

MINISTRY OF EDUCATION AND TRAINING MINISTRY OF CONSTRUCTION
HANOI ARCHITECTURAL UNIVERSITY

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**MANAGEMENT OF SPACE, ARCHITECTURE, AND
LANDSCAPE OF DIKES IN THE HISTORIC INNER
CAPITAL AREA OF HANOI**

**MAJOR: URBAN MANAGEMENT
CODE: 9580106**

SUMMARY OF DOCTORAL THESIS

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ABSTRACT

1. The dissertation's necessity: Hanoi is a city found between rivers, and its location, dikes, and rivers have always been its resources. Over the last three decades, Hanoi has experienced drastic changes and transformed into a thriving city. While the historic inner capital area has succeeded in fundamentally preserving its former structure, its density has grown with more buildings and a higher population. Dikes have always been and will be historical witnesses to urban development. Despite their diminishing functions and forms, their distinctive values and images persevere even in modern days. In schemes for urban planning of the historic inner capital area, dikes receive inadequate attention with their values yet to be accurately evaluated and determined in the city's structure. At the same time, these dikes have not been consistently managed regarding their space, architect, and landscape (hereinafter referred to as SAL). The historic inner capital area (HICA) is an important area for urban development, and thus SAL organization is needed to preserve and make use of the dikes' inherent values. These values are not only present in flood prevention as they were fortifications in the old days and serve transportation purposes nowadays. These values are highly visible in the structure of the HICA throughout the city's thousand-year history and form urban images of the historic inner capital area's SAL. Therefore, these dikes need to be assessed, researched, and managed in SAL organization, urban planning, and urban design as the basis for organizing, implementing, and managing planned urban development to form distinctive SAL for the HICA's image. For the aforementioned reasons, looking into "Management of SAL of dikes in the HICA" is vital, topical, practical, and meaningful.

2. Research purposes: To suggest solutions for SAL management to preserve and make use of the dikes' values in the sustainable development

and preservation of distinctive features of the HICA.

3. Research subjects and scope: Subjects: SAL management of dikes in the HICA; Scope: Boundaries of the HICA are defined per General Planning 1259 from Huu Hong dike to Ring Road No.2, thus this area includes: 4 districts (Dong Da, Hoan Kiem, Ba Dinh, and the North of Hai Ba Trung district) and a part of Southern Tay Ho district, excluding Red River banks (which are parts of Red River corridors); until 2030 with a vision to 2050.

4. Research methods

- * Information collection and survey
- * Non-experimental methods
- * Information processing
- * Urban morphology analysis
- * Historical research; * Map overlay
- * Expert consultation
- * Schematization
- * Forecasting and compilation

5. Research content: With the scope of the thesis topic, the author focuses on researching the orientation of controlling the organization of SAL of dike in urban planning. and institutional management of the HICA.

6. Research results: Identify the characteristic value and role of dikes in the formation and development of historical urban structure; Proposing solutions for SAL management of dykes in the HICA;

7. New contributions of the dissertation:* Identify SAL of dikes in urban development and values of dikes in the HICA area; *.Suggest criteria for identifying distinctive values of dikes; Classify dike forms and divide areas for managing distinctive SAL of dikes; *.Suggest groups of solutions for managing SAL of dikes;

8. Scientific meanings: Identify distinctive values in SAL of dikes in the HICA to use as the basis for the suggestion of solutions in managing SAL of dikes. Systemize principles regarding SAL management of dikes; Contribute reference materials in research and heighten the public's knowledge and awareness regarding distinctive images of these dikes in the city.

9. Definitions (terms): Based on cited definitions, some up-to-date definitions used in the dissertation are as follows:*.Management of dikes' SAL is a part of professional management work in urban architecture and planning, including formulation, assessment, and approval of urban planning to control SAL and organize the implementation and management of urban development as planned; *.Urban topography in the HICA: is a convex and concave (high or low) surface structure in which the dikes act as a natural slope that affects the field of view, light, temperature, and humidity. Dikes in the HICA are construction works that have been preventing floods from Red River, while dikes at To Lich river (a part of the river has been buried and the rest is somewhat affected by floods from Red River) and Kim Nguu river (the river has experienced sedimentation) shaped Thang Long citadel. Currently, urban roadways make up the structure of the HICA's space; *.The HICA's dikes are a system of specialized construction works that shaped this area's artificial space, there by constituting themselves an organic part of modern urban life. These dikes include dikes on the right bank of the Red River and old dikes that can be considered fortifications for the citadel. These dikes are 35 km in length and their breadth, in this research, includes different soil layers as these dikes have changed throughout the historical urban development of the HICA area, from the height of the current dikes to the height of the base of each dike.

