MOZZIE WIPE-OUT

GUIDEBOOK

A guide for mosquito control and prevention at construction worksites

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Foreword

The construction industry plays an important role in ensuring a healthy and safe environment, not just for its workers, but also the people and community around construction worksites. One of the perennial tasks is to ensure that construction sites are not fertile grounds for mosquitos that give rise to dengue and other mosquito-borne diseases.

This guidebook was prepared by the Mozzie Wipe-out Working Group formed by the Workplace Safety and Health (WSH) Sub-committee under SCAL. It provides basic guidance for the development of an effective mosquito breeding prevention plan for construction worksites. It identifies the common issues and provides recommendations to eliminate mosquito breeding by maintaining a dry construction worksite through effective planning, designs and effectively managing the residual risk.

I would like to commend and express my heartfelt appreciation to members of the working group and everyone who have contributed towards this publication. My sincere thanks to Mr Lee Kay Chai, Chairman of SCAL's WSH Subcommittee for his capable leadership.

I hope construction firms will find the recommendations in this guidebook useful in managing their worksites to be free of mosquito breeding. With concerted efforts and the objective to achieve a workplace with ZERO mosquito-borne diseases, I am sure everyone around us will be assured a safer place and a better environment to live in.

Kenneth Loo
President
The Singapore Contractors Association Ltd

Introduction

This Guidebook was developed by the Mozzie Wipe-out Working Group under the auspices of the Workplace Safety and Health Subcommittee of the Singapore Contractors Association Ltd (SCAL). The Working Group comprised the following members:

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	Mr Seah Kok Hua	Samwoh Corporation Pte Ltd
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	Mr Jeffrey Yu	HSL Ground Engineering Pte Ltd
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1 OBJECTIVES

To achieve ZERO mosquito-borne diseases through effective mosquito breeding prevention management using an integrated approach.

To provide basic guidance for the development of effective mosquito breeding prevention plan for construction worksites.

To eliminate mosquito breeding by maintaining a dry construction worksite through effective designs and effectively managing the residual risk.

2 MOSQUITO PREVENTION METHODOLOGY

Identify potential mosquito breeding areas during **planning stage and eliminate it through design.** Residual risk to be identified and effectively managed.

Effectively implement preventive measures at worksite.

Continuous monitoring at worksite and review (if required) for further improvements.

3 PLANNING – ELIMINATE THROUGH DESIGN

3.1 Eliminate the risk

Environmental Control Planning Team

An Environmental Control Planning Team consisting of a manager and environmental control personnel should be formed during the planning or even tender stage to identify the issues and to propose reasonable and practicable measures to eliminate stagnant water in the construction worksite.

Responsibilities

Senior project manager (SPM) / Project manager (PM)	• Establish mosquito breeding prevention plan (MBPP) together with environmental control personnel. • Plan for necessary resources to implement the MBPP. • Allocate budget to implement MBPP.
Environmental control personnel (including Environmental control officer (ECO), supervisor, etc)	• Advice SPM / PM when establishing the MBPP. • Identify critical areas of concern to SPM/PM. • Advise on measures/designs to make the worksite water free.
Project manager/ Construction manager	• Review and approve site MBPP. • Provide necessary resources to implement the MBPP. • Establish MBPP together with ECO. • Assign area / zone IC for MBPP implementation. • Allocate necessary and adequate resources to implement MBPP. • Implement control measures as recommended by NEA and environmental control personnel. • Take necessary action on area / zone IC (main-con or sub-con) who has failed to implement MBPP at site.
Environmental control personnel	• Responsible for implementation, monitor and monthly review of MBPP. • Conduct daily inspection and ensure recommended control measures have been implemented effectively all zones (not exceeding 6 zones – see Section 3.2.2 for more details). • Enforce on any non-compliance identified in the zone. • Report to PM on status of MBPP implementation and further action to be taken. • Issue zone stop work order, if failed to implement MPP effectively.
Area / Zone IC (Main-Con or Sub-con)	• Implement MBPP at your area / zone. • Assign personnel to conduct daily check and rectify non-compliance immediately. • Brief workers on mosquito breeding prevention controls. • Up-keep the housekeeping and storage at your area / zone.

Identify potential areas and recommendations to eliminate/reduce or manage

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
Mobilisation / Preliminary works	• Uneven grounds	• Levelling of the uneven grounds • Provide proper drainage	• Twice-weekly monitoring and treatment to uneven grounds as proposed by PCO.
	• Water caught in trees and plants	• Remove trees and vegetation • Seal the tree hole	• PCO baseline assessment with propose treatment programme for the project
	• Stagnant water in abandon building / structures	• Demolish the structure • Identify locations and seal off the area	
General construction • Site offices / Workers' quarters / Site toilets	• Stagnant water on roof of temporary structures	• Ensure that roofs of all site office, workers' quarters, temporary office are designed and constructed in a manner that will not collect water.	• Conduct regular checks and maintenance to ensure no water collected on the roof.
	• Aircon drip tray	• Remove air-con drip tray. Provide direct piping to divert condensed water to nearby drain.	
	• Water on uneven grounds (toilets / bathrooms)	• Ensure toilet floor screed to correct gradient to eliminate stagnant water.	• Ground to be checked and maintained in a manner that water could be drained to the perimeter drains.
	• Water in bathing tanks		• Check water at least once per week and maintained as required

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
	• Water in unused sinks / toilet bowls / cisterns / gully / floor	• Clear water and seal all unused sinks / toilet bowls / cisterns / gully / floor	• Weekly check and maintenance to ensure seals are in good order.
	• Water in gully / floor traps		• Apply treatment at least once a week.
	• Water in domestic containers / pails	• Educate workers to remove water from containers / pails.	• Weekly checks and removal of any stagnant water
• Common areas and access	• Water below demolished debris	• Manage demolished debris: - Designate two locations to alternate the piling - Each pile to be removed from site within five days.	
	• Water in discarded items / receptacles	• Educate workers on proper disposal of waste.	• Regular housekeeping and removal of any stagnant water • Deploy gravitraps
	• Stagnant water due to uneven grounds or depression	• Concrete the pavement and driveway. • Proper drainage should be constructed. Example, using iDrain (photo on page 22) for effective drainage system, easy maintenance and less choke.	• Ground to be maintained in a manner that water could be drained to the perimeter drains. • Cleaning and maintaining of iDrains.

