



SUSTAINNOVATION FOR BETTER WORLD

**Head of Creative Center for Eco-design
Building Innovation Department
Kasetsart University Architecture**

**THE FUTURE
IS ROUGH !**



THE WORLD IS SICK

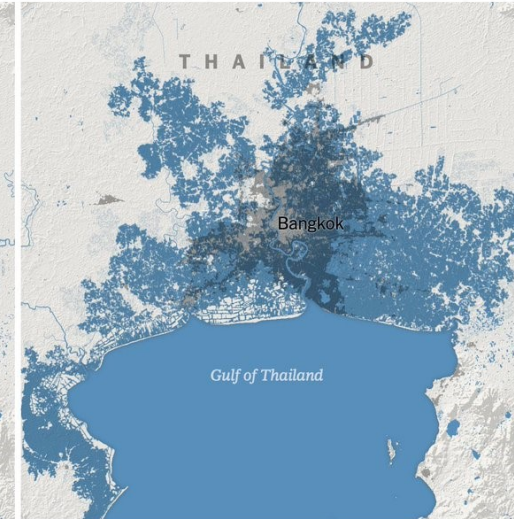
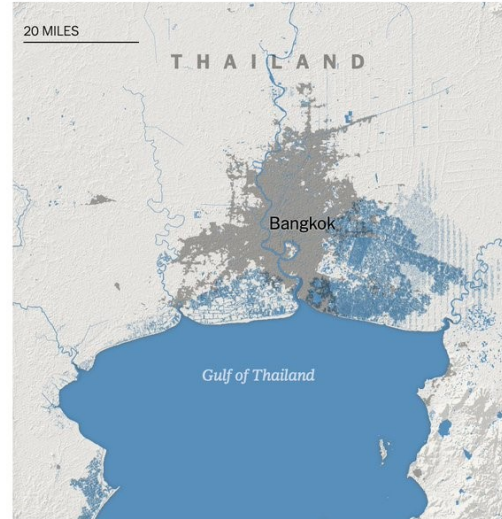


A LOT OF SHOCKS & STRESSES

■ Land underwater at high tide ■ Populated area

Old projection for 2050

New projection for 2050

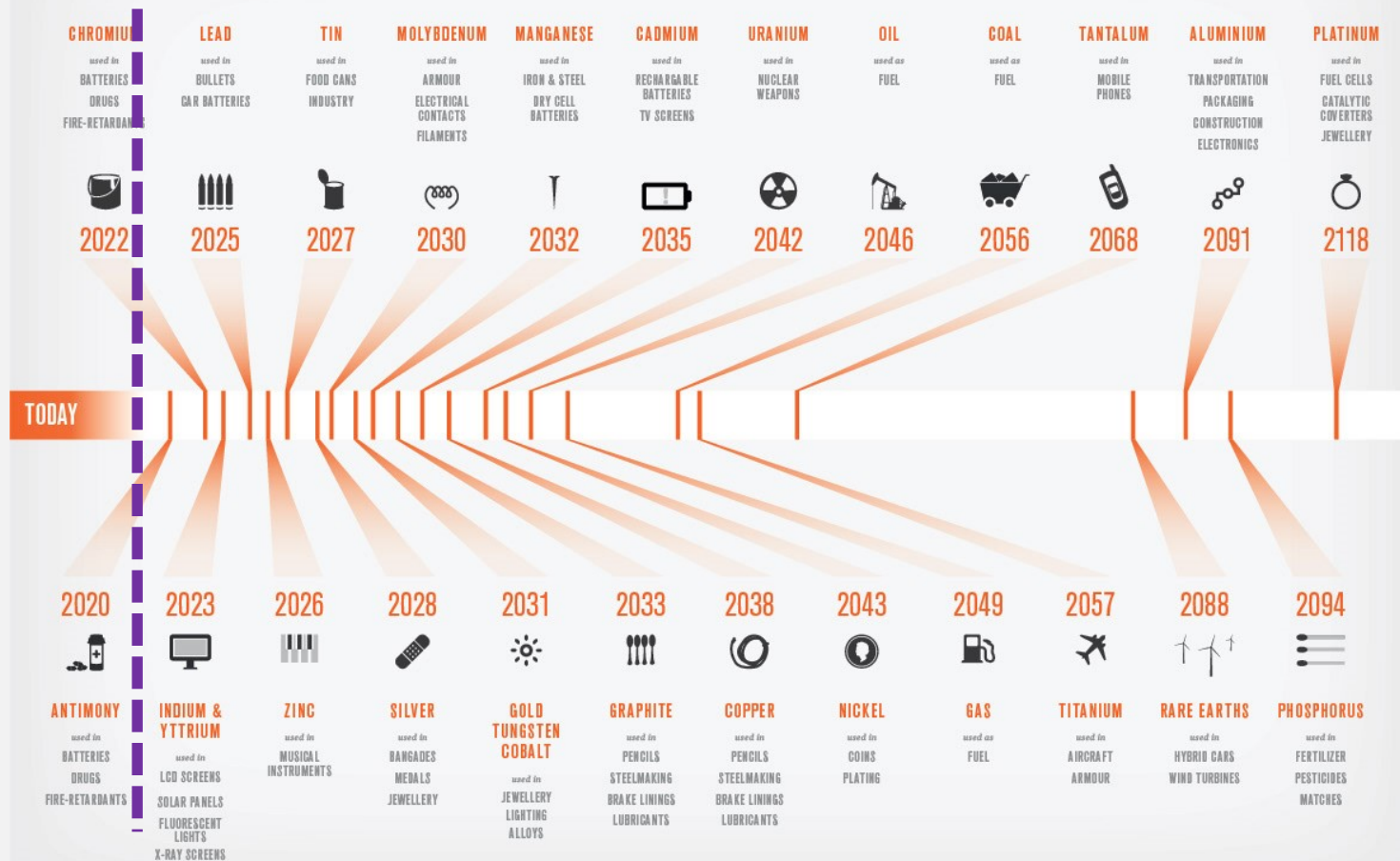


A LOT OF SHOCKS & STRESSES



POOF!

AT THE CURRENT GROWTH RATE OF THE USAGE OF THESE NON-RENEWABLE RESOURCES, THESE PRODUCTS/SERVICES WILL SOON HAVE DISAPPEARED FROM THE FACE OF OUR PLANET EARTH. WHEN? SEE FOR YOURSELF!



**CLEARLY, WE
ARE DOING
SOMETHING
WRONG !**

**HOW CAN WE
DO BETTER ?**





PROJECT BRAND



HOTEL & HOSPITALITY



THEME PROJECT BRAND



PROPERTY MANAGEMENT



RESALE & RENTAL



JOINT VENTURE BRAND



RESEARCH & INNOVATION



GREEN BUILDING
CERTIFICATION





Corporate

MQDC Activities



Projects

Magnolias



The Forestias



The Aspen Tree



Whizdom



Mulberry Grove



Whizdom 101
Residential



Whizdom 101
Development (Phase 2)



Cloud 11



S6



Container Yard



**IS THE WORLD
GETTING BETTER ?**

**AT MQDC, WE ALWAYS
TALK ABOUT HOW WE STILL
DAMAGE THE PLANET
WITH OUR
ECO-CONSCIOUS PROJECTS.**

**TO PUT TOGETHER
NEW SOLUTIONS,
MQDC ESTABLISHED RISC**
[RESEARCH & INNOVATION FOR SUSTAINABILITY CENTER]

2018



RISC

RESEARCH & INNOVATION
FOR SUSTAINABILITY CENTER

MOQDC
FOR ALL WELL-BEING



Magnolias Ratchadamri Boulevard (MRB) 4th Floor

5 RESEARCH HUBS FOR SUSTAINABLE WELLBEING

1. AIR QUALITY (FOR HEALTH & WELLNESS)



2. MATERIALS & RESOURCES



3. PLANT & BIODIVERSITY (INCL. LAND REJUVINATION)



4. HAPPINESS SCIENCE (INCL. HUMAN BEHAVIORS)



5. RESILIENCE SCIENCE



**WE NEED TO
GO BEYOND
SUSTAINABILITY**

RESILIENCE : “resilio” (Latin)
meaning “to bounce back”



RESILIENCE FRAMEWORK FOR CITY DEVELOPMENTS (THAILAND)

