:** Ninety percent of a tree’s roots are within the top 300mm of the surface. Specify directional boring for installation of all site servicing (utilities) within the TPZ of existing trees. Do not allow excavation or trenching within the TPZ of existing trees. Tree roots should not be cut off to accommodate curbs, playgrounds, hard surface walkways or other landscape features. Cutting roots negatively affects the safety, stability and health of the tree. Transplanting existing trees up to 150mm caliper may be an option, depending on the species of the existing tree and time of transplanting.

• **Grading:** Do not change the grade (finished elevation) within the TPZ of existing trees.

### 8.2 New Tree Placement

• **Location:** When planning tree placement be mindful of fire routes, snow clearing and storage locations, service access routes, portable move-in and move-out routes, student safety and security (sight lines), building envelope maintenance and construction access, and tree management (access to water source) (see also Section 3.5).

• **Water source:** If possible, create a source of water for tree management (repair existing hose bibs, install new hose bibs, design building with external roof leaders and cisterns or rain barrels, direct surface runoff toward planting areas).

• **Setbacks:** Use the following setbacks for tree planting, measured as a radius:
  - Bench, seating stone or rock: 2m
  - Fence of an adjacent residential neighbour: 7m
  - Other fences: 2m
  - Paved areas and walkways: 2m
  - Other trees, depending on the species and location: 5–7m
  - Buildings: 7m
  - Running track: 7m (Do not plant trees inside track area if it is designed and used as a playing field)
  - Soccer and football side and end lines: 6m
  - Fire hydrant: 6m
  - Flagpole or light standard: 10m
  - Underground utilities or overhead wires (utilities): 3m

• **Salt damage:** Be mindful of potential winter salt damage in locating trees in “islands” in paved play areas.
  - Determine if play surfaces are kept clear (plowed) in the winter and if salt is currently used. Encourage schools to generally stop plowing and salting paved play areas outside of building access routes.
  - Determine drainage pattern/flow and avoid planting trees in areas subject to salt runoff (e.g. locate planting islands on the uphill side of salted areas or plant trees in large raised planters). (See Fig. 6a, Timber Planter Box with Seating and New Planting, p. 57 and 6b, Timber Planter Box with Seating Detail, p. 58)
Planting trees in above-ground planters is becoming a common practice on sites that are not suited for in-ground planting. Precast concrete planters offer trees protection from salt applied near entrances in winter while allowing a cool place to sit in the shade in the warmer months.

8.3 Tree Planting Specifics for School Grounds

- Select tree species with consideration of the following (see Fig. 11, Recommended Plant Lists, p. 63):
  - Sun/shade requirements.
  - Form (relative to the size of space and proximity to overhead wires).
  - Wood strength (vandalism).
  - Soil needs (type, porosity, characteristics, pH, compaction, etc.).
  - Water requirements (drought tolerance and/or ability to tolerate poor drainage).
  - Salt tolerance (in light of possible winter salting of paved areas).
  - Leaf size (e.g. small leaves best in courtyards).
- Protect newly planted trees from damage due to vandalism, bark damage and mowing by installing a protective wire cage immediately after planting and leaving it in place for 8 to 10 years (See Fig. 7, Wire Mesh Caging, p. 59).
- Install rodent guards on trees planted in natural areas.
- Specify trees with a high branch height (2m clear stem).
- Include watering for the first growing season in the contract specifications.

**DO**
- Design for diversity.
- Use native species wherever possible.
- Plant Honey Locust and Hackberry (small-leaved trees) in courtyards.
- Plan for planting that is manageable/sustainable.

