Need for ESCP in Agricultural Sector – The case of Lojing

Moh Shalahuddin bin Adnan
Faculty of Civil and Environmental Engineering,
Universiti Tun Hussein Onn Malaysia

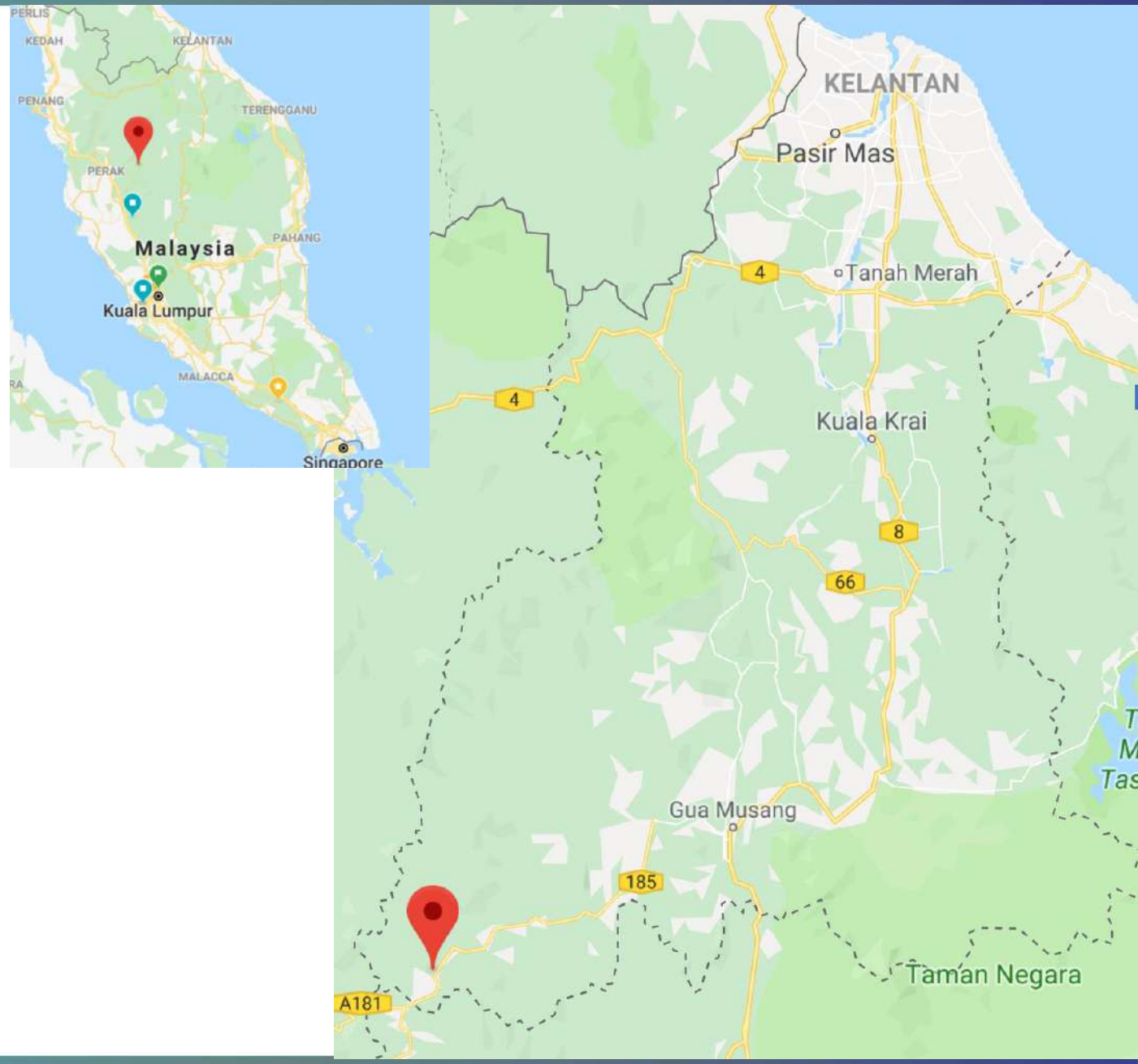
Introduction

The study area is located at Lojing, Kelantan.

The average monthly temperature is range between 12 – 26 ^{0}C

The annual rainfall is range between 1800 – 2900 mm

This area is suitable to plant temperate crop such as tomato, chilies, capsicum, and etc.



Problem & Issues

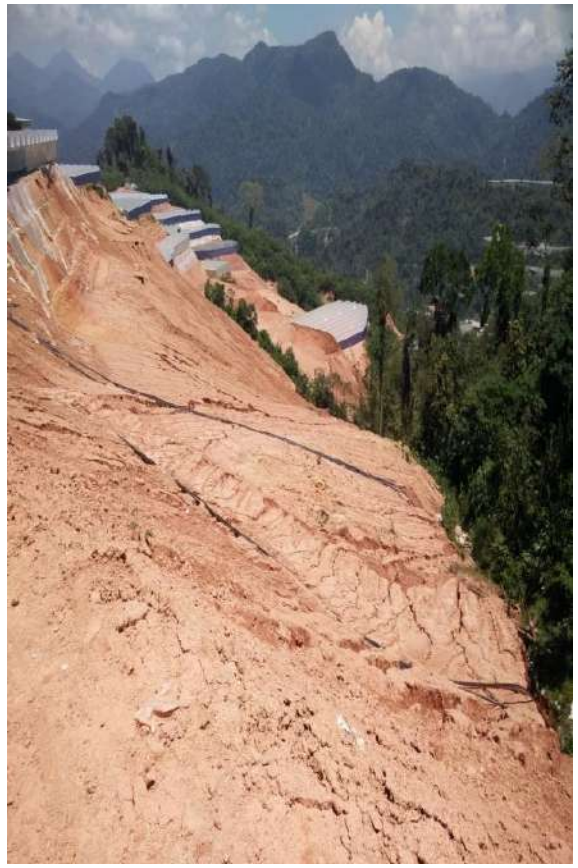
Deforestation;

Forest Area → Agriculture Area/Urban Area

Change of landuse cover - increase impervious layer

Massive land opening and clearing → high erosion and sediment

The massive agriculture activities and landuse changes have resulted in



landslide

Air Pollution

Water Pollution

Biodiversity

Latest Field Visit – July 2019

Sungai Belatop condition; Heavily polluted with sediment and nutrient

Latest Field Visit – July 2019

Sungai Belatop condition; Heavily polluted with sediment and nutrient

SUNGAI BELATOP

SUNGAI PELAUR

SUNGAI CHADOI

SUNGAI JELAI

SUNGAI PENANGAU

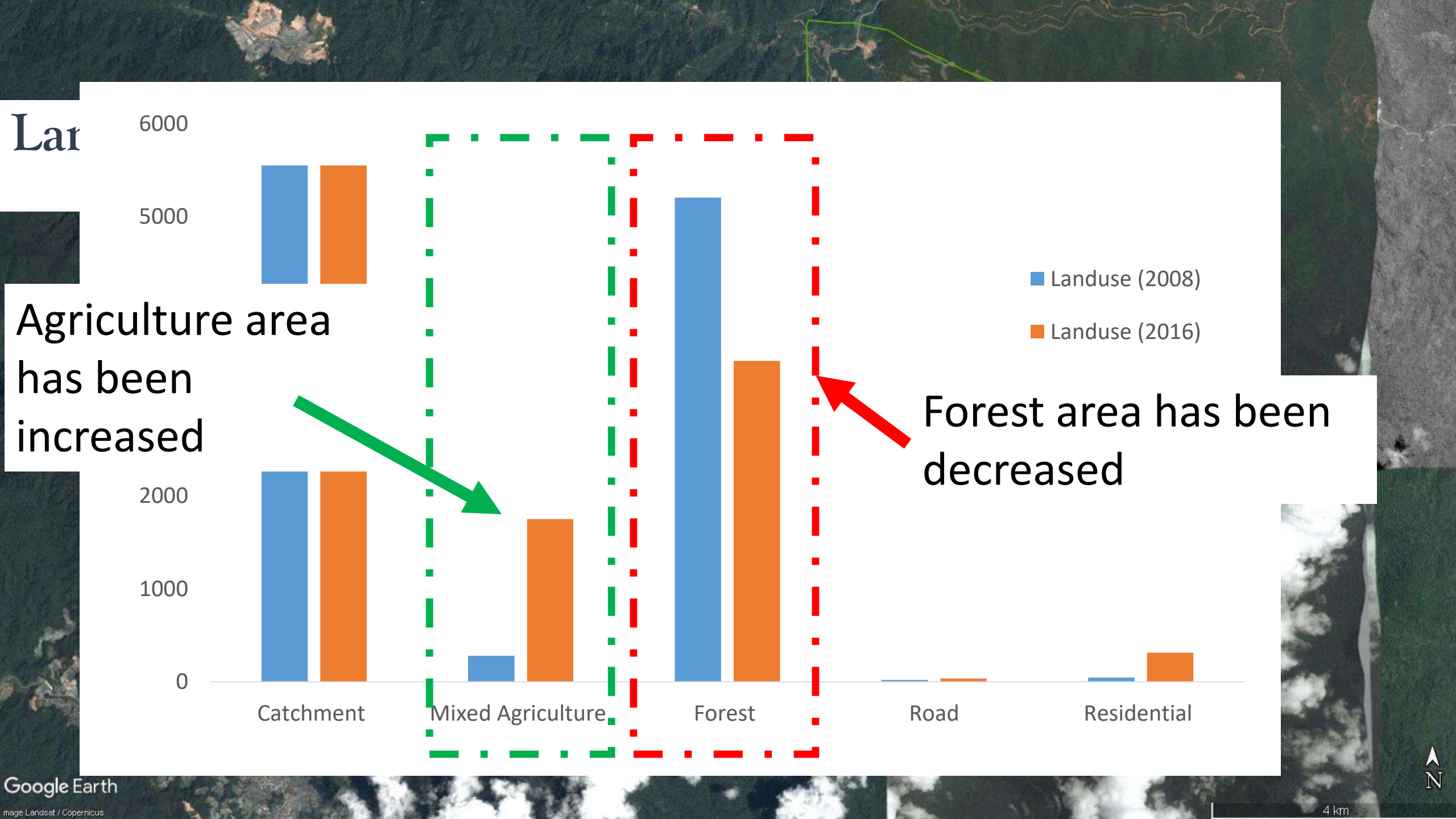
SUNGAI ISOS

These problem happened due to

- Carry out land work without approval (*kebenaran merancang*, KM)
- Carried out the land work not conforming to the approval plan
- No EIA
- No ESCP
- Slope failure
- Encroaching forest reserves

Landuse 2008

Lar


6000
5000
2000
1000
0
Landuse (2008)
Landuse (2016)
Catchment
Mixed Agriculture
Forest
Road
Residential
Agriculture area has been increased
Forest area has been decreased
Google Earth
mage Landsat / Copernicus
4 km
N

