SPF WATER ENGINEERING

MEMORANDUM

DATE: May 28, 2009

TO: Tom Hellen, P.E.,
City Engineer, City of Hailey

FROM: Christian Petrich, Ph.D., P.E., P.G.
Roxanne Brown

RE: *Review of letter from Wendy Pabich regarding water issues in Quigley Canyon*

Per your request, the following is a review of a letter from Ms. Wendy J. Pabich dated May 18, 2009 submitted to the Hailey City Council as part of the hearing record for the proposed Quigley Canyon annexation. Ms. Pabich expressed concerns that (1) the volume of water in Quigley Canyon under existing water rights will be insufficient for irrigation in the development and (2) that the development could lead to a net increase in water use.

The following are comments regarding selected points in Ms. Pabich's letter:

<u>Quigley Canyon's Available Water</u>

1. Irrigation in the proposed Quigley Ranch development will be limited to rates, volumes, and areas authorized under existing water rights. Quigley Ranch has proposed a stand-alone pressurized irrigation system that is not connected to the City's municipal water system. Water from the City of Hailey's municipal water system will not be used for irrigation within Quigley Ranch. A net increased in authorized irrigated acreage would not be possible without a formal administrative process through the Idaho Department of Water Resources (IDWR).
2. Ms. Pabich asserts the entire flow of Quigley Creek was determined to be 2.28 cfs in the "1889 Drake decree". We assume she is referring to the original complaint lodged in Drake vs. Bohlke in which the plaintiffs assert the creek "…carr(ies) about one hundred and fourteen inches of water under four inches pressure." This estimate is not a finding of the Court and does not represent the flow of Quigley Canyon Creek. Given the ambiguity in the decree as to diversion rate, IDWR apparently accepted this estimate as a reasonable diversion limit for water right 37-19736.

   Figure 1 provides an illustration of 2008 flows in Quigley Creek (presented as Figure 3 in our memo of December 31, 2008) based on data supplied by

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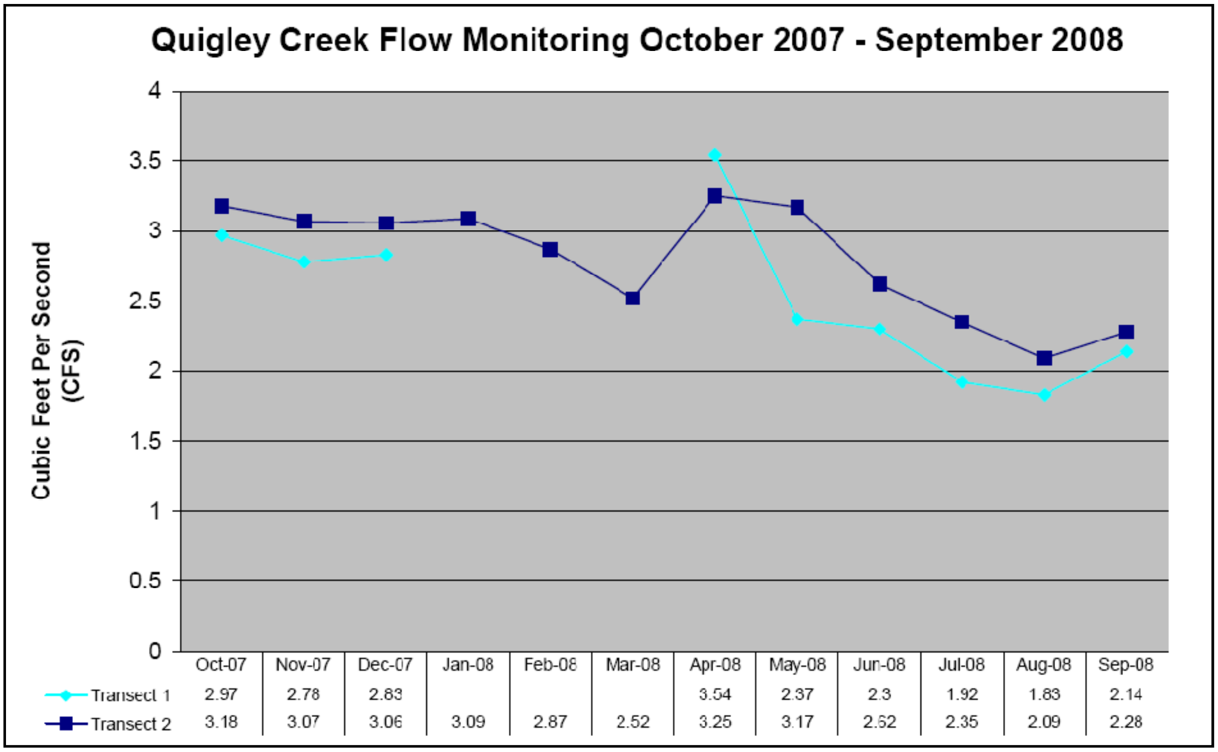
the developers' representative[1]. Reported flows in the 2008 water year (October 2007 through October 2008) ranged from about 1.8 to 3.5 cfs.

