The Knesset

Research and

Information Center

Israeli Water Sector—Key Issues

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1. Introduction

This document was written per the request of Knesset Speaker Yuli Yoel Edelstein, as part of the trilateral collaboration between the Knesset and the parliaments of Cyprus and Greece, and it explores different aspects of the water sector in Israel. The subject of water is very broad and complex, and covering every aspect of this topic in a single document—let alone delving into them—is a genuine challenge. As such, this document focuses on key issues regarding the Israeli water sector—its sources of water, structure, and operating methods—the water crisis in Israel, and methods of addressing it. Furthermore, the document provides a summary review of the actions taken by the 20th Knesset regarding water and suggests several challenges facing the Israeli water sector in light of the UN Sustainable Development Goals that relate to water.

It should be stressed that while issues of water also entail regional and diplomatic aspects—*inter alia* due to the fact that water sources cross international borders—this document will mostly avoid dealing with issues related to Israel's relationship with its neighbors over water.

Major Points:

- **Water use in Israel in 2016 amounted to some 2,346 million cubic meters (MCM); 34% for domestic use and 55% for agriculture.** Water use per capita across all sectors was 257 CM a year, of which use for domestic purposes (including public institutions) was 96 CM a year. Water use per capita has declined in the past two decades, although the past few years have seen an upward trend. There has been a change in the mix of water sources used in agriculture: The use of marginal water (mostly reclaimed - treated wastewater) has increased, while the use of fresh water has dropped. Thus, marginal water composed 60% of the water used for agriculture in 2016.

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- The Israeli water sector has natural and artificial sources of water. **The main natural sources** are the Kinneret Basin, which includes aquifers and rivers that flow into the Sea of Galilee, the Coastal Aquifer, and the Mountain Aquifer. Natural fresh water makes up some 40% of water consumption. In addition to the sources of natural water, **two sources of artificial water play a vital role in the water sector: desalinated water** (mostly seawater), which in 2016 provided

25% of water consumption, **and reclaimed wastewater,** used mostly for agriculture, which in 2016 provided 25% of the water consumed across all sectors.

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- Water in Israel is public property and is provided to the public through a system of State-run and private bodies which are in charge of producing water, transporting them through a national network of canals and pipes, and delivering them to end consumers; they are also responsible for as well as wastewater collection, treatment, and reclamation for reuse. A national authority has operated in Israel for about a decade to coordinate the administrative and regulatory duties of the water sector: **the Water Authority.**

- In the past, local authorities were responsible for providing consumers with water and sewage services. Nowadays, consumers in most cities and towns get their water from 55 **water and sewage corporations.** It appears that establishing corporations has led to significant infrastructure improvements and reduced water loss due to increased investment in municipal water infrastructure. However, ever since the corporations were established, there have been many complaints concerning their high operating costs and inefficient financial management. A joint Knesset committee composed of the Economic Affairs Committee and Internal Affairs and Environment Committee is currently discussing a reform that would significantly reduce the number of corporations in order to make them more efficient.

- **Water rates are set by the Water Authority and are uniform for all domestic consumers.** There are two rate grades: basic water use (up to 3.5 CM per capita per month with a minimum of 7 CM per housing unit) currently costs approximately NIS 6.5 per CM, VAT included; any additional use entails a higher rate—currently approximately NIS 12.3 per CM, VAT included. **Water rates are set so as to cover the cost of providing consumers with water and sewage services (the principle of true cost).**

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- **For years, Israel has faced a water crisis, which has manifested itself in low precipitation and dwindling natural resources** (groundwater and sources of

surface water, primarily the Sea of Galilee). The drought in Israel's north, an area that usually receives greater precipitation, is particularly severe.

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- **In order to deal with the increasing water shortage, Israel has taken several measures. Increasing the supply of desalinated water by constructing desalination facilities** is one of the main measures. Five facilities have been built since the Government decided in the late 1990s that there was a need to prepare for seawater desalination, although the construction timetables have been plagued by many delays. These plants have had economic and environmental implications. According to the Water Authority website, the annual production capacity of the desalination facilities currently stands at some 660 MCM. In 2016, 604 MCM of desalinated water were produced.
- **The growing reliance on desalinated water has brought several challenges.** The production cost of desalinated water is relatively higher than the cost of producing natural fresh water. In addition, desalination causes various types of environmental damage, including increased energy usage (and consequently increased air pollution), harm to beaches owing to the need to construct desalination facilities on portions of the shoreline, fears of pollution from chemicals used in the desalination process and of damage from dumping brine (the saltwater solution that remains after the extraction of desalinated water) into the sea. Desalination also has adverse effects on health due to the lack of minerals (primarily magnesium) in desalinated water, and there are concerns regarding the effects of polluting the sea, which serves as the source of desalinated water, on the water sector.
- **Another method of addressing Israel's water crisis is increasing the use of reclaimed wastewater,** mostly for agricultural purposes. **Israel's rate of water reclamation for reuse is one of the highest in the world—87% of treated wastewater** (or 82% of all wastewater). In 2014, half of reclaimed wastewater met the quality standards required under the regulations for unlimited irrigation (in terms of geographical area, water quantity, and crop type). Alongside the advantages of reclaimed water and despite the water treatment process, the reuse of reclaimed water may pollute the soil, flora, and adjacent water sources.
    - **Alongside steps intended to increase the existing water supply, various measures are being taken to try to reduce water use in Israel.** One way

of accomplishing this goal is setting rules for various aspects of water use through primary and secondary legislation. The main method for putting this measure into use is through issuing a declaration designating **Israel as an area where water use will be limited,** and, accordingly, determining quotas for water use by the type (fresh and reclaimed), use (agriculture, replenishment), geographic area, and meteorological and hydrological properties of the water.

- Another method of reducing water use is through **education and public relations** activities intended to raise awareness as to the importance of this issue and to promote action and the adoption of more economical water use habits. Various campaigns have been launched over the years. The last media campaign on the issue ran in July 2017. The Water Authority is planning to launch another large-scale campaign in early 2018.

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- **The Knesset is one of the main bodies setting policy for the water sector in Israel.** Many of the decisions that have shaped the water sector and determined its methods of action are grounded in primary and secondary legislation that were drafted, discussed, and enacted at the Knesset. Many discussions on a variety of issues relating to the water sector have been held in various committees of the current Knesset, including two joint committees established to discuss bills related to the water sector. One of these bills—Amendment no. 27 to the Water Law—was passed in early 2017, and stipulated*, inter alia*, that water producers will no longer pay levies to the State Treasury in exchange for water production; instead, any payments charged for providing water will be used to benefit the water sector itself.

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- **The water issue debate is influenced by the sixth of UN Sustainable Development Goals (SDGs),** which were adopted in 2015 by the UN General Assembly. **This goal deals in ensuring the availability of water resources and sanitary infrastructures and managing them sustainably.** This goal and its secondary goals present **several challenges for the Israeli water sector:**
  - While the SDGs seek to ensure **complete, equal access** to affordable potable water for the population, as well as proper sanitation and hygiene, and while most citizens in Israel have regular access to water supply via a direct

connection to the national water system, some (particularly in unrecognized Bedouin villages in the Negev) do not. Furthermore, the foreseeable population growth and the diminishing supply of natural water resources present a challenge to maintaining this access.

- **Another goal seeks to diminish water pollution and the volume of untreated wastewater.** Israel may be one of the leading countries when it comes to wastewater treatment and reuse of reclaimed water, but differences currently exist between different population sectors; for example, in towns with a mostly Arab population, only some 76% of households are connected to sewage collection systems. Furthermore, the vast majority of military bases are not connected to a central sewage system that would allow for proper sewage treatment. Additionally, Israel shares its sources of natural water with the Palestinians; as such, the state of Palestinian sewage treatment (which lags considerably behind that of Israel) directly affects the quality of Israel's water resources.
- **Another goal addresses optimizing water use across all sectors.** In this context, we note water corporations' contributions to improving the efficiency of water supply and sewage treatment systems, on the one hand, as well as claims of inefficient conduct, on the other. In the same context, it is worth discussing the significant progress Israel has achieved in **basing a growing portion of agriculture on the use of reclaimed wastewater, as well as examining methods for promoting sustainable agriculture that consumes less water.**
- **Another goal calls for drafting and implementing integrative plans for managing the water sector.** In 2012, the Water Authority presented a policy paper that serves as the first part of a **Master Plan for the National Water Sector through 2050.** In addition to the policy paper, the master plan is supposed to include an implementation plan that addresses implementing the policy and which is meant to bridge the gap between the current state and the desired state. However, overall comprehensive implementation plan has yet to be published, and the master plan has not been brought to the Government for approval.
- Another goal addresses **the implementation of a plan for the protection and rehabilitation of marine and aquatic habitats and ecosystems. We note in** this context that under Israel's struggle with the water crisis, many

resources are allocated to continue meeting the demand for water for human consumption—in agriculture, industry and domestic use. However, **the state of Israel's water resources is deteriorating, and despite efforts to return water to nature, marine and aquatic habitats are in danger.**

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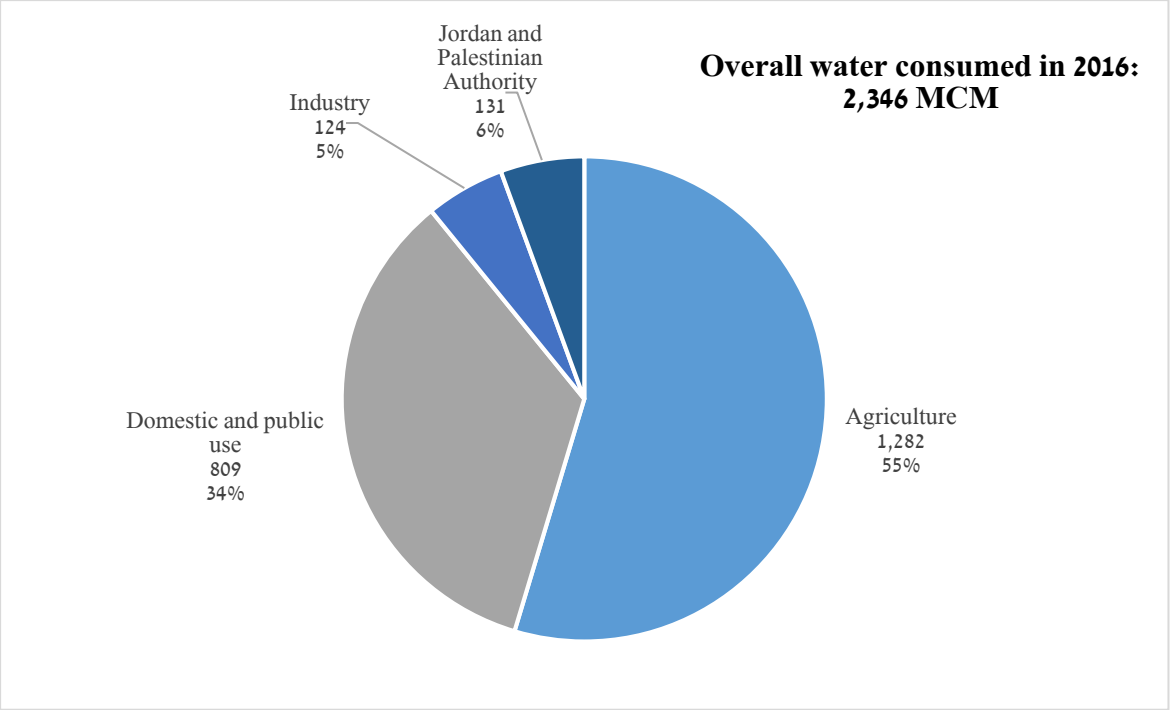
2. Water use in Israel

Water use in Israel in 2016 across all sectors was 2,345,890,300 cubic meters[1] (some 2,346 million cubic meter, abbreviated as MCM). The following chart presents a breakdown of water use per sector.

Chart 1: Overall Water Use in 2016, by sector, in MCM and as a percentage of overall use[2]



[1] A cubic meter (CM) is a unit of volume equal to the volume of a cube with edges one meter in length.

[2] The Water Authority, "Overall Water Consumption in 2016 by Use (in thousands of CM)," 30 November 2017 [Hebrew].

