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## **REVISITING THE WATER ISSUE ACROSS THE CAUSEWAY: THE ORIGINS OF WATER SUPPLY FROM JOHOR TO SINGAPORE (1904-32)**

*This article discusses the origins and historical development of the water supply between Johor and Singapore from 1904 to 1932. It reveals the events that preceded the formative stages of the water-supply scheme; analyses the 1927 water agreement and its implications; and examines the dynamics of water supply to Singapore before the Second World War. It demonstrates that the political framework underpinning the supply of water between the two countries has been determined in favour of Singapore as a matter of colonial legacy. Singapore has traditionally enjoyed a strategic advantage over Johor because the former was more developed, a fact that resulted in part from the British authorities' prioritisation and promotion of the island as the seat of their imperial power in Southeast Asia during the nineteenth and twentieth centuries. As a result, Singapore flourished, becoming more prosperous than her neighbouring states by generating surplus revenue from their economic resources on the strength of their capitalist framework. Consequently, Singapore was able to exploit the water deal to her advantage during the colonial period. Despite the importance of the water deal in the two countries history, it has not been discussed by historians whose writings tend to focus on water issues post-1961.*

**Keywords:** *water supply, waterworks, Johor, Singapore, causeway*

### **Introduction**

Most of the existing writings on the water supply between Johor and Singapore are focused on contemporary developments. In this context, the main issue underlying the water deal is the utilisation of raw water from Johor to cater for Singapore's water consumption, and Singapore's reciprocal provisioning of clean water to Johor. It is well known that water supply between Johor and Singapore has its origin in agreements dating back to the first half of the twentieth century. However, this subject has not been explored in detail from an historical perspective (Yeoh 2003:180-181). In the early twentieth century, Johor and Singapore could be perceived as one integrated economic entity, with Johor acting as a *de facto* extension to Singapore's stronger economy. Singapore's economic primacy was derived from its status as the British

imperial seat in Southeast Asia. By dominating Johor's economy, Singapore and its colonial governors were assured of the economic advantages to be derived from the redistribution of surplus revenue from Johor to Singapore. Resources, including water, were perceived as valuable assets to the island and thus the acquisition of water from Johor to cater for the domestic needs of Singapore was an essential part of their supply and redistribution dynamic.

This paper discusses the origins and historical development of the water supply between Johor and Singapore from 1904 to 1932. It begins with a brief description of the development of waterworks in Singapore and the acquisition of water from Johor to cater for her domestic consumption. Then it moves on to reveal the events that preceded the formative stage of the water-supply scheme, analyses the 1927 water agreement and its implications, and examines the dynamics of water supply to Singapore before the Second World War. In particular, the paper sets out to probe the issue of Singapore having been the net beneficiary of the water supply in question, largely as a result of colonial politics that led to Singapore becoming a more developed region than Johor during the nineteenth and twentieth centuries. The British authorities promoted the island as the seat of their imperial power in Southeast Asia, introducing a capitalist economic system that focussed on generating surplus revenue from natural resources and exploiting the water deal to their advantage. This led to an unevenly weighted Singapore-Johor relationship as Singapore became more prosperous than her neighbouring state. To date, the early twentieth century water deal between the two countries has not been discussed by historians, whose writings tend to focus on water issues post-1961.

## **Waterworks in Singapore**

It is common knowledge that as a result of rapid population growth, Singapore emerged as the most urbanised territory in the Malay Peninsula in the nineteenth century. One of the major problems associated with the process of urbanisation - especially of an island - is public health and the eradication of disease. Undoubtedly, one of the means to deal with this problem is to have a good supply of pure water. Clean water is not only necessary for domestic usage but also for powering a sewage disposal system. This pressing demand for water necessitates the construction of waterworks, including reservoir dams and water catchment areas. These are deemed superior to natural water sources derived from rivers, streams and wells because pollution can be more easily controlled. In Singapore in particular, the same rivers and streams that were used for drinking water were also used as lavatories and a place for washing clothes and utensils (Gullick 1991:258). By the standard of the times, the least polluted water, considered good enough to take a bath in, was water coloured red (Phillips & Sweeney 1975:11). Thus, introducing a modern waterworks

was the only means to provide a safe and potable water supply especially in a tropical environment conducive to water-borne diseases such as typhoid, dysentery and cholera.

In the early years of British settlement, the Singapore authorities did not make securing fresh water for the local population a priority. Certainly, until the 1870s local residents, even those in the town, were still dependent on wells for their daily supply of water. Early plans for reservoirs and waterworks were designed primarily to cater for the supply of fresh water to vessels which stopped at the island's port, such as Resident John Crawford's 1823 proposal, although the scheme itself did not materialise. In the 1850s, despite rising concerns about meeting the local population's water needs, the British authorities failed to extend their support to the plans of the government surveyor, J. T. Thomson, when he proposed a scheme for the supply of 546 million gallons of water to the town from the headwaters of the Singapore Creek in 1852 (Halifax 1921: 326-327). Then in 1857, Tan Kim Seng, a wealthy Straits Chinese merchant and public benefactor, offered \$13,000 to finance Singapore's first waterworks on condition that the water should be made available for the residents free of charge. The Singapore government gave due consideration to the proposal but in 1861, the British authorities in Singapore and India finally refused to approve the water scheme because the total cost was estimated to be higher than \$13,000.

