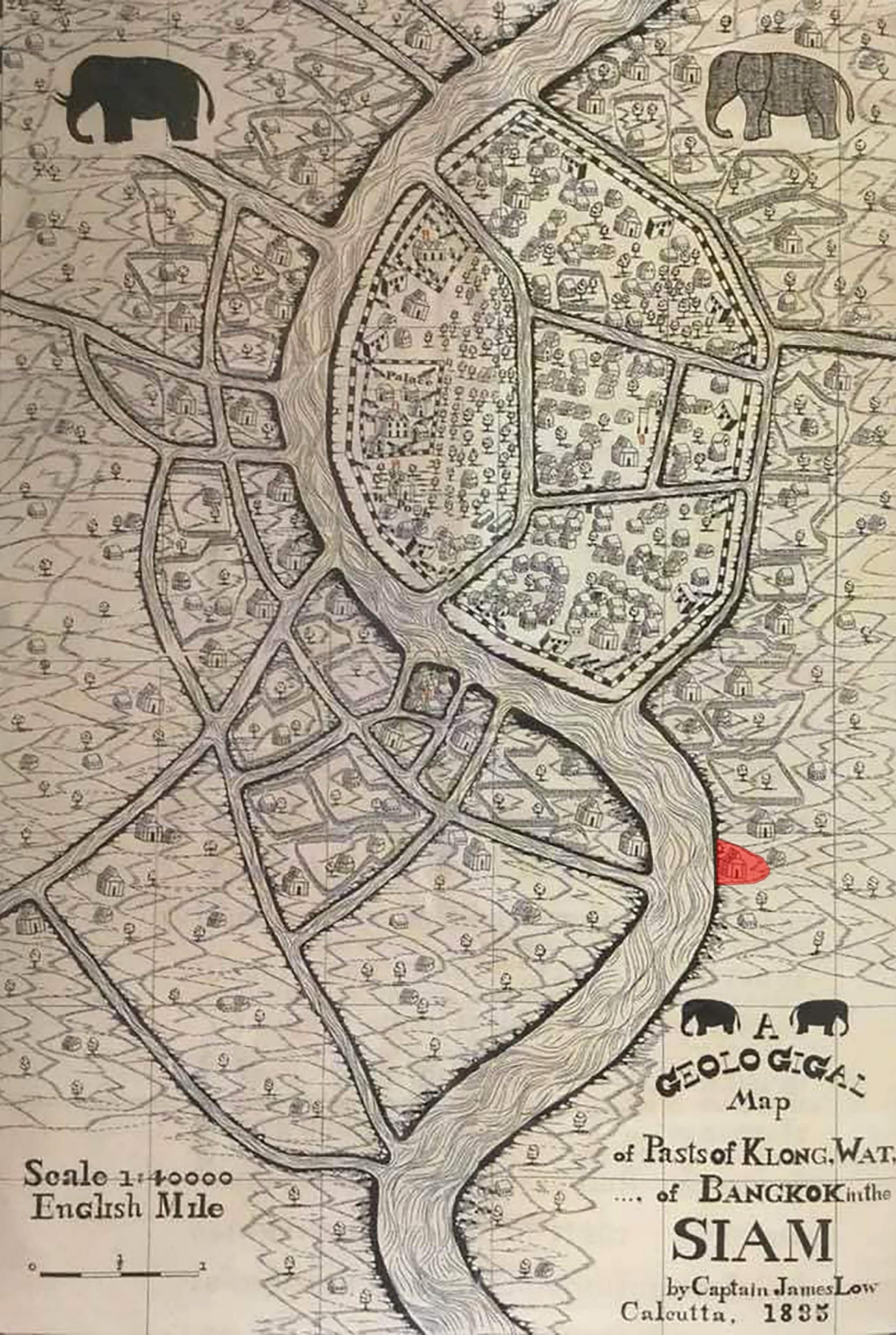


1. Title: The Holy Rosary Church Bangkok and its reflections towards the changing climate



Abstract

Bangkok has been well-known as a water-based community from foreigners' perspectives since the 17th century. However, towards urbanisation in the late 19th century, the city slightly transformed into a land-based community.

