



IoT Deployment and Challenges in Rural Areas

*Seminar on Future Network for Smart Digital Malaysia
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Outline

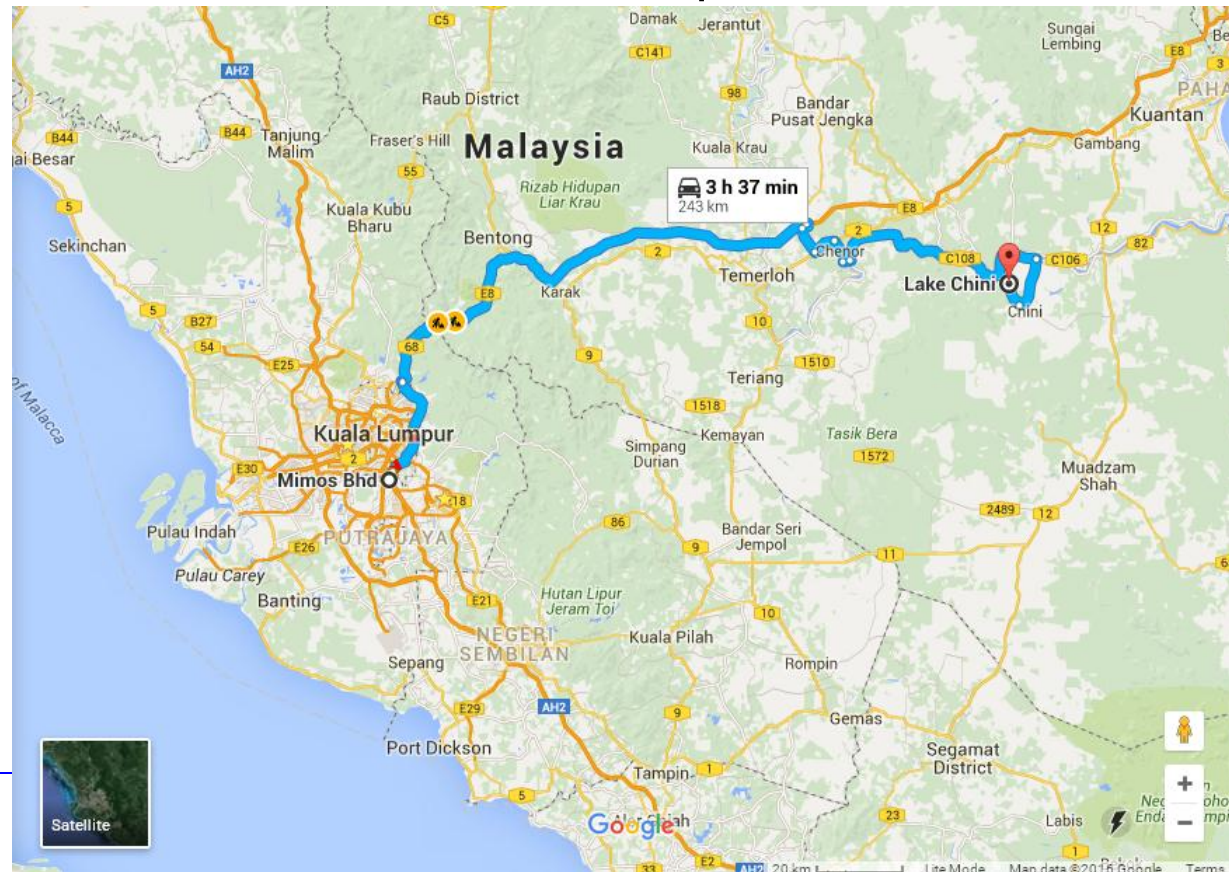
- Introduction
 - ◆ Tasik Chini
- Deployment
 - ◆ Pusat Penyelidikan Tasik Chini (PPTC)
 - ◆ Water Quality Monitoring Stations
- Challenges



Introduction

Tasik Chini

- ◆ Tasik Chini is the second largest fresh water lake in Malaysia. The lakeshores are inhabited by the Jakun branch of the Orang Asli (indigenous people).
- ◆ The 12,565 acres (5,026 hectares) lake is made up of a series of 12 lakes. Sungai Chini, which drains from the lake, flows into Sungai Pahang.
- ◆ Tasik Chini is one of the UNESCO Biosphere Reserve status sites in Malaysia.



UNESCO Biosphere Reserve

UNESCO

Education

Natural Sciences

Social and Human Sciences

Culture

Communication and Information

Media Services

About us

Science & Technology

Environment

IOC Oceans

Priority Areas

Special Themes

Resources



United Nations
Educational, Scientific and
Cultural Organization



Man and
the Biosphere
Programme

Ecological Sciences for Sustainable Development

UNESCO » Natural Sciences » Environment » Ecological Sciences » Biosphere Reserves » Malaysia

A- A+

Ecological Sciences

Man and Biosphere
Programme

Biosphere Reserves

- ▶ Main Characteristics
- ▶ World Network (WNBR)
- ▶ Advisory Committee
- ▶ Designation Process
- ▶ Periodic Review Process
- ▶ Withdrawal of biosphere reserves
- ▶ Regional and Subregional Collaboration
- ▶ Biosphere Reserves in Practice
- ▶ BiosphereSmart Initiative

Capacity Building and

Tasik Chini

Almost all of the Reserve areas are covered by wetland (freshwater lake, Tasik Chini and feeder rivers of the lake) and a slightly steep hill (Chini Hill) as well as the Tasik Chini State Park Reserve Forest.

Declaration Date: 2009

Surface Area: 6,922,97 ha

Administrative Division: Pahang

Ecological Characteristics

The freshwater lake, together with the drainage basin, the gazetted Tasik Chini State Park including the 641 m Bukit Chini showed habitats that are endemic only to Tasik Chini which represent habitat only found in this area.

Other species characteristic of the extreme lowlands may also be present and are of considerable conservation interest due to their diminishing low land habitats elsewhere within Peninsular Malaysia.