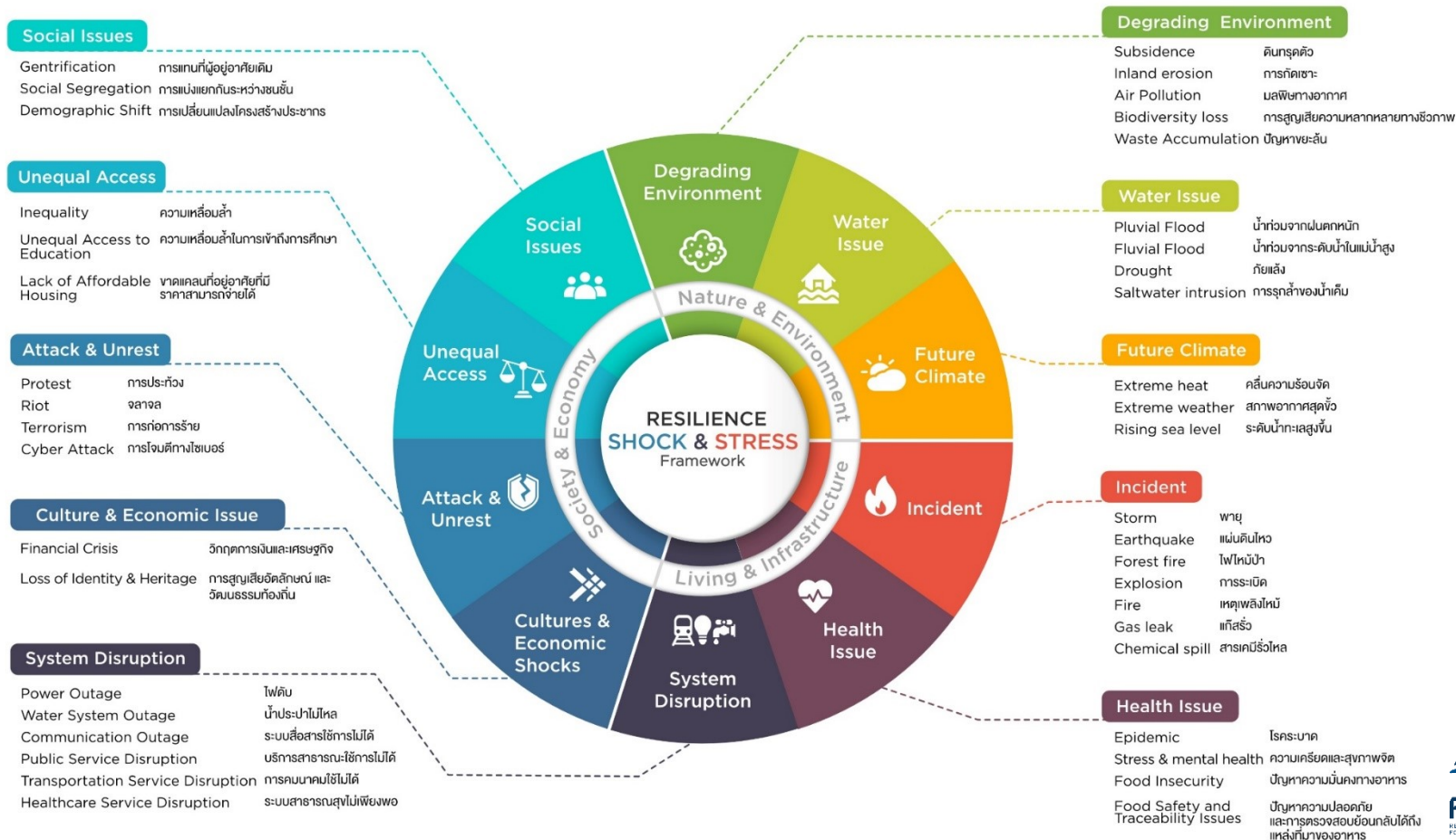
Society & Economy



Nature & Environment

Living & Infrastructure

RESILIENCE FRAMEWORK FOR PROPERTY DEVELOPMENTS (THAILAND)



IMAGINE HAPPINESS

THE FORESTIAS



RISC
RESEARCH & INNOVATION
FOR SUSTAINABILITY CENTER

An aerial architectural rendering of a large-scale urban development. The central focus is a dense, lush green forest that covers a significant portion of the site. Interspersed within and around this forest are various building types: several tall, modern skyscrapers with glass and wood facades, and numerous smaller, multi-story residential or commercial buildings. The development is situated near a body of water, with a winding path or canal visible. In the background, other urban areas and distant hills are visible under a hazy sky.

FOREST INTEGRATED PROPERTY DEVELOPMENT

Imagine Happiness



Social Cohesion



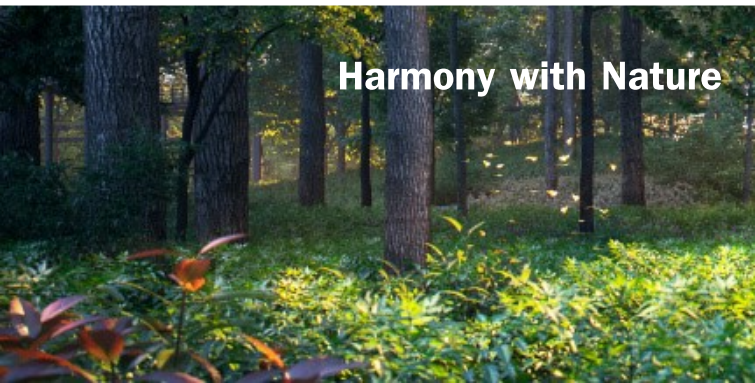
Intergeneration



Forest/ Biodiversity



Harmony with Nature





LIFE AT THE FORESTIAS

As a complete lifestyle destination, The Forestias provides an exhilarating mix of amenities and venues where you can join in the many activities on offer within this thriving community. Made up of residential zones, retail and office spaces, a 6-star hotel, health and medical facilities, cultural and community centers as well as educational and learning institutions, there is something here for everyone.

Computer-generated Imagery for advertising purposes only. Serviced Apartments is a future project (details are subject to change). All text and images are for advertising purposes only. The company reserves the right to amend the details specified herein without prior notice.

WELL-BEING of THE FORESTIAS



1

Thermal Comfort



People who live in a **thermal comfort satisfaction environment** can be more **productive**.^[1]

Leading research indicates **productivity decrease by 6%** when space is **overheated** and **decrease by 4%** when space is too **cold**.^[2]

[1] Huizenga C, Abbaszadeh S, Zagreus L, Zagreus L, Arens E. Air quality and thermal comfort in office buildings: Results of a large indoor environmental quality survey. In: Proceedings of Healthy Buildings 2006. Vol 3. 2006: 393-397. Accessed November 27, 2017.

[2] Seppanen O, Fisk WJ, Faulkner D. Control of Temperature for Health and Productivity in Offices. 2004. <https://eaei.lbl.gov/sites/default/files/lbnl-55448.pdf><https://eaei.lbl.gov/sites/default/files/lbnl-55448.pdf>. Accessed May 22, 2018.

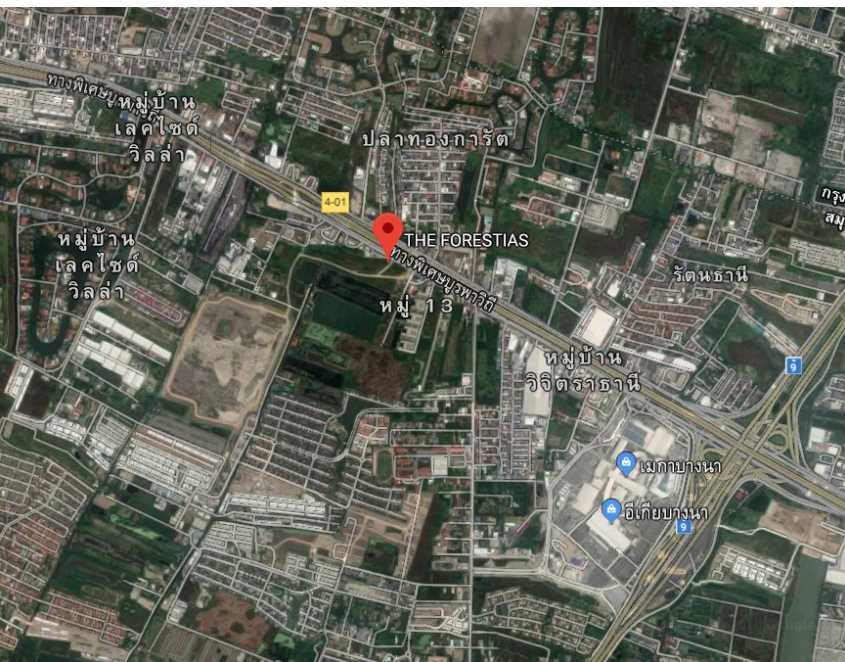
1

Thermal Comfort



FORESTIAS MASTER PLAN - CFD

วัตถุประสงค์ : จำลองลมธรรมชาติบริเวณรอบโครงการ The Forestias และอิทธิพลจากอาคารโดยรอบ ที่ส่งผลต่อลมที่จะปะทะอาคาร



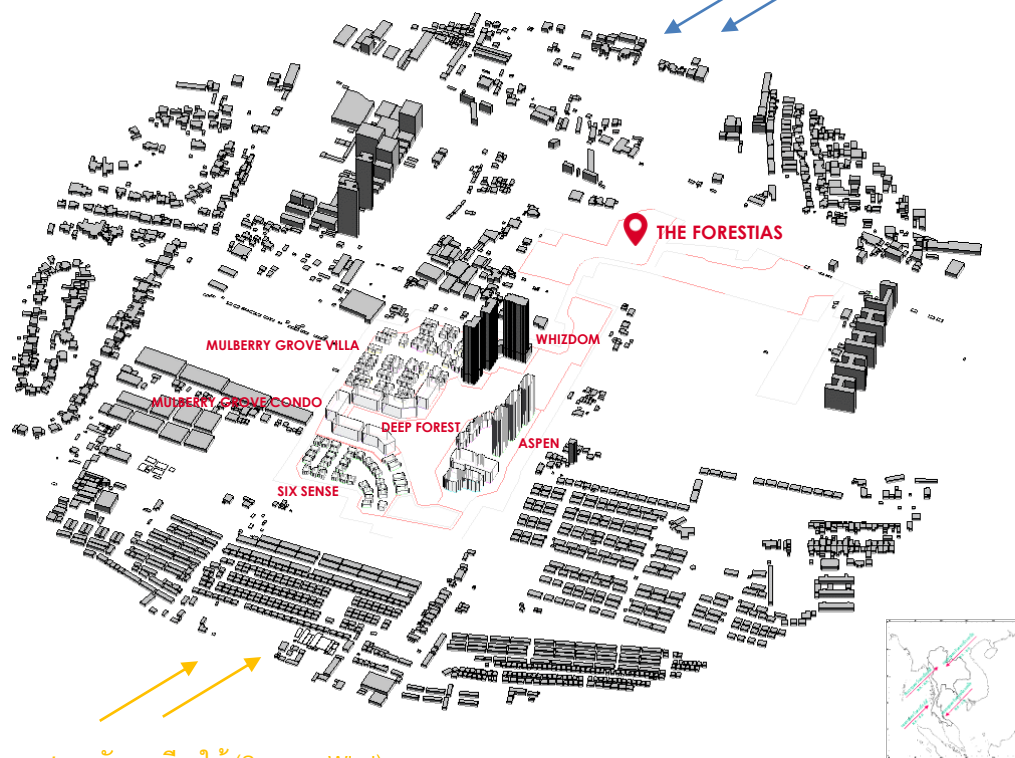
N



ภาพแสดง แผนที่โครงการ The Forestias

ลมมรสุมตะวันออกเฉียงเหนือ (Winter Wind)

ต.ค.-ม.ค.



ลมมรสุมตะวันตกเฉียงใต้ (Summer Wind)

พ.ค.-ต.ค.

