

## 1.0 Water Conservation and Use Opportunities

Water is an important resource for ski areas as well as the surrounding natural environments and communities and should be used as efficiently and effectively as possible. National and local concerns over water supply and permits to take water place ski areas under pressure to reduce the large volume of water used for snowmaking. In addition, water-taking permits issued through the Ontario Ministry of the Environment require high volume water users to closely monitor the amount of water that they take on a daily basis in order to be considered for permit renewal. Snowmaking requires about 175,000 gallons of water to create a 12-inch deep layer of snow over an acre (200- by 200-foot area). Snowmaking requires extremely high volumes of water over short periods of time and can convert between 1500 to 15000 gallons of water into snow in about a minute. Ski areas also use water for food preparation, building operations, and hotel/condominium guests, so it is possible for ski areas to benefit financially from implementing water savings techniques and technologies in all of these areas as well.

### Developing a Water Management Plan









Developing a water management plan is a logical, step-by-step process. It involves more than just conducting a cost-benefit analysis and preparing a report. To be successful, a water management plan should not only consider the technical side, such as installing efficient plumbing fixtures, but also the human side, such as changing employees' long-standing operating procedures and water use habits. It is also important to look at managing water use to comply with the law, make cost-effective decisions, and to document your savings. In terms of measurement, correlate water savings and use to skier visits.

Water management techniques generally fall into three categories:

1. Waste: Reducing losses (for example, fixing leaky faucets and pipes)
2. Total Volume: Reducing the amount of water used by equipment or processes (for example, using ultra low-flow toilets and automatic shut-off faucets)
3. Recycling: Reusing water that would otherwise be discarded (for example, treating water for use in snowmaking or in landscaping irrigation)

For virtually every use of water at a ski resort, managers can choose from a wide variety of water management options. Some options simply involve altering the water use of resort employees and visitors. Other options involve changing the way fixtures and equipment are operated and maintained. The most significant long-term savings, however, will probably require the retrofitting or replacement of fixtures and equipment. In some instances, one option alone might achieve the desired savings (such as replacing showerheads with low-flow models). In others, a combination of options may be needed (for example, inserting flow restrictors and providing automatic sensor controls for bathroom faucets). A comprehensive water management plan should explore all water management options. This plan should recognize that a building's water system, and changes to it, will have an impact on other systems in the building, such as heating. For example, installing a flow restrictor on a faucet not only will reduce the amount of water consumed, but also will lower energy costs associated with heating this water for use and lower sewerage costs based on consumption. The following topic areas should be considered when developing a water management plan for your ski resort.

### (A) In Snowmaking

Does this apply to my facility?	Already in place at my facility	Sub topic:	Water Use for Snowmaking		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)	
		Applicable Sustainable Slopes Principle(s):	Useful Resources:				
		Considerations:	<ul style="list-style-type: none"> <li>Optimize efficiency and effectiveness of water use in snowmaking operations</li> <li>Conduct snow making operations in a manner that protects minimum stream flows and is sensitive to fish and wildlife resources</li> </ul>	<ul style="list-style-type: none"> <li>"Snowmaking is an art and a science".</li> </ul>	Please refer to snow equipment manufacturer's guidelines for guidance on operating efficiencies.		
<input type="checkbox"/>	<input type="checkbox"/>	Complete an inventory of the resort's water resources and monitor seasonal variations that impact snow making activities.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Inspect, pressure test and monitor water distribution lines that feed snow making systems for leak detections to reduce water loss. Water leaks can be caused by corroded underground pipes, faulty piping, or faulty pipe installation.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Train staff responsible for snow making and grooming activities on water use, conservation opportunities and the benefits associated with conservation activities. Staff must know the trail topography of each trail (i.e. How much snow is required?)				●	
<input type="checkbox"/>	<input type="checkbox"/>	In urban areas, ski areas need to abide by municipal watering restrictions. For instance: watering between 7pm and 9pm. Contact your municipality for more information.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Repair any leaks found during inspection of water distribution lines.				●	 
<input type="checkbox"/>	<input type="checkbox"/>	Build an onsite reservoir to draw water for the snow making process rather than drawing water from local water sources (i.e. creeks, rivers). Route all water system bypasses, and overflows back to storage site. Funnel any surface runoff back in to storage reservoir to use again.				◆	
<input type="checkbox"/>	<input type="checkbox"/>	Install a water cooling system to cool the water supplied to snowmaking systems. Reducing the temperature of the water increases the efficiency of the snowmaking process by reducing evaporative losses when the water is released to				■	

