Supplementary materials

Table S1. Flow rates of wastewater to wastewater treatment plants in industrial parks in Chonburi and Rayong, which are among the most important industrial provinces in the Eastern Economic Corridor (EEC), Thailand.

Province	Wastewater treatment plant in industrial park	Flow rate (m^3/d)
Chonburi	I1	10,061[(1)*]
	I2	2353[(1)*]
	I3	1657[(1)*]
	I4	1061[(1)*]
	I5	12,704[(1)*]
	I6	8613[(1)*]
	I7	4053[(1)*]
	I8	6962[(1)*]
	I9	3058[(1)*]
	I10	226[(1)*]
	I11	371[(1)*]
Rayong	IR1	2500[(2)]
	IR2	24,564[(2)]
	IR3	9821[(2)]
	IR4	4159[(2)]
	IR5	550[(2)]
	IR6	5500[(2)]
	IR7	8055[(2)]
	IR8	27,200[(2)]
	IR9	6735[(2)]
	IR10	272.83[(2)]

* Data obtained in 2018.

(1) Suwannasilp, B.B.; Sangsanont, J.; Intaraburt, W.; Sanohwong, K. Survey of current situation of wastewater in the circular economy in Chonburi province and prediction of its potential. *Research Report.* **2020**.

(2) Reports on compliance with measures to prevent and mitigate environmental impacts and measures to monitor environmental impacts of industrial estates **2020.** Environmental Impact Assessment Information Center, Office of Natural Resources and Environmental Policy and Planning, Thailand. https://eia.onep.go.th/

Table S2. Concentrations of pollutants in the wastewater treatment plant effluents of industrial estates in Chonburi, according to our survey in 2018 [1].

Pollutant	Concentration in the effluent (mg/L)
Biochemical oxygen demand (BOD)	< 18
Chemical oxygen demand (COD)	8 - 96
Total Kjeldahl nitrogen (TKN)	< 35.99
Total phosphorus (TP)	0.2 - 13.5
Suspended solid (SS)	< 42
Total dissolved solid (TDS)	228 - 1432
As	< 0.009
Zn	< 2.69
Cr^{6+}	< 0.01
Cr^{3+}	< 0.211
Cu	< 0.21
Pb	< 0.05
Ni	< 0.8
Cd	< 0.01
Mn	< 0.87
Hg	< 0.05
Ba	< 1.02
Se	< 0.005

*ND = not detectable

[1] Suwannasilp, B.B.; Sangsanont, J.; Intaraburt, W.; Sanohwong, K. Survey of current situation of wastewater in the circular economy in Chonburi province and prediction of its potential. *Research Report.* **2020**.

Table S3. Average concentrations of pollutants and their environmental damage costs.

	Nitrogen (N)*	**Phosphorus (P)**	**Suspended solid (SS)**	**Chemical oxygen demand (COD)**
average concentration (kg/m^3)	0.01	0.0023	0.015	0.044
shadow price (THB/kg)	-333.45	-630.97	-0.10	-2.00

*This uses an average concentration of total Kjeldahl nitrogen (TKN) because the concentrations of total nitrogen in effluents were not available.

Table S4. Costs and benefits of different scenarios.

Scenario	Excluding environmental benefits		Including environmental benefits	
Water reclamation for industrial water supply	**Costs**	**Benefits**	**Costs**	**Benefits**
	- Construction - Operation & maintenance	- Water price	- Construction - Operation & maintenance	- Water price - Environmental benefits
Water reclamation for irrigation of plants and green areas	**Costs**	**Benefits**	**Costs**	**Benefits**
	- Construction - Pipeline systems - Operation & maintenance	- Water price - Nitrogen fertilizer - Phosphorus fertilizer	- Construction - Pipeline system - Operation & maintenance	- Water price - Nitrogen fertilizer - Phosphorus fertilizer - Environmental benefits

Table S5. Net present values (NPVs), internal rates of return (IRRs), benefit-cost ratios (BCRs), and payback periods (PPs) for water reclamation projects for industrial water supply when including and excluding environmental benefits.

