Ice Making for Outdoor Ice Surfaces

Parkland Usage and Events Committee, Citizen Services

This handout is based on the outdoor ice making workshop designed and instructed by Henry Stainthorp, ice maker for over 35 years, with additions from other instructors who have assisted in subsequent years.

Any recommendations are those of the presenters and do not reflect the views and opinions of The City of Edmonton Community Services Department. All content of this manual is for informational use only. Please use all information and recommendations at your own risk and liability.

Updated: October 2018

Rink Areas - 3 Common Types of Surface

Grassed Rink Area

1) Level to 1% slope which allows for water run off when the ice melts in the spring

Asphalt Rink Area

1) It is easier to make ice on asphalt than on grassed area

2) Asphalt will absorb sun's rays on a sunny warm day and melt the ice on the south and west facing areas unless you place white sheets or white plastic sheets in these areas before you make the ice. The white sheets or plastic needs to extend approx. 10' (3m) from south facing boards and 3-4' (1-1.2m) for west facing boards

Concrete Rink Area

1) Nice but cost prohibitive to build. These are rarely found in community ice rinks.

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Hoses and Nozzles Measurements

Hoses

Best is a 1”(25mm) ID (Inside Diameter) Hose – Red Rubber (can purchase at Red-L Distributors Ltd).

Do not use a Fireman’s hose, which is 2”(50mm) in Diameter (harder to handle and will freeze to ice once the hose starts to wear).

- Use Cam-Lock Couplers (Red-L) to connect sections

30’ sections of hose are best and easiest to handle

Should have enough hose to reach from your water source to the farthest end of your rink (approximately 200’/61m)

Nozzles

Use an adjustable Red Nozzle (available at Gregg Distributors, also Red-L)

- Not all nozzles are created equal. Watch for a nice, consistent spray pattern. This is ideal for light flooding.

Equipments

Snow Throwers

Recommend Ariens

Keep only 6-8 years and then upgrade

Ensure the equipment is serviced every year

Sweepers

The best equipment to get the ice clean before a flood

Key piece of equipment

Usually recommend Ariens

Keep only 6-8 years and then upgrade

Broom rollers – Usually 26”(660mm) long when new – Replace at 21”/533mm (after 5”/127mm of wear)

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Equipments

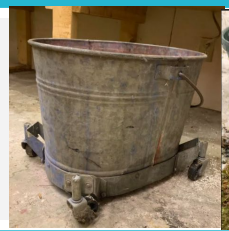
Hose

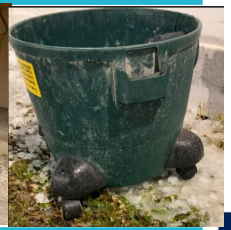
For making and maintaining ice -
Suggest 1”(25mm) ID (Inside Diameter) Hose – Red Rubber

Nozzle

For making and maintaining ice

5 Gallon(19L) Pail on Wheels





Used to make slush to fill cracks and holes in the ice

Use newer style mop buckets with wheels so you can pull or push rather than carry across the ice

Rasp (medium)

Used to smooth off splinters and edges of damaged boards

Equipments

Snow Scrapers

A must have if you don't have a sweeper

Have lots of them so that others can help!

Ensure they are not too heavy to push

Scoop Shovels

Required to scoop snow off ice plus smaller flat shovel used for crack and hole repair

Hammer

Used to pound in protruding nails

Axe

Used to chip out ice around rink boards for easy replacement of boards and to remove excessive ice build-ups

Equipment Maintenance

Should do annual services before the start of the season which includes

- Oil change
- New Spark Plug(s)
- Lubricate any and all applicable areas
- Tighten all nuts and bolts (use Lock-Tite)
- Wash equipment ready for seasons

Grass rinks with a perimeter wooden or plastic board enclosure

1) Repair or replace any rotten or splintered boards in the rink boards (be they wood or plastic)

2) Ensure that gaps do not exceed 1/3”(9mm) (the thickness of a hockey blade)

3) Hammer down flush any protruding nails and screws in the rink boards

4) Paint or repaint any boards that require it - oil based paint is best

5) Mow the grass in early October as short as possible and remove grass clippings and leaves from the area

6) Encourage soccer practices in the rink (they pack down the grass, which makes a better surface to start with

Note:
Wood Boards typically last about 6-12 years depending on maintenance. Puck boards are recommended along the base of the boards. This is usually a specialized plastic from rink product suppliers. Ensure you use outdoor plastic, not the indoor variety

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Snow Bank Rinks
(rinks in which enclosures are snow banks)

1) Mow the grass in early October. Remove any loose grass clippings and leaves

2) Once it has snowed, plough or clear your skating area to four sides to define the flooding/ skating area

3) Encourage soccer practices on the turf (they pack down the grass, which makes a better surface to start with

**See Ice Building Stage for next steps*

Frequently Asked Questions (1/2)

How much water will we use?