CSN

ACOMAX

LIQUID GOLD

Sg Rengil

Sg Berok

Sg Mengerod

Sg Pelaur

Sg belatop

SYARIKAT YANG MENJALANKAN` AKTIVITI PERTANIAN

ALL GREEN

MULTI SYSTEMS

- CSN
- ACOMAX
- ASPEC FLORITECH
- JABATAN PERTANIAN
- YAKIN
- LIQUID GOLD
- MULTI SYSTEMS
- ALL GREEN

Soil Loss Assessment

Analysis of Erosion Rate

Universal Soil Loss Equation (USLE)

$$A = R.K.LS.C.P$$

(developed by Musgrave, 1947; Wischmeier and Smith, 1978)

Rainfall Erosivity Factor, R

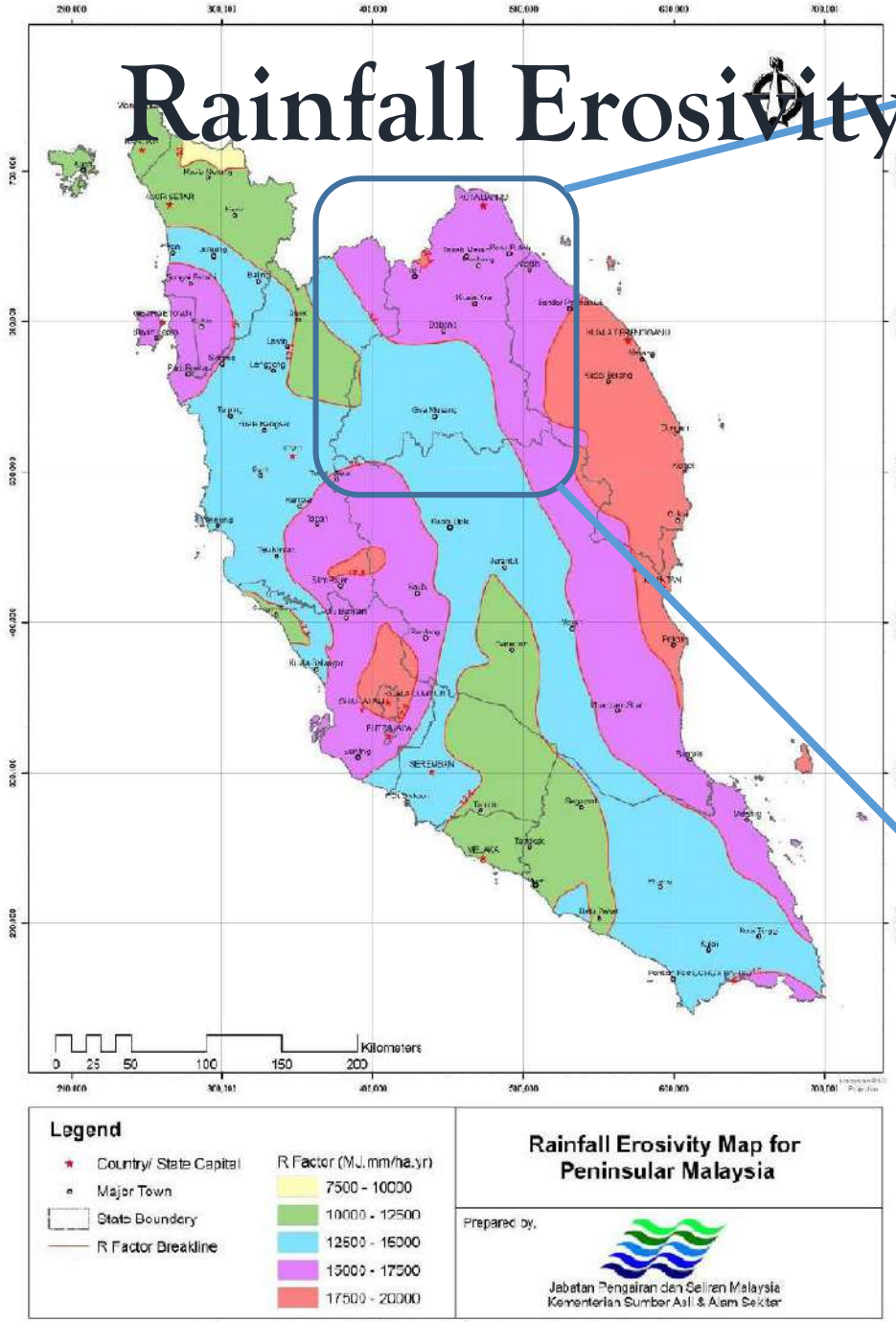
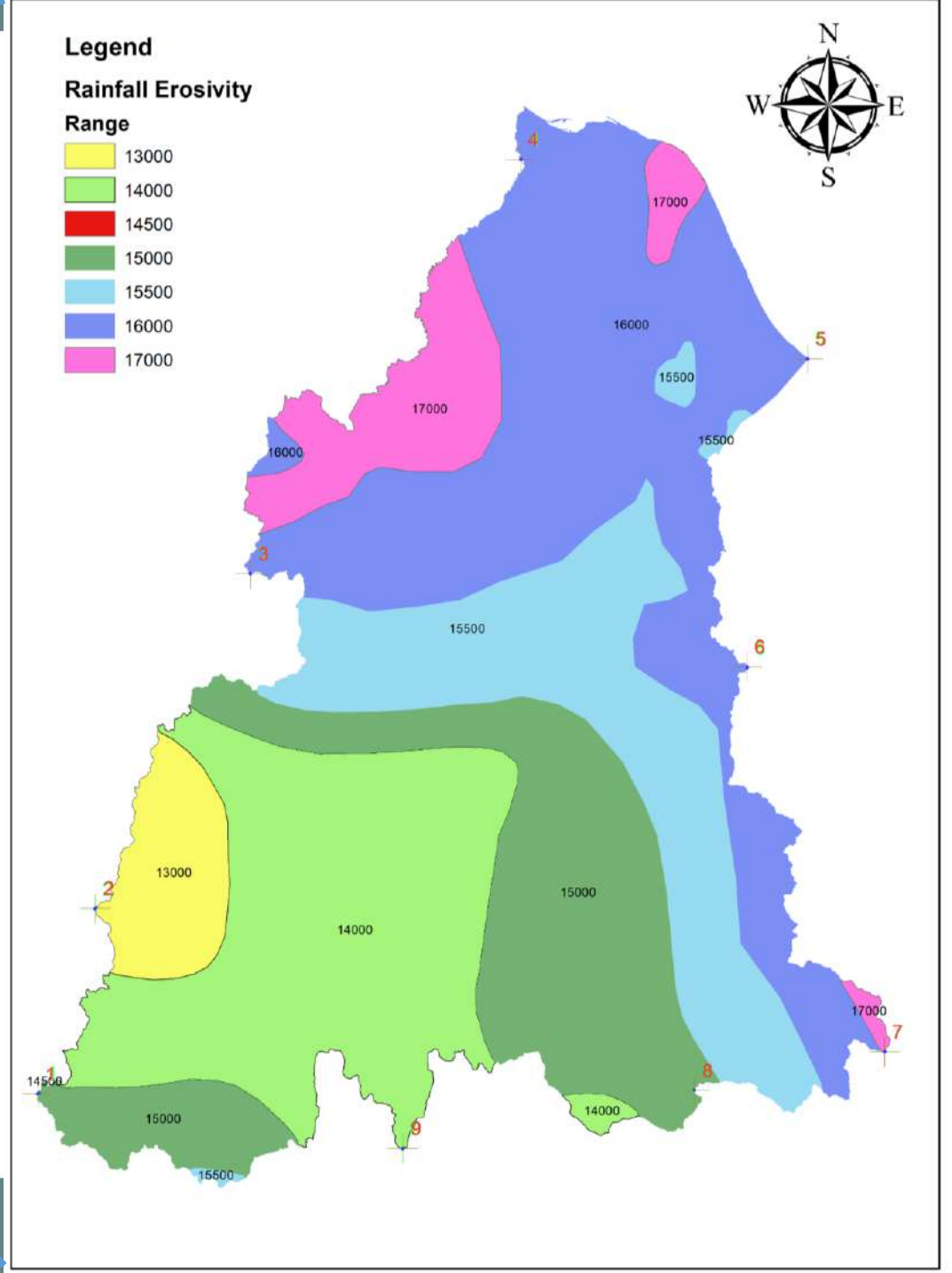


Figure 3.3: Rainfall Erosivity Map for Peninsular



Soil Erodibility Factor (K)

$$K = \left[1.0x10^{-4}(12 - OM)M^{1.14} + 4.5(s-3) + 8.0(p-2)\right]/100 \qquad (3.8)$$

Where,

K – Soil Erodability Factor, (ton/ac.)*(100ft.ton.in/ac.hr)
For SI unit (ton/ha)(ha.hr/MJ.mm), the conversion factor is 1/7.59.

M - (% silt + % very fine sand) x (100 - % clay)

