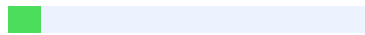




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online at <https://sloap.org/journals/index.php/irjeis/> Vol. 8 No. 6, November 2022, pages: 333-341 ISSN: 2454-2261 <https://doi.org/10.21744/irjeis.v8n6.2250> 333 Analysis of Non Domestic Water Needs in the Clean Water Supply in Badung Regency I Gusti Lanang Made Parwita a I G B Sila Dharma b Mawiti Infantri Yekti c I Putu Gustave Suryantara d I Ketut Sutapa e Article history: Abstract Submitted: 09 September 2022 Revised: 18 October 2022 Accepted: 27 November 2022 The need for clean water is generally divided into two groups, namely domestic water needs, and non-domestic water needs. Non-domestic water needs are water needs other than for household purposes such as for education, industry, tourism, social, and others. In general, the determination of non-domestic water demand is estimated to be around 20-25% of the total domestic water demand. Badung Regency has characteristics as the main tourist area in Bali as evidenced by the existence of 33 tourist destinations, both cultural tourism, natural tourism, artificial tourism, and youth tourism. With these characteristics, this study emphasizes the analysis of nondomestic water needs in the tourism sector. The research was conducted by analyzing various factors related to the need for clean water in the tourism sector such as hotel accommodation, tourism support facilities, and the number of tourism objects available. The results of this analysis are compared with domestic water needs according to the existing population. The analysis shows that non-domestic water demand for tourism accommodations (hotels, villas, and condominium hotels) is 186.76 liters / second, for tourism objects is 7.64 liters / second, restaurants and bars is 24.21 liters/second. Analysis of domestic water needs in Badung Regency in 2018 with a population of 630.00 people of 925 liters/second. This shows that the non-domestic water demand in Badung Regency for the tourism sector is 23.54%. Keywords: Badung regency; clean water supply; domestic water needs; non-domestic water needs; tourism; International research journal of engineering, IT & scientific research © 2022. This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>). Corresponding author: I Gusti Lanang Made Parwita, Civil Engineering, Bali State Polytechnic, Bali,

Indonesia. Email address: gstlanangmadeparwita@pnb.ac.id a Civil Engineering, Bali State Polytechnic, Bali, Indonesia b Faculty of Marine and Fisheries, Udayana University, Denpasar, Indonesia c 15 Faculty of Engineering, Udayana University, Denpasar, Indonesia d Faculty of Engineering, Udayana University, Denpasar, Indonesia e Civil Engineering, Bali State Polytechnic, Bali, Indonesia

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Introduction Bali Province 21 is one of the provinces in Indonesia that is heavily reliant on regional tourism revenue. Several places in Bali, including Badung Regency, Gianyar Regency, Denpasar City, and other districts, have become well-known national and worldwide tourism destinations. Tourist visits, which continue to rise year after year, demonstrate 11 that the tourism industry has firmly established itself as one of Bali's main economic drivers. Badung Regency, which contains 217-star hotels, 323 non-star hotels, 11 condotels, 84 villas, 2,009 tourist huts, 144 rental houses, 346 restaurants, 7 bars, 185 restaurants, 159 spas, 6 karaoke, and 15 live music, is one of the regencies in Bali with the greatest level of tourist visits in 2016. The number of tourism amenities is undoubtedly growing in tandem with the number of existing tourists. Based on population projections from the 2016 census, there were 630,000 residents in 2016, with 321,300 males and 308,700 females, a rise from the 2015 population prediction of only 616,000. In Badung Regency, the population is unequally distributed throughout the sub-districts. South Kuta District has the greatest population, with 152,600 people, or around 24.22 percent of Badung Regency's total population. Meanwhile, Petang District has the smallest population, with only 25,910 residents, or 4.11 percent of Badung Regency's total population. Because this area is home to both higher education and a big population, the distribution of the population in the District of South Kuta cannot be divided. Tirta Mangutama, a regional drinking water corporation, provides clean water services in Badung Regency, with a total service coverage of 64.20 percent. The Evening Zone, Mengwi Zone, Badung City Zone, and South Badung Zone are the four fulfillment schemes

that provide water to Badung Regency, notably for the rise in water from the tourism sector. Given **1** that the tourism sector is a cornerstone in Badung Regency, it is critical to perform a study of the water supply system so that the tourism sector can continue to be supported by a reliable, clean water supply system.