10. Structure of the dissertation: The dissertation is comprised of three parts: Abstract; Body; Conclusions and recommendations. The body includes three chapters: Chapter 1. Overview of the management of SAL of dikes in the HICA in Hanoi (41 pages); Chapter 2. The scientific basis on the management of SAL of dikes in the HICA in Hanoi (45 pages); and Chapter 3. Solutions on the management of SAL of dikes in the HICA in Hanoi (54 pages);

BODY

CHAPTER 1. MANAGEMENT OF SPACE, ARCHITECTURE, AND LANDSCAPE OF DIKES IN HISTORIC INNER CAPITAL AREA IN HANOI

1.1. Management of SAL of dikes in cities around the world: Across the globe, each city comes with its own characteristics depending on its natural location and thus inherently carries elements for identification. Natural location and topography are closely linked to urban spaces in countries around the world. As their geological structure differs from one another, no city is identical to another and so are their dikes, not to mention the political regimes of countries where these cities are found. Therefore, it is necessary for each country to come up with unique measures for urban management. This dissertation provides a general introduction to the management of SAL of dikes or near-river areas in Asia and Europe, as well as a closer look at the Netherlands, a country shaped by its dikes;

1.2. Dikes in Red River Delta and Hanoi

1.2.1. Natural topography and landscape: *.Historical geological formation: Hanoi and the delta are situated in an area with a long and complex geological history as this area has received a huge amount of sediment, mainly clay and sand, from the Red River and Thai Binh River across hundreds of meters. Red River's bed meanders as much as 8 km before it is conquered by the surrounding dikes;*. **The distinctive structure of the topography and natural landscape:** Hanoi's structure has both areas of subsidence and low-lying areas and thus this structure is called "the sagging of Hanoi" [44]. These are similar to wide strokes in Hanoi's topographical canvas, shaping the city somewhat like a valley. The natural landscape is linked to meandering rivers due to their flow through sedimentation, dividing the city's natural landscape into four areas as follows: The North of Red River; the inner metropolitan area (per General Planning 125) expands to

Nhue River and the South of Duong River; Mountainous areas of Ba Vi and Soc Son; The limestone mountains in Chuong My-My Duc; The transitional area between the near-river delta and mountainous area along the dikes of Day River.

1.2.2. Dikes and the formation of Vietnamese people's living spaces:

***.The formation of dikes and topography changes:** Hanoi experiences abrupt changes in elevation at places where its rivers begin. The confluence of Da, Lo, and Thao rivers faces constant threats as the flow of these rivers is swift and turbulent, thus giving birth to floods in huge volumes from high grounds that could submerge the delta should the dikes not be there to provide protection. Therefore, "dikes are strong fortifications, standing tall and significant above sediments" [41: 82]. These dikes are the boundaries of a new living space; ***.Rivers and dikes in urban establishment and development of the historic inner capital area:** The construction of the dikes to prevent floods, as well as fortifications in the historic inner capital area have deformed the rivers, raising the river bed higher and higher, and making the alluvium outside the dikes higher than that inside the dikes. The morphology and structure of villages in the delta have features different from those of villages in other regions due to these dikes.

1.2.3. Classification and identification of dikes' SAL in the urban development of the historic inner capital area: *.Classification of dikes in the historic inner capital area:

Dikes in the HICA area are classified following criteria of functions, the morphology of dike roads, and natural height. These are important elements to form a space. The three types of dikes are as follows: **Type 1 dikes:** Dikes for direct flood prevention (dikes on the right bank of Red River) are special dike roads with a height of 9 to 15 meters and cement embankment walls of 1.5 meters in height to protect the Capital; **Type 2 dikes:** Dikes that no longer directly prevent floods (La Thanh dikes)

are dike roads that embrace Thang Long Citadel from To Lich, Thien Phu, and Kim Nguu rivers in the old days; **Type 3 dikes:** Dikes that have been leveled to the natural height (dikes of Hang Streets) These are remnants of old dikes that were transformed due to the flow of Red River in urban development and some of type 2 dikes: Tran Khat Chan, Dai Co Viet; Lạc Long Quan (from Buoï dike to Xuan La T-junction); Hoang Hoa Tham and Van Cao-West Lake, Buoï dike and Dao Tan-Nguyen Khanh Toan streets.

***. Identification of SAL of dikes in the historic inner capital area: a). Dai**



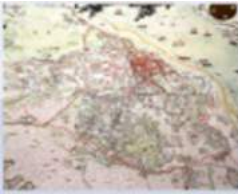

La dike near Red River: SAL of this dike has experienced drastic and varied changes. Originally a dike for flood prevention, it has become spaces of Hang streets and riverside Hang streets in the Old Quarter, and street spaces of the Old Street; **b). Dai La dike in the South of Hanoi:** This is a boundary south of the Citadel. The North of this dike carries the morphology of the pre-1945 urban space, a time when the South of this dike was less developed; After 1986, the South of this dike developed more than its Northern counterpart;

c). Dai La dike in the West of Hanoi (Buoï Street): The West of the Citadel is limited by To Lich River. After 1986, roads connecting the central area of present-day Ba Dinh District to the West of the Citadel received planning and investment, thus developed by leaps and bounds; **d). Dai La dike in the North of Hanoi (Hoang Hoa Tham Street):** This was a part of Dai La and now is Hoang Hoa Tham Street. This street has winding segments due to the flow of To Lich River in the old days; **e). Dike roads near Thien Phu River (Lac Long Quan Street):** These were parts of the suburban areas with villages at the edge of West Lake. Nowadays, the space and landscape have changed as new urban areas have been developed near West Lake; ***. SAL of**

dikes and changes in functions during the HICA's urban development:

