

Description of the sanitation system

Alfuhais and Maheis

Description of the locality



Location and Governance

Alfuhais is situated in the Amman Governorate of Jordan, approximately 20 kilometers west of the capital, Amman. Known for its rapidly growing residential neighborhoods, Alfuhais has expanded significantly due to urban development. The area is characterized by a blend of modern and traditional Jordanian culture, with amenities that cater to the local population.

In contrast, Maheis is located slightly apart from Alfuhais and is often regarded as a quieter residential community for those who work in or around Amman. Alfuhais falls under the jurisdiction of the Amman Governorate, whereas Maheis is positioned in the Balqa Governorate, which is northwest of Salt and 10 kilometers west of Amman.

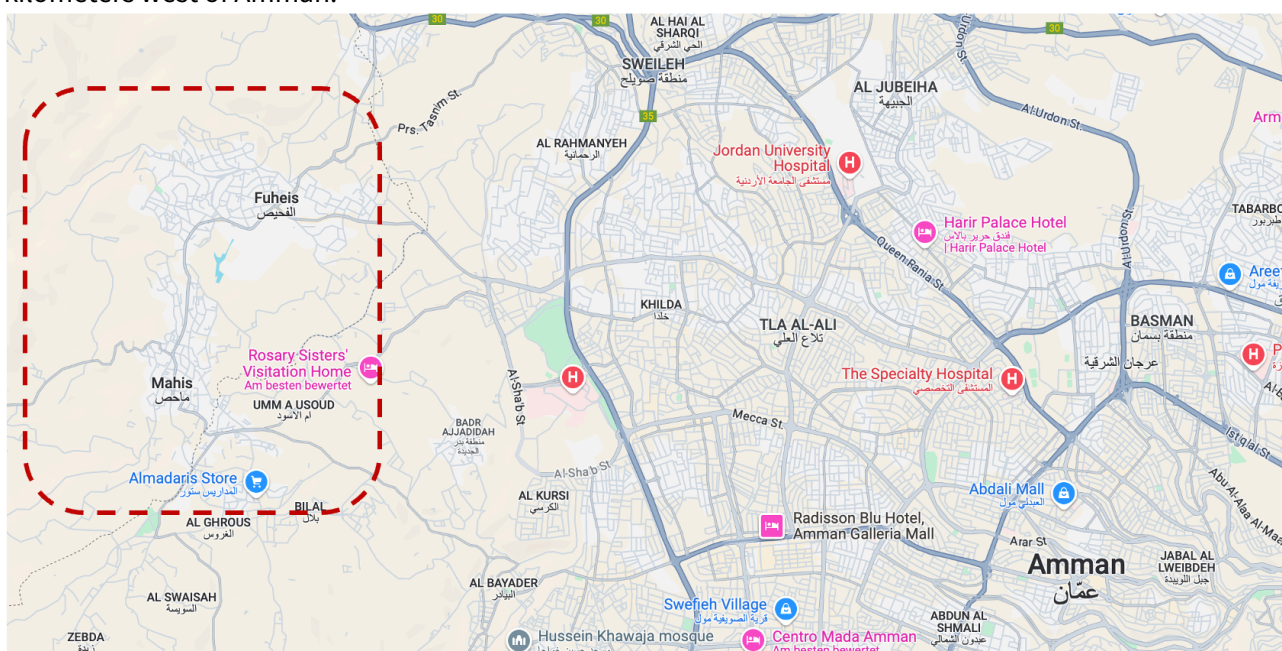


Figure 1: Location of Fuheis and Mahis

Population and Demographics

As of 2021, the population of Alfuhais was estimated at 21,908, with 87% being Jordanian citizens. The demographic makeup indicates a predominantly Christian population, comprising about 95%, and exhibits a male-to-female ratio of 52:48. Maheis, with a population of approximately 17,754 in 2015, is home to residents mainly descending from the Abbadi tribe. The average household size in the region is estimated to be around 4.8 members, reflecting typical family structures in Jordan.

Economic Activities

Both municipalities feature economies historically centered around agriculture, albeit with increasing diversification. Significant agricultural practices in Alfuhais include the cultivation of olives, pomegranates, and grapes, alongside other crops such as wheat and barley.

Maheis relies on an agrarian economy characterized by the production of wheat, barley, tobacco, figs, and olives, although the importance of agriculture is gradually declining. Additional economic activities include kaolin production, drawing from resources in neighboring Fuhais. The region's economic fabric is influenced by Jordan's classification as an upper-middle-income economy, albeit one marked by resource constraints and socio-economic divisions.

