

Memorandum

TO: Constituents Served by Wareham Fire District – Water Department
(Wareham Water)

FR: Board of Water Commissioners

CC: Prudential Committee

Date: March 24, 2017

RE: Response to Questions and Information Requests at the
Water Purification Plant Article Workshop on March 16, 2017

On March 16, 2017, Wareham Water held a workshop to discuss and answer questions regarding the proposed water purification plant warrant articles. A copy of the PowerPoint is posted on our website and WCTV has a video of the workshop. In the workshop, there were two warrant articles proposed that are associated with the water purification plant, Warrant Article 7 and Warrant Article 14.

Warrant Article No. 7 is for the base water purification plant which provides filtration to remove manganese and iron, as well as providing disinfection. It should be noted that these are regulated contaminants. *Inaction on our part will likely result in an administrative consent order by MassDEP in the next few years.* The Board of Water Commissioners recommends the voters approve Warrant Article No. 7.

Many questions were asked and more information was requested. The purpose of this memorandum is to provide responses to questions which were asked during the workshop as well as provide more background information to requests for information. In addition, questions have been submitted via email from a patron who was not able to attend the workshop. Responses to those questions have been provided here as well.

1. What are health risks associated with Warrant Article No. 7? Should I be concerned?
 - a. **Wareham Water Response:** The Massachusetts Department of Environmental Protection (MassDEP) has elected to regulate manganese based on the current health risks associated with elevated levels of the element in drinking water. Similar is true regarding pathogen levels.

The following health related statements have been made by MassDEP, the United States Environmental Protection Agency (USEPA), and the Center Disease Control (CDC). The Board of Water Commissioners would like to reiterate that the since these items are regulated, Wareham Water will be mandated to address these constituents and as such have taken action today.

i. Manganese:

1. <http://www.mass.gov/eea/docs/dep/water/drinking/alpha/i-thru-z/mangfactsheet.pdf>
2. <http://www.mass.gov/eea/docs/dep/water/drinking/mnpws13.pdf>

ii. Viruses:

1. <https://safewater.zendesk.com/hc/en-us/sections/202346137>

iii. Cryptosporidium:

1. <https://safewater.zendesk.com/hc/en-us/sections/202346417>
2. https://www.cdc.gov/parasites/crypto/gen_info/infect_ic.html

iv. Giardia:

1. <https://safewater.zendesk.com/hc/en-us/sections/202346327>
2. <https://www.cdc.gov/parasites/giardia/index.html>

2. Abandon Well No. 9 as well as other Manganese containing wells.

- a. **Wareham Water Response:** Not removing manganese by treatment will likely mean we would have to discontinue using Well Nos. 3, 4, 6, and 9 which contain elevated manganese. The remaining wells would provide insufficient supply to meet our maximum daily demands. In addition, Well No. 9 is a high yielding well and part of the District's long range plan in meeting future demands. Currently we have invested over \$2M in developing and building that well. The Board of Water Commissioners feel that the benefits outweigh the negatives associated with Well No. 9.

3. Can we replace the existing wells?
 - a. **Wareham Water Response:** Couple of responses to this question:
 - i. It is expensive. As a starting round number, it is \$1M to construct the well, not including costs associated with constructing transmission piping, purchasing land, permitting, etc.,
 - ii. It is all one aquifer so it does not guarantee that the problem is solved with a new well so funds could be “wasted”,
 - iii. The MassDEP Water Management Act, which regulates the amount of water we can pump, has Maples Springs Wells Nos. 1 through 4 grandfathered under the permit. That means these wells have the most flexibility as to when we can pump and how much. If we abandon Wells No. 3 and 4 due to elevated manganese (and potentially Well No. 1 and 2 if manganese increases in the future), we will not have this flexibility in the new wells constructed, so increasing the costs mentioned above by potentially requiring Wareham Water to construct more than one well to replace one well,
 - iv. We are land limited so we do not have a lot of places to put a new well without trying to purchase more land (e.g. increasing the cost of new well), and,
 - v. The timeline for getting through the entire process of obtaining funds, finding land, finding a productive well, and permitting can be long, up to decade in length. It is not a straightforward process.
4. Are you adding any staff?
 - a. **Wareham Water Response:** No. Historically MassDEP has allowed facilities such as these operate remotely where the operator only needs to be on site for four (4) hours a day. Under these conditions, we will not be required to add any more staff than we currently have today.
5. Sampling for SOC’s has been inadequate.
 - a. **Wareham Water Response:** Historically we have budgeted upwards of \$50,000/year of the rate payer’s money to voluntarily monitor this issue. A more robust monitoring plan would cost hundreds of thousands of dollars. We do not believe this to be the best use of the rate payer’s money. We believe we are at a junction since we are proposing the water

purification plant to allow the consumer to decide whether they would like to address the issue at this time.