Table 1.4. Changes in functions and SAL under the influence of dikes

Natural factors	Artificial factors	Transformative functions-	Map	Identification of SAL of

		Transformation of SAL		dikes in the HICA
Red River, To Lich River, and Kim Nguu River	Dikes	Irrigation – Agriculture		Urbanized villages outside of Ring Road 1
		Flood prevention – The Citadel		Historic inner capital area – within Ring Road 1 (Huu Hong dike – Tran Khat Chan street – De La Thanh s – Buoi – Hoang Hoa Tham – Lac Long Quan). This is the original structure of the HICA
		Fortification – Military purposes		
		Roadways - Villages		Tran Khat Chan street – De La Thanh s – Buoi – Hoang Hoa Tham – Lac Long Quan (Ke Cho). Old villages
		Streets		The Old Quarter
		Hang streets near the Citadel		
		Flood prevention – Urban areas		
		Roadways – Ports		
		Riverside Hang streets		
Concession areas		The Old Street		

Functional changes of dikes show changes in the structure of traditional villages to villages bordering dikes. These structural changes have changed the morphology of villages: how land plots near dikes are divided

and the morphology of these plots have changed, from the structure of houses bordering rivers-dikes to SAL of riverside streets. These are distinctive features of the historic inner capital area.

1.3. Current situation of SAL of dikes in the HICA: Regarding this topic, the dissertation looks into the current situation of SAL of dikes in the HICA and analyzes the current situation of SAL to see beyond strengths and opportunities, and compile weaknesses and challenges as existing issues to be addressed.

1.4. Current situation in the management of SAL of dikes in the HICA

1.4.1. The management apparatus of SAL of dikes

*** Dike management institutions through different periods**

Period	Characteristics	Mechanism & Policy	Management apparatus
Feudal era			
Ly dynasty	Co Xa Dike		Direct management by the State
Tran dynasty	Dikes were extended to the shoreline		Specialized apparatus: Dike managers and deputy dike managers
Le dynasty	Dike construction began at To Lich River.	Development of village regulations on irrigation and agricultural extension	Addition of agricultural extension officers to collaborate with dike managers
Mac dynasty	Construction of three fortifications outside Dai La from Nhat Chieu, going through West Lake, Cau Dua, and Cau Den to Thanh Tri bordering Northwest Nhi River. These fortifications were a few trượng (1 trượng = 4 meters) higher than Thang Long Citadel, 25 trượng in width, and tens of trượng in length.		
Nguyen dynasty			
Gia Long	Construction of seven dikes. The construction or demolition of dikes was discussed	Issuance of regulations on dikes	Dike manager of Bac Thanh managed dikes in the North.
Minh Mang	The construction or demolition of dikes was heavily discussed (with		The main dike in Bac Thanh was demolished, and the main Dike Management Office was

	the majority in favor of dike demolition)		established in the court (1828); The main Dike Management Office was dismissed, and the dikes were handed over to presiding officers for management (1832).
Tu Duc	Dike protection still received attention	Five regulations on public and private dikes, as well as dike protection and reparation, were issued.	The main Dike Management Office of Bac Thanh was reestablished in Hanoi (1857), Dike Management Apparatus was dismissed (1862)
French occupation	River dikes were constructed and fortified, and additional dikes were constructed for protection such as La Thanh dike	- Regulations on water levels in Hanoi: ≤ 13 meters. - Type I dikes: 4 - 8 meters in height; Type II dikes: 2.5 - 4 meters in height	- Northern Dike Management Council; - The Office of Public Affairs of the North had two departments specialized in irrigation: the Department of Water Treatment and the Department of Irrigation;
After 1954			
1955			Ministry of Irrigation and Architecture
1958			Ministry of Irrigation
1959	Directive 164-CT/TW17 regarding the plan for irrigation and utilization of the Red River.		
1961			Red River Irrigation & Utilization Committee.
1966-1972	The Politburo's issuance of Resolution 65/NQTV on the connection between early irrigation and utilization of Red River's basin.		
1989		Ordinance on dikes.	
1995			The Ministry of Irrigation was merged and became the Ministry of Agriculture and Rural Development.
2000		Ordinance on dikes	
2006		Law on dikes.	
2007	Decision 92/2007/QD-TTg on the planning of flood prevention for Red River and Thai Binh River.		
2013	Hanoi's dike system: 42 classified dikes, 41 dikes and specialized dikes.		
2016	Decision 257/2016/QD-TTg on the planning of flood prevention for the Red River and Thai Binh River.		

* **The current management apparatus of SAL of dikes in the HICA:** In Hanoi, the dike management apparatus and urban SAL management apparatus include district-level authorities that manage per administrative boundaries and specialized departments that manage professional works. Dikes span over multiple administrative units due to administrative boundaries not matching with urban planning boundaries, thus the management of SAL involves many administrative units: Four project management units and five management units for investment in construction projects of districts in the historic inner capital area. Currently, there is no management unit for urban development per Decree 11/2013/ND-CP.