Climate and Environmental Factors

The climate in both towns is classified as hot-summer Mediterranean, with average annual precipitation of approximately 500 mm. This rainfall is distributed across distinct seasons, featuring a dry period and a rainy season that can occasionally yield snowfall at higher elevations. Alfuhais and Maheis both experience the impacts of climate change, with studies indicating an increase in temperature and a decrease in precipitation, leading to greater risks of droughts and flooding.

Water Resources and challenges

Water scarcity is a critical issue, as Jordan is recognized as one of the most water-scarce nations globally. Main water sources in these municipalities include natural springs, wells, and treated wastewater used for irrigation—a practice emphasized in the National Climate Change Policy of the Hashemite Kingdom of Jordan (2013-2020). This policy aims to enhance the adoption of treated wastewater in various sectors, particularly in agriculture, by setting priorities for building codes that mandate its use.

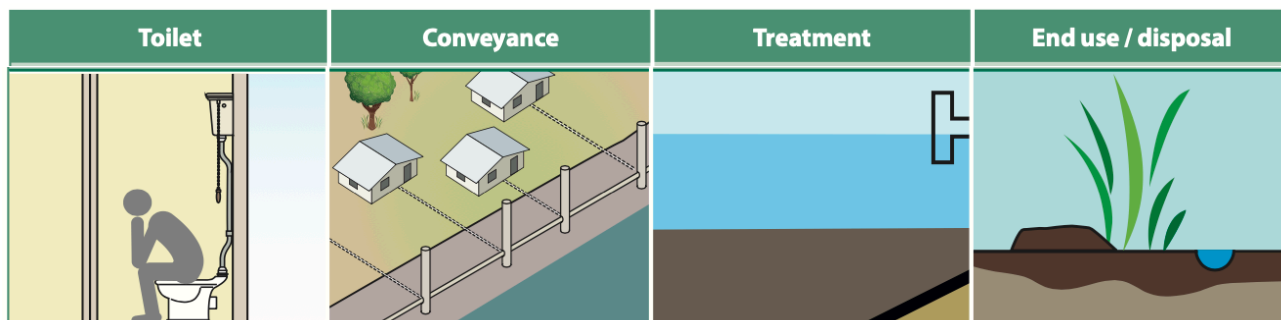
Despite the efforts to manage water resources efficiently, communities near the wastewater treatment plant (WWTP) face significant challenges, such as seasonal overflows potentially contaminating nearby water springs, infrastructural constraints impacting capacity, and variability in industrial wastewater from tourism and local industries. Furthermore, ongoing risks related to climate change, such as extreme weather events and declining precipitation, necessitate robust planning and emergency preparedness measures.

Health Concerns

Currently, there is no disaggregated data linking excreta-related diseases like cholera, diarrhea, and dysentery specifically to wastewater or water contamination in Fuhais and Maheis. However, these health concerns remain a focus area amid ongoing efforts to improve water and wastewater services in the region.

Description of the sanitation system

The sanitation system that will be analysed is the centralized system, also referred as “Flush toilet with sewerage and offsite wastewater treatment, depicted below.



The system centers around the Fuhais and Maheis WWTP, located about 2.5 Km west of Maheis Municipality as shown in the picture below:

