ADDENDUM NO. 3 TO THE CODE OF PRACTICE ON SURFACE WATER DRAINAGE (7th EDITION) – ECM CLAUSES

Ms Brenda
PUB
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PUB SINGAPORE'S NATIONAL WATER AGENCY

Updates to ECM Clauses

- **Erosion Control Measures:**
  - Clause 6.3.7 (1)(b) – Covering up of all bare / erodible surfaces
- **Sediment Control Measures:**
  - Clause 6.3.7 (2)(a) – Perimeter Cut-off Drain
  - Clause 6.3.7 (2)(d) – Holding Pond/Sump
  - Clause 6.3.7 (2)(e) – Treatment System
  - Clause 6.3.7 (2)(i) – Site Hoarding
- Clause 6.3.9 – Maintenance of ECM during Contract Period
- Clause 6.3.10 – Monitoring of Discharge during Contract Period
- Clause 6.3.11 – Removal upon Completion

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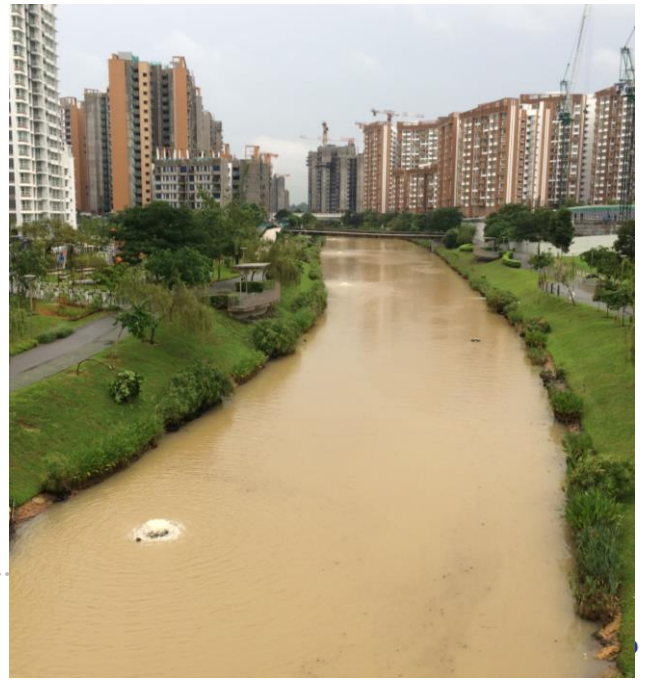


Clause 6.3.7 (1)(b) – Covering up of all bare / erodible surfaces

Clause	Existing	Amended (Changes in **blue**)	Remarks on Changes
6.3.7 (1) (b)	**Effective ECM Components – Erosion Control Measures** *Covering up of all bare / erodible surfaces* - Bare surfaces (including earth stockpiles) shall be covered by concrete-lining, concrete-paving, milled waste, erosion control blankets, close turfing or other suitable materials. Access roads within the site and at exit/entrance as well as the surfaces around the site facilities (such as office, fabrication and storage yards) shall be covered or paved. Work areas shall be covered with canvas sheets, tarpaulin sheeting or other suitable materials during rain or before work stops every day.	**Effective ECM Components – Erosion Control Measures** Covering up of all bare / erodible surfaces - Bare surfaces (including earth stockpiles) shall be covered by concrete-lining, concrete-paving, erosion control blankets, close turfing or other suitable materials. Access roads within the site and at exit/entrance as well as the surfaces around the site facilities (such as office, fabrication and storage yards) shall be covered or paved. Work areas shall be covered with **erosion control blankets** or other suitable materials during rain or before work stops every day.	To specify the use of erosion control blankets to cover work areas at worksites.

