วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

Enhancing local government management of wastewater issues in the Phetchaburi River at Khlong Khachen subdistrict

Suttipong Premthveesuk*[1]Sookjai Promprasansuk[1], Vikorn Tanaratchat[1], Wirote Ritthong[1] Mesith Chaimanee[1]

*Faculty of Engineering and Technology, Shinawatra University, *Email: suttipong.p@ptu.ac.th*

Received: November 1, 2024, Revised: November 15, 2024, Accepted: November 19, 2024

ABSTRACT

Water pollution in Phetchabun province has significantly impacted the local economy, environment, and quality of life. A survey conducted in 2017 revealed that the Phetchaburi River was severely polluted, with a Water Quality Index (WQI) ranging from 31 to 60 and dissolved oxygen (DO) levels below acceptable standards. Key contributing factors include domestic wastewater discharge directly into the river and the construction of weirs obstructing water flow. Approximately 200 households were found to be encroaching on the riverbanks, with most having septic tanks that discharged directly into the river. Additionally, concrete roads and bridges served as barriers to water flow. To address these issues, the relocation of toilets and septic tanks away from the riverbanks has been proposed. River restoration efforts have been supported by the community and relevant agencies, including water management, weed removal, and community engagement. Collaborative efforts and inclusive participation have been crucial for river restoration. Through effective collaboration, the Phetchaburi River can be revitalized and sustainable development can be achieved.

Keywords: dam construction, weir construction, water management, community empowerment

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

1. Introduction

Water pollution in Phetchabun province poses a significant threat to the local economy, environment, and quality of life. A 2017 survey revealed that the Phetchaburi River was severely polluted, with a Water Quality Index (WQI) of 31-60 and dissolved oxygen (DO) levels below the acceptable standard of 2 mg/L. Additionally, the biochemical oxygen demand (BOD) exceeded the acceptable limit of 4.0 mg/L, leading to severe water pollution events such as fish kills. Key contributing factors include excessive aquatic weeds, encroachment by riverside residents who discharge untreated domestic wastewater directly into the river, and the construction of weirs and cross-river structures that obstruct water flow. The reduced water flow and poor water quality have created a critical situation for the Phetchaburi River. Under the polluter pays principle, riverside residents who discharge wastewater into public water bodies should be held accountable and participate in solving the pollution problem. A community-based approach is considered the most suitable solution for the current situation. However, there is often confusion and overlap in the responsibilities of various agencies involved in addressing midstream and downstream pollution. Furthermore, legal and regulatory frameworks for requiring urban communities to establish collective wastewater treatment systems are lacking. The construction of such systems requires significant investments, detailed design, and environmental impact assessments (EIA), which can significantly delay the resolution of water pollution problems.

2. Objective

To propose an enhanced management strategy for wastewater treatment in the Phetchaburi River, particularly in Khlong Khachen, Rong Chang, and the Old City, empowering local communities to sustain positive behavioral changes.

3. Methodology

Building community resilience in the Khlong Khachen, Rong Chang, and Old City subdistricts, as well as engaging the head of the Yan Yao Sub-district Administrative Organization, to implement the following community empowerment mechanisms

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

1.1 Form a team comprised of members from the Khlong Khachen, Rong Chang, and Old City sub-districts, along with the head of the Yan Yao Sub-district Administrative Organization and relevant government agencies to serve as a core coordination group. This team should share a common goal of raising public awareness about water management, encouraging people to stop dumping waste into the river, and coordinating with government agencies.

1.2 Conduct planning meetings to set policies, objectives, assign responsibilities, and identify/select project areas.

1.3 Conduct a feasibility study to assess community readiness, available resources (including facilities and materials), and the financial feasibility of the project.

1.4 Implement community education and engagement programs, including training on source water pollution control, focusing on the 3Rs: Reduce, Reuse, and Recycle.

1.5 Develop activities, indicators, and regulations. All stakeholders should collaborate in selecting activities and setting indicators, as well as developing regulations to support these activities. Generally, activities can be categorized into three cases: 1) Households or small buildings aiming to reduce wastewater generation, separate wastewater, treat wastewater, and reuse wastewater. 2) Households or small buildings not aiming to reduce wastewater but willing to separate and treat wastewater and reuse it. 3) Households or small buildings not aiming to reduce or separate wastewater but willing to conduct basic wastewater treatment.

