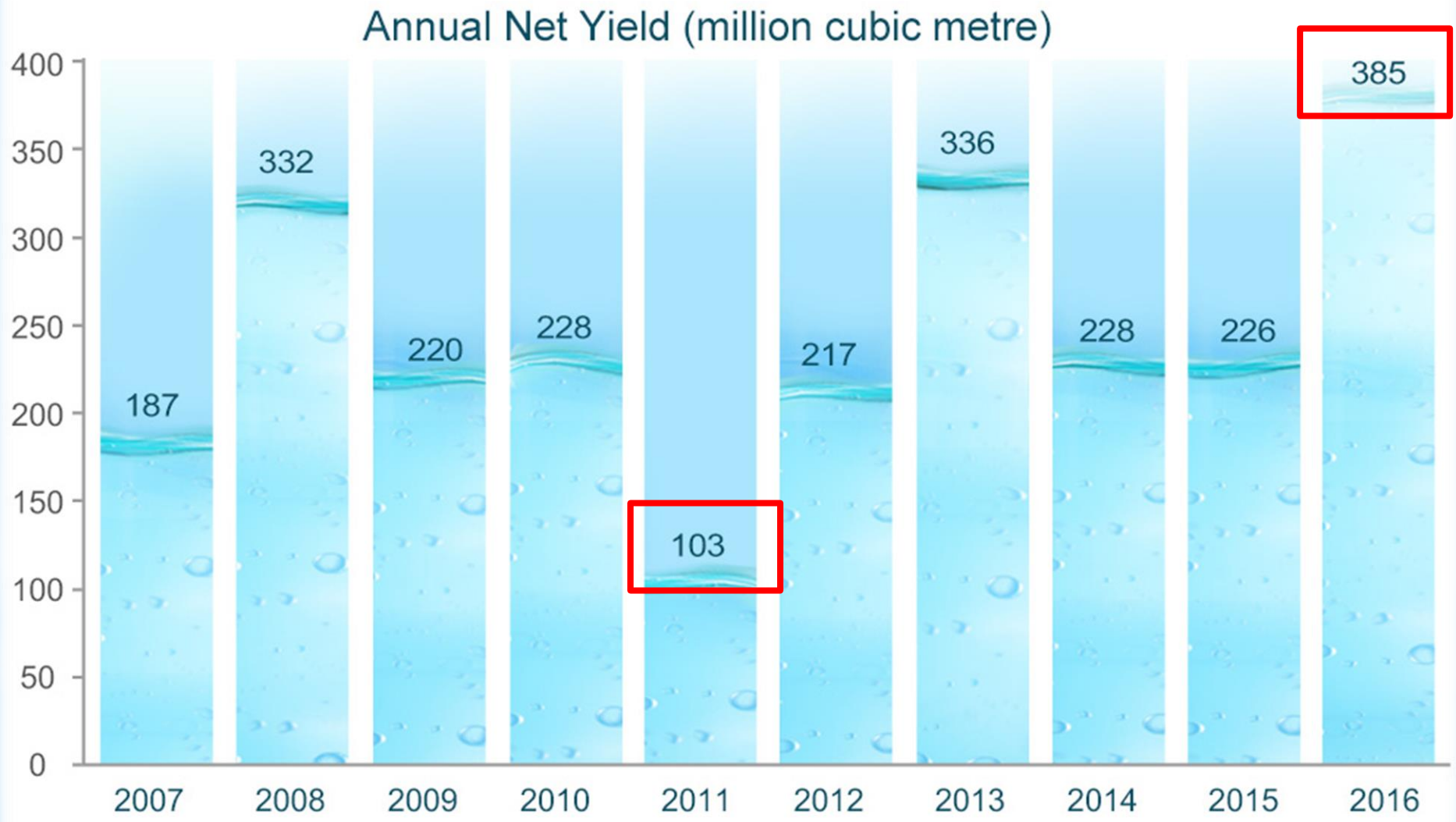
Water Crisis - Myth or Reality

Water Crisis – Myth or Reality

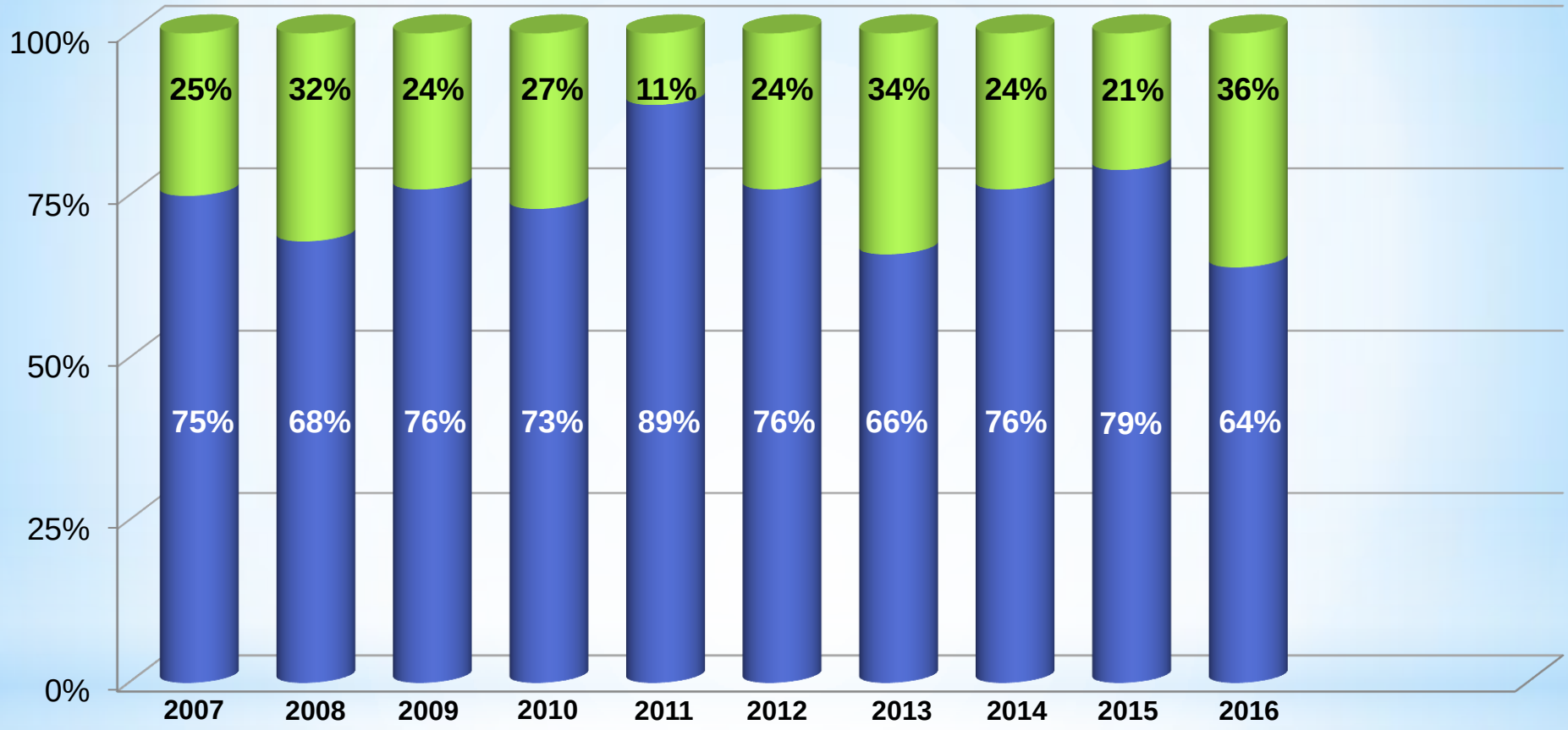
- Introduction
- Current Water Supply in Hong Kong
- Risk Management
- RO Desalination
- Conclusion

