



Project GTZ TA No: 2000.2208.7
Project Document No: AD 003
Edition: 01



ASSESSMENT ON STATUS OF TERTIARY SEWERS IN KfW SERVICE AREA - VINH CITY

March, 2009

Ministry of Construction – Hanoi

in cooperation with

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Technical Assistance on behalf of GTZ by GFA Consulting Group & Associates

Your contact person
with GFA Consulting Group GmbH

Gudrun Krause

Phone +49 (40) 6 03 06168

Fax +49 (40) 6 03 06169

Email: gudrun.krause@gfa-group.de

Address

GFA Consulting Group GmbH

Eulenkrogstraße 82

D-22359 Hamburg

Germany

Prepared by: Nguyen Truong Son, Survey Expert

Reviewed by: Mr. Nguyen Cong Thanh, Trinh Quoc Khanh and Nguyen Hoang Long - Technical Expert

Approved by: Mr. Frank Pogade - Chief Technical Advisor

TABLE OF CONTENTS

1.	Introduction	1
2.	Objectives.....	2
3.	Approach	2
4.	Implementation	3
5.	Summary Population Data of KfW Service Area.....	3
6.	Findings and Recommendations	3
6.1	Findings	3
6.2	Recommendation.....	4
7.	Detailed Findings on Current Status of Tertiary Sewer at Ten Assessed Wards .	9
7.1	Cua Nam Ward	9
7.2	Hong Son Ward	11
7.3	Trung Do Ward	13
7.4	Hung Phuc Ward.....	15
7.5	Truong Thi Ward	17
7.6	Hung Binh Ward.....	19
7.7	Le Mao Ward	21
7.8	Hung Dung Ward	24
7.9	Vinh Tan Commune	25
7.10	Ben Thuy Ward	27

Annex: Map of KfW service area – Vinh City

1. Introduction

On 5 September 2008 Vietnam Prime Minister signed Decision No. 1210/QĐ-Ttg on acknowledgement of Vinh City is the First Level City under the management of Nghe an Province and become the most important center on economic, politic, cultural, science and social of Nghệ An Province and also the North Centre area. Currently, Vinh City has 25 wards and communes with total approximately 283,000 inhabitants and a total size of 10,498 hectare.

Within the framework of the ongoing planning and construction activities of the KfW sponsored wastewater project at 6 Vietnamese provincial towns of Bac Ninh, Hai Duong in the North, Vinh in the centre and Can Tho, Soc Trang and Tra Vinh in the South, substantial investments are underway to collect and treat wastewater.



KfW service area of Vinh City covers three wastewater catchments of Hong Bang, Channel 2 and Channel 3 with the total size of approximately 1,260 ha. These catchments include 10 wards and communes of Cua Nam, Ben Thuy, Hung Phu, Hung Binh, Hung Dung, Trung Do, Truong Thi, Le Mao, Vinh Tan and Hong Son.

Figure 1: Location of Vinh City

Necessary of the assessment of current status of tertiary sewer at Vinh City

- The design of the wastewater facilities assumes a household connection rate to the existing drainage system is in the range of 85-90 percent by 2010. However, some staff of the local service providers expressed their concern that the rate of households connected to public sewers is much lower than assumed in the detailed engineering design and affecting the investment efficiency of the Project funded by KfW.
- The assessment of the tertiary sewer system and rate of household wastewater connection is necessary as it will help the concerned utilities aware the current actual status of tertiary sewer and then prepare effective measures to maximize investment efficiency of the Project financed by KfW as well as to improve sanitation and environment of Vinh City as a whole.

To have better view on the situation of current household connection and tertiary sewers at KfW service area, the Technical Component of the Waste Wastewater Management agreed with Vinh City Infrastructure Management and Development JSC (Vinh - CIMD) and local authorities to conduct two separate surveys.

The **first survey** is a technical assessment on tertiary sewers in the KfW service area in order to identify current status of tertiary sewers (working condition and length) which will be used as tentative inputs for the projection of scope of works as well as cost estimate to improve condition of tertiary sewers within the KfW service area.

The **second survey**, namely community baseline survey will, among other issues, identify the rate of household wastewater connections. The survey is expected to be performed in November 2008.

This report presents methodology and results of the technical assessment on tertiary sewers. The assessment was conducted in a fairly complex area within the limited time and resources the results from this report shall be considered indicative only.

2. Objectives

Objectives of the assessment include three main issues as follows:

- a. Generally assess existing status of tertiary sewers in KfW service area;
- b. Estimate scope of works for improving tertiary sewers within KfW service areas including length and cost of (i) new tertiary sewer to be installed; (ii) existing tertiary sewer to be rehabilitated and / or replaced;
- c. Stakeholders are informed about results of the technical assessment and develop a technical strategy to improve conditions of tertiary systems for wastewater collection and seek required external funding.

3. Approach

The technical assessment was conducted based on the observation, measurement of current status of tertiary sewer system at selected housing plots. These selected housing plots have typical characteristics and are representative for other remaining housing plots in aspects of population density, topography, household wastewater connection ratio and tertiary sewer. Assessment was conducted following steps as below:

Step 1: Collect existing data to have initial overview on status of tertiary sewer system at KfW service area – Vinh City. Data include: KfW design drawings, design reports, maps of wards within KfW service area, conditions of tertiary sewer system according to ward authorities and Vn – CIMD.

Step 2: Identify representative housing plots for quick technical assessment. Based on judgment of data and information which is obtained from step 1 WWM expert selected housing plots (HP) representing the type of tertiary sewer within the ward to be assessed. About 10 wards within KfW service area were assessed. From 2 – 3 representative plots within each ward will be served for Technical assessment.

Step 3: Supported by staff from ward and Vn – CIMD WWM staff conducted technical assessment on tertiary sewer within these selected housing plots. Interview, discussion with persons who is in charge of environment and sanitation, construction of ward and local resident together with field observation/check and measurement of tertiary sewer were conducted to identify status and length of existing tertiary sewer system at the selected housing plots.

Estimate scope of works to improve existing condition of tertiary sewer system at the selected housing plots.

Step 4: Results obtained from step 3 were used to roughly interpolate project scope and cost estimate to improve existing condition of tertiary sewer system for the entire area within KfW service area.

Step 5: Findings from the technical assessment will be disseminated to stake holders concerned to (a) develop a technical strategy to improve conditions of tertiary system for wastewater collection to actual requirements and (b) seek external funding for implementation.

