

Early Waterworks in Kowloon

九龍早期供水設施

CACHe Seminar
14 January 2023

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Report on Kowloon Water Supply

8 Jan 1900 by L. Gibbs 九龍早期供水

- 3 Wells for 150k g tank @Yau Ma Ti, pumped into distributing mains with 2 S/Rs - Yaumati 160k g, Hunghom 90k g (total 250,000g)
- Finished in Dec 1895
- Estimate for 1902: Pop 44,000 Kln and N.T., [Kln City 2,000 Shamshuipo 1,500, 413, 000g/d], av =9 g/diem
- Planned for 500,000g/d
- Gathering grounds on the back of Kln is very similar to Tytam and PFL
- Option 1 was chosen out of 5 options

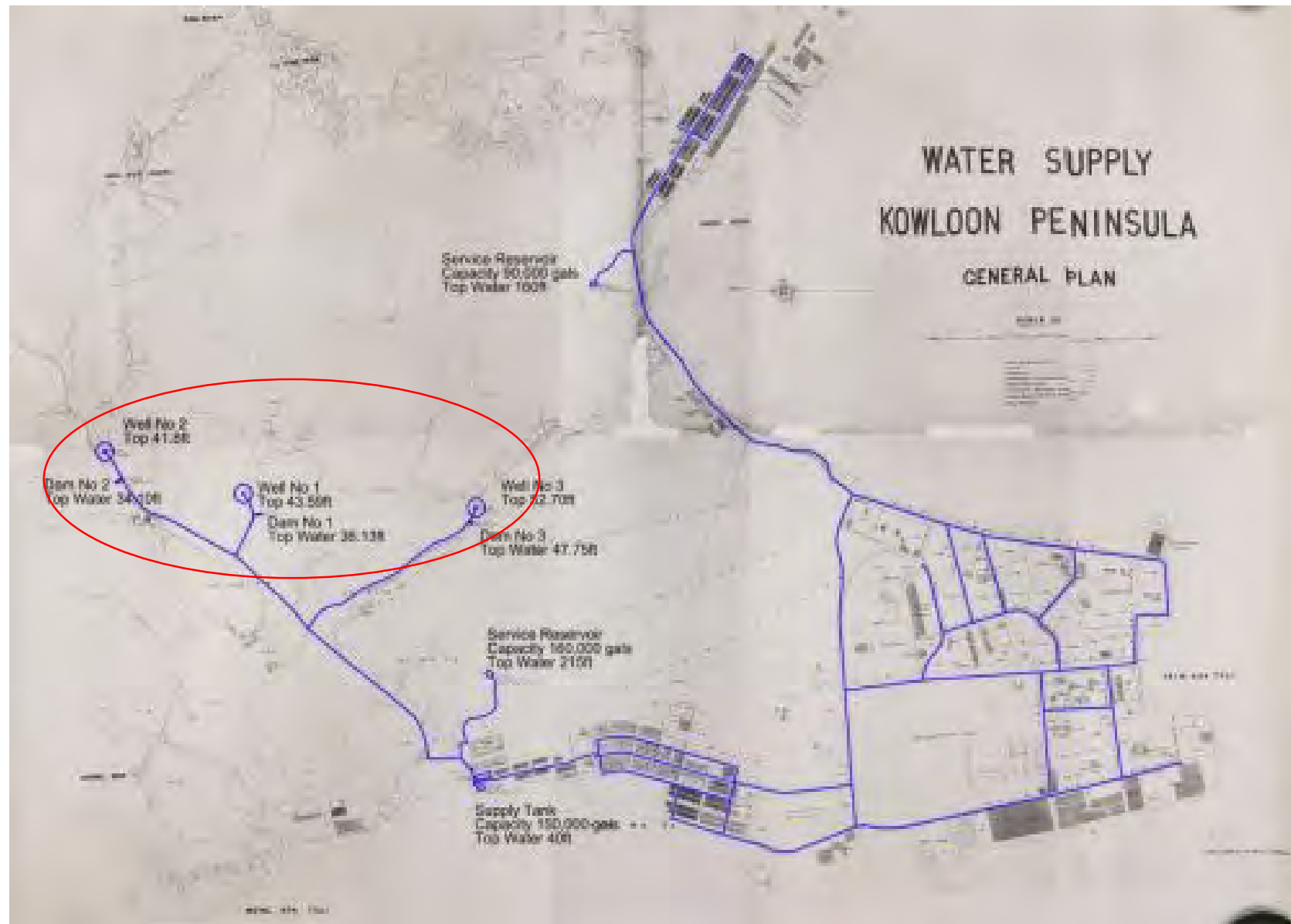
1895 Three Wells (Cooper and Chadwick Reports)

1895 供水系統:由3個井經泵房輸送食水

- Shallow wells and dams, connected by CI pipes to a tank of 150,000 g @ Yau Ma Tei, water pumped into distribution system.
- Regulated by two small reservoirs, YMT 215' 160,000g and @ Hunghom 160' 90,000g
- Supply 232,000g/d, pop @1891 =13,205 +1,000 Indian Troops
- In 1898, consumption > supply, authority for collection of supply from hills in NT, no fire hydrant
- Needed one S/R @ Kowloon City 150,000g

Distribution System

由3個井經泵房
輸送食水



Kowloon Water Supply (Cooper 1892 Report)

Well NO. 1 第1號井

Well No.1 (Proposal Chadwick 1890 Report)

