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SITUATION ANALYSIS IN DANANG in terms of water pollution

“Collective Action for Water Conservation” project



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1. EXECUTIVE SUMMARY

This report focuses on reviewing and analyzing the current situation of surface water pollution issues in Da Nang City to provide an in-depth overview so that the activities of the project “Collective Actions for Water Conservation” (CAWACON) can be designed appropriately to ensure sustainability and be able to connect stakeholders in "Collective Actions" to protect water sources. The report was developed based on the IUCN situation analysis method and using implementation methods including desk review, in-depth interviews, consultation with management agencies, stakeholder workshops, and online survey. In addition, the report uses the results of CECR's "Ocean without Plastic" project and the USAID case study on awareness raising and behavior change in plastic waste management¹. Main contents of the report include: current status, developments and risks of surface water pollution; sources of surface water pollution; the role of stakeholders including local communities; related policies; impacts of water pollution; key challenges; and recommendations for the CAWACON project.

Key findings of the report include:

- Although the main rivers and streams generally meet the water quality for the identified uses in general, pollution hotspots and local water pollution problems has a great influence on tourism in Da Nang such as Phu Loc river, Tho Quang harbor. Besides that, the risk of re-pollution and increased pollution is presented due to a high rate of urbanization and development in the coming time.
- Saline intrusion due to the shortage of water flowing into Da Nang from the Vu Gia river causing shortage of water supply for domestic use, is still a major problem. This have a great impact on people's lives, requiring close coordination between Da Nang and Quang Nam provinces in the management of Vu Gia - Thu Bon river basin, especially Quang Nam province which is located upstream of Vu Gia river.
- The "Surface water resources of Da Nang city to 2030, with a vision to 2045" project issued in 2019 provides a very good legal framework for the protection of water resources and for the activities of the CAWACON project, especially defining the functions of main water sources, a list of water sources for which protection corridors need to be established, sanitary protection zones for water sources for domestic uses water supply, a list of water sources to be conserved.
- The “Environmental City” project issued in 2008 has entered the second phase (2021-2030). In the second phase, the project sets a higher goal through the application of the concept of "environmental protection as a foundation for building an eco-city to achieve sustainable development". This is an ambitious goal and it is very important to clarify the ecological aspect and in particular encourage all parties (and communities) to participate in project implementation through, communication, education, based on information, practical data platform. This is the first year of the decade 2021-2030 to implement the project, so it is necessary to clearly define specific tasks or differences from previous ways. The issue of

¹ https://urban-links.org/wp-content/uploads/MWRP_Executive-Summary.pdf

economical and smart use of water has not yet been raised, although this is a very important aspect in water resource protection in particular and sustainable development in general.

- Pollution hotspot in Tho Quang port still exist due to wastewater and garbage from the fisheries service industry zone and from the activities of the fish market and boats.

On the basis of reviewing and analyzing the current situation, the report proposes activity groups for the CAWACON project in Da Nang to support the implementation of the “Environment City” Project in the field of water pollution management, awareness raising and initiatives implementation of all stakeholders as follows:

- (1) Activity group to prevent water pollution in Tho Quang port
- (2) Activity group to build sustainable developed residential areas model
- (3) Activity group to promote initiatives on smart use of water
- (4) Activity group to improve operational capacity of the Vu Gia - Thu Bon river basin coordination board and cooperate in implementing the “Environmental city” project for the period 2021-2030
- (5) Activity group to enhance publicizing water source information
- (6) Activity group of communications activities and networking activity with community, businesses, scientific organizations, NGOs, and social organizations in water resource protection

2. INTRODUCTION

Da Nang is a centrally-governed city (a city under the jurisdiction of the central government) since 1997. The city is located in the Southern Central region of Viet Nam, consisting of both mainland and sea areas. The city contains 6 urban districts (Hai Chau, Thanh Khe, Lien Chieu, Ngu Hanh Son, Son Tra, and Cam Le) and 2 suburban districts (Hoa Vang, Hoang Sa), divided into 45 wards and 11 communes. On the mainland, except Cam Le and Hoa Vang district, the remaining districts are all adjacent to the sea.²

According to the statistics in 2016, Da Nang has a total area of 1,284.88 km², of which Hoang Sa island district is 305 km² and inland area is 979.88 km² (accounting for 76.3% of the city area). The urban districts have a total area of 246.71 km², accounting for one quarter of the inland area of the city, of which ThanhKhe and HaiChau are the smallest districts (9.47 km² and 23.29 km² respectively, or 0,97% and 2.4% of the inland area of the city.³

There are 6 industrial zones in the city, of which 3 are in Lien Chieu district, 2 in Son Tra district and 1 in Cam Le district.⁴

Da Nang is one of the cities with the highest economic growth rate in the country. In the period of 2011 - 2016, the Gross Regional Domestic Product (GRDP) of the city increased 6-12% / year, reaching 53,787 billion VND in 2016 (at comparative price in 2010), which is 46.8% higher than 2011 (Figure 2-1). Main contributors to the city GRDP were the service sector (about 53-56%) and industry-construction sector (31-33%) (Figure 2-2). Production value (at comparative price in 2010) increased continuously at an average rate of 9.1% / year, reaching 50,371 billion VND in 2016, 1.5 times higher than 2011.

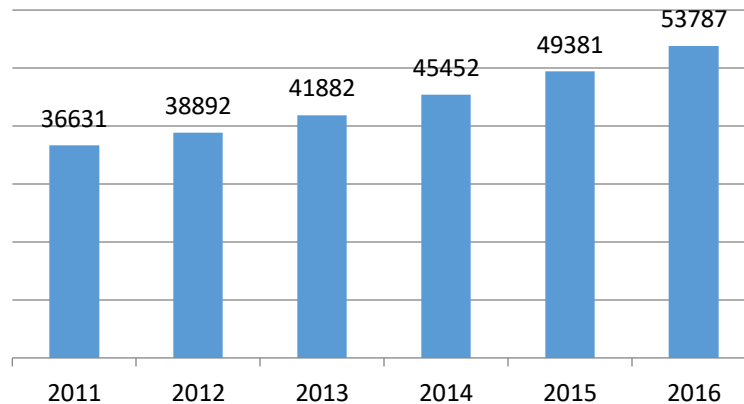


Figure 2-1 GRDP at the comparative price of 2010 (billion VND)

² <https://danang.gov.vn/web/guest/gioi-thieu>

³ Danang Statistical Office 2017, Danang Statistical Yearbook 2016

⁴ <https://iza.danang.gov.vn/cac-khu-cong-nghiep>

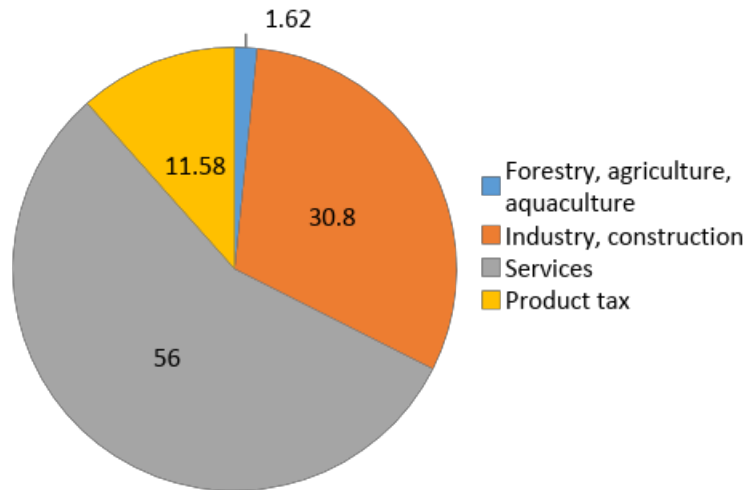


Figure 2-2 GRDP structure in 2016 at the comparative price of 2010

Along with the general economic growth, the income of city residents also increased. At the current prices, GRDP per capita increased continuously from 44 million VND in 2011 to 66.7 million VND in 2016. Income per capita was 4.1 million VND in 2016, 1.4 times higher than that in 2012 (Figure 3).⁵

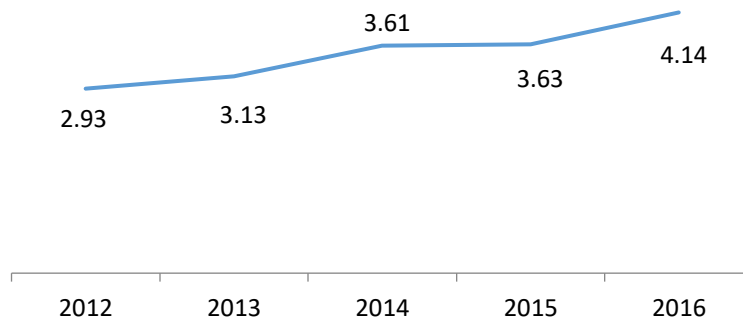


Figure 2-3 Monthly income per capita at the current prices (million VND)

According to the socio-economic development plan of the city, in the period 2016-2020, Da Nang strives to increase GRDP by 8 - 9% per year, GRDP per capita reaches 4,000 - 4,500 USD, the services, industry-construction, and agriculture sector account for 63-65%, 35-37%,

⁵ Danang Statistical Office 2017, Danang Statistical Yearbook 2016

and 1-2% in the structure of GRDP respectively, and production value of services increased by 9.5-10.5% per year.⁶

