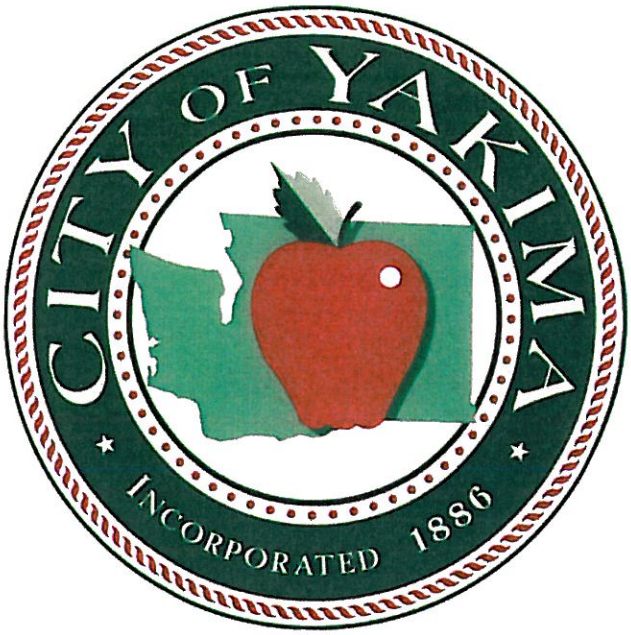


City of Yakima
Wastewater Division
Annual Infiltration and Inflow Report
2010

2010 Annual Inflow and Infiltration Evaluation

Reduction of inflow and infiltration (I/I) is a major priority for the City of Yakima Wastewater Division. I/I ties up capacity of the sanitary sewer system and increases treatment costs. In 2010, the City continued its effort to reduce I/I to the wastewater collection system.

Municipal Wastewater Facilities must demonstrate that wastewater collection systems are not and will not contribute to excessive infiltration or inflow. EPA's Infiltration/Inflow I/I Analysis and Project Certification brochure (Ecology Publication No. 97-03) is being used to determine if there is excessive I/I to the City's wastewater system. The submittal of this report by January 31, 2011 to the Department of Ecology satisfies the requirement of Section S4. D., of the City of Yakima's National Pollution Discharge Elimination System (NPDES) permit WA-002402-03, Infiltration and Inflow Evaluation.

EPA's guidance uses a national average to determine dry weather flow (DWF) and wet weather flow (WWF). For DWF, 120 gallons per capita per day (gpcd) is used and for WWF, 275 gpcd is used to determine non-excessive flows. Flows exceeding these values are considered to be excessive. For 2010, the highest average flow recorded over a 7-14 day period during high seasonal ground water was used to calculate the DWF. The highest single day flow was used as the WWF. The total flow, calculated from the plant loadings, consists of a combination of residential, commercial, and industrial flows as well as infiltration and inflow. These flows were determined by using the 2010 total sewer billed flows. The residential, commercial and industrial flows are used to calculate the I/I by being subtracted from the total flow. With the Urban Service area for both Terrace Heights and Union Gap subtracted and recent annexations added, a Service Area population of 87,557 (Table 3-1a, Sec. 3 Draft 2004 Wastewater facility Plan) is used to calculate the per capita flow rate for the City of Yakima. Terrace Heights and Union Gap flows were classified as industrial.

> *The City reads retail customer's water meters every two months and bills accordingly. For example: September billing is based upon meter readings for July and August. The City will incorporate the bi-monthly billing into the I/I report as oppose to monthly, to illustrate a more representative depiction of events based on recorded influent flows at the plant and when customers were actually billed.*

In 2010, the DWF for the Yakima Treatment Plant was determined using the highest 14-day period during the billing period with the highest flow (September). The highest 14-day average was during the month of August. The following Table illustrates this and the 2010 Infiltration/Inflow Data shows the gpcd for the entire year of 2010.

