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ASSESSMENT OF URBAN PLANNING AND URBAN DEVELOPMENT IN AN VAN DUONG, HUE CITY

November 2017

ASSESSMENT OF URBAN PLANNING AND URBAN DEVELOPMENT IN AN VAN DUONG, HUE CITY

AUTHOR

ISET-VIET NAM

Phong Tran

Anh Tran

THUA THIEN – HUE URBAN PLANNING INSTITUTE

Tung Nguyen

Linh Dang

ABSTRACT

This article presents major findings of a study done in 2014-2015 to assess the urban planning and development process of An Van Duong, one of the most influential urban areas to the development of Hue City. The An Van Duong master plan was approved by the Thua Thien Hue provincial People's Committee in 2005 to expand the city to the south. This urban area is now facing problems related to flooding and inundation, which urged this research to examine and assess its planning and development process to identify possible solutions and strategies for future sustainable development. The selected methods to conduct this research include desk study, documentation, consultative interviews and discussions with relevant stakeholders, and qualitative data analysis and interpretation. This study have identified five key problems of the area and its planning process: (i) An Van Duong's location in a low-lying area; (ii) The scale of planning, which is too big compared to the duration of planning; (iii) The limited engagement of local communities and the wide public in the planning process; (iv) The underestimation of urban drainage systems in flood reduction; and (v) The lack of climate and disaster information and data. This article also presents several recommendations and solutions to tackle these problems, such as re-determination of the planning scale in response to the planning period, intensification of public engagement, and improvement of information exchange and communication between stakeholders.

Key words

Urban disaster risk
Urban flood
Urban climate change resilience
Climate change

BACKGROUND

The urban development process of Hue City in recent years has undergone major changes. Especially, the project of adjusting the urban master plan of Hue City until 2030 with vision to 2050, which was approved by the Prime Minister, sketched out directions for the city's future development. Under the framework of this master plan, An Van Duong is one of the areas significant to the development and expansion of Hue City. The master plan for An Van Duong urban area was approved by Thua Thien Hue People's Committee in 2005, with investments in technical infrastructure. Many projects have been implemented in this area. However, after almost ten years of implementation, the An Van Duong urban area is encountering many problems related to flooding and inundation, resulted from the urbanization process and climate change impacts. Therefore, it is necessary to analyze and examine the process of urban planning and construction from different angles to determine solutions for the development of An Van Duong and draw lessons for other urban areas. This is also the expectation of the local government and community.

Results from the case study on the current situation of flooding and inundation pointed to the following causes of worsening of flood and inundation related to urban development in An Van Duong urban area: elevation raising, transport system, drainage system, and upstream reservoir operation[1]. This paper will assess and analyze the urban planning and implementation process in An Van Duong to understand how this process had led to certain outcomes in urban infrastructure and construction in the local area. At the same time, we will analyze the role of stakeholders in decision making related to land use and development to identify factors in the urban planning and implementation process that contributed to the increase of flooding and inundation. Our main objective is to answer the question: What stages of the planning and implementation process did the causes of increased flooding and inundation risks arise from?

1 See "Phát triển đô thị ở vùng thấp trũng, bài học kinh nghiệm từ đô thị An Vân Dương", Urban Planning Journal, no. 21.

METHODOLOGY

COLLECTION OF DATA ON PLANNING AND IMPLEMENTATION

The research team collected, reviewed and synthesized data and documents related to the forming and development of An Van Duong urban area, and urban plans developed for this area, including: Master plan of An Van Duong new urban area; Detailed plans at 1:2000 for Zones A, B, C, D and E; and Master plan of Hue City until 2030 with vision to 2050. Through these data and documents, the research team explored the background to the planning of An Van Duong, reconstructed the urban planning process with major milestones, and identified the role and level of importance of different stakeholders—including the provincial People's Committee, Department of Construction (DoC), Urban Development Management Unit, planning consultants, other departments and agencies, social organizations, trade unions, project owners, and the local community. Based on this information, we identified issues specific to each period, then began the analysis to identify underlying causes of increased flooding and inundation related to urban planning and development.

CONSULTATIONS WITH LOCAL GOVERNMENTS AND EXPERTS

The research team conducted face-to-face interviews with individuals from the community and officials who were personally engaged in the development and approval of plans for the An Van Duong area to explore the reasons the eastern area of Hue City was selected as the location for urban expansion; and to understand the perception of stakeholders regarding the risks and issues related to flooding in the planning area, the government's orientations in urban planning and development in this low-lying floodplain, and decisions related to land use, elevation, and transport system. After that, the research team organized consultative meetings with experts for more in-depth understanding of the issues, and to reconsider, reevaluate and strengthen our assessments, in order to increase the credibility and objectivity with multiple perspectives. Consulted experts include consultants, managers and experts from project owner entities and implementing agencies in the An Van Duong urban area.

ANALYSIS, POLICY RECOMMENDATIONS, AND SOLUTION SUGGESTIONS

Contents from the consultations provided the basis for the research team to draw suggestions and policy recommendations for future urban development in other areas, as well as suitable solutions to the situation of the An Van Duong area itself. These suggestions and recommendations were presented for further feedback and comments and for revision before finalization.