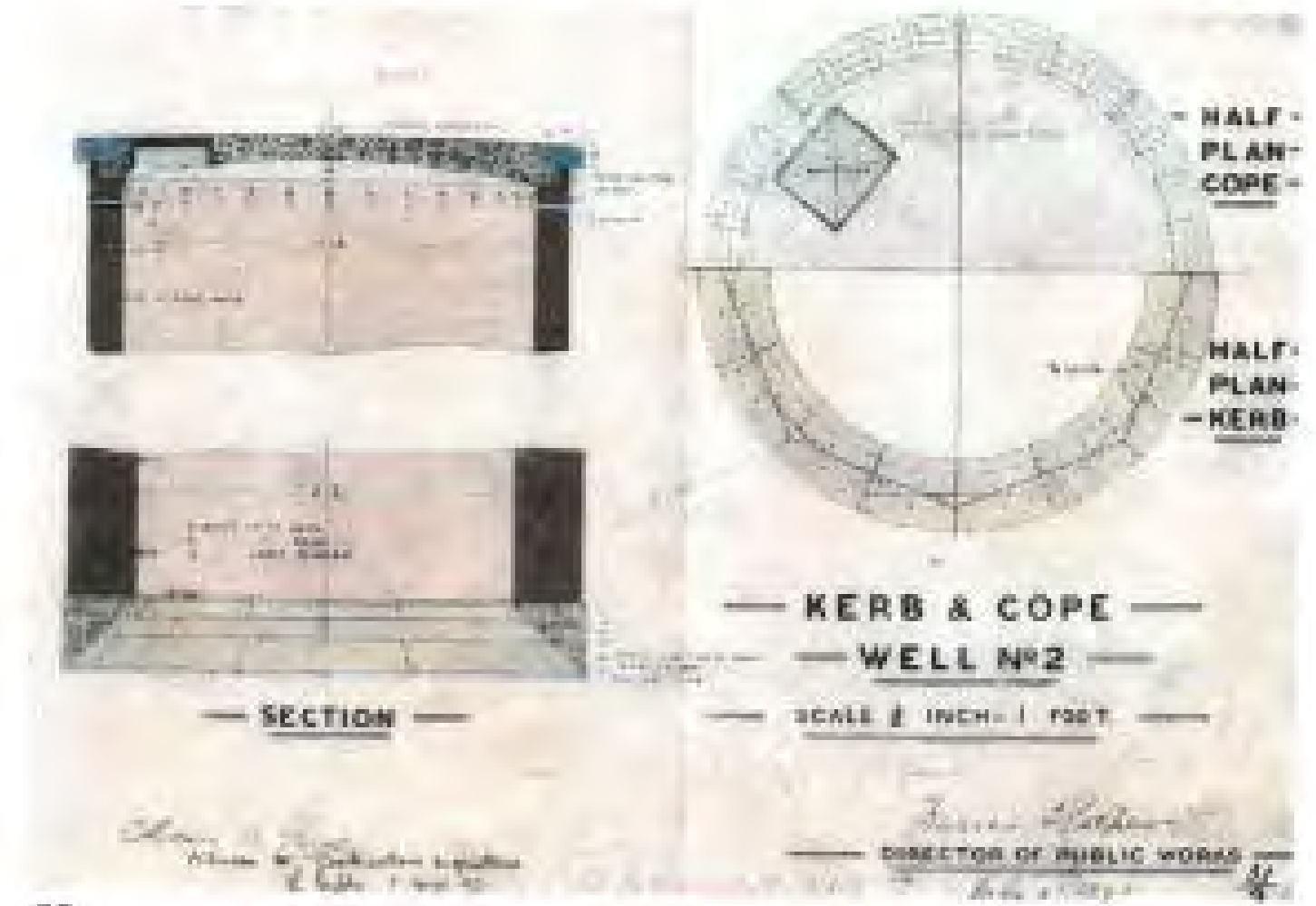
- Brick lining on a metal curb
- Lime concrete dam
- Area served: Mongkoktsui, Yaumati, Tsimshatsui, Hunghom (13,205 souls)
- Check availability of underground water

Well No. 2 and No. 3 第2號及第3號井

Well No.2 (\$4,000) and No.3 (\$4,800)

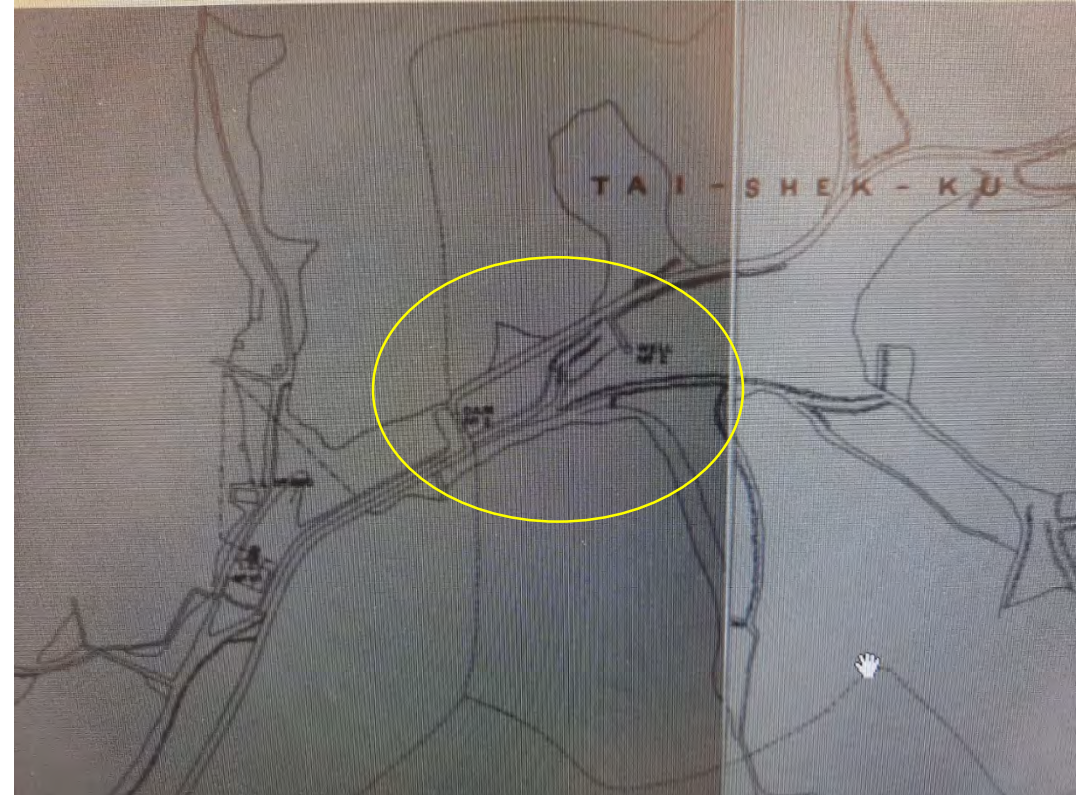
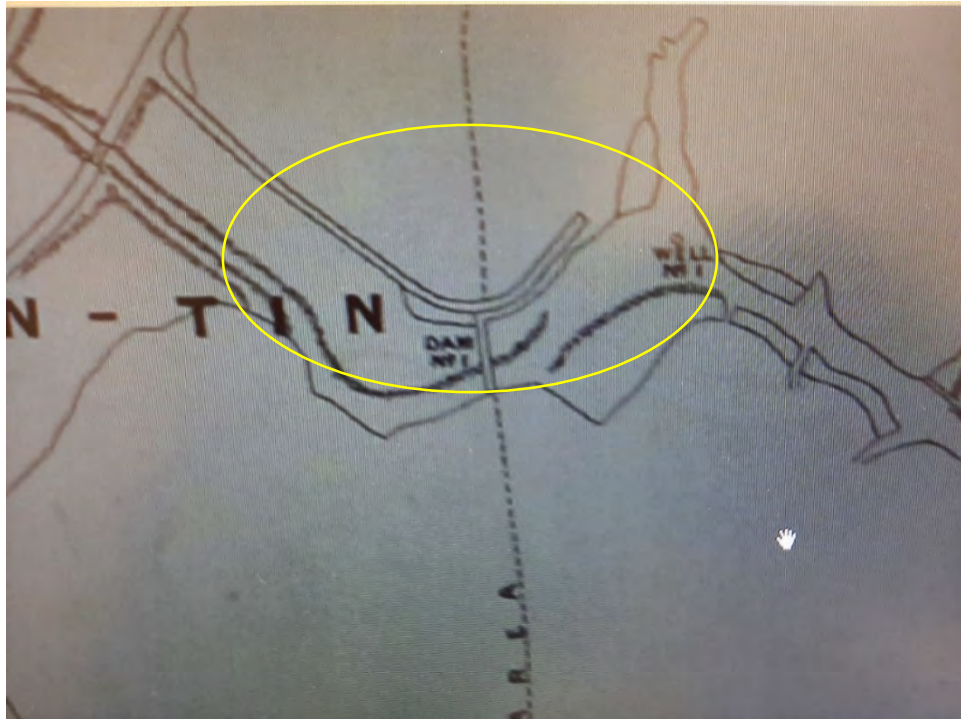
- 9' internal dia, sunk until the impervious substratum is reached + a concrete dam
- Ensure sufficient supply during the dry season
- Water connected to P/S @YMT for pumping into the distribution network and a storage R/S

