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ADAP-T Advancing Co-Design of Integrated Strategies with Adaptation to Climate Change in Thailand

IMPLEMENTATION OF NAYS2DFLOOD MODELING FOR INTEGRATED FLOODPLAIN/STROMWATER MANAGEMENT : CASE STUDY IN SUKHUMVIT AREA, BANGKOK, THAILAND

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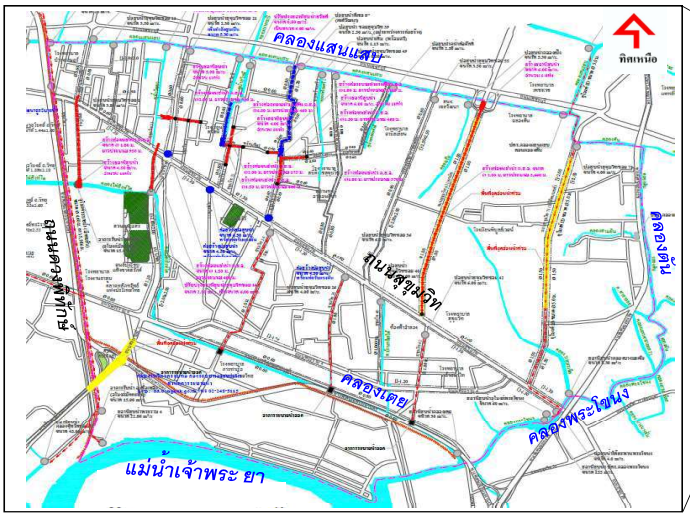
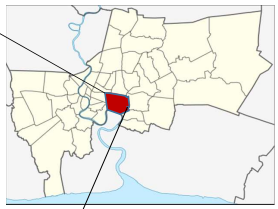
FLOOD IN AREA-13 (SUKHUMVIT-NORTH SUB-POLDER)





Area size
- 22.595 km²

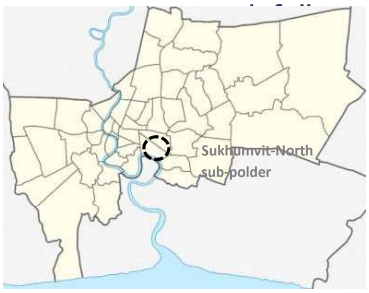
Drainage system
- Canal
- Pipe
- Pumping station

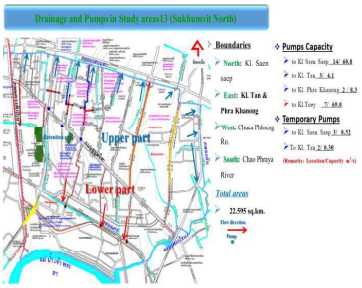
INTRODUCTION





Flooded in October 23, 2018: originated from local high intensity rainfall

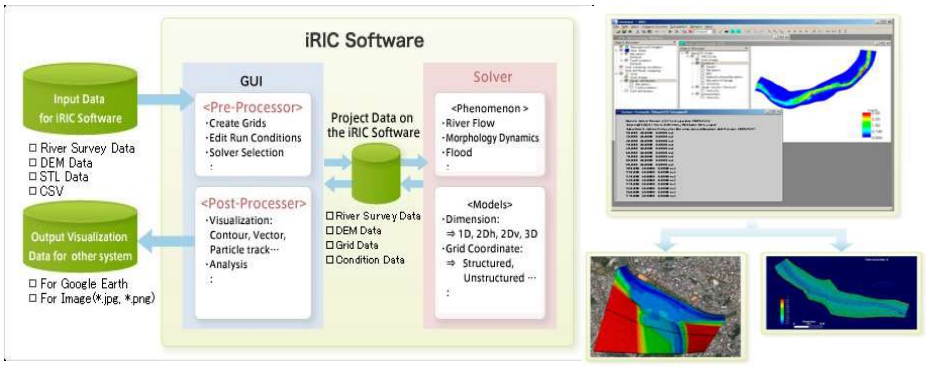




Water management Area-13 Sukhumvit-North sub-polder drainage system

SOFTWARE & MODEL SETUP

iRIC Software
Changing River Science



Governing equations

$$\frac{\partial h}{\partial t}+\frac{\partial \gamma_x hu}{\partial x}+\frac{\partial \gamma_y hv}{\partial y}=q_{in/out}$$

