

# Challenge Statement

How might we use robotics equipment to clean the inside of water tanks

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*Lower Seletar Reservoir*

# Background

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Service Reservoirs in Singapore store treated water in concrete tanks. These tanks are normally cleaned once every ten years -- or earlier if there are water quality issues. Service Reservoir tanks are categorised as confined spaces. They come in various sizes, ranging from 10,000 m<sup>3</sup> to 100,000 m<sup>3</sup>. The tank washing is typically carried out by up to 5 contract workers who use high-pressure hoses to wash away the sediments in the tank. The consolidated sediments are eventually removed manually from the tank by the workers. The whole tank washing process takes about two weeks to complete.





## 3 Types of Service Reservoir

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Fig 1a - Elevated tank



Fig 1b - Elevated tank



Fig 2 – Semi-buried tank



Fig 3 - Buried tank

# Equipment set up for tank washing



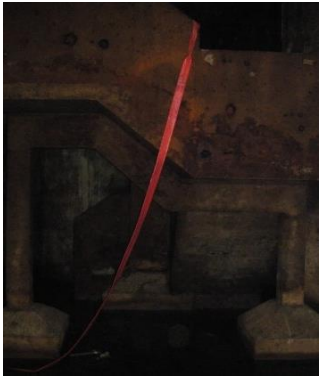
Hydrant



Water meter



Water Pump



Hose



Nozzle



Lighting & Air blower

# Illustrations of tank washing

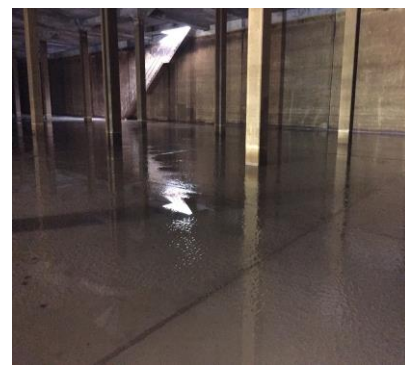
## Before Washing



(1)



(2)

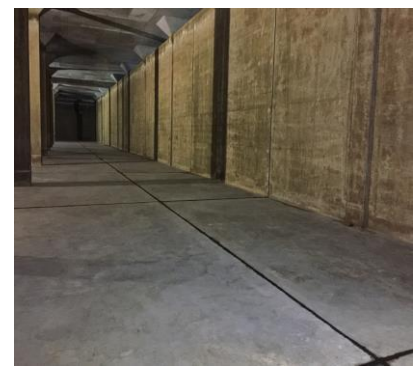
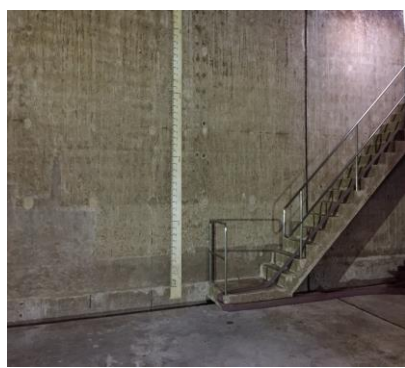


(3)



(4)

## After Washing

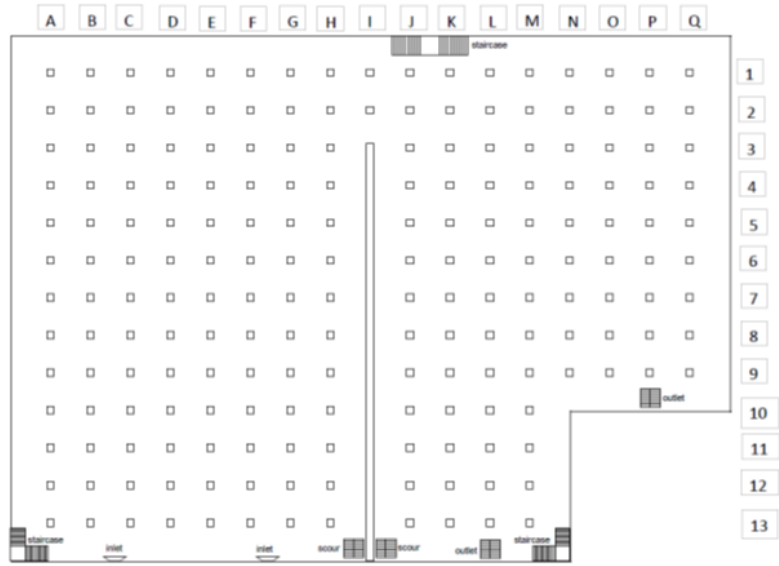




# Opportunities Areas & Key Considerations

The previous slide illustrates one of our bigger tank that has a dimension of 135m x 105m x 7m before and after cleaning.

The current method of washing is by connecting a hose from a nearby hydrant to pressure jet wash the walls and the floor. The collected sediments would then be scooped and collected into bags for disposal. These are the works needed to be done by robot to clean the tank.



# Opportunities Areas & Key Considerations

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The current tank washing method is a laborious and unsafe process. A tank-washing robot would help to eliminate the risks associated with working long hours in a confined space.

The tanks have not been designed to allow for the deployment of such robots. Hence, we are looking for robots which are light, modular and easily deployable. The robots should ideally also be able to work in both dry (empty tank) or wet conditions (submerged in water).



## Current Method of Tank Washing

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No. of men – 6 (1 confined space safety assessor)

Time taken – 2 weeks

Contractors that are engaged to carry out tank washing have to undergo medical examination to screen and test that they are free from water-borne diseases: typhoid and dysentery, cholera and infectious hepatitis. Only those with these medical certificates are allowed to carry out washing inside the tanks.

These tanks are also considered as confined space, hence ventilation has to be carried out prior to entering the tank. Also, prior to entering the tank, a confined space assessor is required to do a gas check before allowing personnel to work in the tank.

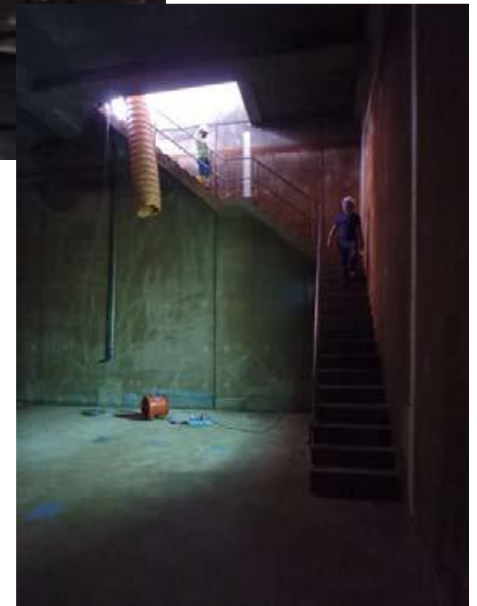




# Key Challenges

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- Entry to the water storage tank may be restricted to a small opening / hatch.
- The space to be cleaned is large and the time allotted for the cleaning may be limited to just a few days / up to 2 weeks.
- The interior of the storage tank is not lit.
- The surfaces may be slippery due to the presence of sediment / silt. Traction may be low, particularly on the walls.
- Collected sludge/sediment may need to be transported up and out of the tank through an opening at the top of the tank.
- No lifting equipment to lift the cleaning robot into the tanks



Thank You



*Lower Seletar Reservoir*