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
	• Water collected in sand buckets, skips and refuse bins	• Drainage outlet to be provided for huge bins without covers • All bins and skips to be cleared at least once a week	
	• Discarded items and receptacles within worksite and along perimeter fencing.	• Refuse management programme - Provide adequate bins - Proper covers for bins - Educate personnel	• Daily general housekeeping
	• Stagnant water in barriers	• Select barriers with design that will not collect water • Ensure barriers and covers are in good condition	• Check covers and replace damage barriers.
Sub-structure stage			
• Common access	• Stagnant water on common access and vehicular access	• Lean concrete/ waste premix site road with sufficient gradient • To construct permanent drain in advance to provide effective drainage system.	• Twice-weekly treatment
• Piling works – spun piles / bored piles / diaphragm wall etc	• Stagnant water due to uneven grounds or depression	• Regularly maintain the ground to ensure no depression	
	• Stagnant water in Steel casings and coring buckets.	• store casing with a gentle gradient to drain off water • Coring buckets stored in a manner that will not collect rain water	• Twice-weekly treatment

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
	• Test blocks stacking area (depression due to heavy loads).	• Test block stacking area to be designed by PE and provide steel plate below test blocks • Regularly maintain the surrounding ground to ensure no depression	• Twice-weekly treatment
	• Test block lifting points	• Use test block designed with lifting points that will not collect water	
	• Water kept for too long in silo or water tank	• Cover all water tanks and outlets with mosquito nettings. • Apply abates to water tanks	• Weekly check and replace water if required
• Excavation (pile caps, trenches, lift pits, ejector pits, etc)	• Stagnant water on steel strutting and walers.	• Provide drainage holes on strutting and walers • Fill strutting & walers with lean concrete to prevent collection of water	• Twice-weekly check and removal of water
	• Stagnant water in excavation / trench	• Provide sump at lowest point and provide automatic pump to remove access water. • Lean concrete the base of the excavation/trench	• Regularly maintain the ground to ensure proper gradient
	• Stagnant water on poorly excavated slope	• Provide lean concrete or erosion blanket over excavated slope for better drainage to minimize stagnant water	• Regular maintenance of lean concrete and erosion blanket

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
• Basements	• Dark areas attract mosquitoes	• Provide adequate lighting to keep the basement bright • White paint to basement wall immediately after construction	
	• Stagnant water due to uneven ground	• Ensure basement ground properly screed to fall to gutter.	• Twice-weekly check and removal of water
	• Stagnant water in gutter / scupper drains	• Ensure gutter properly constructed to drain water to sump pits	• Twice-weekly check and removal of water / choke
	• Water collected in pits (sump, ejector, lift, etc)	• Provide automatic pump to remove access water. • Apply abates to sump pits	• Twice-weekly treatment by PCO
	• Rain water enter basement through openings	• Floor opening to seal off/ install shelter at level 1 • Tower crane and rubbish chute opening to be seal off with GI sheet • Provide bund wall/ use permanent drainage system at early stage to channel water to pumping point. (Water free basement) • Regular Maintenance to perimeter drain & pumping stations, connect permanent RWDP upper floor discharge to Basement/ L1	• Twice-weekly check and removal of water

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
Superstructure stage • Units • Facade • Material storage • Roof gutters • Gutter along corridor • Water tanks on the roof	• Lifting points at precast air-con ledge or balcony	• Fill with sand or mortar	• Regular checks on the fill to ensure it is not damage/ cleared
	• Water in kitchen and toilets gully / floor traps	• Seal off all gully / floor traps	• Regular checks on the seal to ensure it is not damage
	• Stagnant water in planter box	• Ensure effective drainage is provided	• Apply abates • Regular checks on the drainage to ensure it is not choke
	• Frames of curtainwall / cladding	• Tape up all grooves to prevent collection of water	• Regular check to ensure that the grooves are properly sealed
	• Stagnant water in drop-down area	• Cover all unused floor traps	• Biweekly check and clearing of water
	• Water in roof of water tank	• Cover all water tanks and outlets to prevent mosquito breeding example with nettings.	• Regular check to ensure that the provisions are in good condition.
	• Stagnant water in riser area	• Ensure proper screed to gradient in raiser floor	• Biweekly check and make good to prevent stagnant water

STAGES OF WORK	POTENTIAL BREEDING HABITATS	RECOMENDATION	
		Eliminate / Reduce	**Manage residual risk**
External of buildings			
• Swimming pools • Gardens / ponds • Common area • playgrounds • Perimeter drains & I/C	• Water on I/C covers	• Select I/C covers that will not collect water • Temporary seal off the lifting point of I/C cover	
	• Pond & swimming pool water stagnant for long period	• Apply abates until handing over	• Biweekly check to ensure no mosquito breeding
	• Water below timber deck / raised decks	• Ground screed to fall and flow test passed before installing timber deck	• Biweekly check and apply treatment if required
	• Choke drains	• Provide grating to prevent chokage of drains due to fallen leaves	• Biweekly check and cleaning of drains
	• Water collected in trees / plants and fallen leaves	• Select trees and plants that will not collect water	• Biweekly check and clearing of leaves
• Site storage	• Materials collect rain water. • Stagnant water below material storage	• Shelters to be provided for storage areas. - Kerbs to be constructed to prevent water from entering the area.	• Storage management. - Materials to store in manner that will not collect water. - Materials raised above levelled ground (recommended at least 300mm) for easy monitoring and cleaning.
	• Stagnant water on canvas used to cover materials / earth • Water in concrete test cube tanks	• DO NOT cover material with canvas or plastic sheets	• Daily checks and replace water if required

