Water Diversion **REPORT**

RACINE ON THE LAKE

2021 Report on Water Diversion

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EXECUTIVE SUMMARY

The City of Racine (Racine) is submitting this report to satisfy the requirements in the Wisconsin Department of Natural Resources (DNR)'s approval of its diversion application.

The DNR's approval stipulated that Racine must annually report on the following items for the prior calendar year:

1) The total amount of water sold monthly or quarterly to each category of customer within the approved diversion area.

2) The total monthly sewerage flow to the City of Racine Wastewater Treatment Plant from the diversion area.

3) The total consumptive use as specified by the DNR.

4) A summary of the impact of the implemented conservation and efficiency measures required under Wisconsin Administrative Code NR 852.04 and NR 852.05, including quantifiable impacts to water use intensity, as defined in Wisconsin Administrative Code NR 852.03(29).

5) A description of any additional conservation and efficiency measures implemented.

The amount of water diverted in 2021 totaled about 3.4 million gallons, an average of about 9,000 gallons per day. This amount represents 0.13% of the total permissible diversion of 7 million gallons per day. The amount diverted includes water sold and water used to flush the mains for system maintenance. The need for system flushing has since been greatly reduced in favor of system recycling as a water conservation measure. In 2021, return gallons totaled about 6.6 million gallons through both sanitary wastewater return flow and inflow and infiltration (I/I), and average of about 18,000 gal/day. The total consumptive use was then a negative (3.2) million gallons, representing a consumptive use coefficient of -95%. This indicates that metered return flow was nearly double the amount of water supplied to the diversion area. Causes for this would be system I/I, but also a potential error factor in metering low flows in large 30" pipe. This will be an issue until more customers connect to the diversion area water supply. In 2021, Foxconn remained the only connected party. Return flow met all water quality discharge standards.

SECTION 1: TOTAL AMOUNT OF WATER DIVERTED

The Racine Water Utility (RWU) diverted water to the Mississippi River basin, selling water to one industrial customer, Foxconn. The sales were properly coded within RWU's billing system to track the amount of water that was diverted. The total amount of water diverted is the sum of the water sold and the water flushed, which equals 3,389,976 gallons. That represents an average of 9,288 gallons diverted each day (Tables 1,2,3).

The reporting requirements specify the water sold should be segmented into months and/or quarters. RWU used temporary meters to track water demand associated with the operations and maintenance of the infrastructure, including main flushing. Currently, RWU bills its industrial customers monthly and all others quarterly. These permanent meters will measure the demand to calculate the total amount of water diverted. All water diverted in 2021 was measured by permanent or temporary metering.

Table 1. 2021 Water Diversion Total (gallons)

Water sold-residential	0
Water sold-commercial	0
Water sold-industrial	3,374,976
Water flushed	15,000
Water Diversion Total (gal)	**3,389,976**

Table 2. 2021 Industrial Water Sold to Foxconn (gallons)

2021	month gal	quarter gal
January	112,200	
February	210,936	
March	268,532	591,668
April	130,152	
May	203,456	
June	390,456	724,064
July	400,928	
August	434,588	
September	299,948	1,135,464
October	376,992	
November	252,824	
December	293,964	923,780
TOTAL	3,374,976	3,374,976
AVG Day	9,247	

In addition to the water that was sold, RWU used water to flush mains to maintain water quality. The flushing was metered to record the correct amounts, but cannot be attributed to any customer and is instead considered a part of the RWU's operations and maintenance. In 2021, RWU flushing occurred on Jan 12th, Jan 18th, and Jan 25th at hydrant no. 2587 for 5 minutes each (1,000 gpm). This flushing was discharged to the Mississippi River Basin ditch. Flushing is defined as water wasted and is not associated with water recycled for use outside of the diversion area (discussed in Section 5 conservation measures).

Table 3. 2021 Water Flushed by Quarter (gallons)

Quarter	Water Flushed (g)
Q1	15,000
Q2	0
Q3	0
Q4	0
Total	**15,000**

SECTION 2: TOTAL MONTHLY SEWERAGE FLOW

The return gallons totaled 6,611,893 gallons through both sanitary sewerage return flow, and I/I (Table 4). That represents an average of 18,115 gallons diverted each day. The sanitary sewer infrastructure for the diversion area was completed in March 2020 with all return flow to the Racine Wastewater Utility WWTP. The Foxconn facility began to discharge sanitary wastewater in the fourth quarter of 2020 and continues at this time. All other return flow was attributed to inflow and infiltration (I/I) and cannot be attributed to any customer. There also remains a potential error factor in metering low flows in large 30" pipe. This will be an issue until more customers connect to the diversion area water supply and return wastewater flow. In 2021, Foxconn was the only connected customer discharging wastewater back to the Great Lakes Basin. The Foxconn discharge reflects sanitary use only and no process wastewater.

