

2018 ANNUAL REPORT
OF WATER USE, WATER
DIVERSION AND
RETURN FLOW
FOR THE CITY OF
NEW BERLIN, WISCONSIN

CITY OF NEW BERLIN
WAUKESHA COUNTY, WISCONSIN
MARCH 2019



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2018 ANNUAL REPORT OF WATER USE, WATER DIVERSION AND RETURN FLOW FOR THE CITY OF NEW BERLIN, WISCONSIN

INTRODUCTION

The information contained in this document provides the needed data and related explanations of the data required to satisfy the conditions of the WATER SUPPLY SERVICE AREA PLAN AND DIVERSION APPROVAL issued by the Wisconsin Department of Natural Resources (DNR) dated May 21, 2009. In particular, the data and explanations report the following information for calendar year 2018 for the City of New Berlin (CITY):

1. The total amount of water purchased from Milwaukee on a monthly basis. Note: All water used by New Berlin Utility customers is purchased from the City of Milwaukee. **ALL City of New Berlin Wells are out of service.**
2. The amount of water sold to each category and the subcategory of customer on a quarterly basis within the City limits.
3. The amount of water sold to each category and the subcategory of customer on a quarterly basis within the approved diversion area.
4. Average residential per capita use.
5. There is currently NO water pumped from City of New Berlin wells. All wells are out of service.
6. Average residential per capita use.
7. A description of the efforts made by the City to improve water conservation and efficiency and minimize the infiltration and inflow into the sanitary system.
8. Estimates of the total monthly sewerage flow within the City.
9. Estimates of the monthly sewerage return flow from within the approved water supply service area and approved diversion area.

The information is presented in 9 sections with titles identical to those above. Data is presented in a tabular format preceded by explanation of each table, how the data was obtained and how the data was interpreted using estimating techniques, engineering judgment and data analysis. Table titles first contain the section number they refer to then the number of the table.

SECTION 1 - THE TOTAL AMOUNT OF WATER PURCHASED FROM THE CITY OF MILWAUKEE

The City of Milwaukee provides all of the water used by the CITY. In 2009, the CITY still used groundwater until July for some of their water needs. In July 2009, the improvements needed to allow the entire CITY to be served with Lake Michigan water via the City of Milwaukee were completed, thus allowing for discontinuance of groundwater supplies. These projects were completed following the Diversion Approval. All City of New Berlin groundwater wells are abandoned. (Appendix E)

Table 1-1 provides the "Total Amount of Water Purchased from the City of Milwaukee" as measured by Milwaukee and billed to the CITY. Table 1-1 contains 4 columns, the first listing the month, the second representing the cubic feet of water purchased and the third the number of gallons purchased from the City of Milwaukee and the average daily use. All of these totals are determined by the amount of water purchased (and measured) from the City of Milwaukee Water Works. Note: Milwaukee water had an inaccurate meter in 2014.

SECTION 2 - THE AMOUNT OF WATER SOLD TO EACH CATEGORY AND SUBCATEGORY OF CUSTOMER ON A QUARTERLY BASIS WITHIN THE CITY LIMITS

The CITY records and reports all water sold in a report to the Wisconsin Public Service Commission (PSC) by customer class each year. The four customer classes are Residential, Commercial, Industrial and Public. The CITY can further break these water sales records down by geographic location east and west of the sub continental divide and by residential units comprised of condominiums and apartments that are tracked as commercial establishments. Table 2-1 provides a breakdown of these water sales on a quarterly basis for the entire City and by the standard PSC customer classes and the subcategories tracked by the CITY.

SECTION 3 - THE AMOUNT OF WATER SOLD TO EACH CATEGORY AND SUBCATEGORY OF CUSTOMER ON A QUARTERLY BASIS WITHIN THE APPROVED DIVERSION AREA

Table 3-1 reports only water used in the Mississippi river basin on a quarterly basis and also provides a breakdown of residential use by condominiums and apartments in the Mississippi Basin.

SECTION 4 - THE AMOUNT OF WATER DIVERTED TO THE APPROVED DIVERSION AREA ON A MONTHLY BASIS (TO BE ESTIMATED BY THE CITY)

Table 4-1 provides the estimates of the diversion amounts. The estimates are based upon actual percentages of total water use determined by applying an average factor of 57.3 percent groundwater pumpage and 42.7 percent Lake Michigan water usage in 2009. This approximates the water use patterns where the groundwater pumpage was Mississippi River basin pumpage and the Lake Michigan pumping stations was Great Lakes basin pumpage. For the year, the total usage was multiplied by .573 to estimate the diverted amount. The CITY previously maximized the area where Lake Michigan Water was provided to customers so this method provides a reliable estimate of diverted water pumpage.