4. Implementation

Technical assessment was conducted at KfW service areas during October 2008 by WWM survey experts and technical staff from Vinh-CIMD. Filed observations and measurements of tertiary sewers were performed at 26 housing plots with total size of nearly 39 ha. Number and size of plots and total number of household which were selected for assessment are presented at table 2 page 5. At each ward 2-3 housing plots were assessed. Measuring wheel was used to measure length of tertiary sewers.

Data input and analyze were undertaken by WWM expert during November 2008.



5. Summary Population Data of KfW Service Area.

Currently, KfW service area has approximately 21,800 household and covers the size of 1,260 hectare (ha). Summary on population and density of wards and communes is presented at Table 1 below:

Table 1: Household and Density KfW Service Area – Vinh City

No.	Ward Name	KfW population (# household)	KfW size (ha)	Density (household/ha)
1	Cua Nam	415	29	14.6
2	Hong Son	1,872	53	35.3
3	Trung Do	593	57	10.4
4	Hung Phuc	2,964	92	32.2
5	Truong Thi	3,185	180	17.7
6	Hung Binh	5,182	220	23.6
7	Le Mao	2,397	87	27.6
8	Hung Dung	641	125	5.1
9	Vinh Tan	759	182	4.2
10	Ben Thuy	3,821	236	16.2
	Total	21,829	1,260	17.3

6. Findings and Recommendations

6.1 Findings

- a. In general, nearly half of the total tertiary sewers at KfW service areas in Vinh City were constructed long time ago by ward authorities and partly contributed by households. Tertiary sewer there was constructed without proper design or general planning.
- b. Operation and maintenance of tertiary sewers are not properly and do not meet with actual requirement due to lack of regulation frame-works and finance for these tasks.
- c. Nearly half of the exiting sewer system within the area of the KfW financed Project are in poor condition requiring rehabilitation or replacement, especially for wards of Hung Binh, Le Mao, Hung Dung, Vinh Tan and Ben Thuy.

- d. Status of tertiary sewers can be classified in two groups of wards as follows:
- + **Group 1**, includes 05 wards of Cua Nam, Hong Son, Trung Do, Hung Phuc and Truong Thi. Tertiary sewers there are generally in acceptable working conditions. Works as replacement and/or installation of new tertiary sewers are not really necessary at this moment. Almost all tertiary sewers at these wards are now connected public sewer.
 - + **Group 2**, including 05 wards of Hung Binh, Le Mao, Hung Dung, Vinh Tan and Ben Thuy. Generally, tertiary sewers at these wards are in bad conditions. Primary and/or secondary sewers are still lack at some areas within wards of Hung Dung, Vinh Tan and Ben Thuy.
- e. Regarding to length of sewer, on average length of tertiary sewer per house at all assessed housing plots is 6.7 meter (7.5 m for wards within Group 1 and 5.9 m for wards within Group 2). On average, length of tertiary sewer per hectare at assessed housing plots of Group 1 is 504 m and 279 m of Group 2. Construction of new tertiary sewers for wards in Group 2 is urgently needed.
- f. Existing materials of these tertiary sewers are mostly brick with concrete cover or PVC pipe. Quality of tertiary sewers is rather poor, especially for wards of Hung Binh, Le Mao, Hung Dung, Vinh Tan and Ben Thuy.
- g. There are 03 related projects implemented at Vinh City, includes: (i) Development of Citadel Park Project; (ii) Development of Southern Vinh city and (iii) Rehabilitation of Kenh Bac. However, activities relating the improvement of tertiary system have not yet been included in these projects. Needs for improving wastewater collection and treatment at KfW service areas, especially in wards of Hung Binh, Le Mao, Hung Dung, Vinh Tan and Ben Thuy are therefore critically urgent.

6.2 Recommendation

- h. Obviously, since tertiary sewer within the areas of the KfW financed Project is not proper in term of quality and quantity the collection rate of household wastewater to the main sewer and then the wastewater treatment plan is rather low. If no measure is made in order to improve these tertiary sewer it will affect the efficiency of the KfW financed Project.
- i. Propose to carry out the detailed survey of all household wastewater collection systems within the service areas of the KfW financed Project in order to have reliable data on the current status of the tertiary sewer and develop general plan for the improvement of wastewater collection in future.
- j. Regarding to the residential areas only in the KfW service areas, about 93,000 m of tertiary sewers needs to be addressed. If the tertiary sewers, with dimension of 0.5 x 0.6 m and made of brick and concrete cover, are provided to the said residential areas the estimated cost of approximately 7.81 million Euro would be needed. Details are given at table next page:

Table 2: Projection cost for improving status of tertiary sewer at KfW service area

No.	Description	Quantity (m)	Amount (million Euro)
1	Costs as workforce, materials, overhead, contingency for improving of tertiary sewers at residential areas in KfW service area.	93,000	6.25
2	Other costs as detailed technical survey and designs, construction supervision, etc (25% x 6.25 million Euro)		1.56
Total			7.81

- k. Assuming that these above scope of works are implemented in parallel group of ten and one group can handle the construction of 10 meter per day, a total construction period of about 3 years is needed.
- l. Priority, it is recommended to focus on the improvement of tertiary sewer system and household connection at wards of Hung Binh, Le Mao, Hung Dung, Vinh Tan and Ben Thuy.
- m. Propose to carry out pilot works on rehabilitation and replacement of tertiary sewers at 02 wards for experience and lesson learnt before full scale implementation at the remaining wards.
- n. Consideration to mobilize resident's contribution during the preparation and implementation of projects on improvement as well as operation and maintenance of tertiary sewer and household connection.

Further details on status and length of tertiary sewers at assessed housing plots and at entire KfW service area are presented at table 3 in pages 6, 7 and 8. Projection scope of works and cost estimate required for improvement of tertiary sewers are presented at table 4, page 7.