Well No. 2 第2號井



Dam and Well - No.1 and No. 2

第1號及第2號井



Well No. 1 – Pui Ching, wide valley with shallow hills on either side, P/S with brick structures (photo 1896)

第1號井 - 位置近培正中學

九龍以泵供水：窩打老道井



Dam and Well No. 2 – Junction of Princess Margaret Road and Argyle Street (photo 1896)

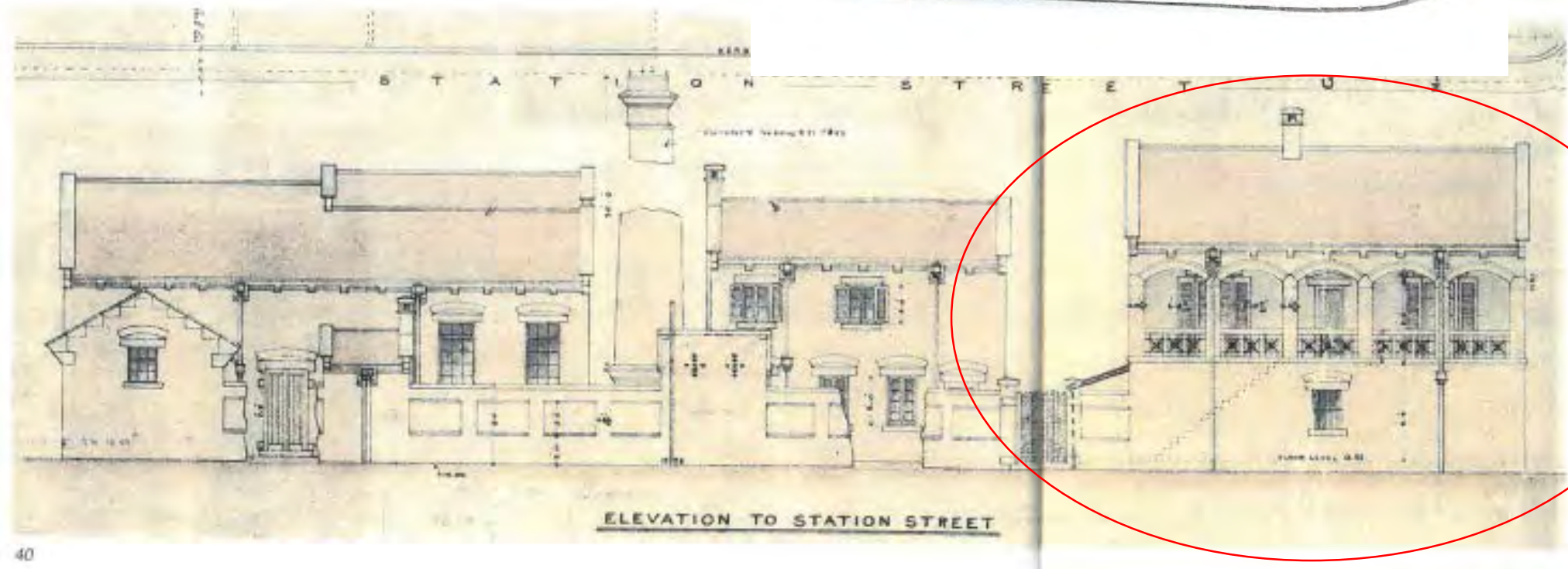
第2號井 - 公主道與亞皆老街交界



Dam and Well No. 3 Junction of Wylie Road and Princess Margaret Road 第3號井 - 衛理道與公主道交界



