Strategic Environmental Assessment and Water Resource Management Master Plan Phetchaburi-Prachuap Khiri Khan River Basin Project

Executive Summary

Mahanakorn Consultants Co.,Ltd.
Innovation Consultants Co.,Ltd.
Paragon Engineering Consultant Co.,Ltd.

Sebtember 2021

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1. Background of the project

The Phetchaburi-Prachuap Khiri Khan River Basin consists of 5 provinces: Ratchaburi, Samut Songkhram, Phetchaburi, Prachuap Khiri Khan and Chumphon. It combines the Phetchaburi River Basin and the Prachuap Khiri Khan Coastal Basin. Because both basins consist of short rivers. and flows into the Gulf of Thailand The use of water in the Prachuap Khiri Khan province must be managed in conjunction with the Phetchaburi River Basin. The Kaeng Krachan Dam is the largest cost water reservoir in the basin. The integration of the two basins will enable better overall water management. Water usage is mainly in the agricultural sector. Economic crops are coconuts, limes, pineapples, sugar cane, and oil palm, followed by the industrial sector. and tourism Most of the industrial sector is agricultural products processing plants. The tourist attractions are in the seaside areas such as Cha-am, Hua Hin, Pranburi, etc. In terms of water problems, there is a water shortage problem in Mueang Phetchaburi District, Khao Yoi District, Ban Lat District, Tha Yang District, Phetchaburi Province. and Hua Hin District Prachuap Khiri Khan Province While most of the flooding problems are caused by inadequate drainage. especially in urban areas economic area along with the water barrier and the influence of sea water

Due to the problem of the area, it is necessary to expedite the flood management plan for the whole system. Manage water needs as the city develops. Because the development of large water reservoirs is more difficult. create a balance between the agricultural sector industry and tourism Support the development of varicose neck area (If there is a need to develop) Links with neighboring countries For example, the Singkhon checkpoint, etc., so the National Water Resources Office as a central agency that determines the policy on water management. A strategic environmental assessment study should be conducted in the Phetchaburi-Prachuap Khiri Khan watershed area. so that the development of the watershed is consistent with the environment without causing any impact or having an impact at an acceptable level and in accordance with the Water Resources Management Master Plan as well as prepare a master plan for water resource management as well as prioritizing future project development plans. flood protection and solving drought problems Actions to solve problems of the area To serve

as a framework for water management in the Phetchaburi-Prachuap Khiri Khan River Basin for all relevant agencies to implement the construction and perform other operations related This will reduce the redundancy of the plan. and increase the efficiency of the budget and establishing a framework for water resource management in the Phetchaburi-Prachuap Khiri Khan watershed area for maximum benefits

2. Objectives of the study

1) To study and prepare a Strategic Environmental Assessment (SEA) report of the Phetchaburi-Prachuap Khiri Khan watershed area.

2) To review the implementation of water resources development in the study area in the past and study the preparation of the 20-year master plan and action plan 5-year water resource management, water resource development and sustainable water resource management practices in the area Consistent with the 20-year Water Resources Management Master Plan (2018-2037)

3) To compile a database of water resources and waterways to support initial decision-making. for water resource management in the Phetchaburi-Prachuap Khiri Khan watershed area Sub-district and tributary watershed levels

3. Summary of the results of the study on the basic information of the watershed

1) Phetchaburi-Prachuap Khiri Khan River Basin: consists of 9 tributaries as shown in **Figure 1-1**, covering an area of 13,371 square kilometers. Divided into an area on the mainland 13,365.70 square kilometers and a total island area of 5.30 square kilometers Covering administrative areas in 5 provinces (Phetchaburi, Chumphon, Prachuap Khiri Khan, Ratchaburi and Samut Songkhram) 21 districts, 164 sub-districts, average rainfall is 1,096.04 millimeters, with 278 millimeters of rainfall in the dry season and an average annual runoff volume in the basin of 3,697.69 million cubic meters. as follows

Figure 1-1 Phetchaburi-Prachuap Khiri Khan River Basin

code	sub basin	catchment area (sq.km.)	% in the basin	Average annual rainfall (mm.)	Average annual runoff (MCM)
1801	Upper Phetchaburi River	3,475.60	26.00	1,034.70	1,162.48
1802	Huai Mae Prachan	1,123.10	8.40	1,143.80	206.58
1803	Lower Phetchaburi River	1,605.10	12.01	881.50	267.70
1804	Pranburi River	2,917.30	21.83	984.80	667.32
1805	Khlong Khao Daeng	653.60	4.89	940.30	126.81
1806	Khlong Kui	705.90	5.28	972.90	157.41
1807	Prachuap Khiri Khan Coast, Part 1	1,703.90	12.75	1,182.80	613.95
1808	Khlong Bang Saphan Yai	487.80	3.65	1,481.60	249.96
1809	Prachuap Khiri Khan Coast, Part 2	693.40	5.19	1,241.94	245.48
Total		**13,365.70**	**100.00**	**1,096.04**	**3,697.69**

Source: Royal Decree Determining the Watershed, B.E. 2021

Note: does not include the area of various small islands. Total area size 5.3 sq km.

2) Land used : In the Phetchaburi-Prachuap Khiri Khan River Basin, there are nationally reserved forest areas totaling 4,278,953.75 rai (6,846.32 square kilometers), accounting for 51.2% of the watershed area. Land use in 2018 was 47% forest area, 40% agricultural area, and 5% community area. Most of the areas in the Phetchaburi-Prachuap Khiri Khan River basin were used for agriculture, animal husbandry and aquaculture. Approximately 3.31 million hectares are agricultural areas in irrigated areas, about 28% of which are rainwater farming. The area used for rice cultivation is 0.50 million rai, field crops, fruit trees, 2.48 million rai, while the soil suitability for agriculture has 0.61 million rai of rice cultivation, suitable area for planting field crops, fruit trees, and woody plants. 1.92 million rai

3) Economic condition : In the overall view of the watershed The average gross provincial product (GPP) of the year 2018 had a total value of 468,816 million baht, an increase of 19,927 million baht from 2017 (4.44%). Per capita income was 189,035 baht per person per year. The main economy is the service sector (46%), followed by the industrial sector (32%) and the agricultural sector (22%). This corresponds to the occupation of the majority of the population outside the agricultural sector (68.5%). Future trends in the sector Service and tourism will continue to play a top role. from the potential of the province and the promotion of the government At the same time, industrial sectors related to agriculture tend to expand investment and marketing from major economic crops. as well as border trade at the Singkhon checkpoint Entrepreneurs will develop their trading potential. Increased investment and marketing to be able to compete in trade with neighboring countries in line with the policy

direction at the national and provincial level It is likely that the demand for employment from the agricultural sector will move to the industrial and service sectors more.