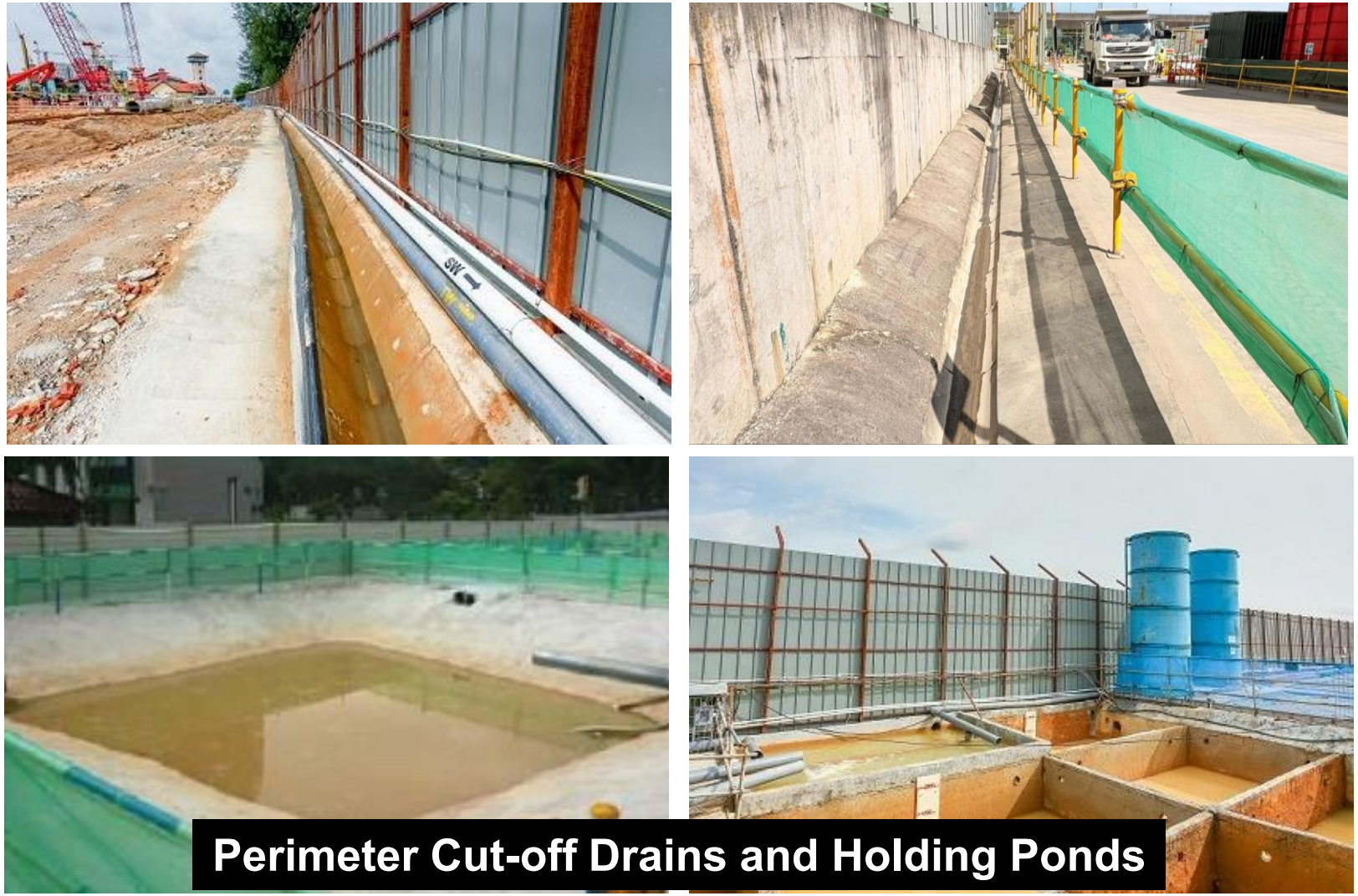
Clause 6.3.7 (1)(b) – Covering up of all bare / erodible surfaces

Use of Erosion Control Blankets

Clause 6.3.7 (2)(a) – Perimeter Cut-off Drain

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.7 (2) (a)	**Effective ECM Components – Sediment Control Measures** The sediment control measures shall trap, contain and treat the silty discharges from within a construction/ earthworks site (including rain, runoff, water from washbay, underground water at basement, etc.) by providing: a. Perimeter Cut-off Drain – Perimeter cutoff drains shall be concrete-lined and adequate to capture all runoff from the site. For sites located above slope, a boundary wall of at least 600 mm high shall be provided along the entire perimeter of the site to prevent overflow onto adjacent properties.	**Effective ECM Components – Sediment Control Measures** The sediment control measures shall trap, contain and treat the silty discharges within a construction/ earthworks site (including rain, runoff, water from washbay, underground water at basement, etc.) by providing: a. Perimeter Cut-off Drain – Perimeter cut-off drains shall be concrete-lined and adequate to capture **and channel** all runoff from the site **to the holding pond/sump**. For sites located above slope, a boundary wall of at least 600 mm high shall be provided along the entire perimeter of the site to prevent overflow onto adjacent properties.	Editorial changes. To clarify that perimeter cut-off drains shall be adequate to capture and channel all runoff from the site to the holding pond/sump.

Clause 6.3.7 (2)(a) – Perimeter Cut-off Drain



Perimeter Cut-off Drains and Holding Ponds

Clause 6.3.7 (2)(d) – Holding pond/sump

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.7 (2) (d)	**Effective ECM Components – Sediment Control Measures** d. Holding pond/sump – All silty runoff shall be collected and channelled to ground holding pond/sump for treatment to the required water quality standard before discharging the runoff into the drain. All silty water shall be treated and discharged within 10 hours after the rainstorm so as to prepare the pond/sump for the next rainfall event.	**Effective ECM Components – Sediment Control Measures** d. Holding pond/sump – All silty runoff shall be collected and channelled to ground holding pond/sump for treatment to the required water quality standard before discharging the runoff into the drain. All silty water shall be treated and discharged within 10 hours after the rainstorm so as to prepare the pond/sump for the next rainfall event. **vi. For above ground holding tank design proposal, contractor shall provide justification that the system is able to function at all times, in particular, during heavy rain in the middle of the night. The justification shall include detailed calculations of number of pumps and pump size, provision of redundancy to cater for maintenance and breakdown, positive suction head at the sump pit, provision of power supply for the automated system throughout the entire operation and the standby manpower as necessary.** **vii. The above information, schematics and technical drawings shall be clearly enclosed in the ECM plan for the contractor to strictly adhere to. Contractor shall engage a QP (mechanical) to design and endorse the pumping system and monitor the performance and revise the ECM design accordingly.**	Editorial amendment – shifting of existing clauses. Clause vi and vii (previously under 6.3.7 (2) (e) Treatment system) shifted to be under 6.3.7 (2) (d) Holding pond/sump.

