

**BUILDING A DIGITAL DATABASE
TO SUPPORT THE SURFACE WATER QUALITY
SUSTAINABLE MANAGEMENT IN CANTHO CITY,
VIETNAM**

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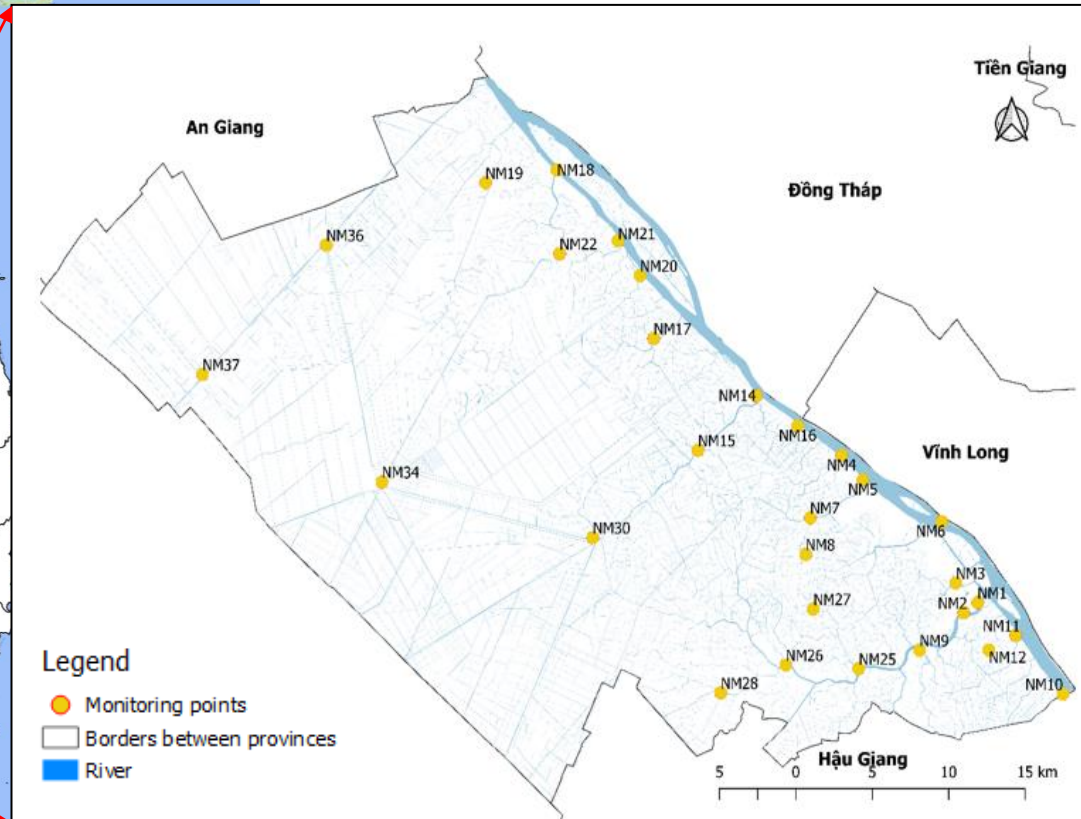
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INTRODUCTION

- Limited Data Management
- Data in multiple formats

- Multiple levels of management
- Non-open data is not shared widely



Study area: CanTho city, Vietnam

OBJECTIVE

This study builds a database on surface water quality in Can Tho city, Vietnam and a WebGIS platform to support updating and managing data on surface water resources at regulatory agencies and at the same time to share information about surface water quality to the community quickly and intuitively.