OM - % of organic matter

S - soil structure code

P - permeability class

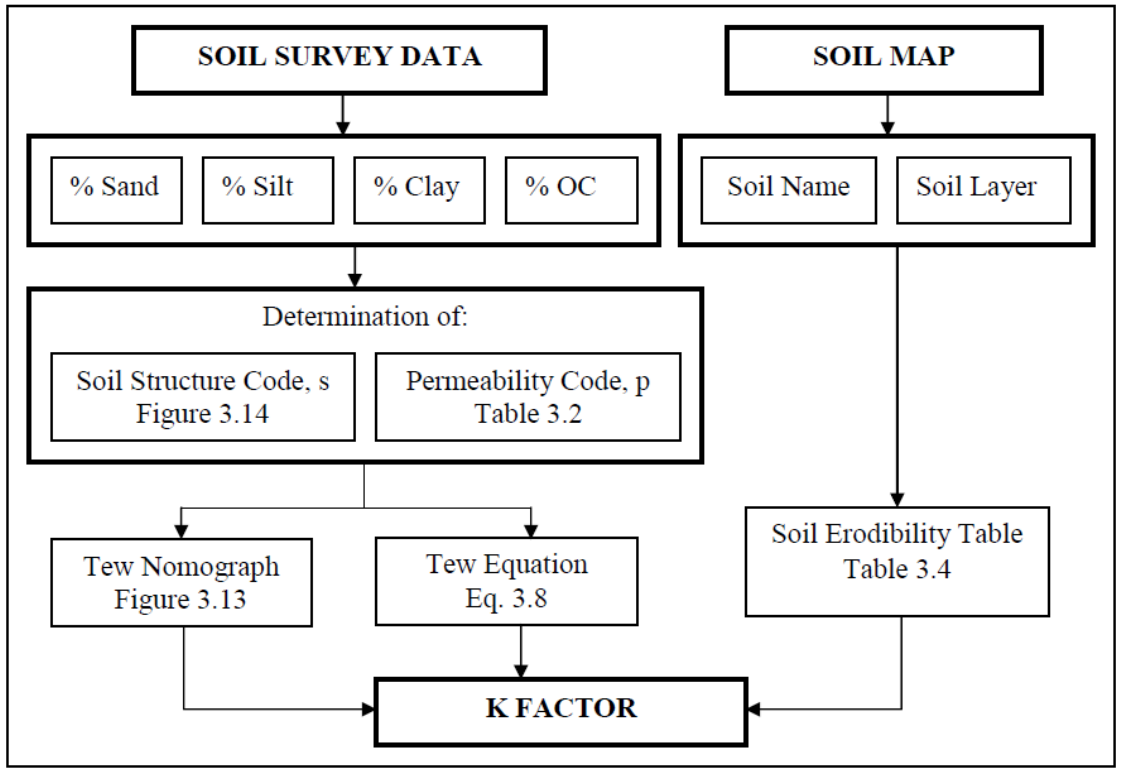
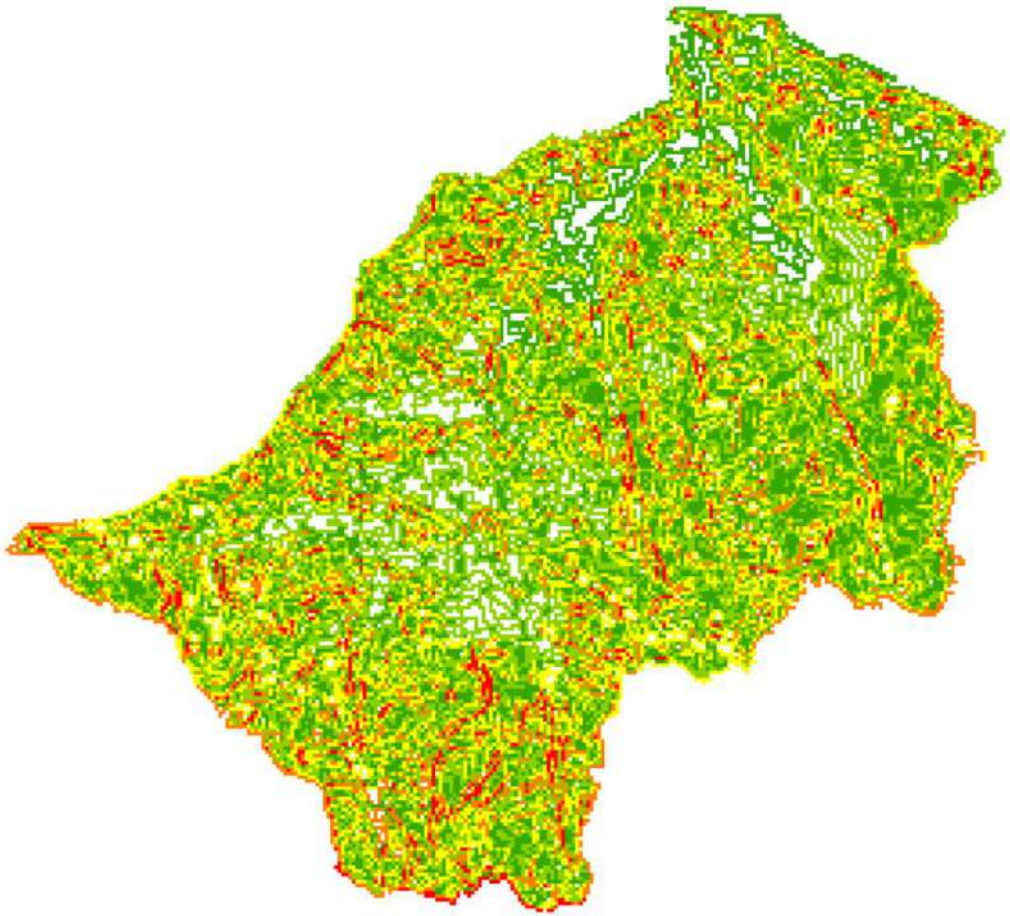
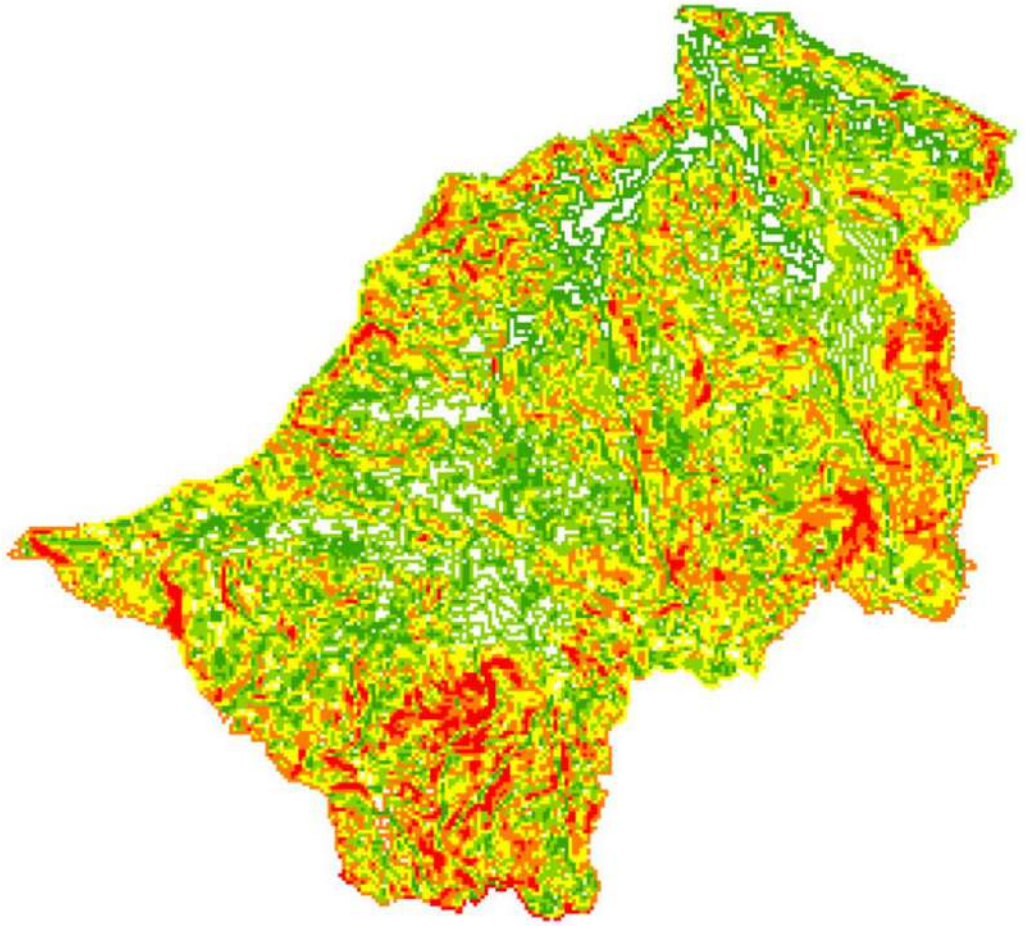


Figure 3.15: Schematic diagrams for determination of K factor



Soil Loss Map (2008)



Soil Loss Map (2016)

Soil Loss

Based on the soil loss assessment showed an **increase in soil loss** from **15,000 m^3/year in 2008** to **63,700 m^3/year in year 2016**, which corresponds to a **430% increase**.

The massive landuse change has contributed directly on the increased of turbidity and total suspended sediment (TSS) in Belatop River.

TSS value at Sg.Belatop during the last visit (July 2019) is about **1230 mg/l** compared with pristine condition which less than **50 mg/l**

How to resolve this issue - ESCP Implemented Project

Preparation of Development Plan

1) Plan the development to fit the site of abandoned farm plots only
2) ESC planning were integrated into site and development
3) Runoff from the site were controlled
4) Disturbed areas were promptly stabilized
5) On site sediment retentions were maximized
6) ESC practices were regularly monitored and maintained

The project is within abandoned farm land that lies on a flat terrain hill plateau. (Malaysia Agrifood Corporation)