Table 3: Status of Tertiary Sewer at Assessed Housing Plots at KfW Service Area

Housing plots	Total number of household	Size (ha)	Density (household per ha)	Tertiary sewer surround housing plot (m)	Tertiary sewer inside housing plot (m)	Total length of tertiary sewer (m)	Status of tertiary sewer at assessed housing plots (m)				Length of tertiary sewer at assessed housing plots (m)	
							Good	Need reha.	Need replace.	Non Exist	Per household	Per hectare
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Cua Nam												
Plot 1	67	0.562	119	360	76	436	436	0	0	0	6.5	776
Plot 2	65	0.462	141	342	0	342	342	0	0	0	5.3	740
2. Hong Son												
Plot 1	97	1.326	73	336	294	630	630	0	0	0	6.5	475
Plot 2	43	0.816	53	355	43	398	398	0	0	0	9.3	488
Plot 3	119	1.340	89	516	350	866	866	0	0	0	7.3	646
3. Trung Do												
Plot 1	61	0.850	72	298	98	396	396	0	0	0	6.5	466
Plot 2	69	1.360	51	312	127	439	439	0	0	0	6.4	323
4. Hung Phuc												
Plot 1	74	1.250	59	450	216	666	666	0	0	0	9.0	533
Plot 2	92	1.166	79	289	254	543	543	0	0	0	5.9	466
Plot 3	61	1.118	55	432	197	629	629	0	0	0	10.3	563
5. Truong Thi												
Plot 1	120	2.120	57	418	762	1,180	1,180	0	0	0	9.8	557
Plot 2	52	1.042	50	218	122	340	340	0	0	0	6.5	326
Plot 3	85	1.583	54	506	190	696	696	0	0	0	8.2	440
Sub - Total 1	1,005	14.99	67	4,832	2,729	7,561	7,561	0	0	0	7.5	504

Cont'd next page

Cont'd table 2

Housing plots	Total number of household	Size (ha)	Density (person per ha)	Tertiary Sewer surround housing plot (m)	Tertiary sewer inside housing plot (m)	Total length of tertiary sewer (m)	Status of tertiary sewer system at assessed housing plots (m)				Length of tertiary sewer at assessed housing plots (m)	
							Good	Need reha. ^(*)	Need replace. ^(**)	Non Exist ^(***)	per household	Per hectare
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
6. Hung Binh												
Plot 1	134	2.016	66	555	477	1,032	1,032	0	0	0	7.7	512
Plot 2	118	3.590	33	285	393	678	0	0	678	456	5.7	189
Plot 3	112	3.070	36	145	417	562	0	0	562	582	50	183
7. Le Mao												
Plot 1	55	1.100	50	486	50	536	536	0	0	0	9.7	487
Plot 2	57	0.986	58	468	110	578	0	0	578	0	10.1	586
Plot 3	90	1.330	68	194	630	824	0	94	730	0	9.2	620
8. Hung Dung												
Plot 1	62	1.220	51	0	0	0	0	0	0	912	0	0
Plot 2	92	0.560	164	306	190	496	306	190	0	0	5.4	886
9. Vinh Tan												
Plot 1	67	0.987	68	287	173	460	140	320	0	0	6.9	466
Plot 2	41	1.600	26	0	0	0	0	0	0	745	0	0
10. Ben Thuy												
Plot 1	108	1.840	59	382	550	932	932	0	0	0	8.6	507
Plot 2	93	2.480	38	0	0	0	0	0	0	996	0	0
Plot 3	107	3.300	32	460	160	620	0	620	0	685	5.8	188
Sub - Total 2	1,136	24.08	47	3,568	3,150	6,718	2,946	1,224	2,548	4,376	5.9	279

Note: *: Rehabilitate existing tertiary sewer: re-mortar, provision of concrete covers, etc

** : Replace existing sewers: remove existing broken tertiary sewer and install new one.

*** : Construct new sewer: to construct sewer for the area where there are no tertiary sewer.

**Table 4: Projection on Scope of Works and Cost Estimate For Improvement of Tertiary Sewer Condition at KfW Service Area
Tertiary Sewer made of Brick and Concrete Cover and Dimension of 0.5 m x 0.6 m**

Ward name / Housing plots	Size (ha)	Size of plots similar to assessed plot * (ha)	Enlarge- ment factor	Scope of works of assessed housing plot (m)			Scope of works of entire KfW area (m)			Estimated cost for entire KfW service area (Euro)					
				Reha.	Replace	New	Reha.	Replace	New	Reha. existing tertiary sewer		Replace. existing tertiary sewer and const. new one		Construction of new tertiary sewers	
										Unit cost	Amount	Unit cost	Amount	Unit cost	Amount
(1)	(2)	(3)	(4 = 3 / 2)	(5)	(6)	(7)	(8 = 5X 4)	(9 = 6X4)	(10 = 7x4)	(11)	(12=8x11)	(13)	(14=13x9)	(15)	(16=15x10)
6. Hung Binh		117.54													
Plot 1	2.02	25.02	12.4	0	0	0	0	0	0	25	0	80	0	65	0
Plot 2	3.59	57.83	16.1	0	678	456	0	10,923	7,346	25	0	80	873,806	65	477,500
Plot 3	3.07	34.69	11.3	0	562	582	0	6,351	6,577	25	0	80	508,048	65	427,479
7. Le Mao		38.44										80			
Plot 1	1.10	14.71	13.4	0	0	0	0	0	0	25	0	80	0	65	0
Plot 2	0.99	12.71	12.9	0	578	0	0	7,450	0	25	0	80	596,034	65	0
Plot 3	1.33	11.03	8.3	94	730	0	779	6,052	0	25	19,482	80	484,136	65	0
8. Hung Dung		6.65										80			
Plot 1	1.22	5.04	4.1	0	0	912	0	0	3,767	25	0	80	0	65	244,826
Plot 2	0.56	1.61	2.9	190	0	0	545	0	0	25	13,633	80	0	65	0
9. Vinh Tan		46.18										80			
Plot 1	0.99	15.51	15.7	320	0	0	5,027	0	0	25	125,680	80	0	65	0
Plot 2	1.60	30.67	19.2	0	0	745	0	0	14,282	25	0	80	0	65	928,307
10. Ben Thuy		90.30													
Plot 1	1.84	12.09	6.6	0	0	0	0	0	0	25	0	80	0	65	0
Plot 2	2.48	39.51	15.9	0	0	996	0	0	15,866	25	0	80	0	65	1,031,308
Plot 3	3.30	38.71	11.7	0	0	685	0	0	8,035	25	0	80	0	65	522,278
Total	24.08	299		604	2,548	4,376	6,352	30,775	55,872		158,794		2,462,024		3,631,700
Total 8, 9, 10 = 92,999 m									Total 12, 14, 16 = 6,252,518 Euro						

Note: - Figures at Column 3 includes residential areas in KfW service area only and excludes public areas as ponds, lakes, parks, public buildings, etc.
- Unit costs given at columns 11, 13, 15 are based on actual costs at Lang Son in January 2008. This cost covers only workforce, materials, overhead, contingency, but not costs on technical survey, designs, construction supervision, etc.