Clause 6.3.7 (2)(d) – Holding pond/sump

Above ground holding tank with pumping system

Clause 6.3.7 (2)(e) – Treatment System

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.7 (2) (e)	**Effective ECM Components – Sediment Control Measures** e. Treatment System – Adequately-sized treatment system shall be installed to treat all silty surface runoff before it is discharged into the drains. The treatment system shall be sized to treat and empty the rain runoff water in the holding pond/sump within 10 hours after the rainstorm so as that to prepare the pond/sump for the next rainfall event. Any other water shall be handled separately and shall not be channelled to the holding pond/sump for treatment. The treatment system shall be calibrated regularly according to the manufacturer's specification. The quality of discharge shall be monitored continuously by a Total Suspended Solids (TSS) meter or by other means. i. The treatment plant treats the silty water at a prescribed flow rate and there is no holding capacity within the treatment plant. Treatment plants shall not be included as part of the total holding pond/sump capacity.	**Effective ECM Components – Sediment Control Measures** **e. Treatment System – Adequately sized treatment system shall be installed to treat all silty surface runoff before it is discharged into the drains.** The treatment system shall be sized to treat and empty the **silty** runoff water in the holding pond/sump within **ten (**10**)** hours after the rainstorm **so as to** prepare the pond/sump for the next rainfall event. Any other water **such as used water, sullage water and slurry** shall be handled separately and shall not be channelled to the holding pond/sump for treatment. The treatment system shall be **installed, calibrated, commissioned, operated and maintained** regularly according to the manufacturer's specifications and maintenance manual. **The treatment system shall be free from any material/substance that will affect the quality of treated water.** i. The treatment plant treats the silty water at a prescribed flow rate. Treatment plants **do not have holding capacity and** shall not be included as part of the **computation of** total holding pond/sump capacity.	Editorial amendment – shifting of existing clauses. Examples given for other type of water not to be handled by ECM system. Treatment system must be operated and maintained regularly to ensure its effectiveness.

Clause 6.3.7 (2)(e) – Treatment System

Manufacturer's Specification (Sample)

(Not Exhaustive)

Influent

Influent Type: Silty water from Construction Activities

Maximum Flow Rates

XYZ20 20m^3/hour; XYZ30 30m^3/hour; XYZ40 40m^3/hour; XYZ60 60m^3/hour; XYZ80 80m^3/hour

Suspended Solids Content

<10,000 mg/litre

Treatment Process

Method: Chemical; Primary: Filtration; Secondary: Sedimentation

General Dimensions

XYZ20 2.0m x 1.6m x 2.5m; XYZ30 3.0m x 1.8m x 2.5m; XYZ40 4.0m x 1.8m x 2.5m;
XYZ60 5.2m x 2.3m x 2.5m; XYZ80 6.2m x 2.3m x 2.5m

Flocculant & Coagulant Tanks

	XYZ20	XYZ30	XYZ40	XYZ60	XYZ80
Mixing Capacity (litres)	200	200	200	500	500
Footprint (cm)	57 x 57	57Ø	57Ø	80Ø	80Ø
Height (cm)	71	94	94	120	120

Chemical Mixers

Power kW	0.18
Voltage (V)	220
Phase	Single
RPM	1450

Clause 6.3.7 (2)(e) – Treatment System

Operation & Maintenance Manual (Sample)

1. General Layout
2. Installation
3. Chemical Mixing
4. Chemical Dosing Pump
5. Primary & Secondary Chamber
6. Desludge System
7. Control Panel
8. Desludge Actuators
9. Dosing Pump Details
10. Material Safety Data Sheets
11. Safe Working Procedures
12. General Maintenance by Customers
13. Daily Checklist by Customer
14. Hose Fitting Guide

Clause 6.3.7 (2)(e) – Treatment System

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.7 (2) (e)	**Effective ECM Components – Sediment Control Measures** ii. For above ground holding tank design proposal, contractor shall provide justifications that the system is able to function at all times, in particular, during heavy rain in the middle of the night. The justifications shall include detailed calculations of number of pumps and pump size, provision of redundancy to cater for maintenance and breakdown, positive suction head at the sump pit, provision of power supply for the automated system throughout the entire operation, and configuration of the automated system and the standby manpower as necessary. iii. The above information, schematics and technical drawings shall be clearly enclosed in the ECM plan for contractor to strictly adhere to. Contractor shall engage a QP (mechanical) to design and endorse the pumping system and monitor the performance and revise the ECM design accordingly.	**Effective ECM Components – Sediment Control Measures** **ii. The quality of discharge into public drain shall be continuously monitored by CCTV linked to the Silt Imagery Detection System (SIDS) for sites 0.2 hectares and above.** **iii. It is strongly encouraged for the treatment system to be equipped with an automated intervention feature to prevent silty water exceeding legal limits from being discharged into public drain. Examples of automated intervention features include but are not limited to:** **• Automatic shutting down of treatment system; and** **• Automatic diversion of silty water to holding pond with a motorised valve.**	Monitoring of the quality of discharge through CCTV linked to the SIDS to align with existing practice. To encourage to equip treatment system with automated intervention feature to prevent silty water discharges exceeding legal limits. Editorial amendment – shifting of existing clauses (ii & iii shifted to clause 6.3.7 (2) (e) under holding pond/sump section)

Clause 6.3.7 (2)(e) – Treatment System

Monitor

CCTV installed at roadside drain monitors discharge from 500 construction sites

Image Analytics

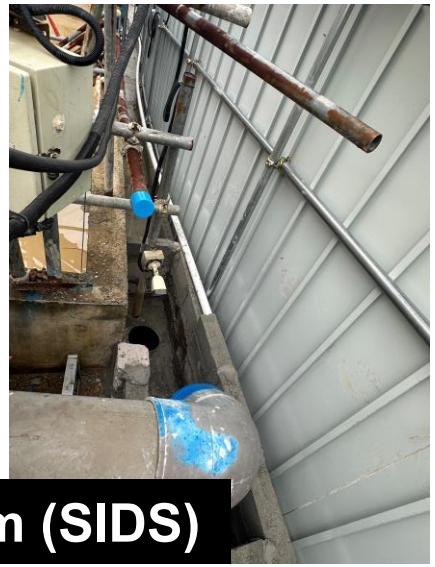
Image sampled by SIDS* at 5-min rate for analysis