PS @ YMT 油麻地泵房



PS @ YMT (ceased operation in 1911, KLN Storage Reservoir 1906) 油麻地泵房

- Chimney demolished in 1912
- 1st Bldg, [engine and boiler house] converted to Post Office 1910s to 1920s, ceased 1967, SA's Street Sleepers' Shelter until end of 1990s
- 2nd Bldg, [workshop G/F, fitters quarters 1/F], Hazardous Goods Store
- 3rd Bldg, [G/F -office, stores, boy/coolie, cook, latrine; 1/F, Overseers' quarters], Hawkers Control Office

Option 1
Kowloon Reservoir
九龍水塘水壩

Required 200 days
consumption

Design 120mg



Kowloon Gravitation Water Supply Scheme: Storage Reservoir (100'H, 350mg) 九龍供水

- On the ridge above Cheung Sha Wan
- Originally an earthen dam with puddle wall at centre, fear of lack of good building stone
- On 12 Dec 1900 endorsed by Director of Public Works, change to masonry/concrete dam as good rock was found
- CI pipe in Tai Po Road to S/R on the hill to the north of Kowloon Tong Village
- Water supply extended to Kln City (E), To Kwa Wan/Ma Tau Wai; Yau Ma Ti, Tai Kok Tsui/ Sham Shui Po (W)
- S/R 150' Dia, 20' Deep, 2 mg
- Dam contractor - Tsang Keng
- In Kowloon City a small S/R of 150, 000 g was added

Kowloon Storage Reservoir – Dam

九龍水塘水壩

86. (Item 35.) *Kowloon Water-works Gravitation Scheme.*—Fair progress has been made in the various sections of this work which is being carried out under the supervision of Messrs. DENNIS, KAY and GIBBS.

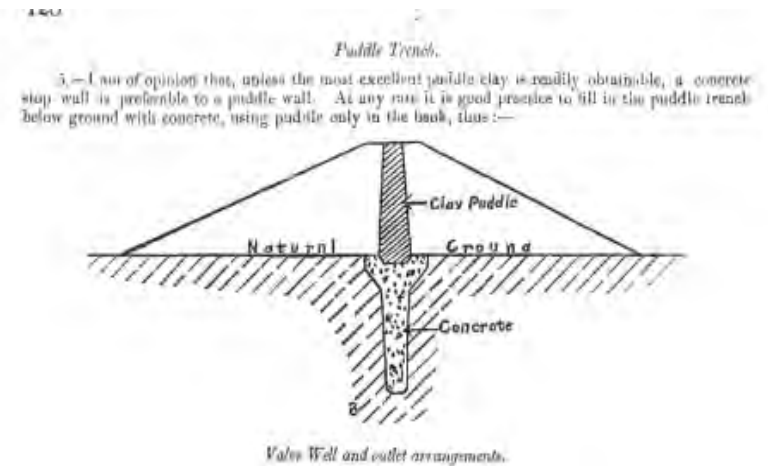
(1.) *Storage Reservoir.*—The concrete work on the main dam was commenced on the 6th January and by the end of the year the dam had been built to 373 feet above Ordnance Datum (the lowest part of foundation being 342 feet). The work done during the year comprises 9,600 cubic yards of cement concrete, 9,200 cubic feet of dressed masonry and 100 cubic yards of rubble masonry.

A commencement was made with the excavation for the bye-wash dam and about 3,000 cubic yards of soil were removed.

The Bungalow was completed and is now occupied by the Overseer in charge of the work.

A road diversion about 1 mile in length which will take the place of the present path crossing the site of the Reservoir was put in hand and the earthwork completed.

Tenders have been prepared and forwarded for the outlet gear for valve well and for the sluices and recording gear for the Bye-wash.



The Dam (from straight to curved) 353mg 1907 -1910

九龍水塘水壩



Kowloon Reservoir Dam 九龍水塘水壩



Tender for S/R Construction 主教山配水庫

THE HONGKONG GOVERNMENT GAZETTE, 12TH DECEMBER, 1902. 2183

GOVERNMENT NOTIFICATION.—No. 768.

Tenders will be received at this Office until Noon of Monday, the 29th December, 1902, for the construction of a masonry and concrete Service Reservoir near Kowloon Tong, in the New Territory, and for the laying of 12" cast iron pipes to connect the Reservoir with the Kowloon mains.

The site may be inspected on Wednesday, the 17th December, leaving the Pumping Station, Yaumatei, at 3 p.m.

No work will be permitted on Sundays.

For Form of tender, specification and quantities apply to Messrs. DEXTON, RAM & GIBBS.

The Government does not bind itself to accept the lowest or any tender.

By Command,

F. H. MAY,
Colonial Secretary.

Colonial Secretary's Office, Hongkong, 12th December, 1902.

憲示 第七百六十八號

輔政使司梅

隨諭事現奉

督辦孔開明人投接在新界九龍塘處建築供水塘並安放十二寸
大生鐵喉相連水喉與九龍大喉此地處可於英十二月十七日即禮
拜三日下午三點鐘由九龍地盤水廠起程前往看驗合約訂明禮拜
日停工所有投標均在本署收標限期收至西曆本年十二月二十九
日即禮拜一正午止如欲領投標格式價看章程及領取圖冊者前
赴田彌臣巷及劫士處請示可也各標價列紙昂任由

國家乘取或附乘不取亦可等因奉此合行出示曉諭為此特示

一千九百零二年

十二月

十二日

S/R at Kowloon Tong

主教山配水庫



Kowloon Tong Tank (Map 1928)

S/R at Kowloon Tong 主教山配水庫

No suitable site near the center of the district to be served

(ii.) *Service Reservoir near Kowloon-ting.*—The contract date for the completion of this work was 30th June. A bonus was offered for earlier completion with a view to making use of the reservoir during the summer rains, the offer however did not produce the desired result and the work was not completed till 10th August.

The reservoir is circular, 150 feet in diameter and 20 feet deep, it has a capacity of 2 million gallons, top water level is 235 feet above Ordnance Datum.

It is now being used in connection with the supply to Kowloon.