Tourism plays an important role in the economic structure of Da Nang, accounting for 23.72% of GRDP (16.544 billion VND) in 2016, of which direct contribution is 13.24%. In the period 2012-2016, the tourism sector grew positively with an average increase of the number of tourists of 13.4% / year, reaching over 4.2 million, of which the number of international visitors is 1 million in 2016 (Figure 2-4).⁷ During the sea tourism season from April to September, especially on the holidays, beaches such as My Khe, Son Tra can attract thousands of people and visitors every day.⁸ Major cultural and tourism events of the city also attract a large number of tourists and it is still increasing. Typically in the International Fireworks Festival in 2018, the number of visitors to the city at the time of opening and the number of visitors stayed in were estimated at 342,992 and 119,624 visitors, respectively, increase 10.2% and 9.3% compared with the same period in 2017.⁹ According to the plan, by 2020, tourism, especially luxury sea tourism will become a key economic sector of Da Nang. The city will welcome 8.9 to 9.35 million visitors, of which 3-3.5 million are international visitors and 5.85 million are domestic ones.¹⁰

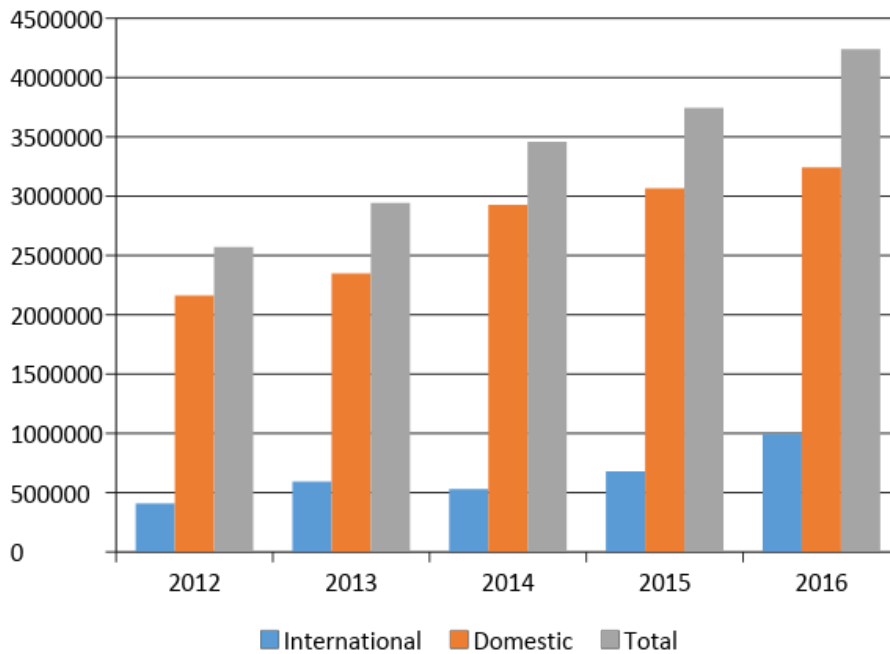


Figure 2-4 Number of tourists in the period 2012 - 2016 (people)

⁶ Resolution No. 135/2015 / NQ-HDND dated December 10, 2015 of Danang People's Council on the 5-year socio-economic development plan 2016 - 2020

⁷ Da Nang Statistical Office 2017, Da Nang Statistical Yearbook 2016

⁸ <https://thanhvien.vn/doi-song/bien-da-nang-dong-nghet-khi-nguoi-nguoi-do-xo-di-tron-nong-964804.html>

<https://www.tienphong.vn/xa-hoi/bai-bien-da-nang-dong-nghit-nguoi-dip-nghi-le-304-15-1267763.tpo>

⁹ <http://baodanang.vn/Multimedia/201804/hanh-trinh-10-nam-phao-hoa-quoc-te-da-nang-2596091/>

¹⁰ <http://tourism.danang.gov.vn/chi-tiet?idcat=58332&articleId=2708600>

In the period 2010 - 2016, the population of Da Nang is gradually increasing, reaching 1,046,252 persons in 2016 with the rate decreased gradually from 3.15% to 1.9% over the years (average 2.26% per year) (Figure 2-5). City residents live mainly in urban areas (87.46%), with more concentration in Hai Chau and Thanh Khe districts (38.6%). The majority of people (76.8%) live in coastal districts. The average population density of the inland of the city is 1,068 people / km². Population distribution is uneven, sparse in Hoa Vang district (179 people / km² or 0.17 time of the average density of the whole city) and dense in Thanh Khe and Hai Chau districts (20,226 and 9,104 people / km², 18.9 times and 8.5 times higher than the average density of the city, 5.5 times and 2.5 times higher than the average density of urban areas).¹¹ It is forecasted that by 2020, the city population will reach 1.6 million, of which the urban population will be 1.3 million (accounting for 81.25%).¹²

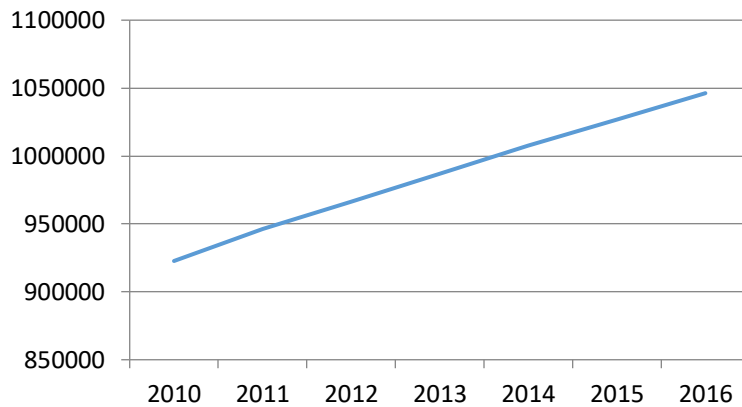


Figure 2-5 Population of Da Nang city (people)

In recent years, Da Nang has been recognized and praised as a city worthy of living, green city of Vietnam. However, Da Nang is still facing many challenges related to the environment, including water pollution. News and images of polluted rivers and lakes, bad smell and floating garbage or trash-filled ports appear more and more in the media.

¹¹ Danang Statistical Office 2017, Danang Statistical Yearbook 2016

¹² Decision No. 2357 / QD-TTg dated December 4, 2013 of the Prime Minister approving the adjustment of general planning of Danang City to 2030 and a vision to 2050

3. OBJECTIVES AND METHODOLOGY

3.1. Objective of the report

This report aims to provide insight into the current situation of water pollution in Da Nang City, the impacts of water pollution on people, life, the economy, and the ecological environment, management activities, polluting behavior, stakeholder roles, upcoming projects and programs, and challenges and opportunities for participation in water pollution prevention and water conservation in the city, in order to design CAWACON project activities and raise stakeholder awareness using participatory approach, citizen science, and advocacy to contribute to Da Nang's strategy to become an eco-city.

3.2. Research Methods

Based on the IUCN Situation Analysis method¹³.

The methods of implementation include:

- Desk review
- In-depth interviews and consultation with management agencies and communities
- Stakeholder workshop
- Online survey

Additionally, the report uses the results of CECR's Ocean without Plastic project and USAID case study on communication to raise awareness and change behavior in plastic waste management.

¹³ IUCN, 2018, Situation analysis - An approach and method for analyzing the context of projects and program (<https://www.alnap.org/help-library/situation-analysis-an-approach-and-method-for-analyzing-the-context-of-projects-and>)

4.1.1. Vu Gia - Han river system:

The Vu Gia - Han river system is located in the downstream of Vu Gia - Thu Bon interprovincial river basin. In Dai An commune (Dai Loc district, Quang Nam province), the Vu Gia river splits into two branches, the main branch is Ai Nghia river flowing to Da Nang, the distributary branch is Quang Hue river converting water to Thu Bon river at Giao Thuy (Quang Nam Province). Vu Gia - Han river system includes major rivers such as Tuy Loan, Yen, Cam Le, Han, Vinh Dien, Qua Giang, Co Co.

According to statistics from 2016 to 2018, in general, the water quality at the monitoring locations on the Vu Gia - Han river basin is within the allowable limits of the National Technical Regulation on surface water quality QCVN 08-MT: 2015 / BTNMT (corresponding to different water uses of specific river sections). However, some indicators exceed the limits at certain monitoring times or monitoring locations, such as suspended solids (usually high in the rainy season), organic matter, nutrients, microbiology. In addition, the downstream area is frequently salinized due to the impact of climate change and hydropower activities in the upper Vu Gia - Thu Bon river basin.

4.1.2. Cu De river system:

Cu De river system is an independent internal river system, located in the north of Da Nang city, originating from the south of Bach Ma mountain, north of Ba Na mountain range, flowing from West to East through Hoa Bac commune, Hoa Lien and Hoa Hiep Bac ward and ending in Da Nang bay. The length of the main river is about 47 km. The Cu De river system includes several tributaries such as Nam River, Bac River, tributary No.2 and other streams.

According to statistics in the period 2016 - 2018, pollution has not occurred in the Cu De river system, except for a few times at some locations where the concentration of nutrients (Ammonium NH₄⁺) exceeds the standard.

4.1.3. Small streams:

Distributed mainly in the eastern slopes of Hai Van pass and Son Tra peninsula, including Da stream, Tinh stream (Son Tra peninsula), Luong stream (Bach Ma mountain, Hai Van) which are the largest streams and are important sources of fresh water for the local people. The stream system has not been polluted due to its location in the mountainous area and there is no significant waste discharge.

Table 4.1 Major rivers and streams in Da Nang and their functions

No.	Names of rivers and streams	Function			
		Water supply	Irrigation	Drainage	Other
I	Vu Gia – Han river basin				

1	Tuy Loan river	✓	✓	✓	
2	Hoi Phuoc river	✓	✓		
3	Lon stream	✓	✓		
4	Tributary 3	✓	✓		
5	Tributary 1		✓	✓	
6	Yen river	✓	✓		
7	Quang Giang river	✓	✓		
8	An Trach – Cau Do river	✓	✓		
9	Cam Le – Han river			✓	Transportation, environment
10	Vinh Dien river			✓	Transportation, environment
11	Co Co river			✓	Landscape, conservation
II	Cu De River Basin				
1	Upstream section of Cu De river (Bac river)	✓			
2	Middle section of Cu De River	✓			
3	Lower section of Cu De river			✓	Ecosystem protection
4	Nam river	✓			
5	Tributary 2	✓			
III	Small streams				
1	Luong stream (Hai Van)	✓		✓	Landscape
2	Da Stream (Son Tra)	✓			Landscape
3	Tinh Stream (Son Tra)	✓			Landscape

4.1.4. Open channel system

The open channel system is a part of an urban drainage system that collects and convey rainwater to the river or sea to prevent flooding. However, in Da Nang, there have not been wastewater collection systems on some areas, so these channels become places to receive and drain wastewater. A typical example is Phu Loc channel (which formerly is a natural river but was renovated to rainwater drainage channel), which has long been considered the most polluted channel in Da Nang. The statistics show that the biggest problems in Phu Loc channel are nutrient, organic matter, and microorganism pollution with prolonged odor, especially during the dry season.