4) Population and social characteristics : Phetchaburi-Prachuap Khiri Khan River Basin The population according to the civil registration in 2019 totaled 1,217,278 people, totaling 549,855 households. The rate of population change in urban areas is higher than rural areas. and in the area that is a tourist attraction such as Cha-am District, Hua Hin District, Pranburi District has a higher rate of population change than other areas When considering the latent population in the area, there is a tendency to increase as well. Most of the community characteristics in the area are rooted in agricultural communities. coastal fishing communities, and others such as the Thai Song Dam community and communities in the highlands which reflects the identity of the socio-cultural in the form of dress, language, food, craftsmanship, local wisdom and traditions

5) Urban system : Urban system management and roles and duties of urban communities at the particle level of the lower central provinces. Classify the service center cities of Phetchaburi and Prachuap Khiri Khan provinces. Cha-am City Group - Hua Hin and the area of influence It plays a role as a high potential city group as the core center of particles (Core Cluster) plays an important role in the international coastal tourism economy. as a service trade center and the communication link via road, rail, water and air, which tends to expand in real estate development to support more tourism and accommodation.

6) Travel : Tourism potential is a variety of tourism formats. Create attraction for visitors, both tourists and sightseers. and generate income from tourism This has resulted in the development of tourist attractions and tourism activities in the area continuously. especially the Cha-am-Hua Hin-Pranburi group There are important tourist attractions along the coast and the inner area that are learning sources for royal projects. eco-tourism and cultural attractions Create a link between Cha-am-Hua Hin-Pranburi tourism groups.

7) Agriculture : The main agricultural crops in the Phetchaburi-Prachuap Khiri Khan watershed area are pineapples and coconuts. It is the most important production source in Thailand. Changes in the price of produce and exports will affect a large number of farmers in the basin. In addition to the main crops that are of economic importance There are also unique plant species in the area. A distinctively famous dish can be developed as a geographical indication. (Geographical Indication: GI). Muang Phet jaggery Khanom Moh Kaeng Phet Pala-U durian Coconut Samut Songkhram Lychee Samut Songkhram Big White Grapefruit, Bang Chang Chili and Lueang Pathiu Chumphon Rice while the production of livestock that is an important

income is Raising dairy cattle, beef cattle, swine, goats and poultry (indigenous chickens, layer chickens, broilers, layer ducks, broiler-ducks) are raised both in small-scale and farm-style farming.

8) Potential of suitable soil for cultivation : Currently, the Phetchaburi-Prachuap Khiri Khan River Basin has approximately 2.53 million rai of suitable soil potential for cultivation, while farmers use about 3.31 million rai of land for farming. Thus, 1/3 of the current arable land is farming on the lacking area. suitability Many areas have sandy soil conditions. low fertility water shortage This results in low yields and requires more agricultural factors. Developing the production quality of agricultural products and agro-industry to meet standards to increase competitiveness in the production and processing of agricultural products to the world market. Therefore, soil quality must be improved and water resources are developed concurrently in order to obtain products with quantity and quality that are in demand in the market.

9) Industry : in the Phetchaburi-Prachuap Khiri Khan River Basin There are 1,071 industrial factories with an investment amount of 104,042 million baht, a total of 41,253 workers and a total number of 8,301,520 horsepower machinery workers. Most of the factories are in other manufacturing industries. which engages in business related to rocks, gravel, sand or soil for use in the construction, production, transmission or distribution of electric power and engage in business related to the separation or landfill or unused materials, etc. For the distribution of industrial plants, most of them are in the lower Petchaburi River tributary basin. Because it is an area that is ready in every aspect, whether it is raw materials, labor and location. which is not far from Bangkok

10) Development of water resources and irrigation: important rivers such as the Phetchaburi River Bang Kloi River Bang Tabun River Pranburi River Kuiburi River Bang Saphan River There are two major water resources development projects: (1) Kaeng Krachan Dam Phetchaburi Province has a capacity of 710 million cubic meters. Delivering water to the irrigation system covering an irrigated area of 336,000 rai, installing 1 generator with a capacity of 19,000 kilowatts, providing an average of 70 million kilowatt-hours of electricity per year. (2) Pranburi Dam Prachuap Khiri Khan Province has a capacity of 391 million cubic meters. It supplies water to irrigated areas covering an area of 235,750 rai. In addition, there are 22 medium-sized water resources development projects, 176 small water resource development projects, 12 electric water pump projects, and 2,752 small water resources, with a total storage capacity of 1,434.77. million cubic meters Irrigation area 1,002,719 rai

11) Water Demand : The Phetchaburi-Prachuap Khiri Khan River Basin has an average runoff volume of 3,698 million cubic meters per year. Currently, the main water demand in the area consists of water demand for consumer and tourism purposes of 82.20 million cubic meters. Irrigation water demand 797.51 million cubic meters Industrial water demand 89.67 million cubic meters Water demand for livestock 12.96 million cubic meters Water needs to maintain ecosystems downstream 85.59 million cubic meters and water demand for cultivation in rainwater agricultural areas is 1,602.43 million cubic meters, a total of 2,670.36 million cubic meters. In the future, demand for water for consumption, tourism and industry tends to increase in line with the growth of the economic sectors of the area. This will bring the total water demand of the entire basin closer to the limit of the available cost water according to the natural conditions of the basin. The development direction of the Phetchaburi-Prachuap Khiri Khan watershed area must take into account the importance and balance of water use activities in various regions in the future.

12) Natural resource and environmental problems in the watershed area : Facing the problem of encroachment on national forest reserves and forest conservation according to the law to occupy agricultural land Erosion problems along the coast especially in Cha-am district Ban Laem District (Phetchaburi Province) Pranburi District Kui Buri District Mueang Prachuap Khiri Khan District Bang Saphan District (Prachuap Khiri Khan Province), while the problem of wastewater will occur in the community area. (Mueang Phetchaburi District, Ban Laem District, Mueang Prachuap Khiri Khan District), tourist attractions (Cha-Am District, Pranburi District, Hua Hin District, and the three bays Mueang Prachuap Khiri Khan) and industrial areas (Aquatic processing establishment, Ban Laem District, Steel Industry - Deep Sea Port, Bang Saphan District). There is also a conflict of utilization of natural resources in coastal areas between communities and conservation groups and the steel industry in Bang Saphan District. Therefore, the development direction of the Phetchaburi-Prachuap Khiri Khan watershed area should take into account the conservation of natural resources. and maintaining environmental quality at the same time

13) Policies, strategies, and development plans at different levels : Regarding the Phetchaburi-Prachuap Khiri Khan watershed area, it was found that the provinces in the Phetchaburi-Prachuap Khiri Khan watershed area were promoted to be (1) famous tourist attractions and building connections to spread tourism throughout the region; (2) the use of technology and innovation. in agricultural production and processing in parallel with the conservation of natural resources and the environment; and (3) to develop trade and investment links with different regions of the world.