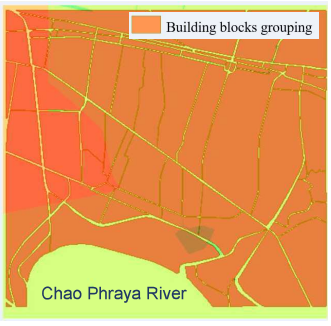
$$\gamma_v\frac{\partial uh}{\partial t}+\frac{\partial \gamma_x hu^2}{\partial x}+\frac{\partial \gamma_y huv}{\partial y}=-\gamma_v hg\frac{\partial H}{\partial x}-\frac{\tau_x}{\rho}-hR_x$$

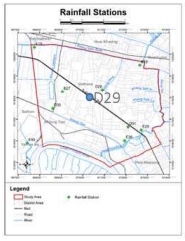
$$\gamma_v\frac{\partial vh}{\partial t}+\frac{\partial \gamma_x huv}{\partial x}+\frac{\partial \gamma_y hv^2}{\partial y}=-\gamma_v hg\frac{\partial H}{\partial y}-\frac{\tau_y}{\rho}-hR_y$$

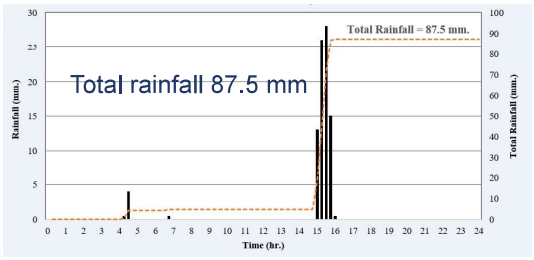
(FDM: CIP scheme)

The architecture of a iRIC software (http://i-ric.org/en/)

SOFTWARE & MODEL SETUP

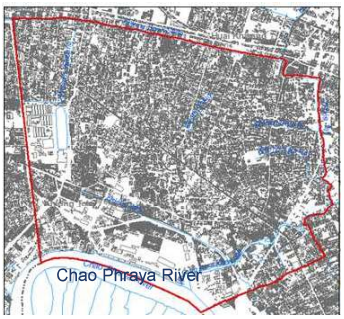


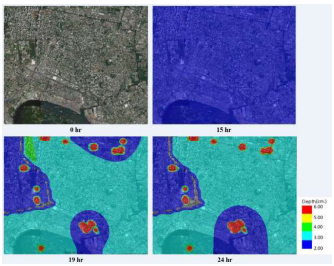


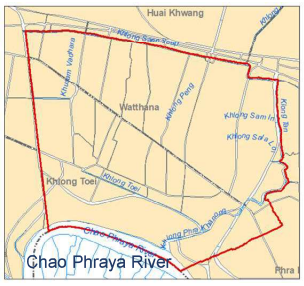


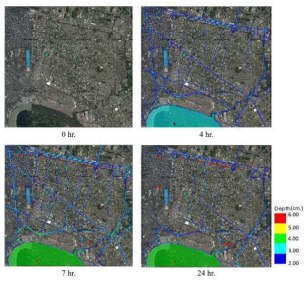
DEM, location and rainfall of D29 (E00) rain gauge station in October 23, 2018

SOFTWARE & MODEL SETUP

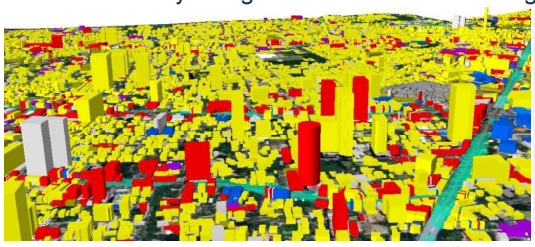








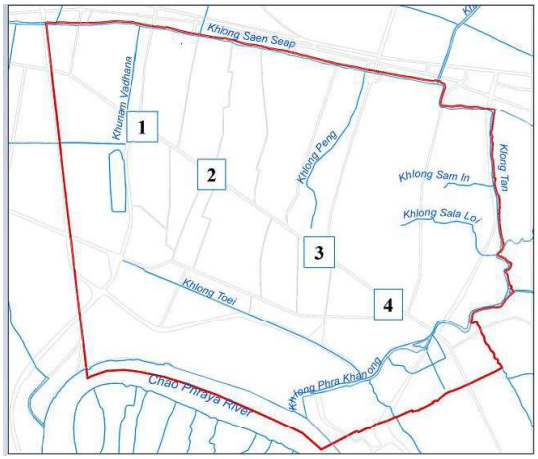
Flooded area by using 5m DEM without building

