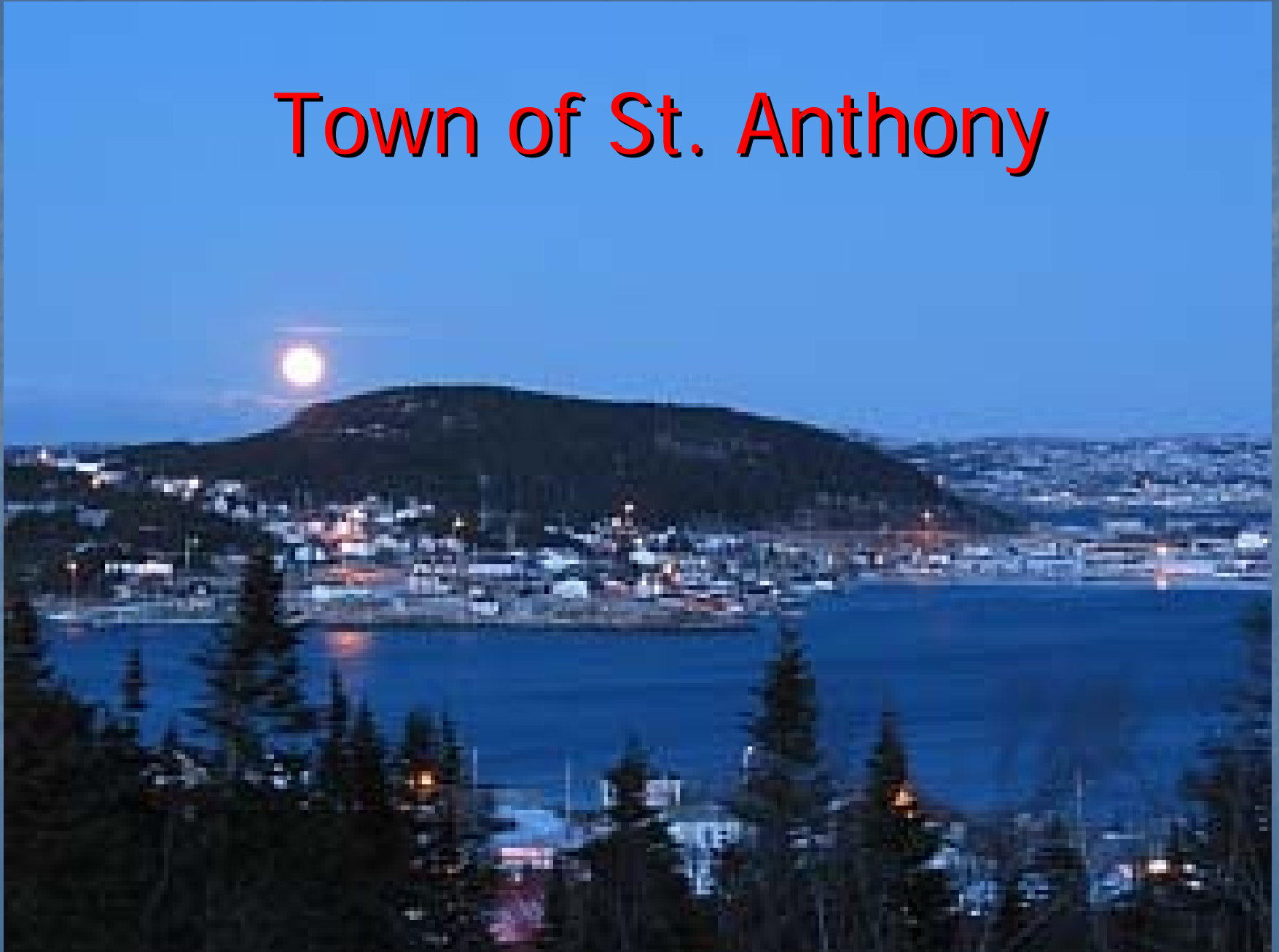


Frazil Ice Intake Issues

Curtis Richards
Town of St. Anthony

Town of St. Anthony



Presentation

Water Intake

Ice Frazzling/Shelling

- 1.0 Introduction – Town of St. Anthony
- 2.0 Town of St. Anthony's Water System
- 3.0 What is Ice Frazzling/Shelling
 - a. Time of the year
 - b. Number of incidents
 - c. What affects does it have on the community
 - d. How is it detected
 - e. How do we correct the issue
 - f. Long term solutions
 - g. Funding/Application/next steps
- 4.0 Conclusion - Questions

Introduction

- Incorporated in 1945
- 2496 population
- Service Center – Cook's Harbour to Goose Cove (5000 people)
- Large business sector
- Provincial/Federal offices

Introduction

- CNA/Cold Storage/Hospital/St. Anthony Seafood's Ltd.
- Town is responsible for
 - Public Works,
 - Parks and Recreation,
 - Tourism and Development
 - Volunteer Fire Department
- 17 employees
- Annual budget of approximately 2 million dollars

Town of St. Anthony's Water System

- The Town has a surface source (St. Anthony Pond) Secondary source (Western Long Pond)
- Intake extends approximately 100 feet and is at a depth of 25 feet.
- The plastic intake pipe is secured to a crib, that keeps it off the bottom and a buoy is used to locate the line.

Town of St. Anthony's Water System

- From the intake, water is then fed through the wet well and screens before flowing to our chlorine building.
- The 12 inch water main then extends approximately 2 km before branching into 3 separate lines that carry water throughout the community and into approximately 1000 homes and 100 businesses.
- Winter flow rate is approximately 2500 lt/minute - Summer flow rates increase to 7000 lt/minute
- Staff check for chlorine residuals 365 days of the year. When an issue arises we impose a boil order advisory and wait for government services to lift the boil advisory

Picture of Wet Well and Pond



Picture of Chlorine Building



What is Frazil Ice/Shelling