The natural freshwater lake included in the Reserve, has its own economical benefits. Of the two beautiful natural lakes in Peninsular Malaysia, Tasik Chini is the second largest natural lake which is located 100 km away from the state capital of Pahang called Kuantan. With the barraging of the only river, Sunqai Chini, that drains the lake.

RELATED INFORMATION

MALAYSIA

- ▶ Website
- ▶ Print version (.pdf)

Contacts

Ministry Of Natural Resources And Environment

Conservation and Environmental Management Division
Level 6, Wisma Sumber Asli
No. 25, Persiaran Perdana, Presint 4
62574 Putrajaya

NETWORKS

Regional:

- ▶ SeaBRnet

Ecosystem-based:

Tasik Chini





NEWS ▾

BUSINESS

LIFESTYLE ▾

SPORTS ▾

WORLD

OPINION ▾

PROPERTY

EDUCATION

CARS BIKES T

Tasik Chini ecosystem under threat?



Tasik Chini's ecosystem is claimed to be in critical condition due to unregulated agriculture, logging and mining. Pix by MUHD ASYRAF SAWAL/ NSTP

By **T N ALAGESH** - March 13, 2017 @ 3:39pm

PEKAN: Months after clusters of lotus flowers started blooming at Tasik Chini, floodwaters spilled into the lake, submerging the iconic plants.

Water from Sungai Pahang, which burst its banks in late January, spilled into Sungai Chini, causing the water level in the lake to rise and become murky.

Lake Chini Resort manager Mohd Azizan Ibrahim said the water level during the floods was about

RECOMMENDED

Toys 'R' Us employees in the dark about their future

M'sian badminton stunned by Morten Frost resignation

Can a dying lake in Pahang be revived?

NOVEMBER 18, 2016 ENVIRONMENT, LIVING, TSOL - ENVIRONMENT

BY MARIA J. DASS



RELATED ARTICLES



Clear group is changing people's mindsets of Moyog River from dump to ecotourism asset



The blues, greens, gr
waters of Tasik Chini
pink from the few blo
across the water, sur

I had heard years ago
"development" and th
tarik.

But the Federal and S
of the past.

Prior to this, lotus pla
dying, slowly succum
logging and mining in

Preserving a natural asset

METRO NEWS

Wednesday, 19 Apr 2017



By Ong Han Sean



Dr Wan Junaidi taking a look at the plants in Tasik Chini.

KUANTAN: Tasik Chini became a topic of discussion at the state assembly, when several assemblymen agreed that efforts must be taken to preserve it as an important natural asset.

State Tourism and Culture Committee chairman Datuk Seri Mohd Sharkar Shamsudin



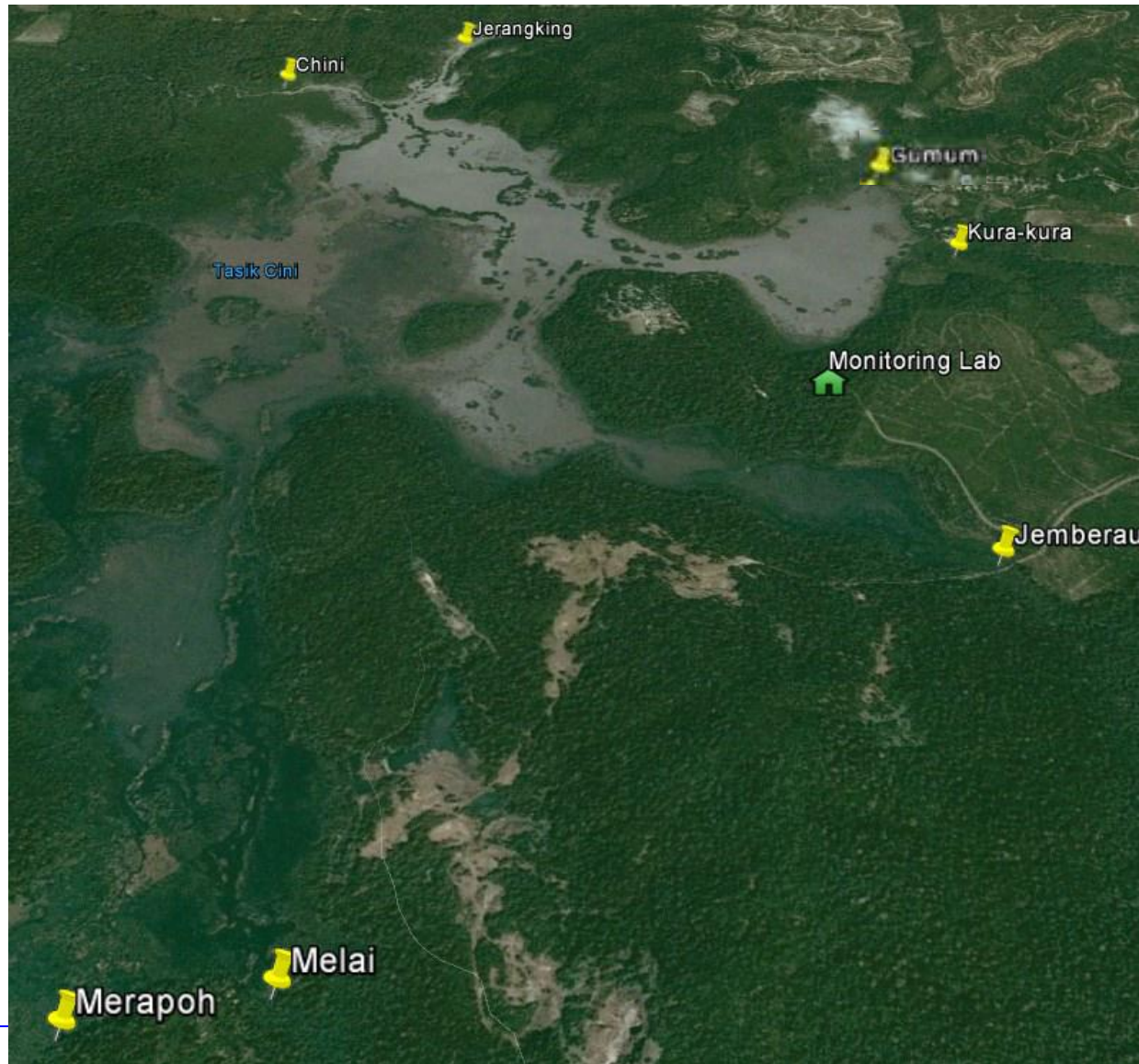
Deployment

Pusat Penyelidikan Tasik Chini (PPTC)