3.2 Manage residual risk

3.2.1 Selection and control of pest control company (PCO)

Selection of PCO

It is important to make sure that the PCO is fully competent to do the job well. The following information should be evaluated prior to awarding the job to the PCO:

(1) Registration with NEA
(2) No. of trained operators in the company and their years of experience in pest control.
(3) No. of staff in the company.
(4) No. of sprayers and power-operated machines (eg fogging machines).

The scope of work and responsibilities of the PCO should be clearly spelled out in the contract. A sample contract "Specifications for mosquito and rodent surveillance and control at construction sites" is available in NEA's website.

Control of PCO

The contract specification (refer to NEA's guidelines), should include PCO's scope of works (covering whole worksite including upper floors) which is adequate for effective mosquito control. The PCO shall provide and present their method statement to site management for mosquito prevention at the worksite.

For mega construction worksites, more than one pest control company may be engaged to cover the whole worksite effectively. As the building work progresses, pest control work must include checking of the upper floors as and when they are constructed.

Twice-weekly PCO checks is recommended. The PCO shall mix chemical at site in order for the worksite to monitor the chemical mixing. Zone IC (main and sub-contractors) to assign personnel to monitor the PCO during the pest control service to ensure the works are carried out in accordance with the specified scope of works.

3.2.2 Worksite zoning

To manage the site well, it should be divided into zones. The number of zones will depend on the area and size of the worksite. In general, there should be two or more, but not exceeding six zones. Zoning can be divided vertically for building projects and horizontally for civil projects.

The site should identify "hot-spots". Hots-spots are areas that require regular attention by the PCO and the in-house Environmental Control Teams. Hotspots identified shall be communicated to both the PCO and the in-house Environmental Control Teams.

Example of four zones. The team will carry out treatment/clearing on a different zone each day. This four-day cycle will allow all areas to be treated and cleaned almost twice every week.

	MON	TUE	WED	THU	FRI	SAT	SUN
Treatment team	Zone A	Zone B	Zone C	Zone D	Zone A	Zone B	
Clearing team	Zone C	Zone D	Zone A	Zone B	Zone C	Zone D	

3.2.3 In-house Environmental Control Teams

The site should establish a Treatment Team and a Clearing Team. Each team should consist of 2 or more environmental control workers depending on the size of the worksite. The teams shall be deployed to conduct regular treatment and clearing daily on different zones. The Environmental Control Teams shall:

- conduct treatment and clearing according to the established programme;
- carry out search and destroy operation as per programme;
- closely monitored by zone IC during mosquito search and destroy operation;
- report to PM and zone IC about potential mosquito breeding areas;
- carry out immediate rectification on potential mosquito breeding areas;
- maintain record of inspection, findings, recommendation, follow-up action, report to PM and action taken for failed to comply requirements.

3.2.4 Effective housekeeping programme

1) PM/ CM and environmental control personnel to establish housekeeping schedule and programme;
2) PM/ CM to assign zone IC to carryout housekeeping as per schedule including sub-contractors;
3) PM/ CM to provide sufficient resources and timing to carry out housekeeping;
4) Environmental control personnel to monitor implementation and report to PM/ CM and relevant zone IC on the housekeeping non-compliance daily basis;
5) Environmental control personnel to communicate housekeeping schedule and findings to relevant zone IC; and
6) Environmental control personnel to maintain record of housekeeping, inspection report, communication and recorded follow-up action etc.

For good management of housekeeping at worksites, the Japanese 5S system should be implemented as follows:.

SEIRI (sort)	Separate required tools, materials, and instructions from those that are not needed. Remove everything that is not necessary from the work area.
SEITON (store in order)	Sort and organize all tools, equipment, files, data, material, and resources for quick, easy location, and use. Label all storage locations, tools, and equipment.
SEISO (shine)	Set new standards for cleanliness. Clean and remove all trash, grease, and dirt. Everything must be clean, tidy, and neatly put in its appropriate place. Cleanliness provides a safe workplace — and makes potential problems noticeable, e.g., equipment leaks, loose parts, missing guards, loose paperwork, or materials.
SEIKETSU (standardize)	Engage the workforce to systematically perform steps 1, 2, and 3 above daily, to maintain the workplace in perfect condition as a standard process. Establish schedules and set expectations for adherence.
SHITSUKE (sustain)	Make 5S part of your culture, and incorporate it into the corporate philosophy. Build organizational commitment so that 5S becomes one of your organizational values so that everyone develops 5S as a habit. Integrate the 5S methodology into the performance management system.

3.2.5 Mosquito repelling plants for the worksites

Plants could be an effective and natural mosquito repellent. By knowing what types of plants repel mosquitoes and where they grow best, a comprehensive approach could be taken to get rid of these pests by using more than one natural mosquito deterrent. Refer to Annex 4 for some types of plants that repel mosquitoes.

4 OPERATIONS

4.1 Requirements of PCO

The appointed PCO shall conduct a pre-con survey / baseline study at the beginning of the project to determine critical focus areas for the project. The PCO shall propose an effective treatment programme for the worksite.

Weekly service report should be submitted by the PCO to the occupier. Any area of concerns shall be recorded in the service report and highlighted to the ECO/PM.

