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Summary

The total estimated volume of clean water needed for the supply of the Jounieh Floating Island is 99,045.2 L/day.

1. GENERAL

1.1. Introduction

This document presents the daily volume of clean water needed to supply the Jounieh Floating Island.

1.2. Definitions

- Developed length: the length along the centerline of a pipe and fittings.
- Diameter: unless specifically stated, it is the inner diameter of the pipe.
- Fixture unit: a quantity in terms of which the load producing effects on the plumbing fixtures are expressed on some arbitrarily chosen scale.
- Flush valve: a valve located at the bottom of a tank for the purpose of flushing water closets and similar fixtures.
- Horizontal branch: a drain pipe extending laterally from a soil or waste stack or building drain with or without vertical sections or branches, which receives the discharge from one or more fixture drains and conducts it to the soil or waste stack or to the building drain.
- Main: the principal artery of any system of continuous piping to which branches may be connected.
- Riser: a water supply pipe which extends vertically one full story or more to convey water to branches or fixtures.

1.3. Abbreviation

- | | |
|---------|--------------------------------|
| – CW | Cold water |
| – CWSFU | Cold water supply fixture unit |
| – DL | Developed length |
| – Ft | Feet |
| – FU | Fixture unit |
| – HW | Hot water |
| – HWR | Hot water return |
| – HWSFU | Hot water supply fixture unit |
| – In | inch |
| – L | Liter |
| – Mezz | Mezzanine |
| – Mm | Millimeter |
| – Per | Person |
| – Psi | Pound per square inches |

– Qty	Quantity
– TEL	Total equivalent length
– WS	Water supply
– WSFU	Water supply fixture unit

1.4. Applicable codes

- 1997 Uniform Plumbing Code, twenty-first edition, ISSN 0733-2335
- American Society of Plumbing Engineers Data Book, Volume 1, ISBN 1-891255-06-1

1.5. Applicable references

- Mechanical and Electrical Equipment for Buildings, ninth edition, 2000 by John Wiley & Sons, ISBN 0-471-15696-5
- Ships and marine technology-drainage systems on ships and marine structures, Reference number: ISO 15749-1:2004 (E) and ISO 15749-3:2004 (E)

2. Fresh Water Supply

2.1. Estimated Water Supply Daily Volume

Using figure 1 below, the daily volume of water needed for the supply of the island is computed. Calculations are tabulated for each deck level in table 1. Based on these numbers, the reverse osmosis system as well as the storage tanks will be sized.

Building Usage	Per Capita (as Listed) Daily Usage	
	Gallons	(Liters)
Airports (per passenger)	3-5	(11-19)
Apartments, multiple family (per resident)	60	(227)
Bath houses (per bather)	10	(38)
Camps		
Construction, semipermanent (per worker)	50	(189)
Day with no meals served (per camper)	15	(57)
Luxury (per camper)	100-150	(378-568)
Resorts, day and night, with limited plumbing (per camper)	50	(189)
Tourist, with central bath and toilet facilities (per person)	35	(132)
Cottages with seasonal occupancy (per resident)	50	(189)
Courts, tourist, with individual bath units (per person)	50	(189)
Clubs		
Country (per resident member)	100	(378)
Country (per nonresident member present)	25	(95)
Dwellings		
Boardinghouses (per boarder)	50	(189)
Additional kitchen requirements for nonresident boarders	10	(38)
Luxury (per person)	100-150	(378-568)
Multiple-family apartments (per resident)	40	(151)
Rooming houses (per resident)	60	(227)
Single family (per resident)	50-75	(189-284)
Estates (per resident)	100-150	(378-568)
Factories (per person per shift)	15-35	(57-132)
Highway rest area (per person)	5	(19)
Hotels with private baths (two persons per room)	60	(227)
Hotels without private baths (per person)	50	(189)
Institutions other than hospitals (per person)	75-125	(284-473)
Hospitals (per bed)	250-400	(946-1514)
Laundries, self-service (per washing)	50	(189)
Livestock (per animal)		
Cattle (drinking)	12	(45)
Dairy (drinking and servicing)	35	(132)
Goat (drinking)	2	(8)
Hog (drinking)	4	(15)
Horse (drinking)	12	(45)
Mule (drinking)	12	(45)
Sheep (drinking)	2	(8)
Steer (drinking)	12	(45)
Motels with bath, toilet, and kitchen facilities (per bed space)	50	(189)
With bed and toilet (per bed space)	40	(151)
Parks		
Overnight, with flush toilets (per camper)	25	(95)
Trailer, with individual bath units, no sewer connection (per trailer)	25	(95)
Trailer, with individual baths, connected to sewer (per person)	50	(189)
Picnic		
With bathhouses, showers, and flush toilets (per picnicker)	20	(76)
With toilet facilities only (per picnicker)	10	(38)