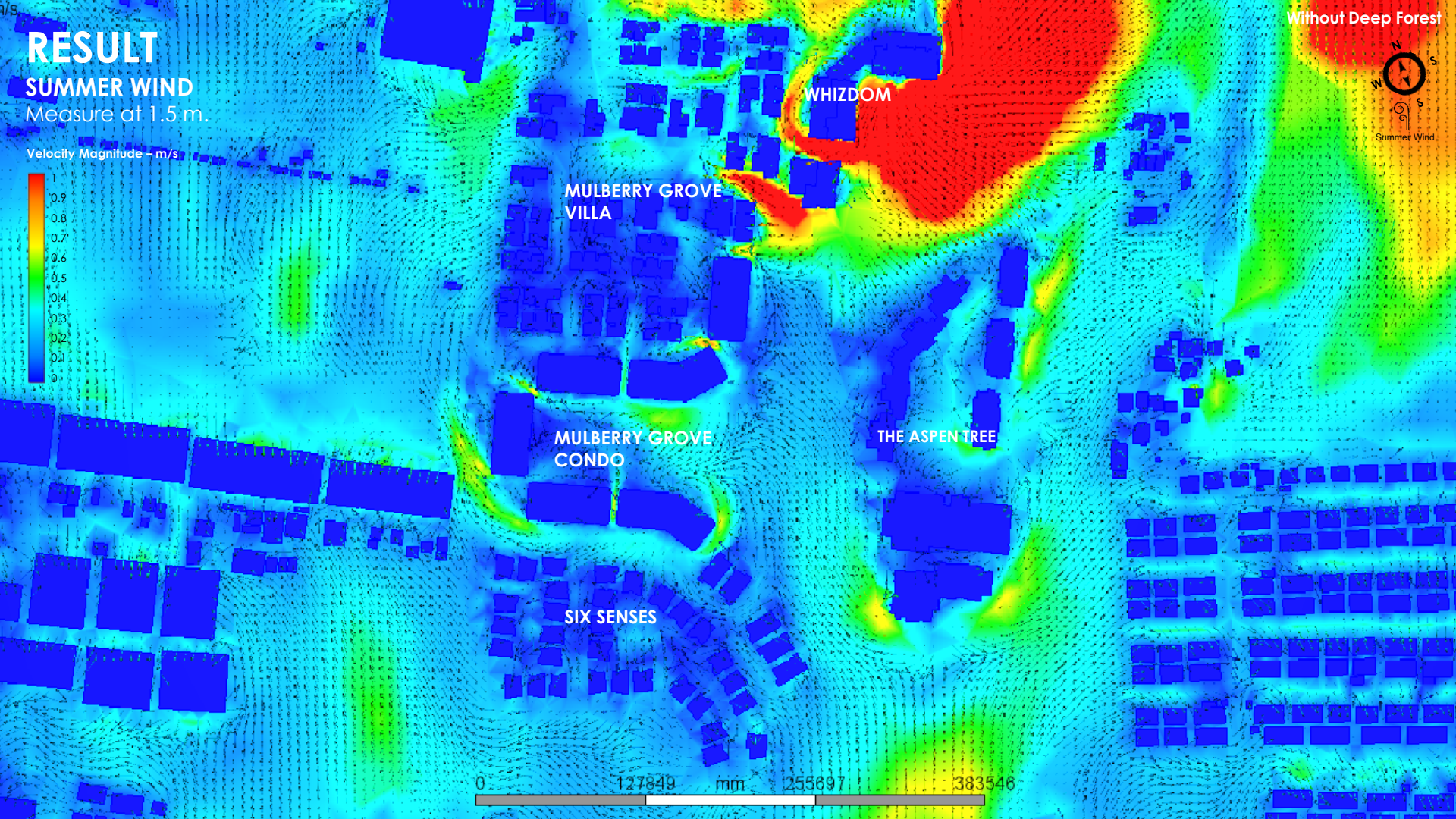
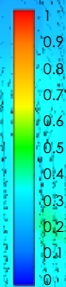
ภาพแสดง โมเดลสามมิติโครงการ The Forestias และ อาคารโดยรอบ ในรัศมี 1 กิโลเมตร

RESULT

SUMMER WIND

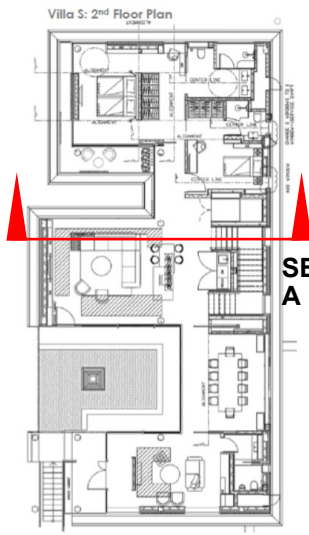
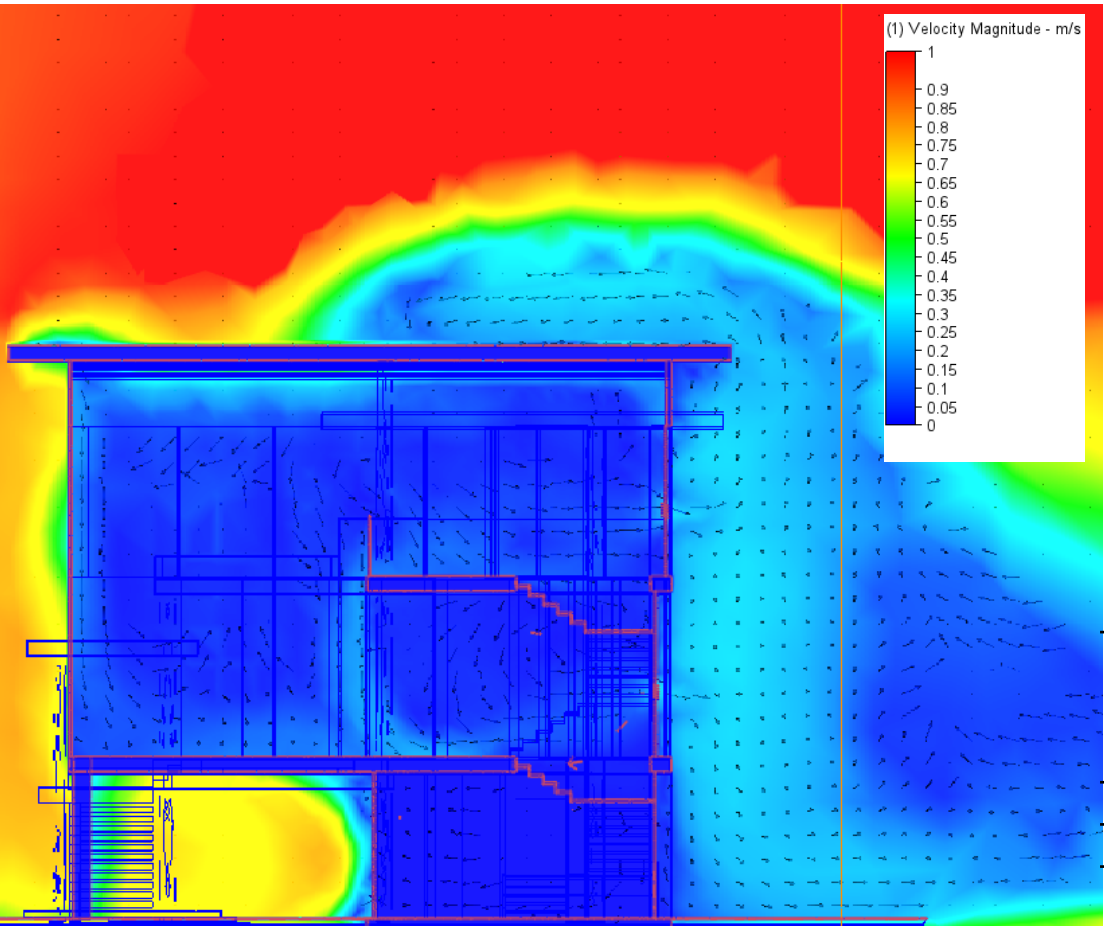
Measure at 1.5 m.

Velocity Magnitude - m/s



0 127849 mm 255697 383546

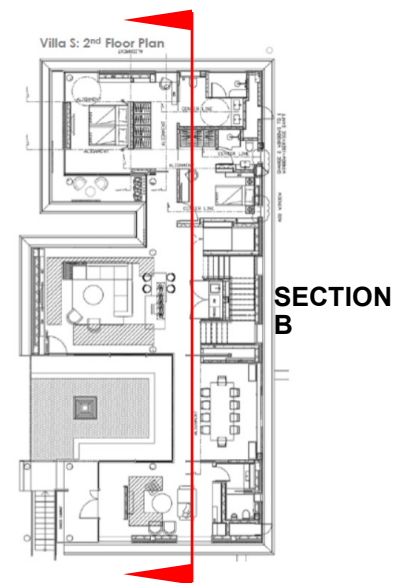
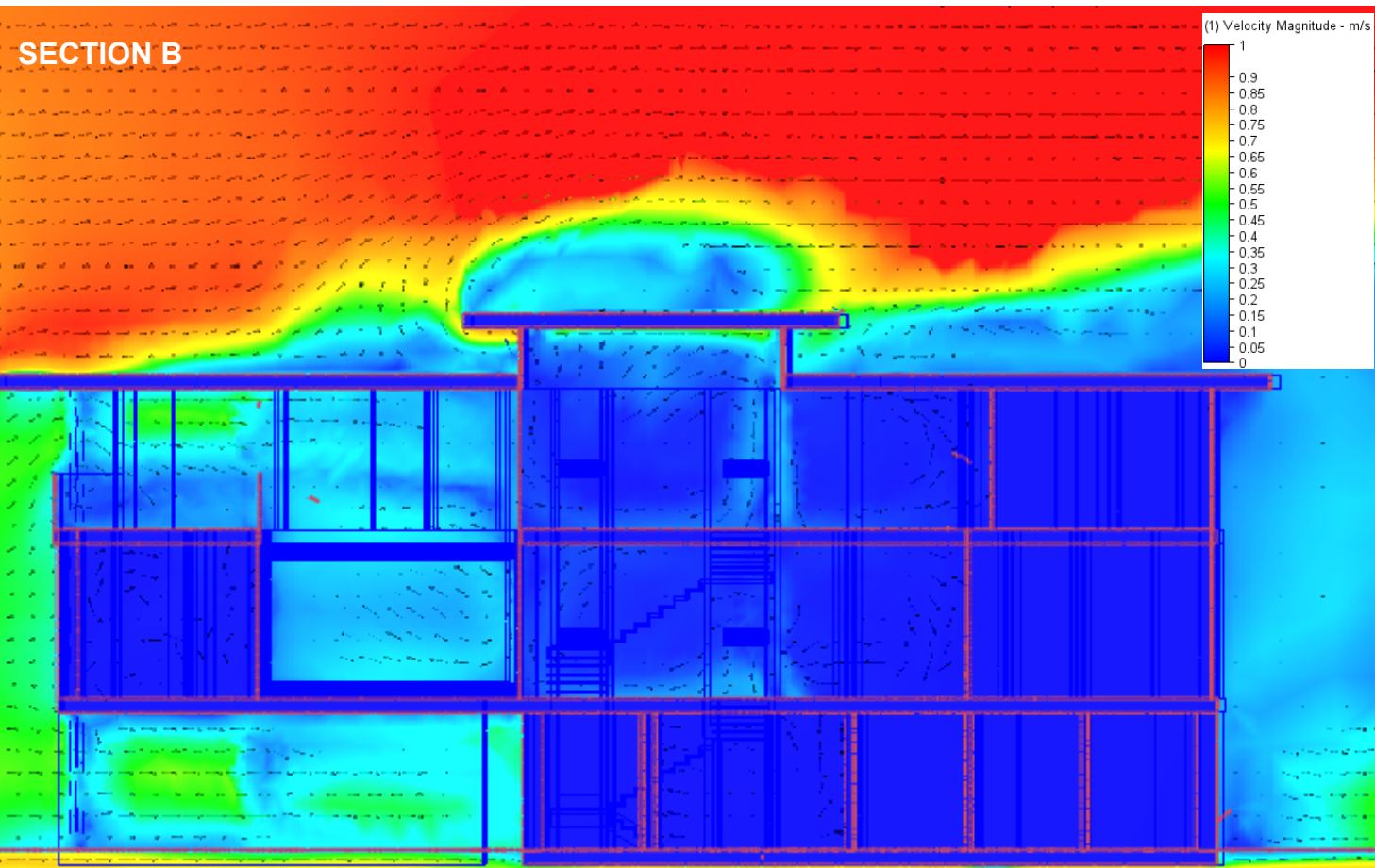
SECTION A