Although each surface is unique and each rink a different size, an example from a local group using a grass surface with boards may help:

Our rink is full size – 200ft x 85ft. We put down at least 10" of ice because the ground is so uneven. This works out to 375 cu. M of water – assuming nothing leaks, sinks into the ground or evaporates

Checking the meter readings from our utility statements for the last 2 years we used between 450 to 500 cu M of water each season. To put this in perspective – that is 50 full size dump truck loads of water, 500,000 Liters or 125,000 gallons

Our meter rate (for 2012) was $1.38 per cu M so this costs us about $700

Frequently Asked Questions (2/2)

How much will the water cost?

Knowing the volume, you can ask your water supplier for the cost per cubic meter to calculate your estimated cost for the season as you see above.

Remember, you can cut your water costs by asking for a second meter to be installed to be used specifically for your rink. The meter will allow you to pay for water without paying the additional drainage fees.

Snow Bank Rinks

Construction of any snow bank rink is a very simple business when we can meet certain conditions. Cold weather would be very helpful

Space required	Any open space, fairly level will do. Be it turf area, packed soil or asphalt. Usual dimensions will be anywhere between 50 to 70 feet wide and between 70 to 100 feet long **Commonly asked question - a regular hockey rink is 200' x 85'*
Accessories needed	1" diameter rubber hose, fittings, a nozzle and ¾" (or 1") water outlet, close by location. Snow scraper for cleaning snow
Labor	Person willing to spend number of hours enduring cold weather and flooding

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How to Start?

First of all, decide how large the rink will be and step it out. If ground is covered with snow, clear it by pushing to individual sides which will make the outlining snow banks at the same time. Banks should be fairly definitely outlined at the ice level to prevent rough edges

Next step is to pour water on, when really cold (ground frozen). We suggest not using a nozzle so we can get maximum water delivered. Cover the entire rink area and once frozen, repeat a number of times until base of approximately 2” of ice is built up, trying to maintain flooding as uniform as possible.

How to Start?

Individual floods should have enough time between as to allow for complete freezing of the previous flooding. Really cold temperatures may allow almost constant flooding (one end will be frozen before you finish the other end).
The first floods will look ugly and chunky but keep flooding layers at a time.

When the entire area is covered by a sheet of ice, it should be level with no bare spots or humps and bumps

From then on, use the nozzle on the end of the hose when flooding. A spraying effect will do the finishing touches to your ice

Tip: For high use areas place puck board and north exposure place white puck board or plastic sheets

Ice Building

Preparing the surface

General Tips

- Cover Metal hose connections with cloth if they will be touching the ice surface. This will stop the metal from melting the ice in those spots
- When turning on the hose make sure your nozzle is open a little so you can maintain control of the hose at all times
- Leave the nozzle open at least a little if you are leaving the rink during a flood. This will ensure the hose does not freeze
- Try not to leave hose running in one spot. This will cause the ice to melt (this does not take long)

Ice Building

Preparing the surface

You can pack or roll the snow, BUT the best is to remove all the snow. You can flood over a skiff of snow no more than ½" (13mm) and not when it is snowing

Make sure that the grass was cut short and preferable previously packed down (soccer teams using the arena in fall is wise)

It is very important to make sure that the board edges and fencing have been cleaned off

Put up a sign during the Ice building stage; "DO NOT USE ICE - ICE TOO THIN" – No one should use the ice while it is being made and until you have 1" (25mm) minimum of ice thickness

Tip for Asphalt rinks

- Put white sheets down on the south & west facing surfaces, before you start flooding – this will decrease the possibility of the ice melting on a warm day
- TIP FOR ASPHALT RINKS Pebble (shoot water from the nozzle up into the air letting it fall like rain) the surface to create a crust of ice to ensure a good bond to the surface

Ice Building

Flooding: Base flooding techniques

You can flood from 0 C to –20 C

- Good temperatures are -5C to -15C
- Best temperatures are -7C to -10C

Temperature should never be greater than 0 C on a day that you are flooding unless you have a thick solid base. Light floods on warmer days will work but they must be very light and will take longer to freeze

Flood every day during the ice building stage

Always do light floods – a 190’ x 85’ (58m x 26m) rink should take about 15-30 minutes (30 Minutes Maximum)

Approximately 60 - 80 floods = 1”+ ice thickness.