September Billing Period 2010 DWF (July/August)

Date	Ave. Daily Flow Rate (mgd)	Ave. Daily Industrial Flow rate for Jul/Aug 2009 (mgd)	Residential + Commercial + I/I (mgd)	Ave. Daily Flow Rate (gpcd)
Aug. 18 - 31	11.18	1.71	9.47	108.13

This table indicates that the DWF for this 14 day average during the September billing period for 2010 Average Daily Flow Rate was 108.13 gpcd and does not exceed the EPA national average of 120 gpcd in determining excessive I/I. The reported value for 2009 was 121.3 gpcd; resulting in a decrease of 10.9% from last year.

The enclosed spreadsheet (2010 Infiltration/Inflow Data) shows that the plant's high flows occur in late summer to early fall rather than in the winter and spring. This is typically the case because the Yakima area is heavily irrigated with many canals running through the city limits.

2010 Infiltration/Inflow Data

Bi-Monthly Billing Period	Plant Flow & Meter Read Months	# Days	Total Plant Flow per Billing Mg	BI-MONTHLY BILLED FLOWS Res flow Mg/billing	Com flow Mg/billing	Ind Flow Mg/billing	DAILY AVERAGE FLOWS Total Mgd	Res Mgd	Com Mgd	Ind Mgd	I/I Mgd	Res+Com+ I/I Mgd	Flow/Capita Gpcd
January	Nov/Dec '09	61	546.21	316.13	136.40	70.59	8.95	5.18	2.24	1.16	0.38	7.80	89
March	Jan/Feb	59	509.45	253.81	114.52	63.11	8.63	4.30	1.94	1.07	1.32	7.57	86
May	Mar/Apr	61	543.59	280.43	172.98	72.79	8.91	4.60	2.84	1.19	0.29	7.72	88
July	May/Jun	61	578.85	366.01	151.46	82.34	9.49	6.00	2.48	1.35	-0.34	8.14	93
September	Jul/Aug	62	656.80	289.18	182.05	95.46	10.59	4.66	2.94	1.54	1.45	9.05	103
November	Sep/Oct	61	677.96	315.85	176.95	136.42	11.11	5.18	2.90	2.24	0.80	8.88	101
Yearly Total			3512.86	1821.41	934.36	520.71							
Yearly Daily Averages							9.62	4.99	2.56	1.42	0.65	8.19	94
total flow	%							52	27	15	11		
billed flow	%							56	29	16			

(Union Gap & Terrace Heights classified as industry)
(Population of Union Gap & Terrace Heights omitted)

To formulate a more realistic picture of I/I, one could utilize a simplified version of EPA's Infiltration/Inflow by taking the difference between the Total Flow and Billed Flow to represent the I/I Flow.

2010

Total Flow: 3,512.86 mg
Total Billed: -3,276.48 mg
I/I Flow: 236.38 mg

236.38 mg/365 days = 0.65 mgd

0.65 mgd x 100/8.7557 = **7.4 gpcd**

2009

Total Flow: 3,647.81 mg
Total Billed: -3,227.29 mg
I/I Flow: 420.52 mg

420.52 mg/365 days = 1.15 mgd

1.15 mgd x 100/8.7557 = **13.1 gpcd**

Using this simplified format, the Yearly Daily Average for I/I calculates to 7.4 gpcd in 2010 and 13.1 gpcd in 2009; compared to 94 gpcd and 100 gpcd in 2010 and 2009 respectively as officially reported by using EPA's formula. The City is concerned that by utilizing the summation of the residential, commercial, and I/I flows to determine the Flow/Capita, this appears misleading and actually inflates the I/I report since industrial is not part of the equation.

The total flows from 2009 to 2010 decreased by 3.56% with the total yearly flows decreasing by 18.35% since 2000. Billed flows decreased 1.52% since 2009.