Site Condition before being Developed

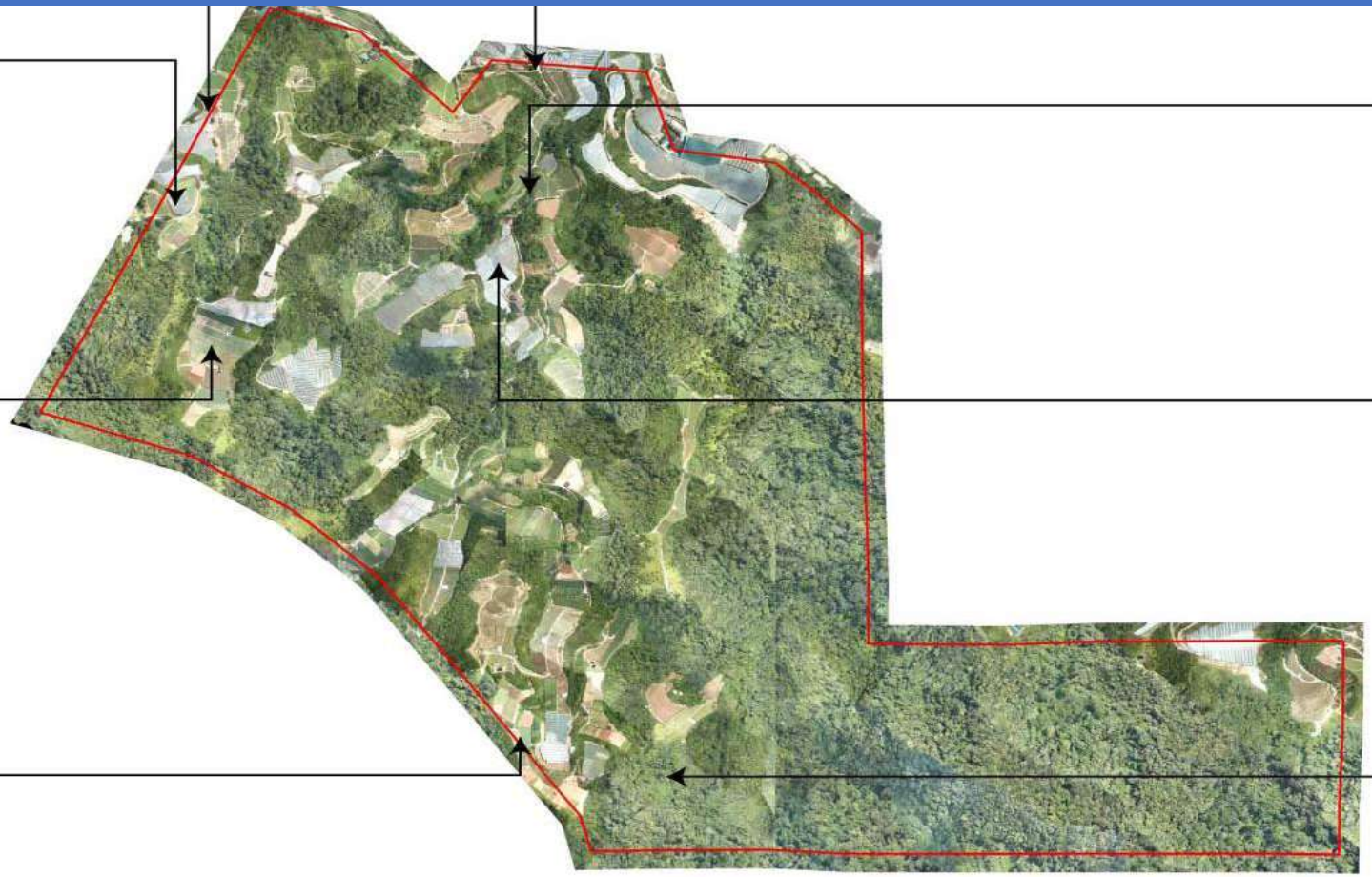

Northwestern entrance to the Project Site


Surrounding Development

N


Northern entrance to the Project Site


Area to be Developed



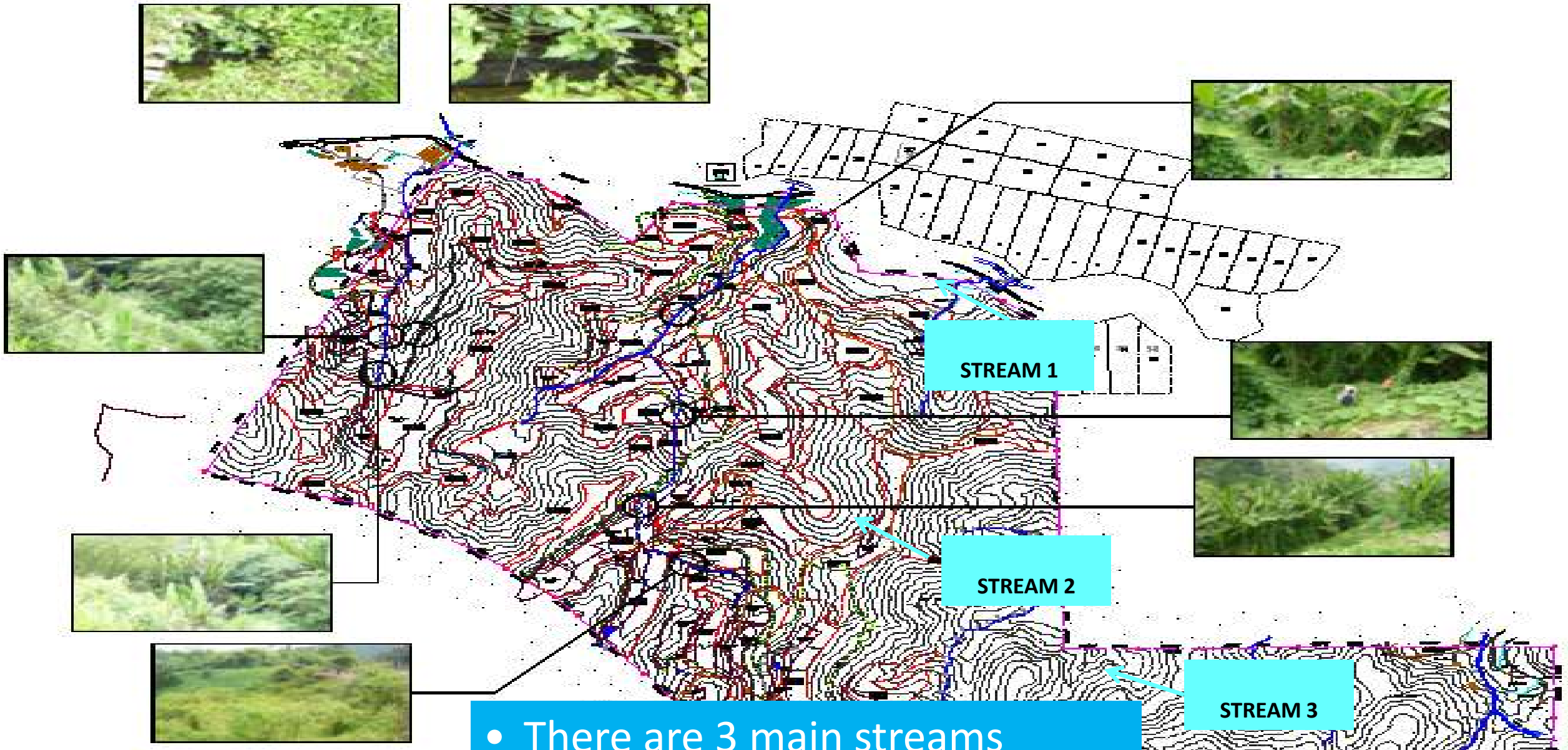

Existing Road within the Project Site


Area to be Developed


Proposed CPPC Area


Illegal Farming within Project Site


Existing Forested Area within the Project Site



- There are 3 main streams
- No canalization
- Flow from South to North

The area is hilly with slopes ranging from 5º to more than 60º.

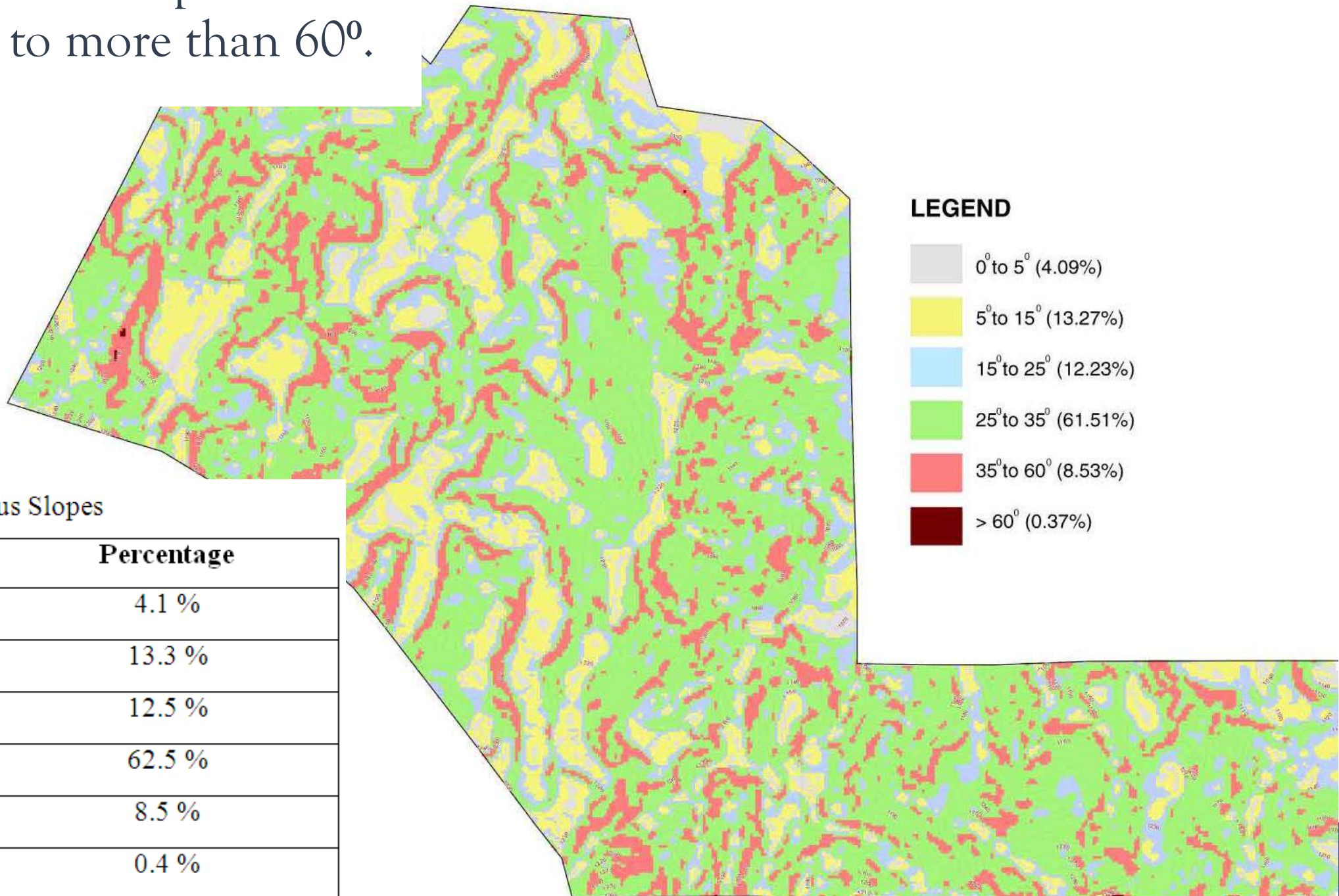
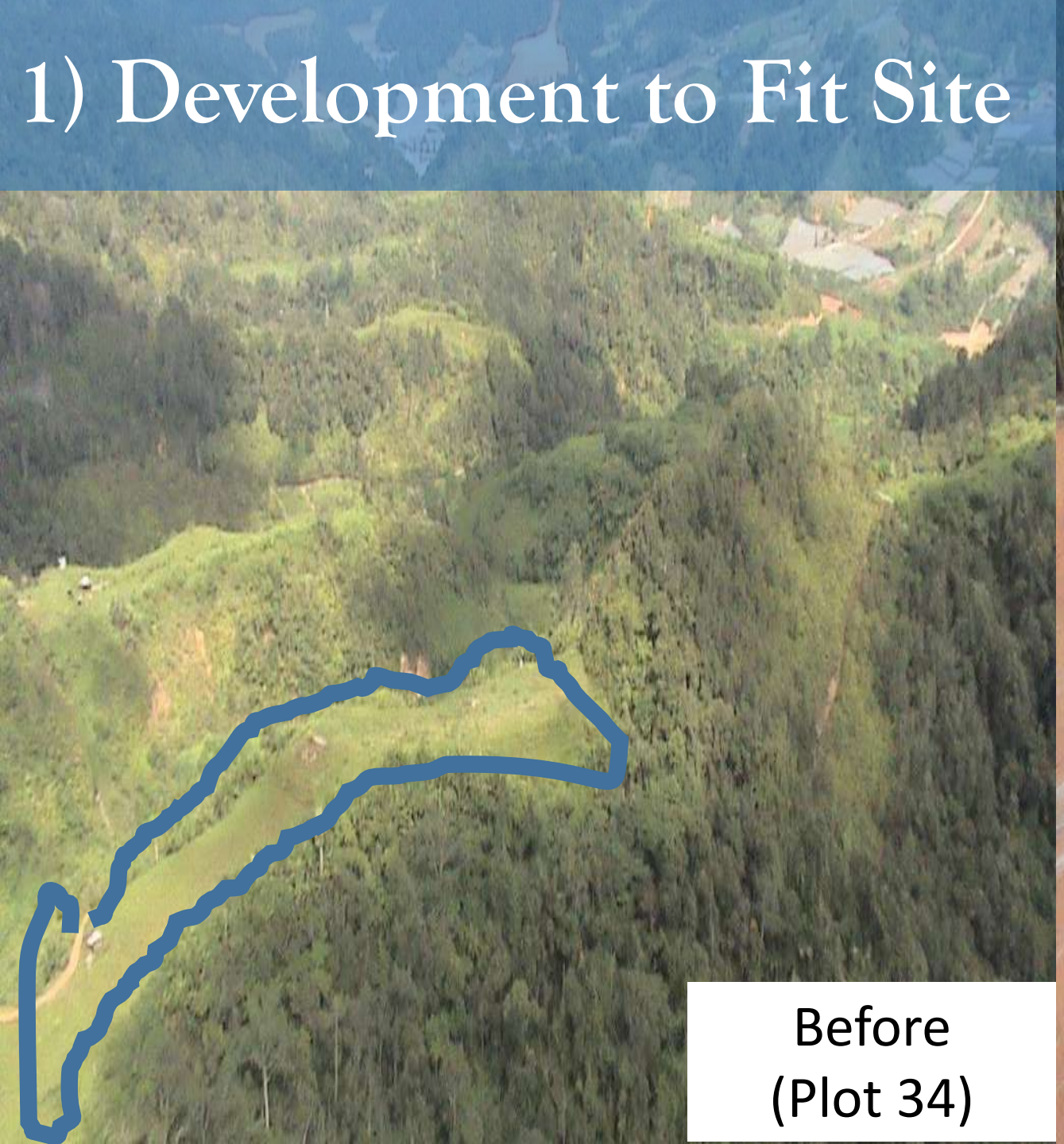


