

## Our Water System

Your water system is permitted and regulated by the Washington State Department of Health. We are required to follow DOH rules and regulations and are required to submit both monthly bacteriological testing samples and routinely sample our water for both organic and inorganic contaminants. We are required to have an operator, or management agency that is State certified in both the production and distribution of drinking water.

Hat Island Community produces its water from two sources; our ground wells and the Reverse Osmosis plant. We store final quality water in two concrete storage tanks located on the high spots on the NW and SE ends of the island in Divisions M and G. With the exception of those homes that surround the storage tanks our water is delivered through gravity feed. The homes nearest the tanks are served on separate pressurized systems.

Our 6 ground water wells are located around the NW end of the island. They are all dug to a depth that places them even with mean sea level and they draw water from the sea level aquifer. As such they are susceptible to salt water intrusion. The end of the island where the wells are located is high in iron and manganese deposits. Numbers 1, 5 and 6 are all located near the intersection of Snohomish Way and Camano Dr in Division A. Well #2 is located at the intersection of Skagit Way and Port Gardner Dr on lot E-4. Wells # 3 and #4 are located on the golf course (though #4 is so high in iron and magnesium that we do not use it for drinking water).

The water from all these wells is pumped to well house #1 on Snohomish Way where it is forced through a filter system. This filter removes most of the particulates from the water and leaves us with a product that while somewhat high in dissolved solids (iron, manganese and chloride) still falls within the quality limits set by the Washington State Department of Health. At the same time the water is chlorinated. From there it all goes into the top of G Tank where it is aerated. Water flows from G Tank to M Tank through a cross leveling line. The capacity of our two storage tanks is 312,000 gallons; additionally there is about 40,000 gallons in the distribution system at any time.

Water from both tanks is delivered throughout the island via a 6 inch main loop which circles the top of the island. 4 inch main lines branch off the main loop to feed large sections of the island where two inch lines deliver it to smaller sections. With the exception of Divisions S, U, I, T, N and H each of these delivery lines is a loop system. This means that the smaller feed lines loop back to the main distribution line. The advantages of a loop system are more even water pressure and the ability to isolate most sections of the system to work on small areas without disrupting service to the Island at large. The disadvantage of a loop system a difficulty is a difficulty in locating breaks.

Homes are fed off the loops using a "Hot Tap" which is not dissimilar from the small copper taps you may have used to install an ice maker in your home water system, just a lot bigger. The community system ends with a shut off valve and the water meter. Residents are responsible for the system beyond that point.

The homes that surround the storage tanks in divisions G and M are too high to receive their water via gravity feed. These homes are supplied by separate pressure loops. These homes lose water pressure when the island loses its main power feed from the mainland.

The Reverse Osmosis or RO system, built and installed in 2002, takes water from two beach wells, which serve to provide large particulate filtration, and pumps it to the RO system where it is forced through three large sand filters and two cartridge filters and finally pumped at very high pressure through a series

of semi-permeable membranes which filter out all the suspended particulates and almost all of the dissolved solids. The product has very little iron or manganese, but actually is similar in salt content to the product of our fresh water wells. The final water is adjusted for Ph, chlorinated, and pumped directly into the distribution system where it commingles with our well water.

During periods of peak demand and production, depending on where on the island you live, you will notice distinct differences in the “feel” of your water day to day. Our well water is lower in Chloride (salt) and higher in Iron and Manganese. It is “HARD WATER”. In the shower it rinses soap off easily and leaves your skin feeling dry. It is also what stains your toilet and leaves deposits on the elements in your water heater and dishwasher. RO water is higher in Chloride and much lower in Iron and Manganese and is what people call “SOFT WATER”. In the shower soap is harder to rinse off and it leaves your skin feeling slippery, it does not stain your toilet nor build up deposits on your heating elements. A very new set of RO membranes will produce water that is so low in dissolved solids that it approaches distilled water.

