

Enhancing the sustainability of water supply and drainage systems through low impact development—a pilot study in Yangon

Background:

The rise of the economy, the rapid urbanization, and the improvement of the living standard of Yangon have led to an urgent demand for enhancing the capacity and sustainability of the existing water supply and stormwater drainage systems. At the same time, Yangon, as a city in a developing country, is facing challenges caused by the currently uneven and inadequate coverage of the infrastructure networks and limited resources for development. Thus, it is critical to devise a sustainable socially-just approach to manage urban water and to upgrade the infrastructures.

Low impact development (LID) practices are semi-natural stormwater management infrastructures that aim to mimic the natural drainage process. They are receiving increasing attention in urban water management worldwide. Typical LID practices include bioretention cells, porous pavements, and rainfall barrels (as shown in Figure 1). LID practices are considered to be more environmentally friendly when compared to the conventional drainage infrastructures because they are effective in improving runoff water quality and provide a venue for recycling stormwater. For example, the stormwater collected by rain barrels (Figure 1c) can be used for irrigation or toilet flushing. The rainfalls in Yangon are abundant (around 2,400 mm per year) and thus can be considered as valuable water resources. Students are expected to conduct pilot studies of adopting LID practices in Yangon.

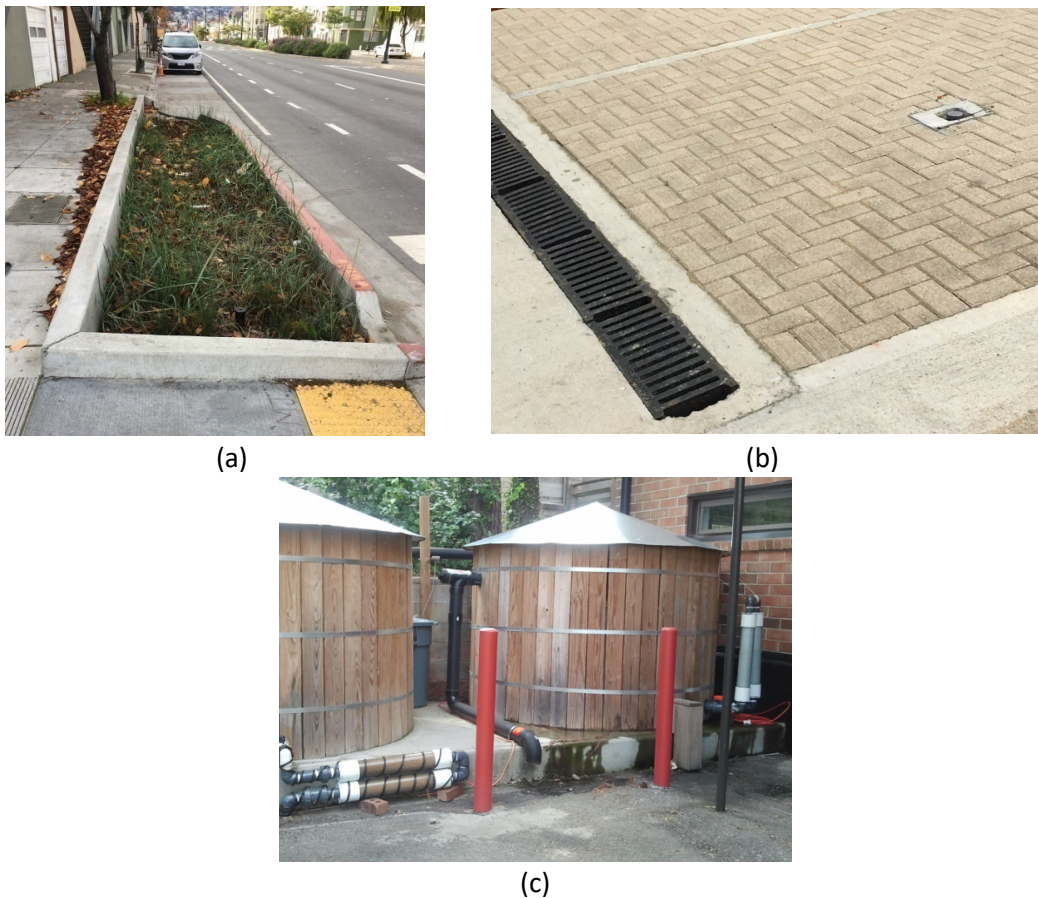


Figure 1 (a) A bioretention cell for collecting surface runoff from highways, (b) a vehicular porous pavement panel, and (c) rain barrels for collecting runoff from the roofs.

