# Water Efficiency Using Water Fixtures in Residential Buildings – A Case Study in Pune City

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***Abstract – The Earth's surface is acquired by 71%with water but only 3% of water can be used as potable water. Nowadays conservation of water is one of the basic principles of green building. The effort should be made to ensure that the fixtures that are used help in reduction of water consumption in residential buildings. Responsible use of fresh water means ensuring that all water consuming fixtures in public as well as residential areas are operating properly, with no leaks or drips, constantly running toilet tanks, or "ghost" flushes from automatic sensor based fixtures. A faucet leak of one drop per second can waste 3-7 gallons of water which is often paid for twice; for the initial consumption and a second time in the form of waste water. This paper involves study of all the water efficient plumbing fixtures such as, taps, toilets, shower heads, urinals, etc. In addition to inspecting regularly for water leaks and responding immediately when receiving reports from residents, public housing authority (PHA) can achieve water saving by ensuring various water fixtures.***

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## 1. INTRODUCTION

One of the most essential natural resource on the planet earth is water, without which life on the planet cannot exist. We have about 1% water available on planet and our population is ever growing. To sustain and to keep up with the growth rate; water is most critical recourse. We have exploited this resource to such an extent that this has become a scanty natural resource. According to the Second UN World Water Development Report, if current level of consumption continue, two third of the global population will live in areas of water stress by 2025. If we have to reside on this planet we need to start conserving the life sustaining resource – WATER. Then water efficiency will help us to level the demand and supply of water while carrying out our day to day activities. Water efficiency is minimizing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered.

Therefore water efficiency can be gained using various fixtures viz. low flow shower heads sinks with auto shutoff mechanism and water saving toilets and urinals and equipments that saves water includes dishwashers, clothes washers, other commercial kitchen equipment such as sprayers and steam cookers. Reducing water use from fixtures and equipment is perhaps the cheap methods to reduce total potable water use. It does not require comprehensive design solutions, just specifying certain products. Avoiding large fountains, pools and other water features will also save water use.

### 1.1. Need for Water Efficiency

The plumbing fixtures that exist today are not only more sophisticated, but they are able to perform at a higher standard of efficiency. As expected, toilets, faucets and shower head have now become the industry standard. Initially, commercial and residential plumbers did not embrace water efficient plumbing, mainly because it was assumed to have questionable performance .There have been significant breakthroughs with new showers fixtures over the past decades. With new air-induction technology, the flow and coverage of water-saving showerheads have tremendously improved. Modern designs and functional improvements have now made choice for efficient fixtures much easy.

Toilets are often the source of most water use (and water wasting) with in a home, accounting for nearly 30% of average homes indoor water consumption. If you have toilet that uses more than 1.6 gallons of

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water per flush (gpf) –as do almost all toilets installed before 1994-replaced it with such as High-efficiency (or ultra low flush) toilet model that uses no more than 1.28 gpf and Dual flush toilet, which has a lower flush button for liquid waste and a higher flush button for solid waste and also Composite toilets. Showering accounts for up to 20% of the average household's indoor waste use. You can cut your shower water use by as much as 70% by switching to an ultra low flow shower head, which is easy to do. And unlike days of yore, many of today's models of high-efficiency will give you a good strong shower stream. Using ultra-low-flow showerheads will also save you money on your energy bills, by reducing the demand on your water heater. According to the WaterSence program, a household could save 300 kilowatt hours of electricity annually, enough to power its television use for about a year. If you have inefficient faucets (which use more than 2.5 gpm ), either replace them with high-efficiency faucets that have a flow rate of no more than 1.5gpm (the current WaterSence standard) OR add a water-saving aerator or flow restrictor to the existing faucets ( an easy and inexpensive modification).

Hence, in order to save water, conserve both water and energy and also to make a healthy environment, water fixtures are most necessary in every home.