Yield from catchment area



Source :Water Supplies Department

Sources of Water Supply – 2007 to 2016



Source : Water Supplies Department

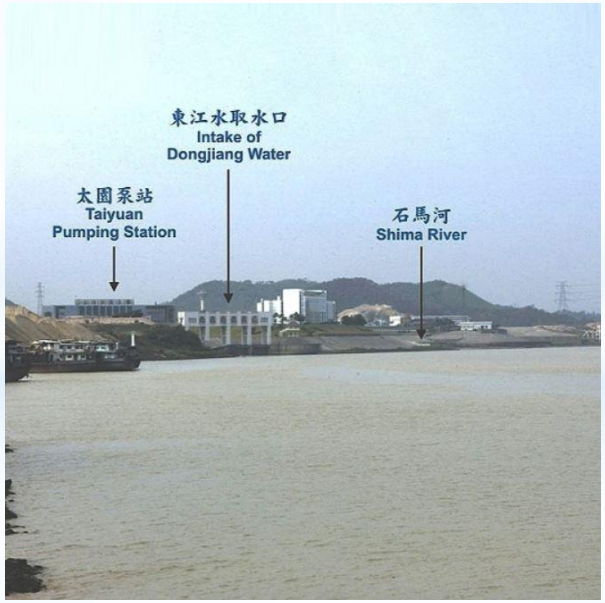
Dongjiang Water

Local Yield (*rainwater*)

Consumption in 2016: 982M *(Say 1 Billion cubic metre)*
Daily average = 2.7M


Schematic Layout Plan of Dongjiang-Shenzhen Water Supply Scheme
After Improvement Works
Before Improvement Works
Dongjiang
Taiyuan Pumping Station
Stage 2 & 3 Dongjiang Pumping Station
Linhu Pumping Station
Qiaotou
Shima River
Shima Pumping Station
Qiling Pumping Station
Matan Pumping Station
Zhangmutou
Tangxia Pumping Station
Tangxia
Jinhu Pumping Station
Zhutang Pumping Station
Shaling Pumping Station
Shangpu Pumping Station
Yantian Pumping Station
Yantian Tunnel
Yantian Reservoir
Shawan Water Tunnel
Shenzhen Reservoir
Bio-nitrification Plant
Shenzhen Reservoir
Taiyuan Pumping Station
Linhu Pumping Station
Qiling Pumping Station
Jinhu Pumping Station
Yantian Tunnel
Shawan Water Tunnel
Deliver Point to Hong Kong
Dongjiang
5


Dongjiang
Tonghu
Dongguan
Taiyuan Pumping Station
Linhu Pumping Station
Changping
Qiling Pumping Station
Qingxi
Jinhu Pumping Station
Fenggang
Guanlan
Shenzhen
Shenzhen Reservoir
Muk Wu Pumping Station
Hong Kong
Dedicated aqueduct
Open Channel
Yantian Tunnel
Connecting pipe between the Shenzhen Reservoir and Muk Wu Pumping Station
Pumping station