Total Yearly Flows

Month	Hydraulic 2000	Hydraulic 2001	Hydraulic 2002	Hydraulic 2003	Hydraulic 2004	Hydraulic 2005	Hydraulic 2006	Hydraulic 2007	Hydraulic 2008	Hydraulic 2009	Hydraulic 2010
January	219.94	298.21	269.37	275.26	269.74	259.62	264.32	289.19	276.55	276.10	264.78
February	244.57	255.62	236.33	242.45	252.59	231.57	229.00	271.29	255.29	242.48	244.67
March	274.19	283.17	262.45	260.33	286.40	261.60	250.69	275.94	267.31	265.97	259.92
April	330.75	313.36	303.48	321.34	349.61	310.03	300.47	321.48	303.19	292.68	283.67
May	370.69	381.00	349.50	337.52	364.56	348.36	345.57	328.34	322.54	324.31	300.90
June	391.48	395.40	353.62	369.70	364.16	313.85	376.52	334.37	318.58	303.63	277.95
July	463.96	436.24	394.40	429.87	395.88	347.31	420.62	366.61	340.95	329.25	317.19
August	519.15	476.89	416.94	419.10	433.67	375.78	418.08	395.87	358.89	367.12	339.61
September	484.75	443.34	427.06	416.47	409.58	382.44	402.94	384.19	350.84	358.32	351.55
October	395.02	347.18	354.52	361.89	365.09	295.40	353.91	355.13	330.74	337.98	326.41
November	309.30	269.19	264.39	267.63	270.33	252.04	283.87	286.04	281.65	278.68	272.65
December	300.46	269.61	270.08	270.88	265.37	260.63	288.70	289.90	268.32	267.53	275.16
Total	4,304.26	4,169.21	3,902.14	3,972.44	4,026.98	3,638.63	3,934.69	3,898.35	3,700.82	3,644.05	3,514.46
% Change Yearly		-3.14%	-6.41%	1.80%	1.37%	-9.64%	8.14%	-0.92%	-5.07%	-1.53%	-3.56%
% Change Compared to 2000		-3.14%	-9.34%	-7.71%	-6.44%	-15.46%	-8.59%	-9.43%	-14.02%	-15.34%	-18.35%

Leakage from irrigation pipes and canals, during the irrigation season, significantly raises the shallow ground water table that runs under the City of Yakima and along the Yakima River. When the irrigation is shut down in the fall, the City's Wastewater Treatment Plant flows are reduced significantly. When turned on in the spring, the plants flows begin to increase and top out in the late summer and early fall. Winter flows are generally well below 100 gpcd and thus not even close to the excessive WWF flow rate of 275 gpcd. Even the highest single day flow of 13.58 mgd (August 26th) is well below this threshold. One can deduce from this data that inflow is not a significant problem because the flows during the wetter weather seasons (winter and spring) are well below this threshold. On the other hand it is obvious that during the irrigation season, the dry weather season, infiltration is a problem and much of the Wastewater Division's focus is on reducing the impacts from this infiltration.

The City of Yakima will continue to pressurize and rehabilitate a major portion of its irrigation system over the next several years to reduce leaking of irrigation water into the water table. The increase in the water table level has been documented as a major source of I/I for the Wastewater Treatment Plant. Phase 3 of the City's irrigation pipe replacement program for the 308 System was initiated in the fall of 2007. It is highly anticipated that when this project is completed, the water table level will be greatly reduced eliminating as much as 2 to 3 million gallons a day of irrigation water from entering into the wastewater system during the irrigation season.

Rainfall Gauges (inches)

Rainfall Gauge Location	Address	2010 (inches)	2009 (inches)
Fire Station #94 (Airport)	2404 W. Washington Ave.	8.74	5.57
Fire Station #92	7707 Tieton Dr.	10.76	6.24
Yakima City Shops	2301 Fruitvale Blvd.	8.64	5.73
Wastewater Treatment Plant	2220 E. Viola	4.91	4.69

The four City rainfall-monitoring locations selected provide spatial distribution of rainfall and ease of service and gauge security. The rainfall gauges represent a gauge density of 1 gauge per 9 square miles. The four locations have remained the same since 2004.

