DESIGN AND ANALYSIS OF STORMWATER DRAINAGE SYSTEM FOR PRINYADA WONGWAN-SATHON VILLAGE USING EPA SWMM MODEL

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Introduction

Residential housing developments generally consist of roads, buildings, and other impervious surfaces that reduce rainwater infiltration and increase stormwater runoff. Therefore, evaluating the performance of stormwater drainage systems is essential for effective planning and design. This project applies the EPA Storm Water Management Model (EPA SWMM) to simulate and analyze stormwater runoff within Prinyada Wongwan-Sathon Village. The model is used to assess the drainage system capacity, identify potential flooding locations, and support the improvement of the drainage system based on engineering principles.

Objectives

1. To delineate the catchments and drainage network of the village.
2. To develop a stormwater drainage system model using EPA SWMM.
3. To simulate runoff under the design storm.
4. To evaluate performance and find flood-prone points.

Methodology

Process

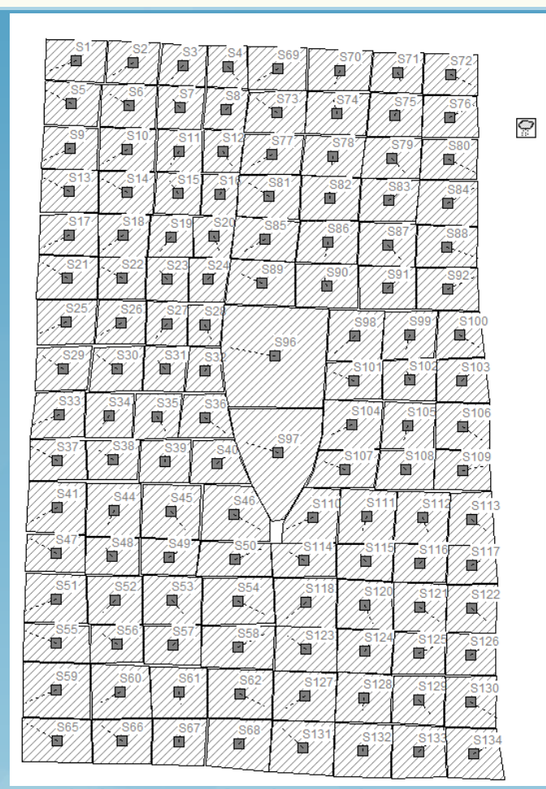
Subcatchment Delineation

Design of Drainage Pipe Alignment, Manholes, and Outfalls

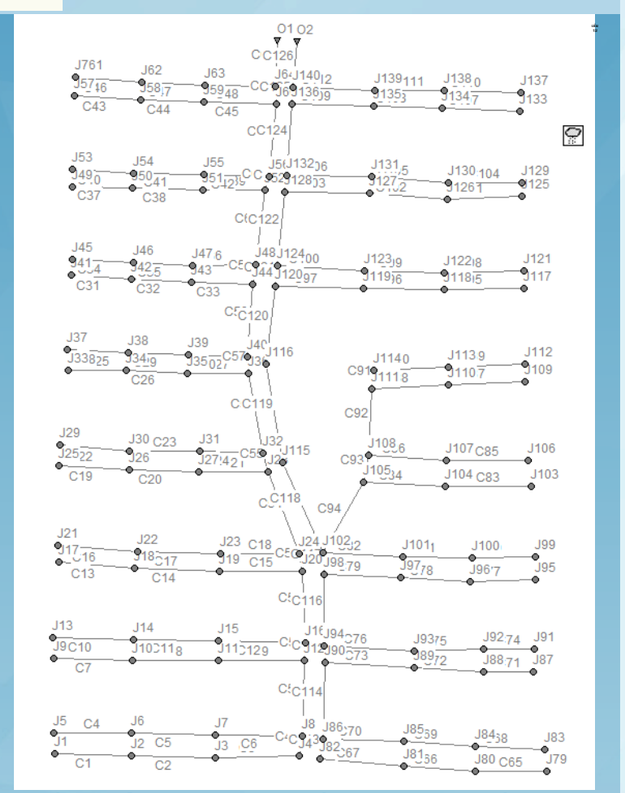
Input of Rainfall Data (Time series)

Run Program

In the delineation of drainage catchment areas and the design of the drainage pipe network, consideration was given to the alignment of the internal roads within the residential development. Residential areas and internal roads were assumed to drain into the nearest manhole. The drainage pipe layout was designed to correspond with the locations of manholes and subcatchment areas, with branch pipes collecting runoff and conveying it to the main drainage pipe before discharging into the canal located behind the study area.