東江水取水口
Intake of Dongjiang Water
太園泵站
Taiyuan Pumping Station
石馬河
Shima River

Principal Water Supply System in Hong Kong

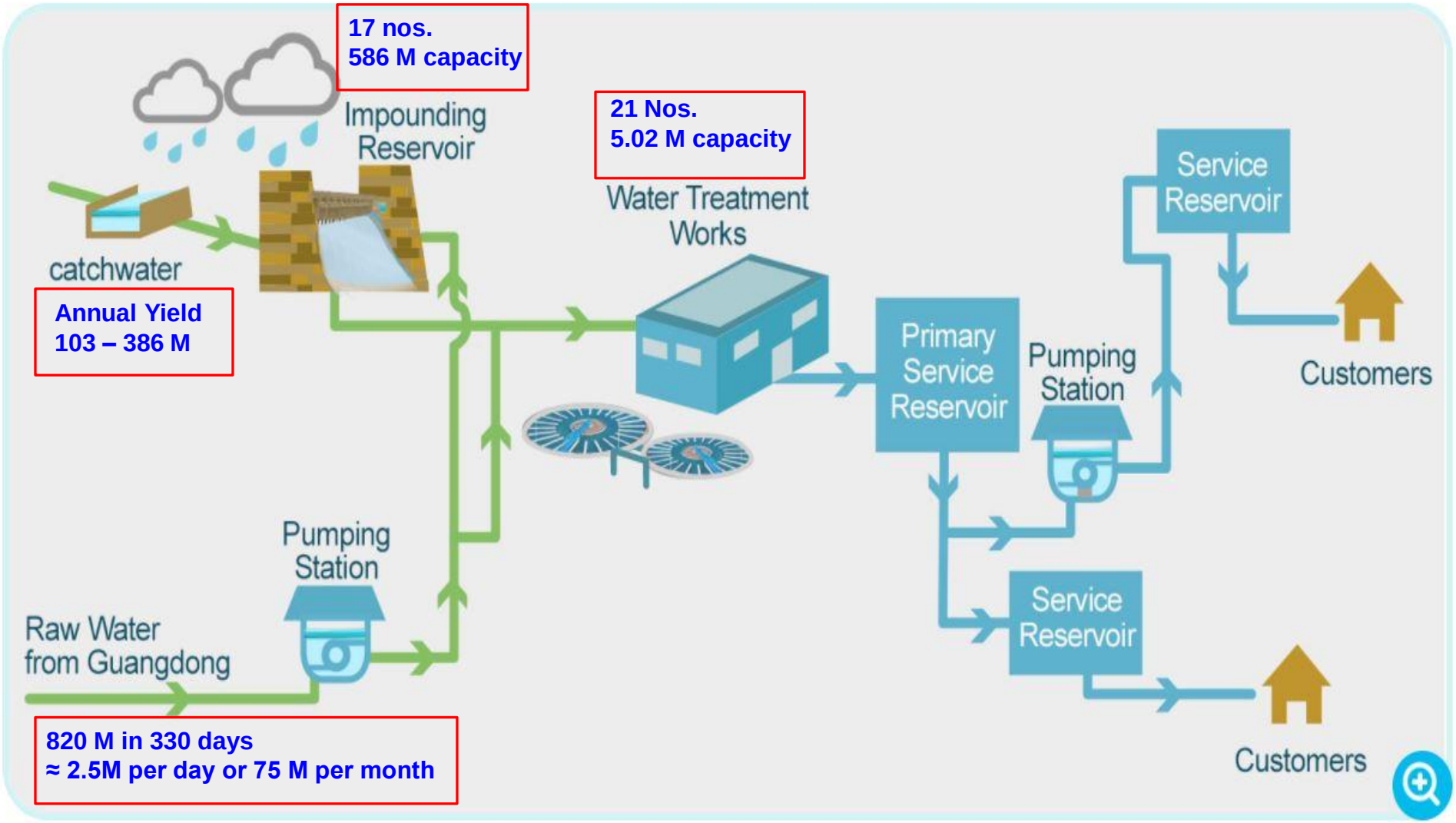
Transfer Tank

Overflow of Reservoirs

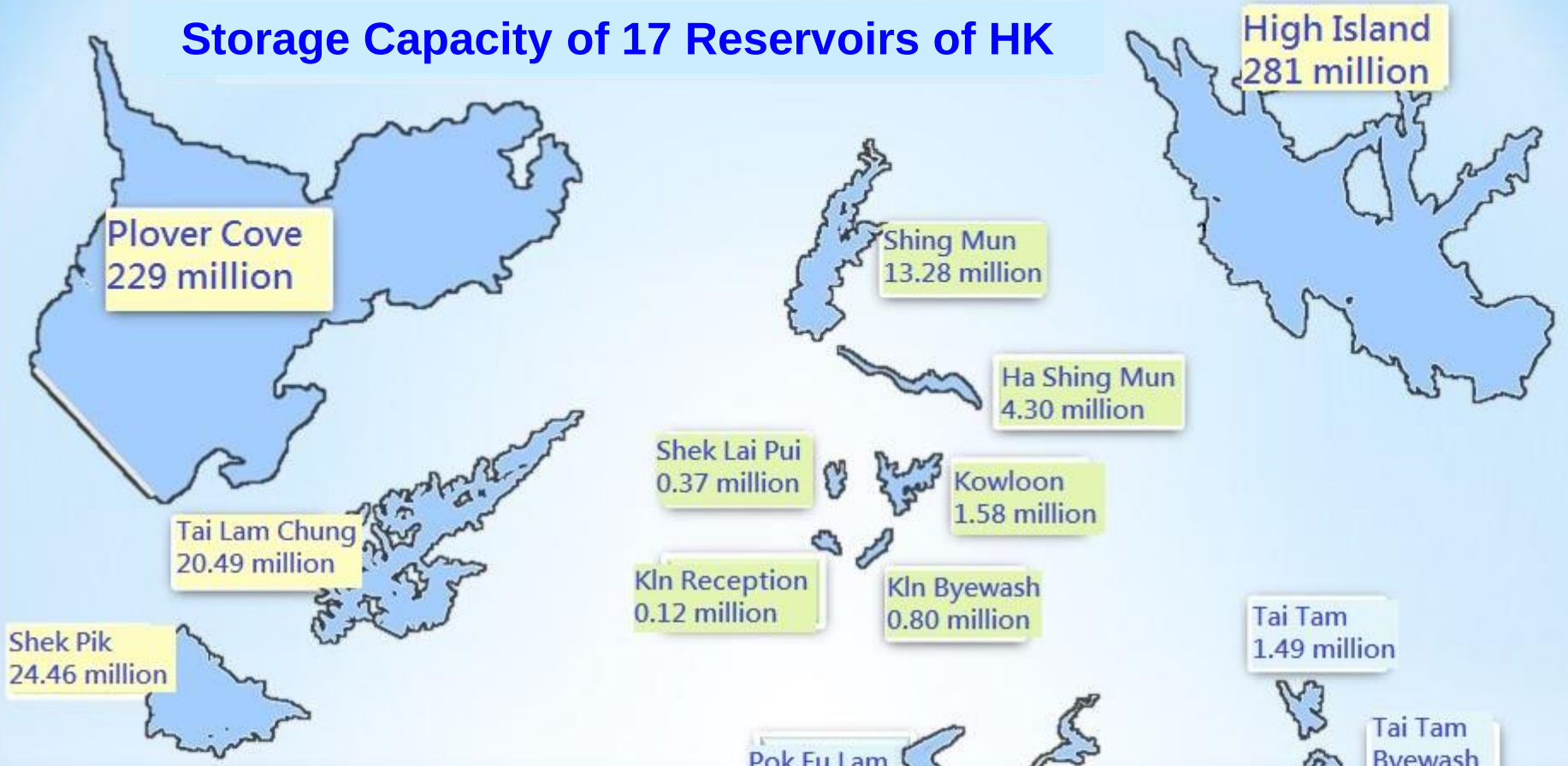
No Inter-Reservoirs Transfer Scheme

Our capacity on receiving Dongjiang water

Fresh Water Supply System



Storage Capacity of 17 Reservoirs of HK



2015/16 Yield From Catchment Area

	Reservoir	Capacity Million M3	Yield Million M3	Area Hectares
1	High Island	281	138	667
2	Plover Cove	229		1200
	Total	510		
3	Old Reservoirs	76	132	N.A.