**DO NOT**
- Plant mono-cultures.
- Specify nut trees near school buildings due to allergies and anaphylaxis. In addition to Walnut, Butternut and Hickory, nut trees include Oak and Beech.
- Specify plants with toxic parts. Refer to CAN/CSA-Z614-07 Table G.1 for plants to be avoided in children's play spaces. Note that most vines have poisonous plant parts, a consideration relevant for creating “green/living walls” in schools.
- Specify deciduous trees less than 70mm caliper or coniferous trees less than 2m height.
- Specify invasive non-native species (e.g. Norway Maple) or species vulnerable to insects and disease (e.g. Ash).
- Be overly influenced by requests from site-management sector for “non-messy” plantings. Small fruit, seed pods, leaves, small pine cones, etc. are natural materials with high play value and learning potential.
- Plant trees with large fruit or large cones (e.g. Austrian Pine). Large fruit attract wasps and together with large cones are frequently used as projectiles by children in the school.
- Plant trees with soft bark (e.g. Ginkgo).
- Plant trees on the top of berms due to possible erosion, compaction and exposed roots.
- Plant trees in the middle of parking lots.
- Determine drainage pattern/flow and avoid planting trees in areas subject to salt runoff (e.g. locate planting islands on the uphill side of salted areas or plant trees in large raised planters).
- Plant trees in areas of potential building expansion, portable installation or parking lot expansion.
- Plant trees close to neighbours’ houses and/or gardens.

### 8.4 Warranty

Include in the planting specifications a two-year maintenance and warranty period and stipulate that the contractor is to inspect the project, check and secure the tree cage and insure all dead and dying trees are replaced.

### 8.5 Maximize Trees

Include as many trees as possible in the design. Strive to exceed the *Toronto Green Standard* goal of 20% canopy coverage of the entire property at maturity. Coverage of much more than 20% is easily achievable on virtually all school grounds, and results in so many positive outcomes.
9.0 Lighting

The *Toronto Green Standard*  
(Ecology)

Reduce energy demand from exterior light fixtures and nighttime glare from lighting.

Do the following:

- Install energy-efficient shield lighting for all exterior lighting fixtures. Lighting must focus downward, eliminating direct upward light and reducing spill light.
- Ensure at least 75% of exterior fixtures are Energy Star compliant or equivalent.
- Install occupancy sensors for exterior lighting fixtures for walkways, parking structures and parking lots.

9.1 Dark-Sky Compliance

Specify only dark-sky compliant fixtures to avoid directly lighting the sky. Veil exposed glare to ensure that light does not “spill” onto neighbouring properties.

9.2 Low-Energy Lamps

Specify low-energy lamps and make use of photo-cells, timers and manual override options to maximize efficiency and flexibility.

9.3 Minimize Lighting

Light the site only as necessary and to the minimum lighting level needed. Be aware that bright pools of light create seemingly darker areas of shadow.
Consider installing occupancy sensors for exterior lighting fixtures on the facades of buildings to conserve energy and deter vandalism. As well, be sure to locate trees away from outdoor security lighting.
10.0 Site Amenities

The Toronto Green Standard
(Solid Waste, Water Quality, Quantity and Efficiency, Ecology)

Facilitate waste reduction and efficient processing.
Reduce the demand for potable water through greater efficiencies.
Protect, restore and enhance the natural heritage system. Protect and increase biodiversity.

Do the following:

- Provide user-friendly and accessible handling and storage facilities for organic waste (i.e. composting areas).
- Use water efficient plant material for at least 50% of landscaped area.
- Ensure that at least 50% of vegetation species planted are native.
- Do not plant any invasive species on properties or streets abutting ravines and natural area parks.
- Where a setback from top-of-bank is required, all plants must be native species.
- Plant a minimum of one tree on site for every 30m² of soft landscaping (e.g. for 60m² plant two trees).

10.1 Seating

Place lots of seating opportunities everywhere, but especially in the shade.

- Logs: Logs for seating are not recommended as they harbour wasps, carpenter ants and mice, are slow to dry, decompose over a relatively short time, and are generally difficult to manage in the long term.
• **Stones:** Flat-topped, block-shaped rocks provide a long-term seating solution. Rounded boulders are not easy to use as seats or tables and their sloped sides tend to be slippery, especially when wet or covered with frost or ice. “Ledgerock” and angular limestone armour stone are generally the best seating stones as they are layered/angular, block-shaped and often contain fossils and crystals.