4. The changing trend of the watershed area

4.1 Development of water resources and water supply costs of watershed areas: by wavy terrain Developing an even distribution system is difficult. There are areas of national forest reserve that must be preserved as important natural resources. The future trend of operations will mainly be the development of medium and small water resources and the improvement of the efficiency of the current project, for example, the capacity improvement of the Kaeng Krachan Dam. (Possible to increase the capacity of 53 million cubic meters) Mae Prachan Dam (Potential to increase capacity by 10-15 million cubic meters) Pa Daeng Reservoir (There is a potential to increase the capacity of 7 million cubic meters), etc. The amount of runoff that can be stored in the watershed in the future cannot be increased much. Therefore, increasing the cost of water in the watershed area, especially in the rainwater agricultural area. A combination of methods is needed, for example, the development of small water resources, which are reservoir projects, canals, swamps, marshes, ponds, shallow wells, artesian wells, etc., distributed according to the terrain. and the potential of the area Increasing the amount of rainfall in the watershed by artificial rain at the right time, etc. In the future, there is a tendency for small water resources to increase.

4.2 Agricultural areas and areas with water allocation for irrigation: Currently, the Phetchaburi-Prachuap Khiri Khan River Basin uses approximately 3.31 million rai of agricultural land. It is an area with irrigation systems of large, medium-sized projects and collecting water with electricity. The total area is 847,171 rai and the benefit area of the small water source development project is another 155,548 rai. This made the water use to be very inefficient. The rest is about 2.31 million rai of rainwater farming area. The potential of soil suitable for cultivation within the watershed area is about 2.53 million rai, therefore one third of the current arable land is for agriculture on the land that is not suitable. Many areas have sandy soil conditions. low fertility water shortage The shift from rainwater farming to irrigated areas requires the improvement of soil quality and concurrent development of water sources. In the next 20 years, if there is no development, In addition to the usual annual plans of various departments Rainwater farming areas tend to develop into areas with water allocation for irrigation of approximately 70,000 hectares. 130,000-200,000 rai (more irrigated agricultural areas Agricultural areas, rainfall is reduced. The total agricultural area is the same) by the Huai Mae Prachan River Basin. It is the tributary with the greatest opportunity for development. and the Pranburi River tributary was the tributary with the least development opportunity.

4.3 Total water consumption : When considering the comparison of the total water demand in the present condition with the natural runoff volume. Of the tributary watershed areas as shown in **Table 4.3-1**, it was found that the Lower Phetchaburi River Basin, Khao Daeng Canal, Klong Kui, and Prachuap Khiri Khan Coast Part I had a tendency of water use to be imbalanced with the amount of runoff of the watershed area. Water sources for consumption from groundwater sources will increase the demand. Areas with a tendency to water scarcity include Ban Lat District. Kaeng Krachan District Phetchaburi Province and covers the entire province of Prachuap Khiri Khan Province

Table 4.3-1 Comparison of the total water demand in the present condition (2020) with the natural runoff of various tributaries

Sub basin	total water demand MCM/year	Runoff MCM/year
Upper Phetchaburi River	436.221	1,162.47
Huai Mae Prachan	128.754	206.58
Lower Phetchaburi River/1	742.246/1	267.69
Pranburi River/2	300.174	667.32/2
Khlong Khao Daeng/2	243.932/2	126.81
Khlong Kui/2	157.501/2	157.41
Prachuap Khiri Khan Coast, Part 1	503.093	613.95
Khlong Bang Saphan Yai	83.709	249.97
Prachuap Khiri Khan Coast, Part 2	75.019	245.48
Total	**2,670.649**	**3,697.68**

Note : /1 There is a cost of water from the water delivery and maintenance project of Ratchaburi on the right bank. and the upper Petchaburi River tributary basin

/2 Deliver water to irrigation areas in the watershed area of Khlong Khao Daeng branch, Khlong Kui.

/3 Cost water is used from the Pranburi River tributary basin.

4.4 Number of visitors : Present (2020) Phetchaburi-Prachuap Khiri Khan watershed area There are 49,058 average number of tourists and tourists per day (approximately 17.9 million people per year). The majority of visitors are in the Upper Petchaburi River basin. followed by the lower tributaries of the Phetchaburi River. and the Pranburi River tributaries, respectively. It was found that there was an average increase in the number of tourists of about 4% per year, considering the capacity of the tourist area. and the capacity to support the accommodation in the watershed area as a whole. Still able to support the number of future visitors in the next 20 years is sufficient.

4.5 Drought problems and water supply-consumption : Always experience drought during January-May every year. The average damage value over the past 10 years is about 85 million baht/year. The number of people affected by drought disasters is 45,541 cases from the study of drought. and listening to the actual drought situation in the area at the 1st small group meeting Able to determine drought-prone areas at the sub-district level in the sub-district in the Phetchaburi-Prachuap Khiri Khan watershed area. as shown in **Table 4.5-1** in the consumption-water management section. In the overview of the population in the Phetchaburi-Prachuap Khiri Khan watershed area More than 92 percent of the water is used, but there is still a problem of insufficient water supply. There are 97 sub-districts in 97 sub-districts facing shortages of drinking water/damaged water distribution system/not covered/need to improve the quality of drinking water.

Table 4.5-1 drought-prone areas at the sub-district level river basin branch in the Phetchaburi-Prachuap Khiri Khan River Basin

Sub basin	Areas at low risk of drought (district)	Moderately prone to drought (district)	Areas at high risk of drought (district)
Upper Phetchaburi River	Kaeng Krachan, Huai Mae Phiang, Don Khun Huai, Cha-am, Bang Kao, Nong Sala, Klat Luang, Khao Krakuk, Ban Nai Dong, Puek Tian, Nong Kae, Hua Hin	Rai Mai Pattana, Tha Mai Ruak, Na Yang	Song Phi Nong, Khao Yai, Tha Khoi
Huai Mae Prachan	Kaeng Krachan Yang Hak	Phu Sawan, Wang Chan, Wang Krai, Huay Luek Tha Mai Ruak	Tha Takraw, Yang Nam Klat Nuea, Yang Nam Klat Tai, Nong Ya Plong
Lower Phetchaburi River	Khao Yoi, Thap Khan, Nong Chumphon, Sa Phang, Nong Chumphon Nuea, Pho Phra, Na Phan Sam Bang Chan, Wiang Khoi, Sammarong, Had Chao Samran, Nong Khan, Ban Nai Dong, Puek Tian, Bang Khun Sai, Bang Kaeo, Ban Laem, Laem Phak Bia, Ban Hat, Samor Phlue, Nong Krachet	Huai Tha Chang, Nong Pla Lai, Nong Prong, Wang Krai, Tham Rong, Ban Than, Ban Lad, Rai Makham, Khok Farm, Nong Kapu, Huai Khong, Huai Luek, Map Pla Khao, Nong Krathum, Ang Hin	Nong Chok, Nong Plub, Don Sai, Thung Luang, Huai Yang Tone
Pranburi River	Pa Deng, Bueng Nakhon, Huai Sat Yai, Khao Jao, Khao Noi, Pranburi, Wang Phong, Pak Nam Pran, Nong Ta Taem	Rai Mai Phatthana, Huai Sai Nuea, Thap Tai Sam Phraya Hin Lek Fai	Nong Plub
Khlong Khao Daeng	Pak Nam Pran, Nong Ta Taem, Sam Roi Yot Salalai, Sila Loi, Rai Kao, Had Kham	Sam Kratai, Khao Daeng, Rai Mai	
Khlong Kui	Kui Nuea, Kui Buri, Don Yai Noo, Had Kham	Sam Kratai, Khao Daeng	
Prachuap Khiri Khan Coast, Part 1	Huai Yang, Ko Lak, Khlong Wan, Bo Nok, Huay Sai	Thap Sakae, Na Hu Kwang, Ao Noi, Prachuap Khiri Khan	Khao Lan, Saeng Arun, Mae Ramphueng
Khlong Bang Saphan Yai	Chang rag, Bang Saphan	Kam-Ned Noppakhun Pongprasat	Thong Mongkhon Ron Thong
Prachuap Khiri Khan Coast, Part 2	Chang rag, Sai Thong, Bang Saphan, Pak Phraek, Chairat, Khao Chairat, Pak Khlong, Chum Kho		