After 3-4 days of flooding (four hours per day), you start to “Connect the Dots”

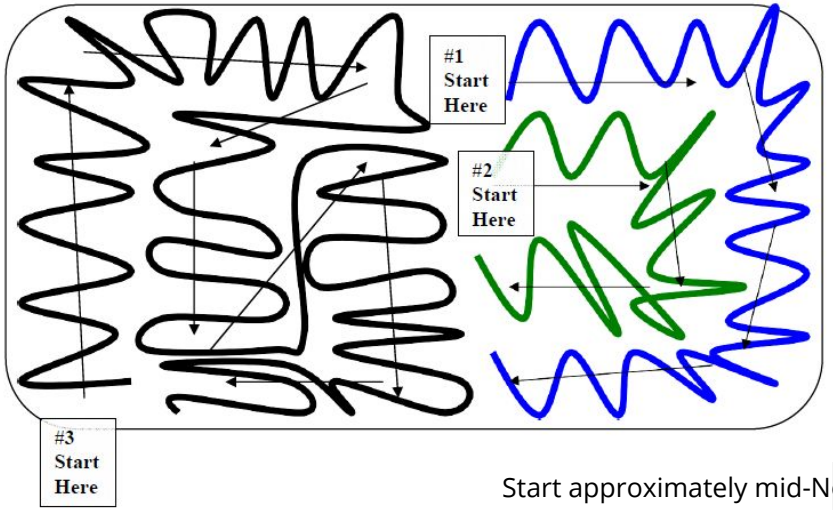
You should always be at least 10-15’ (3 - 4.5m) away from where the water hits

Learn how to pebble. It will come in handy in many situations. To pebble, shoot water from the nozzle up into the air letting it fall like rain. Nozzle should be at a 45 degree with a light flow

Always work from the boards back to the centre of the rink

Base Building Flood Pattern (Initial Flood)

Highly recommended: Use the Lazy Eight method found in Routine Ice Maintenance for all stages of ice making (see page 22)



Start approximately mid-November

You can flood over top of the hose in the initial floods

Don't have the hose on top of the hose. It moves better when it's just on the ice. The hose can bind if it is lying on top of itself

Use a 1.5' to 2' (0.5-0.6m) wide water spray

Ice must be frozen before you coat again

Aim for 4-6 floods per day

Ice making will take ~2 weeks, depending on the weather. The 2-week estimate is based on the temperature being at or below 0 C everyday

Use a **Rain flood** to build and maintain the ice High trajectory - use a 45 degree angle from ice to nozzle

Sweep the hose/nozzle in an arc and always walk backwards away from the area you flood. Wet ice is very slippery ice

Benefits of Light Floods

- Heavy floods go under the boards
- **All** surfaces are best to only light flood
- Heavy floods move as they freeze which makes ripples and cracks

Several fine sprays should be applied before proceeding to a heavier spray. If the weather is cold enough, i.e. -7° C to -15° C spraying can likely be continuous, as the first coat will be frozen almost immediately

However, in warmer weather, additional sprays should not be applied until the previous one is thoroughly frozen

Once the ground has been completely sealed and the water will not run away, the leveling of the ice can begin. Using a heavier spray, repeat the previous procedure, applying as many coats as may be necessary to process to ensure the low spots are filled in gradually, as shell (shale) ice may result if too much water is applied at once. If some spots are particularly low, it may be best to apply water only to those spots until they are built up close to level

Benefits of Preparing your Surface

- Take the time to remove your snow
- Remove all leaves and dead material

You may think a leaf here or there will not cause a problem. Leaving a single leave can cause “Ice Rot” in your surface. As the sun shines down on your surface, the leaf will collect more energy than the surrounding ice. This will cause the ice above and below it to melt. You will need to continually work repairing that yellow pothole that it will create. When you finally decide that you should remove the leaf, as many do, you will find that the freeze-thaw pattern has caused the leaf to rot under the ice. Many have reported a horrific smell from this. Remember to clear your ice before flooding