Following the drought of 1864, the government were forced to reconsider their stance and began to initiate the construction of a waterworks scheme, but the first reservoir did not become operational until 1878. It was situated in the vicinity of Thomson Road, and a masonry conduit was installed to convey the water to within two hundred feet of the Singapore River. All responsibility for the waterworks and the distribution of piped water throughout the town were assigned to the Municipality, and charges for the consumption of water extracted from the waterworks were imposed on the residents. In 1894, the reservoir was enlarged with the construction of an embankment at a point lower down the valley, and a second line of cast-iron pipes were laid along Thomson Road and brought into use in 1898 (Yeoh 2003:177-178).

Nonetheless, due to the increase in population in the nineteenth and early twentieth centuries, water supply for domestic use was still far from sufficient for the town of Singapore. During this period, the daily water supply was limited to twelve hours per day; it also had to be curtailed during the dry season every year, and it was not filtered. Water filtration had been introduced in 1889 but even up to the first decade of the twentieth century, only about a third of the total amount of water from the reservoir had been through a filtration process. Moreover, the quality of the filtered water was not high, and there were frequent complaints from the public that municipal water had a brown colour and turbid appearance, and often contained offensive sediments. Additionally, the municipal authority had to cope with the rapidly growing

demand for water from ‘the Docks and Wharves at Telok Blangah and New Harbour and from suburban districts like Mount Elizabeth and Orchard Road and Chinese streets like Havelock Road, Chin Swee Road and Kallang Road’ (Yeoh 2003:178). By the turn of the century, the average daily supply of water was about 4 million gallons per day, and given an estimated 5 per cent increase annually, at least 6.5 million gallons a day would be required by 1910 due to population growth. The shortage of water became critical when Singapore was faced with long drought seasons in 1901, 1902 and 1904 (Yeoh 2003:179).

### **The Prospect of Water Supply from Johor**

By the early twentieth century, the expansion of the existing water reservoir and the construction of a new one to generate water from the Kallang River and Seletar had become critical. This involved the further expansion of the Thomson Road reservoir and the construction of another reservoir at Pearl’s Hill. However, at this point, the Singapore Municipality began considering obtaining water from the neighbouring state of Johor where fresh, clean water could be found in abundance. The first public reference to the possibility of obtaining water from Johor for Singapore’s domestic consumption can be found in a report from 1904. The idea was first suggested by Robert Peirce, the Municipal Engineer, who had been tasked with producing a report on the Kallang and Seletar Water Schemes. His conclusion was that Singapore Island’s current water supplies would, for all practical purposes, soon be exhausted. Thus, it was perhaps inevitable that Singapore turned to the Johor mainland for its water.<sup>1</sup> Nevertheless, for the next eight years, the Singapore government continued to give priority to the various waterworks that were already under construction, especially the Kallang Scheme.

This neglect may have stemmed from the practical problems that obtaining water from Johor entailed. Indeed, Peirce’s report did not reveal exactly how water might be transported from Johor and it was considered a major venture to be achieved only by extending communication links from Johor to the island. It might not be a coincidence that serious consideration to this idea was motivated by the construction of a railway between Singapore and Johor. The idea of establishing land communication between Johor and Singapore had first been raised by F. G. Slessor, the Engineer in charge of Railway Surveys for the Sultan of Johor in 1892,<sup>2</sup> and coincided with the Colonial Office’s desire, especially Colonial Secretary Joseph Chamberlain, to see Singapore joined with the Peninsula and land communication improved (Moore 1975:162). The Singapore railway from Kranji to Pasir Panjang was completed and began to function in 1903 while the railway link from Gemas to Johor Baharu was inaugurated in 1904 and eventually completed in 1909/10 (Moore 1975:162). There were no other major links spanning the Johor Straits before 1910, when the only means other of communication was a wagon

ferry service established after the completion of the railway line to Johor Baharu (Federated Malay State Railways 1972:108).

The wagon ferry service soon proved inefficient in coping with the growing demand for transportation across the Johor Straits, so the Federated Malay States (FMS) Railways management authority decided to build an iron bridge as a means of land transport in 1912.<sup>3</sup> As it happened, this development occurred in the same year that Robert Pierce renewed his proposal for acquiring a water source from Johor. He visited the Pulai district in Johor to consider potential locations for his scheme and entered into negotiations with the Government of Singapore and the FMS Railways for the provision of space for a large water main upon the proposed bridge across the Johor Straits. Then in 1913, he received new information with regard to the water resources of the Sungei Lenggiu and the Sisik Baharu: tributaries of the Johor River.<sup>4</sup>

Nevertheless, without an effective means of traversing the Johor Straits the water scheme could not be realised, and for the next six years there were no significant developments. This was largely because the FMS Railways and the Straits Government were preoccupied with the type and nature as well as the financial cost of establishing better land communication across the Johor Straits. The Government of the Straits Settlements appointed Messrs. Gregory Eyles and Waring as Consulting Engineers to study the prospect of constructing a bridge. The consulting engineer company had prepared a report which contained six plans for the bridge. The estimated cost for the proposed bridge plans ranged from £639,000 to £789,000. The plans also included the construction of two pipelines of three feet in diameter along the proposed bridge.<sup>5</sup>

Other plans under consideration were to build a causeway instead of a bridge across the Johor Straits. The proposal to build a causeway was brought up by Charles Edwin Spooner, General Manager of the FMS Railways. On 5th September 1913, he proposed to build a rubble causeway across the Straits, arguing that the construction of an embankment would greatly facilitate the provision of a roadway adjacent to the railway at far less cost than if a bridge were to be built.<sup>6</sup> On 4th November 1913, The FMS Railways management authority formally proposed the construction of a causeway to the Singapore Government.<sup>7</sup>

