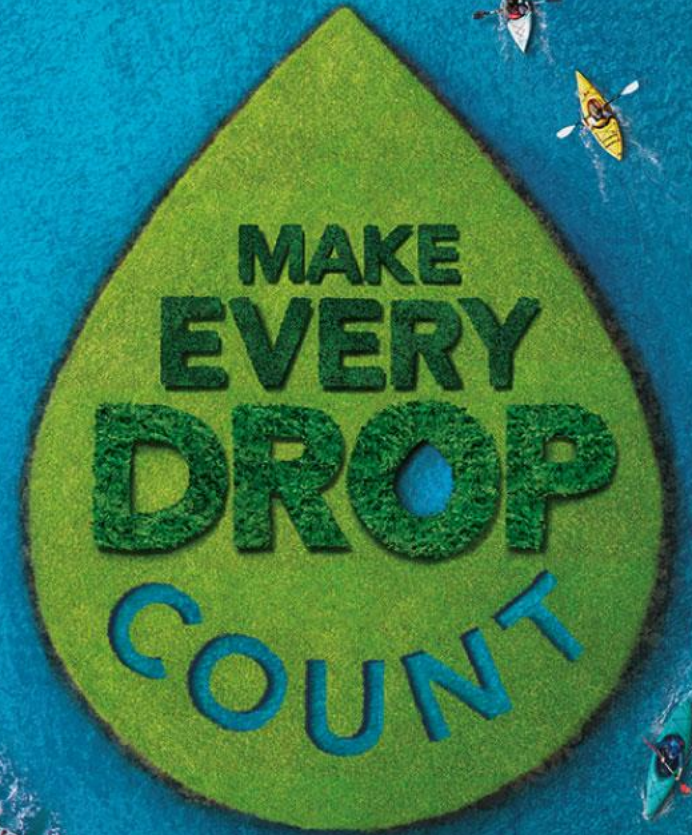


Best Management Practices for Farming Activities

19 Sep 2024



Why control water quality within water catchment?