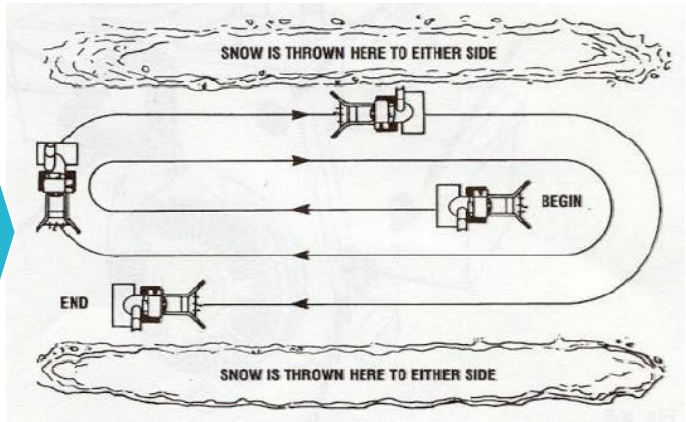
Routine Ice Maintenance

Snow removal: Use the snow thrower then sweep

Always fill the sweeper and snow thrower with gas before bringing it on the ice

Start in the middle of the ice and work both ways (see diagram below)

The discharge chute stays the same direction except when turning. Snow is thrown to each side



Sweep the snow into a windrow near but about 2-3 feet (0.6-1m) away from the boards. This is to make it easier to blow over the boards.

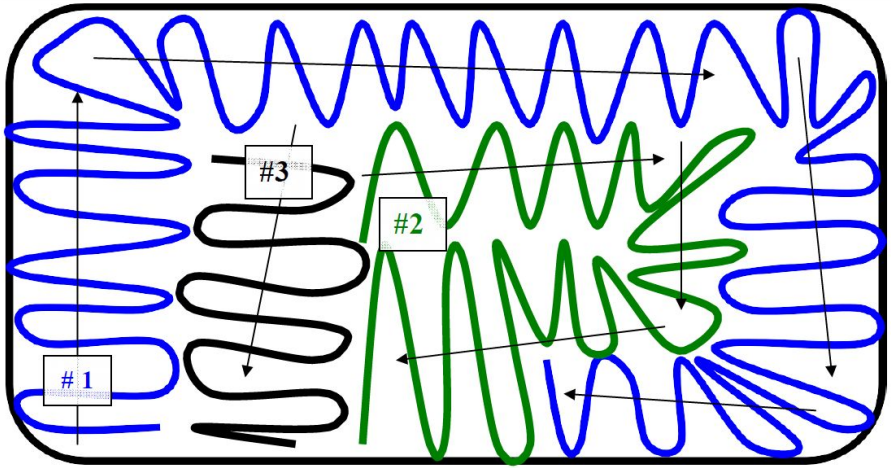
Remember: Always finish removing the snow that you start moving (either by sweeping or snow thrower). Even if it starts snowing, finish removing what you started. Snow left that has been disturbed will become very hard and will be difficult to move the next day.

Key:

1. Ice must be clean before you flood.

2. Use light floods!

Maintenance Flood Pattern



Light Floods Build Strong Ice! – You want to build your ice layer by layer. Going fast can cause many problems such as air bubbles trapped in the ice. Strong ice will help with ice retention as it gets warmer

Do not Flood Below -20 C – Will the water freeze? Yes but it will be a poor quality. Ice cracks too easily at this temperature

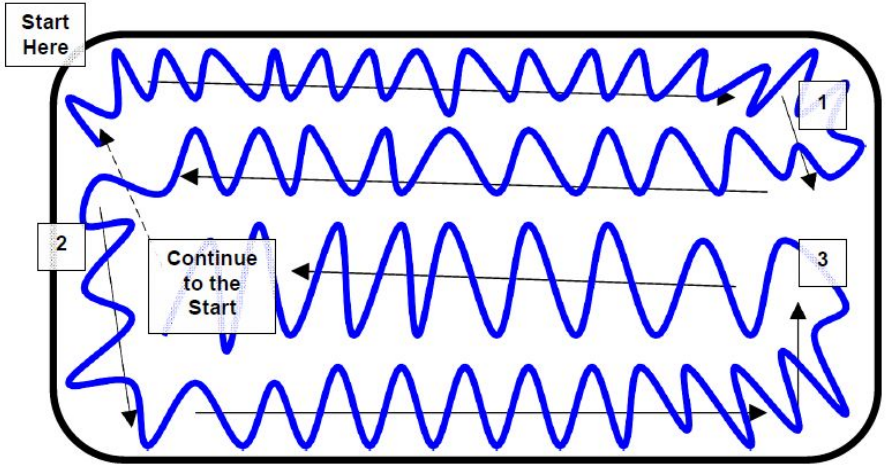
Listen to the Sound of the Ice - If you can hear it cracking, usually because it is too cold, stop. You will cause more problems for yourself in the future. Let it warm up

Do not Flood when it's Snowing – This will make poor quality ice which you will battle with all season

Stop Flooding if it Starts Snowing – Same as above. Be patient and do it right. You will be glad you did