Table 2.1 Percentage of Various Slopes

Slope Angle	Percentage
0º - 5º	4.1 %
5º - 15º	13.3 %
15º - 25º	12.5 %
25º - 35º	62.5 %
35º - 60º	8.5 %
>60º	0.4 %

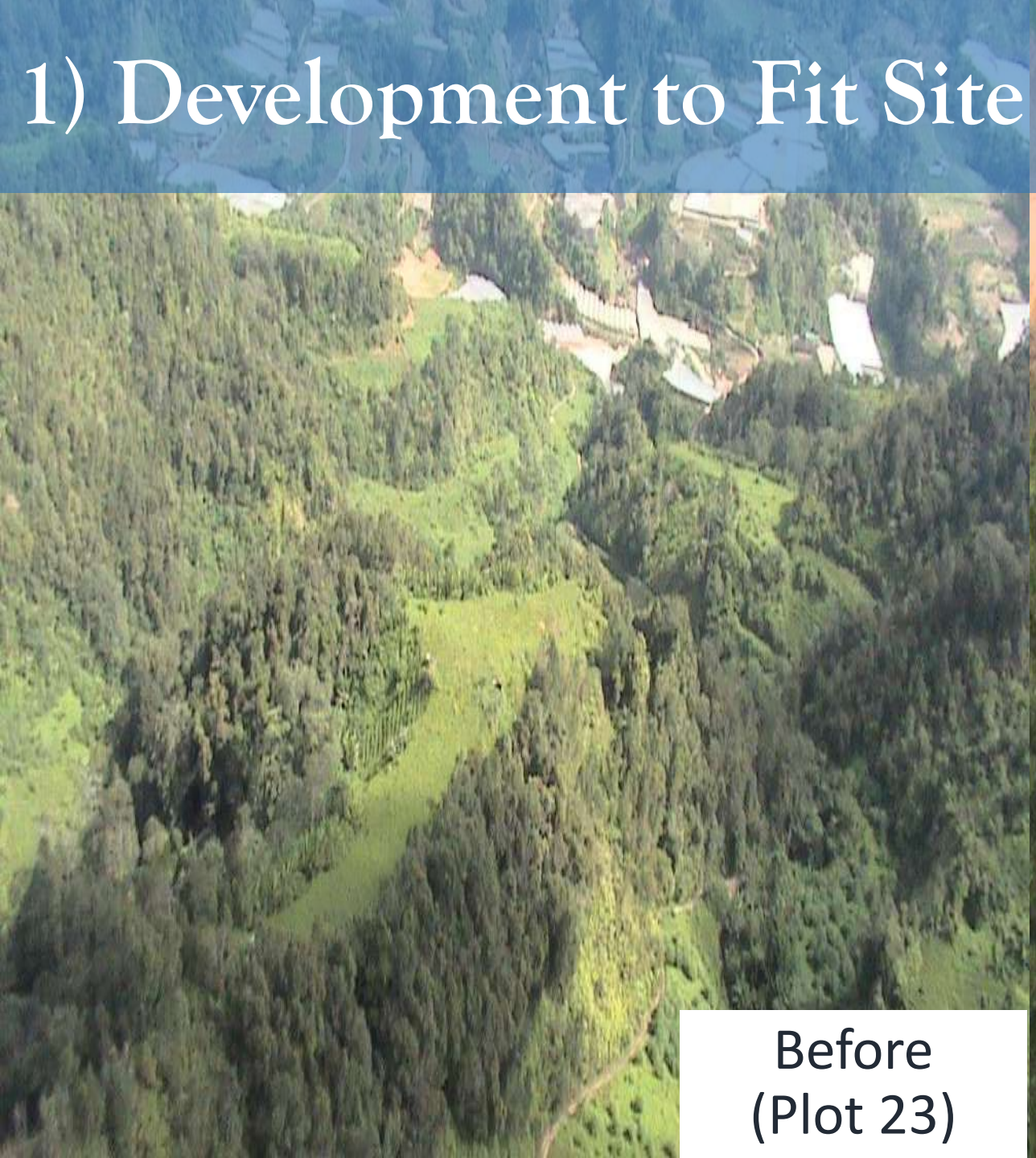
1) Development to Fit Site



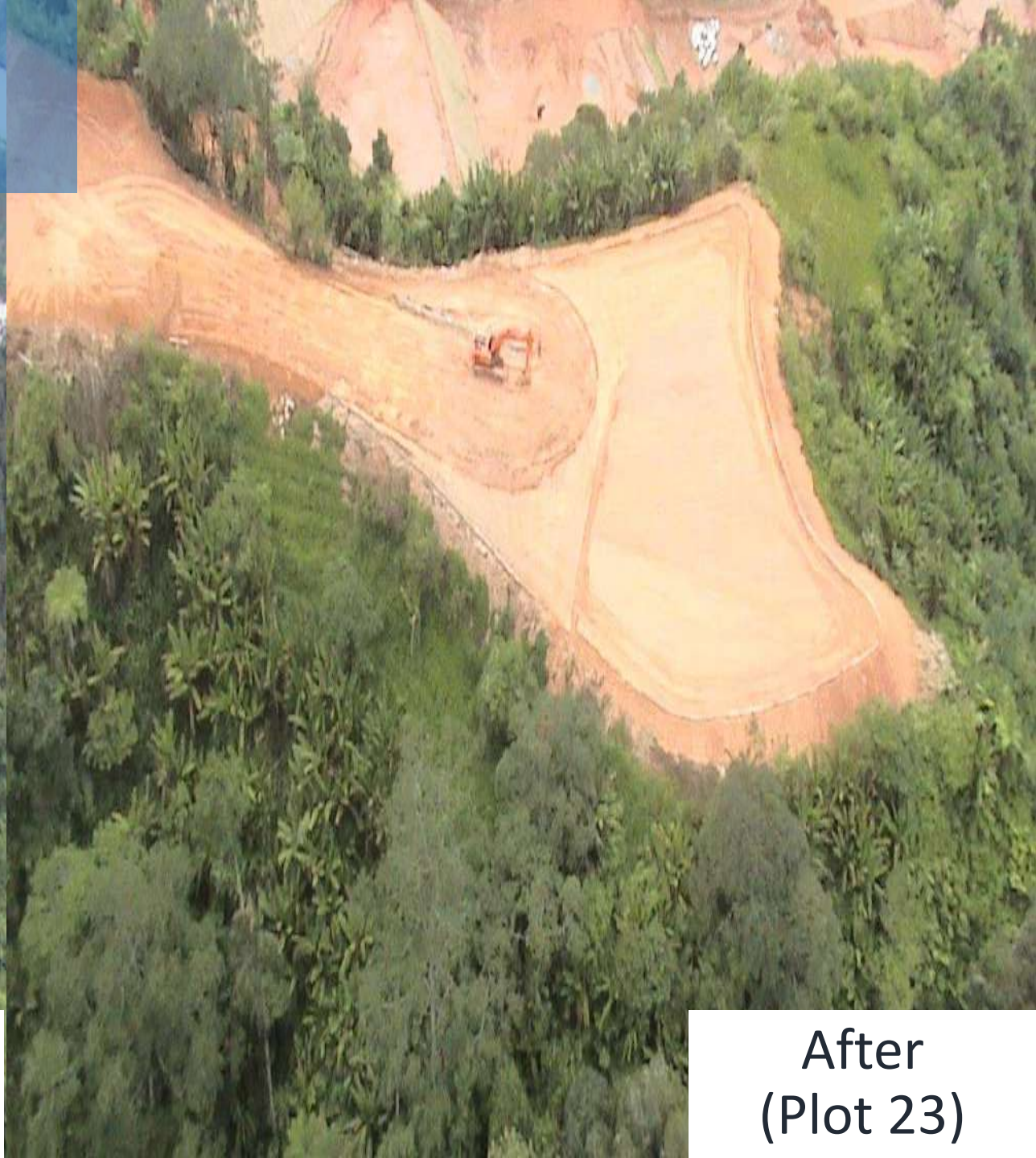
Before
(Plot 34)

After
(Plot 34)

1) Development to Fit Site



Before
(Plot 23)



After
(Plot 23)

Before
(Plot 38)

After
(Plot 38)

2) Integrating ESCP to Site Development

List of ESC's Implemented On Site

Drainage Control	Erosion Control	Sediment Control
Catch drain	Erosion control blanket	Buffer zones
Check dams	Gravelling	Check dam sediment traps
Diversion channel	Revegetation	Construction exits
Slope Drain	Surface roughening	Rock filter dams
Temporary watercourse crossing		Sediment basins
		Sediment fences