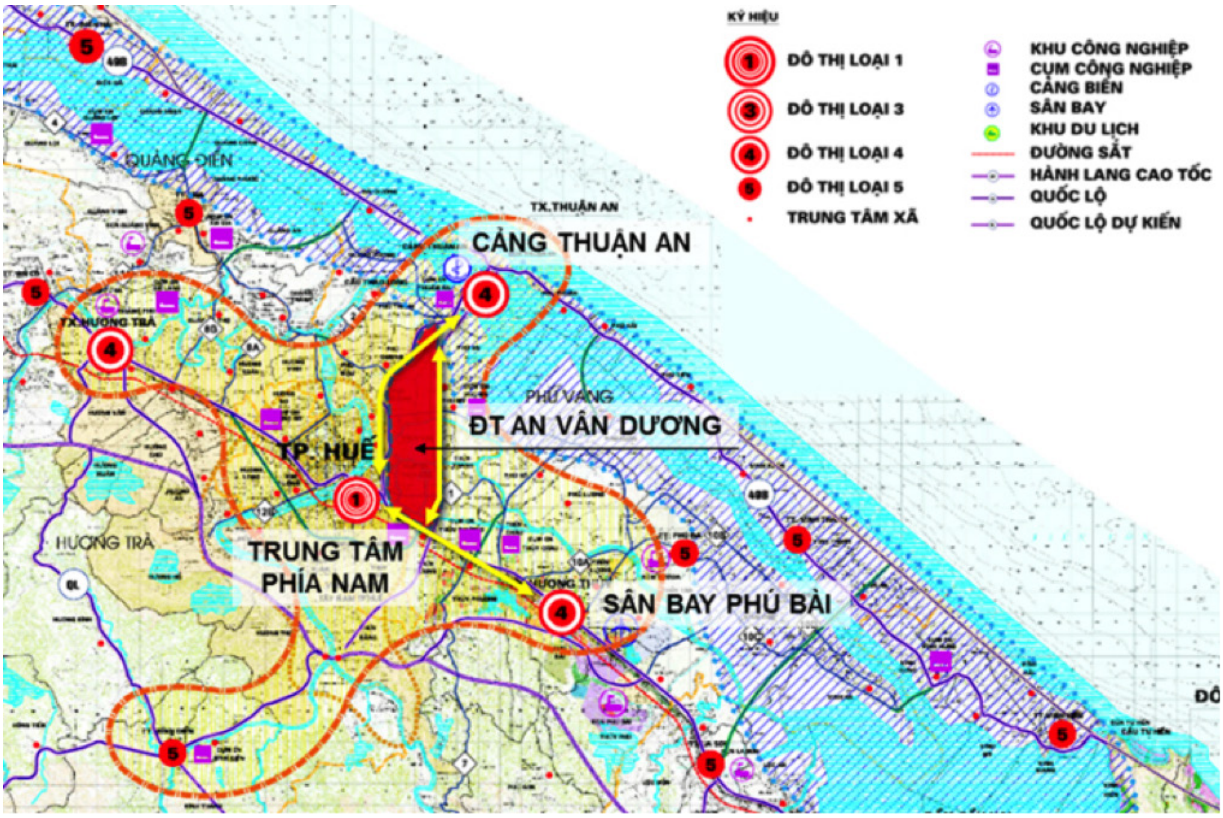
RESEARCH RESULTS

SELECTION OF A LOW-LYING AREA AS THE PLANNING SITE

Context of the plan

The planning of An Van Duong urban area was for the development of Hue City according to the Government's orientation. According to Decision no. 106/QĐ-TTg dated August 10, 1999 by the Prime Minister approving the urban master plan of Hue city, the direction of new urban area development was to be from the southern center of Hue city towards Phu Bai in the southeast and partly towards Thuan An in the east and northeast. Moreover, this plan also helped to meet the need for construction and expansion of Hue City, specifically: First, the establishment of the Thuy Duong – Thuan An route facilitates mobility and importantly, connects Hue City, Thuan An Port and Phu Bai Airport, which helps to promote tourism, service and industry sectors in the eastern area of Hue City, especially tourism development in Thuan An area. Second, creating an additional land pool helps to reduce population density (thus reduce population pressure in the old quarter area and the southern center of the city) through increasing the area of land available for future population development. Third, the plan responds to the need of expanding the city's development space, promote urbanization, build an image of a dynamic modern urban center, and promote the urban upgrade and development process in Hue City (towards the ambitious goal of gaining the entire province the status of a centrally managed city. Fourth, it contributes to fully developing public service, culture and sports facility systems, and constructing new residential areas for the city. Finally, new infrastructure development and land expansion

FIGURE 1. MAP SHOWING RELATIONSHIPS BETWEEN DIFFERENT AREAS IN THE THUA THIEN HUE URBAN REGION*



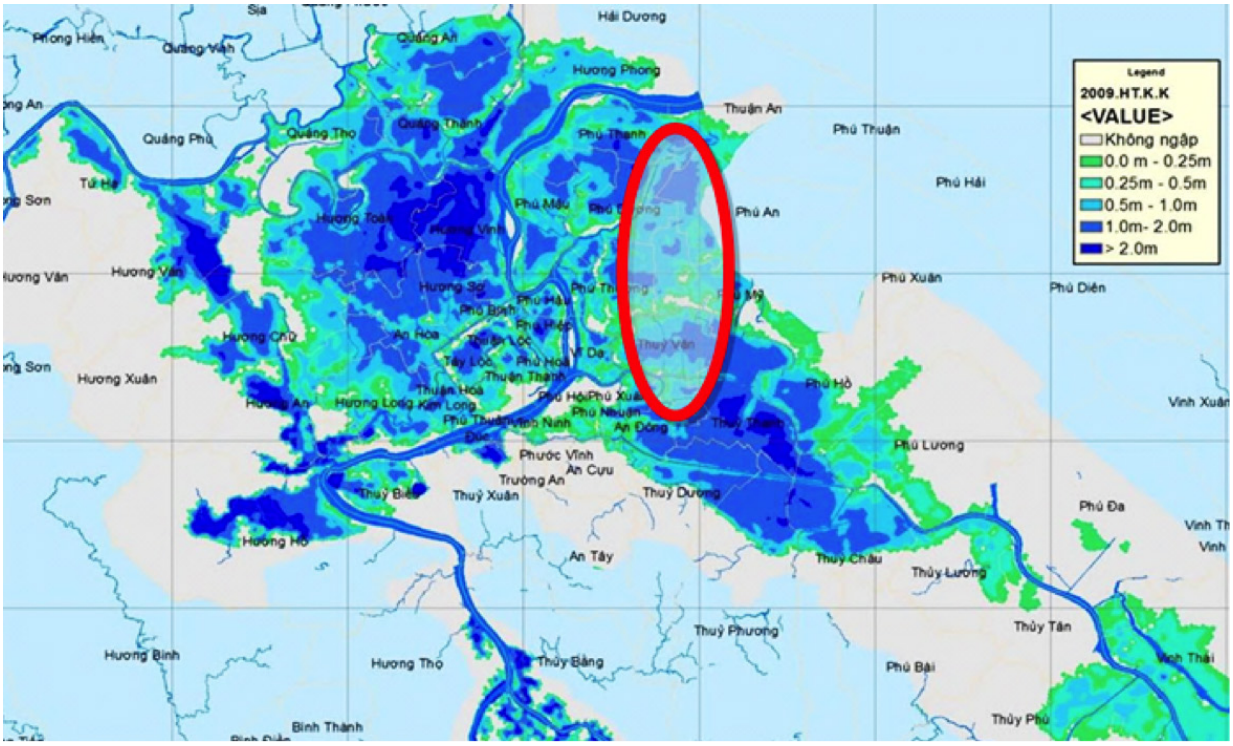
Source: Plan for Thua Thien Hue Urban Region

will draw people and investors to the eastern area of Hue City.

The selection of a low-lying area to the east of Hue City for urban development was made based on clear acknowledgement of potential risks and problems caused by flooding in this area. Specifically, Hue is susceptible to the impacts of annual flooding. Flooding has major impacts on the old center of the city to the south of Huong River, the Imperial City area to the north of Huong River, and low-lying peri-urban areas. An Van Duong area is identified as a particularly low and flood-prone area, which floodwater from the Huong River tends to flow through before reaching the sea at Thuan An estuary.

