Climate-Resilient Urban Infrastructure in Centre-North Vietnam
Final Report

City of Phat Diem
Province of Ninh Binh

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AFD
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CLIENT

NAME	Agence Française de Développement
ADDRESS	Division Eau et Assainissement 5 rue Roland Barthes 75598 PARIS CEDEX 12 FRANCE
CONTACT PERSON	Olivier GILARD Boris CHASTANT

SCE

ADDRESS	4 rue Viviani – CS 26220 44262 NANTES CEDEX 2 Email: sce@sce.fr
CONTACT PERSON	Romain Viavant Tel. +33 2 51 17 81 75 romain.viavant@sce.fr

REPORT

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1. Introduction

1. Phat Diem is located in the coastal district of Kim Sơn in Ninh Bình province. In the past, the land area increased gaining about 80-100 cm per year towards the sea. However, this has changed and erosion now occurs. Therefore, this district is expected to be seriously impacted by climate change with an estimated flood area covering about 51-79% of the whole district, on the basis of a future sea level rise of 50-100 cm. The CRUIV project aims to reduce climate change impacts in Phát Diệm by:

- Improving the drainage of the rivers in Phát Diệm, as well as in Lưu Phương and Tân Thành communes, to protect the life and livelihoods of 420 families along the rivers and to increase water storage-ability in dry season.
- Improving the drainage system in the Western catchment of Vac river with a wastewater treatment plant (WWTP).
- Improving the urban road network to maintain access and evacuation routes during floods
- Developing project management capacity and investment implementation as well as climate resilience urban management.

2. City Context

2.1. Province and City Locations

Figure 1 Map of Ninh Binh Province and Phat Diem Urban area

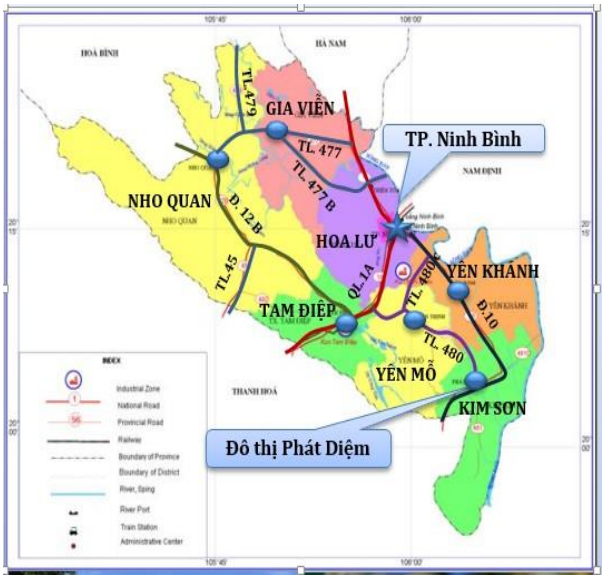


Figure 1: Map of Ninh Bình province

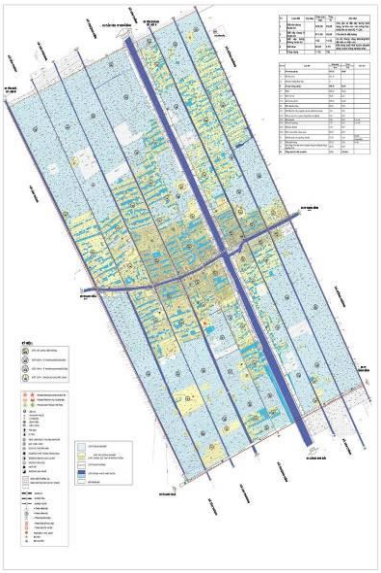


Figure 2: Phát Diệm urban area

2. The project covers the whole of Phat Diem town (located in Kim Son District) on the Southern side of the Vac River and parts of Lưu Phương, Tân Thành, Thượng Kiệm communes.

2.2. Population and Social Condition

3. This table contains social information about the population in Kim Sơn district.

Table1 Kim Son district statistics

Item	Unit	
Average population In which:	Persons	172,260
Male	Persons	86,559
Rate	%	50.24%
Female	Persons	85,701
Rate	%	49.76%
Urban population		12,388
Rate	%	7.19%
Rural population	Persons	159,872
Rate	%	92.81%

(Source: Provincial statistic book)

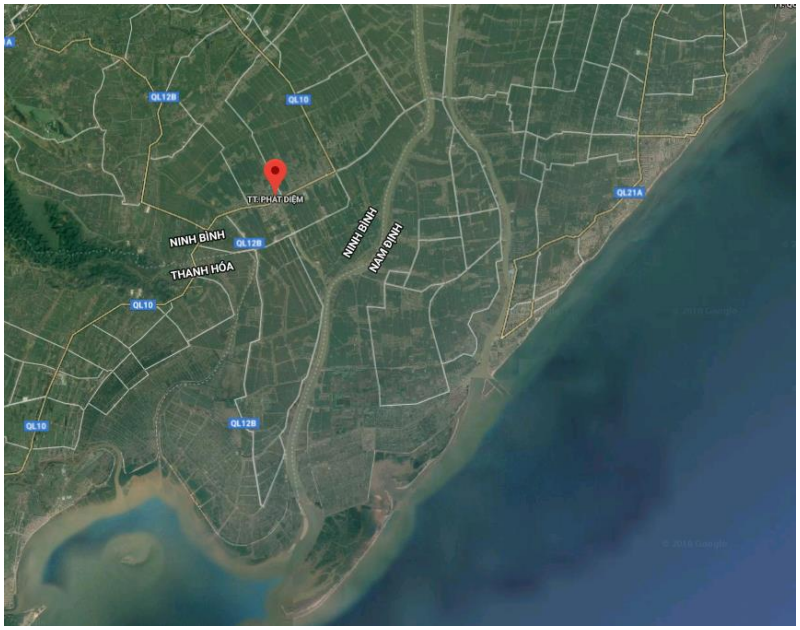
4. As at the end of 2017, the proposed project covers Phat Diem and Lưu Phương, Tân Thành, Thượng Kiệm communes which include 8,553 households (31,303 people). The number of poor families is 531 (1,132 people) which is about 6.21% of total families.

