Toronto Metropolitan University Faculty of Science

Jet Ice WE BRING ICE TO LIFE®

Fast but durable

Is there an optimal water for hockey ice?

Discussions about ice quality in professional hockey often extend beyond temperature and refrigeration systems to include the water used to make the ice itself. Within the rink industry, water chemistry is frequently cited as a factor that can influence how ice feels and performs, particularly in terms of glide, consistency, and durability under elite-level play. While perceptions about “good ice” vary across teams and facilities, water quality is one variable that consistently reappears in technical conversations among ice makers. That connection was articulated clearly by Matt Messer, Manager of Engineering and Ice Operations for Oilers Entertainment Group, during Innovation Day 2024 in Edmonton. In a presentation to industry peers, Messer summarized his experience with a single statement about total dissolved solids (TDS), a measure of the combined minerals and salts present in ice-making water, and their influence on ice quality:

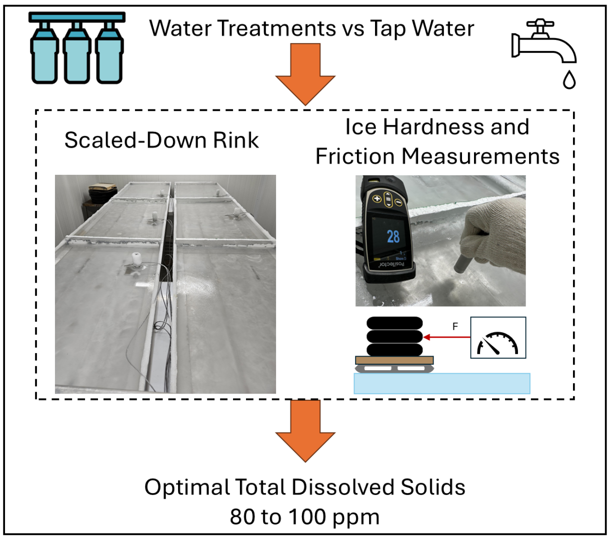
> *Lower TDS count will result in more glide, but will not hold together with higher impact sports like hockey.* — *Matt Messer*

The comment reflects a practical consideration familiar to many rink operators. Increasing water purity can improve glide, but surface durability under high-impact play remains a concern.

Rather than representing a settled rule, this trade-off has largely been shaped by experience and local practice. To better understand how ice makers navigate this balance, researchers in the Faculty of Science at Toronto Metropolitan University (TMU) are conducting an ongoing research program focused on the role of water chemistry in ice performance across a range of ice sports.

As part of this broader effort, water samples are being collected and analyzed from participating National Hockey League (NHL) facilities, alongside other laboratory and rink-based investigations. As this analysis has progressed, patterns have begun to emerge in key water quality parameters. Among teams ranked highly for ice quality in the 2024–2025 National Hockey League Players’ Association survey, the average total dissolved solids concentration was approximately 85 parts per million. This value is substantially lower than typical municipal water, yet far above fully deionized or reverse osmosis water.

This convergence of observations across different elite rinks raises a broader question about what is being optimized. If moderately low TDS levels appear repeatedly across high-performing rinks, what exactly is being optimized, and how does the balance between glide, durability, and surface stability shift across different ice uses, from hockey to skating and other ice sports? To translate these questions into measurable evidence, researchers at TMU have applied controlled, evidence-based testing to isolate how individual factors influence ice performance under repeatable conditions. Their work focuses on how water chemistry interacts with hardness, friction, and surface durability under real-world skating conditions.



These investigations take place on a purpose-built, scaled-down experimental rink that allows environmental and operational variables to be carefully controlled. By producing ice across a defined range of total dissolved solids and evaluating it using non-destructive measurements, the work provides a quantitative framework for understanding how glide and durability are balanced in high-performance hockey ice.

The goal was not to overturn industry experience, but to test it, expand it and refine it. By placing long-standing assumptions about glide, durability, and water purity into a controlled experimental framework, the work begins to quantify a trade-off that has guided ice-making decisions for decades and to reveal new opportunities for optimization.

The results were clear. Ice made with moderately low total dissolved solids consistently balanced glide and durability better than either untreated municipal water or ultra-pure water.

When total dissolved solids were reduced from typical municipal tap water levels to approximately 80 ppm, skate-to-ice friction decreased measurably, producing a faster surface under the same temperature conditions. Importantly, this reduction in friction did not come at the expense of ice hardness. Across the tested temperature range, ice made with 80 ppm water showed hardness values comparable to those produced with untreated water.

By contrast, ice made with ultra-low TDS water around 5 ppm behaved differently. While friction was further reduced, the ice was consistently softer and more susceptible to deformation. In practical terms, the lowest TDS levels produced ice that felt fast but lacked the mechanical resilience needed to withstand repeated high-impact play.

Taken together, the findings point to a narrow but meaningful operating window. Water treated to approximately 80 to 100 ppm total dissolved solids delivered much of the glide advantage associated with purified water, while maintaining the hardness and durability required for hockey. Rather than prescribing a single operating condition, the results provide a quantitative framework for understanding how water chemistry, ice temperature, and performance trade off against one another. This creates flexibility for rink operators, who may be able to adjust multiple parameters simultaneously to achieve desired performance outcomes. Beyond the specific values reported here, the study establishes and validates practical, non-destructive methods for measuring ice hardness and skate-to-ice friction under controlled conditions. These tools allow ice surfaces to be monitored, benchmarked, and optimized systematically, rather than relying solely on subjective assessment or trial-and-error adjustments.

The work was recently published in the journal Sports Engineering following peer review, providing independent validation of both the results and the methodology under conditions designed to reflect real rink operations.

Reference

Hutchins, R.H.S., Wang, J. and Impellizzeri, S. **Effect of water quality on ice hardness and skate-to-ice friction in ice rinks**. *Sports Engineering.* 2026. https://doi.org/10.1007/s12283-025-00538-z