To ensure smooth progress in the construction of An Van Duong urban area and minimize negative flooding effects on its adjacent areas, the Thua Thien Hue provincial government required flood adaptive measures to be incorporated into the development plan. These measures include constructing upstream hydropower reservoirs to regulate and reduce flooding in Hue City center and new urban areas in low-lying neighborhoods; organizing land use structure and transport infrastructure to be well-connected and

FIGURE 2. FLOOD ASSESSMENT MAP IN 2005.



*Source: M-BRACE, 2013

continuous to facilitate safe flood drainage for the entire area; clarifying technical measures for drainage of Hue City and its surroundings; and limiting population development in floodway zones.

The local government had to weigh very carefully the decision to develop a new urban center in the eastern area of Hue city, and requested that planning measures include raising elevation, building drainage channels and culverts to reduce flooding damages. However, to implement these measures is very costly and time-consuming. At the same time, the selection of the low-lying An Van Duong for new urban development brought about various of potential risks of flooding and other natural disasters, particularly in the current context of strong climate change impacts. Main reasons for selecting this low-lying area for urban planning and development are described below.

By the time the master plan of An Van Duong was developed, urban development in Hue city was "spreading" in the manner that new urban areas were constructed in the immediate periphery of existing urban centers. Potential locations and scale of the An Van Duong urban area only included areas within Hue city and some of its surrounding areas.

The recommendations of development sites were made without assessment and analysis of the regional context. At the time the plan of An Van Duong was being developed, the provincial leaders were only

considering between the eastern peri-urban area (An Van Duong urban area) and the western area northwest of Hue Imperial City. In the discussions for location selection, no one pointed to areas further away but with more favorable conditions for development such as Huong Thuy or Huong Tra.

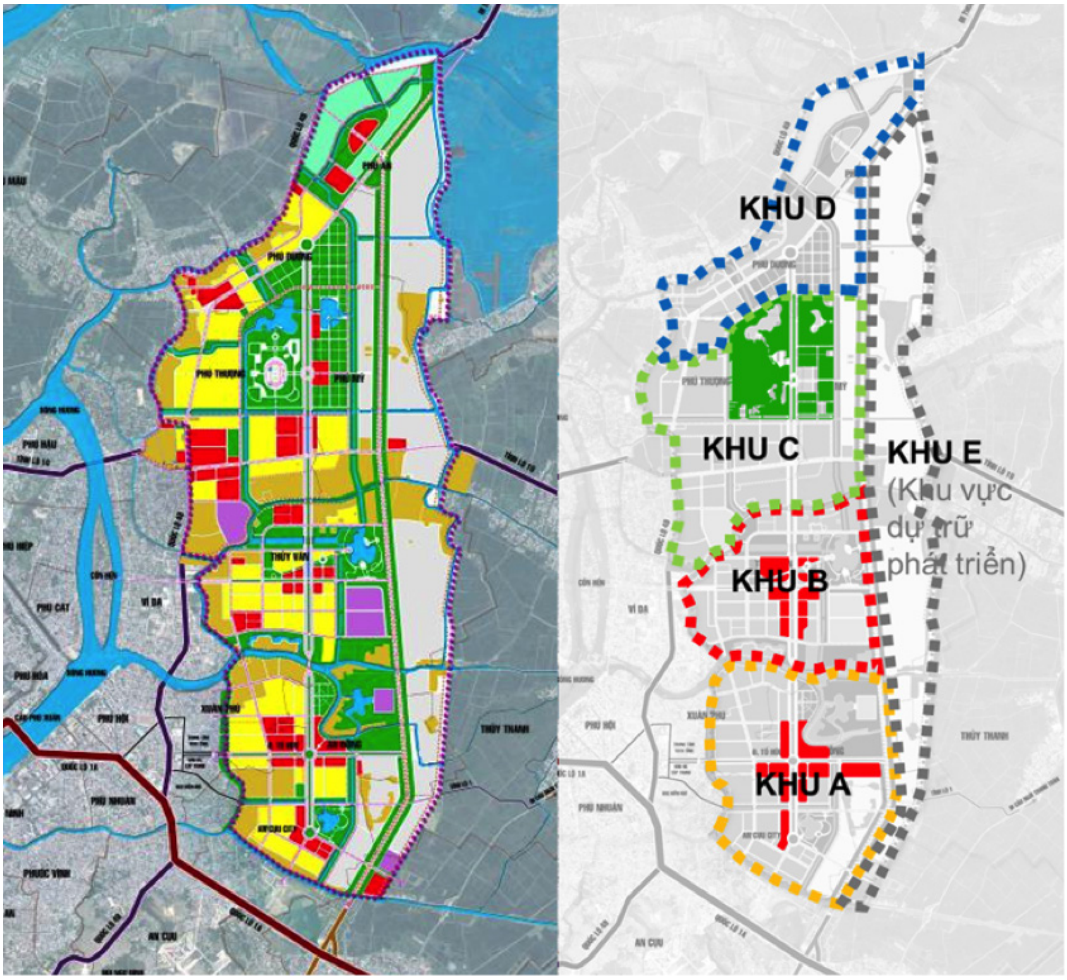
In addition, the selection of this location for urban development was also driven by a strong confidence on the use of large upstream reservoirs on major rivers in Hue for flood regulation. Available measures to limit floods from upstream are one of the main reasons An Van Duong was selected for urban development. Reservoirs do play a critical role in flood management. With flood regulation by upstream reservoirs, the magnitude of flooding and droughts in Thua Thien Hue province has reduced significantly during the recent years. However, using reservoirs as a flood control measure also entails potential risks. Reservoir management is particularly challenging task in the future context of climate change and increased extreme weather events. Firstly, there must be breakthrough measures for effective management and operation of these reservoirs, especially in unexpected circumstances or in severe flood events. Moreover, local people must be properly informed of hydropower reservoir discharge plans. According to the governments of communes in An Van Duong, due to untimely warnings of reservoir discharges, people in low-lying areas did not have enough time to prepare and respond, which affected their agriculture activities and resulted in large crop losses. Secondly, hydropower and irrigation reservoirs should be designed to adapt to new situations, as climate change impacts become more complex and extreme weather events more severe. Monitoring data at Hue Meteo-hydrological Center shows that precipitation in Hue city has increased continuously in recent years with more prolonged rainfall events combined with flooding and inundation. Furthermore, analysis in Hue shows that actual precipitation levels have already exceeded all projections in scenario B2, which is regularly used as a basis for recommending climate change integration into plans and construction process (M-BRACE, 2013).

OVERLY AMBITIOUS PLANNING SCALE IN COMPARISON TO PLANNING TIMEFRAME OF 15 YEARS (FROM 2005 TO 2020)

The An Van Duong urban master plan has very ambitious objectives. It has a total planning scale of 1,700 ha (the majority of which was agriculture land), and aims for a population increase from 11,900 to 25,000 for Phase 1, over 520 ha until 2010, and to 60,000 in the long term. Specifically, Zone A has 202 ha for Phase 1 and 441 ha in the long-term with expected population of 18,400 people; Zone B has 92 ha for Phase 1 and 331 ha in the long term with expected population of 10,600 people; Zone C has 111 ha for Phase 1 and 590 ha in the long-term, with expected population of 20,800 people; and Zone D has 115 ha for Phase 1 and 338 ha in the long-term, with expected population of 10,200 people.