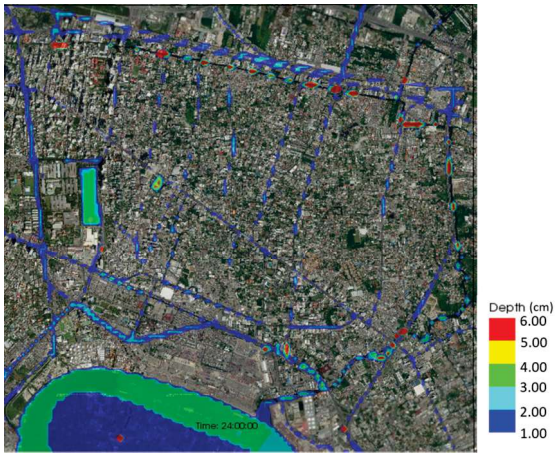


Flooded area by using 15m DEM with grouping building block

RESULTS AND DISCUSSION

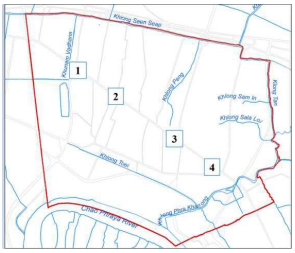
Locations
(1) Aok Montri
(2) BTS Phrompong
(3) Ekamai
(4) Rama4, Khlong Toei

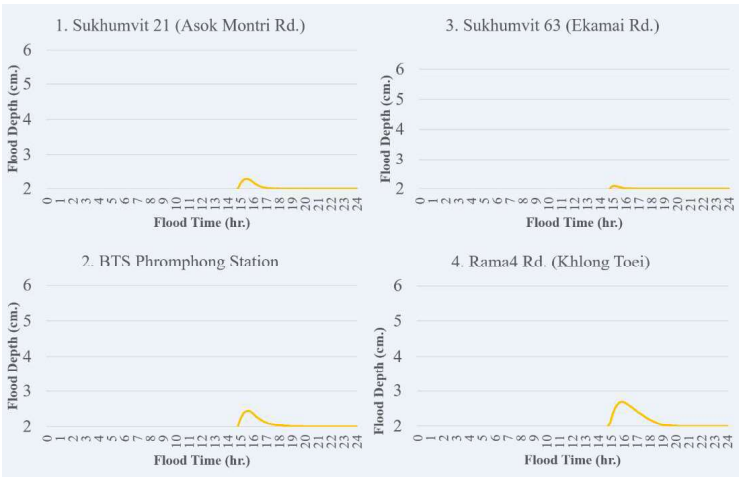




Maximum flooded area in Area-13. (Present scenario).

PRESENT SCENARIO

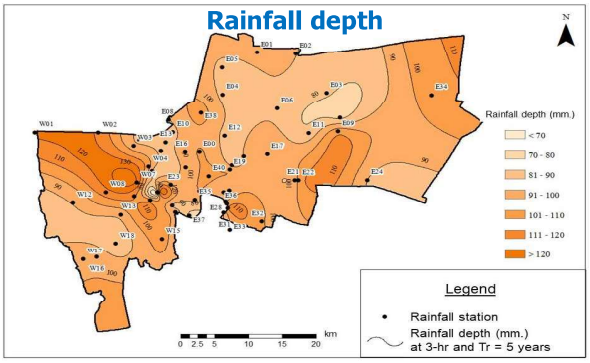


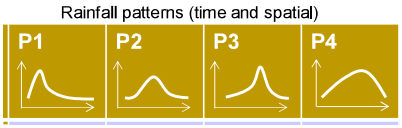


Time series flood depth at several selected locations

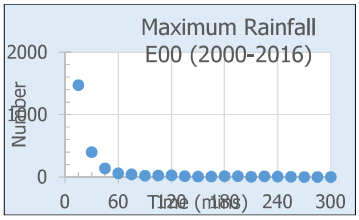
HEAVY RAINFALL SCENARIO

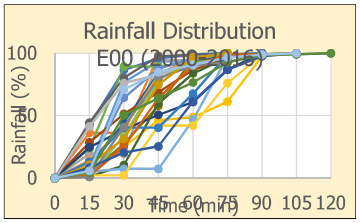
- Design rainfall for present condition in every area of Bangkok
- Use present rainfall pattern of Bangkok Area with rainfall depth from climate change



