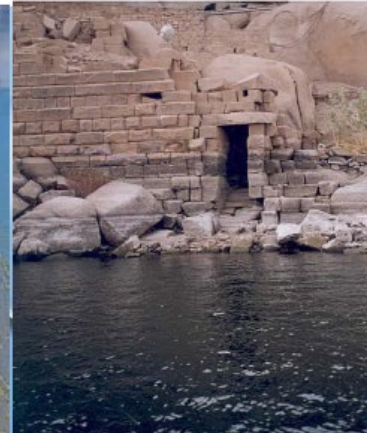
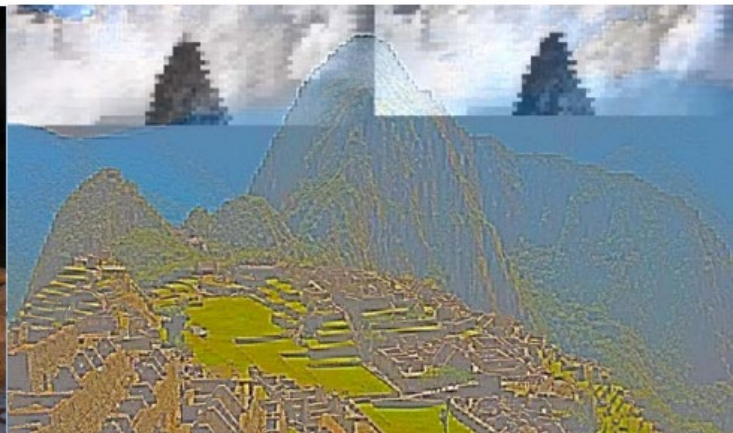
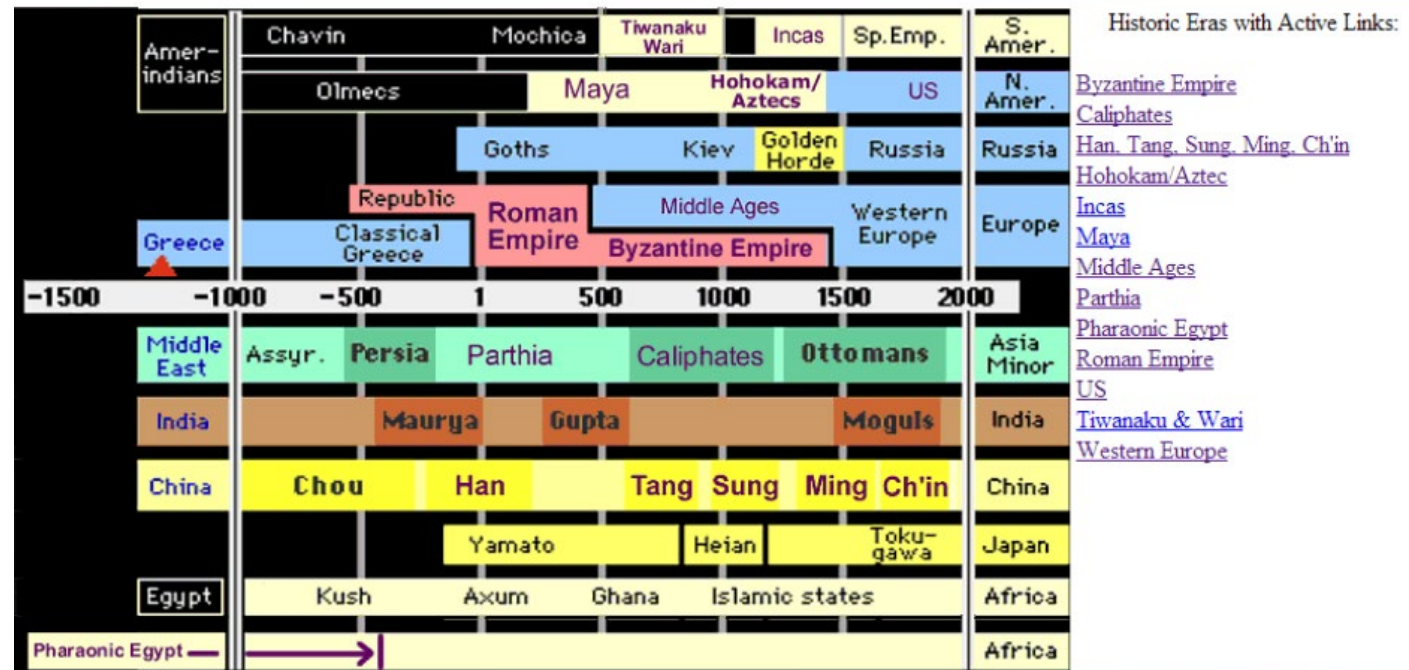


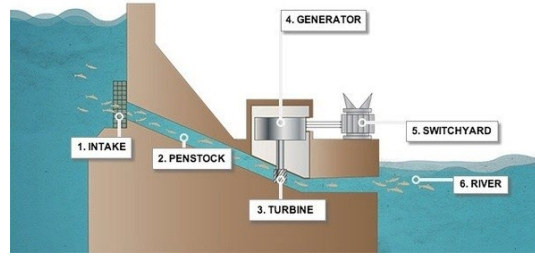
WATER RESOURCES ENGINEERING

People around the world have contributed to this field!