3. We agree with Ms. Pabich that the ultimate determination of water rights available for irrigation use in Quigley Canyon will be determined in the Snake River Basin Adjudication (SRBA).

4. Ms. Pabich correctly asserts that the historical Quigley water rights are limited to the delivery of 888.3 acre-feet annually. However, the ERO report also includes the diversion volume authorized under enlargement claim 37-21348 (52.5 acre-feet). The authorized volume to be diverted under all of the Quigley water rights is therefore 940.8 acre-feet annually.



From John Gaedert, Corparation for Land Planning; In addition, readings of 2.52 cfs and 2.68 cfs were measured at Transects 1 and 2, respectively, on November 20, 2008).

Figure 1: Quigley Creek flow monitoring, October 2007-2008.

5. Ms. Pabich is correct that diversions under surface water rights from Quigley Creek are limited to the amount of water physically available in the creek. However, Quigley Ranch's ground water rights can be used to supplement Quigley Creek water. Although junior-priority ground water rights are vulnerable to a priority call when ground and surface water are managed conjunctively in this area, lag impacts or other factors could partially mitigate effects on the Big Wood River during a priority call. Furthermore, junior-priority ground water rights may or may not be cut in

[1] *Provided by John Gaeddert, Corporation for Land Planning.*

their entirety under conjunctive management. Precise restrictions in the event of conjunctive management have not yet been established. The bottom line is that any future seasonal use restrictions placed on junior-priority Quigley Ranch water rights would likely lead to irrigation restrictions within the Quigley Ranch development.

6. Ms. Pabich suggests that an authorized diversion rate of 2.28 cfs under water right 37-19376 is sufficient for only 114 acres. This assumption is based on an assumed application rate of 0.02 cfs per acre[2]. However, water right 37-19376 authorizes irrigation on 253.8 acres (Table 1). The entire 253.8 acres could be legally irrigated at one time with 2.28 cfs at an application rate of 0.009 inches per acre (0.45 miner's inches per acre). Alternately, a delivery rate of 0.02 cfs per acre could be applied to a rotation of acres within the 253.8-acre place of use.

Water Right No.	Source	Tributary to	Priority Date	Authorized Diversion Rate (cfs/gpm) [1]	Authorized Diversion Volume (af/y) [2,3]	Irrigated Area (acres) [4]
37-2784A	Quigley Creek	Sinks	1/3/1967		16.0	154.0
37-7693	Quigley Creek	Big Wood River	12/16/1977	5.27	30.0 (storage) 888.3 (irrigation)	300.0
37-8283	Quigley Creek	Big Wood River	9/23/1986	0.12	35.0 (storage) 6.7 (instream	
37-19736	Quigley Creek	Sinks	10/11/1889	2.28		253.8
37-20902	ground water		7/21/1966	2.01	340.2	113.4
37-21348 [5]	ground water		4/15/1985		52.5	15.0
37-21349 [6]	ground water		10/28/1969	Recommended for dissallowal		

1. Rights 37-7693 and 37-19736 are limited to a combined diversion rate of 5.27 cfs.
2. Rights 37-2784A and 37-7693 are limited to a total annual storage volume of 30 acre-feet.
3. Rights 37-2784A, 37-7693, 37-19736 and 37-20902 are limited to a total annual diversion volume of 888.3 acre-feet at the field headgate.
4. Rights 37-2784A, 37-7693, 37-19736 and 37-20902 are limited to the irrigation of a combined total of 253.8 acres in a single irrigation season.
5. Rights 37-20902 and 37-21348 are limited to a combined diversion rate of 2.01 cfs.
6. Currently recommended to be disallowed in the SRBA.

Table 1: SPF review of Quigley Canyon Ranch water rights.