3. Drainage and wastewater situation

3.1. Flooded area and sensitivity

5. Phat Diem is located close to the sea (about 10 km West).

Figure 2: Phat Diem location

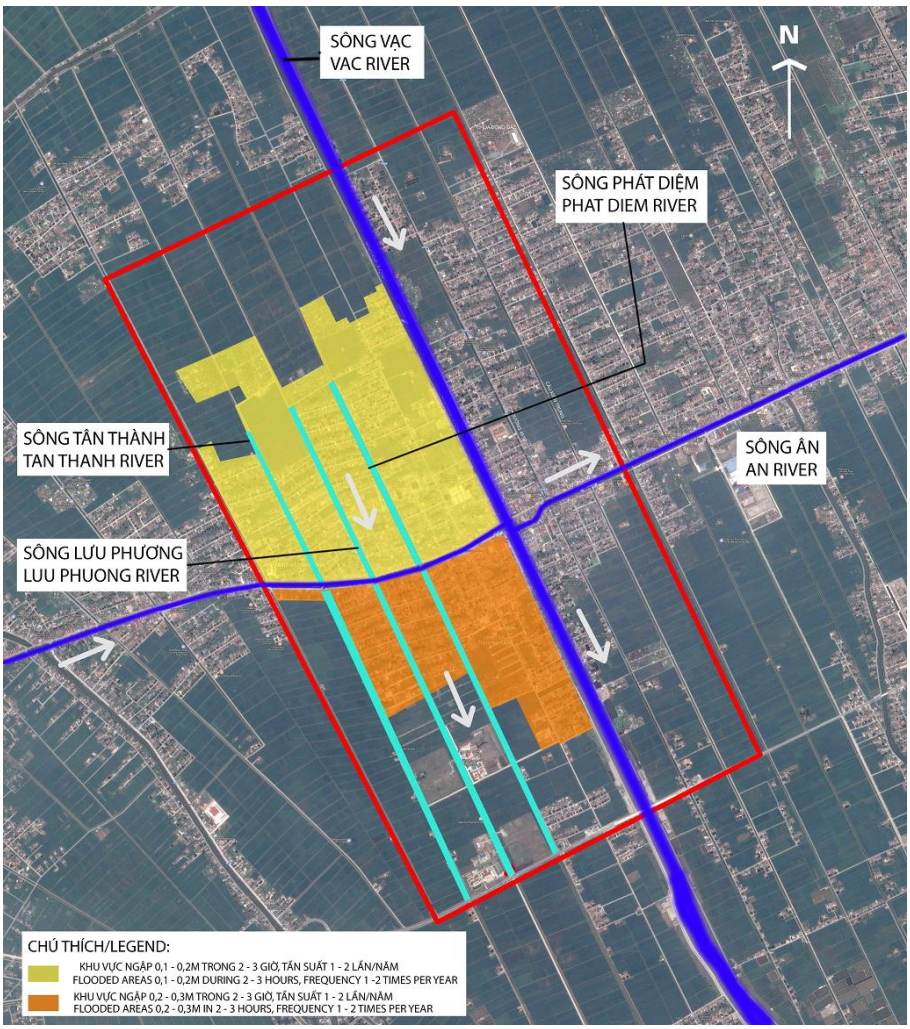


6. Regular flooding occurs in urban areas along the rivers and canals of Phát Diệm, Lưu Phương, Tân Thành. The average flood depth is about 20-30 cm in the north part of

the town while it's about 30 cm to the Southern side of NR 21B. Flooding occurs once a year as an average.

7. Floods are mainly caused by the low altitude of existing roads), heavy rainfalls and the rise of river water level. The combination of these factors can lead to bigger flood in height and impacted area.

Figure 3 Flood risk map on the main residential areas within project scope



8. As the city of Phat Diem is very flat and close to the sea, the city is very sensitive to flood risks. Inadequate drainage (including canals in the city) does not allow the requisite water discharge during rain. Furthermore, during high tides (when drainage gates are closed) the drainage is even more problematic. . A pumping station is supposed to ensure proper water evacuation but is frequently overloaded contributing to flood in the city.

9. This situation is anticipated to be more severe due to climate change impact (higher rain intensity and sea level rise). In this respect, improvement of the drainage system is absolutely essential.

3.2. Existing environmental issues and wastewater situation

10. There is no existing waste water collection and treatment in Phat Diem but most of households own septic tanks. However, it is reported that some waste water flows

directly into the drainage system and to the rivers of Phát Diệm, Lưu Phương and Tân Thành. Traces of pollution are often seen in the rivers but no testing or monitoring have been made to establish the origin of this pollution and its hazardous level.

11. There is no operational system for the proper management and servicing of septic tanks. The district environment centre has a desludging truck (5 m³) but this is unable to operate due to limited space in the small streets. The local authorities do not know where the septic sludge is currently treated or taken for disposal. Any incidents of illegal dumping of septic sludge occurring within the district have not been recorded by the authorities Considering the city geography and high-water table is it likely that most of the wastewater is directly discharged to the water ways, without any treatment. Irregular dredging of the rivers and canals, together with urbanization, have led to these becoming ineffective in some segments.

Figure 4 Narrowed flow of Phát Diệm river and lack of dredge management

Figure 5 Direct wastewater discharge to Phát Diệm river

3.3. Existing drainage network

12. There is no existing modern, comprehensive drainage system. In residential areas the waste water and rain water flow together in open small canals and thence directly in to the rivers.
13. As the city is traversed by several canals, all the drainage is carried through these. This can cause problems when the water level in the canals is particularly high.

3.4. Hydro-meteorological data

14. In Kim Sơn a project for the construction of Kim Đài boat quay (financing approved by AFD) is in progress. Unfortunately, in our project area no detailed hydro-meteorological data is available. The following data is from the Kim Đài boat quay project, together with some data received from Ninh Bình provincial PMU. The data is of a very broad nature and lacking in specific details.

- Rainfall:

The rainy season is from June to October and rainfall in this period accounts for 80–85% of the whole year total. Most rains occur in August and September causing floods. Sometimes in September rainfall can exceed 300mm.

Table2 Average monthly rainfall in stations in vicinity (Unit: mm)

	Station	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	Phủ Liễn	28.4	33.1	47.6	91.9	206.8	237.2	269.0	351.0	392.9	153.5	54.0	33.3	1899
2	Thái Bình	25.8	26.2	48.0	80.5	167.5	201.0	216 5	300.4	327.2	283.1	65.2	24.1	1765
3	Nam Định	24.2	28.5	49.3	90.4	175.8	210.3	228.2	301.9	326.0	223.8	62.5	28.2	1749
4	Văn Lý	27.4	31.4	43.8	65.3	135.5	179.7	195.0	333.0	411.0	243.0	70.5	29.6	1765
5	Ninh Bình	24.6	28.5	54.5	76.7	163.0	236.0	231.2	308.0	370.4	244.3	66.5	30.0	1834
6	Kim Sơn	20.0	23.0	43.1	67.3	137.0	190.5	185.3	330.9	406.5	249.9	66.4	25.9	1746

15. Annually, there are 4-5 small flood events in the province with rainfall of 50-100 mm and one to two serious flood events with rainfall of over 150 mm. The heaviest rains usually come with storms and years 1963, 1968, 1973, 1978, 1980, 1985, 1994, 1996 and 1997 are very typical of this situation, especially 1973 and 1996 when heavy rains came one after another.

16. Rainfall is not equally distributed within the province, and generally the flat region (including Phat Diem) has more rain compared to mountainous areas. About 5 -10 days per year, rainfalls are 50-100 mm and on 2-3 days it is over 100 mm, mostly in August and September (50% of recorded cases). During the rainy season about 50% of days have rainfall and the average monthly rainfall is 200-300 mm. Sometimes, rain occurs for 25 consecutive days with rainfall up to 700-900 mm. Despite the fact that rainfall in short periods are mostly of smaller size, with a frequency =< 10%, the total monthly rainfall is still very high, causing flooding in lowland areas.

- Hydrology:

17. The city of Phat Diem is crossed by two main rivers:
    - An River, crossing from West to East,
    - Vac River, crossing from North to South.

    These rivers are linked by several small canals which are a part of the overall drainage system of the city.

18. There are several main canals in the project area: Tân Thành River, Lưu Phương River, and Phát Diệm River, which are actually irrigation canals. These are connected to the Ân river and the Vạc river. The Vạc River(on the East) is the main connector/receptor for all of the canals. The Vạc river ends at Vạc estuary (near Kim Đài boat quay) and flows to the Đáy river.

Table 3 Highest water level recorded in Vạc River

Year / Location	Max. level (m)					
	1971	1978	1985	1994	1996	2005
Vạc River						
- Cầu Yên bridge (Ninh Bình city)		2.09	2.53	2.28	2.33	
- Cửa Vạc estuary (Kim Sơn district)		1.75	1.95	1.85	2.05	2.06

- Tide:

19. The study area is not directly affected by the tide owing to the presence of tidal gates. However during high tide, the water level in the Đáy river rises and the tidal gate at Biện Nhị is closed, meaning that the Vạc river can no longer flow by gravity to the Đáy river and the water needs to be pumped. When this happens and heavy rain also occurs, the pumps in the Biện Nhị pumping station become overloaded, leading to a rise of water level in the rivers of Tân Thành, Lưu Phương, Phát Diệm, resulting in flooding.

4. Water Supply and Solid Waste assets

20. After collection solid waste is transported to the provincial landfill in Tam Điệp. No details are available about this landfill. The management of solid waste is undertaken by the District Urban Sanitation Center within the town, with some sanitation teams operating in communes. The Centre has two specialized trucks of 6 m³ in capacity and a number of handcarts. Solid waste is transported to a transit point in each commune and moved to the provincial landfill two to three times per week.