### 1.2 Water Saving Tap Aerators

The aerator is a small attachment which fits onto the end of the tap or can be inserted inside of the existing spout. Tap aerator are mostly used with the older taps which runs on an average around 15lit/min. Addition of aerator to an older tap can reduce 6lit per minute. Tap aerator can save as much as half of the daily water usage. The aerators can be installed in bathrooms taps and kitchens sinks where the taps are been frequently used. The various types of tap aerator available in the market are showering flow aerator (spray), foam/bubble flow aerator, custom flow aerator, custom shower flow aerator, hygiene aerator, etc.

### 1.3 Water Efficient Showers

Shower can be one of the biggest users of water in our homes. IF we are using an older style shower heads we could be using more water than we need too. An efficient shower head can save up to 19 liters of water per day. Water saving shower head uses up to 50% less water than regular free flow shower head. There are two types of water saving shower heads available viz. by aerating the water and shower heads with new pulsating technology.

### 1.4 Water Efficient Toilet

Toilet use a lot of water and the water we flush away is usually valuable tap water. Switching to a more water efficient toilet will make a big difference to your household's water use and will help protect our future water suppliers. Toilet flushing counts 1/3 of water used in the home today; one toilet flush using an older style toilet uses 14 litres of water. The new dual flush models use as 2.6 and 4 litres per flush, so only 20% compared older toilets, while composting toilets use no water at all. The various types of water efficient toilet available are dual flush toilet, pressure assisted toilets, composting toilets, etc.

### 1.5 Low Flow Plumbing Fixtures and Technology Used in Low Flow Faucets

The water efficient fixtures and low flow plumbing fixtures should be used to achieve water efficiency. Low flow technology is normally used in faucets, aerator, showerheads and toilets. Technology used in low flow faucets are aerators. The aerator has ability of breaking down the stream of water into many tiny streams and the air will get mixed with the flow of water. This can reduce the use of water in the hand basins and kitchen sinks. The reduction is ranges from 50% – 70% than typical flow rates. It has been observed that we use water in excess amount when flow in the fixtures for more time and thereby providing more quantity. Water sensed fixtures – bathroom sinks, faucets and other accessories use 30% less water than standard flow by reducing the flow of water.

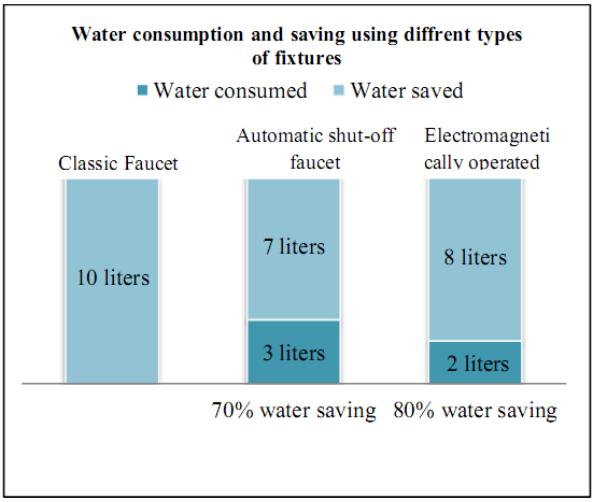


**Chart 1. Water consumption and saving using different types of fixtures**

## 2. CASE STUDY

Name of project: Marvel Cerise, Pune

Location: Kharadi

Total site area: 20,609.42 sq.m

The project intends to use all the flow fixtures which are water efficient, fixture range similar to Grohe EcoJoy™ will be used; which are designed to reduce flow rates, without hammering the performance. The

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project has planned to achieve 30% water efficiency by using various methodologies.

| Dual flush system | Base Line LPF Large Volume | Base Line LPF Small Volume | Nos | Flow Rate LPF Large Volume | Flow Rate LPF Small Volume | Total Flow Rate Large Volume | Total flow Rate Small Volume |
|---|---|---|---|---|---|---|---|
| Water closet | 6 | 3 | 701 | 6 | 3 | 4206 | 2103 |
| Water closet | 6 | 3 | | | | 0 | 0 |
| Water closet | 6 | 3 | | | | 0 | 0 |
| Water closet | 6 | 3 | | | | 0 | 0 |
| Other (user defined) | 6 | 3 | | | | 0 | 0 |
| Other (user defined) | 6 | 3 | | | | 0 | 0 |
| Total average flow rates | | | 701 | | | 6 | 3 |