In recent years, the city has overcome the situation of wastewater sources flowing into the channels such as wastewater discharging into channels B12, B18, B24, Yen The - Bac Son, Khe Can in Cam Le and Lien Chieu districts. There is currently a wastewater collection system along the Phu Loc channel.

To date, the main drainage channels which have wastewater collection systems are: Phu Loc, channel from Bau Sau lake and Trung Nghia lake to Phu Loc channel, Khue Trung, and Phan Lang. In channels that do not have a wastewater collection system such as Phong Bac, the channel connecting Hoa Phu lake to Hoa Minh channel, Tan Trao - Hong Thai, currently, the amount of wastewater generated is not much, so the impact on the environment is not significantly.

4.2. Lake system

In addition to the river system, in Da Nang there is also a system of natural and artificial lakes (irrigation reservoirs) with the function of supplying water for irrigation, domestic uses, flow regulating, microclimate regulating, and creating urban landscape.

4.2.1. Natural lakes:

In Da Nang there are 51 natural lakes scattered across the districts. In the urban area there are 30 lakes, unevenly located with a total water surface area of about 1.8 million m², total volume of about 6.1 million m³, and the average depth ranging from 0.8 to 4.5 m. Among the urban lakes, Bau Tram lake in Lien Chieu district has the largest area (30% of total area), 25 lakes have an area of over 10,000 m² and the rest are small. In recent years, due to the process of urbanization and the incomplete collection of wastewater, the area of some lakes has been narrowed due to encroachment or sedimentation (Do Xu lake, Xuan Hoa A lake, etc.) causing impact to rainwater drainage capacity and pollution in the dry season.

In the urban area, only 7/30 lakes have wastewater collection systems.¹⁴ In the remaining lakes, urban wastewater is discharged directly into the lake. In the hot season, fish death occurs frequently, causing bad smell. Only 4/30 lakes have water quality monitoring points, including Green Lake, Bau Tram, Park lake, Thac Gian - Vinh Trung. The statistics show that, except Green Lake (water source for domestic use), the remaining lakes are in a state of organic,

¹⁴ 29/3 Park Lake, Thac Gian Lake, Vinh Trung Lake. Trung Nghia Lake, West Lake. Khue Trung Lake, Bau Trang Lake

nutrition and microorganisms pollution. Pollution levels in Thac Gian - Vinh Trung lake tend to increase and those in Park lake tends to decrease over the years 2016 - 2018.

Lakes in suburban areas such as Hoa Phu lake, Trung Nghia 1 lake in Lien Chieu district show signs of pollution due to eutrophication, weeds and water hyacinths. At times, fish death still occurs. The reason is the discharge of wastewater and garbage from households residing in the surrounding area.

4.2.2. Artificial lakes (irrigation reservoirs)

Besides natural lakes, in Da Nang there are also 21 irrigation reservoirs with a total capacity of 35.93 million cubic meters, responsible for supplying water for irrigation and domestic water, of which the largest are Dong Nghe, Hoa Trung, and Truoc Dong reservoirs. The reservoirs are mostly located in upstream areas far from residential areas, so they are less polluted. Although the main function is to supply water for agriculture and domestic use, these reservoirs have great potential in landscape and ecology, thus they are currently included in the planned projects listed in the “Environmental City” project of the 2021-2030 period to become protected wetland landscape areas.

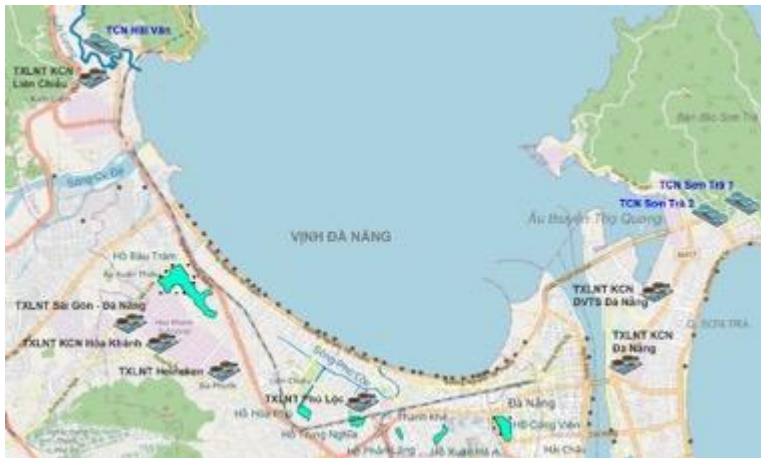
Table 4.2 List of important lakes/reservoirs in Da Nang city

(Source: “Surface water resources of Da Nang city to 2030, with a vision to 2045” project)

No.	Lakes/reservoirs	Perimeter (m)	Area (ha)	Functions
1	Dong Nghe	14,262	172.56	Water regulation and supply
2	Hoa Trung	13,628	107.18	Water regulation and supply
3	Truoc Dong	5,004	27.5	Water regulation and supply
4	Green lake	999.5	5.74	Water regulation and supply
5	Park lake	1,560	10.96	Rainwater regulation, landscape
6	Bau Tram	3,880	36.06	Rainwater regulation, landscape
7	Phan Lang	632	1.8	Rainwater regulation, landscape
8	Hoa Phu	959	4.6	Rainwater regulation, landscape
9	Trung Nghia	930	3.49	Rainwater regulation, landscape
10	Phuoc Ly	839	3.72	Rainwater regulation, landscape
11	Xuan Ha A (Thanh Khe)	653	4.86	Rainwater regulation, landscape
12	Bau Gia Thuong, Bau Gia Ha	1,370	10.44	Rainwater regulation, landscape

13	Khue Trung	1,360	7.85	Rainwater regulation, landscape
	Total	46,076.50	386.32	

4.3. Coastal waters



Eastern coastline of Da Nang city (source: CECR)



Figure 4-1 Da Nang bay and the

Da Nang has a coastline of about 92 km, a deep bay with Tien Sa seaport, a continental shelf territorial sea with a depth of 200 m, forming a large shallow water belt suitable for integrated marine economic development and exchange with foreign countries. The coast of Da Nang has many beautiful beaches such as Non Nuoc, My Khe, Thanh Khe, Nam O, Lang Van with many interesting natural landscapes, of great value for tourism and resort development.

The coastal waters receive both treated wastewater (from centralized wastewater treatment plants) and untreated wastewater (from households, business and service establishments, ships, boats, rivers, and drainage channels). In general, the water area of the beaches is of good quality, however, in Cu De and Phu Loc estuary areas and the areas receiving storm water runoff, there have been signs of Coliform pollution.

The urban wastewater drainage system of Da Nang is a mutual drainage system (collecting both rainwater and wastewater) with about 98% are closed culverts and channels, and the rest is open channels. In many areas there have not been drainage systems or drainage systems not yet connected to the city drainage system, wastewater is discharged directly into the East Sea and Da Nang Bay causing pollution at the receiving locations.

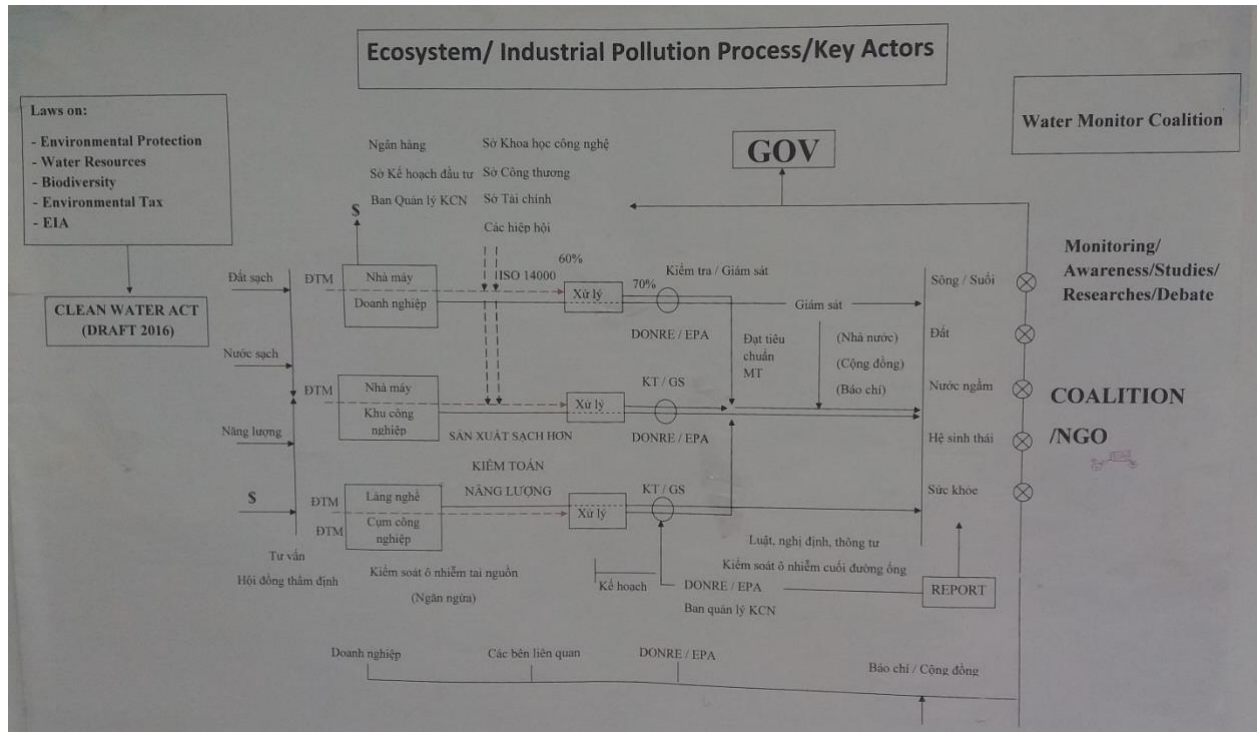
Da Nang city has 18 coastal wards, of which more than 30,570 coastal households with low drainage system connection ratio. Here household wastewater is treated through septic tanks or self-infiltrating causing substantial impacts to the quality of groundwater and coastal water. In addition, the drainage outlets along the coast have diversion structure, therefore at the beginning of the rainy season, wastewater is mixed with rainwater flowing into the sea, causing bad odor, loss of landscape of the beach area, and coastal sea water pollution.