Alerts

Image sampled by SIDS* at 5-min rate for analysis

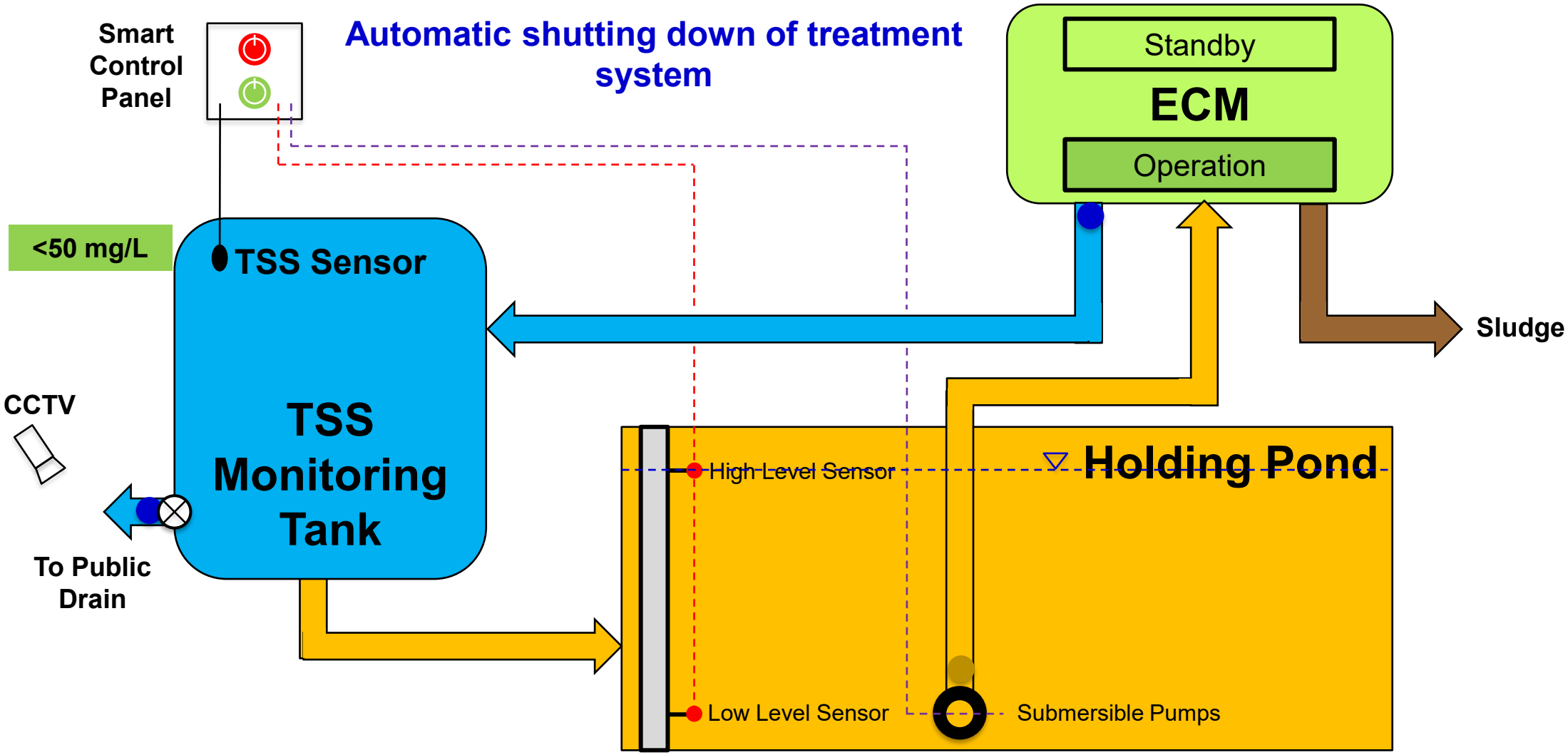
Rectify

Allow monitoring of earth control measure's effectiveness and self-regulation by contractors