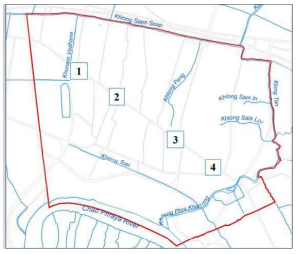


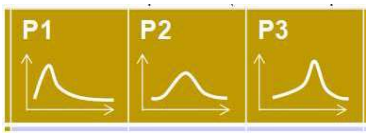
by Napaporn (unpublished)

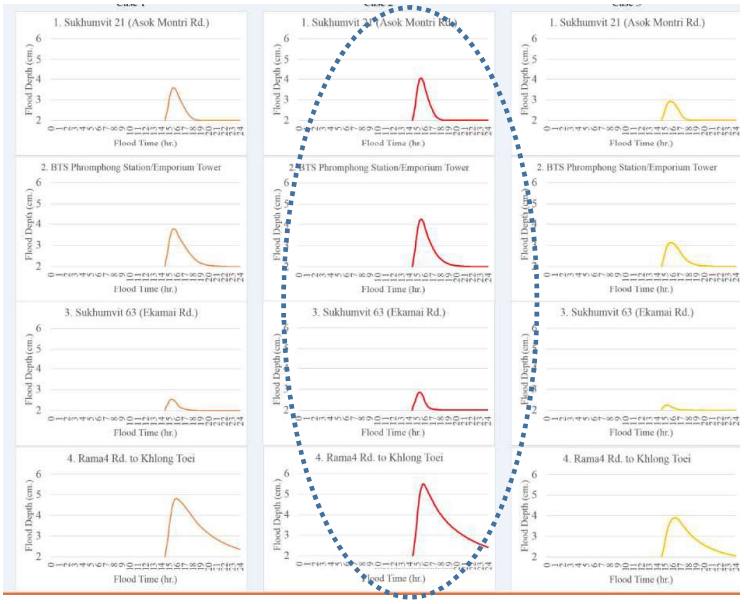




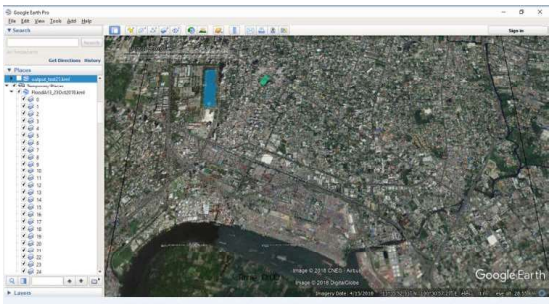
HEAVY RAINFALL SCENARIO

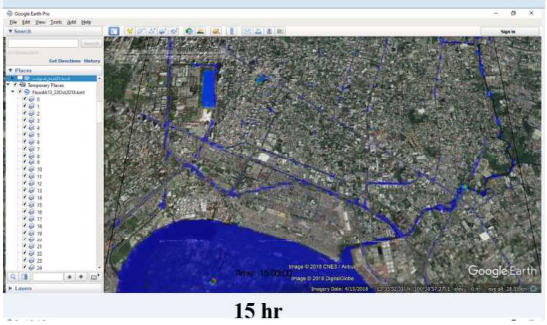




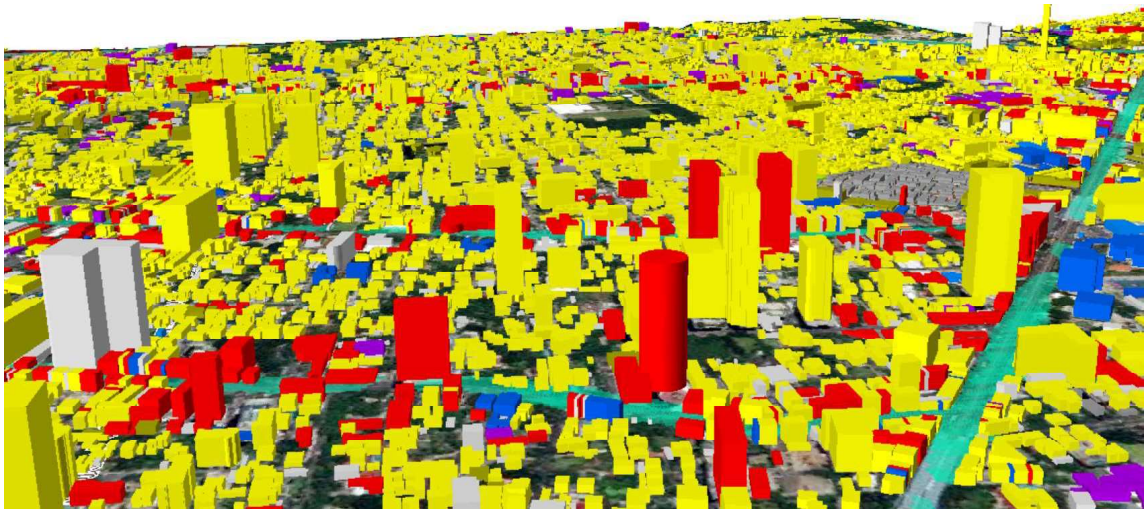