Size of Reservoirs on scale

水塘存水量 ('000 立方米)

Week	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	402,851	376,252	366,313	365,525	379,946	367,755	390,968	423,542	**400,924**
2	397,281	374,745	366,308	366,631	378,677	349,144	394,206	417,909	391,489
3	393,538	373,635	0	367,560	376,672	351,399	400,453	414,599	387,390
4	390,082	372,041	368,276	368,835	374,369	352,250	403,467	410,715	383,373
5	385,681	370,481	368,472	369,058	373,693	352,995	416,202	407,903	378,751
6	0	0	368,397	369,509	373,518	353,800	415,990	405,942	375,550
7	381,920	370,760	368,336	372,025	372,720	0	416,172	402,438	373,446
8	380,780	370,693	0	373,414	371,746	0	415,035	398,895	372,485
9	378,210	369,253	370,066	373,680	370,713	0	413,422	396,903	371,785
48	467,960	448,951	442,355	461,486	433,795	476,516	507,279	480,669	
49	451,471	**449,163**	428,149	444,576	434,055	462,470	495,497	479,729	
50	432,637	431,001	410,741	426,752	422,517	445,916	477,533	460,319	
51	414,881	412,676	393,128	412,051	403,359	427,085	459,314	440,016	
52	391,656	389,871	375,623	404,368	395,637	409,468	441,989	420,055	
	19,544,133	18,677,274	19,982,219	22,692,813	21,495,278	15,846,043	23,066,354	23,101,184	8,915,052
Average	415,833	397,389	407,800	436,400	413,371	440,168	443,584	444,254	371,461
					414,159			9-year average	418,918

Current Storage Position of Impounding Reservoirs

Storage Position of Impounding Reservoirs (Update Weekly)

	4 June 2018	Same Day Last Year
Total Storage of Impounding Resevoirs (Million Cubic Metre)	354.514	410.863
% Full	60.49%	70.11%

Storage in Reservoirs as reserve for Hong Kong?

How long we can survive = storage / consumption

- **Current Situation**

419 M* ÷ **2.7 M** = **155 Days**

- Average water storage figure of 2010 - 2018 as per Water Supplies Department

- **If 3 receiving reservoirs are also contaminated**

(full capacity of remaining 14 reservoirs is 54.7M)

54.7M ÷ **2.7 M** = **20 Days**

- **During drought (30% storage)**

16.1M ÷ **2.7 M** = **6 Days**

Storage in Reservoirs as reserve for Hong Kong?

How long we can survive = storage / consumption

- **Current Situation**

419 M	÷	2.7 M	=	155 Days

- **With 1 RO desalination plants**

352 M*	÷	2.43 M （2.7 x 90%）	=	145 Days

- **With 2 RO desalination plants**

352 M*	÷	2.16 M （2.7 x 80%）	=	163 Days

- **With 3 RO desalination plants**

352 M*	÷	1.89 M （2.7 x 70%）	=	186 Days

* - The lowest water storage figure from 2010 – 2018 as per Water Supplies Department

Storage in Reservoirs as reserve for Hong Kong?

3 receiving reservoirs are also contaminated

- Current Situation (full capacity of remaining 14 reservoirs is 54.7M)