A permanent wastewater flow laser meter was installed by the Village of Mount Pleasant at the Hwy H metering site on March 1, 2020. The Hwy H site records all wastewater return flow from the diversion area Mississippi River basin back to the Great Lakes basin. The Hwy H meter was recalibrated by the manufacturer representative on March 24, 2021 and recalibrated again on June 15, 2021. The village and rep are satisfied that the Hwy H meter is working as intended. The village also installed three permanent wastewater flow meters to record discharge out of Foxconn: gate 5 meter installed Nov 19, 2020; meters at gate 6 and gate 7 both installed Jan 10, 2021. Village personnel read the Hwy H and Foxconn meters daily Monday through Friday. All Foxconn wastewater meters were also recalibrated on June 15, 2021.

Table 4. 2021 Water Returned to Great Lakes Basin (gallons)

2021	month gal	quarter gal
January	576,373	
February	599,727	
March	613,531	1,789,631
April	622,328	
May	466,921	
June	631,902	1,721,151
July	599,879	
August	561,674	
September	429,324	1,590,877
October	422,499	
November	456,995	
December	630,740	1,510,234
TOTAL	6,611,893	6,611,893
AVG Day	18,115	

SECTION 3: TOTAL CONSUMPTIVE USE

The total consumptive water use is the sum of the water sold and the water used for flushing (3,389,976 gallons, also referred to as "water diversion total"), minus the total return gallons (6,611,893 gallons) equals a negative (3,221,917) gallons. This annual water supply and return equates to an average daily consumptive use of a negative (8,827) gallons/day, and a consumptive use coefficient of a negative (95.0%) (Table 5). It is assumed that the extremely low (and negative) consumptive use coefficient had to do with a combination of return water I/I and the difficulty in accurately metering very low flow in large pipe.

Table 5. Total Diversion Area Consumptive Use (gallons)

Water Diversion Supply Total (g)	Return Gallons Total (g)	Total Consumptive Use (g)	Average Daily Consumptive Use (g)	Consumptive Use Coefficient
3,389,976	6,611,893	-3,221,917	-8,827	-95.0%

The Foxconn facility's total consumptive use is calculated by subtracting Foxconn's sewerage return (3,215,807 gallons) from the total gallons purchased (3,374,976 gallons) for a total consumptive use of 159,169 gallons. The average daily consumptive use is 436 gallons/day and the consumptive use coefficient is 4.7% (Table 6).

Table 6. Foxconn Consumptive Use (gallons)

Foxconn Water Sold Total (g)	Foxconn Return Gallons Total (g)	Foxconn Total Consumptive Use (g)	Foxconn Average Daily Consumptive Use (g)	Foxconn Consumptive Use Coefficient
3,374,976	3,215,807	159,169	436	4.7%