		the atmosphere.		
<input type="checkbox"/>	<input type="checkbox"/>	Install new high efficiency snowmaking guns or retrofit/recondition older guns with new nozzles to further reduce snowmaking water and energy consumption. Install high efficiency pumps and compressors for snow making.	■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Use a water additive (Snowmax) as a catalyst to increase the speed of crystallization of the water to snow. Making larger, dryer snow-crystals and also minimize losses from drift off the trail and evaporation.	■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Install flow meters on all snowmaking systems to accurately measure water usage. Document water use and costs from these meters to compare with water uses throughout the resort.	■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Install a system monitoring or control automation to increase efficiency of the snowmaking system. Will allow snowmaker to accurately modify the snowmaking systems by using computer controls to quickly respond to changing weather conditions on the slopes and avoid pumping excess water. Consider wet bulb and dry bulb temperature to determine when to make snow and maximize snowmaking efficiency.	■	💧💰

**Success Story #1: Boston Mills/Brandywine Ski Resort, Ohio**

Seventy (70) new and more energy efficient snowmaking guns were installed. They are able to make the same amount of snow in 382 hours as the old guns did in 650 hours. This represents a 58% increase in production. The new snowmaking system will save 961,854 KWH or 69.5 % over the old system. That amounts to an annual energy cost savings of \$165,026. The new snowmaking machine will oscillate 50 degrees and spread the snow out which will reduce the time spent by the grooming machines in pushing out the piles. Along with less grooming required, the new grooming vehicles will save 9,404 gallons of diesel fuel or 46.9% over the old grooming system. A payback including a deduction for proceeds from sales of old equipment is expected to be less than two years.

**Success Story #2: Blue Mountain Resort, Ontario**

Blue Mountain uses dirt foundations for its super pipe (a snowboarding run, that has 17 foot high walls). This particular design requires 10 000m<sup>3</sup> of snow. Using dirt foundations decreases the amount of snow/water required as well as the amount of energy consumed to make snow by approximately 20%.

**(B) In Facilities**

Does this apply to my facility?	Already in place at my facility	Sub topic:	Water Use in Facilities		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)
		Applicable Sustainable Slopes Principle(s):	<ul style="list-style-type: none"> <li>Conserve water and optimize efficiency of water use in ski facilities</li> <li>Develop outreach that enhances the relationship between the ski area and stakeholders and ultimately benefits the environment</li> </ul>	Resources:		
		Considerations/ Scope:	<ul style="list-style-type: none"> <li>Hotel/lodging</li> <li>Kitchen Activities</li> <li>Laundry Activities</li> <li>Building Operations (cooling towers)</li> </ul>	Audubon Green Leaf™ Eco-Rating Program <a href="http://www.terrachoice.ca/hotelwebsite/indexcanada.htm">http://www.terrachoice.ca/hotelwebsite/indexcanada.htm</a>  Project Planet <a href="http://www.projectplanetcorp.com">http://www.projectplanetcorp.com</a>		
<input type="checkbox"/>	<input type="checkbox"/>	Conduct water use audits throughout facility. In terms of measurement, correlate water use to skier visits. Keep careful records of water use, read the water meter once a week, and compare the weekly water volume used to the various activities at the facility (i.e. amount of laundry, dishes washed or guests staying at the lodge).			●	✍️
<input type="checkbox"/>	<input type="checkbox"/>	Remind employees and visitors to conserve water – public education campaign. Make water use figures known to employees.			●	✍️
<input type="checkbox"/>	<input type="checkbox"/>	Participate in Sustainable Slopes Outreach Day on February 26 <sup>th</sup> , 2005 by communicating the “Keep Winter Cool” message to skiers and snowboarders through table tents at resort lodges and cafeterias and through your ski area’s website.			●	✍️
<input type="checkbox"/>	<input type="checkbox"/>	Regularly check facility for leaks and water waste activities. For instance shut everything off and see if the meter stops.			●	✍️
<input type="checkbox"/>	<input type="checkbox"/>	Install water efficient equipment such as low flow faucets, showers, urinals and toilets throughout the facility.			■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Retrofit faucets by installing aerators with flow restrictors to slow the flow of water or faucets with sensors.			■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Implement an optional linen and towel laundry program at lodging and conference facility.			■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Purchase and use water saving equipment/appliances for kitchens and lodges (i.e. Energy Star dishwashers and clothes washers)			■	💧💰
<input type="checkbox"/>	<input type="checkbox"/>	Control bleed off from ice making machines. Use bleed off for condenser unit.			■	💧
<input type="checkbox"/>	<input type="checkbox"/>	Use air cooled water fountains and ice making machines.			■	💧💰

