



State of Israel



Long-Term Master Plan for the National Water Sector



Part A - Policy Document

Version 4



August 2012



Khoni the Circle Drawer was out walking one day. He saw a man planting a carob tree and asked him: "This tree, how many years will pass until it yields fruit?" The planter replied: "70 years." Khoni said: "Do you really think you will live 70 years, and enjoy its fruits?" He said: "I found this world full of carobs and, just as my forefathers planted for me, I will plant for my children and for my children's children."

(Excerpt from Taanith 23, 1)

When God created Adam He took him and showed him all the trees in the Garden of Eden and said: See my deeds. See how wondrous they are! And everything I have created, I have created for you. Make sure you do not spoil and destroy my work, for if you spoil it no one will correct it after you.

Ecclesiastes Commentary (Koheleth Raba) 9



Planning Division

State of Israel

Foreword

We are honored to submit the first part of the Long-Term Master Plan for the National Water Sector – **the Policy Document**. The document is an update of the initial phase of the Policy Document Version 3, which was approved by the Water Authority Council in July 2011. It follows a public hearing that was held at the end of January 2012. The public hearing was initiated and chaired by the Minister of Water and Energy, following submission of the document for the Minister's approval, after which he submitted it to the Government of Israel for approval. Policy formulation is a lengthy process which should take place on a continual basis, over a number of years. Approval of the Policy Document will serve as the basis for laying down physical and organizational guidelines for the water and sewage sector over the coming decades.

The Long-Term Master Plan for the National Water Sector (LTN-MP) includes both water supply and preservation, and wastewater management. The LTN-MP is composed of two sections:

- **Policy document:** the core of which is presented here, defines the vision, goals and objectives of the national water sector, and the policy of the sector on the major issues. The paper includes the state of the water-reservoirs, an analysis of conditions of uncertainty, and initial recommendations for implementation. It also includes an estimate for the required development plan framework, mapping of managerial, budgetary and professional obstacles, and recommendations for how to remove them. Comprehensively addressing a number of issues, such as: the structure of the national water sector, regulation and others will be carried out later.
- **Implementation plan:** The implementation plan is designed to actualize the policies and to bridge the gap between what exists and what is desired. The implementation plan is divided into two separate components: the planning component and the development component. The planning component is defined as the set of actions that are necessary, as headquarter work, for the realization of the policy and the recommendations approved in the policy document. This includes basic planning work, on the level of master plans and regional plans, and various hydrological professional works. The development component comprises programs of different ranges (normally this refers to long range programs, short-medium range (five-year), and immediate range programs – annual programs). The development program incorporates presentation of the resources, investments and ongoing budget required in accordance with the orders of priority, funding sources, impact on tariffs, cost benefit analysis of engineering

alternatives and policy alternatives. The implementation plan is to be developed along a time axis, in accordance with the resources that are allocated for it.

As part of the policy document, the vision and the objectives of the national water sector were formulated in conjunction with the Authority's management and the members of the Water Authority Council. 11 main issues were analyzed, and dozens of public discussions, management meetings and meetings of the subcommittee of the Authority's Council on the Master Plan (Steering Committee) were conducted. At various stages of the policy document preparation, meetings were also held with external bodies, including: the Ministry of Water and Energy, the Ministry of Agriculture, Mekorot Ltd, the Ministry of Finance, the Ministry of Interior's Planning Administration, the Ministry of Environmental Protection, Israel Nature and Parks Authority (NPA), the Society for Protection of Nature in Israel (SPNI), Adam Teva V'Din (Israel Union for Environmental Defense), etc.

A five year plan was formulated in addition to updating the policy document, and estimating the longterm development. The annual investment is estimated to be around NIS 5 billion. Total investment in the coming five years is estimated at around NIS 25 billion, subject to final approval of the five year plan by the Water Authority Council.

A fundamental condition for the national water sector's capability to implement the development plan is the removal of the various obstacles in the organizational, personnel and other domains. Application of the program recommendations and the work, based on its framework and guidelines, will extricate the water sector from the current crisis, and will lead it to the planning goal, within the framework of a sustainable development policy.

The current policy document (Version 4) was approved in August 2012 and is an extension of the policy document (Version 3) that was approved in July 2011 by the Water Authority Council. This paper includes updates to a number of topics and emphases which arose at the public hearing (January 2012), and under the guidance of the Minister of Water and Energy and the current Authority director. The main topics that were added to this version include: production limitations and setting operating lines for the main reservoirs, goals for developing the water sector in the current decade, and emphases on topics such as the water potential, greywater, etc. A more detailed development plan for the current five year period appears in a separate booklet and is based on this policy document. It serves to implement the plan, and is adapted to Government Resolution 2348.

The submitted policy document is part of a more extensive plan, **on a scale which is unprecedented for the Israeli national water sector throughout all the years of operation of the Water Authority** (and, in the past, of the Water Commission). This paper does not limit itself to the physical and planning aspects of the national water sector, and does not only address the Water Authority's areas of responsibility, but also incorporates certain areas of the management side of the whole water sector. This is in light of the insights which indicated that the main problems of the water sector include issues relating to governability and decision

making. Further actions will be required to ascertain that other bodies, in addition to the Authority, also work towards implementing the recommendations of the Master Plan, following its approval by the Government.

This policy document addresses the primary issues and components of the national water and sewage sector, with regard to significant developments that have occurred in recent years. The document addresses the fundamental issues – the water crisis and current and expected development of desalination plants which change the freshwater supply situation in the country - and the regulatory area on the national and local level – in view of the creation of the Water Authority and the water and sewage corporations, and the need to examine the allocation of responsibility and authority to the various management levels of the national water and sewage sector.

Devising the plan, within the framework of the Water Authority's planning division, creates a broad professional platform which, in addition to the plan's products, will also serve as a professional tool for analyzing future issues with which the water sector will contend, and will support decision making processes of the Water Authority's management. It has been shown that issues and topics addressed through well organized headquarters' work were indeed advanced efficiently (see, for example, the construction of desalination plants). Some of the topics that were not advanced, or experience difficulties, are also connected to insufficient advancement and analysis of these topics at the Authority headquarters

The document was drafted in cooperation with the best consultants and experts in Israel, in the relevant fields. Representatives of the relevant professional units of the Water Authority were also involved.

Emphasis is placed on the fundamental need to ensure resources, for completing and detailing the national water sector LTN-MP. It should be noted that the resources required for completing the Implementation Plan (primarily for the planning phase) exceed the currently allotted resources.

We hope that the Minister of Energy and the Government will approve the report's recommendations in the near future, and will give the go-ahead for the work to progress: advancing analysis of other issues which have not been addressed in this part of the work, and further work on integrating all the proposed policies as part of the implementation plan and its two components (planning and development). Work on both components has started. It should be noted that only a detailed implementation plan will enable the work to be completed as a whole, to achieve the objectives and implement the policy as formulated in this document. Updating the policy document and realizing the implementation stage **should be accompanied by organizational and budgetary preparations, and appropriate steering, within the water sector in general and, in particular, in the Water Authority.**

Steering and Plan Formulation Teams (Policy Document)¹

The policy document approved by the Water Authority Council in July 2011 was supported by a subcommittee of the Water Authority Council (the steering committee) for the LTN-MP and the Authority Management (work team). The two teams were led by Prof. Uri Shani who served as Authority Director General (2007-2011). Acting Authority Director General, Mr. Oded Fixler chaired the policy document (Version 3) approval discussions at the Council, until actual approval. The current Authority Director General Mr. Alex Kushnir participated in the plan discussions, as a member of the Council on behalf of the Ministry of National Infrastructures, and has led the work on updating the policy document and the development plan (five year plan, 2012-2016) since he took up the position. As the Water Authority Council chairman he effected approval of the policy document (Version 4) in August 2012.

Plan Formulation Work Teams

Project Manager

Mr. Miki Zaide, Strategic Planning Manager, Planning Division, Water Authority

Core Team

Mr. Mo Provizor	Senior Planning Division Manager, Water Authority
Prof. Uri Shamir	Consultant
Dr. Yossi Dreizin	Consultant
Mr. Miki Zaide	Strategic Planning Manager, Water Authority

Main Issue Leaders

Vision and objectives	Mr. Miki Zaide
Preparation of the water sector for operation under conditions of uncertainty	Mr. Miki Zaide, Mr. Dennis Gamzin
Freshwater system management	Dr. Yossi Dreizin
Sewage and treated wastewater system management	Dr. Yossi Dreizin, Prof. Menahem Rabhon
Natural water sources management	Prof. Uri Shamir, Dr. Israel Gev
Water quality	Mr. Yaakov Jacques, Dr. Yossi Dreizin
Consumption management	Prof. Uri Shamir
Runoff and drainage management	Prof. Uri Shamir, Prof. Naomi Carmon
Natural values and landscape	Mr. Miki Zaide
Water and agriculture	Dr. Jorge Tarchitzki
The urban water sector	Mr. Yaron Ben Ari, Dr. Yossi Dreizin
Water and energy	Mr. Alon Perelman

¹ The definition of individuals' roles is based on the description of the roles which were in effect when the document was drafted. Subsequent changes in roles have not been cited at this stage.

The approved policy document incorporates a policy paper (compiled by Mr. Miki Zaide) on the geopolitical issue, which was not included in this document.

Other issues that have not yet been fully addressed in this framework and are to be analyzed later:

Regulation and finance (tariffs); Water sector structure; Development policy of the water sector; Preparing for climate change; Advancing the water industry; Water security; human resources and R&D.

Consultancy in various fields:

Pareto Engineering Ltd. – coordination and analysis of the development plan; Hoshva Planning (Matrix Ltd.) – water balances; Yehoshua Schwartz, TAHAL – survey of past plans: Aviv Ltd. – help with managing the project timetables, maps.

Support for Project Management:

Adi Hadar, Adi Hadar Engineering Consultation and Management Ltd.
Alon Perelman, Ethos Architecture Planning and Environment Ltd.
Shany Morgenstern, Adi Hadar Engineering Consultation and Management Ltd.
Israel Mantel, Adi Hadar Engineering Consultation and Management Ltd.
Elisheva Mai, Adi Hadar Engineering Consultation and Management Ltd.
Ariel Rajuan, Adi Hadar Engineering Consultation and Management Ltd.

Contact address:

Miki Zaide michaelz10@water.gov.il

Tel: +972-3-6369696

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- Ministry of Environmental Protection, Israel Nature and Parks Authority
- Ministry of Agriculture
- Ministry of Interior
- Ministry of Health

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Main Points of the Policy Document

(Version 4)

Background

The LTN-MP for the water sector was drafted by the Water Authority, subject to government resolution 2348. The plan includes two parts: (1) **a policy document**, which comprises a strategic plan for developing and managing the water sector in the medium and long term, and (2) **an implementation plan** which is an operational plan for bridging the gap between the present status and the desired state of affairs in accordance with the policy. This includes development plans for different periods of time, investments, and all the professional work required to formulate and to update a development plan based on the evolving conditions.

The policy document was initially approved by the Water Authority Council in July 2011 and underwent a comprehensive process of professional discussion on selected issues, including a public hearing attended by the Minister of Water and Energy, in January 2012. The policy document was reapproved after various updates were introduced in August 2012. The document reflects an overall policy which is designed to guarantee the existence of a sustainable water sector over time, including the planning, economic, social and environmental aspects.

The current document details the main points of this overarching policy and its objectives. It is noted that the plan should be routinely updated, and the policy document and the implementation plan should be periodically examined, in view of accumulating changes taking place over time.

a. The Vision and Primary Objective of the Water Sector

The Policies in this document is driven by a vision which was created through in-depth discussions and meticulous work. The vision generates the basis for the entire policy:

Water is an existential basic need for man and the environment. The water sector comprises a strategic infrastructure for Israel and an essential factor in its development and achieving its national goals as a Jewish, Zionist and democratic State. These include developing and maintaining agriculture, building new settlements, land conservation, strengthening the periphery and the development of the national economy. Management and sustainable development of the water sector will be carried out professionally, efficiently, fairly and transparently, in accordance with advanced criteria, for the benefit of the public and for the preservation of its health. The natural water sources will be rehabilitated and preserved. The Israeli national water sector will serve as a global center of knowhow for water-related technologies and innovations, water-related professional advancement, , and exemplary groundbreaking management of water resources in shortage conditions.

Every component of the vision must be realized in the policy of each domain, and in each of the detailed issues. The **primary objective** derives from the vision, and it translates the vision into operative terms which are described in detail in the policy document, for secondary objectives and components:

To ensure the supply of water, to provide sewage services and designate uses of treated wastewater and manage runoff and drainage – of suitable quality, quantity and reliability, and with economic efficiency, for the sustainable welfare of all the consumers.

b. Main Points of the Policy and the Recommendations

	Topic/Subject	Policy
1	Realizing national goals	<ul style="list-style-type: none"> ❖ The water sector will serve as a supportive factor in realizing Israel's national goals (residential expansion and development, industry, agriculture, nature and landscape, regional agreements, etc.) ❖ The Water Authority Council will guide the development goals for which preparations are to be made as part of the development of the water sector. It will provide the method of realizing national goals, for the purpose of implementing the Government policy and its guidelines and resolutions. ❖ Recommended establishment of a coordination committee (national infrastructures – water, gas, transportation, electricity, etc.).
2	Governability	<ul style="list-style-type: none"> ❖ Reinforcing and structural adjustment of the Water Authority to enable it to function as a financial and professional regulator which will allow cooperation based on advanced and clear criteria, for the purpose of implementing government resolutions.
3	Economic regulation	<ul style="list-style-type: none"> ❖ The water sector will be administered on the basis of incorporation of the costs in the water tariffs. ❖ Analysis of the cost benefit of development alternatives will also aim to minimize costs and apply social considerations in regulation of the water sector, as determined by government policy. ❖ Formulating funding mechanisms so that they enable development stability along a time axis (this will include examination of budgetary frameworks for capital renewal, and a dedicated multi-year budget for developing the water sector in certain areas).