SECTION 5 - THE AMOUNT OF WATER PUMPED FROM EACH MUNICIPAL WELL WITHIN THE CITY LIMITS ON A QUARTERLY BASIS, NOTING THE BASIN IN WHICH EACH WELL IS LOCATED

Table 5-1 provides a list of all City of New Berlin wells were disconnected in 2009 per the DNR after the diversion request was approved. All City of New Berlin groundwater wells have been abandoned. (Appendix E)

SECTION 6 – AVERAGE RESIDENTIAL PER CAPITA USE

Table 6-1 provides a calculation of average residential per capita use. That calculation shows residential per capita use to be 52.53 gallons per capita per day City wide. The calculation takes into account single family residential, condominium residential, and apartment residential and also breaks the information down by basin. The per capita residency occupation rate of 2.62 in 2018 is from the MMSD Operating Manual. The calculation method used in Table 6-1 to determine the population served by the water system has been added at the bottom of the page. Information from the MMSD Cost Recovery Manual is found in Appendix E.

SECTION 7 – A DESCRIPTION OF THE EFFORTS MADE BY THE CITY TO IMPROVE WATER CONSERVATION AND EFFICIENCY AND MINIMIZE INFILTRATION AND INFLOW TO THE SANITARY SEWER SYSTEM

Water Conservation

The CITY adopted a Water Conservation Plan on December 8, 2009. A copy of the plan is attached to this document in appendix A and includes the revisions made in 2013. The Plan has six distinct goals to promote water conservation.

- Reduce per capita residential water consumption from January 1, 2008 by not less than ten (10) percent by the year 2020 for utility customers as per an agreement between the City of New Berlin and the Wisconsin Department of Natural resources (WDNR).
- Enable the City to meet future needs of our growing population.
- Protect Ground and Surface water supplies from unsustainable depletion. Since acquiring Milwaukee water, the Utility was able to reduce hydrant flushing to once per year. This practice alone has saved substantial water each year (Appendix E).
- Eliminate unnecessary waste in water use practices. The Water Conservation Plan provides the necessary authority to limit lawn sprinkling on an odd/even day and time of day schedule. The dry conditions during summer in 2012 prompted a Press Release limiting water sprinkling (Appendix E). The summer of 2015 provided adequate rainfall to assist our water conservation efforts. The Utility posts information on the website, newsletter and Utility bill in an effort to educate customers in water conservation measures (Appendix E)
- Reduce wastewater treatment volume and associated municipal expenditures.

- Promote the increased use of harvested and recycled water for irrigation needs through the use of cisterns where appropriate for commercial and industrial development. The City has had a Rain Garden display at the recycling center for several years. This display includes a working rain barrel. Information on the various native plants, where to obtain rain barrels and lists of classes are included on the City's website (<http://www.newberlin.org/index.aspx?nid=422>). The Water Resources Management Utility has also used rain gardens and bioretention in several of their projects. (Appendix E)

In 2017, the City of New Berlin has eliminated the Third Quarter Sewer Credit to residential customers.

Specific accomplishments include the preparation of the plan near the end of the reporting year. That plan includes a savings projected of 9.4 million gallons of water per year by not using water softeners in the diversion area and a savings of 8.7 million gallons by reducing hydrant flushing from twice per year to once per year for a total estimated annual savings of 18.1 million gallons. Hydrant flushing is performed in spring and fall. Every other hydrant is flushed in spring and the remaining ones in the fall. This ensures that each hydrant is flushed annually on a scheduled basis for maximum efficiency. The CITY also adopted sprinkling restrictions for residents to follow year round. Per capita residential water use decreased city wide from 68.03 in 2007 down to 40.92 in 2018. Adequate rainfall this summer assisted water conservation efforts. (Appendix E)

Beginning in April of 2010, the CITY has a toilet rebate program designed to provide incentives for utility customers to abandon 5 gallon per use toilets and install a water sense 1.3 gallon per flush toilets. The amount of the rebate is \$100 per toilet.