Flowrate 5200 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	-120,836,258		0.82	> 20	16,826,879		1.03	16.5
5%	-118,784,841		0.80	> 20	-3,470,449		0.99	> 20
7%	-117,198,079	NA	0.77	> 20	-19,170,340	4.6%	0.96	> 20
9%	-115,953,376		0.75	> 20	-31,485,801		0.93	> 20
11%	-114,963,693		0.72	> 20	-41,278,021		0.90	> 20
Flowrate 10,000 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	-169,300,496		0.86	> 20	95,436,305		1.08	10.6
5%	-165,355,463		0.84	> 20	56,402,983		1.05	12.2
7%	-162,303,998	NA	0.82	> 20	26,210,886	9.2%	1.03	14.6
9%	-159,910,338		0.80	> 20	2,527,307		1.00	19.1
11%	-158,007,101		0.78	> 20	-16,303,887		0.98	> 20
Flowrate 15,000 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	-223,450,743		0.88	> 20	173,654,458		1.10	8.9
5%	-217,533,194		0.86	> 20	115,104,474		1.07	10.0
7%	-212,955,997	NA	0.84	> 20	69,816,328	11.5%	1.05	11.5
9%	-209,365,507		0.82	> 20	34,290,960		1.03	13.7
11%	-206,510,652		0.80	> 20	6,044,170		1.01	18.0
Flowrate 25,000 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	-392,751,239		0.87	> 20	269,090,764		1.09	9.6
5%	-382,888,657		0.85	> 20	171,507,457		1.07	10.8
7%	-375,259,995	NA	0.83	> 20	96,027,214	10.5%	1.04	12.6
9%	-369,275,846		0.82	> 20	36,818,266		1.02	15.6
11%	-364,517,753		0.80	> 20	-10,259,717		0.99	> 20

*NA = not applicable

Table S6. Net present values (NPVs), internal rates of return (IRRs), benefit-cost ratios (BCRs), and payback periods (PPs) for water reclamation projects for irrigation of plants and green areas when including and excluding environmental benefits.

Flowrate 240 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	11,002,646		3.27	2.31	17,356,329		4.59	1.53
5%	8,907,171		3.04	2.39	14,229,373		4.26	1.57
7%	7,286,330	45.5%	2.82	2.47	11,810,687	68.0%	3.96	1.61
9%	6,014,895		2.62	2.57	9,913,398		3.68	1.66
11%	5,003,956		2.44	2.66	8,404,833		3.42	1.70
Flowrate 480 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	22,945,292		3.63	1.72	35,652,658		5.08	1.15
5%	18,754,341		3.41	1.77	29,398,747		4.78	1.17
7%	15,512,660	60.5%	3.20	1.82	24,561,375	90.2%	4.49	1.20
9%	12,969,789		3.01	1.88	20,766,796		4.21	1.23
11%	10,947,912		2.82	1.93	17,749,666		3.95	1.26
Flowrate 2400 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	114,281,458		3.59	1.78	177,818,290		5.03	1.18
5%	93,326,706		3.37	1.83	146,548,733		4.72	1.21
7%	77,118,302	58.6%	3.16	1.88	122,361,874	87.5%	4.43	1.24
9%	64,403,947		2.96	1.94	103,388,982		4.15	1.27
11%	54,294,560		2.78	1.99	88,303,331		3.90	1.30

Table S6. Net present values (NPVs), internal rates of return (IRRs), benefit-cost ratios (BCRs), and payback periods (PPs) for water reclamation projects for irrigation of plants and green areas when including and excluding environmental benefits. (continued)

Flowrate 3600 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	174,819,687	69.2%	3.78	1.50	270,124,935	103.3%	5.30	1.00
5%	143,387,560		3.58	1.54	223,220,600		5.01	1.02
7%	119,074,952		3.38	1.58	186,940,310		4.73	1.04
9%	100,003,420		3.18	1.63	158,480,972		4.46	1.06
11%	84,839,339		3.00	1.67	135,852,497		4.21	1.08
Flowrate 4800 m^3/d	**Excluding environmental benefits**				**Including environmental benefits**			
	NPV (THB)	**IRR**	**BCR**	**PP (year)**	**NPV (THB)**	**IRR**	**BCR**	**PP (year)**
3%	228,942,916	59.4%	3.61	1.76	356,016,580	88.6%	5.05	1.17
5%	187,033,413		3.39	1.81	293,477,467		4.75	1.19
7%	154,616,603		3.18	1.86	245,103,747		4.45	1.22
9%	129,187,894		2.98	1.91	207,157,963		4.18	1.25
11%	108,969,119		2.80	1.96	176,986,662		3.92	1.28

Table S7. Costs and benefits in NPVs of water reclamation projects for industrial water supply.