		<ul style="list-style-type: none"> ❖ Cross-subsidization of the various sectors in determining water tariffs will be reduced. ❖ Mechanisms will be created for providing the public with a suitable level of service, while ensuring a balance between public and private interests.
4	Management of the water sector in conditions of uncertainty	<ul style="list-style-type: none"> ❖ The water sector will take reasonable steps to prepare for extreme scenarios in all areas of its activities, for supply, consumption and infrastructure development.
5	Management of natural sources of water	<ul style="list-style-type: none"> ❖ The natural sources of water will be rehabilitated and preserved as a strategic value. ❖ Operating lines and preservation goals will be set for all natural water reservoirs. ❖ Management of water extractions from the renewable natural water supplies will be sustainable, and over-extractions (a dropping below "red lines") will be avoided.
6	Management of the freshwater system	<ul style="list-style-type: none"> ❖ Integrated management: the water sector will manage the natural and desalinated sources of water on an integrated basis (via a central national system). ❖ The Sea of Galilee: will mainly be designated for supplying water to the north of Israel, but will remain connected to the national system. ❖ Supply to the center of the country and the other regions: will be based on seawater desalination plants as a complementary source for the natural sources of water. ❖ Supply reliability: supply reliability will be maintained and will also be increased by building circular systems that connect cities to a number of water sources, replacing pipe systems, developing and expanding local and regional pooling, maintaining the local production systems, etc.
7	Management of sewage and effluent	<ul style="list-style-type: none"> ❖ Effluent is mainly designated for agriculture (and for nature in certain approved places). ❖ In certain cases (when there is no designation to agriculture for treated wastewater, and there is Ministry of Health approval) promoting "grey water" projects will be approved. ❖ Intensive efforts will be made to connect most of the sewage producers to sewage treatment plants. ❖ Collection and treatment will be prioritized for central plants, and in consideration of reclamation programs.

		<ul style="list-style-type: none"> ❖ In the coming decade, the quality of treated wastewater will be improved to meet the values set by the Inbar Committee, and the quality of treated wastewater will subsequently tailored to the needs of the water sector, subject to cost benefit analysis, and the accumulated knowhow about the implications of reclamation and amendment of regulations.
8	Water quality	<ul style="list-style-type: none"> ❖ The natural water sources whose quality has declined in recent years, to a level considered inappropriate for public consumption will be restored to drinking water quality, subject to cost benefit analysis. ❖ In addition to quantitative goals for rehabilitation of national reservoirs, qualitative goals will also be set for the natural sources of water, as well as criteria for the quality of the water supply to all consumption sectors. ❖ Other actions: <ol style="list-style-type: none"> 1. Advancing supply of low-salt water to urban communities. 2. Further action to reduce the salinity of water from the Sea of Galilee. ❖ Enhancing the quality of natural water resources by removal of contaminants and by other means.
9	Consumption management (demand management)	<ul style="list-style-type: none"> ❖ Supplying the full requisite quantity of water to all citizens, for all uses. ❖ Consumption management is as important as supply management. ❖ Setting lower per capita annual consumption goals than in the past. ❖ Measures will be taken to make cuts in water consumption more efficient in all consumption sectors (technical, economic, legal and advocacy).
10	Water and agriculture	<ul style="list-style-type: none"> ❖ Agricultural production is a national goal that incorporates community development, and is of social and environmental importance. ❖ The water sector will adapt to promoting this goal (based on a government approved master plan for agriculture) while taking into account all considerations of the water sector. ❖ The quantities of water to be supplied will be stable over time, and in accordance with the government resolutions and the "water arrangement with the farmers". Additional quantities will be supplied, as required, based on covering full costs. ❖ Treated wastewater will be reclaimed mainly for agricultural uses.

		<ul style="list-style-type: none"> ❖ Financial and regulatory mechanisms will be devised for increasing efficiency of use of water for agriculture (including examining regional management mechanisms and transferring regional quotas).
11	Runoff management and drainage	<ul style="list-style-type: none"> ❖ Runoff is a resource and not a nuisance. ❖ Watershed master plans will be prepared, and will incorporate integration between basin-based runoff management and management of urban runoff. ❖ Consideration will be given to the transfer of responsibility for managing runoff and drainage in urban communities to the municipal water and sewage corporations. ❖ Construction for water preservation should be advanced.
12	Environment and water for nature	<ul style="list-style-type: none"> ❖ Nature is an important consumer which should receive water as it requires, subject to supply and ability. ❖ Rehabilitation and preservation of water-dependent ecosystems should be primarily achieved through rehabilitation of the natural sources of water. ❖ Nature's water requirements will be defined and will be quantified in the master plan for nature. The master plan for nature will be subject to approval by the Water Authority Council, subject to an extensive public hearing according to the law. ❖ Environmental principles will be incorporated in the development of the water sector infrastructures. ❖ External costs will be taken into account in analyzing cost benefit of alternatives for implementing projects.
13	The urban water sector	<ul style="list-style-type: none"> ❖ The number of the municipal water and sewage corporations should be reduced. ❖ The corporations should be strengthened, in professional terms, as should the regulation pertaining to them. ❖ The urban water supply systems, and measurement systems, should be rehabilitated and upgraded. ❖ Appropriate levels of service by the corporations to the consumers should be guaranteed.
14	Water and energy	<ul style="list-style-type: none"> ❖ Coordination in the development of infrastructures, between the water sector and the energy sector will be increased.
15	Regional water agreements	<ul style="list-style-type: none"> ❖ Preparations should be made for future peace arrangements and unilateral actions. ❖ Separation of supply systems between Israel and the PA (Palestinian Authority).

		❖ The Red Sea - Dead Sea Water Conveyance project should be advanced as an international project, subject to a feasibility study and government resolutions.
16	Human Resources and R&D	❖ A plan should be prepared for assessing the the number and scope of professionals required in the various areas of the water sector, and in the Water Authority. ❖ Investment in R&D will be significantly increased.

c. The Water Sector Balance for the Duration of the Plan (2010-2050)

The water sector balance presented below is based on a mean forecast of consumption in the various sectors on the one hand, with various policy assumptions, such as: suppressing urban demand, increasing quantities for nature and added treated wastewater usage for agriculture, and on the other hand, a reduction in the quantities of natural water. The gap between consumption and supply will be closed by desalination and importing.

The forecasts are based on data, assumptions and basic parameters of the water sector, which reflect the development of the State of Israel over time in all areas (population, industry, etc.), together with planning objectives and water resources allocation policy (designation of treated wastewater for agriculture, water for nature). The national water balance indicates a possible representative picture of the expected patterns, based on the best available knowledge, and the patterns detailed in the LTN-MP.

The forecasts for closing the gaps through desalination/importing were enhanced by statistical sensitivity tests (simulation) for changes in the various parameters, in order to show the range of results for the various levels of supply reliability (from 75% up to close to 100%), and in order to prepare for extreme situations. The forecast of the water supplement requirements is based on a need for high reliability and on strict assumptions.

Master Plan for the Water Sector – The National Balance

Population and consumption

Year	National pop. (m.)	Per capita consumption (cu.m./capita /year)
2010	7.6	100
2020	9.1	99
2030	10.9	98
2050	15.6	95

Water Sources (mcm/year)

Year	Natural freshwater	Saline	Treated wastewater (incl. Dan Region STP)	Desalination of saline waters	Desalination of sea water and imports	Required supplement	Total supply
2010	1,200	174	450	23	280	4	2,131
2020	1,140	150	573	50	750	9	2,672
2030	1,080	140	685	60	750	50	2,765
2050	1,020	130	930	70	750	671	3,571

Water Consumption (mcm/year)

Year	Urban	Industry			Agriculture				Regional	Aquifers recovery	Nature and landscape		Unforeseeable	Total consumption
		Fresh-water	Saline	Total	Fresh-water	Saline	Treated wastewater (incl. Dan Region STP)	Total			Fresh-water	Total		
2010	764	90	30	120	500	144	400	1,044	143	0	10	60	0	2,131
2020	902	95	30	124	490	120	528	1,138	143	200	50	95	70	2,672
2030	1,064	99	30	129	470	110	645	1,225	143	0	50	90	114	2,765
2050	1,482	108	30	138	450	100	900	1,450	143	0	50	80	278	3,571

Note: Aquifers recovery will mainly take place in the current decade and, as such, it is only presented for 2020.
mcm = million cubic meters

Water Sector Balance: Main Assumptions and Patterns (up to 2050)

- ☒ Population: 15 million in 2050 (based on the population growth rate in recent years – 1.8% per year).
- ☒ Per capita urban and public demand: in 2010 – 100 cu.m./capita/year, up to 2050 a decline of around 5%.
- ☒ From here: doubling the level of supply to cities by 2050 to 1.5 billion cu.m.
- ☒ Supply of natural water: preparations for gradual reduction of up to 15% (climate change, water quality, etc.) by 2050.
- ☒ Need for rehabilitation of the natural reservoirs: addition of about 2 billion cu.m. above the red lines within a decade.
- ☒ Allocation of water for nature: significant increase compared with the current situation.
- ☒ Usage of treated wastewater: doubling urban consumption will more than double the usage of treated wastewater (from around 400 mcm of restored water in 2010 to around 900 mcm in 2050). Most will be designated as agricultural treated wastewater.
- ☒ Volume of water for agriculture: this will increase from about 1 billion cu.m. in 2010 to around 1.5 billion cu.m. in 2050, mainly through an increase in supply of treated wastewater.
- ☒ “Regional” – regional supply: supply to Jordan and the PA of about 145 mcm, which will be derived from the supply of the Israeli water sector, based on current agreements.
- ☒ Preparations for scenarios (unforeseeable): additional unidentified consumption (future geopolitical agreements, increase in immigration, etc.) of up to about 275 mcm in 2050, for various uses.

Required supplement – from artificial sources of water (desalination of saline and seawater and imports) of approximately 750 mcm in 2020. This amount will double 2050. This level will, of course be examined periodically. Nevertheless, an estimated level for 2050 is currently required in order to ensure the sufficient sites and conditions for meeting this target.

d. The Implementation Plan for the Master Plan

The Implementation Plan of the LTN-MP comprises, as was mentioned, two components: planning and development. The following are the main areas comprised in each of the components:

d.1 Master Plan Implementation: The Framework Plan Component

The main essence of the policy document is presented in the Framework Plan Component documentation. The Framework Plan Component is designed for implementation of the main essence of the Master Plan Policy Document. This preliminary plan consists of a collection of professional assignments and procedures which should be completed chronologically, according to priority. Advancement of this planning component is necessary in order to implement the Development Plan Component of the Master Plan Implementation. The

Framework Plan should be deployed throughout a period of 5-7 years, at a cost of tens of millions of shekels.

D.2 Master Plan Implementation: Development Plan Component

As part of the LTN-MP, an estimate of the required level of investment in the water sector, in the short, medium and the long term (up to 2050), was made in order to examine the implications of the policy implementation. The mean annual investment was estimated at around NIS 5 billion (without capitalization). In the current five year period (2012-2016) about NIS 27 billion, including unforeseeable expenses, is required, subject as said, to approval of the five year plan by the Water Authority Council.

The next phase of the plan will include testing the impact on water tariffs, of advancing major projects, in a cost-benefit analysis over time that incorporates forecasted increases in demands. As part of the LTN-MP, obstacles were identified and mapped in relation to the ability to advance projects (including structure and human resources at the Water Authority), in the statutory field (identifying locations for establishing desalination plants, infrastructure facilities and removal of brine), in relation to guaranteeing a development mechanisms budget, regulating the water sector's planning and implementation ability, and in the area of R&D investment. There is a need for inter-ministerial coordination, and structural and organizational preparations for removing obstacles that hinder and/or prevent the appropriate rate of progress of the development plans.

Long-Term Master Plan for the National Water Sector

Policy Document

(Version 4)

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a. Background

Previous master plans of the national water sector were drawn up before the creation of the State. Preparation of this LTN-MP included a review of the master plans that were devised in the past, in order to learn from their incomplete implementation (Yehoshua Schwartz, TAHAL, March 2010). The review included preliminary plans, starting from the Pinhas Ruttenberg plan (1920) for the whole of the north and the valley region, the Elvin Mead survey (1920s), the Lauder milk plan (1944), Blass plan (1944), Hayes plan (1948) and master plans formulated in the last few decades. It should be noted that, to date, no overall long term national master plan for the national water sector, has been approved and adopted.

After the creation of the State of Israel a period began of large scale construction of local and regional water-supply facilities for the rapidly growing population. These facilities were primarily based on utilization of groundwater (some were overused) in the western basins, and of surface water in the eastern basins – the Jordan River basins. In 1952 the governmental company TAHAL was founded, which was joined by planners of the Ministry of Agriculture's Water Administration, Mekorot Ltd. and others. The National Water Carrier was planned by TAHAL and construction began on some of the National Water Carrier's sections. The preparation of the master plan for the national sector initially focused on the Water Division (later the Water Administration) of the Ministry of Agriculture. The preparation of the master plan was overseen by the American engineer Cotton, who served as an advisor to the Government of Israel. He visited Israel a number of times each year and submitted six interim reports, and a final report which was approved in February 1956.

Subsequently (1956-71), the national water system was established, which was operated while large scale planning work took place. The work included research and planning of the national sector, in preparation for extreme situations that were expected in the 1970s and 1980s (1971-76). Other plans that were devised included: the Water Sector Master Plan (Tellem, 1988), the National Master Plan for the Water Sector (1997). The last plan was a (transitional) master plan for developing the water sector between 2002 and 2010, prepared by the Water Commission, in light of the deep crisis in the water sector at the start of the previous decade. On the basis of that plan, a decision was made in 2002 to desalinate 400 mcm per year (mcm/year), and a recommendation was made to invest a total of NIS 20 billion over a decade in all areas of water sector activities.

It should be noted that in the last decades, long term planning was undertaken by the water sector on a continual basis, via TAHAL and via the planning division of the Water Commission/Authority after TAHAL's privatization, but not under the title of national master plans. This planning work included topic-based master plans, regional master plans and developing planning tools for the water sector.

The vision and objectives of the first master plans for the Israeli national water sector were derived from the Zionist vision of creating the State, consolidating its borders and its security and absorbing immigration. Development of the water system was a central component of this vision. Today, the vision of Israeli society is divided between the wish to enhance economic welfare, to achieve social justice, hopes for peace in the Middle East, various other expectations and protecting environmental, landscape and cultural values. As a result, the vision of the water sector has receded, and there is no comprehensive national planning on which to base objectives and goals. The last master plans that were formulated were generally designed to address internal goals of the water sector: satisfying expected levels of demand, with the appropriate quality and with suitable reliability, preserving and rehabilitating the sources of water, and increasing economic and engineering efficiency.