Some 60% of agricultural consumption is of non-fresh water, nearly three-quarters of which is reclaimed water—treated wastewater—and the remaining is saltwater and floodwater.[3]

A review of multiannual consumption data indicates that water use in Israel across all sectors (not including the transfer of water to the Palestinian Authority and Jordan) grew by 26% between 1993 and 2016 (an annual change of 1%). The changes in water consumption are not equal across the various sectors—domestic and public water use increased 43% (1.7% per year),[4] industrial use increased by 5% (average annual increase of 0.3%),[5] water use for agriculture rose by 14% (annual average of 0.6%). Note that **there has been a significant change in the mixture of water used for agriculture—even as the use of marginal water (reclaimed, salt, and flood water) has seen a 177% increase, the use of fresh water in agriculture has declined by 40%**.[6] As mentioned above, marginal water constituted 60% of the consumption in the agriculture sector in 2016.[7]

In 2012, the Water Authority published a long-term master plan for the water sector (through 2050).[8] The plan includes a water use forecast, based on projected population growth, which assumed that by 2015 there would be a decrease of some 5% in water use per capita alongside a considerable increase in the amount of water allocated for nature and the rehabilitation of natural water resources. According to this forecast, water use is expected to reach 2,672 MCM a year by 2020, 2,765 MCM a year in 2030, and 3,571 MCM a year in 2050.[9]

2.1. Water use per capita

As mentioned above, water use in Israel has increased in the past two decades. However, accounting for population growth in Israel during said years (some 2% annually, on average), **water use data from the past two decades indicate a decrease in consumption per capita, though the past few years have seen an increase—**from 331 CM in 1993 to a low

[3] Agricultural use includes a supply of some 30 MCM of water supplied for nature and landscaping. This amount refers to the water supplied by pipeline for a fee and does not include additional, much larger quantities which are already streamed to nature.

[4] This figure refers to the years 1993–2014, as no distinction has been made between domestic and industrial use since 2015.

[5] See Note 4 above.

[6] Presentation of data from the Water Authority, *Water Use in 2016——Summary Report*, November 2017 [Hebrew].

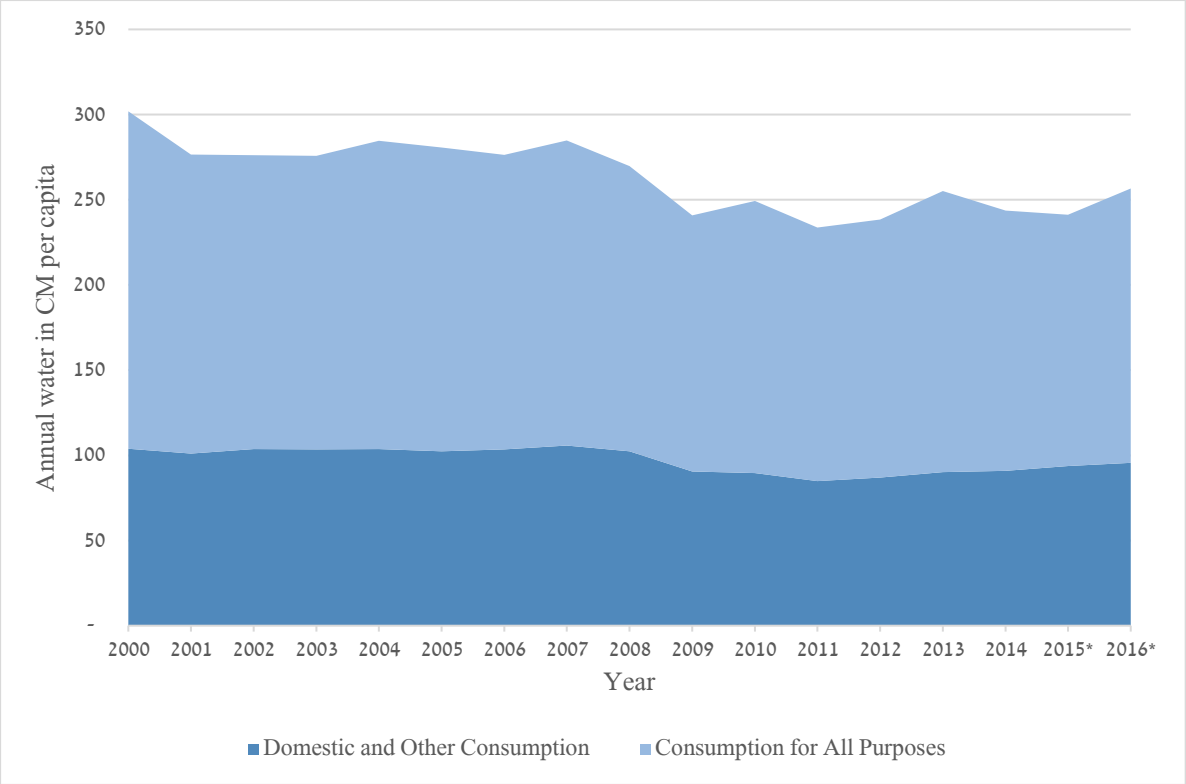
[7] Water Authority, *Water Consumption in 2016——Summary Report*, November 2017 [Hebrew].

[8] The plan addresses the key issues facing the Israeli water sector and fashions solutions for future challenges. The purpose of the plan is to integrate and synchronize engineering considerations (ensuring the quality and quantity of water) with structural, economic, environmental, social and legal considerations. Water Authority, *Master Plan for the Water Sector*, accessed: February 12, 2018 [Hebrew].

[9] Water Authority, *Long-term Master Plan for the Water Sector: Part 1—Policy Paper*, 4th Edition, August 2012 [Hebrew].

of 234 CM in 2011 followed by an increase to 257 CM per capita in 2016.[10] The chart below presents water use in all sectors (agriculture, industry, domestic and public use) as well as only domestic and public consumption. The data refer to per capita water consumption within Israel (i.e., not including water provided to Jordan and the Palestinian Authority) during the past 15 years.

Chart 2: Water use in all sectors and domestic and other water use, per capita, annually, in CM, 2002–2016[11]



* Domestic water use data for 2015–16 are estimated, because, since 2015, water allocations for industry were discontinued and industrial use has been added to the domestic use figure.

The data indicate that **in 2016, per capita water use across sectors was 257 CM annually,** of which **consumption for domestic purposes (including public institutions) was 96 CM annually.** Water use data from the past 15 years indicate that during the first part of this period—until 2008—water consumption remained relatively unchanged: water use of 270–285 CM per capita annually across all sectors, and domestic use of 102–106 CM per capita annually. The period between 2008 and 2011 saw a considerable decrease in use to a low of 234 CM per capita across all sectors (a 13% drop) and 85 CM per capita in domestic use (a 17% drop). Since then, increases of 10% in overall use and 13% in domestic use were

[10] Water Authority, *Water Consumption in 2016*.

[11] Water Authority, *Water Consumption in 2015——Summary Report*, December 2016 [Hebrew]; Water Authority, *Water Consumption in 2016*.

recorded to the 2016 levels (257 CM across all sectors and 96 CM for domestic uses, as mentioned above).

3. Sources of Water in Israel

3.1. Precipitation

The rainy season in the region lasts for about six months, from October to April. Most of the rain, some 75%, falls over the course of three months—December, January, and February.[12] There are no more than a few dozen rainy days in Israel per year, and the number decreases from north to south. For example, the average number of rainy days per year from 1981–2010 was 55 in Safed, 48 in Haifa, 45 in Tel Aviv, 43 in Jerusalem, 27 in Beer Sheva, and 4 in Eilat.[13] Like the number of rainy days, the average annual precipitation decreases as one travels southward. For example, the average annual rainfall from 1981–2010 was 671 mm a year in Safed, 583 mm in Tel Aviv, 539 mm in Haifa, 537 mm in Jerusalem, 195 mm in Beer Sheva, and 22 mm in Eilat.[14] Rainfall also decreases when traveling from west to east. Israel's "desert line," which passes through the northern Negev, is defined as an area where the average annual rainfall is below 250 mm. Therefore, some two-thirds of Israel's territory is considered desert. The annual variance in rainfall is very high; rainfall sometimes reaches twice the average in a rainy year and half the average in drought years.[15]

According to the Water Authority, the average volume of rainfall in Israel is some 7,000 MCM. Of this amount, less than 2,000 MCM is actually collected in surface and groundwater reservoirs and can be utilized. Generally speaking, some 70% of rain returns to the atmosphere by evaporation either directly from the soil or from vegetation, some 5% flows in rivers and some 25% seeps into groundwater (the ratio varies from region to region across Israel).[16]

3.2. Main Water Sources

The sources for Israel's water sector are divided into natural sources—primarily the Sea of Galilee Sea, the Coastal Aquifer, and the Mountain Aquifer—and artificial sources: seawater desalination and wastewater treatment.

[12] Water Authority, "Rainfall in Israel," accessed 21 January 2018 [Hebrew].

[13] The standard averaging period for measuring precipitation is 30 years, and in Israel the updated measuring period is 1981–2010.

[14] Vered Granit, *Climate*, Statisti-lite no. 162 (Beit Dagan and Jerusalem: Israeli Meteorological Service and Central Bureau of Statistics), August 2017 [Hebrew].

[15] Water Authority, "Rainfall in Israel," accessed 21 January 21 [Hebrew].

[16] Ibid.

3.2.1. Natural Sources of Water

The **Sea of Galilee** (located in northeast Israel, in the Jordan Valley) serves as an operational reservoir and the source of the water supply for the national water system. For operational purposes, the lake was assigned a maximum level—the upper red line (209 meters below sea level), which should be exceeded for fear of flooding in sites around the lake—and a minimum level—the lower red line (213 meters below sea level), at which point pumping is prohibited due to concerns regarding damage to water quality and the ecosystem. Nonetheless, it has been decided that the minimum level will be 214.87 meters below sea level (the historic low measured in December 2001).[17] As of 1 January 2018, the level of the Sea of Galilee is 214.37 meters below sea level.[18] **The Kinneret Basin** consists of all of the groundwater reservoirs and rivers that flow to the Sea of Galilee. Unlike the other basins, this water from this basin is mostly surface water pumped directly from the Sea of Galilee (though in recent years, in light of the declining water level of the Sea of Galilee, the extent of pumping has diminished) as well as rivers and springs that feed it. Groundwater is only used on a small scale, although the past few decades have seen an increase in pumping. The quality of the water is quite high.[19]

The Coastal Aquifer is a shallow groundwater reservoir that extends the length of the Israeli Coastal Plain, from Mount Carmel in the north to the Gaza Strip in the south. On the west, the fresh water of the Coastal Aquifer borders on the salt water of the Mediterranean Sea; as a result, **over-pumping from the aquifer may reduce the hydraulic gradient and thereby allow saltwater intrusion into wells. The shallow depth of the Coastal Aquifer has made it available and very easy to utilize, on one hand** (and it is, in fact, utilized by hundreds of wells spread across it), **and extremely sensitive to contamination, on the other hand.** This sensitivity is evidenced in the permeation of contaminants from various sources such as industry and landfill leachate. Furthermore, seepage is also possible from irrigation from fields that lie atop the Coastal Aquifer. The risk of contamination increases in light of the fact that the Aquifer is located under the most populated and industrialized region in Israel. The water quality is defined as good in less than half the wells that pump from the Coastal Aquifer.[20]

In average years, the Coastal Aquifer contributes an estimated 240–300 MCM a year to the Israeli water sector (the aquifer's natural replenishment is estimated at some 250 MCM a year), which places it third after the Mountain Aquifer and the Sea of Galilee.

[17] Water Ordinance (Determining the Permitted Water Level), 5728-1968, §1(b) [Hebrew]. This decision will be in effect until 1 March 2018.

[18] Water Authority, "Kinneret Basin," accessed 15 January 2018 [Hebrew].

[19] Ibid.

[20] Idem, "Coastal Basin," accessed 15 January 2018 [Hebrew].

However, this aquifer serves as an important operational reservoir since it is the only one that can store large volumes of water for a multiyear period. Indeed, during rainy years water collected from other reservoirs in Israel as well as floodwater is pumped into the aquifer proactively.[21]

The Mountain Aquifer (Yarkon-Taninim basin) lies between the mountain ridge of Judea and Samaria on the east and the Mediterranean coast on the west. To the north, the aquifer borders on the Jezreel Valley and the edges of the southern slopes of Mount Carmel. On the south, the basin borders on Sinai. The western portion of the Yarkon-Taninim basin lies below the Coastal Aquifer, and the two are separated by impermeable rock. Over the past thirty years, annual output **(pumping and spring flow) has varied between 304 and 484 MCM.** The basin is currently used by hundreds of wells spread across the foot of the main mountain chain. Water quality is high. Before pumping from the basin began, the water flowed through its two natural outlets: the Rosh HaAyin springs, which feed the Yarkon River, and Taninim Springs. The development of pumping from the basin was accompanied by decreasing water levels in the aquifer and reduced water flow in the springs.[22]

These water resources are augmented by smaller sources: the eastern mountain basins, the Western Galilee basin, the Carmel basin, and the Negev and Arava basins.[23]

3.2.2. Artificial sources of water

In addition to natural water sources, the water sector also has two significant artificial water sources: desalination and wastewater treatment.