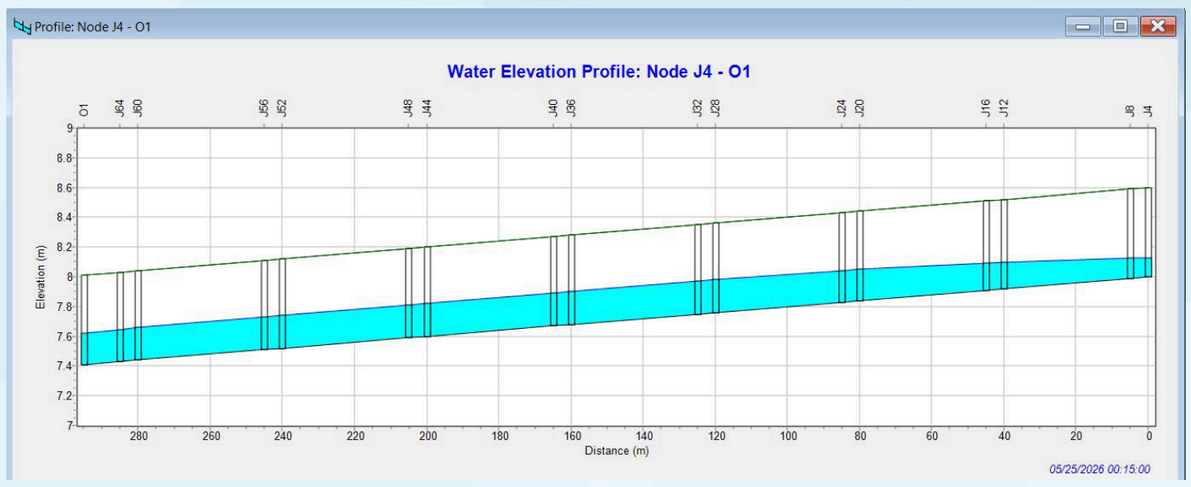
Subdivision of sub-catchment areas within the study area