During the tourism season, beaches receive large numbers of tourists and residents increasing the need for food services and public toilets, thus generating garbage and wastewater causing pollution.

Marine transport and tourism activities also contribute to coastal environmental pollution. Increasing numbers of cargo ships and cruise ships docking at Da Nang ports also generate waste and pollute the coastal water quality. In the coming years, the trend of marine economic development in Da Nang is a spearhead and this is also a high pressure on the environment if the appropriate control measures are not strengthened promptly.

5. ROLE OF STAKEHOLDERS IN WATER RESOURCES MANAGEMENT AND WATER POLLUTION CONTROL

The issue of water resource management and water pollution control is a cross-cutting and multi-stakeholder issue. Separating stakeholders can sometimes be difficult. A very clear example is that the community is influenced by polluted water but they are also the ones that discharge and pollute the water. According to the research report of CECR we have a map of the stakeholders involved in water resource management and pollution control as below:



There are many ways to divide and define the roles of stakeholders / partners in water resource management and water pollution control. The most common way is to determine by the impact factors including: (1) The source of pollutant discharge (2) Management and monitoring of pollution (3) Determination of pollution and treatment of pollution. The stakeholders in Da Nang city are identified as follows:

(1) The source of the polluting discharge, the stakeholders are:

1. Industrial zones
2. Factories
3. Enterprises
4. Hospitals
5. Craft villages
6. Landfills
7. Community (including residential areas, fishermen, farmers)

(2) The group of water management agencies and interventions to control pollution, stakeholders include:

A. State administrative agencies

1. Department of Natural Resources and Environment
2. Department of Construction
3. Department of Agriculture and Rural Development
4. Da Nang City Police
5. Community

B. Education and propaganda agencies:

1. Department of Education and Training
2. Radio and television
3. Associations
4. NGOs

(3) The parties involved in pollution identification and treatment, including:

1. Center for natural resources and environment monitoring (under the Department of Natural Resources and Environment)
2. Domestic water supply company (under the Department of Construction)
3. Sewerage and wastewater treatment companies (under the Department of Construction)
4. Industrial zones (under Department of Industry and Trade)
5. Factories, factories (under Department of Industry and Trade)
6. Enterprises (under Department of Industry and Trade)
7. Hospitals (Department of Health)
8. Craft villages (NA)

- Enterprises initially have interventions to treat polluted water but these are few and focus on large industrial zones or foreign enterprises (eg Heineken company...). With the tendency to manage pollution at source, this group plays a very important role. Raising awareness, changing behavior and applying effective models of water resource management; Pollution control and smart water use need to be strengthened.
- The group of state administrative agencies currently has 03 specialized departments that are directly responsible for water resource management and pollution control: the Department of Natural Resources and Environment; Department of Construction; Department of Agriculture and Rural Development. The police agency (the environmental police department) will be responsible for investigating and detecting crimes related to the environment and water pollution. In addition to the above state agencies, with the current digital age, the community is actively participating in environmental monitoring in general and water pollution control in particular.

- Communication and awareness raising are currently done by the mass media, including: Radio station; television and newspapers. Currently, the mass organizations are making a great contribution to the propaganda in the community about water pollution control. However, information on water resource management and water pollution control has not been regularly updated, so the effectiveness of communication and propaganda is not high.
- The integration into the educational program on water resource management and pollution control has been mentioned by the Department of Education and Training, but has not been promoted and implemented at present.
- With technical agencies and related parties to identify and treat water pollution, Da Nang city is investing in both quantity and quality. These technical institutions are managed by the Department of Natural Resources and Environment and the Department of Construction. The wastewater treatment at the discharge source in a number of industrial zones, factory, enterprise, hospital has initially invested with application of science and technology to treat polluted water.

The People's Committee of Da Nang city is the focal point for decision making on water resource management and pollution control. Relevant agencies are responsible for coordinating with each other in the implementation process; implementing activities and reporting to the People's Committee for handling problems.

6.1. Point sources Pollution

6.1.1. Domestic wastewater:

The total amount of urban wastewater in the whole city is about 141,078 m³ / day, collected into the mutual drainage system through pumping stations and centrally treated at 5 treatment plants: Phu Loc, Son Tra, Hoa Cuong, Hoa Xuan, and Ngu Hanh Son, then discharged into Phu Loc channel, Tho Quang port (Son Tra plant), and Han river.

Currently, about 80% of wastewater in the urban areas has been collected and treated (in the suburban area including Hoa Vang district there has not been a wastewater collection system). However, many systems have been built a long time ago leading to deterioration or failure to meet requirements. Moreover, a significantly rapid urban development rate has resulted in system overload¹⁵. In addition, there are still areas in the urban areas where wastewater has not been collected¹⁶. Especially, only 7/26 regulating urban lakes have wastewater collection systems. Domestic wastewater is a major source of pollution in urban lakes.

Phu Loc channel, one of the polluting hot spots in Da Nang, receives domestic wastewater and waste from households mainly in two wards of East and West Thanh Khe (Thanh Khe district). The percentage of households here with septic tanks is 98.6%, but still 1.4% of the 35,470 households in the district have a soil absorbent toilet. Thus, there is still a quantity of domestic wastewater that is absorbed in the soil, affecting water quality.

Other large domestic wastewater sources originate from business and service¹⁷ establishments concentrated in the coastal area. Notably, 77.2% of wastewater in urban drainage systems comes from small hotels and service establishments. The wastewater volume of 13 large facilities outside the drainage system (discharged directly to rivers and sea) is many times larger than that of large facilities connected to the drainage system. Domestic wastewater increases during the tourism season when the beaches receive large numbers of tourists.

6.1.2. Industrial wastewater:

In Da Nang city, there are industrial zones including Hoa Cam (wastewater volume of 700 - 800 m³ / day discharged into Cam Le river), Hoa Khanh, expanded Hoa Khanh, Lien Chieu, expanded Thanh Vinh industrial cluster (the total volume of wastewater of 6,000 - 8,000 m³ / day discharged into Cu De River). Wastewater from these industrial zones is treated in accordance with the standards before being discharged into the environment, but in the near future, the increase in occupancy rate as well as the inadequate monitoring will lead to the risk of water pollution.

In the area of Phu Loc channel, there are also many sources of wastewater from industrial and medical establishments such as textiles, garment and paper packaging facilities, Thanh Khe hospital, etc.

¹⁵ Collection system in eastern coastal areas, Da Nang Bay area, former Hoa Cuong wastewater treatment stations, Ngu Hanh Son, Son Tra

¹⁶ Some areas in the east coast (wastewater discharged into Co Co river by rainwater drainage system), western area of Cau Do (discharging into Cam Le river), area on the east bank of Han river (discharging into Co Co river), some open channel lines, regulating lakes

¹⁷ 309 establishments were inspected in the last 2 years, with only 27% of small establishments inspected

Tho Quang port receives a large amount of industrial wastewater from Da Nang fisheries service industrial zone with a total wastewater volume of about 3,000 m³ / day (4,000 - 5,000 m³ / day in the fishing season). Although wastewater is pumped to the Son Tra wastewater treatment plant, the ratio of wastewater connection in the industrial area is low and the drainage infrastructure is not adequate causing serious water pollution.

6.2. Non-point sources Pollution

6.2.1. Wastewater from agriculture and aquaculture:

The total area of agricultural land of Da Nang is 2,485 ha, belonging to the districts of Hoa Vang (1,805 ha), Ngu Hanh Son (540 ha), Lien Chieu (124 ha), and Cam Le (16 ha). Leaching and accumulation of residues of inorganic and organic fertilizers pose a risk of water pollution.

In the areas along Cu De River there are alluvial flats with a narrow area, farming activities here are mainly crops such as vegetables, corn and cassava, ... the use of chemical fertilizers and pesticides is insignificant. In addition, there are a number of shrimp farmers in the upstream of Cu De River, but from 2011 until now, the area of shrimp farming tends to decrease due to low productivity and change in land use.

Non-point sources pollution from agricultural activities are very large, for example, excess sources of pesticides and fertilizers in the water flowing into rivers, streams, lakes and coastal water sources. This is a huge source of pollution. Managing these pollution sources requires improvements in integrated agricultural management and farmer participation, as well as a strong legal framework.

6.2.2. Sand and minerals exploitation:

The exploitation of soil, sand and minerals in the upstream area has significantly affected water quality in the downstream area. According to statistics, only about 25% of activities are legal. The uncontrolled exploitation of sand and gravel has caused erosion and increased turbidity of the water source. The types of chemicals used in mining discharging to surface waterways are also a source of pollution that is very challenging in terms of management.