  - Place with tops horizontal/level so they are comfortable as seats and can be used as tables (card games, chess boards can be etched on to surface).
  - Place either tight together or minimum 1.8m apart to discourage jumping from rock to rock.
  - Optimum “seat to feet” height range (related to the top of the mulch) (See Fig. 8, Armour Stone Seating–Single Stones, p. 60):
    - JK/SK: 250 to 350mm
    - Primary: 300 to 400mm
    - Junior: 400 to 500mm
  - Provide a surface such as mulch around the base of all seating stones or paving (not grass) for distance of 900mm minimum. Allow for 150mm depth of mulch around stones.

• **Benches:** In some locations, benches may be preferred over seating stones. The “Boston” bench by Henderson Recreation has proven to be durable in school grounds and easy to repair when needed. Square (or appropriately shaped) wood and metal frame benches placed around trees and “floating” on grade help to protect new and existing trees and provide a shady spot for socializing, play and learning. (See Fig. 9, Wood Bench Surrounding Tree, p. 61)

• **Picnic tables:** Picnic tables in enclosed courtyards function well and do not need to be anchored. Elsewhere in school grounds they should be firmly fastened to paved surfaces for security and to prevent mowing problems. Be aware that they will draw groups of teens after hours and place them accordingly (e.g. away from residential neighbours).
10.2 Class-size Outdoor Seating Areas

Outdoor seating can take many forms and the design possibilities are limitless. The goal in all of these endeavours is to create a space for an entire class (30) to gather at the start and end of an activity or for storytelling, band, drama, art classes and sketching (see Fig. 10, Armour Stone Seating and Retaining Wall, p. 62).

- Provide protection from sun, wind and ideally from rain as well. Locate where there are existing trees/shade or, failing that, plant a grove of trees in and around the outdoor classroom.
- Provide a diverse choice of seating allowing for versatility and variety and arranged to facilitate group discussions/presentations. Take advantage of natural gradients to incorporate different levels of seating.
- Use natural materials.
- Locate away from noisy streets.
- Try to orient in such a way so that children are facing a natural view (if there is one) and are not facing into the sun.
10.3 Nature Study Areas and Gardens

As a designer, be aware that more and more school grounds include nature study areas and gardens of one sort or another. Such endeavours require significant support and need to be carefully sited to foster their success.

Where there is energy and will to create gardens (i.e. where a school and/or community has demonstrated that they are willing and able to sustain them), channel this energy toward creating gardens that will directly benefit the students such as food-producing gardens (urban farming), community gardens with composting areas and learning gardens with fruiting shrubs that provide food and habitat for birds and other wildlife. When establishing these areas consider the following:

- **Protection**: Protect nature study areas and gardens from active play areas (via rail fence, stone edging, spatial separation). Locate in low-traffic areas, well away from “meet and greet” spaces, active play spaces, sports fields, student entrances/exits (line-up zones) and preferably in locations that are accessible to students at recess.
• **Safety:** Consider “Safe-Schools” issues (in the neighbourhood context) when choosing a location and when deciding the appropriateness/advisability of adding evergreens, shrub plantings and/or creating thickets. Be sure to leave a 3-to-4-metre mow strip between the project and neighbouring properties.

• **Access to water:** Ensure a nearby source of water (irrigation, ground hydrants, hose bibs on building, cisterns, rain barrels).

• **An adequate rooting medium:** The biggest limiting factor to a great garden is soil fertility. When considering a garden follow these steps:
  - Double dig where the beds will be located
  - Amend native soils with compost, worm castings, sand, rotted leaves or mushroom compost
  - Plant crops
  - Continue with light cultivation—avoid walking on the amended soil
• **Scale appropriately:** Use a scale appropriate for children. Detail the gardens so it is easy for children to participate, to get their hands in the soil:
  - Raised planters 150–200mm high
  - Planting bed width 950mm wide and accessible from both sides for children younger than 10 years
  - Planting bed width 1200mm wide and accessible from both sides for children 10 years and older
  - Planting bed width 600mm wide when accessible from only one side (planter is against a wall)

• **Start small:** Encourage a “start small, do it well” approach. In this way initial projects are manageable and sustainable and have a greater chance of success.