The approach to the need for a program that would guide development of the sources of water and their management, changed over the years. The first master plans noted the existential need for water. Levy Eshkol declared that: "water is essential to us like blood in our veins." The threats of enemies across the border, on development of the water sector, and the diplomatic and military struggle against such threats, brought the issues of the plans to the epicenter of security-public interest. Since then, recognition of the existential need for natural water has declined. The argument that "a desalination plant is cheaper than one day of a battle" is still made. Thus, the last master plans did not occupy a central position in the interest of the public or of the government. Nevertheless, and mainly due to the crises experienced by the Israeli water sector, the State Comptroller highlighted the lack of master plans in his reports, and the last state committee of inquiry on the subject (the Bein Committee) also addressed this.

The first master plans focused on clear engineering systems: a national electricity grid and a national water carrier, and its regional extensions (Blass 1944). Today, the plans address complex engineering systems as well as non-engineering aspects. Thus, ever increasing expertise is required in many additional fields relating to the preparation of plans, with increasing difficulty in conveying the importance of the program to interested parties and the general public. The public support for the program increases when it is clear that it benefits everyone and it decreases in a situation of conflicting interests, and an unequal division of the program benefits, and of the burden.

The first master plans were led by leading public figures (Pinhas Ruttenberg, Levy Eshkol, Pinhas Sapir) who managed to remove budgetary and legal obstacles by dint of their personality and standing, avoided public, environmental and landscape objections and took care of political and security problems. The nature of the current governmental procedures necessitates the handling of all the said obstacles openly, while involving different interested parties and obtaining wide agreement.

The early plans were formulated when there was little, partial, or insufficiently reliable information available. There were differences of opinion about the assessment of the water potential (differences continue to exist, but less so), the quality and availability of water. Much of the effort to formulate plans involved gathering and organizing information about sources of

water, the consumption of water and the supply systems. The later programs benefit from far more orderly information systems for the use of the various parts of the national water system.

Management of these master plans include initiation, defining tasks, planning, steering and control, adjudication, approval, monitoring and control of implementation. In the first plans there was little separation between the tasks, and most were not carried out at all, or were carried out by individuals or institutions, engineering and economics professionals, and the discussion and approval procedures of the plans were not exposed to experts in a wide range of fields, and to the public and interested parties. In the last programs the leading procedures have already been institutionalized, leading to approval and implementation of the plans, and this is beneficial. Nevertheless, plan approval processes which, for the earlier master plans, were simple have become far more intricate, to the point of generating significant obstacles their advancement in development and management of the sources and the systems.

Today, the definition of the water and sewage system is more extensive, operates at the national level and incorporates the full range of management, organizational, economic, professional and physical means used to manage the water resources and the systems which serve to preserve them and to make their usage by the public efficient over time. The Water Authority is the state body responsible for administering the water sector. The Water Authority's Council, which includes officials representing the relevant government ministries, guides the policy of the Authority's work. However, it should be noted that the water sector is impacted, in terms of its management and operation, by a range of national goals which are administered by other government ministries, even if they are not represented on the Water Authority Council.

Creation of comprehensive policies are required in a very broad range of areas. However, no strategic national plan had been set prior to formulation of the LTN-MP. A strategic national plan would have provided a foundation for setting these policies. The absence of such a plan creates many challenges in management of the water sector. Among these are challenges relating to planning approval processes, weighing all interests, and progressing forward in the absence of national strategic planning from which a guiding policy for the water sector can be derived. Overcoming these challenges, and creating the comprehensive policies comprises the basis the current activity., This is a unique endeavor, relative to all work that was carried out in the past: The new policies will lead to formulation of a long term master plan for the national water sector (LTN_MP) which, when finally approved, will form the basis for all activities in Israel's national water sector.

The Long-Term National Water Sector Master Plan (LTN-MP) was prepared in accordance with a decision by the Water Authority Council in August 2008. It was agreed upon in a policy document in December 2010, discussed at various forums of the Water Authority, and improved until approved by the Water Authority Council on July 4 2011. Examination of the LTN-MP continued at the Water Authority and with the Minister of Water and Energy, and was prepared for the public hearing convened by the Minister on January 31 2012. At the same

time, work proceeded on preparing the two components of the Implementation Plan – Planning and Development.

b. The Long Term Master Plan for the National Water Sector

The Long-Term National Water Sector Master Plan (LTN-MP) is being formulated in accordance with a decision by the Governmental Water Authority Council in August 2008, the first part of which is presented in this document. The LTN-MP is being devised against the backdrop of the crisis in natural water sources, following a protracted series of drought years since 2004 and the structural changes that ensued from the creation of the Water Authority (January 2007). These structural changes include the move of additional bodies to the Water Authority's framework (October 2009).

Advancement of the LTN-MP is based on a vision and definition of objectives and goals. An emergency plan (2010) was devised separately, but in parallel with the LTN-MP. The LTN-MP involves the formulation of an overall and balanced policy which is designed to guarantee a sustainable water sector, with a range of planning, economic, social and environmental aspects over time.

The first and second versions of the LTN-MP were drafted at the end of 2010, and Version 3 was completed in December 2010. Version 3 underwent a series of discussions in numerous forums and was approved by the Water Authority Council in July 2011. The current document – Version 4 – is an upgrade of Version 3 of the policy document.

The LTN-MP is implemented in two main stages, with reciprocal feedback between them:

- **Policy Document:** The essence of this document is presented here, defines the vision, the goals and objectives of the water sector and the policy of the water sector on the principal issues. The paper includes a presentation of the water balance of the national system along the time axis, including analysis of conditions of uncertainty, and initial recommendations for implementation. The paper also includes a framework for the development plan and recommendations for removing management, budgetary and professional obstacles. Full treatment of a number of other issues, such as: the structure of the water sector, regulation, and others, will be completed at a later time.
- **Implementation Plan:** designed to realize the policies and to bridge the gap between what exists and what is desired. The implementation plan is divided into two separate components: the planning component and the development component (see illustration below). The planning component is defined as the set of actions that are necessary, as headquarter activity, for the realization of the policy and the recommendations approved in the policy document. This includes basic planning and various professional hydrological works, on the level of master plans and regional plans.. The development component comprises a program of different timescales (normally this refers to long range programs, short-medium range (five-year), and immediate range programs – annual programs). The

development program incorporates presentation of the resources, investments and the ongoing budget that is required in accordance with the orders of priority, funding sources, impact on tariffs, and cost benefit analysis of engineering alternatives and policy alternatives. The implementation plan will be developed along a time axis, in accordance with the resources that are allocated for it.

The Policy Document was devised under continuous steering by the Authority management and the Water Authority Council, and an intensive assessment involving the best experts, consultants and interested parties in areas of water in Israel. The work stages started with defining a vision for the water sector, and thereafter objectives and goals deriving from the vision were defined, and there was analysis of policy alternatives in each field, and a proposal of recommended policy directions and means.

The issues which comprise the LTN-MP were presented at various stages to a number of government ministries and non-governmental organizations, as well as to senior academics to obtain feedback. This feedback was integrated into the policy document wherever relevant.

The current LTN-MP is the most significant measure taken in recent years for devising an overall long term policy and planning for the Israeli water sector, in all its various aspects, with a view to submitting the plan for government approval. To date, a master plan for the water sector has yet to be approved by the Government of Israel, despite a number of previous attempts to prepare a national master plan. The last master plan that was prepared was “A (transition) Master Plan for 2002-2010” which was formulated against the backdrop of the water crisis at the beginning of the 21st century and which was designed to provide immediate solutions for stabilizing the system – by advancing desalination plants, reclamation systems, cutting down on the use of water, upgrading sewage treatment plants, investing in water monitoring and quality, etc. The total value of investment for the purpose of implementing the transition plan was NIS 20 billion, which was earmarked for implementation by the end of the decade, in all areas of the national water sector and not just desalination. There is no doubt that, had the recommendations of the previous plan been fully implemented, the current crisis would have been averted.

The State committee of inquiry on the subject of management of the Israeli national water sector (the Bein Committee), which operated while the current master plan was being formulated, included the following topics in its recommendations: defining water as a product with shortages and the need for savings, the obligation to preserve the natural sources of water, setting realistic water rates with factors to encourage savings on the one hand while on the other hand, helping the disadvantaged, advancing solutions relating to sewage and the treatment of sewage, increasing enforcement, advancing databases, recommendations on aspects of regulation and other unique topics. The committee also ruled that: “there is an urgent need to set strategic targets and to prepare a long term master plan in the area of infrastructures in general, and in the water sector in particular. The committee of inquiry

believes that the preparation of a comprehensive master plan for the water sector is a crucial and highly urgent requirement.” The committee highlighted the importance of transparency and engaging the public in the preparation of the plan and, indeed, the current plan provides a solution for the committee’s recommendation in this area. The main recommendations of the Bein Committee were recently adopted by a government resolution (no. 2348, dated October 24 2010), following work by the team of Ministries Directors Generals which was established for the purpose of examining the committee’s findings.

The Central Tasks of the Policy Document in the LTN-MP

- Identifying the main issues of the water sector, and all their elements, formulating and updating the policies of the issues and integrating them in the overall policy of the water sector to be approved by the Water Authority Council and by the government.
- Formulating objectives and goals that the Israeli national water sector should achieve in the medium and long term.
- Preparation for operation of the water sector under conditions of uncertainty.
- Devising the necessary framework for the development of the water sector, mapping the obstacles and ways to remove them.
- Creating a framework for integration and coordination between all the plans and bodies in the water sector.
- Detailing and completing the LTN-MP by means of an implementation plan of meeting objectives and developing and managing the water sector in the coming decades (quantitative definition of objectives, prioritizing and detailing the development plans along the time axis, integration of planning in the water sector, detailed guidelines for topic-based and regional planning, operational recommendation for the different issues, developing indices for realizing the objectives of the water sector, etc.)
- Forming a planning infrastructure for the orderly management of the water sector in the coming decades (methodology, database and decision making tools).
- Devising and formulating an inclusive process that includes all interest-groups, the bodies that impact on and are impacted by the water sector, and the public, and creating a platform which supports decision making.
- Deployment for exercising the extended powers of authority of the Water Authority, primarily in areas of regulation and finance.

The Principal Challenges of the Water Sector

Formulating a master plan and, subsequently, the implementation plan is taking place at a time when there are challenges to be addressed. The important ones being:

- Improving the institutional-organizational structure responsible for supervision and regulation of the water sector, both within the Authority itself and with regard to its position within the governmental system as, in the current situation, there are significant weak points that prevent efficient management, including defects and shortcomings in: the division of responsibility and authority, decision making procedures

and removing obstacles to their implementation, making budgets available for ongoing management, adapting the scale of personnel to the scale of the tasks, matching the level of investment in R&D, matching the level of enforcement, etc.

- Development of the infrastructure and artificial water sources required, at the appropriate time, and efficiently, despite the uncertainty of a number of main elements, in order to ensure efficient reliable supply.
- The difficult condition of the water sources (quantity and quality) – there is a decline in natural supply due to a drop in water levels, penetration of contaminants from the unsaturated area, urbanization which reduces recharge, climate change, geopolitical effects – and the difficulty of bringing the natural water sources to a long term stable situation.
- Establishing regulatory rules and efficient mechanisms for financial supervision, including setting tariffs and criteria for service and for ensuring the financial stability of the suppliers.
- Preparation for operating in uncertain conditions relating to future consumption levels, which are impacted by the rate of population growth and the future per capita consumption, fluctuations in hydrological phenomena and the effect of climate change, technological developments, geopolitical issues, etc.
- Finding the right balance between economic, social and environmental considerations.
- Internalizing the need to minimize harm to ecological system, and implementing this in planning and development processes.

In preparing for operation in conditions of uncertainty the plan also maps the relevant scenarios for the development of the water sector, and examines ways of preparing for them. The plan also addresses formulation of a development plan for the water sector, based on the national development policy, and engages in mapping the obstacles for implementing the plan and in recommendations for their removal.

The LTN-MP was devised by defining the vision and objectives of the water sector, identifying the core issues, determining the preferable policy in each, and thereafter completing integration between all the issues. The core issues that were processed in detail to date include:

1. Preparation for operating under conditions of uncertainty
2. Management of the freshwater system
3. Management of the sewage and treated wastewater (effluent) system
4. Management of the natural water system
5. Water quality
6. Demand management
7. Water and agriculture
8. The urban water system
9. The environment and water for nature
10. Runoff and drainage management
11. Water and energy

Regarding other important issues that were addressed by the LTN-MP, basic policies have been devised on different levels. However, this has yet to be fully implemented by the Water Authority management and by the Water Authority Council, within the framework of public and internal discussions. These additional issues include: regulation and finance (tariffs, structure), water arrangements with the neighbors, water security, preparedness for climate change, developing professional human resources and R&D, the development policy for the water sector, advancing the water industry. A position paper was drafted as part of the plan, relating to the water agreements with the neighboring countries, that is not attached to this policy document but was presented to the Council as part of approval of version 3, in July 2011.

Steering and the Mode of Operation while Formulating the LTN-MP

The plan represents an effort that is unprecedented in the Israeli water sector, in terms of the scope and areas of planning, and the level of cooperation with the public and interested parties on formulating the recommendations. The topics of the water sector were divided into the aforementioned issues. The vision and overall objective of the water sector were defined, as well as the range of internal and external objectives which we addressed in the analysis of the policy alternatives and various issues. The primary elements were identified for each issue, and decision making alternatives were defined for each element, which were analyzed using indexes and criteria until the recommended policy alternatives were selected. In addition, initial recommendations for implementation and for realizing the recommended policy were outlined. A policy document was drafted for each issue and this was presented and discussed at public meetings. Different papers that were prepared in the past were used in the preparation of the current policy document, as well as papers specially written for it.

The work was overseen by a subcommittee of the Water Authority Council, and, under its authority, a small work team was appointed comprising the Water Authority's senior management. The direct mentoring and management of the plan were carried out by the person in charge of strategic planning at the planning division with the support of the internal work team (which included external consultants).