1.) TEMPORARY EARTH DRAIN

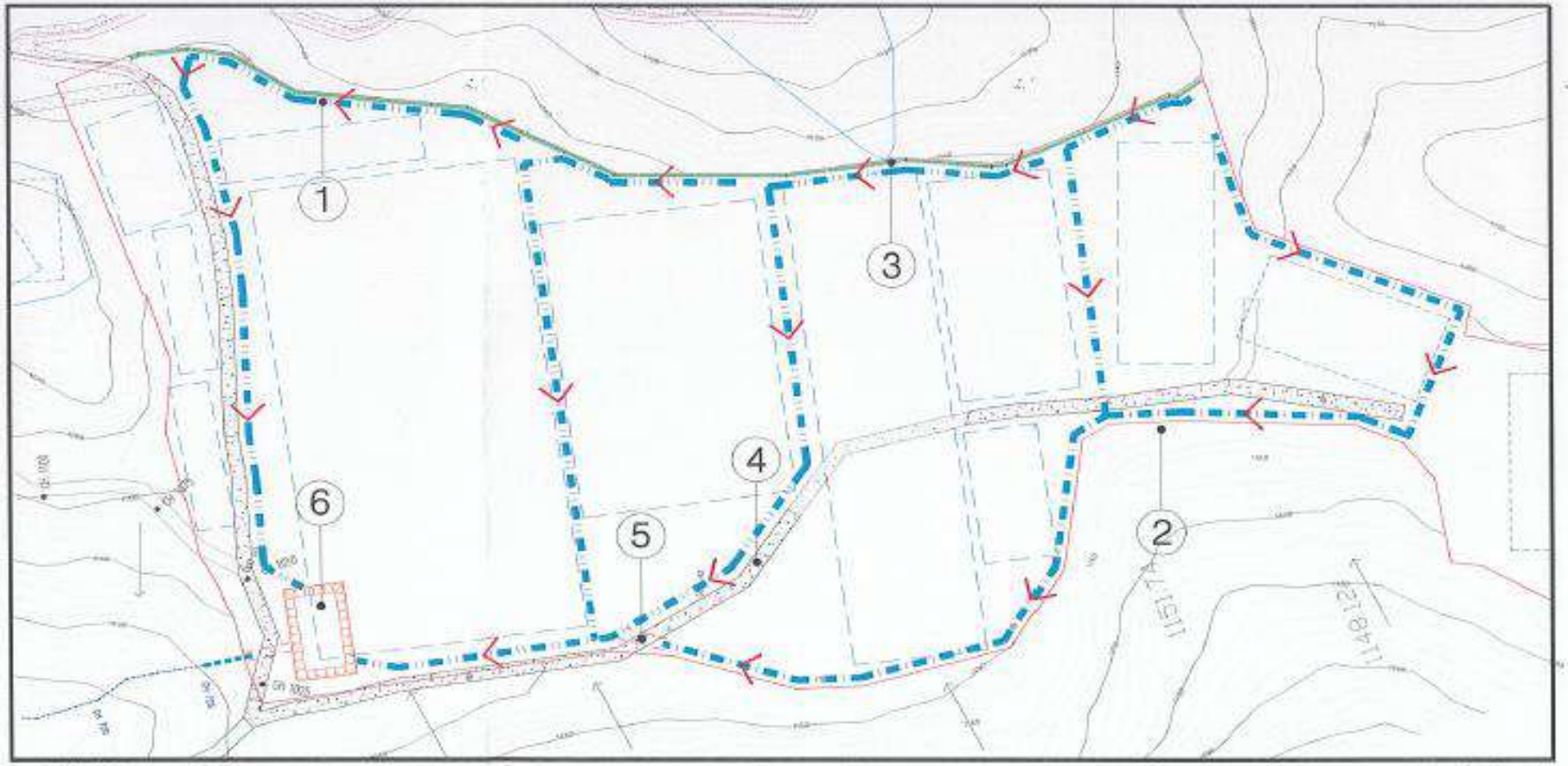
2.) HYDROSEED

3.) SILT FENCE

4) CONCRETED ACCESS ROAD

.) TEMPORARY WATERWAY CROSSING

6.) SEDIMENT BASIN



PROJECT TITLE :

OWNER :

Green Mattress

Silt Fence

Hydroseed

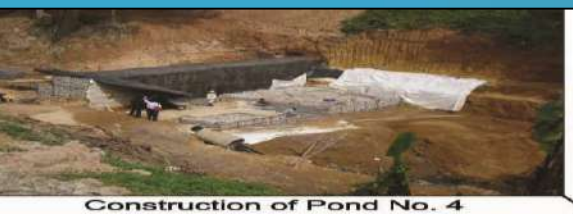
Swale

VIGROLOG

This application is limited to stream which has low flow rate and medium velocity otherwise it would be washed away during storm.