Figure 6 Cart for trash collection and placed in a fixed points before transportation

21. In order to sustain and improve solid waste collection and transfer, the city requires additional transfer stations.

5. Proposed Investments

5.1. Justification and Map of Proposed Assets to be Built

5.1.1. Drainage assets

22. Local floods occur in urban areas in the vicinity of the three rivers of Phát Diệm, Lưu Phương, Tân Thành. The severity and frequency of these floods is not very serious at present but is likely to increase in the future due to climate change, as this coastal region is suffering from erosion and land loss because of the rising sea level . .Due to urbanization, the riverbeds of Phát Diệm, Lưu Phương, Tân Thành rivers have reduced capacity as a result of overgrowing vegetation and sedimentation.

Figure 7 Proposed dredging and embankment sites

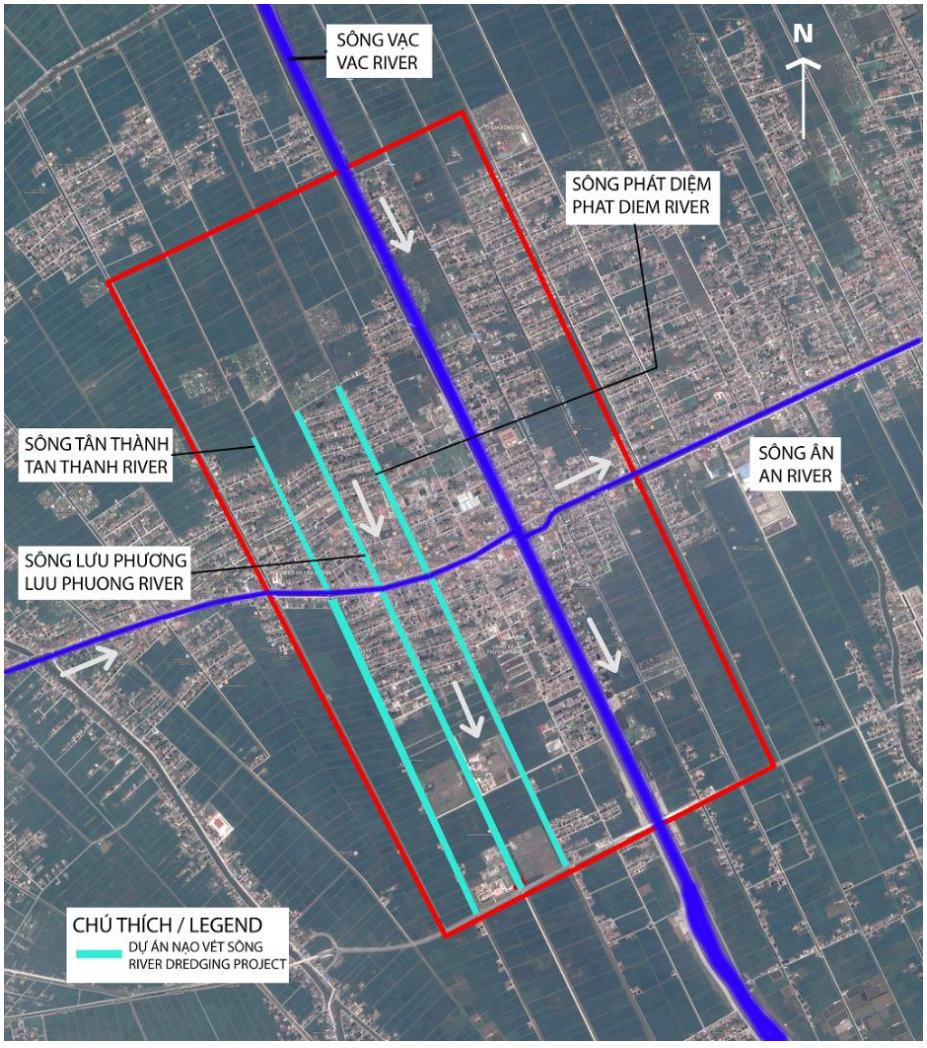


Figure 8 Pictures from site visit

North of Phát Diệm canal

South of Phát Diệm canal

North of Lưu Phương canal

South of Lưu Phương canal

North of Tân Thành canal

South of Tân Thành canal

Table 4 Overview of the proposed drainage project

Component	**Main technical specification**	**Number of beneficiaries**	**Potential social impact**
Drainage system	Not proposed	About 420 families with direct benefit	N/A
Canal improvement	Dredge 19.38 km		None

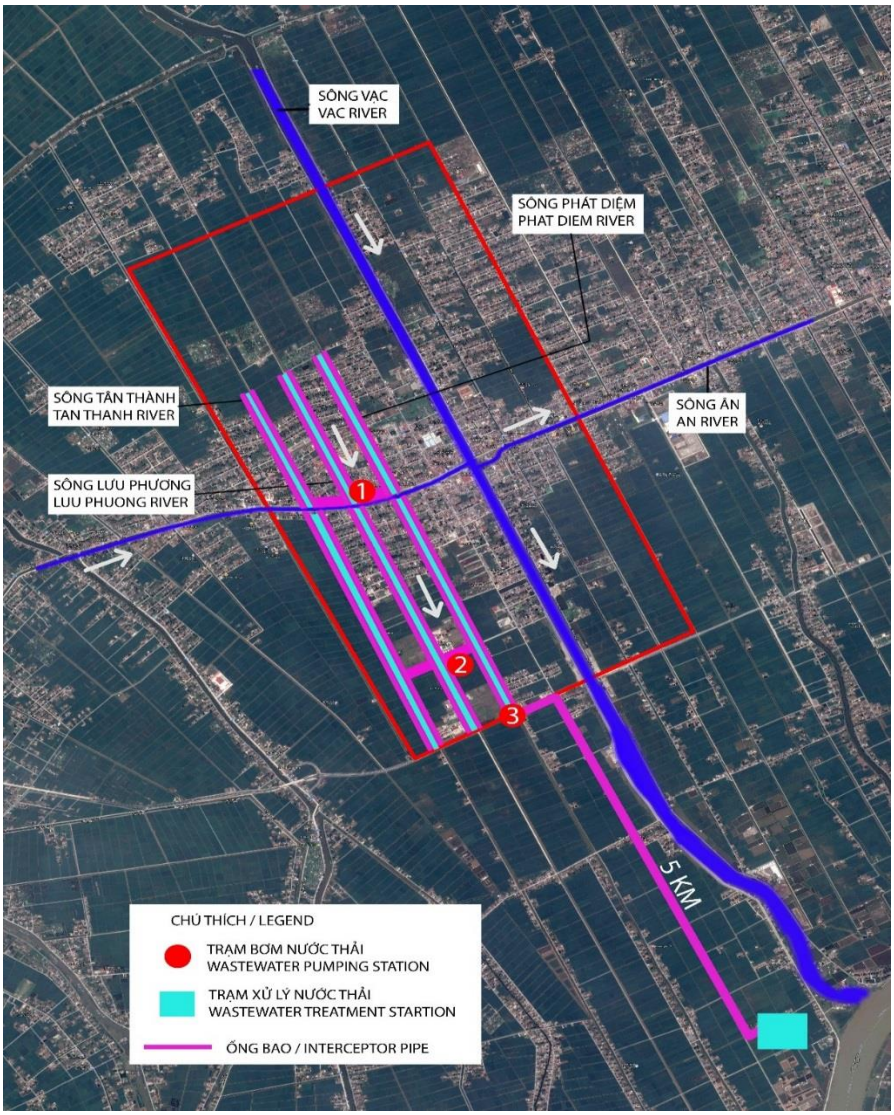
23. The main objective of the drainage component is actually to improve the capacity of the canals in the city. This will serve two purposes:

- Improve the drainage capacity during normal rain events,
- Increase the storage capacity in case of excessive rain events and floods.