Professional academic experts were involved in preparation and steering of the plan, as well as specialists with extensive professional experience in public life. Preparation of the plan included focusing on holding public discussions and involving interested parties and non-governmental bodies (including: the SPNI, Adam Teva V'Din and Friends of the Earth), a large number of government ministries and other interested parties (including Mekorot Ltd). Many of the bodies with which we shared information submitted comments, most of which were incorporated in the policy document. The policy papers were formulated in a process of feedback, until they were drafted into their current form.

The current document includes the essence of the policy, taken from a range of policy papers which were drafted, and a large number of background papers which were written within the framework of the Water Authority planning division, academy and other bodies over the years.

The products of the updating process of the entire plan, and the policy papers on the various issues which were later implemented are available to the public on the Water Authority's web site.

Although much work has been done, the current policy document is not in its final form. Yet as is, it is adequate for approval. The current policies and the recommended alternatives, are considered to be at an interim stage that comprise a basis for additional analysis, with the possibility of future changes.

Other Focuses of the LTN-MP

- **Broad vision** – The plan aims to take an extensive view of the needs of the water sector on the national level, in all areas, and all the bodies that are managed and supervised in the water sector (not only within the boundaries of the direct responsibility of the Water Authority). **In addition, emphasis was placed on the fact that the current water law, government decisions and existing agreements constitute merely the opening point for discussion of the various issues, but do not influence the definition of the vision and recommendations of the plan in the long term.**
- **Long term planning** – The plan looks beyond the present crisis, to planning decades into the future, while recognizing that the level of uncertainty increases the further one looks into the future. Given the distant planning horizon, the recommendations should be updated and examined periodically (every few years), and the updating should be carried out on a continuous basis.
- **Preparing for operation under uncertain conditions** – The plan incorporates principles (and, in certain cases, quantitative goals) which aim to enable the sector to make decisions under conditions that change over time.
- **Continuous work and updating processes** – In view of the long range of the planning, and in order to maintain the relevance of the recommendations and policy, the plan is designed to undergo monitoring of the implementation process, along with continuous updating as a means of coping with the uncertainty, with technological changes and with the situation of the water sector.
- **Basis for decision making** – The plan will formulate a basis for making ongoing strategic decisions in the water sector, while updating and adapting it to the periodically changing conditions.
- **Closing the gaps between what is desired and what can be achieved** – The fundamental question of the objective which should be attained, or strived for in the future, is examined for each issue. In some cases, there are large discrepancies between the desired situation as well as the vision and policy on the one hand, and the status quo on the other hand. At this stage of the Policy Document, where extremely large discrepancies exist as such, an attempt is being made to eliminate the short term problems. Subsequently (at the Implementation Plan stage), the manner of transition from the current situation to the desired situation will be further defined. At this stage of

the Policy Document the emphasis has been placed on the gradual nature of the process, and the manner of its implementation in relation to all the aspects relating to application: personnel, budget, organization, limitations and more.

c. Vision of the National Water Sector

The vision of the water sector is an expression of the basic approach of Israeli society with regard to the topic of water, and it comprises the conceptual idea of the objectives of the water sector. The vision should be concise and clear, should guide all the decisions about the water sector and act as a framework for them. The vision should be attainable, but also ambitious and aim to achieve constant improvement of the water sector. The water sector vision, as agreed in the steering committee after exhaustive discussions, is:

Water is an existential basic need for man and the environment. The water sector comprises a strategic infrastructure for Israel and is an essential factor in its development and achieving its national goals as a Jewish, Zionist and democratic State. This includes developing and maintaining agriculture, building new residential areas, land conservation, strengthening the periphery and the development of the national economy. Management and sustainable development of the water sector will be carried out professionally, efficiently, fairly and transparently, in accordance with advanced criteria, for the benefit of the public and for the preservation of its health. The natural water sources will be rehabilitated and preserved. The Israeli national water sector will serve as a global center of knowhow for technologies and innovation in the water professions, and a groundbreaking example for management of water resources in shortage conditions.

d. Objectives of the National Water Sector

D.1. Primary Objective

A primary objective derives from the vision, which translates the vision into operational terms:

To ensure the supply of water, to provide sewage services and designate uses of treated wastewater and manage runoff and drainage – of suitable quality, quantity and reliability, and with economic efficiency, for the sustainable welfare of all the consumers.

D.2. Detailing the Objectives

The above vision and the primary objective were detailed and formulated for a series of objectives which relate to the principal themes within the domain of the responsibility of the Water Sector. The objectives were divided into two groups: “internal objectives” – which are within the direct responsibility and/or the decision authority of the governmental bodies in the Water Sector and “external objectives” - which relate to national goals which necessitate guidance and channeling at the level of the government policy, in order to preserve the wider strategic requirements of the State of Israel. The aim, of the next stage of the program, is to generate a series of indices (quantitative and/or qualitative milestones and tools for measuring

the condition of the system, and the extent to which the goals are achieved along a time axis), so that it is possible to monitor implementation and the achievement of the objectives.

The Internal Objectives of the Water Sector

1. **Reliability:** supplying water with a high level of regular reliability, for all usages – domestic, industrial, agricultural, nature and landscape and outside elements – with appropriate quantity, quality and reliability based on the approved criteria/agreements for all types of use. In this context, ensuring the supply of water for domestic consumption, for all residents, as a first priority.
2. **Preservation of the natural water sources:** rehabilitation and preservation of sources and reservoirs of natural water, as a strategic infrastructure.
3. **Water security:** ensuring water supply in emergency situations.
4. **Fairness:** fairness in terms of availability, quality and price, in all areas of activity.
5. **Efficient utilization of water:** ensuring efficient use of water, and savings in the utilization of the natural and artificial resources, including reclamation of treated wastewater in all areas of activity of the national water sector.
6. **Efficient management of the water sources:** management of the natural and artificial water sources and the infrastructures, while minimizing costs, and providing benefits for the economy.
7. **Efficient management of the infrastructures:** ensuring the existence, maintenance and development of the national infrastructures in areas of water, sewage and treated wastewater – professionally and efficiently, over time.
8. **Sewage and treated wastewater:** providing sewage services, including collection and treatment of all the sewage and sources of contamination, to the level of quality that ensures the public's health, flexibility of uses and preventing risks for the environment and for the natural water sources.
9. **Management of runoff and drainage:** management of runoff to prevent flooding and the damage they cause, improvement of land drainage and the state of the urban environment and riverbeds, maintaining the ability of rainwater to percolate, replenishment of groundwater sources, and increasing the supply of natural water.
10. **Professional management:** management of the water sector by top professionals, and use of the existing scientific and technological means while advancing and developing human resources, professional expertise, and applying this expertise.
11. **Intelligent regulation:** creating mechanisms and tools for ensuring the best possible provision of services for consumers, while maintaining reasonable water tariffs and supervision of producers and suppliers of water, and of the bodies that treat sewage and supply treated wastewater, while maintaining their stability.

The External Objectives Relating to the Water Sector Which Impact its Management

1. **Geopolitical issues:** ensuring the interests of the State of Israel relating to the areas of responsibility of the water sector, and existing and future agreements with the neighbors.
2. **Human settlements and industry:** ensuring the supply of water and sewage infrastructures for the development of settlements and industry, in accordance with the government decisions and in support of communities in the periphery.
3. **Agriculture:** ensuring qualities and quantities of water that are suitable for the needs of agriculture, maintaining land, preserving fertility of the land, flexibility of selection of crops, and food security.
4. **Health:** supply of water for all uses, while ensuring public health.
5. **Environment, and water for nature:** ensuring water for the rehabilitation and preservation of nature and landscape. Application of environmental principles in the development of infrastructures, including minimizing harm to open public spaces, aiming to limit emissions of contaminants, reducing the area required for infrastructures, etc.
6. **Preserving energy:** advancing savings in energy and reducing air pollution and environmental pollution, as a side result of the water and sewage systems.
7. **The water industries:** support for the Israeli water industry, and advancing it for the benefit of the water sector and its standing in the world.
8. **External relations:** maintaining and strengthening the standing of the Israeli water sector in the world, and contributing to countries with limited capabilities in the various water-related areas.

e. Policy Principles

The policies of the water sector, as devised and presented in this paper, are policies which are expected to be sustainable, and aim to achieve the best possible balance among many requirements. They are expected, to satisfy advanced trends in the management of State infrastructures in general, and the management of water systems in particular, while embracing considerations of engineering, economics and efficiency, along with environmental and social factors. The proposed policies are open, integrated, and designed to achieve a **balance between competing objectives**. This section includes the principles which comprised the basis for the policy proposals on the various issues in the LTN-MP.

1. **Realizing Israel's national objectives** – The water sector is a central contributor in the development of the State of Israel, and should serve as a means or even as a platform for achieving the outside objectives in various areas: advanced quality of life, at least according to the standards of the OECD nations, peace agreements with the neighbors, development of rural settlements, agriculture, the periphery, the environment, the water industry, etc. In accordance with the recommendations of the committee of inquiry on the water sector (the Bein Committee) these outside objectives should be overseen by the Minister of Infrastructures and the government, or by State bodies and public representatives. In their absence, the LTN-MP team will quantitatively define the national goals and objectives. e goals.

2. **Governability** – The groups that contribute to the water sector should be organized so that they operate in full and efficient coordination, while reducing the areas in which the boundaries of responsibility and authority are not clear. Groups that carry responsibilities should be authorized to exercise their authority by guiding suitable policies and allocating the appropriate organizational and budgetary resources, while enhancing the regulatory ability.
3. **Flexibility and preparations for operating in uncertain conditions** – The topic of preparations for uncertain conditions was defined as an independent issue, which was handled on the macro level and within the framework of the other issues. This supposes that the selected policy alternative for each component is stable, even in the event of unexpected changes which could potentially impact the water sector.
4. **Inclusion of principles of sustainable development policy** – The term sustainable development means striving to preserve the principle of intra-generational and inter-generational equal opportunity, particularly in the context of preserving natural resources, and achieving the best possible integration of financial, environmental and social considerations in decision making. In addition, a balance should be found between competing interests, such as: between public interests and private interests. Significant recognition should be given to social and environmental factors when they are combined with engineering and financial considerations for each of policy issues addressed in the plan. These principles should be reflected, inter alia, in the rehabilitation and preservation of the natural sources of water, in guaranteeing supply of water for nature, in preventing direct or indirect negative environmental impacts, in the requirement to incorporate external costs in the analysis of alternatives for projects in the development plan, in reducing the utilization of space for the various infrastructures, in making water usage more efficient, in preventing pollution of water sources, in enhancing energy efficiency and reducing emissions of contaminants, etc. Social considerations will be given regarding setting water tariffs, and will be in accordance with the policy and decisions of the government on the matter.
5. **Supply reliability on the national and local level** – Planning the national water balance will prevent an approach of "walking on the brink", and will not create reliance on average conditions or short range extreme situations in the area of supply and demand. Two key elements will form the basis of planning. One is the prevention of water levels from dropping below "red lines". The second is the maintenance of predefined water levels in the reservoirs as a precautionary measure to ensure uninterrupted operations under uncertainty. The level of reservoirs (in effect, the level of supply reliability) is a matter of policy which should be determined by the decision makers in the water sector (and is recommended in this plan).
6. **Management based on targets and indexes** – Management of the water and sewage system requires a transition to a system that is founded upon objectives and goals. Quantitative targets and indices will be determined for every objective of the water sector, at the planning and implementation stages. Goal-setting is required, such as: water quality goals, and the extent of rehabilitation for each of the natural sources of water, the quality of water supplied for different uses, defining the extent of water supply for nature and the landscape, determining a management goal of average per capita annual consumption

which will serve the system in maintaining the principle of sustainability and resource allocation efficiency.

f. Main Policy Issues and Recommendations

This section contains the main policy issues and recommendations based on the issues included to date in the LTN-MP. Some of the recommendations will be analyzed below as part of the issues that have not yet been fully explored. The following are the main policy issues and recommendations on the various topics analyzed and/or discussed in the LTN-MP (more detailed descriptions appear in section H and I below):

- 1. Realizing Israel's national objectives** – The water sector will continue to be a contributing factor for realizing Israel's national goals (agriculture, industry, settlement and development, inter-regional peace agreements, etc.). In this context the Water Authority will work towards developing the water and sewage system as indicated by the government decisions and by the areas of authority of the relevant ministries. The Water Authority will act in accordance with its authority, subject to cost benefit considerations, and according to its professional discretion. In addition, it is suggested that a committee for coordinating national infrastructures (water, gas, transport, fuel, etc.) be established, for increasing efficiency of the development of the water sector, in the context of which all the bodies responsible for supervision and development of infrastructures will be coordinated within the framework of the areas of responsibility entrusted to them.
- 2. Social fairness and support for the periphery** – The water sector is obliged to exercise full equality in the provision of services to all consumers with regard to aiming to achieve a high level of supply reliability in water and sewage services. The government is able to accommodate special consumers and water suppliers in accordance with their special conditions, such as: helping disadvantaged groups, supporting projects in the periphery that require identification and use of special execution and management mechanisms. A specific budget is required for these needs. The Water Authority operates on the premise that government decisions to allocate a dedicated budget for these areas will dictate the goals and the funding required with regard to social fairness, as well as the extent and level of additional support for the periphery, disadvantaged groups and minorities.
- 3. Governability** – This issue includes the decision making process. The water sector in general and the Water Authority in particular, require structural changes in order to carry out their roles in full. The Water Authority and the Water Authority Council should be independent bodies which operate according to policies guided by the government and by the responsible minister. The Authority will be permitted to regulate the entities under their supervision. This mandate will be increased to full supervisory responsibility and authority. The water sector's planning and management of implementation capabilities requires reinforcement, contingent on the aforementioned structural changes.

4. Water security: The State of Israel exists within a hostile geopolitical environment where there are numerous changes taking place currently, in the neighboring countries. These changes can impact the stability of their regimes. Therefore, planning considerations and management and operating mechanisms will take into account the instability of our region, in security and geological terms. As such, the water infrastructures are at risk, and measures should be taken to cope with a series of scenarios in this area.