- **Frazil ice** is a collection of loose, randomly oriented needle-shaped ice crystals in water.
- It resembles slush and has the appearance of being slightly oily when seen on the surface of water.
- It sporadically forms in open, turbulent, super cooled water.

Frazil Ice Forming at St. Anthony Pond



What is Frazil Ice/Shelling

- We explain it more simply as; when the wind comes from a Northerly direction it brings slob and ice towards our intake. The ice forms along the shore and begins to retract towards the intake. Once it reaches the area around the top of our intake pipe, the suction created by the intake pulls the ice into the intake and forms a glob of ice/slush that blocks the main line and cuts off all water flow to the 1000 homes and businesses in St. Anthony.
- This situation usually occurs in late fall or early winter, when the temperature is around -10, winds are high and about 4 am in the morning.
- This is the worst possible scenario. It is dark, cold, windy and dangerous. Residents are awakening to no water!!!

Frazil Ice on a Johnson Screen



Frazil Ice on a Johnson Screen



How do we detect the problem?

- Detection is difficult, we normally discover the issue only after it has occurred. It is usually detected by an employee or resident who is up early in the morning preparing for work and they discover they have no water in their home.
- Upon receiving notification that water is lost to the Town, Public Works staff immediately begin the process of determining the cause and soon start the trek to the Pond.

Action Taken

- In the meantime, office staff members are called back to start notifying various groups of the situation, such as; Government Services, Council, Municipal Affairs, Emergency Committee (Stand by), media, businesses and hospital, etc..
- Organization would than need to make provisions to protect its own operation/business.
- For example , during our most recent event, Lab-Grenfell Health Authority had to take steps to prepare dialysis patients for a possible medivac to St. John's.

How is the issue Corrected?

