Valuing the benefits of Nature-based Solutions for Integrated Urban Flood Management in the Greater Mekong Region

# TAM PHU PARK, THU DUC CITY – A MULTI-FUNCTIONAL URBAN WETLAND AND ECO-SOCIAL HOUSING SCHEME

## CASE STUDY REPORT

***February 2022***

Prepared for: **AWP, DFAT, World Bank**

Prepared by: **CRCWSC and ICEM**

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# Executive summary

*The vision of this case is the transformation of Tam Phu Park in Ho Chi Minh City's Thu Duc City innovation hub into the first Internet of Things enabled multifunctional urban wetland park in Vietnam.*

Ho Chi Minh City (HCMC) authorities have high ambitions for Tam Phu Park. Under the current area masterplan, the site will be transformed into the 'green lung' of the new Thu Duc City innovation hub – a landscaped area with recreational and leisure facilities, tree cover, food and beverage services and some flood protection infrastructure from constructing stormwater drainage pipes. This is the baseline scenario for this case study.

The proposed hybrid strategy builds upon this plan, proposing a multifunctional urban wetland park, consistent with the long term vision of the innovation district that combines nature-based solutions, leading technology and private sector collaboration. The strategy will reduce costs and increase benefits via a wetland forest and riparian area with terraced design and species that can withstand inundation during high water levels while providing dynamic recreational space and rich ecological habitat for visitors. Water quality will be improved through constructed wetland recirculation and a decentralized wastewater treatment plan, and stormwater harvesting will provide the required water to irrigate the park. An Internet of Things enabled smart water platform will optimize water infrastructure operation and allow for pre-emptive action to protect against extreme events.

Results of this initial strategic assessment over a 40-year period show a very strong overall benefit–cost ratio (BCR) of 36, with a BCR of 22 attributable to the project organization (government implementing agency). Two significant benefits stand out, accounting for the majority of the total additional benefits provided by the hybrid solution. These are reduced capital costs and maintenance costs from reformulating the space for maximal multifunctionality and more natural design, and reduced flood risk inside the park area and for downstream communities.

The hybrid strategy also includes the potential for a portion of land within the park for residential development under an innovative 'eco-social' housing scheme, covering both low- and mid-income housing for resettled local residents. The proposal also includes some high-end luxury developments that will benefit from the high land value after the landscaping works and showcase sustainable building techniques. While the net benefits of the hybrid approach are still significantly positive without this innovation, this part of the development would provide a strong draw for talent to the area in line with Thu Duc City's innovation hub aspirations. It will also reduce disruption and cost of relocating existing park residents. The exact modality of private engagement should be informed by an assessment of risk, risk allocation, governance arrangements as well as current and future regulatory requirements.

This case study demonstrates hybrid solutions can not only bring significant community benefits, but can also reduce upfront and ongoing costs to government. Innovative measures like smart systems and ecological design under fit-for-purpose public–private arrangements can ease the burden on public agencies and support delivery at scale. Piloting and demonstration is necessary to provide proof-of-concept and Tam Phu Park is an opportune site to do so.

Finally, the case study adds to a growing list of practical applications of a 5-step Integrated Urban Flood Management (IUFM) framework in the Greater Mekong region. For information on the IUFM methodology see the IUFM Manual.

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# Abbreviations

| | |
|---|---|
| ADB | Asian Development Bank |
| ARI | average recurrence interval |
| AWP | Australian Water Partnership |
| BCA | benefit–cost analysis |
| BCR | benefit–cost ratio |
| CRCWSC | Cooperative Research Centre for Water Sensitive Cities |
| DFAT | Australian Government Department of Foreign Affairs and Trade |
| DOC | Department of Construction |
| GEDSI | gender equality disability and social inclusion |
| GHG | greenhouse gas |
| GIS | Geographic Information System |
| HCMC | Ho Chi Minh City |
| ICEM | International Centre for Environmental Management |
| IFC | International Finance Corporation |
| INFFEWS | Investment Framework for Economics of Water Sensitive cities |
| IOT | Internet of Things |
| IUFM | Integrated Urban Flood Management |
| LEED | Leadership in Energy and Environmental Design |
| MBR | membrane bioreactor |
| NbS | nature-based solutions |
| NGOs | non-governmental organizations |
| NPV | net present value |
| OECD | Organisation for Economic Cooperation and Development |
| PPP | public–private partnership |

# Project background

Now and in the future, cities need integrated solutions to complex challenges. Floods are the most frequent natural disaster globally, and cause more damage than any other weather or non-weather-related event. And flood-related damages are expected to grow, driven by urbanization, land use changes and climate uncertainty. Compared with conventional 'gray' infrastructure by itself, nature-based solutions (NbS) such as wetland parks, raingardens, bioswales, green roofs and walls, can involve less upfront investment, can be more scalable and flexible and generate a range of environmental, economic and social co-benefits beyond flood management.

A range of innovative hybrid approaches to integrated urban water management are already operational across the Asia–Pacific region. The increasing recognition of hybrid approaches that integrate NbS reflects the changing nature of societies across Asia and the increasing aspirations for improved environmental quality, community health and economic prosperity. However, sometimes it can be difficult for decision makers to justify using NbS, or hybrid solutions compared with conventional measures.

Responding to this challenge, the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) and the International Centre for Environmental Management (ICEM) have been working closely with national government agencies in Thailand and Vietnam to identify and evaluate the full range of market and non-market benefits of NbS, as well as considering appropriate financing and investment models.

The CRCWSC has developed and trialled the innovative Investment Framework For Economics of Water Sensitive cities (INFFEWS) which comprises a Benefit–Cost Analysis (BCA) Tool and a Value Tool that adjusts existing non-market values for application in new contexts. These tools have been trialled extensively in Australia as well as in several cities in China. The current project now applies them to the Mekong region, focusing on Thailand and Vietnam. Four detailed case studies across Thailand and Vietnam demonstrate the Integrated Urban Flood Management process and the assessment including quantifying market and non-market benefits of NbS in monetary terms.

## Case study methodology

Each case study follows the 5-step IUFM process for identifying, valuing and choosing an appropriate mix of flood management interventions for a particular context.[1]

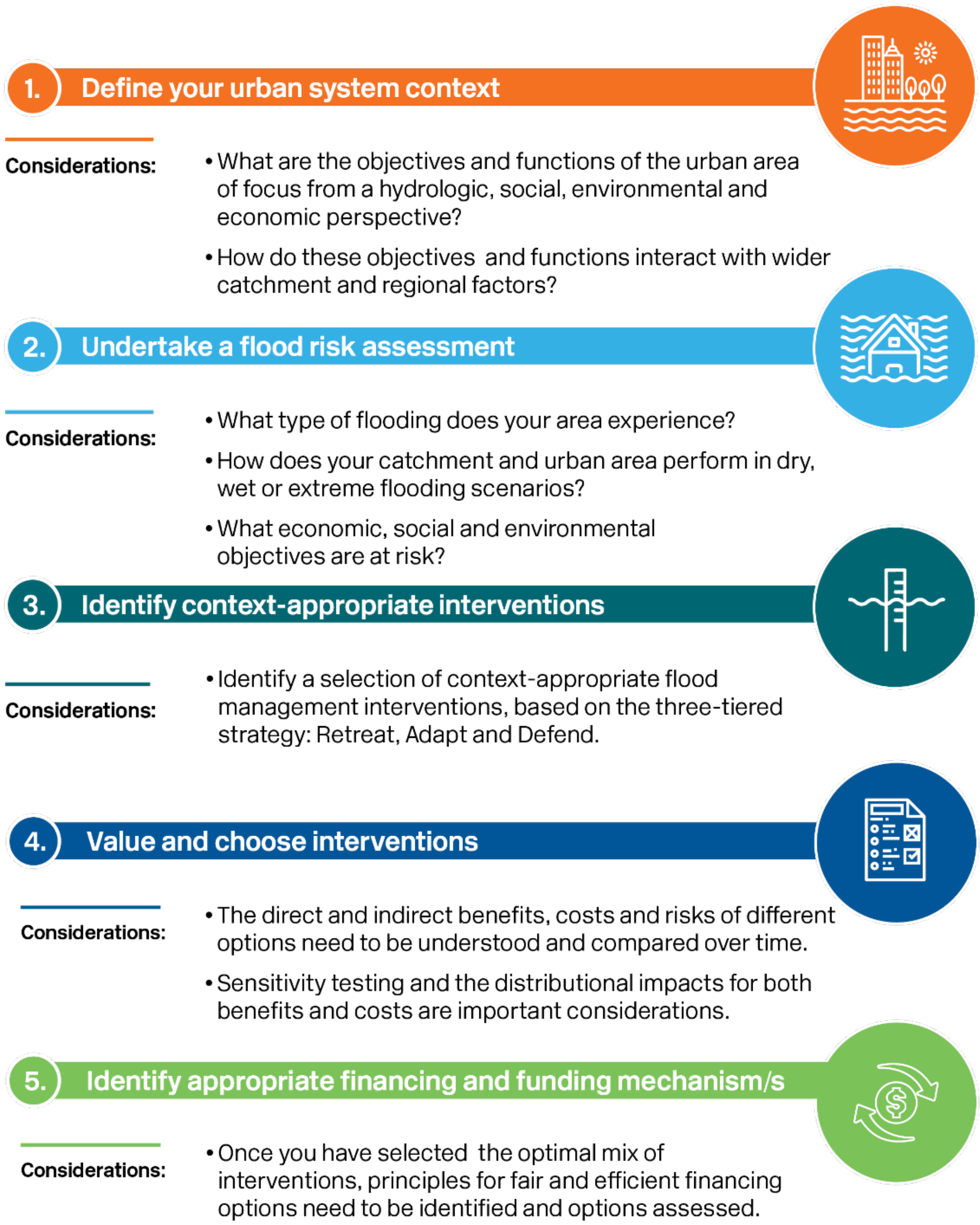


***Figure 1: IUFM process.***
*Source: Project team.*

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[1] Wishart, M., Wong, T., Furmage, B., Liao, X., Pannell, D. and Wang, J. (2021). *The Gray, Green, Blue Continuum: Valuing the benefits of nature-based solutions*. Washington DC: World Bank.

Benefit–cost analysis (BCA) was adopted because it is a rigorous and accepted methodology for comparing the value to the community of different options. BCA can be used for a range of purposes including initial scoping of strategic concepts, detailed comparison of options, and review of whether a project, program or regulation has delivered the promised benefits. This analysis assesses the proposed strategic concepts.

The case study began with an initial site visit and consultations with government agencies. The flood risk assessment stage by was informed by previous ICEM climate change modelling and analysis[2] and a more recent significant study from McKinsey (2020).[3] Context-appropriate interventions were developed based on national and international best practice and the expertise of the project team. To refine the interventions and gather necessary data to value interventions, further detailed onsite investigation and consultations took place in April 2021 which included informal interviews with local residents.

This case study takes the existing masterplan as its base case and compares the additional benefits and costs associated with the hybrid solutions. As a result, the next stage was compiling cost and benefit estimates for the masterplan and hybrid solutions. Costs for the base case solution were taken directly from the Tam Phu Masterplan which includes detailed breakdown of costs per ha according to usage. Costs for the hybrid solution were based on national data and cost norms, supplemented by data from other countries in Asia where there were gaps.[4] Next, the benefits were estimated. In this case study, the most significant hybrid solution benefits were a reduction in capital expenditure and operating expenditure costs relative to the masterplan. Other benefits were estimated via a mix of calculations (e.g. from visitors to similar parks in Vietnam, and costs of water to estimate stormwater savings), supplemented by the INFFEWS Value Tool for benefits such as improved biodiversity which allows practitioners to adjust and transfer value from similar studies into the modelling tool. The cost and benefit assumptions can be found in the Annexes.

Another important consideration in the methodology is how benefits and cost change over time. Some benefits may be one-off, such as increases in property values. Other benefits will build over time, such as avoided flood damage. It is also important to build local technical and financial capacity to maintain assets so they continue to deliver value, as well as defining who will be responsible for maintenance. Additionally, the model recognizes benefits are more valuable now than in say 5, 20 or 40 years' time. The time value of money – or the 'discount rate' is usually set according to national standards, and commonly ranges from 2–6%. In this case, we assumed a discount rate of 4%, but the range adopted for sensitivity testing includes the current government bond yield of 2.4%.

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[2] ADB (2010). *Ho Chi Minh City adaptation to climate change*. Retrieved from https://icem.com.au/portfolio-items/ho-chi-minh-city-adaptation-to-climate-change-study/

[3] Woetzel, J., Pinner, D., Samandari, H., Engel, H., Krishnan, M., Boland, B. and Cooper, P. (2020). *Can coastal cities turn the tide on rising flood risk*, Case study, McKinsey Global Institute.

[4] A previous study conducted by the CRCWSC with support from the World Bank was a key resource. Wishart, M., Wong, T., Furmage, B., Liao, X., Pannell, D. and Wang, J. (2021). *The Gray, Green, Blue Continuum: Valuing the benefits of nature-based solutions*. Washington DC: World Bank.

After the cost and benefit information was added to the model, an important final stage was sensitivity testing. This stage asks how strong the conclusions are when significant changes are made to the assumptions. In cases such as these where the BCA is strategic, without precise costs and benefits, undertaking this step is important for establishing the validity of findings. In this case study, sensitivity testing involved increasing and decreasing costs and benefits by 30%, running the model 1,000 times and building a distribution of probabilities. Similar sensitivity analysis was done for different discount rates and key assumptions such as the take up rate of small scale NbS by private parties and the period of analysis. Results of the sensitivity testing are presented in Chapter 4.

Financing and funding recommendations were formulated based on international and national good practice and innovation. In particular, this study considered how examples from Australia could be applied to Tam Phu Park.

## Stakeholder engagement

Strong stakeholder engagement and co-creation of solutions was critical to the case study approach. As well as promoting IUFM approaches, the project's parallel goal was to build capacity and create a community of practice of national champions who have the necessary tools and knowledge to identify, evaluate and quantify NbS within a robust economic framework.

At the beginning of the process, the case study methodology included initial stakeholder mapping and engagement, which helped to narrow the selection of potential case study sites in line with government priorities. Figure 2 shows the agencies that were involved in the case study at national, provincial and ward level.

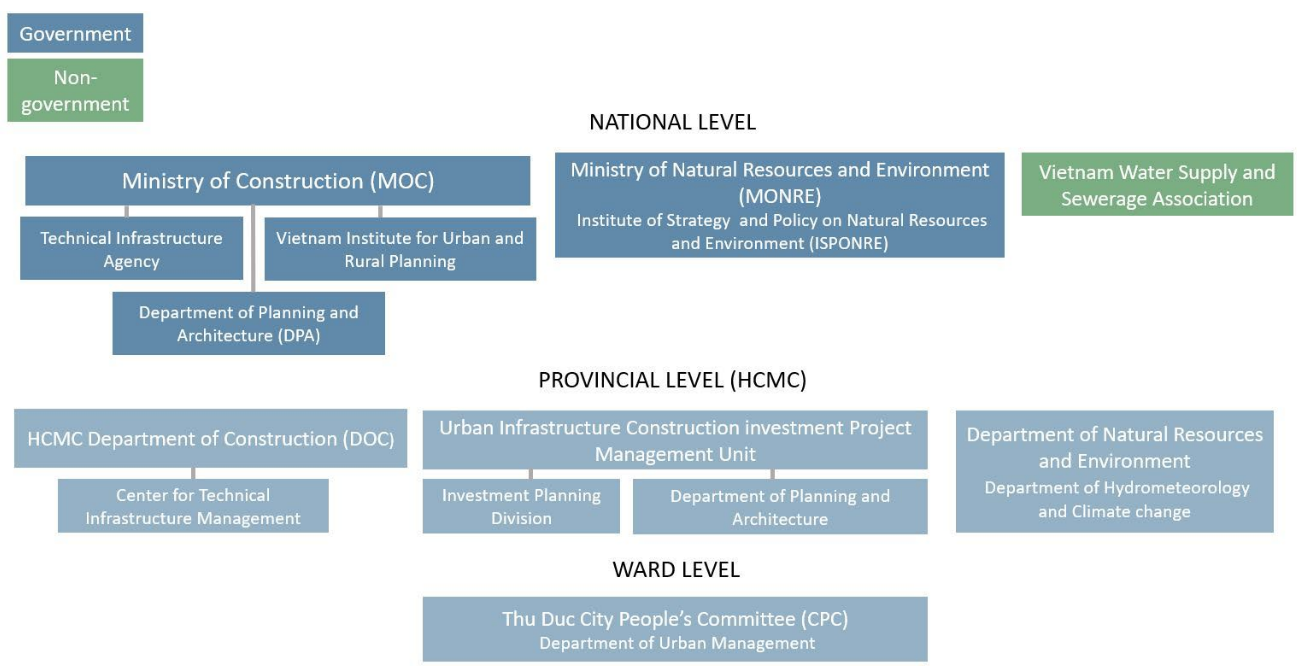


*Figure 2: Agencies involved in the case study at national, provincial and ward level.*
*Source: Project team.*

Aligning with the steps in the IUFM process, a series of capacity building and consultation workshops were organized that brought together key stakeholders and experts to provide feedback and discuss broader implications including opportunities and challenges for scaling up. Following each workshop, the case studies were adjusted to respond to stakeholder input.