Development Water Demand

1. Ms. Pabich projected per-home water use for the Quigley Ranch development using data attributed to the USGS. In particular, she quotes a non-irrigation use rate of 482 gallons per day (gpd) per person from the USGS study and estimates an average demand rate of 1,157 gpd per

[2] 0.02 cfs is equivalent to 9 gallons per minute (gpm) per acre or 1 miner's inch per acre.

housing unit (based on an average occupancy rate of 2.4 persons/unit) during the non-irrigation season (November through March).

In our opinion, an average daily use estimate of 1,157 gallons per home for domestic (i.e., in-home) purposes is highly excessive. This is illustrated with a list of hypothetical activities that would lead to this level of water use (Table 2) in a typical home with an average of 2.4 residents.

Number	Activity	Rate per Activity		Volume	unit
90	Toilet flushes	1.6	gallons per flush	144	gallons
5	Laundry loads	60	gallons per load	300	gallons
10	Dishwasher cycles	15	gallons per cycle	150	gallons
15	10-minute showers	2.5	gallons per minute	375	gallons
50	Tooth brushings	1	gallons per brushing	50	gallons
60	Hand washings	0.5	gallons per washing	30	gallons
	Cooking, cleaning, pets	100	gallons per day	100	gallons
75	House plants	0.1	gallons per plant	7.5	gallons
				1157	gallons

Table 2: Hypothetical number of daily toilet flushes, laundry loads, dishwasher cycles, showers, tooth brushings and hand washings, cooking, cleaning, and house plant watering needed to use 1,157 gallons per day.

2. In contrast, we generally assume that average daily domestic water use in new subdivisions with water-efficient fixtures and appliances will range from about 175 to 250 gpd. This assumption is supported by the following:

   - United Water Idaho serves approximately 80,000 customer connections in the Boise area. Average day demand per connection (i.e., per home) for indoor domestic use *and irrigation* is 475 gallons per day, which is approximately 40% of the 1,157 gpd/unit estimated by Ms. Pabich for only domestic purposes. Domestic water use at newer residential subdivisions in southeast Boise (Harris Ranch and Surprise Valley) that have outdoor irrigation supplied from a separate non-potable water system averages only 205 gallons per day per connection, with winter base loads of 190 gallons per day per connection[3].
   - Estimates of domestic water use and domestic wastewater flows are provided in "Wastewater Engineering" (Metcalf and Eddy Inc., 1991, pages 16, 17, 26, and 27 are included for reference purposes in Attachment B). This reference notes that average municipal domestic water use per capita is 60 gallons per day (Table 2-1 in Attachment B),

[3] These data were obtained directly by SPF Water Engineering from United Water Idaho and are summarized in Attachment A (Table 5-1 from "Spring Valley Ranch Water Supply Alternative Study" July 6, 2004 draft).

which is equivalent to 144 gpd for a typical home with an average of 2.4 residents. The typical wastewater flow rates range from 40 gallons per person per day for summer cottages to 95 gallons per person per day for luxury homes (Table 2-9 in Attachment B).

- EPA WaterSense website (Attachment C) indicates that the average family of four can use 280 gallons per day indoors, or 70 gallons per person per day. The site notes that water-efficient fixtures can substantially reduce this amount of daily water use.
- The City of Hailey City Engineer (Tom Hellen) reports an average winter delivery rate of approximately 167 gallons per day (gpd) per residential connection.

3. For comparison with the hypothetical water use outlined in Table 2, Table 3 lists mix of water uses that would lead to an average daily in-home domestic water use of 200 gallons per day.

Number	Activity	Rate per Activity		Volume	unit
20	Toilet flushes	1.6	gallons per flush	32	gallons
1	Laundry loads	60	gallons per load	60	gallons
1	Dishwasher cycles	15	gallons per cycle	15	gallons
2.4	10-minute showers	2.5	gallons per minute	60	gallons
4.8	Tooth brushings	1	gallons per brushing	4.8	gallons
12	Hand washings	0.5	gallons per washing	6	gallons
	Cooking, cleaning, pets	20	gallons per day	20	gallons
20	House plants	0.1	gallons per plant	2	gallons
				200	gallons

Table 3: Hypothetical number of daily toilet flushes, laundry loads, dishwasher cycles, showers, tooth brushings and hand washings, cooking, cleaning, and house plant watering needed to use 200 gallons per day.