METHODS

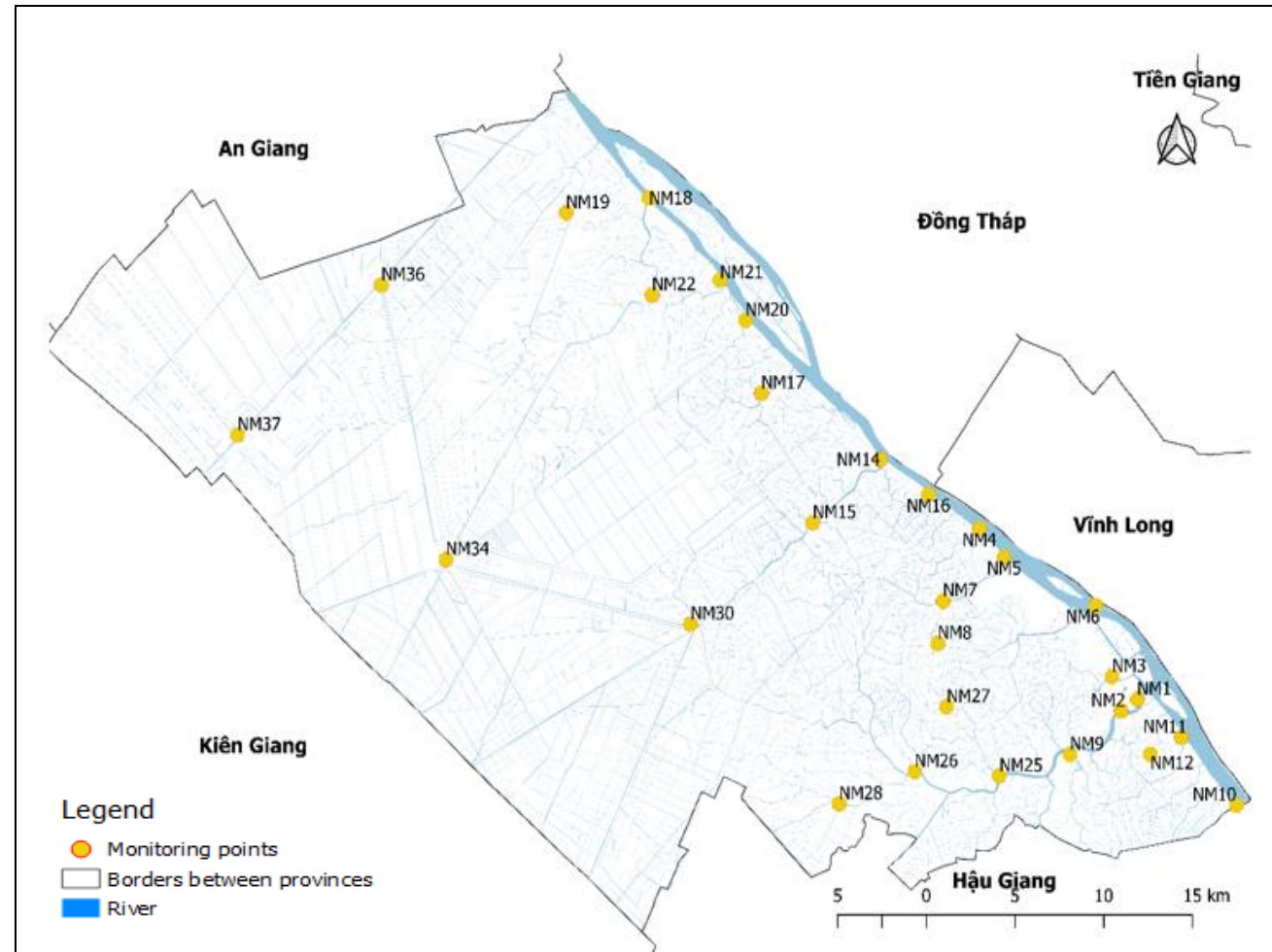
Data collection

from 2014-2018

No.	Parameters	Unit
1	Temperature	oC
2	pH	-
3	As	mg/L
4	Pb	mg/L
5	F-	mg/L
6	DO	mg/L
7	COD	mg/L
8	BOD5	mg/L
9	N-NH ₄ ⁺)	mg/L
10	NO ₃ ⁻	mg/L
11	NO ₂ ⁻	mg/L
12	PO ₄ ⁻	mg/L
13	Coliform	MPN/100 mL

Water quality parameters

- The secondary data was collected including a base map, canals map and rivers map; reports, surface water quality;



The monitoring stations map

METHODS

Calculation of water quality index (VN-WQI)

- The formula for calculating the value of VN_WQI is according to Decision No. 1460/QD-TCMT dated November 12, 2019 of the Vietnam Environment.

$$WQI = \frac{WQI_I}{100} \times \frac{\left(\prod_{i=1}^n WQI_{II} \right)^{1/n}}{100} \times \frac{\left(\prod_{i=1}^m WQI_{III} \right)^{1/m}}{100} \times \left[\left(\frac{1}{k} \sum_{i=1}^k WQI_{IV} \right)^2 \times \frac{1}{l} \sum_{i=1}^l WQI_V \right]^{1/3}$$

In which

WQI_I : Calculation results for pH parameter (group I);

WQI_{II} : Calculation results for group of plant protection drug parameters (group II);

WQI_{III} : Calculation results for heavy metal parameters (group III);

WQI_{IV} : Calculation results for groups of organic and nutritional parameters (group IV);

WQI_V : Calculation results for group of microbiological parameters (group V)

The water quality index is calculated on a scale (WQI value range) corresponding to the symbol and color to assess the water quality to meet the needs of use.