4.6 Flood problems : Flood conditions will occur some years during August-November. During the past 5 years (2013-2017), Phetchaburi province has paid the highest compensation for flood damage in Year 2011, total 48.57 million baht, while Prachuap Khiri Khan province has paid the highest compensation for flood damage in 2013, a total of 13.23 million baht. The number of people affected by flood disasters is 84,690. There are two types of flooding in the area:

1) the occurrence of floods in the nature of wild water flow or flash floods Most of them occur in the upper areas of the basin, namely Nong Ya Plong District, Kaeng Krachan District, Tha Yang District, Ban Lat District, Cha-am District, Khao Yoi District and Bang Saphan District. Flood situation for 2-3 days.

2) The occurrence of flooding in the manner of flooding in the area for several days cannot be drained out in time. Most of them occur in the lower areas of the basin, including Mueang Phetchaburi District, Ban Laem District, and parts of Khao Yoi District, including the lowland areas. The main river is small, meandering and shallow, causing insufficient drainage capacity. In addition, the estuary is influenced by sea level, making it more difficult to drain water into the sea. If there is a high sea level Drainage has a limited time due to the tide occurring twice in a day.

Table 4.6-1 Flood risk areas at sub-district level river basin branch

Sub basin	Risk of flooding Area (Tambon)
Upper Phetchaburi River	Pa Deng, Song Phi Nong, Khao Yai, Cha Am, Don Khun Huai, Na Yang, Bang Kao, Rai Mai Phatthana, Sam Phraya, Nong Sala, Huai Sai Nuea, Klad Luang, Khao Krakuk, Tha Khoi, Tha Mai Ruak, Tha Yang, Ban Nai Dong, Puek Tian, Nong Chok Nong Kae, Hua Hin
Huai Mae Prachan	Kaeng Krachan, Ban Than, Yang Nam Klat Tai Nong Ya Plong
Lower Phetchaburi River	Khao Yoi, Thap Kang, Bang Khem, Sa Phang, Nong Chumphon, Nong Chumphon Nuea, Nong Prong, Nong Pla Lai, Huai Rong, Huai Tha Chang, Tha Lang, Map Pla Khao, Yang Yong, Wang Krai, Rong Khe, Rai Khok, Rai Makham, Rai Sathon, Tamru, Tham Rong Tha Sen, Tha Chang, Ban Lat, Ban Hat, Lat Pho, Samor Phlue, Saphan Krai, Nong Krachet, Nong Kapu, Huai Khong, Huai Luek, Laem Phak Bia, Tha Rang, Tha Rang Ok, Bang Kaeo, Bang Khun Sai, Bang Krok, Bang Tabun, Bang Tabun Og. Ban Laem, Pak Thale, Khlong Krachaeng, Sakae Chong, Don Yang, Ton-Ma-Prao, Ton-Ma-Muang, Tha Rap, Thongchai Na Pan Sam, Na Wung, Bang Chak, Bang Chan, Ban Kum, Ban Mo, Pho Rai Wan, Pho Phra, Rai-Som, Wang Tako, Wiang Khoi Sammarong, Nong Son, Nong Khan, Nong Phlap, Hua Saphan,Had Chao Samran, Don Sai, Thung Luang, Pak Tho Wang Manao, Wan Dao, Laem Yai, Khlong Khon, Pradu Temple, Phraek Nam Daeng, Yi San
Pranburi River	Khao Noi, Pranburi, Pak Nam Pran, Wang Phong, Nong Ta Taem, Thap Tai, Nong Plub, Huai Sat Yai, Hin Lek Fai

Table 4.6-1 Flood risk areas at sub-district level river basin branch

Sub basin	Risk of flooding Area (Tambon)
Khlong Khao Daeng	Rai-Kao Rai-Mai Salalai Silaloi Sam Roi Yot
Khlong Kui	Khao Daeng, Kui Nuea, Kui Buri, Don Yai Nu, Sam Krathai, Hat Kham, Bo Nok
Prachuap Khiri Khan Coast, Part 1	Kao Lak, Khlong Wan, Prachuap Khiri Khan, Ao Noi, Khao Lan, Thap Sakae, Na Hu Kwang, Huai Yang, Ang Thong, Thong Chai
Khlong Bang Saphan Yai	Kam-Nerd-Noppakhun Chaikasem Thongmongkol Pongprasat Mae Ramphueng Ronthong Chang-Raek
Prachuap Khiri Khan Coast, Part 2	Chairat, Saithong, Bang Saphan, Pak Phraek, Pak Khlong

4.7 Water quality in water sources: from the results of monitoring the water quality of the Phetchaburi-Prachuap Khiri Khan River Basin of 17 stations of the Office of the Environment Region 8 during 2016-2019, using general water quality indicators or WQI found that water quality was in the deteriorated to good range. This is comparable to the water quality standards for surface water sources Type 4 to Type 2 by the Lower Phetchaburi River Branch. Pranburi River and Klong Kui. The trend of water quality in communities and estuaries tends to deteriorate. while the upper Petchaburi River tributary and Huai Mae Prachan The water quality in the community has a tendency to improve. In terms of groundwater, there is a quality problem that is not suitable for consumption. and there is a problem of water quality management in the community during the dry season.

4.8 Forest resources and legal conservation areas: legal conservation areas consist of national park area no hunting area wildlife sanctuary in the Phetchaburi-Prachuap Khiri Khan River Basin There is a legal conservation area totaling 4,222.33 square kilometers. (2,638,956.25 rai), accounting for 31.59% of the watershed area There is an area of quality watershed class 1, totaling 3,405.36 square kilometers. accounted for 25.48 percent of the watershed area Forest conservation area (Zone C), economic forest area (Zone E) and forest area suitable for agriculture (Zone A) total 6,799.40 square kilometers. The forest area in the Phetchaburi-Prachuap Khiri Khan watershed area There is a tendency to change more from the past. and did not find an area with degraded forest condition According to the definition of degraded forest condition according to the Cabinet Resolution on June 2, 1987, amended by the Cabinet Resolution on May 9, 1989

5. Potential, conditions, problems and limitations in watershed development

From the results of the analysis of potential, problem conditions and constraints by river basin branches with regard to the district level A summary of the key points is shown in following.