6.2.3. Waste from boat operations:

In Han river mouth and Tho Quang port, there are usually about 400-500 boats anchored, in which, many boats come from other provinces. The issue of domestic solid waste and washing water containing oil and organic matter has not been strictly controlled, causing water pollution, especially in the fishing port area of Tho Quang port. Increasing numbers of cargo ships and cruise ships docking at Da Nang port are also generate waste, polluting coastal water.

The Cu De River mouth is shallow, fishermen's boats are small, so the amount of waste is small and the impact on water quality is negligible.

6.2.4. Garbage leachate:

Wastewater after treatment from the leachate treatment system of Khanh Son landfill is discharged directly into the river basin, with the total amount of wastewater estimated at about 2,000 m³ / day, causing organic, nutrition, grease pollution... This is one of the hot spots that is being addressed.



Figure 6-1 The channel with dark water discharged from the Khanh Son landfill taken on April 9, 2019 (source: Vietnamnet.vn)

Waste pollution, especially plastic waste in the tourist waters of Da Nang, has become a barrier to the tourism industry of Da Nang. Garbage that is not collected by sewers and especially by storm carried into the sea is a huge source of pollution. Beyond to land-based waste, the amount of plastic waste from the ocean swept ashore when it storms is also a great source and has not been recorded. In Tho Quang harbor, every time it storms, the amount of garbage pulls from the river mouth and from the ocean to form giant mountains of trash. According to the Management Board, every time it rains storms, they had to mobilize up to 60 workers to pick up the garbage instead of 13 workers to manage the waste as usual. The types of wastewater discharged from fish trading activities from markets and around fishing ports are also sources of surface pollution, not only polluting water sources but also creating bad odors and air pollution for surrounding area. Tho Quang harbor is one of the hot spots where Da Nang city is concentrating resources to improve the environment and towards reducing pollution in the next 5 years.



Figure 6-2 Garbage floats in the gaps between ships anchored in the port (source: CECR)

6.3. Tho Quang port



Figure 6-3 Thọ Quang port

Located in Da Nang Bay, the area of the Tho Quang port has been an environmental pollution hot spot for years. The main reason is due to wastewater from Da Nang Industrial and Fisheries Service Industrial Area with 29 active projects (96.4%) producing and processing seafood with a total wastewater volume of about 3,000 m³ / day to about 4,000 - 5,000 m³ / day in the fishing season). Although wastewater is pumped to the Son Tra wastewater treatment station for treatment, the rate of wastewater connection in the industrial area is low and the drainage infrastructure poses a risk of serious water pollution. In addition, the area is polluted by sewage, domestic wastewater, and oil-contaminated washing water from anchored boats.

According to a survey by CECR, 2018 within the Ocean without Plastic project, one of the biggest sources of pollution in the port is

solid waste.

Solid waste generated in port comes from 3 locations: ship anchoring area; seafood market; cargo service area with a total waste of about 4,500 kg / day, of which: 60-70% is generated from the area where ships are anchored (about 2700kg / day). The official waste collection at the lock is handled by the environmental team of the Port Management Board. In addition, there are informal plastic bags collecting activities from people in the fish market.

However, waste management, especially plastic waste, still faces challenges:

- The penalty for littering is difficult to implement because the Management Board is a non-business unit with no sanctioning function, and must coordinate with other agencies such as the Border Guard, the environmental police
- More than 70% of ships and boats operating at the port are from outside the province, the communication campaigns face difficulties because they only stay for 1-2 days and leave, then come back 3-4 months later, so the campaigns aren't effective. Due to the low awareness of fishermen and boats, the litter situation often occurs at night, making it unable to collect evidence for sanction.

Shortcomings in the implementation of wastewater and waste management in the port result from the following 3 reasons: (1) Fishermen's practices; (2) With fishermen from different places, different provinces, it is difficult to catch litter behavior. And it is difficult to create a habit of not dumping garbage in the port, because they are from different provinces and only come to the port and fishing port about 3 times a year, so the strict regulations in the area won't change their habitual behavior; (3) Sanctioning litter without evidence, lack of tools to support the sanction despite the regulations on sanctions. Also, according to Mr. Thanh, the enforcement of regulations in port is difficult because the port is a special, wide area with many

different types of people. There are no separate regulations for fishing ships, only regulations for transport ships.

6.4. Summary of the current state of water pollution in Da Nang

The economic development of tourism and fisheries sector of Da Nang depends heavily on the high quality of the urban surface water and the coastal water quality. Despite many efforts, water pollution remains one of the biggest challenges in making the environmental city with ecological approach. Although the main rivers and streams generally meet the water quality for the identified uses in general, pollution hotspots and local water pollution problems has a great influence on tourism in Da Nang. No one pays to go to the beach, the most beautiful beaches in the world, get wrapped in trash. In open canals, pollution from waste water and domestic waste is more common due to incomplete collection systems, problems with wastewater treatment stations, or low awareness of local communities, in which a typical example is the Phu Loc River that has been a polluted hot spot for many years.

Irrigation reservoirs, due to clear water supply functions (for agriculture and domestic use) so they are strictly managed, on the other hand, they are mainly located in suburbs far from residential areas, so there is less pollution, even though there are still unusual incidents. However, in urban lakes, most of which are located in high-density urban areas and do not have a wastewater collection system, pollution is more common, having a significant impact on ecology, landscape and people's quality of life, especially in the dry season.

Coastal waters are downstream areas, receiving both treated and untreated wastewater, combined with a high density of coastal population, so pollution still occurs, especially in the tourism season when wastewater and garbage increases or at the beginning of the rainy season, when the amount of wastewater mixed with rainwater is discharged into the sea without being collected and conveyed to the treatment station. In particular, the pollution hot spot in the Tho Quang port still exists, due to the problem of wastewater and garbage from the fisheries service industrial zone, and the operation of fish markets and ships.

7. POLICIES RELATED TO SURFACE WATER RESOURCE IN DA NANG

The planning documentary system issued by the city is quite completed and most of them have been updated for the new period (2020-2030), in which there are plans that directly affect the management and protection of water resources in Da Nang, including:

- Master plan of Da Nang city to 2030, with a vision to 2045
- Plan on water supply system of Da Nang city to 2030, with a vision to 2050
- Plan on drainage of Da Nang city to 2030, with a vision to 2050

In addition, there are other plans that are related to and impact more or less on water issues in Da Nang such as the industrial development plan of Da Nang city, the land use plan of Da Nang city, the irrigation plan and hydropower plan in Vu Gia - Thu Bon river basin.

Currently, there are 3 projects and schedules of Da Nang directly related to the management and conservation of surface water:

7.1. The "Environmental City" project

2008 – 2020 period:

In addition to the achieved achievements, the city still has 3 criteria that have not been evaluated or achieved by 2020 (the rate of factories controlling air pollution; the rate of water quality meeting the requirements; the rate of industrial solid waste reuse). The planning work still has many shortcomings leading to the failure to comply with regulations and standards. The investment in environmental technical infrastructure is inadequate, the calculation of scale and selection of treatment technology is not insufficient. Monitoring tools and human resources are not yet compatible with urban development and new specialized management practices. The financial resources from the state budget are not really sustainable, while the mobilization from socialization is still very new, so there are many difficulties and problems.

2021 – 2030 period: more attention paid to the ecological aspect.

The city aims to continue maintaining and elevating the targets under the 2008 approved project, and has targets associated with the following specific activities:

1) 2021 – 2025 period

a) Preventing environmental pollution: Integrating environmental issues into the city's planning, strategies and programs; inspect and sanction violations of law by polluting projects and works; implementing the ISO 14000 model; replacing existing buses into Euro-standard buses; building monitoring network.

b) Environmental improvement: Invest, renovate, and upgrade the domestic water and wastewater collection and treatment systems in industrial areas and clusters in the city.

c) Nature conservation: Review plans, develop the green parks system, street greenery, greenery management; implement tasks and programs under the biodiversity conservation project 2021-2030.

d) Capacity building, awareness raising: Develop supporting policies in production technology improvement activities, waste treatment technologies; maintain activities in response to the movement and model of environmental protection of all people and enterprises.

2) 2026 – 2030 period

a) Prevention of environmental pollution: Build and implement circular economy; encourage the application of the management model according to ISO 14000 standards; increase the use of renewable energy; building models of eco-industrial areas; convert to use of environmentally friendly fuels for the bus system.

b) Improvement of the environment: Implement treatment solutions to reuse wastewater; encourage investment in advanced technologies; encourage investment in recycling production projects.

c) Nature conservation: Take measures to increase the area of public green trees; to build wetland landscape protection zones and marine biodiversity conservation zones.

d) Strengthening strategies, raising awareness: Propagate, raise awareness about environmental protection, circular economy; strengthening human resources; assess the satisfaction of organizations, people and businesses on environment quality, and environmental protection.

The city now offers many solutions on policy mechanisms, science and technology; on construction and resource development, and on finance. The city also has other support solutions to maximize the mobilization of resources in the society and promote the participation of the business community, socio-political organizations, and the people in environmental protection such as:

- Communication campaigns, education, awareness and responsibility raising for environmental protection and tree planting and biodiversity conservation. Additionally, integrate environmental issues into the curriculum to enhance environmental education
- Maximize the means of communication and develop and organize communication programs, training courses to raise awareness on environmental protection among people.
- Create favorable conditions for enterprises to cooperate in forming industrial symbiotic nets and give priority to ODA loans for programs of environmental rehabilitation and restoration, construction enhancement of wastewater treatment facilities.

7.2. "Surface water resources of Da Nang city to 2030, with a vision to 2045" project

The project is proposed to strengthen the state management of water resources in the city, control the exploitation, use of groundwater resources, and implement solutions to protect water resources.