4. It is often assumed that approximately 95% of domestic water use is non-consumptive, meaning that most of the water used for in-home purposes returns to the ground or surface water system (e.g., the Big Wood River). At this percentage, a daily delivery rate of 200 gpd/unit for domestic purposes would result in a consumptive use of about 10 gpd per housing unit (i.e., 10 gpd per housing unit does not return to the local hydrologic system).
5. Ms. Pabich also questions the volume of water that ERO has projected for irrigation use. Again, irrigation water within Quigley Canyon will be delivered in a separate pressurized irrigation distribution system; municipal water will not be used for irrigation in Quigley Canyon. Irrigation will be limited by (1) the elements of the water rights (diversion rate, annual diversion volume, and authorized irrigated area), and (2) surface water availability. Furthermore, irrigation in Quigley Canyon will be limited by any

constraints imposed under conjunctive management of ground water and surface water sources.

6. At our April 30, 2009 meeting with the City and Quigley's representatives, we suggested that it would be helpful to evaluate irrigation water availability based on a detailed project phasing plan. This will allow a more detailed analysis of the extent to which Quigley Canyon irrigation water will be available for the project under existing water rights and various water administration scenarios.

In summary, we appreciate the thoughtfulness with which Ms. Pabich questions water use in the proposed Quigley subdivision. Based on our review of Quigley Canyon water rights, materials submitted by ERO on behalf of Quigley Canyon, and Ms. Pabich's letter, we conclude the following:

1. Irrigation water use will not increase over currently authorized diversion rates, annual diversion volumes, and authorized irrigated area.
2. The net increase in consumptive water use for domestic (in-home) purposes will likely be in the range of approximately 10 gallons per unit per day (or 3,840 gallons per day for 384 homes). This consumptive use is very small compared to the average daily City of Hailey withdrawals of 3.14 million gallons per day.

Please call if you have any questions regarding this review.

<u>References</u>

Metcalf and Eddy Inc., 1991. Wastewater Treatment, Disposal, and Reuse. McGraw-Hill, Inc.

<u>Attachments</u>

Attachment A: Water use data from the Harris Ranch and Surprise Valley subdivisions (Ada County.

Attachment B: Metcalf and Eddy reference pages.

Attachment C: EPA WaterSense link: http://www.epa.gov/watersense/docs/ws_indoor508.pdf

Attachment A:
Water use data from the
Harris Ranch and Surprise Valley subdivisions

TABLE 5-1

Water Demand per Customer

Single (combined) vs. Dual System (separate)

Estimated Design Demand

Surprise Valley Subdivision/Harris Ranch with a Dual Irrigation System			Residential Usage - United Water Average Irrigation and In home Combined		
100	CCF	Annual Volume	220	CCF	Annual Volume
75,000	Gallons	Annual Volume	165,000	Gallons	Annual Volume
190	Gallons	Base Load Demand	250	Gallons	Base Load Demand
205	Gallons	Average Day	475	Gallons	Average Day
250	Gallons	Peak Season	-	Gallons	Peak Season
315	Gallons	Peak Day	1,000	Gallons	Peak Day
0.22	gpm per customer		0.69	gpm per customer	
Peaking Factors			Peaking Factors		
Peak Season to Base Load		1.66	Peak Season to Base Load		4.00
Peak Day to Average Day		1.54	Peak Day to Average Day		2.11

Spring Valley Ranch - Design Demands:

Typical Design Demands - w/commercial, irrigation, unaccounted for water

Peak Day per Customer

1,440 gpm per customer
1.0 gpm per customer
0.75 gpm Irrigation (peak day)
0.25 gpm Potable (peak day)

Design Demand Goal with Water Conservation Program

Peak Day per Customer

1,000 gpm per customer
0.7 gpm per customer
0.5 gpm Irrigation (peak day)
0.2 gpm Potable (peak day)
250 gallons Storage Requirement - Peaking

Attachment B:
Metcalf and Eddy Reference Pages

WASTEWATER ENGINEERING
Treatment, Disposal, and Reuse

Third Edition

METCALF & EDDY, INC.

Revised by

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2. *Industrial wastewater.* Wastewater in which industrial wastes predominate.
3. *Infiltration/inflow (I/I).* Water that enters the sewer system through indirect and direct means. Infiltration is extraneous water that enters the sewer system through leaking joints, cracks and breaks, or porous walls. Inflow is stormwater that enters the sewer system from storm drain connections (catch basins), roof leaders, foundation and basement drains, or through manhole covers.
4. *Storm water.* Runoff resulting from rainfall and snowmelt.