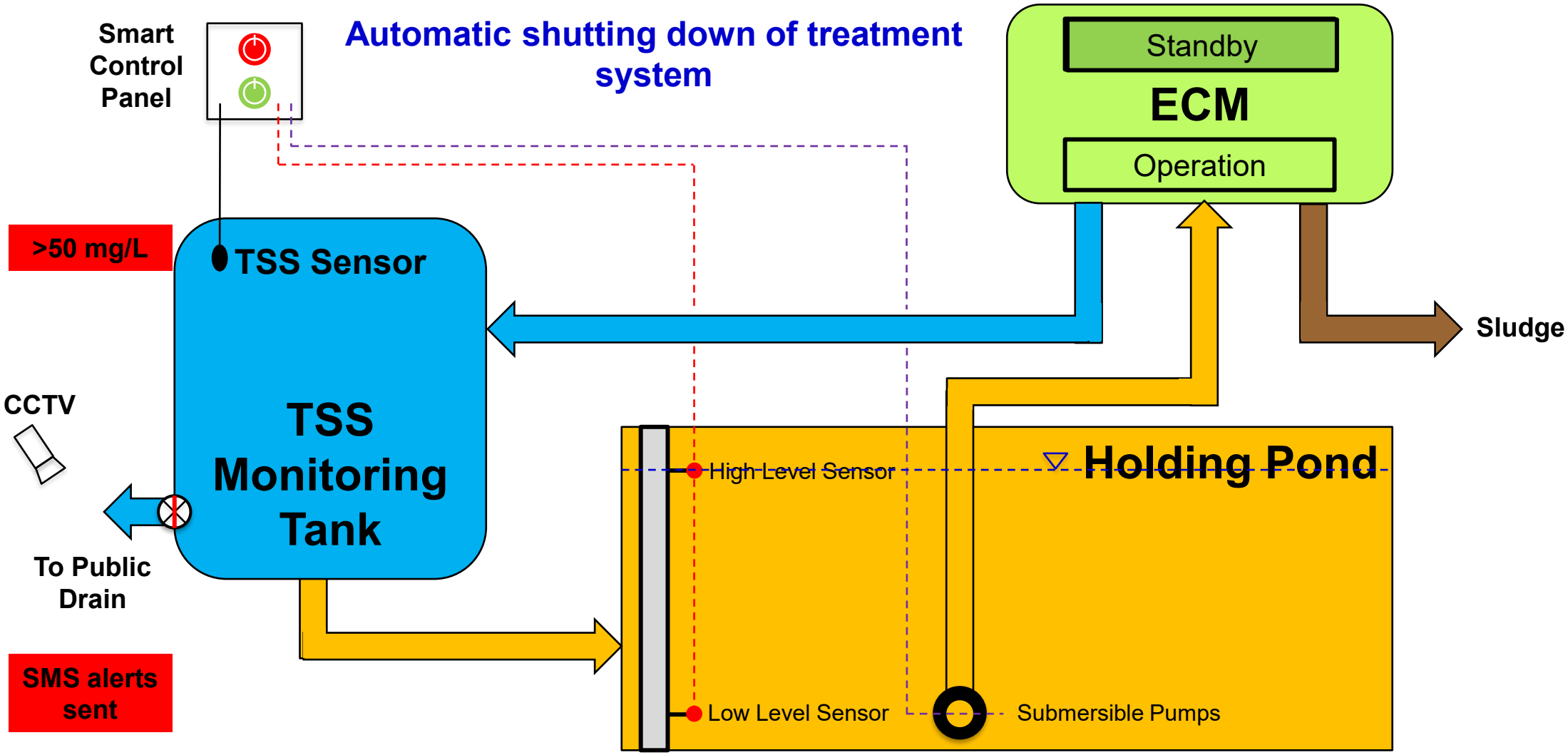


Silt Imagery Detection System (SIDS)