HYDRAULICS (DAMS)

- ELWHA DAM
- HETCH HETCHY



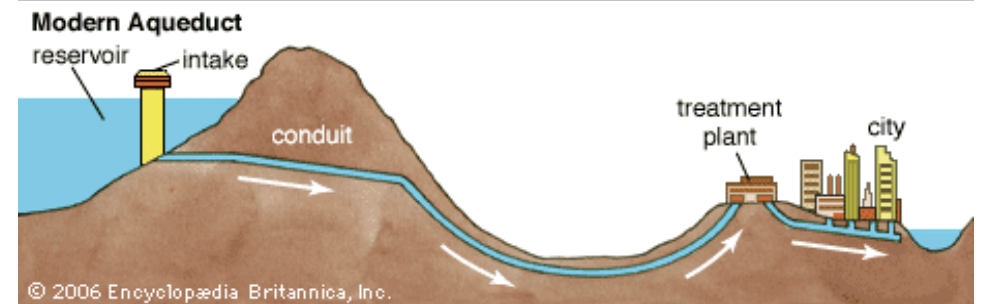
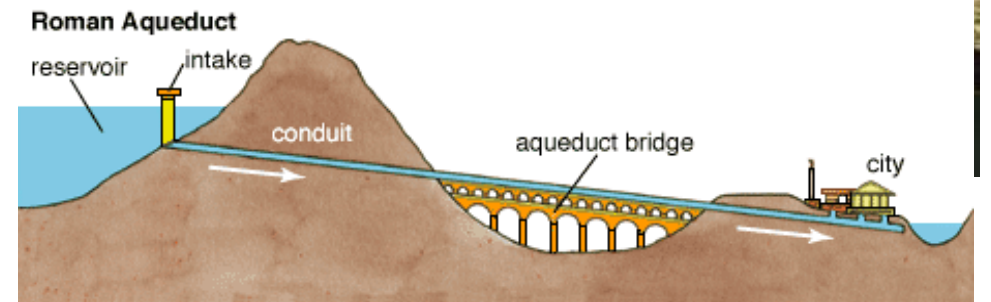
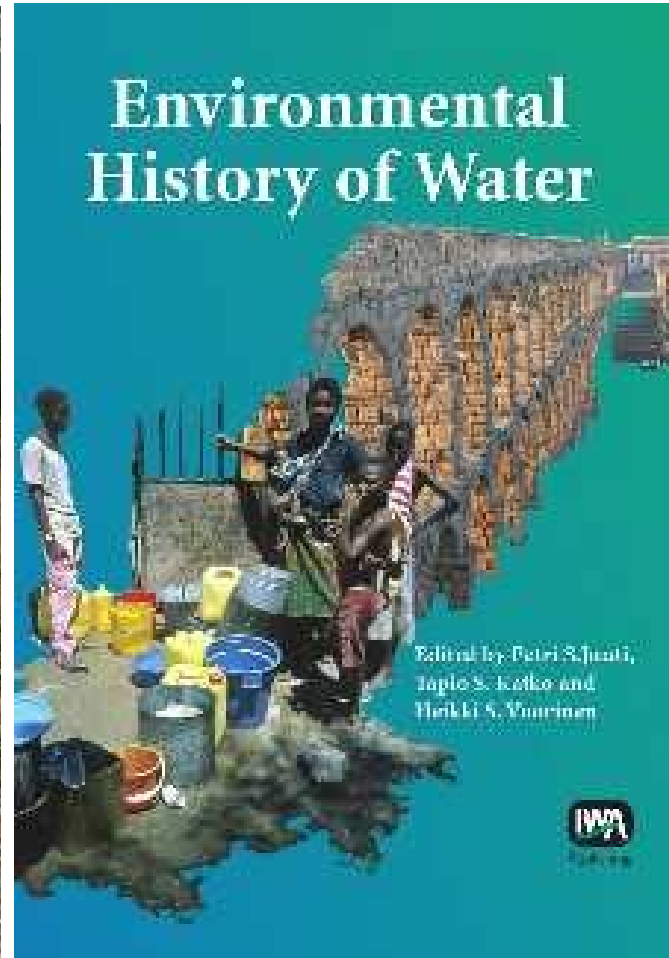
- Ethics
- Social Injustices
- Racial Injustices
- Ecosystem
- Fighting for a Cause
 - John Muir



