1. **Will there be an opportunity to prepay the debt before it is borrowed from the Municipal Finance Authority (MFA)?**
   Yes. Once the project has been completed but in advance of the debt being locked in with the MFA the ACRD will provide an opportunity to prepay the debt. The estimated total cost per parcel of the prepayment is between $2,000 to $2,400 depending on the final costs of the project. Upon the completion of the project detailed information will be provided regarding the prepayment option.

2. **Where can I get more information regarding how we came to this point?**
   All the information is available from the ACRD website www.acrd.bc.ca. The information is based on the many questions that have been presented and how other local governments handled this process. A public meeting will be held in Bamfield on October 17th at 6:00 pm at the School (before the monthly Community Affairs meeting). In attendance will be ACRD staff, Chris Downey from Koers, and Island Health representatives, Gary Anderson and Stephanie Bruvall. For any other question please contact the ACRD (250) 720-2700 or email amcgifford@acrd.bc.ca.

3. **The Assent Vote (Referendum) – how will it be conducted?**
   Full details regarding the process are provided on the ACRD website. Please look for the legal advertisement that details the process, your opportunity, and your eligibility to vote.

4. **Will Ulta Violet Protection (UV) be required or not.**
   Providing UV protection as well as the filtration and chlorination is best practice for many DAF systems in the Province. Although in this design, UV treatment is not required to meet log credits. Salt Spring uses the same combination for it's water treatment plants. UV in a multi barrier approach provides the best protection against Cryptosporidium. The decision has not been made whether to include UV or not but the costs are factored into the estimates. Please refer to the UV Memo dated October 3, 2016 for detailed justification for inclusion.

5. **Would the use of UV be written into the operating permit if it is installed or could it be used only as needed for possible operational savings?**
   Yes, UV would be utilized full time if the system is designed and installed when the project is completed. The terms and conditions of the operating permit would be reviewed and updated in consultation with the ACRD to reflect the additional treatment.

6. **Could there be a partial treatment to reduce costs?**
   No, this would not be allowed, we must treat all water all the times.

7. **Will the water treatment increase the amount of Aluminum content in drinking water?**
   There are traces of aluminum occurring naturally in the water, but they are below standards. The DAF process will not add to the content, finished water must meet tolerances for water quality and testing is to continue regularly to monitor such levels on the finished product. These results will be reported publicly.

8. **How will Fire Flows be impacted by the capacity of the treatment facility?**
   The volume required for fire flows is to be provided by the reservoirs in the distribution system, this is one of their primary purposes and the ultimate volume of the reservoirs is designed on

the basis of fire flow needs. The capacity of the water treatment facility is not the limiting factor.

9. **Has the regional district considered other options such as "Design Build" to achieve the same or better results at a lower cost?**
   The Design Build process is something that has potential to provide cost savings for larger projects ($ 8 million plus). Essentially the owner (ACRD) would ask the possible contractors to team up with an engineer to provide the design to achieve intended results of the project. For this project, most of the treatment plant component sourcing work has been completed by Koers. This should be contemplated at the outset of the project and again generally to realize cost savings the projects are of a larger cost and scope.

   It should be mentioned that we do not have the resources on staff to oversee this project in a design build format, that would need to be contracted out, this would then reduce much of the cost savings within that model.

10. **What water quality can we expect from a new plant? Will the DAF process improve my household water quality?**
    The new DAF facility will deliver high quality drinking water. Users will experience a significant improvement in taste and odour with this updated treatment process. Not only will the 'earthy' taste and odour be gone but that of chlorine should be reduced.

11. **Do you have to upgrade the delivery system infrastructure as well?**
    No major upgrades are needed in order to commission the water treatment facility. Any works are contemplated in the project costs. BUT, there are needs to upgrade and improve the distribution system over and above the treatment facility. A review of the water system performed by Koers engineering in 2013 identified the priorities based on age, condition and water distribution needs.

    Other works will be ongoing as part of the ACRD's ongoing infrastructure upgrades and future asset management plan to ensure fiscal management over all of the ACRD assets.

12. **I heard that DAF is a new technology, so is it proven?**
    Yes, it is proven, the Dissolved Air Floatation process has been widely used for water clarification for the last 40 years and, in the last 20 years, DAF has become the main alternative to sedimentation. In the case of Bamfield, the use of floatation makes more sense than other methods as listed by the engineer because of the costs. Water treatment facilities on Salt Spring, at Coal Harbour, Tofino and in Port Hardy use DAF.