7. Detailed Findings on Current Status of Tertiary Sewer at Ten Assessed Wards

7.1 Cua Nam Ward

General:

Cua Nam is located at the center of Vinh City and bordered by Cua Tien River at the West, South West and South; by Ho Xuan Huong Street at the East; by Dang Thai Than Street at the North; and Pham Ngu Lao Street at the North East. Currently, there are 3,324 households are living in the area of 196 ha.

The KfW service area covers 28.97 ha and approximately 415 households. Generally, primary and secondary sewers were built along streets and are now in good condition. Tertiary sewers within the KfW service area were constructed by community organizations and now are working properly.

Technical assessment was conducted at 02 selected housing plots, findings are as follows:

Housing Plot 1:

- Plot 1 is bordered by Dang Thai Than Street at the North; Tran Hung Dao Street at the West; Phan Dinh Phung Street South and Ho Xuan Huong Street at the East.
- The Plot 1 has the size of 0.56 ha and 67 households. Households are generally connected to public sewer.
- Total length of sewer surrounding the housing plot is 360 m made of concrete pipe and installed by Vinh City. These sewers are in good condition.
- Total length of tertiary sewer inside the housing plot is 76 m, made of PVC pipe or brick. These sewers are still working properly.
- Photos at the right hand side partly present location of sewer at Plot 1.



Housing Plot 2:

- Plot 2 is bordered by Phan Dinh Phung Street at the North, Ho Han Thuong Street at the South; by Lane 26 - Phan Dinh Phung Street at the West and Lane 32 - Phan Dinh Phung Street at the East. The plot: has size of 0.46 ha 65 households.
- Total length of tertiary sewer surrounding the Plot 2 is 342 m. No tertiary sewer is found inside the housing plot.
- Sewers of Plot 2 are now connected to public sewers.
- Photos at the right hand side partly present location of sewer at Plot 2.



- Maps of assessed housing plots are as below.

Figure 2: Map of Housing Plot 1 – Cua Nam

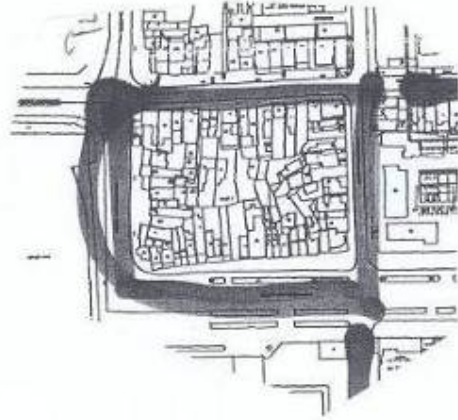
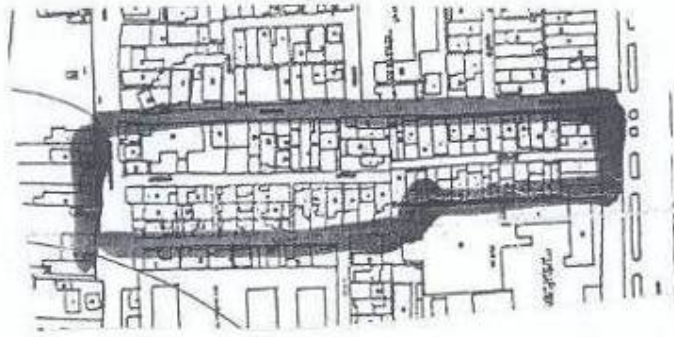


Figure 3: Map of Housing Plot 2 – Cua Nam



7.2 Hong Son Ward

General:

- Situated at the center of Vinh City, Hong Son Ward is bordered by Tran Phu street at the North; Ho Xuan Huong street at the West; Nguyen Du, Ngo Duc Ke and Dinh Nhat Than streets at the South and Luc Nien street at the East. The Ward has the size of 53 ha and approximately 1,872 households.
- Primary and secondary sewers were built by Vinh city and are still working properly. Tertiary sewers are found at almost all areas of the ward. Assessment on tertiary sewers was performed at 03 housing plots with findings as follows:

Housing Plot 1:

- Plot 1 is bordered by Phan Dinh Phung street at the North; Hoang Nghia Cat street at the West, Ngo Duc Ke street at the South and Hoang Danh Suong street at the East. Plot 1 has the size of 1.32 ha and 97 households.
- Tertiary sewers were built recently and are now in proper working condition. It were made of brick and covered by concrete flaps. Tertiary sewers are now connected to public sewer.
- Length of tertiary sewers surrounding the plot is 336 m and that inside the plot is 294 m.
- Photo at the right hand side partly present tertiary sewer at Plot 1.



Housing plot 2

- Plot 2 is bordered by Lane 2, Hoang Ke Viem street at the North; Hoang Ke Viem street at the West; Ngo Duc Ke street at the South and Hoang Dieu street at the East. This Plot has the size of approximately 0.81 ha and 43 houses.
- Tertiary sewers at this housing plot were built long time ago. Materials of the tertiary sewer are PVC pipe or brick with concrete cover.
- Total length of sewer surrounding housing plot is 355 m. It was built long time ago without maintenance or upgrading. If possible, the rehabilitation on these sewers is necessary. Total length of tertiary sewer inside the Plot is 43 m. These sewers are now connected to public sewers.
- Photo at the right hand side illustrate tertiary sewer at Plot 2.



Housing plot 3:

- Located at the center of Vinh City - the fairly developed area. The Plot is bordered by Tran Phu street at the North, Le Huan street at the West; Ngo Duc Ke street at the South and Cao Xuan Huy street at the East. The Plot has the size of approximately 1.34 ha and 119 houses.
- Length of sewers surrounding the plot is 516 m and is in proper working condition. Length of tertiary sewer inside the plot is 350 m and it is now in proper working condition.
- Photo at the right hand side partly present tertiary sewer at Plot 3



Below are maps of assessed housing plots

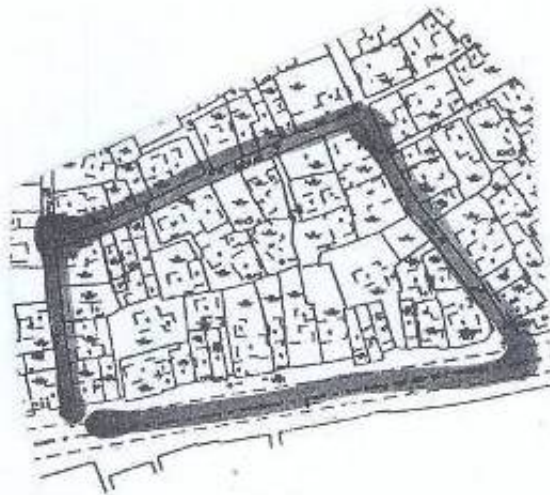
Figure 4: Map of Housing Plot 1 – Hong Son



Figure 5: Map of Housing Plot 2 – Hong Son



Figure 6: Map of Housing Plot 3 – Hong Son



7.3 Trung Do Ward

General:

Situated at the Southern part of Vinh City, Trung Do Ward is bordered by Cua Tien river at the South West; Lam river at the South East; Nguyen Du and Le Duan Streets at the North East; Tran Phu street at the North and Vinh Tan Ward at the West. The Ward has the size of 262 ha and 2,560 households, approximately.

