Policy for the Provision of Shade at Parks, Forestry and Recreation Sites

Service Improvement and Coordination
Divisional Coordination and Community Engagement
Parks, Forestry and Recreation Division
February 2007

Policy for the Provision of Shade – Parks, Forestry and Recreation

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Shade Policy and Technical Considerations for the City of Toronto

1.0 POLICY AND OBJECTIVES

1.1 The Need for Shade

Skin cancer is a largely preventable disease, related to exposure to solar ultraviolet radiation (UVR) throughout the year and in particular during the summer months. In addition to skin cancer, over exposure to UVR has been linked to a number of significant health problems.

UVR exposure to children is perhaps the most significant issue. Children have the highest sun exposure of any age group. Furthermore, research suggests that childhood may be a time of particular susceptibility to the carcinogenic effects of UVR.

As a result, it is only prudent that Parks, Forestry and Recreation try to ensure that it keeps the need for shade at the forefront of its capital planning and programming efforts, providing opportunities for natural and constructed shade wherever possible

1.2 Purpose

To include, wherever possible, opportunities for shade at Parks, Forestry and Recreation sites and facilities, thereby assisting to improve the health and well being of the citizens of Toronto as acknowledged in the Parks, Forestry and Recreation Division's strategic plan *Our Common Grounds*.

1.3 Policy Statement

Parks, Forestry and Recreation recognizes that the provision of shade can be an effective means of reducing exposure to UVR and subsequently assisting to reduce the possible ill effects sun exposure may have on the health of the citizens of Toronto.

Additionally, the provision of shade can provide significant co-benefits including: reducing greenhouse gas and air pollutant emissions, mitigating the urban heat island effect and reducing energy costs through energy savings.

By addressing the provision of shade, both natural and constructed, at Parks, Forestry and Recreation sites and facilities whenever possible, the division will move closer towards achieving the directions set out in Our Common Grounds Strategic Plan and priorities set forth by Toronto City Council.

1.4 Policy Objectives

Shade provision at Parks, Forestry and Recreation sites and facilities will be increased in a cooperative and incremental manner, wherever feasible, as part of the division's approach to designing and retrofitting its assets.

Short Term:

- To increase the opportunities for UVR protection at Parks, Forestry and Recreation sites and facilities through education and promotion of shade strategies to appropriate staff members and to the general public where possible.
- To ensure that the provision of UVR protection is a consideration in the planning process with respect to the development of all Parks, Forestry and Recreation sites and facilities.
- To seek community advice and input to assist with planning of future shade creation activities as part of the division's regular capital program activities.

Long Term:

- To provide city staff and the public with greater opportunities to access shade at all Parks, Forestry and Recreation sites and facilities.
- To implement, wherever possible, the UVR reduction strategies contained in this document and its appendices with respect to the future development or redevelopment of all Parks, Forestry and Recreation sites and facilities.
- To achieve continued and measurable growth in the number of UVR protection elements available at Parks, Forestry and Recreation sites and facilities.
- To ensure UVR protection initiatives become an integral part of any new Parks, Forestry and Recreation development project.

1.5 Recommendations: Strategies for Achieving Objectives

The recommendations and guidelines presented in the following sections are intended to assist Parks, Forestry and Recreation staff in adopting "best practices" for maximizing protection against UVR, especially in outdoor spaces at childcare centres and summer camps. Through the implementation of strategies for incorporating shade at Parks, Forestry and Recreation sites and facilities, measurable progress towards a culture of UVR protection can be achieved.

2.0 PROVISION OF SHADE

2.1 Planning for Shade: Direct UV vs. Indirect UV

Shade designs based on an intuitive understanding of sunlight and shadow may over estimate the degree of sun protection afforded by certain structures and arrangements of trees, thereby increasing the risk of sunburn and skin damage.

The visible light from the sun follows a direct path from the sun to the surface of the earth. It casts discrete shadows with sharp edges between areas of light and shade. However, a substantial portion of incoming UVR (especially the UVB radiation) is scattered by water droplets, dust and other particles as it travels through the atmosphere. UVR that is scattered or reflected is referred to as indirect UVR. When the sun is high in the sky about 50% of the sunburning UVR follows a scattered path to earth. The percentage is even higher on cloudy days or when the sun is low in the sky (Diffey, 2003).

Indirect ultraviolet may reach a person from any direction. As a rule of thumb, the amount of scattered UVR reaching a person is proportional to the amount of the sky that the person can see from their vantage point. Therefore, when designing shade structures or selecting and positioning trees to reduce UVR exposure, it is important that the structures/trees effectively block both the direct sunlight and the view of much of the sky.

The shade under a lone beach umbrella blocks direct UVR but does a poor job of blocking scattered UVR. The shade under a single tree can block a fair amount of UVR: a dense canopy offers very good UVR protection near the trunk but the level of screening diminishes markedly near the periphery of the shaded area. The overlapping shade pattern from a healthy, mature stand of trees blocks a substantial amount of the view of the sky and provides solid UVR protection.

Reflection of UVR off of fresh snow nearly doubles UVR exposure. UVR is moderately increased by reflection off other bright surfaces such as white sand or concrete. Less UVR is reflected off uneven or darker surfaces such as lawn grass, other ground covers or asphalt.

Shade trees and shaded areas play a key role in sun protection and also serve many other environmental and aesthetic functions. Concrete, by contrast, reflects UVR rays and is therefore a poor surface for outdoor activities. Grass is preferred.

Access to shade is essential at all outdoor spaces where children play and generally wherever activities take place during times of high UVR. Effective shade and UVR reduction initiatives can be implemented at various facilities and venues, including: day care centres, schools, outdoor pools, beaches, splash pads and wading pools, parks and playgrounds, sport fields and skateboard parks. Shade is also important along pedestrian and bicycle paths, public squares and other public spaces.