Similarly, the Holy Rosary Church community was one of the first settlements in Bangkok in which buildings and settlements depended on the river and canal systems. By studying the church's community's components in the past centuries, the results show that (1) the community had adapted itself based on the changing context of the city. (2) Changes in the late-20th century impacted the connections between the church and its communities. (3) Rising sea level has increased risk to the community and the church building, considered the most valuable relic from the past.

Consequently, short and long-term mitigation measures were proposed, including redesigning the waterfront, re-linking connections between the church and communities, and increasing people's awareness on a bigger scale. As flooding is a macro impact on the city, the Holy Rosary Church community can be the pilot project to increase awareness and enhance the resilience towards climate change to cultural heritage, which is hardly discussed in Thailand nowadays.

Fig.1 Map of Bangkok in 1835 by Captains James Low: The red location was the estimated area of the Holy Rosary Church community. Published in Calcutta, India

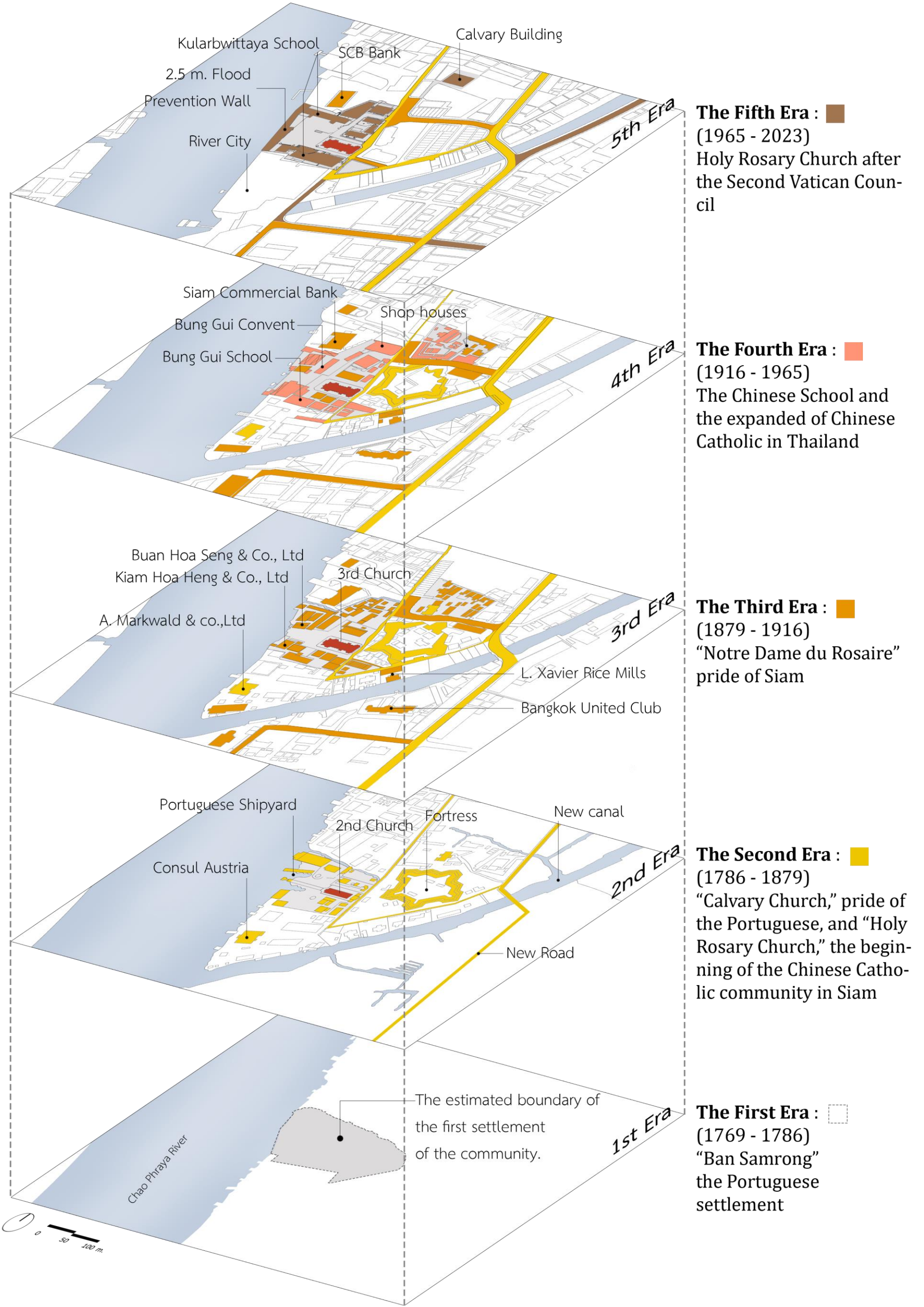


Fig.2 Chronology of the Holy Rosary Church community from 1769 – 2023, edited and updated from (Arpichart K., 2018)

1.1 Introduction and adaptation of the Holy Rosary Church Bangkok

The community had adapted itself based on the changing context of the city.

- The first buildings were built as raised-floor timber architecture in 1769.
- Later, the Portuguese used the advantages of access to the river for building ships and commuting with the rest of the city. (Fig 2 - 2nd Era)
- The New Road (the first road of Bangkok) was built in the mid-nineteenth century, some canals were filled, and the Holy Rosary Church community was expanded towards the roads.
- The community built internal roads to connect with the New Road.
- The 3rd church was built in 1891 in Gothic Revival Architecture, later called 'Notre Dame du Rosaire' of Bangkok. Because of the understanding of flooding season, the gothic revival building was built with a floor level higher than one meter above the ground.