13. **Does the ACRD have experience with DAF technology?**
    Neither the ACRD Staff or Bamfield Water Contractor have direct experience, but there are commissioned facilities and training that will be available as a resource. We are confident the water operator will be able to manage the works.

14. **How will waste products be handled?**
    We are examining all options for disposal of the liquid waste or "float" from the DAF process. The operational costs are conservative and will be approximately $20,000 per year. As new technology occurs and the improvements are made to operation in the system we would hope

to see this cost reduced. The current plan has the waste trucked from Bamfield to an approved facility for disposal.

15. **Who's going to build the new plant? Will it go to tender?**
    The builder has not been chosen. If the borrowing bylaw is approved and the Detailed Design is complete, we will issue a RFP and qualified contractors who have experience with similar projects, especially water treatment plants who will bid on the construction and installation.

16. **How long will it take to build?**
    Once construction starts, it is expected to take between 8-12 months to build. The time line has the completion scheduled for November 2017.

17. **Why is Island Health directing the District to build a water treatment plant?**
    Island Health's mandate is to ensure the Canadian Drinking Water standards are being met. It is actually up the owner of the water system to come up with a solution to meet these standards. The ACRD and Engineer (in consultation with the BWS committee) has evaluated and came to a solution to have BWS adhere to the Canadian Drinking water standards. The fact is that Island Health has not directed the ACRD to build a treatment plant, it is a solution that was approved by Island Health.

    Regulation of drinking water quality is a provincial responsibility. Each province and territory has developed legislation and/or policies to protect the quality of drinking water from source to tap. All jurisdictions base their requirements on the Canadian Guidelines for Drinking Water Quality and enforce them through legislation, regulation or permitting.

    In BC, the authority for regulating drinking water quality rests with the Ministry of Health. In most Canadian communities, drinking water is treated, stored and delivered to homes and businesses by an incorporated Local Government, such as a Municipality, Regional District or an Improvement District. The ACRD manages the day-to-day operation, maintenance and monitoring of the drinking water treatment and distribution to ensure the water delivered to consumers meets the required drinking water quality standards.

    Water quality standards for all of BC are established by the BC Drinking Water Protection Regulation. Island Health has the authority to enforce the regulation through treatment standards (the Surface Water Treatment Objectives) and by attaching conditions to water system operating permits. In the case of the BWS permit for the water system, Island Health has included a condition to comply with the Surface Water Treatment Objectives through the use of DAF water treatment technology. On Vancouver Island all surface water systems serving over 500 people have had their operating permits modified to meet this treatment standard. The purpose of the policy is to add additional barriers in the multi-barrier approach to safe drinking water.

    To comply with Island Health's treatment standard, the ACRD, as the water system owner, is required to provide two treatment processes including filtration. The permit also includes a condition to meet a schedule for the design, construction and start-up of a DAF water treatment plant. The District must construct the plant because the terms and conditions on the operating permit are legally binding.

18. Why was DAF technology selected?

Dissolved Air Floatation (DAF) was selected based on Pilot Study which confirmed that this was the best available technology for Bamfield's water quality. Island Health has confirmed this is a selected technology to be used.

Understanding the capabilities of the various treatment processes to effectively deal with water quality issues, makes it possible to conceptualize potential treatment processes. For Bamfield, the following processes were considered viable options:

Conventional Treatment (Coagulation, Flocculation, Sedimentation/Floatation)

For municipal systems, the conventional treatment process for reducing turbidity and naturally occurring organic matter is coagulation, flocculation and sedimentation (floatation) typically followed by filtration. A chemical agent (coagulant) is added to the water to encourage suspended solids to bind together to form larger particles (flocculation). These larger particles are then removed after they sink (sedimentation). For low density particles, the process of Dissolved Air Floatation (DAF) can be used in place of sedimentation. DAF introduces a cloud of very fine air bubbles which attach to the floc particles causing them to rise to the surface where they are skimmed off. Following either of these two processes the water is typically filtered to remove the remaining particulate matter. Bench scale tests and pilot studies are completed to assess the effectiveness of various treatment processes and coagulants.

Ozonation

Ozone is a strong oxidizing gas that reacts with most organic and many inorganic molecules. It is more reactive than chlorine. The reaction is rapid in inactivating microorganisms and oxidizing metals such as iron and manganese. Unlike chlorine, it does not leave a residual after being added to the water. Since ozone does not produce a disinfecting residual, chlorine is normally added afterwards to provide a protective residual throughout the distribution system.