This section provides a discussion of both natural and constructed shade components for use in planning of future city-owned and operated sites and facilities.

2.2 Natural Shade

Trees are a natural source of shade all year round. They also provide many other tangible and intangible social, economic and environmental benefits. From a health perspective, trees help to reduce carbon dioxide, trap and hold airbourne pollutants including dust, ash, pollen and smoke and replenish the atmosphere with oxygen. They also impact our moods and emotions and provide immeasurable psychological benefits. When used architecturally, trees provide space definition and landscape continuity. There is no doubt that trees add natural habitat and character to our open spaces by providing beautiful shapes, forms, textures, colours and flowers.

The location, species and size of tree will determine the degree of shade that is provided. Strategically placed trees will help create a welcome oasis of shade that is a respite from the summer heat and sun. Trees come in a variety of shapes and sizes. Coniferous trees keep their leaves all year round but do not have full canopies that would maximize the provision of shade when the sun is strongest (typically from 11 a.m. and 4 p.m.). Deciduous trees lose their leaves in autumn and provide shade during the spring and summer after new leaves have grown. Deciduous trees that have large leaves forming dense, full crowns will provide more protection from ultraviolet rays than those trees with smaller leaves and more delicate, fine textured crowns.

Tree Selection Considerations:

To maximize shade, large-growing deciduous trees with full canopies should be considered for planting. Consideration must be given to planting the right tree in the right spot. The selection of trees must consider not only the shade benefit, but also the trees' physical needs and the ability to survive and thrive in the selected planting location. Therefore, the species adaptability to the City's climate, soil and physical site conditions must be considered. Trees that are native to Canada and well adapted to local conditions have a good chance of successful establishment. In addition, the maintenance requirement of an area where planting is planned must be considered. For example, is the planting area near a swimming pool, wading pool or other water feature, and will the occasional fall of leaves or small twigs from nearby trees be of concern from a maintenance perspective? Some trees produce more debris than others. Trees that bear fruit that fall during the summer season or attract insects may discourage people from taking advantage of the shade provided by the trees. The maintenance associated with trees themselves (e.g., maintenance pruning) must also be considered during the planning stages for tree planting.

Spacing of trees is an important consideration. Trees should be spaced appropriately being mindful of the species, the size the tree crowns will attain as trees mature, and the desire to have the crowns grow as close together as possible without hindering natural growth and development.

The following should be considered when selecting trees for effective shade:

- Site conditions (e.g., soil condition, water availability and the available growing space above and below ground for trees to thrive and grow to maturity)
- Site maintenance requirements
- Species of tree and its growth characteristic (e.g., large, medium or small-growing tree, long-lived or short-lived tree, growth rate of tree, mature canopy size, density of leaves and canopy, etc.)
- Tree maintenance requirement (maintenance pruning)

Tree planting should typically be done on the south or southwest side of the area, feature or structure that is to be afforded natural shade protection. For UVR protection through the key 11 a.m. and 4 p.m. window, shade would be positioned to provide coverage to the target area for at least the five hour (75 degree) sweep of the sun from southeast through southwest each day from leaf-out through September. The maximum angle of the sun above the horizon climbs to 70º in Toronto in late June dropping gradually to 50º in mid-September. Benches may be placed under mature trees or strategically near younger trees such that users may take advantage of shade that is provided during the hottest part of the day. Trees may be planted in groups rather than individually in order to achieve larger areas of shade in a shorter period of time. Tree planting may also be done in such a way that it complements existing landscape themes (e.g., formal or informal themes and landscape designs). A wide variety of species of trees are available for planting and the desired landscape effect is limited only by the imagination of the designer.

2.3 Constructed Shade

Constructed shade can be permanent (structures that last for a least 10 years) or non-permanent (seasonal or otherwise removable).

Permanent shade usually comprises overhead coverage with a supporting structure that can include side shade. Permanent shade coverage can be free-standing or attached to existing structures. Shade structures, whether free-standing or attached, can be supported by concrete, wood, masonry, steel or tensile materials, or a combination of these.

Overhead shade can be effected by means of a range of opaque or translucent materials. Rigid translucent materials such as treated glass, polycarbonate, acrylic or fibreglass sheeting can block direct UVR while allowing the transmission of heat and diffuse light. Side barriers can be very important for the reduction of indirect UVR, especially if the overhead barrier's height is a substantial fraction of its length or width or if people will be located near the perimeter of the shaded area.

In Canada, indirect UVR is a more important consideration as sun angles are quite low in comparison to other countries and therefore a greater percentage of UVR is indirect.

Non-permanent shade can include portable structures such as large tents, umbrellas and marquees. Demountable systems can provide shade on an as needed basis over a variety of surfaces (e.g., adjustable or retractable systems such as fabric awnings).

Ways of Achieving Constructed Shade

- **Free Standing Open Air Structures**

  Provides all weather protection.
  Solid roofs are favourable as UVR protection in areas of high use, over long periods of time and especially where the users are between 0-18 years of age.

- **Attached Canopies/Awnings:**

  Durable, solid roofs that require little maintenance. Opaque materials, which usually provide maximum protection from UVR. These materials are often durable and resistant to weathering and are thus a cost-effective method of providing total protection from UVR.

- **Temporary Structures (Tents/Umbrellas/Canopies)**

  Provide different amounts of protection depending on the type of material. As with clothing, the denser the weave, the higher the Ultraviolet Protection Factor (UPF). Some materials are plastic coated and may therefore provide more protection since plastics generally absorb UVR strongly.

  Canvas is often used for umbrellas. When first manufactured, canvas usually has a high protection factor. However, after exposure to weather, canvas is prone to deterioration and may, as a result, provide less effective protection.