The matter was discussed by the FMS Railways and the British authorities in Singapore and in London over the next few years, but no conclusive decision was made until 1917.<sup>8</sup> It was only in March 1917 that Governor Arthur Young conveyed the official plan for the scheme to the Colonial Office in London. In this plan, the construction of the causeway would comprise of a railway, a road and pipelines, at an estimated total cost of £739,000. In fact, the estimation of the cost for constructing the pipeline facilities alone was £40,000.<sup>9</sup> The Colonial Office was notified that the Singapore Municipality was prepared to fully cater for the cost of the construction of the pipeline

facilities across the causeway.<sup>10</sup>

In the same year, a separate suggestion was tabled, this time to construct a stone causeway instead of a rubble one. This proposal came from W. Eyre Kenny, Director of Public Works in the FMS Railways. He argued that the stone causeway was viable in the long run in terms of its maintenance costs and its capacity to sustain a heavy load from land traffic across the Straits. The Government of the Straits Settlements then appointed Messrs Coode, Fitzmaurice, Wilson & Mitchell of Westminster as consulting engineers to draft the proposal and estimate the cost for the construction of the causeway. It was estimated that the construction of a stone causeway would cost between £750,000 and £800,000.<sup>11</sup>

The Singapore Government eventually decided in 1919 that communication across the Johor Straits should be by means of a granite causeway based on the designs proposed by the consulting engineer company. This decision allowed the Singapore Municipal Commissioners to make arrangements with FMS Railways for the accommodation of a water pipeline across the causeway.<sup>12</sup> Formal negotiations took place between the Singapore Municipality and the Government of Johor - represented by the General Adviser - and on 24 April 1920, the causeway's construction was officially inaugurated with the presence of Sir Laurence Guillemard, Governor of the Straits Settlements and Sultan Ibrahim of Johor.<sup>13</sup> Finally, the prospect of obtaining water from Johor could be realised.

## **The Exploration of Water Resources in Johor**

In September 1920, the Municipal Commissioners, with the consent of the Johor Government, decided to conduct an investigation into the water resources of the southern portion of Johor state. The work was entrusted to Mr. S. G. Williams, then Water Engineer (Special Works). Williams spent the next two years studying two alternative sources of water which from Pulau and Pelepah. His findings were then conveyed to the Government of Johor who agreed to sign a memorandum on the further exploration of those two locations for water catchments.<sup>14</sup> Williams concluded that Pulau was the most viable location but the survey involved arduous exploration of virgin jungle that had barely been penetrated. Nevertheless, he presented an impressive report on how the Pulau catchment area was vastly superior to those in Singapore. He estimated that the rainfall that might be considered as a collectable run-off in Pulau stood between forty and fifty-four per cent. By contrast, in Singapore, although the average run-off from the catchments over a long period was fifty-three per cent, the minimum run-off could be as low as thirty-three per cent of total rainfall.<sup>15</sup> The Government of Singapore invited Messrs. Sir Alex Binnie, Son & Deacon to study Williams' report in 1922. They in turn agreed with Williams' findings that the development of the Gunong Pulau Scheme would be advantageous.<sup>16</sup>

Williams however continued to carry out his investigations into three other possible sources in 1923: the Lenggü scheme, Semangar scheme and the Scudai River scheme. He discovered that Lenggü appeared to be a relatively viable alternative to Pulai, but Pulai's location was still the nearest available source of water and its capital cost would be lower than that of Lenggü. The only disadvantage of the Pulai Scheme compared to Lenggü was that the cost of its headwork was substantial and involved control and pumping. In addition, the envisaged construction was such that it would not be possible to occasionally avoid pumping waste. Its life span was also limited to a period of forty to forty-four years; thereafter, a new water supply would have to be sought elsewhere, probably in an entirely different site. Thus Williams was left with a quandary: Pulai would be cheaper than Lenggü to establish but would have a comparatively short life whereas Lenggü would have longevity, but would require higher costs. Semangar for its part gave promises of both longevity and economy. Pulai derived its advantages almost entirely from the gravitational advantages of its supply, whereas Lenggü or Semangar would be pumped supplies.<sup>17</sup>

The report concluded that if the Pulai Scheme was to be carried out to its full extent, it could possibly generate up to nineteen million gallons per day as shown in Table 1 below:

Table 1: Potential Quantity of Water Production of the Pulai Waterwor

List No.	Location	Nature Of Water Supply	Method Of Water Production	Gallons Per Day
Instalment No. 1	Pulai II & III	Impounded water	Gravitation	6,500,000
Instalment No. 2	PontianKetchil	Dry-weather flow	Pumped	3,000,000
Instalment No. 3	Pulai I	Dry-weather flow	Pumped	1,500,000
Instalment No. 4	PontianKetchil	Impounded water additional to Instalment No.2	Pumped	4,500,000
Instalment No. 5	Pulai I	Impounded water additional to Instalment No.3	Pumped	1,500,000
Instalment No. 6	Ayer Hitam	Dry-weather flow	Pumped	2,000,000
			<b>TOTAL</b>	19,000,000

Source: GAJ 757/23, Water Supply from Johor, 17 July 1923, National Archive of Malaysia, Johor Branch.

