

Water Treatment Solutions for [SMALL] Towns

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The Culligan logo is written in a blue, cursive script font.

Typical Issues with NL Surface Water

- Suspended Solids
- Colour & Turbidity
- Taste & Odour
- Dissolved Organic Carbons
- Contaminants (Iron, Manganese, Arsenic)
- THM's and HAA's



THM's and HAA's

- Trihalomethanes, Haloacetic Acids
- Not in the source water, but formed when chlorine oxidizes organics in the water
- Organics are measured as Total Organic Carbons (TOC's). Dissolved Organic Carbons (DOC's) are the part of TOC's that cannot be filtered out with a “regular” filter



THM's and HAA's

- Both THM's and HAA's are possible carcinogens - which would cause cancer
- Health Canada: Maximum Allowable Concentration of THM's = 100 parts/billion
- Maximum Allowable Concentration of HAA's = 80 parts/billion
- Some towns in NL have **TRIPLE** the MAC!!!



So, You Need a Water Treatment Plant Right?



All you need is a few million dollars...

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Can My Town Afford Water Treatment?

- There seems to be a perception out there that if you can't afford one of the large, expensive water plants, you simply have to put up with your poor water quality.
- “Potable Water Dispensing Units” were created so towns which could not afford such a plant can at least have a source of clean water...an excellent solution, especially for towns with high flow.



Can My Town Afford Water Treatment?

- The Potable Water Dispensing Units are the best solution if your flow is high compared to your population base. Certainly a success story in NL so far.
- In some circumstances however ALL of your water can be treated.



Can My Town Afford Water Treatment?

Even if you can't afford the Harley...



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Can My Town Afford Water Treatment?

You can still get from A to B like
Donnie



Donnie Dumphy - How to Be Deadly

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Can My Town Afford Water Treatment?

- Scalable treatment processes are available. Some of them are new, some of them have been around since public water systems were first built.
- KEY factor: Flow Rate. If your system is relatively free of leaks, you don't have any major commercial water users (eg fish plants), and your flow is relatively low, you probably CAN afford to treat all your water.



Can My Town Afford Water Treatment?

- Consider this: if your flow is < 50 US gal/min the capital cost for a full water treatment system may be less than the cost of a potable water dispensing unit!

So towns, consultants, and government need to look at all the options to choose the best path forward in water treatment.



Proposed Treatment Regimen

Remember our “typical” NL surface water issues:

- Suspended Solids
- Colour
- Taste & Odour
- Dissolved Organic Carbons (THMs/HAAs)
- Contaminants (Iron, Manganese, Arsenic)



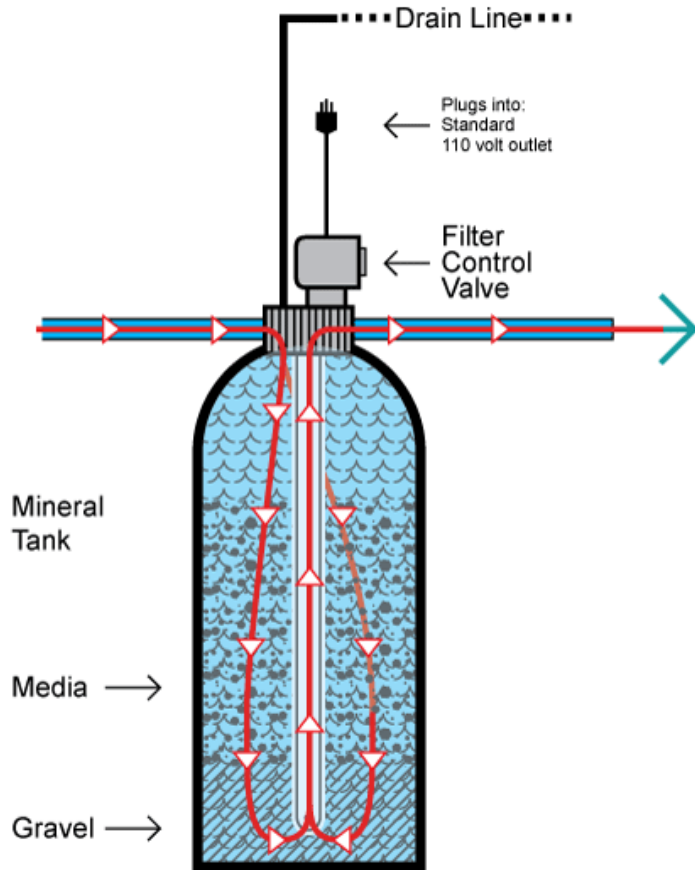
Suspended Solids: Depth Filter

- Filter vessel filled with sand, much like beach sand
- Can be multimedia, simply different sizes of sand-like material
- Removes suspended solids and some Turbidity.
- No chemical use required for cleaning, just backwashing.