Desalination: Water desalination is performed by removing dissolved salts from water to create potable water. Since Israel has a constant shortage of natural water, desalinated water serves as an important and major source of water for the water sector. The quality of water produced in desalination facilities is excellent. Nearly 90% of the desalinated water is produced in five seawater desalination facilities—Ashkelon, Palmahim, Hadera, Sorek, and Ashdod—and the rest comes from other facilities for desalinating salty groundwater (mostly in the Arava).[24] According to the Water Authority, the addition of desalinated water into the national system has improved the quality of fresh water and reclaimed water for agriculture, reduced the salinity of lands and groundwater, and provided stability and reliability to the water supply. However, desalination also has economic and environmental costs, including

[21] Ibid.

[22] Idem, "Taninim Basin," accessed 15 January 2018 [Hebrew].

[23] Idem, "Water Sources," accessed 15 January 2018 [Hebrew].

[24] The distinction between salty water and brackish water is based on the level of salinity: The salinity levels of brackish water do not exceed 10,000 mg of salt per liter of water, while the salinity level of seawater can reach 40,000 mg of salt per liter of water. See Water Authority, "Planning and Development—Desalination," accessed 15 January 2018 [Hebrew].

high energy consumption—which results in increased air pollution, use of chemicals, use of land on the coast, possible effects on the marine environment as a result of returning brine to the sea, and more.[25] In 2016, 604 MCM of desalinated water was produced in Israel.[26]

Wastewater reclamation: Over 500 MCM of sewage is produced in Israel every year. Most of it (93%) is treated at some level in sewage treatment plants, which are usually located adjacent to each city or group of cities. Some 87% of treated wastewater (i.e., 82% of all wastewater) is reused, mostly for irrigation in agriculture. Israel has one of the top wastewater reclamation rates in the world. Reclamation is performed by dozens of plants that provide over 400 MCM of water annually—some 30% of water provided for agriculture and some 20% of all the water provided for all uses. The scope of agricultural lands irrigated with reclaimed wastewater in Israel is estimated at some 1.3 million dunams (130,000 hectares).[27]

For more details about water desalination and wastewater reclamation, see Chapter 6—Methods of Addressing the Water Crisis.

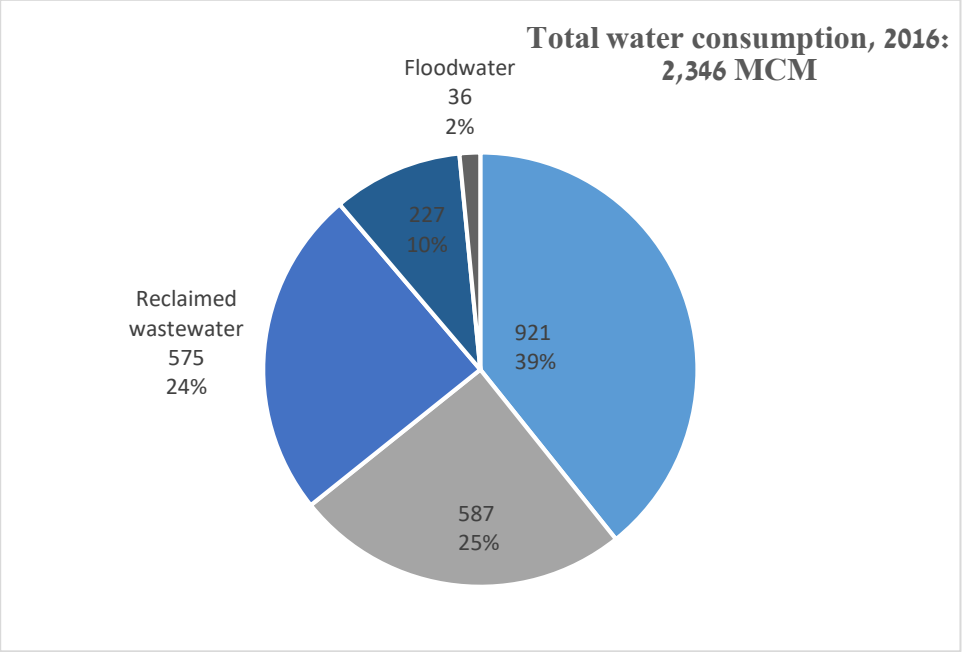
As noted above, 2,346 MCM of water were consumed in Israel in 2016. The chart below shows the distribution of consumed water by source.

[25] Ministry of Environmental Protection, *Desalination Facilities: the Ministry's Environmental Policy for Protecting the Marine and Coastal Environment—Mediterranean Sea*, June 2002 [Hebrew].

[26] Email from Hila Gil, Director of Desalination and Chairwoman of the Water Authority's Desalination Administration, 25 February 25 2018 [Hebrew].

[27] Water Authority, "Reclamation of Wastewater and Low-Quality Water," accessed 15 January 2018 [Hebrew]; Ariel Cohen, Dina Fayman, Matan Israeli, and Natasha Koller, *Collection and Treatment of Sewage and Reuse of Wastewater for Agricultural Irrigation: National Survey—2014*, (Water Authority and Israel Nature and Parks Authority), December 2016 [Hebrew].

Chart 3: Water use in Israel in 2016, by resource, volume in MCM, and percentage of overall use[28]



Noted that the extensive use of desalination and reclaimed wastewater has reduced the Israeli water sector's dependence on pumping water from the Sea of Galilee and other sources. However, reduced precipitation and multiple drought years continue to lead to harm to ecosystems (the Kinneret basin, Dead Sea, and streams) and agriculture.

The 2012 master plan for the water sector provided a medium and long-term forecast for the balance of water resources in Israel (assuming a drop in the supply of natural water and an increase in wastewater reclamation). According to this forecast, a gap will form between water supply and use, which is expected to expand over the course of the coming decades: In 2020, supply is expected to reach 2,663 MCM a year, which, when compared with the projected use, will result in a shortage of 9 MCM a year; in 2030, supply is expected to reach 2,715 MCM a year, which, when compared with the projected use, will result in a shortage of 50 MCM a year; and in 2050, supply is expected to reach 2,900 MCM a year, which, when compared with the projected use, will result in a shortage of 671 MCM a year. According to the plan, closing the gap between supply and demand requires supplements from artificial

[28] Water Authority, "Overall Water Consumption in 2016," 30 November 2017 [Hebrew]; Email from Sharon Nussbaum, Director of Supervision (Suppliers) and Information in the Water Authority, 25 February 2018 [Hebrew]. Note that the figure for reclaimed water includes 39 MCM of fresh water transferred through the Shafdan system. The figure for brackish water includes 18 MCM of desalinated water from the facility in Ma'agan Michael.

water resources (desalination of brackish water, seawater, and imports) of some 750 MCM a year in 2020, and twice that by 2050.[29]

National water system[30]

As mentioned above, Israel is characterized by limited water resources, with the northern part of the country experiencing higher precipitation relative to the south. Therefore, Israel's National Water Carrier —an integrated system of channels and pipes to pump and transport water from the Sea of Galilee to the center and south of Israel—was constructed in the 1960s. At the time it began operating, some 80% of the water flowing in the carrier was allocated for agriculture and some 20% for drinking. Rapid population growth and changes in the country's consumption habits have led to an increase in urban water use and further burdened fresh water resources. Pumping capacity from the Sea of Galilee to the National Water Carrier currently amounts to some 400 MCM a year, but in practice, a much lower volume has been pumped in the past few years.

Nowadays, the main water supply system relies mostly on the National Water Carrier and connects the main water resources (both natural and artificial) to the main waterway system. The national water network currently extends from the Sea of Galilee in the north to Mitzpe Ramon in the south. The areas south of Mitzpe Ramon—the Arava Valley and Eilat—rely on local wells of brackish groundwater and on desalinated water. Water supplied via the central water system is based on three natural sources—the Sea of Galilee and its surroundings, the Coastal Aquifer and the Mountain Aquifer—as well as water from desalination facilities spread the length of the coast. Using this type of national system allows for regulation of the quantity of water pumped from each source of water.

4. The Structure and Management of Israel's Water Sector

The Water Law, 5719-1959 regulates the issue of water in Israel by setting an overall spatial policy, making this the most comprehensive legal arrangement for the Israeli water sector. The law dictates that water sources in the country are state-run public property (i.e., there is no private ownership of water in Israel) intended for the use of Israel's citizens and its development.

The water supply chain is comprised of several sectors and involves multiple players. **The production sector** includes Mekorot, seawater desalination facilities, and water pumping by

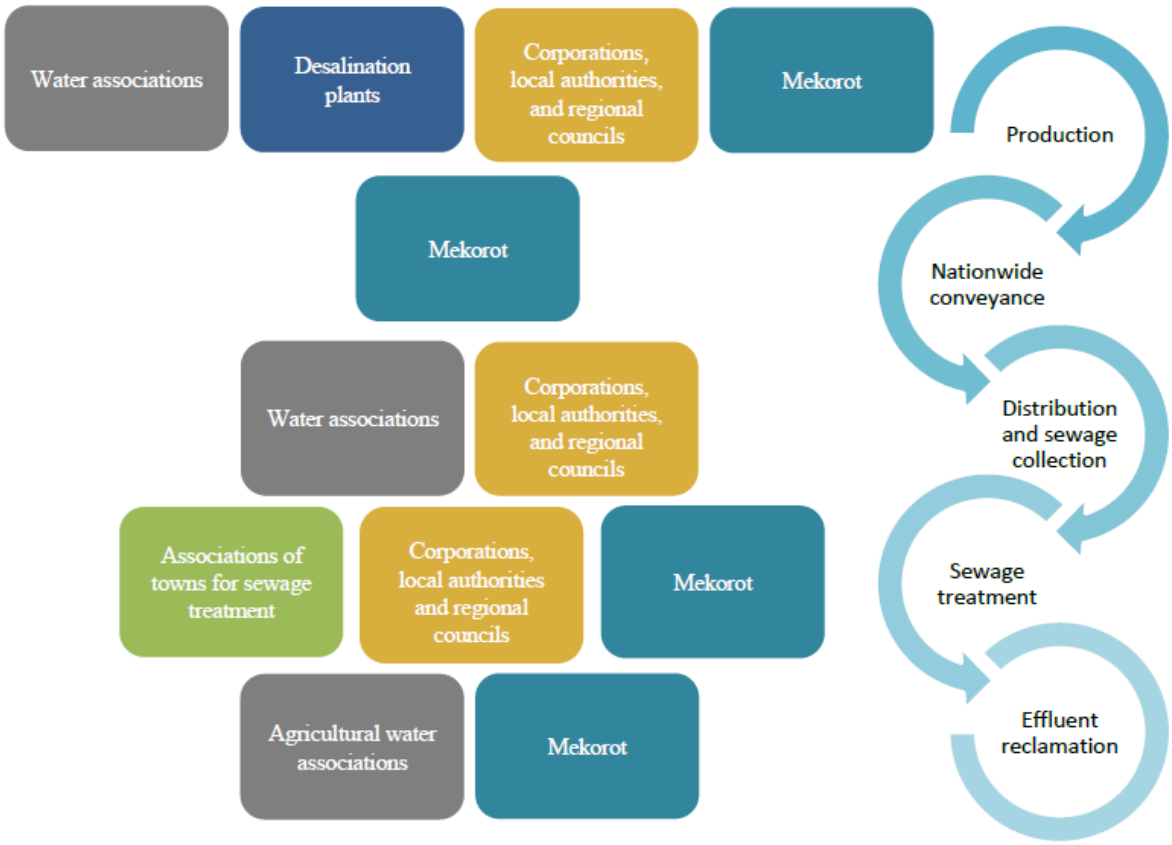
[29] Water Authority, *Long-term Master Plan.*

[30] Idem, "National Waterway System," accessed 15 January 2018 [Hebrew].

local providers. The distribution sector is comprised mostly of water corporations, local authorities that have not incorporated yet or are not required to do so, and other local providers. In most cases, water providers (corporations and others) also collect sewage from end consumers and transfer it to sewage treatment facilities, which are held by groups of municipalities or by local providers. From there, the water is sent back, via providers, to end agricultural and industrial consumers. Several desalination facilities have been added in recent years, and they serve as a major part of the water production segment. All of these hundreds of entities are supervised by the governmental Water and Sewage Authority (the Water Authority), which was established as the sole professional entity that would hold various responsibilities and determine the rules governing various issues.[31]

The following chart presents a schematic view of the supply chain in the Israeli water sector.

Chart 4: Water Sector Service Supply Chain[32]



[31] Water Authority, *Regulation of Mekorot Water Company Ltd.*: Report of the Advisory Committee on the Long-Term Economic Regulation of the Water Sector, September 2014, pp. 24–25 [Hebrew].

[32] Ibid., p. 24.