BMP's Implemented

Work Progress at Earlier Stage of Development


Construction of Pond No. 4


Contractor Site Office


Pond No. 2


Aggregrates are laid at Road 12


Untouched forest west of Plot 13


The untouched forest in the eastern portion of Plot 10


Stone aggregates for Dam of Pond No. 4


Upgarded Road 12


Cleared area at the western wing of Plot 30


Cleared area at Plot 31


Cleared area at the eastern wing of Plot 30


On-going upgrading works of Road 18


Land preparation at Plot 32


Land grading works at Plot 38


Land preparation at Plot 37


Land preparation at Plot 36

Sanitary facilities at earthworks workers quarters at Pt 9

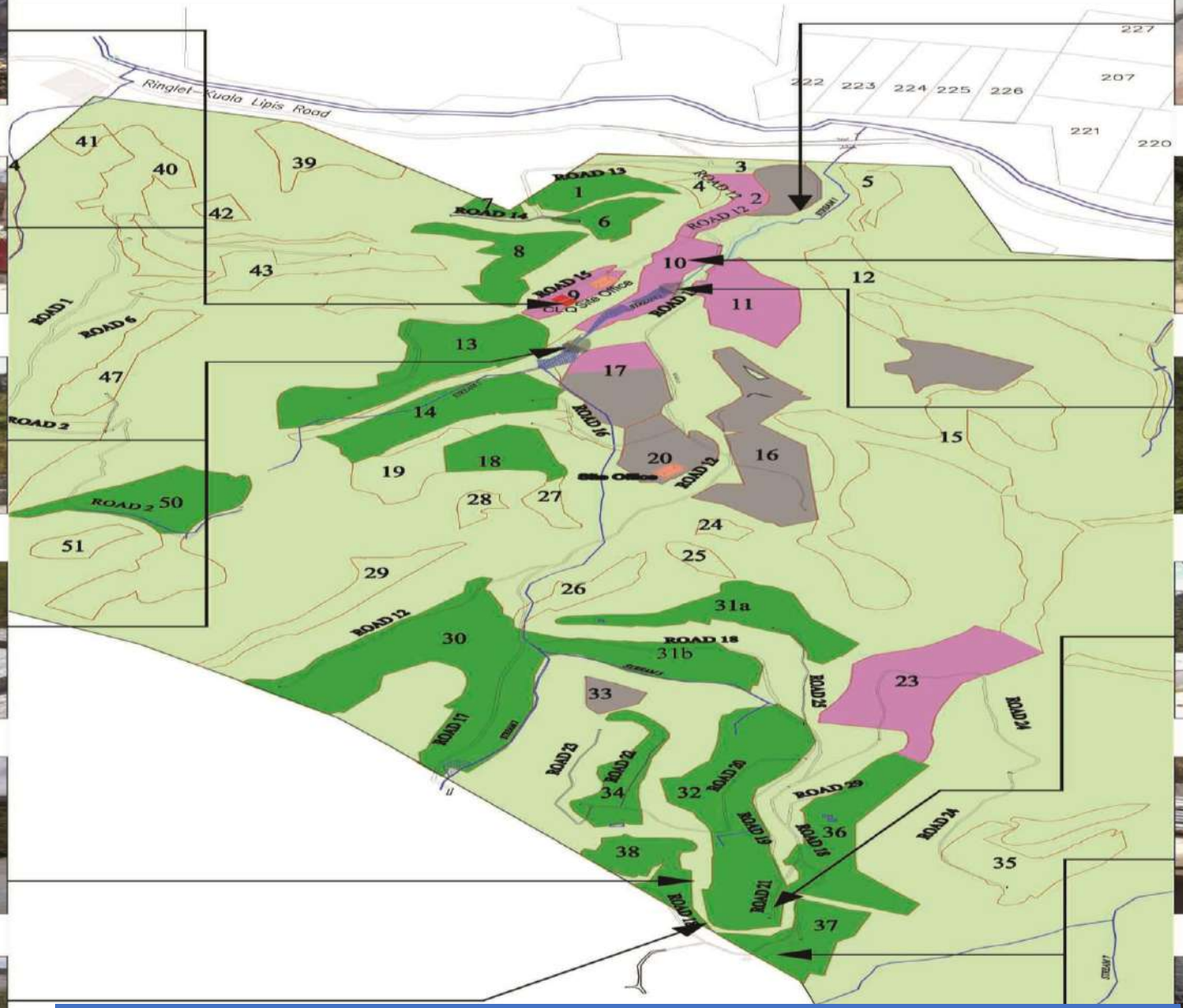
Oil and used oil storage area at Plot 9

Slope at RP4 is hydroseeded and stabilised with gabions encased in wire mesh

Permanent pond RP4

Part of slope at Plot 38 is covered with plastic sheet

Lush green hydroseeded slope at Plot 37



Road 12, roadside drain and hydroseeded slope at plot 2

Waste bin is transferred from Plot 2 to Plot 10

Permanent pond RP2

Upgraded Road 19 complete with roadside drain and streetlighting

Oil interceptor at genset storage area

Genset within concrete bund at plot 37

Work Progress & BMPs Implemented during operational Stage

Water Quality Sampling Points


Water sampling point W3 during dry day sampling


Water sampling point W5 during dry day sampling

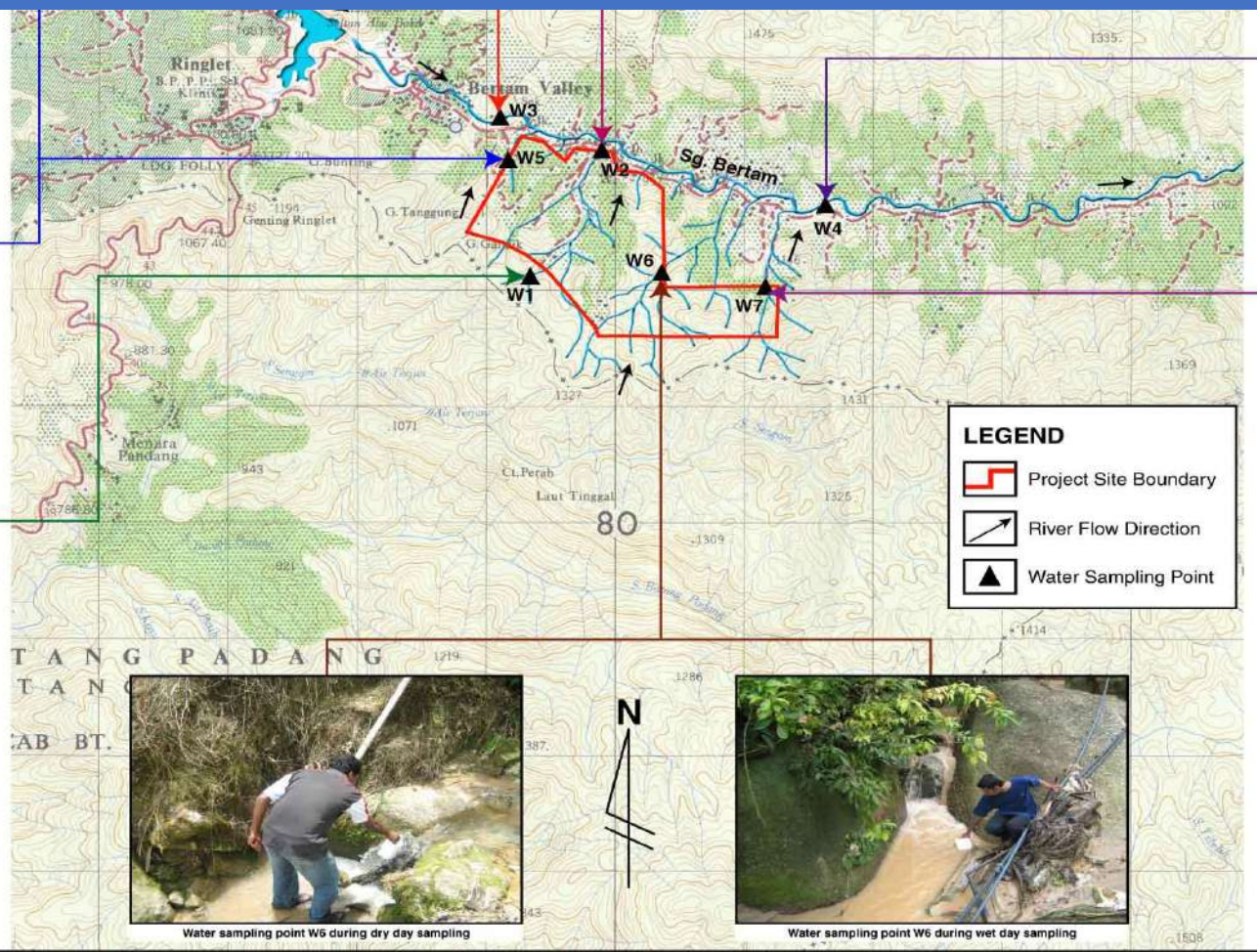

Water sampling point W5 during wet day sampling


Water sampling point W1 during dry day sampling


Water sampling point W1 during wet day sampling


Water sampling point W3 during wet day sampling


Water sampling point W2 during dry day sampling



Water sampling point W6 during dry day sampling

Water sampling point W6 during wet day sampling


Water sampling point W2 during wet day sampling

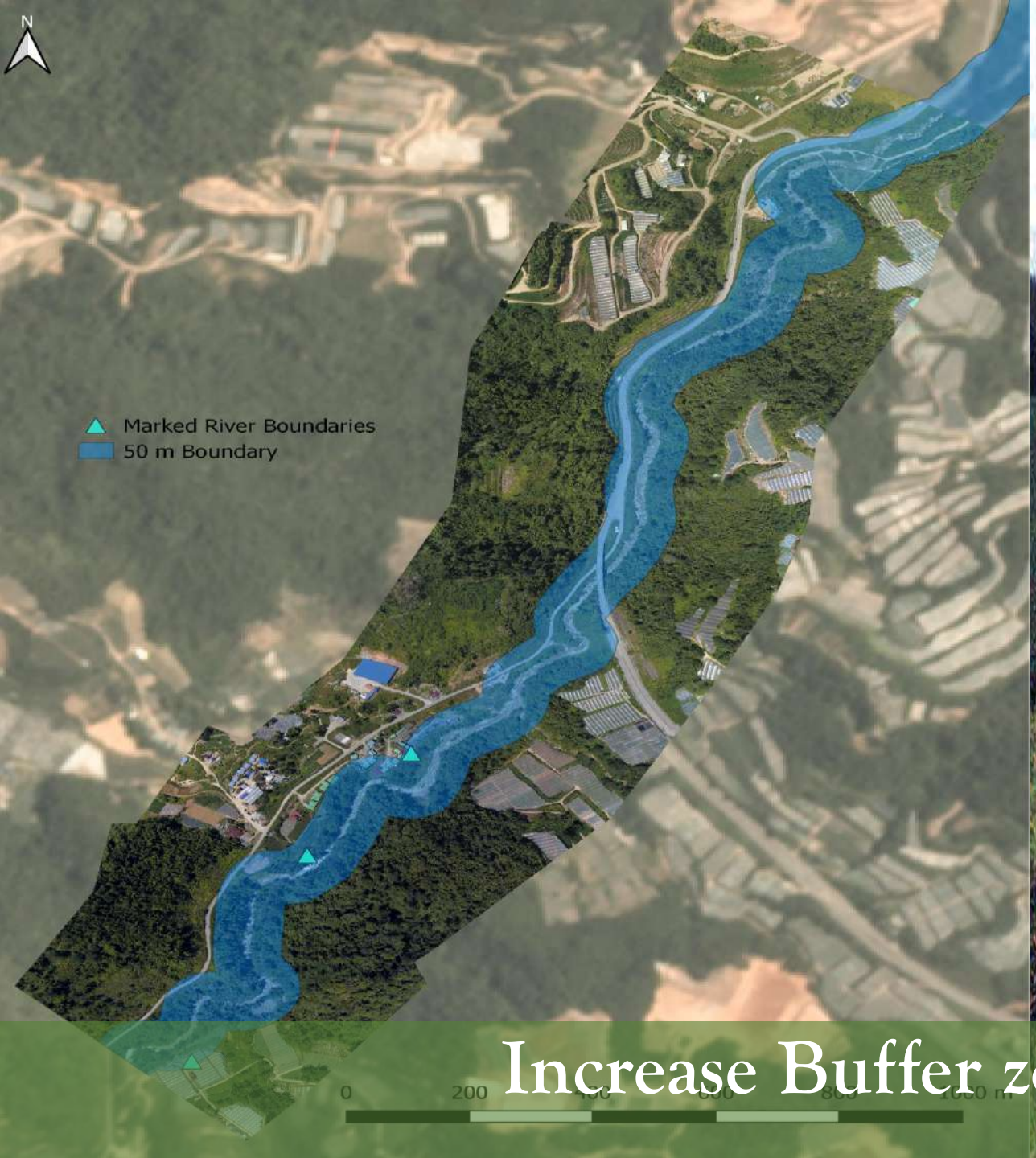

Water sampling point W4 during dry day sampling

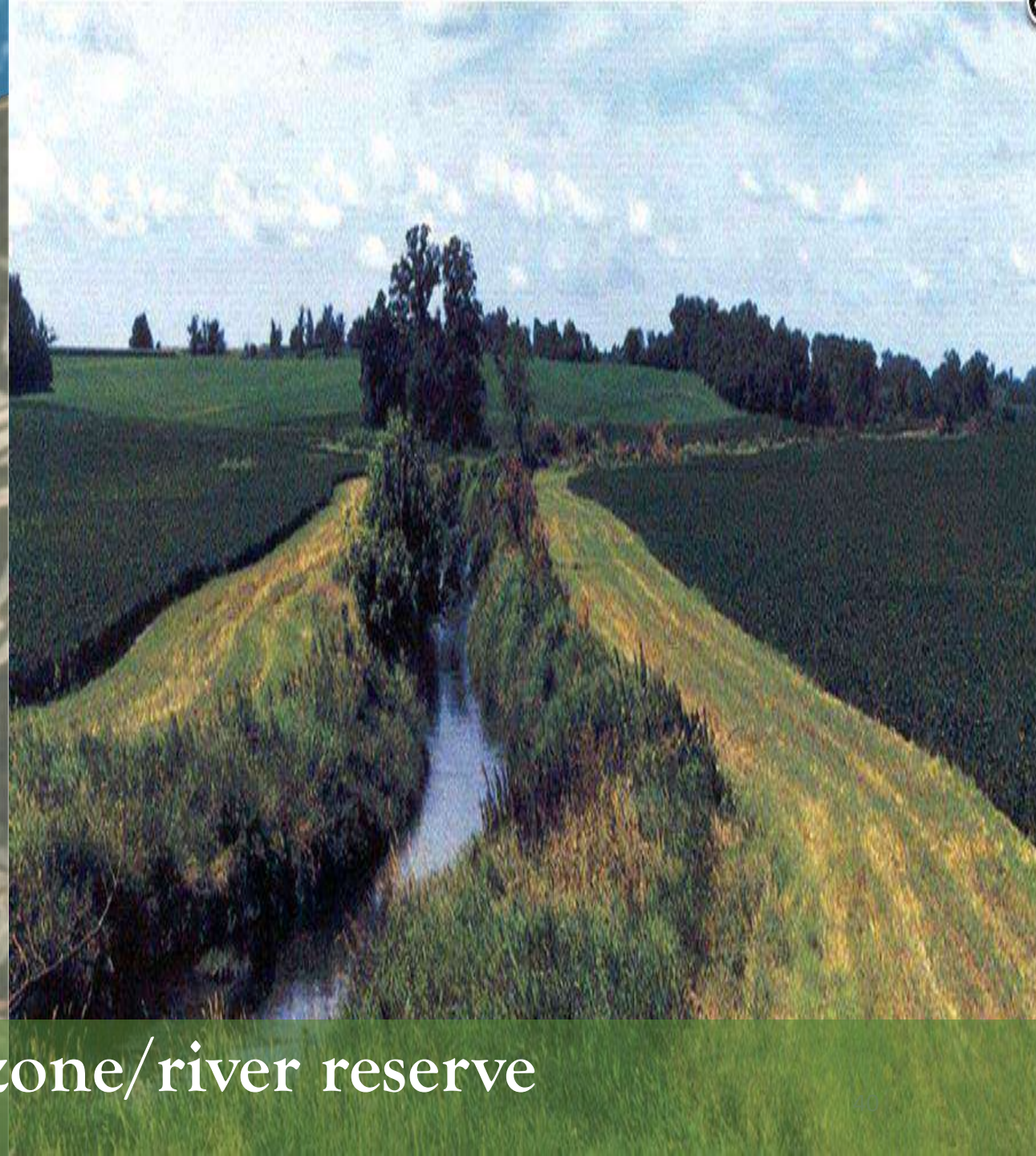

Water sampling point W4 during wet day sampling


Water sampling point W7 during dry day sampling


Water sampling point W7 during wet day sampling

Further Mitigation Measures

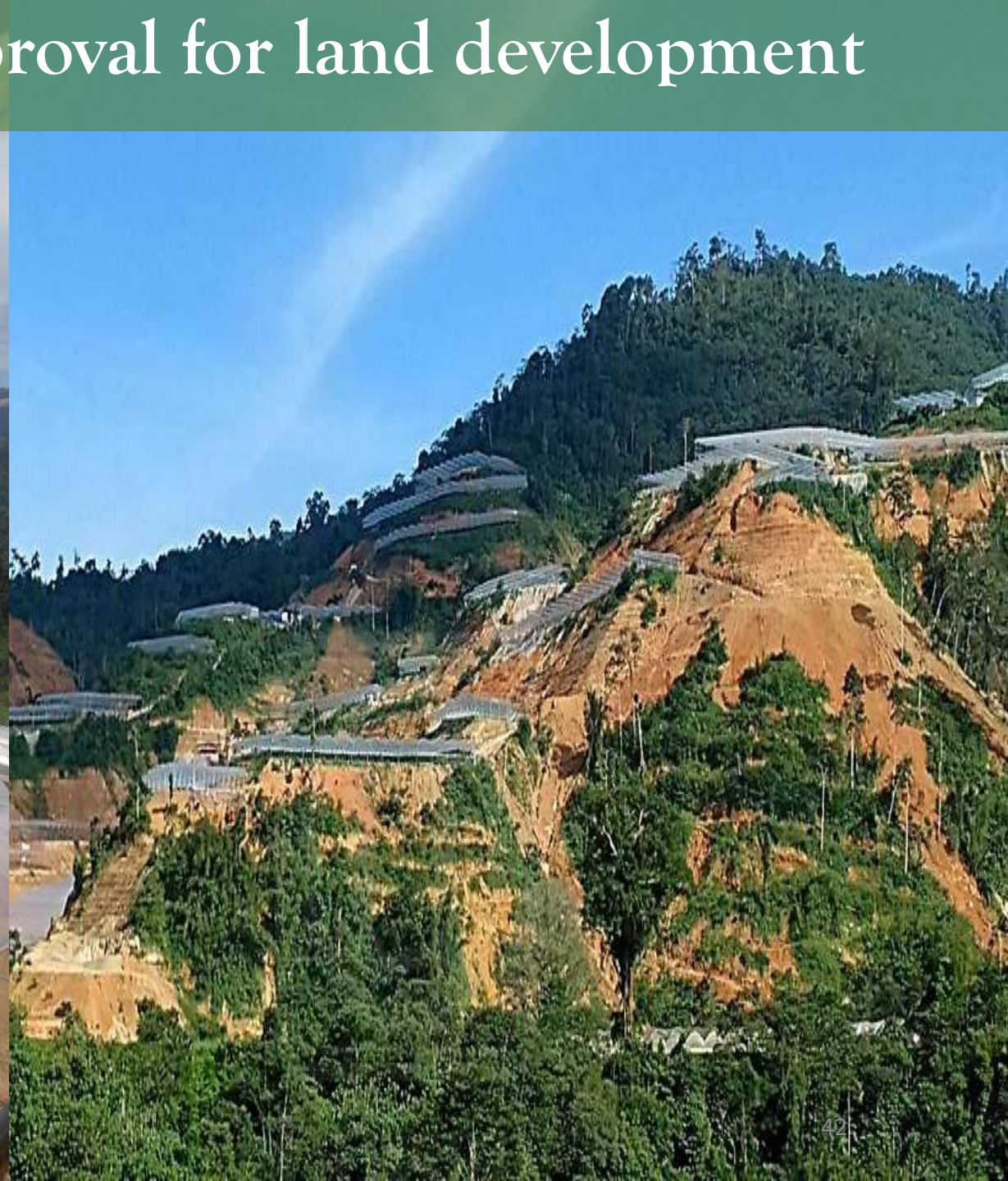




Increase Buffer zone/river reserve

Close/Seize all the area/activities that caused pollution or non-compliance to the issued permit and restore back to pristine condition