**Success Story #3 – Bridger Bowl Ski Area, Montana**

In the redesign of a new base area day lodge complex, Bridger Bowl installed waterless urinals as a water conservation project. Water usage and wastewater treatment are important issues at our resort. We estimate the reduction in water usage will be as much as 25% to 35% compared to current yearly volume. As each toilet flush amounts to approximately 1.5 gallons of water use, we estimate based on our yearly 170,000 skier visits that 255,000 gallons of water will be saved per year. Not only will we reduce water usage, we will reduce sewage volumes and improve sanitation. The installation cost was approximately \$3500. The urinals are simple to clean and maintain.





**(C) Landscaping and Summer Activities**

Does this apply to my facility?	Already in place at my facility	Sub topic:	Water Use for Landscaping and Summer Activities		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)
		Applicable Sustainable Slopes Principle(s):	Considerations:			
		<ul style="list-style-type: none"> <li>Maximize efficiency in water use for landscaping and summer activities</li> </ul>	<ul style="list-style-type: none"> <li>Soil conditions</li> <li>Surface conditions</li> <li>Vegetation (water needs, adaptability)</li> </ul>	<b>Resources:</b> Audubon Cooperative Sanctuary Program: <a href="http://www.audubonintl.org/programs/acss/golf.htm">www.audubonintl.org/programs/acss/golf.htm</a>  Golf Course Superintendents Association of America: <a href="http://www.gcsaa.org">www.gcsaa.org</a>  Greening Your Golf Course: <a href="http://cdpfe.state.co.us/el/documents/golfcourse/golfp2guide.pdf">http://cdpfe.state.co.us/el/documents/golfcourse/golfp2guide.pdf</a>		
<input type="checkbox"/>	<input type="checkbox"/>	Implement an irrigation schedule. Water grounds at night when the temperature, solar radiation, and wind speed are lower. Make use of rain gauges or computerized weather stations as a means of determining how much watering is needed. Consider vegetation, soil type, slope, site use, and specific vegetation management practices when developing schedule.			●	💧
<input type="checkbox"/>	<input type="checkbox"/>	Inspect and repair irrigation system regularly to ensure that there are no leaks and that heads are not broken or misaligned.			●	💧🔧
<input type="checkbox"/>	<input type="checkbox"/>	Install timers, soil moisture sensors and rainfall shutoffs for irrigation system.			●	💧
<input type="checkbox"/>	<input type="checkbox"/>	Plant heat resistant, drought tolerant vegetation in landscaped areas to reduce maintenance. Improve water retention of soil through use of compost.			●	💧
<input type="checkbox"/>	<input type="checkbox"/>	Collect water (i.e. filter backwash from pool, rain) for non-potable water use (i.e. lawn watering).			●	💧

**Success Story #4: Monterra Golf: Certified Audubon Cooperative Sanctuary (at Blue Mountain Resort, Ontario)**

This is an international program that is designed to help landowners preserve and enhance the environmental quality of their property. After 3 years of on-going effort, Monterra Golf became 1 of only 9 courses in the province to receive this coveted designation. To achieve this we had to meet rigid standards of management as set out by the Audubon Program. Golf courses earn their designation when they have organized, implemented and documented projects in each of the following categories: environmental planning, wildlife and habitat management, outreach and education, water conservation, water quality management and integrated pest management. For example as established by the Audubon Society water conservation management is sufficient when it includes maximizing irrigation efficiency; determining proper irrigation times and rates; reducing hectares irrigated; recapturing and re-using water; and incorporating drought tolerant plant species.