1.6 Monitor and evaluate the project after a certain period (e.g., 3 or 6 months) based on the established indicators. If the project does not meet its targets, revisit step 1.5 to refine activities, indicators, and regulations.

4. Results

Khlong Khachen Sub-district of Phetchabun Province has a total population of 9,352, has a total population of 5,729, comprising 2,767 males and 2,962 females. And Mueang Kao Sub-district of Phetchabun Province has a total population of 6,007, with 2,917 males and 3,090

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

females. The combined population of these three sub-districts is 21,088. Through a joint meeting with local administrative organizations, a survey was conducted with the following results

1.1 Survey of households, factories, shops, and other buildings adjacent to the river. Based on the Department of Marine Department's announcement in 2018, a registration of riverside households was conducted. It was found that approximately 200 households were encroaching on the Phetchaburi River in 2018. Currently, there are no new encroachments.

1.2 Survey of wastewater management and treatment systems in households encroaching on the Phetchaburi River: All households located within the river zone have septic tanks or seepage pits, and none have wastewater recycling systems.

1.3 Survey of water obstructions in the Phetchaburi River, Mueang District, Phetchabun Province: The survey revealed that the most common water obstructions in the Phetchaburi River, particularly in Khlong Khachen, Rong Chang, and Mueang Kao subdistricts, are concrete roads with pipes, followed by dirt roads with pipes, and concretepile wooden-floored and roofed bridges.

Table 1: Waterway Obstructions in the Phetchaburi River

No.	Sub-district	Type of Obstruction	Quantity
1	Khlong Khachen	Concrete road with pipes	1
		Dirt road with pipes	3
		Asphalt road with pipes	1
2	Rong Chang	Concrete road with pipes	5
		Concrete-pile wooden-floored and roofed bridge	1
		Asphalt road with pipes	1
		Dirt road with pipes	2
3	Mueang Kao	Concrete road with pipes	4
		Dirt road with pipes	1
		Water gate with 2 non-functional panels	1

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

This table provides a summary of the various obstructions found in the Phetchaburi River, specifically within the Khlong Khachen, Rong Chang, and Mueang Kao sub-districts. The obstructions are primarily man-made structures such as roads, bridges, and water gates.

1 Types of obstructions: The most common obstructions are roads made of concrete, dirt, or asphalt, often with pipes embedded within them. There are also concrete bridges with wooden floors and roofs, as well as water gates.