Rain generates surface runoff



Runoff is released into the drains and canals

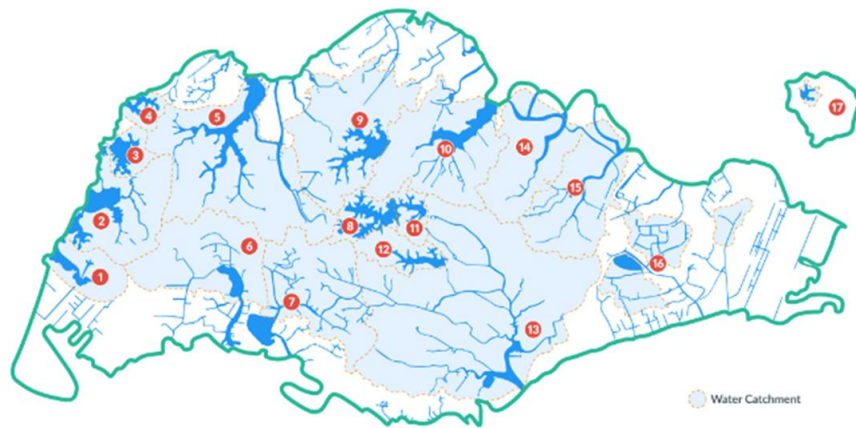


Within water catchment, runoff eventually flows into reservoirs

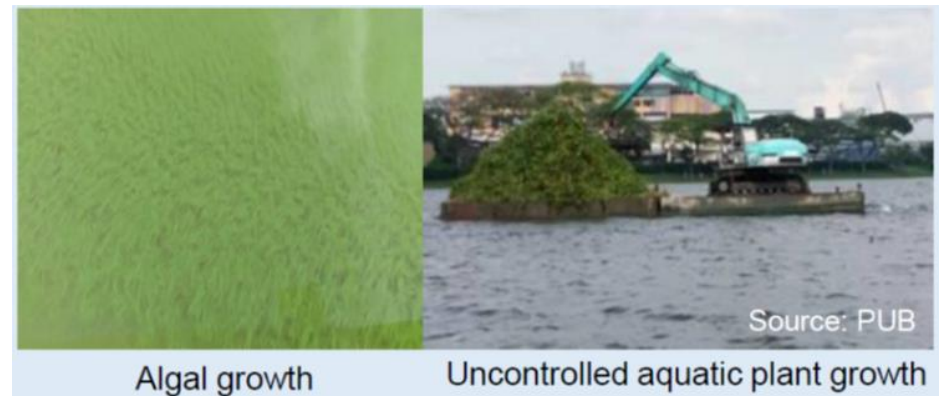
- Two-thirds of Singapore is catchment for our drinking water supply
- Runoff from water catchment will flow into watercourse (reservoirs), which is used for treatment to potable water.
- Good water quality in water catchment and reservoirs is important for the production of good drinking water for the residents of Singapore.

Why control water quality from farming activities?

- Unmanaged runoff from agricultural developments may lead to high levels of suspended solids, nutrients (nitrogen and phosphorus) and organics entering the reservoir(s), leading to algae, aquatic plant growth and poor water quality.
- PUB requires water pollution control measures and Best Management Practices (BMPs) to be incorporated in the design of all agricultural developments sited within water catchment areas



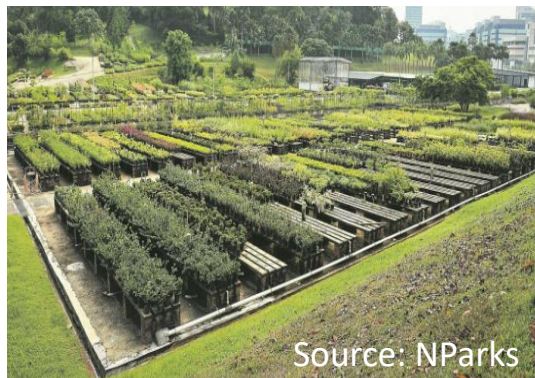
Water catchment area in Singapore (in blue)



Algal growth

Uncontrolled aquatic plant growth

What are the BMPs and how do they help?



Cut-off drains channel runoff to the **water treatment pond** and pond water can be used for irrigation



Use only **pesticides and herbicides approved by SFA** to ensure food and environmental safety



Sheltered vegetable plots help to contain nutrients and retain moisture to support plant growth



Good housekeeping allows optimal use of plot space



Growing wetland plants in the water treatment pond allows for a more environmentally sustainable treatment process compared to chemical treatment



Closed-loop water recirculation system to manage any nutrient-rich runoff for reuse within the site

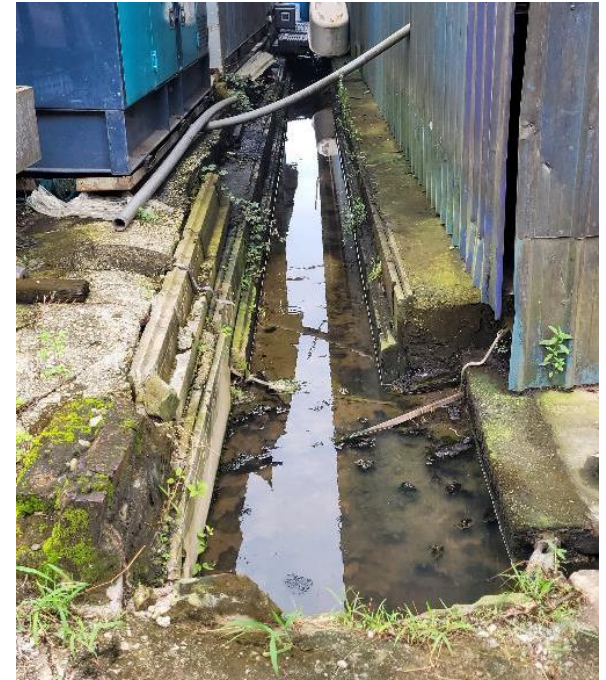
Examples of housekeeping required improvements



Compost is not covered properly
resulting to leakage of high nutrients
into surface run-off