Comparison of flood depth by rainfall pattern 1-2-3



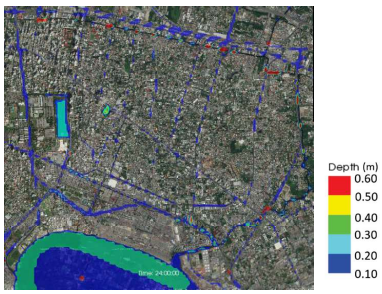


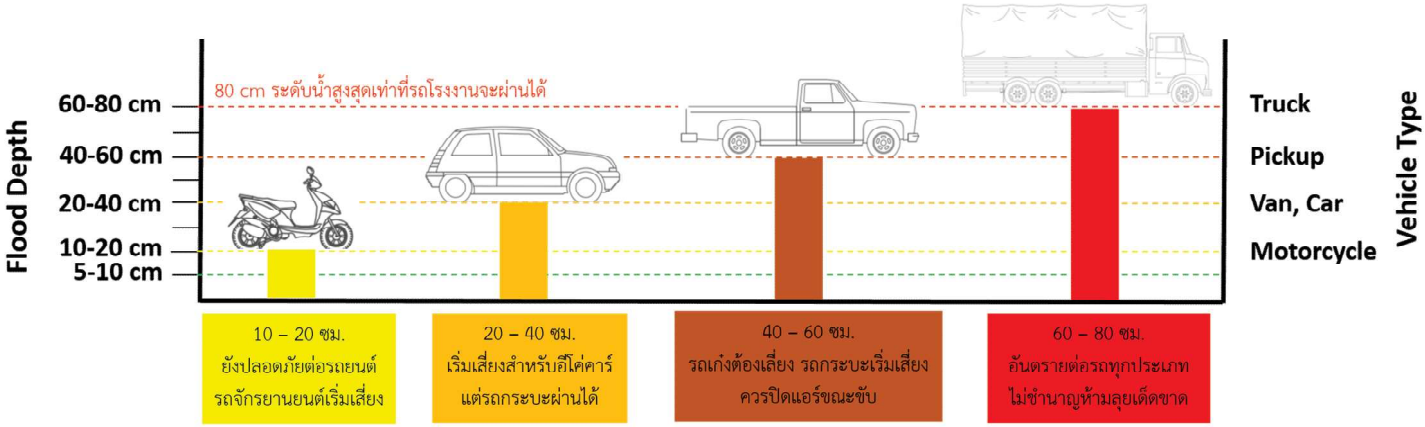
Visualization of calculation results to Google earth (animation)



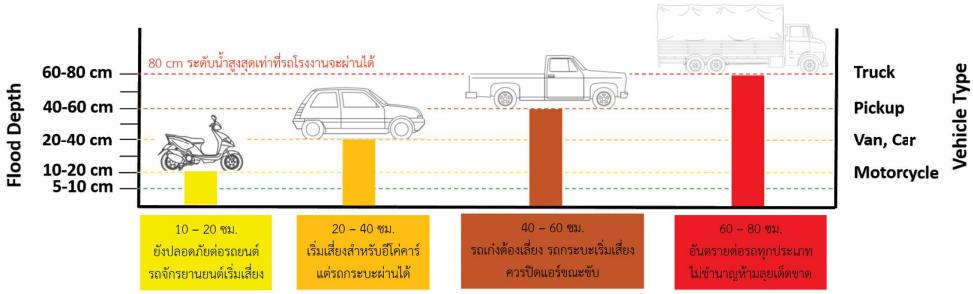
Visualization of calculation results to ArcGIS (animation)

