

PUB to deploy autonomous drones to enhance reservoir monitoring

Advanced drone system will aid in PUB operations, including management of aquatic plant growth and monitoring of reservoir activities



Singapore, 27 May 2021 – National Water Agency PUB will deploy Beyond Visual Line of Sight (BVLOS) drones to conduct monitoring at six reservoirs across Singapore, starting from the end of this month. Equipped with remote sensing systems and a camera for near real-time video analytics, the drones will initially be deployed at MacRitchie and Marina, before being rolled out progressively at Serangoon, Kranji, Lower Seletar and Lower Peirce later this year. They are specially programmed to observe water quality, and will also be used to monitor water activities.

2 Presently, PUB officers conduct daily patrols to look out for excessive growth of aquatic plants and algal blooms, which could affect the water quality in the reservoirs. During these patrols, data is also collected on water activities – such as fishing and paddling activities – in and along the reservoirs' edge, to ensure they are conducted safely.

3 Every year, a total of 7,200 man-hours are spent on these tasks. By tapping on unmanned drones to carry out monitoring operations, PUB expects to save about 5,000 man-hours which can be redirected to other works. The drones are capable of surveying large areas of the reservoir, collecting comprehensive data, and also triggering alerts when it detects activities such as illegal fishing.

4 Mr Yeo Keng Soon, Director of PUB's Catchment and Waterways Department, said, "With 17 reservoirs – which are an important water supply source for Singapore – under our care, it can be a challenge manpower-wise to effectively monitor what goes on at each reservoir and ensure the reservoirs are in optimal condition. Our use of drones is in line with PUB's commitment to leverage technology as part of the SMART PUB roadmap to improve our operations and meet future needs.

5 "With the drones, we can channel manpower to more critical works such as the inspection and maintenance of reservoir gates, as well as pump and valve operations. The drones also act as an early warning system that enhances our response time to the myriad of issues that our officers grapple with on a daily basis."

Advanced drone tailored for PUB's operational needs

6 PUB has awarded a contract to ST Engineering to utilise the Group's proprietary drone operating system, DroNet, which has been customised to meet PUB's requirements. This follows successful trials that were conducted at the reservoirs last year.

7 There will be one drone deployed at each reservoir. At MacRitchie and Marina, the drone will be housed in an automated pod, capable of taking off and landing autonomously. It will embark on pre-programmed flight paths within the reservoir compound, and will be monitored remotely by an operator. The drone is programmed to carry out the following tasks:

- **Monitoring water quality:** The drone's water quality remote sensing system analyses the water for turbidity and algae concentration – these measurements provide a good correlation to actual water quality. If necessary, PUB officers will be deployed on-site to collect water samples for further laboratory analysis;
- **Monitoring aquatic plant growth:** Using video data collected during earlier trials, a video analytics algorithm will identify aquatic plant overgrowth in the reservoir via the drone camera's live video feed. The algorithm is also capable of differentiating between plants that are breaking the water surface and plants that are submerged;
- **Monitoring water activities such as paddling activities (e.g. kayaking) and fishing:** Drone camera's live video feed will capture these activities – a video analytics

algorithm will flag potential concerns such as anglers fishing in non-designated areas or overcrowding of vessels in a particular area.

8 PUB officers will be able to monitor the statistical data and live-video feed from the drone via an online dashboard. Near real-time alerts on illegal water activities will also be sent to a dedicated Telegram channel that officers can access via their mobile phones. They will then be able to prioritise urgent cases that pose potential danger to public and respond in a timely manner.

To download photos and footage of the drone, visit: <https://bit.ly/3hxYjt2>

Annex A: Infographic on PUB's drone deployment

Annex B: Frequently Asked Questions (FAQs)

For media queries, please contact:

Mr Lee Min Kok
3P Network Dept, PUB
Tel: 9756 5514
Email: lee_min_kok@pub.gov.sg

Ms Hana Schoon
3P Network Dept, PUB
Tel: 8322 8922
Email: hana_schoon@pub.gov.sg

About PUB, Singapore's National Water Agency

PUB is a statutory board under the Ministry of Sustainability and the Environment (MSE). It is the national water agency, which manages Singapore's water supply, water catchment, and used water in an integrated way. From April 2020, PUB also took on the responsibility of protecting Singapore's coastline from sea-level rise as the national coastal protection agency.

PUB has ensured a diversified and sustainable supply of water for Singapore with the Four National Taps (local catchment water, imported water, NEWater, desalinated water). PUB leads and coordinates whole-of-government efforts to protect Singapore from the threat of rising seas and the holistic management of inland and coastal flood risks.

PUB calls on everyone to play a part in conserving water, in keeping our waterways clean, and in caring for Singapore's precious water resources. If we all do our little bit, there will be enough water for all our needs – for commerce and industry, for living, for life.

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Annex A: Infographic



Annex B: Frequently Asked Questions

1. Is recreational drone-flying allowed at the six reservoirs?

PUB's drone deployment is solely for operational purposes and has been approved by the Civil Aviation Authority of Singapore. With the exception of Marina Reservoir (*subject to obtaining the required permits*), the public are not allowed to fly drones at the other five reservoirs. A full list of the parks and Nature Reserves where drone flying is not allowed can be found on the National Parks Board's (NParks) website [here](#).

2. How often will the drones be flown at the six reservoirs?

Drone flights at Marina and MacRitchie will be conducted four days a week, at regular intervals throughout the day. At the other four reservoirs, the frequency of drone flights will be approximately one or two days a week.

3. The drones that PUB is using are quite large. Will my safety be compromised should a drone crash?

The drones are equipped with robust redundancy systems that will prevent total failure. Contingency plans are in place for an operator to take over and manually land the drone in the water.

4. Is the drone equipped with facial recognition technology? Will my data be collected without permission?

The cameras installed on the drones are used solely for PUB's operational needs, and are equipped with video analytics capabilities to conduct monitoring of reservoir water quality, aquatic plant growth and water-related activities. Personal data in any form, including facial recognition, will not be collected.

5. I live near one of the six reservoirs. Should I be concerned about my privacy?

The drones will fly according on pre-programmed flight paths over the water body and will stay clear of residential areas.