5. A framework for the development plan – The investments framework based on the needs characterized in the policy document, is estimated at about NIS 200 billion from the current year until the year 2050 – an average annual cost of about NIS 5 billion. The presented development plan and in particular, the clauses that relate to long-term plans, are a (relatively rough) general estimate that is dependent, among other things, on developments outside the water sector, such as demographic change, climate change, political agreements, etc. As such, after approval of the policy stage of the LTN-MP, the Implementation Phase of the LTN-MP will be initiated. It will include a more in-depth review of the methodological aspects of the projects. This will include a cost benefit analysis and the impact of the projects on the tariffs.

During the implementation stage, if it becomes apparent that particular projects will impact the tariffs to an excessive degree, the matter will be submitted for discussion by the Council with regard to actual implementation, prioritization and funding of the projects. In addition to financial considerations, steps should be taken to remove the statutory and other obstacles to execution of the projects, including appointing suitable parties for project management, coordination, planning and implementation. **The development plans cannot be implemented without inter-ministerial coordination, and appropriate structural and organizational preparations for removing the obstacles.** The scale of investment in R&D and advancing the water industry should be defined in proportion with the level of investment in the water sector.

6. Human resources – As part of the structural changes, the required resources will be designated for developing, reinforcing, and adapting the professional manpower of the water sector. The water sector should be capable of meeting the challenges presented by the recommendations in this document. A national plan will be drafted for assessment of the scale of the human resources shortfall in the various fields, and for the training requirements, will be drafted.

7. Management of the water sector under conditions of uncertainty – The national water sector will prepare for extreme scenarios in all areas of its operation. Future planning will include scenarios of a decline in the supply of natural water, and a decline in water quality, as well as possible changes on the consumption side. Preparation for extreme situations should be carried out both by increasing supply and by possible reductions in demand levels.

8. Management of the freshwater water system – The water sector will operate in a centralized and integrated manner which maximizes the advantage of size and national networking of the supply system, including the natural and artificial sources of water. The Sea of Galilee will be primarily designated for the north of Israel. Supply to the

center of the country, and the other regions, will be largely provided by desalination plants, as a complementary source to the natural sources of water. At the level of the primary regional and local supply systems, supply reliability will be maintained by building circular systems (like the guiding principle for the Western Water Carrier project), connecting cities with a number of water sources, replacing old piping systems with new ones of suitable diameters for water consumption needs several decades into the future, developing local and regional reservoirs, preserving local production systems, etc. The planning will be formulated to accommodate a range of scenarios with the required water quality, based on the accepted criteria.

- 9. Management of natural sources of water** – The natural sources of water will be rehabilitated and preserved as a strategic asset. As such, rehabilitation zones will be determined as well as defining the zones in which this will not be viable. Operating rules will be set for each of the natural sources of water. Management of annual allocations and extraction from the renewing natural sources of water will be sustainable. Excessive extraction and dropping below “red lines” will be avoided.
- 10. Management of sewage and treated wastewater** – The sewage and treated wastewater management system should be structurally organized. Efforts should be made to ensure that the reclamation systems are cost-based and meet national targets (as decided by the government), and efficient in removal of treated wastewater. Aggressive action will be taken to connect as many producers of sewage as possible to sewage treatment plants, with clear prioritization of central plants. Construction and regulation of sewage treatment plants will be based on proven ability of their management, technical and financial reliability. Treatment of sewage and regional reclamation systems will be primarily based on criteria of reliability, efficiency and spatial fairness. In some cases (when there is agricultural designation for treated wastewater, and there is Ministry of Health approval), approval will be issued for advancing “gray water” projects. Gradual enhancement, in the present decade, of the quality of treated wastewater will be advanced to Inbar Committee standards, and to enhanced levels, according to cost – benefit analyses, the accumulated knowhow regarding reclamation impacts, and according to future regulations.
- 11. Water quality** – The importance of the quality of water and treated wastewater in all areas of the water sector will be recognized. Decision making will take into account maintaining the quality of natural sources of water. Efforts should be made to ensure that natural sources of water which were used for drinking in the recent past, should be restored to potable water quality. In addition to quantitative goals for rehabilitation of the water reservoirs, quality targets will be defined for the natural sources of water, as well as criteria for water quality for all consumption sectors. Other steps which should be taken: to supply low-salinity water to urban communities, to improve the quality of treated wastewater, to reduce the amount of salt used in reclamation plants, to reduce the saline content and treatment of water in the Sea of Galilee, and to enhance the natural sources of water by removing contaminants and by other means.
- 12. Consumption management (“Demand Management”)** – In the water sector, consumption management is of equal importance to supply management. Management of consumption will include setting annual per capita consumption targets, and reduced

agricultural consumption targets compared with previously accepted levels, as well as implementation of a range of activities and efficiency improvement methods for savings in all consumption sectors: technical, public relations, financial, and reduction of water losses.

- 13. Water and agriculture** – Agriculture in Israel is of importance for rural communities, and socially and environmentally, and its preservation is a national objective. The water sector will gradually adapt to the scope of agricultural expansion, as determined by the Ministry of Agriculture and approved by the government (preferably based on a national master plan for agriculture).

The agricultural sector will be irrigated mainly by marginal water (saline and treated wastewater) and by a minimal amount of freshwater. The current obstacles to consumption of treated wastewater in agriculture should be reduced, including: improving the ability to channel treated wastewater to regions that are currently without alternatives, redefining the well-protection radii and upgrading the reclaimed treated wastewater as soon as possible. The quantity of freshwater which is currently supplied, according to the framework of the government decisions, will be based on “the water agreement with the farmers”. Additional quantities will be supplied as required, based on covering full costs. Financial mechanisms for increasing the efficient use of water in agriculture will be devised. It will be possible to manage water allocations for agriculture on a regional basis, and it will be possible to transfer water quotas between farmers.

- 14. Runoff and drainage management** – Runoff water should be viewed as a resource that can be utilized for different objectives, and not just as a nuisance to be disposed of. It is necessary to establish professional bodies with expertise for managing this resource effectively. Measures should be taken to integrate management of basin runoff water and urban runoff. Management of runoff and drainage water, in structural terms, should be implemented. Consideration should be given to transferring responsibility for managing runoff and drainage water in urban settlements to the municipal water and sewage corporations. Construction for the purposes of capturing runoff should be advanced. Basin-based master plans should be prepared. The Water Authority should step up its participation with the bodies responsible for professional management and for determining the professional and management requirements, with the emphasis on urban runoff.

- 15. Environment and water for nature** – Nature is a consumer with no less importance than other consumption sectors. The water-dependent ecosystems will be rehabilitated and preserved. Water allocation for nature will be increased, primarily by means of rehabilitating the natural sources of water. Nature’s water needs will be defined and quantified by means of a wide public committee whose findings will be subject to approval by the government. Environmental principles will be incorporated in water system infrastructures (preserving the landscape during development work, providing incentives for reducing pollutant emissions, providing incentives for reducing the surface areas consumed by infrastructure, commercial and industrial facilities, etc.). External costs will be taken into account in analyzing cost benefit of alternatives to implementing projects.+

- 16. Urban water system** – The municipal water and sewage corporations should be strengthened, in professional terms, as should the regulation pertaining to them. Water and sewage corporations will be established on the basis of managerial, technical and financial ability. The number of municipal water and sewage corporations should be significantly reduced, based on engineering, geographic, financial and social considerations. The municipal water supply systems and measurement systems should be upgraded. Appropriate levels of service by the corporations to the consumers should be guaranteed.
- 17. Regulations** – The Water Authority is the main regulator which is responsible, among other duties, to carry out the role of financial and professional supervision of the various water suppliers: Mekorot Ltd., water and sewage corporations and others. In this regard, the water sector will be administered by inclusion of the costs in the water tariffs. In order to achieve maximum efficiency, costs will be minimized in order to set the most reasonable water tariffs possible. In this context, production levies and taxation should be earmarked for developing the water sector. Measures should be undertaken to reduce cross-subsidizing between the various sectors in determining water tariffs. Based on the decisions of the Director Generals' Committee with regard to implementing the conclusions of the Committee of Inquiry on the water sector, planning the development plan of the Water Authority will be funded by water tariffs. Mechanisms will be established for providing suitable services to the public while ensuring an equilibrium between the public and private interests.
- 18. Regional water arrangements** – Plans should be prepared for peace arrangements with regional neighbors. Steps should be taken to advance solutions for separating the Israeli Authority and the Palestinian Authority's water supply systems as much as possible, while allowing for the possibility of partial supply via the Israeli water system, when necessary, in coordination with the sides. The Red Sea - Dead Sea Water Conveyance project is currently undergoing discussion and a feasibility study. If it is approved it will be able to provide a basis for Dead Sea rehabilitation (instead of a unilateral solution for which the Israeli national water sector would be solely responsible).
- 19. Water and energy** – The water sector is a relatively large consumer of national electricity (around 8%) and, as such, coordination on planning the development of infrastructures between the water sector and energy sector will be increased. In addition, extensive steps will be taken for the purpose of improving energy efficiency in all areas of the water sector's operations.

g. Selected Topics - Preliminary Evaluation

The topics in this section were highlighted in the public hearing which took place on January 31 2012, in the presence of the Minister of Water and Energy, and should be implemented by government resolution 2348. Further details regarding some of the topics (including recommendations for implementation) can be found in the document, part of which will be addressed in greater detail in the upcoming stages of the LTN-MP, as part of the continuing advancement of the Implementation Plan and update to the Policy Document.

a. Structure of the Water Sector

A number of major reforms have been carried out in the water sector, during periods of crisis management in the sector. Some of the reforms necessitate a number of years of implementation, followed by refinement, to optimize results in an adaptive management framework.

- **Establishing the Water Authority** – The Water Law was amended in 2007 and the Water Authority replaced the Water Commission. The Water Authority Council comprised senior officials from government ministries: Ministry of Water and Energy, the Water Authority, Ministry of Agriculture, Ministry of Finance, Ministry of Interior, Ministry of Environmental Protection and two public representatives. The structure of the Water Authority is meant to undergo changes in accordance with a government resolution (2348, October 2010), with the addition of the Ministry of Health to the Water Authority Council and the separation of the role of Chairman of the Council, and of Water Authority Director General. The Water Authority Council has been given the authority to determine the consumer water tariff mechanism, subject to existing arrangements, such as the arrangement with the farmers. The Council acts as a regulator of the water suppliers (primarily Mekorot Ltd. and the water and sewage corporations). In addition to the management activity by the Water Authority Council, a public council for water and sewage (without authority) will be established, under the Minister of Water and Energy, which will periodically examine policy issues and will request clarifications from the Water Authority Council. There is pressure to reduce the level of authority of the Water Authority Council, and to transfer some of the areas of authority to the Knesset. The independence and areas of authority of the Water Authority Council should be preserved, as defined by law, whether or not there is pressure to limit them.
- **The urban water sector** – Since the law for creating municipal water and sewage corporations came into effect in 2001, over 50 corporations have been established which cover 90% of Israel's population. The aim of corporatization was to raise the level of professionalism and efficiency of the management of the urban water sector by centralizing billing and the supply of water and financial management as "a closed cost center", for the purpose of developing infrastructures and creating a dedicated management body.

The idea of corporatization is basically a good one, but implementation brings with it quite a few problems. There are approximately 48 local corporations that have yet to incorporate with the encouragement of the Union of Local Authorities in Israel. Furthermore, weaker municipalities are encumbered with numerous commonly occurring problems. There is concern over the stability of the corporations in the future, and their ability to provide professional and efficient service. In order to enhance efficiency, the Water Authority recommends a reduction in the number of corporations. Based on work carried out to date, approximately 20 corporations, (rather than approximately 50) is the estimated ideal number. The main obstacle in this area is in the political sphere (municipal politics as well as the influence of the local nation-level authorities).

- **The structure of the treated wastewater sector** – Treated wastewater is currently (and will continue to be in future) transported and reclaimed for agriculture. Approximately 50% of treated wastewater is currently reclaimed by Mekorot Ltd. (mainly at the Kishon Conglomerate plant, at Carmiel and the Dan Region Sewage Treatment Plant) and by local water corporations and private entrepreneurs. A decision needs to be made with regard to the way in which the sewage and reclamation plants will operate in the future, and how inter-regional transfer of sewage and treated wastewater is to be administered (by the private sector or by Mekorot Ltd., with establishment of the necessary tariff mechanism). A master plan for sewage and treated wastewater was recently initiated which includes an evaluation of the sewage and treated wastewater sector. This entails an analysis of treated wastewater uses, optimum mobilization, and a number of issues relating to regulation of the treated wastewater sector.
- **Management of surface runoff and drainage** – In 2010, the government made a decision to transfer responsibility for managing runoff and drainage to the Ministry of Agriculture. However, as drainage is an important water resource, which is controlled by the Water Authority, the Water Authority must be involved in the reform that is being formulated. Contacts between the two bodies are designed to bring about the introduction of a new law (instead of the law from 1957) which, on the one hand, formalizes aspects of management of drainage as a water resource and on the other hand, as a potential cause of damage.

Regulation of management of runoff and drainage in urban areas is necessary as part of the wider issue of administration of basin-based runoff. The reform includes a proposal to establish a national council for the management of runoff and drainage, and a national authority which will oversee the regional drainage authorities. Advancing the reform will only improve the situation if suitable resources are allocated to it, particularly skilled manpower. The Water Authority has to take steps within its organizational structure in order to guarantee the goals and objectives of the water sector in this area, both in the current situation and when amendments are made to the law and regulations.

b. Sustainable Management and Innovation

The LTN-MP reflects and promotes innovation in the water sector:

- 1) The LTN-MP expresses sustainable development in its overall and updated sense:
 - General overview – The LTN-MP is based on a long term view and incorporates sustainable development considerations as follows:
 - From an environmental standpoint – The LTN-MP attaches great importance to the preservation and rehabilitation of the natural sources of water, setting preservation operating rules for natural sources of water, and the extensive allocation of water for nature.
 - From an economic standpoint – The LTN-MP is designed to achieve efficient use of water and to inculcate consumption management principles together with management of water sources and infrastructure development. The aim is to reduce cross-subsidization, as well as introducing as reasonable water tariffs as possible, which

incorporate the true costs of the water. The infrastructure facilities will be established subject to cost benefit considerations.

- From a social standpoint – Close attention to social fairness in the provision of water and sewage services and in the regulatory rules. Developing service criteria and ensuring development of water and sewage systems, in the country's social and geographical periphery.