6. Have the proposed construction costs been confirmed?
 - a. **Wareham Water Response:** Our consultant Kleinfelder has developed the construction cost on a line item basis similar as would be done by a contractor. We have also reached out to a contractor and they have confirmed that the cost we have developed is reasonable. Hence the Board of Water Commissioner do not expect to exceed this value. It should be noted here that the construction market for these types of projects rise and fall and as such it is not within our control to provide an exact number. However, we followed the best practices in the industry and believe we have carried sufficient contingency to cover these variations.
7. Where are SOC's coming from?
 - a. **Wareham Water Response:** We believe the SOC's to be associated with clandestine dumping and/or from agricultural activities up-gradient from the wellfield.
8. What is cause of Manganese and iron issue? One should address this issue before building the WPP.
 - a. **Wareham Water Response:** The Plymouth-Carver Aquifer that feeds our water supply wells was formed thousands of years ago by glacial deposits of sand and gravel. These deposits yield large volumes of water, but contain significant amounts of the naturally occurring iron and manganese distributed throughout the underground aquifer. The minerals can be at higher levels in certain areas and lower levels in other areas, depending on how the glacier deposits originally formed. These minerals can be either in solid form, or dissolved in the groundwater. The groundwater which Wareham Water pumps tends to be corrosive (low pH) hence the water has a propensity to dissolve metals into solution.

Elevated iron and manganese is a common occurrence in Massachusetts aquifers, and many other towns have also had to install treatment systems to filter iron and manganese. Examples are: Dartmouth, Marion, Mattapoisett, Dighton, West Bridgewater, Harwich, Mashpee, Holliston, Mansfield, Middleboro, Danvers, and Brewster to name a few. While being a common, it is not well understood why iron and manganese levels can remain low for many years and then increase in certain wells, as we have observed in some of ours. There are several inter-related factors that could cause the minerals to become dissolved and mobilize in

the water, including the water pH, the amount of oxygen present, and the presence of natural microbes. These factors can change in unpredictable ways over time and be influenced by several variables including the amount of water pumped, changes in nearby land use, the amount and pH of rainfall, and proximity to wetlands. What is typically observed, however, is that once levels start to rise, they tend to stay elevated. Although Wells 1 and 2 are currently low in iron and manganese, they are so close to Wells 3 and 4 and of the same age and depth, that it is likely that they will all develop high iron and manganese in the future.

Since the minerals are present throughout the aquifer, and exact location and reasons for higher levels cannot be pin-pointed, the cause cannot be removed or eliminated. It is noted that during the 1980s, technology solutions were tried in several communities that injected oxygen into aquifers. These technologies have since been abandoned as they often resulted in 'plugging' the aquifer and rendering wells un-usable.

The only alternatives therefore (once blending and sequestering are no longer sufficient, which WFD has tried) are 1.) abandon a well and find a new location or 2.) install treatment to remove the iron and manganese.

Before deciding to build treatment, finding a new well location was carefully considered as an alternative by the Water Commissioners. Developing a new well is a time consuming and costly undertaking involving exploration and testing, obtaining permits, and purchasing land and/or negotiating easements. A new well must have a minimum of 11.5 acres of land around it that is owned or controlled by the water supplier. This process can take 5 to 10 years and cost in the millions of dollars. In addition, due to the unpredictable nature of iron and manganese concentrations, there is no guarantee the same situation will not arise in the future.

9. What is the existing debt load of Wareham Water?
 - a. **Wareham Response:** The existing debt load is provided in Table No. 1. The proposed water purification plant is forecasted to be online in ~2020. Wareham Water has obtained a State Revolving Fund (SRF) Loan which requires a positive vote at District meeting. The first repayment on the loan if approved would be once construction is substantially completed (~2020). Note this does not include betterment payments which are considered a pass through.

Table 1: Existing Debt Load for the Water Department from Capital Improvement Projects.