SECTION A

ไม่มี	มีการระบายอากาศ		
	ภายในอาคาร		
	รับผู้ไม่ได้	รับผู้ได้ (สบาย)	รับผู้ได้ (รบกวน)
0 - 0.05	0.05-0.25	0.25 - 0.99	1.00 - 1.99

Notice : Velocity (m/s)



ไม่มี	มีการระบายอากาศ		
	ภายในอาคาร		
	รับรู้ไม่ได้	รับรู้ได้ (สบาย)	รับรู้ได้ (รบกวน)
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Notice : Velocity (m/s)

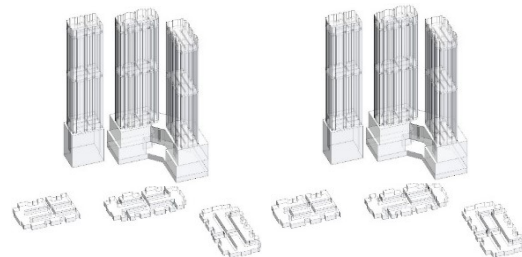
RESULT

COMPARE

All buildings

Open Corridor case

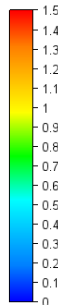
Close Corridor case



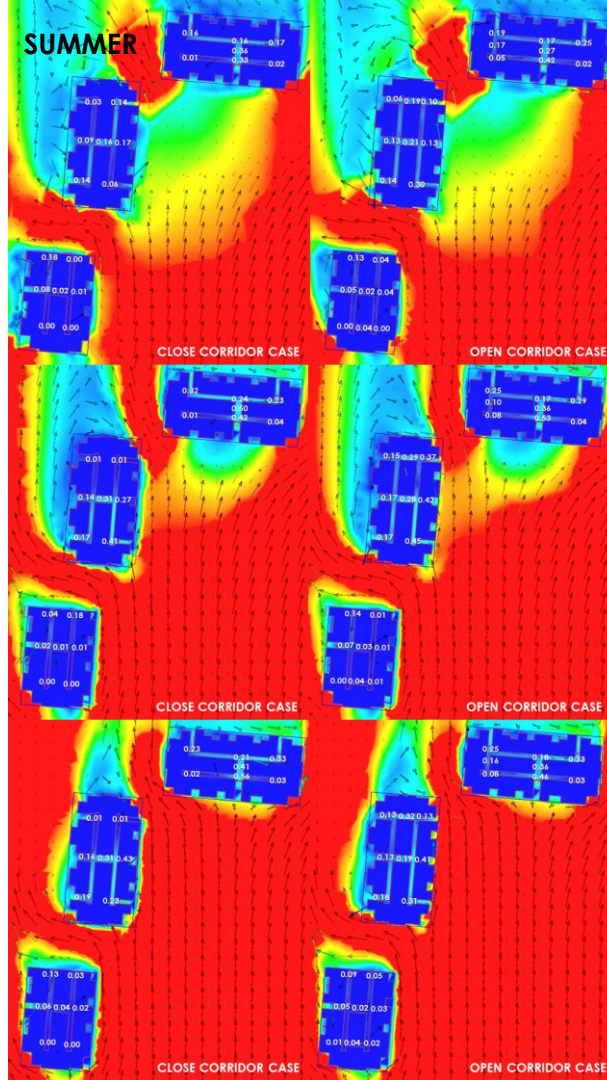
No ventilation	Ventilated		
	Indoor		
	No air movement	Comfortable	Maybe Disturbed
0 - 0.05	0.05-0.25	0.25 - 0.99	1.00 - 1.99
Notice : Velocity (m/s)			

Velocity Magnitude - m/s

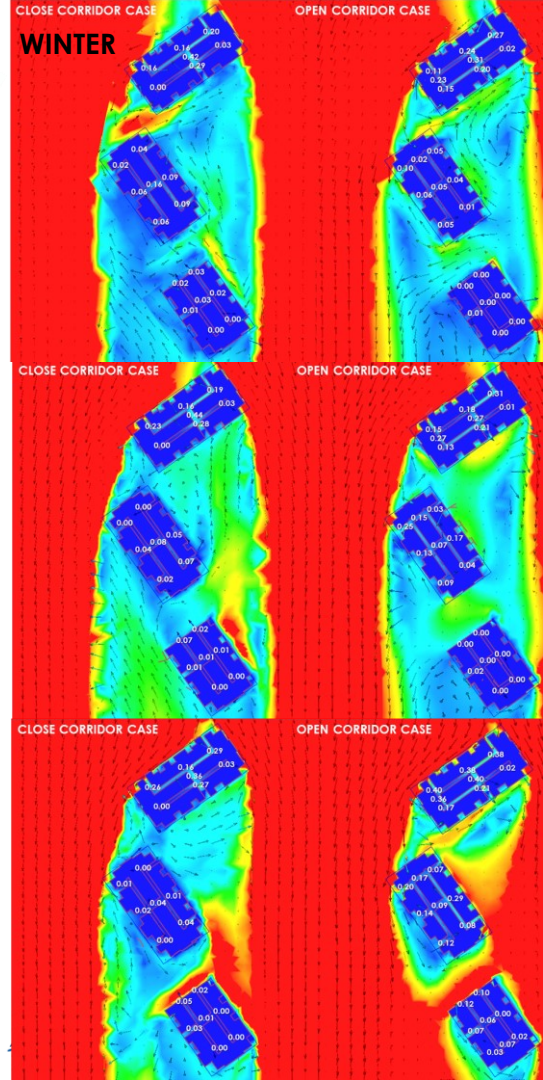
Comparing these 2 schemes.
Open corridor case helps flow the air thoroughly, but with low velocity overall.



SUMMER



WINTER



RESULT

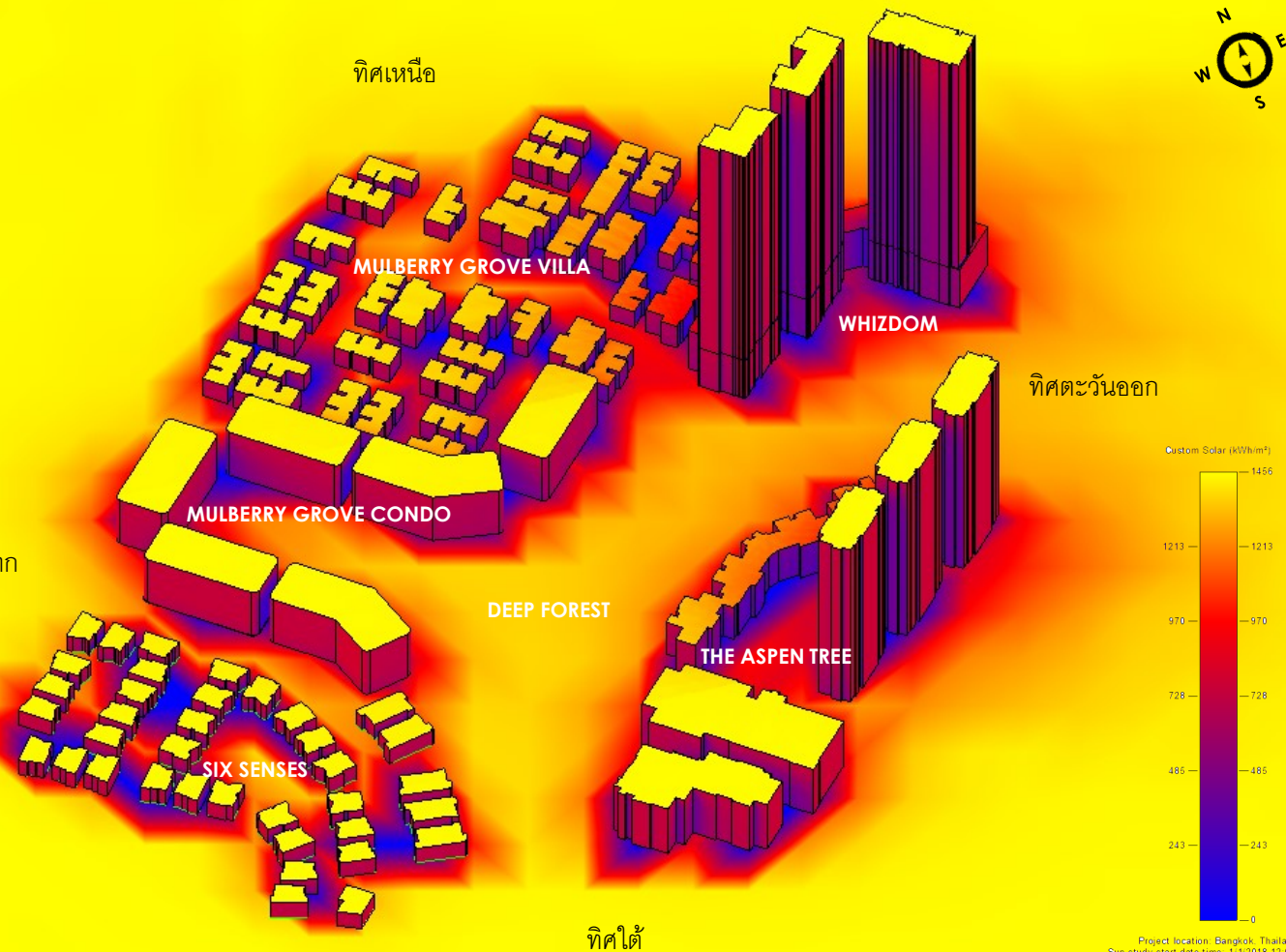
SOLAR RADIATION

โครงการอยู่ในพื้นที่โล่งแจ้ง ปราศจากอาคารสูงโดยรอบ จากภาพแสดงปริมาณความร้อนฝั่งทิศตะวันตก ทิศใต้ ค่อนไปทางทิศตะวันออกเล็กน้อย แสดงถึงปริมาณค่อนข้างสูงในทิศใต้ มากที่สุดเมื่อเทียบกับทิศอื่น ตามการโคจรของดวงอาทิตย์ รูปด้านอาคารฝั่งนี้ควรให้ความสำคัญกับการออกแบบแผงบังแดด

summary

- พื้นที่โล่งแจ้งบริเวณ Mulberry Grove Villas และ Condo รวมทั้ง Six Senses ที่ความสูงอาคารไม่สามารถบังเงาได้ ยังได้รับปริมาณความร้อนสูง
- บริเวณ Deep Forest ได้รับปริมาณความร้อนมีศักยภาพในการปลูกต้นไม้ได้ดี

ทิศตะวันตก

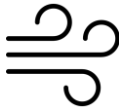


ทิศตะวันออก

ทิศใต้

2

Air Quality



People who live in **higher concentration** of **PM_{2.5}** (21 $\mu\text{g}/\text{m}^3$) has **psychological distress score** 17% higher compared to those who live in lower concentration (5 $\mu\text{g}/\text{m}^3$).