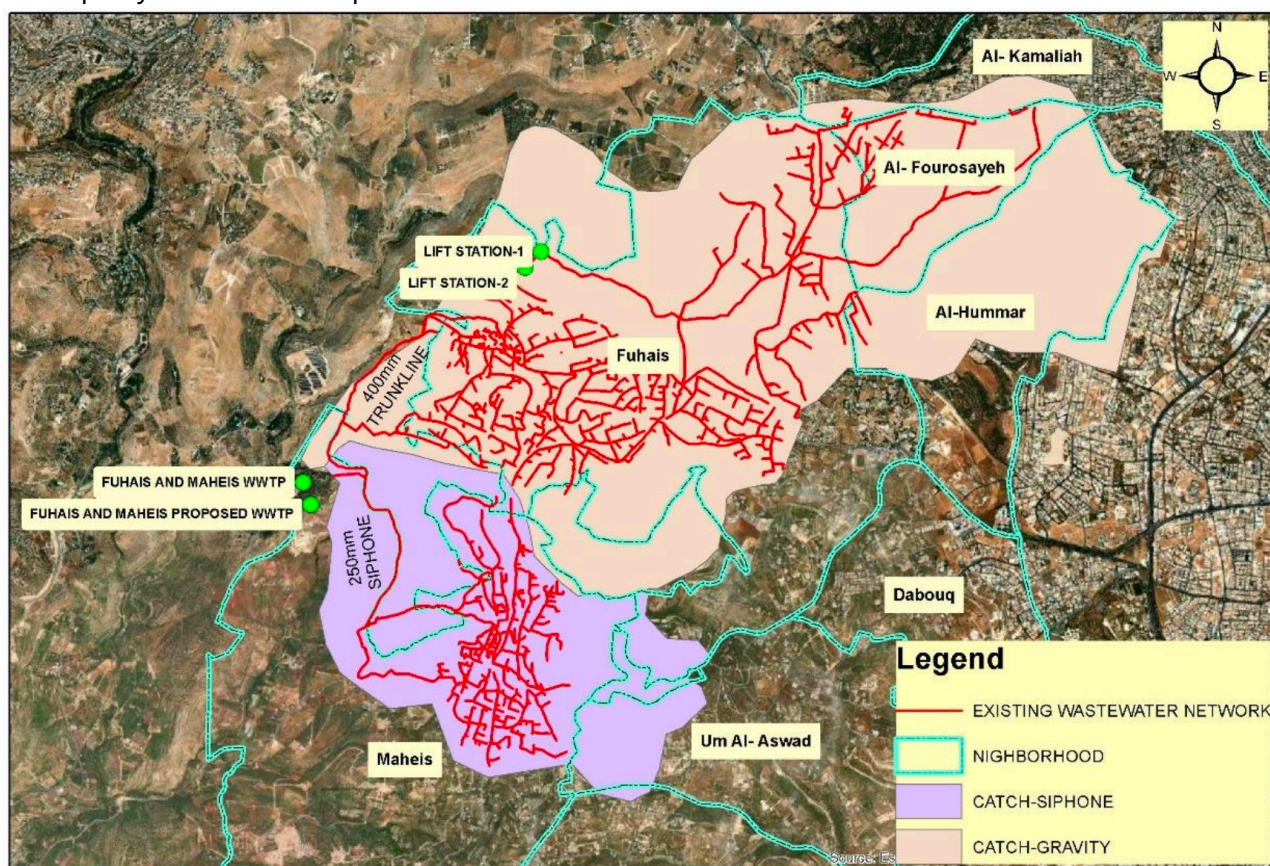


Figure 2: Location of the Fuhais and Maheis WWTP

The plant was designed and constructed early in the 1990s and started to operate in 1997. The plant was designed to treat an average flow of 2,400 m³/d, the process that was chosen was **activated sludge process** (extended aeration). It was commissioned and operated by WAJ up to October 2018 then Miyahuna took over the responsibility of the plant operation and maintenance activities.

The following lines explain the sanitation system service chain, with all the functional components (toilet – conveyance – treatment – dispose/reuse).

Toilet

About 100% households located in the city are using flush toilets. Black water is mixed with greywater. The estimated water use per capita is 92 l/c/d and return flow is 85% as per MWI National Wastewater

Infrastructure Master Plan. In 2025, the dry weather flow rate is estimated at 4,262 m³/day. According to WAJ, the per capita water consumption will increase, reaching 110 l/c/d in year 2025. The following table shows the estimated inflows to WWTP.

Area	Dry Weather Flow Rate (m ³ /day)						
	2022	2025	2030	2035	2040	2045	2050
Fuheis	1,273	1,428	1,674	1,931	2,200	2,488	2,790
Maheis	1,519	1,669	1,895	2,121	2,349	2,587	2,831
From Amman Area	1,011	1,165	1,420	1,696	1,991	2,313	2,657
Total	3,803	4,262	4,989	5,748	6,541	7,388	8,277

Table 1: Estimated inflow to WWTP

Conveyance

The existing Fuhais and Maheis WWTP receives raw wastewater through two main pipelines: a 400mm gravity trunkline and a 250mm siphon, where the 250mm siphon pipeline reaches to an existing pressure break tank located approximately 100 meters before the existing collection manhole, where the raw wastewater from both the trunkline and the siphon is received and diverted to the existing Fuhais and Maheis WWTP via a 500mm trunk line. While the gravity trunkline allows wastewater to flow through the pipe naturally, the siphon utilizes the difference in elevation to create pressure. Both pipelines are currently effective in transporting raw wastewater to the existing WWTP. In the following diagram, the existing Fuhais and Mahais WW Systems Schematic can be seen:

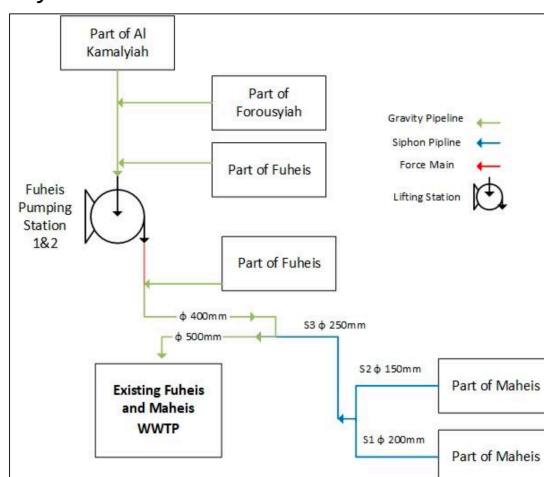


Figure 3: existing Fuhais and Mahais WW Systems Schematic

Treatment

The WWTP is situated in the Balqa governorate, about 20 kilometers northwest of Amman and 2.5 km west of Maheis Municipality. It serves Fuhais Municipality, Maheis Municipality, Al Forousyiah, and part of Kamaliyah area. It treats wastewater up to secondary level.

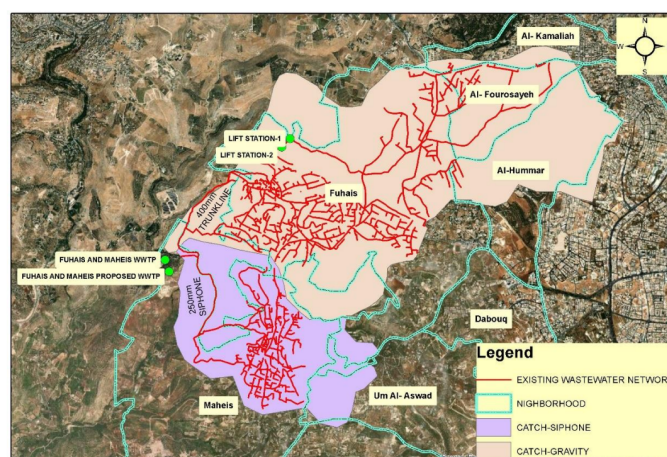


Figure 4: Location of the Fuhais and Mahais WWTP

The WWTP was designed with Extended Aeration to treat an average influent flow rate of 2,400 m³/d generated from population of about 28,305 persons with BOD₅ load of 2,280 kg/d (BOD₅ Concentration of 950 mg/l) in year 2010. Currently, the WWTP receives an average flow of 3,600 to 3,800 m³/d and BOD₅ load of 2,412 Kg/d in 2021. The inflow records indicated that the plant overloaded (hydraulically and biologically). The following diagram shows the overall site layout, with the process components: screens channels, grit and grease removal channels, equalization tank, distribution chambers, aeration tank, settling tank, chlorination, maturation pond, as well as a dewatering system.