Original Loan Amount, Project Name, and (Principal Annual Payment)	Principle Remaining	Year Loan Ends
Issue Date: 11/1/2004		
<i>\$1,550,000 Water Mains (\$70 to \$80K)</i>		
Principal	\$581,240	2025
<i>\$1,545,000 Well No. 8 (\$70 to \$80K)</i>		
Principal	\$579,372	2025
<i>\$1,000,000 Water Mains (\$46 to 50K)</i>		
Principal	\$375,004	2025
Issue Date: 10/15/2007		
<i>\$220,000 Land Acquisition (\$10K)</i>		
Principal	\$110,000	2028
<i>\$150,000 Water Mains (\$10K)</i>		
Principal	\$60,000	2023
Issue Date: 6/1/2009		
<i>\$1,375,000 Water Tank (\$65 to \$70K)</i>		
Principal	\$815,000	2029
Issue Date: 10/15/2012		
<i>\$194,140 Water Storage Tank Mixing System (\$20 to 30K)</i>		
Principal	\$70,000	2020
<i>\$560,000 Oak Street and Indian Neck Road Water Mains (\$25-30K)</i>		
Principal	\$440,000	2032
<i>\$1,479,000 Well No. 9 (\$75 to \$80K)</i>		
Principal	\$1,155,000	2032
Issue Date: 10/22/2015		
<i>\$550,000 Land Acquisition (\$55K)</i>		
Principal	\$495,000	2026
<i>\$500,000 MS Water Quality/ Land Acquisition (\$50K)</i>		
Principal	\$450,000	2026
<i>\$558,000 Well No. 9 and Treatment Design (\$55K)</i>		
Principal	\$495,000	2026
Total Estimated Principle Debt	\$5,625,616	

10. Would like to see 5-year outlay of how the costs are going to play out

a. **Wareham Water Response:** See Table 2 below.

{Go to Next Page}

Table 2: Forecasted Operation Budget from 2020 to 2030.

Budget Item	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecasted Operation Budget	\$3,213,000	\$3,294,000	\$3,377,000	\$3,462,000	\$3,549,000	\$3,638,000	\$3,729,000	\$3,823,000	\$3,919,000	\$4,017,000	\$4,118,000
Existing Debt Payment	\$704,334	\$667,356	\$650,384	\$633,222	\$601,086	\$578,685	\$371,506	\$204,111	\$198,223	\$182,544	\$111,944
Estimated Water Purification Plant Payment											
Article No. 7: Fe & Mn removal and disinfection	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000	\$920,000
Article No. 14: SOC removal	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000	\$360,000
Estimated Operation of Water Purification Plant											
Article No. 7: Fe & Mn removal and disinfection	\$260,000	\$264,000	\$268,000	\$273,000	\$278,000	\$283,000	\$288,000	\$293,000	\$298,000	\$303,000	\$308,000
Article No. 14: SOC removal	\$190,000	\$193,000	\$196,000	\$199,000	\$202,000	\$206,000	\$210,000	\$214,000	\$218,000	\$222,000	\$226,000

Notes:

1. Values have been rounded to nearest \$1,000, except for existing debt.
2. Forecasted operation budget is based on a 2.5% increase each year based on FY18. Does not include betterment which is considered a pass through. Nor does this budget cover other capital projects such as main replacement, etc.
3. Operational cost for the treatment have been increased each year by 1.5%.
4. Operation budget numbers shown are based on Water Purification Plant running at 3.0 MGD for a whole operational year. For approximation, these number can be scaled linearly down based on flow through the water purification plant.

11. What are health risks associated with Warrant Article No. 14? Should I be concerned?
 - a. Wareham Water has been voluntarily testing for SOC's and been sharing the results with public and MassDEP. No formal maximum contaminant level has been set by MassDEP and USEPA to date. Warrant Article No. 14 is for additional treatment to remove synthetic organic compounds (SOCs) that are unregulated. The Board of Water Commissioners are not making any recommendation on this warrant article. Rather this is a voter's choice as this is treatment beyond what is currently mandated by the MassDEP.

i. Why is Wareham Water Concerned with the SOC issue?

1. The fact SOC's are being detected suggest a link to human activities up-gradient of the wells.
2. In the event of a chemical spill or miss-application, it is not certain that we would detect that spill before it reaches production wells.
3. The MassDEP guidance levels for SOC's have generally been decreasing over time.
4. The European Union, another regulator similar to US EPA, has lower guidance levels for SOC's compared to MassDEP highlighting the reasonableness for Wareham Water's concerns.
5. The monitoring for SOC's has been periodic on a grab (i.e. once or twice a year) basis. Not clear if sampling is detecting the "highs" or "lows" in SOC levels.
6. With the proposed water purification plant, Wareham Water will be drawing more water out of the Maple Springs wellfield over time.
7. The chemicals which are applied change. At times, analytical methods do not exist to analyze compounds in water.
8. Proper continuous monitoring of SOC's would cost hundreds of thousands a year or more. Hence the benefit of treatment as a physical barrier online all the time is better than monitoring for protecting community.