Three types of sewer systems are used for the removal of wastewater and stormwater: sanitary sewer systems, storm sewer systems, and combined sewer systems Where separate sewers are used for the collection of wastewater (sanitary sewers) and stormwater (storm sewers), wastewater flows in sanitary sewers consist of three major components: (1) domestic wastewater, (2) industrial wastewater, and (3) infiltration/inflow. Where only one sewer system (combined sewer) is used, wastewater flows consist of these three components plus stormwater. In both cases, the percentage of the wastewater components varies with local conditions and the time of the year.

For areas now served with sewers, wastewater flowrates are commonly determined from existing records or by direct field measurements. For new developments, wastewater flowrates are derived from an analysis of population data and corresponding projected unit rates of water consumption or from estimates of per capita wastewater flowrates from similar communities. These subjects are considered further in this chapter.

2-2 ESTIMATING WASTEWATER FLOWRATES FROM WATER SUPPLY DATA

If field measurements of wastewater flowrates are not possible and actual wastewater flowrate data are not available, water supply records can often be used as an aid to estimate wastewater flowrates. The types of water-use data available and how the data can be analyzed and applied for estimating wastewater flowrates are discussed in this section. Where water records are not available, useful data for various types of establishments and water-using devices are provided for making estimates of wastewater flowrates.

Municipal Water Use

Municipal water use is generally divided into four categories: (1) domestic (water used for sanitary and general purposes), (2) industrial (nondomestic purposes), (3) public service (water used for fire fighting, system maintenance, and municipal landscape irrigation), and (4) unaccounted for system losses and leakage. Typical per capita values for these uses are reported in Table 2-1. The importance of categorizing water use for the purposes of estimating wastewater flows is discussed in this section.

TABLE 2-1
Typical municipal water use in the United States[a]

Use	Flow, gal/capita · d		
	Range	Average	Percent based on average flow
Domestic	40–130	60	36.4
Industrial (nondomestic)	10–100	70	42.4
Public service	5–20	10	6.0
Unaccounted system losses and leakage	10–40	25	15.2
	65–290	165	100.0

[a] Ref. 8.
Note: gal × 3.7854 = L.

Domestic Water Use. Domestic water use encompasses the water supplied to residential areas, commercial districts, institutional facilities, and recreational facilities, as measured by individual water meters. The uses to which this water is put include drinking, washing, bathing, culinary, waste removal, and yard watering. Using the average flow values reported in Table 2-1, over one-third of the water used in a municipal water supply system is for domestic purposes.

Residential areas. Water used by residential households consists of water for interior use such as showers and toilets and water for exterior use such as lawn watering and car washing. Typical data for interior water use are presented in Table 2-2. Water use for exterior applications varies widely depending upon the geographic location, climate, and time of year and mainly consists of landscape irrigation.

TABLE 2-2
Typical distribution of residential interior water use[a,b]

Use	% of total
Baths	8.9
Dishwashers	3.1
Faucets	11.7
Showers	21.2
Toilets	28.4
Toilet leakage	5.5
Washing machines	21.2
	100.0

[a] Adapted from Ref. 9.
[b] Without water-conserving fixtures.

of water, the variation from year to year in the ratio of wastewater to water supply will not be great.

2-3 WASTEWATER SOURCES AND FLOWRATES

Data that can be used to estimate average wastewater flowrates from various domestic and industrial sources and the infiltration/inflow contribution are presented in this section. Variations in the flowrates that must be established before collection systems and treatment facilities are designed are also discussed.

Domestic Wastewater Sources and Flowrates

The principal sources of domestic wastewater in a community are the residential areas and commercial districts. Other important sources include institutional and recreational facilities. For existing developments, flowrate data should be obtained by direct measurement. For areas being developed, methods of estimating flowrates are considered in the following discussion. Wastewater flowrates for small systems (systems with 1000 people or less) may differ significantly from larger systems and are discussed in Chap. 14.

Residential Areas. For many residential areas, wastewater flowrates are commonly determined on the basis of population density and the average per capita contribution of wastewater. Data on ranges and typical flowrate values are given in Table 2-9. For large residential areas, it is often advisable to develop flowrates on the basis of land-use areas and anticipated population densities. Where possible, these rates should be based on actual flow data from selected similar residential areas, preferably in the same locale.