1.4.2. Planning throughout different periods: Chinese occupation and feudal era; Planning of Hanoi in 1943; Planning of Hanoi in the 1956-1960 period; Planning of Hanoi in the 1960-1975 period; Planning of Hanoi in the 1981-2000 period (Decision 100/TTg dated April 24, 1981); Planning of Hanoi in the 1992-2010 period (Decision 132/HDBT dated April 18, 1992); Planning of Hanoi in the 1998-2010 period (Decision 108/1998/TTg dated June 20, 1998); Through six of these plans for Hanoi (prior to General Planning 1259), it is clear that dikes are assessed only for technical preparation, irrigation, and flood prevention. Dikes in the organization of SAL have not received direction adequate to their values and served only as boundaries for urban development.

1.4.3. Current situation of community participation: The law has not prescribed the process for consulting communities and the subjects of this process. Innovation is needed in the development of planning and institutions in the management of investment in urban development, as well as the actual participation of communities in urban development.

1.4.4. SWOT analysis of the current situation in the management of dikes' SAL and identification of management strategies: This should be

done to come up with a basis for identifying existing issues and navigate the research for solutions.

1.4.4.3. Existing issues in the management of SAL of dikes in the historic inner capital area: (i).Regulations on urban management in the HICA, as well as the management of SAL of dikes are scattered among different legal normative documents;(ii).Transferable values of dikes are recognized for classification and zoning;(iii).The management of SAL of dikes is related to five administrative units with five focal points for project management and other city-level project management committees that manage investment in the urban development of the HICA;(iv).There has not been any database system on the urban development of the HICA.

1.5. Related scientific works and dissertations: Foreign and domestic scientific studies and dissertations related to dikes in Hanoi mainly focus on the dikes and banks of the Red River, as well as safety in flood prevention. There has not been a comprehensive and systemic study on dikes in the historic inner capital area or the management of SAL of dikes in the HICA.

1.6. Research topics and solutions: (i).Identification of the dikes' roles in forming distinctive urban features of the HICA in Hanoi. (ii).Suggestion of solutions on the management of SAL of dikes in the HICA of Hanoi. This is the main outcome of the dissertation. (iii). Recommendation of solutions to contribute to the completion of mechanisms, policies and legal normative documents in the management of SAL of dikes in the HICA;

CHAPTER 2. SCIENTIFIC BASIS ON THE MANAGEMENT OF SAL OF DIKES IN THE HISTORIC INNER CAPITAL AREA IN HANOI

2.1. Scientific basis on the management of SAL of dikes in the HICA

2.1.1. SAL of dikes in the HICA: Identify related definitions: SAL of dikes in the HICA; Identify roles in directing the control and organization of SAL in the management of SAL of dikes.

2.1.2. Theories on the organization of dikes in the HICA: Identification is the development of urban development policies for the establishment of SAL to ensure consistency with SAL of the HICA and make use of the dikes' values;*. SAL of dikes in relation to theories in urban morphology: Invariable factors and urban morphological changes; The relationship between dikes and rivers in the urban structure; The role of dikes in the spatial morphology of streets; *. SAL of dikes in relation to theories on the image of the city by Kevin Lynch: Dikes in the HICA carry morphological elements that form an awareness of a city with its own unique structure and rich in its meanings;*. SAL of dikes in relation to theories on soft boundaries of Jan Gehl: The relationship between the senses and scale of buildings; Horizontal sensing mechanisms; Sensation and movement speed; Soft border organization; *. Transferable values of dikes in SAL of the HICA per international charters and conventions: This shows that values in need of management and protection, as well as heritages, reflect the rich development history of the country and region, as well as an organic part of modern life.*. SAL of dikes in urban perception according to theories on urban factor analysis: Identification of zones and points to take in different scenic views like colorful paintings continuously unfolded on a facade.

2.1.3. State management regarding SAL of dikes in the HICA: Management of SAL organization per theories on urban design includes two topics of the urban environment and spatial morphology; Management of SAL per theories on urban policies and urban management includes two objectives of humans and sustainable development.

2.2. Legal basis for the management of dikes' SAL: The dissertation has looked into the Law on Dikes, Construction Law, Law on Planning, Law on Architecture, Law on the Capital, related regulations, as well as applicable standards and compiled different types of planning that are currently

implemented to use as the basis for suggesting solutions;

2.2.3. Related types of planning per the Law on Planning: General Planning on the Construction of Hanoi Capital (General Planning 1259); Related projects on urban planning and zoning; Management regulations per construction planning and planning of related sectors and fields; System of relationships between the management of dikes' SAL and urban development management.

2.2.4. Guidelines and policies on the development of databases in urban management: These are directions for the application of science and technology in managing the development and implementation of plans

2.3. Factors affecting the management of SAL

2.3.1. Population and socioeconomic development

2.3.2. Inheritable values of dikes in the HICA: Values in their age, validation, and uniqueness;

2.3.3. Cultural and social development of communities: SAL of dikes in the urban landscape in relation to cultural heritages in the HICA;

2.3.4. Climate change and urban technical infrastructure: The dissertation raises risks of flooding due to the influence of climate change and the environment of the HICA; The height of land leveling and surface water drainage in urban planning;

2.3.5. Application of science and technology in the management, development, and implementation of plans and SAL management: In addition to the collaboration between different levels and sectors, this is an important topic to develop a smart city;

2.4. The role of community participation: Community participation in managing SAL is very important as people directly benefit from and utilize SAL of dikes.