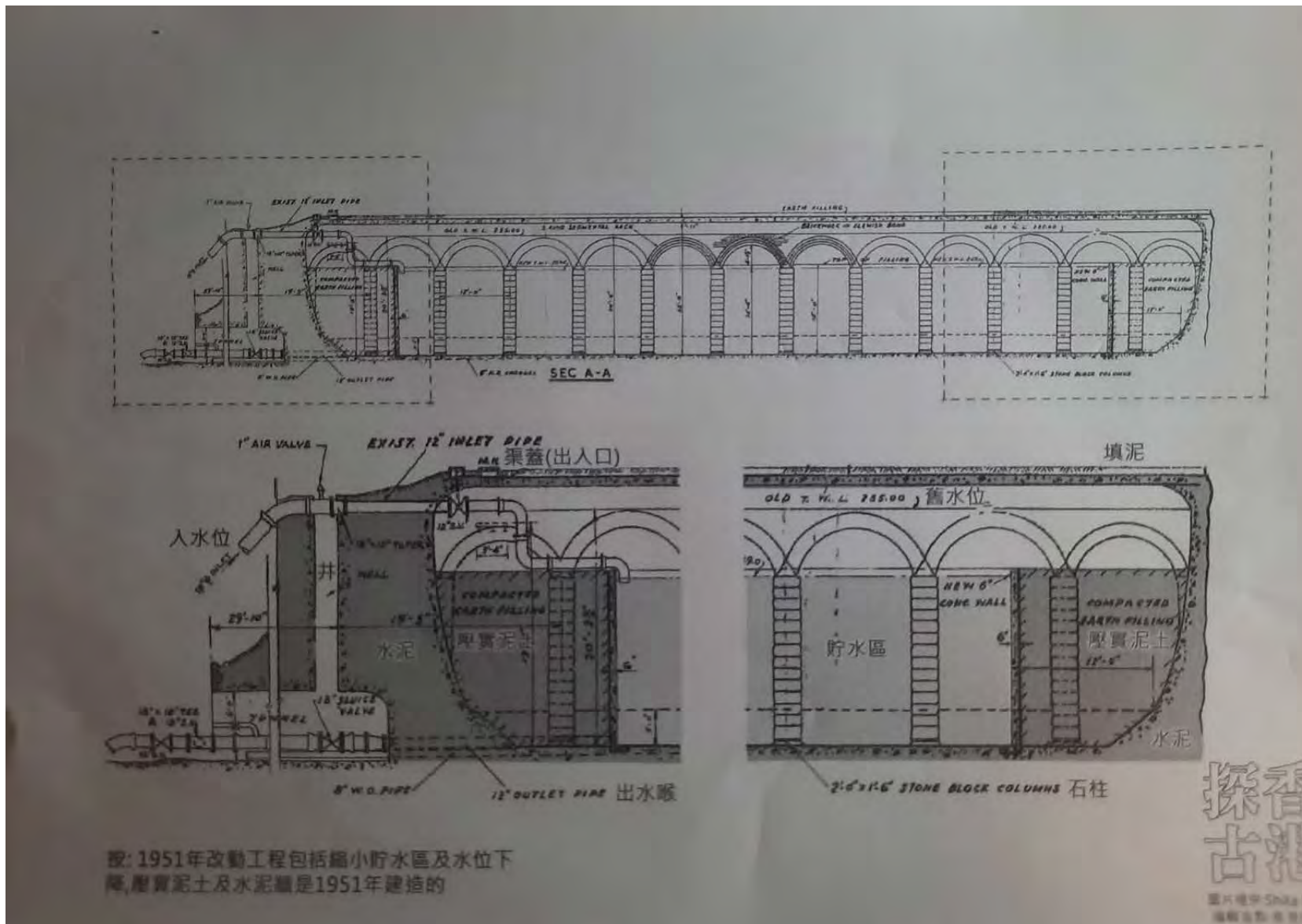
In connection with this work a meter-house was built near the Tai Po Road and the Venturi Meter fixed there to measure the whole supply to the Peninsula.

S/R 主教山配水庫

- Invitation for the tender for the construction dated 12 December 1902
- A masonry and concrete S/R, 12"CI pipe connect to S/R and Kowloon mains.
- Contract was signed with Tung Shing in Feb 1903. The S/R was sunk below ground level and constructed principally of cement concrete with granite pillars and brick arches to support the concrete vaulting which formed the roof.
- By end of the year, half of the brick arches were completed. Water level is 255 feet above Ordnance Datum.
- Reported in 1904, the contract date was 30 June 1904. Bonus was offered for early completion but the S/R was completed on 10 August not before start of the rainy season.

- The S/R is 150 feet in diameter.
- S/Rs - at least two compartments for maintenance without putting the whole reservoir out of service.
- Circular reservoirs are less suitable for subdivision. Circular layout with the least circumference for a given capacity, may be the best to suit the site layout without requiring deeper excavation.
- Drawing dated 1951 (repairs in 1950s) shows the lowering of the water stored and also reduction of storage area. Perhaps due to the compartmentation purpose or leakage from the circular wall. Out of service from April 1984.

S/R at Bishop Hill 主教山配水庫



Bishop Hill S/R 主教山配水庫

Photo: Hong Kong Reminiscence.



Unique in Hong Kong

特色有蓋，圓形，本地材料，磚拱結構，花崗岩石柱，
花崗岩石件之頂部和底部較細小，中間最潤

- Cover
- Circular on plan
- Local materials
- Brick arching
- Piers formed by granite blocks
- Granite blocks, narrower at top and bottom, wider at mid depth
- Skilled craftsmen