Value VN-WQI	Water quality	Purpose of water use	Color (RGB code)
91 - 100	Very good	Good use for domestic water supply purposes	Blue (51;51;255)
76 - 90	Good	Used for domestic water supply purposes but need appropriate treatment measures	Green (0;228;0)
51 - 75	Medium	Use for irrigation and other equivalent purposes	Yellow (255;255;0)
26 - 50	Bad	Use for navigation and other equivalent purposes	Orange (255;126;0)
10 - 25	Least	Water is heavily polluted, needs future treatment measures	Red (255;0;0)
<10	Pollution	Poisoned water, need to take measures to overcome and treat	Brown (126;0;35)

METHODS

Build spatial interpolation map

- From the results of the WQI calculation, the water quality partition maps according to the WQI index were built by the interpolation method IDW (Inverse Distance Weighted) on QGIS software (version 3.18).
- The weight of each point is calculated according to the equation:

$$Z_0 = \frac{\sum_{i=1}^N Z_i \times d_i^{-n}}{\sum_{i=1}^N d_i^{-n}}$$

In which:

Z₀: estimated value of variable z at point i;

Z_i: sample value at point i;

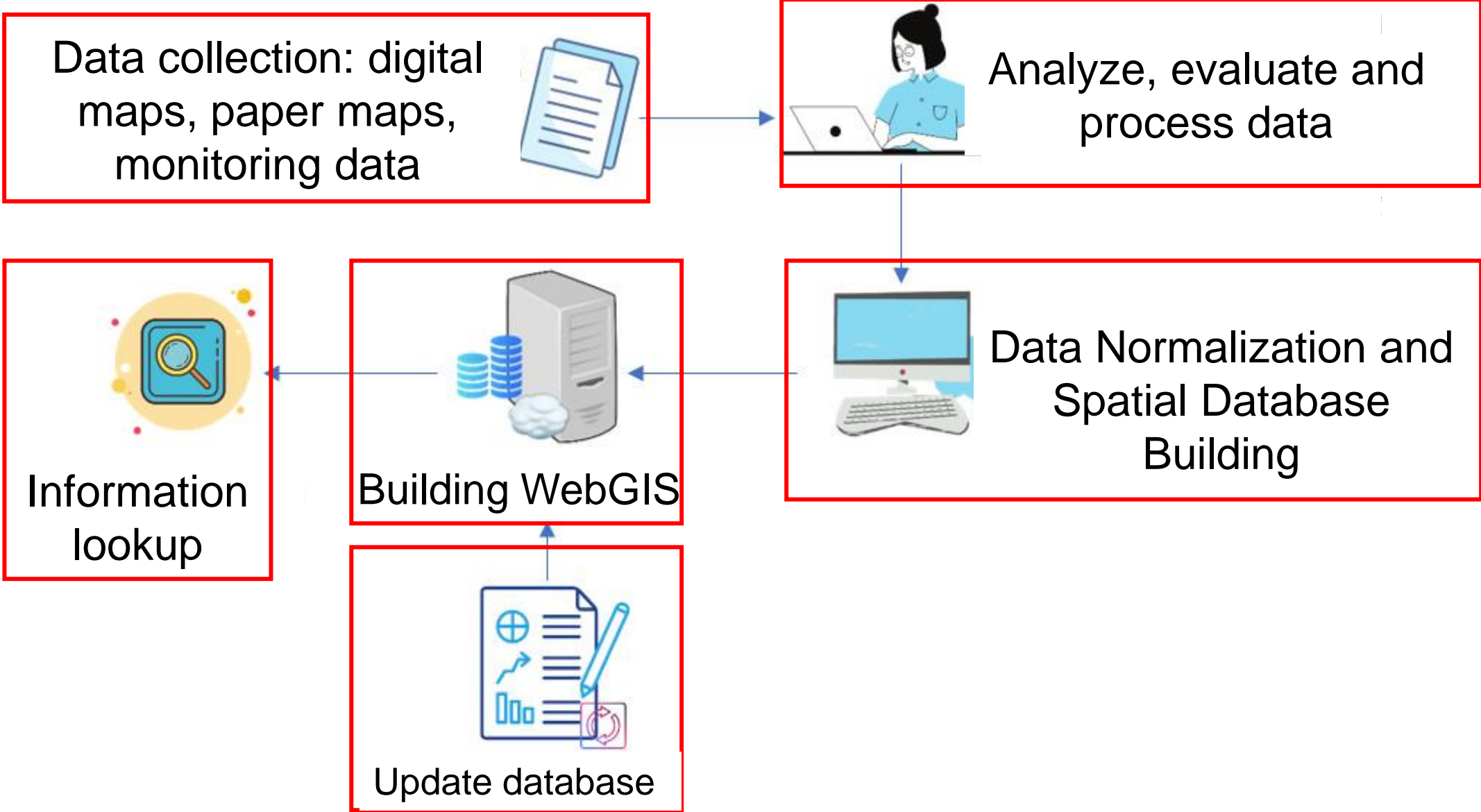
D₁: Sample point distance for point estimation;