2.5. Lessons learned: The HICA is shaped by dikes, therefore it does not follow traditional urban structures. Consequently, cities with similar morphology are limited. The dissertation introduces lessons from cities that stand near rivers, heritage preservation policies, and the application of GIS in urban management; ***.Foreign experience:**The dissertation introduces lessons on the management of SAL in Asian cities such as Bangkok (Thailand), Shanghai (China), and Amsterdam (the Netherlands); the use of GIS in Lyon’s urban communities; Management policies: referencing the Law on Urban Planning of France; ***.Domestic experience:** The dissertation introduces lessons on the management of SAL in Da Nang, Ho Chi Minh City, and the management of SAL of streets in Ba Dinh, Hanoi.

CHAPTER 3. SOLUTIONS ON THE MANAGEMENT OF SAL OF DIKES IN THE HISTORIC INNER CAPITAL AREA IN HANOI

3.1. Opinions, objectives, and principles in the management of SAL of dikes in the HICA: ***.Opinions** The dissertation proposes six opinions as follows: **i)** Finalize the special roles and values of dikes; **ii)** Manage and develop SAL of the HICA for popularization; **iii)** Manage SAL based on the control and organization of SAL, urban planning, urban design, and urban development in the HICA; **v).**Complete management institutions for the comprehensive and synchronous development of SAL of dikes in the HICA, meeting sustainable development requirements; **vi)** Effectively make use of resources provided by SAL of dikes and communities to enable urban development. ***.Objectives:** The dissertation identifies five groups of objectives regarding management: **i)**Social objectives;**ii)**Balance in the urban ecological environment and climate; **iii)**Economic development; **iv)**Preservation and utilization of dikes’ transferable values; **v)**Sustainable development.***.Principles:**The dissertation proposes four principles for management: **i)**Sustainable development of SAL of dikes with the utmost

safety in the prevention of floods for the Capital;**ii**)The guided and controlled organization of dikes’ SAL in the formulation of projects on urban planning and urban design;**iii**)Consistency with General Planning 1259, preserving distinctive images and transferable values in the urban space of each dike;**iv**) Heightened roles of communities in the development, monitoring, and implementation of projects under urban planning.

3.2. Criteria for identifying distinctive values of dikes and classification of dike forms in the HICA

3.2.1. Criteria for identifying distinctive values of dikes: 05 criteria: **(i)**. A dike’s attachment to the historic inner capital area’s landscape; **(ii)**.A dike’s values regarding construction techniques and construction materials; **(iii)**.A dike’s representation of the HICA’s urban development history;**(iv)**.A dike’s representation of the HICA’s cultural characteristics and features; **(v)**.A dike’s time of construction and age;

3.2.2. Classification of dike forms:

Table 3.1. Classification of dike forms in the HICA

Type	Street name	Form
1	Huu Hong dike, Au Co and Nghi Tam streets	
2	Yen Phu street	



<p style="text-align: center;">3</p>	<p style="text-align: center;">Tran Nhat Duat street</p>	<p>Architectural elevation drawing of Tran Nhat Duat street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 27.7-29.2, 29.6-30.8. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM NHẤT DUẬT. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>
	<p style="text-align: center;">Tran Quang Khai street</p>	<p>Architectural elevation drawing of Tran Quang Khai street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 21.7-29.7, 21.3-29.7, 29.8-31.1. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM QUANG KHAI. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.5-4.4, 3.5-7.0, 9.7-10.1, 0.2-1.3, 13.5-11.3, 13.8-13.3, 11.5-12.5, 11.6-12.0, 11.3-12.0. </p>
	<p style="text-align: center;">Tran Khanh Du & Nguyen Khoai streets</p>	<p>Architectural elevation drawing of Tran Khanh Du & Nguyen Khoai streets. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 24.7, 24.7, 24.7, 24.7. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM KHANH DU & NGUYỄN KHOÀI. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>
	<p style="text-align: center;">Lac Long Quan street</p>	<p>Architectural elevation drawing of Lac Long Quan street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 25.0-26.4, 25.0-26.4, 25.0-26.4, 25.0-26.4. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM LẠC LONG QUAN. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>
<p style="text-align: center;">4</p>	<p style="text-align: center;">De La Thanh street</p>	<p>Architectural elevation drawing of De La Thanh street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 25.5-31.5, 25.5-31.5, 25.5-31.5, 27.1-31.1, 29.1-31.1. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM ĐE LA THANH. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>
<p style="text-align: center;">5</p>	<p style="text-align: center;">Buoï street</p>	<p>Architectural elevation drawing of Buoï street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 29.7-31.2, 29.7-31.2. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM BUI. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>
<p style="text-align: center;">6</p>	<p style="text-align: center;">Hoang Hoa Tham street</p>	<p>Architectural elevation drawing of Hoang Hoa Tham street. It shows a street with buildings on both sides. Key features include: <ul style="list-style-type: none"> Building heights: 29.1-30.1, 27.1-28.6, 24.6-25.1. Street name: ĐƯỜNG HỒNG - ĐƯỜNG THẠM HOÀNG HOA THAM. Other labels: KẾ ĐÀ (13.3-14.0), 11.5-12.0, 11.6-12.0, 11.3-12.0. Ground level: 0.0-10.5, 0.7-11.2, 11.0-11.8. </p>