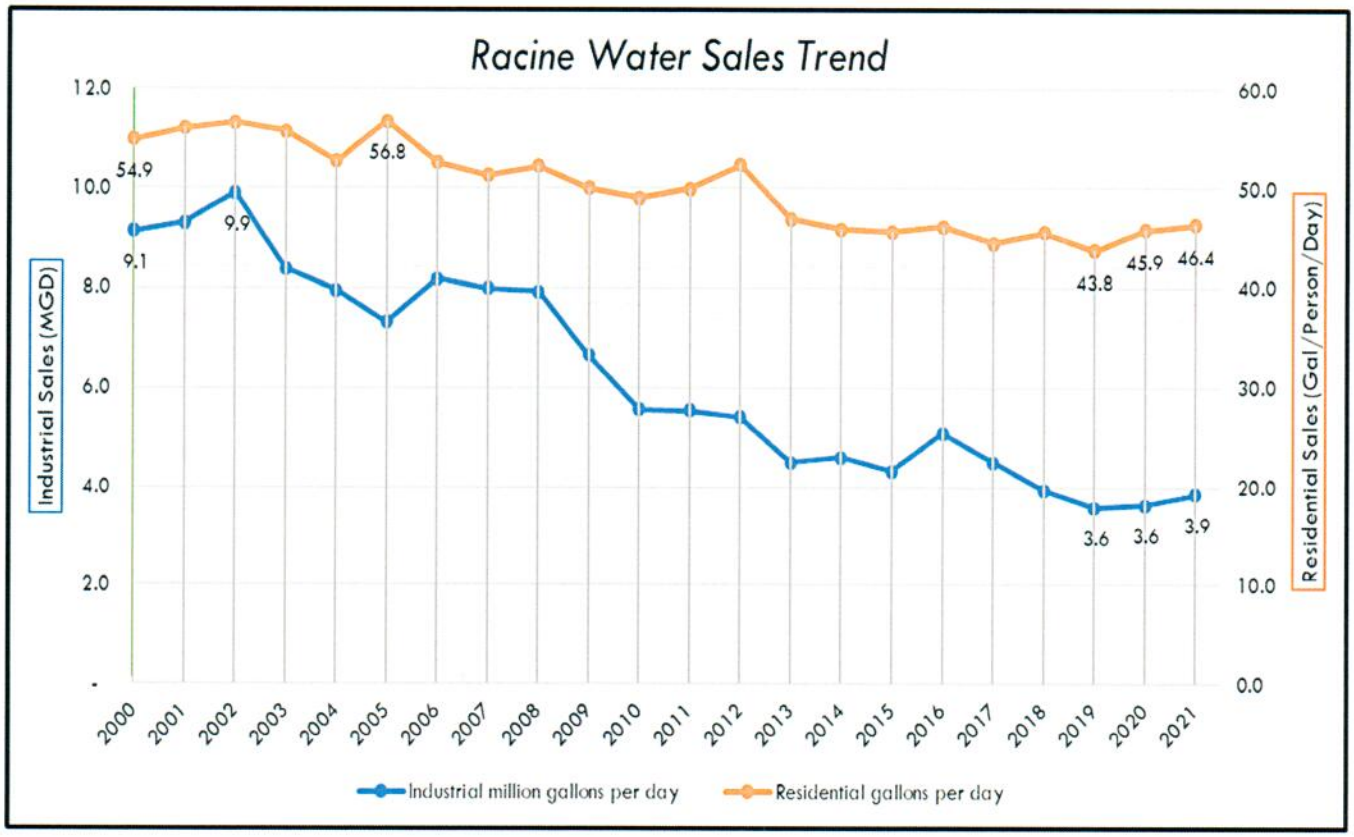
In a letter titled "2020 Documentation of Reporting Requirements for the City of Racine Diversion of Lake Michigan Water" dated August 28, 2020, the Wisconsin Department of Natural Resources assumed a 10-percent consumptive-use coefficient for Racine's Diversion Application.

The 2021 overall consumptive use coefficient of -95.0% (and Foxconn's consumptive use coefficient of 4.7%) by far comply with the assumed 10% consumptive use coefficient. There are a number of reasons why this occurred in 2021. Foxconn site landscaping use decreased from the previous year as construction of the Foxconn facilities and grounds was completed and stagnant. Water used for landscaping at the Foxconn site is not returned to the Racine Wastewater Treatment Plant from the diversion area. The RWU anticipates the overall consumptive use coefficient to stabilize as normal industrial operations at the facility are finalized and more permanent customer connections are made. Water main flushing by the RWU due to extremely low water supply volumes in the Mt. Pleasant TID #5 area was greatly minimized through operational controls. A total of 6,356,556 gallons were flushed in 2020, but was reduced to 15,000 gallons in 2021.

SECTION 4: SUMMARY OF THE IMPACT OF CONSERVATION AND EFFICIENCY MEASURES AND ADDITIONAL MEASURES IMPLEMENTED

The declining water use trends noted in the diversion application for RWU have continued. Per-person demand has fallen from 55 gallons per person per day in 2000 to 46 gallons per person per day in 2021 (Figure 1). However, this number has increased slightly the last two years, most likely due to the pandemic and the increase in time spent at home. Also, 2021 was a very dry year so more water was very likely used for lawn and garden irrigation purposes. The industrial decline has continued with demand falling from 9.1 million gallons per day in 2000 to 3.9 million gallons per day in 2021. This decline seems to have stabilized the last two years. The expectation is that industrial use will increase with expansion in the Village of Mt Pleasant TID#5 area in the future.