9. Once the SOC's are in the aquifer, travel time to the well can be <1 year up to 20 years.
10. The disinfection process with chlorine/UV may create SOC byproducts. The associated health risks with the byproducts are unknown.

The following are questions which have been submitted outside of the workshop meeting by Barry Cosgrove.

1. Am I correct that the only agricultural operation in the immediate vicinity of the wells is the neighboring Makepeace Cranberry bogs?
 - a. **Wareham Water Response:** That are several agricultural activities in the vicinity of the wells.
2. And among the pesticides you found in the water were, among others, the following:
 - a. Carbaryl correct?
 - b. And Carbaryl is a likely Carcinogen correct?
 - c. Chlorothalonil was detected also correct?
 - d. And Chlorothalonil is a probable Carcinogen correct?
 - e. And the level of Chlorothalonil found exceeded the EPA and MassDEP permitted levels correct?
 - f. And you also detected Norflurazon in the wells correct?
 - g. **Wareham Water Response:** The levels of SOC's found in the product wells and/or monitoring wells are provided in Table 3.

Table 3: SOC's Detected in the Aquifer

Pesticide (Trade Name)	Highest Value (Average Value) in Water to Date (ug/L)	MassDEP Guideline or Informal Guidance Concentration (ug/L)	Cancer Classification
Carbaryl (Sevin)	0.72 (0.004)	40	likely
Chlorothalonil (Bravo)	1.7 (0.011)	1.5	likely
Dichlobenil (Casoron)	0.19 (0.001)	7	possible
2,6-dichlorobenzamide (BAM)	2.6 (0.204)	32	non-cancer
Methoxyfenozone (Intrepid)	0.69 (0.20)	700	not likely
Napropamide (Devrinol)	3.7 (0.022)	800	not likely
Norflurazon (Evital)	1 (0.071)	10	possible
MTBE	5.4 (no average calculated)	70	possible

3. And this chemical is restricted from certain use in Zone two correct?
 - a. **Wareham Water Response:** Chlorothalonil is on the Massachusetts Groundwater Protection List which means that there are restrictions on the conditions under which the compound can be used within a Zone II groundwater recharge area:
<http://www.mass.gov/eea/agencies/agr/pesticides/groundwater-protection-list.html>
4. And all the wells are in zone 2 correct?
 - a. **Wareham Water Response:** Yes
5. And zone 2 is the “re charge” area ... or said another way the area that must be most protected from pollutants correct?
 - a. **Wareham Water Response:** A Zone II is defined in 310 CMR 22 as the area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated. The regulations in 310 CMR 22.21 describe the specific prohibitions against certain land uses and chemicals storage.

6. Am I correct that the water flows from the direction of the bogs (north) toward the wells (south)?
 - a. **Wareham Water Response:** On a macro scale, the groundwater flows from North to South in the aquifer.
7. Has Makepeace provided any proof that the chemicals found in the wells are chemicals that are not applied to their immediately neighboring bogs?
8. Am I correct that the current evidence is that the bogs use pesticides of the type found in the wells?
9. And in fact, Makepeace has never denied that the chemicals found in the water are chemicals they purposely apply to their bogs correct?
10. Is it therefore correct that the most probable cause for the pesticide levels and possible Carcinogens in the Wells are the pesticides applied to the bogs by the Makepeace?
 - a. **Wareham Water Response to Questions 7 through 10:** The agricultural compounds detected are consistent with the product application records provided by the growers at Wareham Water's request. It should be noted that not all the SOC's in Table 3 are agriculturally related.
11. Am I correct that the levels of many of the pesticide from the bogs which are found in the wells presently exceed the permitted levels considered safe for human consumption in Europe?
 - a. **Wareham Water Response:** The European Union has lower standards than the MassDEP.
12. I am correct that the cost to build the components necessary to remove the pesticides from the bogs is \$5.5M [plus approx. another \$200K every 3-4 years]?
 - a. **Wareham Water Response:** Warrant Article No. 14 which addresses the process for SOC removal is for \$5.5M. The operational costs have not been fully developed as the testing process is still ongoing and should be completed later this month. Estimates for operation are provided in Table 2.
13. So, the cost to taxpayers to install the treatment capabilities to remove the pesticides from the bogs would be about \$6 per month or about \$72 a year?
 - a. **Wareham Water Response:** The cost for the SOC removal or destruction treatment process is estimated at \$6/month.