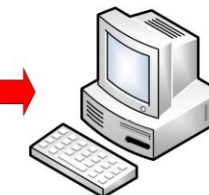
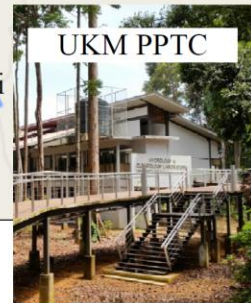
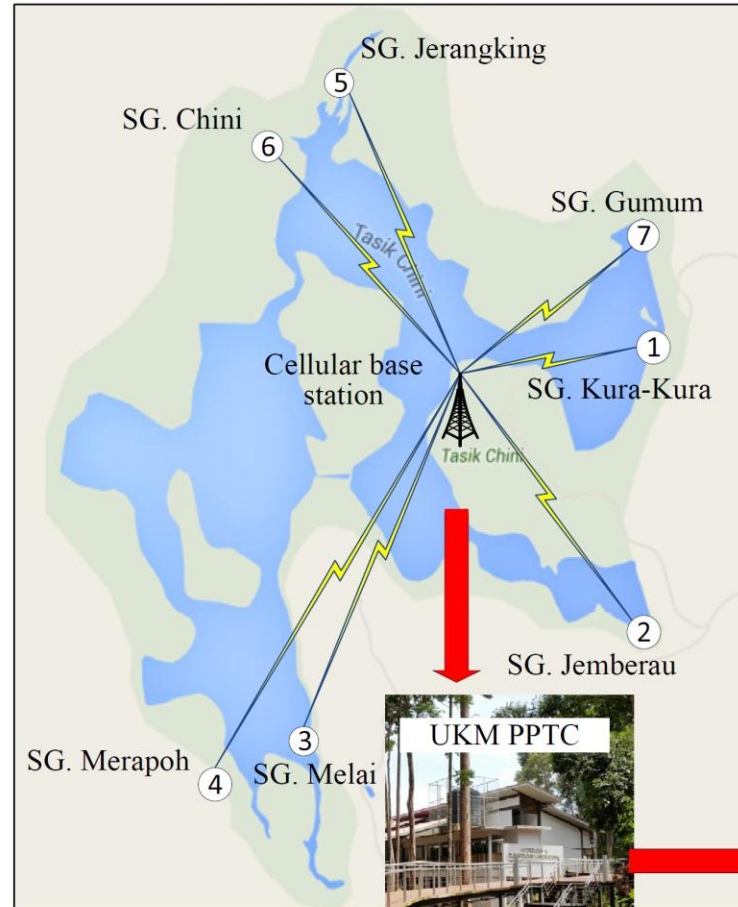
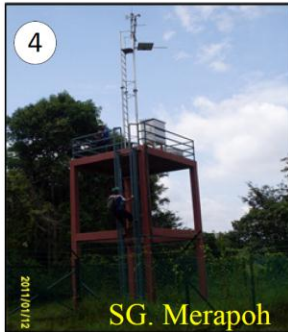
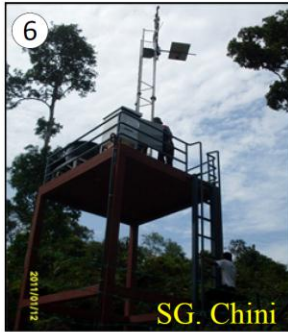
- Research center facilities (belongs to UKM)
- Command Control Centre and Monitoring Stations for data collection (water quality)



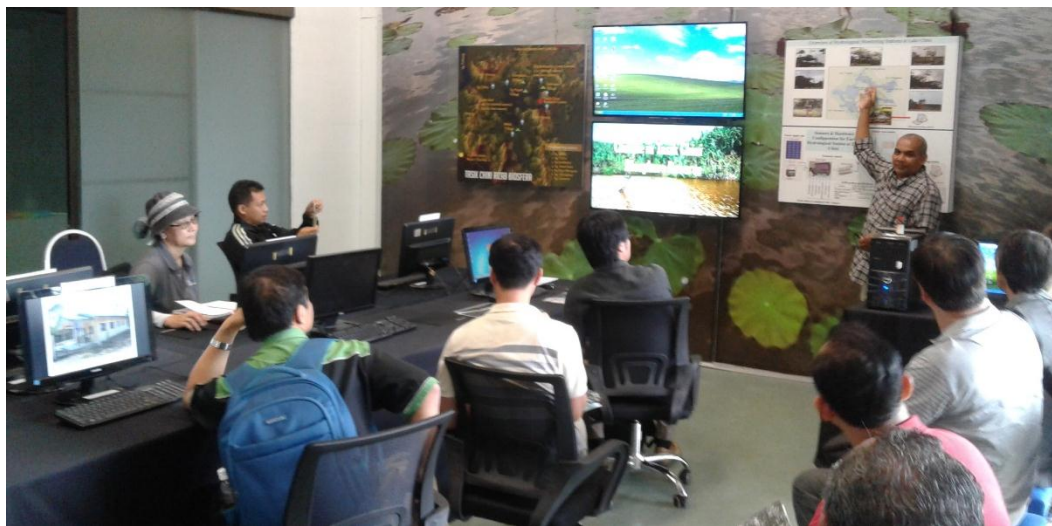
Monitoring Lab (PPTC) (*green*) and Monitoring Stations (*yellow*)