Also during 1922 and 1923, Mr. John Brooke Scrivenor, the FMS Government Geologist, submitted reports on the geological formation of the section of Gunong Pulai proposed for a dam, which concluded that it met the fundamental condition that there were no mining or other industries to have existed upon the catchment area.<sup>18</sup> At the end of 1923, Messrs. Sir Alex Binnie, Son & Deacon concluded their observations on all these reports, resolving that the Gunong Pulai Scheme possessed advantages over any other.<sup>19</sup> Consequently,

in December 1923, the Commissioners adopted Messrs. Sir Alex Binnie, Son & Deacon's report and appointed them as consulting engineers for the scheme. Pulai was chosen for two reasons. First, the Pulai streams were at a sufficient elevation level above Singapore to enable water to be delivered by gravity, whereas water from Pontian Kechil reservoir, three hundred and thirty feet below Pulai, had to be pumped. Second, it was only during heavy rains that there was a comparatively large increase of suspended and dissolved solids which rendered the water turbid, and in need of filtering and clarifying before being admitted to the main pipelines. Furthermore, analyses of water taken throughout the investigation and construction period showed that the water was organically pure.<sup>20</sup>

### **The Negotiation Process in the Run-Up to the 1927 Water Agreement**

It was during the course of the 1920s explorations that negotiations on the subject of the water supply between Johor and Singapore were held between the President of the Singapore Municipal Commissioners and the General Adviser of Johor, Hayes Marriott, with consent from Sultan Ibrahim.<sup>21</sup> The issues discussed during the 1923 negotiations eventually became provisions of the draft agreement on the water supply. Those matters were related to the acquisition of land for public utilities involved in the waterworks, the quantity, and the price of the water. The water agreement was eventually finalised on 5 December 1927 and was signed by His Highness the Sultan and Sovereign Ruler of The State and Territories of Johor as the first party, and the Municipal Commissioners of the town of Singapore as the second.

It can be observed that the core concern of the waterworks scheme centred on the acquisition or rental of the land to be involved in the scheme. The rent proposed by the Johor Government was 30 cents per acre for the first 2000 acres and \$5.00 per acre for all land exceeding that quantity.<sup>22</sup> The Singapore Municipality was very concerned with the financial repercussions of the annual rate of \$5.00 per acre, and it affected their decision to choose the Pulai Scheme because it only covered 5,470 acres, as opposed to the Lenggüi Scheme which covered about 50,000 acres.<sup>23</sup> Even if the Pulai Scheme was to expand, the total amount of rent would not exceed \$35,600 per annum. Officials in the Singapore Municipality considered that if the Lenggüi River Scheme were to be chosen, the high rent would have serious ramifications; the cost estimated at \$240,600 per annum. This initial estimation of cost was based on the low volume of water quantity generated. However, in the later period, there would be an increase in the draw-off from the area. Based on this rate, it was estimated that the rent charge would represent 16.7 cents per 1,000 gallons in 1930, a sum which would decrease as the draw-off increased to 3.6 cents per 1,000 gallons in 1975. They also argued that the rent of \$5.00 per acre was very high, especially since the Johor Government would share the benefits of



any water obtained from the area.<sup>24</sup>

Accordingly, the Johor Government granted a concession towards the rent for the initial period of the water scheme. They proposed that the annual rent payable under the water scheme would be 30 cents per acre per annum until 1932, and only after that year would the rent of \$5.00 per acre be applied to the land extended beyond the original agreement to each additional instalment per annum up to the year 1950.<sup>25</sup> This rate was later stipulated in the water agreement of 1927. The implication was that the rent was only to be charged on the initial areas of the Pulau Scheme which covered just 2,100 acres of land: as such, the rent charge amounted to \$630 per annum stipulated in the Water Agreement of 1927, clauses 1, 3 and 7.<sup>26</sup>

The issue of land rental was also connected to the question of timber in the waterworks area. During the negotiation process, the Singapore Municipality tried to explore the possibility of obtaining a revision on the rental rate by raising the issue of the utilisation of timber in the area. They pointed out that much of the area was accessible for the cutting of timber, of which some 30-35 tons per acre could be obtained. They suggested that due consideration should be given to the utilisation of timber for such a period as was practicable, with a view to securing the Johor Government's customary revenue. It was noted that although much good timber had already been removed from this area, an estimated 10,000 acres of primary jungle remained untouched. Those timber sources would provide sufficient timber for the construction works, and might also be used to supply firewood to meet pumping requirements for many years. The timber could be cheaply processed and the cost of firewood delivered to the pumping station was estimated to be \$3.00 per ton. Since the timber lay in the catchment area for the water scheme granted to the Municipal Commissioners of Singapore, they assumed that no royalty would be payable upon timber cut and used by the Commissioners. However, they also contemplated the feasibility of exporting hardwood logs to Singapore for use in Municipal works. In this case, they were prepared to pay government royalties and export duties on timber exports. The cost of firewood obtained from the catchment area, especially in Lenggü River (including the Government royalty), was \$5.50 per ton.<sup>27</sup> Accordingly, the 1927 water agreement stipulated that the Commissioners were permitted to use timber and firewood on the reserved land for waterworks purposes, but that they should not remove any timber or firewood for other reasons. Furthermore, it was also stated that the Commissioners might quarry granite on the reserved land for the waterworks, but not for any other purposes.<sup>28</sup>

Before the agreement could be concluded, the Commissioners wanted to resolve the question of rent at Pulau. Of the 5,470 acres, 30 cents per acre was imposed for the first 2000 acres and \$5.00 per acre was imposed on the remaining 3,470 acres. This was to prevent premature land concession by the Singapore Municipal Commissioners because such an acquisition would be

an impediment to future industrial development. However, they argued that in this circumstance, the question of impeding development was irrelevant. In fact, they viewed that the reservation of this area for waterworks purposes would bring revenue to the Johor Government as well as helping them with the problem of water supply.<sup>29</sup> Accordingly, it was stipulated in the water agreement that the Commissioners would pay an annual sum of \$5 for every acre of land of the extended reserved areas.