Urban planning in Vietnam still follows a top-down process. In reality, it is entirely the translation of 5-10 year socio-economic objectives into land use plans and plans of functional spaces. This approach has many shortcomings and does not meet requirements for climate change adaptation and sustainable development. The overall objective of the master plan for socioeconomic development of Thua Thien Hue province to 2020, approved by the Prime Minister

HÌNH 3. LAND USE PLAN AND LOCATION OF ZONE A, B, C, D AND E*



Source: The research team from analysis of An Van Duong urban master plan.

on 17/6/2009, is to develop Thua Thien Hue into a centrally administered city. This has been the overall objective for Hue city over the past 20 years. One of the key requirements for the province to achieve this objective is to speed up urbanization rate. This requirement was specified in the development plan of Thua Thien Hue region until 2025 (approved in 2009), which aims for an urbanization rate from 40–45% in 2015 and 55% in 2020 in entire province. In 2011, in the adjustments to the urban master plan of Thua Thien Hue region, approved by Thua Thien Hue PPC in Decision no. 986/QĐ-UBND dated 13/5/2011, this target urbanization rate was set to increase to 60–62% in 2020, 63–65% in 2030, and 65–70% in 2050. Therefore, the majority of urban development plans in the province were greatly larger in size

than actual development potential, thus are highly infeasible. Actual population development rate of Hue City is much lower tan these targets. After 9 years of implementation, Hue city population increased from 290,000 in 1999 to only 350,000 in 2014 (an increase of 60,000 in 15 years). This population increase of the entire Hue city is equal to the expected population planned for An Van Duong area alone. Moreover, people in Hue often choose to live in areas nearby the city center (such as Kim Long and Huong So wards), or less flood-prone areas (such as higher lying areas to the west). In conclusion, the planned population growth in An Van Duong was much larger than the actual prospect. Inevitably, the province was unable to identify financial resources and plan investment staging appropriately for construction. According to the master plan, the construction of all zones A, B, C and D will be completed at the end of Phase 1 in 2010, on a total area of 520 ha. All major roads, including regional roads such as Thuy Duong – Thuan An and the northern ring road, and key roads inside the city, were planned to be constructed in this phase.

These targets in the development of An Van Duong urban area, together with provincial leadership's desire to quickly develop the area, led to patchy construction in An Van Duong. Moreover, the province had to invest in technical infrastructure systems that directly connect to and support all private investment projects at very high cost. In the construction of An Van Duong area, Thua Thien Hue province also faced particular difficulties in mobilizing investment and resources for infrastructure construction. Due to lack of funds, the province could only invest in the construction of roads but not important drainage infrastructure that should accompany these roads[2], which led to increased flooding and inundation in the area. In addition, because of the expectation and pressure to rush completion on schedule, the selection of investors was ineffective. Many investors registered and were allocated lands for construction, but did not start construction. These delays mean that substantial areas of agricultural land were taken too early to allocate to construction projects and then left to sit idle. Although the Urban Development Management Unit was highly attentive to making proper compensation to the displaced people, hasty acquisition of agriculture land led to disruptions of farming livelihoods in the An Van Duong area. People had to adopt alternative livelihoods, usually low-paid and unstable ones (such as tricycle rickshaw drivers, construction workers, factory workers, retail traders, or day-laborers), and their lives became much more difficult.

LACK OF PARTICIPATION BY THE COMMUNITY, SOCIAL ORGANIZATIONS AND PROFESSIONAL ASSOCIATIONS

In developing urban plans, the participation of stakeholders, including the government, relevant departments/agencies, the community, social organizations and professional associations, is critical to the success of the plan. This collaboration will help the plans to be more feasible, contextualized, and directly responsive to the needs of the community, at the same time facilitate implementation. In the planning of An Van Duong urban development, there was active participation of functional departments and consultants, who provided many useful suggestions.

2 According to interviews with technical staff of Thua Thien Hue Urban Development Unit

Moreover, the plan also received support by the provincial People's Council before being approved. However, the participation of the community, social organizations and professional associations was limited. This was largely due to the fact that consulting with these stakeholders was not legally required at the time the planning process was taking place[3]. The result is ineffective implementation of the An Van Duong urban development plan, and unadequate flood management measures. There has been increased flooding and inundation in existing residential areas, and prolonged flooding in an extensive area.

INSUFFICIENT PRIORITY GIVEN TO THE CONSTRUCTION OF DRAINAGE COMPONENTS IN IMPLEMENTATION

As described above, water and flood drainage measures were always considered one of the top priorities in developing the An Van Duong master urban plan. However, in the actual implementation of this plan, there were many problems related to flood management.

The ground elevation proposed for the residential areas was inappropriate, leading to increased flooding and inundation. In the approval of the detailed plan for Zone A in 2007, and Zone B and C in 2009, the ground elevation for construction in An Van Duong urban area continued to be reduced to approximately 2.1 m[4], with the aim of improving drainage capacity in a large area. However, the suggested ground elevation for existing residential areas was inappropriate, and there were no workable drainage measures for these areas. Detailed urban plan at the ratio of 1:2000, prepared for Zone A, B and C, required that the ground elevation of existing residential areas should be 2.0-2.3 m, equivalent to that of newly constructed areas. At this ground elevation, natural surface drainage measures were suggested. The current elevation of most existing residential land was 0.3-1.0 m lower than stipulated in the detailed plan, while no ground elevation raising measures were proposed. In fact, this cannot be done in large scale for residential areas with long-established and fairly stabilized topograhy. Ground elevation raising is actually unfeasible to carry out in large scale if proposed. Therefore, existing residential areas will have lower ground elevation. This together with the lack of drainage facilities made these areas the first to be hit by flooding impacts and made the flooding more prolonged. The main cause is that local flooding and inundation information was not updated and processed properly by relevant agencies.