N: Factor for determining weight based on a distance.



METHODS

Building WebGIS



RESULTS

Calculation of water quality index

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VN-WQI TOOL

INPUT
DATA

RUN

VN-WQI RESULTS

CÁC NHÓM THÔNG SỐ	
Nhóm I	<i>pH</i>
pH	-
Nhóm II	<i>Thuốc bảo vệ thực vật</i>
Aldrin	µg/L
BHC	µg/L
Dieldrin	µg/L
DDTs	µg/L
Hept.	µg/L
Nhóm III	<i>Kim loại nặng</i>
As	mg/L
Cd	mg/L
Pb	mg/L
Cr	mg/L
Cu	mg/L
Zn	mg/L
Hg	mg/L
Nhóm IV	<i>Hữu cơ và dinh dưỡng</i>
DO	mg/L
TRANG CHỦ NHẬP LIỆU KẾT QUẢ	

Bảng 1. Quy định các giá trị q_i , BP_i cho các thông số nhóm IV và V

i	q_i	BOD ₅	COD	TOC	N-NH ₄	N-NO ₃	N-NO ₂	P-PO ₄	Coliform	E.coli
		(mg/L)							(MPN/100ml)	
1	100	4	10	4	< 0.3	2	0.05	0.1	2,500	20
2	75	6	15	6	0.3	5	-	0.2	5,000	50
3	50	15	30	15	0.6	10	-	0.3	7,500	100
4	25	25	50	25	0.9	15	-	0.5	10,000	200
5	10	50	150	50	5	> 15	> 0.05	4	10,000	200