54.7M ÷ 2.7 M = 20 Days

- With 1 RO desalination plants

54.7M ÷ 2.43 M (2.7 x 90%) = 23 Days

- With 2 RO desalination plants

54.7M ÷ 2.16 M (2.7 x 80%) = 25 Days

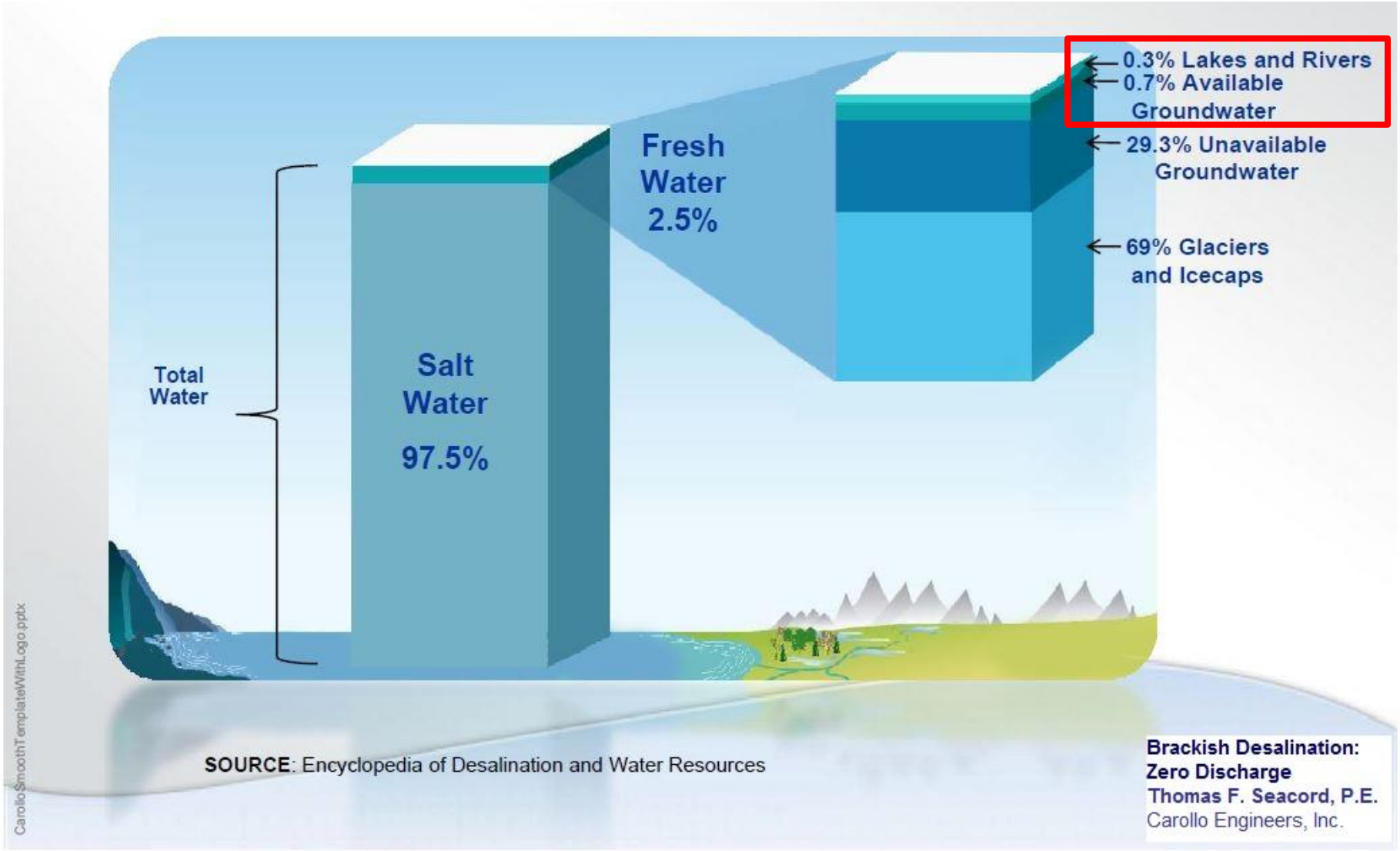
- With 3 RO desalination plants

54.7M ÷ 1.89 M (2.7 x 70%) = 29 Days

More resilience with 10%-30% continued fresh water supply

Should we adopt water desalination by RO

Saltwater is the most abundant water source on Earth

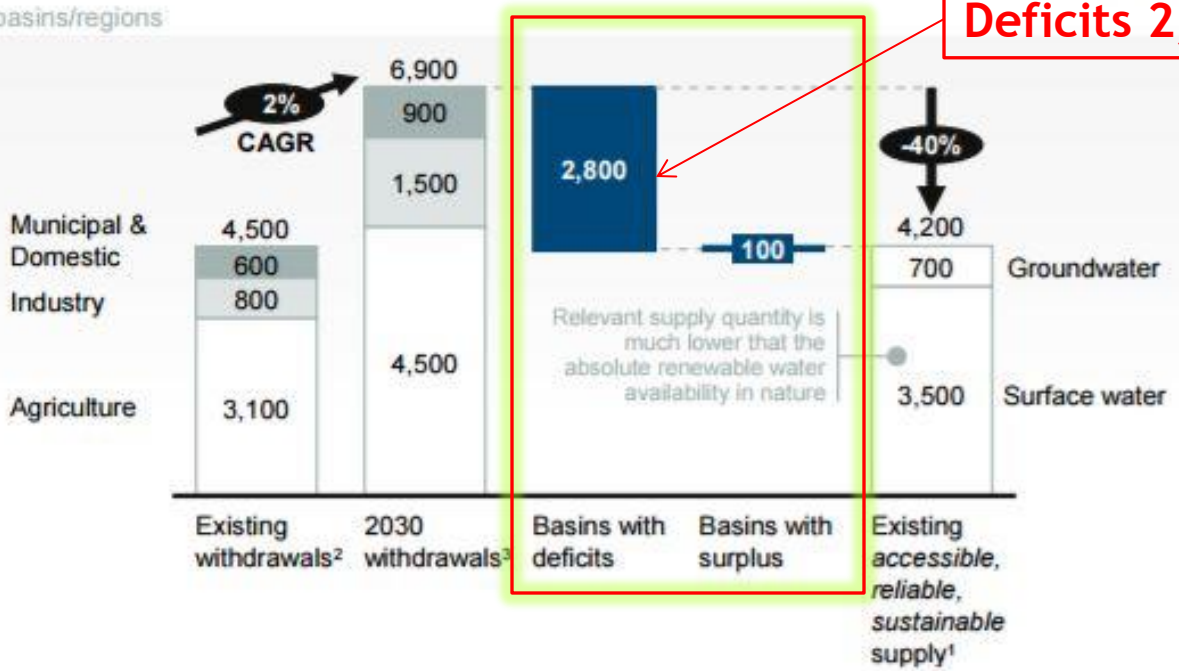


Global Water Shortage

Exhibit I

Aggregated global gap between existing accessible, reliable supply[1] and 2030 water withdrawals, assuming no efficiency gains

