Restoration of the Besor-Hebron-Be'er Sheva Stream

A Transboundary Project Supported by the JNF Parsons Water Fund

Installation of Hydrometric Monitoring Stations on the Hebron and Beersheba Streams

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Selection of locations for hydrometric stations

Over the period of the project, there were a number of trips and meetings to consider possible locations for the hydrometric stations. This process took time, as each trip to investigate locations was summarized and conclusions noted; and subsequently additional locations visited. At the same time, both internal meetings were held and meetings with the groups operating in the region, including the Shikma-Besor Drainage Authority, Mekorot Water Company, the sewage pre-treatment plant and the Israeli hydrological service. Criteria for choosing the locations depended on the following: (1) addressing research needs; (2) hydrological characteristics, hydrometric, hydraulic and geomorphological measurement sites; (3) technical considerations, including maintenance, composition and type of sensors, energy requirements, security concerns regarding vandalism, (4) and economic considerations including the cost of facilities, maintenance and make-up of sensors. The three following locations (out of 15 options tested) were chosen as the most suitable and appropriate equipment was selected (Figure 1).

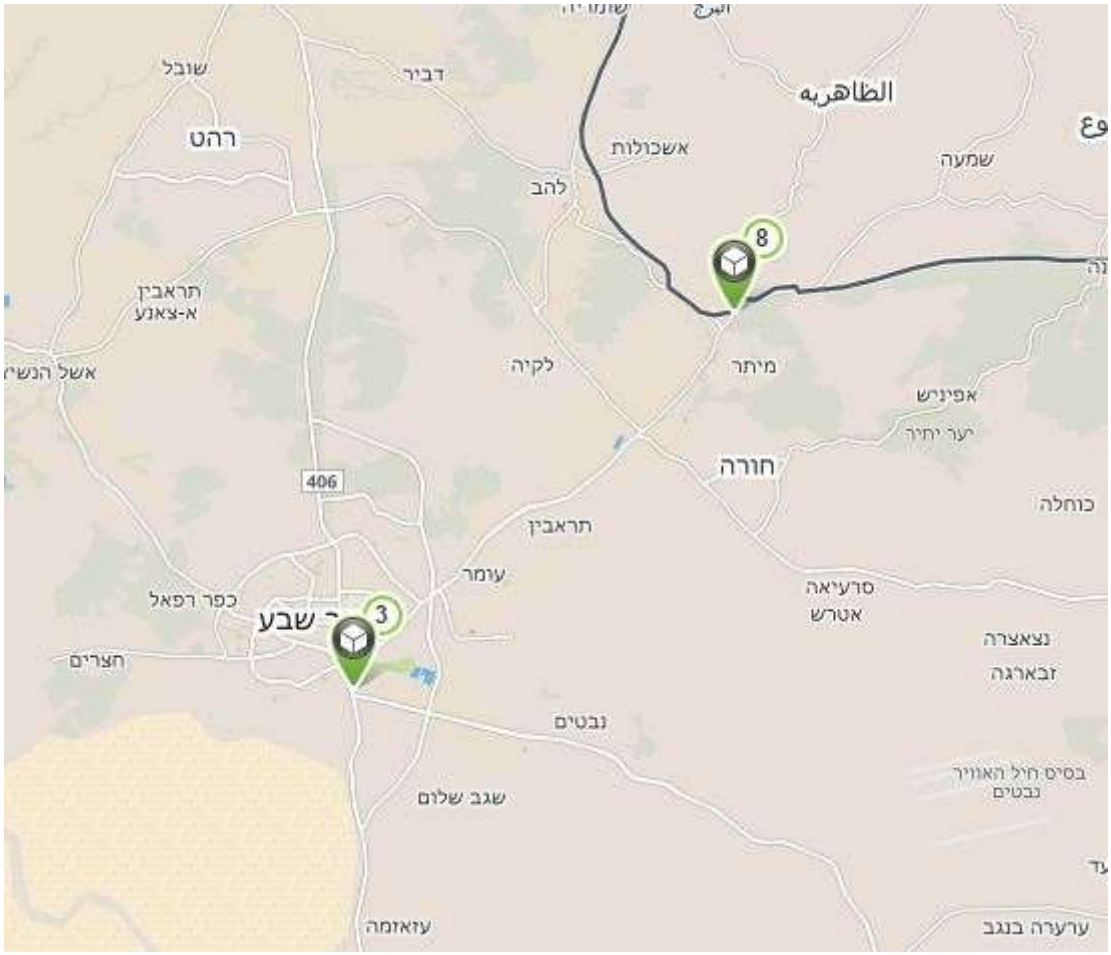

Figure 1: Location of the approved sites for hydrometric monitoring

Hydrometric stations to measure the water level and flow in the Hebron Stream

At the point where the Hebron Stream crosses the Green Line, a wastewater pre-treatment plant that treats sediments from the constantly flowing effluent that originates from the West Bank is located. This flow of effluent is measured continuously. It was therefore decided that there was no need to install a complex device that requires on-going maintenance where there is a constant flow. Alternatively, it was decided to utilize the area downstream from the weir that was established to catch wastewater, and install a site to measure flood flow. As mentioned, the base flow is measured regularly, whereas flood flow that is not caught at the wastewater treatment (WWT) plant is measured at present by the hydrometric station established downstream. Because the station is located in a dry area for most of the time, we could use an inexpensive pressure sensor and connect this to a collection and transmission platform of the Ayyeka Company (See Appendix 1) that supplies power from a small long-lasting battery. Since this location is close to the collection site, we

received permission to install the storage and transmission system at their facility (Figure 2), thus avoiding possible damage to the instruments and reducing the costs of equipment protection. The station was built in a stable area, which will preserve the cross section of flow and facilitate flow calculations (Figures 3-4). The Shiqma-Besor Drainage Authority is responsible for monitoring the floods.