4.1. The Water Authority

The Governmental Authority for Water and Sewage (the Water Authority) was founded in January 2007 as a state oversight authority for water and sewage services. The authority was created to coordinate all the administrative and regulatory responsibilities, which had previously been held by multiple entities, under a single governmental body entrusted with the efficient and professional management, regularization, and supervision of the Israeli water sector.[33] The Water Authority is in charge of regulating, managing, operating and developing the water sector; preserving and rehabilitating natural water resources; developing new water resources and setting prices for the various sectors; setting standards for services the water corporations are required to provide; ensuring the corporations' conduct meets said standards; setting rules for calculating the cost of services offered by the corporations; and setting rules that govern payments and fees.[34]

4.2. Mekorot

Mekorot Israel National Water Company Co. is an infrastructure company that provides most of the water consumed in Israel. Mekorot, which is defined in the Water Law as the national water company, is under full government ownership and answers to the Water Authority. It serves as a vital service provider and has a monopoly on water transportation and supply. Mekorot's main operations focus on producing (or acquiring) fresh water and transporting it via the main pipeline to the water use centers. Additionally, the company deals in wastewater reclamation, brackish water supply, and desalination. The components of the infrastructures used by Mekorot were established gradually, as the State developed.[35]

In 2015, Mekorot provided 60% of the water to consumers and provided 33% of the water produced in Israel.[36]

4.3. Water corporations

Before the early 2000s, local authorities were in charge of providing water and sewage services. In 2001, the Water and Sewage Corporations Law, 5761-2001 was passed to

[33] Under this framework, the Water Authority received the duties granted through legislation to the Water Commission, the Public Utility Authority—Water and Sewage, The Minister of Finance, Minister of Interior, Minister of National Infrastructures and Minister of Agriculture over setting water tariffs and production levies. Later on, the Administration for Sewage Infrastructure Development at the Ministry of National Infrastructures and the Supervisor of Corporations and the Water Administration in local authorities at the Ministry of Interior were also transferred to the authority.

[34] Assaf Wininger, *Aid to the Needy in Water Bill Payments*, Knesset Research and Information Center, 14 November 2011 [Hebrew]; Victor Fatal, *Description and Economic Analysis of the Municipal Water Sector and Water and Sewage Corporations*, Knesset Research and Information Center, 9 December 2014 [Hebrew].

[35] Water Authority, *Regulation of Mekorot Water Company*, p. 18 [Hebrew].

[36] Based on data from Central Bureau of Statistics, *Water Production and Consumption* 2017 Statistical Abstract of Israel, Table 21.4, 1 November 2017 [Hebrew].

transfer responsibility for the municipal water sector from local authorities to private water corporations. The explanatory notes to the government bill presented the rationale for moving to the corporate model by stating, *inter alia*, that operations in the water and sewage sector within the local authorities was largely influenced by these authorities' priorities and financial state. Consequently, said the explanatory notes, over time, the water and sewage services provided in many local authorities in Israel suffered from many problems, such as insufficient infrastructure, particularly as regards sewage treatment systems; maintenance levels that did not meet standards, which led to high levels of water loss in some authorities as well as environmental pollution; failure to streamline systems and insufficient utilization of modern systems, failure to meet environmental quality standards; and poor service to citizens.[37]

The Water Corporations Law, which, as noted above, was passed in 2001, was intended, *inter alia*, to ensure proper levels of service, quality and reliability in the field of water and sewage service for affordable prices and without prejudice; create a closed monetary system in the water field, i.e., use the revenues from water and sewage services to invest in water and sewage systems, in operating them, and providing services; and ensure the professional and efficient business management of the systems.[38]

In August 2004, the Water Corporations Law was amended to state that six years after the effective date of the law (i.e., 31 July 2007), local authorities would no longer be allowed to operate the water and sewage services under their jurisdiction directly but rather through a company. However, the deadline for mandatory incorporation has since been postponed several times, and it is currently set for 30 June 2019.[39]

According to the Water Authority, to date, 55 water and sewage corporation have been established , serving 155 local authorities out of the 183 authorities required by law to incorporate[40] (the law does not apply to local authorities in the Judea and Samaria region, regional councils, and water associations[41]). In 2015, the Water Authority

[37] Water and Sewage Corporations Bill, 5758-1999 [Hebrew]. According to the Water Authority's report before the corporations were established, the municipal water sector lacked investments amounting to some NIS 4 billion for infrastructure rehabilitation and expansion. The under-investment in the water sector leads to a high level of water loss, i.e., leaks and the loss of reclaimed water that could be used in the agricultural sector. See Water Authority, "Summary of Belinkov Committee Report," appears in: Fatal, *Economic Description and Analysis*.

[38] Wininger, *Aid to the Needy*. Note that a water and sewage corporation is established by the local authority, which owns and controls it, however it is not a regular municipal corporation as described in the Municipalities Ordinance. The corporation is a limited company subject to oversight and licensing under the Water and Sewage Corporations Law. The corporations act both as for-profit business companies and as publicly-owned public bodies for the provision of crucial services. Fatal, *Economic Description and Analysis*.

[39] Water and Sewage Corporations Law, 5761-2001 §6a(b).

[40] Water Authority, "Water and Sewage Corporations," accessed 16 January 2018 [Hebrew].

[41] Nearly 1,000 water associations operate in Israel and mainly provide water in the rural sector: *kibbutzim*, *moshavim*, community settlements and Arab villages; Tami Schor, Deputy Director General for Regulation at

estimated that 94% of Israel's citizens would receive water and sewage services from corporations by the end of 2015.[42] The Water Authority's website states that there is no plan to establish new corporations; instead additional communities will be added to existing corporations.[43]

According to the Water Authority's report, the transition to corporations has led to many improvements, especially an increase in the investments in municipal water infrastructures, a reduction in water loss, and a considerable increase in the percentage of calibrated water meters. According to the authority, the increased investments also lifted obstacles in the construction industry through investments in wastewater treatment facilities and necessary municipal infrastructure.[44] However, ever since the establishment of the corporations, there have been many complaints their high operating costs and inefficient financial conduct. For example, in 2011, the Water Authority found that the corporations' total management and operating costs were actually some 40% higher than their recognized cost (the recognized cost is the expected operating cost of each water corporation as set by the Water Authority in accordance with each corporation's characteristics: size, extent, topography of the area where it operates, quality of wastewater treatment, etc.).[45] The Water Authority reviews various aspects of the water corporations' function and publishes the results regarding each corporation separately.[46] The most recent data, from mid-2015,[47] **indicate that the general functioning of 10 out of 55 corporations (18%) was insufficient or failing,**[48] **and the operating costs of 25% of the corporations were either significantly far from the benchmark or received a failing grade.** Audits by the **State Comptroller** in 2015–16 and 2016–17 also revealed various shortcomings in the operation of audited corporations, *inter alia*, failure to appoint directors, failure to appoint control committees and failure to submit internal audit reports, entering engagements without tender or even an agreement or while

the Governmental Water and Sewage Authority, Record No. 47 of the Economic Affairs Committee, 10 August 2015 [Hebrew].

[42] Email by Efrat Benzuz, Head of the Corporations Branch at the Governmental Water and Sewage Authority, in response to query by the Knesset Research and Information Center regarding the conduct of water corporations vis-à-vis consumers on financial matters, 5 November 2015 [Hebrew].

[43] Water Authority, "Water and Sewage Corporations."

[44] Water Authority, summary of Belinkov Committee Report.

[45] Victor Fatal, *Economic Description and Analysis*.

[46] Water Authority, "Audits and Metrics of Water and Sewage Corporations' Conduct," accessed 29 January 2018 [Hebrew].

[47] Water Authority, "Corporations' Function by Various Conduct Metrics (June 2015)" [Hebrew].

[48] Metrics reviewed: consumer service, operating costs, water security, infrastructure development, industrial waste monitoring, interfacing with the regulator, publications, water loss, debts due to water payments.

exceeding the agreement period and deviating considerably from the sums stated in said engagement.[49]

In April 2013, the Water Authority submitted a proposal to reform the water and sewage corporations, which suggested merging the existing corporations into 15 regional corporations.[50] The Government approved the main points of the Water Authority's program to reduce water prices for the municipal sector in its economic program for 2013–14 and in a decision on streamlining the distribution segment of the municipal water and sewage sector.[51] The program sought to merge all the water and sewage corporations into 15 regional companies by 1 July 2014, while local authorities without their own water corporations would join the regional companies. In August 2013, the Water and Sewage Corporations Law was amended as per the government's decision; however, following an arrangement between the Federation of Local Authorities in Israel and the Water Authority, it was decided to allow corporations that meet a series of financial and operating parameters to postpone the merger.[52] A bill was introduced in the 20th Knesset to reduce the number of water corporations to 11.[53] The bill passed in a preliminary reading with Government support,[54] and a joint committee of the Knesset Economic Affairs Committee and Internal Affairs and Environment Committee was formed in preparation for a first reading.[55] So far, the committee has held many discussions on the matter with all of the interested parties—including the Water Authority and the Federation of Local Authorities in Israel—in an attempt to reach an agreed-upon outline for operating the sector. *Inter alia*, the committee discussed the possibility of lowering the number of corporations and even eliminating them outright. The committee's deliberations have yet to conclude.

4.4. Water rates for domestic use

Water rates are set by the Water Authority and are uniform for all domestic consumers, whether they are serviced by a water corporation or, alternatively, live in local authorities that have yet to establish a corporation or are exempt from doing so.[56] The sewage charge

[49] State Comptroller, *Governmental Water and Sewage Authority: Water Corporations—Correspondence and Management,* in: Annual Report 67a, November 2016 [Hebrew]; idem, *Governmental Water and Sewage Authority: Water Corporations Management Issues*, in: Annual Report 68a, October 2017 [Hebrew].

[50] Water Authority, Water and Sewage in Local Authorities Administration, *Regional Incorporation of Water and Sewage Corporations in Israel: Outline and Financial Feasibility Proposal*, April 2013 [Hebrew].

[51] Government Secretariat, "Government Decision No. 161 on Improving Distribution Segment of the Municipal Water and Sewage Sector," 13 May 2013 [Hebrew]; Ministry of Finance, *2013–2014 Economic Program*, the Water Sector (pages 77–87), May 2013 [Hebrew].

[52] Victor Fatal, *Economic Description and Analysis*.

[53] Water and Sewage Corporations Bill (Amendment—Reducing the Number of Water and Sewage Corporations), 5777-2016, sponsored by MK Itzik Shmuli and a group of Knesset Members (p/20/3523).

[54] Record of the 20th Knesset, Session 185, December 28, 2017, Page 16 [Hebrew].

[55] Record No. 220 of Knesset Committee Meeting, February 15, 2017 [Hebrew].

[56] Rates are updated once every six months.

collected by water corporations is determined uniformly by the Water Authority and is included in the water rates. Since 2010, **there have been two grades for domestic consumers. The first grade is the amount of water for basic use (up to 3.5 CM per capita monthly and no less than 7 CM per household),[57] for which consumers are charge a rate (since July 2017) of some NIS 6.5 per CM, VAT included. Any extra water consumed is charged at a higher rate—currently some NIS 12.3 per CM, VAT included.[58]** Note that over the past five years, average domestic usage per capita was some 90 CM annually, i.e., a monthly average of 7.6 CM.[59] According to the Central Bureau of Statistics, average monthly domestic water and sewage expenses in 2015 were NIS 145.[60]

Since 2014, certain population groups (such as the disabled and elderly) have been eligible for an additional 3.5 CM of water under the basic rate, in addition to the 3.5 CM to which the general population is eligible, i.e., 7 CM of water total at the discounted rate.[61] Under the current rates, eligible individuals who take full advantage of the benefit (i.e., consumption of 7 CM of water for eligible persons) stand to save some NIS 20 monthly. As of late 2015, the benefit has only been partially realized: not all eligible persons received the benefit in practice, and not everyone who received the benefit took full advantage of it.[62]

Until 2009, the water rate for consumers varied between corporations, and there was no clear and transparent link between the rate and the actual costs of water and sewage services borne by each corporation. **In January 2010, the water and sewage rate reform took effect. This reform was based, *inter alia*, on the real cost principle: water tariffs are supposed to cover the cost of providing water and sewage services to consumers.** Water corporations buy water from Mekorot (or pay a levy for self-production). The difference between the price the corporation pays Mekorot and the rate for consumers is supposed to cover the corporation's operating costs. Because of the variations between the corporations' operating costs, the state of their infrastructure, and the financial state of the authorities in which they operate, it was decided that the price each corporation pays Mekorot would be set according to the corporation's unique characteristics. In this manner, the difference

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[57] In July 2011 a decision was made to increase the amount of water eligible for the low rate from 2.5 CM to 3.5 CM per capita per month, in order to help large families, needy families, and families that consume water efficiently and economically. Consequently, the data from the Central Bureau of Statistics showed a 4.7% drop in water rates in July 2011; Asaf Wininger, *Aid to the Needy*.

[58] Water Authority, "Water and Sewage Rates for Domestic Consumers in Municipal Water and Sewage Corporations," accessed 21 January 2018 [Hebrew].

[59] Water Authority, *Water Consumption in 2015*, December 2016; idem, *Water Consumption in 2016*.