Temporary structures can be located on an "as needed basis" and have the flexibility to be moved or relocated as trees mature or other shade is provided.

Materials for Constructed Shade

There is a vast array of materials available to provide shade coverage. Some materials, mentioned below, are specifically designed to provide UVR protection.

Polycarbonate and Fibre Glass Sheeting:

Solid materials, which allow infra red (heat) rays and visible light to be transmitted. Materials are effective in locations where less cool is required (conducts heat). UVR protection ratings should be obtained from the manufacturer to ensure the highest protection is obtained.

Shadecloth:

Least effective roofing material for protection from UVR. Often gives a false sense of security, as a large degree of UVR still penetrates the material despite the presence of shade. Shadecloth is not ideal for use as UVR protection.

2.4 Co-Benefits of Shade Creation

A shade policy for the Parks, Forestry and Recreation Division can assist in providing co-benefits for urban heat island mitigation and reductions in the emission of air pollution and greenhouse gases.

- **Urban Heat Island**

Heat islands develop in cities as naturally vegetated surfaces are replaced with asphalt, concrete, rooftops and other manufactured materials. The artificial materials store much of the sun's energy and remain hot long after sunset. This produces a dome of elevated temperatures over a city, significantly higher than air temperatures over adjacent rural or suburban areas.

A higher ambient air temperature in the city exacerbates the negative health impacts of heat waves. Heat is the major weather-related killer within temperate climate cities, and during extreme heat waves in vulnerable urban areas, hundreds of people can die, as they did in Chicago in 1995. Higher temperatures also speed up the chemical reactions that produce smog. This in turn, increases suffering by people with cardiac and respiratory problems, and increases health costs. In addition, the warmer a city is in the summer the more demand there is on electricity through the use of air conditioning. Energy costs go up, and to meet growing demand, power plants must increase their use of fossil fuels, which negatively impacts air quality and leads to climate change. Cities can be cooled by strategically placed vegetated areas. Trees and other vegetation can shade buildings, pavements, parking lots and roofs, and naturally cool a city by releasing moisture into the air through evapotranspiration. Through direct shading and evaporative cooling, shade trees can contribute to reductions in air conditioning use in summer.

- **Air Pollution**

Summer's onset signals the beginning of an unfortunate cycle. Heat turns summertime into smog season by "cooking" pollution and sunlight and accelerating the formation of smog. Smog is a photochemical reaction of nitrogen oxides (NO_X) and volatile organic compounds (VOCs). NO_X and VOCs react in sunlight and produce smog. The reaction rate is highly temperature sensitive. Approximately 1,000 people die prematurely and 5,500 hospitalizations occur every year in Toronto because of smog, especially seniors and people with cardiac and respiratory problems (Toronto Public Health, 2004). Shade trees, by lowering ambient air temperature, can help to slow the process of smog formation and improve local air quality.

- **Climate Change**

Scientists expect climate change to increase average global temperatures by 1.4 to 5.8 degrees Celsius by the end of this century (IPCC, 2001). Climate change is expected to exacerbate heat stress mortality significantly. In Toronto, the average number of days that exceed the heat-stress threshold of 32ºC is currently 5, and is projected to double by the 2020s, and surpass 30 by the 2080s (Chiotti and Mills, 2002). The use of trees as a shade device also has the benefit of acting as a carbon sink and thereby reducing CO_2 in the atmosphere. Climate change could also have significant impacts upon air quality and mortality, which is already responsible for 1,900 premature deaths annually in Ontario, and is expected to exceed 2,500 by 2015 (Ontario Medical Association, 2000).

- **What Air Pollution and Climate Change has to do with Shade Creation**

Air pollution and climate change are two different problems with one common source. They are both caused when fossil fuels are burned for energy. So what can a shade policy do to alleviate this problem? Shade can play a significant role in the reduction of emissions from the burning of fossil fuels for energy. Not only will this help to reduce local air pollution and help mitigate global climate change, but it can also have the added benefit of financial savings. The costs of planting shade trees to protect humans from dangerous UV can be partially offset through the strategic placement of those shade trees to reduce energy costs.

- **Energy Savings Potential**

Hotter summers significantly increase cooling costs. Toronto's energy demand is now highest during the summer months.

The strategic planting of trees provides significant potential for energy reductions. A study undertaken in 2002 by the Lawrence Berkeley National Laboratory for the Toronto Atmospheric Fund, determined that potential peak-power avoidance through the implementation of urban heat island mitigation strategies was about 250MW (about a 20% reduction in peak power use). Shade trees accounted for 51% of that potential energy savings (Akbari and Konopacki, 2001).

By shading people and buildings, a number of different problems can be solved with one solution and thereby due diligence can be practiced in protecting Toronto residents from harmful UVR, cooling the city during the summer, reducing the risk of increased air pollution and helping Toronto achieve its greenhouse gas reduction goal.

- **Encourages Physical Activity**

In a time where the need for physical activity is becoming more and more important for both children and adults, creating shade gives the public the opportunity to participate in physical activity in their local parks, playgrounds and sport fields. It provides an environment that protects them from the harm of UVR exposure while at the same time providing a cool and comfortable environment that foster both participating in physical activity and /or protecting spectators.