Impact of Flood Depth to Vehicle Type





Map or Attribute about Impact of Flood on Road in the study area



Road name
- Flood length/distance
- Flood depth
- Flood duration (estimate: be safe for all of vehicle (under 20 cm))

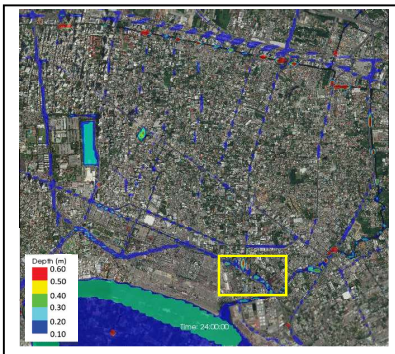
1. เส้นทางที่ได้รับผลกระทบมีเส้นไหนบ้าง แต่ละช่วงมีความลึกกี่เมตร

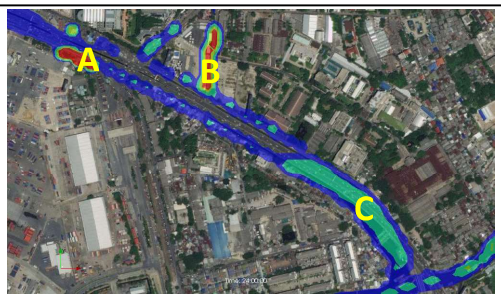
- บอกระดับว่ารถประเภทไหนผ่านได้ตามระดับความลึกในแต่ละช่วง
- เพื่อเตือนและบอกถึงความเสี่ยงที่อาจจะเกิดขึ้น
- **ระดับน้ำมากกว่า 30 ซม. ปิดถนน**

2. เส้นทางที่ไม่ได้รับผลกระทบ หรือได้รับผลกระทบน้อย เพื่อเสนอแนะให้ใช้เป็นเส้นทางเลี่ยง

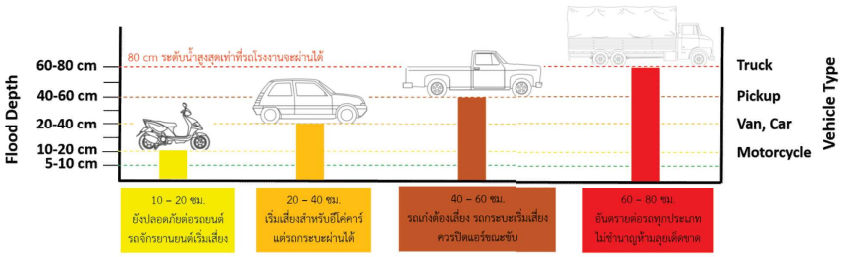
-น้อยกว่า 10 ซม. (ผ่านได้ทุกประเภท และสามารถใช้ความเร็วในการขับขี่ภายในเมืองได้ตามปกติ แต่อาจมีการติดขัดเนื่องจากปริมาณรถที่มาจากการใช้เป็นเส้นทางเลี่ยง)
-10-20 ซม. (รถยนต์ผ่านได้หมดแต่อาจต้องใช้ความเร็วต่ำเพื่อป้องกันคลื่น และน้ำเข้ารถ ซึ่งอาจจะส่งผลต่อการจราจรที่ติดขัดเพิ่มขึ้นในเส้นทางนั้น)

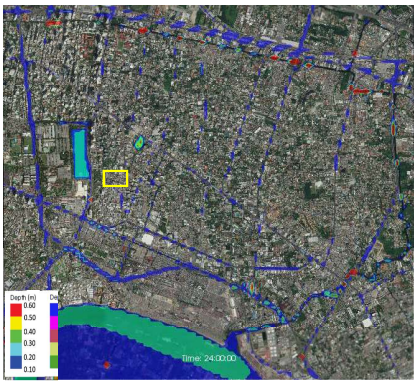
3. ในแต่ละเส้นที่ท่วม บอกระยะเวลา (ประมาณ) ว่าระดับน้ำจะลดลงอยู่ในเกณฑ์ที่รถสามารถผ่านได้ประมาณกี่อีก ชม.