Three workshops were held:

- **1. Foundational training for national stakeholders (21–22 January 2021):** This 2-day event provided a high-level overview and introduction of the topics, including examples of NbS as multifunctional water infrastructure in Australia, China and Vietnam. The session also introduced the case studies, covering Steps 1 and 2 of the IUFM process and seeking feedback on whether the project team had adequately understood the local context and issues faced.

- **2. Identifying Integrated IUFM and NbS Interventions (30–31 March 2021):** The second session focused on the Step 3 of the IUFM process, presenting the hybrid solutions and the anticipated benefits for the two Vietnamese case studies (one in Phu Quoc and the other in Ho Chi Minh City). Key questions put to stakeholders focused on local feasibility, whether the solutions adequately responded to the issues identified in the previous phase, and whether the benefits were accurately described.

- **Valuing and comparing IUFM solutions (18 June, 26 November 2021):** A final session was held separately for each case study. Each session focused on Steps 4 and 5 of the IUFM process, presenting the results of the BCA analysis, and outlining potential modalities for funding and financing. A key goal is to test the assumptions in the model with participants to ensure their appropriateness.

To ensure continuity of learning outcomes and to support the development of a community of practice, the same participants were invited to each event. However, as the case study progressed, the project team's understanding of the institutional landscape and key stakeholders was finessed. This led to the important addition of the Thu Duc City People's Committee, who were not included in the initial engagement. Stakeholder participation from the national level was critical in ensuring the case study considered both local perspectives and high-level policy concerns.

# 1. Define your urban system context

## 1.1. Thu Duc City – HCMC's new innovation hub

Tam Phu Park is situated in Thu Duc City – a new area that was formed by merging District 2, District 9 and the former Thu Duc district in the east of Ho Chi Minh City (HCMC) to become Vietnam's largest innovation hub. When completed it will encompass 211 $km^2$ and contain a population of 1 million people. The initiative has attracted strong investment interest from Vietnam and abroad. The new city aims to foster proximity between innovative industries including tech companies in District 9, ecologically designed residential spaces and financial services in District 2 and universities in Thu Duc District, creating a new engine of growth. The long term urban planning goal is to build climate resilience and increase liveability via a healthier and culturally rich environment.

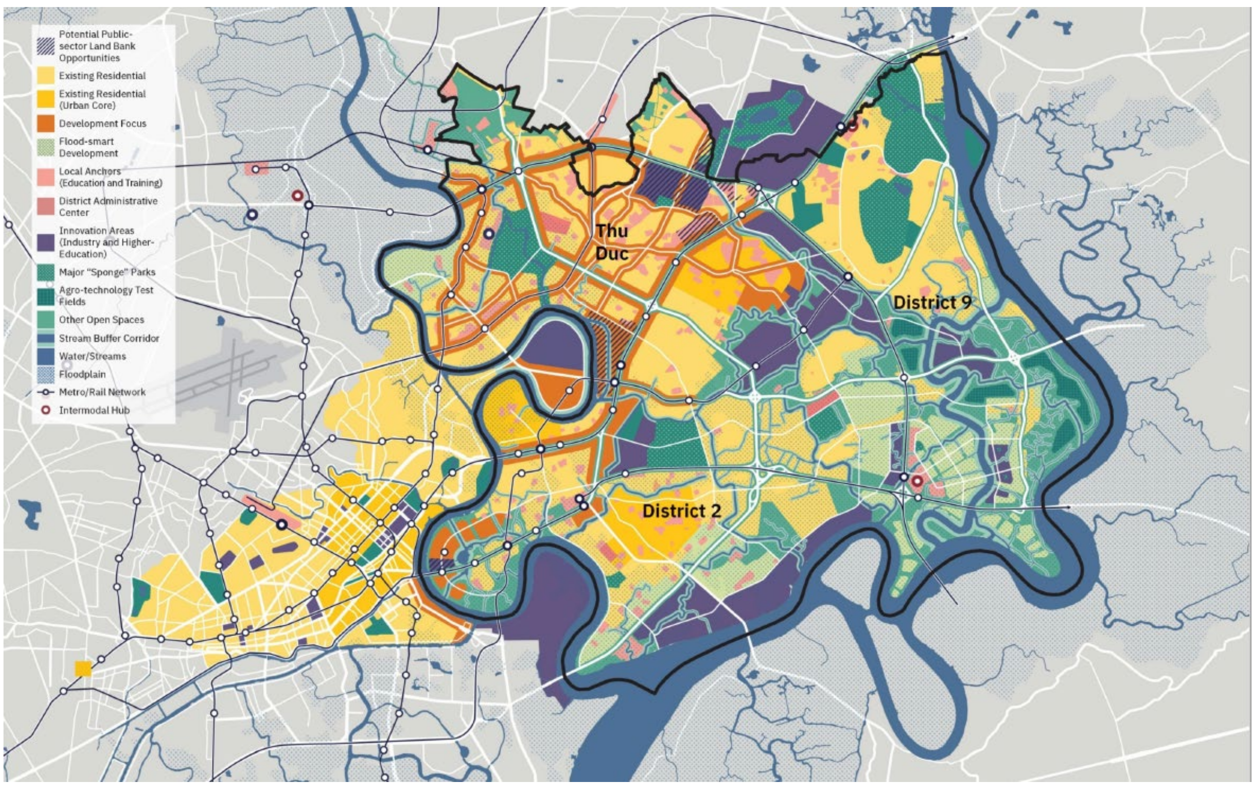


***Figure 3: Districts which will be merged to form Thu Duc City.***
*Sources: Sasaki and Encity.*

The planned Tam Phu Park is envisaged to be the largest park and 'green lung' of Thu Duc City. The site is located in Tam Phu ward, and includes land within the administrative boundaries of four wards – Tam Phu, Tam Binh, Hiep Binh Chanh and Linh Trung. About 1,200 households with around 5,800 residents currently reside within the site. Of these, an estimated 30% are local people while 70% have migrated from elsewhere, mostly in search of work opportunities. Only 3% of the 5,800 residents have a certificate of residential land use right; the rest either have a certificate of agriculture land use right or have settled on the land informally. Although it is considered an urban area, average household income is still low, with many households categorized into poor or near-poor groups (although because residents are informal, official income brackets are unknown).

The Tam Phu Park site is directly affected by the irregular semidiurnal tidal regime of the Sai Gon River through the Go Dua River. A network of rivers and creeks runs through the site, the largest being Go Dua River. Go Dua River's surface water area within the site is 16.8 ha, accounting for 13.7% of the total site area. The water level in the river fluctuates by up to 5 m, and at its lowest the river can be crossed on foot at some locations. The Go Dua catchment also receives stormwater outflow from neighboring Binh Duong Province. The groundwater table in this area is high, only 0.5 m from the surface. The topography is flat and low lying, with an elevation of 0.0–0.8 m. The majority of the site is fallow agricultural land, used for annual and perennial tree plantation. Some small scale food and beverage shops, leisure fishing ponds and manufacturing and production facilities such as sand mining also operate.

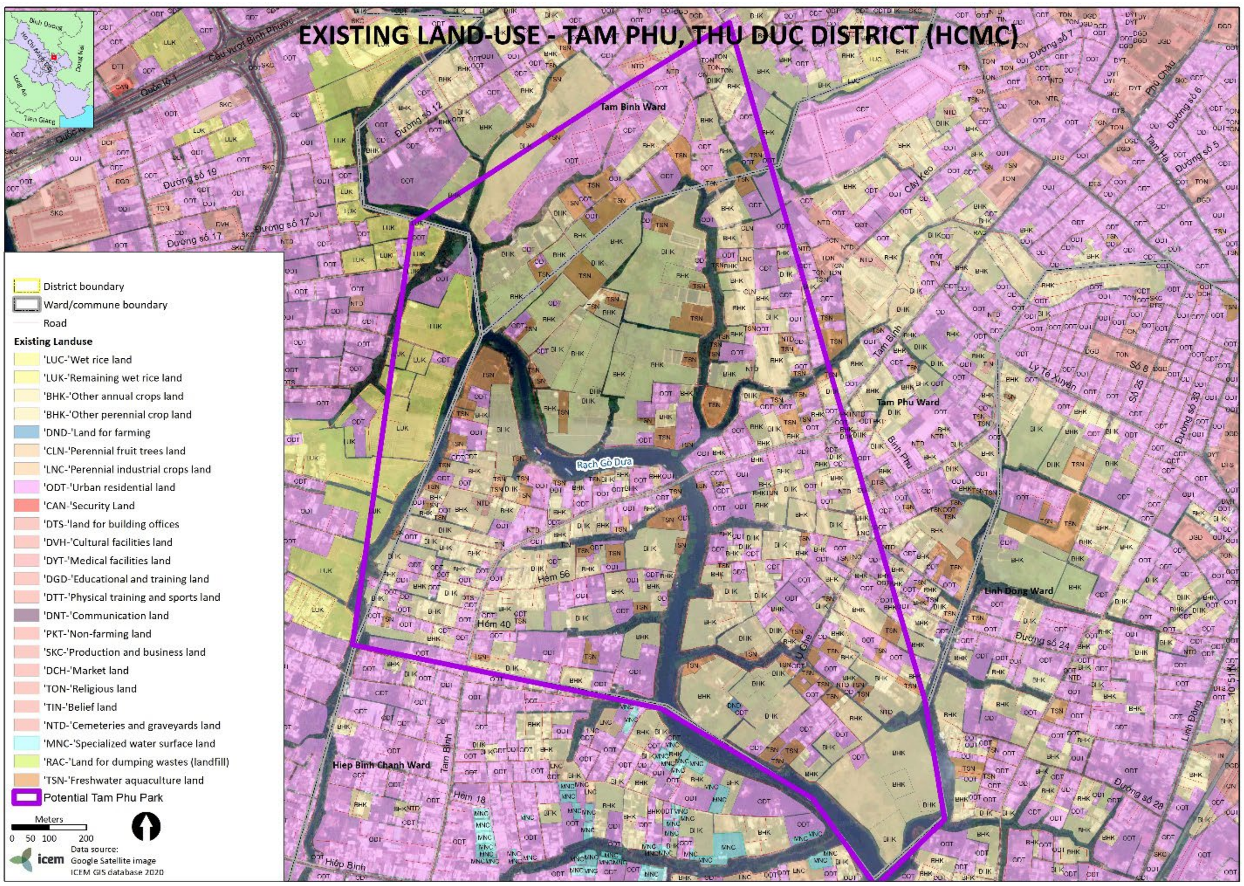


***Figure 4: Existing land use in the planned Tam Phu Park site.***
*Source: Project team.*

***Figure 5: Temporary storage site of building sand and informal fishing (top left), residential hosues (top right, bottom left, bottom right).***
*Source: Project team, site visit in April 2021.*

## 1.2 Water supply, drainage and sewerage infrastructure in Tam Phu

Residents in former Thu Duc district, including within the planned Tam Phu Park, have access to centralized water supply service with reasonable quality and reliability provided by Thu Duc Water Treatment Plant (WTP), and pay tiered water tariffs according to level of consumption and income. Operating since 1966, Thu Duc WTP is still the largest water plant in HCMC. The WTP is located in Linh Trung ward, Thu Duc City and sources its raw water from Dong Nai River via Hoa An pumping station and a 10.8 km transmission network. From the initial capacity of 450,000 $m^3$/day, the WTP has increased its capacity several times and is currently capable of supplying 850,000 $m^3$ of clean water per day to HCMC.

By 2012, 5,740 decentralized wells in the area of former Thu Duc district withdrew groundwater for domestic uses at the rate of 40,000 $m^3$/day. Additionally, 21 centralized rural water supply schemes extracted groundwater at a rate of 5,000 $m^3$/day. As the Thu Duc WTP network expanded, groundwater extraction was gradually phased out, and groundwater is no longer used as a water source in the planned Tam Phu Park area.

Currently, the combined drainage system in the former Thu Duc district collects both stormwater and wastewater. Drainage structures include a pipe sewer, box culverts, drains with slab covers, open drains and natural creeks and canals. In 2007, a pilot underground tank was constructed in Vo Van Ngan Road, with capacity of more than 100 $m^3$. The outdated drainage system was built a long time ago and few upgrades have been carried out, while the structures are all small scale and cannot drain large amounts of water when it rains heavily. At the same time, the mouth of the sewer across Pham Van Dong Street near To Ngoc Van Street has been encroached by locals, which narrows the flow of drainage.

In addition, 5 tidal gates in the former Thu Duc district protect against tidal flooding for an area of 2,100 ha: Go Dua, Thu Duc, Ong Dau, Rach Da and Cau Duc Nho. The gates are equipped with electric or oil pumping systems that pump water to Sai Gon River during times of high tide (when the water level of Sai Gon River is above 1.3 m) in combination with heavy rainfall events. However, the capacity of these systems is so small that efficiency is low (Table 1).

| No. | Name | Location | Dimension (m) | | No. of pumps | Pump capacity ($m^3$/s) | Type of pump |
|---|---|---|---|---|---|---|---|
| | | | B | Z | | | |
| **1** | Go Dua | Hiep Binh Chanh ward | 35.0 | –4.00 | 6 | 0.25÷0.27 | Oil |
| **2** | Thu Duc | Linh Dong ward | 30.0 | –3.50 | 3 | 0.25÷0.27 | Electric |
| **3** | Ong Dau | Hiep Binh Phuoc ward | 25.0 | –3.00 | 4 | 0.25÷0.27 | Oil |
| **4** | Rach Da | Hiep Binh Phuoc ward | 10.0 | –3.00 | 2 | 0.25÷0.27 | Oil |
| **5** | Cau Duc Nho | Hiep Binh Phuoc ward | 3.0 | –3.00 | | | |