5.1.2. Wastewater assets

24. There is no existing waste water collection and treatment system but most of the houses own a septic tank. However, no septic tank emptying services are undertaken by the authorities in the city and there is no treatment facility for septic sludge. This lack of a wastewater management system results in some direct discharge of totally untreated wastewater in to the rivers. Traces of pollution are often seen in the rivers but no testing, nor monitoring, has been undertaken to establish the origin of this pollution and its hazard level. The local authorities do not know where the septic sludge is currently treated or disposed.

Figure 9 Location of WWTP and proposed design for the WW network



25. The proposed wastewater project will have the following main characteristics:

- Construction of a combined network on the Western part of the city,
- Construction of a WWTP located 10 km to the south of the city centre.

Figure 10 Site visit pictures

Combined system flows directly to North side of Phát Diệm river

Proposed site for WWTP – agriculture land far from urbanized area (10 km away from city centre and 5 km away from city boundary)

Table 5 Overview of the proposed wastewater project

	Main technical specification	Number of beneficiaries	Potential social impact
Collection network	Combined 400-600 mm diameter pipes	About 5000 families	Implement together with road component
WWPS	3 nr. pumping stations		Implement together with road component
WWTP	1 nr. WWTP 3,000 m3 capacity per day Activated sludge process No phasing has been studied Household connections not proposed No reuse of wastewater was studied No septic tank management or servicing was studied		500 m2 agricultural land affected

5.1.3. Solid waste assets

26. The existing landfill facility of the province is located in Tam Điệp which is about 20 km away. This means that the proposed solid waste transfer sites are very much needed as they will contribute to a reduction in transfer/transport costs. At the transfer site locations compaction of waste could be undertaken and specifically dedicated trucks could be used to transport the waste between the city and the landfill. These sites were indicated in the Phát Diệm urban master plan which has been previously approved by the PPC.

Figure 11 Location of SW transfer sites

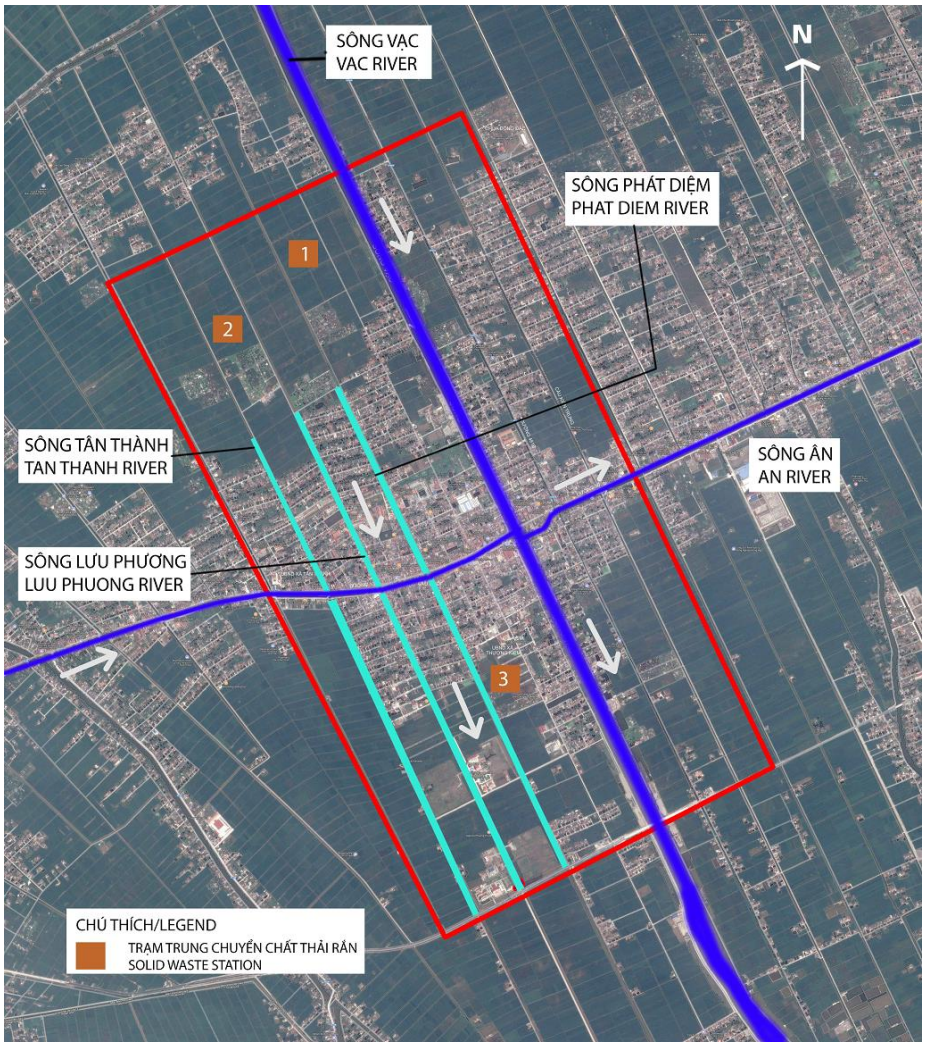


Table 6 Overview of the proposed solid waste project

	Main technical specification	**Number of beneficiary**	**Potential social impact**
Landfill	Not proposed	8553 families	None
Equipment	Three transfer sites proposed, capacity of each is 3,000 m3		Limited

27. The locations of each of the proposed transfer sites are within rice fields. The sites will require some raising of ground levels to ensure sure that they are safe from flooding.