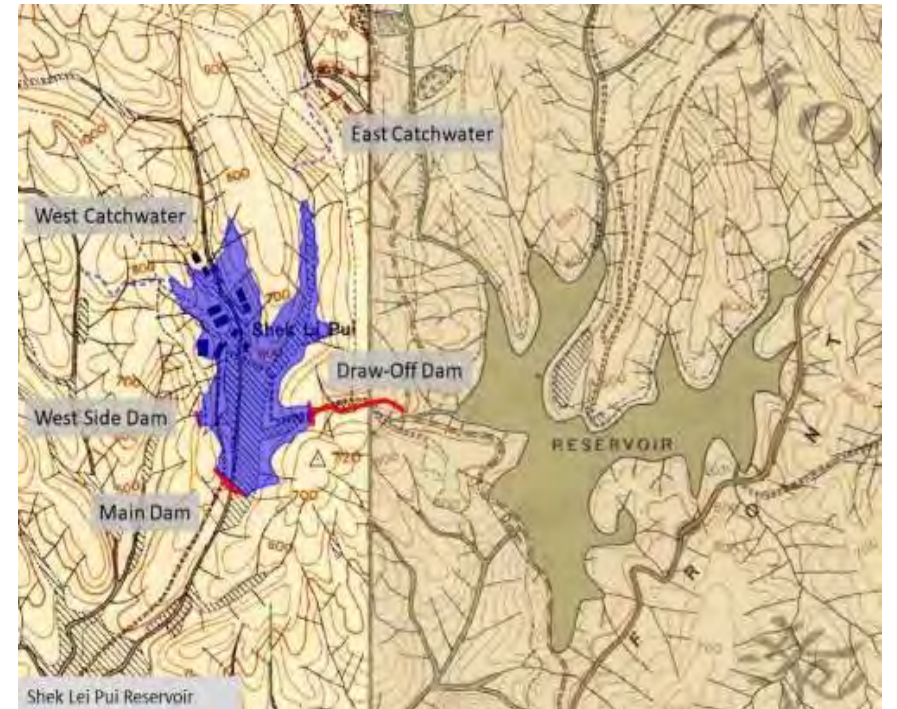
S/R at Pokfulam 1869 & 1890 ???

Kowloon Group of Reservoirs

- Kowloon Reservoir 353mg 1907 – 1910
- Shek Lei Pui reservoir 116mg 1925
- Kowloon Reception Reservoir 1926 (receive water from Shing Mun Reservoir to Shek Lei Pui water treatment plant)
- Kowloon Byewash Reservoir 185mg 1931
- A water tunnel connecting the Kowloon Byewash Reservoir to the Lower Shing Mun Reservoir started in 2019. The project was completed in 2022 to reduce the overflow by the group into the Butterfly Valley.

- Construction of a water tunnel connecting the Kowloon Byewash Reservoir to the Lower Shing Mun Reservoir started in 2019. The was completed in 2022. The Inter-reservoirs Transfer Scheme (IRTS) consists mainly of a water tunnel, 2.8 km in length and 3 m in diameter, connecting the two reservoirs.
- The purpose of the tunnel is to reduce the quantity of the overflow from the Kowloon Group of Reservoirs into the Lai Chi Kok Transfer Scheme (LCKTS) and to make better use of the water collected by the Kowloon Group of Reservoirs which will otherwise overflow into the Butterfly Valley and discharge into the sea.

Shek Lei Pui Reservoir 1925



Kowloon Byewash Reservoir 1931



Kowloon Byewash Reservoir (2022)



Shing Mun Reservoir (Upper/ 1935 Jubilee)

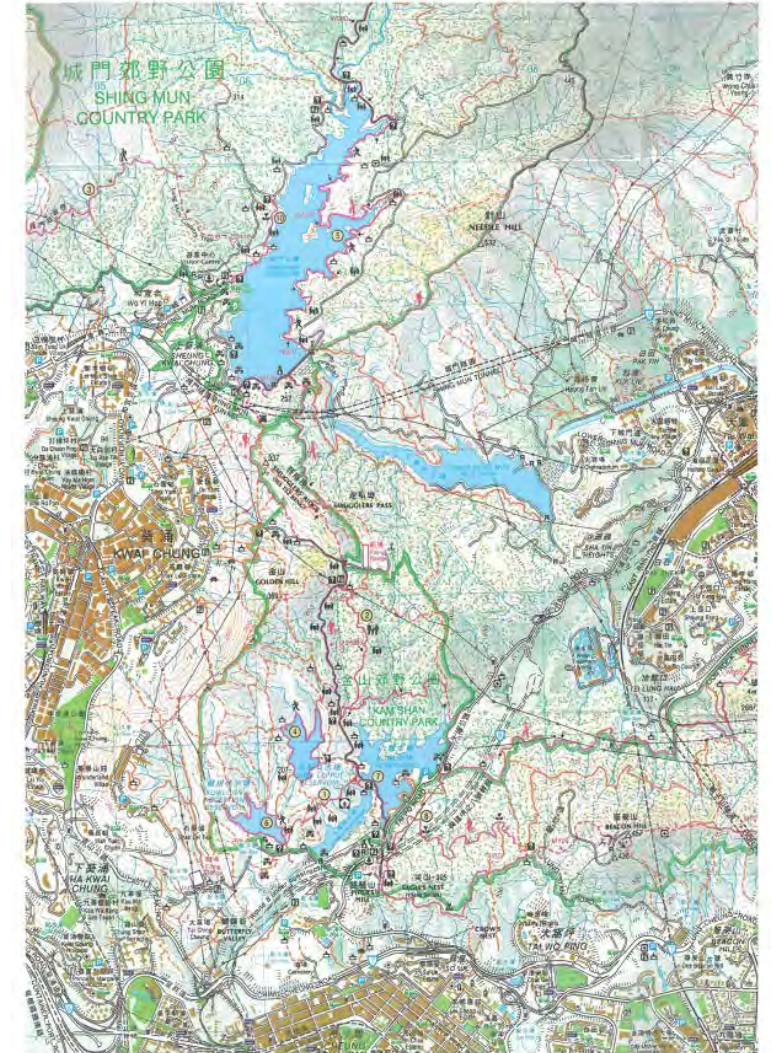
- 1929 Water shortage, Rider Mains closed for 219 days, water imported by 21 tanks
- Dam recommended at where river entered a steep gorge
- Binnie as the Consultant for design and construction
- Relocation of eight villages, 855 people, \$296,898
- By end of 1930 villages emptied, buildings demolished

Shing Mun Valley

In the mid-17th century, the Ming Dynasty rebel soldiers occupied the south-western base of Needle Hill and built a fort (Shing) and gate (Mun) to control the area.

They raided local villages until their surrender to the Ching Dynasty army in 1656.

The fort was closed to Pineapple Dam.