***Table 1: Tidal gates in former Thu Duc district.***

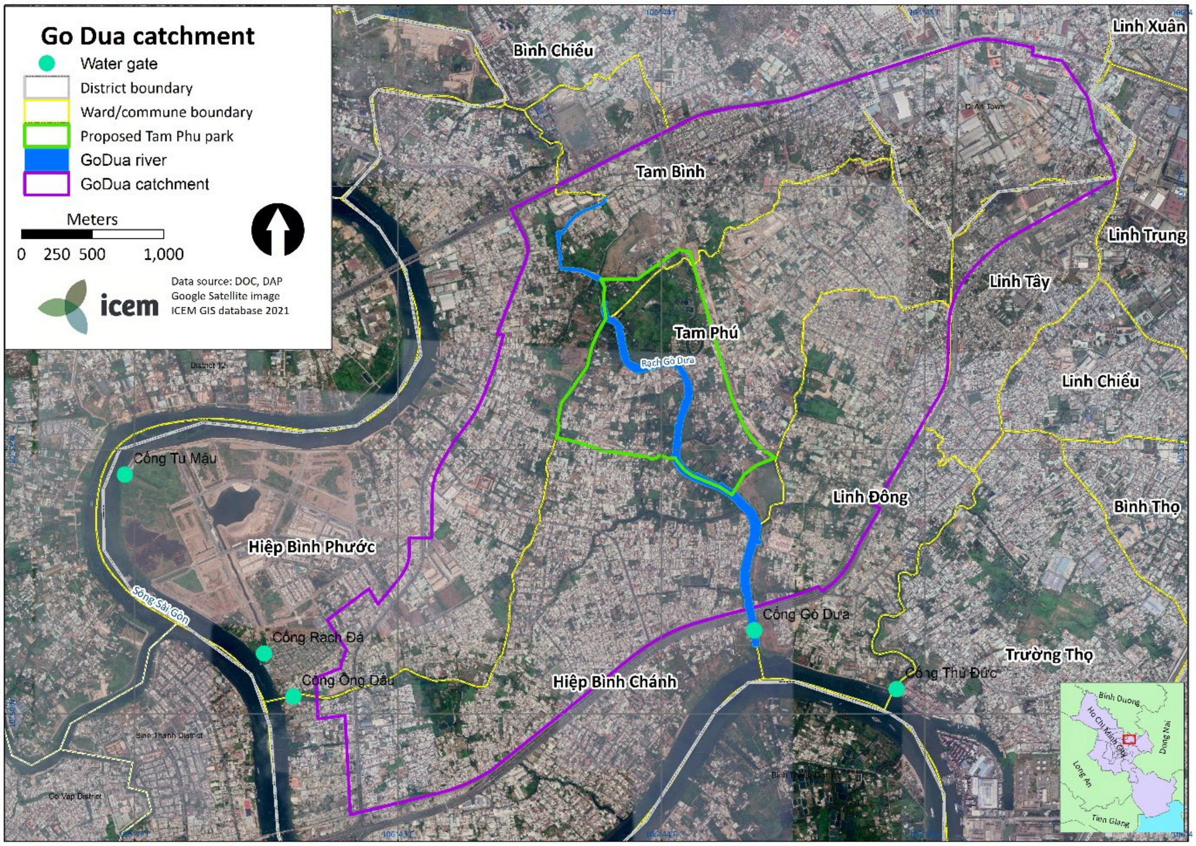


***Figure 6: Go Dua catchment with locations of 5 tidal gates in area of former Thu Duc district***

*Source: HCMC UICI, Project proposal for flooding and tidal prevention in Go Dua catchment, Thu Duc City, April 2021.*

Currently, the former Thu Duc district does not have a centralized wastewater treatment system. Industrial wastewater treatment facilities are located in the Linh Trung I processing zone (Q=5,000 $m^3$/day), Linh Trung II (Q=3,000 $m^3$/day) and the Binh Chieu industrial area (Q=3,600 $m^3$/day). Domestic wastewater is mostly preliminarily treated by septic tanks, before being discharged to the combined sewer system or to open water bodies. Most households have installed their own septic tanks (exact ratio is unknown), while some households located along the streams and canals discharge directly to these natural drainage channels. Regulations require septic tanks to be constructed in compliance with national technical standard *TCVN 10334:2014 on Precast thin wall reinforced concrete septic tanks apply to the toilet*. However, since septic tanks are constructed by households themselves and there is limited supervision from responsible authorities, no information on the quality and operational status of septic tanks in the area is available.

# 2. Undertake a flood risk assessment

## 2.1 Flooding challenges in Ho Chi Minh City

HCMC lies in the sub-equatorial monsoon tropical climate zone, with 2 distinct seasons: the wet and the dry. The wet season lasts from May to November, with heavy but short-lived downpours almost daily. Annual average precipitation is about 2,000 mm, with rainfall between June and October accounting for around 90% of total annual rainfall. Low lying land of no more than 1 m in almost half of city, reduced permeable surfaces and overloaded drainage systems from rapid urbanization means pluvial flooding occurs frequently, disrupting daily life, threatening health and safety, and damaging property and infrastructure. Situated in the delta, tidal flooding and storm surge is also common, and can combine with pluvial floods to be particularly damaging. Poor communities including the city's approximately 2 million informal migrant laborers tend to reside in unregulated and more flood-prone areas, meaning they suffer disproportionality from flood impacts and recover more slowly from flood events.

In the future, climate change projections show rising sea levels and more intense storms which will increase flood risk as well as exacerbate land subsidence. A recent McKinsey study predicted HCMC's flood risk could increase by 5–10 times by 2050. In an extreme scenario of a 180 cm sea level rise, without significant climate mitigation actions, a 1-in-100-year flood event flood event could inundate 66% of the city and cause economic damage between USD 3.8–7.3 billion.[5] Other notable challenges currently facing HCMC are damage from saline floodwater and infrastructure gaps, particularly the current combined sewerage system which is a priority for Thu Duc City for upgrade. Although land subsidence is not currently a problem in the case study area, this may be because the land is underdeveloped. As construction is rolled out for Thu Duc City, the situation is likely to worsen.

## 2.2 Water management challenges in Tam Phu Park

The Tam Phu Park site is prone to fluvial, pluvial and tidal flooding. The site, as well as the broader former Thu Duc district, is more vulnerable to pluvial flooding due to a limited drainage system that cannot cope with heavy rain. As noted above, the existing drainage system is small scale, was built a long time ago and now needs upgrading. Since construction, the catchment includes more buildings and impermeable surfaces, further reducing drainage capacity.

During the wet season, persistent flooding occurs in many streets in the district, notably the roads of Kha Van Can, Go Dua, Duong Van Cam, Dang Thi Ranh, Ho Van Tu, Le Van Tach, Vo Van Ngan, Linh Dong, Provincial Highway 43 and To Ngoc Van. Because of the semidiurnal tidal regime (the alternating 6-hour high tide and 6-hour low tide), the flood waters can drain with the falling tide and flooding usually lasts no more than 2–3 hours. Within the park site boundaries, flood depth is only 10–20 cm; but in the main streets the flood depth can reach up to 50 cm due to decreased permeability.

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[5] Woetzel, J., Pinner, D., Samandari, H., Engel, H., Krishnan, M., Boland, B. and Cooper, P. (2020). *Can coastal cities turn the tide on rising flood risk*. Case study, McKinsey Global Institute.

Flooding impacts the daily lives of local communities in many different ways. Traffic is heavily disrupted, and public safety is threatened; it is common to see motorcyclists fall off bikes. Polluted floodwaters flow into houses along both sides of the streets causing damage and the closure of shops. When the floodwaters recede, polluted residue remains.

**FLOODED ROADS IN THU DUC (Ho Chi Minh City)**

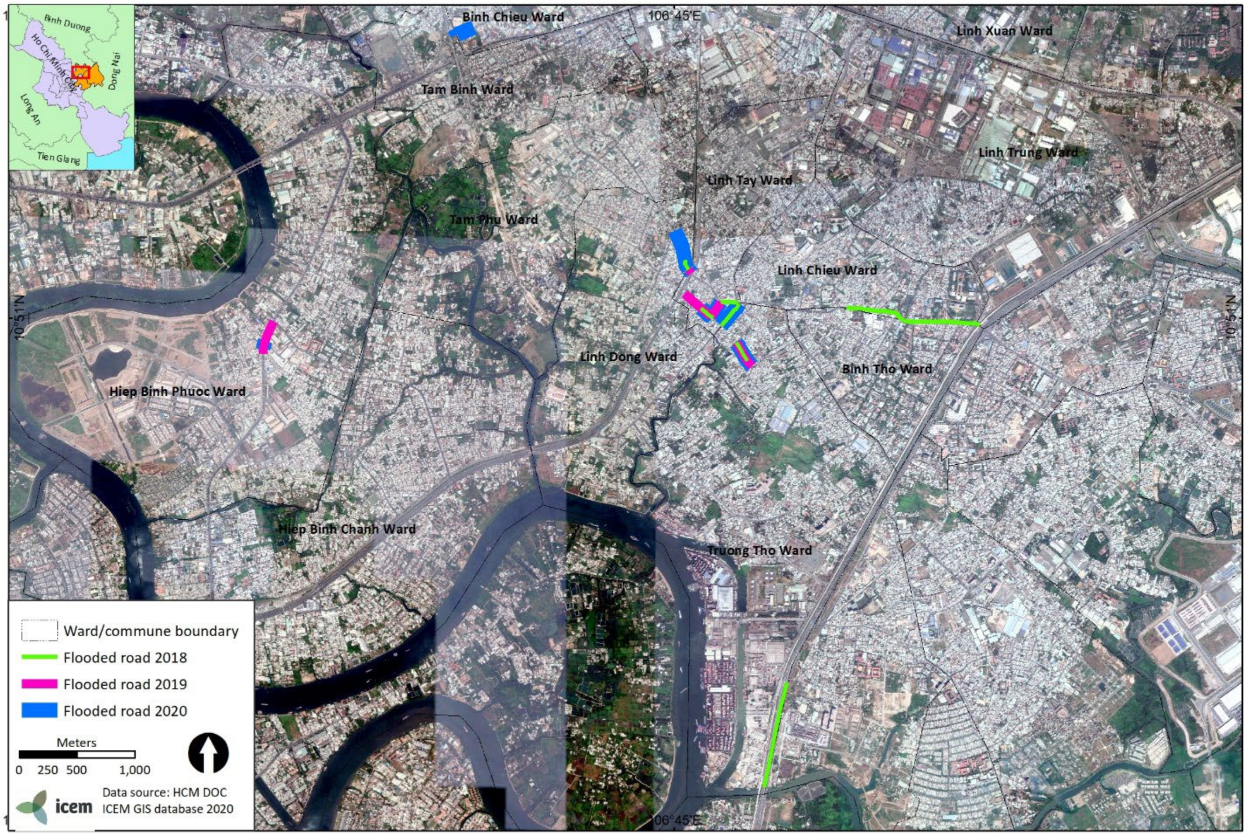



*Figure 7: Flooded main roads in former Thu Duc district in 2018–2020.*
*Sources: Project team, HCMC DOC.*

Existing flood management measures in the area include the grade IV river dikes along the banks of the Go Dua River, reinforced by uPVC plastic pile, gabion and coconut pile. The dike system was designed to protect against a 50-year average recurrence interval (ARI) flood event and has helped to mitigate fluvial flooding risk in the area. The Go Dua tidal gate provides additional protection against tidal flooding and saline intrusion. With the threats of fluvial and tidal flooding prevented for all but extreme (greater than 1:50 year) events from the existing measures, pluvial flooding remains the most significant threat for not only the area within the park site but also the area outside.

*Figure 8: Go Dua tidal gate.*
*Source: Project team, from site visit in April 2021.*

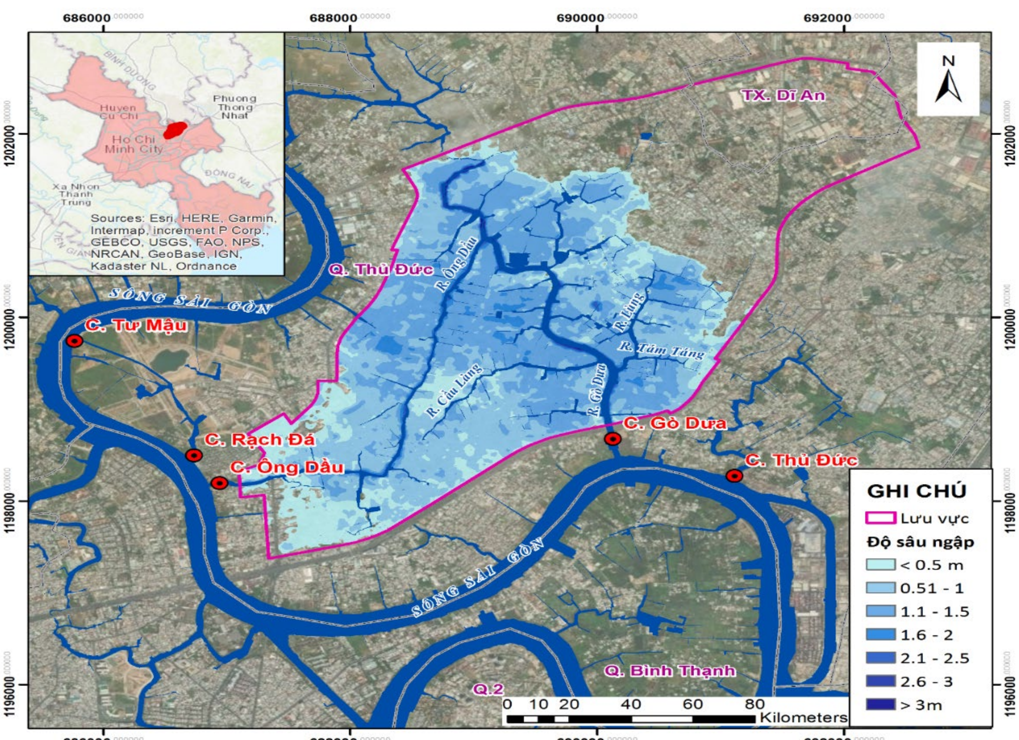



*Figure 9: Flood extent of Go Dua catchment under existing topography and water level of +1.4 m.*
*Source: HCMC UICI, Project proposal for flooding and tidal prevention in Go Dua catchment, Thu Duc City, April 2021.*

Regular flooding and flooding from extreme events are expected to increase significantly in the future, in terms of extent, depth and duration. As modelled in the ADB project *The Ho Chi Minh City Adaptation to Climate Change Study,*[6] total area affected by regular floods in former Thu Duc district was projected to increase by 20%, or over 300 ha, by 2050 under a high emission scenario. In Tam Phu ward specifically, the area prone to regular flooding would increase from 140 ha to 216 ha by 2050, or by over 54%. The study also predicted significant increases in depth and duration for regular and extreme flood conditions by 2050:

- a 21% increase in average maximum flood depth during regular flooding (0.15 m)
- a 17% increase in average maximum flood duration during regular flooding (24 days)
- a 49% increase in average maximum flood depth during extreme events (0.63 m)
- a 41% increase in average maximum flood duration during extreme events (8 days).

As well as flooding, the planned park site also experiences concerning levels of water pollution. Annual water quality sampling at Binh Phu Bridge on the Go Dua River showed the levels of ammonium ($N\text{-}NH_4^+$) were 4 times higher and of coliform were 5 times higher than national permissible standards for surface water quality. Currently, there is no proper sewerage system in and around the site. Wastewater, mostly from domestic sources is discharged into open/closed drains and creeks that flow into the Go Dua River. Contaminated water not only degrades the living environment of the local residents but also poses a significant threat to public health, for instance through water-borne diseases.

***Figure 10: Water pollution and household discharge in creeks flowing into Go Dua River.***
*Source: Project team, site visit April 2021.*

[6] ADB (2010). *Ho Chi Minh City adaptation to climate change*. Retrieved from https://icem.com.au/portfolio-items/ho-chi-minh-city-adaptation-to-climate-change-study/

# 3. Identify context-appropriate solutions

## 3.1 The conventional solution

The ‘baseline’ scenario in this case study is the planned Tam Phu Park with a total area of approximately 126 ha. The construction Tam Phu Park Masterplan was approved in Decision No. 1622 by the Thu Duc District People’s Committee in 2008. The park is intended to become an area for sports and leisure, including green space (defined as manicured lawn, trees and shrubbery), water space (lake areas), an area for sport, an amusement area, a kids area, space for small scale enterprise including food and beverage vendors, a traditional craft village and a small scale boat club with rowing boats. 34.1 ha is allocated for green space, while 25.5 ha is allocated for water bodies (11.1 ha for open lakes, plus surface water area of Go Dua River). Electric buggies are proposed for transportation within the park, connecting with external transportation links. Landscaping will include diverse habitats for birds and aquatic species, flower gardens and multiple trees to improve urban temperatures.

This baseline or conventional approach contributes to Decision 529/QĐ-UBND (14 February 2020) targets relating to developing a green, environmentally friendly city:

- increasing HCMC’s green area by 5 ha/year on average
- constructing 150 ha of parklands (including public parks and parks in residential areas)
- meeting an urban greening ratio of 0.65 $m^2$/person.

| No. | Components of the park by functional area | Area (ha) |
|---|---|---|
| 1 | Kids area | 6.4 |
| 2 | Sports area | 7.1 |
| 3 | Exhibition area | 4.5 |
| 4 | Amusement area | 16.5 |
| 5 | Service area | 2.5 |
| 6 | Squares | 3.9 |
| 7 | Traditional craft village area | 6.2 |
| 8 | Statue garden | 5.0 |
| 9 | Flower square | 6.5 |
| 10 | Green space | 34.1 |
| 11 | Water space | 25.5 |
| 12 | External transportation area | 7.8 |
| | Total | 126 |

***Table 2: Components of Tam Phu Park by functional area.***

*Source: 2008 Masterplan, HCMC DOC.*

The current park masterplan estimates non-potable water demand will be 854 $m^3$/day, which includes park irrigation, road cleaning and firefighting. Domestic water demand for staff and tourists was estimated at 37 $m^3$/day according to Table 1 of the masterplan. When it was prepared, the masterplan proposed using groundwater for the park’s water supply, including for domestic and public uses, before switching to the main city water supply network. Since the area is now already connected to the city water supply network, it is assumed groundwater pumping will not be needed when the park is developed.