**Table 1. Average flow rates**

| | |
|---|---|
| Average flow rates of all flush systems used (large volume) | 6 |
| Average flow rates of all flush systems used (small volume) | 3 |

**Table 2. Average flow rates**

| Flow Fixture | Base Line | Nos | Flow rate | Total flow rates |
|---|---|---|---|---|
| | LPM | | LPM | LPM |
| Toilet taps | 12 | 772 | 8.3 | 6407.6 |
| Kitchen taps | 12 | 432 | 8.3 | 3585.6 |
| Other taps | 12 | 1620 | 8.3 | 13446 |
| Low flow shower | 12 | | | 0 |
| Other (user defined) | 12 | 629 | 8.3 | 5220.7 |
| Other (user defined) | 12 | | | 0 |
| Other (user defined) | 12 | | | 0 |
| Other (user defined) | 12 | | | 0 |
| Other (user defined) | 12 | | | 0 |
| Other (user defined) | 12 | | | 0 |
| **Total** | | **3453** | | **28659.9** |

**Table 3. Flow rate of fixtures used in project**

Efficient water usage in day to day life is of most important. The World Health Organization (WHO) recommends 135 lit./day/person for a residential scheme. About 80-85% of the allotted water is wasted as grey water or sewage. The development has a proactive approach towards water conservation and water efficiency. It will use various methodologies including high efficiency fixture, water less urinals in common areas etc. and will use treated grey water for flushing and landscaping. The project has planned to achieve 30% water efficiency by using above mentioned methodology.

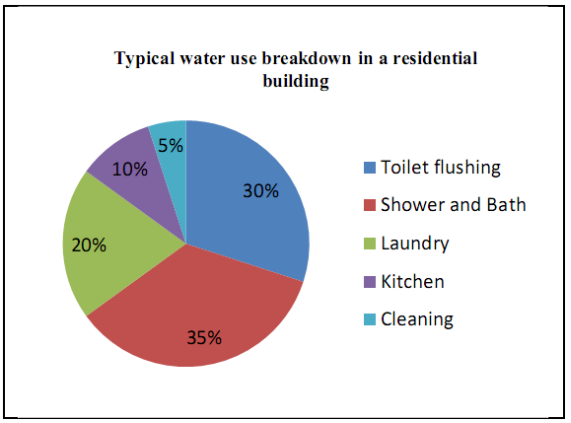


**Fig. 1. Water usage in residential building**

| Fixtures | Recommended estimated flow rate | Average Existing flow rate (all 45 houses) |
|---|---|---|
| Sink faucet | 6 liters/min | 8.31 liters / min |
| Kitchen Faucets | 6 liters/min | 10.55 liters / min |
| Toilet Hoses | 6 liters/min | 9.42 liters / min |
| Shower Heads | 9.5 liters/min | 8.72 liters / min |
| Toilets | 6 / 4 liters/flush (dual / single) | 8.07 liters / flush |

**Table 4. Flow rates for various fixtures**

## 3. CONCLUSION

The prime objective of this paper is to minimize indoor water usage by installing efficient water fixtures. This paper also empathizes on protective approach towards water conservation and water efficiency and has used various methodology using high efficiency fixtures. As per WHO (World Health Organization) recommends 135 lit/day/person for residential areas. We can minimize water consumption by using various water efficient fixtures – tap aerators, water efficient showers, water efficient toilet, etc. by using this fixtures we can save up to 50% - 70% of water per day. The several technology discussed in the present paper have been successfully but in the practice for saving

water. Using large volume of water increases maintenance and life cycle costs for building operations and increases consumer costs for additional municipal supply and treatment facility vice versa facilities that use water efficiently can reduce costs.

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