4.2 Vector control programme

What	Frequency	Who
Pre-con survey / baseline study	Initial	Initial
General inspection	Daily	ECO / Area I/C / Zone I/C
Area housekeeping	Daily	Respective sub-contractor / Housekeeping Team
Waste disposal	Daily	Environmental Control Team / Housekeeping Team
Mass housekeeping	Weekly	All personnel
Treatment	Twice-weekly	PCO
Fogging / misting	When required only	PCO
Mozzie wipe-out exercise	Quarterly	All personnel
Internal audit	Six-monthly	HQ Environmental Control Team / External audit team
Promotion / Campaign	Six-monthly	All personnel

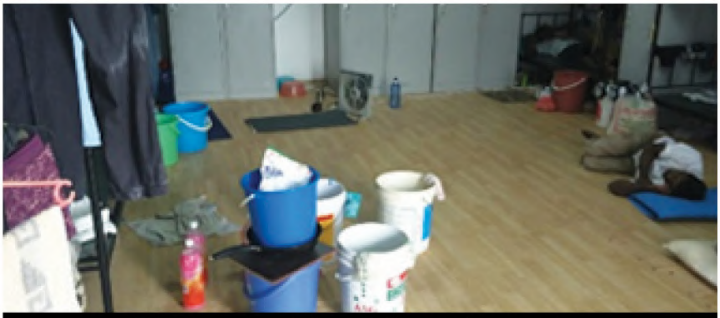
The programme should be communicated to relevant parties and displayed at all the blocks for easy reference.

4.3 Examples of potential issues and solutions

A. MOBILISATION / PRELIMINARY WORKS	
Issues	• Uneven grounds in forested areas • Water caught in trees and plants • Stagnant water in abandon buildings / structures
Illustrations / Photos	 Remove trees and vegetation  Remove breeding habitat in trees  Identify potential breeding spots and seal off (stagnant water in demolished handrail)  Provide effective drainage system

GENERAL CONSTRUCTION

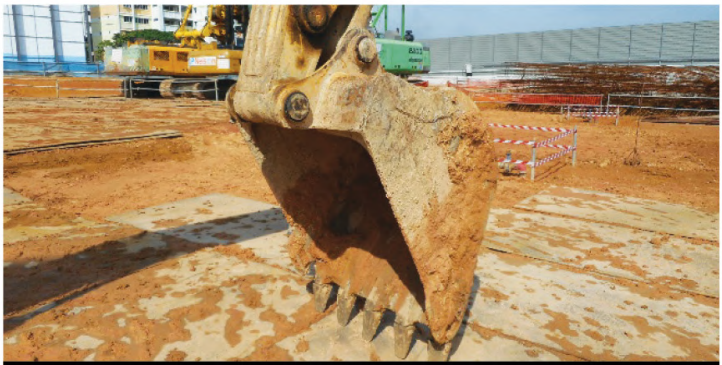
Issues	**Site offices / Workers' quarters / Site toilets** • Stagnant water on roof of temporary structures • Aircon drip tray
Illustrations / Photos	 Ensure that roofs of all site office, worker quarters, temporary office are designed and constructed in a manner that will not collect water  Poorly constructed roofs will collect water  Replace air-con drip trays with direct piping to channel condensed water to a nearby drain

Issues	**Site offices / Workers' quarters / Site toilets** • Water on uneven grounds (toilets / bathrooms) • Water in bathing tanks • Water in unused sinks / toilet bowls / cisterns / gully / floor • Water in gully / floor traps • Water in domestic containers / pails
Illustrations / Photos	 Ensure toilet floor screed to correct gradient to eliminate stagnant water  Clear water and seal all unused sinks / toilet bowls / cisterns / gully / floor traps   Educate workers to keep bath area clean and dry. Remove water from containers / pails

Issues	Common areas and access • Water in discarded items / receptacles
Illustrations / Photos	 Deploy Gravitraps  Vector control team and kit  Educate workers on proper disposal of waste

Issues	Common areas and access • Stagnant water due to uneven grounds or depression • Water collected in sand buckets, skips and refuse bins
Illustrations / Photos	 Concrete the pavement and driveway  Proper drainage should be constructed. Example, using iDrain for effective drainage system, easy maintenance and less chokage  All bins and skips to be cleared at least once a week

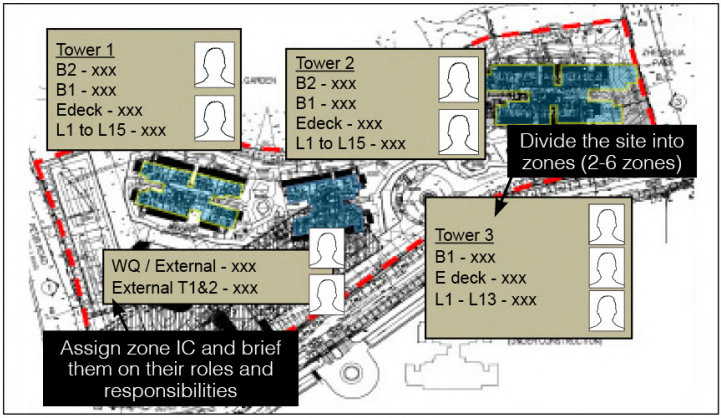
Issues	**Common areas and access** • Discarded items and receptacles within worksite and along perimeter fencing • Stagnant water in barriers
Illustrations / Photos	 Housekeeping along perimeter fencingwater  Refuse management programme - Provide adequate bins - Proper covers for bins  Select barriers with design that will not collect water  Ensure barriers and covers are in good condition

Issues	**Machineries / Equipment** • Stagnant water on machineries / drip trays • Water collected in excavator's bucket / tracks
Illustrations / Photos	 Daily checks and movement of machine to remove water (Machine track may collect water)  Shelters to be provided for generators / welding machines  Educate machine operators to park their machines in a manner that will not collect water