[60] Central Bureau of Statistics, Household Income and Expenses: data from 2015 Household Expense Survey—general summaries, "Table 3. Monthly Income and Consumption Expenditure in Deciles of Households by Gross Money Income per Household," 13 July 2017.

[61] Water and Sewage Corporations Law, 5761-2001 §102(b1) [Hebrew]; Water and Sewage Corporations Regulations (Standards and List of Citizens Eligible for Discount Payment in 2014 Fiscal Year), 5774-2014 [Hebrew].

[62] Ido Avgar, *Water Corporations' Treatment of Consumer Issues*, Knesset Research and Information Center, 9 November 2015 [Hebrew].

between the rate paid by consumers (which is uniform) and the payments to Mekorot will cover the corporation's operating and development costs. The average price all corporations pay for water will be set according to the cost of water supply and sewage treatment throughout the country. As mentioned above, water is sold at two rates according to consumption. The lower rate is meant to represent the principle that water is a basic necessity and that the cost of using an amount of water sufficient for basic domestic needs should be affordable. The higher rate is meant to represent the cost of desalinated water, whose production cost is higher than that of pumping fresh water.[63]

Based on data from the Water Authority, the State Comptroller asserted in 2012 that water rates had gone up by some 30% following the reform.[64] Since the reform, water prices reached their peak in July 2013; since then, they have dropped consistently. Currently, the price of water (using the lower rate) is some 20% lower (nominally) than the rates set in January 2010, when the reform was first implemented, and some 30% lower than the peak price reached in July 2013.[65]

Over the years, many have attributed the increase in water rates to the establishment of water corporations and their high operating costs.[66] The position of the Water Authority, as presented on its website,[67] is that there is no direct link between the fact that management of the water and sewage sector was handed to corporations and the rate increase. The rates went up due to the Government's decision to stop subsidizing the water sector's costs and to roll all of the costs onto the consumers as is customary with other infrastructure services, such as electricity. The Water Authority stresses that the rates reflect all investment in the municipal water and sewage sector (for example, establishing and upgrading wastewater treatment facilities) and in the national water sector (for example, desalination facilities). The water and sewage rates that corporations charge are set according to the known cost rather than the actual cost; this is meant to ensure that the rate does not include inflated costs and even to encourage efficiency, for instance, by limiting the number of employees in a corporation.

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[63] Water Authority, *Water and Sewage Rate Reform*, January 2010 [Hebrew].

As the report notes, in the past, the current consumption component of the water rate consisted of three grades, and the price went up the higher the quantity of consumed water. This may have encouraged consumers to save water, but it also created a negative incentive for corporations as their profit per CM of water increased the more consumers consumed.

[64] State Comptroller, *Annual Report 63a, Governmental Water and Sewage Authority*, October 2012 [Hebrew].

[65] For the list of rates set since the reform took effect in January 2010, see Water Authority, "Rates," accessed 21 January 2018 [Hebrew]. For an economic analysis of the municipal water sector see: Victor Fatal, *Economic Description and Analysis*.

[66] See, e.g., the discussion in the Internal Affairs and Environment Committee on terminating water corporations: Record No. 307 of the Internal Affairs and Environment Committee, 16 June 2014 [Hebrew].

[67] Water Authority, "Water and Sewage Sector Reform," accessed 21 January 2018 [Hebrew].

In this context, note that the Knesset Research and Information Center found that in 2011, the average water price for Israeli households was 44% lower than the average price in developed countries. As mentioned above, since 2011, the price of water in Israel has dropped even further. In 2011, water bills amounted to some 1% of household expenditures in Israel, as compared to some 2.4% on average in European Union member states.[68]

5. Water crisis in Israel

The State of Israel, most of which has an arid or semi-arid climate, has been facing a water crisis for years, with low precipitation and dwindling natural water resources (groundwater and surface water resources, especially the Sea of Galilee). In October 2017, the Water Authority announced that according to projections, this winter (2017–18) is expected to arid, and it comes on the heels of four consecutive arid winters.[69] In January 2018, the Minister of Energy, who is in charge of the Water Authority, declared that according to existing forecasts, the current winter will likely see only some 70% of the multiannual average rainfall, and that a state of emergency exists in the water sector.[70]

According to the announcement by the Water Authority, the situation in Israel's north is particularly severe, as the drought there is the worst since the 1920s. Springs in the Galilee have run dry, and given another arid winter, the Water Authority is concerned that next summer, even big springs that have never run dry, such as the Banias, will face a similar fate. Furthermore, the volume of water flowing into the Sea of Galilee in the past four years is the lowest ever on record: in August 2017, water flow to the Sea of Galilee reached a record low—that month, the Sea of Galilee lost 26 MCM of water (the previous record was set in August 2014). As a result, the water level in the Sea of Galilee is expected to drop and

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[68] Victor Fatal, *Development of Water Pricing for Households in Israel and Developed Countries*, Knesset Research and Information Center, 25 February 2014.

[69] Water Authority, "Press Release: Water Sources Lacking some 5.2 Billion CM, More than 1 Billion CM under the Red Lines," 2 October 2017.

In hydrological year 2013/14 (the hydrological year starts in September and ends in May) the weighted national average precipitation reached 62% of the multiannual average, and particularly low precipitation was measured in the northern basins—the drainage basins for the —Sea of Galilee and the Western Galilee, with 47% and 53% respectively. In 2014/15 the weighted national average precipitation may have reached 105% of the multiannual average, but precipitation in the Sea of Galilee Basin did not achieve its multiannual average either (98%). In 2015/16, the weighted national average precipitation reached 81% of the multiannual average, though particularly low precipitation was measured in the northern basins—68% in the Sea of Galilee's drainage basin and 65% in the Western Galilee. In hydrological year 2016/17 the weighted national average precipitation reached 71% of the multiannual average. Water Authority, *2014 Annual Report—State of Water Resources*, 22 June 2016; idem, *Summary of Rainy Season 2014/2015 and its Main Hydrological Characteristics*; idem, *Summary of 2015/2016 Rainy Season and its Main Hydrological Characteristics*; *Highlights of Hydrological Balance in 2016/17 and Monthly Hydrological Situation*, 1 October 2017 [all Hebrew].

[70] Ministry of Energy, "Spokesperson's Announcement: Drought Team Presents Recommendations to Minister of Energy: Steps to Increase Water Supply and Develop More Water Sources and Steps to Reduce Demand for Water," 16 January 2018 [Hebrew].

may break the record low set in 2001, despite the fact that almost no water has been pumped from the Sea of Galilee in recent years.[71]

In October 2017, the water level of the Yarkon-Taninim Aquifer was lower than or equal to the red line; it lacked 18 MCM compared to the red line and 47 MCM compared to its level the previous year. In early October, the flow rate of Taninim Springs, which drain the aquifer, was the lowest ever documented. The Coastal Aquifer's water level was close to the red line, and it lacked 59 MCM compared to its level the previous year.[72]

6. Methods of addressing the water crisis

6.1. Water desalination

As mentioned above, because Israel has a shortage of natural water, desalinated water serves as an important and major source of water. Israel's first desalination facility was established in Eilat in the 1970s (the facility functions to the present day and provides 20 MCM of water a year, mostly from the desalination of brackish groundwater).[73] In 1999, due to a severe water crisis, the Government of Israel decided to prepare for seawater desalination. In the following years, the Government adopted a series of decisions about establishing desalination facilities,[74] but in practice, the first seawater desalination facility only started operating in 2005. By October 2015, five seawater desalination facilities had begun operation—Ashkelon, Palmachim, Hadera, Sorek and Ashdod—each capable of producing 90–150 MCM of water a year (some of the facilities were built with lower production capacities that were increased over time). In addition, several brackish water desalination facilities operate across the country producing several dozen more MCM of water a year. Most of the desalination facilities were established as BOT projects (build, operate, transfer) in which the concessionaires plan, build, and operate the facility for a period of time, after which ownership of the facility is handed to the State. One facility (Palmachim) will remain in the hands of the concessionaire once the concession expires.[75]

[71] Water Authority, "Press Release: Sea of Galilee Level Continues to Drop, Over 5 Meters Short of Full Sea of Galilee," 24 August 2017; Press Release: Repercussions of Last 4 Years of Drought: Historic Low in Sea of Galilee Intake, 3 September 2017; "Press Release: Water Resources Lacking some 5.2 Billion CM." [All Hebrew]

[72] Water Authority, "Press Release: Water Sources Lacking some 5.2 Billion CM," 2 October 2017; idem, *Summary of 2015/2016 Rainy Season*; idem, *Highlights of Hydrological Balance*.

[73] Water Authority, "Desalination Facilities in Israel", accessed 30 January 2018 [Hebrew].

[74] Flora Koch Davidovich, *Water Desalination in Israel: Government Decisions 1997–2008*, Knesset Research and Information Center, 12 January 2009 [Hebrew].

[75] Water Authority, "Desalination Facilities".

According to the Water Authority, the production capacity of all desalination facilities stands at some 660 MCM of water a year.[76] In 2016, 604 MCM of desalinated water was produced, of which 62 MCM originated from brackish groundwater.[77] In January 2018, Minister of Energy Yuval Steinitz said in a Knesset plenary discussion that due to the current water crisis, water production in desalination facilities has been expanded beyond the quota originally agreed upon with the facility operators, such that the amount of desalinated water in 2018 will be higher by 70 MCM. He further noted that plans for the coming years call for the construction of two new desalination facilities (in the Western Galilee—see additional information below—and at Sorek) and the expansion of the desalination capacity of the current facilities. According to the minister, these changes are expected to provide an additional 350–500 MCM of water a year.[78] It should also be noted that according to a 2008 Government decision, the total volume of desalinated seawater is to be least 750 MCM a year by 2020.[79]

6.1.1. Delays in construction of desalination facilities

In 2006, the State Comptroller attested that according to Government decisions, seven desalination facilities were to have been built by the end of 2004. In practice, by the time of the audit, only one facility had started operating—the facility in Ashkelon, which started operation in August 2005—while another facility was under construction. The Comptroller found that the Ministry of Finance, the Water Commission, and the Ministry of National Infrastructures had dragged their feet and failed to execute the Government's decisions.[80]

Delays in the construction of desalination facilities have continued even afterwards. The State Comptroller wrote in a 2012 report that only three facilities had been built by 2009, and they started providing water between one and five years past the scheduled date.[81] The facilities that were built subsequently were also established late. The facility at Sorek, which

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[76] Water Authority, "Water Resources—Desalination"; idem, "Desalination Facilities in Israel," accessed 15 January 2018.

[77] Hila Gil, Director of Desalination and Chairwoman of the Water Authority's Desalination Administration, email, 25 February 2018 [Hebrew].

In October 2015, the Water Authority's Council decided that the extent of seawater desalination in 2016 would be 550 MCM out of a maximum 585 MCM. In reality, the State purchased 542 MCM because the facility in Ashdod suffered from malfunctions that prevented it from producing the full amount of water intended (see below for more on the operating difficulties faced by the Ashdod facility). Email from Hila Gil (ibid.); Water Authority Council, "Meeting Minutes No. 134," 26 October 2018, sent via email by Olga Salfner, Adviser to the Water Authority Director and International Relations Coordinator, 25 February 2018 [Hebrew].

[78] 20th Knesset Minutes, Session 306, Statement by Minister of National Infrastructures, Energy and Water Yuval Steinitz, pp. 353–54 [Hebrew].

[79] Government Secretariat, Government Decision No. 3533 on review of Israeli Water Sector and emergency plan for dealing with severe water crisis, June 1, 2008 [Hebrew].

[80] State Comptroller, *Annual Report 56b, Establishing Sea Water Desalination Facilities—Ministry of Infrastructures*, May 9, 2006 [Hebrew].

[81] State Comptroller, *Annual Report 62, Establishing and Connection Sea Water Desalination Facilities*, May 1, 2012 [Hebrew].

according to the State Comptroller's report was supposed to become operational in 2012, only started operating (according to the Water Authority website) in late 2013; the facility in Ashdod, which was also supposed to become operational in 2012 (after it was originally supposed to become operational in 2004), only started operating in late 2015; and the Western Galilee facility, which was supposed to become operational in 2013 (and was originally supposed to start operating in 2004), has yet to be constructed.[82]

The most recently constructed facility is that in Ashdod, which is operated by a subsidiary of Mekorot. As noted, construction of this facility had been delayed for years, and the State Comptroller attested back in 2012 that the failure to construct the facility over the course of a decade (as of the report's publication) indicates an ongoing failing and a severe problem with the Government's ability to govern, which harm the public interest.[83] In addition to construction delays, various problems were found after the in the facility's construction that prevent it from operating to the fullest extent that was planned. The delays and malfunctions inflicted a loss of hundreds of millions of shekels on Mekorot (which is State-owned), and the cost of fixing the current malfunctions at the facility is estimated to run at least NIS 200 million. Due to the shortcomings in the construction and operation of the facility, the Ministry of Finance, Water Authority and Mekorot have been working in recent months to promote the sale of the desalination facility to a private concessionaire.[84]

According to the statement by the Minister of Energy in the Knesset plenum, in January 2018 the Water Authority's council approved the construction of the seawater desalination facility in the Western Galilee.[85] The process to advance construction of the desalination facility in the Western Galilee began back in the early 2000s. In 2007, a contract from 2003 for building the facility was terminated, and various alternatives as to the facility's location and manner of its construction have been considered over the years. As a result, construction of the facility has been postponed time and time again.[86]

As mentioned above, the drought in northern Israel is particularly severe; in the absence of a desalination facility in the area, the nearly complete dependence on natural water sources makes the crisis particularly acute.