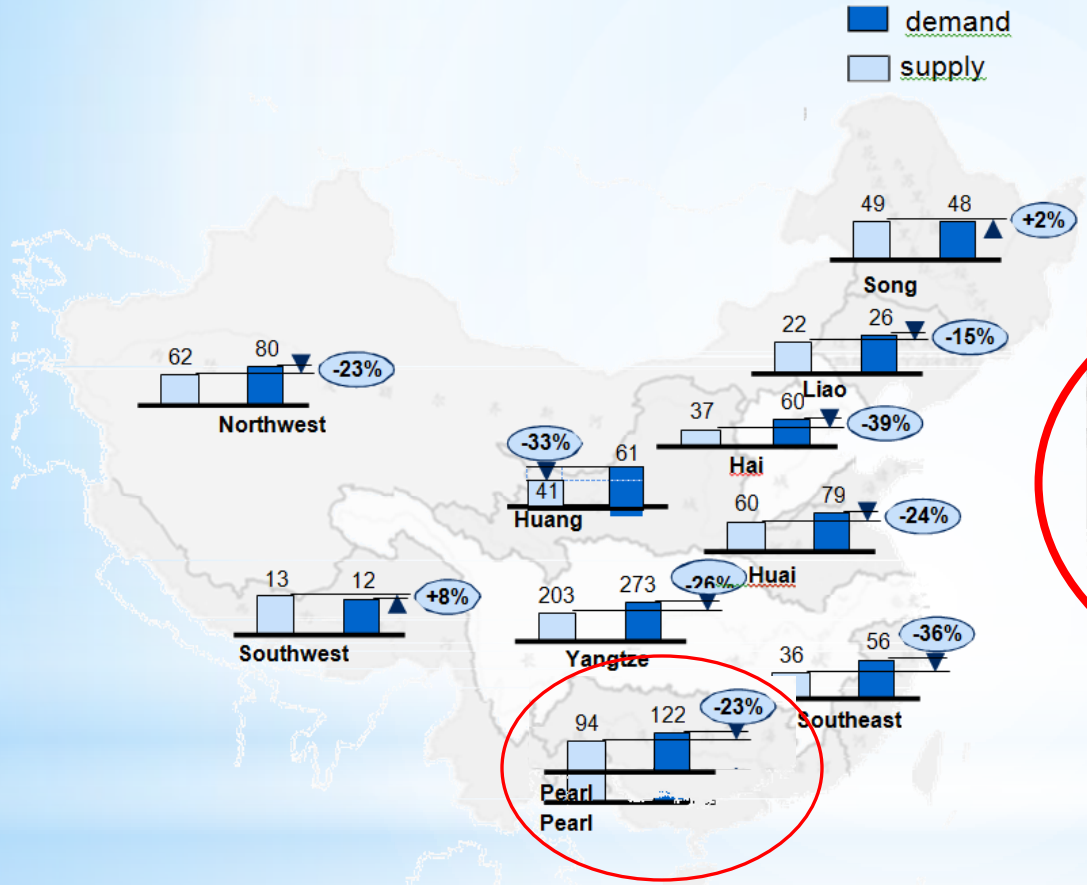
Billion m³, 154 basins/regions



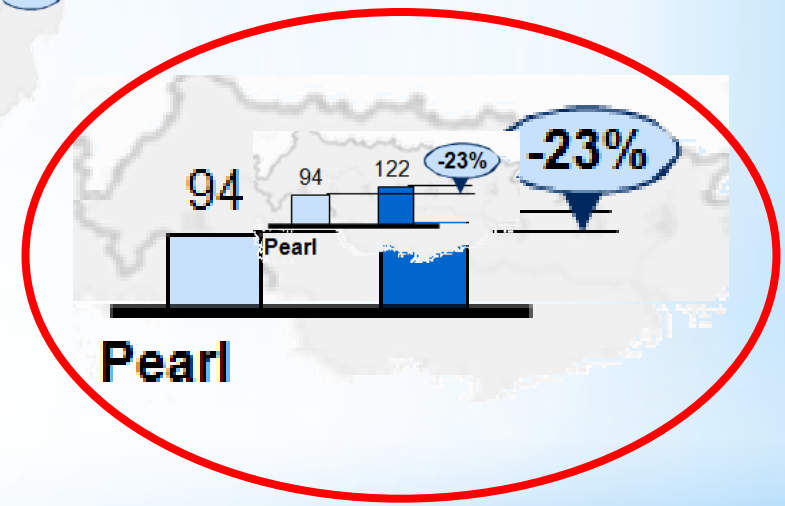
1 Existing supply which can be provided at 90% reliability, based on historical hydrology and infrastructure investments scheduled through 2010; net of environmental requirements
2 Based on 2010 agricultural production analyses from IFPRI
3 Based on GDP, population projections and agricultural production projections from IFPRI; considers no water productivity gains between 2005-2030

SOURCE: Water 2030 Global Water Supply and Demand model; agricultural production based on IFPRI IMPACT-WATER base case

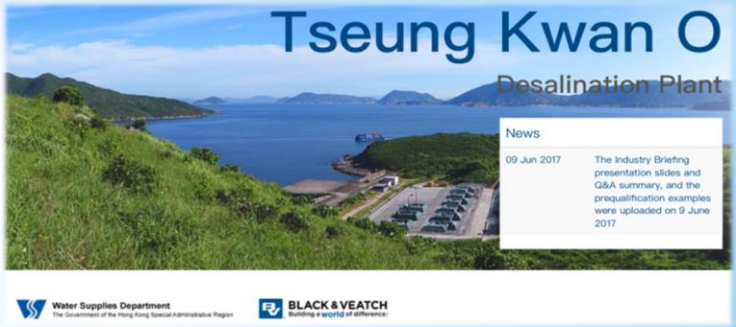
Water Shortage in China by 2030



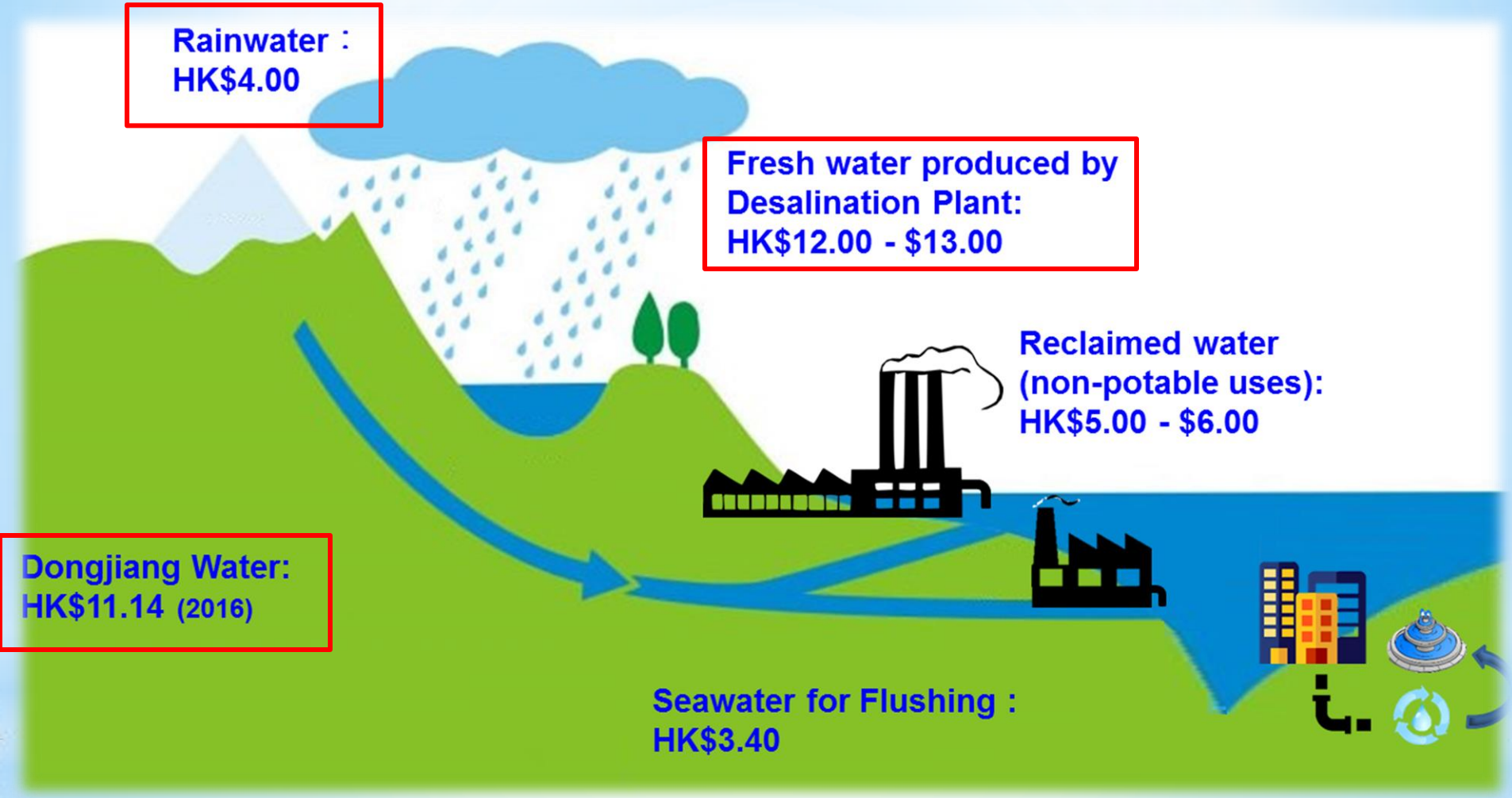
Pearl River Basin



28 Billion cubic metres



Unit Cost of Water in Hong Kong



Remarks: Figures from Water Supplies Department

Reverse osmosis works using semipermeable membranes to remove salt from water. Today's membranes are 20 times more efficient and one-fifth the cost of the first membranes tested in the 1950s.