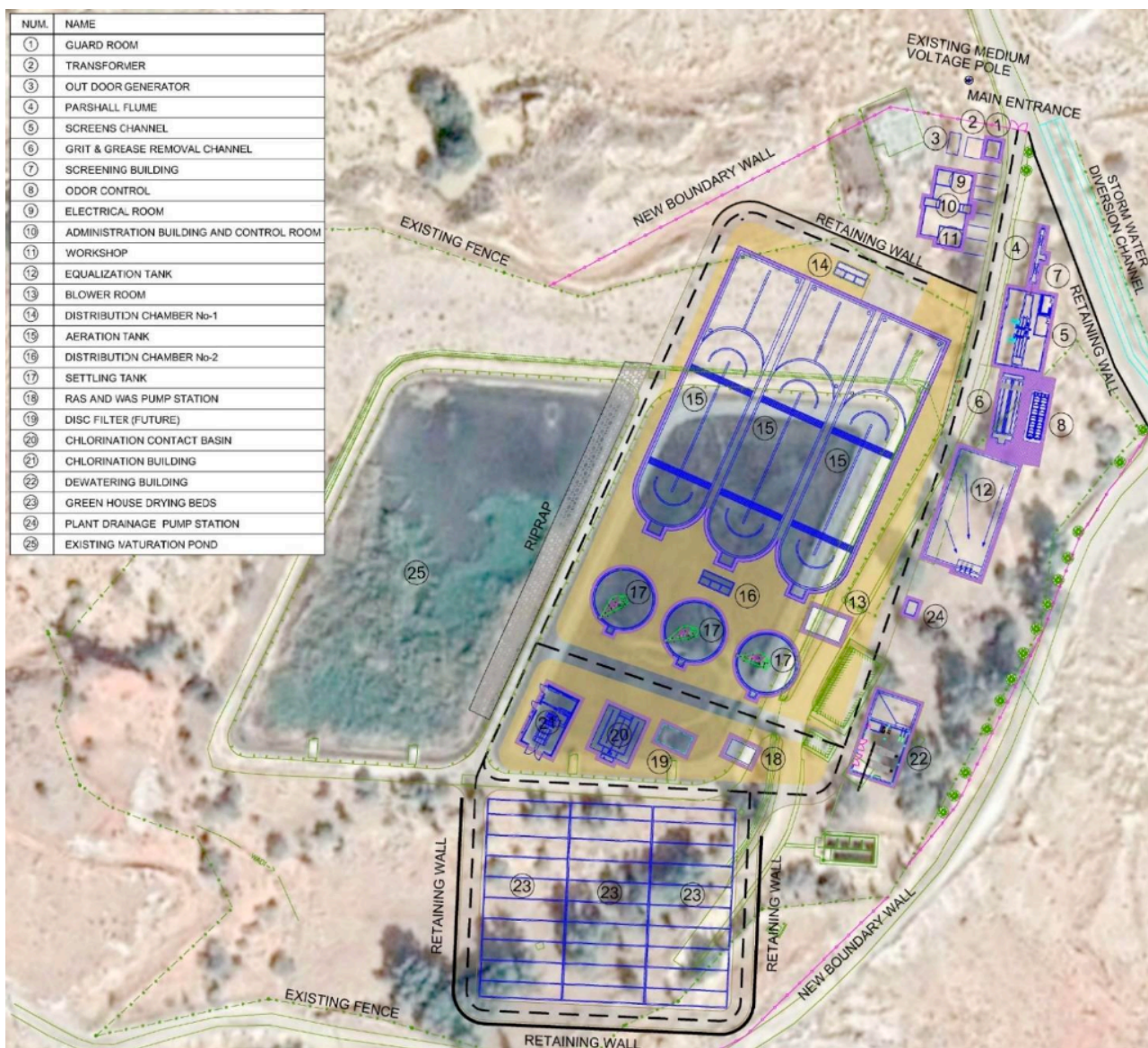


Figure 5: Fuhais and Mahais WWTP Overall Site Layout

The Effluent Standards include the targets BOD₅ ≤30 mg/l, COD ≤100 mg/l, and TSS ≤30 mg/l, among others, to ensure safe discharge into the environment as per the JS 893/2021.

An expansion project is underway to accommodate future wastewater flows. It plans to expand the WWTP to handle 8,300 m³/d by 2050, addressing a daily organic load of 6,225 kg as BOD₅. Future inflows are projected based on population growth and increased per capita water usage, estimating a total inflow of 8,277 m³/d by 2050.

Disposal/reuse

In the municipalities of Fuhais and Maheis, agriculture plays a vital role in the local economy, particularly as these regions grapple with the severe water scarcity that affects much of Jordan. Given the challenges posed by limited water resources, farmers in these areas have increasingly turned to treated wastewater as a critical resource for irrigation.



Figure 6: Use of treated wastewater in Fuhais and Mahais

The primary crops in Fuhais and Maheis, including lemon and olive trees, are well-adapted to the semi-arid Mediterranean climate prevalent in the region. These crops thrive under conditions where freshwater resources are scarce, making them excellent candidates for irrigation with treated wastewater. The use of treated wastewater through drip irrigation allows farmers to maintain healthy crop yields and mitigate the impacts of water shortages, particularly during dry spells.

The reliance on treated wastewater is profound within the agricultural community. According to the WWTP director, local farmers depend heavily on this resource to sustain their irrigation needs. Interruptions or reductions in the supply of treated wastewater can lead to considerable distress among farmers, prompting substantial concerns and complaints regarding potential crop loss and economic repercussions.

However, alongside the benefits of using treated wastewater, there exists a notable sensitivity regarding public perception. Farmers often find themselves navigating complex social dynamics when it comes to the use of treated wastewater for irrigation. During public interactions or interviews, some may deny using treated wastewater, primarily due to fears surrounding market acceptance. The apprehension that crops irrigated with treated wastewater might be perceived as inferior or unsafe compared to those grown with fresh water creates a challenging environment for farmers.

As such, the agricultural activity in Fuhais and Maheis underscores not only the importance of treated wastewater as an essential irrigation resource but also the need for public education and awareness campaigns to improve market perceptions. By fostering a better understanding of the safety and benefits of using treated wastewater in agriculture, stakeholders can help alleviate farmers' concerns and promote the sustainability of local food production amidst ongoing water scarcity challenges.