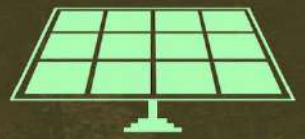
Freeze/stop issuing a new approval for land development



Implementation of new style of Agriculture Practice

RENEWABLE PRODUCTION

A 30-story vertical farm needs 26 million kWh of electricity, but it can generate 56 million kWh through solar energy and the use of biogas digesters.



EFFICIENT USE OF URBAN SPACE

Crops can be stacked as high as the building is built.

WATER CONSERVATION

Hydroponics uses 70% less water than traditional agriculture practices. Urban waste like black water can be recycled and used for indoor farming.

INCREASED YIELD

One acre in an indoor vertical farm can produce the same yield as 4 to 6 outdoor acres, depending on the crop. And there's no running out of arable land.

YEAR-ROUND CROP PRODUCTION

There would be no more "seasonal crops" as vertical farming technology ensures continuous crop production even in non-tropical regions.

WEATHERPROOF

Crops are grown in a controlled environment and are therefore not exposed to extreme weather events like droughts and floods.

ENVIRONMENTALLY FRIENDLY

Indoor growing conditions in vertical farms reduce or eliminate the use of chemical pesticides.

BEST CROPS FOR VERTICAL FARMING

Fast-turn crops are recommended for most commercial vertical farms. A 'turn' is the time it takes to turn a seedling into a product that's ready to go to the market.

Lettuce

Arugula

Kale

Spinach

Basil

Cilantro

Chard

Oregano

Chives

SKY GREENS, SINGAPORE

Sky Greens was the world's first commercial vertical farm. Plants are grown on nine-meter-tall, A-shaped towers, each hosting 38 tiers of troughs. Troughs rotate around the aluminum towers to ensure uniform distribution of sunlight, proper air circulation, and irrigation.

At FarmedHere, tilapia are cultivated in aquaponic tanks where nutrient-rich fish effluents are circulated among the plant beds. Plants absorb the nutrients and clean the water, which is then circulated back to fish tanks to keep tilapia flourishing. It was the first organic vertical indoor farm to be certified by the USDA.

FARMEDHERE, CHICAGO

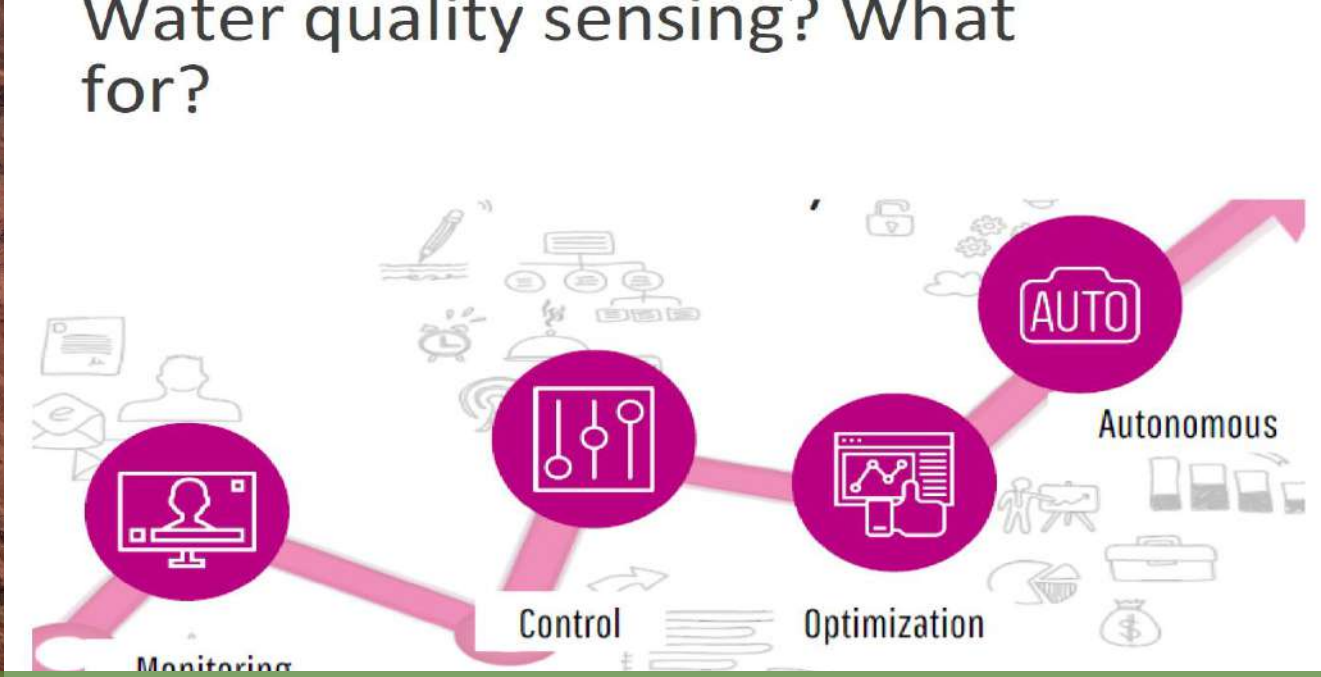
MIRAI CORP, JAPAN

Mirai Corp, a 25,000 square foot facility, is currently world's largest indoor farm. The facility uses 40% less power, 80% less food waste, and 99% less water than outdoor fields. It is also 100x more productive than outdoor fields, producing 10,000 lettuce heads per day.

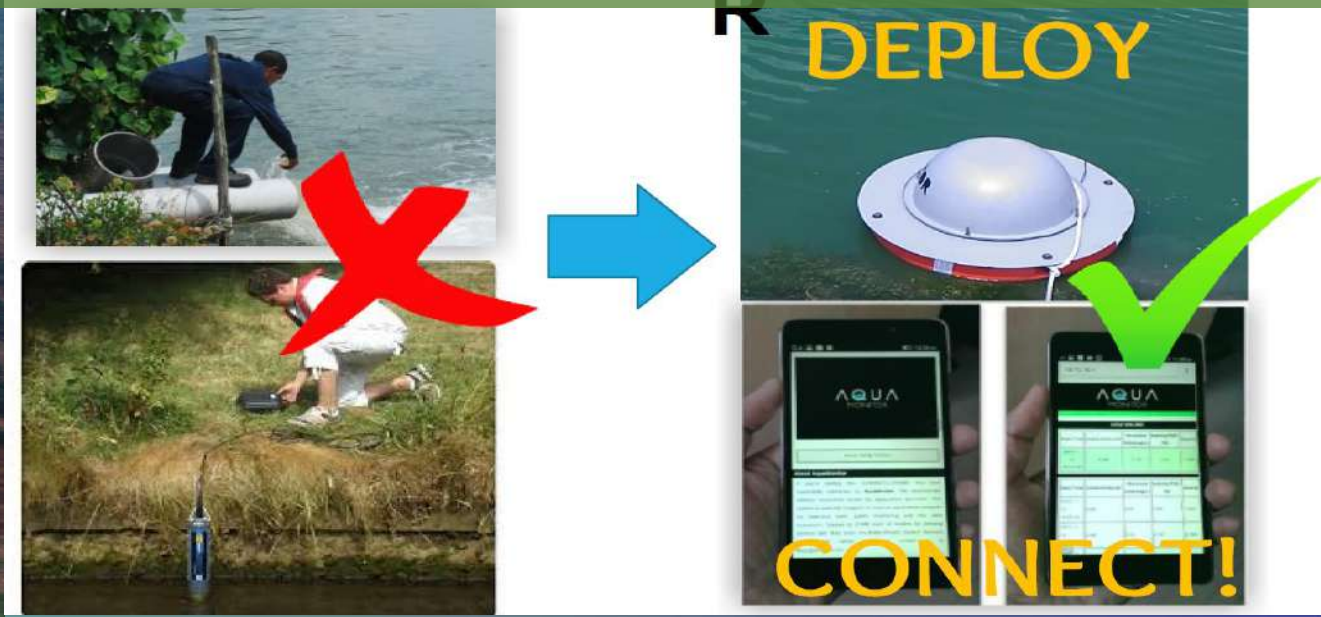
When New Jersey's AeroFarms facility becomes fully operational, it will be the world's largest vertical farm. The 70,000 square foot compound will produce 2 million pounds of food per year, with the capability to grow more than 250 varieties of leafy greens and herbs.

AEROFARMS, NEWARK

Regular spot check and rigorous monitoring by authorities



Monitoring using technologies/IoT



Environmental Police

Conclusion

- ESCP is compulsory in Agriculture Sector
- Implementation of Good practices (monitoring)
- Need a Future Direction of new agriculture method (environmental friendly)


thank you
danke
謝謝
рахмат
ngiyabonga
شكراً جزيلاً
teşekkür ederim
Баярлалаа
спасибо
gracias
dank je
tapadh leat
хвала
bedankt
dziękuję
hvala
mauruuru
kiitos
dankie
dhanyavad
asante
manana
obrigada
tenki
enkosi
bayarlalaa
gràçie
köszönöm
nanni
nandri
akun
dankon
aciu
djiere dieuf
tau
mochchakkeram
murakoze
chokrane
дякую
mamnun
go raibh maith agat
chnorakaloutioun
gratias ago
grâcies
sulpáy
sukriya
kop khun krap
taiku
sagolun
obrigado
sobodi
dèkuji
arigatô
takk
dakujem
trugarez
ありがとう
grazie
mèsi
didi madloba
najis tuke
tanemirt
rahmet
terima kasih
merci
kam sah hamnida
rahmat
diolch
dhanyavadagalu
shukriya
merce
мерси
ধন্যবাদ
감사합니다
xièxie
ευχαριστώ

Acknowledgment

MALAYSIAN STORMWATER ORGANISATION

PERUNDING AZMAN OOI & RAO SDN BHD

KUASA PERSATUAN AKTIVIS SAHABAT ALAM

TROPICAL RAINFOREST CONSERVATION & RESEARCH CENTRE