2 Materials and Methods

The research approach was carried out in stages, beginning with secondary data collecting and progressing to primary data collection and analysis. Secondary data collection includes data collected from **8** the Badung Regency Public Works Office, the Bali Provincial Public Works Office, the Bali Penida River Council, and the Bali Regional Development and Infrastructure Center, all of which are involved in providing clean water services. Meanwhile, the major data collected comprises information on the irrigation structure's size and current discharge measurements.

3 Results and Discussions

Overview of Badung Regency

8 Badung Regency is one of the most popular tourist destinations in Bali Province, extending from south to north and comprising six sub-districts. This regency covers 418.52 km², or 7.44 percent of Bali Province, and has an elevation range of 0-2075 meters above sea level. Regency of Badung The following boundaries are located between 08o14'20 "-08o50'48" South Latitude and 115o05'00 "- 115o26'16" East Longitude: Ocean Indonesia, west of Tabanan Regency, north of Buleleng Regency, east of Bangli Regency, Gianyar, and Denpasar City, in the south: Ocean Indonesia, north of Buleleng Regency, east of Bangli Regency, Gianyar, and Denpasar City. The location of the Badung Regency area can be seen in Figure 1 below

IRJEIS ISSN: 2454-2261 □ Parwita, I. G. L. M., Dharma, I. G. B. S., Yekti, M. I., Suryantara, I. P. G., & Sutapa, I. K. (2022). Analysis of non domestic water needs in the clean water supply in Badung Regency. *International Research Journal of Engineering, IT & Scientific Research*, 8(6), 333–341. <https://doi.org/10.21744/irjeis.v8n6.2250-335> Fig 1. Map of Badung Regency According to data from Badung Regency's Central Bureau of Statistics, the population of Badung Regency in 2018 was 630,000, with 321,300 male inhabitants and 308,700 female residents, a rise from the predicted population of only

616,000 people in 2015. In Badung Regency's six sub-districts, the greatest population is unequally distributed throughout the subdistricts. South Kuta District has the greatest population, with 152,200 people, or around 24.22 percent of Badung Regency's total population. Meanwhile, Petang District has a population of at least 25,910 individuals, accounting for 4.11 percent of Badung Regency's total population. The average population density of Badung Regency is quite high, reaching 2,378.53 people per km², with the maximum population density being in Kuta District, at 5,866 people per km². Meanwhile, Petang District has the lowest population density, with 225 persons per square kilometer. The social conditions of each location are substantially influenced by population density. Complete population data can be seen in Table 1 and Figure 2 below. Table 1 Distribution population of Badung Regency Source: [13 Central Bureau of Statistics of The Province of Bali.2021](#)

No	Sub District	Area (km ²)	Population (people)	Population Density (people/km ²)
1	Kuta Selatan	101.13	152,600	1,509
2	Kuta	17.52	102,770	5,866
3	Kuta Utara	33.86	127,400	3,763
4	Mengwi	82.00	130,040	1,586
5	Abiansema	69.01	91,280	1,323
6	Petang	115.00	25,910	225
	Total	615.52	630,000	

□ ISSN: 2454-2261 IRJEIS Vol. 8 No. 6, November 2022, pages: 333-341 336 Fig 2. Population distribution of Badung Regency Badung Regency water supply system The Tirta Mangutama Regional Drinking Water Company, Badung Regency, is in charge of providing piped drinking water in Badung Regency. At the District level, each management unit already exists. The Tirta Mangutama Regional Drinking Water Company in Badung Regency obtains its drinking water from springs, groundwater, and rivers. As a result of recent changes and community activities, it is now more important than ever to upgrade drinking water infrastructure (Villarreal & Dixon, 2005; Archana et al., 2016). The provision of drinking water as a whole network system must be assessed, both in terms of the need for raw water and the network system's improvement at both the transmission and distribution levels. Tirta Mangutama Regional Drinking Water Company, Badung Regency now has 7,097 connections in Abiansema District, 10,280 connections in Kuta District,