Research from Harvard University indicates **breathing high levels of PM_{2.5}** result in increased **stress from oxidative stress** and more severe inflammation in people with congenital disease after inhalation of high amounts of small dust.^[3]

In addition, **9-month-old child**, who lives in a **damp house** and live with **smoking people** has more **emotional symptoms** and **behavioral problems** by the age of 3.^[4]

[3] Huizenga C, Abbaszadeh S, Zagreus L, Zagreus L, Arens E. Air quality and thermal comfort in office buildings: Results of a large indoor environmental quality survey. In: Proceedings of Healthy Buildings 2006. Vol 3. 2006: 393-397. Accessed November 27, 2017.

[4] Seppanen O, Fisk WJ, Faulkner D. Control of Temperature for Health and Productivity in Offices. 2004. <https://eaei.lbl.gov/sites/default/files/lbnl-55448.pdf><https://eaei.lbl.gov/sites/default/files/lbnl-55448.pdf>. Accessed May 22, 2018.



A man in a white shirt is sleeping at his desk, with his head resting on a laptop. He is holding a white coffee cup in his right hand. The desk is dark, and the laptop is silver. A white computer mouse is visible on the desk. The background is slightly blurred, showing a window with a view of a city.

The average person spends about 90% of their time breathing indoor air, so it's critical to make sure that your indoor air quality (IAQ) is high. Installing an indoor air quality monitor can help ensure that the air you breathe won't damage your health or your home, and can even help your HVAC system to work more efficiently.

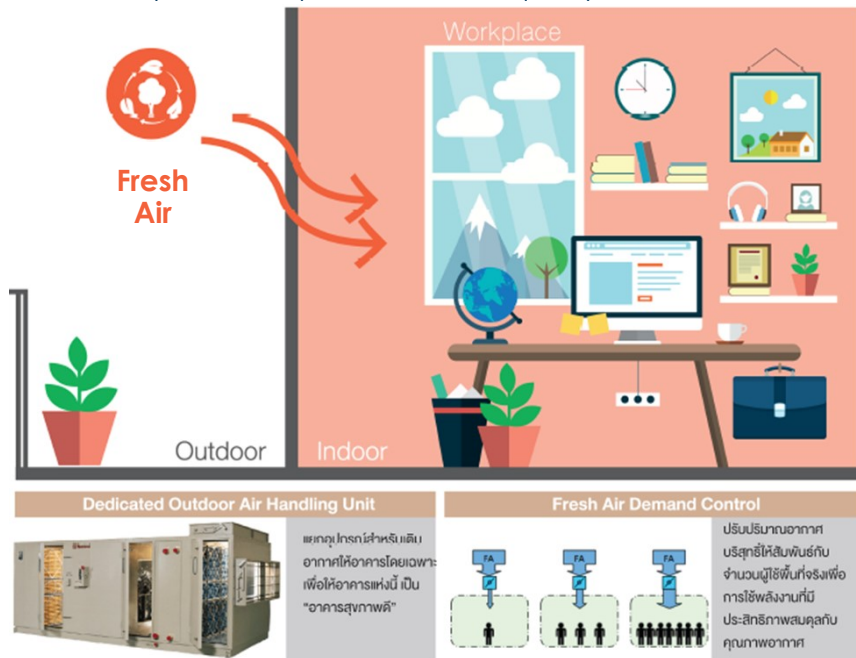
Source: US Environmental Protection Agency

2

Air Quality

Air pollution prevention

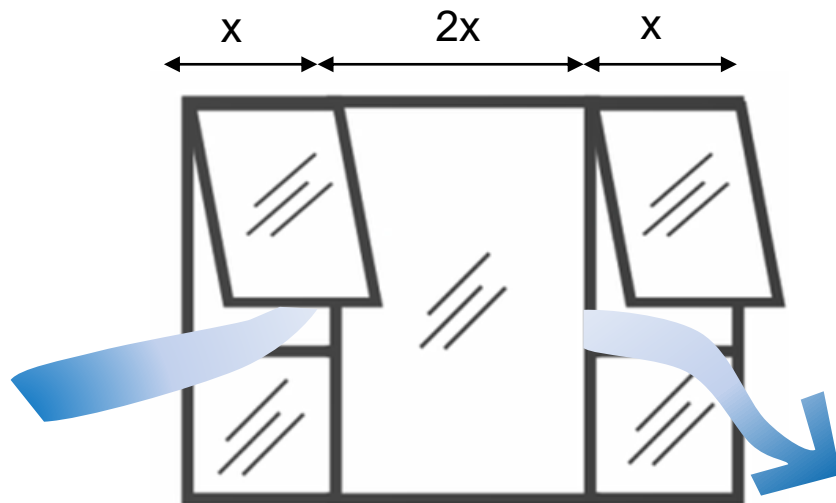
Ductless air conditioning system
Filtrate outdoor air pollutants with high efficiency filters.
Fresh air system to improve indoor air quality.



Ventilation enhancement

Every space is able to naturally ventilated.

Ventilation door & window provide to increase ventilation.



Indoor & outdoor air monitoring

Weather station

- Air Temperature ($^{\circ}\text{C}$)
- RH (%)
- Wind speed/ Wind direction
- Rain
- Air Pressure
- Light Intensity



Air Quality Monitoring

- PM10/PM2.5
- Ozone
- NO₂



THE FORESTIAS

AIR QUALITY REPORT

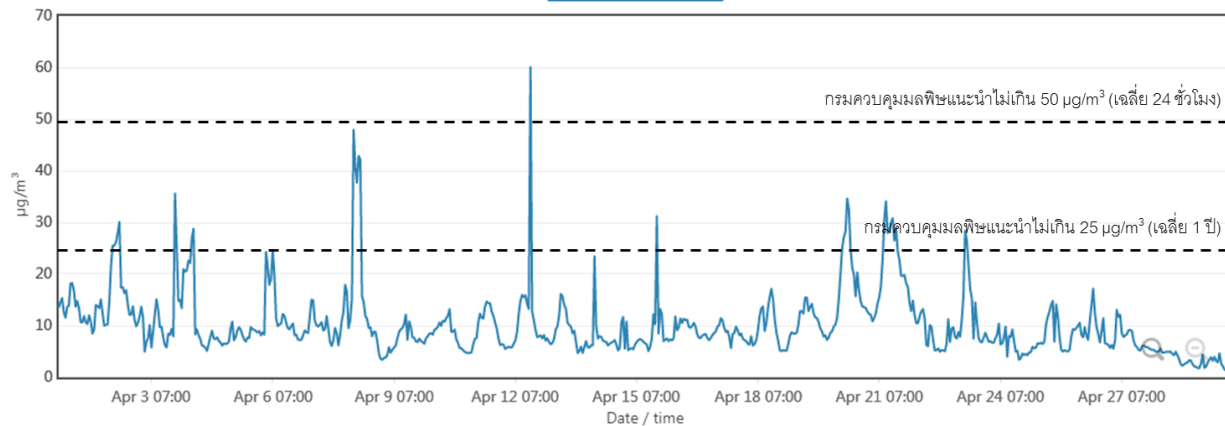
ประจำวัน ที่ 1-30 เมษายน 2562

บันทึกข้อมูลด้วยเครื่องมือ:



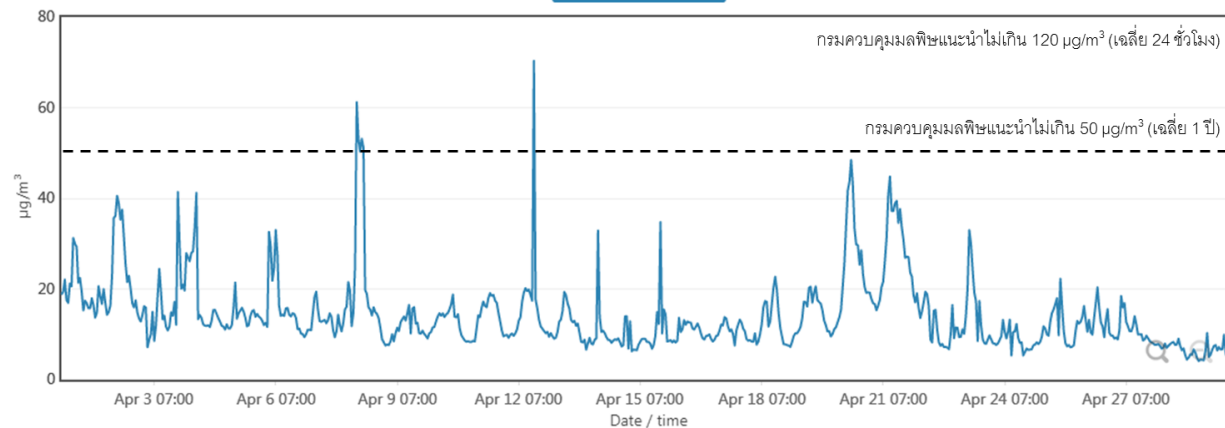
PM2.5

PM2.5 - AQY-BA-452



PM10

PM10 - AQY-BA-452



Ductless Air Conditioning System & Fresh Air System

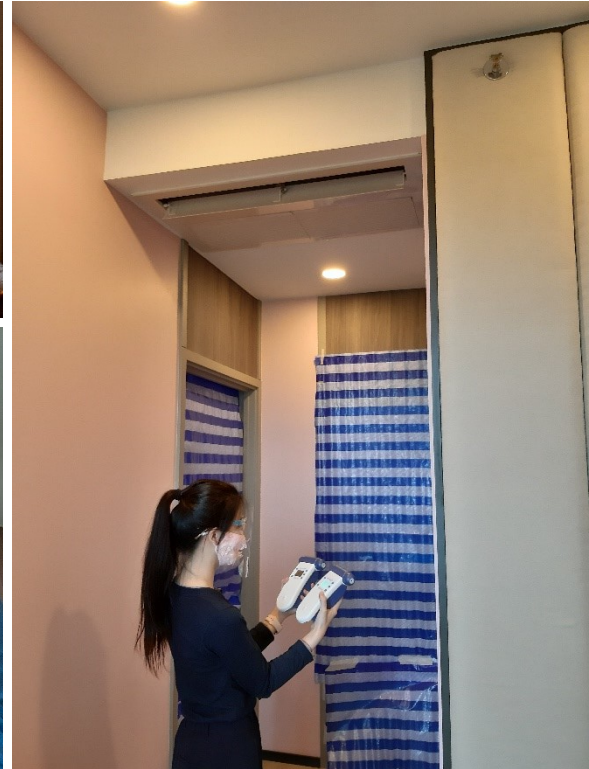
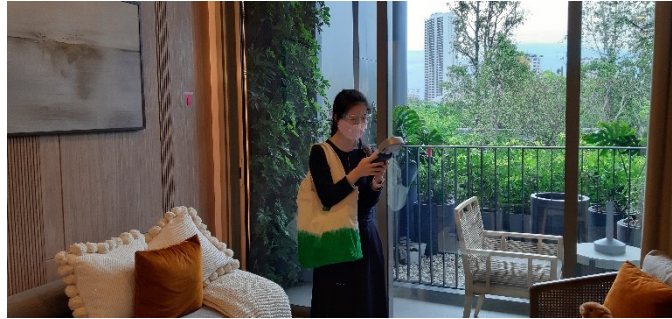
Forestias เลือกใช้ระบบปรับอากาศระบบน้ำเย็นที่ไม่มีท่อลม และ ระบบเติมอากาศบริสุทธิ์ ในรูปแบบต่างๆ เช่น ERV, Fresh air fan, DOAS (Dedicated Outdoor Air System)



Onsite Measurements

Show Unit at Forest Pavilion : 28 May 2020

ทำการตรวจวัดคุณภาพอากาศภายหลังการติดตั้งงานระบบด้วยเพื่อประเมินประสิทธิภาพการทำงานของระบบให้เป็นไปตามที่ออกแบบไว้



3

Lighting Quality

Many studies have shown daylight exposure impacts our moods and **reduces depression**.^[5]

Insufficient daylight exposure affects the **onset of depression** and **decreases cognitive function** in individuals. ^[6]

[5] Lam RW, Levitt AJ, Levitan RD, et al. Efficacy of bright light treatment, fluoxetine, and the combination in patients with nonseasonal major depressive disorder a randomized clinical trial. JAMA Psychiatry. 2016; 73(1): 56-63. doi: 10.1001/jamapsychiatry. 2015. 2235.

[6] Kent ST, McClure LA, Crosson WL, Arnett DK, Wadley VG, Sathiakumar N. Effect of sunlight exposure on cognitive function among depressed and non-depressed participants: A REGARDS cross-sectional study. Environ Heal A Glob Access Sci Source. 2009; 8(1): 34. doi: 10.1186/1476-069X-8-34.

3

Lighting Quality

Optimize Daylighting

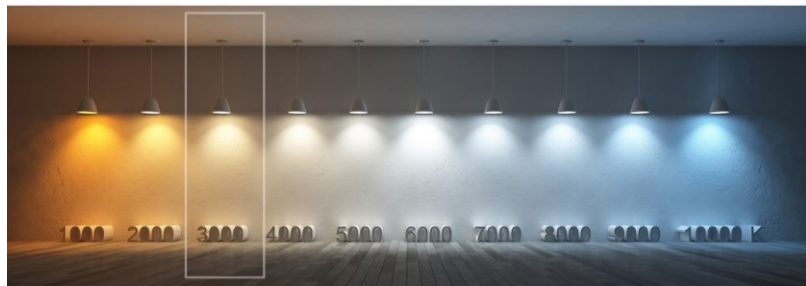
Using Natural daylight >45-55% of indoor space.

Using warm white to create cozy, calm and comfortable indoor controlled by home intelligent systems.

Warm White

2700K

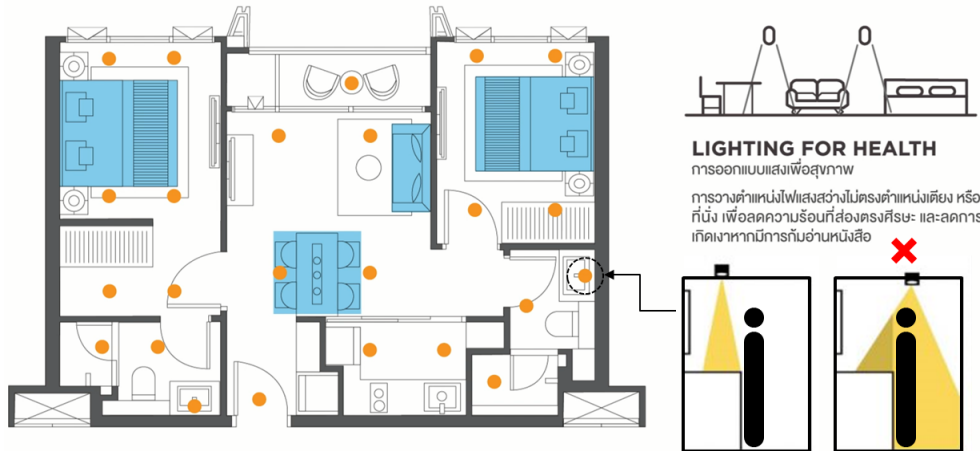
Warm, Cozy, Calm, Comfortable,
Relaxing, Intimate, Friendly



Visual Lighting Design

Good lighting positions to enhance visibility and health.

Adequate lighting levels for each type of activity.



3

Lighting Quality:

COLOR RENDERING INDEX (CRI) VALUES
OF COMMON LIGHT SOURCES

GOOD COLOR RENDERING	100 CRI	DAYLIGHT INCANDESCENT HALOGEN INCANDESCENT
	90 CRI	GOOD CERAMIC METAL HALIDE GOOD FLUORESCENT
	80 CRI	GOOD L.E.D.'S
	70 CRI	BAD FLUORESCENT METAL HALIDE
O.K.	60 CRI	BAD L.E.D.'S
AVOID	50 CRI	
	40 CRI	
	30 CRI	HIGH PRESSURE SODIUM
	20 CRI	
POOR COLOR RENDERING	10 CRI	
	0 CRI	LOW PRESSURE SODIUM

เลือกใช้หลอดไฟ LED ประสิทธิภาพสูง ช่วยการมองเห็น และ ถนอมสายตา โดย
คำนึงถึงค่าดัชนีความถูกต้องของสี (CRI) >90 (มาตรฐาน WELL Building Standard)



2700K CRI 100



2700K CRI 90



2700K CRI 80



2700K CRI 70

CRI: 90
ExcellentCRI: 80
GoodCRI: 50-70
Fair

4

Acoustic Quality

Reduction in noise level leads to **less distraction, overall stress,** and **potential health risks.**^[7]

Building facade and the **interior walls** can design to subdue **exterior** or **interior noise** much to the **benefit of personal comfort** during work, study or sleep.^[8]



[7] Evan GW, Jonhson D. Stress and open-office noise. J Appl Psychol. 2000; 85(5): 779-783.

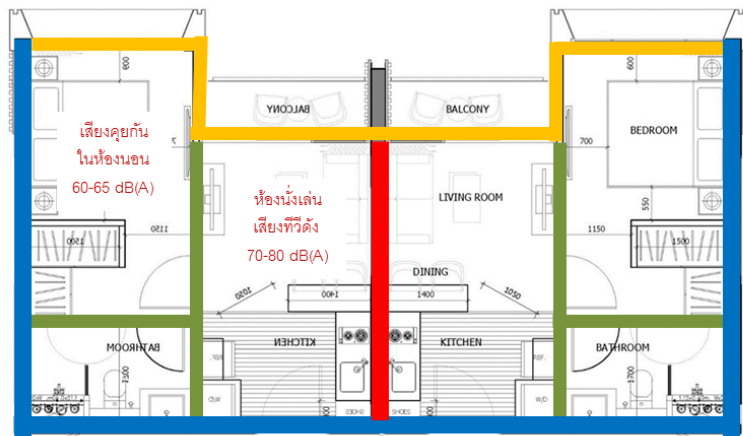
[8] Fyhri A, Aasvang GM. Noise, sleep and por health. Modeling the relationship between road traffic noise and cardiovascular problems. Sci Total Environ 2010; 408(21): 4935-4942.

4

Acoustic Quality

Noise reduction

Noise reduction walls for each function

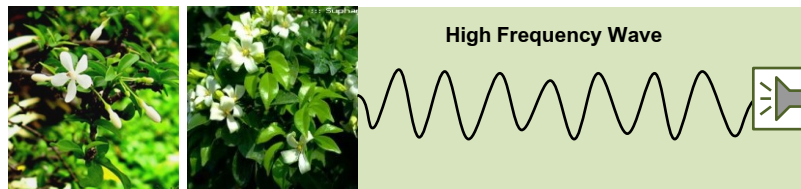


Sound Transmission Class for Material Specification

คอนกรีต 15 cm	มวลเบา 10+5+10 cm	มวลเบา 15 cm	มวลเบา 10 cm
STC = 49 dB	STC = 55 dB	STC = 46 dB	STC = 43 dB

Green buffer zone

Reducing exterior sound from roads or outdoor noise with plants



High frequency wave (เสียงแตร เสียงนกหวีด) filtered by small leaves plants
such as Wrightia religiosa Bent / Orange Jessamine / ไม้มะลิ / แก้ว



Low frequency wave (เสียงกลอง เสียงรถยนต์) filtered by large leaves plants
such as Breadfruit, Teak and MacArthur Palm / สาเก สัก หมากเขียว

Onsite Measurement: Show Unit at Forest Pavilion : 28 May 2020

ป้องกันเสียงรบกวนระหว่างห้องพัก และ ภายในห้องพักเอง (เสียงจากเครื่องปรับอากาศ, เสียงจาก ERV) ทำการตรวจวัดคุณภาพเสียงจริงที่เกิดขึ้น



5

Health & Safety

Early exposure to **toxic chemicals** may lead to **cancer** and **Alzheimer's**.^[9]

Falls are the **second leading cause** of **unintentional injury deaths** worldwide!