1) Potential

- High area on the west side Most of them are in forest reserves and national parks. It is an area of abundant forest upstream. Suitable for preserving and conserving upstream forests. and ecotourism
- Plains on the east side There are marine and coastal resources as the economic base of tourism areas. Fisheries and aquaculture
- Project to prevent flood problems in Phetchaburi province improves drainage efficiency
- Flood Relief Project in Bang Saphan District help alleviate the flood and the shortage of drinking water
- The main cash crops are coconut, pineapple, sugar cane, aloe vera, rubber, oil palm.
- Cha-am-Hua Hin coast Has the potential to develop together as a service center west coast tourism
- The geographical location connected to the Republic of the Union of Myanmar has the potential to develop a linking trade route. Passing through a special relief point at Singkhon checkpoint
- It is the location of the largest steel industry in the country at Bang Saphan District.
- Saphan Hin Pier Khao Takiab Pier Pak Nam Pran Pier Support for occupation and tourism

2) Problem

- From the condition of the western mountainous area with high slopes There is a risk of flooding and landslides in the event of heavy rain. May cause damage to people in the vicinity
- Water shortage during the dry season due to topography The watershed area in the west is a slope area, causing the rainfall to drain from the area quickly. In addition, the

central part of the area, such as Khao Yoi District, Nong Ya Plong, Cha-am and Hua Hin, is a rain shadow area. with little rainfall Additional water supply is required.

- Lowland areas / coastal areas (Ban Laem District, Mueang Phetchaburi District, Ban Lat District, Tha Yang District, Hua Hin District, Bang Saphan District) are often flooded in the area for several days. because it is an area that receives water downstream before it flows into the sea and was influenced by the sea bolstering Drainage is therefore slow. In addition, the river was compromised or there were obstacles to the waterway. The mouth of the trench is shallow from the deposition of sand sediments.
- Coastal erosion tends to be more severe. Affects the loss of agricultural land, community areas and tourism areas. scenery of the beach which affect tourism
- Infrastructure (water supply, waste/waste management) is insufficient to support the expansion of the community. latent population increase number of tourists especially in Cha-am municipality, Hua Hin municipality. and contiguous areas in the tourist area

3) Restriction

- Most of the hillside slopes have a sandy loam soil condition. high erosion Moderate natural fertility There is a need to improve soil rehabilitation in agriculture.
- The terrain consists of a small sub-basin system, the central area is undulating. Developing reservoirs and water distribution systems is difficult. There is no development potential of medium-large natural surface water resources.

6. Water resource problems and solutions

From the analysis of potential, problem conditions and limitations, together with the results of scoping by SEA process, it was found that the Phetchaburi-Prachuap Khiri Khan watershed area There are major spatial water resource problems that need to be addressed. Summary as in **Table 6-1**

Table 6-1 Problems in spatial water resources in the Phetchaburi-Prachuap Khiri Khan River Basin and corrective guidelines

Area	Key Points/Causes	Solution
Khao Krapak Subdistrict, Tha Yang District Wang Chan Subdistrict, Kaeng Krachan District Tha Takhro Subdistrict, Nong Ya Plong Subdistrict Nong Ya Plong District Phetchaburi	Drought due to the rain shadow of the Tanaosri Mountains The condition of the upper area has a slope to store little water. water shortage	- Fon Luang - Develop artesian wells - Construction of a water supply system - solar pumping station
Ban Laem Subdistrict, Bang Kaeo Subdistrict Bang Khrok Subdistrict, Laem Phak Bia Subdistrict Tha Raeng Subdistrict, Ban Laem District Phetchaburi	Flooding for a long time because it is the area that receives the water downstream before the water flows into the sea. and draining slowly when seawater is bolstered.	- Adding drainage channels to divert water from the Phetchaburi River into the sea
Mueang Phetchaburi District, Phetchaburi Province	flood due to - Heavy rain above the water - Drainage from Kaeng Krachan Dam - There are obstacles in the water.	- Adding drainage channels to divert water from the Phetchaburi River into the sea - Improved water barriers - Increase capacity + improve River Outlet at Kaeng Krachan Dam - Install an automatic station to measure rain and runoff in the upstream area - Use urban planning measures
Ban Lat District, Mueang Phetchaburi District Ban Laem District, Phetchaburi Province	Flooding due to heavy rain above the water and drainage from the Kaeng Krachan Dam	- Dredging and expanding drainage canals into the sea around Laem Phak Bia Subdistrict - Expansion of the canal into the sea in Cha-am district - Dredging the Phetchaburi River to increase drainage - water barrier - Flood protection and drainage system
Hua Hin District, Prachuap Khiri Khan Province	water shortage due to urban expansion increase of tourists	- increase reservoir capacity
	Flooding in Hua Hin municipality in the plains along Petchkasem Road because there is a road and the railroad blocking the drainage channel The efficiency of drainage into the sea is reduced.	- Improved water barriers
Tambon Yang Nam Klat Nuea Yang Nam Klat Tai Subdistrict Nong Ya Plong District Khao Yai Subdistrict, Cha-am District, Phetchaburi Province Khao Chao Subdistrict, Pranburi District Prachuap Khiri Khan Province	Flooding from wild water flows	- Restoring upstream forests, Yang forests, Cha-am forests, Ban Rong forests - Improved stream efficiency

Table 6-1 Problems in spatial water resources in the Phetchaburi-Prachuap Khiri Khan River Basin and solutions (continued)

Area	Key Points/Causes	Solution
Pranburi Prachuap Khiri Khan Province	Flooding in the lowlands along the Pranburi River and the area along Petchkasem Road due to insufficient drainage	- Cut off flood peak / increase the capacity of the Pranburi Reservoir - Improved stream efficiency - Improved water barriers
Pongprasat Subdistrict Chaikasem Subdistrict Ron Thong Subdistrict, Bang Saphan District Prachuap Khiri Khan Province	Flooding from water flowing from the Tanaosri Mountains	- Improve the efficiency of the river by dredging the Bang Saphan Canal, Mae Ramphueng Canal, and Huai Khao Ma Rong. Expansion of drainage channels around roads and railroad tracks. - Develop water reservoirs in upstream areas - Flood protection and drainage system - Improved water barriers
Kamnoppakhun Subdistrict Municipality Bang Saphan District Prachuap Khiri Khan Province	Water from Bang Saphan canal flows into the flood. Temple area and Wat Huai Sai Khao The most critical point that must be monitored is the Bang Saphan Hospital area.	
Mueang Phetchaburi Cha-am Subdistrict, Nayang Subdistrict, Cha-Am District Phetchaburi Pranburi Subdistrict, Pak Nam Pran Subdistrict Pranburi Khlong Wan Subdistrict, Prachuap Khiri Khan Subdistrict Mueang Prachuap Khiri Khan Nong Kae Subdistrict, Hua Hin Subdistrict, Hua Hin District Prachuap Khiri Khan Province	wastewater from community sources /Hospital/Restaurant and tourist attraction	- Control of wastewater at the source /community wastewater treatment system
Khao Yoi District, Ban Laem District Tha Yang District, Phetchaburi Province Khao Noi Subdistrict, Pranburi District Nong Phlap Subdistrict, Hua Hin District Prachuap Khiri Khan Province Pak Tho Subdistrict, Pak Tho District, Ratchaburi Province	agricultural waste water /Industry	- Control / limit the amount of wastewater at the source