Consequently, the Johor Government granted three provisions to the Commissioners. Firstly, the Singapore Municipal Council was granted the right to enter upon, occupy and use the land lying within the said reserved area – with the exception of the public roads, public road reserves, government reserves, or government railway lines - to lay and maintain pipelines and aqueducts and other construction works and things requisite or expedient or convenient for waterworks and the supply of water. Secondly, the right was also given to lay and maintain pipelines and aqueducts along or under such parts of public roads, public road reserves, government reserves and government railway lines which had existed before the commencement of the waterworks. Lastly, the Commissioners would make good all damage done to the roads and public works of the Johor Government in the course of laying, maintaining, renewing or repairing the said pipeline other than such damage as was to be attributed to fair wear and tear. Should the Commissioners fail to make good any such damage in accordance with the foregoing covenant to the satisfaction of the Johor State Engineer within one month of the receipt of a notice in writing from him to do so, the damage might be made good by the Johor State Engineer and the cost thereof should be recoverable from the Commissioners. The certificate of the State Engineer would be considered conclusive evidence of the sum due by the Commissioners in respect of damage which they might be liable to make good, but should not be conclusive as to the liability of the Commissioners to make good the repairs carried out by the State Engineer.<sup>30</sup>

The most straightforward issue in the negotiation process was the quantity and the price of the water to be derived from the scheme. The total cost for the completed work was \$22,000,000.<sup>31</sup> Nevertheless, the Johor government did not contribute financially to the process of exploration in 1920, or the completion of the waterworks scheme in 1932. Mohamed Said bin Sulaiman points out that from Johor's point of view, the primary reason for the waterworks was to meet the domestic needs of Singapore, whereas for Johor the water supply was only a secondary concern. The question of whether Johor would use the water from the scheme was not a major consideration before the construction began. The issues of the quantity and the price of the water were raised only after the process of installing the pipelines through Johor Baharu in 1925 (Sulaiman 1951:250-251). In fact, at that time, Mohamed Said bin Haji Sulaiman points out that the price of 25 cents for 1,000 gallons of treated water to Johor was considered low, despite there being no charge for the raw

water used for Singapore's domestic purposes (Sulaiman 1951:251). Since the water pipes from Gunong Pulai to Singapore were to be laid through Pasir Pelangi or Ulu Ayer Molek Estate, the Sultan of Johor inquired whether such arrangements would allow the estate to get free supply of water.<sup>32</sup> In return, the Sultan was given an exemption on paying quit rent and water charges for two bungalows belonging to him at Woodneuk and Tanjong Katong in Singapore.

Accordingly, it was stated in the water agreement of 1927 that the Johor Government was to pay to the Commissioners the sum of 25 cents for every 1,000 gallons of water supplied. It was not liable for any other charge or sum in respect of the said supply of water and the Commissioners would only supply water within the State to the Johor Government. It was entitled to obtain the supply of 800,000 gallons of water daily but the Johor Government was not obligated to take the said quantity of water. The agreement also stipulated that if at any time, or times, after the end of 1929, the Johor Government was able to prove to the Commissioners that the said 800,000 gallons of water per day was insufficient to meet the proper and reasonable requirements of the inhabitants of the town of Johor Baharu, then the Johor Government was entitled to receive an additional quantity of up to 1.2 million gallons of water per day and the Commissioners were not in any event liable to supply more than this.<sup>33</sup>

### **The Construction of Waterworks in Johor**

The first waterworks to have been built in Johor was Gunong Pulai. The scheme was approved formally by the Johor Government on 1 October 1923, when the Lands and Mines Commissioners received permission from the Sultan to conduct a survey of the land for the purpose of construction of the pipelines.<sup>34</sup> Coincidentally, this move was taken on the same day as the ceremonial opening of the Johor Causeway.<sup>35</sup> The construction of this scheme began in 1924, three years before the first official water agreement was signed between the Government of Johor and Municipal Commissioners of the town of Singapore in 1927. It was based on the fact that the Singapore Municipality was legally bound to pay rental on the land used in the Pulai Scheme in 1924.<sup>36</sup> Consequently, according to this water agreement, the Commissioners were permitted to occupy and use the reserved land for all or any of the purposes relating to the waterworks as mentioned below:

- 1) To construct and maintain waterworks;
- 2) To construct and maintain reservoirs, dams, tanks, pipelines, aqueducts, filters and other things required for waterworks;
- 3) To construct and maintain all work incidental to or convenient for all or any of the purposes herein mentioned;
- 4) To erect and maintain buildings, machinery and plant

- requisite, expedient or convenient for all or any of the said purposes;
- 5) To erect and maintain houses and other buildings for and in connection with the construction maintenance and upkeep of all the said work and things and with the waterworks staff of the Commissioners and requirements;
  - 6) Every other purpose properly connected with or incidental to or convenient for all or any of the said purposes.<sup>37</sup>

The construction of the Waterworks scheme was entrusted to Consulting Engineers Messrs. Sir Alex Binnie, Son & Deacon of London. Throughout the process, the work had been carried out under their direction by R. H. L. Pearson, Chief Resident Engineer from 1924 to 1927, and thereafter by Mr. G. B. Gifford Hull, Chief Resident Engineer from 1927 to their completion in the early part of 1932.<sup>38</sup> Pulau's streams and the approximate catchment areas are listed in Table 2 below:

Table 2: The Streams and Approximate Catchment Areas of the Pulau Sche

<b>Streams</b>	<b>Approximate Catchment</b>
Pulai II, flowing southwards	1,550 acres
Pulai III, flowing southwards	430 acres
Pontian Kechil, flowing southwest	3,000 acres
Ayer Hitam, flowing westwards	490 acres
<b>TOTAL</b>	5,470 acres

Source: Adapted from Singapore Municipal Commissioner, Singapore Waterworks, Water Supply from Johor, 28 Feb. 1932, CO 1069/561, p. 3.