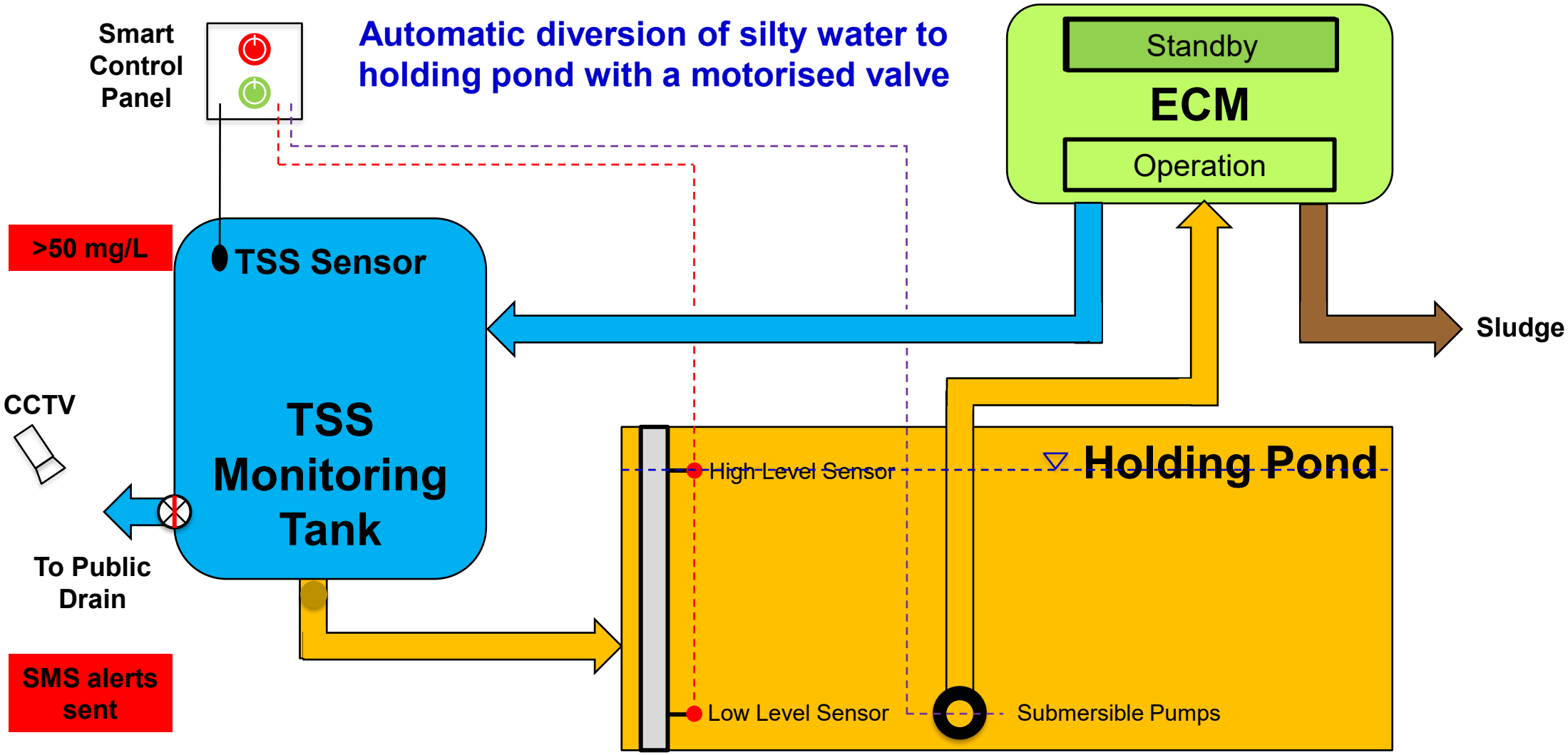
Clause 6.3.7 (2)(e) – Treatment System



Clause 6.3.7 (2)(e) – Treatment System

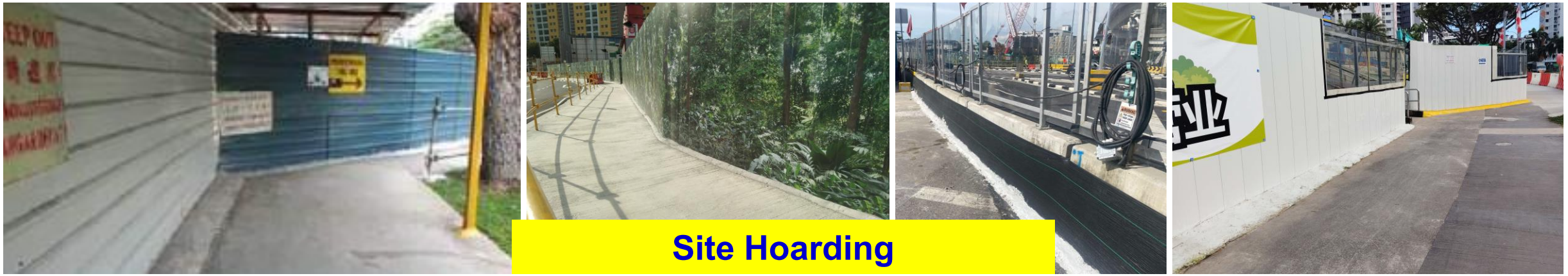


Clause 6.3.7 (2)(e) – Treatment System



Clause 6.3.7(2)(i) – Site Hoarding

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.7 (2) (i)	**Effective ECM Components – Sediment Control Measures** *(none)*	**Effective ECM Components – Sediment Control Measures** **Site Hoarding – Gap at the base of site hoarding shall be properly sealed to prevent the outflow of silty water from the site.**	New clause i to align with current practice.



Site Hoarding

Clause 6.3.9 – Maintenance of ECM during Contract Period

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.9	**Maintenance of ECM during Contract Duration** The ECM implemented on site shall be checked and maintained regularly to ensure that the ECM remains effective throughout the whole duration of works. This shall include: i. Replacing of silt fences and erosion control blankets ii. Re-paving of worn-out concrete surfaces iii. Replacing of membrane modules iv. Calibration of silty water treatment plant according to the manufacturer's specification v. Removal of silt accumulated in the holding sump vi. Removal of silt accumulated at the silt fence and beside the boundary wall	**Maintenance of ECM during Contract Period** The ECM implemented on site shall be checked and maintained regularly to ensure that the ECM remains effective throughout the whole duration of works. This shall include: i. Replacing of silt fences and erosion control blankets ii. Re-paving of worn-out concrete surfaces iii. Replacing of membrane modules iv. Removal of silt accumulated **in drain** and the holding **pond**/sump v. Removal of silt accumulated at the silt fence and beside the boundary wall **vi. Removal of sludge accumulated in the ECM treatment plant**	To remove clause iv since it will be covered under clause 6.3.7 (2) (e). New clause vi to align with existing practice.

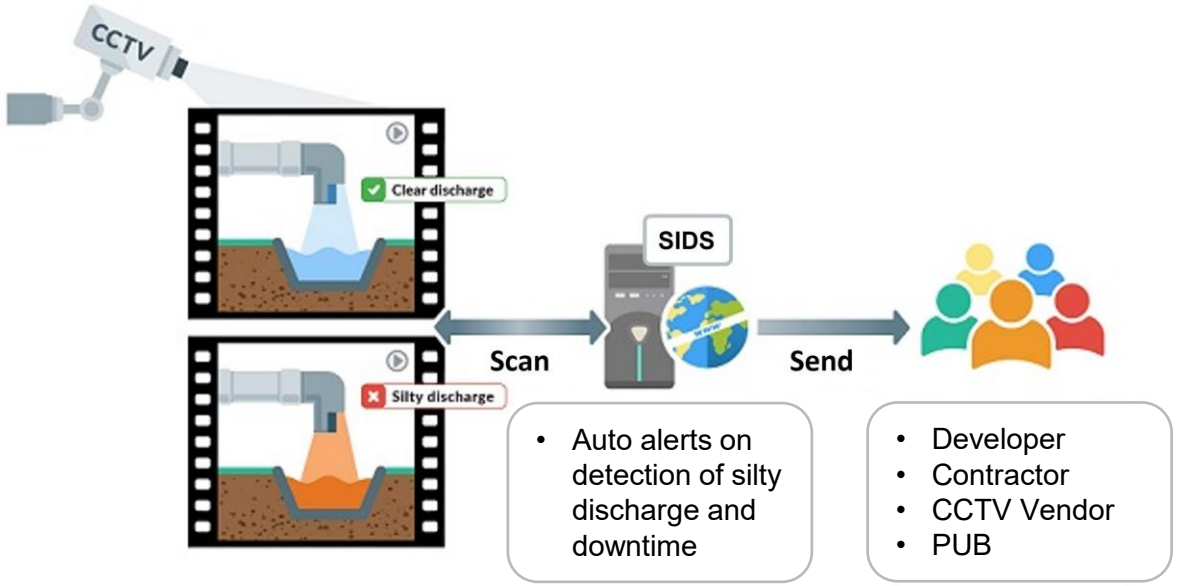
Clause 6.3.9 – Maintenance of ECM during Contract Period