The project specifies main implementation contents including protection of water quality for domestic water supply purposes; management of exploitation, use of groundwater resources by regulating the registration of groundwater extraction. In addition, the project also specifies the reporting responsibilities of organizations and individuals licensed by the City People's Committee on water resources, including incident report and activities report of exploitation and use of water resources, discharge wastewater into water sources.

7.3. Plan to treat environmental pollution in Tho Quang port in the 2020 – 2025 period

Facing the pollution situation of Tho Quang port, a pollution treatment plan has been set out to control the pollution sources in the area. In addition, the plan also aims to assess waste sources to propose specific solutions, systematically control and manage the environment, especially waste from anchored boats, improve management of environmental sanitation. In addition, plans are put in place to strengthen patrols, detection and handling of violations, assign

functions, duties and responsibilities to agencies, and ultimately regulate relevant regulations regarding the capital source for the implementation of the plan.

The activities in the plan are divided into sections with the main activities as follows:

- Wastewater pollution treatment / wastewater control: complete technical infrastructure system; control the quality and flow of wastewater; inspect and detect violations of discharging untreated waste, using unregistered groundwater, failing to fulfill financial obligations on environmental protection, letting wastewater leak.
- Odors control: dredging sludge; transferring domestic solid waste to service units; intensifying inspection, detecting vehicles leaking wastewater, vehicles parked, circulating not in accordance with regulations, causing environmental pollution; regularly inspect odor control, dredging systems, deodorizing spraying systems, preserving sludge, waste products, recycled solid waste, ... before transferring; to control the delivery and receipt of solid waste and sludge.
- Solid waste management: enhance inspection, patrol, detect and handle violations of regulations on dumping, environmental sanitation inside and outside the industrial area and other regulations for ships docking at Tho Quang Management Board; providing solid waste receiving, collecting and storing waste equipment / tools; organizing environmental sanitation.
- Strengthen management measures: propagate and guide the implementation of regulations on environmental protection for people at the port; inspecting and examining the observance of the law; train the environmental monitoring team in the community; other control management mechanisms.

In particular, the component of strengthening management measures, specifically propaganda activities providing instructions on the implementation of environmental protection regulations for ships, traders, vehicle owners, and management board staff with the participation of all mass organizations and the support of other social resources needed.

8. ASSESSMENT OF IMPACTS AND DEVELOPMENT OF SURFACE WATER POLLUTION AND PEOPLE'S PERCEPTIONS OF WATER POLLUTION

8.1. Assessment of surface water pollution impacts

In Da Nang, the problem of surface water pollution is affecting many different aspects and fields and is increasingly serious. The socio-economic sector as well as the people's lives are severely affected.

Firstly, from the perspective of economic issues, water pollution has had a strong impact on two main areas in Da Nang's economy: (1) tourism services and (2) fisheries and aquaculture.

In terms of tourism, polluted water is destroying landscapes, sea water, and beaches. Typically, in the area of Son Thuy beach, Hoa Hai ward, Ngu Hanh Son, wastewater is discharged directly to the beach. This situation is causing concerns and worries of the people living around the beach area: "If you go to swim in the beach and accidentally get seawater into your mouth, it is like drinking dirty water "¹⁸. Tourist services are also affected by water pollution.

Fisheries and aquaculture are also severely affected by water pollution. The mass death of fish and aquatic creatures in Da Nang has caused billions of losses for the aquaculture farmers. Bank loans for seed, food, labor as well as the destruction of dead fish leave people in difficult circumstances.



Figure 8-1 Fish deaths in aquaculture households in Co Co River area, Khue My ward, Ngu Hanh Son district

(source: <https://baotainguyenmoitruong.vn/da-nang-ca-chet-trang-be-nghi-do-o-nhiem-nguon-nuoc-285090.html>)

¹⁸ [Quản lý đô thị Đà Nẵng: Tiên nghi - Xanh - Sạch - Đẹp | Facebook](#)

Therefore, the water pollution problem is hindering the development and affecting the economic growth of Da Nang.

In addition to the trillions of losses caused by water pollution, the lives and health of the people in Da Nang also face dangers and heavy impacts from water pollution.

First of all, the living environment, the households living near and adjacent to the polluted areas are suffering from stench, their lives are turned upside down. Mr. Van Ganh, living in Khanh Son, Hoa Khanh Nam ward, Lien Chieu district, said: "Even during meals the doors must be closed, but the stench is still getting into the house, it is impossible to have a delicious meal. We hope the authorities have measures to solve this issue"¹⁹.

Not only the environment, but people's health is also at risk of being affected and it is causing concern to the people. (60% of interviewed people think that water pollution is affecting their lives, according to the CECR survey in December 2020).

8.2. Evaluation of development in surface water pollution and future threads

Along with the general trend of water pollution nationwide, in Da Nang, the water pollution level tends to increase. (About 40% of the respondents said that the surface water quality of the city is deteriorating, according to the CECR survey in December 2020).

Besides, Da Nang is also facing the trend of re-pollution of water sources. In the case of Bau Trang lake after 6 months of handling pollution, there has been a phenomenon of re-pollution. According to Mr. Bui Duc Nhien - Secretary of Sub-Division of Residential Area No. 2 in West Thanh Khe ward, pollution started again on September 18, 2020. "The water in the lake turned black over a night. After about 5 days, the pollution gets worse. The stench is strong. Many types of fish living in the lake are lethargic, they are sure to "turn their stomach up" soon"²⁰. In order to avoid re-pollution occurring, water source monitoring needs more attention.

The research team also conducted a quick review of information on water pollution in Da Nang in the media. The results show that the coverage of this information tends to appear significantly more frequently in the past 2 years.

¹⁹ <https://vietnamnet.vn/vn/thoi-su/moi-truong/nguoi-da-nang-khon-kho-vi-dong-nuoc-den-ngom-hoi-thoi-521278.html>

²⁰ <https://m.facebook.com/tsdn.vn/posts/184658086496615>

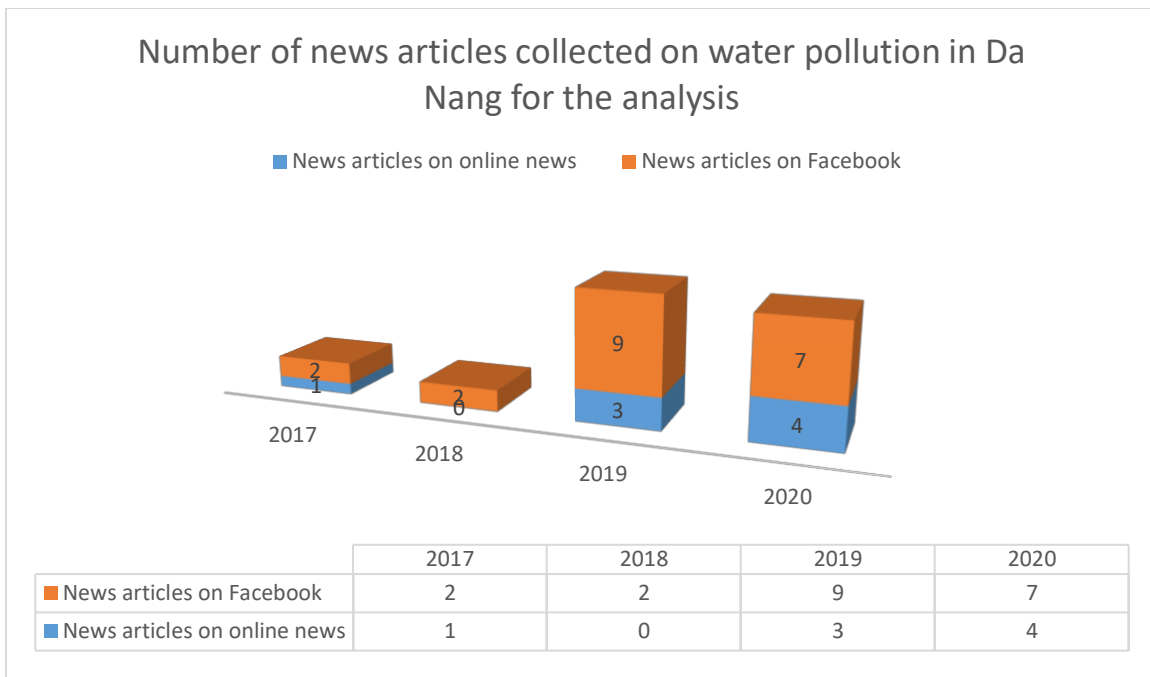


Figure 8-2 Information on water pollution in Da Nang on websites and Facebook

8.3. Quick assessment of awareness and willingness to participate of the local community

The research team have conducted a quick survey through an online form for local communities on awareness and concerns about water pollution and water protection.

Some key information from the survey results are as follows:

- Age: 18-70 years old, of which the majority are from 30-50 years old (57%).
- Education level: (64%) respondents have a college degree or higher (of which 1/10 people have expertise in natural resources and environment), the rest are high school qualifications.
- Current job: (62%) are currently doing jobs requiring expertise, the rest are freelance workers, housewives.
- Residence: (50%) live in Hai Chau district, where is the central district of Danang. Particularly, Hoa Vang district (suburban) did not have respondents.
- All respondents use tap water for subsistence and production activities, however (21%) use additional bottled water for drinking and well water for other activities.
- (69%) suppose that the city faces water shortages for domestic use and production, (48%) of respondents suppose that surface water is being polluted (ponds, lakes, rivers, streams, seas, ...), (38%) of respondents suppose that the quality of drinking water was not guaranteed.
- (55%) of respondents suppose that the water source is little or no polluted, (36%) of respondents suppose that the water source is polluted and very polluted (of which 9 people provide specific information), (9.5%) of respondents do not know the situation.
- (40%) respondents are unaffected, (26%) of respondents are less affected, and (33%) of respondents are significantly or seriously affected by problems of water. (28%) of respondents provided more specific information.

- (88%) of respondents suppose that the main reason of water pollution is wastewater, of which the majority suppose that the main source of wastewater is untreated or treated inadequately production wastewater.