- Later, the stair was filled with pavement, believing it would help avoid the flood.

Changes in the late-20th century impacted the connections between the church and its communities.

- The urban transformation in the 20th century slightly ceased water transportation; many canals were filled up as pathways for pedestrians and vehicles.
- Flood prevention walls were initially introduced and built along both sides of the river at the end of the 20th century, with 2.5 meters height above sea level.
- The Holy Rosary Church Flood prevention wall was built in the 2000s, and access from the church to the river has been halted. (Fig.4)

1.2 Risk, possibilities and mitigation measures



Fig.3 "Notre Dame du Rosaire" or the Holy Rosary Church during the construction with piers and shops along the river, c.1896

Fig.4 The Holy Rosary Church with the 2.5 meter-height flood prevention wall, 2023

The rising sea level has increased the community and the church building risk.

- At the current pace, the sea level is rising about 3 mm. per year, and Bangkok is sinking about 25 mm annually.
- The church faced leakage and overflow from the flood prevention wall several times during the flooding season (October - November).
- Ad-hoc mitigation methods were adapted (Fig. 6-10), such as (1) using sandbags to protect water at the church's entrances, (2) monitoring and manually pumping water out from the church, and (3) creating temporary access for entering the church.

Short-term mitigation measures

- Redesigning the waterfront and re-linking connections between the church and communities. (Fig. 11-13)
- Experiment with redesigning the drainage system and water protections for the Holy Rosary Church. (Fig. 14-16)



Fig.5 The Holy Rosary Church with the staircase at the porch, c.1908. (Wright, A. 1908)

Fig.6-10 Porch of the Holy Rosary Church during flooding season with sandbags, temporary path and volunteers, 2022. Currently, the interior floor level of the Holy Rosary Church is the lowest point on the property, which was the result of consistently filling up the surrounding landscape to avoid flood. However, this increases the risk of flooding as there needs to be a retention area for water.