Objectives:

This interdisciplinary project aims to engage students from HKU and Dagon University to identify sustainable and socially-just measures for upgrading the water supply and drainage systems in Yangon. Through this project, the students are expected to,

1. Develop and exercise practical skills in solving engineering and social development problems;
2. Improve communication, organization, and coordination skills by working in a multidisciplinary team and interacting with stakeholders from different segments of society;
3. Foster an international perspective and an awareness of the civic responsibility, which will encourage them to serve the sustainable development of the society;
4. Contribute to the improvement of the living environment of local communities and the accumulation of knowledge regarding the strategic planning of sustainable infrastructures in Yangon.

Activities and timeline:

This project is expected to be carried out in two phases (plus a pre-trip workshop):

Phase I: December 28, 2019 to January 17, 2020.

The project may be conducted following the suggested timeline below:

1. Compiling background information and determining an investigation direction

Students are encouraged to collect and analyze relevant information before the start of the project in Yangon and upon arriving in Yangon. During the first few days, the students and relevant staff from HKU and Dagon University, as well as the local experts who are familiar with water-related issues are expected to have a plenary meeting to discuss the current status of the water supply and drainage systems and the possibilities to implement LID practices in Yangon. Such a meeting may be held after a field trip, if possible. By the end of the meeting, students should reach an agreement among themselves, with the guidance of experts, the general direction of the project. The possible topics can be, but certainly not restricted to the following: (1) comparing the effectiveness of different types of LID practices in the context of Yangon, (2) evaluating the feasibilities to implement rain barrels and other types of LID practices in local communities, and (3) exploring the possible solutions to integrate LID practices in the current short-term or long-term urban infrastructure development plans.

2. Forming sub-working groups

The students from HKU and Dagon University are expected to form multiple sub-working groups that each focuses on investigating the (1) technical, (2) economical, (3) social, or (4) political aspect of adopting LID in Yangon. Each group should include students from both HKU and Dagon University. Due to the multidisciplinary nature of this project, the working groups are required to work closely and exchange information interactively throughout the entire project. Each group shall have a student team leader, who should be responsible for deciding the form and schedule of communication within and between the working groups. The group-forming meeting may be held on the first or the second day with the support of professoriate staff from both universities.

3. Multi-dimensional assessment of adopting LID in Yangon

Each working group is expected to investigate a specific aspect of adopting LID in Yangon. The first stage of the investigation may last for about one week, and then a plenary meeting may be held for discussing the initial findings and planning further investigations. Each group is required to propose its investigation plan and may use the following suggested activities as a reference.

Technical group

- Prepare a data collection campaign and decide on the proposed engineering project, e.g., its type, location, scale.
- Collect data of the proposed study site, covering the meteorological condition, land use, layout and design of current stormwater drainage system and water supply networks, etc. Identify relevant guidelines, regulations, and tools that facilitate the design and assessment of LID practices.
- Propose LID design(s) that is(are) tailored to the conditions of Yangon, specifying the layout, detailed design, construction plan, and technical considerations, etc. Estimate the effectiveness of the candidate design(s) in terms of rainwater harvesting and natural drainage regime restoration.

Economical group

- Collect data regarding the costs of infrastructure projects in Yangon, e.g., prices of construction material, consultant fees, labor costs. Gather information regarding the monetary value of the direct and intangible benefits, e.g., savings in upgrading water supply network, the price people willing to pay for cleaner water in the rivers.
- Perform cost-benefit analysis of the specific LID projects proposed by the technical group, which may be helpful for shaping the candidate designs. Establish the financing plan of the LID projects, in collaboration with the political group.
- Perform demand analysis, project risk and uncertainty analysis to identify the least-cost solution that meets construction/development plan suggested by the technical group and the social group.

