

## Wastewater Treatment and Reuse

In May 2024, Illinois amended Public Act 103.0801<sup>1</sup> to clarify the potential for use of treated wastewater. It enables the Illinois Environmental Protection Agency and Illinois Pollution Control Board to adopt rules for treated wastewater reuse for approved purposes such as industrial cooling or crop irrigation. Water reuse opens the door for Illinois to benefit from a water resource that is typically wasted by reducing withdrawals from groundwater resources, lakes, and streams in water-stressed areas. In addition, there is potential for significant energy savings when treating wastewater effluent to standards appropriate for reuse applications, which could provide operational cost savings for water treatment plants.

Wastewater reuse has been practiced in the US southwest and Florida for decades.<sup>2</sup> Historically, much of Illinois has had access to plentiful freshwater resources and therefore has faced little need to reuse treated wastewater. However, urban density, industrialization, and climate change are causing water shortages on an increasing basis in parts of Illinois. Changing rainfall patterns and more frequent droughts throughout the state<sup>3</sup> have led to groundwater depletion, higher water treatment costs, periodic water use restrictions, and localized occurrences of dry wells.

Many people may not realize that treated wastewater is already reused every day. For example, wastewater effluent is discharged into streams and lakes. Drinking water plants draw from those sources, for purification into drinking water for public water supplies. Interestingly, treated wastewater effluent is often cleaner than the water body it is entering.

The receiving stream may contain contaminants such as algae, sediments, microbes and runoff containing fertilizer, oils, other chemicals, and biological matter. Wastewater treatment processes remove most of these contaminants, which makes it easier to treat to standards acceptable for certain types of reuse. As the image below shows, the plant effluent is clearer than the receiving stream.



<sup>1</sup> <https://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=103-0801&GA=103>

<sup>2</sup> <https://www.mdpi.com/2073-4441/13/20/2818>

<sup>3</sup> <https://www.drought.gov/historical-information?dataset=0&selectedDateUSDM=20250128&state=Illinois>

## The Case for Reuse in a Water-Stressed Region of Illinois

Northeastern Illinois has the highest water consumption and greatest water stress. Urban density and industrialization have drawn down the groundwater aquifer in the region where communities are facing the potential for water supply wells running dry.<sup>4</sup> Drilling deeper wells has a significant energy and economic impact, because to reach the next deeper aquifer, many communities will need to drill an additional 200 to 1,500 feet.<sup>5</sup> For each million gallons per day pumped, this extra depth adds between \$28,000 to \$203,000 per year in pumping energy costs. Deeper water is also more likely to have salt and radon contamination requiring additional treatment to remove, further increasing energy, chemical, and capital improvement costs.

Lake Michigan can provide some relief to these northeastern Illinois communities, but a 1967 Supreme Court Decree limits Illinois' Lake Michigan water diversions to 2.1 billion gallons per day.<sup>6</sup> In recent years, Illinois has been consuming about 85% of this allotment<sup>7</sup>, so there is only a limited amount available to offset groundwater consumption, and not every community will be able to source water from the lake.

### Options for Wastewater Reuse

Water is used for many different purposes, but not all require drinking-quality water. Figure 1 shows how water is used in Illinois, in terms of average annual million gallons per day (MGD). It helps to illustrate sectors with potential for high impact applications of treated wastewater reuse. There are many possible reuse applications, some of which are described below. The following options for wastewater reuse are listed in order of the treatment intensity for each reuse scenario, from least intensive to most intensive.

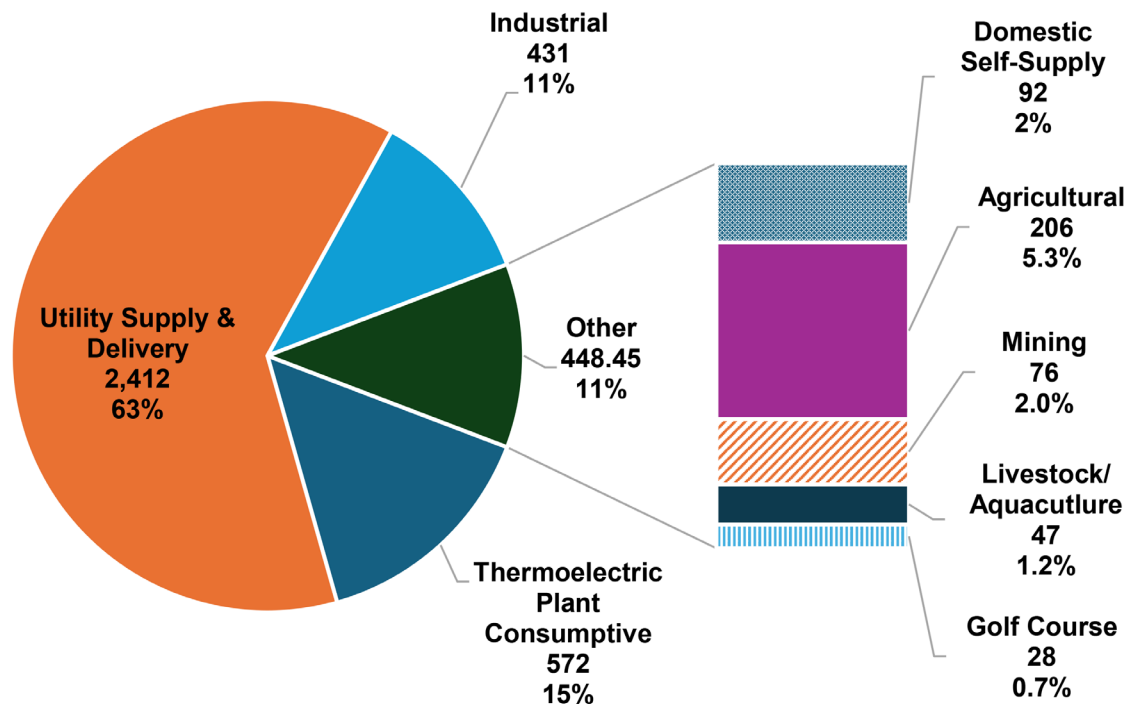


Figure 1: Water end-use breakdown in MGD for Illinois based on 2015 USGS Water Consumption Survey