Figure 2: Storage system and transmission site located within the grounds of the WWT site to prevent vandalism

Figure 3: Looking downstream, beyond the weir that catches the base flow.

Figure 4: The sensor passes through a pipe located adjacent to the infrastructure of the channel.

Hydrometric station to measure the water quality in the Hebron Stream

After touring the WWT facility, a suitable site was found where the water quality station could be placed. This site receives flow directly during base flow, as well as during floods. This installation site allowed us to install a relatively simple device and save construction and maintenance costs (Figures 5-6), because the device does not need to be flood resistant, there is no need for security measures against vandalism (the facility is staffed 24 hours a day), and it is easy to get to the sensors for maintenance.

Selected sensors include conductivity, temperature, optical dissolved oxygen, and turbidity. These are all connected to the storage and transmission platform from Ayyeka (Appendix 1) and their maintenance is not particularly high. Because there is a constant flow, they require weekly cleaning and recalibration twice a year.

Figure 5: Water quality measurement station in the Hebron stream installed in a holding area at the collection site of the WWT facility.

Figure 6: Station for measuring water quality in the Hebron stream - view from above.

Hydrometric Station to measure the water level and flow in the Beersheba Stream.

After pretreatment for the wastewater at the Green Line, the wastewater continues to flow from the Hebron Stream to the Beersheba Stream. In order to measure the base flow and flood flow level, the decision was made to install a level radar which measures the flow level with remote sensing. Since the radar is not mounted in the flow, it requires relatively little maintenance and avoids the need for contact with wastewater during treatment at the station.

In order to install the radar, an appropriate bridge in terms of its location above the stream was located (Figure 7), eliminating the need to install an expensive device to mount the radar during the large floods that occur in the Beersheba Stream. Radar measures the flow continuously and, when a flood occurs, alerts the relevant parties.

The box in which the instruments are located is designed for easy maintenance access, but also is well protected from damage because it is constructed from sturdy material and has special hidden locks to prevent vandalism (Figure 8).

Because the radar requires more energy than the pressure sensor, the station includes a battery and therefore, it needs checking only every six months to a year. (Figure 9).

Because the stream channel is not stabilized, the cross-section of the stream channel needs to be measured and from this, calculations of flow will be made. The Shiqma-Besor Drainage Authority maintains the channel of the base flow and we will coordinate with them so that correct calculations of the stream cross-section will be taken for calculating flow rates, especially during flood events. Water level data are received continuously via the radar and transmitted securely over the internet (Figure 10).

Figure 7: The radar station was installed on the bridge at the southern point of Beer Sheva to monitor water levels and flow rates in the Beersheba stream

Figure 8: The container in which the instrumentation is located. The container is painted to blend with the environment, has special locks, the hinges are internal, and there are no external signs that there is an electronic system in it (such as a solar panel or antenna)

Figure 9: Instruments in the container padded with Styrofoam. The internal battery and battery supply energy for the system for about six months to a year.

Figure 10: Example of water level data from the website

Appendix 1: Autonomous platform for collecting and transmitting data

1. Ayekka products were designed and developed to operate autonomously, to be installed in isolated locations that lack a power source. The system's internal battery provides the power needed to run a sensor, to store data, and to transfer data via cellular communications. If needed, the system can be connected to an external power source.
2. The system collects the data as needed. Data are transmitted at a chosen rate to a database; the frequency of transmission can be set according to certain thresholds.
3. Instant alerts (SMS or email) can be specified depending on certain thresholds.
4. The system settings and software updates are done remotely, via cellular communication and the server does not require physically going into the field. As part of the annual service package, the company will make any configuration changes at your request.
5. Assuming a measurement frequency of five minutes and a transmission frequency twice a day, the internal battery will suffice beyond 12 months (depending on cellular signal strength), so there is no need to install electrical connections, a solar panel or for frequent battery replacement.
6. The internal antenna is highly sensitive.
7. High reliability of transmission. The units are supplied with a unique SIM card from the Ayekka Company, which includes the option of working with several alternative cellular networks in parallel (Orange, Cellcom and others), depending on the signal strength and availability of mobile phone networks. In special cases, such as installation along borders, foreign data networks can be used in order to improve communication and performance.
8. The system includes an internal GPS that enables time synchronization of all systems. The internal clock does not need to be set, as it is updated automatically.
9. The data is backed up on servers in two independent centers. There is a level of encryption of data transmission and on the Cloud according to the requirements of the Prime Minister's Office for Information Security.
10. The client will have access to the Cloud database to view and manage all the stations and the measured data.
11. Data can be downloaded as an Excel file into a website with username and password access.
12. A wide variety of sensors can be installed to the Ayekka systems.
13. Sample Site

https://home.ayyeka.com
user: demo
password: akdemo