Flowrate (m^3/d)	Discount rate	Present values of costs (THB)		Present values of benefits (THB)		NPV (THB)	
		Construction	O&M	Water price	Environmental benefits	Excluding environmental benefits	Including environmental benefits
5200	3%	108,200,000	564,748,946	552,112,688	137,663,136	-120,836,258	16,826,879
	5%	108,200,000	473,065,505	462,480,664	115,314,392	-118,784,841	-3,470,449
	7%	108,200,000	402,148,781	393,150,702	98,027,739	-117,198,079	-19,170,340
	9%	108,200,000	346,519,594	338,766,218	84,467,575	-115,953,376	-31,485,801
	11%	108,200,000	302,287,935	295,524,243	73,685,672	-114,963,693	-41,278,021
10,000	3%	145,000,000	1,086,055,665	1,061,755,169	264,736,801	-169,300,496	95,436,305
	5%	145,000,000	909,741,355	889,385,892	221,758,446	-165,355,463	56,402,983
	7%	145,000,000	773,363,040	756,059,042	188,514,884	-162,303,998	26,210,886
	9%	145,000,000	666,383,834	651,473,496	162,437,645	-159,910,338	2,527,307
	11%	145,000,000	581,322,953	568,315,852	141,703,214	-158,007,101	-16,303,887
15,000	3%	187,000,000	1,629,083,497	1,592,632,754	397,105,201	-223,450,743	173,654,458
	5%	187,000,000	1,364,612,033	1,334,078,838	332,637,668	-217,533,194	115,104,474
	7%	187,000,000	1,160,044,560	1,134,088,563	282,772,325	-212,955,997	69,816,328
	9%	187,000,000	999,575,751	977,210,243	243,656,467	-209,365,507	34,290,960
	11%	187,000,000	871,984,429	852,473,777	212,554,822	-206,510,652	6,044,170
25,000	3%	332,000,000	2,715,139,162	2,654,387,923	661,842,002	-392,751,239	269,090,764
	5%	332,000,000	2,274,353,388	2,223,464,730	554,396,114	-382,888,657	171,507,457
	7%	332,000,000	1,933,407,600	1,890,147,605	471,287,209	-375,259,995	96,027,214
	9%	332,000,000	1,665,959,585	1,628,683,739	406,094,112	-369,275,846	36,818,266
	11%	332,000,000	1,453,307,381	1,420,789,629	354,258,036	-364,517,753	-10,259,717

Table S8. Costs and benefits in NPVs of water reclamation projects for water reclamation projects for irrigation of plants and green areas.

Flowrate (m^3/d)	Discount rate	Present values of costs (THB)			Present values of benefits (THB)				NPV (THB)	
		Construction	Pipeline system	O&M	Water price	Nitrogen fertilizer	Phosphorus fertilizer	Environmental benefits	Excluding environmental benefits	Including environmental benefits
240	3%	1,400,000	505,000	2,932,350	15,639,202	149,446	51,349	6,353,683	11,002,646	17,356,329
	5%	1,400,000	505,000	2,456,302	13,100,276	125,184	43,013	5,322,203	8,907,171	14,229,373
	7%	1,400,000	505,000	2,088,080	11,136,428	106,418	36,565	4,524,357	7,286,330	11,810,687
	9%	1,400,000	505,000	1,799,236	9,595,927	91,697	31,507	3,898,503	6,014,895	9,913,398
	11%	1,400,000	505,000	1,569,572	8,371,051	79,992	27,485	3,400,877	5,003,956	8,404,833
480	3%	2,000,000	870,000	5,864,701	31,278,403	298,891	102,698	12,707,366	22,945,292	35,652,658
	5%	2,000,000	870,000	4,912,603	26,200,551	250,368	86,025	10,644,405	18,754,341	29,398,747
	7%	2,000,000	870,000	4,176,160	22,272,856	212,836	73,129	9,048,714	15,512,660	24,561,375
	9%	2,000,000	870,000	3,598,473	19,191,854	183,394	63,013	7,797,007	12,969,789	20,766,796
	11%	2,000,000	870,000	3,139,144	16,742,101	159,985	54,970	6,801,754	10,947,912	17,749,666
2400	3%	12,000,000	2,795,000	29,323,503	156,392,016	1,494,456	513,489	63,536,832	114,281,458	177,818,290
	5%	12,000,000	2,795,000	24,563,017	131,002,755	1,251,840	430,127	53,222,027	93,326,706	146,548,733
	7%	12,000,000	2,795,000	20,880,802	111,364,278	1,064,178	365,647	45,243,572	77,118,302	122,361,874
	9%	12,000,000	2,795,000	17,992,364	95,959,272	916,971	315,067	38,985,035	64,403,947	103,388,982
	11%	12,000,000	2,795,000	15,695,720	83,710,505	799,924	274,851	34,008,771	54,294,560	88,303,331
3600	3%	16,000,000	2,795,000	43,985,254	234,588,024	2,241,684	770,234	95,305,248	174,819,687	270,124,935
	5%	16,000,000	2,795,000	36,844,525	196,504,133	1,877,761	645,191	79,833,040	143,387,560	223,220,600
	7%	16,000,000	2,795,000	31,321,203	167,046,417	1,596,268	548,471	67,865,358	119,074,952	186,940,310
	9%	16,000,000	2,795,000	26,988,545	143,938,908	1,375,456	472,601	58,477,552	100,003,420	158,480,972
	11%	16,000,000	2,795,000	23,543,580	125,565,758	1,199,885	412,276	51,013,157	84,839,339	135,852,497
4800	3%	24,000,000	5,210,000	58,647,006	312,784,031	2,988,912	1,026,978	127,073,664	228,942,916	356,016,580
	5%	24,000,000	5,210,000	49,126,033	262,005,510	2,503,681	860,255	106,444,054	187,033,413	293,477,467
	7%	24,000,000	5,210,000	41,761,604	222,728,555	2,128,357	731,295	90,487,144	154,616,603	245,103,747
	9%	24,000,000	5,210,000	35,984,727	191,918,544	1,833,942	630,135	77,970,070	129,187,894	207,157,963
	11%	24,000,000	5,210,000	31,391,439	167,421,010	1,599,847	549,701	68,017,543	108,969,119	176,986,662