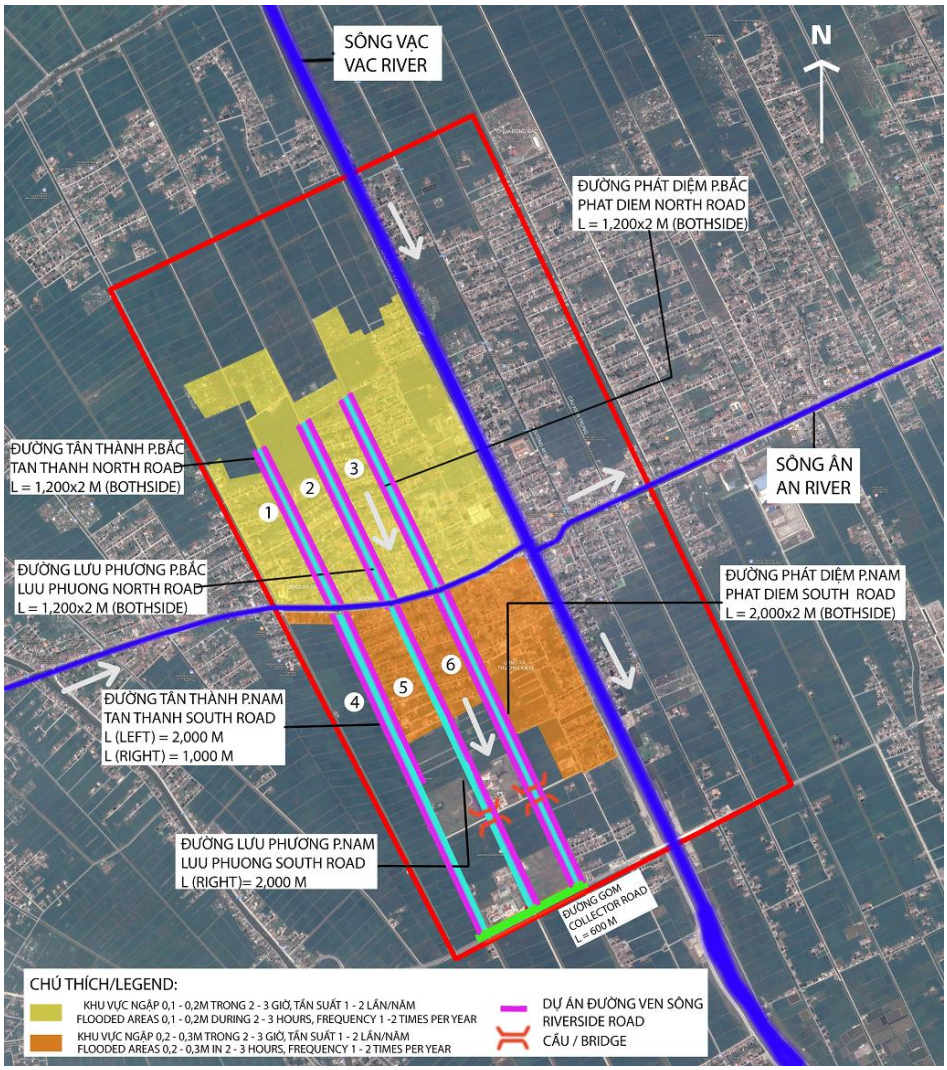
5.1.4. Road assets

28. The existing roads along the rivers of Phát Diệm, Lưu Phương, and Tân Thủy are narrow, which makes two-way traffic very difficult during flooding., Additionally there is no connectivity between the roads. The low altitude of the roads (1.5 m) relative to the highest river level (1.7–1.9 m) contributes to an increase in the impacts of the floods. After improvement these roads, will have proper route markings, which are a legal tool to protect them from encroachment. The new roads will also contribute to the reduction of flood impacts as the height of the canal embankment elevations will be increased. On the southern part of the city, the project includes provision of additional accesses and bridges to ensure connectivity between roads and to reduce intersections with NR21B bypass road.

29. This will then contribute to:

- Reduction of flood risks,
- Improvement of canal capacity, as no further encroachment could take place,
- Improvement in connectivity and safety during floods, as alternative roads would be available if some of the roads are flooded.

Figure 12 Location map of proposed roads



30. As stated previously, all proposed roads are located alongside the canals (generally with a road to each side of the canal) and are in the flood prone urban area. Two bridges will be built in the South of the city in a flood free area, which will contribute to ensuring access to the city and connectivity in case of flood.

Figure 13 Site visit pictures

Northern side of Tân Thành river

Southern side of Tân Thành river

Northern side of Lưu Phương river

Southern side of Lưu Phương river (left side constructed, a service road on the right side)

Northern side of Phát Diệm river

Southern side of Phát Diệm river

Table 7 Overview of the proposed road project

	Main technical specification	**Number of beneficiary**	**Potential social impact**
Improvement of road 1 (Northern segment of Tân Thành river)	Improvement and widening of 1230 m on each side of river. Carriageway 7 m, sidewalk 1 m.	Over 5,000 people enjoy direct benefit and people in surrounding enjoy indirect benefit	About 20 Households
Improvement of road 2 (Northern segment of Lưu Phương river)	Improvement and widening of 1230 m on each side of river. Carriageway 7 m, sidewalk 1.5 m.		About 65 Households
Improvement of road 3 (Northern segment of Phát Diệm river)	Improvement and widening of 1230 m on each side of river. Carriageway 7 m, sidewalk 1 m.		About 70 Households
Improvement of road 4 (Southern segment of Tân Thành river)	Improvement and widening of 980 m on each side of river. Carriageway 7 m, sidewalk 3.5-8.5 m. Improvement and widening of 320 m on each side of river. Carriageway 7 m, sidewalk 1-3.5 m.		About 36 Households
Improvement of road 5 (Southern segment of Lưu Phương river)	Improvement and widening of 980 m on each side of river. Carriageway 7 m, sidewalk 8 m. Improvement and widening of 320 m on each side of river. Carriageway 7 m, sidewalk 1-1.5 m.		About 62 Households
Improvement of road 6 (Southern segment of Phát Diệm river)	Improvement and widening of 980 m on each side of river. Carriageway		About 47 Households

	7m, sidewalk 4-6m. Improvement and widening of 320 m on each side of river. Carriageway 7m, sidewalk 1m.		
New road, connecting 3 roads in Southern part of NR 21B	Length 0,6 km, Carriageway 7 m, sidewalk 5 m		No households

31. The proposed design is consistent with the desired objectives.

5.2. Critical Review of Preliminary Design

5.2.1. Drainage assets and River embankment

32. The data obtained confirms that the general flood situation is the result of a combination of two main parameters: the lack of maintenance of the current drainage infrastructure and the spatial configuration of the city and rivers.
33. Therefore, the planned project focuses on the dredging of all canals and the improvement of their embankments, by the removal of existing obstructions and surface degradations, and the formation of embankments of constant section all along the rivers. These works will increase the overall discharge capacity of the rivers..
34. It is a fact that over time a lot of infrastructure has been built which is now reducing the canal/river cross-section in a number of locations. The following picture illustrates a place where a small bridge is reducing the width of the river from 6 m to 1 m.

Figure 14Section flow reduced by a self-made bridge

35. This kind of infrastructure greatly increases the flood risk as it has major impact on the drainage capacity of the whole canal/river.

36. The feasibility studies will have to identify and record all of these small bridges and analyse if they need to be replaced by larger bridges which do not create any flow section reduction. At this stage, we highly recommend a hydraulic modelling for all the canal and rivers in order to determine precisely the impact of any such new infrastructure on the flood situation.

5.2.2. Wastewater assets

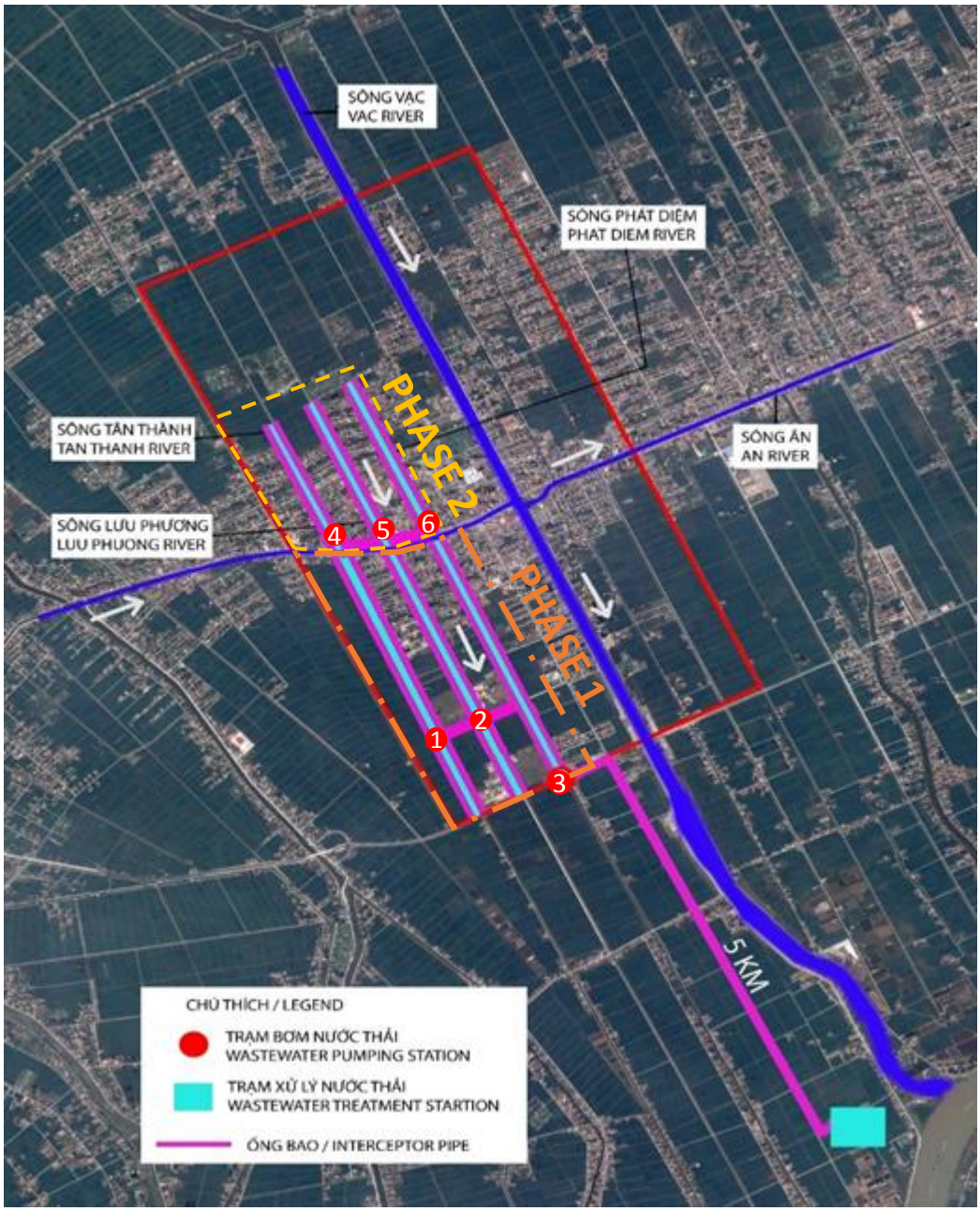
37. In light of the current wastewater situation in the city, the proposed solution is a completely new project which will significantly improve the convenience people's lives. However, the scale of the designed network will require a high level of maintenance specifically on the three pumping stations in addition to the highly technical treatment plant proposed.