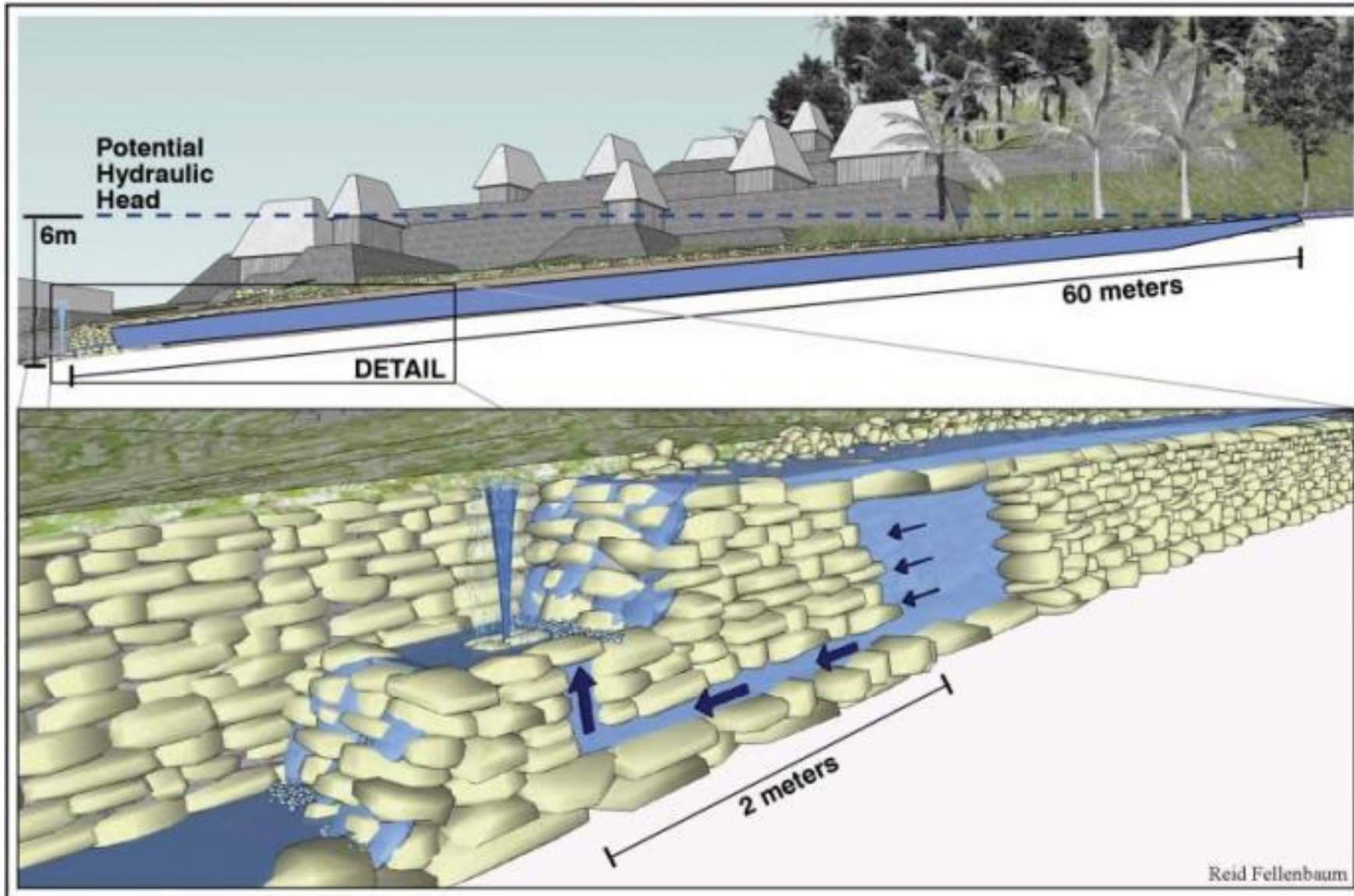
**Klallam Tribe
Chinook Salmon**



AQUEDUCTS



ANCIENT MAYAN PLUMBING



HOW DO THE FOUNTAINS WORK IN THE TAJ MAHAL?