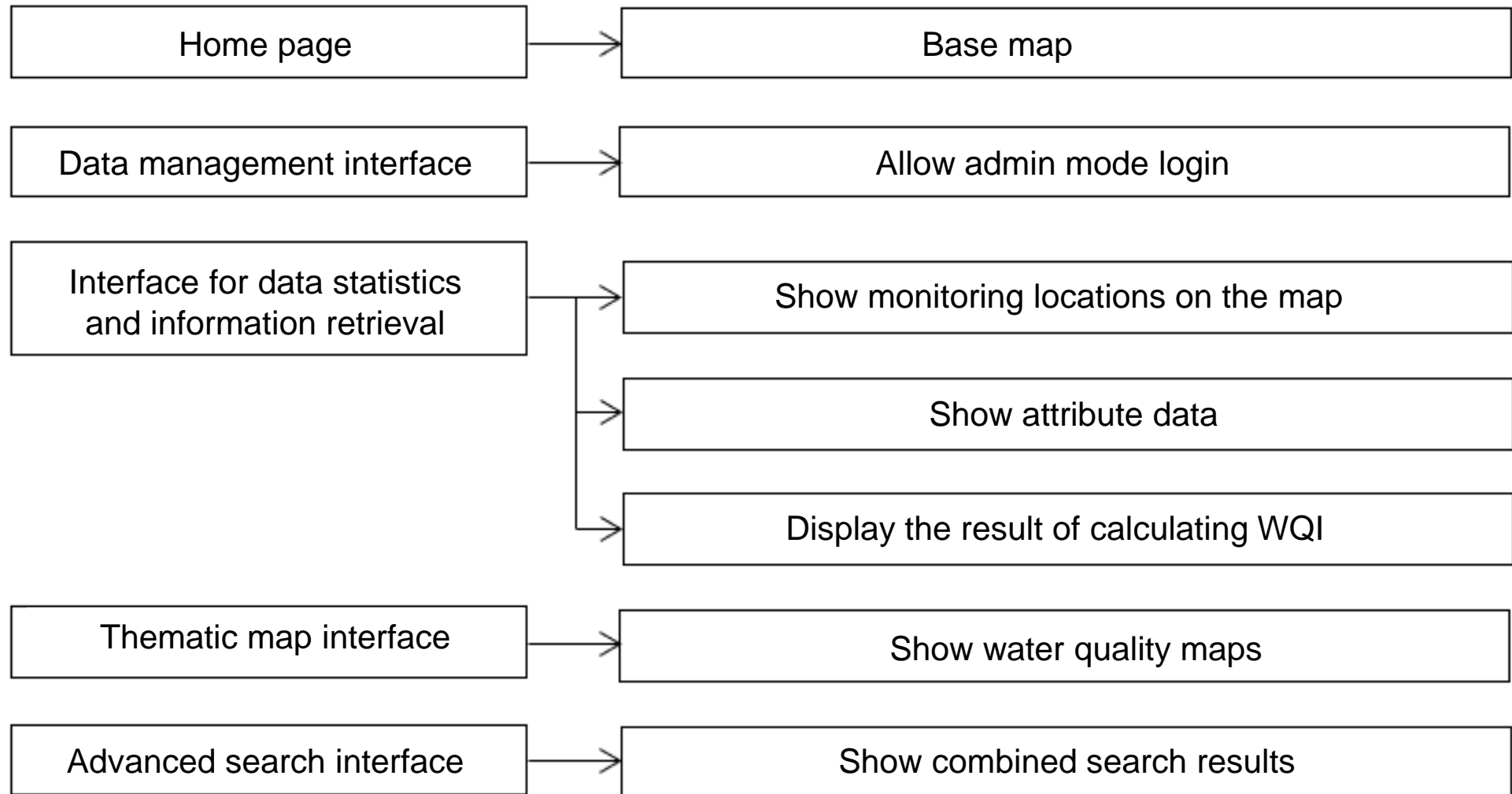
Bảng 2. Quy định các giá trị q_i , BP_i cho các thông số kim loại nặng (nhóm III)

i	q_i	As	Cd	Pb	Cr	Cu	Zn	Hg
		(mg/L)						
1	100	0.01	< 0.005	< 0.02	0.01	0.1	0.5	
2	75	0.02	0.005	0.02	0.02	0.2	1	0.001
3	50	0.05	0.008	0.04	0.04	0.5	1.5	0.0015
4	25	0.1	0.01	0.05	0.05	1	2	0.002
5	10	> 0.1	0.1	0.5	0.1	2	3	0.01

VN_WQI		
VN_WQI (WQI chuẩn 5 nhóm)	VN_WQI (không có nhóm V)	VN_WQI (5 nhóm & có trọng số)
88	79	85
91	83	88
84	76	82
85	76	82
87	77	84
79	82	80
77	80	78
84	77	82
88	78	85
87	76	83
89	80	86
91	82	88
85	72	80
90	81	87
85	73	81
86	76	82
90	81	87
74	68	72
68	55	63