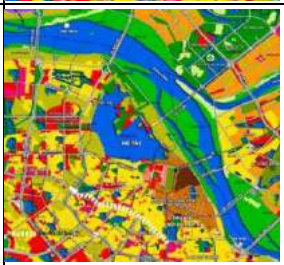
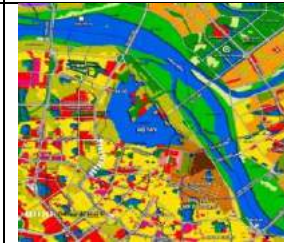
***. Subjects for form classification:** Type 1 and type 2 dikes; ***. Criteria for and classification of dike forms:** Suggested groups of criteria include: Appearance, height, construction material, and scope of distinctive soil layers; Dike forms are classified into six types;

3.3. Zoning for the management of SAL of dikes in the HICA

3.3.1. Criteria in zoning for the management of dikes: Zoning for the management of each dike type is necessary to identify distinctive zones per the following three criteria: (a).Structure of the HICA's space; (b).Factors forming the structure and morphology of SAL in each period in urban development; (c).The scale of dike types and dike forms is dependent on soil layers that are identified by each dike form. Accordingly, dikes are classified into two dike types and six dike forms; five zones for dike management are proposed to direct the control and organization of SAL.

3.3.2 Directions for control and organization of SAL in dike management zones : **Table 3.2.** Directions for control and organization of SAL of dikes

Dike management zone	Dike location	Dike type	Dike form	Direction
I		1 and 2	1, 3 and 6	The HICA's ecological reserves are combined with new construction works, architectural renovation, and urban architectural morphology
II		1	2 and 3	Relics of old Thang Long, as well as valuable historical and cultural architecture, are collected.

III		2 and 3	4	Distinctive spaces including villages, old apartments, and relics bordering Ring Road 1. Tuoi Tre Park, Thong Nhat Park.
IV		2	4	The landscape of villages, old apartments, Ring Road 1; water surface of retention basins; relics, major cultural works, parks, open spaces;
V		2	5	Distinctive space and landscape of To Lich river, Thu Le park, and Ring Road 2.

3.4. Solutions for managing the organization of SAL for urban planning projects

3.4.1. Requirements on managing the organization of SAL of dikes: The dissertation proposes requirements on the management of SAL of dikes for each subject: SAL per 05 dike management zones;

3.4.2. Impact control framework for SAL of dikes in dike management zones: SAL in dike management zones is controlled based on the evaluation of impacts from 10 factors that affect SAL in management zones to ensure consistency;

3.4.3. Groups of solutions for developing a framework for the organization of SAL of dikes: Height identification of the ground where a

dike was constructed; Identification of a dike's height; Organization of soft boundaries (including 15 criteria);

3.5. Solutions for managing SAL in distinctive areas

3.5.1. Suggested areas with distinctive SAL of dikes:

Table 3.6. List of areas with distinctive SAL

Area no	Area name	Area no	Area name
	Dike zone I	14	Tran Hung Dao bridge junction
1	Quang An - Co Loa		Dike zone III
2	Tu Lien bridge junction (TBD) & Thang Loi hotel.	15	Nguyen Khoai - Tran Khat Chan junction.
3	Thanh Nien street	16	Dong Mac gate.
4	Bach Thao - Ngoc Ha - Quan Thanh Temple.	17	Thanh Nhan Park
5	Van Cao - West Lake	18	Cau Den gate.
6	Buoi-Lac Long Quan-Hoang Hoa Tham junction.	19	Thong Nhat park-Dong Lam gate.
7	The West of West Lake-West Lake-Quang An- Co Loa		Dike zone IV
8	Nguyen Hoang Ton – West Lake.	20	Kim Hoa street; Kim Lien Temple and Pagoda.
9	Nhat Tan bridge.	21	O Cho Dua junction.
	Dike zone II	22	Lang Ha-De La Thanh junction.
10	Truc Bach lake.	23	Cong Chanh-Nguyen Chi Thanh junction.
11	Long Bien bridge.		Dike zone V
12	Chuong Duong bridge - Cho Gao - O Quan Chuong junction.	24	Cau Giay gate - Buoi - Voi Phuc temple - Thu Le park junction.
13	Co Tan garden.		