Credits:

The Parks, Forestry and Recreation shade policy document was substantially created from the October 2004 Shade Policy and Technical Considerations for the City of Toronto that was submitted for consideration by City Council. The majority of the text and factual information was developed and written by members of the city's Shade Policy Committee, as below:

Shade Policy Committee Membership List

(Includes members of the Ultraviolet Radiation Working Group)

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Dave Broadhurst – Atmospheric Division – Environment Canada – Ontario Division
Heidi Campbell – Evergreen and Toronto District School Board
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Providing Shade at
Parks, Forestry and Recreation Sites and Facilities

Appendix I: Technical Considerations

This section details some of the various public facilities owned and operated by the City and provides a discussion of some general design considerations. In addition to city-owned facilities, there are many public sites that would benefit from the addition of planned, usable shade. Agencies, boards, commissions, departments and school sites often host community events during peak exposure times.

i.) Childcare Centres, and Recreation Centres/Programs/Camps

Outdoor spaces at childcare centres need to provide opportunities for shade. Children attend these facilities up to 5 days a week and may spend a considerable time outside during the peak time for risk to UVR exposure. Consideration should be given to the provision of both natural and constructed shade, as well as encouraging use of personal protection such as protective clothing and sunscreen.

ii.) Outdoor Pools, Beaches, Splash Pads, and Wading Pools

Outdoor pools, beaches, splash pads, and wading pool are areas that can be of high risk for UVR exposure to vulnerable segments of the population, especially children and seniors. These areas are primarily used during summer when the UVR levels are at their highest, users typically wear minimal clothing, there is often little shade, and there may be high levels of indirect UVR.

While opportunities for shade can be provided, it should be noted, that shade alone cannot provide total sun protection, and signs should advise users to use protective clothing, sunglasses and sun screen. Signs should post the current UVR levels.

Landscape designs for these areas should make provisions for natural and constructed shade along circulation routes, for staff, and consider retractable shade over parts of the pool and portable shade, such as umbrellas. Both the toddler pool areas and a prescribed percentage of the total pool grounds should be protected by natural and/or constructed shade. For pools consider solid roof materials which transmit light yet block UVR. For beaches, consider providing natural shade on the backshore.

iii.) Parks and Playgrounds

There is a need to provide opportunities for shade in parks. Parks tend to be used most heavily in the middle of the day, when UVR levels are the highest. Designs should consider permanent and natural shade over play structures and adjacent viewing areas, shade in picnic and seating areas, and along circulation routes. Increasing the amount of shade also reduces potential UVR reflection from surrounding surfaces. Aside from shading specific facilities, it is suggested that a portion of the grounds be shaded. Designs need to allow for winter and shoulder season light and warmth.

iv.) Sports Fields and Skateboard Parks

The risk of UVR exposure can be high in these areas. They tend to be wide open spaces, with little shade protection and are often used by spectators who are there for extended periods of time while watching games. There is a risk of indirect UVR, especially in skateboard parks. Designs should consider integration of natural and constructed permanent shade for spectator seating and players off field areas. Other provisions for shade include trees around the perimeter of the grounds.

v.) Multi-Use Pathways

It is important to provide opportunities for shade along pathways. For natural shade, trees should be planted on opposite sides of the pathway, the shade should cover the pathway, and there should be adequate clearance to the branches and trunk from the ground and from the edge of the pathway. Rest Areas along the pathway should provide adequate shade coverage for users of the pathway.

vi.) Urban Agriculture

The term “urban agriculture” is applicable to the various methodologies used to grow food within urban boundaries with the primary locations being home gardens, allotment gardens and community gardens. These gardens require as much sun (usually) as they can get. It is the gardeners that require shade. Therefore, unlike the advice given for “Natural Shade” above, shade vegetation or structures should be situated on the north or northeast side of the area. These gardens are the logical place to use fruit trees, berry and nut bushes and fruit-bearing vines as the method of providing both shade and food.

Providing Shade at
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Appendix II: Developing, Designing and Executing a Shade Audit

A. Planning

Planning is essential for effective shade implementation. The following steps should be considered when planning for shade.

- ♦ Establish a project team, including representatives of key stakeholders. Conduct an inventory of shade provision across a range of facilities and prioritize urgency.

- ♦ Conduct a shade audit to determine the adequacy of existing shade and need for more shade at specific sites. Need to determine if shade is appropriately located, of adequate size, and cost effective. See below for more details on how to conduct a shade audit.

- ♦ Prepare a project plan or timeline.

- ♦ Design phase - consider shade requirements, use of natural and/or constructed shade, range of shade options and costs, durability, risk factors such as vandalism, discuss with relevant stakeholders, and determine preferred shade option.

- ♦ Determine implementation process based on Capital works schedule, funding issues and ability to incorporate with other work planned for site or facility.

- ♦ Implementation should include a communications/education strategy and post implementation monitoring for effectiveness.

B. The Shade Audit

The purpose of conducting a Shade Audit is to provide a strategic plan for the provision of sufficient UVR protective shade at a given site. This is achieved by:

- ♦ Establishing usage patterns at the site;
- ♦ Assessing the quantity and usability of existing shade and the need for additional shade;
- ♦ Providing recommendations on how to create additional shade at the site and/or how to modify existing usage patterns to maximize use of existing shade;

- Incorporating any recommendations into future development plans for the site.

a.) Conducting a Shade Audit

A shade audit consists of four components:

1) Interviews
2) Site Examination/Fieldwork
3) Assessment
4) Recommendations

A project team skilled in measurements/scaling, horticulture and an understanding of sun angles/light exposure is essential.

b.) Interviews

Important background information should be obtained by conducting interviews with site managers, city staff and site users. This will provide invaluable assistance in undertaking the assessment stage of the audit.

Information obtained during interviews should include:

- The availability of a site plan or survey detailing the location of hard services and existing features (e.g.,pipes, underground cables, trees, play structures, etc.) and any other relevant site data that may be relevant;
- Site usage patterns – activities that take place at the site, along with where and when they occur;
- The time of year day when the site is most in use;
- The number of people using the site and their age breakdown
- Opinions as to the adequacy of existing shade at the site and the need for more shade / UVR protection;
- Longer term development plans for the site;
- Required performance characteristics of new shade structures (e.g.,rain protection, wind protection, etc.); and
- Other considerations such as resistance to vandalism, durability requirements.

c.) Site Examination/Fieldwork

This stage of the audit involves the collection of site data as well as the confirmation of information obtained during the interview stage of the process. As both observation and detailed measurement need to be made, two site visits may be optimal. The first visit should be at a time of typical site use so observations of usage patterns can be made and the critical protection time confirmed. The second site visit should occur at a time when users will not be inconvenienced so that measurements can be made.