- (81%) of respondents aware of pollution by observing that the water is discolored or more turbid than usual, and (19%) of respondents see wastewater and waste discharged directly to the sewage system.

- (57%) of respondents suppose that the water quality in the area has improved in the last 5 years, the rest suppose that the quality has not changed or deteriorated. However, only (21%) respondents could show the specific changes.

- In the forms of accessing information about water issues, the majority is social networks with 64%, the traditional forms (newspaper, television, radio, ward radio) account for 48%, and website / electronic newspapers account for 33%.

- Among the activities to protect water sources, (90%) of respondents have implemented water saving, (29%) of respondents have participated in sanitation activities to clean channels, ditches, lakes, ponds, rivers, streams, coasts; (24%) of respondents have participated in propaganda or mobilized other people to participate, especially (9.5%) of respondents have proposed or reported to the authorities.

- (64%) of respondents agree to join a community network for water protection in Da Nang operating on social media platforms, (31%) of respondents will consider, only (5%) of respondents may not participate.

- In addition to participating in the general activities of the network when called upon, (43%) of respondents can participate more deeply through organizing, contributing content and initiatives to activities. In particular, (17%) of respondents can propose or organize the implementation of the initiative.

- Most respondents can participate in providing information on water issues, of which (48%) of respondents are very willing, (52%) of respondents can participate to a certain extent.

- Most suppose that time is the main factor hindering participation in a community network for water protection, with (93%); followed by the level of understanding with (43%). In particular, (14%) expressed that disbelief would affect their participating decision.

- In addition to the investment in water supply and drainage infrastructure, most respondents (83%) suppose that it is necessary to increase the disclosure of information, communication, education, and support the community to participate in protection water source.

Summary:

Regarding the water sources used: All respondents use tap water (because the respondents all come from the urban districts), but a large proportion of respondents suppose that tap water is not guaranteed of quality and have to use bottled water and water purifier for dining.

Regarding perceptions on water issues:

- The perceptions of surveyed people on water issues in Da Nang are quite clear, but the **number of people who can provide more specific information is small.**

- Among surveyed people, most agree on water shortage, while only about half mentioned about water pollution. In addition, half of the respondents also said that the water source is not polluted. One possible cause is water shortage is easier to recognized (since people mainly use tap water) and has a more pronounced effect.

- The number of people affected by water problems is quite large, accounting for nearly two thirds. In particular, one third of people are significantly affected.

- Wastewater from daily life, production and business is considered by the majority to be the main source of pollution, especially production wastewater. **In addition, about half said domestic wastewater and waste were a major problem.**

- A rather large percentage (more than 40%) said that the quality of the water source tended to deteriorate in the last 5 years.

- **Social media is the most popular channel** that people access for information on water pollution, followed by traditional channels (newspapers, television, radio, ward radio) while the access via electronic newspapers and websites is the lowest, accounting for 1/3 of the respondents.

Regarding the ability to participate in related activities:

- Most of respondents practice water saving, but only less than half of them have participated in cleaning activities or persuade people not to discharge waste to the water source.

- The desire to participate in the network for water protection is quite high, in which many people can participate more deeply in the organization and implementation of activities, or propose initiatives. **The main obstacles are time and level of understanding.** In addition, the factor of persuasion also needs to be considered when designing activities. Most of the respondents also suppose that it is necessary to **increase the disclosure of information, communication, education, and support the community to participate in water protection.**

9. COMMUNITY PARTICIPATION

9.1. Local community

Movements, models of environmental protection in general and water protection in particular mobilize the participation of people, organizations and unions in Da Nang with the goal of building an environmental city from 2008 to 2018.

a) The movement "Green - Clean - Beautiful Sunday"

The movement, which was implemented before the enactment of the Project, was one of the tasks required to be effectively implemented. The goal calls for the participation of people to join hands with the local government to change the city's situation to become Green - Clean - Beautiful. Up to now, this movement has been effective.²¹

The localities and units have maintained the works effectively with an creative method to mobilize more and more significant participation and contribution to the treatment of environmental pollution points, especially cleaning in polluted empty plots. The number of people participating in environmental protection activities is increasing. In order to maintain the Movement and promote the role of the community, on November 21, 2014, the City People's Committee established Decision No. 8460 /QD-UBND on the regulations on evaluation, grading

²¹ Specifically, every Sunday morning (about 30 minutes), citizens participate in environmental sanitation in the residential area. Currently, these activities are executed in many localities and units every Sunday.

and emulation criteria for implementation. Every year the City People's Committee organizes rewards and encourages to mobilize the movement.

b) The "Green School" model

Environmental protection in the school has been well implemented. Integrating environmental education into core subjects at all levels and directing the organization of environmental thematic extracurricular activities has effectively mobilized a large number of students and teachers at all levels to participate in environmental protection in areas launched by the locality, schools, and education sector.²²

On December 17, 2014, the City People's Committee approved Decision No. 9083 / QD-UBND about the set of standards and procedures for selecting and recognizing "Green Schools" for primary schools in the city. Accordingly, the organization, construction and selection of "Green Schools" in the districts are implemented in a uniform manner, with close coordination among units. In 2018, more than 30 primary schools won the title of "Green School" in the city.

c) Construction of "environmentally friendly wards and communes"

With the goal of becoming environmental districts, the People's Committees of districts have built a plan, specific criteria on the basis of the City's Project. For evaluation, on February 4, 2018, the City People's Committee established Decision No. 48 / QD-UBND on the set of criteria for achieving the standard of "environmentally friendly wards". Up to now, 21/56 wards and communes are recognized as "environmentally friendly wards and communes".

d) Model of plastic waste reduction, waste separation at source

With the source waste separation program launched by the city, formerly known as the Women's Union initiatives, many models of waste separation at source have been deployed throughout the city. In which, the prominent model is waste value chain model by the project "Ocean without plastic" implemented in Son Tra and Thanh Khe in 2018 and continues to be maintained up to now.

The movement to reduce plastic waste, especially single-use, low-value plastic, has been launched throughout the city with many restaurants, hotels and cafes participating.

9.2. Media, newspapers, social networks units

a) "Environment City" Category

"Environment City" Category on Da Nang radio and television broadcasting has become familiar with the citizens. Since 2014 up to now, the number of topics has increased to 18 topics per year, not to mention other environmental reports and programs on other news agencies. Every year, in response to major events and emerging environmental issues, the city conducts live seminars about many topics, such as "Pollution of the vacant lot", "Waste collection by hour", etc.

²² According to statistics, in schools, there are 05 models to implement the project, such as: "The road you take care of", "The flower garden you plant", "The sound of the environmental drum" ... Construction of green-clean - beautiful schools and classes are focused. As a result, over 330 schools have trees, and the landscape of schools is guaranteed. More than 250 schools have new sanitation facilities, over 330 schools have sanitation facilities. All schools focus on creating a clean and beautiful landscape.

b) Journalism and Communication Award on the “Environmental City” project

Since 2017, the Department of Information and Communications has held the Journalism and Communication Award, including many different groups of topics, therein a communication topics on the Project; thereby providing information, propagandizing important the city's undertakings and policies on the topic "Building Da Nang - an environment city", contributing to raising awareness, mobilizing and encouraging citizens and businesses to join hands to perform policies and guidelines of the Party, governments and city in the environmental field, most clearly demonstrated through the active participation of the entire community and citizens after natural disasters.²³ In addition, through the Journalism Working Group, many outstanding environmental problems have been discovered, helping managing agencies to handle, respond to the press, and show the city's concern of environmental issues.

c) Social networks updating environment and pollution news

Currently, there are about 10 facebook pages regularly updating information on pollution reflected by the people

10. MAJOR CHALLENGES RELATED TO WATER SOURCE PROTECTION IN DA NANG

Da Nang is rapidly developing and this has put a lot of pressure on water conservation. Key challenges in water conservation include:

Firstly, it is the pressure from socio-economic development as well as GRDP growth. Wastewater collection and treatment systems, and treatment of polluted beaches, rivers and lakes are creating a huge amount of work. These challenges require a huge mobilization of resources from government agencies and the community, as well as scientists.

Besides the source of polluted wastewater from industrial zones or residential areas, a large part is due to the emission of waste into water sources as well as rivers and lakes. In Da Nang, the Khanh Son landfill is currently overloaded, and is seriously polluting the water source. Waste has been and is still a big challenge of Da Nang for the goal of sustainable development.

In addition to the challenges related to infrastructure and waste, the changing perceptions of all subjects (including citizens, political, social organizations, mass organizations ...) is considered as core interventions for water conservation. The change of perception is not only limited to communication programs, but also aims to change the attitudes and behavior of these subjects on water conservation.

- ***Water shortage due to saline intrusion and pollution:*** the current demand for clean water in Da Nang is huge, but the water supply is very limited. Access to expandable

²³ From October 16 to October 20, 2013, after Nari Typhoon, the city mobilized more than 30 units to participate in sanitation and waste collection to release 52 main streets in 04 urban districts, with 80 vehicles. The total amount of garbage collected and transported was 3,800 tons for 05 days. In particular, at the APEC Summit 2017 event held in Da Nang, in just 1 day (November 5, 2017), apart from the city's collection force, over 13,000 people were directly mobilized to participate in coastal environmental sanitation, more than 16 businesses supported 103 permanent support vehicles; more than 07 businesses volunteered to provide material support such as: food, drinking water, gloves, garbage bags, tools ... that collected 1,100 tons of trash from the city's beaches, promptly ensuring the environment before the event.

and exploitable water sources is limited. Therefore, water security is one of the challenges that should be prioritized in research and action in Da Nang. Currently, 97% of domestic water supplied to Da Nang is taken from Vu Gia River through Cau Do water plant, if environmental incidents upstream occur due to unavoidable factors such as chemical leakage, wastewater spills or explosions in industrial zones, oil spills during transportation, Cau Do river's water will be seriously polluted. If the Cau Do water plant has to be shut down, Da Nang will have a serious water shortage for many days, greatly affecting daily activities and production. According to the monitoring data for the period 2011-2015, the water quality of Yen river and Cau Do river is only B1 grade QCVN 08-2015 / BTNMT (only suitable for irrigation purposes), with the emission sources in the Tuy Loan and Yen river basins, the water quality of Cau Do River may be further degraded in the future.