Figure 1. Racine Water Sales Trend



The ratio of system maximum day pumpage to average day pumpage equaled 1.60 in 2021, up from 1.39 in 2020 (Table 7). Tables 8 and 9 provide data and calculations for water use per residential equivalent unit (REU). System REUs total 48,350 in 2021 (Table 8). In 2021, water usage per Residential Equivalent Unit was 266 gpd / REU (Table 9), which is an increase from 2020 (257 gpd/REU) and 2019 (238 gpd/REU). The calculation is found by dividing average day water use by total REUs. This increase can likely be attributed to the pandemic and the increase in time spent at home (2020-2021), as well as irrigation water use during the very dry 2021. Total service area population per capita water usage in 2021 was 41 gal/person/day, the same as 2020 (Table 10).

Table 7. 2021 Water System Pumpage Maximum to Average Day Ratio

Year	Total Year Pumpage (Mgal)	Average Day Pumpage (Mgal)	Max Day Pumpage (Mgal)	Max to Average Day Ratio
2020	5,575.437	15.275	23.380	1.39
2021	5,700.570	15.618	24.952	1.60

Table 8. 2021 Residential Equivalent Units (REUs)

Meter size	Number of Meters	REU Ratio	REUs
5/8	27,015	1	27,015
3/4	5,332	1	5,332
1	1,008	2.5	2,520
1 1/4	0	3.7	0
1 1/2	537	5	2,685
2	540	8	4,320
2 1/2	0	12.5	0
3	119	15	1,785
4	61	25	1,525
6	19	50	950
8	10	80	800
10	9	122	1,098
12	2	160	320
Total	34,652		48,350

Table 9. Water System Average Day Water Use Per REU

Year	Total Water Sales (Kgal)	Average Day Water Use (Kgal)	Water Use / REU (gpd / REU)
2020	4,528,450	12,407	257
2021	4,696,327	12,867	266

Table 10. Water System Per Capita Residential Water Usage

Year	Residential Demand (Mgal)	Total Service Area Population	Gal/Person/Day
2012	1,909	112,104	47
2013	1,714	98,903	47
2014	1,678	98,786	47
2015	1,667	98,413	46
2016	1,687	98,342	47
2017	1,625	98,435	45
2018	1,664	98,504	46
2019	1,600	98,301	45
2020	1,674	111,510	41
2021	1,695	113,085	41

The population served is an estimate as an unknown number of residents remain on a private well and not utility municipal water supply. This is particularly the case in Mount Pleasant.

RWU has worked to implement the conservation and efficiency measures it laid out in the diversion application that meet requirements in Wisconsin Administrative Code NR 852.04. Table 11 below summarizes these efforts. It describes additional measures undertaken since the application was submitted.

Table 11. Conservation and Efficiency Measures

Abbreviation	Requirement	Location
PWS-1	Water-use audit	RWU annually submits to the PSC its water production, sales, and nonrevenue water with its annual report as required by Wisconsin Administrative Code PSC 185.85(3). RWU also uses the American Water Works Association water audit software to conduct audits that help quantify losses and identify areas to improve efficiency and recovery.
PWS-2	Leak detection and repair program	RWU prepared a water loss control plan under Wisconsin Administrative Code PSC 185.85(4) and submitted it to the PSC prior to submitting its diversion application. RWU continued its efforts to upgrade water mains by replacing about 19,700 ft of older main in 2021. RWU contracted with AECOM in 2020 to perform a leak detection survey on approximately 241 miles of water main as part of RWU's efforts to reduce nonrevenue water. The 2020 work accounted for roughly half of the RWU water system with estimated detected leakage of 815,000 gpd. AECOM completed another 204 miles in 2021 to complete the system with additional estimated detected leakage of 544,000 gpd. See Appendix A for a copy of the 2021 report.
PWS-3	Information and education outreach	RWU includes the information required by Wisconsin Administrative Code PSC 185.33(1) and (1m), e.g. rates and volume unit conversions, in its customer water bills. RWU has posted the conservation and efficiency information required by Wisconsin Administrative Code PSC 185.96 online. See https://www.cityofracine.org/Water/WaterConservation/ and click on the Water Conservation links labeled "Conservation Practices" and "Leak Detection Program" to view the conservation and efficiency information. The City of Racine is working to ensure green building standards are incorporated into city operations and all new private developments and is committed to the US Green Buildings Council Leadership in Energy and Environmental Design (LEED) certification system.
PWS-4	Source measurement	RWU meters water produced and pumped into the distribution system and verifies the accuracy of its station meters in accordance with Wisconsin Administrative Code