Measurements of sun exposure can be either observed or calculated, depending on the time available and the expertise of the individual undertaking the work.

- ♦ Observation method: shade is marked on the ground at the site and measured on two occasions (critical protection time and at the same time on at non-critical period such as a winter day).
- ♦ Projection method: involves the use of sun angles and charts to plot where shade will theoretically fall on two occasions (critical protection time and at the same time on at non-critical period such as a winter day).

In using the observation method, a six month period must lapse so that the shade patterns can be assessed at both the critical protection time (summer) and again in winter.

Main tasks for undertaking fieldwork are:

- ♦ Observing site usage patterns
  – type of activities, gathering locations, are people utilizing existing shade (if any);
- ♦ Preparation of the site plan
  – obtain accurate site plan, confirm accuracy of the site plan (random measurements to confirm), add any elements not captured;
- ♦ Investigating the site
  - – photography of site including usage, trees, existing structures, problem areas etc.
  - – make note of any significant ground level changes, site considerations such as emergency access, types of ground surfaces (concrete, grass areas, gravel) etc.
  - – building / structure heights, length & width
  - – locations of trees, the species, maturity, condition and estimated canopy diameter.
- ♦ Measure existing shade – either observation or projection method and record results on the existing site plan.

d.) Assessment

At this stage in the Shade Audit, shade patterns at two period in time should be plotted to scale on the site plan. The next stage of the audit involves assessing the quantity and usability of existing shade and the need for additional shade.

Tasks to be completed during this stage include:

- ♦ Consider the impact of future tree growth on the amount of shade at the site.
  - Will tree growth significantly alter the amount or distribution of shade?
  - How long will it take before significant changes occur?
- ♦ Consider the amount of existing shade at the critical protection time and compare this with the need for shade, taking into account the additional shade that may result from tree growth.
- ♦ Consider whether the location of existing shade is appropriate given the usage patterns at the site, addressing areas of inadequacy, access etc.
- ♦ Where should additional shade be located (if required), considering seasonal usage patterns.
- ♦ Consider impact of indirect UVR on the site and possible means of reducing its impact on the site.

e.) Recommendations

The final stage involves the formulation of recommendations related to each of the following:

- ♦ The desired shade/UVR protection goal for the site
- ♦ Strategies for achieving the desired goal, addressing:
  - site management practices
  - optimization of existing shade
  - creation of new areas of shade
  - minimizing the effects of indirect UVR
- ♦ The proposed timeframe
- ♦ A proposal for undertaking the implementation, including a project management approach and any financial considerations.

C. Design Brief

As a final part of the Shade Audit, a design brief should be developed in order to set out the parameters within which the designer /supplier must work. It is intended to convey the information you have gathered and developed through the various stages of the audit to relevant professionals who will be undertaking the next steps. Information required for the design brief includes, but is not limited to, the following points:

- ♦ Site information:
  - location of proposed project;
  - location of underground services;
  - emergency or other access routes to be maintained;
  - any site constraints that may impact the design (future development, ground conditions etc.)
- ♦ Performance Characteristics:

- area to be protected from UVR
- critical protection time
- type of shade required (built or natural, permanent or non-permanent)
- specific requirements such as rain/wind protection
- nature of activities in the proximity of the project location
- special climatic conditions
- maintenance requirements
- longevity
- other considerations (e.g.,threat of vandalism, etc.)

♦ Financial and Human Resources:
  - Provide as much budget information as available
  - Advise if there are skills within the organization that can be accessed in order to assist in the project completion
  - Advise of any community involvement or concerns that might exist.

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APPENDIX III: ULTRAVIOLET RADIATION – Background information

(as developed by the interdivisional shade policy working group – 2004)

I. Overview

The International Agency for Research on Cancer, a World Health Organization body, has determined that solar radiation, and more particularly the ultraviolet portion of solar radiation, is a human carcinogen for skin cancer (International Agency for Research on Cancer, 1992). Exposure to UVR also increases the risk of lip cancer, some types of eye melanoma and cataracts (Mills, 1997; Vajdic, 2002). It can cause sunburn and premature skin aging and wrinkling. It can trigger skin reactions in those using "photosensitizing" substances, including a number of common medications. And it decreases the body's immune system.

Children and adolescents are particularly vulnerable. They have the highest amount of sun exposure of any age group. Nearly 50% of Ontario children under age 12 were reported by their parents as spending more than two hours per day in the sun, on average, during the months of July and August 1996 (Ontario Sun Safety Work Group, 1998). This is in contrast to 37% of 15-24 year olds and less than 25% of older adults.

Research suggests that childhood and adolescence are a time of particular susceptibility to the carcinogenic effects of UVR.

Skin cancer is the most common form of cancer, accounting for about 1/3 of all new cancers every year. In 2002, 240 residents of Toronto were diagnosed with melanoma, the most serious form of skin cancer. About (36%) of those were under the age of 55, and 67 people died from it (Cancer Care Ontario – Ontario Cancer Registry, 2004). Although Toronto statistics are not available for the other forms of skin cancer, Canada-wide estimates suggest that over 4500 Torontonians would have been diagnosed with their first basal cell or squamous cell carcinoma in 2002 (Canadian Cancer Statistics, 2004). This is more than the number for the next three most common cancers combined: ie. breast, prostate and colorectal.