Overview of Hydrological Monitoring Stations at Lake Chini



Control Centre at PPTC



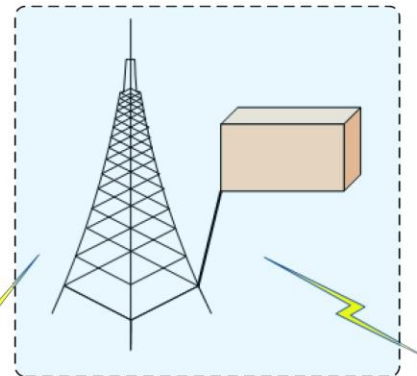
Monitoring Station



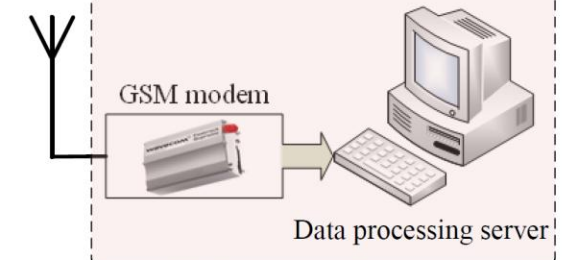
Current Setup

Sensors & Hardware Configuration for Each Hydrological Station at Lake Chini

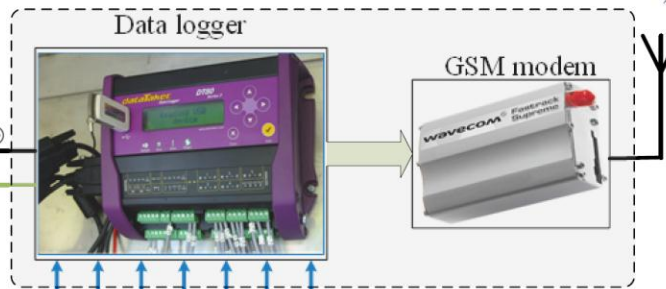
Cellular base station



Data processing station



Telemetry station

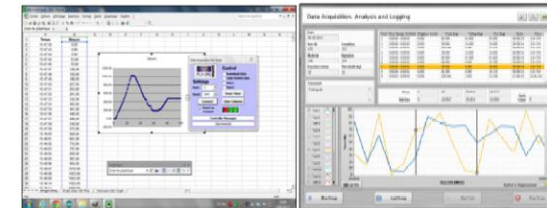


- Wind speed
- Wind direction
- Temperature
- Humidity
- Barometric pressure
- Rain gauge
- Solar radiation

GSM modem specifications

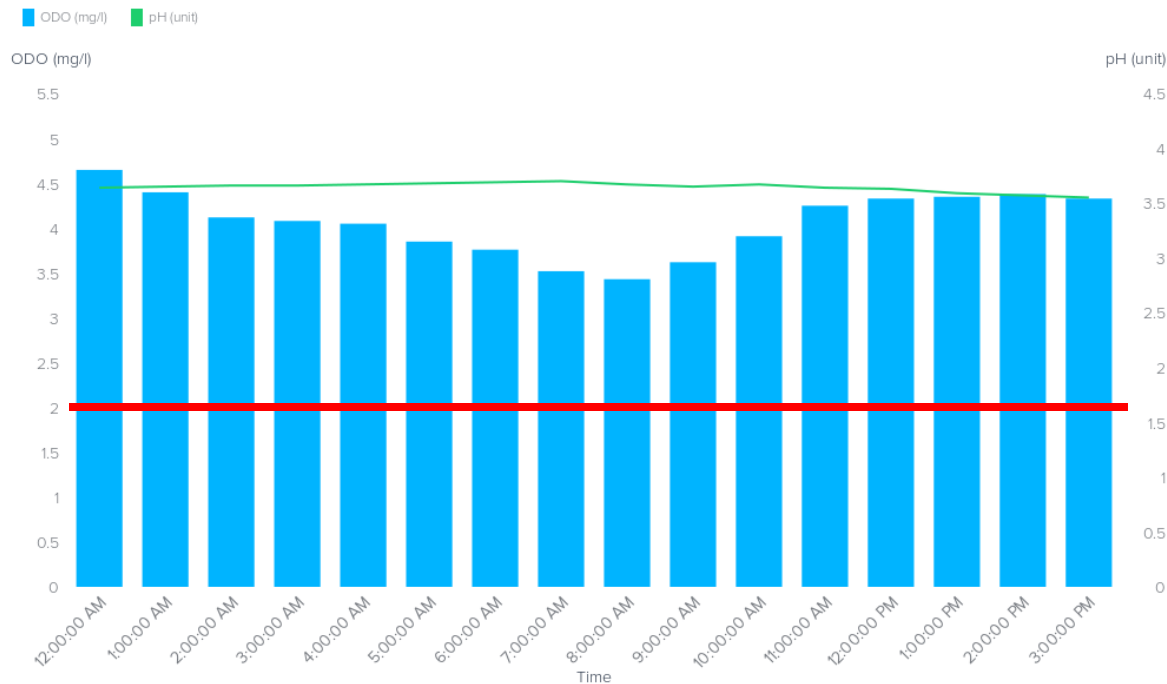
Interface	GPIO(x2), Analogue Audio(x2), RS232 (x1), SMA
Wireless Connectivity	GSM, GPRS Class 10, EDGE Class 10, Bluetooth
Operating Frequency (MHz)	850/900/1800/1900
Max Sensitivity (dBm)	-109 @ 900 MHz

Each station is equipped with 7 sensors



Sample Measurements at Jemberau Station

Dissolved Oxygen (ODO) and Acidity (pH), Saturday, 15/10/2016 12:00 am to 3:00 pm



Filters:

GUIDELINE:

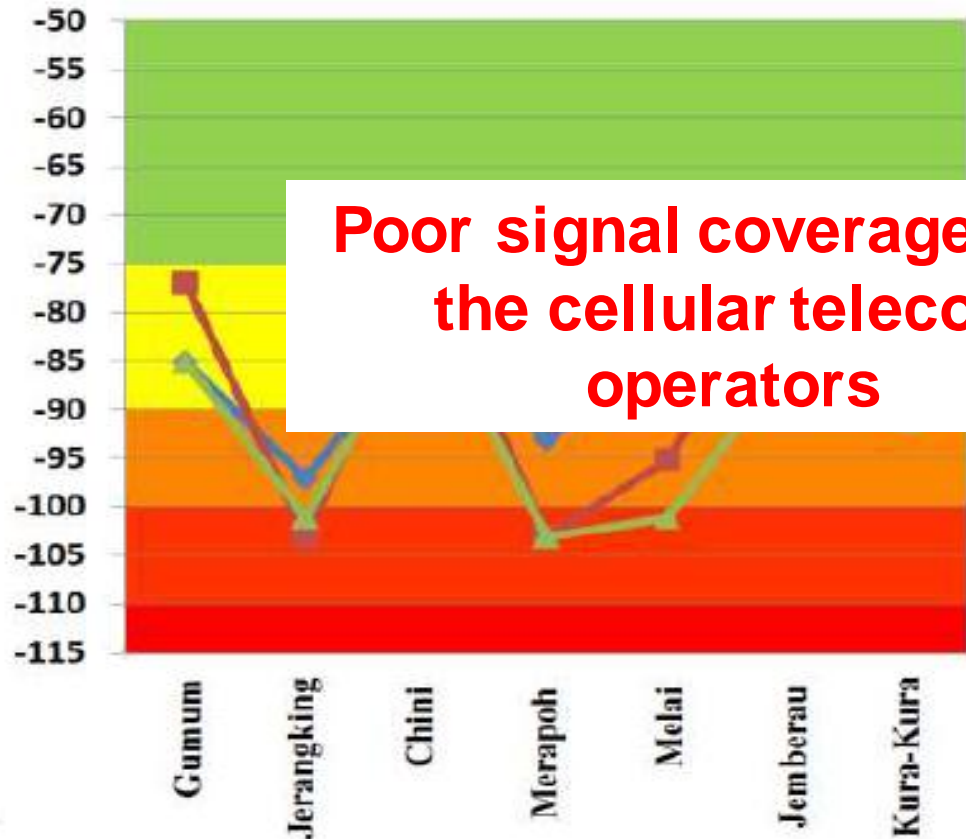
- 0-2 mg/L: not enough oxygen to support life
- 2-4 mg/L: only a few fish and aquatic insects can survive
- 4-7 mg/L: good for many aquatic animals, low for cold water fish
- 7-11 mg/L: very good for most stream fish



Challenges



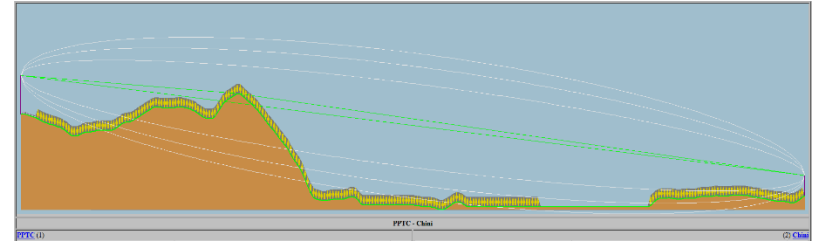
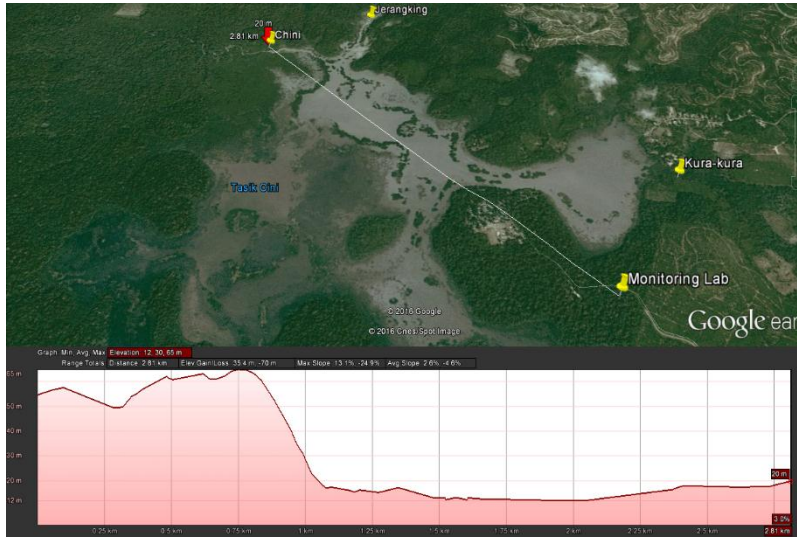
RSS (dBm)



Classification	RSS range	Indicator
Excellent	> -70 dBm	Green
Good	-70 to -85 dBm	Yellow
Fair	-86 to -95 dBm	Mustard
Poor	-96 to -109 dBm	Orange
No Signal	< -110 dBm	Red

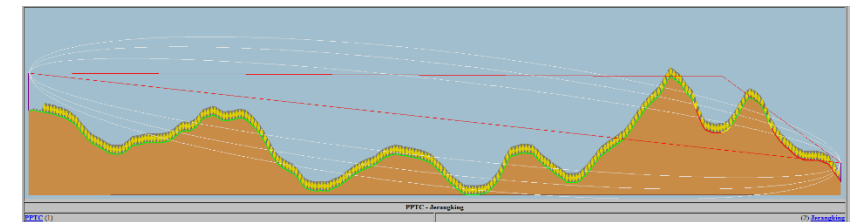
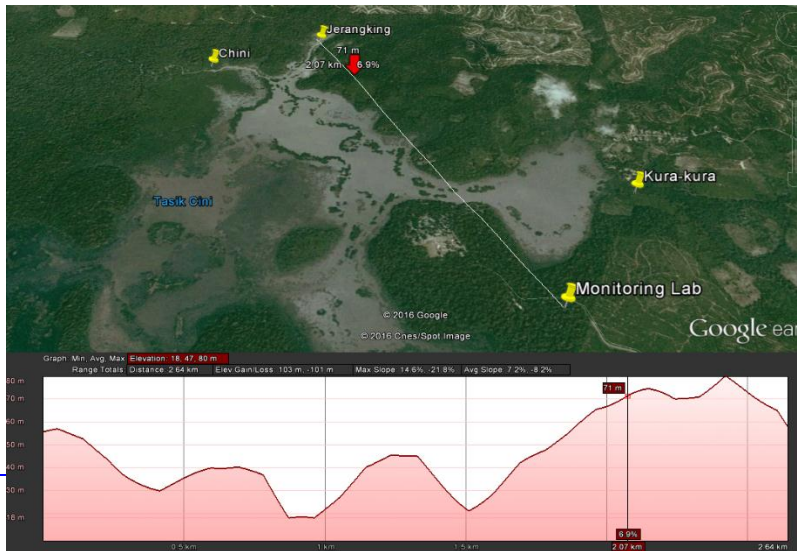
Propagation Environment

Sg. Chini St.