2 Quantity: The table lists the number of each type of obstruction found in each subdistrict.

3 Sub-districts: The obstructions are categorized based on the three sub-districts where they are located.

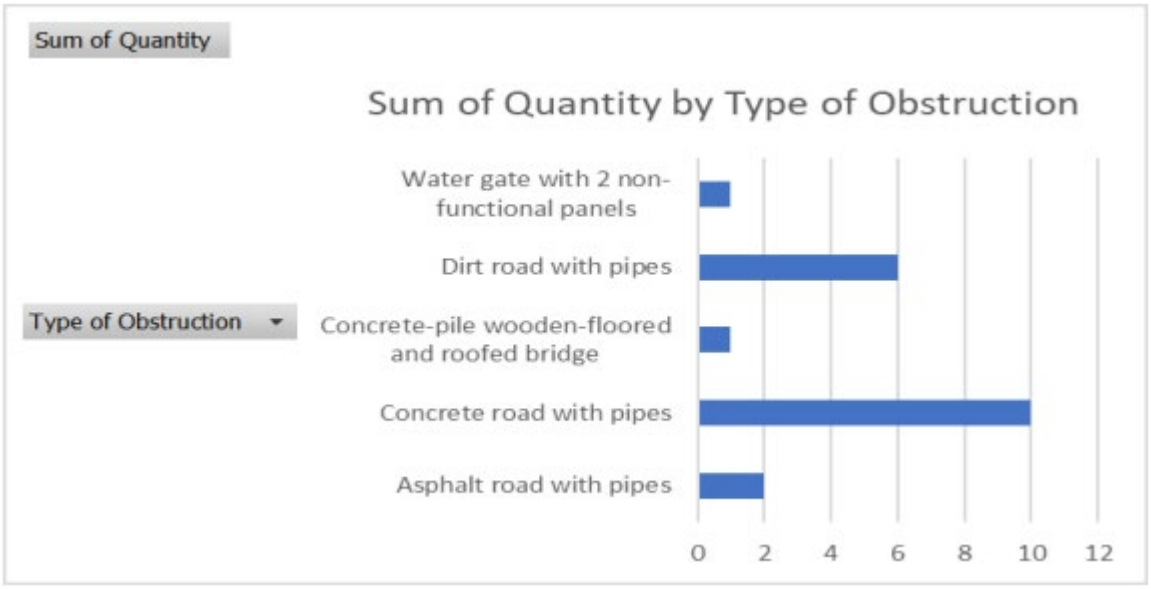

Figure 1. Sum of Quantity by Type of Obstruction

From figure 1. The bar graph visually represents the total number of each type of obstruction found in the Phetchaburi River across the three sub-districts: Khlong Khachen, Rong Chang, and Mueang Kao. The x-axis represents the quantity of obstructions, while the y-axis categorizes the different types of obstructions.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

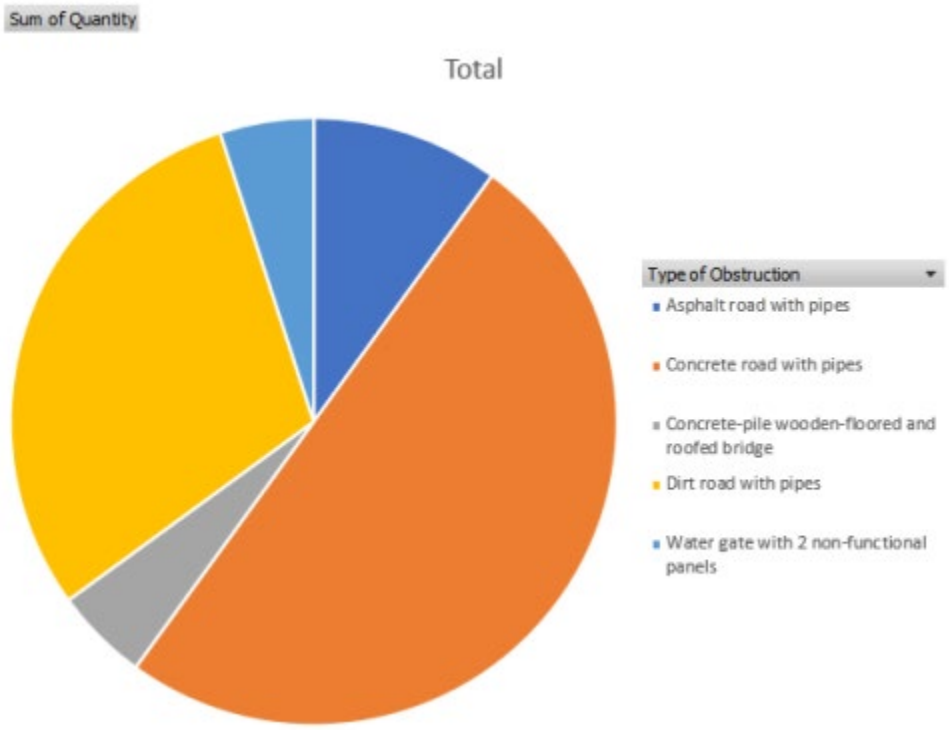

Figure 2. The pie chart clearly demonstrates that the Phetchaburi River.

From figure 2. This pie chart provides a visual representation of the distribution of different types of obstructions found in the Phetchaburi River across the three sub-districts: Khlong Khachen, Rong Chang, and Mueang Kao. Each slice of the pie represents a specific type of obstruction, and the size of the slice corresponds to the proportion of that obstruction relative to the total number of obstructions. Survey results indicate that one of the primary causes of water pollution in the Phetchaburi River is the encroachment of households. These households have constructed toilets and septic tanks directly within the river, discharging wastewater into the river. To address this issue, it has been decided to relocate these toilets as far away from the river as possible. A joint meeting with three local administrative organizations (LAOs) has concluded that toilets and septic tanks will be moved away from the riverbank in Moo 5, Khlong Khachen sub-district, for two households. Funding for this project will be provided by the "Father Puu" River Conservation Group.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 1 ฉบับที่ 3 (กันยายน 2567 - ธันวาคม 2567)
Multidisciplinary Journal of Shinawatra University, Volume 1 Issue 3 (September – December 2024)