Issues	**Site storage** • Stagnant water on canvas used to cover materials / earth • Stagnant water below material storage • Water in concrete test cube tanks
Illustrations / Photos	 DO NOT cover materials with canvas or plastic sheets  Shelters to be provided for storage areas

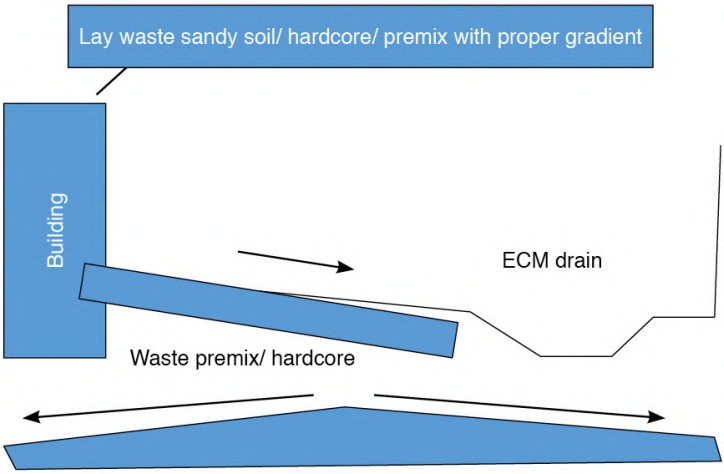
SUB-STRUCTURE STAGE

Issues	• Stagnant water on common access and vehicular access
Illustrations / Photos	



Construct a permanent drain in advance to provide an effective drainage system

Concrete / waste premix site road with effective gradient for drainage

Issues	• Common areas (other than building and access)
Illustrations / Photos	  Lean concrete/hardcore/premix access with proper gradient

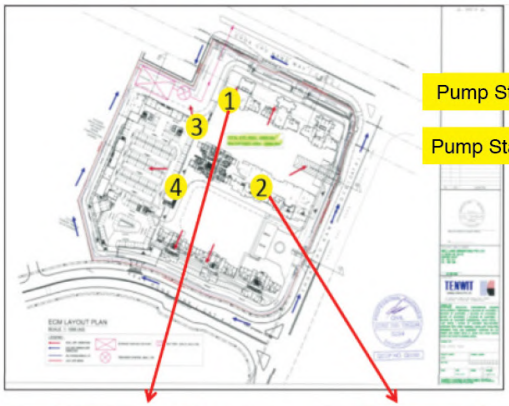
Issues	**Piling works – Spun Piles / bored piles / diaphragm wall etc** • Stagnant water due to uneven grounds or depression • Stagnant water in Steel casings and coring buckets
Illustrations / Photos	 Regularly maintain the ground to ensure no depression. Provide lean concrete over excavated slope  Regularly adjust steel plates and maintain the surround ground to ensure no depression  Store coring buckets and casing with a gentle gradient / position that will not collect water

Issues	**Piling works – Spun Piles / bored piles / diaphragm wall etc** • Test blocks stacking area (depression due to heavy loads) • Test block lifting points • Water kept for too long in silo or water tank
Illustrations / Photos	 Test block stacking area to be designed by PE and provide steel plate below test blocks  Use test block designed with lifting points that would not collect water  Cover all water tanks and outlets with anti-mosquito nettings. Apply abates to water tanks

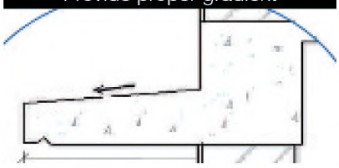
Issues	**Excavation (Pile caps, trenches, lift pits, ejector pits, etc)** • Stagnant water on steel strutting and walers • Stagnant water in excavation / trench
Illustrations / Photos	 Check and fill all areas with lean concrete to prevent collection of water  Provide sump at lowest point and provide automatic pump to remove excess water

Issues	**Excavation (Pile caps, trenches, lift pits, ejector pits, etc)** • Stagnant water in excavation / trench • Stagnant water on poorly excavated slope
Illustrations / Photos	  Provide erosion blanket over excavated slope for better drainage to minimize stagnant water  Provide lean concrete over excavated slope for better drainage to minimize stagnant water

Issues	**Basements** • Dark area attract mosquitoes • Stagnant water due to uneven ground • Stagnant water in gutter / scupper drains
Illustrations / Photos	 Ensure basement ground properly screed to fall to gutter  Provide adequate lighting to keep the basement bright  Ensure gutter properly constructed and maintained to drain water to sump pits

Issues	**Basements** • Water collected in pits (sump, ejector, lift, etc) • Rain water enter basement through openings
Illustrations / Photos	 Pump Station No 3 at Block 7 Pump Station No 4 at Block 13 Provide drainage system at early stage to channel water to pumping point (Water free basement)   Provide automatic pump to remove excess water Pump Station No 1 at Block 3 Pump Station No 2 at Block 5  Regular maintenance to perimeter drain & pumping stations, connect permanent RWDP upper floor discharge to Basement/ L1  Tower crane and rubbish chute opening to be seal off with GI sheet