Performance	
Distance	2.783 km
Precision	10.0 m
Frequency	450.000 MHz
Equivalent Isotropically Radiated Power	6.310 W
System gain	142.68 dB
Required reliability	90.000 %
Received Signal	-77.11 dBm
Received Signal	31.23 μV
Fade Margin	18.07 dB

Jerangking St.



Performance	
Distance	2.571 km
Precision	10.0 m
Frequency	450.000 MHz
Equivalent Isotropically Radiated Power	6.310 W
System gain	142.68 dB
Required reliability	90.000 %
Received Signal	-103.19 dBm
Received Signal	1.55 μV
Fade Margin	-8.01 dB

Network Infrastructure & Connectivity

- LoRa
- WiSUN
- Others – NB-IoT, Weightless, TVWS ...

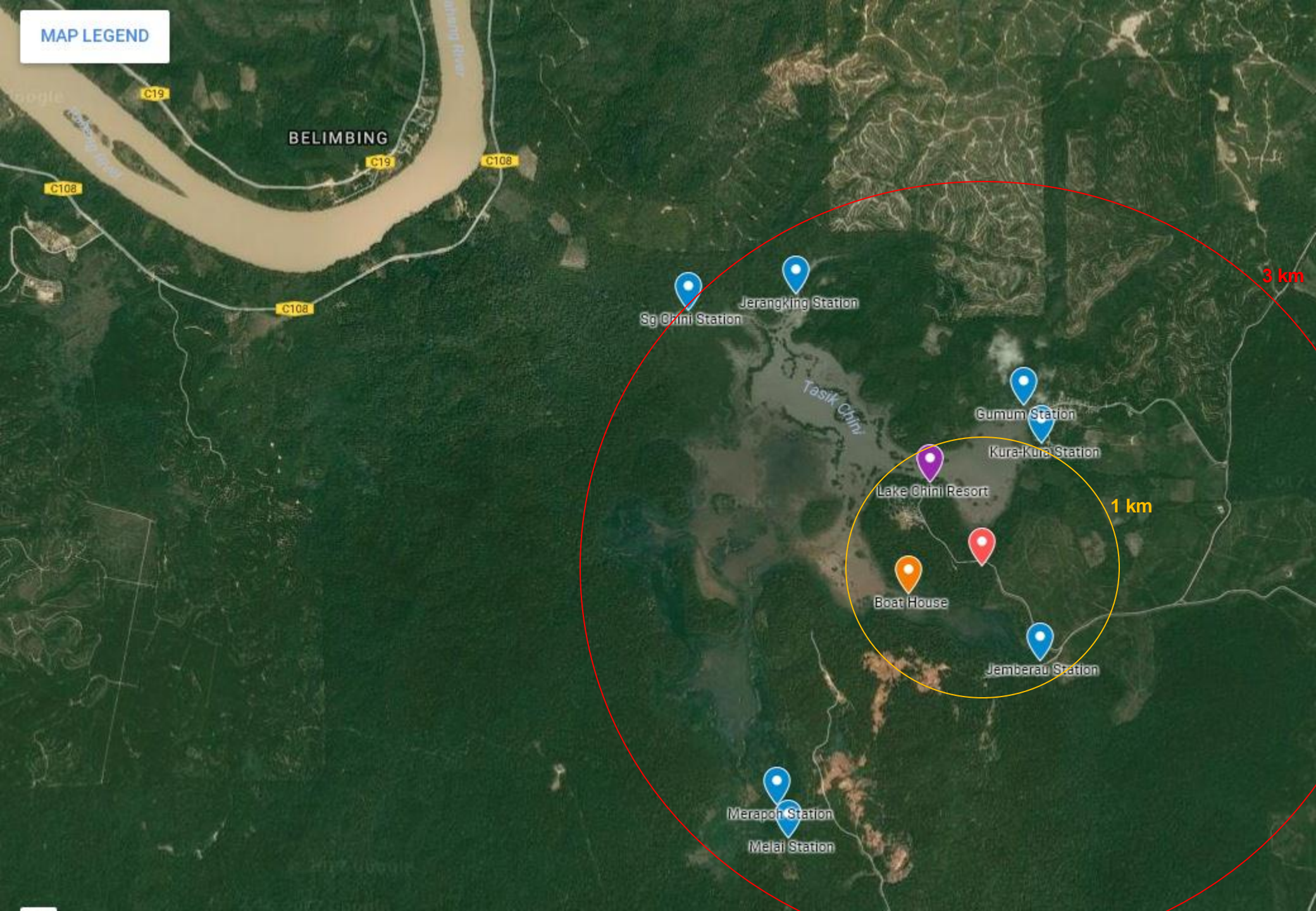