In 2012, the State Comptroller wrote that the State of Israel suffered high financial, social, and environmental costs due to the water shortage, while inflicting economic damage on generations to come and on agricultural production. Based on estimates by the

[82] Ibid.; Water Authority, "Desalination Facilities in Israel," accessed February 14, 2018 [Hebrew].

[83] State Comptroller, *Annual Report 62, Establishing and Connection Sea Water Desalination Facilities*, May 1, 2012 [Hebrew].

[84] Minutes from Finance Committee Meeting no. 840, November 1, 2017 [Hebrew].

[85] Minutes of the 20th Knesset, Session 306, Statement by Minister of Energy Yuval Steinitz, p. 364 [Hebrew].

[86] State Comptroller, *Annual Report 62, Governmental Water and Sewage Authority*, 1 May 2012 [Hebrew].

Water Authority, the comptroller ruled that the economic damage caused by the lack of 100 MCM of water amounted to more than NIS 400 million a year. **As such, the Comptroller stated that delays in the construction of desalination facilities cause serious harm to the economy and the environment and that the cost of the damage to the economy and the environment due to non-supply of water increases with the length of the shortage.** The Comptroller noted that the Ministry of Finance, Tender Board, and Mekorot were not shown to have reviewed or evaluated the financial and environmental implications of the state of the water sector and the shortage it faced or the cost of the damage to the economy and the environment due to the failure to provide water.[87]

6.1.2. Other challenges for desalination

Besides the delays in construction of desalination facilities and the damage that these delays inflict upon the Israeli water sector, **increasing the use of desalination brings about other challenges:**

Economic cost: Constructing a desalination facility is a complex and costly project; a 2009 document by the Knesset Research and Information Center estimated the cost of establishing a facility with the capacity to produce 100 MCM of water a year at some NIS 1.5 billion, not including the large-scale investment needed to connect the facility to the national system.[88] Furthermore, the current cost of producing desalinated water, which involves energy and various chemicals, is comparatively higher than the cost of pumping natural water. According to the Water Authority Website, the cost of desalination currently stands at NIS 2–3 per CM.[89]

Environmental damage: The Water Authority notes that it works to diminish the environmental repercussions of desalination facilities.[90] Nevertheless, the construction of desalination facilities on the beach limits use of the shoreline and may cause harm to nature, landscapes, and archeological and historic sites; harm to marine activity and other marine facilities; potential harm to the marine environment due to the disposal of desalination concentrate—in which the concentration of salt is roughly twice as much as it is in seawater—into the sea; a concern for polluting seawater with various chemicals; the placement of underwater pipes; damage to the hydrological system; noise pollution; increased energy use

[87] State Comptroller, *Annual Report 62, Establishing and Connection Seawater Desalination Facilities*, 1 May 2012 [Hebrew].

[88] Flora Koch Davidovich, *Water Desalination in Israel*.

[89] Water Authority, "Planning and Development—Desalination," accessed 15 January 2018 [Hebrew].

[90] *Inter alia*, by considering environmental factors in tender proceedings for establishing desalination facilities (quality of the proposal from an environmental perspective), requiring the facilities to monitor the marine environment, and an emphasis on energetic efficiency and increased production during low national consumption hours and reduced production during high national consumption hours. Water Authority, "Water Resources—Desalination"; idem, "Planning and Development—Desalination," accessed 15 January 2018.

(and subsequently an increase in air pollution);[91] the use and storage of chemicals, hazardous materials, etc.[92]

Damage to health due to the lack of minerals in the water: As mentioned above, the desalination process is intended to remove dissolved salts from the water. However, this process also removes ingredients vital to human health, such as calcium and magnesium, almost completely. Magnesium is a mineral vital to the functioning of the human body, which is consumed, *inter alia*, through drinking water. Studies show that magnesium consumption in various countries, including Israel, is insufficient. The growing reliance on desalinated water has led to concerns of a lack of magnesium, which could have serious health repercussions.[93]

The Ministry of Health supports adding magnesium to desalinated drinking water. The Ministry of Finance and the Water Authority object to doing so, suggesting that magnesium can be supplied in more efficient ways than through water, most of which is not used for drinking.[94] In 2013, a decision was made to conduct a pilot to examine technologies for adding magnesium to drinking water. The pilot was not carried out due to budgetary disputes, and in 2016, the temporary order was extended and set September 2018 as the deadline for carrying out the pilot.[95]

Concern for marine pollution affecting the water sector: The quality of desalinated water reflects the level of pollution in the seawater used to produce it. Furthermore, polluted water can damage desalination facilities. As a result, when the seawater is polluted in the area from which water is pumped to the desalination facility, the plant is generally shut down. This has indeed happened on several occasions in the past two years, when the desalination

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[91] According to data from the Ministry of Environmental Protection, the overall energy consumption of all desalination facilities in 2016 was some 5.5 terawatts. However, the air pollution resulting from the energy consumption of the desalination facilities is calculated not as part of the pollution generated by the desalination facilities but as pollution generated by the power plants. Ruth Kiro, Air Quality and Climate Change Coordinator in the Ministry of Environmental Protection, email, February 6, 2018 [Hebrew].

[92] Ministry of Environmental Protection, *Desalination Facilities: the Ministry's Environmental Policy for Protecting the Marine and Coastal Environment—Mediterranean Sea*, June 2002 [Hebrew].

For more information on environmental dangers see: Sinaia Netanyahu, "Sea Water Desalination—Strengths, Challenges and Risks," *Ecology & Environment* 4 (December 2017): 38–47 [Hebrew].

[93] Shelly Levy, *Magnesium Shortage in Desalinated Water*, Knesset Research and Information Center, 10 January 2011 [Hebrew]; Shiri Bass-Spector, *Adding Magnesium to Desalinated Water*, Knesset Research and Information Center, 15 February 2012 [Hebrew].

Prof. Itamar Grotto, Director of Public Health in the Ministry of Health, noted during a discussion of the Internal Affairs and Environment Committee in 2016 that the ministry estimates that adding magnesium to drinking water would prevent some 250 deaths a year. Record No. 160 of Internal Affairs and Environment Committee Meeting, 21 March 2016 [Hebrew].

[94] A Water Authority representative in the Internal Affairs and Environment Committee meeting claimed that the cost of implementing the move will be NIS 150–400 million a year. Gilad Fernandez, Senior Deputy Director General of Economics in the Water Authority, see Record No. 160 of Internal Affairs and Environment Committee Meeting, 21 March 2016.

[95] Public Health Regulations (Sanitary Quality of Drinking Water and Drinking Water Facilities), 5773-2013; Record No. 160 of Internal Affairs and Environment Committee Meeting, 21 March 2016.

facility on the Ashkelon coast was shut down due to extremely high levels of organic seawater pollution, which apparently originated from the Gaza Strip.[96] To date, desalination plants have been shut down for only short periods of time, but it may well be necessary to shut down desalination facilities for longer periods in case of extreme pollution. This could cause significant damage to the water sector, whose dependence on desalinated water is only increasing.

6.2. Wastewater reclamation

According to a wastewater treatment survey performed by the Water Authority with the Nature and Parks Authority,[97] as of 2014 (the most recent year for which this survey is available, to date), **the rate of wastewater treated in Israel is high and stands at some 93%.** The remaining, untreated wastewater is sent to preliminary filtration facilities and streams. **Some 87% of treated wastewater** (or 82% of all wastewater) **is reclaimed for reuse**. According to the report, Israel is one of the leading countries in the world in the percentage of treated wastewater reclaimed for agricultural irrigation. **Reclaimed wastewater is used primarily for agricultural irrigation** (next to a negligible percentage used for gardening and industry). As mentioned above, **according to Water Authority data, 575 MCM of reclaimed water were used in 2016, constituting some 25% of the overall usage that year.**[98] It is estimated that some 1.3 million dunams of agricultural lands in Israel were irrigated with reclaimed water in 2014.[99]

Wastewater treatment is mostly carried out in wastewater treatment facilities, which are usually located adjacent to each city or to several cities together. The largest treatment plant is the Dan Region Wastewater Treatment Plant (Shafdan) owned by Dan Region Association of Towns for Sewage and Environmental Issues, which has seven member municipalities. In addition, other towns are also connected to the facility, which serves a total population of some two million people.[100]

In January 2010, the Public Health Regulations (Effluent Quality Standards and Rules for Sewage Treatment), 5770-2010 were approved. These set forth criteria for permissible levels of salt, pollutants, metals, and more in reclaimed wastewater. The levels are determined by the type of treatment the water undergoes and according to the intended use of the water

[96] State Comptroller, *Annual Report 67b, Water Pollution between State of Israel and the Territories of Judea and Samaria and the Gaza Strip*, 16 May 2017 [Hebrew]; Record No. 444 of the Internal Affairs and Environment Committee, 5 July 2017 [Hebrew].

[97] Water Authority and Israel Nature and Parks Authority, *Collection and Treatment of Sewage and Reuse of Wastewater for Agricultural Irrigation: National Survey—2014*, December 2016 [Hebrew].

[98] Water Authority, "Overall Water Consumption in 2016 by Use (in thousands of CM)," 30 November 2017 [Hebrew]; Reclaimed wastewater includes 39 MCM of fresh water transferred on the Shafdan system.

[99] Water Authority and Israel Nature and Parks Authority, *Collection and Treatment of Sewage*.

[100] Water Authority, "Wastewater Reclamation" by Mekorot, accessed 30 January 2018.

(unrestricted agricultural irrigation, restricted agricultural irrigation for nonedible crops, or discharge into streams). The quality requirements set in the regulations were gradually introduced over the course of the five years after the regulations took effect.

According to a report published in late 2016, the quality of reclaimed wastewater showed improvement in 2014 as compared to previous years. The report's authors credit this improvement to the improved quality in background water (the water that is consumed and turns into wastewater) due to desalination, the reduced use of water from the Sea of Galilee, and the implementation of wastewater treatment rules by water corporations. According to the report, **in 2014, some 54% of reclaimed wastewater underwent tertiary treatment and met the quality standards that the regulations require for using reclaimed wastewater in unrestricted irrigation.**[101] Most wastewater treatment facilities that did not meet the requirements were in the process of upgrading, and the results of these upgrades were expected to significantly improve the quality of effluents. At the time, the Water Authority estimated that within two years some 80% of effluents would meet tertiary quality.[102]

It should be noted that **alongside the obvious advantages of wastewater reclamation, the substantial use of reclaimed water for agricultural uses could have negative environmental effects.** Unlike fresh water, wastewater contains organic and inorganic contaminants, and despite treatment and purification, the reuse of wastewater may contaminate the ground, vegetation, surface water, and the adjacent groundwater. This is because irrigation is performed near surface water and above groundwater, meaning that the water flows and percolates from agricultural fields into natural water resources, thus becoming an active part of the water cycle in Israel. Even if the Water Authority's estimation of the improved quality of reclaimed wastewater was realized, it appears that even today not all reclaimed water meets the regulations' quality requirements. Furthermore, there are potential risk factors (persistent organic micro-pollutants originating from pharmaceutical and cosmetic residues) that are not included in the regulations and whose presence in reclaimed water is unmonitored.[103]

[101] The sewage treatment process in intensive purification facilities is divided into three main stages: primary treatment (rough mechanical filtration of sewage and initial sedimentation), secondary treatment (a biological treatment for the breakdown of organic matter, removal of suspended solids, sludge sedimentation and disinfection) and a tertiary treatment (biological removal, additional filtration and disinfection). Ministry of Environmental Protection, "Sewage Treatment Methods," revised 16 November 2017, accessed 12 February 2018 [Hebrew].

[102] Water Authority and Israel Nature and Parks Authority, *Collection and Treatment of Sewage* [Hebrew].

[103] Dror Avisar and Gefen Ronen-Eliraz, "Irrigation with Effluents—What to Watch Out For," *Ecology & Environment,* 4 (December 2017): 48–55 [Hebrew]; Shiri Bass-Spector, *Organic Microcontaminants in Wastewater: Environmental and Health Aspects*, Knesset Research and Information Center, 5 January 2011 [Hebrew].