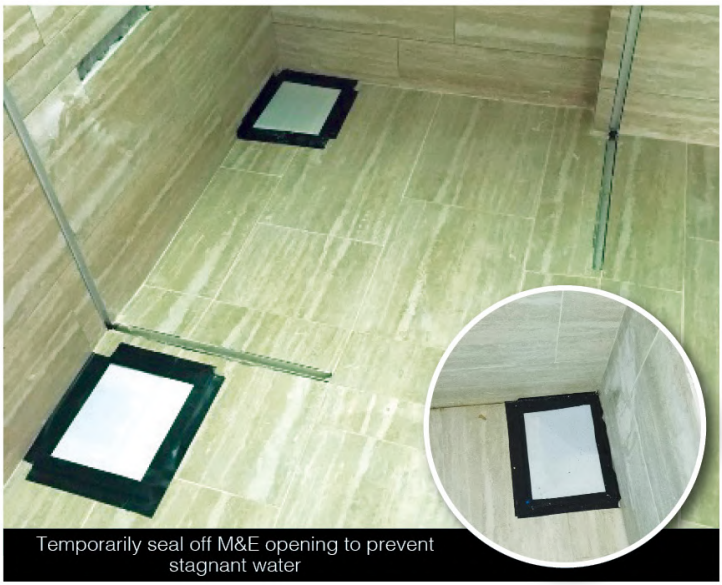
B. SUPER-STRUCTURE STAGE

Issues	**Stagnant water** • Balcony • Air-con ledges
Illustrations /	 No materials storage at balcony and provide sufficient drain out holes Provide proper gradient   Regular checks to ensure proper drainage and no chokage

Issues	**Stagnant water / Rain water enters building & units** • Finished floors within units / corridor / PBU / CD shelter • Staircase vent shaft • Staircase landings • PBU/Toilets
Illustrations / Photos	 Bunds / kerbs to prevent water from entering area  PBU/Toilets openings covered and raised  Seal-off possible water egress through window/ riser opening/corridor etc

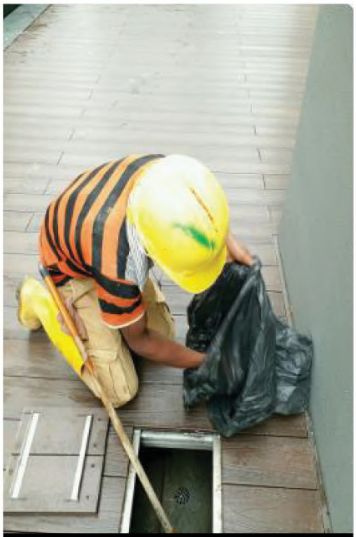
Issues	• Roof top
Illustrations / Photos	 Proper gradient and commission permanent drain out facility early  Cover all water tanks and outlets with anti-mosquito nettings  Cover all water tanks and outlets with anti-mosquito nettings

Issues	• Swimming pool, • Planter box and • Other water features
Illustrations / Photos	 Shelter for swimming pools during construction  Temporally top-up with earth or planting early to minimize stagnant water (Planters)

Issues	**Within units:** • within M&E pipes, • Manhole • Floor traps • Drain and • Water tanks
Illustrations / Photos	  Clear water and seal all unused sinks / toilet bowls / cisterns / gully / floor  Temporarily seal off M&E opening to prevent stagnant water

Issues	• Pre-cast components lifting points • Temporary water supply to upper floors
Illustrations / Photos	 Provide bund wall to collect waste water at tap / drinking points  Provide drain out for waste water from the bunds  Connect drainage to pump stations

EXTERNAL OF BUILDING

Issues	**Swimming pool, gardens / ponds, common area, playgrounds, perimeter drain & I/C and other landscape features** • Water on I/C covers • Pond & swimming pool water stagnant for long period • Water below timber deck / raised decks
Illustrations / Photos	 Temporary seal off the lifting point of I/C cover  Apply abates until handing over  Check, clean and apply treatment if required  Ground screed to fall and flow test passed before installing timber deck

Issues	**Swimming pool, gardens / ponds, common area, playgrounds, perimeter drain & I/C and other landscape features** • Choke drains • Water collected in plants and fallen leaves
Illustrations / Photos	  Regular cleaning to prevent choke  Select trees and plants that will not collect water  Provide grating to prevent chokage of drains due to fallen leaves

STORAGE MANAGEMENT

Issues	• Materials collect rain water • Stagnant water on canvas used to cover materials / earth • Stagnant water below material storage • Water in concrete test cube tanks
Illustrations / Photos	 Implement 5S for effective housekeeping  Materials raised above levelled ground (recommended at least 300mm)  Designated storage area with hardcore/ lean concrete base and sufficient gradient

Issues	• Stagnant water on canvas used to cover materials / earth • Stagnant water below material storage • Water in concrete test cube tanks
Illustrations / Photos	 DO NOT cover material with canvas or plastic sheets  Stack materials such a manner not to collect water during raining (upside down)  Proper covers. Example, prefabricated cover for PBU

5 CHECK, REVIEW AND IMPROVE

5.1 Mozzie Wipe-out Programme Performance Review

The management team shall monitor the performance of the Mozzie Wipe-out programme. Monitoring shall include but not limited to the following:

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mozzie infected disease												
NEA Visits												
NEA Fines												
NEA SWO												
Breeding spots												
PCO findings												
Mozzie trapped												

5.2 Performance evaluation of PCO

The site should establish a system to evaluate the performance of the PCO. ECO/ Environmental control personnel should monitor and review the effectiveness of the pest control services and feedback to PM/ CM. If the PCO does not provide satisfactory services, the occupier should terminate the contract and engage another PCO to do the work.

The following criteria could be considering in the evaluation system:

- Penalties from NEA;
- Comprehensiveness of checks conducted on the site;
- Constructive advice given to the site;
- Promptness of response; and
- Effectiveness of chemicals provided by the PCO.