2) The LTN-MP is oriented towards innovative R&D in the areas of water, with emphasis on:

- Promoting basic and applied research in all water professions, including monitoring and advancing experimental projects, for the development of "non-conventional" water sources, including secondary water sources, surface runoff and grey water.
- Promoting investment in R&D – developing water technologies, to help the creation of global water industries centered in Israel.

Israel will continue to be one of the world's leading countries in the administration of water resources whereby a major part of the water supply is based on desalinated water and on purified treated wastewater, using innovative technologies.

c. Uncertainty

It is important that the short- and medium-term activity is consistent with and is determined by the long term needs. As such, short- and medium-term progress in all areas must be achieved efficiently, and in accordance with the long-term perspective. With long term planning, including the LTN_MP, the level of uncertainty increases with increasing planning-duration into the future. Uncertainty is dealt with at the planning stage, by defining possible scenarios, and analyzing them. The most robust policy and development plans are identified within the domain of possible scenarios, which allow development in stages, and both resilience and flexibility under changing conditions.

One must take into consideration that sometimes addressing uncertainty involves preparing contingency plans. However, in other circumstances it can involve investments that generate redundancy in the system that thereby enhance supply-reliability and preparedness for situations that were not initially anticipated.

For some of the scenarios there is no consensus regarding their quantitative impact. Nevertheless, these scenarios can be quantitatively assessed with regard to their general impact on the system's ability to cope with them. For example, there is agreement that that climate change impacts exist. However, there is no consensus regarding the extent of its impact, even when various international and local opinions are considered. Based on the range of these opinions, it is possible to quantitatively arrive at the required preparation for meeting supply-reliability levels, in view of the possible decrease in the supply of available natural water, in rates that are agreed on by the policy makers, while examining the resulting impact, including costs. However, some of the scenarios cannot be quantitatively assessed: for example, the extent of the system's ability to remove obstacles to the development of the

water sector, regional geopolitical scenarios, the level of State intervention in the water sector, and its implications.

To ensure long-term relevance of plans in general, and the LTN_MP in particular, procedures under conditions of uncertainty must be defined separately. Uncertainty accommodated by using an integrated approach:

- a. On the national level – This involves mapping the subjects that will have an impact on the activity of the water sector, and analysis of the supply reliability within the range of changing values that impact it (according to the aforementioned approach).
- b. On the level of the subject in question – This relates to issues of uncertainty and topics related to the details of those issues. This part is expressed in the policy document and in the detailing of the issues later in this chapter.

The following is the mapping of the topics of the principal scenarios selected for preparations within the framework of the LTN-MP:

- **Overall national strategic planning with regard to the State of Israel in the future:**
This refers to the national goals and objectives which are specifically defined by political leaders. These definitions impact the water sector and require engineering and budgetary preparation (geopolitical deployment, the size and spread of the population, the scale of agriculture required, etc.). Such activities must be founded upon government resolutions, forecasts of the Central Bureau of Statistics (CBS), national outline plans and guidance by the political leadership.

The current level of government involvement in water sector management needs to be taken into consideration in future water sector management. Ideally, further governmental involvement will be provided in the management of national objectives. To accommodate the fact that national governmental specifications are not always directly stipulated, the water sector needs to prepare on an organizational level, as well with tools and methods, to deal with the absence of full and overall guidelines in most areas which relate to national policy. These preparations are also necessary in order to present possible consequences for the national guidance that is indeed provided. The following scenarios include areas of national planning policy which are formulated in the absence of such guidance (or when there is only partial guidance), in order to analyze their impact on the water sector to the fullest extent possible, their impact on the water sector. The objective is to create coping mechanisms in these areas.

- **Government intervention in the water sector:**
Maintaining the current level of intervention into the future, requires greater government involvement. Specifically, governmental involvement is required in order to define national objectives. These will provide guidance for defining policies while maintaining the independence of the Water Authority Council in determining water sector management policy.
- **National-economic strength:**

Israel was recently accepted to the OECD, with a high level of national-economic strength relative to developed countries. Its economic strength has provided the means for developing Israel's water sector without outside constraints.

- **Political agreements with neighboring countries and authorities:**

Alternatives to a permanent agreement with the Palestinian Authority are currently under examination, on the assumption that the permanent settlement on the subject of water will be similar to the basic format of the interim agreement. With regard to Jordan, preparations should be made for joint activities with regard to the Red Sea - Dead Sea Water Conveyance project, and rehabilitation of the lower Jordan River area. For now, preparations for arrangements with the other countries will only take place on the level of basic planning and research.

- **Water security:**

Planning considerations will include the premise that our region is not stable, in terms of security and geology and, as such, the water infrastructures are at risk, and preparations should be made for a range of scenarios in this area.

- **Land resources for developing the water sector:**

Planning should be conducted under the premise that there is a shortage of available land. Consequently land use should be minimized for future water infrastructures. This will be carried out by coordinating planning with other infrastructures. Progress will also be made with infrastructure tunnels and feasibility studies for executing part of the production capacity of desalinated water on artificial islands or facilities in the sea, or underground.

- **Water potential**

Estimating Israel's water potential, in other words the overall total of water available to the water sector, has undergone quite a few changes over the years, as reflected in reports and professional literature. There has been a decrease in the assessment of the potential over time and steps should be taken to prepare for this eventuality (see Chapter H – Water Balance).

- **Climate change:**

Reference will be made to climate change, as part of preparations for a drop in the supply of natural water, on the national and the regional levels. This is a result of changes in the amount of precipitation, a rise in the multi-year average temperatures, leading to increases in rates of evaporation and transpiration, changes in the distribution and intensity of rainy days, a rise in the level of the Mediterranean Sea, an eastward shift in the shoreline, etc.

- **Population size and population centers.**

Preparations are required for building infrastructures in population centers, in accordance with the National Outline Plan (NOP) 35 (in which approval was granted for a vision of developing the Negev and the Galilee). Water infrastructures will be based on a high realization factor premise of the NOP for development in the periphery of Israel. Thus, development in the periphery will be based on the premise that population expansion will evolve as planned. A low realization factor premise of the NOP is the

basis of development of the population centers. In other words, when planning supply systems, the assumption is that the dense populations in the center of the country will continue to grow according to the current patterns.

- **Level and deployment of agriculture:**

The extent to which agriculture uses potable water for irrigation in the agricultural sector will be similar to the current extent, with some degree of decrease. Potable water requirements for agriculture will be similar to the current requirements across the irrigated area. The rest of agricultural activities will primarily be based on treated wastewater, and its deployment will not change fundamentally. However, an increase is expected in the size of land irrigated by treated wastewater in the south of the country.

- **Dependence of agriculture on water prices:**

In the long term, there will be a full adjustment to variable water prices which will reflect the full cost of water, and will include increased agricultural efficiency.

- **Quality of natural sources of water:**

In recent years, rehabilitation and preservation work has been undertaken on natural water sources. Nevertheless, steps should be taken to prepare for continual deterioration in the quality of the natural water sources despite rehabilitation efforts (removal of contaminants, eastern drainage, improvement of treated wastewater etc.).

- **Technological developments:**

The LTN-MP takes into consideration, to an extent, the possible impact of technological developments, both in terms of supply and in terms of demand. For example: reduction of desalination costs, advanced methods for upgrading the quality of treated wastewater, improving piping and tunneling, reducing domestic consumption by means of various water-saving accessories and devices, and cutting pumping energy requirements by means of advanced equipment and control. The technological changes which are already in the public domain do not have a fundamental impact on the decision making which is now necessary. The effect of technological changes will be addressed in accordance with actual developments and according to the topic in question, as part of periodic updating of the LTN-MP.

- **Water costs:**

The water costs are contingent on the technological methods used for production and transportation, the cost of raw materials, salaries, the cost of energy, etc. Technological improvements will lower costs. Furthermore, energy costs will be reduced with the country's transition to natural gas and electricity. On the other hand, there are obstacles of regulation, geopolitical issues, land availability, the cost of raw materials etc., which are liable to generate increases in the cost of production. Today, one cannot assess, with certainty, the overall direction of the costs pattern. The full range of factors that impact the cost of water supplied must be closely monitored. This will be achieved, as noted, by means of periodic updating of the plan.

- **Dependence of the water sector on availability of energy:**

The Israeli energy sector is undergoing a continuous improvement in light of the numerous discoveries of energy sources in the country. Thus, the working premise is

that energy availability will be guaranteed (despite various local problems that are emerging today), on a price level similar to the current one.

d. The Water Potential

- **Potential of natural water:**

The replenishment rate of natural water between the Jordan River and the Mediterranean Sea, was estimated in the middle of the last century at somewhere in the region of 3 billion cu.m., or possibly 4 billion cu.m., a year. Recent reports from the Hydrological Service (based on certain conditions), indicate that this has decreased to less than 1.5 billion cu.m. a year. Assessment of the hydrological water potential includes several considerations, including: factors relating to rainwater infiltration, renewable water sources and hydrological water balances, some of which are still not completely closed, water quality, etc. The potential of natural water has been updated, generally downwards, with the increase of hydrological knowhow. **The water potential for the purposes of planning and operation is different from the potential of water based on the hydrological balance of the water sources, as a wider range of considerations dictates what can be used and what should be used from the sources.** These include geopolitical constraints, allocations of water for nature, reference to production problems and costs, etc. The main premise in the plan is that the natural water potential in Israel has been almost entirely extracted (some say it is has been over-exploited). The following actions and assumptions were made for the purpose of determining the water potential for planning needs:

- Working on the base figures of the Hydrological Service as released in a report (The Balance of Natural Water between the Jordan River and the Sea, February 2012, in English).
- The planning related to data from 1993-2009 (even though there is a partial database from the beginning of the 1930s). The reasons for this are as follows:
 - The database for the previous period is somewhat deficient, for various reasons, such as measurement conformity, premise transparency, etc.
 - The premise that the last period is a correct reflection of the pattern of losses in the replenishment rate to the system.
 - In 1992 (hydrological year 1992-3) was the wettest year since orderly measurements of precipitation and refill started (around 3 billion cu.m. were replenished in that year) and is an extraordinary year with regard to future planning. It should be noted that this wet year replenished water but also significantly raised the saline content of the coastal aquifer (due to pushing the saline water out of the non-saturated area). A decision was made not to relate to this in the presentation of the water potential in the balance table (although it was taken into account in the analysis of scenarios in the plan).
- Relating all the planning considerations to the hydrological water potential generates a waterreplenishment rate of around 1,200 mcm a year for the purposes of planning in the water sector (see policy document, Chapter H)

- Surface runoff:

The median potential surface runoff consists of a total volume of approximately 200 mcm per year. Some floodwater is already utilized, although this occurs to a larger extent in the periphery (reservoirs on the Golan Heights, in the Arava, Menasheh streams, Shikma Valley, etc.), than in the Dan Region. It should be noted that this 200 mcm/year relates to all of the runoff potential. Part of this volume is unavailable for use, due to environmental and other considerations.

The principal problem with increasing capture and use of runoff is the impracticability of establishing a collection capacity and/or achieving penetration ability, particularly in the central region of Israel. This is due to financial considerations (land value), or due to statutory obstacles. The planning phase of the implementation plan will incorporate a master plan for the management of runoff and drainage. This plan will manage runoff across the collection basin, and will provide water conservation planning, which will include benefits of runoff management and minimizing flooding damages.

- Greywater:

The level of reclamation of water for agricultural use in Israel is the highest in the world (around 70% of urban sewage). However, there is room for improvement in efficiency. This includes recycling gray water. Greywater, which comes from domestic use – kitchen sink water, shower water and washing machines, is differentiated from “black water”, which comes from flushing toilets. With increasingly acute water shortages comes an increasing tendency worldwide to use gray water. Greywater offers two main uses:

(a). Domestic use – Greywater can be used for flushing toilets, thereby replacing the use of freshwater (savings potential of about 100-150 mcm a year). As this will only be introduced in new construction projects, a potential of 50 mcm savings can be achieved by the end of the planning period (2050).

(b). Public urban use – Greywater can be used for irrigation in parks (current potential of 30 mcm a year). Once again, the premise is that the potential is far smaller, as only some of the parks will be able to adapt to irrigation with recycled water.

The obstacles to using greywater today are mostly of a regulatory nature, from the Ministry of Health, which is concerned about public health issues due to cross-connections (between freshwater systems and greywater systems) and the difficulty of supervision and control of this type of system which, in effect, acts as a small sewage treatment facility within buildings and/or public districts. A cost benefit analysis carried out by the Water Authority (in 2007, Pareto Engineering Ltd.) indicated that it is not economically viable to implement projects of this kind on a small scale, in view of the costs involved in various components derived from implementing such projects, except in very specific cases. However, treated domestic wastewater is re-used nation wide, for the irrigation in the agricultural sector. Furthermore, a shortage of this treated wastewater exists for agricultural use. Thus, the approved policy for Water Authority, in the short- and medium-term, is to promote increasing the supply of treated wastewater for agricultural use. Nevertheless, interested parties will not be prevented from

carrying out their specific greywater re-use projects, provided that they have received all the requisite approvals from the relevant ministries (particularly the Ministry of Health). In the long term, with the forecasted increase in the volume of treated wastewater supplies, there is room to reexamine this position, and the topic will be addressed, inter alia, as part of the master plan for sewage and treated wastewater, which is currently in a preliminary stage of work.

e. Production Constraints

1. General

As part of the rehabilitation and preservation of the natural water sources, as a strategic value, operational lines were defined by the Hydrological Service (which, in effect, comprise production constraints) for each of the main natural water sources. Further to the policy findings of the LTN-MP, the work will be extensive in terms of its geographical deployment, and the resolution of the various cells in each reservoir. The Water Authority's operating committee reports on the state of the reservoirs, and detailed production guidelines are given to Mekorot Ltd. and private producers.

The red line: This is defined as a lower threshold water level below which hydrological damage is possible. The Hydrological Service defined red lines for most of the main water sources. This section details the red lines of the Sea of Galilee and the groundwater aquifers, and the principles and insights behind setting these lines. The policy is that red lines will not be crossed again in the future. The water levels of the reservoirs will be rehabilitated over time, until a target of approximately 1.5 billion cubic meters or more above the red lines is obtained.