<u>Toilet Replacements By Year</u>					
2010	78	2013	6	2016	7
2011	45	2014	7	2017	9
2012	12	2015	10	2018	6

The PSC approved the program to continue in 2018. (For Examples of reduced water consumption after low flow toilet installation, Appendix E) The Utility also performed 80 leak detection tests in 2018 and provides this service free of charge to utility customers. In addition, the Badger Meter RTR/Neptune meter system that we now use can verify whether a customer has a leak. This allows us to notify the customer to set up an appointment to perform a free leak inspection to help reduce the amount of water that is wasted. (Appendix E)

In 2013 the Utility began offering customers free toilet leak dye tablets available at City Hall and the Library. This continued in 2018 and will be offered in 2019. The City's website advertised the EPA's WaterSense "Fix A Leak Week" which gives tips on checking for and fixing leaks. (Appendix D)

The Utility has implemented the cross connection inspection program that was mandated by the DNR for commercial and industrial customers and has been inspecting residential customers since 2012 when meters are replaced or when answering a customer service call. In 2018 there were 773 residential inspections were conducted. (Appendix E) The Utility began documenting if customers are operating water softeners or have removed or disconnected the unit. Since March 2012 Utility personnel that perform meter pulls have documented whether softeners have been disconnected or removed from residences. They have found over 90% of softeners were not in use. (Appendix E) In 2005 and also in 2009 when Milwaukee water was delivered to Utility customers on various sides of the continental divide, letters were sent to customers that provided information regarding the changes in water, including water hardness data and encouraged customers to disconnect their softeners. (Appendix E) Based on estimates and an average softener regeneration of once a week, the average residential customer would save over 2,600 gallons per year. (Appendix E) Because of variables such as weather, occupancy rates, economic conditions and the fact that meters are read quarterly in thousand gallon increments, it is difficult to provide an actual water savings realized in 2011 through disconnection of water softeners. Hydrant flushing water usage has reduced since we began this program. (Appendix E) A 5 Year Water Use Analysis is also listed. (Appendix E)

The City of New Berlin became a member of the Alliance for Water Efficiency in 2013 and began using the AWE Tracking tool to monitor conservation efforts. The Utility teamed with the Energy Efficiency Program's Focus on Energy, sponsored by WE Energies to provide residential citizens with a no-cost energy savings program that provided high efficiency faucet aerators, showerheads, kitchen flip aerators, insulation of hot and cold water heater pipes and water heater temperature setback assistance. The results were impressive with 943 homes responding to the program for a total water savings of 5,772,429 gallons.

In 2015 Kaempfer and Associates conducted a new water study of the entire Utility area. The Utility has a 20 year project schedule to improve reliability and conservation.

The Utility repaired 20 water main breaks, repaired 3 leaking service lines, performed 3 valve replacement and repairs and replaced 4 hydrants. During road projects the Utility had 15 hydrants and valves replaced and 17 main line valves replaced. The Utility also replaced 5100' of 8" water main lines and replaced 29 service lines to the property line to those buildings.

With the completion of the conservation plan and use of the CITY web site to provide public education on the need for water conservation, New Berlin is committed to continuing to educate the public. Along with the Water Conservation Plan, Utility personnel use a "Residential Demand Management Program" to monitor high consumption, show customers the amount of water caused by leaks, and provide informational material on water conservation. (Appendix E) Many studies

have shown the value of public education is an important component of water conservation efforts. The City's website contains educational information with kid's pages for water conservation activities and links to a drip calculator and other resource to provide helpful information to utility customers. The Utility also provides classes to schools and businesses and hands out coloring books and water usage wheels to promote water conservation and information on Water Smart Landscape Designs on the website. (Appendix D)

Infiltration and Inflow (I/I)

The City has an annual I/I program that has been in place since 1997. The City spent \$977,819.00 in 2018 on I/I reduction. Table 7-1 lists the I/I reduction projects from 2015. The Utility has invested an average of \$764,012 per year from 2000-2013 in I & I reduction. (Appendix B) Private I & I investigation and implementation began in 2013.

Infiltration and Inflow (I/I) occurs in all sanitary sewerage systems. Infiltration refers to rainwater and groundwater that seeps into the system through defective pipes and joints. Inflow refers to storm water and surface water that enters the sewer directly. Both cause "clear water" to enter the system and increase treatment costs, cause sewer backups, bypassing and overflows.