The first part of the construction work was the pipeline between Pulau and Singapore. Pipes were made in England by Messrs. Stewarts & Lloyds in three diameters, 33", 36", and 39" in order to be easily nested for economical transport. Upon their arrival in Singapore, they were lined with half an inch of cement mortar by the Hume Pipe Company. The actual work of lying was done by contract to Messrs. United Engineers for the section from Pulau to Tampoi Road (about 11 miles), and Messrs. F Ogden, Brisbane & Co., for the section from Tampoi Road to Singapore (about 9¼ miles). Work proceeded concurrently on both sections, and the pipeline was finished in the early part of 1927. From now on, the pipelines could carry water to Singapore from a temporary intake built across Pulau II Stream, below the site for the Pulau Dam. The pipeline was laid through the jungle, swamps and cultivated country areas. Across swamps, the pipes were supported on concrete piers built on piled foundations. The ground was tested throughout its entire length for acidity, and in acid ground the pipe was surrounded by concrete to protect against external

corrosion. Two pipelines were necessary for the final development of the scheme, except underneath the lock on the Johor side of the Johor Causeway where two pipes were laid in the form of an inverted siphon; and across the canal at Mount Zion where two pipes were laid in the form of an arch, the pipeline was single and the laying of the second pipeline was to be deferred until such time as Singapore would need more water than the capacity that the single pipe would supply. While this work was carried out, preliminary work was also at hand at Pulau.<sup>39</sup>

Headwork at Gunong Pulau began with planning and supervision, a task entrusted to Dr. P. S. Hunter the Municipal Health Officer and agreed by Sir Malcolm Watson. The clearing of the jungle and the draining of the swampy areas proceeded concurrently, with the construction of the access road, coolie lines to house 1,200 coolies, and quarters for the European staff. A hospital, stores, workshops and police quarters were also erected. All the preliminary work was completed in 1925 and by that time work was also in hand on the excavation for the foundations of the dam: on the flume to carry the river across the foundation excavation, and on the tunnel connecting the catchments of Pulau II and Pulau III.<sup>40</sup>

After the removal of 94,000 cubic yards of excavated materials, including soft material and weathered rock, an excellent granite foundation was laid throughout the whole length of the dam, the average depth to good rock being about 25 feet. The first concrete was placed in the dam in March 1927 and by September the dam across the bottom of the valley was brought up to ground level. The culvert through the dam was completed by August 1927, the river diverted through it, and the temporary flume removed. The dam was built with Portland cement concrete and faced above ground and on both upstream and downstream sides with granite masonry. It was provided with a spillway capable of passing all flood water, and on the upstream side with a masonry valve tower containing the inlet pipes and the valves which controlled the supply of water to the filters. Despite the restricted nature of the site and the inconvenient situation of quarries and sand deposits, there was good progress. By June 1928, sufficient advancement had been made to justify starting work on the Col dam. This consisted of a concrete dam 340 feet long and 30 feet high with a concrete cut-off trench 18 feet deep upstream of the dam, the two being connected by a 126,000 square foot reinforced concrete mattress. This work was completed by the middle of November 1928. About this time, work commenced on clearing the reservoir area of brushwood and the removal of railway tracks, crushing and mixing plants, prior to the reservoir being filled.<sup>41</sup>

Work on the tunnel connecting the catchments of Pulau III and Pulau II continued from both ends until it was completed in June 1928. The tunnel was driven through material varying from solid granite to material resembling quicksand. That part of the tunnel driven through soft ground was lined with steel segments, inside which a lining of concrete six inches thick was placed.

The net diameter of the tunnel after lining was 4 feet 11 inches. Through the quicksand, the tunnel had an additional thickness of one foot of concrete on the outside of the steel. In the rock section, only the floor and half of the sides of the tunnel were lined with concrete. The water from Pulau III was diverted into the tunnel by a concrete diversion 120 feet long and 20 feet high with a concrete cut-off trench on the upstream side 100 feet from the dam, the two being connected by a reinforced concrete apron. The filters were of the rapid-gravity, mechanically cleaned type. Filtration was to take place in one building consisting of a five storey chemical house containing engines and pumps for pumping filtered water to the wash water tank at the top of the building, along with air compressors, alum tanks, lime mills, containers and Venturi recorders. Another filter building was three storeys high, containing filters at the top, and a clear-water tank of 1,000,000 gallons capacity at the bottom. The filters were completed in mid-1929, the event that marked the beginning of Singapore's filtered water supply.<sup>42</sup>