Location of LoRa Gateway at PPTC



LoRa Gateway



MAP LEGEND



BELIMBING

C19

C108

C108

Sg Chini Station

Jeranking Station

Tasik Chini

Gumum Station

Kura-Kura Station

Lake Chini Resort

1 km

Boat House

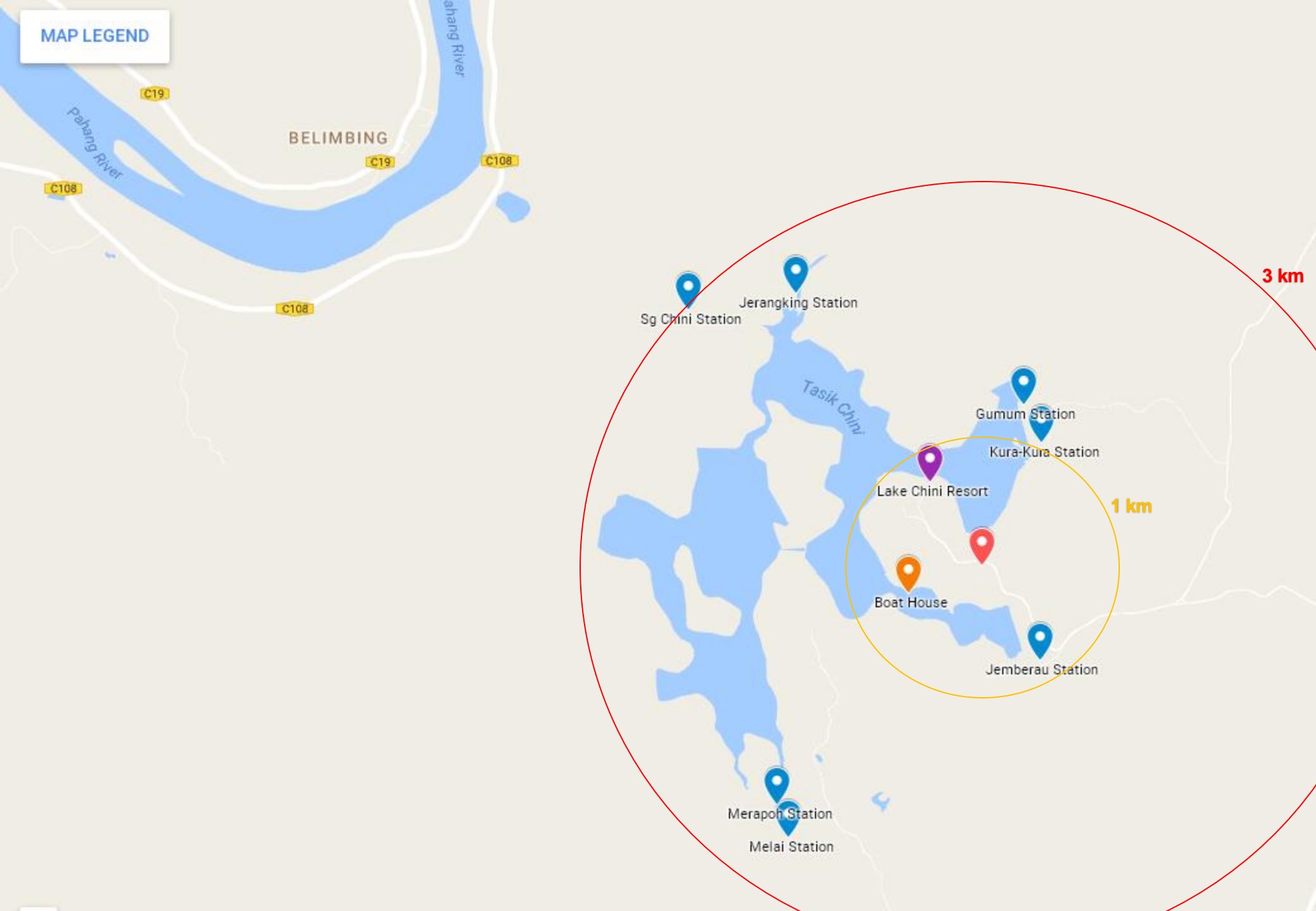
Jemberau Station

Merapoh Station

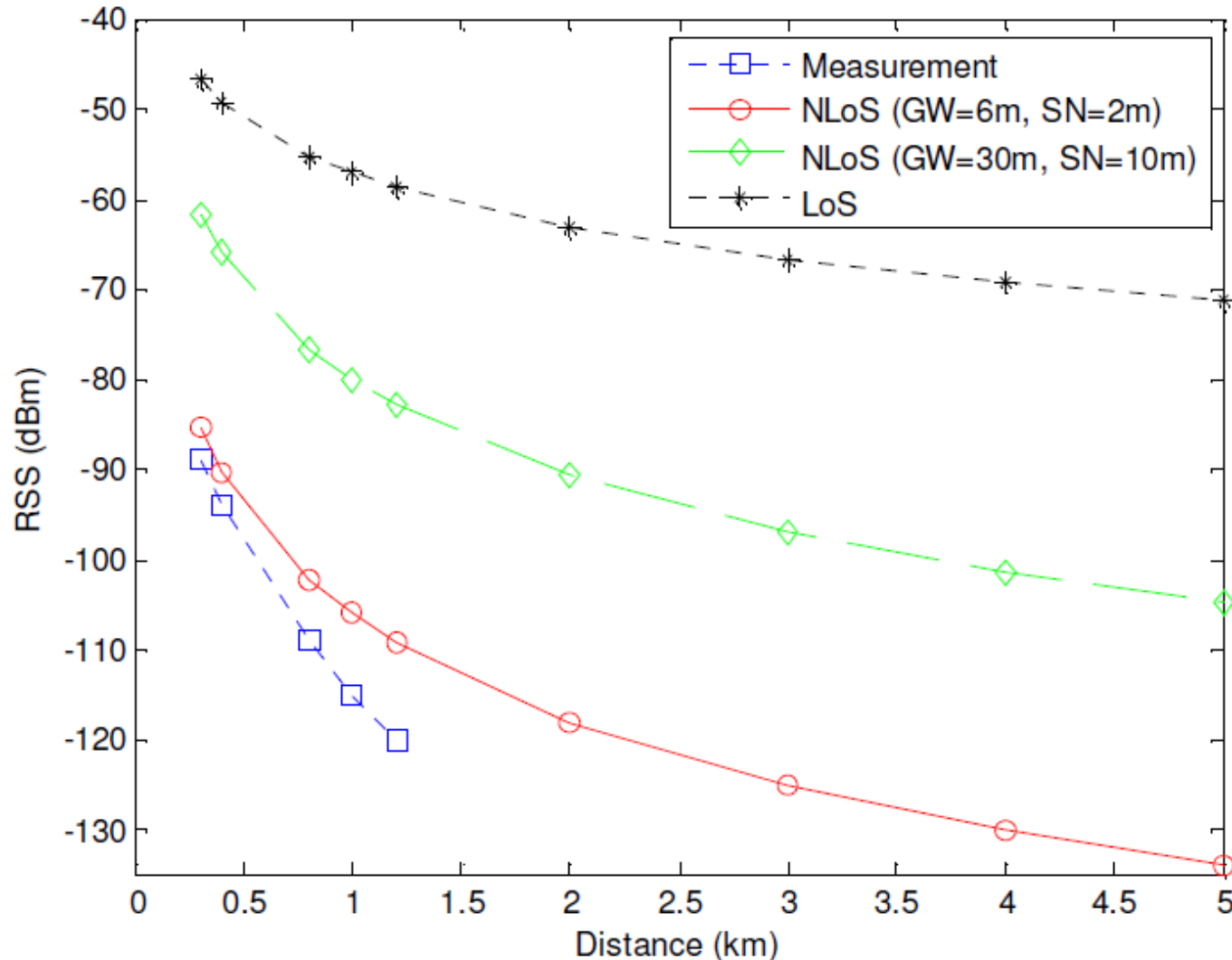
Melai Station

3 km

MAP LEGEND



RSS vs. Distance



- RSS for actual measurement at Tasik Chini and theoretical propagation models is given in this slide.
- NLoS propagation model is based on Hata Model for different gateway (GW) and sensor node (SN) height.