Fact Sheet

Seawater desalination in Singapore

Research Office
Legislative Council Secretariat

FSC21/15-16

1. Introduction

1.1 In the 2000s, Sing alternative source of fresh diversification strategy. "fourth National Tap",[1] me to the Public Utilities Boar forecast to almost doubl Against this, the Singapor desalination capacity to the continue to be sourced fro to provide information on Singapore, including the pr

2. Seawater desalin

2.1 Being Singapore's 1970s the feasibility study alternative source of fresh fruition at that time due t improvement to seawater global popularity of the rev the production cost. Th seawater desalination in Sin

[1] The other three National Taps are from Malaysia; and (c) NEWater (
[2] PUB is a statutory board establish with managing Singapore's water
[3] RO technology is a desalination pr allows the passage of water mole

2.2 There are currently two seawater desalination plants in Singapore, namely the SingSpring Desalination Plant and the Tuasp These two plants are both located in Tuas,[4] adoptir operating with a combined capacity of producing al desalinated water per day.[5] They were built u partnership, whereby the private sector had been appoi build, own and operate the plants, and to deliver desali distribution to households and industries.

SingSpring Desalination Plant

2.3 The SingSpring Desalination Plant is the first plant in Singapore. It was constructed in 2004, and co 2005 with a designed annual capacity of 50 million c per day). The SingSpring Desalination Plant is infrastructure project awarded by PUB to the priv public-private partnership approach. Through ope Pte Ltd ("SingSpring")[6] was appointed to design, build, plant, as well as arranging the project financing. Und agreement signed between PUB and SingSpring, SingSpr desalinated water to PUB over a 20-year period from 20 of desalinated water in the first year of delivery was s per cu m.[7] Annual price adjustments for the subseque factors such as fuel price and rate of inflation.

Tuaspring Desalination Plant

2.4 Singapore's second seawater desalination Desalination Plant, was constructed in 2011. It con 2013 with a designed annual capacity of 116 million c per day). Being one of the world's most energ

desalination plants, the Tuaspring Desalination Plant is equipped with a self-sufficient on-site power plant to provide it with a secure source of electricity supply for seawater desalination. Excess power is sold to the national power grid.

2.5 PUB appointed Tuaspring Pte Ltd ("Tuaspring")[8] to design, build, own and operate the plant, as well as arranging the project financing. Under the bilateral water purchase agreement, Tuaspring is required to deliver desalinated water to PUB over a 25-year period from 2013 to 2038, with the price set at a low of S$0.45 (HK$2.79) per cu m in the first year of delivery.[9,10] Similar to that of the SingSpring Desalination Plant, subsequent annual price adjustments of the Tuaspring Desalination Plant also take into account factors such as fuel price and rate of inflation.

3. Production process of desalinated water

3.1 In Singapore, seawater is processed into desalinated water which is then blended with treated water from the reservoir for distribution to homes and industries. The desalination of seawater involves the following three processes:

(a) pre-treatment process – filtering suspended solids from seawater;

(b) double pass RO treatment process – removing salt from seawater by double passage of seawater through a semi-permeable membrane;[11] and

In a double pass RO system, the permeate water from the first pass becomes the feed water to the second pass. Further treatment of the permeate water through the second pass leads to production of higher quality desalinated water.

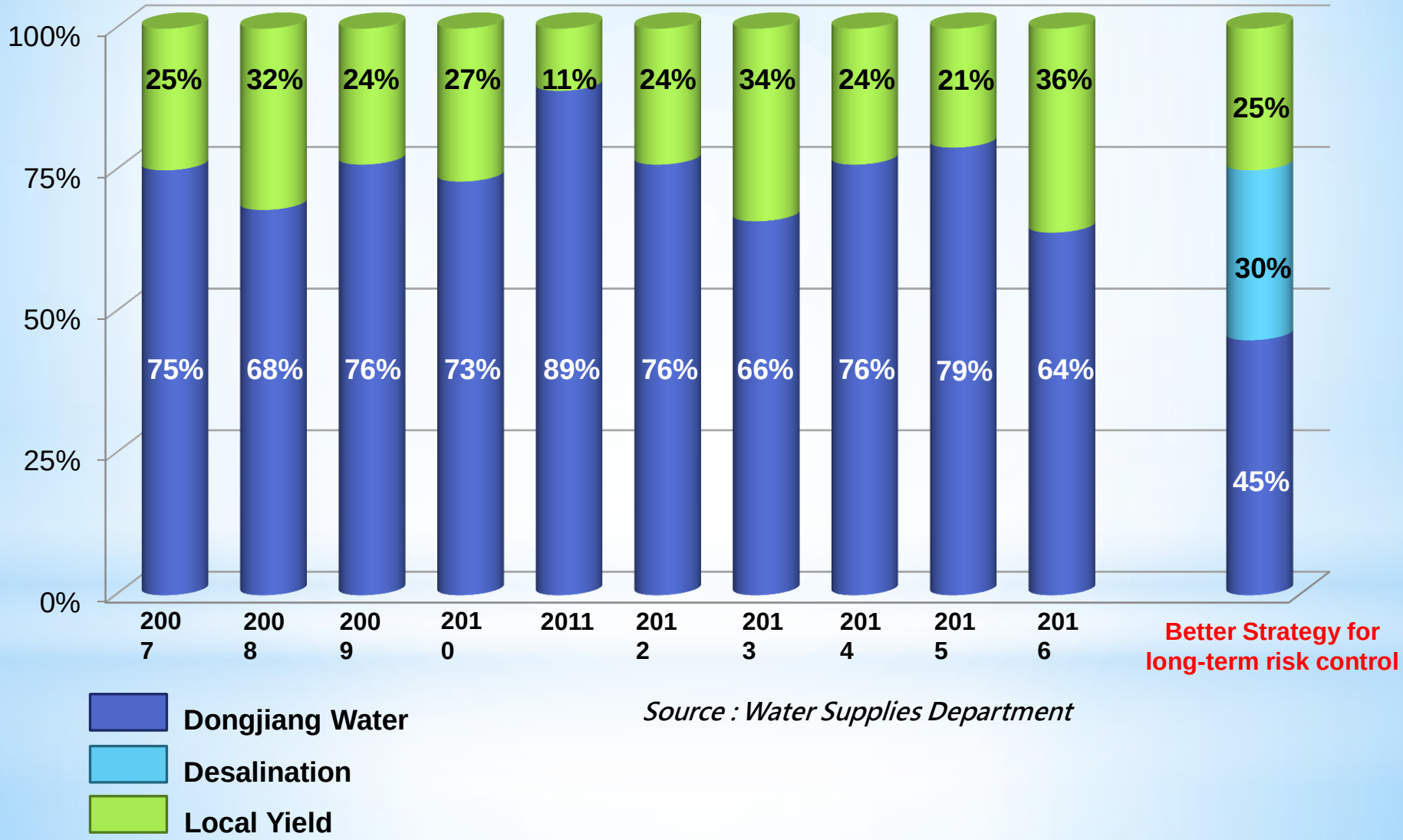
Tuaspring is required to deliver desalinated water to PUB over a 25-year period from 2013 to 2038, with the price set at a low of S$0.45 (HK$2.79) per cu m in the first year of delivery.