The masterplan also proposed a separate sewer system for the park. Stormwater drainage pipes would be designed with a return period of 2–3 years, and a localized wastewater treatment plant with a capacity of 3,000$m^3$ per day would be installed. This case study assumed that while included in the masterplan, this system may take a number of years to be constructed because is not a short-term priority. Therefore, interim measures are required.

Although the Tam Phu Park was not designed to mitigate floods, the availability of water spaces and stormwater drainage system should add additional flood protection benefits to the site and the broader catchment. Key benefits of the planned Tam Phu Park compared with the 'do nothing' scenario are:

1. improved aesthetic value
2. improved wastewater management
3. avoided flooding damage for events with return period of 2–3 years
4. increased recreational opportunities
5. improved air quality
6. reduced urban heat related impacts.

## 3.2 The hybrid approach

The alternative approach preserves all of the masterplan elements, but reconfigures them to be multifunctional and to support the long term vision of Thu Duc City. The main components are:

1. a wetland forest and riparian zone to serve as a flood retarding basin
2. water quality management through constructed wetland
3. stormwater harvesting
4. separation of sewage and drainage by including a decentralized wastewater treatment plant as an interim measure until connection to the centralized system
5. piloting of a smart water management system as a key demonstration site of the innovative aspirations of Thu Duc City
6. sale or lease of land for residential development under a public–private partnership to develop a flagship 'eco-social' housing scheme for high-end luxury development and resettlement in-situ for existing dwellers.

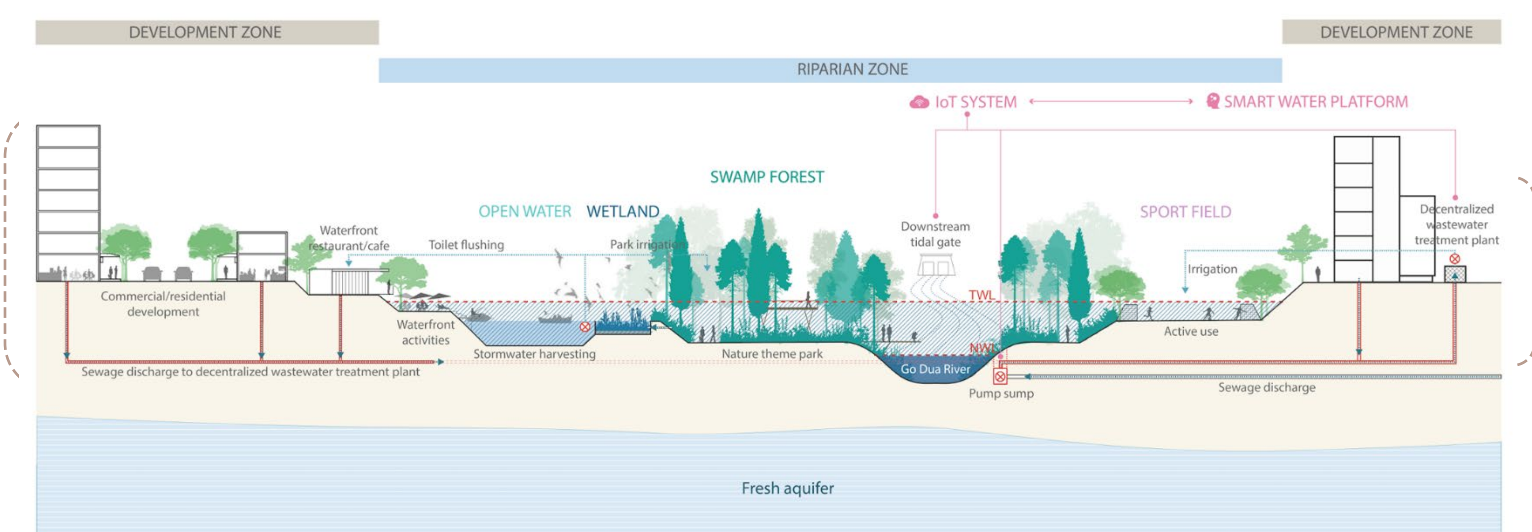


*Figure 11: Transect overview of the components of the hybrid approach.*
*Source: Project team.*

Key additional benefits of the hybrid approach compared with the masterplan (conventional solution) are:

1. increased flood protection for events greater than a 2–3 year return period
2. improved water quality
3. additional water supply (reduced recurring cost of irrigation as part of park maintenance)
4. improved urban ecology
5. enhanced and optimized recreational spaces
6. increased efficiency and reduced construction cost of water management infrastructure
7. cost recovery through residential zoning and development
8. improved social equity through an in-situ resettlement scheme.

The reconfigured functional areas of the Tam Phu Park are outlined below, with changes highlighted. The reconfiguration reduces the area for the sports field and amusement area, yet the remaining size is still significant and the original function would still be possible in the reduced space. Green space (manicured lawn, trees and shrubbery) has been reduced slightly but has also been diversified to reintroduce more natural and multifunctional features, including a riparian zone for greater flood attenuation and improved urban ecology. Total water space remains and 1 ha is added for a constructed wetland. The most significant change is zoning 12 ha for residential purposes.

| No. | Components of the wetland park by functional area | Area (ha) – hybrid | Area (ha) – conventional |
|---|---|---|---|
| **1** | Kids area | 6.4 | 6.4 |
| **2** | Sports area | 3 | 7.1 |
| **3** | Exhibition area | 4.5 | 4.5 |
| **4** | Amusement area | 12 | 16.5 |
| **5** | Service area | 2.5 | 2.5 |
| **6** | Squares | 3.9 | 3.9 |
| **7** | Traditional craft village area | 6.2 | 6.2 |
| **8** | Statue garden | 5.0 | 5.0 |
| **9** | Flower square | 6.5 | 6.5 |
| **10.1** | Green space | 18.7 | 34.1 |
| **10.2** | Green space – riparian zone | 11 | 0 |
| **11** | Water space | 25.5 | 25.5 |
| **12** | External transportation area | 7.8 | 7.8 |
| **13** | Constructed wetland | 1 | 0 |
| **14** | Land for resettlement (affordable apartments) | 8 | 0 |
| **15** | Land for high-end apartments and commercial development | 4 | 0 |
| | Total | 126 | 126 |

*Table 3: Reconfigured functional areas under the hybrid approach.*
*Source: Project team.*

The following section describes components 1–5 of the hybrid approach in detail. Component 6 which focuses on cost recovery is included in Chapter 6.

### 3.2.1 Wetland forest and riparian zone

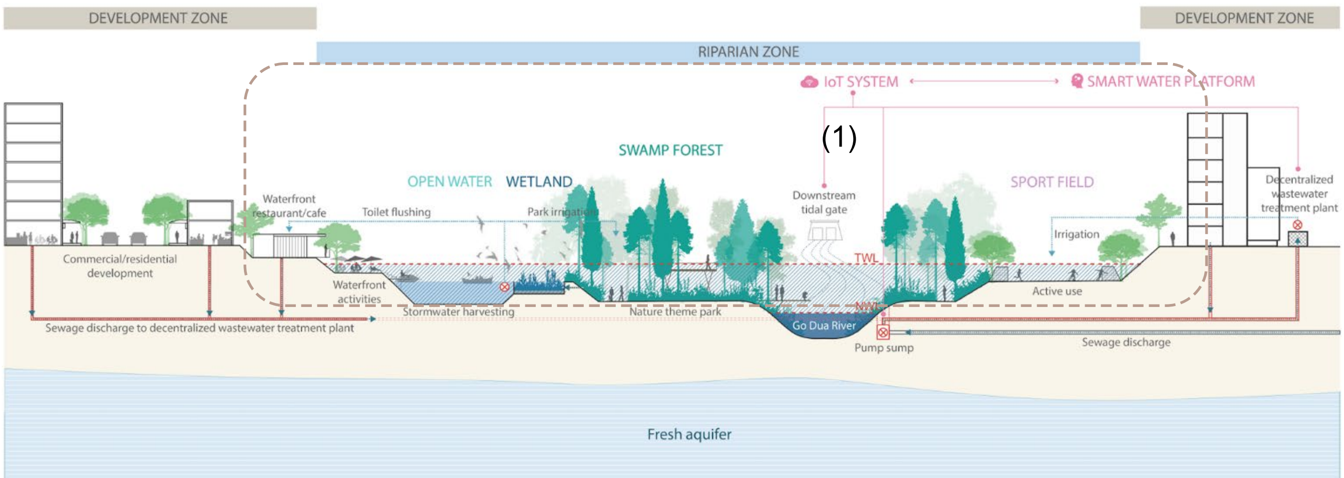



***Figure 12: Cross-section of the hybrid strategy showing component 1 – wetland forest and riparian zone.***

*Source: Project team.*

The riparian zone of the Go Dua River will be developed in a terraced design. Several plant species could be used, including native wetland species such as *Melaleuca* and *Nypa fruticans* (which already grow freely in the fallow site), *Sonneratia caseolaris*, *Ficus microcarpa* and *Ficus benjamina*, along with landscaping grasses such as *Zoysia tenuifolia* and *Zoysia japonica* and park trees. This flexible design means the riparian zone can be maximally used for both recreation and flood attenuation as water levels rise and precipitation falls. This design improves the park's drainage capacity and flood storage under regular and extreme flooding scenarios and provides additional flood protection benefit for the Go Dua catchment as well as downstream communities compared with the conventional design. This landscaping will also provide dynamic recreational spaces and experiences along the waterfront with a diversity of terrestrial and aquatic plants more naturally mimicking those found in nature, and improved urban ecology as a result of the wetland forest.

The riparian zone is proposed to extend 50 m from either side of the bank of Go Dua River, covering a total area of 11 ha. A good early warning system would be required to allow visitors to evacuate during an extreme event. This terraced design is already employed effectively in other cities including in Singapore and Japan.


***Figure 13: Bishan Park in Singapore showing normal water level (top) and inundation to top water level (bottom) in an extreme rain event, with the main park infrastructure (pathway, bridge and non-wetland vegetation) outside of the inundation zone.***
*Sources: CRCWSC and Herbert Dreiseitl.*

### 3.2.2 Constructed wetland

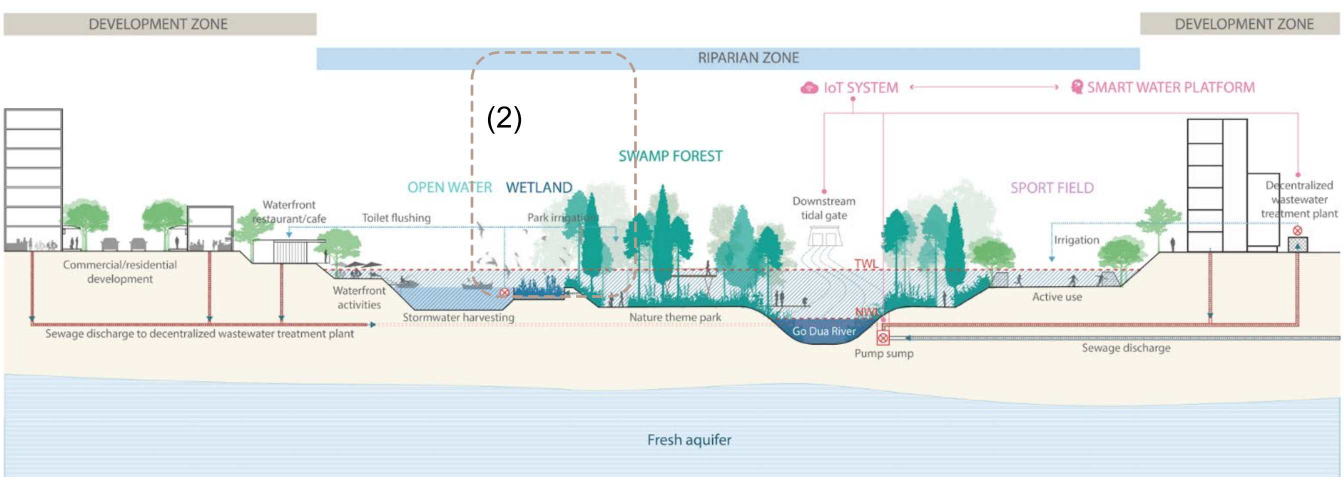



***Figure 14: Cross-section of the hybrid strategy showing component 2 – constructed wetland.***
*Source: Project team.*

A key part of the design includes separating the open water (lakes) from the Go Dua River to protect the lakes in the park from external pollution for maximum amenity value. However, when the riparian zone is inundated during flood events and when floodwater level exceeds a certain threshold, water should be allowed to enter the lake in the park via the constructed wetland where it would be filtered. The constructed wetland also collects and treats surface runoff before it enters the lake. Water is treated via microorganisms in reedbeds and other aquatic plants, whose root systems break down the contaminated effluent. In Vietnam, local species that have been successfully used to treat water as part of constructed wetland systems include *Phragmites australis* and *Typha angustifolia.*[7] When water levels are normal, water would also be recirculated through the wetland to ensure water quality in the lakes can support water-based activities.

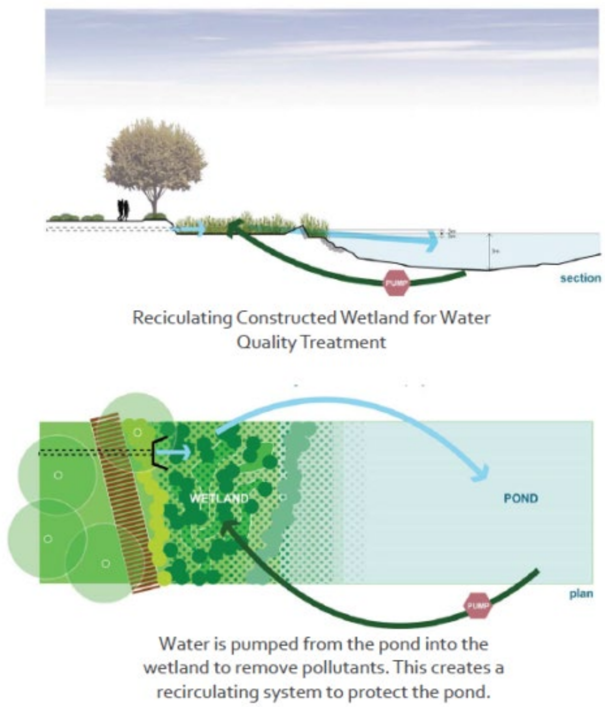
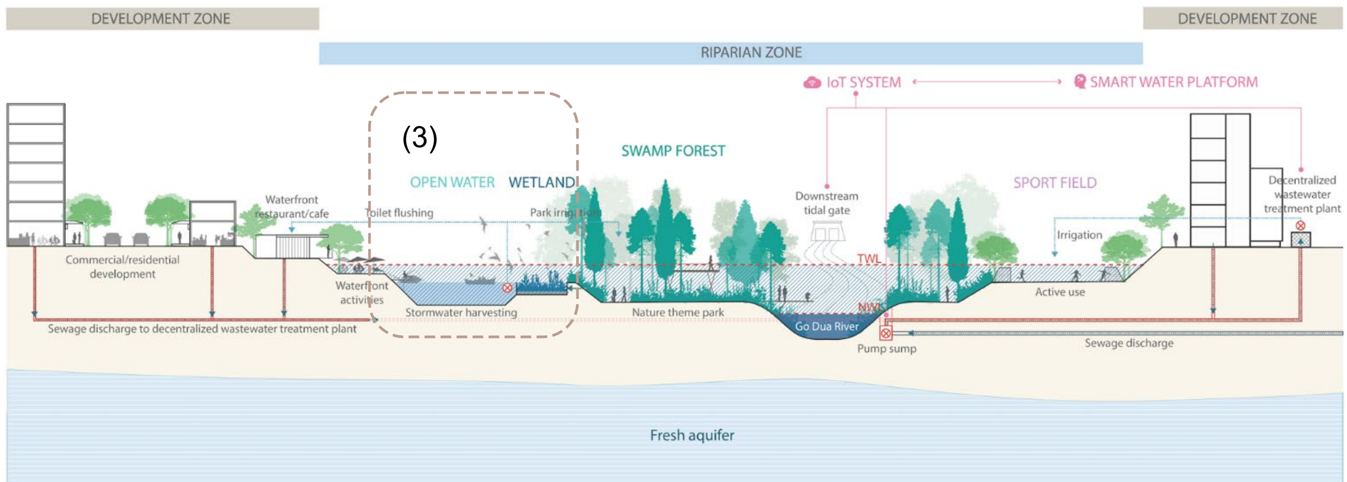



***Figure 15: How a constructed wetland for water quality treatment works.***
*Source: AECOM.*

[7] Anh, B.T.K. (2018). 'Selection of suitable plant species for wastewater treatment by constructed wetland at the Formosa Ha Tinh Steel Company', *Vietnam Journal of Science and Technology*, *56*(2C), 157–163.