• **Interpretation:** Signage should be included to explain the intent and purpose of the garden project to the community.

• **Community involvement:** Nature study areas and gardens need to be integrated into the curriculum and require involvement and commitment of school and daycare staff, and the community for on-going site management.

School ground garden initiatives, including food-producing gardens, can be an instrument for positive change in a community.
10.4 Play Equipment

It is not necessary that school grounds contain “conventional” fixed play equipment, but where they do and in general, the design and installation of play equipment should comply with the latest version of CAN/CSA-Z614-07 Children’s Play Spaces and Equipment. Keep in mind that its intention, as outlined in Section 1.6 of the previously mentioned document is:

“…to promote and encourage the provision and use of play spaces that are well-designed, well-maintained, innovative, and challenging, and in so doing, contribute to the development of healthy children.”

In addition, the following considerations are specific to school ground play equipment:

- **Equipment:**
  - Separate “pods” of equipment (rather than a single large composite structure) are preferable as they accommodate more children, are less likely to be dominated by a single group and are not conducive to games of tag (running), which can be a problem on structures with lots of ramps, bridges and decks.
  - Equipment, including guardrails and railings, should be as visually open as possible and tubular slides and solid-walled crawl tubes should be avoided.
  - Roofs are expensive and do not provide significant shade where it’s needed (trees are preferred).
  - The areas underneath platforms should be enhanced with play counters, seats, play tables, etc. to maximize play value, particularly for younger children.

- **Protective surfacing:**
  - Granitic sand or engineered shredded wood are recommended as the protective surfacing material for school grounds. Each of these materials has positive and negative aspects; there is no perfect protective surface. Nonetheless, granitic sand has greater play value and, according to a Hospital for Sick Children study, provides better impact attenuation than shredded wood, but can be blown, tracked or otherwise migrate onto adjacent hard surface play areas and into schools. Shredded wood is an accessible surface but decomposes fairly quickly and needs to be topped up or replaced regularly.
  - Subdrainage must be installed beneath the protective surfacing.
  - All loose-fill protective surfacing, but particularly granitic sand, should be contained in some manner (e.g. excavated soil/turf edge, timbers, rolled asphalt paving, concrete curb) and the perimeter and protective surfacing should all be level (one elevation).
  - Natural materials are preferred to synthetic surfaces. Poured-in-place rubber is not recommended for use in green school grounds.
10.5 Railings and Access Barriers
(including bollards, fences and gates)

• **Railings:** Be aware that children use them as turning bars (a mid-rail may be added to railings to discourage this) and as seating, particularly where there is a seating-deficit. Providing other play and seating options helps to reduce these problems.

• **Access barriers:** Carefully consider each situation and tailor the solution to address the project's specific needs.
  ◦ If the goal is to control vehicles but allow pedestrians to pass, then bollards or P-gates are likely choices.
  ◦ If the goal is to keep children and balls out of parking lots and other vehicular areas (make play space safer/usable right to the edges), then chain-link fences and gates are likely choices.
  ◦ If there is a need to channel/regulate drop-off and pick-up, and control or prevent pedestrian movement (direct flow and prevent spill-out), then chain-link may be the answer, keeping in mind that there may be other considerations.
  ◦ Swinging gates, sleeved slider gates and fold-down bollards are preferable over post-mounted chains at parking lot entrances.
• **Gates**
  - Gates leading in to the school grounds should open toward the outside (parking lot or driveway) so that access can be gained during the winter.
  - Pedestrian gates should be minimum 1.2m wide (clear opening) or wide enough to allow caretaking equipment such as a riding mower or snow blower/plow.
  - Maintenance gates should be double gates and minimum 2.4m wide (clear opening) or wide enough to allow access for equipment such as a tractor, backhoe or skid-steer (so wheelbarrows do not need to be used for bringing in materials).
  - Emergency vehicle and truck access gate openings should be minimum 4.3m wide.

