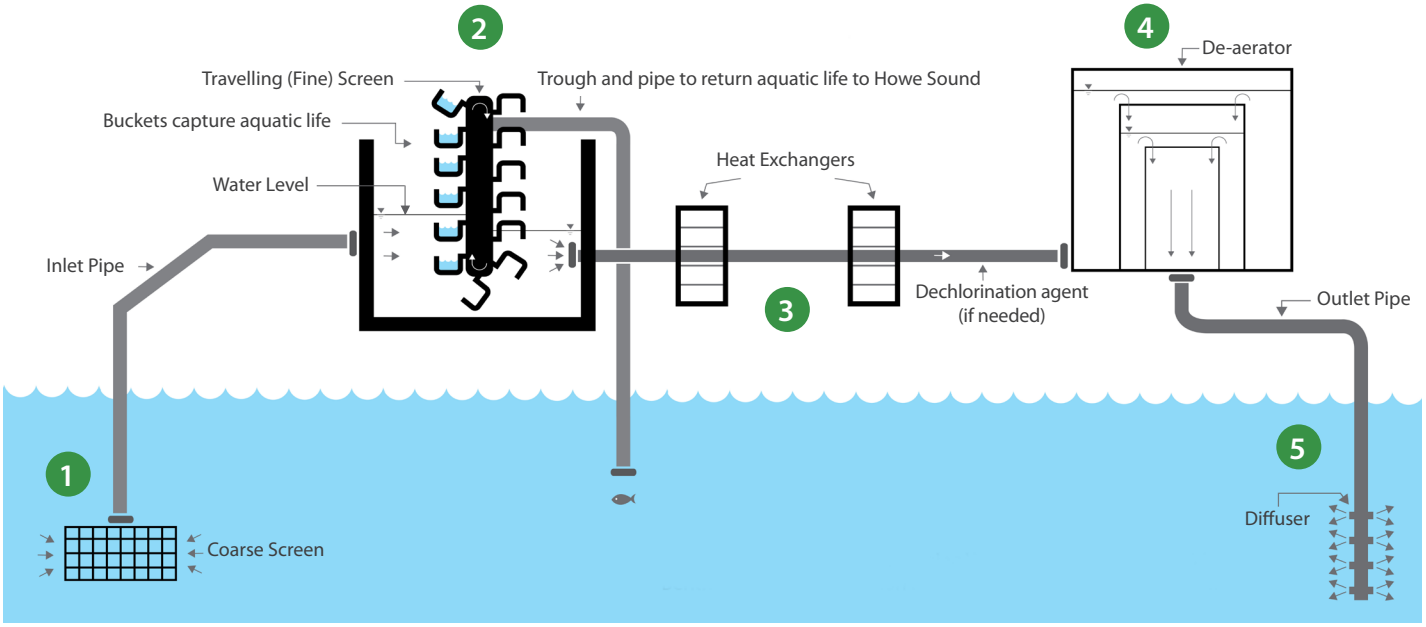
Seawater Cooling System

DID YOU KNOW?

- Seawater is one of the most abundant, efficient, and inexpensive cooling mediums available
- Seawater cooling has been used in more than 50% of the LNG plants built since the 1960s
- Seawater cooling produces less noise and visual effects than air cooling

Liquefied natural gas, or LNG, is natural gas in a liquid state. Natural gas becomes a liquid when it is cooled to approximately -162°C. This process, called liquefaction, shrinks the volume of the gas by 600 times, making it easier to store and transport to markets around the world. Heat created during the liquefaction process is typically removed through air or seawater cooling systems. Woodfibre LNG will use a seawater cooling system.

The seawater cooling system will comply with applicable legislation and guidelines, including the BC Water Quality Criteria, the Canadian Environmental Quality Guidelines, and the *Fisheries Act*. This will be achieved through Project design, chlorine removal, and the diffuser design. Below you will find an artist's rendering of the conceptual design of Woodfibre LNG's seawater cooling system.



1. INTAKE STRUCTURE

- The intake will be located at a depth of more than 25 metres, which is below the depth where marine organisms are found in the greatest numbers.
- The intake will be located approximately 2 metres above the seafloor, above sediment and bottom-dwelling organisms.
- The intake will be covered by a coarse screen, which will stop larger marine life such as adult fish and seals from entering the pipe.
- Seawater will enter the intake at a velocity of 0.1 metres per second, which is less than the swim speed of adult fish.

2. TRAVELLING SCREENS

- Once seawater enters the intake, it will travel through 4.75 mm (3/16 inch) travelling screens.
- The travelling screens rotate continuously, and move small fish and other marine organisms that travelled through the intake, into collection buckets that are filled with water.
- Any small fish and other marine organisms in the collection buckets are then returned to Howe Sound.

3. HEAT EXCHANGERS

- The heat exchangers operate on the same principles as the radiator of your car – except heat is transferred into the seawater rather than into the air.
- The seawater will travel through pipes past the heat exchangers, where the seawater will absorb the heat generated during the cooling of the LNG. The seawater will not come into contact with or near refrigerants of the LNG facility.
- A sodium hypochlorite (chlorine) solution will be added to the seawater in the pipe to discourage the growth of marine organisms that can cause clogging and make the system less efficient. The dosage of hypochlorite solution will be optimized and adjusted so that the minimum necessary amount is added to the seawater.
- Woodfibre LNG is currently investigating only adding sodium hypochlorite periodically as needed.

4. DE-AERATOR

- Before being discharged back into Howe Sound, the seawater will pass through a de-aeration tank. This tank is designed to encourage mixing of seawater and the air, which removes chlorine from the water.
- A de-chlorination agent will be added to the seawater, if it is needed, to reduce the chlorine concentration to meet water quality guidelines.

5. DIFFUSER

- Seawater will be discharged to Howe Sound through an outlet pipe and a diffuser system at a depth of more than 25 m, which is below the depth where marine organisms are found in the greatest numbers.
- The diffuser will include ports along its length to promote mixing of the seawater with the water around it, which helps reduce the volume of warmed water.
- The temperature of the seawater will be less than 21°C, or 10°C above the water temperature of Howe Sound, whichever is less.
- Residual levels of chlorine at the discharge ports will be less than 0.02 mg/L. This is much less than the chlorine in drinking water, which is approximately 0.04 mg/L to 2.0 mg/L.
- Within 10 metres of the diffuser, the water temperature will be less than 1°C different than the surrounding water (ambient water temperature) in Howe Sound.

DID YOU KNOW?

Because of the diffuser design and dissipation of heat, the total volume of water with a temperature between 1°C and 10°C above the surrounding water is expected to be less than 125 cubic metres (approximately 1/20th the volume of an Olympic-size pool). This volume will not increase over time.