38. However, it is important to note that the overall city context (flat land with a high water table and several canals) is not very favourable to the construction and operation of a wastewater network. Indeed, the wastewater network will be below the water table and hence very sensitive to groundwater infiltration. In this respect we would recommend that consideration be given to a design basis which assumes an equal volume of infiltration water to wastewater volume. (This is the practice adopted in France in such conditions). If a standard rate of infiltration (about 10% is often considered by Vietnamese companies) were to be adopted, the whole system would be under-designed and the WWTP would not be able to function as the received load would significantly exceed the anticipated load.

5.2.2.1. Proposed catchment area

39. The proposed catchment area covers most of the city. In order to cross all rivers and canals, only three pumping stations are planned in the Pre-FS. At this stage, we cannot guarantee that the design proposed in the Pre-FS is efficient, especially when it comes to crossing rivers and canals. Indeed, it seems very hazardous to construct a very deep network or siphon systems under these rivers. It seems essential to build at least six pumping stations instead of three in order to cross the many water channels. This should be confirmed during the FS preparation based on results of geotechnical and topography surveys (including canals bathymetry.

40. The following map presents potential improvements of the project components which can be further studied during the FS.



41. Consideration: could therefore be given to

- A phasing of investment with the Southern part executed first (closest to the WWTP),
- One pumping station for each canal crossing. This would be strongly recommended as siphons will be (i) complicated to operate and (ii) very sensitive to water infiltration.

42. An initial reduced scope network, as a first stage, would allow the city to gradually improve its wastewater management knowledge and technical skills. thereby enabling a more extensive and complex wastewater solution to be executed as a second stage. This is why phasing is strongly recommended for consideration..

43. This phasing would also contribute to the reduction of CAPEX in the short term due to (i) limited network length and (ii) reduced WWTP capacity (1,500 m3/d).

44. Consideration could even be given to having two WWTPs, one for the Northern catchment area and one for the Southern catchment area. This could reduce pumping costs and the number of river crossings.

5.2.2.2. Proposed WWTP process

45. In Phat Diem, the proposed location for the Waste Water Treatment Plant is a great distance from the city and is not suitable. It is essential to re-locate the WWTP location in a 5 km radius from the city centre in order to reduce pipe length and the number of pumping stations.

46. In Phat Diem, a Conventional Activated Sludge system has been recommended. This solution is quite adaptable but would present some drawbacks in the Phat Diem situation:

- Design is calculated on the hydraulic load (especially for the final settling tanks). Hence, this would have to be done considering a high water infiltration volume.
- It will require a large tank, likely needing to be constructed with special foundations, on account of the ground conditions. This will increase the cost.
- The O&M can be rather expensive and complex in cities such as Phat Diem which have no skills and limited funds for wastewater management.

47. The Consultant would therefore recommend the use of:

- If sufficient land is available near the city - A lagoon based solution or a French Reed bed system
- If available land is limited near the city - A trickling filter process could be considered.
- Both systems are robust and well-known solutions.
- A trickling filter process would present the advantage of reduced CAPEX and OPEX (especially as it does not require forced aeration).

48. The Consultant would also like to mention that no sludge treatment line is mentioned in the pre-FS. It is of major importance that the FS includes for such a line to ensure that treatment is properly executed. As an alternative, a good option may be to install a sludge drying bed.

49. As the site is most likely to be privately owned, the Consultant would strongly recommend that the city purchases the biggest piece of land possible in order to implement a lagoon based WWTP, as this process is very easy and cheap to operate. Considering the limited existing technical skills in Phat Diem the use of this process would greatly improve the viability of the project.

Table 8: WWTP required area depending on the process

Process	Lagoon	French Reed bed filter	Trickling filter	CAS
Required land 1,500 m3/d	3.5 ha	1.2 ha	3,000 m2	1,800 m2
Required land 3,000 m3/d	6.0 ha	2.2 ha	5,000 m2	2,500 m2

Another enhancement of this project that could be made is to include in the treatment plant a system that could also treat the sludge from septic tanks. Indeed, the lack of a solution to correctly manage and eliminate this sludge will remain an issue even after the realisation of the current proposed project.

5.2.3. Road assets

50. Currently, the road system in Phat Diem comprises of roads which run alongside each of the rivers and canals. Accordingly, these roads are often impassable during the rainy season due to the rise of rivers level.

51. The project in the pre-FS has three main purposes:

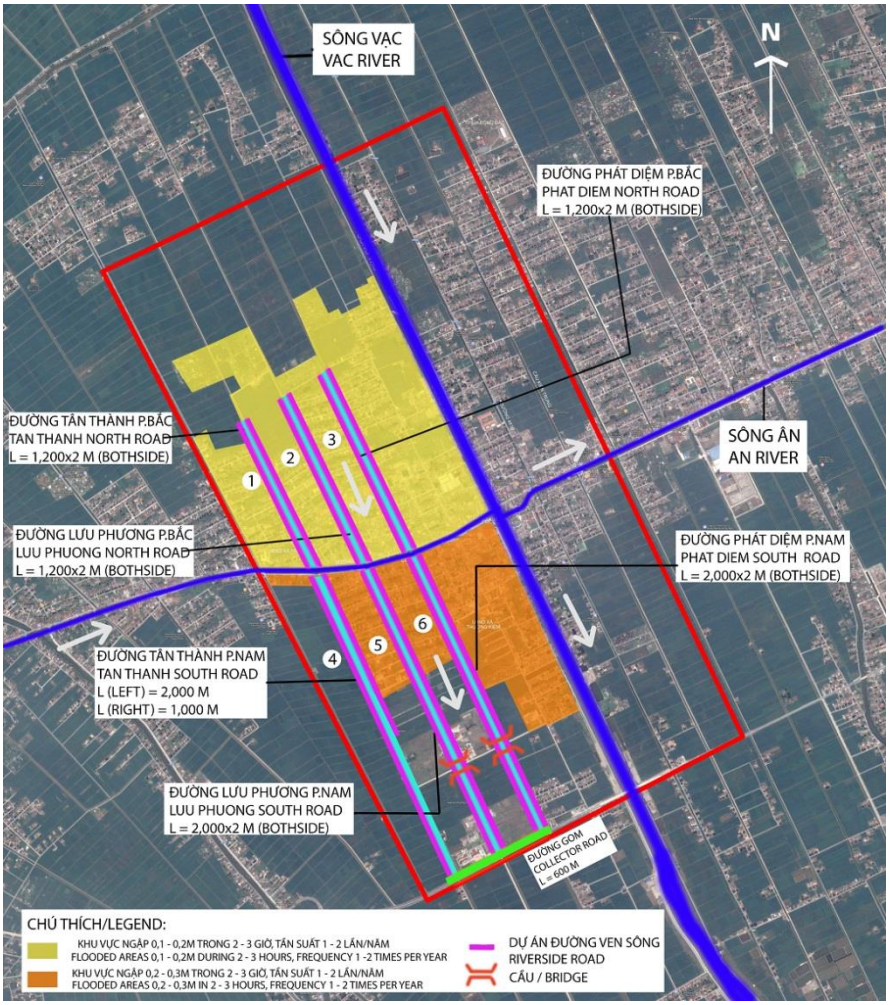
- Maintain the circulation inside the city and to allow population and goods to circulate in all circumstances
- Increase the flood protection,
- Increase the evacuation and rescue possibilities in case of emergency.