Wastewater systems all have differing designs, construction, ages and are located in varying climates. With this in mind, there are not national standards for allowable I/I. Rather, EPA has required through the NPDES permit program that all wastewater overflows be eliminated. This requirement has prompted many sewerage systems to take active measures to reduce I/I. The MMSD is one of these.

MMSD addresses I/I reduction by placing limits on peak hourly flow rates. If a metered area exceeds the limits, I/I reduction is required. The requirements for these metered areas, also called "meter sheds" as listed in the MMSD 2035 Facility Plan are:

Sanitary Meter Shed Area/Acres	Maximum Allowable Peak Hourly Flow Rate (Gallons per Acre per Day)
Less than 250	18,400
250 to 499	17,700
500 to 999	16,400
1,000 to 2,499	13,700
2,500 to 4,999	9,400
Greater than 5,000	4,000

Based upon the MMSD Facility Plan sewer flows for New Berlin, all areas of the City are currently in compliance with the above limits.

The City of New Berlin annually contracts with a consultant to monitor sewer flows during wet periods. Preliminary results of the 2009 flow monitoring plan and analysis of flows by the city's consultant and 2010-2018 results are provided in Appendix C.

Precise quantification of I/I is impossible with today's technology. Area and velocity flow meters are used annually by the City to derive estimates of sewer flows by basin and sub-basin. These meters replace older style "level only" meters and are considered to be more accurate. Still, the environment in which they are placed has flooding, toxic gases, high levels of solids and other impairments which readily affect the meters performance. Data that is collected must be collated and suspect data discarded. The remaining reliable data is then professionally analyzed and reasonable professional estimates of sewer flows can then be made. This is the program used by New Berlin.

The most current estimates by the City's consultant indicate that total average daily sewer flows are 5.67 MGD. The attached email correspondence from the City and R.A. Smith indicates how they arrived at this figure. Using basin monitors this flow can be divided into flow east and west of the sub continental divide. This was determined by using all of the flow from basins 5 and 6 (Meter 5A) and 50 percent of the flow from basin 7 (Meter 7B).

The City has spent over \$20 million since 1997 on I/I reduction efforts. This includes all capital projects for manhole rehabilitation, studies and sanitary sewer replacement or relining. They received only 1 of 2 awards given by MMSD for their I/I reduction efforts in 2003. Listings of past projects are attached. Future projects will focus on higher I/I areas as identified by annual studies.

New Berlin ranks 5th out of 29 communities in expenditures for I/I reduction. This places them well ahead of many larger and older communities with more I/I.

It is important to realize that the I/I will occur and transmit some quantity of water across the basin divide. It is more important to realize that approval of the diversion has eliminated about 2.0 MGD of pumped water from outside the basin flowing into the basin on a daily basis. This, coupled with the strong commitment to reducing I/I by New Berlin, as evidenced above, absolutely minimizes the amount of water entering the basin from outside the basin.

Going forward, New Berlin proposes to monitor the amount of water used inside and outside the basin by customer water meter. Further, they propose to continue with the annual quantification studies and will use the results of those studies to estimate sewer flows on both sides of the divide. This information will be available on an annual basis for the previous year.

SECTION 8 – ESTIMATES OF TOTAL MONTHLY SEWERAGE FLOW WITHIN THE CITY

Appendix C contains excerpts from an email provided by R.A. Smith to the City on Sewerage flows. These estimates were developed based upon metering performed by that firm and by MMSD during 2011-2018.

SECTION 9 – ESTIMATES OF THE MONTHLY SEWERAGE RETURN FLOW FROM WITHIN THE APPROVED WATER SUPPLY SERVICE AREA AND DIVERSION AREA

Table 9-1 provided by R.A. Smith estimated flows both in the Great Lakes basin and Mississippi basin. The estimates assume all of basin 5 and 6 and 50 percent of basin 7 provide sewerage flows from the Mississippi Basin, and the remaining flow is from the Great Lakes Basin.