Table S9. Actual amount of irrigation water from water reuse in industrial parks in Chonburi in 2018 [1].

Industrial park/zone	Irrigation flow rate (m^3/d)
I2	43
I3	44
I4	56
I5	2922
I6	1981
I7	932
I8	1601

*I5-I8 are zones where wastewater is collected to different wastewater treatment plants but they are located in the same industrial park.

*These industrial parks/zones used only reclaimed water for irrigation of plants and green areas.

[1] Suwannasilp, B.B.; Sangsanont, J.; Intaraburt, W.; Sanohwong, K. Survey of current situation of wastewater in the circular economy in Chonburi province and prediction of its potential. *Research Report.* **2020**.

Text S1. Calculation of irrigation water demand

For water demand of green areas in an industrial park, crop evapotranspiration (ETc) of grass was estimated from crop coefficient (Kc) and reference crop evapotranspiration (ETo) as shown in equation S-1.

$$ETc = Kc \times ETo \quad \text{(S-1)}$$

The Kc of grass was obtained from Royal Irrigation Department (RID) (http://water.rid.go.th/hwm/cropwater/iwmd/pdf/rev_cwr_manual.pdf) and the ETo for Chonburi province based on Penman-Montieth equation was obtained from RID (http://water.rid.go.th/hwm/cropwater/CWRdata/ETo/eto_east.pdf).

Irrigation water demand was calculated from the difference between grass evapotranspiration (ETc) and effective rainfall in each month (m) as shown in equation S-2

$$\text{Irrigation water (m)} = \text{ETc (m)} - \text{Effective rainfall (m)} \quad \text{(S-2)}$$

The 30-year average rainfall data (1981-2010) in Chonburi province were from Thai Meteorological Department (TMD) https://www.tmd.go.th/province_weather_stat.php?StationNumber=48459 and the effective monthly rainfall was calculated as shown in Table S based on a guideline from RID. The irrigation water demand of grass is shown in Table S.

Table S10. Effective monthly rainfall in Chonburi [RID]

Monthly rainfall (MR)	Effective rainfall
0-10	0
11-100	MR x 0.8
101-200	MR x 0.7
201-250	MR x 0.6
251-300	MR x 0.55
> 300	MR x 0.5

Table S11. Irrigation water demand of grass in Chonburi

Month	ETo (Penman-Monteith) mm/day	Kc (grass)	ETc mm/day	Rainfall (1981-2010) mm/mon	Rainfall mm/day	Eff. Rainfall mm/day	Irrigation water mm/day
Jan	4.09	0.85	3.48	9.9	0.3	0.0	3.5
Feb	4.55	1.24	5.64	14.3	0.5	0.4	5.2
Mar	4.83	0.57	2.75	47.5	1.5	1.2	1.5
Apr	5.14	1.05	5.40	74.1	2.5	2.0	3.4
May	4.48	0.88	3.94	175.3	5.7	4.0	0.0
Jun	4.13	1.23	5.08	147.7	4.9	3.4	1.6
Jul	4.12	1.03	4.24	140.6	4.5	3.2	1.1
Aug	3.74	0.98	3.67	154.1	5.0	3.5	0.2
Sep	3.43	0.77	2.64	268.9	9.0	5.4	0.0
Oct	3.49	1.09	3.80	208.9	6.7	4.0	0.0
Nov	4.09	0.58	2.37	48.8	1.6	1.3	1.1
Dec	4.16	1.24	5.16	5.5	0.2	0.0	5.2
						Average	1.9

The irrigated green areas based on the flow rate scenarios and the average irrigation water of grass of 1.9 mm/day is shown in Table S- assuming irrigation efficiency of 70%.

Table S12. The irrigated green areas based on flow rate scenarios

Flow rate (m3/day)	240	480	2400	3600	4800
Irrigated green area (ha)	9	18	88	133	177