• **Chain-link fences**
  - Fences should be heavy duty, i.e. be constructed of 6-gauge mesh.
  - Use bottom rails if located near areas where snow is removed and stored/piled.
  - Provide a mowing strip if adjacent to paved areas (extend the paving under the fence).
Recommended Construction Details and Plant Lists

Figure 1 Wood Rail Fence  
     2 Bio-Retention/Infiltration Trench  
     3 Limestone Screenings Walkway  
     4 Deciduous Tree in Hard Surface  
     5 Deciduous Tree Planted in Soft Surface  
     6a Timber Planter Box with Seating and New Planting  
     6b Timber Planter Box with Seating Detail  
     7 Wire Mesh Caging  
     8 Armour Stone Seating – Single Stones  
     9 Wood Bench Surrounding Tree  
    10 Armour Stone Seating and Retaining Wall  
    11 Recommended Plant Lists
Figure 1  Wood Rail Fence
Not to Scale

SECTIONAL ELEVATION

NOTES:
1. STEP FENCE AT POSTS, AS REQUIRED TO SUIT NEW FINISHED GRADES (RESPOND TO SITE SPECIFIC CONDITIONS).
2. ALL WOOD TO BE WHITE CEDAR, ROUND POSTS AND RAILS, BARK REMOVED AND SKINNED/TURNED TO REMOVE IRREGULARITIES (SUCH AS BRANCH STUBS), FREE FROM WARPS, CHECKS AND CRACKS. AVAILABLE THROUGH BUTTON FENCE 705-458-9506
3. ALL BOLTS, NAILS AND OTHER FASTENERS TO BE GALVANIZED
Figure 2  Bio-Retention/Infiltration Trench
Section - Not to Scale

- Minimum 4/5 width at top of trench
- Center line of Bio-Retention pit to be level or slightly lower than perimeter, avoid crowning of cover material (i.e., Fibar)
- Finished grade, re-grade surrounding area to slope toward drainage pit at min. 2%
- Topsoil and sod
- Fibar. Note: specified depth is depth after settlement. Fibar provides insulating qualities and year-round drainage.
- 50 mm DIA. Clear crushed stone
- Terrafix 270R (or approved equal) filter cloth lining top, sides, and bottom of drainage pit overlap all joints.
- Topsoil and sod
- 100 to 150 mm DIA. Clear crushed stone
- Optional:
  - Three 375mm DIA. big ‘O’ or equal storm sewer pipe C/W end caps. Drill 25mm DIA. holes at 500mm O.C. throughout length and on all sides of pipe. Place side-by-side in bottom of pit as shown. Length of pipe to be 500mm shorter than length of pit.
  - Scarify inside surfaces of drainage pit excavation before backfilling with clear stone to maximize permeability

- Cannot grow on top of this but can plant on sides
- Overlap Terrafix 270R (or approved equal) filter cloth past the mid-point of trench width approximately 300mm
- 800mm typical - but may vary
- As required
- 100 to 150 mm DIA. Clear crushed stone
- Subsoil
- 400mm 300mm 800mm 1500mm typical - but may vary
Figure 3  Limestone Screenings Walkway
Section - Not to Scale

**NOTE:** Limestone screenings to be a fine crushed limestone product composed of 50% limestone dust and the balance composed of an even spread of particles up to 3 mm size.

Possible Uses: Trails, Meet and Greet Areas, Soccer Goalie Zones, Baseball Infields

Limestone screenings: In all locations where the longitudinal or cross slope exceeds 2%, screenings are to be pre-mixed with stabilizer (i.e., Envirobond – 1-866-636-8476. 10lbs of stabilizer per tonne of limestone screenings), or mix on site based on quantities.

Finished grade
Topsoil
Subgrade compacted to 95% S.P.D.
Planting trees to provide shade where children play often means putting them in asphalt. The following is a technique that’s proven successful in school grounds.