Annex 1

CHECKLIST FOR MOSQUITO BREEDING SITES IN CONSTRUCTION WORKSITES

Location:	
Date:	
Inspected by:	

Items	Description	Checked	Findings*		Actions Taken		*Description of findings	Remarks
			Stagnant water	Mosquito breeding	Clear stagnant water	Apply chemical		
		✓	(please tick accordingly)					
1	**Construction Area**							
a	Puddles on ground and concrete floor at all levels							
b	Building materials - zinc sheets, form work, steel bars, metal beams, pipings, uninstalled toilets, etc including canvas sheets							
c	Demolition debris							
d	Equipment and machineries, including excavators, etc							
e	Water storage/ filtration/ sedimentation tanks, drums, containers							
f	Barriers							
g	Trenches							
h	Bulk waste containers, skips & refuse bins							
i	Sump pits/ silt traps							
j	Drains/ temporary channels constructed for drainage							
k	Vehicle wash bays							
l	Lift wells							
m	Planter boxes							
n	Discarded items & receptacles							

Items	Description	Checked	Findings*		Actions Taken		*Description of findings	Remarks
			Stagnant water	Mosquito breeding	Clear stagnant water	Apply chemical		
		✓	(please tick accordingly)					
2	**Storage Yard**							
a	Puddles on ground and concrete floors							
b	Freight containers							
	i) Container and canvas roof, including secondary roof							
	ii) Ground below containers							
c	Building materials - zinc sheets, form work, steel bars, metal beams, pipings, uninstalled toilets, etc including canvas sheets							
d	Equipment and machineries							
e	Concrete test cube tanks							
f	Tool boxes							
g	Paint tins/ cans							
h	Discarded items & receptacles							
3	**Container Office**							
a	Freight containers							
	i) Container and canvas roof, including secondary roof							
	ii) Ground below containers							
b	Air-conditioner drip trays							
c	Any other water bearing receptacles							

Items	Description	Checked	Findings*		Actions Taken		*Description of findings	Remarks
			Stagnant water	Mosquito breeding	Clear stagnant water	Apply chemical		
		✓	(please tick accordingly)					
4	**Living Quarters**							
a	Freight containers							
	i) Container and canvas roof, including secondary roof							
	ii) Ground below containers							
b	Plastic containers/ cooking pots & pans/ domestic containers							
c	Discarded items & receptacles							
5	**Toilet & Bathroom**							
a	Concrete floor							
b	Pails (including rim of overturned pails)/ plastic containers							
c	Toilet cisterns & unused toilet bowls							
d	Bathing point concrete tanks							
e	Drainholes of unused sinks							
f	Gully/ floor traps							
6	**Cooking & Washing Area**							
a	Cooking pots & pans/ domestic containers							
b	Discarded items & receptacles							

**Indicate any mosquito breeding sites or irregularities in "Description of findings"*

PROJECT DENGUE CONTINGENCY PLAN

The worksite has formalized a set of contingency plan in line with NEA's nation-wide Dengue Community Alert System.

http://www.nea.gov.sg/public-health/dengue/dengue-clusters

The alert system is classified into **Green**, **Yellow** or **Red** zones.

More than 10 dengue cases in the neighbourhood

Less than 10 dengue cases in the neighbourhood

No dengue cases over 21 days of surveillance

	ACTIONS	MONITORING
GREEN (No Action Cluster)	• Daily vector inspection (Zoning Method) • Weekly oiling and larviciding by PCO. Re-application required after every rain • Weekly trimming of overgrown grass • Housekeeping at the end of every alternate day focusing on removing all receptacles/ litters on site	• Daily monitoring of vulnerable areas
YELLOW (Cluster of < 10 cases)	• All Green Alert requirements • Daily vector inspection with more detailed Serach-and-Destroy operation • Twice weekly oiling and larviciding by PCO • Weekly intensified mass carpet combing for Search-and-Destroy operation	• Monitoring of adult mosquito population using Ovitrap or Gravitrap • Daily monitoring of workers showing symptoms of dengue. Workers who show symptoms of dengue are to seek medical attention immediately
RED (Cluster of >= 10 cases)	• All Yellow Alert requirements • Daily in-house vector control inspection (Zoning Method). Increase the detailed Search-and-Destroy operation frequency in each zone to twice per day (morning and evening) • Housekeeping at the end of each day focusing on removing all receptacles/ litters on site • Daily application of mosquito repellents on all workers working on site	

Figure 1: Measures to be undertaken by Contractor

In the event a site worker/ staff is diagnosed with dengue, the steps below are to be followed:

- Inform Client site team and Contractor Corporate HSE as soon as possible
- Provide the details of the patient as follows:
  - ✓ Name
  - ✓ Company
  - ✓ Date of diagnosis
  - ✓ Residential address
  - ✓ Location of workplace(s)
  - ✓ Current well being
- Isolate worker from site
- Ensure patient applies mosquito repellent daily to prevent mosquitos from biting him/her and spreading the virus
- Conduct carpet combing of site as soon as possible (fogging, search and destroy inspection and housekeeping)
- Follow yellow alert measures for 21 days

VECTOR-BORNE DISEASE OUTBREAKS IN OUR NEIGHBOURHOOD: DENGUE / ZIKA VIRUS COLOUR CODES ALERT

Alert: RED

There are 10 or more Dengue / Zika Virus cases in your neighbourhood

TAKE ACTION!!!

- Setup the temperature monitoring station at guard post.
- Record all site personnel including visitors details who enter to the site.
- Ensure all site personnel are issued surgical masks (Put on the masks if necessary).
- Temperature checked at guard post using infra forehead/ eardrum thermometer and record the temperature including visitors.
- Any person found to have fever/ unwell will be put in sick bay for isolation or advice the personnel to consult doctor.
- Activate housekeeping team to comb every corner of the site compound to look out for potential breeding ground daily. And take necessary action to rectify any shortcomings.
- Spray/ Apply mosquito larvicide to eliminate all potential larvae or mosquitos breeding ground.
- Report all findings to HSSE personnel and advise PD/PM accordingly.
- Apply mosquito repellent and wear long-sleeved shirts and pants.
- Take part in Company/ or NEA campaign activities in the area.