Table 1-1

Total Amount of Water Purchased From the City of Milwaukee
 Annual Report of Water Use, Water Diversion and Return Flow - 2018
 City of New Berlin, Wisconsin

Month	Cubic Feet	Monthly Total Amount of Water Purchased From The City of Milwaukee	Average Daily Usage (SCADA)
January	120,597	90,206,556	2,909,889
February	92,238	68,994,024	2,464,072
March	92,598	69,263,304	2,234,300
April	104,092	77,860,816	2,595,360
May	120,198	89,908,104	2,900,261
June	107,442	80,366,616	2,678,887
July	132,186	98,875,128	3,189,520
August	123,306	92,232,888	2,975,254
September	100,496	75,171,008	2,505,700
October	109,012	81,540,976	2,630,354
November	93,948	70,273,104	2,342,437
December	87,002	65,077,496	2,099,274
Total Annual Pumpage	1,283,115	959,770,020	2,627,109

Source: City of Milwaukee, Wisconsin Public Service Commission, and SCADA

Note: ALL of water used by the City of New Berlin Utility customers was purchased from the City of Milwaukee. New Berlin wells are no longer in service

Average: 2.630 million gallons per day
 79,980,835 gallons per month

Highest Day: May 28, 2018 5,919,000

Lowest Day: December 20, 2018 1,758,000

Table 2-1

Amount of Water Sold to Each Category and Subcategory of Customer on a Quarterly Basis Within the City Limits
 2018
 Annual Report of Water Use, Water Diversion and Return Flow - 2018
 City of New Berlin, Wisconsin

	Major Category (Gallons Sold in Thousands)				
	Residential	Commercial	Industrial	Public	Total
1st Quarter 2018	99,729	79,817	15,642	1,775	196,963
2nd Quarter 2018	87,578	69,915	15,944	1,774	175,211
3rd Quarter 2018	133,030	92,426	18,720	2,304	246,480
4th Quarter 2018	88,967	76,859	17,294	1,899	185,019
Total	409,304	319,017	67,600	7,752	803,673

	Residential Subcategory (Gallons Sold in Thousands)		
	Great Lakes Basin	Mississippi Basin	Totals
1st Quarter 2018	66,252	33,477	99,729
2nd Quarter 2018	58,324	29,254	87,578
3rd Quarter 2018	91,112	41,918	133,030
4th Quarter 2018	58,396	30,571	88,967
Total	274,084	135,220	409,304

	Condominium and Apartment Subcategory of Commercial Category (Gallons Sold in Thousands)		
	Great Lakes Basin	Mississippi Basin	Totals
1st Quarter 2018	16,139	23,016	39,155
2nd Quarter 2018	14,489	20,826	35,315
3rd Quarter 2018	17,086	25,401	42,487
4th Quarter 2018	14,537	21,051	35,588
Total	62,251	90,294	152,545

Source: City of New Berlin, Wisconsin

Table 3-1

Amount of Water Sold to Each Category and Subcategory of Customer on a Quarterly Basis Within the Approved Diversion Area - 2018
 Annual Report of Water Use, Water Diversion and Return Flow - 2018
 City of New Berlin, Wisconsin

	Major Category Mississippi Basin (Gallons Sold in Thousands)				
	Residential	Commercial	Industrial	Public	Total
1st Quarter 2018	33,477	55,803	13,892	1,223	104,395
2nd Quarter 2018	29,254	48,261	14,555	1,224	93,294
3rd Quarter 2018	41,918	62,853	16,918	1,865	123,554
4th Quarter 2018	30,571	54,524	15,605	1,270	101,970
Total	135,220	221,441	60,970	5,582	423,213

Condominium and Apartment Subcategory of Commercial (Gallons Sold in Thousands)	
	Mississippi Basin
1st Quarter 2018	23,016
2nd Quarter 2018	20,826
3rd Quarter 2018	25,401
4th Quarter 2018	21,051
Total	90,294

Source: City of New Berlin, Wisconsin

Table 4-1

Amount of Water Diverted to the Approved Diversion Area on a Monthly Basis
 Annual Report of Water Use, Water Diversion and Return Flow - 2018
 City of New Berlin, Wisconsin

Month	Estimated Amount Diverted in Gallons
January	51,688,357
February	39,533,576
March	39,687,873
April	44,614,248
May	51,517,344
June	46,050,071
July	56,655,448
August	52,849,445
September	43,072,988
October	46,722,979
November	40,266,489
December	37,289,405
Total	549,948,223

Source: City of New Berlin, Wisconsin and Ruekert & Mielke, inc.

Table 5-1

All water provided to City of New Berlin Utility customers are serviced by City of Milwaukee water.

There are NO New Berlin ground water wells in service.

We have abandoned wells 1, 2, 3, 4, 5, 7, 8, 9, 10 and 11

All wells were disconnected when we received permission for our diversion request and all water is provided by Milwaukee Water.