Walk Flat on the Ice - Lean slightly forward when flooding to keep your balance. No heel to toe

Lazy Eight Flood – General all Purpose Flood Pattern



This pattern can be used to build the base or for maintenance

It will allow you to continually flood as long as you want depending on the weather and temperature outside

Spray water using a circular or back and forth motion. The water should splash on the surface and not pool for best results

Start in a corner of the ice and spray while moving backwards. You should be covering 25% of the ice surface

At Turn 1, begin moving up the centre portion of the ice covering the next 25% of the ice

At Turn 2, follow the boards to the outside section of the ice along the far boards, not up the centre again. Cover 25% of the ice

At Turn 3, move back into the centre and cover the last 25% of the ice surface. From the Centre, you will be able to continue spraying to the original starting point and begin the Lazy Eight again

If the water is not freezing by the time you come around again, decrease the amount of water flowing from the nozzle to allow for freezing. At ideal temperatures and with experience, you can even flood open hose with continuous freezing using the Lazy Eight

Ice Repair

Cracks form as a result of temperature variations, and when it is too cold the skates also crack the brittle ice

- All holes and cracks (over ¼”/6mm wide) in the ice need to be repaired before flooding

Use a 5-gallon (19L) bucket (preferably on wheels)

- Fill the bucket ½ full with warm water and then add fresh snow to make a thick slush
- Use the “Slush” mixture to patch holes and cracks in the ice

The Technique to fill is

- **Splat** use the shovel to place some of the slush to fill the crack or hole
- **Compress** the slush into the crack or hole with your foot
- **Scoop** any excess off the ice with your flat-bottomed shovel or trowel
- **Spray** flood as you would the whole ice surface with a fine light spray. Depending on repair you may need to spray the area a few times leaving 1 hour to freeze between each time
- **Squeegee** **(**If you can keep it in warm water) You can go over the spot with a warm wet squeegee to smooth the surface

Rink Board Maintenance

Daily

- Check for Protruding Nails or Screws
  - Hammer in nails or twist in screws
- Check for Splintered Wood or Rotten Boards
  - Repair splintered boards by nailing together and then filing if possible using a medium rasp. Replace if necessary. Use Spiral Ardox Nails as they hold better than regular nails. Flatten the point of the nail before using, as this will reduce the possibility of splitting the board
  - Replace rotten boards by chipping ice out around the rotten board. Then remove the rotten board and replace with a new painted board

Weekly

- Check for ice accumulation on the dasher boards. Remove before flooding

If you have Running Water Under Boards...

- If you have water running under the boards you a have a few options of how to fix this:
  - get some snow and pack the snow against the boards. Spray lightly with water until you have a build up of ice
  - you can use thick slush as mentioned in the Ice Repair section. Once in place you spray lightly with want to keep building on it
  - You can use wet newspaper if it is a large gap to fill the gap, cover with slush mix and spray lightly

Line Making

- You can use ice paint (available at rink or curling supply stores) for any lines. For the amount you will use we suggest, you purchase tempera paint from the dollar store (the same that children use in the elementary school).
  Do not use paints with oil in them as it will cause problems with your ice
- You can use wool for lines by stretching the wool across the ice and freeze it down, then paint between the lines
- Do not use paper for line and circles. The sun will melt under the paper and leave air pockets
- It is advisable to water down the paint with warm water to give a faint color to the lines. If the paint is too thick, the sun will heat the paint which will melt the ice above it faster than the surrounding ice
- To paint lines, you can use a curling broom (available at rink supply stores). A foam brush will work just as well and you will save money
- Paint lines earlier in the process. A good level to do them is round 2 inches (5cm). You want more ice above the lines than below them
- You can find the proper dimensions for ice lines on the internet. Adjust them accordingly for your ice surface size

EPCOR Grant

- EPCOR is pleased to offer Community Leagues in Edmonton an $800 grant to assist in building safe skating locations in the city. Applications must be submitted by December 15, 2020.

- Please go here to submit the application
  https://communityicerink.optimytool.com/en/

- You will need proof of permission from the land owner when you apply on the grant.
  If you are unsure please check with your Neighbourhood Resource Coordinator (NRC).

Acknowledgments

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Pictures

- Pg 10 – Cam-lock Couplers taken from http://cipatiyudhapersada.indonetwork.co.id/580863/camlock-coupling.htm on November 11, 2010
- Pg 10 – Nozzle taken from http://www.plumbersurplus.com/Prod/D-O-Smith-16534-Water-Pro-Spray-Nozzle-Firehouse-Red/59371/Cat/1146?RefID=CJ on November 11, 2010

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