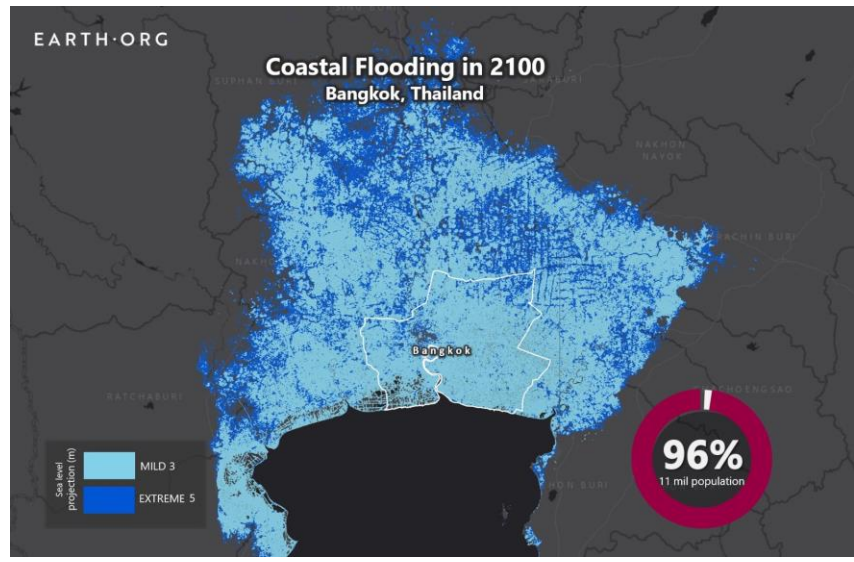
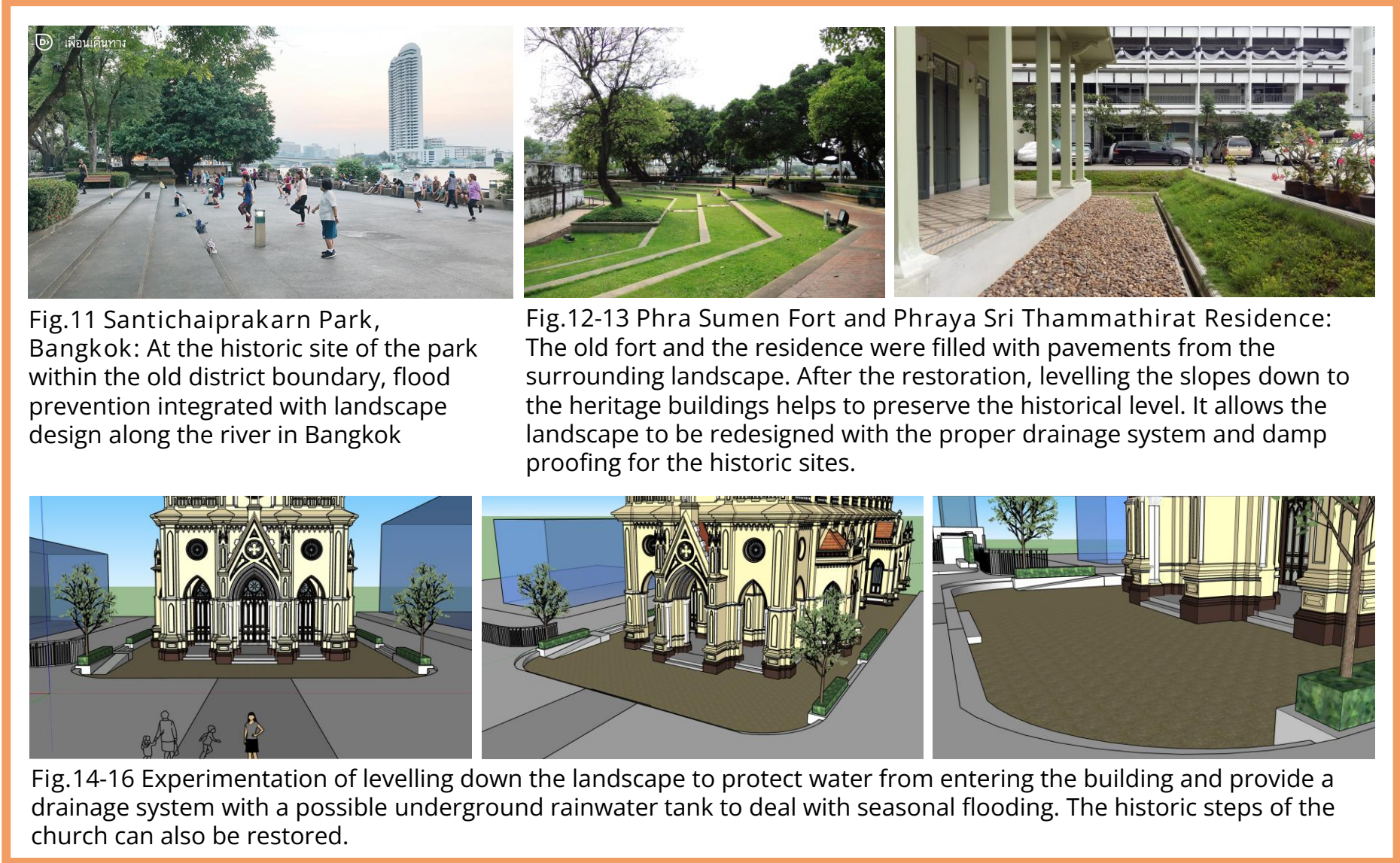