## 3.3.3 Stormwater harvesting

***Figure 16: Cross-section of the hybrid strategy showing component 3 – stormwater harvesting.***
*Source: Project team.*

The hybrid approach proposes stormwater harvesting as a water source for irrigation and internal public uses. This component will reduce the recurring cost of park maintenance because water from city main water supply network would not be needed for this purpose.

The recommended approach is modelled on the highly successful Melbourne Royal Park wetland stormwater harvesting system. In the reconfigured Tam Phu Park, surface runoff will be collected through a diversion structure that acts as a sediment trap to capture the large size pollutants such as leaves. The flow is then channelled into the constructed wetland, where water will be filtered and cleaned. After treatment, the water flows into an underground tank that can be situated below one of the sports fields. A final treatment process using UV light is applied before water is pumped out for uses including park irrigation, road cleaning and for non-potable uses such as toilet flushing in the amusement area and residential area.

The stormwater system will be designed to supply 854 $m^3$/day of water for park public uses. Water for domestic uses of staff and visitors will still be drawn from the centralized water supply network.

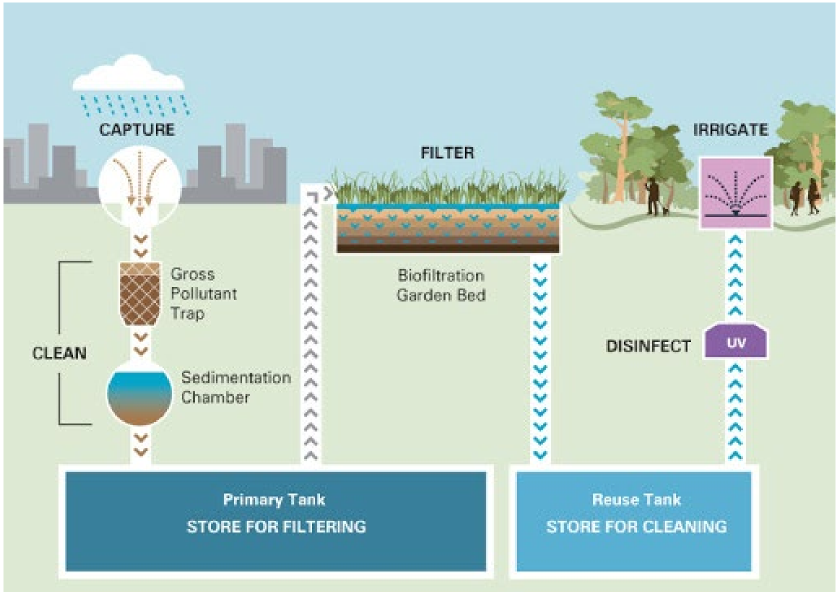
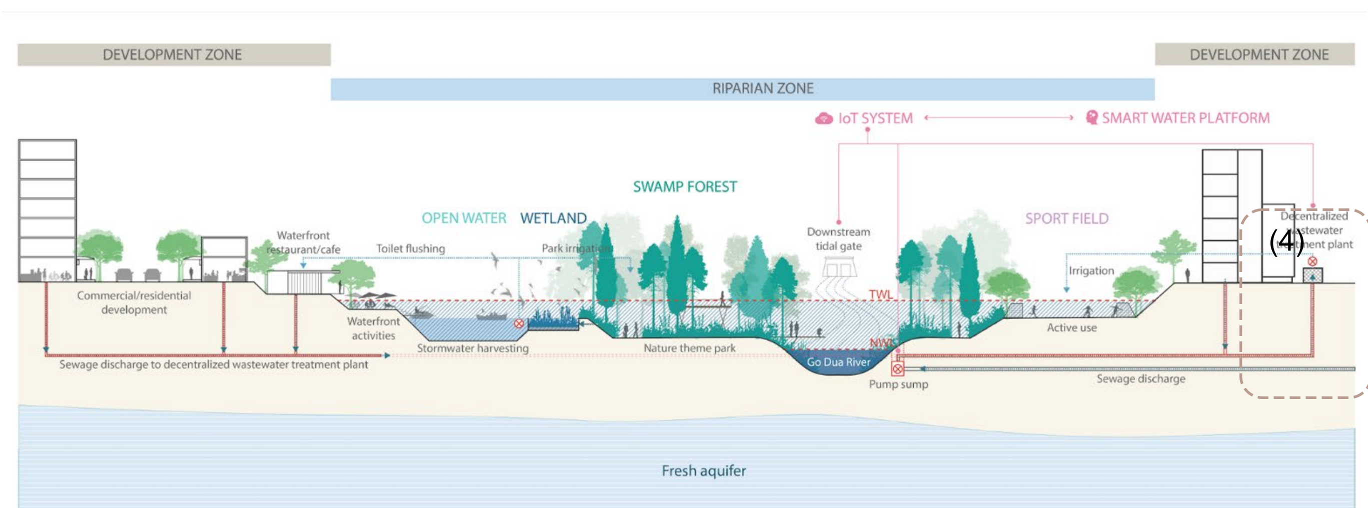



*Figure 17: Diagram showing stormwater harvesting system.*
*Source: City of Melbourne Urban Water.*




### 3.3.4 Decentralized wastewater treatment plant

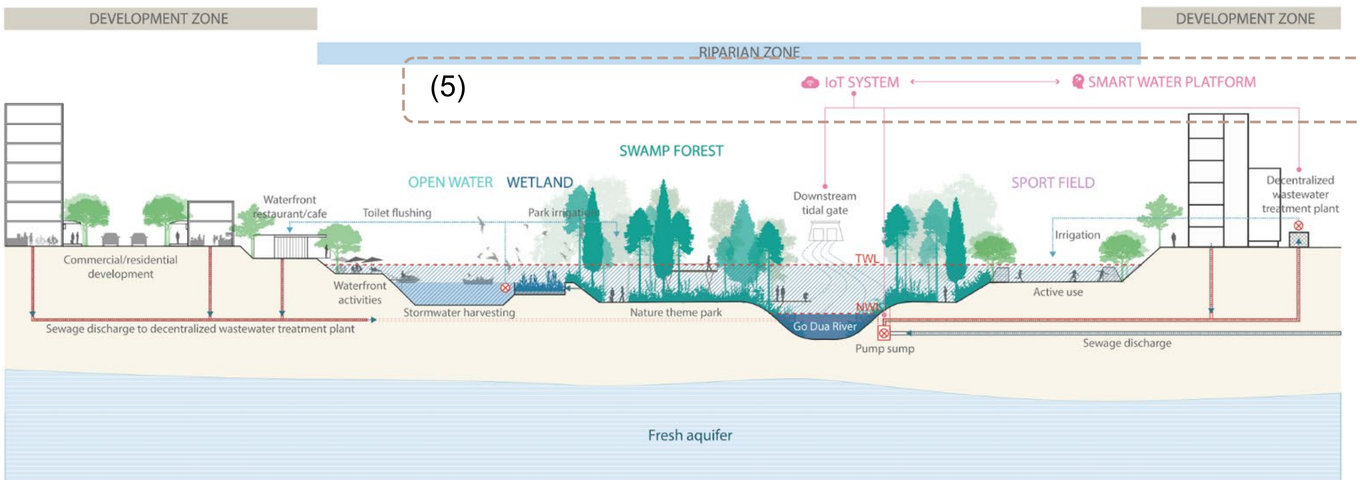
*Figure 18: Cross-section of the hybrid strategy showing component 4 – decentralized wastewater treatment plant*
*Source: Project team*

Under the masterplan, a localized wastewater treatment plant (WWTP) with capacity of 3,000 $m^3$ per day and new sewerage pipes will be constructed. The hybrid approach retains with this component. The separate sewer system, and the decentralized WWTP, will play an important role as an interim measure to collect and treat wastewater from the surrounding unsewered local area and the proposal residential, commercial and other functional areas within the park. This decentralized system will be connected to the centralized North Sai Gon I sewerage system that includes a WWTP in Truong Tho ward, once the centralized system is implemented and operational.

Wastewater would be treated through filtration and purification using a membrane bioreactor (MBR) – a sustainable and cost-effective technology that combines microfiltration with biological treatment to produce high quality effluent that can be discharged into the lake and used for park irrigation.

The localized treatment plant could be built and operated by the private sector via a fee-for-service contract with municipal government to lower upfront costs. It would not only provide wastewater management services for the area, but the treated effluent, meeting national standards on water quality, could also be recycled and reused to support ongoing park maintenance. The treatment plant can be very small, e.g. incorporated into park design (see Figure 19) or hidden in the basement levels of a building in the residential/commercial zone.


***Figure 19: Darling Island Wastewater Treatment and Recycling Facility.***
*Source: Permeate Partner.*




### 3.3.5 Internet of Things enabled smart water platform

***Figure 20: Cross-section of the hybrid strategy showing component 5 – IOT enabled smart water platform***
*Source: Project team.*

This component of the hybrid approach proposes an Internet of Things enabled smart water platform using sensors, cloud-based data storage and connection to weather forecasting. It would optimize the operation of water infrastructure, including the tidal gates, pumps, planned wastewater treatment and recycling plant, and proposed stormwater harvesting and aquifer recharge facilities. For example, when high tides coincide with intense rain events, the smart system closes the tidal gate and distributes flood storage across the polder and smart pumps which drain water into low lying areas to avoid inundation and damage to businesses and property.

## What is the ‘Internet of Things’?

The Internet of Things, or IOT, refers to the billions of devices that are now connected to the internet, all collecting and sharing data. Connecting all these ‘things’ and adding sensors enables them to communicate real-time data to each other as part of ‘smart’ platforms.

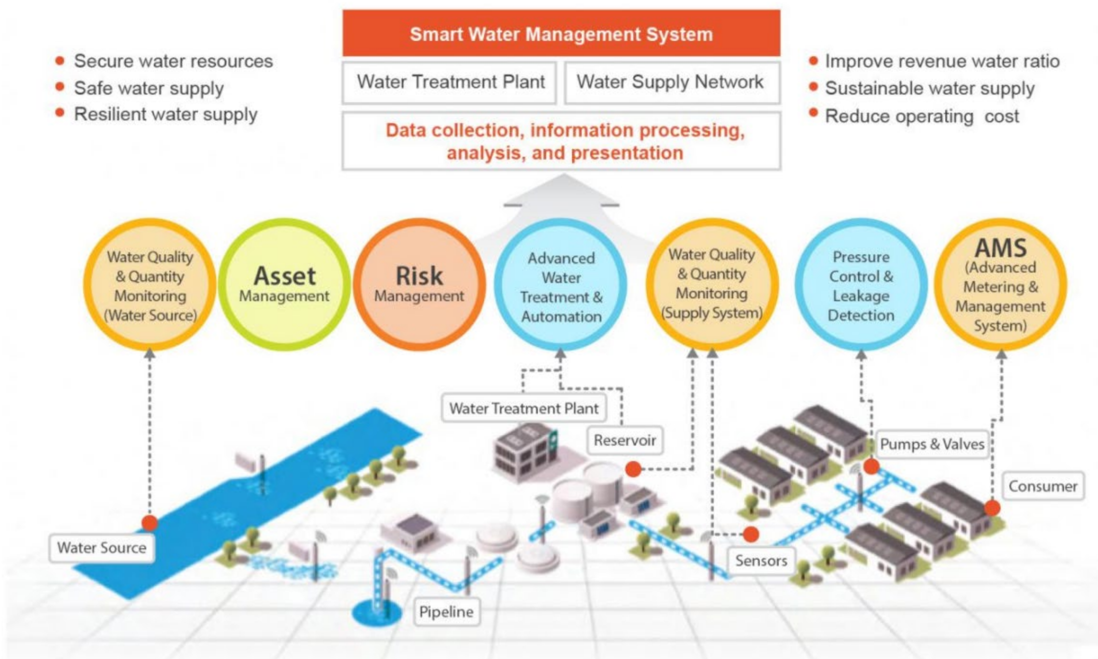



*Figure 21: Smart water management system components.*

*Sources: You Kwangtae, CEO UnU Civil and Environmental Engineering, Republic of Korea.*

A smart water platform could be a flagship pilot demonstration for the smart city vision of the new Thu Duc City (discussed further in Chapter 6). This system should also support gender equality diversity and social inclusion (GEDSI) outcomes e.g. navigation to accessible toilet facilities as well as safe and inclusive movement through the park at all times of the day or night. Such a system could also facilitate coordination between publicly and privately owned infrastructure and provide information to aid performance-based contracts as part of public–private partnership (PPP) arrangements.

This component is aspirational and was not included in the BCA, but is described here as part of the overall vision and strategy for the park. There are many opportunities in terms of the functionality of the system. Further consideration of scope is required to ensure it supports the government's objectives for Tam Phu Park and Thu Duc City. Scoping and developing the system should also respond to local private technical capacity as well as local, national and international partnership opportunities.

### 3.3.6 Flagship 'eco-social' housing scheme

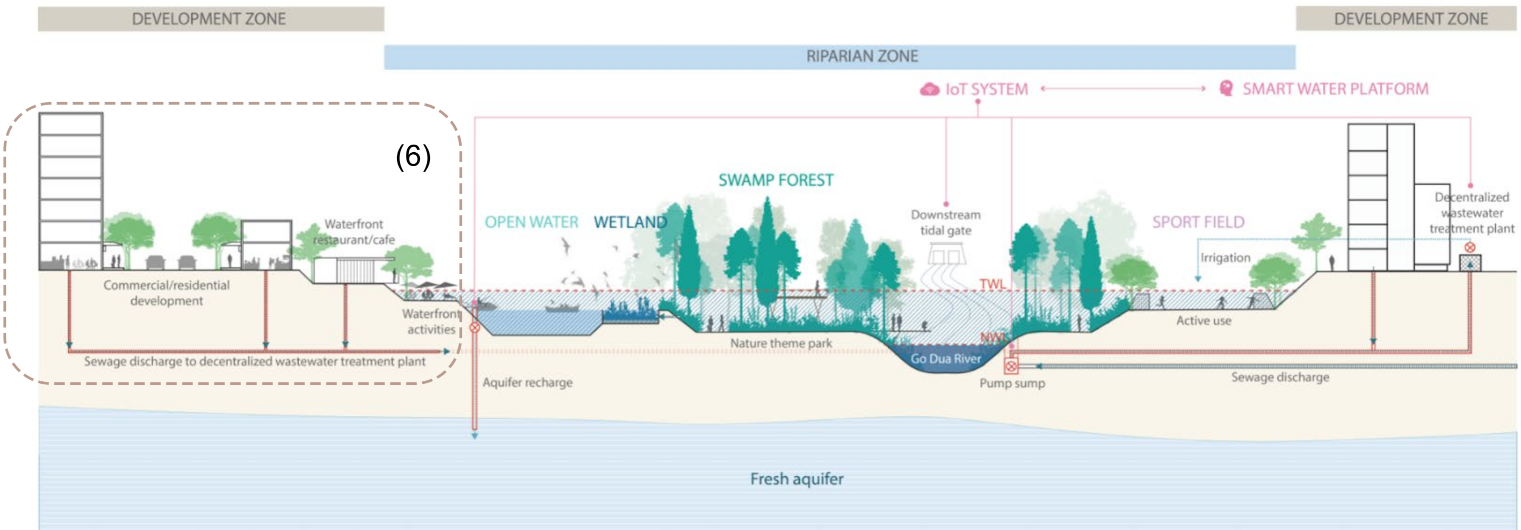



***Figure 22: Cross-section of the hybrid strategy showing component 6 – land sale or lease for residential development.***
*Source: Project team.*