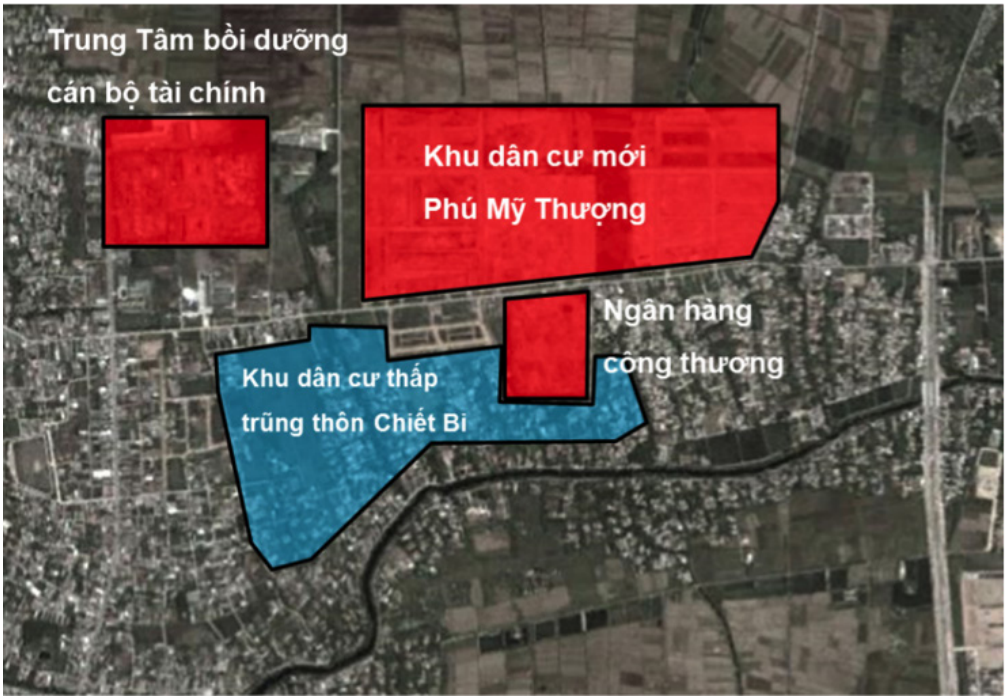
Proposed ground elevation for green areas, parks, and sports areas was also inappropriate. In the master plan, ground elevation of these places is lower than that of nearby residential areas and public facilities, in this way they contribute to storing floodwater and reducing flood impacts on surrounding areas. However, the elevation of these places as provided in the detailed plans of each zone is 2.0 m (almost equal to the limit ground elevation for annual flood control at 2.01 m). Thus, their supposed role in water sharing and limiting flooding impacts, as stipulated by the master plan, no longer applies.

The road and drainage systems constructed were ineffective. System of drains along roads is not working for two main reasons. First, the system of

3 According to item 2, Article 21, Construction Law 2003, only detailed plans require consulting with local community. It is not required for urban master plans.

4 Ground elevation to control annual flooding

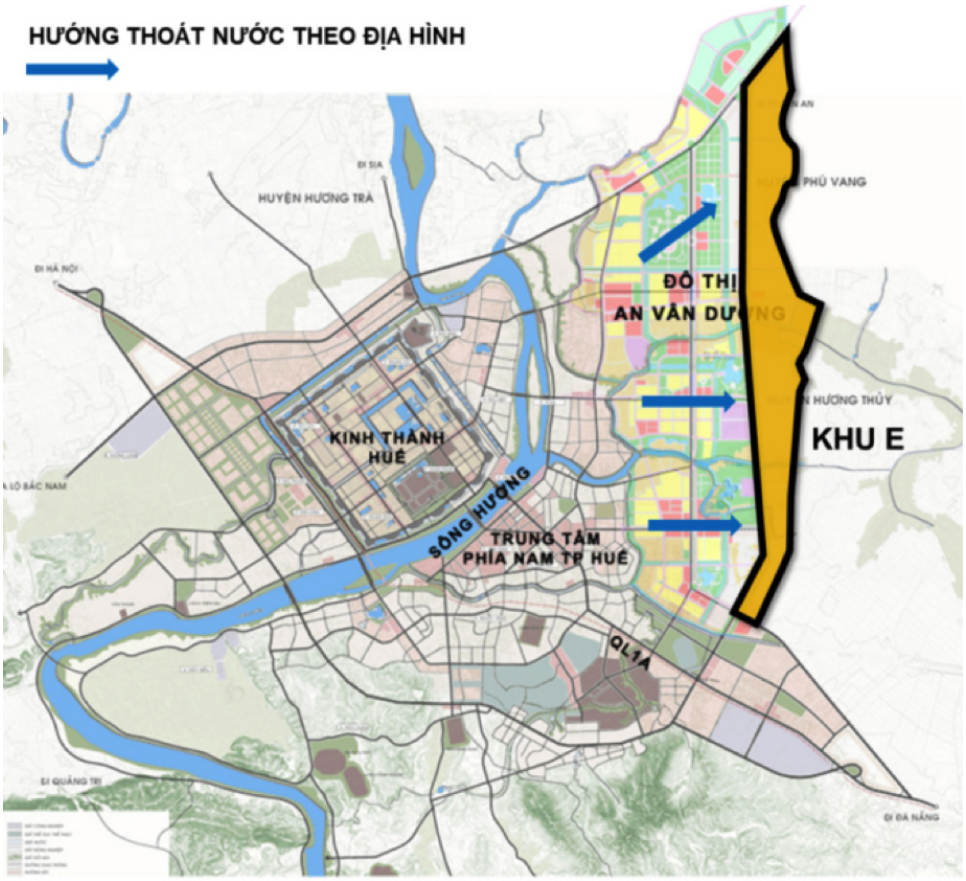
FIGURE 4. MAP OF FLOODED AREA IN CHIET BI VILLAGE, PHU THUONG COMMUNE, PHU VANG DISTRICT, AN VAN DUONG URBAN AREA



canals and regulating lakes planned to link to river branches and allow quick drainage to rivers and the sea had not been built. Thus, rainwater and floodwater drainage was not facilitated as stated in the elevation scheme. Second, the urban drainage systems that accompany the construction of major roads are planned to allow the collection and drainage of water to rivers. However, these drainage systems were not fully constructed and were not connected directly to rivers and channels. Instead, construction stopped mid-way inside residential areas and ends abruptly in areas where construction projects have not started. As a result, floodwater cannot drain out to rivers, causing localized flooding and inundation in existing residential areas, and increasing flood duration in many major parts of An Van Duong urban area.