Adults older than 65 suffer the greatest number of fatal falls.^[10] **Falls of all kinds** represent an important cause of **child injury** and **death**.^[11]

[9] US National Library of Medicine National Institutes of Health

[10] WHO, National Center for Health Statistics

[11] National Center for Health Statistics



- Every Year we have more than 20,000 new chemicals have been introduced:
 - 85% lacked data on chemicals' health effects
 - 67% lacked health or environmental data of any kind
- 232 Toxic Chemicals were found in umbilical cord blood

Source: United States Environmental Protection Agency (EPA)

- Humans are exposed to 300 toxins before birth!
- Less than half of common chemicals have been tested for toxicity to humans.
- Early exposure to toxic chemicals may lead to cancer & Alzheimer's.

**Source: US National Library of Medicine
National Institutes of Health**



- Falls are the second leading cause of accidental or unintentional injury deaths worldwide.
- Each year an estimated 424,000 individuals die from falls globally.
- In 2013, 31,240 persons died as the result of falls: 16.2% of all injury deaths.
- The overwhelming majority of fall-related deaths (96.7%) were unintentional.

Source: WHO, National Center for Health Statistics

- Falls of all kinds represent an important cause of child injury and death. In the United States, approximately 140 deaths from falls occur annually in children younger than 15 years. Three million children require emergency department care for fall-related injuries.
- Such strategies involve parent counseling, community programs, building code changes, legislation, and environmental modification, such as the installation of window guards and balcony railings.
- Discourage or prohibit children from playing on fire escapes, roofs, and balconies, especially those that are not adequately fenced with vertical bars that have openings of 4" or less.

Source: National Center for Health Statistics



5

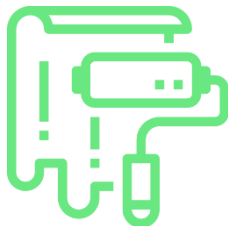
Health & Safety

Healthy Material Selection

Low VOCs Materials / Food Grade Materials



E1 Wood and Wood Composite Materials / No Wall Papers



No Granite (Indoor Area) / Healthy material for bedroom floors

Safety Design

Non-slip floor

REFERENCE STANDARD



R9 3 to 10°

เป็นค่าที่ต่ำสุดที่รับได้
สำหรับกระเบื้องที่ปูพื้นที่โถง



R10 10 to 19°

บริเวณที่ต้องเปียกน้ำ



R11 19 to 27°

พื้นที่ภายนอก
(Outdoor Area)

Laminated glass and tempered glass

High Balustrade

Light & Plug for Health (45 cm from pillows)

6

Inspiring Community

The Forestias as an innovation showcase and playground: พื้นที่บ่มเพาะ ศักยภาพวิจัย สร้างแรงบันดาลใจ และจุดประกายแนวคิดใหม่ๆ ให้กับวงการอสังหาริมทรัพย์



**Sustainability and
the Circular
Economy**



MQDC
FOR ALL WELL-BEING
**Net-Zero
WASTE**



Circular Economy

“โครงการรีไซเคิลหัวเสาเข็ม เพื่อนำมาเป็นส่วนผสมในพื้นคอนกรีต”

Recycled Concrete Aggregate (RCA)



“โครงการผสมขยะพลาสติกเพื่อเพิ่มความแข็งแรงถนนยางมะตอย”

Plastic Asphalt Road



Project: Mulberry Grove @ the Forestias

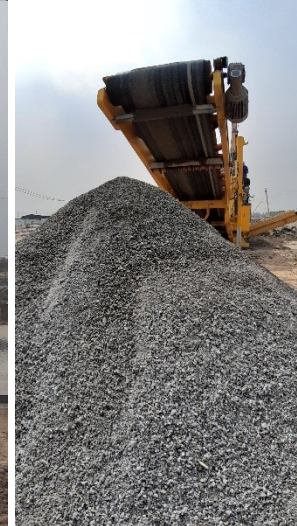
Date: pilot test 10 Jan 2020

เตรียมพื้นที่สำหรับรองรับ RCA ให้ไม่ผสมดิน

- ต้องแยกเหล็กขนาดใหญ่ออกจากหัวเข็ม



Cost: 135,000 บาท/500 ตัน



Date: 31 Jan 2020

The Forestias







Call Carpet Maker today for a presentation
 ADDRESS : 194 Moo 1 Jangsanit Rd., Muang Peer, Ban Phai, Khon Kaen 40110. Thailand
 Tel: +66 43 286 734-5
 E-MAIL: connect@thecarpetmaker.com



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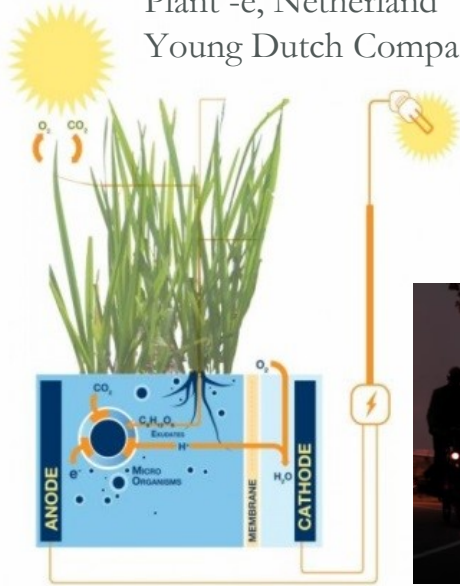
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THE CARPET MAKER
 THAILAND

Plant-e

Plant -e, Netherland
Young Dutch Company



(28 kWh/year/m²)

A Dutch company harnesses electricity from living plants, and then uses it to power cell phone chargers, Wi-Fi hotspots, and now over 300 LED streetlights in two sites in the Netherlands.

Plant-e was founded on September 14, 2009 as a spin-off company from the sub-department of Environmental Technology from Wageningen University.



Plant-e mockup activities at the Forestias





7

Living with Nature

Nature or **High quality outdoor space** are associated with **lower rates** of **depression**, **anxiety** and **stress**.^[12]

Studies have found neighborhoods with more than **20% of green space** help **reduce stress rate**, and if there is more than **30% of green space**, it further reduces the **anxiety rate**.^[13]

[12] Beyer, K. M., et al.(2014). Exposure to neighborhood green space and mental health: evidence from the survey of health of wisconsin. International Journal of Environmental Research and Public Health, 11(3), 3453-72.

[13] Cox, D. T. C., et al. (2017). Doses of Neighborhood Nature: The Benefits for Mental Health of Living with Nature. Bioscience, biw173.



Living with Nature

Biodiversity

Green spaces connect us with nature.

Learn to love nature and animals (Forestias).



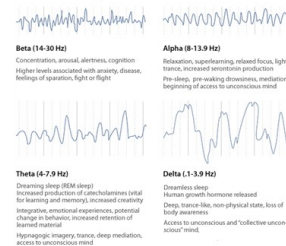
Nature Therapy

High-quality outdoor green space to connect with nature

Color, Aroma & Sound Therapy



Four Categories of Brain Wave Patterns



Biodiversity Survey

Pre-Development Phase



Site Data Collection



After the survey, we found >60 bird species which are rare in BKK area.



Biodiversity Survey

Pre-Development Phase



RESIDENT BIRDS

Before project development



นกกระปูด



นกกาเหว่า



นกเขาสก



นกยางควาย

After project development



นกตีทอง



นกกาขนิม



นกอีแรด



นกสีน้ำตาล



นกปรอดหน้าขาว

MIGRATORY BIRDS

Before project development



นกจับแมลงสีน้ำตาล

www.oknation.net/blog/plains-wanderer



นกกระสาแดง



นกยางกรอก

© Tim Manson



นกแอ่นทุ่งใหญ่

www.oknation.net/blog/plains-wanderer

After project development



นกกระเต็นหัวดำ



นกแซวสวรรค์



นกอีเสือ



นกแต้วแล้วธรรมดา

www.oknation.net/blog/plains-wanderer

Biodiversity Survey



Pre-Development Phase



Biodiversity Survey

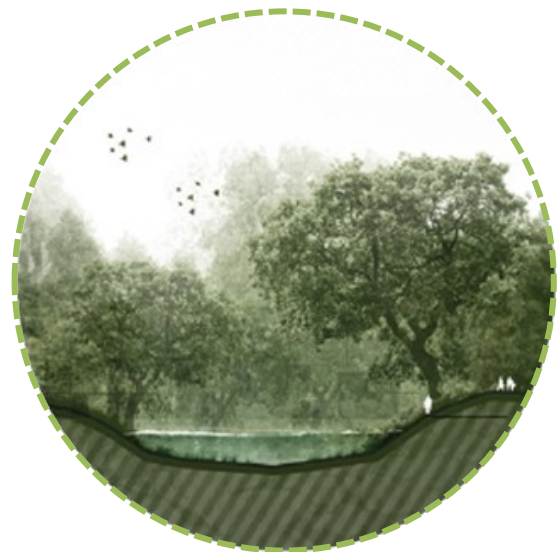
Pre-Development Phase



Existing Site Analysis

Soil testing

Water testing

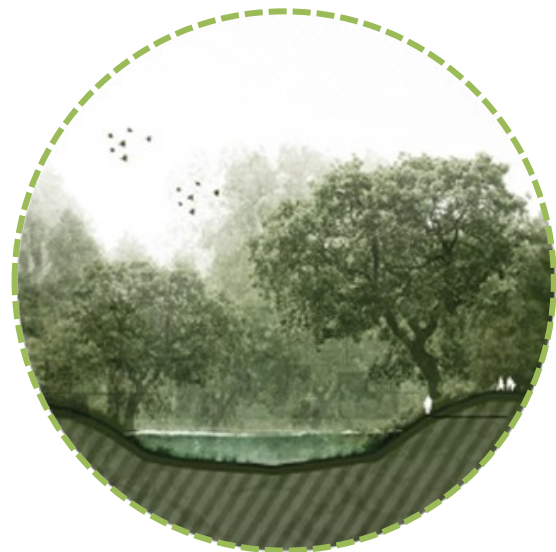


ดินชั้นบนมีปริมาณอินทรีย์วัตถุค่อนข้างสูงและ N-P-K ค่อนข้างดี ดินชั้นล่างส่วนใหญ่มีระดับความเค็มปานกลาง