7. Strategic watershed development guidelines Phetchaburi-Prachuap Khiri Khan River Basin

Guidelines for the development of strategic watershed areas of the Phetchaburi-Prachuap Khiri Khan River Basin It is derived from the process of development, evaluation and selection of alternatives according to the guidelines outlined in the "Guideline".Environmental Assessment at Strategic Level" (NESDB 2020) Results of Assessment and Selection of Alternative Development for the Phetchaburi - Prachuap Khiri Khan Watershed Area There is a direction of development of the area as a characteristic of mixed development. During the development of tourism together with the development of agriculture that still maintains the old farming system or may adjust the cultivation system in some tributaries The Phetchaburi-Prachuap Khiri Khan watershed area has been developed in 9 areas, namely 1) the development of consumer water management 2) the development of water security in the production sector 3) the development of flood and flood management 4) development of water quality management and conservation of water resources; 5) development of conservation and restoration of degraded watershed forests; and prevent soil erosion 6) management development 7) tourism development development 8) agricultural product potential development development and 9) trade and investment capacity enhancement development local

8. Linking the results of the SEA study to the preparation of the 20-year water resource management master plan

Development guidelines for the Phetchaburi-Prachuap Khiri Khan watershed at the strategic level above It will be forwarded to the water resource management master plan process. The preparation of the 20-year water resource management master plan and the 5-year water resource management action plan will be carried out only in the areas related to resource management, i.e. the 1-6 development plans based on the SEA study. can be transferred to the development goals to solve problems in water resource management of the Phetchaburi-Prachuap Khiri Khan River Basin to lead to the preparation of the 20-year water resource management master plan

9. Preparation of the 20-year water resource management master plan

9.1 Target of the Master Plan: In the preparation of the 20-Year Water Resources Management Master Plan and the 5-Year Water Resources Management Action Plan will be implemented only in the areas related to water resource management, i.e., the 1 - 6 Development Plans. The goals of development are as follows.

1) Development of consumption-consumption water management

- Expand the district / increase the efficiency of the village water supply system provide adequate water resources and improve water quality to meet the standards of 656 villages
- Develop city water supply/economic areas in 10 main communities

2) Development of water security in the production sector

- in irrigated areas Increase the storage of 174.39 million cubic meters.
- In the rainy agricultural area Providing additional water for 563.13 million cubic meters, covering 97 sub-districts

3) Development of flood and flood management

- Prevent economic areas with 25-year recurrence cycles, mainly in lowland areas along the Phetchaburi River, in Tha Raeng Sub-District, Bang Khrok Sub-district, Tha Raeng Ok Subdistrict. Laem Phak Bia Subdistrict, Ban Laem Subdistrict (Ban Laem District), Ban Kum Subdistrict, Thong Chai Subdistrict, Na Pan Sam Subdistrict, Hat Chao Samran Subdistrict (Mueang Phetchaburi District) 253,462.50 rai
- Prevent economic areas that have a 25-year recurrence cycle in the area of Kamnophakhun Subdistrict, Mae Ramphung Subdistrict, Phong Prasat Subdistrict (Bang Saphan District) 14,118.75 rai

4) Development of water quality management and conserve water resources

- Improving the wastewater treatment system for 4 urban communities
- Construction of a group of 40 wastewater treatment systems

5) Development of conservation and restoration of degraded watershed forests and soil erosion prevention.

- Conservation and restoration of forest areas for conservation and upstream forests of 1.5 million rai

6) Management development

- Establish a water user organization as well as encouraging water user organizations to participate in the process of effective water resource management in the

Phetchaburi-Prachuap Khiri Khan watershed area. and increase the knowledge of adaptation to climate change

9.2 Plans/projects Considered in the 20-Year Water Resources Management Master Plan: The 20-Year Water Resources Management Master Plan has divided the plans/projects into 2 levels: 1) Work plans/projects according to the Phetchaburi-Prachuap Khiri Khan Watershed Area Development Strategy at the Strategic Level, comprising plans/plans / medium-sized, large-scale and high-priority projects (Backbone Project) according to the Phetchaburi-Prachuap Khiri Khan watershed development strategy; and 2) plans/plans/small projects of the water resource management unit That is in line with the Phetchaburi-Prachuap Khiri Khan watershed development strategy, a total of 2,427 projects are plans/projects that have been implemented during the year. 2018-2021, a total of 685 projects, remaining to be operated in the next phase during the year 2022-2037, another 1,742 projects with a budget of 54,231 million baht, summarized in **Table 9.2-1.**

Table 9.2-1 Summary of plans/projects considered in the 20-year water resource management master plan 2018-2037

summarize	Implemented and in process (Year 2018-2019)	proceed to the next phase (Year 2022-2037)	including the basin
Number (project)	685	1,742	2,427
Budget (Million Baht)	21,521	54,231	75,751
Capacity (million cubic meters)	142.03	474.34	616.37
Agricultural Benefit Area (Rai)	61,275	363,055	424,330

9.3 Important Projects (BackBone Projects)

The preparation of the 20-year water resource management master plan has considered plans/projects. that are consistent with the objectives in the development according to the Phetchaburi-Prachuap Khiri Khan watershed development strategy together with information on water resources development plans of various agencies collected in past topics A large, medium-sized development project or a group of project plans of the same type. useful for a wide area covering many districts and has a relatively high investment cost Considered as a group of projects that are of high importance (Backbone Project) found that the project / plan which is of high importance in the Phetchaburi-Prachuap Khiri Khan watershed area There are a total of 21 projects, summarized as **Figure 9.3-1.**