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Depth Filter Backwashing



- In service, water flows down through the media, which catches the solids
- Filtered water flows up through the riser
- In backwash, the flow is reversed, driving water up through the media
- The dirt flies off and goes out to drain.

Organics: “Organics Scavenging” filter with Macroporous Resin



- Vessel is much the same as depth filter, but filled with beads of “polymeric” compounds (looks like caviar)
- Through ion exchange, the resin removes organics. It gives up chloride ions, and accepts fulvic and humic acids (major components of organics). Removing these removes colour.

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Organics: “Organics Scavenging” filter with Macroporous Resin

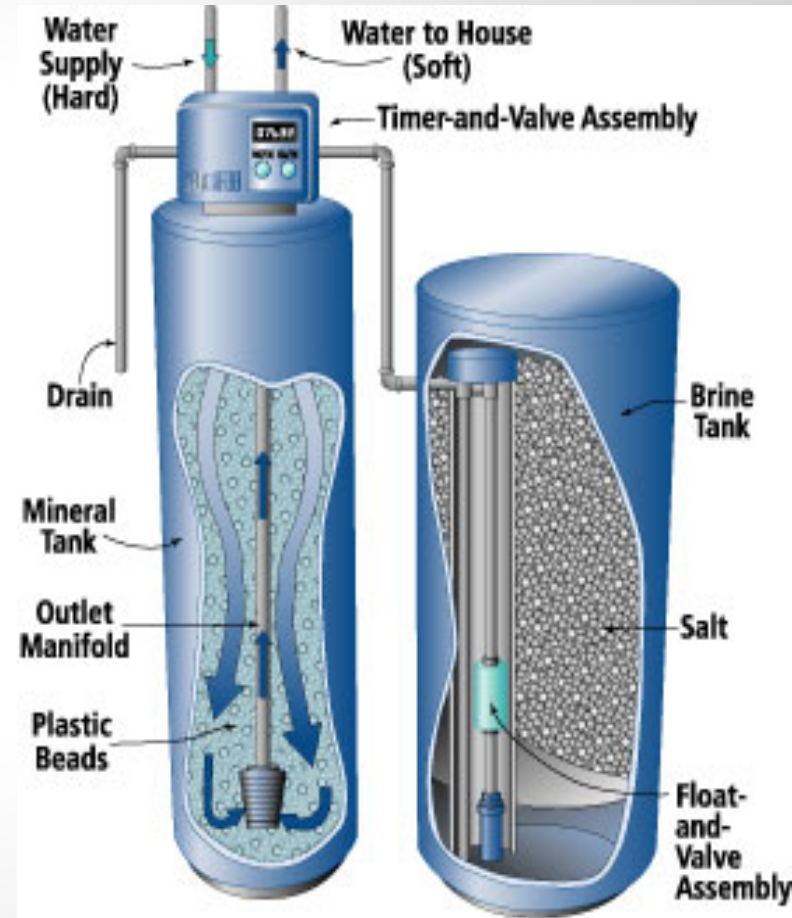
- Same as a softener used to remove calcium and magnesium ions, except the resin is specially made for accepting organics
- The resin will eventually become “saturated” with the organics, at which time it needs to regenerate.