- Green diamond markers and red square markers represent the simulated configuration for GW = 30m & SN = 10m, and GW = 6m & SN = 2m, respectively.

Comparison of LOS/NLOS models and measurement at Chini Lake (Freq = 922MHz)

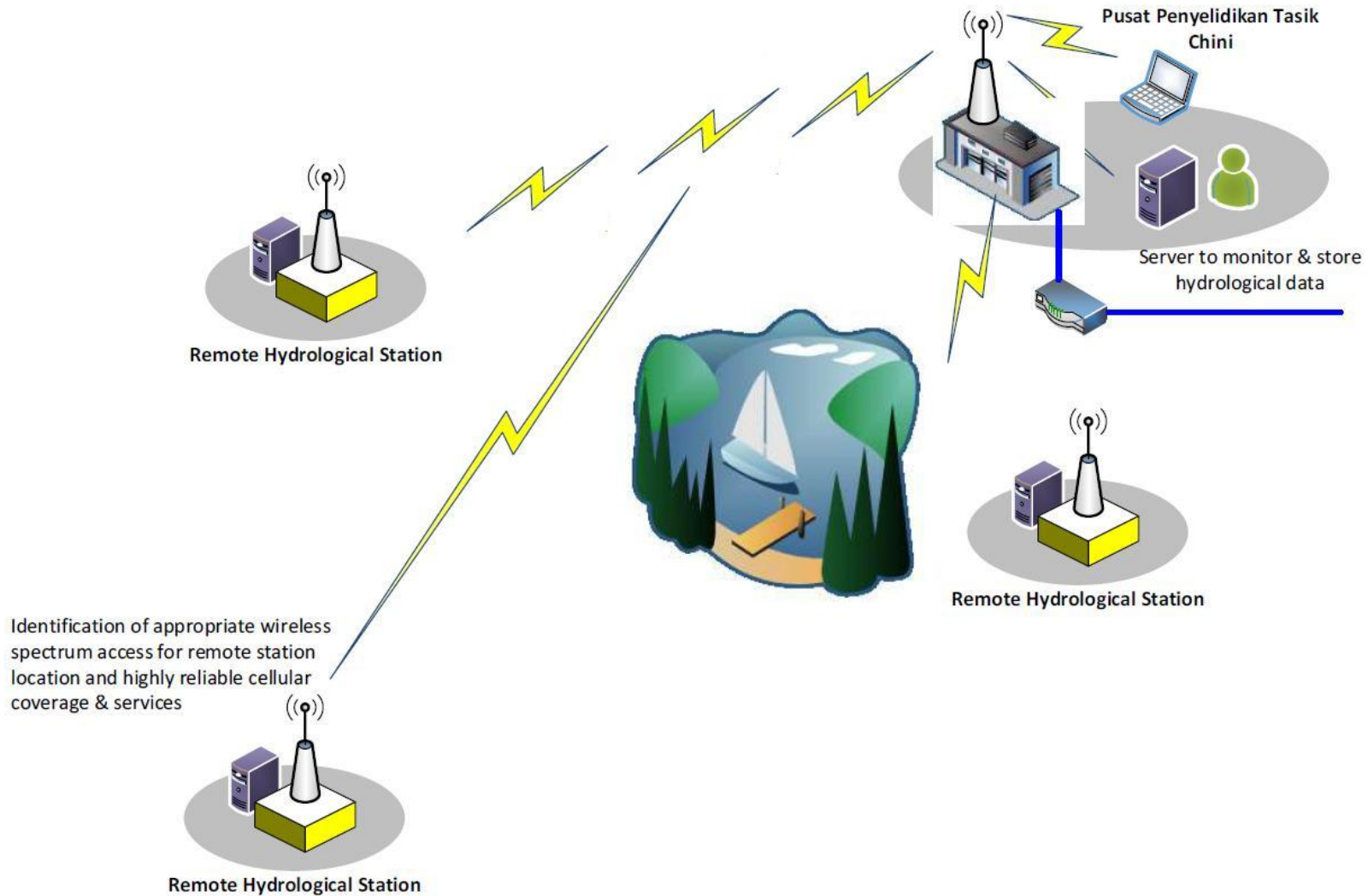
Summary

- Ultimate aim
 - ◆ Provide IoT solution for environmental preservation (sensors, connectivity, middleware, analytics etc)
- Challenges
 - ◆ Network Infrastructure & Connectivity
 - Propagation environment, vegetation effect, terrain, etc
 - ◆ Business Model
 - Community and environmental driven



Thank You!

Network Architecture (LTE and TVWS Network)



Spectrum Measurement Results