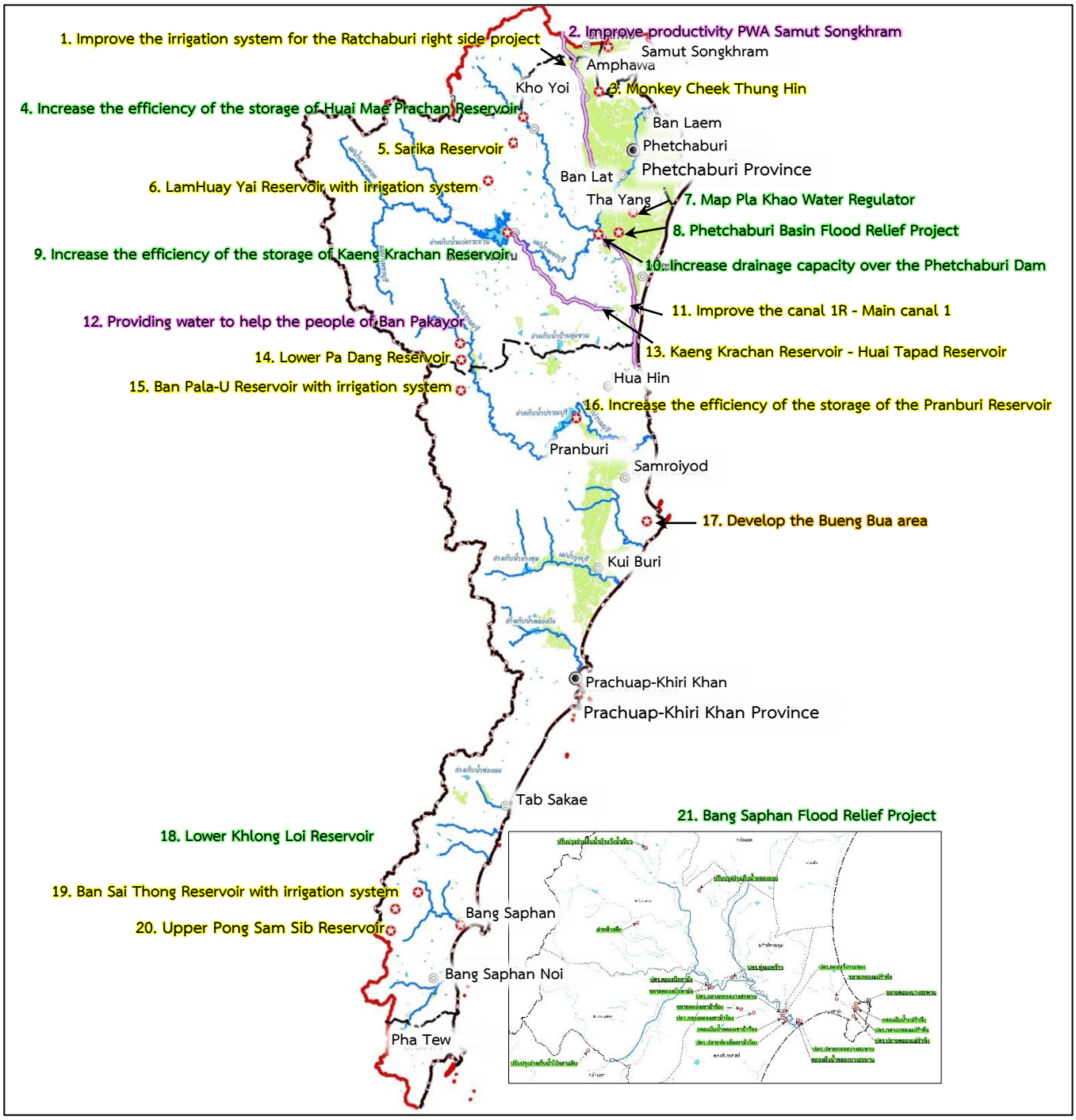

Figure 9.3-1 Projects/programs which is of high importance in the Phetchaburi-Prachuap Khiri Khan watershed area

10. Economic Impact Assessment and Cost Effectiveness of the Master Plan

Economic Impact Assessment and Cost Effectiveness of Plans/Projects according to the Water Resources Management Master Plan in the Phetchaburi-Prachuap Khiri Khan Watershed Area 2018-1937, 2,427 projects with an investment of 75,751 million baht, with a total economic impact of 257,750 million baht, representing a rate of return on investment (ROI) 3.4 times, meaning that every 1 baht of investment in the project Can create economic impact 3.4 baht It can be concluded that the plans/projects according to the Water Resources Management Master Plan in the Phetchaburi-Prachuap Khiri Khan River Basin are beneficial to the overall economy and are worth the investment.

11. Feedback

1) Water management

- The development of water for consumption is primarily based on surface water sources. Due to the introduction of groundwater for consumption There may be problems with groundwater quality such as salinity and hardness. This is caused by the geological features in the watershed area. However, in the event that groundwater quality needs to be improved for consumption It is necessary to improve the quality of groundwater to meet the standards set by law for consumption or consumption. For methods of improving the quality of groundwater that are experiencing problems with salinity and hardness, such as adding chemicals Slow filtration (drip system) and reverse osmosis (RO) etc.

2) Management of water security in the production sector

- The Phetchaburi-Prachuap Khiri Khan River Basin has a potential of 3,698 million cubic meters/year of runoff in natural waterways. There is a total water demand of the river basin at present at approximately 2,671 million cubic meters/year, of which the agricultural water demand is up to 2,413 million cubic meters/year. The amount of water that must be procured for water security The manufacturing sector needs to operate in a variety of ways. The development of runoff reservoirs in the mainstream needs to be undertaken as a cost water source for the dry season. including helping to alleviate floods and for consumption However, the development of medium-sized and large water reservoirs may have an impact on forest land use. as well as the impact on the land and property of the people Therefore, measures to prevent and reduce the impact should be studied. before construction to mitigate the impact that will occur

- The area away from the main stream and Don area It is necessary to develop small water reservoirs spread among farmers' fields. Farmers who use water have to sacrifice some of their land for water storage, so there should be a campaign to use water sparingly. Or choose to grow plants that use less water.
- By soil properties in the basin Digging a small pond should be deep and narrow. and prevent leakage to reduce water loss
- Management plan for water security in the production sector according to this strategy Consider on the basis of alternative 2 and alternative 4 agriculture in the future if farmers' cultivation patterns change from the present. will result in the amount of water supplied change accordingly
- To create water security in the production sector, consider procuring sufficient water sources for agriculture and agro-industry in irrigated areas. together with improving the efficiency of water use in the agricultural sector In the rainwater agricultural area, the emphasis is on the development of water sources for subsistence agriculture outside the irrigation area. by considering water reserves to be sufficient to meet the average water demand during the dry season

3) flood and flood management management

- There are 2 types of flooding in the area: 1) the occurrence of flooding in the nature of wild water or flash floods from heavy rain Most of them occur in the upper areas of the watershed in Nong Ya Plong district.Kaeng Krachan District, Tha Yang District, Ban Lat District, Cha-am District, Khao Yoi District and Bang Saphan District Flood conditions for 2-3 days. The amount of flooding that occurs in this manner when it flows into the downstream areas will cause flooding in the lower areas. If there is no cut off the amount of flood water along with the conservation of watershed forest areas It will be difficult to alleviate the flooding problem in this manner. 2) The flooding in the form of flooding in the area for several days cannot be drained out in time. Most of them occur in the lower plains of the basin. There is a small main stream winding, with a slight slope and shallow, the drainage is slow. This causes insufficient drainage capacity, often occurring in Mueang Phetchaburi District, Ban Laem District, and parts of Khao Yoi District, which are economically important areas of the province. Along with rivers being compromised or obstructing waterways such as Petchkasem Road and the Southern Railway. In addition, the estuary is also influenced by sea level, making it more difficult to drain water into the sea. If there is a high sea level Drainage time is limited due to the tide occurring

twice in a day. Determination of flood mitigation measures in the lower basin needs to be considered in conjunction with city planning measures. and requires a combination of several water management structures, including drainage and flood prevention systems for important communities. Main river bank protection building Monkey cheeks/water rafters overflowing riverbanks in low-lying areas Improve water barriers Improve drainage of Petchkasem Road/Double track railway In Cha-Am, Hua Hin, Bang Saphan areas, diversion channels were built to help drain water from the main streams to protect economic areas. adding a drainage channel into the sea Must study suitability and environmental impact The canal diversion bypasses the city and the water control building before deciding to proceed.