- Once staff determines that water lost is a result of Ice Frazzling at the intake.
- Town staff would then determine the safest and quickest means of correcting the situation. In all cases this involves getting the main intake line out of the water/Ice and freeing the frazil ice from the line.
- In past 10 years the Town has lost its water due to ice frazzling approximately 5 times. The occurrences seem to be more prevalent in recent years and we feel that it is due to the changing weather conditions.

Occurrences .. How they were Corrected?

- Our most recent incident occurred on December 31st, 2010. Conditions at the time: St. Anthony pond was open frigid water with frazil ice forming at the near end towards the intake. Temperature -10, wind-chill -20, winds approximately 50 km, snow on the ground. (The day previous December 30th, 2010 staff was at the pond to carry out an inspection and everything was fine)
- To correct the problem, staff placed a boat in the water and began the task of reaching the buoy. Two of our employees are divers and have access to wet suits that they wear while performing this work. As well, everyone involved is required to wear safety flotation devices before venturing onto the ice or getting in the boat.

How is the issue Corrected, Con't?

- Workers beat their way to the buoy but because of high winds they couldn't maintain their position, let alone pull the intake out of the water.
- Due to the associated risks, staff came ashore and decided to wait for the winds to drop, or for more ice to form.
- Eventually the ice formed out to the buoy and the boat and motor was launched again in an attempt to pull the buoy. Still no luck.
- In a desperate attempt to raise the intake, a rope was connected to a vehicle and Intake Pipe was pulled sideways. The movement caused the loosening of the frazil ice and water began to flow.
- Line is presently out of its normal location and will not be corrected until spring 2011.

How is the issue Corrected?

Con't

- On another occasion in 2008, staff used chainsaws to cut a ice trench the length of the pipe.
- With the help of wench, staff raised the blocked line out of the water.
- Staff than wheeled the Steam Jenny onto the ice surface and freed the Frazil Ice blockage with steam.
- In both incidents, water was lost to the community for a period of 8 – 12 hours.







What affects does it have on our community?

- Medical Services

- Equipment malfunctions
- Patient care is jeopardized
- Surgeries and procedures have to be cancelled
- In some cases patients have to be flown out to other facilities for care.

- Boil Water Advisory

- Costs associated with placement and removal of advisory
- Costs incurred by businesses and other organizations

- Fire Flow eliminated

- Pumper Trucks are on back up

Con't

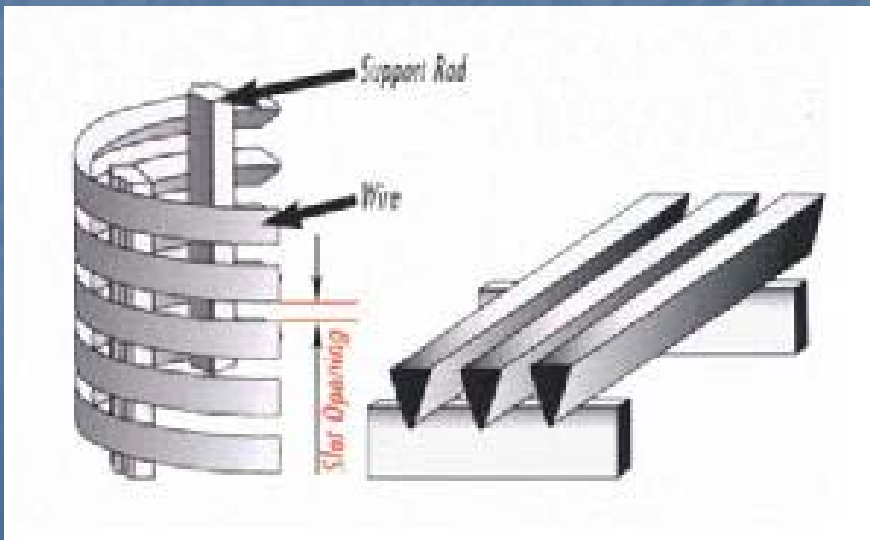
- Other Concerns
 - Fear of main line and service lines freezing
 - Fear of old lines collapsing
 - Staff Safety
 - Loss of Business
 - No other means for water
 - The whole community comes to a stand still