Construction in Zone E did not fullly consider flood risks and might lead to more severe flooding. Currently, the 1:2000 detailed plan for Zone E of An Van Duong urban area is being implemented. According to the master plan, Zone E was to be a reserve zone, serving additional functions absent in the other zones. For this reason, Zone E was to be constructed after the construction of Zone A, B, and C and an evaluation of any missing functions completed. Our surveys show that only 13% of An Van Duong urban area had been completed or were under construction so far. Thus, there remain large

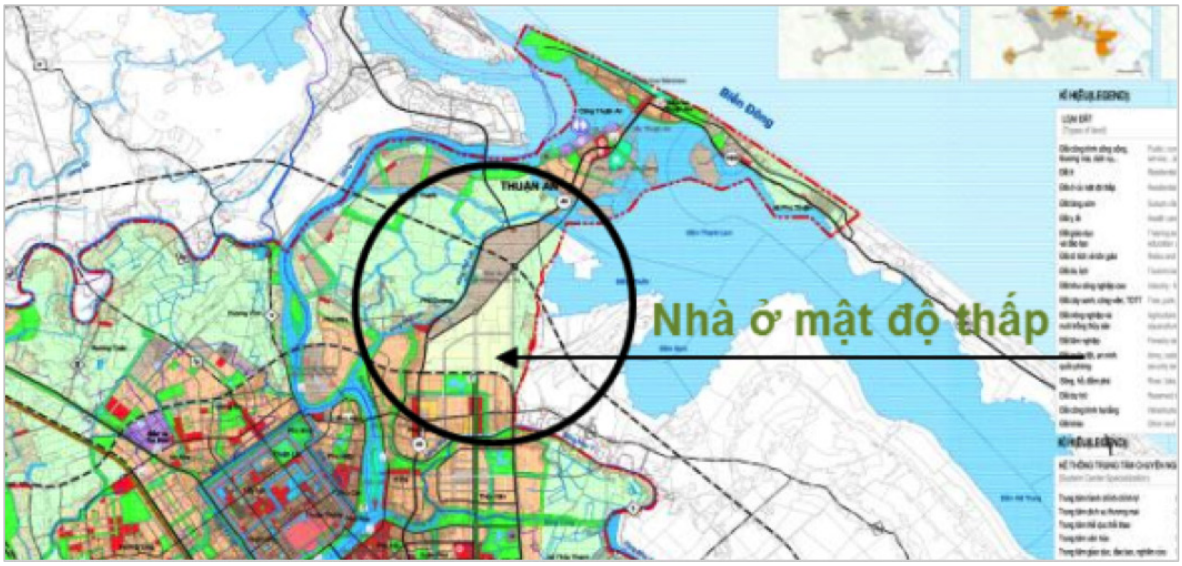
FIGURE 5. LOCATION OF ZONE E, AN VAN DUONG URBAN AREA



areas of low-lying agricultural and residential land in An Van Duong. Therefore, if the construction of Zone E is carried out before these remaining areas are developed, it is likely to, along with the Thuy Duong – Thuan An road, create artificial walls that block the flow of floods, exacerbating flooding and inundation in Zone A, B, and C and the entire center area south of Hue city, including the Imperial City area.

There were limitations in the implementation of this plan during development of Hue City urban master plan until 2030 with vision to 2050. In 2012, the Korean International Cooperation Agency (KOICA) supported Thua Thien Hue province to revise Hue City urban master plan until 2030 with vision to 2050. The main consultant of this project is the joint venture of two Korean companies: Dohwa (responsible for spatial planning direction), and Hana (responsible for planning technical infrastructure). With the experience and vision of these international consultants, responding to climate change and natural hazards is one of the most important directions identified for the adjustment. To adapt and respond to natural

FIGURE 6. MAP OF LAND USE PLAN AS APPROVED BY THE NATIONAL GOVERNMENT



hazards in Hue City in general and An Van Duong urban area in particular, the project suggested three related strategies, i.e., satellite city model (compact city) combined with green belts for flood drainage; prioritizing the expansion of space for floods (green belts for flood drainage) along rivers; and limiting development in low-lying areas in the east.

One important adjustment suggested was to limit development in low-lying land around the current Hue City area, one such important location being the northern area of An Van Duong (Zone D). This area will be developed in a way that preserves low-land agriculture and lagoon surface landscapes, combined with developing small to medium-scale eco-tourism models in certain areas along the Huong River. At the same time, housing development is not encouraged outside existing rural neighborhoods that need upgrading.

However, in the land use plan submitted by the city to the national government for approval, there were some important diversions from the above suggestions. The entire agriculture area in the northern area of An Van Duong was assigned to be an area of low-density housing. In this way, the nature of this area will be very different from the overall idea by the Korean consultants, with further urban development towards the direction of Thuan An town. As a result, water flows will be obstructed and flood risks heightened in existing residential areas in Hue City.

LACK OF DATABASE ON CLIMATE CHANGE AND NATURAL DISASTERS

In the development of An Van Duong urban master plan, many flood response measures were suggested. The consultants and local government are both keenly interested in these measures. However, at the time of An Van Duong master planning (prior to 2005), climate change information was not as widely accessible as it is today. Therefore, flood response measures were suggested mostly based on historical flood data, especially the extreme flood in 1999, and so highest ground elevation for annual flood control in the area is 2.01 m. However, according to more recent research, planning to respond to climate change in today's context means to acknowledge that flood and storm events that today we call 'historic' will occur more frequently in the future. At the same time, the intensity of these 'historic' flood and storm events might increase (heat waves will be more intense, and typhoons will be more violent) (DiGregorio, 2013). Applying the most optimistic scenario of future GHG reduction, the Institute for Meoteo-hydrology's modeling results forecasted that in the central region of Vietnam, summers will become hotter, drought periods will be longer and more severe, and tropical storms will be more frequent and strong (MNE, 2012).

POLICY RECOMMENDATIONS AND SOLUTIONS

This research had identified several issues related to increased flooding in the area, which fall into five categories: policy, perspectives, implementation process, information, and communication, and suggested solutions under each category. Solutions are divided into two types: policy recommendations for urban development are lessons from the urban planning and development process in An Van Duong that can be applied in new urban development in the future, and suggested measures to resolve flooding issues in An Van Duong urban area.

GENERAL POLICY RECOMMENDATIONS FOR URBAN PLANNING AND DEVELOPMENT

Selection of site for new urban planning and development

Category	Issue	Recommendations
Perspectives	Lack of awareness about how climate change impacts increase flood risks in low-lying areas	Raising awareness of local government leaders and staff through training programs from central to local levels

Identification of planning scale

Category	Issue	Recommendations
Perspectives	Lack of awareness on the need for realistic assessment of population development and investment needs	Raising awareness for government leaders and staff and consulting agencies through education programs from national to local levels
Implementation process	Lack of guidelines on urban assessment methods	Incorporating the needed contents in the following documents: Law on Planning, Government decrees, and MoC circulars

Stakeholder participation in the planning process

Category	Issue	Recommendations
Policy	Lack of specific guidelines on community consultation and the roles of departments and agencies Lack of regulations to require consultation for certain types of projects	Incorporating the needed contents in the following documents: Law on Planning, Government decrees, and MoC circulars
Perspectives	The role of local community in planning is not fully acknowledged.	Organizing communication and awareness raising activities
Implementation process	Community consultation is mostly procedural.	Issuing new circulars to provide detailed guidelines on the process of community consultation
Information	Planning information is mostly managed by functional departments and local government. Local people and business face difficulties in accessing information on urban plans.	Creating new channels to provide planning information to the community, such as websites and supporting software