As the membranes age they become less efficient and allow higher levels of salt and minerals to pass through. Our RO system is four years old and is therefore approximately half way to the time when we should be replacing its membranes. (Money is in the RO reserve account to pay for that replacement). When the beach wells are producing at peak capacity the RO is capable of producing over 40,000 gallons per day, or 12 million gallons a year.

### **Frequently Asked Questions:**

Q: Why do we still have capacity issues, I thought that the RO was suppose to solve all that?

A: During the peak summer season there are 268 or more homes occupied each weekend. Using a conservative average of 200 gallons per household per day we consume 53,600 gallons per day which over a three day weekend is just over 50% of our total storage capacity. In a perfect world we can produce 40,000 – 48,000 gallons per day if we operate the RO and our fresh wells at full capacity 24 hours per day; this is neither practical nor affordable. We are an island and water will always be a limited resource.

Q: Why don't we run the RO all the time?

A: When the RO was first conceived it was as a supplemental water system. Over the years many of you have grown to think of the RO as our primary producer. While the RO is capable of producing 40,000 of water per day, that water that it produces is between 2 and 3 times more expensive than that of our fresh water wells.

Q: Why is the RO so expensive to operate?

A: There are many elements that go into the production of our water, labor, supplies, chemicals, repair parts. I'll address two of these. The RO is a very sophisticated and specialized instrument with a computerized control system, parts for it are wildly expensive compared to our fresh water wells which are fairly simple systems. But the easiest comparison to make is electricity. While the maximum capacity of the RO is 40,000 gallons per day it can not sustain that production. On average the RO runs 8-10 hours per day at about 26 gallons per minute that's roughly running at 82% of capacity. Lets call that cruising speed. To produce 40,000 per day we have to run the system at 32-34 gallons per minute for 24 hours, Lets call that flank or ramming speed. Just like you can't run a boat a flank speed all the time, we can't run the RO at full capacity constantly.

To produce water the RO requires three electric pumps, the 5 horse power beach well pump, the 55 horse power main pump and a 5 horse power finish water pump. Together it takes 65HP to run the RO. HP is a measurement of power consumption and one HP equates to 746 Watts. Therefore a one horsepower

motor running for one hour consumes 746 Watt/hours (ten 75 watt light bulbs would consume 750 watt/hours) But the RO uses 65 HP while it runs and over an hour consumes  $65\text{HP} \times 746\text{Watts/HP} = 48,490$  watts/hour or 48.5 Kilowatt/hours (KWH). At the commercial rate of \$0.08 per KWH the RO costs \$3.88 per hour to operate, during which time can produce 1,560 gallons of water which equates to \$.025 per gallon, just for electricity.

Our wells consume 5 HP per hour or 2.2 KWH which costs us 17 cents per hour during which time we can produce about 480 gallons; so the electrical cost per gallon is \$.003 per gallon.

Comparing electricity alone the RO costs 8 times as much to produce one gallon of water.

Q: Why do the RO's Beach wells have to be cleaned out each year?

A: When the beach wells were first drilled and tested there was no iron bacteria present, but over the years iron has infiltrated the wells and over time it fouls the pump blades and screens reducing the volume and pressure that the pumps can generate. As the RO demands huge amounts of water to operate, beach well production is critical. Until we can find a better long term solution the beach wells will require annual cleaning just prior to the summer season.

Q: How many more homes can be built on the island before we must install a second RO unit?

A: Our water system is authorized 461 connections. On December 31<sup>st</sup>, 2006 there were 268 residential connections, plus 23 community owned connections equaling a total of 291 connections leaving 170 residential connections. We have between 10 and 12 connections approved but not installed so there are 160 connections remaining before we will need to increase capacity based on water hook up authorizations.

However, 461 connections using 200 gallons per day will consume right about 100,000 gallons per day and we can produce a maximum production about 48,000 gallons per day so it is possible and likely that we will need to expand the RO plant long before we reach our 461 authorized connections.