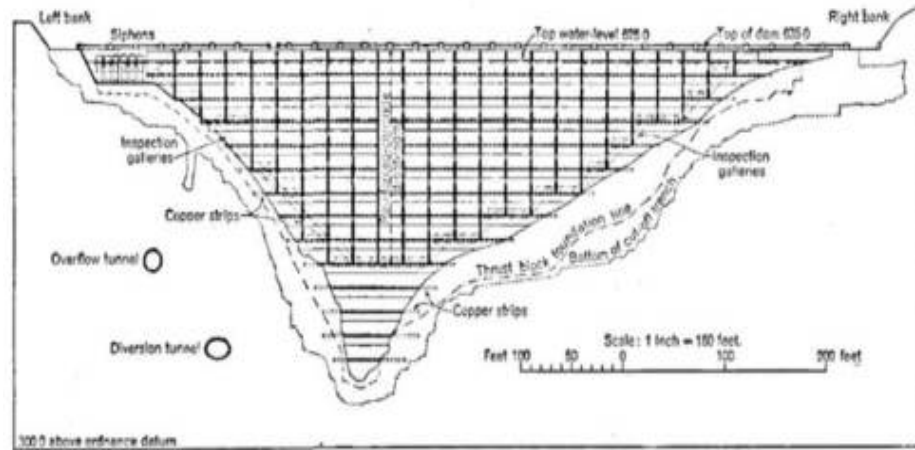
Upper Shing Mun Reservoir



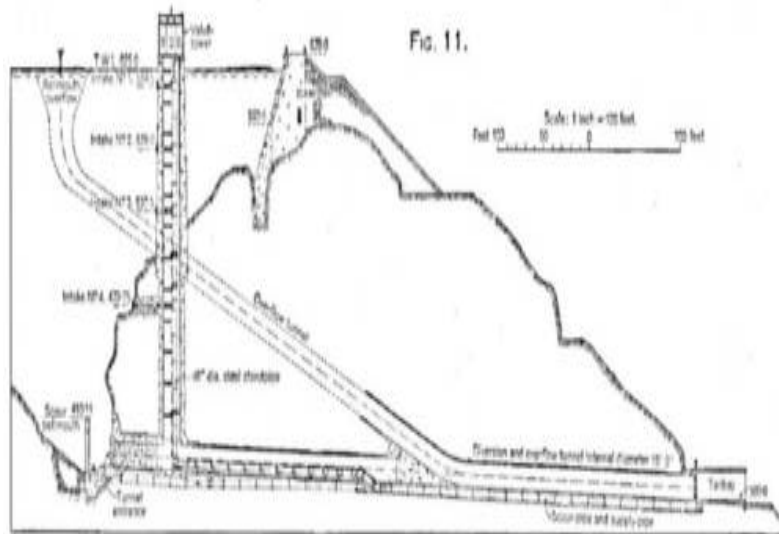
Design of the Dam

- 1932 A masonry dam top level 182m changed to 190m, capacity from 2,000mg to 3,000mg, need raising the level at the Pineapple Pass and an additional low dam
- Decomposed granite found 15m below the valley dam site
- 1933 Dam location moved down river below the water falls, dam width reduced but 12m higher
- Gardens Road Service Reservoir

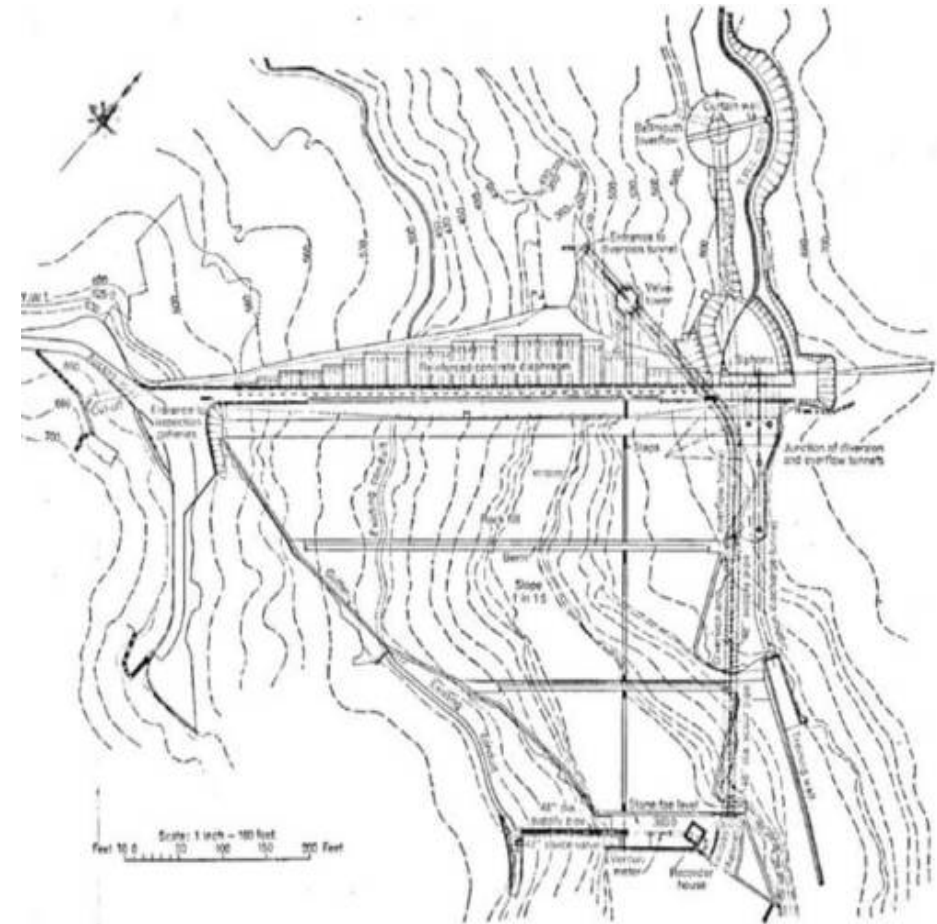
Dam Elevation and Plan / Section of Diversion Tunnel



ELEVATION OF DAM.



SECTION OF DIVERSION TUNNEL.