Reducing overall exposure to sunlight is the most important way to prevent skin cancer and the other health effects of UVR. The provision of natural and artificial shade combined with personal sun protection methods (hats, appropriate clothing, sunscreen) are important strategies for reducing exposure and protecting exposed skin when outdoors.

Reducing exposure to UVR for children and youth should be a high priority. This population tends to be outdoors more than adults and exposure during the early years of life is a major determinant of lifetime risk of skin cancer.

II. What is Ultraviolet Radiation?

Solar UVR is in the invisible portion of the electromagnetic radiation spectrum, having shorter wavelengths and higher energies than visible light. The two types of UVR that reach the earth's surface are UVA and UVB. Both UVA and UVB penetrate the skin and can cause DNA damage. UVA wavelengths are longer and penetrate deeper into the skin. UVB wavelengths are shorter and more energetic. UVB is the primary cause of sunburn. Both UVA and UVB are involved in causing skin cancer and skin aging. Although most UVR exposure is from the sun, tanning equipment also emits UVA and UVB radiation. UVR exposure can also occur in some specialized occupational settings where electrical welding equipment, black lights, germicidal lamps, UV curing lamps or UV lasers are used.

Factors Affecting UVR Exposure

The amount of UVR that a person receives depends on the strength of the sun’s rays, the nature of the local area (e.g., shade and reflective properties of the surface) and the amount of time spent outside, especially in the sun. The strength of the sun’s rays is influenced by several factors:

- ♦ **Angle of the sun above the horizon:** The higher the angle of the sun, the more directly it shines down on the earth and the less incoming UVR is absorbed by gases in the atmosphere. The angle of the sun is determined by latitude, time of year and time of day.

  - Latitude: The sun is highest in the sky near the equator and hence the UVR is strongest in that region. UVR weakens as you move towards the poles. Southern Ontario, as the most southerly region of Canada has the strongest UVR in the country.

  - Season: The sun is most directly overhead in May, June and July dropping slowly to its lowest elevation in December and January. UVR intensity generally follows this pattern with some additional influence by the seasonal cycle in atmospheric ozone.

  - Time of Day: In the Toronto area the sun reaches its zenith around 1:20 p.m. EDT and UV levels generally follow suit. In May through August UV levels are generally high or very high from 11:00 a.m. through 4:00 p.m. This “high UV” window can be slightly wider in June and July.

Typical maximum daily UV levels under sunny skies				
April	**May**	**June/July**	**August**	**September**

Moderate-High	High	Very high	High	High-Moderate

- **Cloud Cover:** Thin or patchy clouds have little effect on UVR strength, allowing readings to approach those experienced under sunny skies. Even under mainly cloudy skies 70% of UVR can pass through. However, a thick, heavy, dark cloud deck blocks most UVR.
- **Stratospheric Ozone:** The stratospheric ozone layer over Ontario is on average about 5% thinner than in the early 1980s. This corresponds to roughly a 6% increase in clear sky UVR. Stratospheric ozone varies from day-to-day in response to changing weather patterns resulting in short-term swings in clear-sky UVR of about 10%. In late spring, ozone thickness may be reduced by up to 20% for brief periods of time.

  UVR in Canada has historically been strong enough to cause skin damage. Ozone depletion has added to this risk. The ozone layer is expected to gradually recover to "normal" (pre 1980) thickness by around 2050.

- **Elevation:** The atmosphere becomes thinner and less polluted as altitude increases. As a result, with every kilometre rise in elevation, UVR increases by 9%. This is not an important factor in Ontario.
- **Air Pollution:** UVR will generally be reduced by several percent on days with high smog concentrations.

There are also a couple of specific local factors that influence the amount of UVR reaching a person:

- **Shade:** Shade structures and mature trees can intercept most incoming UVR. The key is for them to be selected and situated so as to block both direct sunlight and indirect UVR scattered from all directions in the sky. Shade properties are discussed in detail in section 3.1 – Planning for Shade: Direct UV vs. Indirect UV.
- **Reflection:** UVR exposure can also be increased by reflection off bright surfaces such as snow (50-90%), white sand or concrete (10-15%). Less UVR is reflected off uneven or darker surfaces such as lawn grass (2-4%) or asphalt (4-8%) (Gies, 2003).

  Under most conditions UVR is increased by about 5-10% by reflection off of water surfaces. When the sun is very low in the sky UVR reflection will be greater. However, this is not particularly significant because incoming UVR is weak (UV Index <1) at these low sun angles. (Madronich, 1993).

Assessing the level of UVR: The UV Index

Environment Canada developed the UV Index to inform Canadians about the strength of the sun's UV rays. The higher the UV Index number, the stronger the sun's rays, and the greater the need to take precautions. Readings typically range from 0 to 10 in Canada, although they may exceed 14 in the tropics.

At Ontario's range of latitudes, solar UVR is strongest and can therefore do the most damage to skin between May and August. Even when it doesn't feel hot or when there is light cloud cover, there is plenty of UVR during these months. The UV Index forecast considers the sun's position in the sky and factors that vary from day-to-day such as cloud cover, atmospheric ozone concentration and reflection of UVR off of snow.

The table below outlines the sun protection actions recommended at different levels of the UV Index. Personal UVR exposure depends on the strength of the sun's rays, (as indicated by the UV Index) as well as local features (shade, reflection off surfaces other than snow) and the amount of time spent outside, especially in the sun.

What does the UV Index mean?

UV Index	**Category**	**Sun Protection Actions**
0 - 2	Low	Minimal protection needed if outside for less than one hour. Wear sunglasses on bright days.
3 - 5	Moderate	Cover up, wear a hat, sunglasses and sunscreen if outside for 30 minutes or more
6 - 7	High	Protection required. Reduce time in the sun between 11 a.m. and 4 p.m. and seek shade, cover up, wear a hat, sunglasses and sunscreen.
8 - 10	Very High	Take full precautions (see "high" category) and avoid the sun between 11 a.m. and 4 p.m.
11+	Extreme	Very rare in Canada. Take full precautions and avoid the sun between 11 a.m. and 4 p.m. Unprotected skin will be damaged and can burn in minutes.