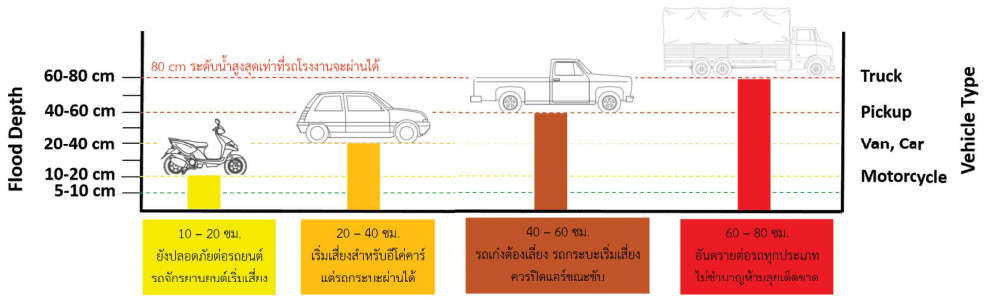




On 16 th May, 2017







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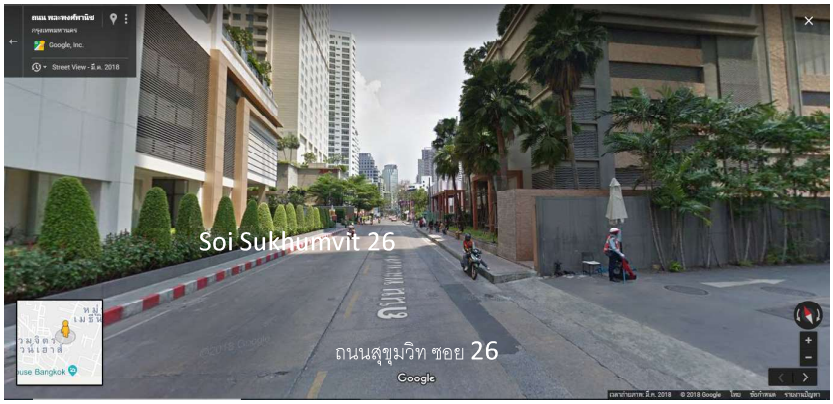

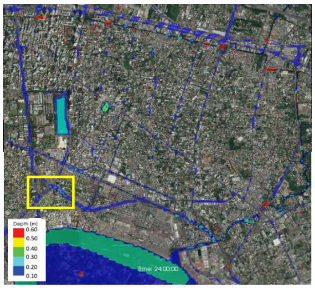

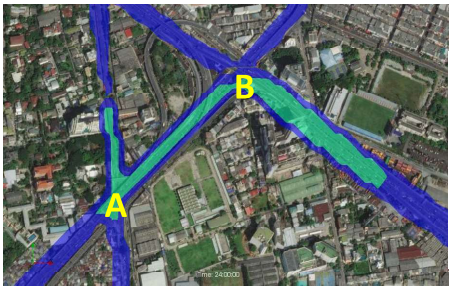

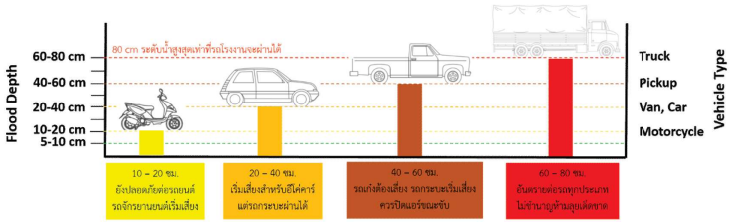

On 16 th May, 2017

CONCLUTIONS

This study explored the potential simulation for 2 scenarios;
(1) present condition, and (2) future impact of heavy rainfall

The results show that improved the drainage capacity locally, such as, sewer and pumping systems can reduce present flood condition.

Future work

- Consider climate change
- Adaptation plan & Measures

Advancing Co-Design of Integrated Strategies with Adaptation to Climate Change in Thailand

ACKNOWLEDGMENT

This research was supported by “Advancing Co-design of Integrated Strategies with Adaptation to Climate Change in Thailand (**ADAP-T**)” supported by the Science and Technology Research Partnership for Sustainable Development (SATREPS), JST-JICA.

We are also indebted to Department of Drainage and Sewerage (DDS: BMA) and Ms. Komkong T. (RA) for providing some fields and calculation data.