19,757 connections in South Kuta District, 16,384 connections in North Kuta District, 10,222 connections in Mengwi District, and 2,901 connections in Petang District. Tirta Mangutama Regional Drinking Water Company, Badung Regency, has a total installed capacity of 1,173.29 liters/second based on the water source capacity utilized. Tourism sector water needs The need for water for tourism is determined by the number of existing tourism facilities such as hotels, villas, and so on, and other supporting facilities such as restaurants, bars, and others (Wuysang et al., 2018; Warren, 2000; Kooy et al., 2018). **6 The tourism sector in Badung Regency is the most favored** and contributes the largest to the revenue of Badung Regency each year. This is due to the large number of tourist attraction objects in Badung Regency, most of which are scattered in the Districts of South Kuta and Kuta. The development of **6 the tourism sector in Badung Regency is** also influenced by the existence of Ngurah Rai Airport in Tuban, Kuta District. Preservation efforts for tourism **17 areas in Badung Regency** need to be considered carefully because **Badung Regency has a** large degree of dependence on the tourism sector. Based on the Bali Provincial Regulation No. 16 of 2009, regarding the Spatial Plan for **8 the Province of Bali**, it is stipulated that areas that are used as tourism areas include Badung Regency which includes 3 areas, namely Nusa Dua, Kuta, and Tuban. Based on the Badung Regent Regulation No. 7 of 2005 dated 7 February 2005 regarding tourist objects and tourist attractions in Badung Regency, 33 tourist objects in Badung Regency are scattered in all districts and generally **1 in the form of** natural tourism objects in the South Badung area, mostly **in the form of** beach tourism, mangrove parks, and turtle conservation. cultural tourism **in the form of** temples, and youth tourism **in the form of** the GWK monument and recreation area Water Boom Park & Spa. The growth **24 of tourism in Badung Regency** has sparked growth in a variety of other sectors, all of which have an impact on the region's economic development (Chambers & Clarke, 1966; Macedonio et al., 2012). Economic activity and trade are rapidly expanding, as are tourism demands. Various tourism activities are being developed that will require a large amount of community participation. The tourism industry employs a substantial number of people in southern

Badung. Because it simply takes a little time to go to the South Bali area, the location of Ngurah Rai airport has an impact on the development of the tourism sector in southern Badung. Furthermore, this neighborhood has excellent roads, power, and clean water services (BoucheKima, 2003; Koop et al., 2019). Tourist destinations in Badung Regency can be seen in table 2.

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337 Table 2 Tourist destinations in Badung Regency Tourist accommodation As evidenced by the increasing increase of tourism facilities and infrastructure 5 from year to year, tourism activities are a backbone of promise in supporting development in Badung Regency. Kuta and Nusa Dua are the most popular tourist destinations in Badung Regency. Hundreds of star and non-star 11 hotels, as well as various types of lodging, are located in this neighborhood. 170-star hotels with 26,543 rooms, 551 non-star hotels with 37,314 rooms, 885 jasmine hotels with 3,146 rooms, and 59 condotels with 8,992 rooms make up Badung Regency's tourism accommodations. The 1 number of hotels and rooms can be seen in Table 3

Table 3 The number of hotels and rooms Source: Badung Regency Tourism Office, 2020