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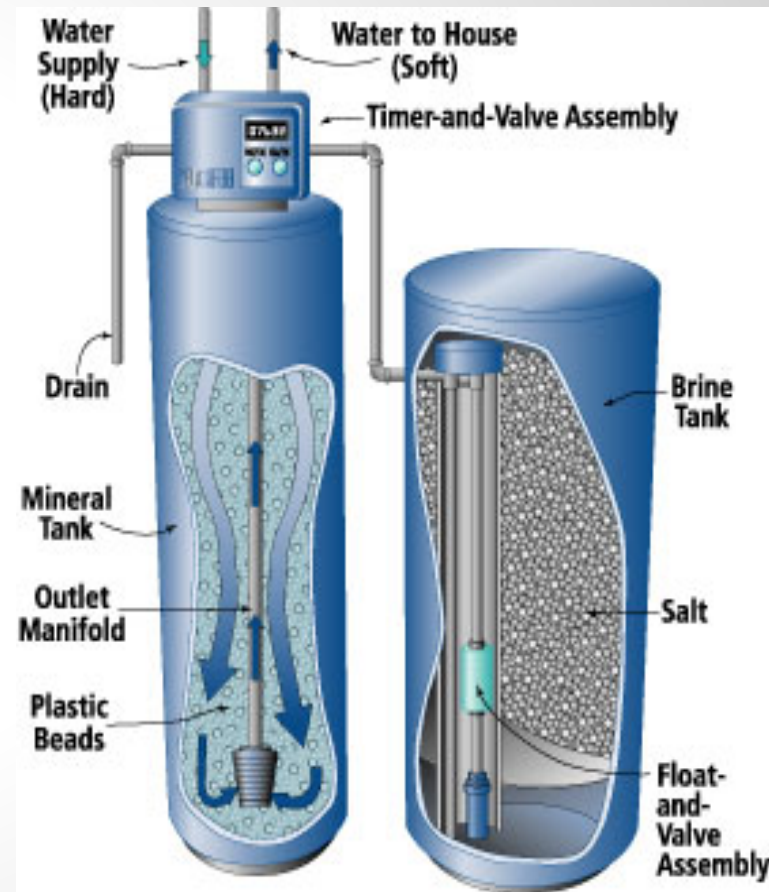
Organics: “Organics Scavenging” filter with Macroporous Resin

- To regenerate, it goes through a backwash cycle, also draws in brine solution from a brine tank
- The organics are thrown off to drain, the resin accepts chloride ions again to return to original state



Organics: “Organics Scavenging” filter with Macroporous Resin

- This process then uses a chemical - softener salt - which is the one chemical cost of the proposed system
- Softener salt is available from hardware stores at \$4.79/bag. A small town with flow of 25 USGPM would spend \$300 per month.



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Remaining Organics, Colour, Taste, Odour: Granular Activated Carbon



- Vessel is much the same as filter, and operates the same way, but filled with small grains of a type of charcoal or burnt coconut shells
- The carbon has a porous structure that gives it an inconceivable amount of surface area...1 gram = 1000 square meters surface area
- Organics, other molecules get trapped in the pores as water passes through the bed

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Remaining Organics, Colour, Taste, Odour: Granular Activated Carbon



- The longer the contact time (residence time) of water in the carbon filter, the better the removal of unwanted contaminants
- As the carbon grains become full of matter, they need to be backwashed.
- Much the same as the filter, water flowing in the reverse direction throws off the matter.

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Other Contaminants

- Iron & Manganese: conventional softeners, or Greensand filters
- Arsenic: activated alumina, anion exchange
- These are basically the same type of vessel and control head used in the other filters, just with different media.
- As needed these items can be added.



What kind of manpower is needed? How much maintenance is required?

Not much more than you are used to:

- No lab work
- Backwashing and regeneration are fully automated. They can be done on a time clock (typically every 3rd day, at 2am), or based on actual water usage recorded by an integrated flow meter.
- Just need to keep the salt tank filled!



What if my water is **HEAVILY LOADED** with organics?

- The media filter can be preceded with injection of a coagulant (eg Alum)
- Then your water treatment system would be the same as conventional water treatment (eg Bay Bulls Big Pond, Clarenville WTP), except without the sedimentation which is optional anyways.



What are the disadvantages/challenges?

- Resin in the organics scavenger will eventually be saturated beyond the point of regeneration. Life of resin is 3-5 years.
- Town would need to replace the resin - example cost \$2800 per 14" resin filter.
- Carbon will also need replacement every 4-6 years (\$540 per 14" vessel)