Fig.17 Sea Level Rise Expectations in the year 2100. Light blue shows 3 meters of Sea Level Rise, expected in 2100. In contrast, blue illustrates extreme Sea Level Rise at 5 meters. About 96% of Bangkok and its metropolitan would be underwater if there were no mitigation measures at the macro level. (Illustration from Earth.org, 2023)

Long-term mitigation measures

- The unavoidable Sea Level Rise (SLR) is one of the global climate concerns and is predicted; the mild-range scenario projected 0.5-1.2 m of SLR, and the pessimistic scenario estimates SLR at 1-2.5 m in 2100, based on the current Sea Level Projection (Kopp et al., 2017). Mainly due to ocean thermal expansion and ice melt.
- If there are no mitigation measures on the macro scale, most of Bangkok and the metropolitan will be underwater by then. (Fig. 17)
- The church should engage local-sustainable NGOs, water engineers, and landscape architects to find long-term solutions on a meso scale more extensive than the church's property.
- SLR is a regional and global issue, and it is crucial to increase people's awareness on a bigger scale.

- Some coastal cities, such as the low countries (Flanders and the Netherlands), have shown that effectively implementing dikes, levees, and barriers can reduce the threat of flooding on a macro scale.
- All the involved stakeholders in Bangkok and the Metropolitan should raise the urgency and fund research about the protection of the city and cultural heritage sites, as well as seek advice and collaboration for analysis and design from successful cases abroad.

Bibliography

- Arpichart, K. (2018). Setting and Its Contribution to Interpretation and Presentation: A Case Study of The Holy Rosary Church, Bangkok, Sarasat Faculty of Architecture, Chulalongkorn University Vol.4/2018 ISSN: 2630-0141 Published: 2018-12-14.
- Kopp, R. E., DeConto, R. M., Bader, D. A., Hay, C. C., Horton, R. M., Kulp, S., Oppenheimer, M., Pollard, D. & Strauss, B. H. (2017). Evolving Understanding of Antarctic Ice-Sheet Physics and Ambiguity in Probabilistic Sea-Level Projections. Earth's Future, 5(12), 1217-1233.
- Wright, A. (1908). Twentieth Century Impressions of Siam: Its History, People, Commerce, Industries, and Resources, with which is Incorporated an Abridged Edition of Twentieth Century Impressions of British Malaya. London: Lloyd's Greater Britain.

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