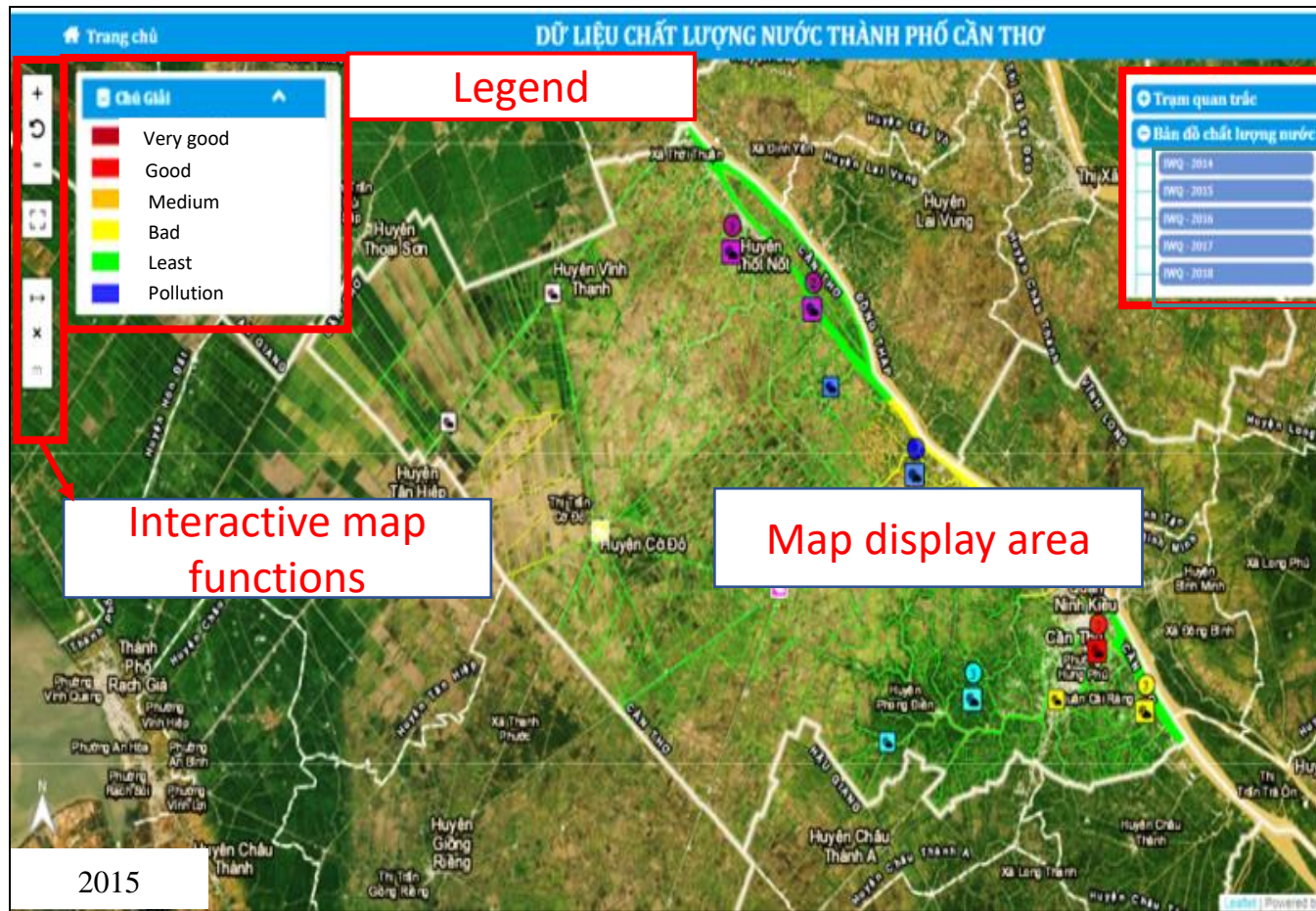
RESULTS

Building WebGIS



Module structure in webGIS application

RESULTS



Legend

Interactive map functions

Map display area

2015

Web display

Trạm quan trắc

Bản đồ chất lượng nước

- NPQ - 2014
- NPQ - 2015
- NPQ - 2016
- NPQ - 2017
- NPQ - 2018

Station

Quality map

Time

Layers management

Quản lý

Điểm quan trắc

Thông số quan trắc

Thêm mới dữ liệu

Cập nhật dữ liệu

Add and update data

Ngày thu	Mã điểm NM1
Nhiệt độ:	Ngày thu mẫu 2015-03-11
BOD:	Thông số pH 6.62
COD:	Thông số DO 6.65
DO:	Thông số COD 8
pH:	Thông số BOD 3
	Thông số TSS 11
	Độ đục (NTU) 9
	Chỉ số Coliform 2400
	Chỉ số (PO4)3- 0.02
	Chỉ số (NH4)+ 0.24
	Đợt quan trắc 2

CONCLUSION

- *The study has built a water quality database in Can Tho city with open source code, which can expand utilities, allow remote access, help manage and monitor, and access information.*
- *Pieces of information on surface water are convenient, and fast, saving money, time and effort.*
- *The database from the study has supported updating and systematizing data and interdisciplinary data in line with the Government's technology development orientation.*
- *For this result can be used to integrate results from similar studies*
- *However, the application only stops at the level of local research, has not yet launched a pilot application because it needs to update other related tools.*



Thanks for your attention!