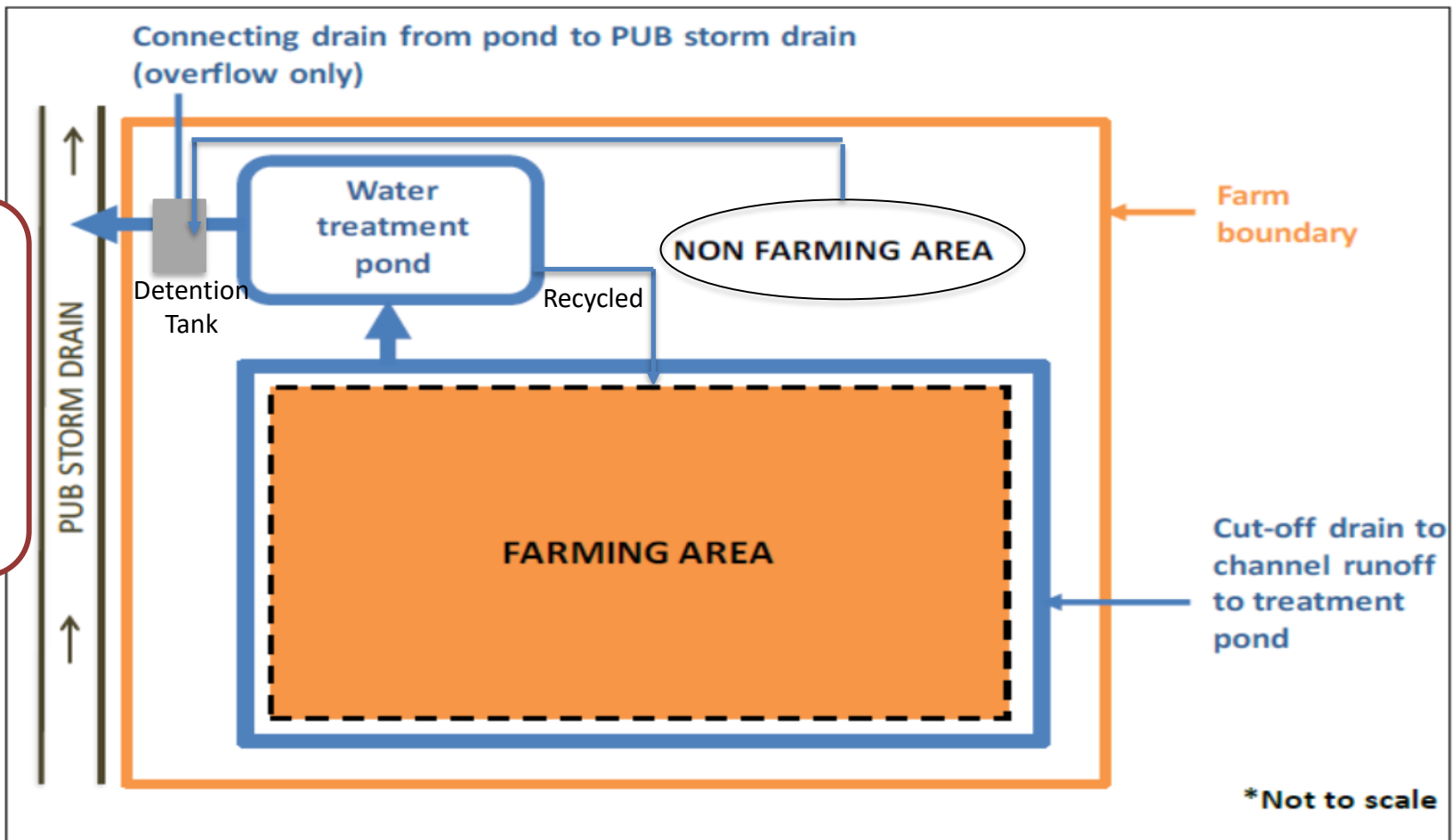
Debris is not cleaned up, waste is not
kept properly



Stagnant water, and un-silted drain
resulting accumulation of pollutants
and mosquito breeding