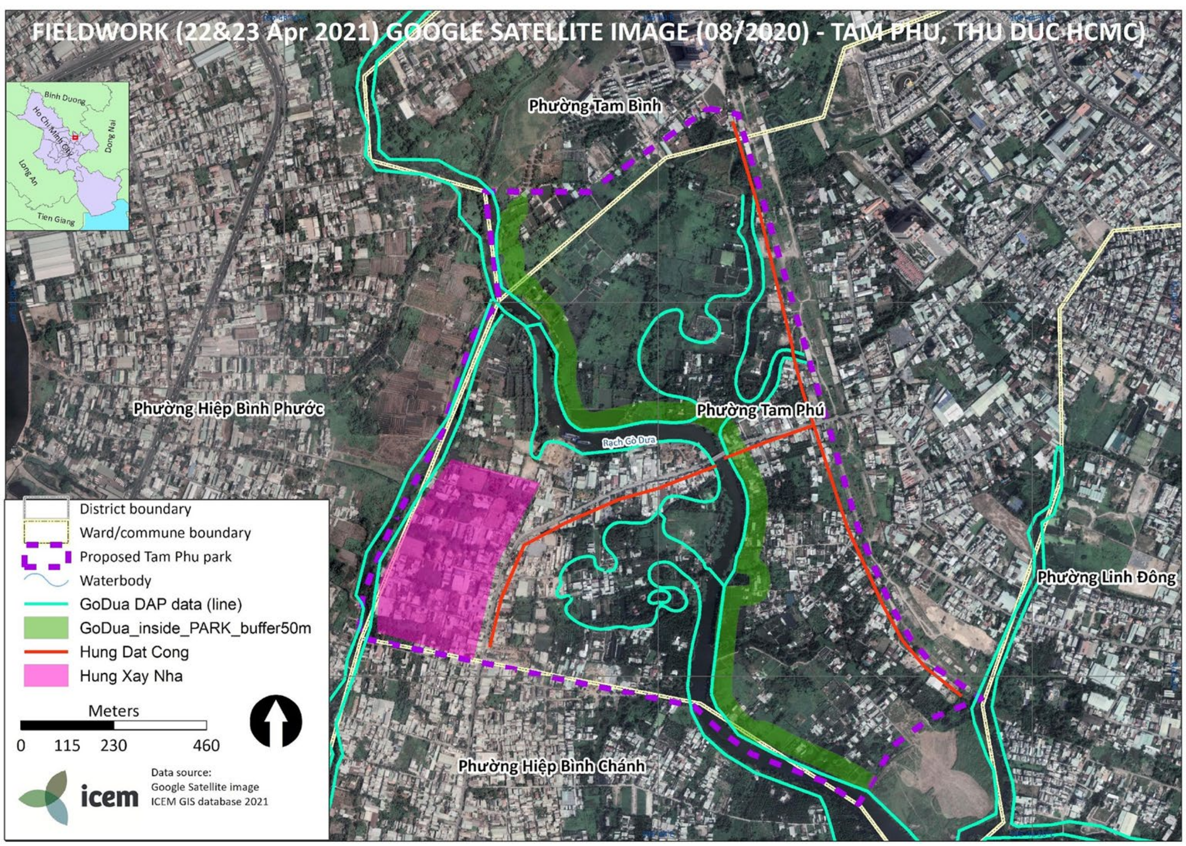



***Figure 23: Potential zoning for hybrid park plan.***
*Source: Project team.*

Currently, the Tam Phu Park Masterplan does not include a residential area. By zoning a small portion of the wetland park for residential development (e.g. as shown in Figure 22), the responsible municipal agency can take advantage of the increased amenity for cost recovery, while maintaining the vast majority of the park for public usage. Feedback from the training and consultation sessions noted that without selling the land, the government may not have the budget to develop the park at all.

The proposed housing development represents about 9.5% of the park area, so on the one hand including it would reduce the park's contribution to meeting HCMC's green space targets. On the other hand, integrating high quality housing aligns with the vision of the innovation district, particularly when considering urban liveability and the need to attract talent to the area. Additionally, there are important social inclusion considerations to developing housing on the site. The current predominantly low-income occupants of the site would need to be relocated under the current masterplan and hybrid approach. Allocating a portion of the land to housing may minimize social disruption, allow vulnerable groups to maintain important ties to the local area, and reduce potential risk of opposition to resettlement.

The recommended strategy is to sell or lease approximately 12 ha of the park, reserving 8 ha for low- to mid-income housing to accommodate the 1,200 existing households, and making the remaining 4 ha available for sale/long term lease for high-end luxury housing and commercial development. Rather than selling the land, the government could enter into a PPP, which could assist with financing and risk management and promote innovation. This approach ensures revenue flows back to the municipal government in the long run.

Importantly, all housing (including the low-income housing) would focus on sustainability which is the site's selling point. The land should be marketed according to these visions, for instance 'living with water' (Figure 24).

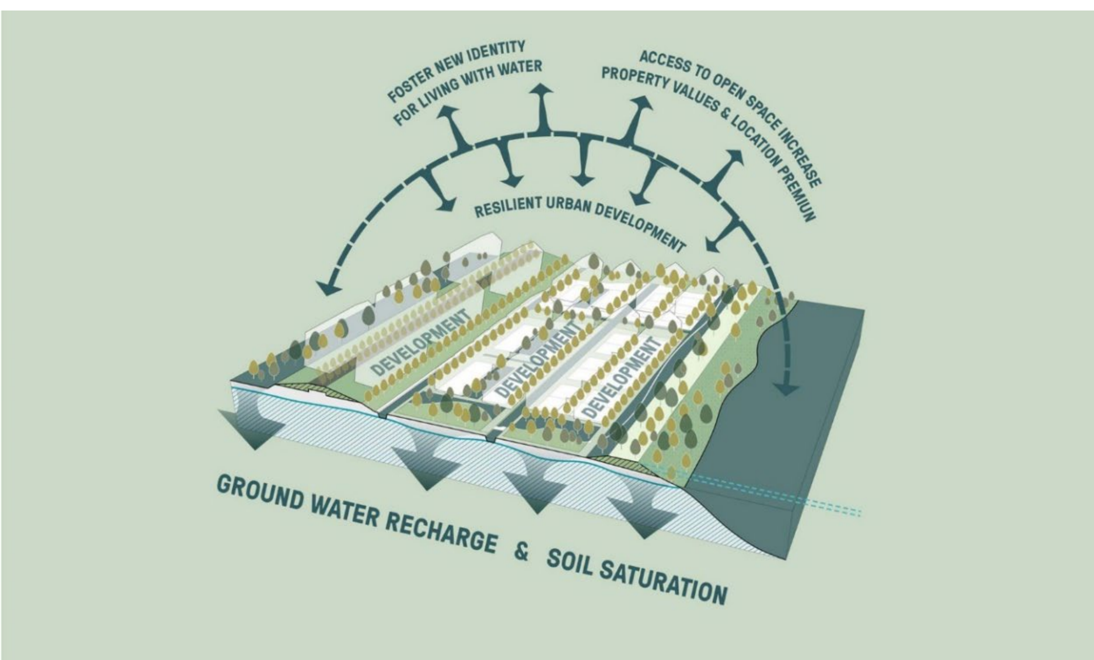



***Figure 24: Vision of Thu Duc City focusing on living with water.***
*Source: Sasaki and Encity.*

A PPP arrangement could explore a flagship 'eco-social' housing scheme including ecological and smart design.[8] Green buildings have gained increasing attention in Vietnam, e.g. with the introduction of certification programs like LEED (Leadership in Energy and Environmental Design) and IFC's EDGE (Designed Excellence for Greater Efficiency).[9] Green building designs can be cheaper and more efficient in the long run, including techniques like reflective paint and thermal resistant aerated concrete blocks to lower temperatures, intelligent systems to detect motion to save energy in non-active periods, maximized natural ventilation, rainwater harvesting for non-potable water supply via water tanks on roofs, and water-efficient single flush toilets.

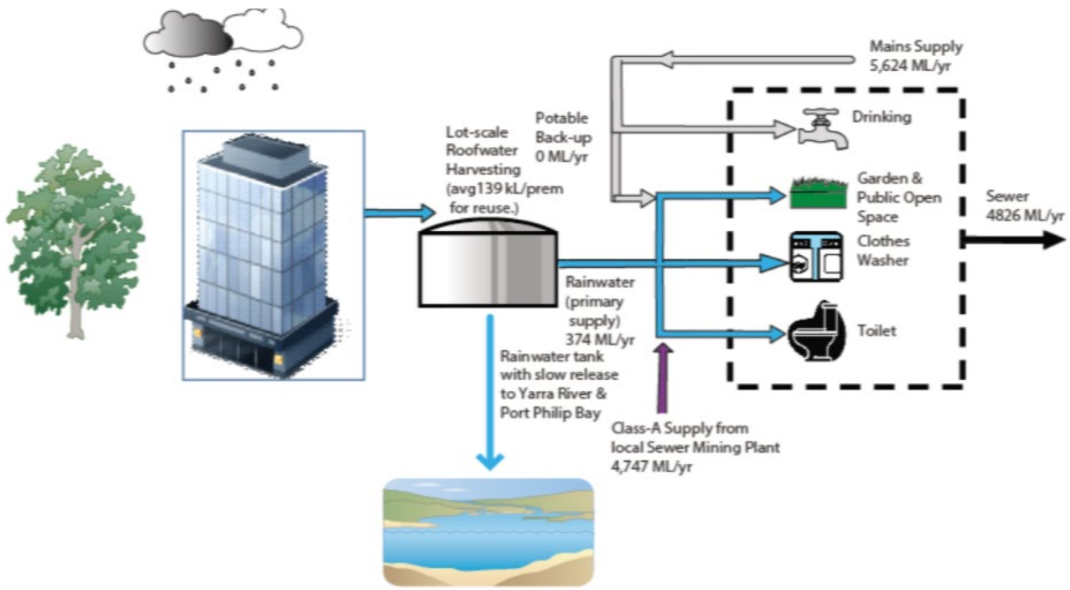



***Figure 25: Sustainable water system, Fishermans Bend Melbourne, Australia.***
*Source: South East Water.*

Green roofs and walls could also enhance building aesthetics, and provide additional flood mitigation benefits by improving absorption and water reuse, making up for the loss of permeable area in the park from the land development. Stormwater harvesting together with smart systems for irrigation can help address urban heat island effects. Until the main sewerage network and wastewater treatment plant is operational, the new development would be serviced by the decentralized wastewater treatment plant under the hybrid plan which represents an additional cost recovery option.

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[8] See Tran, T. and Truong, T. (2018). 'Towards eco-social housing in Vietnam: challenges and opportunities', in *MATEC Web of Conferences* (Vol. 193, p 01001). EDP Sciences.
[9] Edge (Excellence in Design for Greater Efficiencies) (2021). *Edge in Vietnam*. Retrieved from https://edgebuildings.com/certify/vietnam/

# 4. Value and choose interventions

This section provides an overview of the results of the BCA. It compares the baseline scenario (the solution in the 2008 Masterplan) with the *additional* measures in the hybrid approach. Costs were estimated in Vietnam Dong and converted to current USD with adjustments for purchasing power parity. The cost and benefit components and assumptions across the 40-year project period can be found in the Annexes.

It is important to note this study is a high-level strategic assessment with data limitations. The main purpose is to ask, given the information available, whether the strategy is worth further investigation. The results can also help to prioritize measures, by examining which BCR is the strongest of the different components of the solutions, and formulate fair funding and financing arrangements based on the distribution of costs and benefits. Detailed assessment, e.g. regarding precise volume and water flow, is outside of the scope of this project and should follow as part of a pre-feasibility and pilot stage.

## 4.1 Overall BCR

Results show a very strong overall BCR of **36** over a 40-year period, with an NPV of over **USD 51 million.** Breaking down the overall BCR, the net benefits attributable to the project organization remained very strong, at **22**, with an NPV of around **USD 31 million.**

Sensitivity testing was applied to the results, with costs and benefit assumptions reduced and increased by 30% and then applied to 1,000 different simulations to test the impact of different combinations of assumptions. The results showed the probability that the overall BCR is greater than 1 was 1, or 100%, with a minimum BCR of 21 and a maximum of 57. The results for the project organization were also strong, with the probability that the overall BCR is greater than 1 of again 1, or 100%, with a minimum BCR of 12 and a maximum of 36.

### Key economic terms

**Net present value:**
Calculates today's value of a future stream of payments over the entire life cycle including costs and benefits

**Benefit–cost ratio:**
Compares the present value of all benefits with the cost. For every dollar spent, the BCR gives you how much you will get back in benefits

## 4.2 Capital and operating costs

The BCA considers capital and operating costs over a 40-year period to identify the additional costs in the hybrid solution relative to the masterplan. All other functional areas and associated costs were excluded because the model assumed they remain the same (e.g. the kids area and exhibition area). The *additional* costs of the hybrid solution are the stormwater harvesting and sewerage reticulation and treatment system needed for the residential area. The model assumed the project organization will bear these costs. Total additional construction costs were estimated at USD 796,000 (including a 10% contingency allowance).

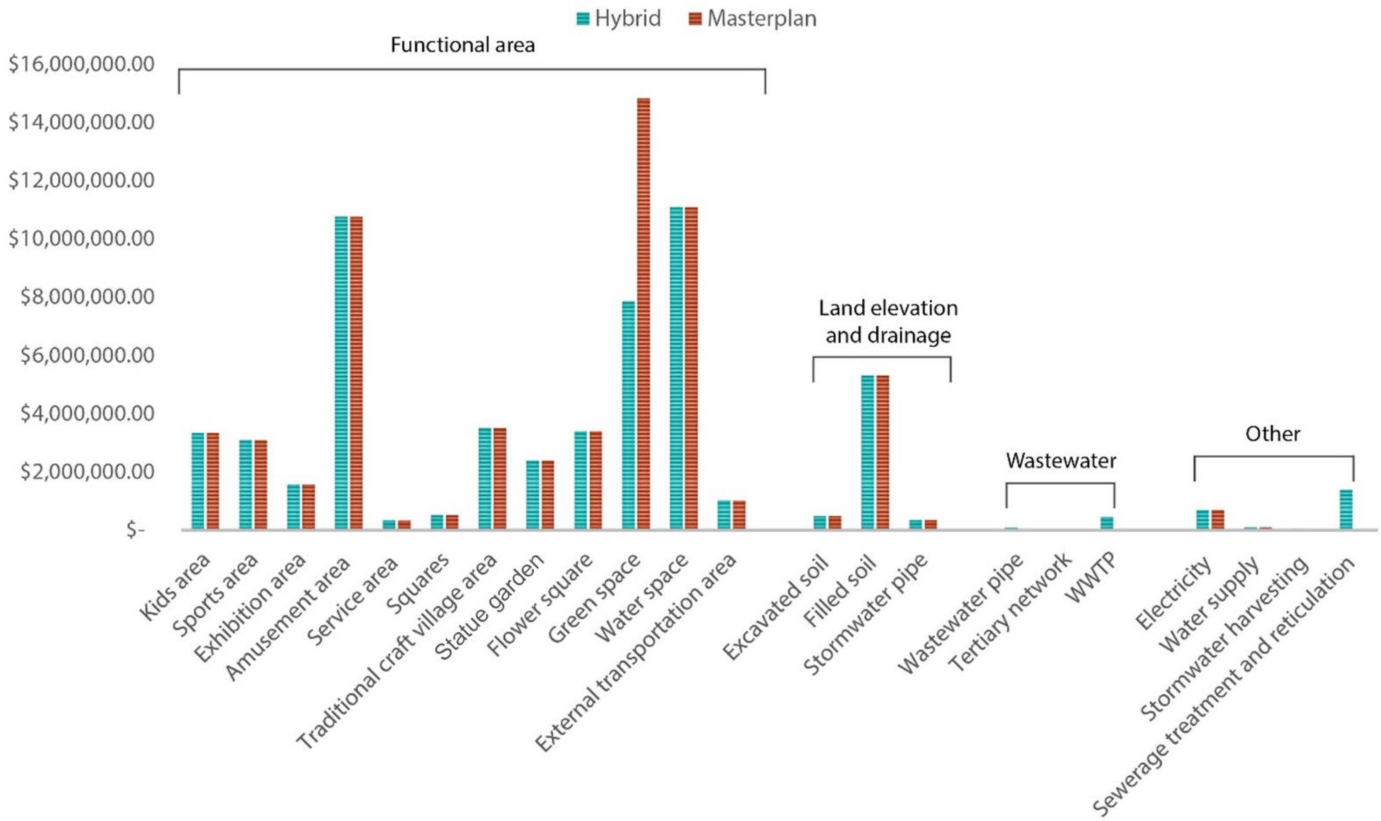


***Figure 26: Capital cost comparison of the masterplan and hybrid solutions.[10]***
*Source: Project team.*

For this strategic assessment, operation and maintenance cost were assumed to be 0.2% of construction cost. Adding these costs over a 40-year period and discounting them to a present value suggested a total additional cost of approximately USD 1.5 million. The cost assumptions can be found in Annex 1.