		PSC 185.83 and 185.85(2). RWU documents its compliance with these requirements in its annual report to the PSC on pages W-14, Sources of Water Supply-Statistics, and W-27, Water Conservation Programs.
PWS-R1	Distribution system pressure management	RWU analyzed distribution system pressure management in a 2017 water-system study. It operates the distribution system to meet pressure requirements in Wisconsin Administrative Code NR 811.70(4). The study concluded that pressure does not appear to be a major contributor to main breaks or leaks.
PWS-R2	Residential demand management program	RWU has posted residential water conservation information on its website. See explanation for PWS-3 for the link. RWU continues to notify customers of high-water use through mailings that accompany the water bills and survey residences for leaks on customer request. RWU generally sends mailings if water use has risen for the quarter over 50% of what it had been in the prior year.
PWS-R3	Commercial and industrial demand management program	RWU has spoken with the City of Racine's largest industrial water user, who began reducing demand mid-year in 2020. Implementing these plans will lead to an annual reduction in demand of approximately 300 million gallons. RWU will work with the communities in which it provides service to review their requirements for commercial and industrial landscaping and watering.
PWS-R4	Water reuse	RWU will continue to look for opportunities to work with individual large-volume commercial and industrial water users to explore opportunities for water reuse within their facilities.

SECTION 5: ADDITIONAL CONSERVATION MEASURES

Three major geothermal projects will result in water conservation: Geothermal for one major industrial water user, geothermal in a new hotel development, and investigating the possibility of geothermal for a new municipal healthcare clinic and community center. The City of Racine City Development Department recognizes that 14% of the world's potable water is used by buildings, and therefore the Department promotes green building certifications like USGBC's LEED and Wisconsin Green Built Homes, which include water conservation measures related to indoor use, outdoor use, specialized uses, and metering. One component of these certifications is the measurement of all sources of water relative to a building: cooling towers, appliances, fixtures, process water and irrigation. Using an "efficiency first" approach, projects are asked to first pursue water use reduction strategies and then to consider nonpotable and alternative sources of water. Metering at the whole-building level is an important goal ensuring projects can monitor and control water use to identify opportunities for water savings.

The RWU instituted an operational procedure change in the fall of 2020 to recycle water from the system high pressure (933 zone) to and from the intermediate pressure (875 zone). The diversion area in Mt Pleasant resides in the 933 zone. As this new water infrastructure still has only one permanent connection, water becomes stagnant requiring periodic system flushing to maintain water quality. Recycling the water, instead of flushing (wasting), not only saves water but also greatly increases and stabilizes the chlorine residuals throughout the 933 zone.

The Utility has two pump stations, one along Braun Road and the other along STH 20, that boost water from the 875 to 933 zone. The intent of recycling is to create an artificial water demand in the 933 pressure zone to allow water to flow through that zone and maintain water quality without wasting water through flushing. Recycling works by pumping water into the 933 zone with one station while backfeeding water out of the 933 zone with the other station. Backfeeding is accomplished by opening a small bypass line to allow water to flow backward through the pumping station supply lines, which creates the artificial demand. The discharge pumps at the recycling station are off during this time and the rate of flow is recorded by the supply line meter and is controlled via a throttling valve. This pumping is then flipped every 4 weeks or so by pumping from STH 20 and recycling at Braun Rd. This operational change greatly reduces the need for main flushing in the 933 zone and is expected to continue until more permanent connections are made. There remains a small segment of dead end main in the 933 zone in the diversion area where occasional flushing will still be necessary, but that is minimal. Figure 2, below, depicts recycling water at the STH 20 booster station.

While recycle water passes through the diversion area, it is not used in the diversion area. The recycle rate is normally about 225 gpm and approximately one-third of this recycle flows through the diversion area. For 2021, about 39 million gallons (average 107,000 gpd) of water was recycled through the diversion and used elsewhere in the RWU system. Recycling water, in lieu of flushing, is estimated to save between 3 million and 4 million gallons per year of wasted water.

Figure 2. Racine Water Utility High Pressure Zone Recycle