<sup>4</sup> <https://blogs.illinois.edu/view/7447/803479>

<sup>5</sup> [http://joliet.granicus.com/DocumentViewer.php?file=joliet\\_cbb36f2f8b167ff7407b731c8e3e0737.pdf](http://joliet.granicus.com/DocumentViewer.php?file=joliet_cbb36f2f8b167ff7407b731c8e3e0737.pdf)

<sup>6</sup> <https://dnr.illinois.gov/waterresources/lakemichiganwaterallocation.html>

<sup>7</sup> <https://www.isws.illinois.edu/iswsdocs/wsp/LakeMichiganDiversion.pdf>

## Industrial and Thermoelectric Power Plant<sup>8</sup> Cooling

Treated wastewater can be used for industrial and thermoelectric cooling purposes with minimal additional treatment, and the impact potential is high. Figure 1 shows that industrial and thermoelectric power plants are major water users in Illinois. Because significant infrastructure investment would be required to install miles of supply piping from wastewater plants to these facilities, the best initial opportunities are those where the points of use are near the source of treated wastewater. An example of an industrial use for wastewater reuse is a proposed dual-pipeline from Chicago to Joliet to supply industrial sites with cooling water.<sup>9</sup>

## Non-Crop Irrigation

Water for irrigation at golf courses, parks, and municipal green spaces can be supplied by treated wastewater effluent. The water is treated to remove harmful microbes, but retains nutrients that plants need to thrive. This type of reuse is already in practice in some Illinois communities, and it can be impactful and economically beneficial in communities where the wastewater treatment plant is near the point of use. An excellent example of this type of system is the Pingree Grove non-potable irrigation system.<sup>10</sup>

## Agricultural Irrigation

Wastewater effluent treated to remove hazardous microbes, heavy metals, and chemicals can be used to irrigate crops. There could be public resistance to the use of treated wastewater to irrigate food crops, but many crops in Illinois are grown for purposes other than feeding people. The most socially acceptable agricultural use for treated wastewater would likely be for non-food crops such as corn and soy used for industrial chemical products. With additional treatment and regulatory oversight, food crop irrigation and water for livestock could be socially acceptable reuse applications. Figure 1 shows that agriculture uses a significant portion of water consumed in Illinois and this sector is expected to continue to grow as industrial farms insure against periodic draught in the state due to changing climate.<sup>11</sup> However, many of these locations are remote, so economically feasible reuse applications will likely be limited to farms located near a wastewater treatment plant.

## Indirect Potable Reuse

Wastewater effluent treated to near-potable water quality can be used to recharge water sources like groundwater aquifers, lakes, and reservoirs. This type of reuse is indirect because the treated wastewater is discharged and diluted within an intermediate natural water body. This type of wastewater reuse has a high impact potential when recharging sources for potable water supplies in water-stressed regions. Proactively addressing public acceptance will likely be important, additional wastewater treatment may be required, and if human consumption is possible, additional regulatory oversight will be necessary for groundwater recharge projects.

<sup>8</sup> "Thermoelectric power plant" as used here includes electric power generation facilities that use water for cooling and other purposes, and the category includes coal-fired, gas-fired, and nuclear plants.

<sup>9</sup> <https://greatcities.uic.edu/2023/07/19/from-waste-to-water-a-framework-for-sustainable-freshwater-supply-in-northeastern-illinois/>

<sup>10</sup> <https://www.villageofpingreegrove.org/160/Water-Sewer-Services>

<sup>11</sup> <https://news.illinois.edu/a-warming-midwest-increases-likelihood-that-farmers-will-need-to-irrigate/>

## Direct Potable Reuse

While this option is currently prohibited in Illinois, it may be a potential option in the future, with high impact potential in water-stressed regions. As pressure on existing water supplies continues to increase, wastewater plants co-located with potable water treatment to allow direct potable reuse could become a viable and cost-effective option. The main hindrance would be public acceptance of direct reuse of treated wastewater for potable purposes. Supplying wastewater directly to a potable water plant would minimize the need for additional piping infrastructure, as the existing potable distribution system can be used. The trade-off for lower piping infrastructure investment is more expense in purification technologies at the water plant.

## Next Steps

An important step going forward will be community engagement to address public acceptance, in advance of, or in parallel with the development of regulations for wastewater reuse. Where water stress is highest, the reuse of treated wastewater will be more feasible and socially acceptable than in areas where water stress is minimal. By prioritizing applications such as industrial reuse, with high-impact, relatively low intensity and low risk, wastewater reuse can help to mitigate rising water costs and avoid water shortages in water-stressed communities. Introducing wastewater reuse for non-human consumption uses like industrial cooling and irrigation also provides an opportunity for water suppliers and regulators to verify water quality procedures, validate infrastructure design and develop maintenance procedures for new types of water supply systems. The development of these designs and procedures will facilitate the development of more stringent regulations should potable reuse be required in the future by Illinois communities.



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