Table 6-1

Average Residential Per Capita Use
Annual Report of Water Use, Water Diversion and Return Flow - 2018
City of New Berlin, Wisconsin

Basin	Cust Class	2018 Quarter (Use in Thousands)				Total	Population	Average Residential Per capita Use in Gallons per Day
		1st	2nd	3rd	4th			
Great Lakes	C-CONDO/APT	16,139	14,489	17,086	14,537	62,251	3,511	
Great Lakes	R Residential	66,252	58,324	91,112	58,396	274,084	13,494	
	TOTALS					336,335	17,005	54.19
Mississippi	C-CONDO/APT	23,016	20,826	25,401	21,051	90,294	4,797	
Mississippi	R Residential	33,477	29,254	41,918	30,571	135,220	7,503	
	TOTALS					225,514	12,300	50.23
Combined City Wide Residential Per Capita Water Use						561,849	29,305	52.53

Source: City of New Berlin, Milwaukee Metropolitan Sewerage District

Calculations: We took the average number of residential connections and multiplied it by the occupancy factor. Then, we broke down the number of bedrooms and multiplied that by the appropriate occupancy factor and finally added the number of condos multiplied by their occupancy factors. We took the occupancy factors out of MMSD's Cost Recovery Manual. The calculation is complicated by two factors; 1) a significant portion of the city is not served by municipal water and 2) the PSC & DNR have different classification methods for residential customers specific to condo and apartment units. (See Table 6-1, P.2)

Table 6-1, P.2

2018 Connections

Basin	Customer Class	Q1	Q2	Q3	Q4	Average	Occupancy Factor	Population
		Count	Count	Count	Count			
MILW	C-CONDO/APT	173	173	173	173			
MILW	R Residential	5140	5142	5153	5166	5,150	2.62	13,494
MISB	C-CONDO/APT	817	817	817	817			
MISB	R Residential	2860	2860	2865	2870	2,864	2.62	7,503

2018 Condo/Apartment Population Calculation

Basin	Bedroom	Units	Factor	Population	Total	
MILW	Apartment	1	458	1.50	687	
MILW	Apartment	2	937	2.50	2,343	
MILW	Apartment	3	79	2.62	207	
MILW	Condo		110	2.50	275	3,511
MISB	Apartment	1	398	1.50	597	
MISB	Apartment	2	897	2.50	2,243	
MISB	Apartment	3	21	2.62	55	
MISB	Condo		761	2.50	1,903	4,797

29,305

Factors are from MMSD Cost Recovery Manual

Table 8- 1 & 9-1

Estimates of the Monthly sewerage return Flow From Within the Approved Water Supply Service Area and approved Diversion Area

Annual Report of Water Use, Water Diversion and Return Flow - 2018

City of New Berlin, Wisconsin

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	3.24	97,200,000	1,182,600,000
Mississippi River Basin	2.43	72,900,000	886,950,000
Total	5.670	170,100,000	2,069,550,000

Source:

R.A. Smith and Milwaukee Metropolitan Sewerage District

See below for the flows across the divide. The figures for 2018 are similar to the readings we calculated for 2017 for both the Great Lakes Basin (3.19 MGD) and Mississippi River Basin (2.56 MGD). The table is what needs to be submitted, but feel free to review the rest of the information, which we've

Below is Table 9-1, which has been used in past reporting by the City, which estimates the monthly sewage return flow across the divide. As in past years, I've also included the methodology used to arrive at the numbers below for your reference later in this email.

Basin	Average Daily Flow (MGD)	Monthly (30-Day Flow Gallons)	Annual Flow (Gallons)
Great Lakes Basin	3.24	97,200,000	1,182,600,000
Mississippi River Basin	2.43	72,900,000	886,950,000
Total	5.67	170,100,000	2,069,550,000

Here is the formula and information for first calculating the total sewer flows and then once again across the divide.

The following information is a summary of metered information from the MMSD, City-wide flow monitoring, and lift station pumping data. The information below gives a conservative estimate of the flows from the City to MMSD in 2018.

Because MMSD has only two meters monitoring flows from the City, we needed to rely more heavily on Utility-Owned meters to estimate the flows below. The following are the average flows for the City during 2018.

MMSD Meter DC0306 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2018 through October 2018.)