Maintenance of perimeter cut-off drains and treatment plant

Clause 6.3.10 – Monitoring of Discharge during Contract Period

Clause	Existing	Amended (Changes in **blue**)	Remarks on Changes
6.3.10	**Monitoring of Discharge during Contract Duration** The site operator/contractor shall monitor the discharge water quality as cited in Clause 6.3.1 before it enters the roadside/ outlet drain(s). The site operator/contractor shall for this purpose, provide a continuous monitoring system which include the necessary monitoring instrument and CCTV system upon requested by the Board. The CCTV system shall be positioned at the drain so that it is able to view the discharge outlet(s) along with the upstream of the drain clearly. The CCTV image quality shall be able to distinguish the clear water and the silty water clearly. The site operator/contractor shall keep the CCTV in operations at all times. The site operator/contractor shall submit regular reports (including photographic and monitoring records) of the site ECM as well as those for discharge quality upon requested by the Board.	**Monitoring of Discharge during Contract Period** The site operator/contractor shall monitor the discharge water quality as cited in Clause 6.3.1 before it enters the roadside/ outlet drain(s). The site operator/contractor shall for this purpose, provide a monitoring system such as monitoring instrument and CCTV system upon **request** by the Board. The CCTV system **if installed**, shall be positioned at the drain so that it is able to view the **treated water flow from** the discharge outlet(s) along with the upstream of the drain clearly. The CCTV image quality shall be able to distinguish the clear water and the silty water clearly. The site operator/contractor shall keep the CCTV in operation **and link it to the Silt Imagery Detection System (SIDS) at all times upon request by the Board.** **The site operator/contractor shall promptly respond to the SIDS alerts and take immediate remedial actions for abnormalities captured by the alerts.** The site operator/contractor shall submit regular reports (including photographic and monitoring records) of the site ECM as well as those for discharge quality upon requested by the Board.	Editorial changes to enhance clarity of the clause. To align with existing practice to link the CCTV to the SIDS at all times. To align with existing practice for site operator/ contractor to take immediate remedial actions for abnormalities captured by the SIDS alerts.

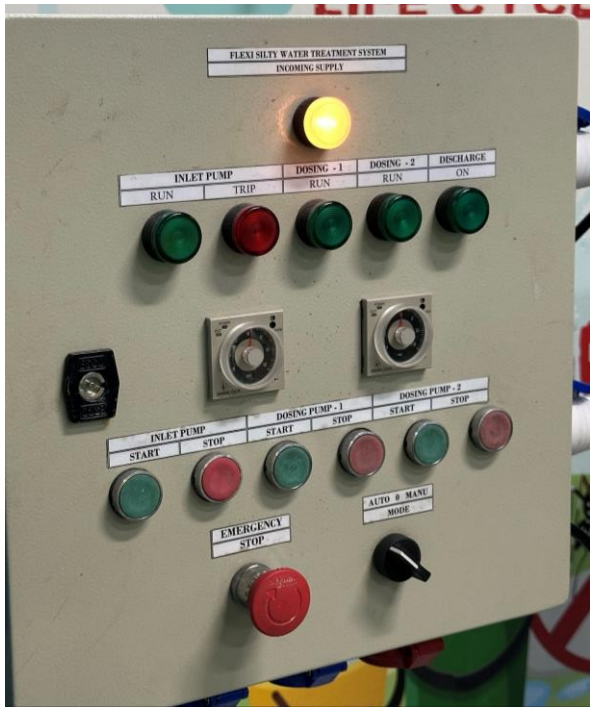
Clause 6.3.10 – Monitoring of Discharge during Contract Period



- Auto alerts on detection of silty discharge and downtime

- Developer
- Contractor
- CCTV Vendor
- PUB

SIDS alerts



Clause 6.3.11 – Removal upon Completion

Clause	Existing	Amended (Changes in blue)	Remarks on Changes
6.3.11	**Removal upon Completion** The ECM shall not be removed before the completion of work. The site operator/ owner shall inform the Board prior to removal of the ECM on completion of the project.	**Removal upon Completion** **All** ECM shall not be removed before the completion of work. The site operator/ owner shall inform the Board prior to removal of the ECM on completion of the project.	Editorial changes.