52. The project's main design focus is the enhancement of six roads to increase evacuation capacity from the flooded area to the higher and safer places.

53. These improvements consist mostly in the upgrading of existing secondary or tertiary roads by raising the road-level in association with improvements to the river/canal embankments. Some roads planned during the PFS have already been constructed.

The following map illustrates the proposed road improvement.

Figure 15: Proposed road network improvement



54. Having regard to the requirements, these proposals appear to be a well-designed solution. The proposed roads are of a reasonable size and sufficiently elevated to avoid flooding. As mentioned previously their presence will also contribute to the avoidance of any encroachment on the embankments.

5.3. Potential green design of infrastructure and climate change impact

55. As mentioned previously in the wastewater management section, the Consultant recommends using a lagoon based WWTP process. Indeed, this process is the one requiring the least energy-use among all potential wastewater treatment processes. Furthermore, the lagoon based solution would also contribute to further reduction of bacteriological pollution within the treated wastewater, which may result in an increase in the potential for the reuse of wastewater.

56. With regards to climate change impacts, we can highlight the following benefits from proposed sub-projects, especially as on account of its location the city of Phat Diem, is very sensitive to climate change:

- Proposed drainage components (dredging of outflow channels and improvement of the embankments through the upgrading of roads) will improve resilience toward future rain events which are likely to increase as a consequence of climate change impacts.
- Existing reductions of canal cross-section by the prior addition of random structures should also be further considered during the FS. Removal (and future restriction on construction) of such structures should be considered.
- The wastewater proposals will also contribute to improving the existing situation. Indeed, separating rainwater and wastewater will reduce the vulnerability of inhabitants during floods as the two will no longer be mixed.
- Last but not least, the road proposals will contribute greatly in reducing vulnerability as they will provide proper evacuation routes and improve access for rescue teams.

5.4. Cost estimate (CAPEX – and OPEX for WWTP only)

57. The following tables summarize the cost for investment in Phat Diem. The updated costs have been prepared taking account of the proposed improvements in the project components. The full cost estimate is detailed in the annex.

Table 9: Cost estimate

	SCE CAPEX estimation (EUR) including proposed updates	**Pre-FS estimation (EUR)***
TOTAL	**27,028,043**	**22,948,621**
Drainage and roads**	24,327,012	19,258,839
Wastewater network and WWTP	2,608,247	3,615,555
Solid Waste	92,784	74,227

** costs from AFD table (v.12)*
*** have been combined as they are strongly linked*

58. The cost estimate proposed following the review of the Pre-FS is higher than the one proposed in the Pre-FS. This is mainly due to an update of the quantities. Furthermore, some unit costs have also been reviewed. We have also included the two bridges in the cost estimate as they were not mentioned in the pre-FS.

59. Considering the early stage of the project, we would recommend treating the cost estimates with caution as neither topographic nor geotechnical surveys have been conducted.

60. OPEX for the wastewater management system (including WWTP – considering full catchment as in pre-FS – 30,000 inhabitants) will be in the range of EUR 20,000 per

year for a simple process (such as lagoon) and EUR 50,000 per year for a more complex solution (such as CAS).

6. Institutional set up and financial issues

6.1. Existing institutional set up

61. Phat Diem town is a capital of Kim Son district, Ninh Binh province. The town is at the ward/commune level in the Vietnam administration hierarchy.
62. As a consequence of the above, the O&M of urban infrastructure in Phat Diem is very poor. It can be said one that no regular maintenance work is carried out. Repairs are executed only occasionally when infrastructure has failed ,or when there is some additional budget allocated from an upper level budget in the form of a project, which happens very rarely.
63. Drainage and roads (local roads) are not subject to regular maintenance. Damages are subject to repair on a case-by-case basis using the town budget. In some cases local communities also make contribution to repair works.
64. A Wastewater service is not provided due to the absence of a collection system and treatment facility. Currently wastewater fees are not levied. However the usual practice in Vietnam in general is: a wastewater fee is collected together with the water supply bill (ranging from 5 to 10% of the water supply fees, depending on the decision of Provincial/District People' Councils). At this very low rate, the fees collected are not sufficient for O&M of WW systems and the deficit is covered by local budgets. Many provinces and cities have introduced a roadmap for the increase of wastewater fee in order that eventually the costs of O&M will be fully covered by users' contributions.
65. In Phat Diem, the rate of septic tank availability is high. However, septic tanks are not maintained regularly. The District Environmental Center has a desludging truck (5 m3 capacity) but it is not able to operate because it is too large to move in the small lanes of the town. Desludging is provided by unknown service providers but it is not known where the sludge is taken and dumped after collection. These services have never been monitored..
66. Solid waste (refuse) service is provided by the District Environment and Sanitation Centre. A Solid waste fee is levied on a per family basis. Apparently the Town's People Committee has to subsidise the costs of the solid waste service.

6.2. Potential financial and economic impacts

67. Based on the previous assessment and on the list of proposed projects, the following impacts from proposed projects related to financial and economic issues can be highlighted.

Table 10: Financial and Economic projects impacts

n°	Name	Financial impacts	Economic impacts	Value for money
1	Drainage – embankment and management access improvement	*Medium impact* Medium CAPEX Low OPEX	*High impacts* Significant economic gains for large area of the town (transportation, health, households, land value, urban landscape…)	*Very Good*
2	Wastewater – WWTP and WW collection network	*High impact* Medium CAPEX High OPEX	*High impacts* Economic gains for a large area (environment, health, land value, tourism…)	*Very Good*
3	Solid waste management	*Low impact* Low CAPEX Low OPEX	Economic gains for a large area (environment, health, urban landscape…)	*Good*
4	Emergency Evacuation access connectivity	*Medium impact* High CAPEX Low OPEX	*High impacts* Economic gains for a western area (transportation, evacuation, landscape, land value,…)	*Good*

7. Safeguards issues

7.1. Preliminary social screening related to project components

68. The main social issues will occur because of the road component, with a significant number of households impacted and requiring resettlement/relocations.

69. The feasibility study will have to precisely identify a way to finance the connections between the proposed sewage network and the houses to ensure that the cost of these connections will not be an impediment to the development of an efficient wastewater network.

70. The project will bring several social benefits as it will reduce flooding, improve road connections and rescue during floods. Wastewater management will also improve the health of inhabitants.

7.2. Preliminary environmental screening related to project components

71. The major initial impacts of this project on the environment are the destruction of natural spaces in order to build infrastructure such as roads incorporating embankments, ,wastewater pumping stations and treatment plant and solid waste (refuse) transfer stations.

72. On the other hand, the provision of a proper wastewater management system will greatly improve the environment in the city and help to reduce health hazards.