KfW service area of Trung Do ward has the size of 57 ha and about 593 households. Almost all sewers in the KfW service area are connected primary and secondary public sewers. They are still in proper working condition. If possible rehabilitation works as provision of concrete cover or re-mortar tertiary sewers are necessary.

Tertiary sewers in 02 housing plots were assessed and findings are as follows:

Housing Plot 1:

- The Plot 1 is bordered by Bui Thi Xuan street at the South, Lane 47 - Bui Thi Xuan street at the West ; Lane 17, Bui Thi Xuan street at the East and Han Mac Tu street at the North. The Plot has the size of approximately 0.85 ha and 61 households
- Length of tertiary sewer surrounding the plot is 298 m and length of tertiary sewers inside Plot 1 is 98m. Tertiary sewers are connected to public sewers in proper working conditions
- Photo at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 2:

- Situated at the center of Vinh City the Plot 2 is bordered by Nguyen Thiep street at the North East; Lane 33 - Nguyen Thiep street at the North West; and Nguyen Son street at the South West; Lane 75 – Nguyen Thiep street at the South East. The Plot 2 has the size of 1.36 ha and 69 houses, approximately.
- Tertiary sewers in the Plot 2 were installed long time ago by community organizations. Length of tertiary sewers surrounding the plot is 312 m and that of tertiary sewers inside the plot is 127 m.
- Tertiary sewers there are now connected to public sewer systems.
- Photo at the right hand side partly present tertiary sewer at Plot 2.



Below are maps of assessed housing plots at Trung Do Ward

Figure 7: Map of Housing Plot 1 – Trung Do

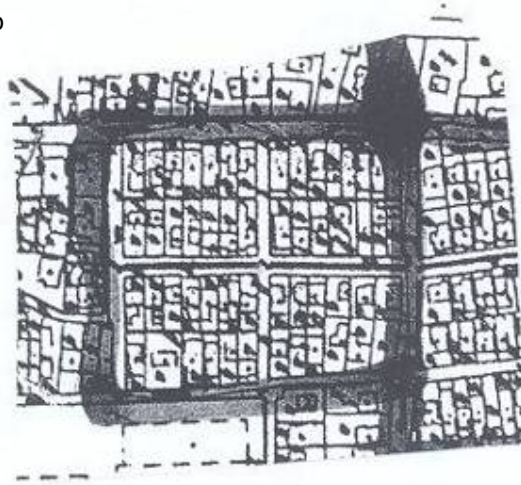
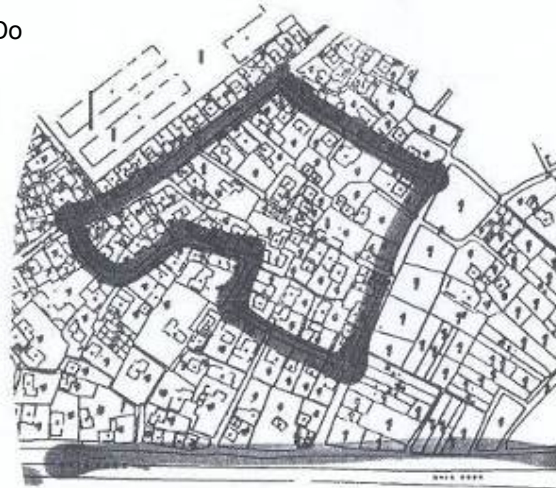


Figure 8: Map of Housing Plot 2 – Trung Do



7.4. Hung Phuc Ward

General:

Located at the center of Vinh City, Hung Phuc Ward covers the land of 104 ha and around 3,117 households. The Ward is bordered by Nguyen Si Sach street at the North; Le Hong Phong street at the South; Nguyen Van Cu street at the West and Le Nin at the East.

The KfW service area covers about 92 ha and around 2,964 households. Almost all residential areas within the KfW service areas were built recently with proper planning and tertiary sewers are better than other wards. 03 housing plots were assessed and findings are as follows:

Housing Plot 1:

- Located at the South of Hung Phuc Ward, Plot 1 is bordered by Hecman street at the West; Lane 2, Hecman street at the South; Alley 3, Lane 2, Hecman street at the East. The Plot has the size of 12.5 ha and 74 households, approximately.
- Generally, tertiary sewers at Plot 1 are in proper working condition. It were made of brick with reinforce concrete cover. Length of tertiary sewer surrounding the plot is 450m and that inside the housing plot is 216m.
- Photos at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 2:

- Situated at the North of Hung Phuc Ward the Plot 2 is bordered by Nguyen Si Sach street at the North; Tan Phuc street at the West; Dinh Le street at the South and Lane 110 - Nguyen Si Sach street at the East. The Plot 2 covers the area around 1.16 ha and 92 households.
- Tertiary sewers in there are now in proper working conditions. Length of tertiary sewers surrounding the Plot is 289m which were made of brick with concrete cover and that inside the housing plot is 254m.
- Photo at the right hand side partly present tertiary sewer at Plot 2.



Housing Plot 3:

- Situated at the West of Hung Phuc Ward the Plot 3 is bordered by Nguyen Van Cu street at the South West; by Nguyen Quoc Tri street at the South East; by Lane 3 – Nguyen Quoc Tri street by the North East; by Lane. The Plot covers the land of about 1.12 ha and 61 households.
- Photo at the right hand side partly present tertiary sewer at Plot 3.



- Tertiary sewers of this Plot are now are now connected to public sewers and in proper working conditions. Length of tertiary sewers surrounding the Plot is 432 m and that of tertiary sewers inside the Plot is 197m. If possible, rehabilitation as re-mortar or installation of concrete covers for tertiary sewers without cover is recommended.