A. Make a square cut into the asphalt (minimum 1850 X 1850mm) – (maximum 3050 X 3050mm). Follow these dimensions to avoid extra cutting of porous pavers (turf stone).

B. Remove asphalt leaving a 10cm ledge of granular base around the inside perimeter of the asphalt cut to allow for a firm base for the turf stone to sit on.

C. Excavate all gravel and soil to a depth of the root ball plus 10cm to accommodate the sand layer and turf stone (turf stone must be laid on a bed of sand). Scarify edges of hole to avoid smooth surfaces.

D. Prune dead or damaged branches before planting.

E. Place tree in the hole. Be sure that the root ball rests on solid ground and the tree is straight before backfilling. Begin backfilling with 2/3 local soil and 1/3 composted soil amendments up to 1/3 of the root ball. Tamp with feet to stabilize and prevent air pockets. Thoroughly soak.

F. Place a 2" x 4" board across the hole and continue to backfill to 10cm below the board – this is to ensure that there is enough space for the sand and for the turf stone layer to be laid flush with the surrounding asphalt surfacing.

G. Never lay turf stone at the time of planting. Trees must be watered for several weeks to let soil and sand materials settle.

H. Top up with sand as necessary before laying stone.

I. Three weeks after planting lay turf stone. See illustration below.

J. Backfill spaces in turf stone with sand or use a soil mix for growing grass seed.

K. Using a standard 5/8" hose, set water flow on low and soak the area for approximately 15 minutes.
Figure 5  Deciduous Tree Planted in Soft Surface

A. Dig a hole at least twice the width of the root ball and angle the sides to 45 degrees.

B. Be sure that the sides of the hole are scarified to help roots penetrate surrounding soil and to increase drainage.

C. Prune dead or damaged branches before planting.

D. Set the tree slightly higher (approximately 50mm) than adjacent finished grade to allow for settlement.

E. Be sure that the root ball rests on solid ground and the tree is straight before backfilling. Use a 2” x 10” plank alongside the rootball to straighten.

F. Bend back the wire basket and remove rope and burlap from the top ⅓ of root ball before backfilling with soil.

G. Begin to fill the hole in around the tree with a blend of ⅔ local soil and ⅓ composted soil amendments.

H. Backfill to ⅓ the root ball depth and tamp with feet to stabilize root ball and prevent air pockets.

I. Continue to backfill to the top of the root ball. Mound backfill slightly to make a saucer of soil around the tree.

J. Water the entire backfill area until saturated. Add more soil to compensate for settling if needed.

K. Apply 150mm of tub-ground mulch to a diameter of 2m (no less that ½ a cubic yard per tree). Take mulch to edge of excavation. Keep mulch weeded and replace annually.

L. Subsequent watering – 32 gallons/week for the first two years throughout the months of May – October.
Figure 6a  Timber Planter Box with Seating and New Planting
Section – Not to Scale

Notes:
1. Prune dead or damaged branches before planting
2. Remove all nursery tags and ties from the canopy
3. Remove all ropes and ties from the base of the tree
4. Follow Figure 5 Deciduous Tree Planted in Soft Surface from E through F
5. Begin to fill the planter box in around the tree with triple mix
6. Follow Figure 5 Deciduous Tree Planted in Soft Surface from H through L

Wood timber base: refer to Figure 6b Timber Seating Base Detail for installation details

Subsoil  Backfill with soil mix  Set root ball on firmly packed soil to prevent settling

Asphalt  Compacted 3/4" crusher run limestone

Bend wire basket and remove burlap, rope and/or nylon ties from top 1/3 of root ball. Do not disturb root ball.