## (D) Wastewater and Stormwater Management

Does this apply to my facility?	Already in place at my facility	Sub topic:	Wastewater and Stormwater Management		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)
		Applicable Sustainable Slopes Principle(s):				
		Considerations:	<ul style="list-style-type: none"> <li>Local municipalities sewer use by-laws</li> </ul>	<b>Resources:</b> Stormwater Pollution Prevention Handbook <a href="http://www.ene.gov.on.ca/envision/water/stormwaterpph.htm">http://www.ene.gov.on.ca/envision/water/stormwaterpph.htm</a>  Municipal Water/Wastewater Programs <a href="http://www.ec.gc.ca/water/en/links.cfm?category_id=9&amp;sub_section_id=22">http://www.ec.gc.ca/water/en/links.cfm?category_id=9&amp;sub_section_id=22</a>		
<input type="checkbox"/>	<input type="checkbox"/>	Monitor wastewater quality and plan with local communities for present and future wastewater needs.			■	
<input type="checkbox"/>	<input type="checkbox"/>	Implement a stormwater management plan to collect and re-use water from various sources			■	
<input type="checkbox"/>	<input type="checkbox"/>	Reuse treated wastewater/greywater for non-potable uses (i.e. landscaping, golf course irrigation)			■	
<input type="checkbox"/>	<input type="checkbox"/>	Construct a treatment system for reusing wastewater in snowmaking activities			◆	

### Success Story #5: Stratton Mountain, VT

To reduce sand and silt loading, Stratton no longer dumps snow at 200+ tons annually into the Styles Brook watershed. In addition, the resort has eliminated 2 acres of gravel surface parking, which was causing silt and sand loading to streams in the North Branch watershed. To further improve water quality, the resort has constructed state-of-the-art stormwater and treatment measures that reduce peak flow rates and prevent both sand and silt loading to a tributary in the North Branch watershed from another 4-acre parking area. Finally, the resort implemented the first phase of roadway improvements at the sewage treatment plant to eliminate excessive sediment loading to a tributary stream.

To control wastewater, Stratton implemented an erosion control project that resulted in 66 bushes, 8 trees, and 50 ferns being planted along one riverbank property. This prevented flooding during a very rainy week in the summer of 1999, and a community member commented, "It was the first time in years our property did not wash away."

## Water Use Data Collection Template

<b>Surveyed by:</b>				<b>Date:</b>		
<b>A. Snowmaking</b>						
Number of guns		Volume of water used				
Water source						
<b>B. Facilities</b>						
Meters/						
Kitchens	Any energy efficient					
Guest rooms						
<b>C. Landscaping</b>						
<b>Type of Irrigation:</b>	<b># hours used/day</b>	<b>Units</b>	<b>Make &amp; Model</b>	<b>Avg. flow rate</b>	<b>Avg. Uses</b>	<b>Comments</b>
Drip						Flow Restrictors Used? <input type="checkbox"/> Yes <input type="checkbox"/> No  Adjustable Water Pressure? <input type="checkbox"/> Yes <input type="checkbox"/> No
Sprinklers						
Other						
Timers used on Sprinklers: <input type="checkbox"/> Yes <input type="checkbox"/> No			If Yes: Morning: from _____ am to _____ am Evening: from _____ pm to _____ pm			
Any leaks? <input type="checkbox"/> Yes <input type="checkbox"/> No			Description:			
Condition of irrigation equipment: <input type="checkbox"/> Good <input type="checkbox"/> Warn			Description:			
Other Equipment: <input type="checkbox"/> Yes <input type="checkbox"/> No			Description:			
<b>D. Wastewater</b>						
Building wastewater is currently: <input type="checkbox"/> Treated on site <input type="checkbox"/> Connected to the municipal water system <input type="checkbox"/> Other						