Building Usage	Per Capita (as Listed) Daily Usage	
	Gallons	(Liters)
Poultry		
Chickens (per 100)	5–10	(19–38)
Turkeys (per 100)	10–18	(38–68)
Restaurants with toilet facilities (per patron)	7–10	(26–38)
Without toilet facilities (per patron)	2½–3	(9–11)
With bar/cocktail lounge (additional quantity per patron)	2	(8)
Schools		
Boarding (per pupil)	75–100	(284–378)
Day, with cafeteria, gymnasium, and showers (per pupil)	25	(95)
Day with cafeteria but no gymnasiums or showers (per pupil)	20	(76)
Day without cafeteria, gymnasiums, or showers (per pupil)	15	(57)
Service stations (per vehicle)	10	(38)
Stores (per toilet room)	400	(1514)
Swimming pools (per swimmer)	10	(38)
Theaters		
Drive-in (per car space)	5	(19)
Movie (per auditorium seat)	5	(19)
Workers		
Construction (per person per shift)	50	(189)
Day (school or office, per person per shift)	15	(57)

Source: *Manual of Individual Water Supply Systems* (1975).

*These values may be reduced as follows: with flow controls, up to 25% reduction
; with water recycling, up to 50% reduction.

Figure 1: Water Supply Building Usage - Mechanical and Electrical Equipment for Buildings, 9th edition, table 9.2, p.538-9

Table 1: Estimation of the daily volume of water needed based on the type of occupancy

Item	Type of Occupancy	Description	Volume / Capita (L/day)	Qty. (#)	Daily volume (L/day)	
Hull						
1	Hotels with private baths(2 per./room)	Guest rooms	227.0	76.0	17,252.0	
2	Hotel w/o private baths (per person)	Labor staff rooms	189.0	55.0	10,395.0	
3	Toilet (per customer)	Laundry and kitchen Storage	26.5	8.0	212.0	
4	Laundries, self-service(per washing)	laundry and linens storage	189.3	16.0	3,028.8	
5	Stores(per toilet room)	Kitchen storage and cold storage	151.4	2.0	302.8	
6	Swimming pool (per swimmer)	Swimming pool services	38.0	88.0	3,344.0	
					Subtotal	34,534.6
Main Deck						
7	Restaurant with toilet facilities (per patron)	Restaurant and public toilets	26.0	439.0	11,414.0	
8	Bar cocktail lounge(per patron)	Snack/Drink bar	8.0	70.0	560.0	
9	Club (per resident member)	Maksaf	218.9 ¹	183.0	3,458.7	
					Subtotal	15,432.7

¹ Assumed to be equal to its waste water flow rate

Mezzanine					
10	Hotels with private baths(2 persons per room)	Guest rooms	227.0	10.0	2,270.0
11	Toilet facilities (per patron)	Kitchen WC, public toilets, Gym & Spa wet area	32.0	79.0	2,528.0 ²
12	Hospital (per bed)	Hospital	946.0	2.0	1,892.0
13	Bar cocktail lounge(per patron)	Coffee shop	8.0	60.0	480.0
14	Kitchen(per meal)	Kitchen	22.7 ³	963.0	21,860.1
15	Spa	Spa	-	-	-
				Subtotal	29,030.1
First Floor					
16	Hotels with private baths(2 persons per room)	Guest rooms	227.0	21.0	4,767.0
17	Hotel w/o private baths (per person)	Service room	189.0	6.0	1,134.0
				Subtotal	5,901.0
Second Floor					
18	Hotels with private baths(2 persons per room)	Guest rooms	227.0	17.0	3,859.0
19	Hotel w/o private baths (per person)	Service room	189.0	4.0	756.0
				Subtotal	4,615.0

² Rows 11 is equivalent to rows 11 & 12 in the waste water table

³ Assumed to be equal to its waste water flow rate

Third Floor					
20	Hotels with private baths(2 persons per room)	Guest rooms	227.0	9.0	2,043.0
21	Hotel w/o private baths (per person)	Service room	189.0	4.0	756.0
				Subtotal	2,799.0
Fourth Floor					
22	Restaurant with toilet facilities(per patron)	Restaurant and public toilets	26.0	197.0	5,122.0
23	Hotel w/o private baths (per person)	Service room	189.0	6.0	1,134.0
				Subtotal	6,256.0
Bridge					
24	Hotels with private baths(2 persons per room)	3 toilets in the bridge	227.0	2.0	454.0
25	Kitchenette (per meal)	Kitchenette	7.6 ⁴	3.0	22.8
				Subtotal	476.8
Total Estimated water supply					99,045.2 L/day

⁴ Assumed to be equal to its waste water flow rate