Proper sun protection includes wearing a broad-rimmed hat, a shirt with long sleeves and wrap-around sunglasses or ones with side shields. Choose sunscreen with 15+ SPF (sun protection factor) that offers protection against both UVA and UVB rays. Apply generously before going outside and reapply often, especially after swimming or exercise.

Environment Canada’s UV index

For more information on the UV Index visit http://www.msc.ec.gc.ca/topics/UV

The UV Index forecast provides an indication of the maximum UV Index reading expected that day. This maximum typically occurs in the early afternoon when the sun is highest in the sky. For the Toronto area, this peak falls near 1:20 p.m. EDT. People are advised to be most vigilant about sun protection practices within a few hours either side of this peak (11:00 a.m. to 4:00 p.m. protection window). Environment Canada includes the UV Index in the public forecast any day the index is expected to reach three or higher.

III. What is Skin Cancer?

There are three main forms of skin cancer: basal cell carcinoma, squamous cell carcinoma and malignant melanoma. Basal cell carcinoma and squamous cell carcinoma, together referred to as "nonmelanoma skin cancer," comprise about 95% of skin cancers diagnosed each year (Canadian Cancer Statistics, 2004). Since most cancer registries do not record nonmelanoma skin cancers, high quality local statistics are not generally available and extrapolations from areas where such data are collected must be used.

Basal cell carcinoma is the most common form of skin cancer but does not spread to other organs, so only very rarely results in death. Its treatment can, however, be very mutilating if it occurs on the face. It affects more men than women and occurs most often on the face and neck (including scalp and ears in men). Multiple basal cell carcinomas in the same person are not uncommon. Although it most commonly occurs in older people, it is not unknown at younger ages.

Squamous cell carcinoma is less common than basal cell carcinoma, but has the potential to metastasize (spread to other organs) and cause death, but does so infrequently. It also is more common in men than women and, even more so than basal cell carcinoma, has a very strong preference for the face and neck, forearms and back of hands. Squamous cell carcinoma is very rare in young people and increases steadily in incidence with increasing age.

Melanoma is the least common form of skin cancer but can be fatal if not diagnosed in its early stages. It accounts for the vast majority of skin cancer deaths. It is equally common in men and women and occurs equally often on the face/neck and shoulders/trunk (back and chest), when the relative skin area on each of these body areas is taken in to account. It is one of the more common cancers in young adults up to age 45. After about age 50, the incidence rises very little with increasing age.

Skin cancer alone accounts for about one third of all cancers diagnosed in Ontario. About one in seven Canadians will get some form of skin cancer during their lifetime and one in 90 will develop melanoma (Cancer Care Ontario, May 2002).

IV. How does UVR Work to Cause Skin Cancer?

UVR works in many different ways to cause skin cancer. Each time skin is exposed to sun and becomes tanned or burned, damage is done to individual cells, including their

DNA. It is important to realize that skin cells can be damaged with exposure to UVR that isn't long enough to cause either burning or tanning. There are repair systems in the skin, but they are not foolproof. Some cells in the skin die, because they are so badly damaged. Some cells are able to repair the sun-damaged DNA. However, some of the DNA damage may not be repaired, resulting in defective cells in the skin. UVR also acts by decreasing the body's immune system, and this makes it difficult to destroy the defective cells. These defective cells that are not destroyed may slowly grow over time and produce a tumour.

The cells involved in the three different forms of skin cancer all lie in the outer layer of the skin, the epidermis. Squamous cells are closest to the surface and melanocytes farthest away. This is relevant because, as noted earlier, UVA penetrates deeper into the skin than UVB so that different amounts of the two types of UVR reach different types of cells. It is therefore not surprising that the relationships between UVR exposure and the three forms of skin cancer differ.

When the skin is exposed to UVR, the pigment producing cells (melanocytes) make more melanin. This brown pigment protects the skin by absorbing UVR and prevents it from penetrating deeper in the skin. The skin becomes darker, or tanned. Unfortunately, the melanin in a tan does not block out enough of the radiation to prevent skin damage. A tan is a sign that the skin has been damaged. The pigment cells produce pigment all the time, which gives people their skin colour. People with darker skin that tends to tan rather than burn do have more protection against UVR.

Sunburn is the skin's visible reaction to acute over exposure to UVR. Sunburn (redness, swelling, pain and blistering) increases the risk of skin cancer. Chronic exposure to UVR is widely recognized as a major cause of skin cancer and signs of aging, including wrinkles.

Epidemiological research suggests that higher levels of cumulative UVR over many years, such as that received by long-term outdoor workers, are required to produce squamous cell carcinoma. Melanoma is more closely related to how much intense intermittent exposure one receives or the kind of exposure that can result in sunburn to skin that is not customarily exposed. This is consistent with melanomas being relatively common on the trunk, which is not normally exposed. Intermittent exposure early in life appears to be particularly important, as evidenced by the relatively early age at which melanoma occurs. Basal cell carcinoma seems to be somewhere in the middle, related to both amount and type of exposure.

It is important to note that all forms of skin cancer are related to the amount of sun exposure accumulated in a lifetime. As with all adult forms of cancer, there is a substantial lag time between exposure and evidence of skin cancer.

V. Who Gets Skin Cancer?

There are certain characteristics which identify people as being at higher risk. People with fair complexion, particularly those with red hair, are more susceptible to skin cancer than those with darker natural colouring. Those who tend to burn easily, tan poorly or freckle are also at higher risk of all forms of skin cancer. As noted earlier, children and adolescents may be particularly susceptible to the carcinogenic effects of UVR.