(New Berlin Basins 1, 4, 5, and 6) = 2.06 MGD (2.812 MGD in 2009, 2.766 in 2010, 2.430 in 2011, 2.292 in 2012, 2.479 in 2013, 2.00 in 2014, 1.66 in 2015, 2.05 in 2016 and 2.21 in 2017)

MMSD Meter MS0213 (This is an area-velocity meter similar to what the utility uses. I trust the accuracy of this data. The average flow below is from March 2018 through November 2018.)

(New Berlin Basin 9) = 1.07 MGD (0.403 MGD in 2009, 0.452 in 2010, 0.369 in 2011, 0.65 in 2012, 0.982 in 2013, 0.474 in 2014, 0.967 in 2015, 1.17 in 2016 and 1.04 in 2017)

(New Berlin Basin 2, utility owned meter 2002-A) = .14 MGD (0.084 MGD in 2013, .095 in 2014, 0.141 in 2015, .075 in 2016 and .146 in 2017)

(New Berlin Basin 3, utility owned meters 2003-B and 2003-C) = .49 MGD (.503 in 2009, .551 in 2014, 0.327 in 2015, .41 in 2016 and .45 in 2017)

(New Berlin Basins 7 and 10, utility owned meters 2007-B and 2010-A) = 1.89 MGD (2.292 MGD in 2009, 2.530 in 2010, 2.083 in 2011, 1.420 in 2012, 2.527 in 2013, 1.834 in 2014, 1.55 in 2016 and 1.88 in 2017)

(New Berlin Basin 8, utility owned meter 2008-C and lift station 6) = .02 MGD (.041 MGD in 2015, .058 in 2016 and .026 in 2017)

Total 2018 Average Daily Flow = 5.67 MGD à * 365 = 2.07 Billion Gallons
(about a 1.4% decrease from 2017 numbers and about a 6.78% increase from 2016)

Total 2017 Average Daily Flow = 5.75 MGD à * 365 = 2.10 Billion Gallons
(about a 8% increase from 2016 numbers and about a 16.2% increase from 2015 numbers)

Total 2016 Average Daily Flow = 5.31 MGD à 5.31 * 365 = 1.94 Billion Gallons
(about a 8.6% increase from 2015 numbers and about a 6.9% increase from 2014 numbers)

Total 2015 Average Daily Flow = 4.89 MGD à 4.89 * 365 = 1.785 Billion Gallons
(about a 1.5% decrease from 2014 numbers and about a 25.75% decrease from 2013)

Total 2014 Average Daily Flow = 4.966 MGD à 4.966 * 365 = 1.813 Billion Gallons
(about a 25% decrease from 2013 numbers and about a 2% increase from 2012 numbers)

Total 2013 Average Daily Flow = 6.586 MGD à 6.586 * 365 = 2.404 Billion Gallons
(about a 35% increase from 2012 numbers)

Total 2012 Average Daily Flow = 4.874 MGD à 4.874 * 365 = 1.780 Billion Gallons
(about a 10% decrease from 2011 numbers)

Total 2011 Average Daily Flow = 5.397 MGD à 5.397 * 365 = 1.970 Billion Gallons
(about a 10% decrease from 2010 numbers)

Total 2010 Average Daily Flow = 5.979 MGD à 5.979 * 365 = 2.182 Billion Gallons
(about a 1% decrease from 2009 numbers)

Total 2009 Average Daily Flow = 6.025 MGD à 6.025 * 365 = 2.199 Billion Gallons
(about a 10% increase from 2006 numbers)

Since the above indicates total flow from the City, we need to estimate what it is on each side of the divide... here is how we do it...

One MMSD meter measured flows from all of New Berlin Basins 1, 4, 5, and 6. Since we only wanted the flows from 5 and 6, I subtracted the flows recorded for 1 and 4 from the flow monitoring data that we have been collecting for the City every year. The result should give us a good idea of what flows basins 5 and 6 are contributing.

MMSD Meter DC0306 = 2.06 MGD

New Berlin Flow Meter Basin 1 (utility meter 3001-G, 0.43 MGD) and Basin 4 (utility meter 3001-A, 0.17 MGD)

Resultant Basin 5 and 6 flows = 1.46 MGD

Assuming that half of flow from Basin 7 and 10 is pumped over the sub-divide line we get:

New Berlin Basins 7 and 10, (utility owned meters 2007-B and 2010-A) = 1.89 MGD/2 = .95 MGD

Add Basin 8 (utility owned meter 2008-C and lift station 6), and the above two together and we get our number à 1.46 + .95 + .02 = 2.43 MGD

Ben G. High, P.E.
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