Below are maps of assessed housing plots

Figure 9: Map of Housing Plot 1 – Hung Phuc



Figure 10: Map of Housing Plot 2 – Hung Phuc



Figure 11: Map of Housing Plot 3 – Hung Phuc



7.5. Truong Thi Ward

General:

Truong Thi Ward is bordered by Le Hong Phong street at the North; Nguyen Van Cu, Ho Tung Mau, Truong Thi and Le Duan streets at the West; Bach Lieu street at the South East; Nguyen Huy Oanh and Phong Dinh Cang streets at the East. The Ward has the size of 180 ha and total 3,185 households.

The Ward is fully covered by KfW service area. In general, infrastructures as sewer, power, road and lane were planned before construction. Tertiary sewers are mostly up to requirements. If possible minor rehabilitations as provision of concrete cover or re-mortar tertiary sewers would be necessary at some areas. Assessment of tertiary sewer was conducted at 03 housing plots with findings are as below:

Housing Plot 1:

- Located at the center of Truong Thi Ward the Plot has the size of 2.12 ha and total 120 households. Plot 1 is bordered by An Duong Vuong street at the North; Tra Lan street at the West; Lane 63 – Vo Thi Sau street at the South and Vo Thi Sau street at the the East.
- Tertiary sewer of the Plot is fairly good. Total length of tertiary sewer surrounding the Plot is 41 8m and total length of tertiary sewer inside the Plot is 762 m. Provision of concrete cover is necessary for 122 m length of tertiary sewer. All these sewers are now connected to Channel No. 3.
- Photo at the right hand side partly present tertiary sewer at Plot 1.



Open tertiary sewer – HP1

Housing Plot 2:

- Situated at the South of Truong Thi Ward Plot 2 covers the size of 1.042 ha and total 52 households. It is bordered by Bach Lieu street at the South; Lane 2, Bach Lieu street at the South West; Lane 3, Nguyen Kiem street at the North West; Nguyen Kiem street at the North East.
- Tertiary sewers there were built long time ago by community organizations without general planning. Total length of tertiary sewer surrounding the Plot is 218 m and that sewer inside the Plot is 122 m. All these tertiary sewers are now connected public sewer.
- Photo at the right hand side partly present tertiary sewer at Plot 2.



Tertiary sewer – HP2

Housing Plot 3:

- Located at the North of the Ward covers the area of 1.58 ha and total 85 households. Plot 3 is bordered by Lane 6, Nguyen Van Cu street at the North; Nguyen Trung Ngan street at the East; Lane 2, Nguyen Van Cu street at the South and the West.
- Total length of tertiary sewer surrounding the Plot is 506 m and that of tertiary sewer inside the Plot is 190 m. Tertiary sewers there are now working properly and connected to public sewers at Nguyen Van Cu street.
- Photo at the right hand side partly present tertiary sewer at Plot 3.



Below are maps of assessed housing plots

Figure 12: Map of Housing Plot 1 – Truong Thi

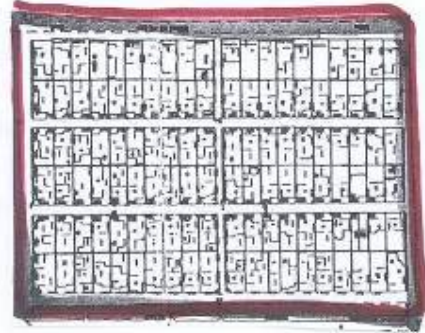


Figure 13: Map of Housing Plot 2 – Truong Thi



Figure 14: Map of Housing Plot 3 – Truong Thi

7.6. Hung Binh Ward

General:

Situated at the center of Vinh City Hung Binh Ward has the size of 220 ha and approximately 5,182 households. It is bordered by Nguyen Si Sach street at the North; Le Loi street at the West; Nguyen Van Cu street at the South East; Nguyen Thi Minh Khai street at the South West and Ho Tung Mau street at the South.

Hung Binh Ward is fully serviced by the KfW Project. Current status of public tertiary sewer in the Ward is rather poor except some small areas where infrastructure system was developed properly. Installations of new tertiary sewer, new household connection and replacement and rehabilitation of existing tertiary sewer at this area is necessary.

Assessment was performed at 03 housing plots and findings are as below:

Housing Plot 1:

- Plot 1 is bordered by Le Hong Phong street at the North; Van An street at the West; Nguyen Duc Canh street at the East and Lane 13, Nguyen Duc Canh at the South West. Plot 1 has the size of 2.01 ha and 134 households. Tertiary sewers in this area are fairly good.
- Length of tertiary sewers surrounding the Plot 1 is 555 m and length of tertiary sewer inside the Plot is 477 m. It was made of brick with concrete cover..
- Photo at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 2:

- Plot 2 is bordered by Tan Tien street at the North East; Lane 3, Tan Tien street at the North West; Tan Yen street at the South West; Lane 1, Tan Yen street at the South East. The Plot 2 covers the land of 3.5 ha and 118 households.
- Tertiary sewer in Plot 2 is rather poor and has not yet been connected to public sewer. Total length of tertiary sewer surrounding the Plot is 285 m and length of tertiary sewer inside the Plot is 393 m. Replacement of tertiary sewers there is needed, especially installation of new sewers for some parts of the Plot 2.
- Photo at the right hand side partly present tertiary sewer at Plot 2.





Housing Plot 3:

- The Plot 3 is bordered by Van Duc Giai Street at the North East and South East; Nguyen Tien Tai Street at the North West and Lane 1A – Van Duc Giai Street at the South West. The plot has the size of 3.07 ha and 112 household.
- Similar to the housing Plot 2, tertiary sewer system at this housing plot is rather poor as it were mostly constructed by households without general plan years ago and the maintenance and rehabilitation or upgrading of these sewer has been neglected. Measures as installation of new sewer, replacement and rehabilitation of existing sewer are necessary.
- Total length of tertiary sewer surrounding the Plot is 145 m only and is now in bad condition. These sewers should be replaced in order to improve working condition of these sewers.
- Total length of tertiary sewer inside the Plot is 417 m. It is also in poor condition and requires replacement and rehabilitation.
- Photo at the right hand side partly present tertiary sewer at Plot 3.