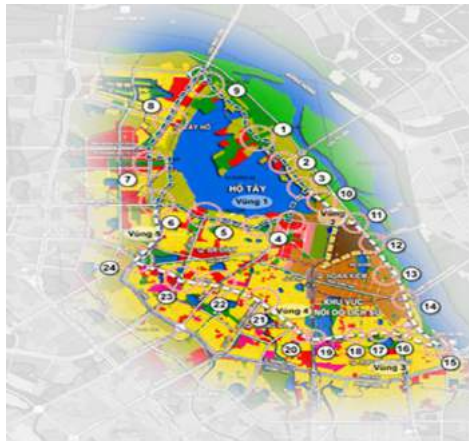


Image: 3.25. Areas with distinctive SAL of dikes in the HICA

The dissertation suggests 24 distinctive areas of dikes to use as the basis for management, control and formulation of urban planning, urban design, management regulations of the HICA's architecture, including Dike zone I: 09 areas; Dike zone II: 05 areas; Dike zone III:05 areas;Dike zone IV:04 areas;Dike zone V: 01 area;(table 3.6; image:3.25):

3.5.3. Direction on controlling SAL of distinctive areas of dikes in the HICA: The dissertation proposes requirements in the management of SAL in distinctive areas, clarifies boundaries of buffer zones, as well as lines of sight and points of view for 24 distinctive areas at five dike zones across six managed items: **a.**Heritage, historical and cultural relics; **b.** Environment and natural landscape; **c.**Open spaces; **d.**Public spaces; **e.** Urban and village areas; **f.** Urban architecture

3.6. Solutions for the completion of mechanisms, policies, and legal normative documents: Regarding legal normative documents: Amend and supplement with content related to values of dikes as a basis for the management of dikes' SAL; Complete urban planning projects and prescribe content on the management of SAL in the HICA; Complete urban development programs; Develop maps and database systems for urban management.

3.7. Solutions on organizing apparatuses for the management of urban development in the HICA: The dissertation proposes: Opinions on the organization of management apparatuses; Positions and functions of the committee on the management of urban development in the HICA Tasks and rights of the committee on the management of urban development in the HICA, including eight tasks as well as its organizational structure and operating costs;

3.8. Solutions on the development and utilization of a system of databases for managing SAL of dikes and urban development in the HICA:

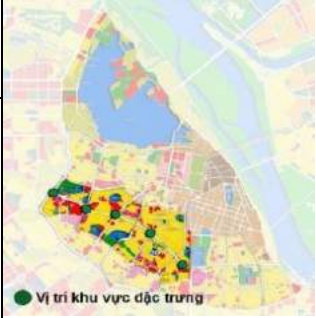
The dissertation proposes: Objectives and principles in the development of a database framework; Relevant types of databases; Content in the development of the database framework: Data on maps for the development of databases for managing SAL of dikes in the HICA, Models for layering different maps, categorization in system management, Collaboration with relevant departments and sectors;

3.9. Solutions on making use of community's participation in managing SAL of dikes in the HICA:

The dissertation proposes: Requirements in the formulation of legal regulations, A five-step implementation process, and regulations on information collection, research, and publication;

3.10. Application and utilization of map databases in researching morphological changes of dikes and directing the control and organization of SAL in the case of Kim Hoa street:

Table 3.17. Direction on managing the organization of SAL on Kim Hoa street, distinctive area no. 20

Dike management zone	Dike type	Dike form	Characteristics and functions	
IV	2	4	Old Kim Nguu river dikes; old fortifications; Renovated area with restrictions on the construction of residential highrises. Main functions: housing, heritage, Kim Lien temple and pagoda, tourism, commercial services.	

.Construction materials: A type of old dike constructed using soil..Form: No banquette, dike shoulders form a layer of architecture, its accompanying landscape is Xa Dan street (Ring Road 1) at the lowest natural surface. There are two soil layers: the dike and the lowest natural surface.*. Scale: The dike scale expands to residential areas on its side and beyond, to the bordering roads for at least 50 meters at areas with the lowest natural surface.*. Average dike height: Dike height: + 8.1; Height of residential areas: from + 5.5 (the South of Kim Hoa street where it borders