4) Water quality management management and conserve water resources

1. Water quality of surface water sources: determined by using general water quality indicators or WQI, found that the water quality was in the deteriorated to good level. This is comparable to the water quality standards for surface water sources Type 4 to Type 2 by the Lower Phetchaburi River Branch. Pranburi River and Klong Kui. The trend of water quality in communities and estuaries tends to deteriorate. while the upper Petchaburi River tributary and Huai Mae Prachan The water quality in the community has a tendency to improve. Wastewater problems arise from (1) the use of chemical fertilizers in agricultural areas. (2) The expansion of urban areas. including no wastewater treatment before discharging into the river from the community Tourist attractions (3) from industrial factories in the area Therefore, the management of wastewater from the source should be controlled. together with promoting and publicizing the farmers in the area to use agricultural chemicals properly Promote public relations for people in the area and tourists to take care of surface water resources.

2. Prevention of coastal erosion problems: This is the SEA plan/work plan according to the draft regulations of the Prime Minister's Office in the SEA study on coastal development plans. It needs to be considered in accordance with the context and development potential of the area. by Samut Songkhram Province The coastal area is a conservation area. Phetchaburi Province Most of the beachfront areas are suitable for urban development and tourism, especially in Cha-am sub-district. There is a high risk of coastal erosion in Laem Phak Bia Sub-district. Prachuap Khiri Khan Province Most of the areas are suitable for urban development and tourism. There are suitable areas for industrial development at Ao Manao, Thap Sakae Beach, Ban Tang Sai and Bang Saphan, Suan Son-Khao Tao Beach, Pranburi Beach, Kui Buri, Khlong Wan-Wang Duan. And some bridges are at a very

high risk of coastal erosion. Considering guidelines for preventing and solving coastal erosion problems to suit the conditions of the area are as follows:

- Coastal equilibrium by natural processes by implementing coastal protection measures. to limit activities that would interfere with coastal stability defining the retreat area to prevent the effects of coastal erosion
- Coastal erosion protection is implemented in a manner consistent with or mimicking nature so as not to interfere with the scenery, such as beach restoration. Setting up sediment trap poles for mangrove planting Or use an engineering structure in areas prone to severe erosion, such as offshore breakwaters, sand trappings, bank protection dams. and a barrier against waves on the beach, etc.
- Coastal erosion solution uses a form that is consistent with nature and mimics nature. as well as to address the root causes of coastal erosion problems such as demolition or improvement of structures that prevent coastal sediment movement, reforestation and sand transfer.
- Coastal rehabilitation by restoring mangrove forests, beach forests, and coastal stabilization. Adding beach sand to allow dissipation of waves and reduce the risk of coastal erosion.
- Encourage local communities to participate in coastal restoration and conservation activities.
- Enhance knowledge for provincial and local government agencies In order to correct the problem according to the academic principles and not cause the effect of continual erosion to neighboring areas

3. Wetland Utilization: Determination of measures and guidelines for utilizing and developing wetland land in accordance with ecosystems and natural balance. Prevent encroachment on drainage boundary lines Accelerate drainage in the rainy season and consider the ways to store water for use in the dry season

5) Conservation management and rehabilitation of degraded watershed forests and prevent soil erosion

- Conservation and restoration of forest areas for conservation and watershed forests Conservation and restoration of forest areas for conservation and upstream forests pay attention to areas that still have forest conditions in conservation areas such as national parks. wildlife sanctuary Conservation Forest (Zone C) because it is an area with direct responsibility

for the area. The operation model is based on the guidelines of the Bureau of Watershed Conservation and Management. Department of National Parks wild animals and plants by continuing to operate throughout the period of the Strategic Plan In addition, the community should be encouraged to Participate in the conservation and restoration of watershed forest areas for the people to see the importance How to coexist and take advantage of forests without encroachment

- The area within the Phetchaburi-Prachuap Khiri Khan River Basin has 2.53 million rai of suitable soil potential for cultivation, while about 3.31 million rai is used by farmers for agricultural purposes. Misuse of land is not consistent with soil performance. This causes the quality and performance of the soil to deteriorate. low yield per rai Farming therefore needs to increase the production factors higher. In addition, most of the waterfront area is a set of soils with high erosion. The river was therefore shallow due to sedimentation in the river. causing low drainage capacity Therefore, it is necessary to promote soil improvement in unsuitable areas to increase yields. especially the areas outside the irrigated area in the Huai Mae Prachan River Basin. and the upper Petchaburi River tributary

6) Water Management

- Water resource management of the Phetchaburi-Prachuap Khiri Khan watershed area Need an organization that oversees the overall management of water resources in the whole system Therefore, it is necessary to develop water user organizations for water resource management at all levels. Preparation of water resource management plans, development of database systems, including participation of all stakeholders.

7) Development of agricultural production potential development

- Agricultural Extension Plan in the Phetchaburi-Prachuap Khiri Khan River Basin has taken into account the problems of the production sector in the agricultural sector Therefore, there are several approaches to be combined. However, in many The roadmap depends on government policies. which is beyond the decision-making power of the operational level Therefore, the success of the management plan for the development of agricultural production potential Therefore, it is necessary to rely mainly on the government's driving mechanism.

- zoning of agricultural areas Control land use in conjunction with water management. It will help the number of agricultural products of each type of economic crops to be in the amount suitable for the market to support the production. This is to prevent oversupply of products. including to control the amount of water used for cultivation Help

reduce conflicts in water use activities. This has a positive effect on water management in the basin.

- Approximately 16% of the agricultural area in the watershed is in the area of the NESDB. Therefore, land use measures need to be established. and agreements between government agencies that own the area with government agencies that develop including farmers who use
- Plant price insurance measures Control the cost of seeds, fertilizers, promote the marketing of agricultural products. and community products community enterprise
- Promote agricultural knowledge Use of technology to assist in production breed development alternating high yield crops
- Develop integrated agriculture linking the agricultural industry Seeking new markets for agricultural-fishery products by promoting the establishment of a platform and trade area in the province. to be a central source for trade negotiations and development of trade and investment as well as creating opportunities to negotiate with entrepreneurs in foreign countries

8) Tourism development development

- Control development in accordance with the identity of each area. and has local cultural traditions by creating ecotourism agricultural tourism Thai way of travel to integrate tourism with other sectors and make use of tourism areas to suit the potential of tourism development and generate income for communities that care and conserve tourism areas and natural resources

9) Development of the capacity building of trade and investment in the area

- Develop infrastructure water supply and provincial utilities in the watershed area to support economic growth and urban development
- Build and improve infrastructure to support upstream and downstream industries in watershed areas.
- Promote the utilization of ports and water transportation
- Promote sustainable energy management Support the use of alternative energy to reduce energy costs. Develop Petchaburi, Cha-am, Hua Hin as a city to reduce energy consumption.
- Promote border trade tourism with neighboring countries upgrade the border relief point as a permanent border crossing point