Social group

- Collect information regarding the different sources of the risks and challenges of the stormwater drainage and water supply system in Yangon, e.g., insufficient capacities due to rapid urbanization and population growth, imbalanced infrastructure development among different regions of the city, increased public awareness that calls for more sustainable ways of managing urban water, changes in the perception towards urban flooding due to the improvement in living standard.
- Interview stakeholders from different segments of society and identify the group of people or regions that are most vulnerable to certain risks that are presented in the current urban water systems. Conduct a survey to understand the interests and willingness-to-pay of the stakeholders for different services provided by the LID practices. For instance, residents in regions with limited access to potable water may prefer LID options that can reuse stormwater.
- Propose socially-just short-term and (or) long-term LID adoption plans, which can be useful for the technical group to identify the type of LID practices and the political group to draft policy recommendations.

Political group

- Review the current short-term and long-term plans for upgrading the current urban water systems proposed by the Yangon government and different researchers. Study the LID adoption plans and policies that are proposed by other cities in the world, e.g., Hong Kong, New York City, Melbourne. Perform a SWOT analysis on the current upgrade plans with references to and in contrast with the policies of other cities.
- Bring forward various queries, related but not limited to the effectiveness, costs and social impacts, regarding the potential adoption of LID practices and direct the investigations of other working group to answer these queries.
- Make specific policy recommendations. Discuss the research findings of the whole project with relevant authorities in Yangon.

Phase II: March 9 to 13, 2020

4. Further investigations and summary of the findings

The working groups should conduct further investigations after the plenary meeting concerning the initial findings (as stated in step 3) for a period of a few days to one week. In the final few days, the working groups may work together to draft an investigation report that summarizes the findings, the proposed LID adoption plans, and recommendations for future studies and projects. A final meeting can be held to conclude this project. Representatives from each group will give oral presentations to the involved staff and experts, the partners Universities, and any other interested parties in Yangon.

Expected output:

The output of this project shall be summarised in a report, which should also be presented orally to relevant parties. The report is expected to include the following results.

1. The engineering design of a LID project that is tailored to the conditions in Yangon.
2. An assessment of the cost and benefits of adopting LID practices in Yangon.
3. Socially-just approaches for adopting LID practices in Yangon.
4. Policy recommendations to the LID adoptions in Yangon.
5. A road map for future projects and studies in Myanmar, with a possible long-term goal of supporting the local communities to adopt LID practices.

Recommended references and resources:

1. United States Environmental Protection Agency, 2019. Stormwater Management and Green Infrastructure Research. <https://www.epa.gov/water-research/stormwater-management-and-green-infrastructure-research>
2. The Asian Development Bank (ADB), 2017. Guidelines for the Economic Analysis of Projects.
3. Jayasooriya, V. M., Ng, A.W.M., 2014. Tools for modeling of stormwater management and economics of green infrastructure practices: A review. *Water, Air, & Soil Pollution* 225.8: 2055.
4. The Water Research Foundation, 2009. BMP and LID Whole Life Cost Models: Version 2.0. <https://www.waterrf.org/research/projects/bmp-and-lid-whole-life-cost-models-version-20>
5. Vojinovic, Z., Abbott, M. B., 2012. Flood risk and social justice. IWA Publishing.
6. CIRIA, 2019. B£ST (Benefits Estimation Tool). <https://www.susdrain.org/resources/best.html>
7. New York City Department of Environmental Protection, 2019. Green Infrastructure Grant Program. <https://www1.nyc.gov/site/dep/water/green-infrastructure-grant-program.page>
8. Scottish Natural Heritage, 2019. Green Infrastructure Fund Projects. <https://www.greeninfrastructurescotland.scot/our-projects-0>

Subsidies:

Participants will each receive a subsidy of HK\$5,000.

Application: Online form

(https://docs.google.com/forms/d/e/1FAIpQLSeFGzzjhHphM7hJs5-Im_19tJ3BgLyC1MvBO1n7v8kzTrfiuA/viewform)

Application deadline:

November 15, 2019 (6 pm)

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