Xa Dan street and +7.5 (the North of Kim Hoa street). The difference from the dike to the lowest natural surface is about 2 - 4 meters.*. Suggestions: renovation within 250 meters and urban reconstruction within 500 meters	
Item	Direction on control
a	<ul style="list-style-type: none"> - Preserve and renovate historical relics and urban architecture associated with the development space of old apartment complexes (Kim Lien, Trung Tu, Thanh Cong, Ngoc Khanh, etc.). Expand green spaces to 250 meters around significant monuments such as Kim Lien Pagoda and Kim Lien Temple (worshiping Cao Son Dai Vuong (Mountain God) who guarded the south of the Citadel). - Preserve the morphology of the dike as a structural heritage of La Thanh and old Kim Nguu dike to the southwest of the old Citadel.
b	<ul style="list-style-type: none"> - Improve landscape conditions by incorporating water surfaces in urbanized villages in the direction of reducing population density, adding urban architectural morphology, trees, and water surfaces such as Ba Mau lake North of Kim Hoa street.
c	<ul style="list-style-type: none"> - Create open spaces connected with main roads such as Dong Lam gate, connecting to the space of Thong Nhat park. - Encourage the utilization of the land between Ring Road 1 and the dike where construction is not probable to create an open space and improve social morphology.
d	<ul style="list-style-type: none"> - Connect with the space of universities such as Hanoi University of Science and Technology; Combine land plots into a larger plot to accommodate the dike's morphology and use it as the basis for designing and ensuring consistency in lines of view from the dike; do not build highrises on the land between the dike and Ring Road 1.
e	<ul style="list-style-type: none"> - Comply with zone planning H1-3, regulations on construction works, and approved construction planning and urban design.
f	<ul style="list-style-type: none"> - The architecture of urban villages bears the impression of pre-1954 suburban villages, as well as urban development space over different periods from 1954 to the present day with low construction density and houses with five or fewer floors. House sample competitions for the issuance of construction permits are organized. - Within 250 meters of relic sites, the height of architectural works must not be wider than the three gates and higher than the roofs of Kim Lien Pagoda and Kim Lien Temple. - Within 500 meters, height is determined per lines of view
<ul style="list-style-type: none"> - Restricting factors: Determination of maximum view angle: $\Delta = 37^{\circ}, \Omega = 10^{\circ}$; Maximum height: Kim Hoa street: 12 meters; Xa Dan street: 20 meters at the lowest natural surface and a minimum clearance of 3 meters from edges of the current dike; - Direction for SAL of the street: Increase utilities, increase open space, reduce construction density to create open space for pedestrians; arrange utilities on Xa Dan street's sidewalks; - Utilize the difference in height to create motorbike parking for residents and guests in combination with open space between two blocks, increasing utility for residents; 	

-In the urban reconstruction area outside the 250-meter area, encourage the application of typical house models to issue construction permits with three groups and 15 soft boundary criteria. Formulate an urban reconstruction plan for distinctive area no. 20 to implement the management of SAL of Kim Hoa neighborhood with the participation of its community per the process proposed in section 3.7 of the dissertation;

Note: **a.** Heritage, historical and cultural relics; **b.** Environment and natural landscape; **c.** Open spaces; **d.** Public spaces; **e.** Urban and village areas; **f.** Urban architecture.

3.11. Discussion: The dissertation discusses its results based on the research to clarify the system and scientific basis of the management of SAL in the HICA in order to propose scientific and practical solutions for controlling the organization of SAL of dikes and three topics of **(a).***Feasibility*; **(b).***The handling of dikes that are no longer used in flood prevention*; **(c).***Extended application to other dikes in a similar position*; **(d).***Limitations of the group of solutions on the organization of management apparatuses during their implementation.*

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions: Decree 15-NQ/TW prescribed the focus on preserving and utilizing the values of cultural heritage and architectural works with existing advantages to create new development spaces for the Capital. Currently, SAL of dikes has not received adequate attention. Studies on the organization of SAL of dikes in urban planning are insufficient, thus creating major challenges in urban management and urban development in the HICA. Therefore, the management of SAL of dikes is very necessary and in need of further research. After researching the current situation and scientific basis, the dissertation has proposed: six opinions, five objectives, and four principles, as well as criteria for identifying distinctive values of dikes, classification of dike forms and zoning of dikes for management; Completion of mechanisms, policies, legal normative documents, and the management of SAL; Management of dikes' SAL; Utilization of community's participation in management; Management apparatuses in urban development areas;

Development and utilization of database systems. Based on the proposed suggestions, the dissertation has conducted studies and applied them in directing the organization of SAL in the case of Kim Hoa street.

2. Recommendations: The dissertation would like to propose to different management authorities as follows: *i) The Government and its agencies:* Review and complete legal normative documents on managing SAL of dikes in the Red River delta; *ii) Authorities and management agencies of Hanoi:* Supplement regulations on dike planning and architecture in the amended Law on the Capital, and establish the committee on the management of urban development in the HICA; *iii) Stakeholders:* Experts and professional associations, through their professional activities, strongly influence policies as well as planning methods to spread the transferable values of dikes in the delta. The community raises their sense of responsibility and self-reliance and contributed ideas and resources to build the image of Hanoi, a capital born between rivers.

**THE AUTHOR'S SCIENTIFIC ARTICLES RELATED TO THE
DISSERTATION'S TOPIC**

- 1) Dao Duy Hung (2016)**, Urban space of old dikes in Hanoi, the case of Kim Hoa street - Dong Da district, Hanoi, Vietnamese journal of urbanism no. 23, 2016, ISSN 1859-3658.
- 2) Dao Duy Hung (2021)**, Dikes are factors affecting spatial changes, architecture, and landscape in the historic inner capital of Hanoi, Vietnamese journal of urbanism no. 42,2021, ISSN 1859-3658.
- 3) Dao Duy Hung (2021)**, Values of dikes in preserving architectural and urban heritage in the historic inner capital of Hanoi, Vietnamese journal of urbanism no. 42,2021, ISSN 1859-3658.
- 4) Dao Duy Hung (2022)**, Identification and classification of dikes in SAL of the historic inner capital of Hanoi, Vietnamese journal of urbanism no.44,2022, ISSN 1859-3658.