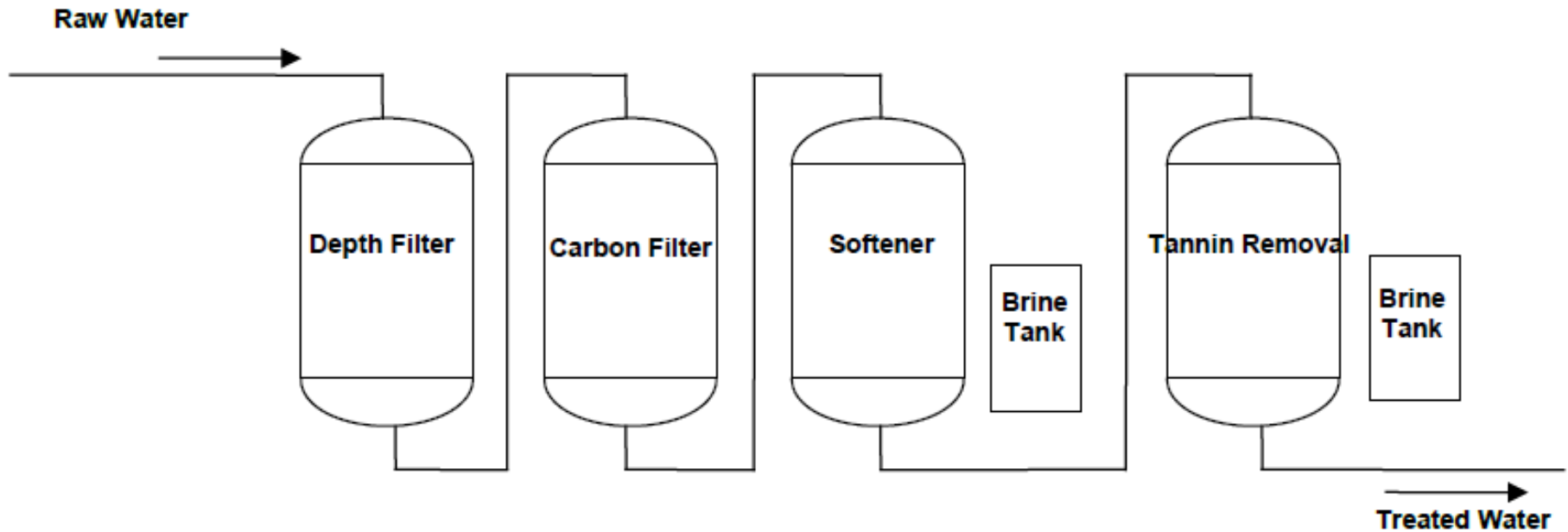


**What are the
disadvantages/challenges?**

*Towns need to Budget and
Plan for media replacement!*

The logo for Culligan, featuring the name in a blue, cursive script font.

Example of Treatment System Layout



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What if I have no reservoir tank, and my system is “always on”

- You would need to double up to facilitate backwashing...two depth filters, two carbon filters, two organics scavengers, and one shared brine tank that is a little larger.
- In each case while one unit is backwashing/regenerating, the other is on line.



Example of Installed Treatment System



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Flexibility of the System

- The depth filter, carbon filter, and organics scavenging filter are all complete technologies that may be used on their own or in combination
- For example, if suspended solids are your main concern, all you may need is a depth filter, then there's no chemical costs.
- Carbon alone is a viable treatment option



Case in Point: Town of Salvage



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Case in Point: Town of Salvage



- Salvage had an older Culligan Hi Flo 50 that hadn't been in proper use for years.
- Chlorine usage was very high. THM's were QUADRUPLE the MAC.
- We filled them with new coconut GAC.

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Case in Point: Town of Salvage

- They put in new electronic controllers like the ones shown in this picture.
- The system was reinstated July 2014, no other treatment was added.



Case in Point: Town of Salvage

- With placement of new coconut-shell GAC Salvage was able to completely clarify their water. Remember GAC has a 4-6 year life.
- Achieved reduction of chlorine usage to $\frac{1}{3}$ of previous levels!!!
- Waiting for results of THM tests but they will be lower, as both chlorine and THM precursors have been largely reduced.



Concluding Remarks

- The level of water treatment can be “as good as bottled water”, or based on budgets, could be only selected to do the most important part of the job (partial reduction of organics only to meet THM/HAA limits)
- Many vendors including Culligan can provide a full test of these processes either as a ‘benchtop’ analysis, or even a small scale pilot at your plant for very little cost.



Concluding Remarks

- Towns need to realize that affordable treatment is available, scaled to your flow and water plant size.
- THM's and HAA's are a serious concern. If a town cannot afford or get funding for a membrane, ozone, or full conventional water treatment plant, the quest for reducing these byproducts should not end there.
“Intermediate” solutions are available.



Questions?

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