Possible Measures to Reduce Frazil Ice on Intakes

- Extend intake farther from shore
- Position intake in deeper water
- Reduce intake velocities
- Use vibration to free buildup of frazil ice
- Heated screens
- Provide a coating system on screens
- Back flow with air to dislodge frazil ice buildup
- Install baffle plate to intercept frazil ice

Vee-Wire Intake Screens

- Reduce intake velocities
- Screen slot sizes range from 0.01 inch to 1.0 inch
- Screen diameters range from 12 inch to 84 inch depending on flow and pressure drop requirements
- Vee-Wire technology helps prevent screens from fouling promotes effective backwashing



Typical Intake & Screen Arrangement

- Install vee-wire intake screen
- Extend into deeper water



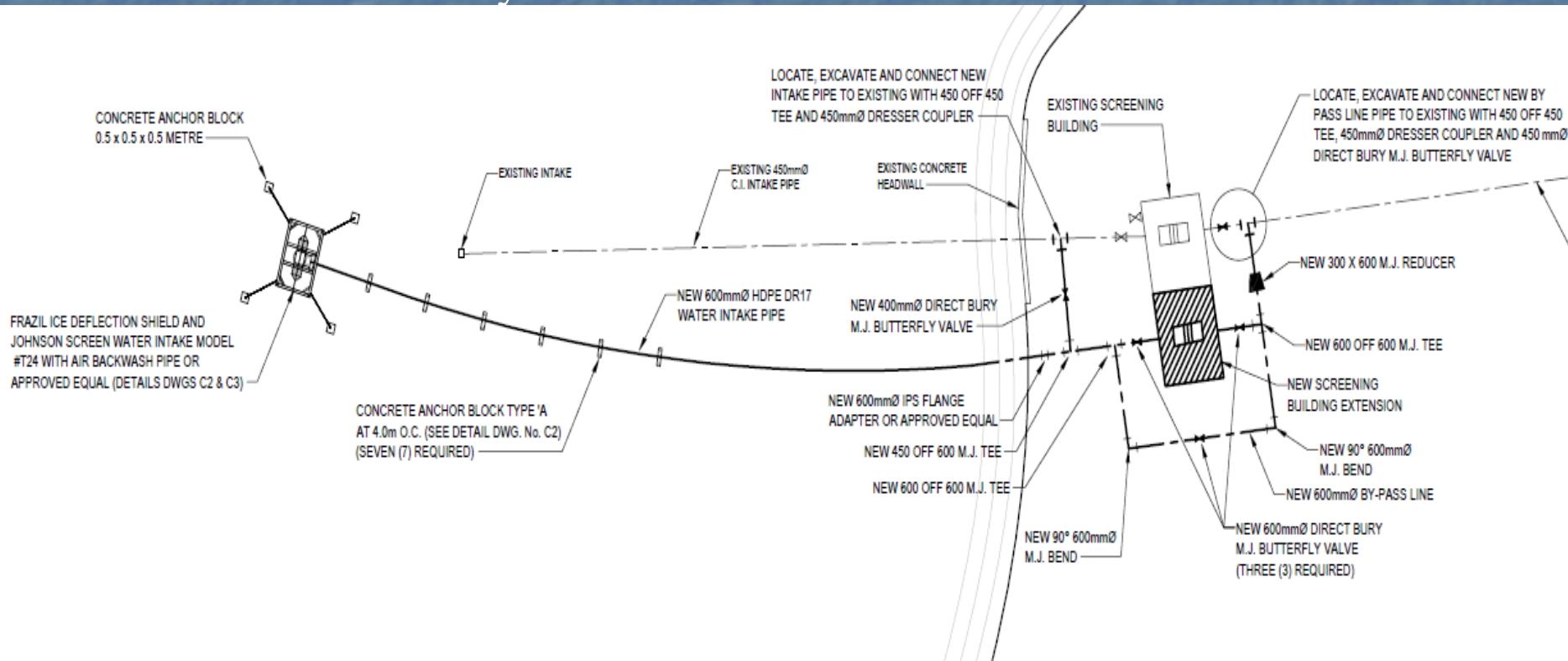
24 inch Dia. Johnson Screens



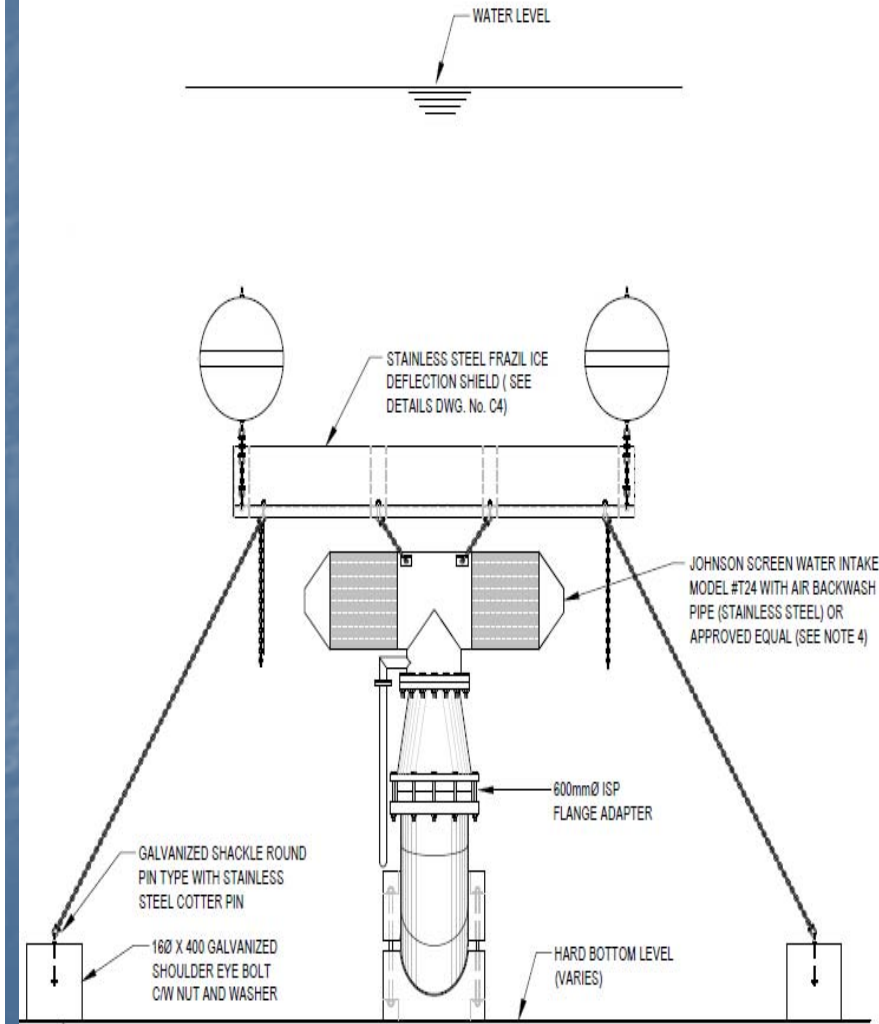
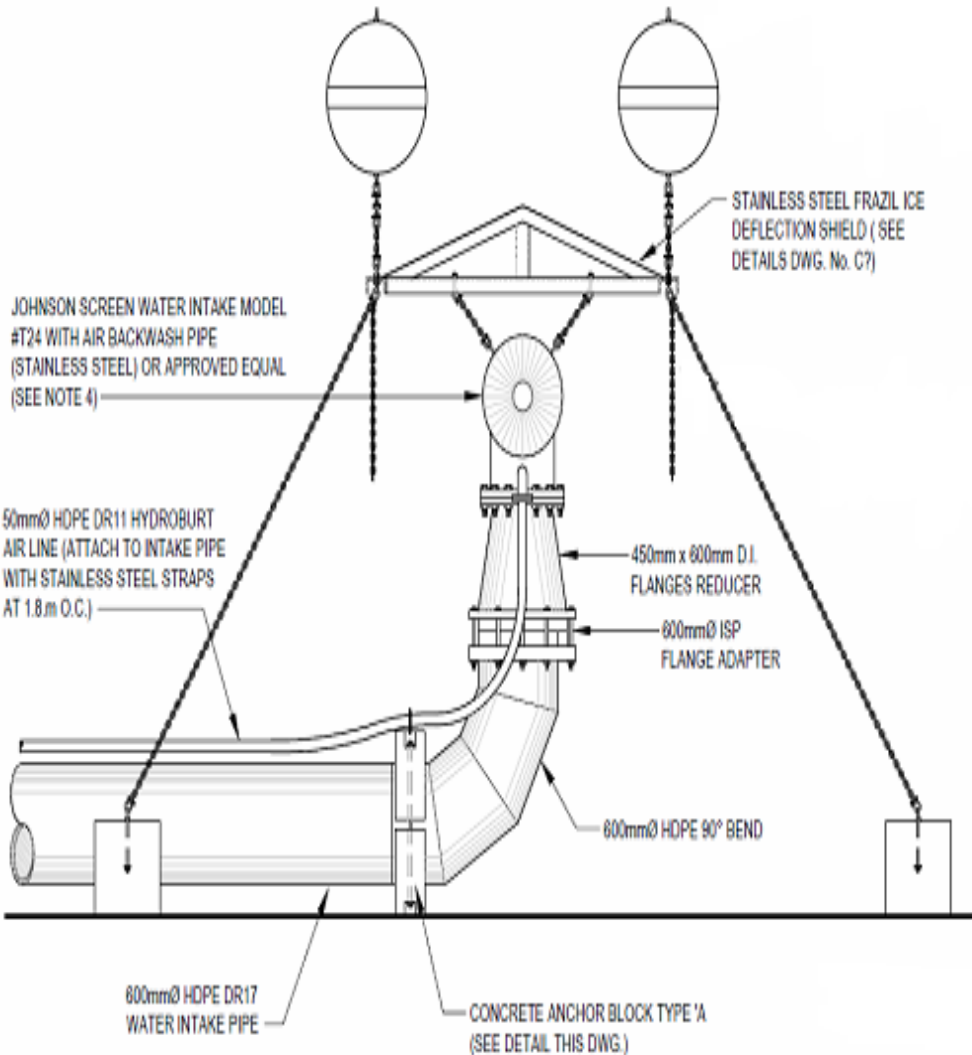
Extending Intake

Proposed Intake for the Town of St. Anthony

- Extend intake by approximately 40 ft
- Install 24 inch vee-wire screen
- Install frazil ice shield above screen
- Install air flush line for emergency backwash
- Install a heat trace system



Proposed Intake for the Town of St. Anthony



Recommendations

- Avoid locating new intakes in coves or on shorelines where prevailing north and north easterly winds tend to produce slush/frazil ice conditions
- Where possible, maintain a minimum water depth to screen of 10 ft
- Maintain intake velocities below 0.5 ft/sec
- Install a baffle plate above the intake screen to intercept frazil ice

Application/Funding

- The Town has received commitment from Municipal Affairs for funding to correct the problem.
- Our engineering firm NLCEL has prepared an estimate to complete this work, \$350,000.
- Town anticipates a permission to go to tender in the near future.
- Our Goal is to commence work this summer, ensuring that we don't have this issue during the winter of 2011-12.

Conclusion

- Thank you for your time
- Questions