In the past, the preparation of population projections for use in estimating wastewater flowrates was often the responsibility of the engineer, but today such data are usually available from local, regional, and state planning agencies. If the data are not available and population projections have to be prepared, Ref. 5 may be consulted for population forecasting methodology.

Commercial Districts. Commercial wastewater flowrates are generally expressed in gal/acre · d (m^3/ha · d) and are based on existing or anticipated future development or comparative data. Average unit-flowrate allowances for commercial developments normally range from 800 to 1500 gal/acre · d (7.5 to 14 m^3/ha · d). Because unit flowrates can vary widely for commercial facilities, every effort should be made to obtain records from similar facilities. Estimates for certain commercial sources may also be made from the data in Table 2-10.

Institutional Facilities. Some typical flowrates from institutional facilities, essentially domestic in nature, are shown in Table 2-11. Again, it is stressed that flowrates

TABLE 2-9
Typical wastewater flowrates from residential sources[a]

Source	Unit	Flow, gal/unit · d Range	Typical
Apartment:			
High-rise	Person	35–75	50
Low-rise	Person	50–80	65
Hotel	Guest	30–55	45
Individual residence:			
Typical home	Person	45–90	70
Better home	Person	60–100	80
Luxury home	Person	75–150	95
Older home	Person	30–60	45
Summer cottage	Person	25–50	40
Motel:			
With kitchen	Unit	90–180	100
Without kitchen	Unit	75–150	95
Trailer park	Person	30–50	40

[a] Adapted in part from Ref. 7.
Note: gal × 3.7854 = L

vary with the region, climate, and type of facility. The actual records of institutions are the best sources of flow data for design purposes.

Recreational Facilities. Wastewater flowrates from many recreational facilities are highly seasonal. Typical data on wastewater flowrates from recreational facilities are presented in Table 2-12.

Sources and Rates of Industrial (Nondomestic) Wastewater Flows

Nondomestic wastewater flowrates from industrial sources vary with the type and size of the facility, the degree of water reuse, and the onsite wastewater treatment methods, if any. Extremely high peak flowrates may be reduced by the use of detention tanks and equalization basins. Typical design values for estimating the flows from industrial areas that have no or little wet-process type industries are 1000 to 1500 gal/acre · d (9 to 14 m^3/ha · d) for light industrial developments and 1500 to 3000 gal/acre · d (14 to 28 m^3/ha · d) for medium industrial developments. Alternatively, for estimating industrial flowrates where the nature of the industry is known, data such as those reported in Table 2-6 can be used. For industries without internal recycling or reuse programs, it can be assumed that about 85 to 95 percent of the water used in the various operations and processes will become wastewater. For large industries with internal water-reuse programs, separate estimates must be made. Average domestic

Attachment 3

Attachment C:
EPA WaterSense Water Use

Indoor Water Use in the United States

Americans use large quantities of water inside their homes. A family of four can use 400 gallons of water every day, and, on average, approximately 70 percent of that water is used indoors.

The bathroom is the largest consumer of indoor water. The toilet alone can use 27 percent of household water. Almost every activity or daily routine that happens in the home bathroom uses a large quantity of water. For example:

- Older toilets use between 3.5 and 7 gallons of water per flush. However, WaterSense® labeled toilets use at least 60 percent less water.
- A leaky toilet can waste about 200 gallons of water every day.
- A bathroom faucet generally runs at 2 gallons of water per minute. By turning off the tap while brushing your teeth or shaving, a person can save more than 200 gallons of water per month.

Outside the bathroom, there are many opportunities to save water. Here are some common water-efficiency measures, along with a few solutions to those problems you may not have known existed:

- High-efficiency washing machines can conserve large amounts of water. Traditional models can use 50 gallons or more of water per load, but newer, energy- and water-conserving models (front-loading or top-loading, non-agitator ones) use less than 27 gallons per load.

How Much Water Do We Use?

Source: American Water Works Association Research Foundation, "Residential End Uses of Water," 1999

- Washing the dishes with an open tap can use up to 20 gallons of water, but filling the sink or a bowl and closing the tap saves 10 of those gallons.
- Keeping a pitcher of water in the refrigerator saves time and water instead of running the tap until it gets cold.
- Not rinsing dishes prior to loading the dishwasher could save up to 10 gallons per load.

WaterSense, a partnership program sponsored by the U.S. Environmental Protection Agency, seeks to help families and businesses realize that they can reduce water use by doing just a few simple things, such as upgrading to higher quality, more efficient products. For more information, visit <www.epa.gov/watersense>.

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