Typical Design

Discharge from outlet points shall comply with **Allowable Limits for Trade Effluent Discharge to Watercourse (EPM(TE)R)**



A TYPICAL CUT-OFF DRAIN AND TREATMENT POND FOR AGRICULTURAL RUNOFF MANAGEMENT

Allowable Limits for Trade Effluent Discharge to Watercourse



Water Quality

[The National Environment Agency](#) / [Our Services](#) / [Pollution Control](#) / [Water Quality](#) /
Allowable Limits for Trade Effluent Discharge to Watercourse or Controlled Watercourse

Keeping Our Water Clean

Allowable Limits for Trade Effluent Discharge to Watercourse or Controlled Watercourse

Allowable limits for trade effluent discharge

	Items of Analysis	Watercourse	Controlled Watercourse
	(Units in milligram per litre or otherwise stated)		
1	Temperature of discharge	45°C	45°C
2	Colour	7 Lovibond Units	7 Lovibond Units
3	pH Value	6- 9	6- 9
4	BOD (5 days at 20°C)	50	20
5	COD	100	60
6	Total Suspended Solids	50	30
7	Total Dissolved Solids	-	1000

What can vegetable farms/nurseries do to protect reservoir water quality?

(Note: Conceptual diagram is not drawn to scale)

NON-FARMING AREA

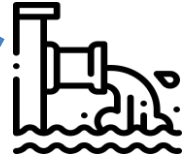


- Fertilisers, soil amendments, pesticides, herbicides, plant waste, compost and feedstocks:
 - ✓ Sheltered
 - ✓ Kerbed
 - ✓ Impervious flooring
 - ✓ Prevent from leaching into storm drain

WATER TREATMENT POND#

(or alternative QP proposals)

For open developments, cut-off drain to channel runoff to treatment pond



Any Discharge into PUB Storm Drain

✓ To meet EPMA Allowable Limits and PUB discharge water quality guidelines

✗ No process water

✗ No washing water

✗ No seawater

✗ No sludge

FARMING AREA



- No raw animal waste as fertiliser.
- Ensure any compost is fully composted before use.
- Use only pesticides (including herbicides) registered with SFA, and in accordance with the manufacturers' recommendations and guidelines
- Do not apply fertilisers, soil amendments and pesticides within 2m of the drains or the reservoir.
- Where possible, shelter and kerb up the farming area.



VEGETATED BUFFER STRIP*

PUB STORM DRAIN

Could be combined with rainwater harvesting and stormwater detention purpose
*Where abuts watercourse (reservoir or storm drain), can be part of NParks' planting verge

What can fish farms do to protect reservoir water quality?

(Note: Conceptual diagram is not drawn to scale)

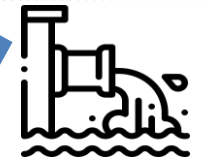
NON-FARMING AREA

- Animal waste, including dead animals, are to be stored indoors or in covered, leakproof bins, and disposed off-site regularly.
- If the site uses any drugs/vaccines for its animals, these medical wastes shall be properly stored and disposed off-site according to an approved method by the authorities and shall not be disposed into the watercourse.

WATER TREATMENT POND#

(or alternative QP proposals)

For open developments, cut-off drain to channel runoff to treatment pond



Any Discharge into PUB Storm Drain

✓ To meet EPMA Allowable Limits and PUB discharge water quality guidelines

✗ No process water

✗ No washing water

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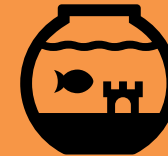
VEGETATED BUFFER STRIP*

PUB STORM DRAIN

FARMING AREA



- Ponds/tanks for the holding of animals shall be properly and adequately designed to ensure no overflow and leakage of nutrient-rich water into the watercourse.
 - Implement a closed-loop water recirculation system for reuse within the site; or
 - Ensure ponds/tanks for the holding of animals are sheltered/covered with rain-impermeable material to prevent the overflow of nutrient-rich water into the watercourse



Could be combined with rainwater harvesting and stormwater detention purpose
*Where abuts watercourse (reservoir or storm drain), can be part of NParks' planting verge

What can poultry farms do to protect reservoir water quality?