As well as the additional costs, a key change in the hybrid solution involved reformulating total green space to allow for the riparian zone, constructed wetland and space for residential development. These interventions are less costly per ha than green space in the masterplan, so were included under benefits as a comparative cost saving (Figure 27).

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[10] These are the direct costs associated with each strategy. The total cost also includes the costs associated with raising taxes which the government then uses to finance its expenditure on the strategies.

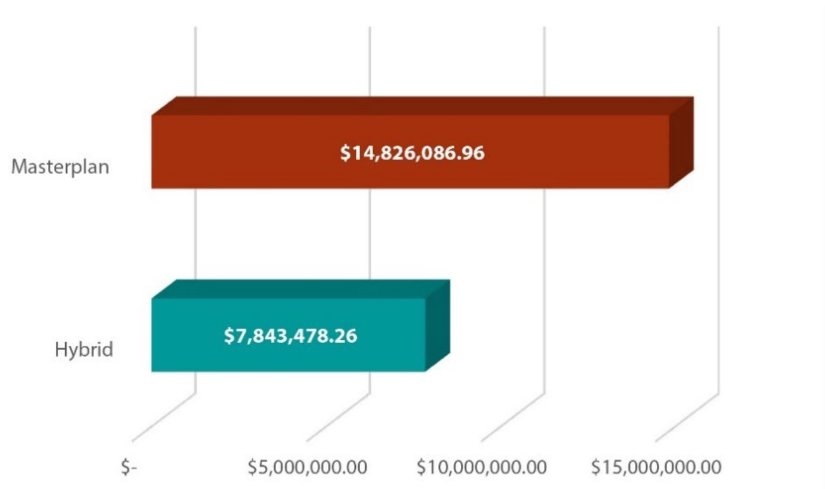


***Figure 27: Comparative costs of green space in the masterplan and hybrid solutions.***
*Source: Project team.*

The costs of constructing the residential development were not included because the model assumed this component takes place under a separate public–private arrangement. Costs for preparing the land for lease or sale were included under excavation and filling costs. The costs of land acquisition and compensation were assumed to be the same between the masterplan and hybrid solution, although it is possible the residential development could deliver financial benefits to HCMC depending on risk/return appetite and the form of PPP selected (see Chapter 5). Importantly, even without the residential development, the hybrid solution is still cheaper than the masterplan.

## 4.3 Benefits summary

This case study identified and quantified 14 different benefits. Quantification included estimating construction and operation costs savings as well as applying the INFFEWS Value Tool to estimate the value of increased property values arising from improved amenity and biodiversity and to approximate people's willingness to pay to avoid flood damage. Benefits to residents inside and outside the park were considered over 40 years and discounted to give a **total present value of over USD 53 million**.

Figure 28 shows the contribution of individual benefits. By far the greatest benefit is the cost savings from reduced capital and operating expenditure costs of green space compared with the masterplan, representing 56% of total benefits.[11] Importantly, these benefits come not from significant reductions to green space coverage, but from diversifying the type of green space. Elements that more closely mimic nature require less maintenance than the manicured design

[11] For both the masterplan and hybrid solutions, the model assumed operating expenditure was 0.2% of capital costs. Sensitivity testing (+/- 30% change) found operating costs were not sensitive (i.e. significantly raising or lowering costs did not change the overall result of a BCR greater than 1).

included in the masterplan. For example, the capital and operating costs of the riparian zone (which is still a green area) are cheaper than green space under the masterplan. Using native species also saves costs.

The next greatest benefit came from reduced flood risk, representing 30% of total benefits. Reduced flood risk was separated into three groups – reduced pluvial and extreme fluvial flood risk inside the park (i.e. willingness to pay of residents in the development to avoid flood damage), and reduced extreme flooding risk to people living outside the park.

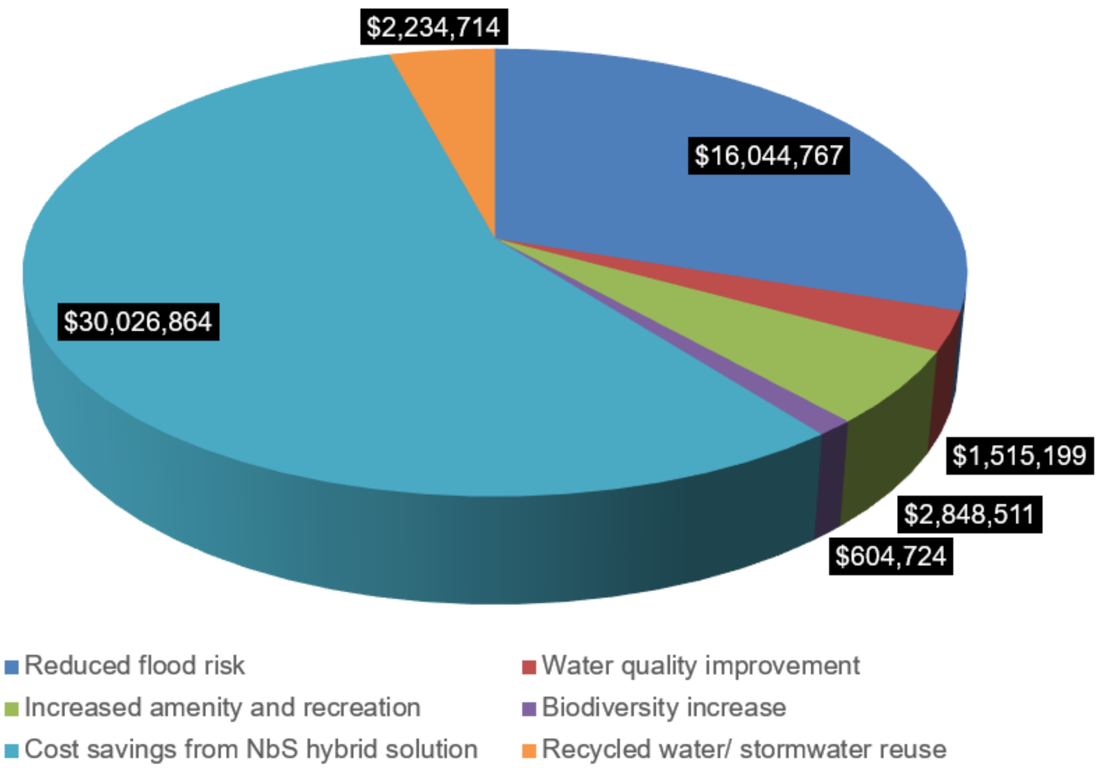


***Figure 28: Total benefits.***
*Source: Project team.*

## 4.4 Distribution of costs and benefits

The stakeholder groups considered in the BCA were: the national government, the provincial (HCMC) government, people who will live in the park as part of the residential development, people who live around the park (within a 500 m radius) and downstream communities. This case study assumed the provincial government will bear 100% of the costs (the costs and benefits to the private developer for the residential land were not included). Figure 29 shows the distribution of benefits – with the largest group being the provincial government. These results show a hybrid strategy can create significant value both to the local and downstream HCMC community, as well as reduce upfront and ongoing costs for the government. While the provincial government may bear the costs, the benefits that will flow back still strongly outweigh them, with the BCR of 22.1 providing a strong incentive for further detailed exploration of the hybrid solution.

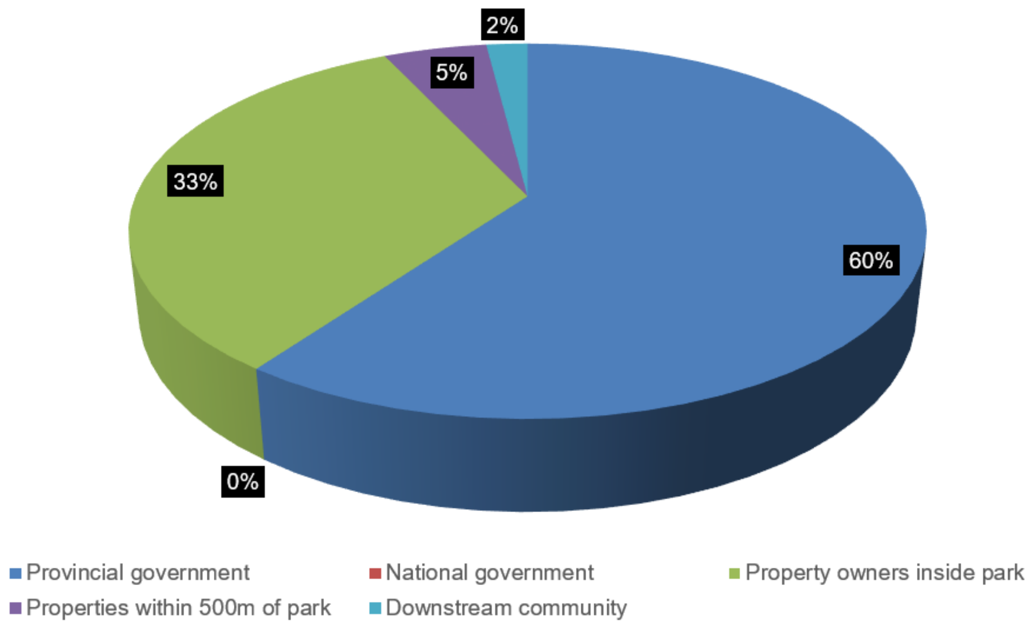


***Figure 29: Distribution of costs and benefits.***
*Source: Project team.*

# 5. Identify appropriate funding and financing mechanisms

Vietnam has placed a high priority on green growth and climate resilience, shifting away from traditional models of growth to sustain the development gains of recent decades. The country adopted a National Green Growth Strategy (VGGS) and developed a corresponding Green Growth Action Plan. To finance the VGGS, Vietnam needs to mobilize huge investment capital, estimated to be at least USD 30 billion. Sustainable and equitable investment also needs to increase to achieve future policy and national strategy goals.

As Vietnam moves from a centrally planned to a market-oriented economy and from a low- to a middle-income country, the mix of available financing sources is changing. Official development finance, which is provided at concessional terms, is likely to decline both in relative importance and absolute volumes. Going forward, development assistance (ODA) will likely decrease even further with the country's graduation from the International Development Association (IDA) in July 2017 and the Asian Development Bank's (ADB) Asian Development Fund in January 2019.[12]

Despite the huge investment demands for infrastructure and green growth, the Government of Vietnam cannot directly inject the necessary capital. Coupled with the recent limitations to accessing incentive capital from foreign financial institutions, budget constraints and tightening public expenditure are also barriers. Meanwhile, investment in public works such as urban parks has been largely funded by public sector so far. For these reasons, the country needs different finance mobilization strategies to secure much needed investment capital to fund deficits in urban infrastructure.

The Tam Phu Park case study assumed a similar gap applies to meet the future greening, flood protection and leisure needs in Thu Duc City. The case study initiatives help bridge this funding and financing gap, noting many of the ingredients needed to support sustainable green growth are already in place but further evolution is needed.

## 5.1 Enabling policy and strategy

As noted above, the Government of Vietnam has developed a VGGS, approved in Decision No. 1393/QĐ-TTg (25 September 2012) and a corresponding Green Growth Action Plan for 2014 – 2020 period, approved in Decision No. 403/QĐ-TTg (20 March 2014). The VGGS has the following visions:

- Green growth is an important part of sustainable development to ensure fast, efficient and sustainable growth while making a significant contribution to implementing the national climate change strategy.
- Green growth must lead to increased investments in conservation, development and efficient use of natural capital, reduced greenhouse gas emissions and improved environmental quality, and thereby stimulate economic growth.

[12] OECD (2019). *Transition finance country study Viet Nam: On the edge of transition*. June.

- Green growth is the cause of the entire Party, all people, every level of government, ministries, localities, enterprises and social organizations.

The VGGS identifies sustainable urbanization as a specific solution, with some relevant activities:

- Develop and implement masterplans for rainwater drainage systems, urban waste and wastewater collection, transportation and treatment systems. In areas that are highly vulnerable to climate change, infrastructure should be adapted to minimize economic losses.
- Develop green cities, ecological urban areas and green works.
- Green the urban landscape. Prioritize the allocation of public land to quickly expand the area of green coverage and water in urban areas, meeting the standards set for each city grade level. Stimulate investment and development of green space in urban projects and encourage communities, enterprises and households to mobilize resources to green urban landscapes.

Achieving the visions set out in the VGGS will require mobilizing the right scale and mix of funding and financing, and accessing public and private resources, both domestically and internationally. The VGGS itself calls for increased investment across sectors, including through PPP and international sources, and specifically calls to scale up domestic financing for green growth.

HCMC issued Decision No. 529/QĐ-UBND (14 February 2020) to develop a green and environmentally friendly city from 2020–2025. This planning document called for capital sources from the state budget via programs to support climate change, the private sector, the community and international aid. It also instructed the government to create a legal basis to encourage financial institutions and businesses to invest resources to implement activities set out in the city's Green Growth Action Plan.

The solutions set out in this case study strongly align with these national strategies, particularly as they promote private sector engagement for resources mobilization and climate resilient infrastructure. Achieving the vision will require mobilizing the right scale and mix of funding and financing from public and private sources.

## 5.2 Legal framework for green finance

Recognizing the importance of a legal framework for green finance, Vietnam has taken steps to confirm action and implementation plans for this area. Specifically, in 2015, the Governor of State Bank of Vietnam (SBV) signed Decision No. 1552/QD-NHNN issuing the Action Plan of the banking sector to implement the National Strategy on Green Growth toward 2020. In addition, the SBV has integrated the green credit program into the legal documents it issues.

The framework for green finance has been gradually forming and the financial system has actively participated in greening the economy. For example, the SBV issued Decision No.1604/QD-NHNN (7 August 2018) approving the Scheme on green bank development. This scheme aims to increase the awareness and social responsibility of the banking system towards environmental protection and climate change, by gradually greening banking operations and directing credit capital into financing environmentally friendly projects. The Green credit program could be a modality to finance the hybrid strategy for Tam Phu Park.

## 5.3 Recognition and valuation of investment options that support policy objectives

Improving access to financing requires a robust approach to project proposal development and evaluation, acknowledging all relevant costs over the project lifecycle, considering broader value adding opportunities, and valuing both economies of *scale* and economies of *scope*. As illustrated by the case study, the IUFM approach can balance large infrastructure assets and smaller scale decentralized solutions as well as green, gray and non-structural solutions that reduce the overall cost to be financed. The Tam Phu Park case study highlights the additional value of NbS in supporting large investment. It is important for public authorities to include the sorts of values highlighted in this case study in investment decisions as a business-as-usual activity. A stronger business case clearly aligned with government policy objectives not only increases the likelihood of public funding support, but information on the size and distribution of benefits can also be used in community education and engagement, which in turn helps mobilize private action for public and private good.

## 5.4 Demonstration projects

Standalone projects can demonstrate the value of a particular technology or approach. Given the relatively new concept of NbS, the lack of a practical methodology and tools to quantify the benefits, and a shortage of evidence about the benefits of NbS over conventional approaches, this case study provides an example of how combining and green solutions could bring additional values to urban infrastructure investment. The results should increase the confidence of local government in pursuing such hybrid approaches, and increase the likelihood of funding and financing.