2. Operating Lines for the Sea of Galilee

The Sea of Galilee serves as an operating reservoir and a water source for the national supply system, and for local and other consumers. It provides between one quarter and one third of the country's natural water supply.

Average annual water entry to the Sea of Galilee is 629 mcm/year (1985-2009) whereby around 180-200 mcm/year is used in the area above the Sea of Galilee and does not reach it (thus, the average annual water potential which is due to reach the Sea of Galilee is about 800 mcm/year).

The Dan Spring is the largest single water source in the Sea of Galilee basin (and, in fact, in the entire country) and, on average, provides around 250 mcm a year. Around a third of this volume is used by consumers, and the rest reaches the Sea of Galilee. In the summer, the Dan is the primary water source in the Sea of Galilee basin. The flow rate of the Dan is an indication of the hydrological situation in the collection basin.

Table 1 and Figure 1 show the operating lines in the Sea of Galilee. Table 2 shows the definitions of the hydrological situation at the Dan springs, based on the flow rate which is measured annually on April 1 (generally the maximum flow rate of the year).

Table 1: Operating Lines for the Sea of Galilee

Operating Line	Height (meter)	Notes
Upper Red	-208.80	The level above which water spills out of the Sea of Galilee
Green	-211.50	The average desirable level comprises the middle level between the lower red and upper red lines. This leaves a free capacity of around 450 mcm up to the level of a “full Sea of Galilee.”
Lower Red	-213.00	The level below which it is recommended not to drop, due to concern over the ecological stability of the Sea of Galilee. This is 4.2 m. from the upper red line (reserves of around 700 mcm) and dropping below this is liable to generate severe level fluctuations in wet years in which the level of the Sea of Galilee rises.
Minim. Legal Line	-214.87	The historic minimum level set on December 2 2001.

Figure 1: Operating Lines in the Sea of Galilee and Historic Level Changes

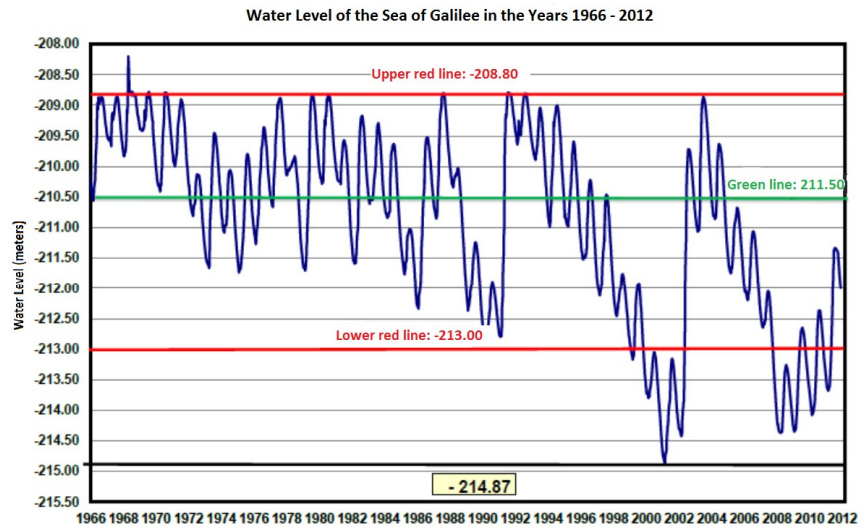


Table 2: Definitions of the Hydrological State of the Dan Springs

Total Dan Springs Flow (cu.m./sec)	Hydrological State	Notes
9-9.5	Average	Median, 50% percentile of the total flow rates measured at the spring
Over 10	Good	Percentile of 75% and above
Less than 8	Bad	Percentile of 25% and below

3. Red Lines in the Main Groundwater Basins

3.1 Background

The hydrological red lines are suggested by the Hydrological Service and are due to be discussed professionally by a wide decision making forum, as the implications of setting the lines touches on other considerations (such as: scope of cuts for agriculture, supply to nature and landscape, tourism, etc.). This document contains the recommendations of the Hydrological Service for these lines. At the implementation stage of the plan, the definitions of the lines, and the methodology for setting them, will be examined and will be updated as required. The general policy is that when the red lines are set, they are not to be deviated from (except for in emergency situations).

The groundwater basins are divided into hydrological cells. The red lines are defined for each of the hydrological cells. In this document the lines will be described according to these different basins.

3.2 The Coastal Aquifer

There are a number of processes associated with the coastal aquifer, including: long-term over-use relative to replenishment (Due to the reduction in the quantity of salts being flushed into the sea, and the penetration of sea water from the west), salination from natural sources (penetration from the east), ongoing pollution as a result of human activity (agriculture, urbanization, industry), accumulation of pollutants in the non-saturated area and their slow seepage into the groundwater, reduction of refill due to urbanization effects, and a severe problem of the water quality (pollutants in general, and in particular chlorides and nitrates). The historic volume in the coastal aquifer in the 1930s was about 2,000 mcm greater than that in 2011. The accumulative reduction from the aquifer over the last 75 years, together with apparently intensive human activity, explains the dismal situation of the coastal aquifer in terms the quantity and quality of the water.

The reduction in coastal aquifer volume due to excessive utilization leads to the penetration of seawater into the coastal aquifer, leading to severe salination (in certain areas this penetration has reached a distance of some 2 km. from the coast). The red

line of the coastal aquifer only refers to the requirements for preventing further penetration of seawater into the aquifer.

The lower red line (the minimum permitted level) in the cells of the western coastal aquifer were set in order to maintain a balance between the volume of freshwater flowing to the sea and the quantity of seawater penetrating the aquifer (primarily between the interface and the ceiling of sub aquifer) B). The desirable level is higher, as penetration of seawater should not happen at all.

Red lines for the eastern coastal aquifer cells were set in relation to the lower threshold levels in the western reservoir cells. The red lines in each of the coastal cells are detailed in Table 3.

Table 3: Red Lines in the Coastal Aquifer Cells

Red Lines in the Coastal Aquifer (meters above sea level)	Cell no.	Red line height ¹ (m.)	Cell no.	Red line height ¹ (m.)
	Western Coastal Aquifer		Eastern Coastal Aquifer	
Binyamina	31	0.45	51	0.6
Caesarea	32	0.75	52	1.8
Hadera	33	0.25	53	1.25
Emek Hefer	34	0.55	54	2.2
North Sharon	35	0.25	55	1
South Sharon	36	0.25	56	0.85
Gush Dan	37	0.25	57	0.75
Halon & Bat Yam	38	0.75	58	2
Rishon LeZion	39	0.65	59	1.7
Rehovot	40	0.85	60	2.25
Yavne	41	0.55	61	1.45
Ashdod	42	0.4	62	1.1
Nitzanim	43	0.85	63	2.35
Ashkelon	44	0.65	64	1.8
Gaza North	45	0.55	65	1.65
Gaza South	46	0.5	66	1.5

¹ Height above sea level

3.3 The Yarkon-Taninim Aquifer

The Yarkon-Taninim aquifer (the western mountain aquifer, YARTAN) comprises a source of very high quality water. The aquifer levels respond rapidly following pumping/refill. The freshwater groundwater in the aquifer is in equilibrium with an adjacent salty water aquifer that has a salt concentration of seawater. The drop in the level of freshwater is liable to lead to a change in the balance, which would lead to salination of the freshwater areas of the aquifer.

The red line indicates the threshold level recommended by the Hydrological Service to prevent the influx of salty water. This level stands at: 9 meters 12 meters and 13 meters above sea level in cells 210, 211 and 220 respectively.

3.4 The Western Galilee

The highest quality water in the Western Galilee basins is in the mountain aquifer. The freshwater groundwater in the basins of the mountain aquifer of the Western Galilee (Cabri and Naaman basins) is in equilibrium with water with salt levels that range between salty to brackish. A drop in the freshwater level is liable to cause a change in the equilibrium, which would cause salination of the freshwater areas of the aquifer and the drilling locations.

The red line: indicates the lowest level recommended by the Hydrological Service to prevent the salination of the groundwater. This level stands at: +4 m. in the area of the Afek Springs in the Naaman Basin, and +6 m. to the west of the Cabri Basin.

3.5 Carmel

The main aquifer in the Carmel Basin is the mountain aquifer. The freshwater groundwater in the Carmel Basin is in equilibrium with salty water. A drop in the levels of the freshwater is liable to cause a change in the equilibrium and, as a result, will salinate the freshwater areas of the aquifer and the drilling locations.

The red line: indicates the lower threshold recommended by the Hydrological Service to prevent the salination of the groundwater. This level stands at: +2.5 m. to the west of the basin.

3.6 Einan

The aquifer used in the Einan Basin is the mountain aquifer with drainage to the east which contains high quality groundwater. The hydrological information we currently have does not indicate any danger of salination, as a result of the decrease in levels. Even so, a drop in the levels damages the production capacity from wells and, as such, a red line was set in the basin at a height of +50 m. This is the only location in the groundwater basins where the red line does not indicate a danger of salination of groundwater, and where the red line was defined on the basis of operational considerations.

h. National Water System Balance for the Term of the Plan

The supply of the water system compared with the consumption requirements is normally presented by means of a "water balance". The balance of the water sector, shown below, incorporates figures, premises and basic parameters of the water sector, which reflect the development of Israel in all areas (population, industry, etc.) along the time axis, together with planning targets and the policy on allocating water resources (for example: for agriculture). The presented balance does not purport to present an accurate forecast of planning and operating purposes, rather, it is a representative situation of the expected trends, based on the best available knowhow, and policy patterns as indicated in the LTN-MP, in the framework of the expected basic scenario in each area. The balances reflect the existing government decisions and their implications for realizing Israel's national objectives, in terms of the national water sector. The balances were devised for a planning horizon of 2050 whereby, naturally, the certainty level in the short term is relatively high, and decreases towards the year 2050.

Preparations should be made in the water sector for more extreme situations. In each subject area, these preparations are based on probabilistic analysis of the gap between supply and demand, and checks in terms of cost-benefit analyses. The following assessment presents the gaps between the expected demand and the supply of natural water within the framework of

the basic scenario. Later analyses of the gap between supply and demand in relation to a set of different scenarios will be presented. At the next stage of the LTN-MP (the Implementation Plan) the regional water balances will be analyzed.

The basic water balance is based on the following main premises:

- **Planning range:** The planning range is long term (up to the year 2050), with interim ranges in the balance table: 2010 as the starting point, 2020 and 2030 as interim ranges. Formulation of a long-term water balance does not purport to offer an accurate forecast of the future. The idea is only to present the development of expected patterns, based on the best available knowhow. All the data and all the premises which will be presented later must be reexamined periodically in view of technological, demographic, geopolitical, etc. changes.
- **Natural sources of freshwater:** The natural sources of freshwater will comprise the basis in water supplies, and the artificial water sources will provide a complementary source. The figures for natural supply in all areas in Israel indicate a dramatic downward change with regard to quantities of available water for consumption that were considered, up to a decade ago, as potential which could be realized. This provides justification for attaching greater importance to recent evaluations, of the estimated water potential which can be exploited.

An analysis was recently carried out by the Hydrological Service (Entitled: The Natural Water Resources Between the Mediterranean and the Jordan River, February 2012, in English). According to this document, the total annual potential of Israel's natural water is 1,631 mcm a year, based on figures for 1993-2009. From this total, 1,434 mcm a year of this freshwater is characterized by inferior quality: It contains more than 400 mg of chloride per liter (and in some areas, high levels of nitrates and other similar pollutants). These inferior supplies will reduce the usable water-potential (without expensive treatment, by tens more millions of cubic meters).

A total of 325 mcm per year of additional losses are incurred from water that seeps into the earth, but flows out to the sea rather than penetrating the ground to reach the aquifer. After accounting for these losses to the sea, and via sub-standard water quality, on average² only approximately 1,100 mcm per year of water defined as

² Based on work performed by the Hydrological Service (Natural Water Sources between the Jordan River and the Sea, published February 2012), the total natural enrichment of bodies of freshwater with a saline content of less than 400 mg. of chloride per liter, in terms of the multi-year mean (mcm/year) according to basins, for 1993-2009, according to basins: coastal – 116, western mountain – 333, eastern mountain – 174 (of which it is estimated that only 40 mcm/year will be available to Israel, based on agreements), northeastern mountain – 134 (of which only around 90 mcm/year will be available to Israel), Lower Galilee – 20, Western Galilee – 102, Mt. Carmel – 25, Negev – 4, Sea of Galilee – 526. Total – only 1,434 mcm/year. Out of this, a total of 1,255 mcm/year will be available to Israel (after deducting water which is not under our control on eastern mountain, of about 124 mcm/year, and the northern mountain aquifer of about 45 mcm/year, totaling about 180 mcm/year which is not controlled by Israel. After deducting losses, the total available to Israel is only about 1 billion cu.m.. Assuming this will be mixed with salty water and/or there will be further treatment, we have taken into account 1.2 billion cu.m. that will be available to the Israeli water sector.

freshwater is available for use. Assuming that it is possible to utilize approximately 100 mcm/year, of the brackish water component, the total supply of natural water available to the Israeli water sector is, today, only approximately 1,200 mcm/year, taking into account existing water agreements with the Palestinian Authority (with regard to management of all sections of the mountain aquifer).

Moreover, an expected gradual decline of about 15% of natural supply from the historical mean (1993-2009), was incorporated into the water balance between the years 2010 to 2050, due to various factors (climate change, further deterioration of the water quality, urbanization, increased losses due to rehabilitation of reservoirs and geopolitical issues).

Desalination of 70 mcm/year of brackish water is planned in the upcoming years (from facilities in various locations in Israel). There is additional potential for production and desalination of water in the Negev, and other sources (primarily fossil water which does not renew annually). The feasibility of extracting this water (including disposing of the concentrate from the desalination process) should be examined later. The viability of this option is declining due to the more cost-effective alternative of seawater desalination on the Mediterranean coast. As such, these quantities have not yet been included in the current water balance.