- ***Wastewater from daily activities and services has not been thoroughly collected, causing pollution of rivers, lakes, and coastal areas:*** currently, about 80% of wastewater in urban areas has been collected and treated (not including Hoa Vang district, most of which do not have wastewater collection system). However, many projects have been invested for a long time and the rapid growth of urban development has resulted in an overload of the system. In addition, there are still urban areas where wastewater has not been collected.
- ***Online monitoring system, pollution forecasting and control tools, and environmental data system for forecasting, preventing and promptly handling environmental problems is inadequate:*** currently, there are 9 monitoring points for river water quality in Da Nang (4 points on the Vu Gia - Han river system, 3 points on Cu De river, 2 points on Phu Loc river), 6 monitoring points for lake water quality (at 6/30 lakes include: ...), 10 coastal water quality monitoring points, and 12 waste source monitoring points (centralized wastewater treatment stations, Khanh Son wastewater treatment station, industrial zones, wastewater treatment stations of Heineken and Coca Cola companies). Distributed wastewater treatment stations have no monitoring system. In addition, at the present, there is only 1 permanent automatic environmental monitoring station in Cam Le river.
- ***Community supervision has not been promoted and fully supported:*** in 2019, the city issued a list of sanitary protected areas for drinking water intake areas (belonging to Cau Do, Airport, Hai Van, Son Tra I and II water plants) and in 2018 the city issued a list of water sources that need to establish protection corridors (including 71 rivers, channels and lakes, however the spatial scope of the corridor has not been determined and marked). These are important legal bases to prevent acts of damaging water sources such as encroachment, waste discharge, wastewater, sand mining, minerals causing landslides, pollution and changing flows. However, how to monitor these corridors and protected areas has not been mentioned, especially the participation of communities and local associations and mass organizations.
- ***Propaganda, raising awareness of people about environmental protection, changing habits in dealing with the environment is not effective:*** part of the reason is that there is no solution or sanctions are not strong enough for people to implement and comply. For example, in Tho Quang port there is still the problem of wastewater, waste from fishermen's boats when they docked, and wastewater, waste from service business activities in the fish market area.

11. RECOMMENDATION FOR CAWACON PROJECT IN DA NANG

The analyses in the above sections reveals various opportunities for the project to contribute to policies, projects and plans of Da Nang city on the following content:

- Communication to raise community awareness about water source protection
- Models for efficient water use in communities and businesses
- Researches, evaluations, reviews and communication programs at Tho Quang port
- Supports for state management agencies: improve management capacity, develop action plans, etc.
- Support to publicize environmental information, including information on water sources

Therefore, the research team propose 6 groups of activities to focus on in Da Nang city as follows:

(1) ACTIVITY GROUP TO PREVENT WATER POLLUTION IN THO QUANG PORT

- Communication to raise awareness about environmental protection, water resource protection for objects operating in the area, focusing on particular objects such as fishermen and boat owners. Building a self-managed model for environmental protection and water source protection.
- Research on management mechanism and build a base database system for environmental management in locks and fishing ports.

(2) ACTIVITY GROUP TO BUILD SUSTAINABLE DEVELOPED RESIDENTIAL AREAS MODEL

- Building models of sustainable residential areas equipped with knowledge and capacity in environmental protection, disaster prevention, climate change response, waste management, and efficient use of energy in which focus on water resource protection and efficient water use.
- Documentation and development of guidelines for sustainable residential development, water resource protection and efficient water use.

(3) ACTIVITY GROUP TO PROMOTE INITIATIVES ON SMART USE OF WATER

- Promote smart water use initiatives through seminars; Launching movements in the community, businesses; Vote and replicate initiatives; technical assistance packages to implement a typical initiative.
- Research the current status, opportunities and challenges of water reuse solutions for appropriate uses that have been applied by units / businesses. Develop policy recommendations on water reuse and hold talks with environmental law enforcement agencies.

(4) ACTIVITY GROUP TO IMPROVE OPERATIONAL CAPACITY OF THE VU GIA - THU BON RIVER BASIN COORDINATION BOARD AND COOPERATE IN IMPLEMENTING THE “ENVIRONMENTAL CITY” PROJECT FOR THE PERIOD 2021-2030

- Develop a 5-year work plan for the Vu Gia - Thu Bon River Basin Coordination Board and support the implementation of specific activities such as: map of discharge sources into the upstream of the river basin, thematic seminars, consultation workshops...

- Develop a plan to implement the “Environmental City” project and support the implementation of activities related to mobilizing private sector resources in the project implementation

The project could make a space to connect, facilitate and mobilize resources (finance, expert) from stakeholders to ensure developed implementation plans are feasible and sustainable based on the participatory approach with consideration to each actor’s strength and benefit harmonization.

(5) ACTIVITIES GROUP OF DEVELOPING INFORMATION SYSTEM ON WATER RESOURCES PROTECTION

In line with common goals of the project, the information system on water resources protection in Da Nang city should be developed toward the following purposes:

- To publicize information on water environment, water sources, and waste sources (both wastewater and garbage).
- To support monitoring activities of the local communities.
- To support communications and education activities through visual, easy to understand and access information and data.

Information sources for this system are official data of the state governmental management agencies and data generated from the project activities of the above activity groups. In order to ensure sustainability, the system should be managed, maintained, and continuously updated by one appropriate state governmental management agency (such as the Da Nang MONRE) upon the project’s end.

(6) ACTIVITY GROUP OF COMMUNICATIONS ACTIVITIES AND NETWORKING ACTIVITY WITH COMMUNITY, BUSINESSES, SCIENTIFIC ORGANIZATIONS, NGOS, AND SOCIAL ORGANIZATIONS IN WATER RESOURCE PROTECTION

- Online training programs for youth, students and promoting initiatives to protect water resources, use water effectively, with a focus on primary school students.
- Communication campaigns to protect water resources (World Water Day, Earth Day, ...) and workshops, seminars to share successful models, experiences and lessons on water resource protection and efficient water use.

Communications and training activities should take full advantage of the above information system to enhance persuasiveness and spread.

REFERENCES

- [1] "Đề án tài nguyên nước mặt thành phố Đà Nẵng đến năm 2030, tầm nhìn đến năm 2045," Sở TN&MT thành phố Đà Nẵng, 2018.
- [2] "Dự thảo Đề án "Xây dựng Đà Nẵng - Thành phố môi trường" giai đoạn 2021-2030," UBND thành phố Đà Nẵng, 2020.
- [3] "Báo cáo tổng hợp kết quả 10 năm thực hiện Quyết định số 41/QĐ-UBND ngày 21/8/2008 về Đề án "Xây dựng Đà Nẵng - Thành phố môi trường"," UBND thành phố Đà Nẵng, 2019.
- [4] "Quyết định số 20/2020/QĐ-UBND ngày 6/7/2020 của UBND thành phố Đà Nẵng về ban hành Quy định về quản lý, bảo vệ tài nguyên nước trên địa bàn thành phố Đà Nẵng," 2020.
- [5] "Báo cáo thực trạng và giải pháp thu gom, xử lý nước thải trên địa bàn thành phố Đà Nẵng," UBND thành phố Đà Nẵng, 2020.
- [6] "Quyết định số 4111/QĐ-UBND ngày 16/9/2019 của UBND thành phố Đà Nẵng về việc phê duyệt dự án đầu tư xây dựng công trình: đầu tư các trạm quan trắc môi trường tự động trên địa bàn thành phố," 2019.
- [7] "Quyết định số 4121/QĐ-UBND ngày 16/9/2019 của UBND thành phố Đà Nẵng phê duyệt vùng bảo hộ vệ sinh khu vực lấy nước sinh hoạt của các công trình đã được cấp phép khai thác, sử dụng nước mặt phục vụ mục đích cấp nước sinh hoạt trên địa bàn tp Đà Nẵng," 2019.
- [8] "Quyết định số 4514/QĐ-UBND ngày 8/10/2018 của UBND thành phố Đà Nẵng ban hành danh mục các nguồn nước phải lập hành lang bảo vệ trên địa bàn thành phố Đà Nẵng," 2018.
- [9] "Báo cáo tổng hợp về công tác quản lý môi trường tại khu vực âu thuyền và cảng cá Thọ Quang," UBND thành phố Đà Nẵng - Sở TN&MT, 2020.
- [10] "Báo cáo tình hình thực hiện công tác quản lý tài nguyên nước năm 2019," UBND thành phố Đà Nẵng - Sở TN&MT, 2019.
- [11] "Quyết định số 2375/QĐ-UBND ngày 6/7/2020 của UBND thành phố Đà Nẵng về ban hành kế hoạch xử lý ô nhiễm môi trường tại khu vực âu thuyền và cảng cá Thọ Quang giai đoạn 2020-2025," 2020.
- [12] "Quyết định số 947/QĐ-UBND ngày 1/3/2019 của UBND thành phố Đà Nẵng về việc phê duyệt đề án Tài nguyên nước mặt thành phố Đà Nẵng đến năm 2030, tầm nhìn đến năm 2045," 2019.

- [13] "Báo cáo hiện trạng môi trường - Dự thảo Đồ án Điều chỉnh quy hoạch chung thành phố Đà Nẵng đến năm 2030, tầm nhìn đến năm 2045," UBND thành phố Đà Nẵng, 2020.
- [14] CECR, "Báo cáo nghiên cứu dự án Đại dương Không nhựa," 2018.



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