Updates to ECM Clauses

- **Erosion Control Measures:**
  - Clause 6.3.7 (1)(b) – Covering up of all bare / erodible surfaces
- **Sediment Control Measures:**
  - Clause 6.3.7 (2)(a) – Perimeter Cut-off Drain
  - Clause 6.3.7 (2)(d) – Holding Pond/Sump
  - Clause 6.3.7 (2)(e) – Treatment System
  - Clause 6.3.7 (2)(i) – Site Hoarding
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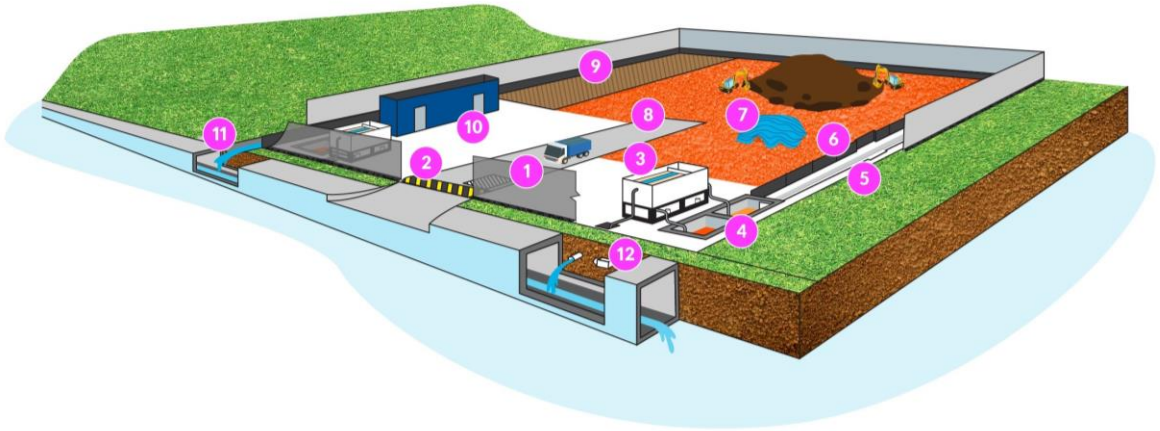
ECM Provisions at a Construction Site



1. Seal up the bottom of hoardings
2. Provide hump at site entrances
3. Provide adequate silty water treatment plants
4. Provide adequate holding ponds
5. Provide cut-off drains to channel silty water to the holding ponds
6. Provide silt traps for cut-off drains within worksite
7. Cover up earth stockpiles with Erosion Control Blankets (ECBs)
8. Pave up access paths / roads
9. Cover bare earth surfaces with ECBs
10. Pave up site office areas
11. Provide cut-off drains to separate clean water from silty water
12. Install CCTV link to the Silt Imagery Detection System (SIDS) at public drain to monitor discharge of treated effluent

Thank you

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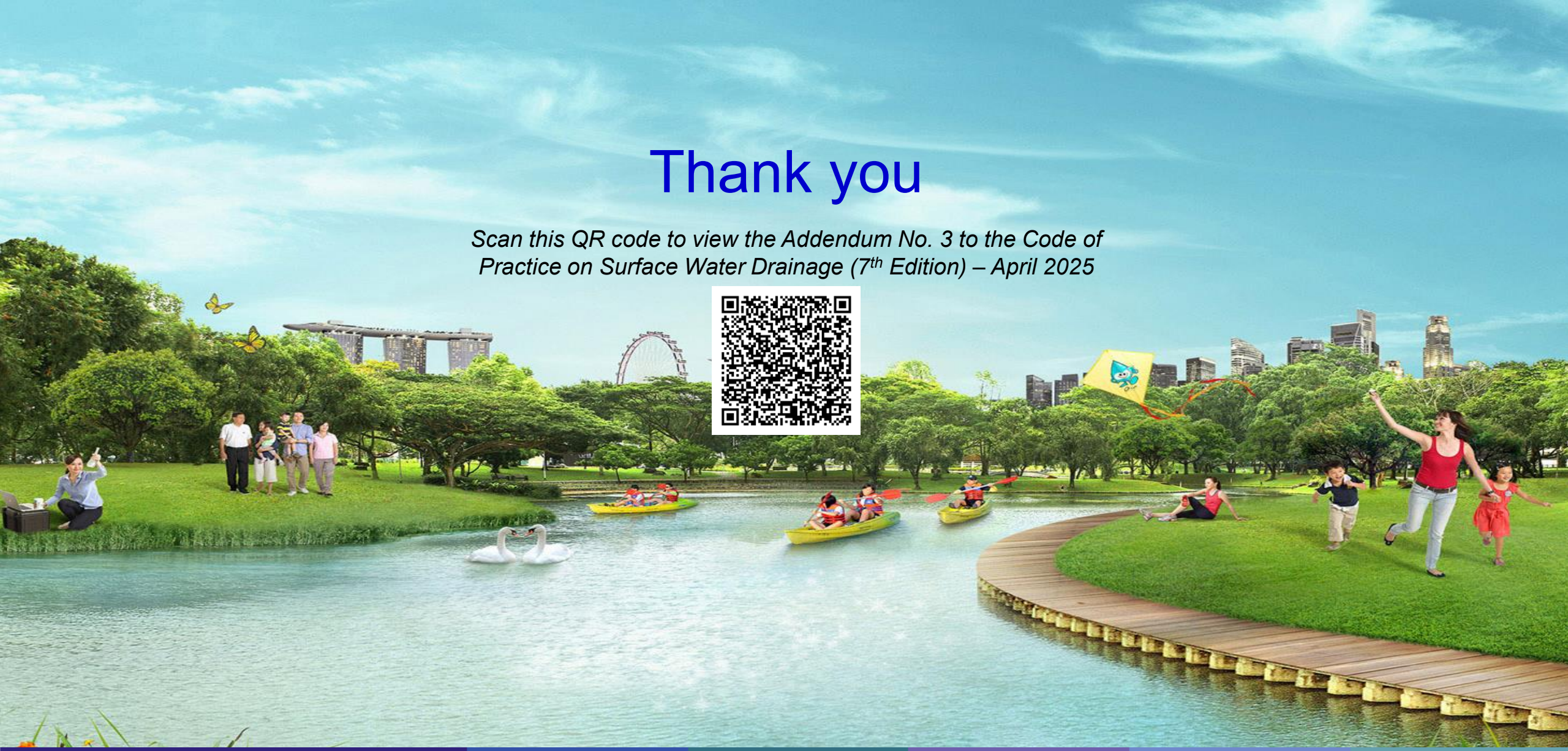

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