Below are maps of assessed housing plots

Figure 15: Map of Housing Plot 1 – Hung Binh

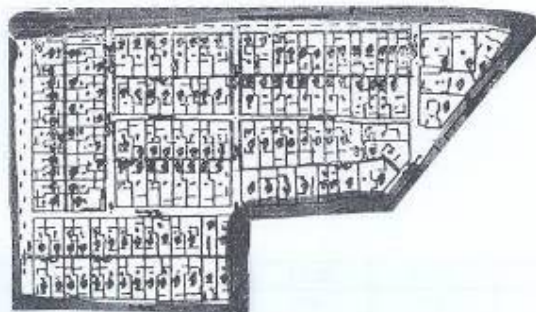


Figure 16: Map of Housing Plot 2 – Hung Binh



Figure 17: Map of Housing Plot 3 – Hung Binh



7.7. Le Mao Ward

General:

Situated at the center of Vinh City, Le Mao Ward has total approximately 2,379 households and covers the size of 87 ha. The Ward is bordered by Hong Bang and Thai Phien streets at the West; Tran Phu street at the South; Nguyen Thi Minh Khai street at the North East and Le Mao street at the South East. The Ward is fully inside the KfW Project service area.

Generally, only public sewers along main streets of Tran Phu, Hong Bang, Thai Phien, Nguyen Thi Minh Khai, Dinh Cong Trang and Le Mao are still working properly, tertiary sewers within the Ward is rather bad. Investment on installation of new sewer and replacement and rehabilitation of existing sewer is urgently needed to improve the condition of wastewater discharge of the Ward.

Assessment was implemented at 03 housing plots and findings are as below:

Housing Plot 1:

- Situated at the South West of the Ward the Plot has the size of 1.1 ha and total 55 households. The Plot 1 is bordered by Hong Bang street at the West; Trinh Hoai Duc street at the North; Ngo Van So street at the East and Dinh Cong Trang street at the South.
- Total length of sewer surrounding the Plot is 486m which is still in proper condition. No action is required towards this type of sewer.
- Total length of tertiary sewer inside the Plot is 50m. It was built long time ago and without proper maintenance then minor rehabilitation as re-mortar of this sewer should be considered. These sewers are now connected to main public sewers.
- Photos on tertiary sewer of the Plot are presented at the following page.



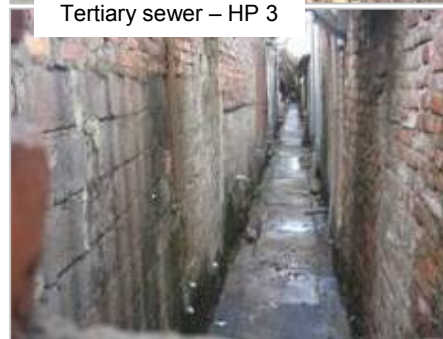
Housing Plot 2:

- The Plot 2 is bordered by Lane 10, Dang Tat street at the North West and North East; and South West, Le Van Tam street at the South East. The Plot has the size of 0.98 ha and total 57 households
- Total length of tertiary sewer surrounding Plot is 468 m and total length of tertiary sewer inside the Plot is 110 m. All tertiary sewers there were built long time ago without planning. Tertiary sewers there were made of stone with concrete cover. And are now in very poor condition.
- Photos at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 3:

- Plot 3 is bordered by Phung Phuc Kieu street at the North and the East; Lane 8, Phung Phuc Kieu street at the South and Lane 4, Phung Phuc Kieu street at the West. The Plot has the size of 1.33 ha and 90 households.
- Total length of tertiary sewer surrounding the Plot 3 is 194m and length of tertiary sewer inside the Plot 630m. Rehabilitation as re-mortar and installation of concrete cover to approximately 730 m of tertiary sewers and replacement of about 94 m of tertiary sewer is necessary. These tertiary sewers are now connected to public sewer.
- Photos at the right hand side partly present tertiary sewer at Plot 3.



Below are maps of assessed housing plots

Figure 18: Map of Housing Plot 1 – Le Mao



Figure 19: Map of Housing Plot 2 – Le Mao



Figure 20: Map of Housing Plot 3 – Le Mao



7.8. Hung Dung Ward

General:

Located at the East of Vinh City and is bordered by wards of Hung Loc and Hung Hoa at the North and North East, by wards of Hung Phuc and Truong Thi at the West; Ben Thuy Ward at the South and the Lam River at the South East. The ward has the size of 605 ha and the total number of households is approximately 3,621.

The KfW service area is situated at the South part of the ward and is bordered by Nguyen Viet Xuan Street at the North; Phong Dinh Cang Street at the South West; Ben Thuy ward at the South and the Lam river at the South East. The total size of this area is around 125 ha and there are 641 households living at this area. Nearly half part of this area is still a cultivated land.

Generally, tertiary sewer at KfW service area is rather poor. Assessment was conducted at 02 housing plots and findings are as below:

Housing Plot 1:

- Plot 1 is bordered by Nguyen Viet Xuan street at the North; Lane 32, Nguyen Viet Xuan street at the West; Ham Nghi street at the East and Phan Cong Tich street at the South. The Plot has the size of 1.22 ha and 62 households. The Plot is in thinly populated area and inhabitants are mostly farmers.
- There is almost no tertiary sewer in the Plot. Tertiary sewers exist at some sections of lanes inside the Plot but it is only used for storm water collection. Household wastewater is discharged to gardens and then absorbed by soils.
- Installation of new sewer at this housing plot is urgently necessary to improve sanitation condition at this area.
- Photos at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 2:

- Plot 2 is bordered by Phan Cong Tich street at the North; Phong Dinh Cang street at the West; Lane 10, Phong Dinh Cang street at the South and Lane 2, Phan Cong Tich street at the East. The Plot has the size of 0.52 ha and 92 households.
- Infrastructure as sewer was developed before construction of houses. However, as these sewers were built long time ago without maintenance, tertiary sewers there are degraded heavily. Rehabilitation as installation of concrete cover and re-mortar are needed.
- Length of tertiary sewer surrounding the Plot is 306 m and length of tertiary sewer inside the Plot is 190 m.
- Photo at the right hand side partly presents tertiary sewer at Plot 2.