(Note: Conceptual diagram is not drawn to scale)

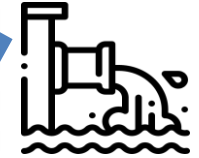
NON-FARMING AREA

- Poultry waste, including dead poultry, are to properly and promptly **contained indoors** or in **covered, leakproof bins**, and disposed off-site regularly.
- If the site uses any **drugs/vaccines** for its animals, these medical wastes shall be **properly stored and disposed off-site** according to an approved method by the authorities and shall not be disposed into the watercourse.

WATER TREATMENT POND#

(or alternative QP proposals)

For open developments, cut-off drain to channel runoff to treatment pond



Any Discharge into PUB Storm Drain

✓ To meet EPMA Allowable Limits and PUB discharge water quality guidelines

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✗ No sludge

VEGETATED BUFFER STRIP*

PUB STORM DRAIN

FARMING AREA

- All poultry shall be housed in **roofed and fully enclosed sheds with concrete flooring**. No free roaming of poultry outside the poultry/bird sheds in the farms;
- No used water from the poultry/bird farm shall be discharged into the storm drain;
- **No slaughtering** of poultry is allowed within the farms;
- On-site burial for poultry carcasses is not allowed in the farm.



Could be combined with rainwater harvesting and stormwater detention purpose
*Where abuts watercourse (reservoir or storm drain), can be part of NParks' planting verge

Environmental Protection and Management Act

Penalties for discharging toxic substances or hazardous substances into inland waters

17.—(1) Any person who discharges, or causes or permits to be discharged, any toxic substance or hazardous substance into any inland water so as to be likely to cause pollution of the environment shall be guilty of an offence and shall —

- (a) be liable on the first conviction to a fine not exceeding **\$50,000** or to imprisonment for a term not exceeding **12 months** or to both; and
- (b) be punished on a second or subsequent conviction with both imprisonment for a term of not less than one month and not more than **12 months** and a fine not exceeding **\$100,000**.

Power of Director-General to require the removal and cleaning up of toxic substance or trade effluent, oil, chemical, sewage, hazardous substance or other polluting matters

18.—(1) The Director-General may, by written notice, require any person who has discharged or caused or permitted to be discharged or spilled any toxic substance, trade effluent, oil, chemical, sewage, hazardous substance or polluting matters onto any land or into any drain or the sea, to remove and clean up such toxic substance, trade effluent, oil, chemical, sewage, hazardous substance or polluting matters within a specified time to be fixed by the Director-General as he or she considers fit.

(2) Any person who fails to comply with a notice issued under subsection (1) shall be guilty of an offence and shall be liable on conviction to a fine not exceeding **\$50,000**.

Environmental Protection and Management Act


Power of Director-General to require measures to be taken to prevent water pollution due to storage or transportation of toxic substances or any other polluting matters

19.—(1) (1) The Director-General may, by written notice, require any person who effects, permits or carries out any activity related to the storage or transportation of a toxic substance or any other polluting matters —

- (a) to use a method of storage, operation or process to prevent water pollution;
- (b) to construct or install spill containment facilities;
- (c) to use containers, tanks, tank containers or road tankers that are constructed to meet stipulated standards and with approved materials;
- (d) to install and operate equipment to prevent any leakage or discharge from containers, tanks, tank containers or road tankers;
- (e) to install and operate pollution monitoring equipment to prevent and detect any leakage or discharge;
- (f) to carry out specific tests on equipment, tanks or any other related facilities and to submit the results of these tests;
- (g) to prepare and submit contingency plan for events of accidental discharge or spillage of oil, chemicals, trade effluent or other polluting matters;
- (h) to carry out any works as required by the Director-General that are necessary to prevent water pollution.

(2) Any person who fails to comply with any requirement in subsection (1) shall be guilty of an offence and shall be liable on conviction to a fine not exceeding **\$20,000**.

Thank You



MAKE
EVERY
DROP
COUNT