Electricity Consumption by Type of Users in 2017

Export 出口	4828	2.97%
Industrial 工業	11585	7.1%
Domestic 住宅	42127	26.7%
Commercial 商業	103893	66.2%
Total 總用電量	162432 TJ 太焦耳	

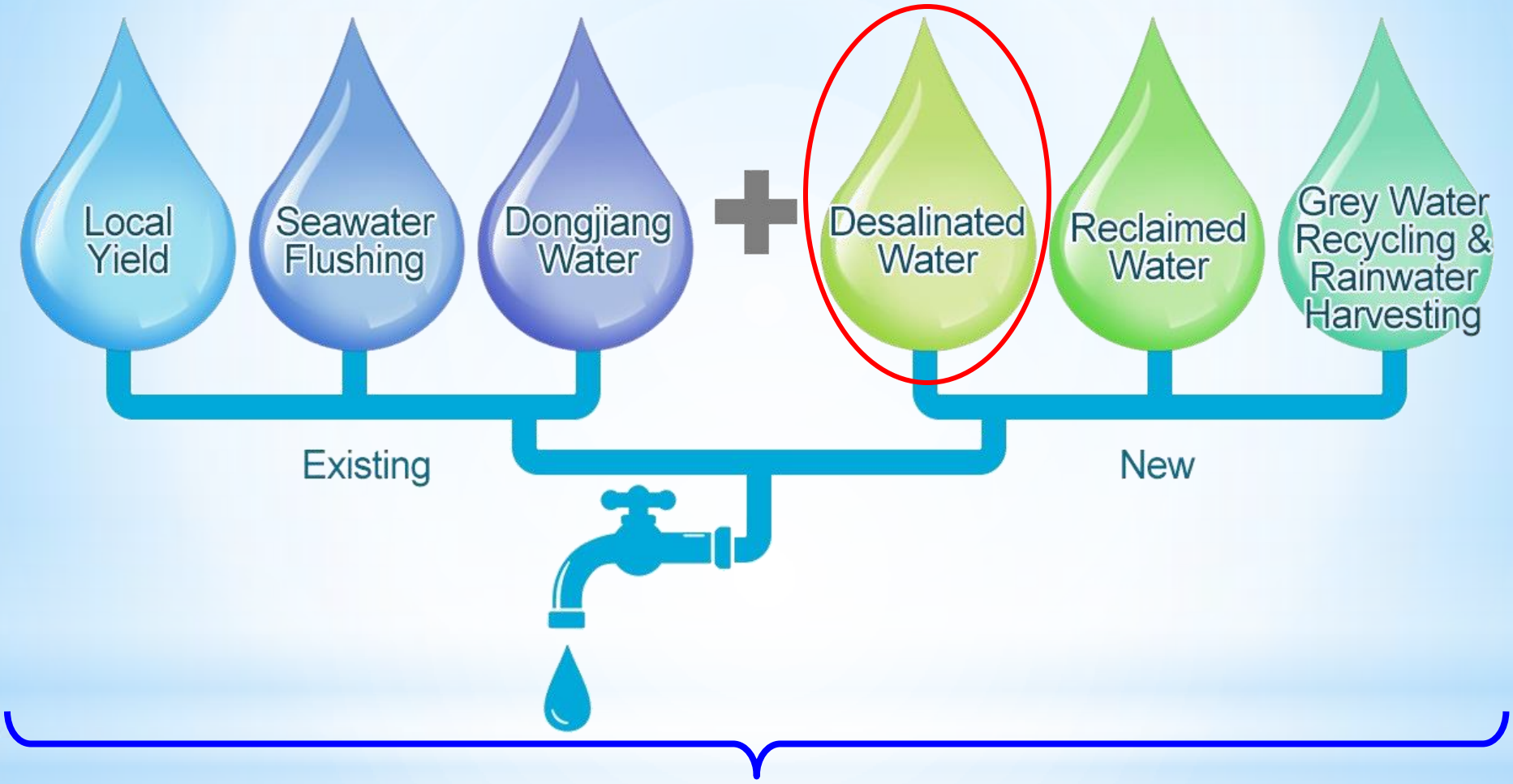
- 8-hectare site at TKO Area 137
- Ultimate water production capacity at 270000 m^3 per day
- Electricity Consumption
- 270000 x 3.5kwh = 945000kwh
- Say 1000000kwh, i.e. 3.6TJ
- 1314TJ a year
- 0.81% of 2017 electricity consumption
- 3 Desalination Plant of similar capacity
- 2.43% of 2017 electricity consumption

Sources of Water Supply – Better Strategy



Source : Water Supplies Department

The Total Water Management Strategy



Moving towards a 6-Pronged Water Supply Structure

Source : Water Supplies Department

Israel is creating a water surplus using desalination

By 2015 - 600 million cubic meters per year

An insurance policy against future extreme drought

largest SWRO desalination plant in the world

Capacity: 624,000 m^3/day (228 million m^3/year)

Technology: Reverse Osmosis (RO)

Project Type: Build-Operate-Transfer (BOT)

Location: Sorek, Israel

Footprint: 100,000 m^2 (10 ha)

Commission Date: 2013

Technological leadership

innovative design incorporating vertical arrangement of 16” membranes in a large-scale facility, resulting in a reduced footprint hence saving costs.

Environmental responsibility

minimizes marine, shoreline and land impacts thanks to pipe jacking of long and large diameter pipelines, smart structural design and sludge treatment for reduced energy and chemical consumption.

Carlsbad, California – carbon neutral SWRO Plant.

Thank you