For the fountains in the north-south canal and the lotus pond and its canal, copper pipes were used. To ensure uniform and undiminished water pressure in the fountains, a copper pot was provided under each fountain pipe. The water supply came first into the pot only and from there, rose simultaneously in the fountains, which means that the fountains were controlled by the pressure in the pots rather than pressure in the pipes. The main supply of the water in these pots came through earthenware pipes, some of which were replaced with cast iron back in 1903.



Water for the Alhambra Palace Granada, Spain The Nasrid Scholars

“A supply was established by building a dam and aqueduct from the River Darro over six kilometers away. This channel, the Acequia Real, was the first to bring water to the palace and the beginning of a complex water network for the growing palace-city. Subsequent improvements included reverse qanāts, an ingenious irrigation system that takes river, run-off and subterranean water and channels it underground towards the hill, where it pools in a cistern beneath the complex. Recent discoveries suggest that [complex hydraulic devices](https://omrania.com/inspiration/water-management-why-the-alhambra-palace-was-ahead-of-its-time/) were then used to draw water up to the palace.”

<https://omrania.com/inspiration/water-management-why-the-alhambra-palace-was-ahead-of-its-time/>



Transfer of Hydraulic Technology to Europe and Other Places

The Islamic mastery of hydraulic technology is far more advanced than acknowledged by some of the sources many are too keen to follow, and which hence distorts the exact role of Muslim engineering skills. Indeed, to the likes of Gimpel[93] and White,[94] the Muslims hardly made any contributions in such a field. Reality, however, is far the opposite. First and foremost, the hydraulic works of the Ancients were found by the Muslims in a state of decay and ruin,[95] and they did not just repair them, but also added considerable skills of their own.

To Spain, for instance, the Muslims brought irrigation techniques which not only laid the foundations for the prosperity of the country, but also with nothing as elaborate and as efficient seen before in Europe.[96] After the country was retaken by Christian forces, the Muslims, masters of great skills then, were allowed to retain their functions and serve the new crown. Alongside builders, paper and textile makers, manufacturers of iron and experts of all sorts, the Spaniards also retained and used Muslim irrigation works, their attendant rules and even regulations.[97] Hill also notes that the introduction of desilting sluices, the arch dam, and hydropower made their first appearances in the Islamic world, observing that it is 'difficult to see how these can be other than Muslim inventions.'[98] As Edmund Burke iii notes, Middle Eastern water management technology spread wide and Islamic hydraulic engineering knowledge was also vital in shaping the environment of early modern Europe.[99] Mark Cioc has noted that the two main centers of hydraulic knowledge in early modern Europe were Venice and the Low Countries.[100] The hydraulic engineering prowess of both, he suggests, while indebted to Roman and indigenous precedents (notably polder construction) also drew heavily upon the water management technological package that had been assembled under Islamic auspices.[101] The dyking of the Dutch coast and inland marshes as well as the damming of the Rhine and the Po river systems owed much to this source.[102] Islamic hydraulic technology was taken by the Spaniards to the Americas and Mexico.[103] Glick has even traced an Islamic origin to the water systems of San Antonio and the southwestern United States.[104] More recently Mesoamerican archeologists have finally had to concede that both Mexican galleries and Peruvian *puquios* were derived from *qanat* technology imported by the Spanish.[105]



Figure 6: An acequia flowing toward Granada from the spring in the village of Alfucar in the foothills of the Sierra Nevada, was first built in the 13th century and is still flowing today. (Source).



Figure 7: Aerial view over Wadi Hanifa Wetlands, Riyadh, Saudi Arabia in which appears the al-Ha'ir dam in the southern section. (Source)

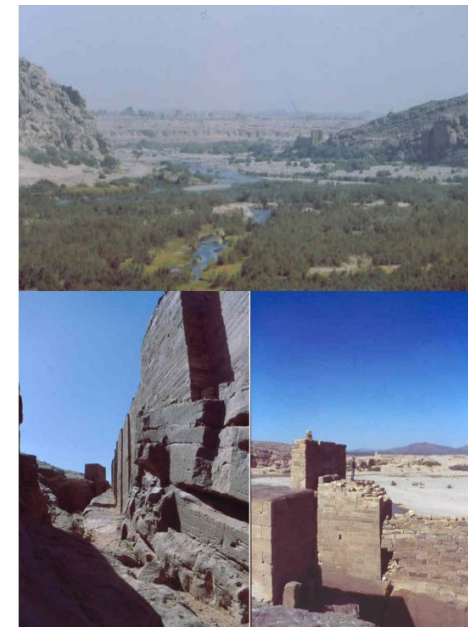


Figure 4a-b: The sluice gates of the old dam of Marib in Yemen: (a) the gates are clearly visible on the right hand side of the river; (b) close up view of the sluice gates. (Source)