Climate change integration

Category	Issue	Recommendations
Policy	Lack of legal framework for integrating climate change into urban plans	Incorporating the needed contents in the following documents: Law on Planning, Government decrees, and MoC circulars
Perspectives	Lack of awareness on climate change and warnings on its impacts on buildings and infrastructures	Strengthening communication and training
Implementation process	Lack of land surveys, synthesis, and assessment of climate change impacts and trends	Organizing research, monitoring and assessment of local flood impacts
Information	Lack of local climate change data	Conducting research to collect, analyze and provide accurate local climate change data
Communication	Lack of channels for data accessing	Creating new channels to provide planning information to the community, such as websites and supporting software

Limitations in the urban planning and implementation process

Identification of ground elevation

Category	Issue	Recommendations
Perspectives	Lack of awareness on flood response measures, leading to improper responses. For example: assigning ground elevation of 2.0 m for green zones and parks deprived them of the role in storing floodwater, preventing inundation and facilitating drainage.	Organizing communication and awareness raising
Communication	Lack of local voicing over issues related to increased flooding and inundation in existing residential areas	Strengthening the participation of local communities in urban planning and implementation

Transport infrastructure

Category	Issue	Recommendations
Implementation process	Roads constructed lack capacity for local flood drainage, instead become walls that prevent flood flows and increase flood duration. Bridge spans are not large enough to drain floods.	Constructing large enough culverts under roads at suitable locations for flood drainage. Constructing new bridges with adequate spanning
Communication	Lack of information sharing between local governments and local community to increase responsiveness to inundation in village roads	Enhancing engagement of local residents in the urban planning and implementation process

Drainage system

Category	Issue	Recommendations
Implementation process	Lack of drainage infrastructure in many existing residential areas, which leads to increased inundation	Building the infrastructure as needed
	The drainage systems are not constructed together with roads.	Building the infrastructure as needed
	There are difficulties in connecting different projects in the planned areas.	Reviewing data to ensure accuracy before construction

Upstream reservoir operation

Category	Issue	Recommendations
Implementation process	No measures to prevent or respond to failures in reservoir operation	Proposing scenarios related to reservoir operation and corresponding responsive actions for each scenario
Communication	Communication of reservoir discharge to communities is not done properly.	Strengthening the management of reservoirs, providing timely information to downstream communities about reservoir discharge plans

SPECIFIC MEASURES TO REDUCE FLOODING IN AN VAN DUONG

Urban planning

Category	Issue	Recommendations
Perspectives	Investment focuses were not in accordance with the area's potentials in terms of location and landscape.	Adjusting investment priorities to focus on completing the construction of Zone A, and investing in eco-tourism in the northern area (an area with typical lagoon landscape)
Implementation process	Planning scale was over-ambitious compared to timeframe of the plan, actual urban development, and housing demand in Hue.	Conducting a comprehensive assessment of the urban planning and implementation process in An Van Duong to provide the basis to adjust the plans in accordance to actual urban development potentials of Hue City.
	Investment phasing was inappropriate.	Adjusting the investment phasing, specifically: • Limiting development in the northern area • Focusing on construction in Zone A, the area with best advantage for urban development • Determining the phasing of other zone's construction based on the province's resources and actual capacity of investors
	There is no appropriate development model for Zone D.	Selecting an appropriate model for the development of Zone D based on the following criteria: • Minimizing large-scale urban development • Developing clustered eco-tourism at suitable locations • Developing ecological neighborhood models
	There is yet any proper planning direction for the reserve zone (Zone E). The plan has to make sure of: • Providing flood drainage • Supplementing missing functions in Zone A, B, C and D • Appropriate urban model	Proposing suggestions for Zone E, specifically: • Researching and assessing functions needed in Zone E • Creating new green areas connecting planned green areas in Zone A, B, C and D • Developing ecological neighborhood models
Information	Lack of information on climate change and flooding and appropriate structural measures for local people and investors	Conduct research to collect, analyze and provide accurate data on climate change and flooding in An Van Duong urban area