8. Next project steps

8.1. Current progress with regards to Vietnamese authorities

73. Based on our discussion with the cities, the following implementation roadmap is anticipated.

1	Submit Pre-FS for Prime Minister approval (completed)	4/2018 (April)
2	Review of Pre-FS by ministries (ongoing)	05/2018
3	**Prime Minister Approval**	**06/2018**
4	Selecting FS consultants	07/2018
5	Selecting topographic surveyor and other technical services	07/2018
6	Selecting consultants (EIA, social, environment reports)	07/2018
7	Draft final FS reports and detail design and other necessary studies	10/2018
8	AFD Fact-finding Mission	10/2018
9	Final FS reports and other necessary studies	11/2018
10	AFD Due-Diligent Mission	11/2018
11	**FS approval**	**12/2018**
12	**Loan negotiation**	**12/2018**
13	Selecting detail design consultants	01/2019
14	**Loan agreement signing**	**03/2019**
15	Recruiting Project Coordination Unit (project implementation support consultant)	5/2019
16	Approval of overall project budget and procurement plan	6/2019
17	Capacity building for project implementation phase	7/2019
18	Recruiting detail design consultants	8/2019
19	Completion of detail design	11/2019
20	Approval of detail design and preparation of procurement of contractors	12/2019
21	**Project Completion and asset handovers and capacity building on O&M**	**05/2022**

8.2. Next steps towards Vietnamese authorities

74. The Pre-FSs were submitted to MPI. MPI is consulting with the relevant ministries in regards to this project. After gathering all comments, Pre-FSs will be submitted to the Prime Minister for approval, which is expected to be fully completed in June 2018. After that the project preparation will follow the roadmap as shown above.

Annex 1 – Detailed Cost Estimate

No	Items	Unit	Amount	Construction cost (EUR) including contingencies
A	Direct cost			
I.1	Drainage and road			24 327 012
1	North of NR 21B: road and embankment for Phát Diệm river			2 374 639
1,1	Concrete embankment for Phát Diệm river on North of NR21B	m	2 400	1 546 392
1,2	Upgrading of Phát Diệm road	m	2 400	804 124
1,3	River dredge	m3	8 400	21 649
1.4	Removal of old stone embankment of Phát Diệm river	m3	600	2 474
2	North of NR 21B: road and embankment for Lưu Phương river			2 371 546
2,1	Concrete embankment for Luu Phuong river on North of NR21B	m	2 400	1 546 392
2,2	Upgrading of Luu Phuong road	m	2 400	804 124
2,3	River dredge	m3	7 200	18 557
2,4	Removal of old stone embankment of Luu Phuong river	m3	600	2 474
3	North of NR 21B: road and embankment for Tân Thành river			2 365 361
3,1	Concrete embankment for Tan Thanh river on North of NR21B	m	2 400	1 546 392
3,2	Upgrading of Tan Thanh road	m	2 400	804 124
3,3	River dredge	m3	4 800	12 371
3,4	Removal of old stone embankment of Tan Thanh river	m3	600	2 474
4	South of NR21B: river dredge, improvement of Phát Diệm road			6 373 608
4.1	Dredge of Phát Diệm river	m3	25 600	65 979
4.2	Removal of old stone embankement of Phát Diệm river	m3	600	2 474
4.3	Concrete embankment for Phát Diệm river, south of NR21B	m	1 700	1 095 361
4.4	Stone embankment for Phát Diệm river, south of NR21B	m	2 700	1 322 165
4.5	Upgrading of Phát Diệm road on the left of river from Km 0+00 to Km0+980 with Btop=7m, Bbase=19 m	km	980,0	1 111 340
4.6	Upgrading of Phát Diệm road on the left of river from Km0+980 to Km1+300 with Btop=7,0 m, Bbase=17 m	km	320,0	313 402
4.7	Upgrading of Phát Diệm road on the left of river from Km1+300 tới Km 1+990 with Btop=7,0 m, Bbase=9 m	km	900,0	695 876
4.8	Upgrading of Phát Diệm road on the right of river from Km0+00 tới Km0+980 with Btop=7,0 m, Bbase=9 m	km	980,0	757 732
4.9	Upgrading of Phát Diệm road on the right of river from 0+980 tới Km1+300 with Btop=7,0 m, Bbase=17 m	km	320,0	313 402
4.10	Upgrading of Phát Diệm road on the right of river from Km 1+300 tới Km1+990 with Btop=7,0 m, Bbase=9 m	km	900,0	695 876

No	Items	Unit	Amount	Construction cost (EUR) including contingencies
A	Direct cost			
I.1	Drainage and road			24 327 012
5	South of NR 21B: river dredge and upgrading of Lưu Phương road			4 453 866
5.1	Dredge Lưu Phương river	m3	25 600	65 979
5.2	Removal of old stone embankement of Luu Phuong river	m3	600	2 474
5.3	Concrete embankment for Luu Phuong river, south of NR21B	m	1 700	1 095 361
5.4	Stone embankment for Luu Phuong river, south of NR21B	m	2 700	1 322 165
5.5	Upgrading of road Lưu Phương on the left of river segment Km 0+00 to Km0+980 with Btop =7 m, Bbase= 23 m	km	980,0	-
5.6	Upgrading of road Lưu Phương on the left of river segment Km 0+980 to Km1+300 with Btop =7 m, Bbase= 17 m	km	320,0	-
5.7	Upgrading of road Lưu Phương on the left of river segmentKm 1+300 to Km 2+200 with Btop =7 m, Bbase= 9,5 m	km	900,0	-
5.8	Upgrading of road Lưu Phương on the right of river segment Km 0+00 to Km 0+ 980 with Btop =7 m, Bbase= 23 m	km	980,0	1 144 175
5.9	Upgrading of road Lưu Phương on the right of river segment Km 0+980 to Km1+300 with Btop =7 m, Bbase= 17 m	km	320,0	313 402
5.10	Upgrading of road Lưu Phương on the right of river segment Km1+300 to Km2+200 with Btop =7 m, Bbase= 9,5 m	km	900,0	510 309
6	South of NR 21B: river dredge and upgrading of Tân Thành road			5 410 722
6.1	Dredge of Tân Thành river	m3	26 000,0	67 010
6.2	Removal of old stone embankement of Tan Thanh river	m3	600,0	2 474
6.3	Stone embankment for Tan Thanh river, south of NR21B	m	4 400,0	2 154 639
6.4	Upgrade of Tân Thành road on the left of Tân Thành river segment Km 0,00 to Km0+980 with Btop=7,0 m Bbase=19,0 m	km	980,0	1 111 340
6.5	Upgrade of Tân Thành road on the left of Tân Thành river segment Km 0+980 to Km 1+300 with Btop=7,0 m Bbase=15,5 m	km	320,0	296 907
6.6	Upgrade of Tân Thành road on the left of Tân Thành river segment Km1+300 to Km2 +200 with Btop=7,0 m Bbase=15,5 m	km	900,0	835 052
6.7	Upgrade of Tân Thành road on the right of Tân Thành river segment Km0+980 to Km 1+300 with Btop=7,0 m Bbase=10,0 m	km	320,0	247 423
6.8	Upgrade of Tân Thành road on the right of Tân Thành river segment Km1+300 to Km 2+200 with Btop=7,0 m Bbase=10,0 m	km	900,0	695 876

No	Items	Unit	Amount	Construction cost (EUR) including contingencies
A	Direct cost			
7	Connection road for Phát Diệm, Lưu Phương, Tân Thành roads with Btop=7,0 m Bbase=12,0 m and upgrading, recovery of affected facilities by the project	km	0,6	463 918
8	Construction of 2 bridges crossing Phát Diệm, Lưu Phương rivers with width of 14m	m2	2,0	513 353
8,1	Phát Diệm river bridge, B=14m, L=20m	m2	280,0	320 845
8,2	Lưu Phương river bridge, B=14m, L=12m	m2	168,0	192 507
I.2	WW collection and WWTP			2 608 247
1,1	WW network D400 - D600	m	13 000,0	1 340 206
1,2	Construction of 3 WW pumping stations	station	3,0	185 567
1,3	WWTP	1000 m3	1 000,0	1 082 474
I.3	Solid waste			92 784
1,1	Construction of 3 solid waste transit sites	m2	1 500,0	92 784
	Total construction cost			27 028 043