150mm depth of tub-ground mulch over soil mix
Figure 6b  Timber Planter Box with Seating Detail

Section – Not to Scale

**NOTES:**

1. **USE 2” X 10” CEDAR CAP FOR THE SEATING PLANK**
2. **THE ELEVATION OF THE TOP PERIMETER TIMBER SHOULD REMAIN CONSTANT (LEVEL)**
3. **THE TOP TWO CORNERS OF THE CEDAR SEATING PLANK SHOULD BE CHAMFERED**
4. **CROSS LAP OR OVERLAP THE TIMBERS ON ALL CORNERS**

**PRESSURE TREATED TIMBERS - 150MM X 150MM [6” X 6”]**

**ASPHALT**

**COMPACTED 3/4” CRUSHER RUN LIMESTONE**

**GEOTEXTILE BARRIER TO BE STAPLED ONTO THE INSIDE OF THE 6”X 6” TIMBER WALLS TO PREVENT SOIL FROM LEAKING OUT. IT IS NOT TO BE USED ON THE BASE OF THE PIT – THIS WOULD RESTRICT ROOT DEVELOPMENT AND COMPROMISE TREE STABILITY.**

**NOTES:**

1. **USE 2” X 10” CEDAR CAP FOR THE SEATING PLANK**
2. **THE ELEVATION OF THE TOP PERIMETER TIMBER SHOULD REMAIN CONSTANT (LEVEL)**
3. **THE TOP TWO CORNERS OF THE CEDAR SEATING PLANK SHOULD BE CHAMFERED**
4. **CROSS LAP OR OVERLAP THE TIMBERS ON ALL CORNERS**

**USE 12MM REBAR TO SECURE LOWER WOOD TIMBER IN PLACE DEPTH OF REBAR, TO BE AS REQUIRED PER SITE CONDITION**

**COMPACTED OR UNDISTURBED SUBSOIL (BASED ON SITE CONDITIONS)**

**150MM TUB GROUND MULCH**

**BACKFILL OF EXCAVATED SOIL**

**LINE OF BASE BEYOND**

**8200MM [27’]**

**250MM [10’]**

**150MM [6’]**
This method is highly recommended for active play areas. These cages can be constructed from materials that are available from a fencing products distributor.

1. The wire cage is 10 gauge galvanized welded 50mm x 50mm [2”x 2”] wire mesh that is 1.2 or 1.5m high.

2. Use 3 regular T-bars that are 2.4m long. Evenly space them around the tree about 300mm out from the trunk of the tree — this helps to protect the trunk of the tree from vandalism and from mechanical damage (lawnmowers, string trimmers).

3. Overlap the required amount of wire mesh by 2 squares, but make sure that the overlap is located between the T-bars. This ensures that the cage will remain round and will not leave a sharp point or ridge along the T-bar (a safety issue).

4. The bottom of the cage should be 150mm above grade or top of mulch so that you can weed and clean garbage at the base of the tree. This gap also allows for mulching, which should be done annually.

5. The tops of the T-bars should be 5cm below the top of the mesh. This type of tree cage can stay around the tree for about 10 years before removing it.
Figure 8  Armour Stone Seating – Single Stones

Section – Not to Scale

NOTES:
1. WHEN PLACING GROUPS OF STONES THE SPACING BETWEEN THEM SHOULD BE 2M MINIMUM. (FOR EXAMPLE, OUTDOOR CLASSROOM.) FOR NATURAL ARMOUR STONES THAT ARE FITTED TOGETHER FOLLOW THE SAME PRINCIPLES AS SHOWN IN THE DETAIL ABOVE; HOWEVER THE GAPS BETWEEN THE STONES MUST BE NO LARGER THAN 50MM AND ALL STONES SHOULD BE AT A CONSTANT ELEVATION.
2. FOR CHILDREN FROM 4 – 6 YEARS OF AGE THE SEAT-TO-FEET HEIGHT MAY NEED TO BE REDUCED TO BETWEEN 250MM – 350MM.
3. PRIOR TO PROJECT COMPLETION ENSURE THAT ALL SHARP CORNERS AND EDGES ON EXPOSED SIDES OF STONES ARE ELIMINATED (ROUNDED) BY BUSH-HAMMERING OR OTHER SIMILAR MEANS TO SATISFACTION OF LANDSCAPE ARCHITECT.
4. ENSURE THAT ALL ARMOUR STONES ARE INSTALLED WITH SEATING SURFACE LEVEL.
Figure 9  Wood Bench Surrounding Tree
Not to Scale