Below are maps of assessed housing plots

Figure 21: Map of Housing Plot 1 – Hung Dung

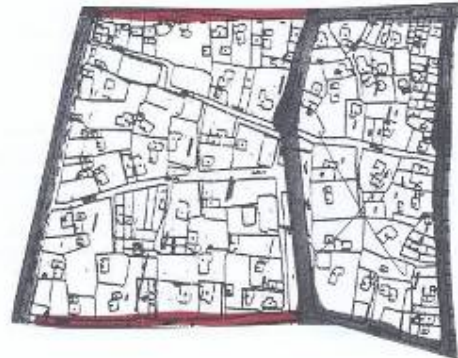
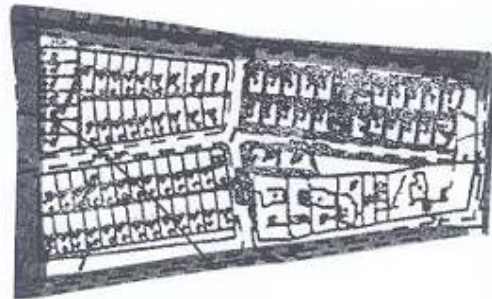


Figure 22: Map of Housing Plot 2 – Hung Dung



7.9. Vinh Tan Commune

General:

Situated at the Southern part of Vinh City, Vinh Tan Commune is bordered by Ngo Duc Ke street and Cua Tien River at the North; communes of Hung My and Hung Think at the South and Vinh river at the East. The Commune has the size of 356 ha and approximately 2,256 households. Nearly two third of the total area of Vinh Tan Commune is currently cultivated lands and empty land which will be used for urban development in future.

KfW service area covers the size of 182 ha and 759 households, approximately. The area is situated at the North Eastern part of Vinh Tan Commune. Nearly two third the size of KfW service area is still a cultivated land.

Generally, tertiary sewers at this area are in poor condition. Assessment was conducted at 02 housing plots, findings are as below:

Housing Plot 1:

- Plot 1 is bordered by Ngo Duc Ke street at the North; Lane 16, Cao Duc Ke street at the West; Hong Bang Channel at the East; Alley 189, Ngo Duc Ke street at the South. The Plot has the size of 0.98 ha and total 67 households.
- Tertiary sewers there were built long time ago without proper planning. It is in bad condition and requires rehabilitation. Photo at the right hand side partly presents tertiary sewer at Plot 1.
- Total length of tertiary sewer surrounding the Plot is 287 m and length of tertiary sewer inside the



Tertiary sewer – HP1

Plot is 173 m. Total length of tertiary sewer need to be rehabilitated is approximately 320 m. Tertiary sewer in this Plot is now connected to Hong Bang Channel.

Housing Plot 2:

- Located at the Southern part of Vinh Tan Commune and closed to Den Bridge and the dyke of Vinh River, the Plot has the size of approximately 1.6 ha and 41 households.
- Main and secondary sewer have not yet been installed at this area. No tertiary sewer was found at this Plot yet. Presently, household wastewater is discharged to garden for soil absorbed. Total length of sewer needed to be installed is approximately 745 m. Below are photos presenting status of wastewater discharge in Plot 2.



Below are maps of assessed housing plots

Figure 23: Map of Housing Plot 1

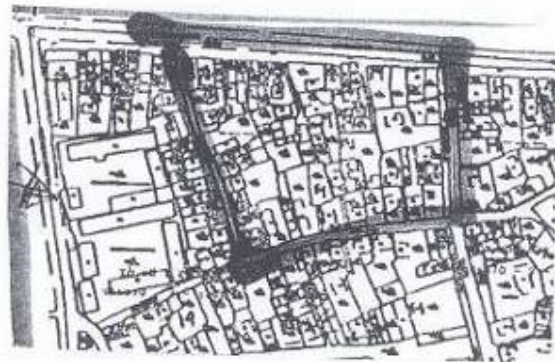


Figure 27: Map of Housing Plot 2

7.10. Ben Thuy Ward

General:

- Situated at the South East of Vinh City and is bordered by Hung Dung Ward at the North; Truong Thi Ward at the West; Trung Do Ward at the South West and the Lam river at the East. The Ward has the size of 2.6 ha and total 3,821 households.
- Ben Thuy Ward is fully inside the KfW service area. In general, tertiary sewers of the Ward are rather poor. At some streets there have no public primary or secondary sewers. Tertiary sewers are available at approximately one six of the total size of the Ben Thuy Ward. Assessment was conducted at 03 housing plots and findings are as below:

Housing Plot 1:

- Located at the Northern part of Ben Thuy Ward and it is bordered by Nguyen Huy Oanh str at the North West; Vo Thi Sau Street at the South West; Lane 2 Vo Thi Sau Street at the South East and Alley 19 – Lane 2 Vo Thi Sau Street at the North East. This housing plot has total size of 1.84 ha and total population of 108 households.
- Infrastructure as power, wastewater sewer was developed before construction of houses. Tertiary sewer there were built long time ago. Materials of the tertiary sewer are PVC pipe or brick with concrete cover.
- Total length of sewer surrounding housing plot is 382 m and total length of sewer inside the housing plot is 550 m. These sewers are now connected to future KfW components.
- Photos at the right hand side partly present tertiary sewer at Plot 1.



Housing Plot 2:

- Situated at the center of Ben Thuy Ward and is bordered by Hoang Thi Loan street at the West; Nguyen Binh street at the North; Phan Da street at the South and East. The Plot has the size 2.48 ha and 93 households.
- There has been no public sewer at this Plot. Household wastewater is discharged to garden or landfill for soil absorption. Below are some photos presenting natural ditches, septic tanks along street, lane within the Plot.
- Photos below partly present tertiary sewer at Plot 2.





Housing Plot 3:

- Plot 3 is bordered by Lane 1, Nguyen Duc Dat street at the North, Huynh Thuc Khang street at the West; Lane 5, Nguyen Duc Dat street at the South and Nguyen Duc Dat street at the East. The Plot has the size of 3.3 ha and 107 households.
- Tertiary sewer surrounding the housing plot is open type. It is only used for discharging rainy water. It is dry all time. Household wastewater is discharged to gardens or to underground tanks (tanks with no bottom flap then wastewater will be absorbed by soil).
- Total length of tertiary sewer surrounding the Plot is 460 m and length of tertiary sewer inside the Plot is 160 m. Tertiary sewers there are not connected to public sewers.
- Photos at the right hand side partly present tertiary sewer at Plot 3.



Below are maps of assessed housing plots

Figure 24: Map of Housing Plot 1 – Ben Thuy



Figure 25: Map of Housing Plot 2 – Ben Thuy



Figure 26: Map of Housing Plot 3 – Ben Thuy



Annex

Figure 3: Catchment area of Channel No. 3, including wards of Hung Dung, Trung Thi, Ben Thuy and parts of Trung Do. Total size of the catchment is 350 ha.

(Source: Drainage Design Report - Carl Bro in Association with MVV Consulting)