6.3. Promotion of water conservation

Next to the efforts to increase the supply of clean water, there are various methods to try to diminish water use in Israel.

6.3.1. Legislation and regulations

One of the measures being taken to reduce water use is setting rules for various aspects of water use through legislation or secondary legislation. **The main method for acting on this measure is through a declaration designating Israel as an area subject to limitations on water use.**[104] This declaration is issued by the Water Authority's council under Article 36 of the Water Law. **Pursuant to this declaration, the authority's council sets quotas for water use in rules published in the Government Gazette** by water type (fresh and reclaimed), use (agriculture, replenishment), geographic area, and meteorological and hydrological properties.[105] The Minister of Agriculture dictates standards for allocating water to farmers in accordance with the maximum overall amounts that the Water Council allows for agricultural uses.[106]

Regulatory tools are also used to reduce water usage in more specific fields. For example, the Water Regulations (Rules for Washing Cars and Paved Surfaces with Water), 5761-2001 prohibit washing cars with running water and require the carwash owner to install a rinse water recycling system. The Water Rules (Water Use in Rationing Area), 5736-1976 prohibit irrigating private or public gardens larger than 50 m^2 unless they are equipped with an efficient irrigation system that allows economical irrigation. Moreover, the rules dictate that irrigation of gardens using methods other than drip irrigation may only be performed during the evening and nighttime hours.

Another example is a 2010 amendment to Article 9a of the Water Law requiring every public entity to install water-saving accessories in buildings it owns or uses. The Water Rules (Water-Saving Accessories), 5771-2011 issued by the Water Authority in the wake of the amendment define "water-saving accessory" as a product whose proper installation and use will lead to significant savings in water use, such as dual-flush toilet tanks, waterless urinals, faucet aerators, and automatic faucets.

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[104] Kovetz HaTakanot (Collection of Regulations) 6728, Water Regulation (Rationing Area), 5769-2008, 4 December 2008 [Hebrew].

[105] See: Kovetz HaTakanot 7921, Water Rules (Detailed Arrangement for Rationing Area), 5778-2018, 4 January 2018 [Hebrew].

[106] See: Kovetz HaTakanot 7774, Water Regulations (Standards for Allocation Water for Agriculture in 2017) (Temporary Order), 5777-2017, 9 February 2017; Ministry of Agriculture, Water Regulations Draft (Standards for Allocation Water for Agriculture) (Temporary Order), 5778-2018 [all Hebrew].

Pictured: faucet aerator (flow regulator) on a faucet[107]

6.3.2. Increasing rates

Another method for reducing water use is setting a higher rate for excess water use. As mentioned above, before 2010, water tariffs for consumers were graded, i.e., they increased with the amount of water consumed. This may have promoted water saving among consumers, but it also created a negative incentive for corporations to conserve water; because the corporations paid a fixed price for water acquired from Mekorot, their profit per CM of water increased the more customers consumed. Note that it was decided as part of the reform in water rates, that the grading of water prices (high and low rates) will already apply to the price corporations pay Mekorot.[108]

Under the 2009–2010 Arrangements Law,[109] an ordinance was enacted imposing a toll on excess water use. Article 80 of the law clarified that the purpose of the ordinance was to "reduce water use among domestic users, as part of the efforts to address the serious water crisis and to ensure sustainable water resources." The ordinance stated that domestic consumers would pay a toll of NIS 20 for every cubic meter of water consumed beyond a set amount. (The exact amount depends on the period and number of household members; the minimum amount is 16 CM a month per household.)[110] In practice, implementation of the

[107] Nicole-Koehler, File:Faucet2.JPG, Wikimedia Commons, the free media repository, 28 February 2009, Licensing: CC BY-SA 3.0, accessed 21 February 2018.

[108] Water Authority, "Water and Sewage Rate Reform," January 2010.

[109] Economic Efficiency Law (Legislative Amendments to Implementation of 2009 and 2010 Economic Plan), 5769-2009 [Hebrew].

[110] Ibid., §82.

ordinance was frozen in winter 2010, several months after it was enacted;[111] it was later frozen again until it expired in late 2010.[112]

6.3.3. Public relations and campaigns

Another method of reducing water use is through education and public relations activities intended to raise awareness as to the importance of this issue and to spur action and the adoption of more economical water use habits. In this context, the Water Authority stated that education to water conservation is based on public relations, development of education to water conservation in kindergartens and schools, and information campaigns (alongside the use of regulatory and economic tools, implementation of technological methods, etc.).[113] The Authority further stated that between 2008 and 2012, a series of campaigns was launched in several stages, with each stage adjusted in accordance with insights from the preceding stage and with the public's response. The Water Authority did not provide budgetary data for all of the years, but it noted that the budget for this matter was some NIS 21 million in 2008 and some NIS 15 million in 2009. Note that there was a considerable drop in water use in 2008 and 2011, which the Water Authority attributes to the effectiveness of the campaigns and the aforementioned complementary activities.[114]

The most recent media campaign on this issue was conducted in July 2017 (on the radio, websites, and social media) on a budget of some NIS 1 million. The Water Authority plans to launch another large-scale campaign in early 2018.[115]

7. Steps by the 20th Knesset to Address the Water Sector

The Knesset is one of the main arenas in which policy for Israel's water sector is set. Many of the decisions that have shaped the water sector and determined its methods of operation, which have been described throughout this document, are grounded in primary and secondary legislation that was drafted, discussed, and enacted at the Knesset. Alongside the legislative processes which take place at the Knesset, many discussions on various aspects of the water sector have been held in various Knesset committees over the years,

[111] Economic Efficiency Law (Legislative Amendments to Implementation of 2009 and 2010 Economic Plan) (Amendment No. 2), 5769-2009 [Hebrew].

[112] Economic Efficiency Law (Legislative Amendments to Implementation of 2009 and 2010 Economic Plan) (Amendment No. 3), 5769-2009 [Hebrew].

[113] Email from Olga Salfner, Advisor to the Water Authority Director and International Relations Coordinator, response to query from the Knesset Research and Information Center, 5 November 2017.

[114] Ibid.

[115] Ibid.

including a parliamentary inquiry committee into the water sector that operated under the 15th Knesset.[116]

Water has also been a key issue in the plenary and committee discussions during the 20th Knesset. The current Knesset formed a joint committee composed of the Economic Affairs Committee and Internal Affairs and Environment Committee to study an amendment to the Water Law (Amendment no. 27, which passed in January 2017). Furthermore, the current Knesset formed a joint committee of the Economic Affairs Committee and the Internal Affairs and Environment Committee to debate the Water and Sewage Corporations Bill. Besides the many discussions on the bills in these joint committees, various other Knesset committees have held additional discussions on matters related to the water sector. For example, the Public Inquiries Committee discussed the need for an exceptions committee in the water corporations.[117] As mentioned, the Internal Affairs and Environment Committee discussed shutting down the Ashkelon desalination facility due to pollution caused by the dumping of wastewater into the sea in the Gaza Strip,[118] the water shortage in Arab and Jewish communities,[119] and three discussions on the lack of a sewage connection for IDF bases in Judea and Samaria.[120] A subcommittee of Science and Technology Committee discussed hydraulic fracturing ("fracking") and its effects on water sources.[121] The Finance Committee discussed the allocation of water for agriculture,[122] water rate discounts for eligible populations,[123] and Mekorot's desalination facility in Ashdod (as mentioned above, the construction of the plant was delayed and various defects were found during its operation).[124] The State Control Committee discussed water pollution in the State of Israel from Judea and Samaria and the Gaza Strip.[125] The Knesset Economic Affairs Committee discussed the water crisis in the north and the damage to agriculture there; [126] it also held a series of

[116] To review the committee's conclusions, see: Parliamentary Inquiry Committee Report on Water Sector [Hebrew].

[117] Record No. 22 of Public Inquiries Committee Meeting, 10 November 2015 [Hebrew].

[118] Record No. 444 of Internal Affairs and Environment Committee, 5 July 2017 [Hebrew].

[119] Record No. 238 of Internal Affairs and Environment Committee Meeting, 18 July 2016 [Hebrew].

[120] Record No. 139 of Internal Affairs and Environment Committee Meeting, 29 February 2016; Record No. 364 of Internal Affairs and Environment Committee Meeting, 6 March 2017; Record No. 139 of Internal Affairs and Environment Committee Meeting, 14 June 2017. [All Hebrew]

[121] Record No. 2 of Science and Technology Committee Subcommittee for Examining and Monitoring the Production of Gas and Oil Using Unconventional and Renewable Technologies, 31 January 2017; Record No. 3 of Science and Technology Committee Subcommittee for Examining and Monitoring the Production of Gas and Oil Using Unconventional and Renewable Technologies 15 March 2017. [All Hebrew]

[122] Record No. 706 of Finance Committee Meeting, 17 May 2017 [Hebrew].

[123] Record No. 705 of Finance Committee Meeting, 17 May 2017 [Hebrew].

[124] Record No. 714 of Finance Committee Meeting, 5 June 2017; Record No. 840 of Finance Committee Meeting, November 1, 2017. [Both Hebrew]

[125] Record No. 240 of State Control Committee, 24 May 2017 [Hebrew].

[126] Record No. 571 of Economic Affairs Committee Meeting, 25 July 2017 [Hebrew].

discussions on rules for disconnecting consumers' water, which were approved in late January 2018.[127]

Some 30 bills regarding the water sector were brought before the 20th Knesset. The current Knesset passed an amendment to the Water Law (Amendment No. 27) which stipulates, *inter alia*, that water producers will no longer pay the State levies for water production; instead, payments they are charged will be used to benefit the water sector. (Before this amendment, private water producers were required to pay the State a levy for the right to produce water. These levies, which amounted to some NIS 300 million a year, went into the general State treasury.) The law abolished the levy method and created a closed monetary system, whereby payments by private water producers stay within the water sector and are not transferred to the State's coffers. This change allowed for, *inter alia*, a reduction in the water rate for private consumers, which, as noted above, took place in July 2017.[128]

Additionally, many queries and dozens of motions for the agenda of the 20th Knesset were submitted regarding the water market and water crisis.

8. Challenges to the Water Sector from the UN SDGs Regarding Water

The debate on water issues is influenced by the **UN's Sustainable Development Goals:** in 2015, the UN General Assembly embraced a set of objectives and goals for 2015–2030 to promote sustainable development (known as Sustainable Development Goals, or SDGs). The UN's 2015 decision consists of 17 main goals and 169 targets in various fields.[129]

Due to the importance of water as a resource, the sixth main goal in the UN's decision was dedicated to the following issue: **ensuring the availability of water resources and sanitation infrastructure and managing them sensibility.** Various targets have been set to achieve this main goal, and while some are more relevant to developing countries, some are also relevant to the Israeli water sector.

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[127] The actual rules were approved by the Economic Affairs Committee toward the end of the 19th Knesset and came into effect in March 2015. The rules place limits on the water corporations and allow them to disconnect consumers from the water supply for outstanding debts only after they meet a set of conditions, exhaust all collection proceedings, and receive approval from the Director of the Water Authority, see Water and Sewage Corporations Rules (Disconnection from Water Supply), 5775-2015 [Hebrew]. The current Knesset has held discussions on amending the rules include instructions for disconnecting polluting factories from the water system. The rules were approved by the committee on 30 January 2018, see Economic Affairs Committee, "Press Release: Economic Affairs Committee Approves Rules to Regulate Disconnection from Water Supply for Polluting Businesses and Factories," 30 January 2018 [Hebrew].

[128] Record No. 1 of Internal Affairs and Environment Committee and Economic Affairs Committee Joint Committee to Discuss the Water Bill (Amendment No. 27), 5776-2016 (m/1008), 20 June 2016; the Knesset, Press Release: "Finally Approved: Water Law," 30 January 2017; Water Authority, Press Release: "Updated Water Rates for Domestic and Agricultural Use starting June 1, 2017," accessed 13 February 2018. [All Hebrew]

[129] United Nations, Sustainable Development Goals, "Goal 6: Clean Water and Sanitation," 25 September 2015, accessed 21 January 2018.