Gravity Filtration (GF)

Water enters a gravity filtration system above the media and passes downward through the granular media and supporting gravel bed. Filters are cleaned by backwashing upward through the bed with wash troughs suspended above the filter to collect the backwash water for disposal. Gravity filters can be used effectively for source water with lower turbidity levels.

Additionally, different types of adsorptive filter media are available, such as activated carbon. Carbon's particles have a large surface area with high adsorptive qualities. Activated carbon can be used to remove dissolved organic carbon compounds that are generated by decaying vegetation in the watershed, which is the main cause of high colour events and disinfection by-product formation. Biological filtration processes typically follow ozone disinfection and can be one of the most difficult to operate and maintain filtration system.

Membrane Filtration (MF)

Membrane filtration involves passing water through microscopic pores causing the suspended and/or dissolved solids to be physically strained out of the water. There are different types of membranes, which are classified by pore size. From largest to smallest, they are; microfiltration (10 to 0.1 um), ultrafiltration (0.1 to 0.01um), nanofiltration (0.01 to 0.001 um), and reverse osmosis with pour sizes as small as 0.001 um. Micro and ultrafiltration membranes have limited ability to remove dissolved organics and the addition of a coagulant may be

necessary. Inappropriate use of a coagulant can shorten the life of membranes. Pilot testing is typically required to verify whether or not particle removal can be improved with coagulant addition. Membrane treatment systems are more technically complex, have higher Capital and O&M costs.

CONCEPTUAL TREATMENT PROCESSES RELATIVE COSTS

See below for a list summarising some of the relative costs of the conceptual treatment processes.

	Relative Capital Costs	**Relative O&M Costs**
Option 1:		
DAF GF Chlorination	Moderate Moderate Low	Moderate Low Low
Option 2:		
Ozone GF (Biological) Chlorination	Moderate High Low	Moderate High Low
Option 3:		
GF (Activated Carbon) UV Disinfection Chlorination	High Moderate Low	High Moderate Low
Option 4:		
Conventional Treatment MF Chlorination	Moderate High Low	Moderate High Low

CONCLUSIONS

Based on the results of the pilot test, Option 1 is an effective treatment process for removing disinfection by-product precursors while reducing turbidity levels in the Sugsaw Lake raw water source. Also, based on the proposals received during the RFP process, it is a cost effective treatment process considering both Capital and O&M costs. There are several DAF plants that are currently operating on Vancouver Island. We are not aware of any Municipal Water Treatment Plants on Vancouver Island Utilizing Ozone or Activated Carbon media.

19. Why was Pilot testing limited to only the DAF alternative?

Prior to pilot testing it is important to select a couple of viable treatment processes that are currently available from reputable suppliers. Each process requires pilot testing to confirm the treatment effectiveness. Renting a pilot plant can cost anywhere from $25,000 to $50,000 each, plus the costs of operating, reporting and interpreting the results, which can add an additional $25,000 to $50,000. Given this cost the alternative was narrowed to the DAF plant before pilot testing proceeded.

20. Will there be waste generated from the treatment process?

Typically, the treatment processes associated with the removal of organics and turbidity all generate significant waste streams that need to be discharged into a municipal sewer, holding tanks or an onsite disposal system. Other products such as Geobags can be reviewed after

construction to determine if pumping and hauling can be replaced with dewatering and solid waste disposal.

21. What is Dissolved Air Flotation (DAF)?

Dissolved Air Floatation (DAF) is the process of floating the particulate and organic material to the surface of a tank instead of trying to settle them out before removal.

22. What are the benefits of DAF technology?

- The DAF process can accommodate facilities needing a small "footprint".
- The DAF process will physically organics that are contained within the water. Toxins that are outside the cells will be destroyed by chemical oxidation.
- The DAF process can help to remove microscopic parasites from treated water by physically removing their cells.
- The DAF process is very effective at reducing turbidity and removing organics. Coupled with filtration, the DAF process will provide extremely clear water that is suitable for disinfection by UV light.
- Once these substances have been removed, less chlorine will be required for disinfection and the taste and odour of the finished water will be significantly improved.

23. What would happen if a "No" vote is the result?

A "No" result means the ACRD cannot borrow the monies for 1/3 of the costs of the required treatment works and the project could not proceed. The Island Health terms and conditions on the Operating Permit requires the new treatment to be operational by January 31,2018, this condition will remain and an alternative will need to be developed with costs for consultation and engineering. A minimum 6 months is required before consideration of another borrowing bylaw can be given.