VI. Communications/Education

One of the steps in a comprehensive approach to this policy includes education and raising awareness. This approach to the policy will contribute to the policy success and longevity. Education and raising the awareness of all city staff is essential when developing and implementing new policies to facilitate improved health for residents of Toronto and to clearly communicate the intention of the policy. Information shall be developed and disseminated to educate staff by the ultraviolet radiation working group and the multi-disciplinary shade policy team in partnership and collaboration with the relevant city divisions and departments.

Additionally, workshops and seminars need to be developed to assist in informing staff of the importance of UVR protection to prevent skin cancer and other sun related illnesses.

The shade policy will compliment the existing City of Toronto employee personal sun protection policy. In addition, city employees should continue to role model sun protective behaviour.

The following standard sun safety recommendations are endorsed by Health Canada, Canadian Cancer Society, Canadian Dermatology Association, Environment Canada and other key organizations to help reduce the risk of long-term damage to the skin:

- Try to reduce sun exposure between 11 a.m. and 4 p.m. during the months of May through August and the amount of time spent in the sun (e.g., schedule outdoor sporting events for early evening; if you're a jogger, plan to do so first thing in the morning)
- Seek shade or create your own shade (e.g., choose outdoor cafés with umbrellas or covered porches)
- Wear clothing to cover your arms and legs
- Wear a wide brimmed hat and wrap-around sunglasses with UVA and UVB protection
- Apply sunscreen with minimum SPF #15 or higher with UVA and UVB protection (higher for individuals spending extended periods of time out-of - doors).

With respect to the community-at-large, measures such as information pamphlets or media releases in local newspapers will assist in increasing the awareness of the importance of exercising sun safety protective behaviour and making use of shade.

The development of a longer term UVR reduction plan and communications strategy is an essential next step evolving from the initiatives outlined in this document.

Appendix IV: Bibliography

1. Australian Institute of Environmental Health. Creating Shade at Public Facilities. Policy & Guidelines for Local Government. Edition 2. Retrieved from http://www.health.qld.gov.au/phs/documents/shpu
2. Cancer Care Ontario. (May 2003). Cancer 2020 Report: Targeting Cancer – An Action Plan For Cancer Prevention and Detection.
3. Canadian Dermatology Association
4. Chiotti, Q., and Mills, B. (2002). The Toronto-Niagara Region Study Assessment Framework: *The Importance of Integrated Mapping for Environment and Health.* In D. MacIver and H. Auld (ed) Integrated Mapping Assessments of Changing Vulnerability and Variability in Climate, Biodiversity, Land-use and Built Environments.
5. City of Toronto. (2002) Human Resources Policies - Policy on Climate-Related Hazards - (iii) Sun Protection – February 18, 2002 Retrieved from http://witoronto.ca/intra/hr/policies.nsf
6. Diffey, B. (2003). What can be done to reduce personal ultraviolet radiation exposure? Prevention of Skin Cancer. Edited by D. Hill, J. Elwood and D. English. Kluwer Academic Publishers. 2003 p. 245
7. Environment Canada. (2004). UV index (Reproduced with the permission of the Minister of Public Works and Government Services Canada, http://www.msc.ec.gc.ca/topics/uv
8. Federal Provincial Territorial Radiation Protection Committee (1999).
9. Gies, P., Roy, C. and Udelhofen, P. (2003). Solar and Ultraviolet Radiation. Prevention of Skin Cancer. Edited by D. Hill, J. Elwood and D. English. Kluwer Academic Publishers. p. 36.
10. Greenwood, JS., Soulos, GP., and Thomas, ND. (1998) Undercover: Guidelines for Shade Planning and Design. New South Wales Cancer Society and New South Wales Health Department, Sydney, Australia.
11. Hill, D.,Elwood, J., and English, D. (2003). Edited. Prevention of Skin Cancer. Kluwer Academic Publishers.
12. Intergovernmental Panel on Climate Change (2001). Climate Change 2001: The Scientific Basis.
13. International Agency for Research on Cancer Expert Group (1992). Solar and ultraviolet radiation. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol 55. Lyon, France: IARC Press.
14. Konopacki, S., and Akbari, H. (2001). Toronto Energy Savings - Energy Impacts of Heat Island Reduction Strategies in the Greater Toronto Area, Canada.
15. Madronich, S. (1993). UV Radiation in the Natural and Perturbed Atmosphere, in *UV-B Radiation and Ozone Depletion*, M. Tevini ed., Lewis publishers, pp. 34-40.
16. Mills CJ, Trouton K, Gibbons L. (1997). Second symposium on ultraviolet radiation-related diseases. Chronic Disease Canada, 18:27-38.
17. National Cancer Institute of Canada. (2004). Canadian Cancer Statistics, Toronto, Canada, 2004.
18. Ontario Medical Association (2000). The Illness Costs of Air Pollution in Ontario.
19. Ontario Sun Safety Work Group. (1998). Sun exposure and protective behaviours: Ontario Report 1998. Toronto: Canadian Cancer Society (Ontario Division).
20. Ontario Task Force on the Primary Prevention of Cancer. (March 1995). Recommendations For The Primary Prevention of Cancer.
21. Statistics Canada (1996). National Survey on Sun Exposure and Protective Behaviours.
22. Toronto Cancer Prevention Coalition Action Plan for Cancer Prevention in the City of Toronto (November 2002). Retrieved from www.toronto.ca/health/resources/tcpc/index.htm
23. Vajdic, CM., Kricker, A., Giblin, M. et al. (2002). Sun exposure predicts risk of ocular melanoma in Australia. International Journal of Cancer, 101:175-82.
24. York Region Sunsense Coalition (2003). Shade: A Planning Guide.York Region Health Department.