No	Tourist attraction	Attraction type	Village	Sub Distric
1	Uluwatu Temple	culture tourism	Pecatu Kuta Selatan	1
2	Nyang Nyang Beach	Natural Tourism	Pecatu Kuta Selatan	2
3	Padang Padang Beach	Natural Tourism	Pecatu Kuta Selatan	4
4	Labuan Sait Beach	Natural Tourism	Pecatu Kuta Selatan	5
5	Batu Pageh Beah	Natural Tourism	Ungasan Kuta Selatan	6
6	Melasti Beash	Natural Tourism	Ungasan Kuta Selatan	7
7	Samuh Beach	Natural Tourism	Benoa Kuta Selatan	8
8	Geger Sawangan Beach	Natural Tourism	Benoa Kuta Selatan	9
9	Nusa Dua Beach	Natural Tourism	Benoa Kuta Selatan	10
10	Tanjung Benoa Beach	Natural Tourism	Tanjung BenoaKuta Selatan	11
11	Turtle Island	Natural Tourism	Tanjung BenoaKuta Selatan	12
12	Mangrove Park	Natural Tourism	Tanjung BenoaKuta Selatan	

Selatan 13 Jimbaran Beach Natural Tourism Jimbaran Kuta Selatan 14 Garuda Wisnu Kencana culture tourism Jimbaran Kuta Selatan 15 Kedonganan Beach Natural Tourism Tuban Kuta 16 Kuta Beach Natural Tourism Kuta Kuta 17 Water Boom Natural Tourism Kuta Kuta 18 Legian Beach Natural Tourism Legian Kuta 19 Bom Bali Monument Natural Tourism Kuta Kuta 20 Petitenget Beach Natural Tourism Kerobokan Kuta Utara 21 Berawa Beach Natural Tourism Tibubeneng Kuta Utara 22 Canggu Beach Natural Tourism Canggu Mengwi 23 Seseh Beach Natural Tourism Munggu Mengwi 24 Sada Temple culture tourism Kapal Mengwi 25 Taman Ayun temple culture tourism Mengwi Mengwi 26 Keraban Langit Temple culture tourism Sading Mengwi 27 Baha Eco Tourism Natural Tourism Baha Mengwi 28 Blahkiuh Village Youth tourism Blahkiuh Abiansemal 29 Monkey Forest sangeh Natural Tourism Sangeh Abiansemal 30 Tanah Wuk Natural Tourism Sangeh Abiansemal 31 Nungnung Waterfall Natural Tourism Pelaga Petang 32 Pelaga Agro Natural Tourism Pelaga Petang 33 Pucak Tedung Temple Pelaga Petang

Location	No.	Year	Total Room
1	2014	98	16,350
2	2015	155	24,683
3	2016	155	24,683
4	2017	155	24,683
5	2018	170	26,543

Room total 355 34,815 999 3,937 2 2015 155 24,683 458 28,282 685 2,405 3 2016 155 24,683 521 33,075 775 2,750 4 2017 155 24,543 539 35,698 839 2,983 5 2018 170 26,543 551 37,314 885 3,146

Star Hotel Non Star hotel Room total

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Water requirements Domestic water requirements are estimated by multiplying 5 the population by the water requirements per liter/per person per day. In this instance, 12 the water requirements of each location change depending on the local conditions. The more the use water in a developed area, the more it is used (Robles-Durazno et al., 2019; Zhang et al., 2019). The following is a list of how each region's water is used: Water needs are 221 liters per second in South Kuta Subdistrict, 358 liters per second in Kuta and North Kuta Subdistricts, 188 liters per second in Mengwi District, and 116 liters per second in Abainsemal District. The Petang District's water needs are 30 liters per second, whereas the Petanu water treatment plant's service area is 12 liters per second. Water demand in

Badung Regency is shown in Table 4 Table 4 Water needs for domestic water use in Badung Regency Source: analysis, 2020 The number of tourism lodgings, tourist attractions, and other tourism support facilities in Badung Regency is used to assess the need for non-domestic water. According to the data, star hotels have 12 a water demand of 92 liters per second, non-star hotels have a requirement of 78 liters per second, and jasmine hotels have a demand of 78 liters per second. condotel 12 liters per second, and 4 liters per second. 12 The water demand for 33 tourism items is computed using the water requirement for toilets of 7.64 liters per perdtik and the water demands for supporting facilities such as restaurants (16.03 liters/second), bars (5.41 liters/second), and depots (2.16 liters/second). and the need for water for catering (0.61 liters/second). If proxied, non-domestic 18 water needs in the tourism sector with domestic water needs in Badung Regency in 2019 amounted to 23.54%. The analysis results are shown in Tabel 5 Table 5 Water demand 1 for the tourism sector Source: Analysis 2020 No, Service Area Area Population Water Requitements (km2) (people) (liter/second) 1 Kuta Selatan 101.13 152,600 221 2 Kuta & Kuta Utara 51.38 230,170 358 3 Mengwi 82.00 127,400 188 4 Abiansemal 69.01 130,040 116 5 Petang 115.00 91,280 30 6 WTP Petanu 25,910 12 Total 615.52 630,000 925