FIGURE 7. MAP OF SUGGESTED DEVELOPMENT IN ZONE D

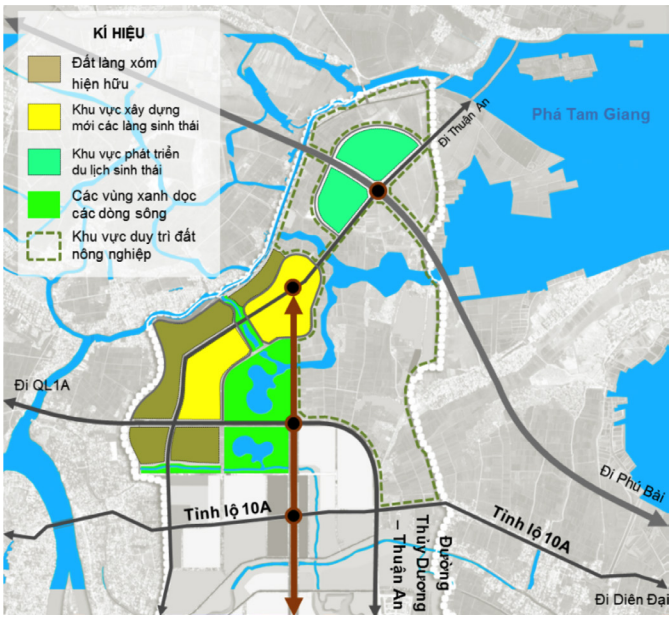


FIGURE 8. MAP OF SUGGESTED DEVELOPMENT IN ZONE E

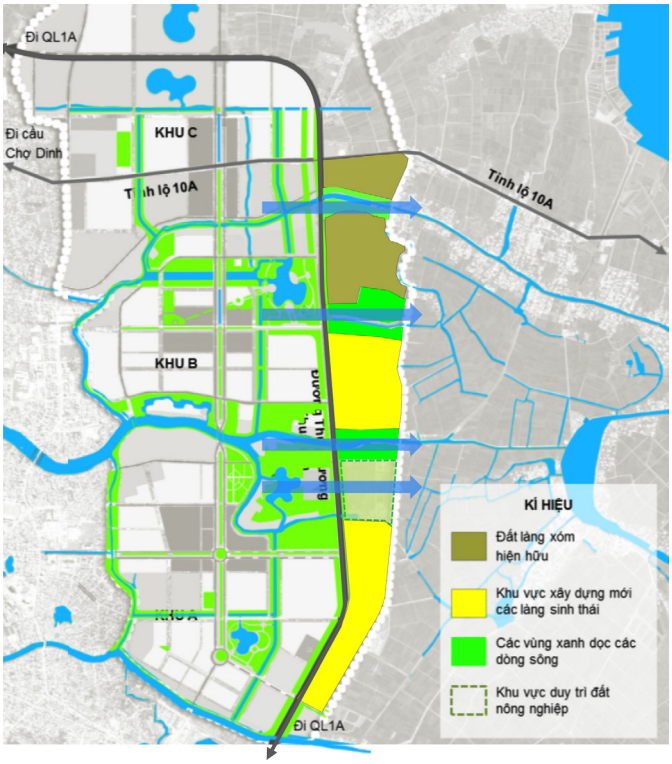
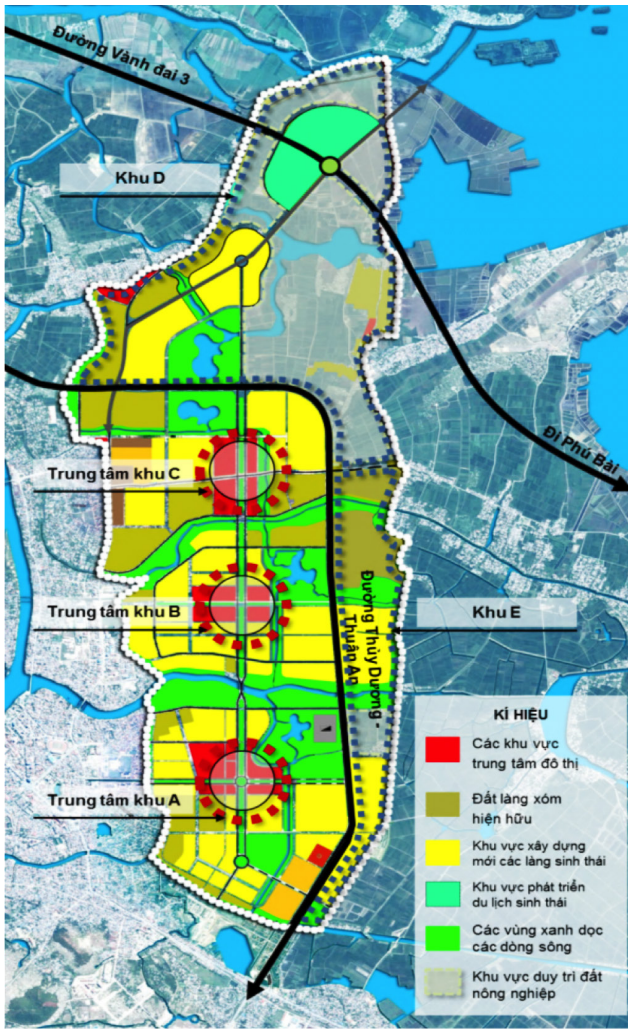


FIGURE 9. MAP OF ADJUSTMENTS TO THE URBAN MASTER PLAN OF AN VAN DUONG



Drivers of increased flooding

Drainage

Category	Issue	Recommendations
Perspectives	Project investors are not concerned about connecting with the drainage systems in the project's surroundings.	Organizing communication and awareness raising. Proposing ways to reward and encourage, or preventive sanctions to make sure of needed drainage system inter-connection.
Implementation process	Lack of water collection and drainage systems in existing residential areas.	Building water collection system at locations adjacent to new urban areas with higher elevation to help collect the water from higher areas and direct it into the common drainage system or rivers. Building a sewage drainage system along village roads to facilitate quick drainage during time of flooding.
	Water transferring canals have not been built in constructed areas (Zone A and along provincial road no. 10).	Build water transferring canals in Zone A and along provincial road no. 10 in An Van Duong urban area.
Communication	Lack of information sharing between local governments and local community to increase responsiveness to inundation in village roads.	Enhancing consultation with local community regarding local flooding and inundation situations, at the same time soon resolve flooding issues in the area.

Transport system

Category	Issue	Recommendations
Implementation process	Culverts in major north-south roads are not wide enough for flood drainage. Bridge spans are not large enough for flood drainage.	Constructing a system of large culverts across constructed roads to ensure proper flood drainage Constructing new bridges when possible

FIGURE 10. MAP OF THE WATER COLLECTING AND DRAINAGE SYSTEM ALONG VILLAGE AND HAMLET ROADS (DRAINAGE TOWARDS THE NORTHERN BRANCH OF NHU Y RIVER)

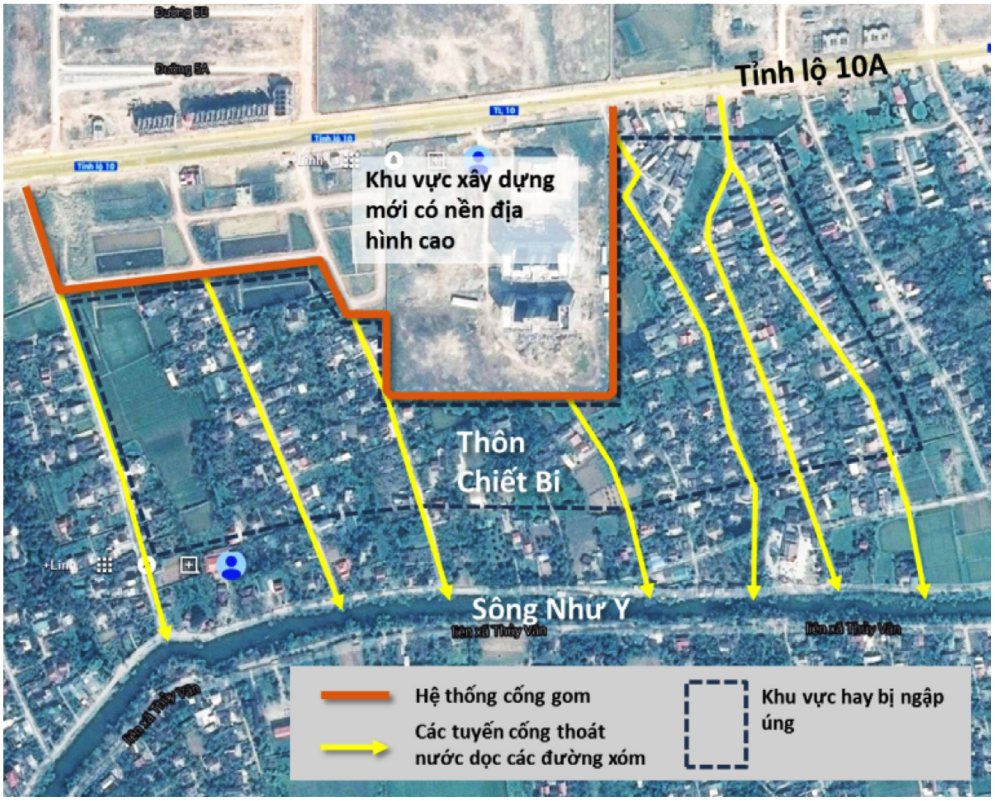


FIGURE 11. MAP OF SUGGESTED LOCATION FOR CULVERTS IN ZONE A, AN VAN DUONG URBAN AREA

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Funded by the Rockefeller Foundation

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