***Upgrading or Downgrading of Colour Codes Alert depending on NEA's mozzie website / or Company Management decision**

Alert: YELLOW

There are less than 10 Dengue / Zika Virus cases in your neighbourhood

TAKE ACTION!!!

- Stock up adequate mosquito larvicide for worksite and mosquito repellent for site personnel.
- Ensure infra forehead/ eardrum thermometers are working (If faulty, replace immediately).
- Inform all persons at site through TBM on the symptoms of any dengue/ zika virus, ie, mild fever, rashes, sore eyes, muscle and joint pains.
- Activate housekeeping team to comb every corner of the site compound to look out for potential breeding ground every alternate day. And take necessary action to rectify any shortcomings.
- Spray/ Apply mosquito larvicide to eliminate all potential larvae or mosquitos breeding ground.
- Report all findings to HSSE personnel and advise PD/PM accordingly.
- Apply mosquito repellent (if necessary) and wear long-sleeved shirts and pants.

***Upgrading or Downgrading of Colour Codes Alert depending on NEA's mozzie website / or Company Management decision**

Alert:
GREEN

Thank you for your efforts to fight against Dengue/ Zika virus. Please remain vigilant

TAKE ACTION!!!

- Continue to do the Mozzie-Wipeout accordingly to HSE programme.
- Spray/ Apply mosquito larvicide to eliminate all potential larvae or mosquito breeding ground.
  3
- Ensure housekeeping in tip top conditions.

***Upgrading or Downgrading of Colour Codes Alert depending on NEA's mozzie website / or Company Management decision**

Annex 4

TYPES OF MOSQUITO-REPELLING PLANTS

Apart from the **Citronella grass**, there are other plants used to repel mosquitoes:

Types of mosquito-repelling plants	Photograph of plants
1. Peppermint Most bugs do not like the smell and taste of peppermint. Plus, if you happen to get bitten, rubbing peppermint leaves directly onto the skin provides relief.	
2. Rosemary When burned, rosemary may smell good to humans, but it is unpleasant enough to keep mosquitoes away.	
3. Pelargonium Also called the "mosquito plant", it is a cross between the Chinese Citronella and the African Geranium. The leaves, which resemble those of a fern, contain citronella oil, which repels mosquitoes.	

Types of mosquito-repelling plants	Photograph of plants
4. Marigolds The plant contains pyrethrum, an ingredient found in many insect repellents. It has an aroma that bugs find repulsive.	
5. Lemon balm For a quick mosquito repellent, crush a handful of lemon balm leaves in your hand and rub them on your exposed skin.	
6. Lemongrass Its strong fragrance makes lemongrass a natural insect repellent. To help deter mosquitoes, it is usually planted along walkways and close to seating areas.	

Annex 5 - Immediate Response plan and Vector Control (VC) action plan to lift SWO

NEA issues stop-work-order (SWO) to construction site(s) that is found with mosquito breeding or with poor housekeeping. The intend of the SWO is to ensure that the occupier takes adequate efforts and measures to clean up the worksite, and to remove all potential breeding habitats to prevent breeding of mosquitoes.

The Immediate Response plan is to help the contractor plan and prepare the site for re-inspection by NEA to lift the SWO. At the same time, the contractor shall prepare the Vector Control (VC) action plan to show how mosquito prevention measures will be maintained on site.

Immediate Response plan

Respond items	**Timeline**	**Action Person**	**Notes / Remarks**
Call Response Team meeting	Immediate	Site OIC (PD/SPM/PM)	
All stakeholders to attend			Attendance list
To assign zone / area I/C for the entire worksite			Zoning plan and names of PICs (Main & Sub-con)
To deploy sufficient workforce to carry out items stipulated in the SWO			Manpower allocation plan
Items from NEA SWO **(Refer to Appendix A)**	Throughout SWO	Zone / area I/C	Photo of implementations (Before & after)
Compile report for submission	Throughout SWO	ECO	Photo of implementations (Before & after)
VCO visits for the whole site	Immediate	ECO	Service report
Gravi-trap deployment & monitoring	Immediate	ECO	Location plan of gravi-trap

Vector Control (VC) Action Plan for sustainability

Respond items	**Before SWO**	**During SWO**	**After SWO***
Mass housekeeping	Weekly	Daily	Weekly
Area housekeeping	Daily	Daily	Daily
Mozzie wipe-out (Search & destroy)	Ad-hoc	Daily / zone	Twice a week / zone
VCO visits for the whole site	Weekly	Twice weekly	Weekly
Gravi-trap monitoring	Nil	Daily	Twice a week
Education & awareness	Ad-hoc	Immediately & Daily	Weekly / Monthly
Reporting & monitoring of dengue clusters via MyENV App/web	Ad-hoc	Daily	Daily

*Recommended for sustainability

This Action Plan shall be monitored and reviewed by the top management

Appendix A - Items from NEA SWO

S/N	Items from NEA SWO for ALL zones and areas	Action by ALL Zone / area I/C
1	Collect and properly dispose of all disused water-bearing receptacles and accumulated debris	
2	Drain off all stagnant water on every floor of the building	
3	Backfill and level all ground depressions	
4	Place all building materials 30cm above ground level	
5	Remove all stagnant water in and on machinery and building materials	
6	Provide proper drainage system around your premise to drain away all stagnant water	
7	Submit comprehensive vector control and sanitation programs	
8	Submit photos of corrective measures taken to spruce up the site	
9	Implement all measures necessary to eradicate vectors within the site	

Note: NEA will inspect the whole worksite during re-inspection. SWO will not be lifted if breeding ground(s) is/are detected and/or housekeeping at any area is not in good order.

References

In preparing this guidebook, reference was made to the following publications:

2. NEA Scope of work for mosquito breeding prevention

3. NEA Checklist for mosquito breeding sites

Acknowledgement is made for the use of information from the above publications and contribution from members of SCAL.