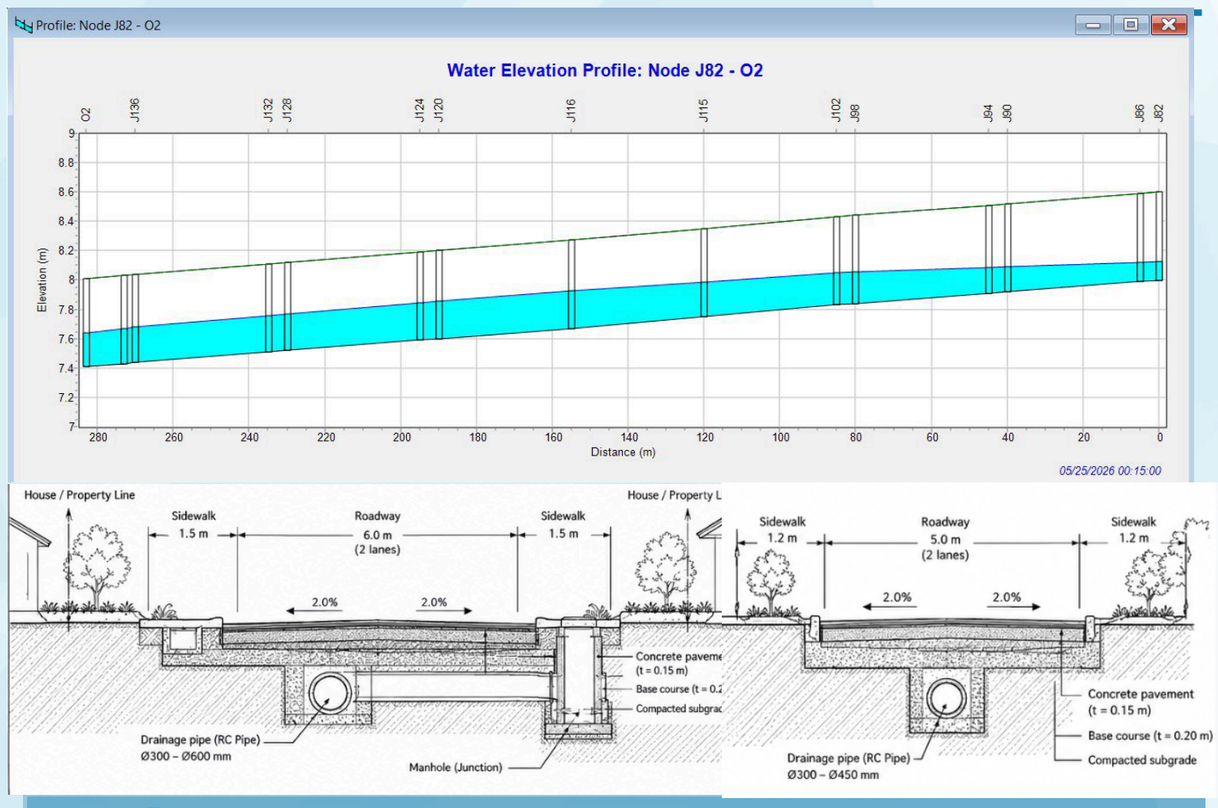


Plan of stormwater drainage pipelines, manholes, and outfall points

Results

The EPA SWMM simulation demonstrated that the drainage system can generally accommodate the design storm runoff. However, some pipe sections showed Max/Full Depth values close to 1.00, indicating potential surcharge conditions. Furthermore, Outfall O2 experienced a higher maximum flow (0.469 m³/s) than Outfall O1 (0.448 m³/s), suggesting that additional attention should be given to the receiving water body connected to O2.





Utilization

1. A systematic guideline for designing the stormwater drainage system within the residential village was developed.
2. A stormwater drainage system model for the study area was created using the EPA SWMM program.
3. Areas at risk of flooding or manhole overflow were identified.
4. Recommendations for improving the stormwater drainage system to adequately accommodate the design rainfall were proposed.

BOQ / Cost Estimate

BILL OF QUANTITIES						
Project: Stormwater drainage system, Prinyada Wongwan-Sathon Village						
No.	**Description**	**Qty**	**Unit**	**Material (THB/unit)**	**Labour (THB/unit)**	**Amount (THB)**
1. Conduits						
1.1	Supply and lay RC pipes TIS class 3, Ø0.40 m (conduits C1–C126)	3,850.00	m	650.00	250.00	3,465,000.00
2. Manholes and junctions						
2.1	RC manholes, precast or cast in place (J1–J140)	140.00	nos	3,500.00	1,200.00	658,000.00
2.2	RC manhole covers / steel inlet grates	140.00	sets	1,500.00	300.00	252,000.00
3. Outfalls						
3.1	RC outfall structures O1 and O2 with headwall	2.00	nos	25,000.00	8,000.00	66,000.00
3.2	Flap gates Ø0.40 m (anti-backflow)	2.00	sets	12,000.00	2,000.00	28,000.00
4. Earthwork						
4.1	Trench and manhole excavation (average depth 1.20–1.80 m)	2,300.00	m³	0.00	120.00	276,000.00
4.2	Sand bedding and backfill	850.00	m³	380.00	100.00	408,000.00
				TOTAL		**5,153,000.00**

Conclusions

This project developed a stormwater drainage model for Prinyada Wongwan-Sathon Village using EPA SWMM. The model was used to simulate stormwater runoff, evaluate the performance of pipes, manholes, and outfalls, and identify potential flood-prone locations. The results can support future planning and improvement of the stormwater drainage system.

Recommendations

- Improve model accuracy using detailed field survey and rainfall data.
- Evaluate drainage performance under various design storm return periods.
- Upgrade drainage components in areas identified as flood-prone by the EPA SWMM simulation.

References

[1]Akan, A. O., & Houghtalen, R. J. (2003). Urban hydrology, hydraulics, and stormwater quality: Engineering applications and computer modeling. John Wiley & Sons.
[2]Rossman, L. A., & Huber, W. C. (2016). Storm Water Management Model reference manual volume I: Hydrology (Revised, EPA/600/R-15/162A). U.S. Environmental Protection Agency
[3]Rossman, L. A., & Simon, M. A. (2022). Storm Water Management Model user's manual version 5.2 (EPA/600/R-22/030). U.S. Environmental Protection Agency.

Key Courses Used in the Project

1. Hydrology and Hydraulics (runoff, Rational Method, Manning's equation)
2. Water Resources Engineering (EPA SWMM drainage modelling)
3. Environmental and Sanitary Engineering (stormwater discharge to canal)
4. Surveying (catchment and road layout from satellite images)
5. Highway Engineering (drainage along internal roads)