In this section, we will present a short summary of the challenges facing the Israeli water sector in light of the UN's SDGs that relate to water. The goals refer to different aspects of the policy for managing the water sector: **the social aspect** (physical and financial access to water); **the health and environmental aspect** (water quality, pollution prevention, wastewater reduction); **the administrative aspect** (building infrastructure, integrative management of the water sector, preventing water shortages); **the environmental aspect** (protecting marine and aquatic habitats); and **the foreign relations aspect** (international cooperation and technological assistance to developing countries). The sections below present the Sustainable Development Goals related to water that are the most relevant to the issue discussed herein followed by a brief (uncomprehensive) discussion of the state of the Israeli water sector in relation to the goal and the challenges involved in attaining it. As mentioned above, though discussion of water involves regional and international issues because, *inter alia*, water sources (particularly in Israel) cross national boundaries, because this limited document has thus far barely touched on issues related to Israel's diplomatic relations with its neighbors over water issues, this section, too, will generally avoid discussion of the international aspects of the Israeli water sector**.**

1. **By 2030, achieve universal and equitable access to safe and affordable drinking water for all**
2. **By 2030, achieve access to adequate and equitable sanitation and hygiene for all**

The vast majority of Israeli citizens enjoy a regular water supply through a direct connection to the national water system, but **the projected population growth and the diminishing supply of water from natural sources present a challenge for maintaining this access.** As mentioned above, in 2012, as part of its master plan, the Water Authority prepared a forecast of the balance of the water sources and the projected consumption in the Israeli water sector. Based on this forecast, the plan's authors concluded that there will be a shortage of 50 MCM of water a year in 2030, and in 2050, the shortage will grow immensely to 670 MCM of water a year.[130] Furthermore, tens of thousands of Bedouins living in unrecognized villages in the Negev; access to water in a considerable portion of these villages is partial. In many cases, homes are not connected to the water supply network; instead, access to water is via supply tankers, an expensive method of supply that permits only limited consumption.[131]

Beyond technical access to water, the aforementioned target emphasizes the **price of water.** As noted, in 2010, a reform was carried out in the water rates for domestic consumers based

[130] Water Authority *Long-Term Master Plan*.

[131] For more information see: Shiri Bass-Spector, *Health and Environmental Issues in Unrecognized Bedouin Villages in the Negev*, Knesset Research and Information Center, 31 January 2011 [Hebrew].

on the principle of real cost (i.e., the price of water is meant to represent the cost of production). This reform led to a marked increase in water prices (followed, as noted above, by a significant decrease) and also included cutting off the water supply to consumers who amassed debts to water suppliers and failed to pay them. As a result, rules were approved in 2015 that make it very difficult for water corporations to cut off consumers' water due to debt.[132]

3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

As mentioned above, Israel may be one of the leading countries when it comes to wastewater treatment and the reuse of reclaimed water, but this situation has a few exceptions. F**or example, the rate of households connected to sewage collection systems (the "sewage treatment connection rate") among the Jewish population stands at some 95%. However, in towns with mostly Arab population the rate stands at only some 76%.**[133] Furthermore, a large number of military bases are not connected to a central sewage system that allows for proper sewage treatment; despite a government decision to connect 177 bases to the sewage system by 2015,[134] as of June 2017, some 100 bases included in the plan have yet to be connected to any sewage solution.[135] Additionally, Israel shares sources of natural water with the Palestinians; as such, the state of waste treatment among the Palestinians (which is considerably behind that in Israel) directly affects the quality of the water sources used by Israel.[136]

In 2014, 33 MCM of raw sewage (6.5% of all wastewater) were treated improperly: by dumping in septic tanks and sedimentary basins, releasing into to streams, etc.[137] The 2015

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[132] Water and Sewage Corporations Rules (Disconnection from Water Supply), 5775-2015 [Hebrew]. The rules allow corporations to disconnect consumers from the water supply due to accumulated debt only after several conditions have been met: the consumer did not pay for the services for more than a single period (consecutively or occasionally), which resulted in a current debt of over NIS 1,000 and fewer than 12 months have passed since the payment date of the last billing period; all collection proceedings have been exhausted; it has been determined that the consumer apparently has sufficient means that would allow him or her to pay their current debt even though exhausting all collection proceedings has not led to collection of the current debt collection, or that the consumer is abusing the disconnection prohibition; and approval was received from the Director of the Water Authority.

[133] Shiri Spector-Ben Ari, *Environmental Protection in Arab Communities*, 7 April 2016 [Hebrew].

[134] Government Secretariat, Government Decision No. 1770 on Plan to Connect IDF Bases to Sewage System, 10 June 2010 [Hebrew].

[135] Shiri Spector-Ben Ari, *Connecting IDF Bases to Sewage Infrastructure*, June 13, 2017 [Hebrew].

[136] See: State Comptroller, *Annual Report 67b, Water Pollution between State of Israel and the Territories of Judea and Samaria and the Gaza Strip*, 16 May 2017; Shiri Spector-Ben Ari, *Wastewater Treatment in Judea and Samaria*, Knesset Research and Information Center, 2 March 2016. [Both Hebrew]

[137] Water Authority and Israel Nature and Parks Authority, Collection and Treatment of Sewage.

State Comptroller's Report[138] presented Water Authority data according to which, between 2000 and 2013, some 200 potable water drillings—some 20% of potable water drillings in existence at the time—were shut down due to pollution and salinization; about a third of the drillings were shut down due to industrial pollution. The data further indicate that the amount of contaminated groundwater in the Coastal Aquifer is estimated at over 10% of the active reservoir in the aquifer.

4. By 2030, substantially increase water-use efficiency across all sectors

According to the Water Authority, establishing the corporations has led to increased investment in water infrastructure and significantly lowered water loss (leaks).[139] However, at least in the past, complaints have been made concerning inefficient financial conduct among some of the corporations as well as excessive management and operating costs.[140] Since the water sector is managed as a closed monetary system, corporate financial inefficiencies mean fewer investments in water infrastructure.

Furthermore, Israeli agriculture is becoming increasingly reliant on reclaimed wastewater, and the portion of fresh water used for agriculture is diminishing.[141] However, some branches of Israel's agricultural sector are water-intensive and should perhaps consider methods of promoting more sustainable agriculture. For example, they could switch to alternative crops that are more suitable for a semi-arid climate or adopt technological developments that will enable more economical water consumption for agricultural purposes.

5. By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

In 2012, in accordance with a 2010 Government decision regarding the principles of managing the water sector in Israel,[142] the Water Authority submitted a policy paper that serves as the first part of a **master plan for the water sector through 2050.**[143] **Besides the policy paper, the master plan is supposed to include an implementation plan, to address implementing the policy and to bridge the gap between the current situation and the desirable situation,** but apparently, such an overall implementation plan has **yet to be published.** The policy paper notes that the resources necessary for completing the implementation plan exceed the resources allocated to the issue at the time. The State

[138] State Comptroller, *Annual Report 66a, Aspects of Water Resource Pollution Prevention*, 28 October 2015 [Hebrew].

[139] Ram Belinkov, "Report for Water Authority," sent via email, 27 November 2014, appears in Victor Fatal, *Economic Description and Analysis*.

[140] Victor Fatal, *Economic Description and Analysis*.

[141] Processing of the Water Authority's data, *Water Consumption in 2016*, November 2017 [Hebrew].

[142] Government Secretariat, Government Decision 2348 on Principles for Management of Israeli Water Sector, 24 October 2010 [Hebrew].

[143] Water Authority *Long-term Master Plan*.

Comptroller noted in 2015 that the Water Authority had not finished preparing the implementation plan—or, by implication, the master plan for the water sector—and consequently, the master plan had not been brought to the Government for approval.[144] On this point, the Water Authority stated that **the policy paper as approved at the Water Authority's council in August 2012 is being revised and that the implementation plan comprises all of the work plans undertaken by the Water Authority. These are agreed upon each year in accordance with budgetary considerations as well as other constraints.**[145]

6. By 2020, protect and restore water-related ecosystems

As part of Israel's efforts to address its water crisis, many resources are allocated to continue meeting the demand for water for human use—agricultural, industrial, and domestic. However, as described in the section dealing with the water crisis, the state of Israel's water resources is deteriorating, and despite ongoing replenishment efforts, marine and aquatic habitats are in danger. In 2014, the Water Authority published a summary report of the master plan for returning water to nature. The master plan focuses on some 200 bodies of water (including some 140 streams), for which the guidelines for determining the quantity and quality of water that needs to be diverted to them in order to maintain their ecological health have been updated.[146]

According to the stream pollution report by the Ministry of Environmental Protection, **between 1994 and 2015 the amount of pollutants discharged into Israel's 12 main streams dropped between 63% and 95%, but the pollution in some of the streams is still evident.** The report cites some 71 permanent sources of pollution (not including wastewater from the Palestinian Authority, which, as stated above, is a major source of pollution).[147] According to the Ministry of Environmental Protection's Coastal Water Pollution Report, **in 2016, metals (mercury, cadmium, chrome, copper, lead or nickel) were found in the sediments of most coastal streams near their outlet to the sea , probably due to the dumping of waste into the stream and the lack of natural water flow, with the exception of flooding during wintertime.** Many of the stream estuaries in Israel have shown medium to severe levels of contamination from phosphate, ammonia, and fertilizers (nutrients). In most of the streams, the high concentrations of phosphate and ammonia are related primarily to the dumping of domestic wastewater and effluents. The large nitrate

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[144] State Comptroller, Annual Report 66a, *Aspects of Water Resource Pollution Prevention*, 28 October 2015 [Hebrew].

[145] Mickey Zaida, Supervisor of Strategic Planning in the Water Authority's Planning Department, Response to query from the Knesset Research and Information Center, 14 February 2018 [Hebrew].

[146] Water Authority, *Summary Report of Nature Water Replenishment Master Plan*, November 2014 [Hebrew].

[147] Ministry of Environmental Protection, "Contaminant Load in Israel's Streams in 2015," November 2015, accessed 7 February 2018 [Hebrew].

concentrations most likely originate from agricultural runoff water enriched with fertilizers as well as overflows from wastewater oxidation ponds.[148]

Although the findings indicate that nutrient concentrations in most polluted streams are lower than in the mid-90s, since the early 2000s, nutrient concentrations have maintained the same level, and in some streams, they have even increased. Nutrient concentrations in most of the streams on Israel's coast are considerably higher compared to stream estuaries in other places around the world, which result especially from the combination of a low natural flow and the dumping of sewage.[149]

One of the most prominent examples of the environmental crisis over water is the state of the Dead Sea. In the past few decades, the level of the Dead Sea level has dropped by approximately one meter a year (and even more in recent years), as a result of a nearly complete absence of water intake from the Jordan River (due to the construction of Degania Dam in 1964) and Yarmouk River (due to the construction of dams on the river in Syria and Jordan), as well as human actions such as pumping water and transferring it to evaporation ponds for mineral production (at the Israeli and Jordanian Dead Sea Works). **In 1900, when measuring the level of the Dead Sea began, it stood at 392 meters below sea level. In the 1980s, the level was some 400 below sea level, while currently (January 2018), the level stands at 432 below sea level.** This drop has led to various environmental phenomena, including terrain changes, coastline recession, a drop in groundwater level, creation of collapse sinkholes (round, deep holes created by the dissolution of halite deep underground), disconnection of the northern basin from the southern basin, damage to the ecosystem, and increased water salinity. These phenomena cause environmental, infrastructural, and touristic damage.[150]

One of the options currently being considered for addressing this phenomenon is streaming water from the Red Sea via the **Red Sea–Dead Sea Conveyance Project.** This idea is not new, but in the 2000s it started to become more viable.

According to the existing plan, which is grounded in a 2013 memorandum signed by Israel, Jordan and the Palestinian Authority, and the 2015 agreement between Israel and Jordan, the first stage will consist of installing a pipeline to carry 300 MCM of water a year, which will be pumped from the Gulf of Eilat and transferred along the Arava Valley on the Jordanian side. A hydroelectric power plant will be constructed alongside the pipeline, as well as a

[148] Israel Oceanographic and Limnological Research Institute, Israel's National Monitoring Plan in the Mediterranean Sea - Scientific Report for 2016, *Part 3: Sea Pollution Monitoring*. June 2017 [Hebrew].

[149] Ibid.

[150] Eliezer Schwartz, Yehuda Tamar, Omer Schwartz and Ami Tzadik, *Decline in the Level of the Dead Sea—Description, Analysis, Repercussions, and Solutions*, Knesset Research and Information Center, 17 November 2008; Water Authority, "The Dead Sea," accessed 22 January 2018; "Report on Dead Sea Level Data 1976–2018," updated 1 January 2018. [All Hebrew]

desalination facility that produces 65 MCM a year. Water that is not desalinated will flow into the Dead Sea. The overall cost of the first stage of the project is estimated at over $1 billion and the plan is to carry it out under the BOT model.[151]

Though one of the main goals of this project is to address the declining level of the Dead Sea, experts estimate that the volume of water streamed during in the first phase of the project (235 MCM a year) will only slightly slow down the rate by which the water level drops; it will not eliminate it or raise the water level. Furthermore, as the volume of water streamed to the Dead Sea increase (the outline for the complete plan calls for transferring up to 1,100 MCM a year) it might increase the potential for environmental damage as a result of the transfer of seawater (whose salinity level is significantly lower than that in the Dead Sea) to the Dead Sea: changes to the water's color and chemical composition, the development of marine vegetation, and more.[152]

[151] Roy Goldschmidt, *Information on Red Sea–Dead Sea Water Conveyance and its Environmental Repercussions*, Knesset Research and Information Center, 6 June 2016 [Hebrew].

[152] Ibid.