No.	Description	Water requirements (liter/second)	Total (liter/second)
1	Hotel Star hotel	92	186
2	Non star hotel	78	186
3	Budget jotel	4	2
4	Condotel	12	2
5	Sub total	186	186
6	Tourist atraction	7.64	7.64
7	Sub total	7.64	7.64
8	Restoran	16.03	16.03
9	Bar	5.41	5.41
10	Food stall	2.16	2.16
11	Catering	0.61	0.61
12	Sub total	24.21	24.21
13	Total	217.85	217.85

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Strategy for fulfilling clean water Several rivers in the Badung Regency area, including the Badung River, Mati River, and Penet River, have the potential to be developed based on available data. Until now, the effluent that has been discarded in the estuary has a good

chance of being reused in the future. (Hickner, 2010; Thyagaraju, 2016; Jan et al., 2010).

Tables 6 and 7 illustrate the findings of measuring the potential of rivers that can be exploited for clean water development. Table 6 Results of measurement of the current discharge potential of Badung River Source: measurement results, 2020 Table 7 Results of measurement of the current discharge potential of Mati River Source: Measurement results, 2020

4 Conclusion Several inferences can be drawn from 19 the results of the previous section's explanation, such as: a) For its own regional income, Badung Regency is heavily on tourism. b) This Regency has an uneven population pulse, with the biggest population concentration in the South Kuta sub-district, based on the number of inhabitants. c) Water requirements for residential use are estimated based on a population of 630.00 people in 2018 and water demands of 925 liters per second. d) Meanwhile, non-domestic water consumption is 217.85 liters per second, primarily 11 in the tourism industry.

e) When comparing non-domestic and domestic water needs, it can be concluded that non-domestic water needs 1 for the tourism sector in Badung regency are 23.54 % f) For future water fulfillment, Badung Regency can utilize water from the Badung river through the Nusa Dua estuary reservoir with an increased capacity and by taking water from the Mati river. This can be done after seeing 19 the results of the instantaneous discharge measurement which is ideal for use in the downstream

No	Discharge (m ³ /second)	Wide Water level (m)	Velocity (m/second)
1	L1 1.5	H1 0.24	V1 0.75
2	L2 2	H2 0.23	V2 0.73
3	L3 2	H3 0.24	V3 0.74
4	L4 2	H4 0.24	V4 0.75
5	L5 2	H5 0.24	V5 0.73
6	L6 2	H6 0.23	V6 0.74
7	L7 2	H7 0.24	V7 0.74
8	L8 2	H8 0.25	V8 0.74
9	L9 2	H9 0.24	V9 0.74
10	L10 1.5	H10 0.24	V10 0.75
11	L11 1.5	H11 0.23	V11 0.75
12	L12 1.5	H12 0.24	V12 0.75
Total	22	Average 0,24	Average 3,89

No	Discharge (m ³ /second)	Wide Water level (m)	Velocity (m/second)
1	L1 2	H1 0.5	V1 0.52
2	L2 2	H2 0,35	V2 0.57
3	L3 2	H3 0.45	V3 0.52
4	L4 2	H4 0.51	V4 0.60
5	L5 3	H5 0.45	V5 0.47
6	L6 3	H6 0.33	V6 0.29
7	L7 2	H7 0.25	V7 0.28
Total	16	Average 0.41	Average 0.46

Wide Water level Velocity

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