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CEDAR PLANKS, EDGES EASED

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PLANTING IN CENTRE OF BENCH SQUARE

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INSTALL MIN. 150 DEPTH TUB GRINDER SHREDDED BARK MULCH INSIDE SQUARE OF BENCH

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CENTRE BRACKETS

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CORNER BRACKET

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PLAN

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SECTION

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NOTES:
1. FINISH ON ALL GALVANIZED METAL FRAME COMPONENTS TO BE FRATT AND LAMBERT (N14) A BLACK COFFEE ALKYD GLOSS PAINT.
2. FRAME COMPONENTS SHALL BE ELECTRICALLY WELDED.
3. WOOD COMPONENTS TO BE LEFT UNFINISHED. ALL WOOD TO BE FREE OF WARPIS, CHECKS AND CRACKS.
4. ALL BENCHES TO BE INSTALLED WITH SEAT'S LEVEL.
Figure 10  Armour Stone Seating and Retaining Wall
Section – Not to Scale

Notes:
1. Vertical heights will vary depending on site conditions, i.e., grade changes.
2. Be aware of CSA standards with regards to maximum height of stone.
3. Ensure that all armour stone are installed with seating surface level.

Finished grade with surface treatment per layout plan

Topsoil and sod or seed per layout plan

Undisturbed subsoil

Terrafix 270R (or approved equivalent) filter cloth
Overlapping all joints by 300mm

Minimum 250mm depth and width
(19mm clear crushed stone)

Minimum 250mm depth 19mm crusher run limestone compacted to 100%
S.P.D, beneath bottom course of retaining wall
Figure 11  Recommended Plant Lists

Deciduous Trees in Hard Surfaces (75mm caliper)
- Honey Locust (Gleditsia triacanthos var. inermis)
- Silver Maple (Acer saccharinum)
- Ironwood (Ostrya virginiana)
- Hackberry (Celtis occidenetalis)

Coniferous Trees in Hard Surfaces (250–300cm tall)
- White Spruce (Picea glauca)
- Austrian Pine (Pinus nigra) – (an acceptable non-native species)

Deciduous Trees in Soft Surfaces (75mm caliper)
- Tulip Tree* (Liriodendron tulipifera)
- Honey Locust (Gleditsia triacanthos var. inermis)
- Kentucky Coffee Tree (Gymnocladus dioicus)
- Silver Maple* (Acer saccharinum)
- Red Maple* (Acer rubrum)
- Sugar Maple* (Acer saccharum)
- Yellowwood (Cladrastis lutea)
- Hackberry (Celtis occidentalis)
- Basswood (Tilia americana)
- Ironwood (Ostrya virginiana)

Deciduous Trees in Groves in Soft Surfaces
Use a variety of trees to improve biodiversity and to integrate with curriculum goals. For example, you can plant 8 trees in a circle with armour stone seating to form a shaded outdoor classroom. Same list as Deciduous Trees in Soft Surfaces (75mm caliper) (See above).

Coniferous Trees in Groves in Soft Surfaces (250–300cm tall) (plant 3, 6, or 8 of the same species – space them at 3–4m apart)
- White Spruce (Picea glauca)
- White Cedar (Thuja occidentalis)
- White Pine (Pinus strobus)

Large Shrubs Planted as Singles or in Groves (200-250cm tall)
- Downey Serviceberry (Amelanchier arborea)
- Shadblow Serviceberry (Amelanchier canadensis)
- Nannyberry (Viburnum lentago)
- Elderberry (Sambucus canadensis)
- Alternate Dogwood (Cornus alternifolia)
- Redbud (Cercis canadensis)
- Gray Dogwood (Cornus racemosa)

*Best Shade Trees – refers to sun-blocking ability of the tree
Much of the material in these guidelines have been sourced from Evergreen publications:


In addition, thanks are due to the Design Group at the Toronto District School Board, where many of these were refined.