Yakima Precipitation (inches)

Month	2010 Monthly Total	2009 Monthly Total
January	1.97	0.97
February	1.01	0.67
March	0.14	0.84
April	0.53	0.25
May	1.46	0.76
June	1.07	0.52
July	0.08	0.03
August	0.05	0.09
September	0.88	0.43
October	0.74	0.89
November	0.83	0.55
December	2.38	0.97
Total	**11.14**	**6.97**

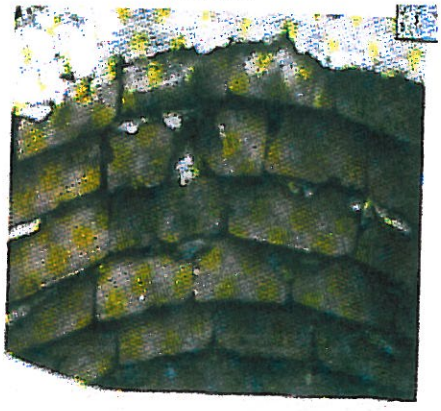
Data provided by the National Climatic Data Center

Comparing 2010 to 2009, reported yearly total precipitation levels increased by 59.8%.

Sanitary Sewer and Stormwater Systems

The City of Yakima has approximately 7,000 manholes, of which 50% are block or brick and mortar. As these manholes have aged over the years, much of the mortar has deteriorated and created voids in which infiltration can enter. Repairing or replacing these manholes is a top priority in reducing groundwater infiltration into the wastewater system. The City has an aggressive manhole rehabilitation program to address this very issue by relining such manholes with fiber-impregnated cementatous grout, effectively eliminating any infiltration. See photos below.

Before



After

Another effective process conducted by the City is "cured in place pipe (CIPP) repair." This allows for the permanent repair of cracks or voids in sanitary sewer pipes eliminating infiltration, without having to excavate the pipe.

Additional Utility Work performed:

Sanitary Sewer	**2010**	**2009**
• Manholes raised to grade	18	56
• Channel repairs	22	42
• Replacement of hinged manhole lids	4	24
• Replacement of standard manhole lids	4	6
• Manhole rings sealed	45	48
• Manholes rehabilitated	0	40
Stormwater		
• Inlet repairs	25	44
• Replacement of hinged manhole lids	3	4
• Pipe repairs	4	5
• Replacement of basins	8	5
• Replacement of basin covers	6	1
• UICs raised to grade	80	2
• Swale reconstruction	3	0
• Curb repair	12'	0

Camera Observations

Wastewater Collection crews perform a significant amount of TV inspections of pipe over the course of the year to identify areas of infiltration; maximizing the planning of future grouting and repair projects.

• Broken sewer pipes	32	22
• Cracked sewer pipes	195	36
• Needing CIPP repairs	8	4
• Needing lateral repairs	6	3
• Needing joint repairs	744	14

Construction Projects

- 5 projects totaling 1,965 feet of pipe was relined from manhole to manhole.
- 2 projects required a flow re-design.
- 2 dig and repair projects (stub and drop manhole)

In summary, flow volumes discharged by the commercial and industrial sectors are more accurately depicted within the report due to the record keeping of the City's Pretreatment Program and the implementation of a new billing system in April of 2010. Through smoke-testing and dye-testing, extensive time and effort is also being exerted by the City's Collection crew in identifying flows from wastewater dischargers connected to the WWTP, with no previous account history and billing information. The City continues to identify and prioritize projects in its efforts to further reduce infiltration to its wastewater system.

The City was well below the threshold for excessive I/I for the year in accordance with the EPA flow guideline for DWF even with the increased level of recorded precipitation from the previous year. The City recorded a DWF value of only 108 gpcd during its peak high flow period. Much credit must be given to the efforts of both the City's Collection and Stormwater crews for their continued success in reducing the amount of infiltration entering into the City's wastewater system. Doing so help preserves capacity for future growth and reduces treatment costs.

Report submitted by:

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January 27, 2011