Tam Phu Park is a high-profile initiative that aligns well with the vision of Thu Duc City as an innovation hub driven by smart technologies. It presents an opportunity to leverage technical and financial support from several parties, including public agencies, the private sector and research institutes towards the smart water management system. HCMC is already in the second stage (2021–2025) of its initiative to become a smart city, with 5 sub-projects approved. *Building HCMC into a smart city* is implemented in 3 phases: 2017–2020, 2021–2025, and after 2025. The first phase focused on developing a technology platform for a smart city: cloud computing infrastructure, backup data centers, open data platforms, big data analysis platforms, shared data warehouses and shared databases, and an intelligent operations center (IOC). The second phase will focus on updating the database and applying smart solutions in specialized fields, from digital government, security, health to traffic, environment and flood control. The hybrid approach aligns well with this second phase, providing an opportunity for on-the-ground application of the smart technology platform and cloud infrastructure to lead the way for future works.

## 5.5 Leveraging private investment

Public finance and funding will continue to play an important role in promoting green growth and IUFM. The IUFM process also seeks to help bridge the public infrastructure gap by identifying and monetising additional revenue streams, reducing the need for public funding and increasing financeability and scalability

> **THE FIRST STORMWATER PURCHASE AGREEMENT IN CHINA**
>
> On September 25 2020, Changsha Gaoxin District Park Company and the Hunan Yuchuang Environmental Protection Company signed the first stormwater purchase agreement in China at the Hunan Province Green Development Exhibition Sponge City Forum.
>
> According to the agreement, the Changsha Gaoxin District Park Company will purchase stormwater from the Hunan Yuchuang Environmental Protection Company at a 20 percent of the piped water price for landscaping and cleaning purposes. The Hunan Yuchuang Environmental Protection Company has worked on rainwater retention and utilization from 2014 and has utilized 0.5 million cubic meters of rainwater, which amounts to 2 percent of the total rainwater during the last 6 years, which means there is still large potential for rainwater utilization.
>
> Source: Changsha Evening News 2020

The Tam Phu Park Masterplan already includes various plans for private investment through commercial activities including the amusement area, traditional craft village, exhibition area, food and beverage service area and small-scale water-based activities. An IUFM approach also encourages identification of new revenue streams. An example is selling stormwater to the park management body, as is done in Hunan, China. The potential revenue generated from wastewater collection and treatment services provided by the decentralized wastewater treatment plant could also be opportunity to attract private investment in the park. The revenue generated would reflect the volume of wastewater treated and the current tariff for recycled water.

In addition, this case study highlights the significant potential cost recovery benefit of zoning and then selling or leasing land in a small portion of the park, while increasing environmental and recreational benefits from the remaining space through multifunctional design. Land is always a scarce and valuable resource. Availability of and accessibility to land for investment is highly attractive to draw to form a PPP with the private sector.

Currently, some components of the proposed hybrid solution could be covered by PPP arrangements, while others could not. Specifically, the Law on Public–Private Partnership Investment No. 64/2020/QH14 (18 June 2020) and Decree No. 59/2014/NC-CP (16 June 2014) do not apply to public parks such as Tam Phu Park. However, PPPs can be used to invest in irrigation, water supply, drainage and wastewater treatment systems.

The case study illustrates the benefits that could be generated if policy and regulations were changed to allow for all the components outlined in the hybrid solution. The benefits present a compelling argument for government to consider changing policy and regulation to allow for PPPs in a broader range of circumstances. A recent study on public open space in Vietnam also recommended the government reconsider the private sector's role e.g. allowing and incentivising the private sector to provide public open space.[13]

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[13] Labbe, D., Musil, C. and Tran, T.M.T. (2020). *The role of the private sector in the production of open public spaces in Hanoi and Ho Chi Minh City.* Retrieved from https://observatoire-ivanhoe-cambridge.umontreal.ca/wp-content/uploads/2021/06/2020-t1-1.pdf

The exact form of the PPP would likely depend on the public agency's appetite and allocation of risk. The following examples demonstrate the range of ways to use the land in Tam Phu Park and the various ways of leveraging private sector engagement.

Figure 30 shows some different forms of engagement and the amount of risk versus return they may entail. The least risk option of selling or leasing the land as it is also generates the lowest return. The second option would be to improve the land by completing the ground works, and then sell or lease the land for a higher price. The third option is for the government to be a partner and consider an acceptable risk level. The highest level of engagement would entail a joint venture with the government as a partner in the property development. Alternatively, government may decide the skills and resources to develop the land are already present, so the housing could be achieved through a public initiative without any private involvement. In this case, all of the revenue from unit sales returns to the government.

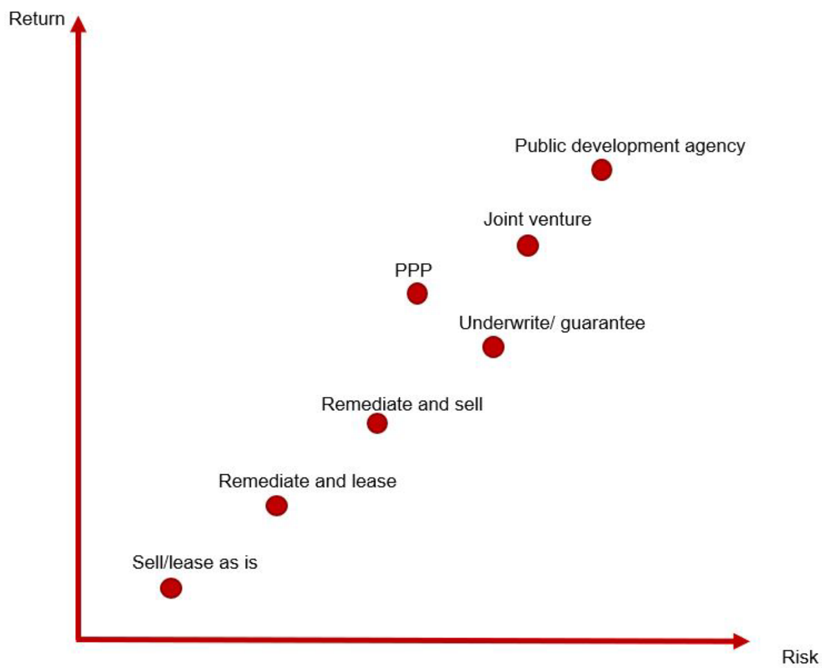


***Figure 30: Types of public–private engagement and associated risk and return.***
*Source: Project team.*

The decision about the type of public–private engagement depends on 3 factors:

1. Be clear about what the risks are, and who owns those risk. 'Optimal risk management' refers to allocating risk to the party best placed to manage it.
2. Put governance arrangements in place before the private sector is introduced.
3. Ensure objectives are clear and transparently considered. Objectives may include a focus on what is efficient and maximizes return, and/or what is fair and delivers maximum community good.

Another strategy is the government underwriting risk to encourage private sector uptake until the technology is proven (e.g. agreeing to fix any problems for a period of time). At Lyndhurst, (Melbourne, Australia) this strategy was used and provided a critical platform for scaling up water sensitive urban design technology (in its infancy at the time) from pilot to business as usual. Moreover, it underscores the importance of demonstration and scaling up.

***Figure 32: Swale between two roads in Lyndhurst.***
*Source: Melbourne Water.*

## Partnership between South East Water and Villawood Properties

This example showcases the genuine partnership between a government-owned water entity and a private property developer to deliver stormwater capture and reuse technology to 460 homes in Melbourne. The system captures and treats rainwater and stormwater for non-potable usage via a series of treatment systems. The aim is to supply 70% of drinking water needs, reduce wastewater discharge by 75% and reduce peak flood events by 26%. This arrangement added value to the community while generating strong returns as a fully commercial activity.

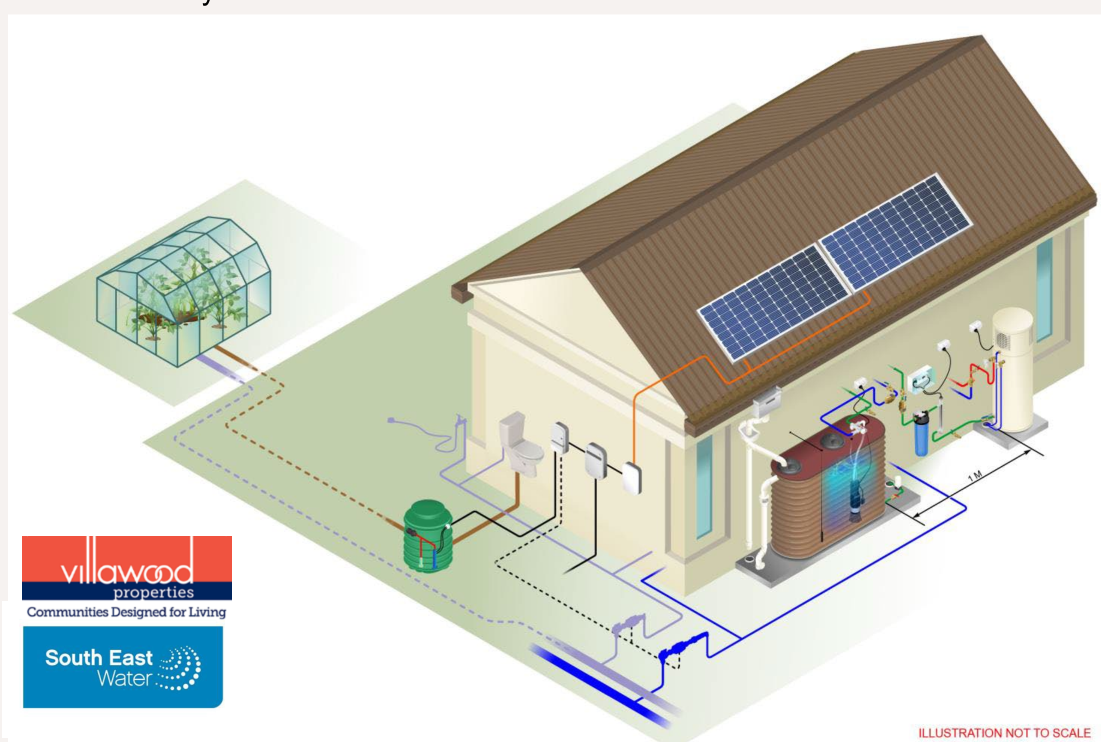


***Figure 31: Stormwater capture and reuse – partnership between South East Water and Villawood Properties.***
*Source: South East Water.*

## The Western Treatment Plant, Melbourne, Australia

Melbourne's Western Treatment Plant is an example of one site with multiple strategies for private sector collaboration. The plant has been operating since the 1890s, currently serving around 2.5 million people in Australia's second largest city. The site is multifunctional; as well as treating sewage, it's a 5,000 ha farm, a biogas energy facility with gas from treatment ponds harnessed and turned into electricity, and a source of recycled water (provided to surrounding agricultural areas). And it's an internationally recognized wetland under the Ramsar convention and a habitat for migratory birds from as far as Siberia and China.

*Figure 33: The Western Treatment Plant.*
*Source: Melbourne Water.*

The plant engages with the private sector in 4 ways:

**1. Outsourced sewage treatment construction and operations:** While asset ownership and overall management responsibility remains with the government-owned water business, the private sector delivers most capital investment and operating activities.

**2. Leased agricultural service:** The farm was originally run by the government water agency, but good water managers are not necessarily good farmers. Taking this lesson on board, the plant entered into a long-term lease with a private sector party. This risk is low, but so is the return.

**3. PPP for energy generation:** The plant also has a build-own-operate-transfer arrangement with a private energy generator. The private company operates this part of the plant, and offers opportunities for skills transfers. This engagement has higher risk and higher return.

**4. Partnership for property development:** The final mode of engagement is a full partnership between the water utility and private developer where water agency pursued a higher return for higher risk.

This example demonstrates the government deciding modalities of private sector engagement based on understanding objectives, risk and skills.

# 6. Recommendations and next steps

The following high-level recommendations and next steps have emerged from the case study development.

- **Further refining benefits and costs:** The strategic assessment provided by this case study illustrates the significant merits of a hybrid approach. Sensitivity testing confirmed that even with the high-level assumptions, the overarching conclusion remains valid. Further refining the key inputs is recommended, particularly examining the potential cost savings offered by the hybrid solution. The INFFEWS Value Tool enabled application of research from other locations to estimate local benefits. A local revealed or stated preference study of key benefits could also be considered. Further developing costs and benefits not only increases confidence in the proposed approach but also provides relevant local research to inform scaling hybrid approaches to other parts of HCMC and Vietnam.

- **Monitoring the performance of NbS:** NbS are central to the benefits offered by the hybrid solution. Park development and maintenance should include appropriate monitoring and analysis of the performance of NbS elements to support local adaption and scaling. This monitoring could also include community engagement and citizen science opportunities.

- **Prioritizing separated sewage and wastewater system for Thu Duc City:** It is not possible to develop Tam Phu Park as a high-quality urban space without properly controlling wastewater discharge into the Go Dua River. Until the main wastewater treatment plant and sewerage can be constructed and begin operating, it is recommended to prioritize constructing the decentralized wastewater treatment plant at the site. As noted above, selling recycled water from the plant could also generate another revenue stream.

- **Updating Tam Phu Park Masterplan to align with the needs of Tam Phu:** The original masterplan was drafted in 2008. Since then, the local area and broader city context have changed significantly. There are more informal residents living in the site. HCMC continues to grow in population and economic power. Plans for Thu Duc City are rapidly coming to fruition. In line with this changing context, the masterplan needs to be adjusted to reflect current and future needs, particularly relating to the park's role as the 'green lung' of Thu Duc City. Maximizing multifunctionality as exemplified in this case study is recommended, as well as potential zoning for residential development as both a draw for talent to the area, and to ensure social inclusion.

- **Resettling existing residents in the park site in-situ:** Maximizing social inclusion is a key recommendation. The proposed mix of low- and high-income housing maintains the vibrancy of the area and protects against green gentrification and the exclusion of low-income residents who have strong community and livelihood ties. This outcome could be achieved through a flagship 'eco-social' housing scheme including ecological and smart design to lower costs.

  An issue that must be resolved is that the proposed housing development exceeds the 5% maximum building density prescribed under Decision QCVN 01:2019/BXD. The project aims to illustrate what is possible. Possible options for addressing this issue include: revising the masterplan to remove the proposed housing development from the park, or revising the regulations limiting building density. These options could be considered as part of a feasibility study on the housing development.

- **Ensuring accessibility of the park:** We recommend entry to the main park be free. This approach ensures accessibility for all local residents to enjoy the improved leisure and amenity opportunities. The vision of Thu Duc City should be inclusive. Accessible park design (including paths, toilet facilities, signage, activities offered and plantings) should also support gender balance and inclusion of people with a range of cognitive, physical and sensory disabilities.

  Some income generating leisure facilities like the amusement area could include an entry fee (and actual fee should be determined after considering factors such as who benefits and how, people's willingness and capacity to pay and the costs).

- **Providing policy and regulatory support for smart city industries:** Strong policy and regulatory support is required to support nascent smart cities industries and transform Thu Duc city into a demonstration area for smart systems. After successfully developing a smart technology platform, HCMC is now in the second stage of its smart city development initiative, currently focusing on applying smart solutions. It is important that this stage nurtures NbS as part of smart city industries, by providing incentives and forming strategic partnerships to deliver smart services, e.g. the smart water management system in Thu Duc City.

- **Assessing private sector engagement strategy:** Private sector engagement represents a good opportunity to address funding and financing. Under the current regulations, the private sector could be leveraged for several of the components in the hybrid solution, namely the smart water management system and the wastewater treatment plant. The government could also consider amending the framework to allow for PPPs for the residential developments proposed in the hybrid solution.

  Importantly, the government must evaluate the strategy properly, considering risk, risk allocation, governance arrangements between entities and objectives of the engagement before offering any contracts and tenders. Local authorities in charge of the park must be clear about the risks and who owns them, and have regulatory and contractual arrangements that support the selected strategy. Arrangements will also need to consider incentives, costs and responsibilities throughout the project lifecycle.

- **Reflecting safety concerns in design standards:** Some of the measures recommended in this case study such as the wetland park designed to operate under varying levels of inundation have not been extensively piloted in Vietnam. As with any new techniques, policy and regulatory obstacles associated with approval processes may emerge. Specifically, safety considerations will need to be carefully integrated into design standards for successful upscaling of NbS. Community education and engagement is also important. Successful examples such as Singapore's Bishan Park include an early warning system to trigger alerts for the public to move out of low-lying areas during an oncoming flood event. For Tam Phu, such a system could be integrated with the recommended smart water management system for Thu Duc City.