From 1927 onwards, three sections of the works were being carried out simultaneously. Two of them were in Johor i.e., Pulau and Pontian, and one reservoir was at Fort Canning in Singapore. During 1928 and part of 1929, the number of men employed exceeded 3000. The pipeline from Pulau to Singapore was done by contract and the works had been managed by direct administration of the Singapore Municipality. It was concluded that the decision to adopt this method had been fully justified by the result, which showed a large saving both in money and time over the estimated costs and period of completion. Fort Canning Service Reservoir was put into service towards the end of 1928. It was made from a reinforced concrete structure of 30 million gallons capacity and built at the top of Fort Canning Hill, Singapore. It was about 800 feet long and had an average width of 300 feet, and a depth of 30 feet. Construction at Pontian started early in 1928 and the whole construction was finished at the end of 1931. Thus the complete scheme as at 1932 consisted of eight components:

- 1) The Gunong Pulau Dam, 600 feet long and 120 feet high, built across the Pulau II Stream; and the Col Dam, 340 feet long and 30 feet high, built across a depression in the ground at the upper end of the reservoir. These dams formed a storage reservoir of 1,220 million gallons capacity, known as the "Sultan Ibrahim Reservoir" (Sulaiman 1951:251). The reservoir could yield an average daily supply of 6½ million gallons.
- 2) The Pontian Kechil Reservoir, situated five miles beyond the Gunong Pulau Reservoir, fed by streams flowing down the softer slope of the Gunong Pulau range of hills. This reservoir was formed by two dams, one known as the North Dam, 65 feet high and 600 feet long; and the other, known as the South Dam, 45 feet high and 2,900 feet long. These two dams formed a reservoir

of 3,200 million gallons capacity, which yielded an average of 9 million gallons of water a day.

- 3) A pumping station which contained eight pumps each and was able to deliver 3 million gallons a day from Pontian Reservoir to Pulau. These pumps were driven by Diesel engines of 360 GHP each.
- 4) Two steel pipelines, 30 inches in diameter, from Pontian Kechil to Pulau for 3½ miles.
- 5) Aerating and Sedimentation Tanks large enough to treat the removal of iron from the combined supply of Pontian and Pulau.
- 6) An installation of mechanically operated filters able to filter 18 million gallons of water a day.
- 7) Two steel pipelines, 36 inches average diameter and 30 ¼ miles long, from the Pulau filters to Singapore. The essential section was the point from Johor Baharu in which the pipeline traversed the Johor Causeway and crossed Singapore Island, to Pearls Hill Reservoir on the line already finally surveyed. This particular section of the pipeline was expected to furnish the whole supply of water from Johor to Singapore in the future if other schemes were to be constructed and connected to it for the same purpose. The total cost after the completion of the construction of two pipelines underneath the lock of the Johor Causeway was \$214,371.43.<sup>43</sup>
- 8) A covered service reservoir of 30 million gallons capacity on Fort Canning Hill, Singapore.<sup>44</sup>

It was hoped that upon the completion of the scheme, water supplies from Johor together with Singapore's own supplies would meet all of Singapore's water requirements until 1951. In 1932, the water supply from Singapore alone was 11 million gallons. Potentially, Gunong Pulau and Pontian Kechil could each yield 6.5 million gallons and 9 million gallons per day respectively.<sup>45</sup> This estimation was 3.5 million gallons less than the quantity predicted in 1923.<sup>46</sup>

The maximum quantity of water supply to Singapore acquired from Johor until the year before the outbreak of the Second World War was 12 million gallons per day; by comparison, the quantity supplied to Johor from this scheme was 800,000 gallons per day.<sup>47</sup> This demonstrates that the quantity of water from Johor to cater for domestic use in Singapore was 15 times more than that of Johor.

## Conclusion

It can be concluded that the historical development of the water supply between Johor and Singapore in the early twentieth century demonstrates that Singapore's advantage was derived from her situation as the British imperial

seat in Southeast Asia. This paved the way for Singapore to enjoy economic supremacy, although the island lacked its own natural economic resources. Singapore's advantages stemmed from the fact that the British authorities invested in the island and developed its economic capacity through schemes such as the railway link and an increased water supply to support its growing population. Subsequently, the island flourished as a trading centre and became more prosperous than her neighbouring states. Singapore's adoption of a capitalist style economy enabled the island to generate surplus revenue from the resources of neighbouring states like Johor. This has been demonstrated by Singapore's ability to inject capital investment into schemes to exploit cheap raw materials, i.e. water.

By contrast, Johor's main interests were short sighted, in this case to gain immediate returns from the waterworks scheme, by receiving rental on the reserved land and from the timber sources available in the area. Indeed the price of water, especially raw water, did not become an issue during the initial stage of Johor's waterworks construction. In fact, in the case of free-of-charge raw water and the charge of 25 cents for 1,000 gallon on treated water to Johor were not subject to any controversy during the whole pre-Second World War period. Consequently, under the circumstances of the colonial period, Singapore was able to exploit continuously the water deal. The primary objective of the water scheme was to supply water to Singapore rather than Johor. From Singapore's point of view, the only detrimental prospect in the water supply deal with Johor was the depreciation of their capital investment. Nevertheless, this prospect was considered marginal compared to the advantages gained by Singapore through the deal from which Singapore acquired fifteen times more water than Johor before the Second World War.