5. Conclusion and Recommendation

Survey results revealed that the lower section of the Phetchaburi River, which is a wider area, still contained a small amount of water. This led to a collaborative effort to find ways to replenish the Phetchaburi River to ensure continuous water flow. Villagers with agricultural land adjacent to the river were invited to help open the Dong Sretthi water discharge structure to replenish the Phetchaburi River. This initiated a large-scale restoration process of the Phetchaburi River basin, attracting more agencies to join the restoration efforts. A significant driving force behind the "Father Puu" River Conservation Group's initiative to restore the Phetchaburi River basin was the spark of an idea to revitalize the river. The group worked with local homes, temples, and schools to cultivate environmental awareness among villagers, encouraging them to regularly remove water hyacinth to maintain water quality.

Thanks to the collective efforts of villagers, local and national agencies, the Phetchaburi River has been successfully revitalized. The river now has a better drainage system, reducing flooding and restoring its ecosystem. Villagers have regained their reliance on the river as a source of protein. The success of the Phetchaburi River restoration project is a testament to the strength of community involvement.

Additional Recommendations:

1. Foster community engagement and awareness: Encourage active participation and a sense of shared responsibility among community members.

2. Promote knowledge and facilitate processes for wastewater separation and reuse:

Educate the community about the importance of separating wastewater and explore ways to recycle it.

3. Implement wastewater separation and reuse: Establish systems to separate wastewater and utilize it for beneficial purposes.

4. Install wastewater treatment systems: Construct wastewater treatment facilities for

buildings and communities, located away from the river.

5. Focus on creating participatory activities and fostering a shared sense of responsibility: Organize activities that promote community involvement and environmental consciousness.

6. Establish an environmental conservation fund: Create a fund to finance the construction of wastewater treatment systems.

7. Form a provincial task force for wastewater management: Establish a dedicated team to oversee wastewater management at the provincial level.

8. Develop a sustainable river development plan: Create a comprehensive plan for the longterm conservation and management of the river.

9. Relocate buildings and houses encroaching on the riverbank: Move structures that have illegally expanded into the river area.

10. Strictly enforce existing laws: Ensure that current regulations related to environmental protection are effectively implemented.

11. Promote new legislation for the management and control of the Phetchaburi River:

Advocate for the development of specific laws to protect and regulate the river.

6. References

Pisanu Charoennetrakul, 2010. *A Framework for Community Wastewater Management in Khao Rup Chang Subdistrict, Mueang District, Songkhla Province*. Independent Master's Thesis, Master of Public Administration Program, Local Government College, Khon Kaen University.

Kamolnan Pinngam, 2020. *Wastewater Management in Phimmarat Municipality, Bang Bua ThongDistrict, Nonthaburi Province.* Independent Research Report, Master of Public Administration Program, Public Administration and Public Affairs, Thammasat University.

Maine, M.A., Sune, N., Hadad, H. (2006). *Nutrient and metal removal in a constructed wetland for wastewater treatment from a metallurgic industry*

Naz, Muhsin. Uyanik, Sinan. Yesilnacar, M.Irfan. and Sahinkaya, E. (2009).*Side-by side comparison of horizontal subsurface flow and free water surface flow constructed wetlands and artificial*

neural network (ANN) *modelling Ecological Engineering. 35*. 1255-1263.

Poggi-Varaldo, H.M., Gutiérez-Saravia, A., Fernández-Villagómez, G., Martinez-Pereda, P.,Rinderkncht-Sei as, N. (2002). *A full-scale system with wetlands for slaughterhose waste*

water treatment. In: Nehring, K.W., Brauning, S.E. (Eds.), *Wetlands and Remediation II. Battelle Press.* Columbus. 213-223.

Sakadevan, K., Bavor, H.J. (1998). Phosphate adsorption characteristics of soils, slags and zeolite to be used as substrates in constructed wetland systems. *Water Research. 32*. 393-399.

Summerfelt, .T., Adler, P.R., Glenn, D.M. and Kretschmann R.N. (1999). Aquaculture Sludge removal and stabilization within created wetlands. *Aquaculture Engineering. 19*. 81-92.

Van de Moortel, Annelies.M.K., Rousseau, Diederik.P.L., Tack, Filip M.G. (2009). A comparative study of surface and subsurface flow constructed wetlands for treatment of combined sewer overflow: A greenhouse experiment. *Ecological Engineering. 35*. pp.175-183.