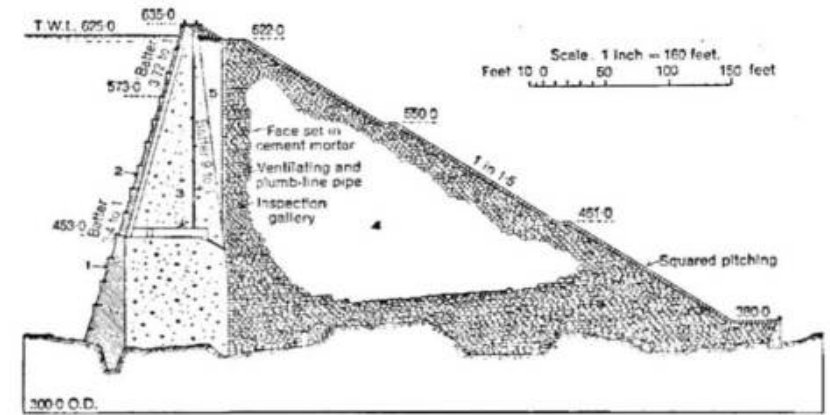
Dam Design

- Two choices for dam structures –
- Gravity dam– concrete core (cut off water) + rock fill (resist water pressure)
- Concrete arch dam – curved concrete structure to resist water load, less material, cheaper, faster

- Three factors: eliminate cracks, seismic, cost
- Finally a Rock filled gravity dam was chosen – cheaper - low labour costs + ample rock materials

Five Parts of the Dam

- 1 cut off wall - prevent leakage below and sides of dam
 - 2 concrete face - prevent water penetration
 - 3 concrete thrust block - transmit water pressure to the rock fill (retain rock fill when water is drawn down)
 - 4 Rock fill – reaction to water pressure
 - 5 Sand wedge – even pressure transmitted to rock fill
-
- Diversion tunnel – 4.5m dia and 300m long



CROSS SECTION OF DAM.

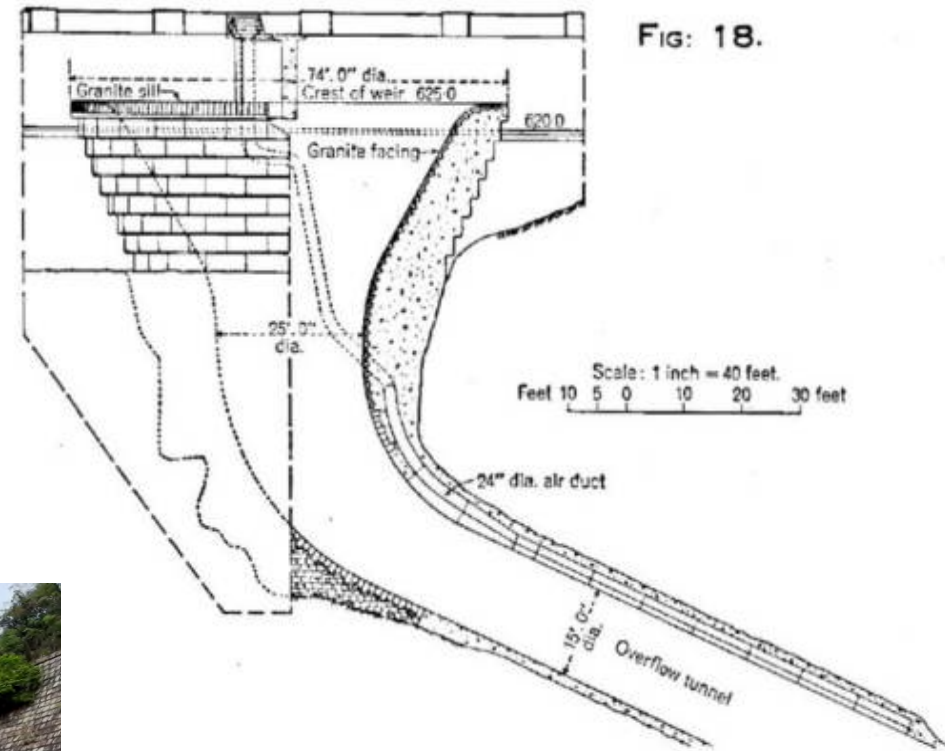
Shing Mun Reservoir

- Weir for overflow, not economic for the dam structure
- Circular bell mouth weir, independent of the dam
- Weir 22.6m wide, tunnel 4.6m wide
- Malaria infection
- Workforce 2,500 + European staff
- 1933 started excavation of dam foundation and tunnel

- Two aerial carriers – stone from quarry to crushers and 5-ton concrete from batching plant to dam
- Sept 1935 Started impounding
- End of 1936 Completion
- Formal completion ceremony 31 Jan 1937
- Dam height 85m, highest in the Empire
- \$8 million, completed in three years (original 4 years)



Valve Tower and Overflow Weir



BELLMOUTH OVERFLOW: ELEVATION AND SECTION.



GOVERNMENT OF HONGKONG

THIS RESERVOIR WAS BEGUN IN 1933
AND FINISHED IN 1937.

ITS CAPACITY IS THREE THOUSAND MILLION GALLONS.
THE HEIGHT OF THE MAIN DAM IS 280 FEET.
IT WAS DESIGNED BY MESSRS. BINNIE, DEACON & GOURLEY
AND CONSTRUCTED UNDER G. B. GIFFORD HULL,
M. M. INST. C. E. RESIDENT ENGINEER.

NISI DOMINUS FRUSTRATA

Summary

Water Supply System: 供水系統

- Hong Kong Island – From gravitational to pumping
港島 - 地心吸力/重力自流 至 以泵供水
- Kowloon – From pumping to gravitational
九龍 - 以泵供水 至 地心吸力/重力自流

Reservoir Dam: 水壩

From earthen (puddle clay) to masonry/cement concrete to earthen and rockfill

泥壩 至 石砌/混凝土壩 至 泥和石壩

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Acknowledgement

Wikipedia

HK Maps.HK

Paul Zimmerman

Hong Kong Reminiscence

Hal Empson “Mapping Hong Kong – A Historical Atlas”

Prof Ho Pui Yin “Hong Kong Water Supply 150 Years”

The Industrial History of Hong Kong Group

Thank you very much