Existing Site Analysis

Soil testing

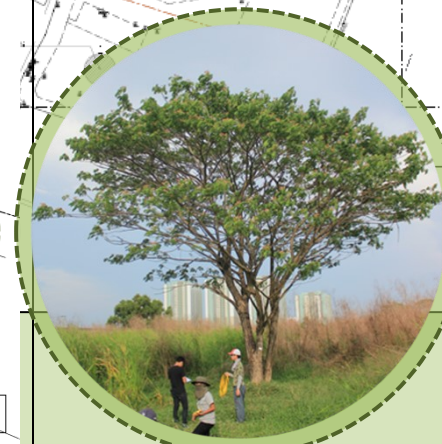
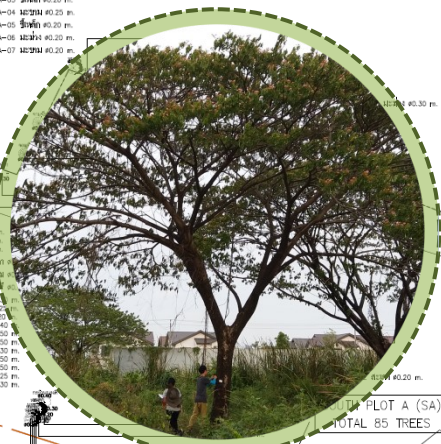
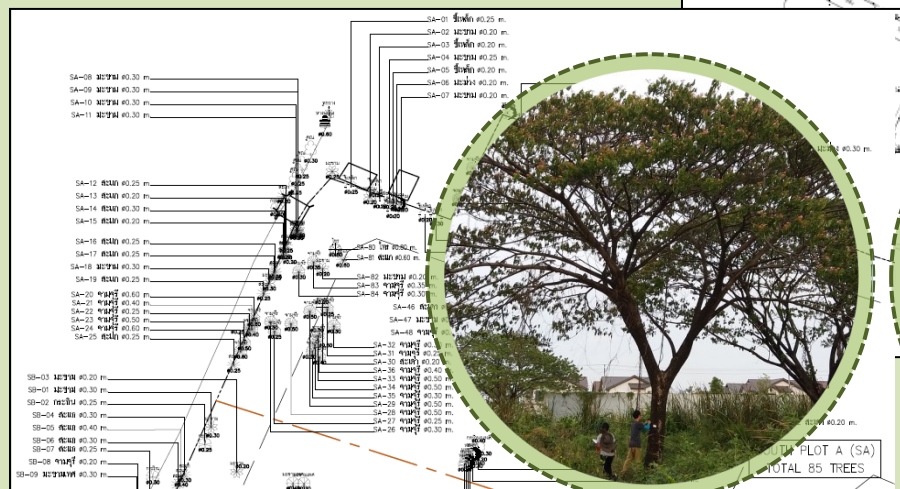
Water testing



น้ำมีค่า pH เป็นกลาง มีคุณภาพปกติตามแหล่งน้ำผิวดินสามารถใช้รดน้ำและเกษตรกรรมได้

Existing Site Analysis

Existing Tree







Providing **various types of activities and mental health promotion programs** such as **gardening**, research suggests that gardening is associated with **decrease stress**.^[14] In fact, **30 minutes of gardening** decrease **cortisol** level from **stressful to normal**.^[15]



[14] Soga, M., et al. (2017). Health benefits of urban allotment gardening: improved physical and psychological well-being and social integration. *International Journal of Environmental Research and Public Health*, 14(1), 71.

[15] Van Den Berg, A. E., & Custers, M. H. (2011). Gardening promotes neuroendocrine and affective restoration from stress. *Journal of Health Psychology*, 16(1), 3-11.

8

Living Quality

Activity and program for mental health

Wide range of activity to relax for everyone.

Promote good mental health activities.



Reference: Bennie, M., & Maureen. (2020, May 04). How Does Your Garden Grow? Mental Health, Wellness & Skills Development Through Gardening. Retrieved May 26, 2020, from <https://autismawarenesscentre.com/how-does-your-garden-grow-mental-health-wellness-skills-development-through-gardening/>

Worry-free (Premium Care & 30-year warranty)

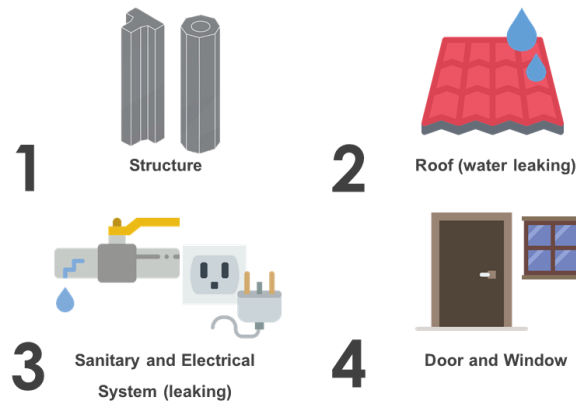
Guarantee quality of structural durability and well-functioning homes.

No roof leaks, no sanitary & electrical system leakages, and door & windows

MQDC POLICY



4 issues



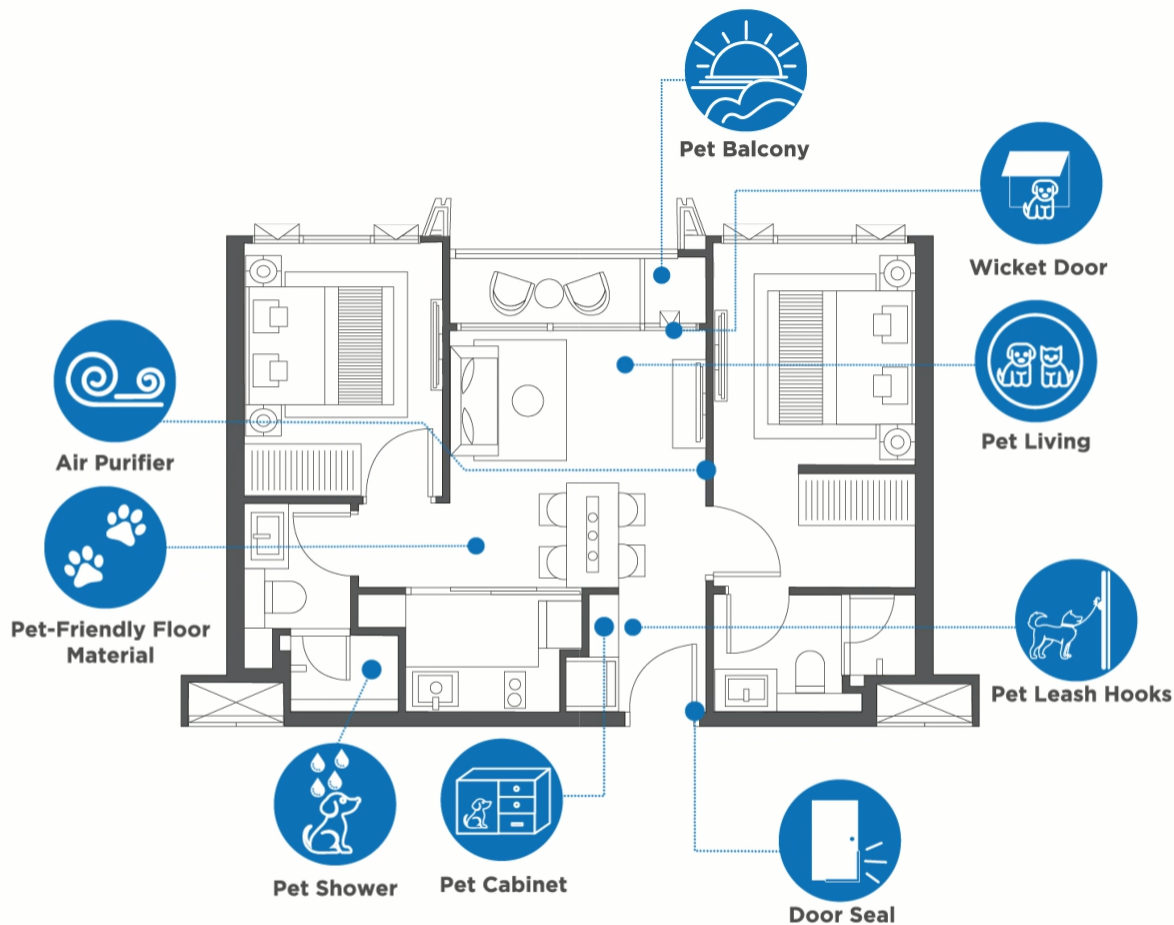
Pets are associated with **happiness in their owners**, research has demonstrated **positive connections between pets and the physical health and mental health as well.**

*Katherine Jacobs Bao and George Schreer
Department of Psychology, Manhattanville College, New York, USA*

Pets can help to improve our cardiovascular health.

National Institutes of Health, Department of Health and Human Services





PET-FRIENDLY DESIGN

การออกแบบห้องพักอาศัยที่เป็นมิตรต่อสัตว์เลี้ยง

whiz



PET-FRIENDLY DESIGN

Functional Diagram (Residential Units)

WELL-BEING of THE FORESTIAS





7.3 Energy saving

40,000 tons

annually by using Central Utility Plant (CUP) and

Reduce carbon emission

30,000 tons of

CO2e annually



11.2 Provide access to sustainable transport systems for all. With shuttle bus services and A car-free zone with EV charging stations



6.3 Net zero discharge **0** lite water discharge to municipal



13.1 Reduce **CO2** emission



83,430 tons of CO2e annually



15.2 Total area of forest

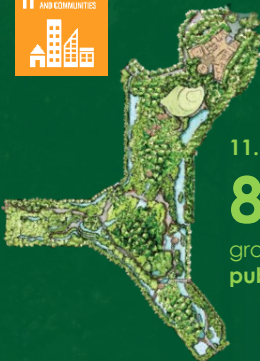
48,000

sq.m. or **30** rai or **45%** of the project landscape.



11.7 A Canopy Walk

8-12 m. above ground is open to the public.



3.9 Maintain good air quality by green area. To reduce pollution in outdoor air.



12.5 **90%** of construction waste will be upcycling to walking and jogging tracks, or for paving surfaces.



15.5 Total number species

500+ species of plant, animal, insect, and others.





THE
FORESTIAS

Imagine Happiness





THIPPAPORN AHRIYAVRAROMP

Founder & Chairman
DT Group of Companies



SUSTAINNOVATION FOR BETTER WORLD

**Head of Creative Center for Eco-design
Building Innovation Department
Kasetsart University Architecture**