14. And speaking of tax payers ... is it correct that that Makepeace uses the water it needs for its bogs for free?
 - a. **Wareham Water Response:** Wareham Water does not have any service taps that supply water to bogs. The bog operators report that the system is spring feed and/or uses their own surface water supply for bog operations.
15. And citizens pay a tax rate of about \$11 per \$1,000 in valuation but Makepeace pays a property tax rate of about \$11 per acre?
 - a. **Wareham Water Response:** This is outside the scope of operation for Wareham Water.
16. So then, the logic is this ... Wareham tax payers, who pay over 100x (at least) the property tax rate that Makepeace pays, are nevertheless being asked to burden the full cost of removing the pesticides from the town water wells ... which pesticides came from the Makepeace for-profit cranberry bogs?
 - a. **Wareham Water Response:** This is outside the scope of operation for Wareham Water.
17. And you have asked Makepeace to be a responsible citizen in this regard but they have failed and refused to provide you a response?
 - a. **Wareham Water Response:** Wareham Water has reached out to the growers to partner in addressing this issue. No formal response has been provided to date. We have partnered in the past in the monitoring efforts. Makepeace also has discontinued operation of one of their bogs which is up-gradient of the wells.
18. So, as far as you know now, Makepeace is willing to accept the risk that the entire town of Wareham could be made sick by their pesticides which have entered our water supply?
 - a. **Wareham Water Response:** This is outside the scope of operation for Wareham Water.
19. Were citizen's or any other entity, public or private, invited to comment on the Water District's informational flyer announcing the March 16, 2017 Workshop regarding the water treatment plant issue BEFORE the flyer was mailed /distributed? What citizen's or entities, if any, commented on the flyer based on your invitation for comment? Did the Makepeace company make any comments regarding the flyer before it was distributed? Were these Makepeace comments invited comments or unsolicited comments? Did

Makepeace inform you or the Fire District that it insisted on the removal of any and all references to cranberry bogs in the Water Purification flyer? Did the Makepeace company inform you any other Water District representative of its intent to bring legal action if the flyer made any reference to cranberry bogs? Who specially at Makepeace communicated this warning of legal action? Did you take this legal threat seriously? Did you comply with Makepeace's request?

- a. **Wareham Water Response:** The content of the informational flyer was developed by the Water Commissioners over a series of severally publicly posted meetings. A final draft version was provided to the growers as a courtesy. We reviewed suggested changes in consultation with our legal counsel and made selected minor changes to the flyer.
20. During the hearing, you were specially asked what were the possible causes of the SOC's entering the wells. and your first answer was "agricultural activities". You were then asked what agriculture activities and you stated "farming". Why did you refuse to answer the question by directly mentioning cranberry bogs? Was your failure to answer due in any way to the threat of legal action by Makepeace?
- a. **Wareham Water Response:** The flyer and workshop presented what we know for information, and described potential solutions to several water quality concerns. No legal action has been threatened by the growers with respect to these responses.
21. Did Makepeace advocate to you or to the Board of Water Commissioners not to recommend citizen approval of the treatment components designed to remove SOC's (Option B)?
- a. **Wareham Water Response:** No such statements were made. The 'citizen approval' recommendation is based on the fact that the SOC's are not regulated in drinking water (treatment is not mandated) and the levels are largely below health advisory thresholds.
22. Did Makepeace threaten legal action against you, the Board of Water Commissioners, or the Water Fire District if the Commissioners voted to recommend citizen approval of Option B (the installation of a GAC System within the Water Purification Plant)?
- a. **Wareham Water Response:** No such statements were made by growers.

23. If Option B is not approved ... what is the Water District's plan, if any, for the control and mitigation of these SOC's?
- a. **Wareham Water Response:** Provisions will be made in the proposed treatment design under Warrant Article No. 7 to allow to address the SOC issue at later date if needed.
24. Has Makepeace informed you or the Fire District that it will not accept any financial or legal responsibility for the intrusion of SOCs into the Town water wells?
- a. **Wareham Water Response:** No such statements were made by growers.

{End}