## End Notes

1. CO 1069/561, 1932. Singapore Municipal Commissioner Hereafter known as SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, National Archive at Kew, United Kingdom, formerly known as Public Record at Kew (hereafter referred as NAKUK).
2. CO 273/179, 1892. Johor proposed Railways, Johor Bahru to Segamat 106 ½ miles. Report with estimate of cost by F.G. Slessor, Engineer in charge of Railway Survey for H.H the Sultan of Johor, March 1892, NAKUK.
3. CO 273/413, 1913. Proposed Bridge Over the Johor Straits. FMSR Report of the Year 1912, NAKUK.
4. CO 1069/561, 1932, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
5. CO 273/413, 1913, Proposed Bridge Over the Johor Straits. FMSR, Report of the Year 1912, NAKUK.



6. CO 273/416, 1913, FMS General Manager to Arthur Young, Governor of the Straits Settlements, 5 Sep. 1913, NAKUK.
7. CO 273/416, 1913, FMS General Manager to Arthur Young, Governor of the Straits Settlements, 4 Nov. 1913, NAKUK.
8. CO 273/447, 1916, see all the correspondence from Governor of the Straits Settlements to the Colonial Office, 11 Nov. 1916 together with the enclosure of the report from Consulting Engineer to The Governor of the Straits Settlement, 9 Apr. 1914; and the reply from Colonial Office to Governor of The Straits Settlements, 11 Dec. 1916, NAKUK.
9. GAJ 247/1919, enclosure 1, Governor Arthur Young to Walter Long, 28 March 1917, National Archive of Malaysia, Johor Branch (hereafter referred as NAMJ).
10. GAJ 247/1919, enclosure 2, Governor Arthur Young to Walter Long, 21 June 1917, NAMJ.
11. FC 641/1917, Causeway across the Straits of Johor, Federal Council Annual Report (hereafter referred as FCAR), National Archive of Malaysia.
12. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932.
13. GAJ 270/1920, see the subject on *Laying of foundation stone at Johor Causeway*, NAMJ.
14. CLMJ 2465/1920, Memorandum of conference at Johor Bahru on subject of Gunong Pulau & Pelepah, NAMJ.
15. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
16. GAJ 757/23, Report by Messrs Sir Alexander Binnie, Son, and Deacon<sup>7</sup>, submitted to the Singapore Municipal Commissioners in 1922, NAMJ.
17. GAJ 757/23, Water Supply from Johor, 18 Jan. 1923 and 17 July 1923, NAMJ.
18. GAJ 757/23, Water Supply from Johor, 16 July 1923, NAMJ.
19. GAJ 757/23, Water Supply from Johor, 24 Nov. 1923, NAMJ.
20. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAMJ.
21. The correspondence to Sultan Ibrahim of Johor (r. 1895-1959) on the water issue was mostly conveyed from the president of the Singapore Municipal Council to Mohamed Said bin Haji Sulaiman who served as the Private Secretary to the Sultan from 1910-1955. See Sulaiman, Mejar Dato' Haji Mohamed Said bin Haji, 1951. *Hikayat Johor yang kedua: Tawarikh Yang Maha Mulia Ibrahim Sultan Johor dari permulaan hingga kedatangan Jepun (1941)*, Johor Bahru: Pejabat Cetak Kerajaan Johor, pp. 250-1.
22. GAJ 757/23, Agreement as to water rights at Gunong Pulau, Paper to be laid on the table of the council of state at the meeting, 24 Oct. 1923, NAMJ.

23. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
24. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAKUK.
25. GAJ 757/23, Agreement as to water rights at Gunong Pulai, Paper to be laid on the table of the council of state at the meeting, 24 Oct. 1923, NAKUK.
26. This agreement is officially stipulated as the Agreement as to Water Rights at Gunong Pulai, 5th Dec. 1927, hereafter known as The Water Agreement of 1927, NAMJ. The Malay translation version of this agreement is written in the Malay Jawi script.
27. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAMJ.
28. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAMJ.
29. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAMJ.
30. See clauses 7, 10 and 20 in The Water Agreement of 1927.
31. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
32. CLMJ 704/25, The Proceeding on the Water Supply from Johor in the Council of Minister of Johor of 1925, NAMJ.
33. See clauses 22, 23 24 and 28 in The Water Agreement of 1927.
34. GAJ 757/23, Letter from the General Adviser to the President Municipal Commissioners, 8th Sep., 1923 and letter from the President Municipal Commissioners to the General Adviser, 26th Sep. 1923, NAMJ.
35. GAJ 632/1923, Ceremony of the Opening of the Causeway across the Johor Straits on the 1st Oct. 1923, NAMJ.
36. See clause 3 in The Water Agreement of 1927.
37. See clause 13 in The Water Agreement of 1927.
38. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAMJ.
39. Water Supply from Johor, 26 May 1929, Administrative Report of Singapore Municipal Council hereafter known as ARSM of 1929, National Archives of Singapore (hereafter referred as NAS).
40. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
41. ARSM 1929, Water Supply from Johor, 26 May 1929, NAS.
42. ARSM 1931, Water Supply from Johor, 7 Dec. 1931, NAS.
43. SS 2273/1924, Johore Annual Report 1924, NAMJ; See also Sulaiman, 1951. Hikayat Johor Yang Kedua, p. 249 and Jabatan Percetakan Negeri Johor, 1955. *A Souvenir commemorating the diamond jubilee of his highness the Sultan of Johore, (1895-1955)*, Johor Bahru: Jabatan Percetakan Kerajaan, , p. 21.
44. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor, 28 Feb. 1932, NAKUK.
45. CO 1069/561, SMC, Singapore Water Works, Water Supply from Johor,

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46. GAJ 757/23, Water Supply from Johor, 17 July 1923, NAMJ.
47. WO 203/4118, 1945. Water Supply and Singapore, 10 Oct. 1945.

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