- **Rehabilitation of the natural sources:** the operational natural reservoirs will be rehabilitated to an average total of about 1,500 mcm above the red lines (or about 2,000 mcm above the black lines) by 2020 (as measured at the end of the fall).
- **Population:** As of the end of 2008 the total population in Israel was approximately 7.5 million people. A fixed annual growth rate of 1.8% was assumed. This rate reflects the trend reported by the CBS (Central Bureau of Statistics) in recent years. The following analysis of scenarios also takes into account a possibility for a lower growth rate (gradual decrease to 1.3% a year).
- **Per capita urban and public consumption:** Past consumption forecasts were biased upward as they incorporated an estimation of a rise in living standards which would generate an increase in water consumption, as well as considerations of supply reliability. Based on the results of actions undertaken in the field of consumption management, and the rise in water tariffs, for the purpose of analyzing the needs of future consumption patterns, it was assumed that the mean per capita annual consumption would remain around a level of 100 cu.m. per capita a year in 2010, and will be 95 cu.m. per capita per year in 2050, notwithstanding a rise in living standards. The decline to 95 cu.m. per capita a year in 2050 takes into consideration more efficient use of water and the inclusion of treated wastewater in urban gardening. Nevertheless, a constant decline in per capita consumption to these levels, will only be achieved if the appropriate resources for savings in water usage are invested. These values represent general patterns at the national level, for the

purpose of planning supply systems (calculating diameters, etc.). In addition to these values, one should take into account supply reliability factors, in accordance with the level and scale of the plan.

- **Industrial consumption:** A fixed annual increment of 0.5% is projected in consumption of freshwater from the current consumption rate (approximately 90 mcm/year) to the year 2050. This reflects the expected expansion of industrial activity. It was assumed that industry will grow at a higher rate than this, but will become more efficient in water consumption, and in the integration of marginal waters in the supply.
- **Amount of treated wastewater:** The amount of treated wastewater derives from a multiplication of reclamation factors by the demand levels along the time axis (0.6 in the domestic sector and 0.2 in the industrial sector). The principal designation of treated wastewater will be for agriculture, and the remainder will be allocated to nature and landscape, and for other uses such as irrigation public gardens and for industry.
- **Agricultural consumption:** Utilization of high quality reclaimed treated wastewater will be maximized nation-wide in the agricultural sector. Furthermore, a decrease in the nation-wide consumption of freshwater is planned in the agricultural sector, from approximately 500 mcm/year in 2010, to approximately 450 mcm/year by 2050. It is important to note that a further decrease below 450 mcm/year is contingent on the solutions that will be proposed for: regions that do not currently have an alternative to potable water; the removal of constraints on areas of well-protection radii; and improving the quality of the treated wastewater in order to allow unlimited agricultural use.
- **Water for nature:** The quantity of water allocated to nature and landscape refers to the quantity that is set aside within the water sector balance, and supplied directly for this purpose. This volume will increase from 10 mcm/year currently to 50 mcm/year by 2020. In addition, a minimum of 30 mcm/year of treated wastewater of high quality will be supplied specifically to the Yarkon and Sorek rivers. In addition to these direct allocations, nature and landscape will benefit from the discharge of natural water due to the rehabilitation of the natural sources.
- **Regional water supply:** This includes the supply of water from the Israeli system to Jordan and to the Palestinian Authority (PA; including self-production by the PA). Water supply to Jordan is based on existing agreements.
- **Unexpected water supply needs:** The topic of including the partial or full supply of water to the PA on an operational level, is subject to future political arrangements. There is great uncertainty over the scale and timing of the supply of water in the

future. As such, a forecast was mostly based on continued growth in the needs of regional supply, in accordance with what is known from the last few years (included in Table 1 in the "unforeseeable" column). If designated desalination plants are constructed for providing water to the PA (on PA territory), and for future regional arrangements, the discrepancy that will need to be met between demand and supply will be less than that shown in the balance table below.

The water balance in the basic scenario (Table 1 below) is described in three sub-tables: the top one refers to the natural and artificial sources of water (national supply, and includes the gaps (between consumption and availability) that need to be bridged. The bottom table refers to national consumption in the different sectors, according to the types of water used in each sector. The water balance presented here is a sort of “basic scenario”. The aim of the tables is to provide a general view of the developing trends in the water sector balance. The gap between demand and supply (natural and existing artificial), is represented in the “Required Supplement” column in the top table. National supply includes the desalination volume that has been approved by the government to date (750 mcm/year up to 2020).

The basic national balance indicates the need for an overall addition to the natural supply of **about a minimum of approximately 1,500 mcm/year** by the year 2050 (total of the columns: desalination of sea water, desalination of saline and additional required supplement). Of this volume, about 500 mcm/year (33%) is water that is supplied to the neighbors (Jordan and the PA). Analysis based on the framework of scenarios and high supply reliability policy indicates that the requirements are greater than this (see below).

Note: Uncertainty regarding the extent of the future dependence of the water sector on regional water agreements will necessitate periodic re-examination of the balance, as well as updating decisions on planning and developing the main infrastructures for integrating desalinated water and for supply of water. The balance and development plan presented here are based on the status quo, which is continued development based on existing agreements and the situation in the field.

Table 1 – The National Water Balance – Basic Scenario

Population		
Year	National popn. (millions)	Per capita consumption (cu.m. per capita per year)
2010	7.6	100
2020	9.1	99
2030	10.9	98
2050	15.6	95

Water Sources (mcm/year)							
Year	Natural freshwater (1)	Brackish (direct consumption)	Treated wastewater (incl. Dan Region STP)	Desalination of brackish waters	Desalination of sea water (2)	Additional Required (3)	Total supply *
2010	1,200	174	450	23	280	4	2,131
2020	1,140	150	573	50	750	9	2,672
2030	1,080	140	685	60	750	50	2,765
2050	1,020	130	930	70	750	671	3,571

In 2008, an additional 46 mcm of floodwater was used that was not taken into account.

(1) Total average replenishment of natural freshwater, less losses for water with less than 400 mg. of chloride per liter.

(2) “Desalination” – according to the approved government decisions.

(3) “Required supplement” = the difference between total consumption of freshwater (bottom table) and total sources of freshwater.

Year	Urban	Water Consumption (mcm/year)												
		Industry			Agriculture				Regional *	Reservoir storage recovery	Nature and landscape**		Unforeseeable	Total consumption
		Fresh-water	Brackish	Total	Fresh-water ***	Brackish	Treated wastewater (incl. Dan Region STP)	Total			Fresh-water	Total		
2010	764	90	30	120	500	144	400	1,044	143	0	10	60	0	2,131
2020	902	95	30	124	490	120	528	1,138	143	200	50	95	70	2,672
2030	1,064	99	30	129	470	110	645	1,225	143	0	50	90	114	2,765
2050	1,482	108	30	138	450	100	900	1,450	143	0	50	80	278	3,571

* Regional consumption includes supplies to the PA and Jordan.

** Some of the treated wastewater used for nature and landscape is treated wastewater that is not actually used, and flows in riverbeds.

*** The decline in consumption of freshwater for agriculture is contingent on conversion to high quality treated wastewater, and a change in definitions of well protection radii.

Probabilistic Analysis of the Differences between Demand and Natural Supply

Introduction:

In the previous section (Table 1) the gap between the supply and demand for freshwater primarily appeared in the “Desalination of sea water” and “Required supplement” columns. This gap is the result of implementation of the policy and expected trends of supply and demand in the various sectors, based on the status quo. The presented balance does not purport to be an accurate forecast, but rather a representative situation of the expected trends, based on the best available knowhow and policy patterns as indicated in the LTN-MP, in each area.

Planning in the water sector should address a range of scenarios which the water sector will have to contend with. Figure 1 below shows the results of a probability analysis of the gap between the forecasted future consumption and the forecasted natural freshwater availability. This gap will have to be bridged by additional supply, most or entirely by desalination. Desalination will constitute a supplementary solution, that will be based on cost –benefit analyses and implementation capacities, after the other sources have been exhausted, such as production from aquifers which have not yet been fully utilized, additional savings in water usage, water imports, etc. Any volume of water that is obtained from other sources will reduce the amount of desalinated water required, based on the results presented below. The analysis was carried out at the national level, in other words the total demand and total supply of natural water throughout the country are included, and the reserves and the resulting storage in the system refer to the three-basin system .

Thus far the accepted practice was to analyze the reliability of supply at the national level, **based on the variability on the supply side only**. For the first time an integrated probability analysis of supply scenarios (beyond the known historical hydrological variability) was performed in the Planning Division of the Water Authority **jointly, together** with the probabilities of the scenarios on the demand side.

All the details, calculation methods, the assumptions and parameter values that were used to carry out the calculations appear in a separate report.

The results that appear in Figures 1 and 2, below, are based on a probability analysis carried out with simulations that include repeated runs with random values of the demand components, and the supply changes, based on selected statistical representation (defined probability functions) of the supply and demand variables, and on the use of the historic enrichment series of the natural supply.

Definition of the scenarios:

- The scenarios of some of the consumption factors are represented by random variables that have a normal distribution, with given parameters of expectation and standard deviation, and truncated at two standard deviations. These factors include:
 - The rate of population growth

- Per capita consumption in the urban sector
- The rate of industrial consumption growth
- The overall rate of consumption growth in the Palestinian Authority
- The following scenarios are represented by random variables with a binomial distribution (discrete variable, with a given set of values and their probabilities):
 - The addition of water to the Israeli water system as a result of implementation of the Red Sea Dead Sea Water Conveyance project.
 - Reduction of the supply, for various reasons, from the coastal aquifer, the Yarkon-Taninim aquifer and the Sea of Galilee.
 - A decrease in the supply of freshwater for agriculture
 - An increase in the supply of water for nature and landscape
- The scenarios are represented by means of parameters that vary from year to year, and reflect the development of the scenarios along the time axis and the probabilities of their realization.

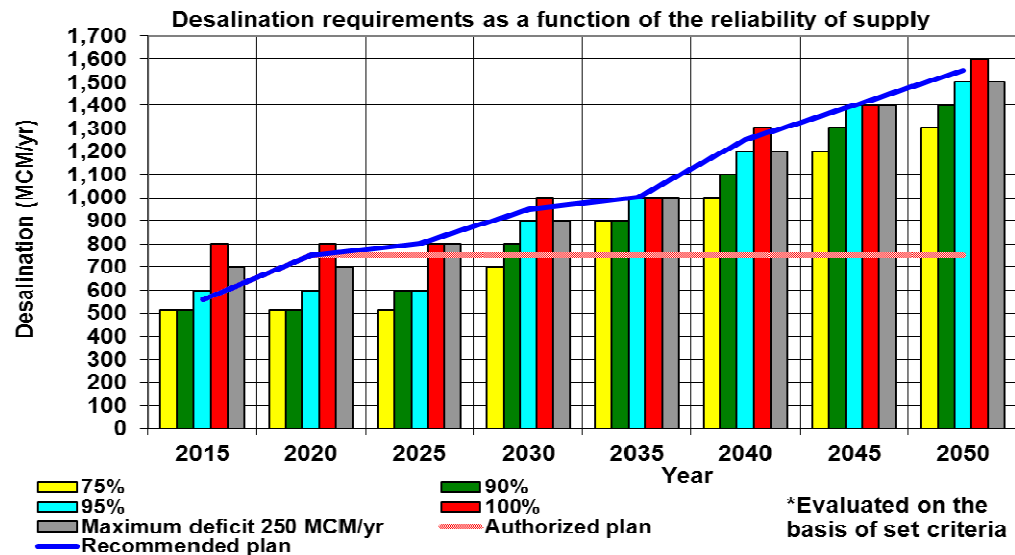
Natural Supply Data:

A historic series of the annual replenishment data was available for each of the water sources. This dataset contains 75 years of freshwater data from 1935 to 2009. In addition to the use of the natural supply data, supply change scenarios were run (as mentioned earlier. These scenarios include several different potential reductions in natural supply).

The Required Scale of Desalination and Imports:

- For every randomly generated combination of scenario values (on the supply side and on the demand side) the historical natural replenishment series is superimposed, for the entire planning horizon, and the series of the shortages between supply and demand results are presented. The gap between demand and supply is closed by adding supply (mainly desalination) to the required reliability level (. This calculation was performed for a series of reliability values. The results are mainly indicated by the required level of desalination (installed capability) and by the resulting level of reservoirs in the sources, above red lines, over time. The results are shown in Figures 1 and 2.

Figure 1: Results of Probability Analysis of Gaps between the Forecasted Demand and the Supply of Natural Water: Coverage of Gaps, With Desalination



Note: The desalination values were rounded to the nearest 100 mcm/year, which is the estimated common module of a seawater desalination plant.

The red horizontal line marked “Authorized plan”, which coincides with the blue line to 2020, represents the scale of desalination that was approved by the government in 2008. This is 600 mcm/year by the year 2013, and 750 mcm/year by the year 2020. In this presentation, the red horizontal line is continued to 2050, even though the government decision only addresses the period up to 2020.

The full blue line represents the volume of desalination required to make up the gap between demand and natural supply, with a high level of reliability, for the set of defined scenarios. **This is the line of the level of desalination recommended for the planning period.**

The recommended policy for this plan aims to achieve full reliability of supply of freshwater in a way that will be secure even if extraordinary events take place, as they are represented by the extreme scenarios.

Figure 1 illustrates results at intervals of 5 years (the calculations are made annually) to 2050. The columns represent the difference between demand and supply of natural water for each year, a gap which should be covered by desalination, with varying levels of reliability: 75%, 95% and 100% (100% means coverage of the largest difference calculated, although from a statistical point of view there may be greater values, but very infrequently).

Reliability of 95% in a particular year means that there is a likelihood of only 5% of there being a shortfall, when all the scenarios are simulated (if 500 repetitions were performed with the model: this refers to 25 repetitions out of 500 in which there was any shortage). One should take into consideration that for some of the repetitions in which there was a shortage, large shortages will occur (several hundred mcm/year) which the water sector **cannot accommodate**, even with high levels of reliability (in excess of 90%). As such, an additional reliability criterion was examined: a constraint was set whereby the largest shortfall is not allowed to exceed 250 mcm/year (grey bars).

Inspection of the figure indicates, for example, the following: In 2020, for reliability levels: 75%, 90%, 95%, 100% and a criterion of 250 mcm/year, desalination at the national level of 510 mcm/year, 510 mcm/year, 600 mcm/year, 800 mcm/year, and 700 mcm/year respectively, will be required. In other words, maximum reliability in 2020 will be achieved if a desalination capability of 800 mcm/year is installed within the current decade.

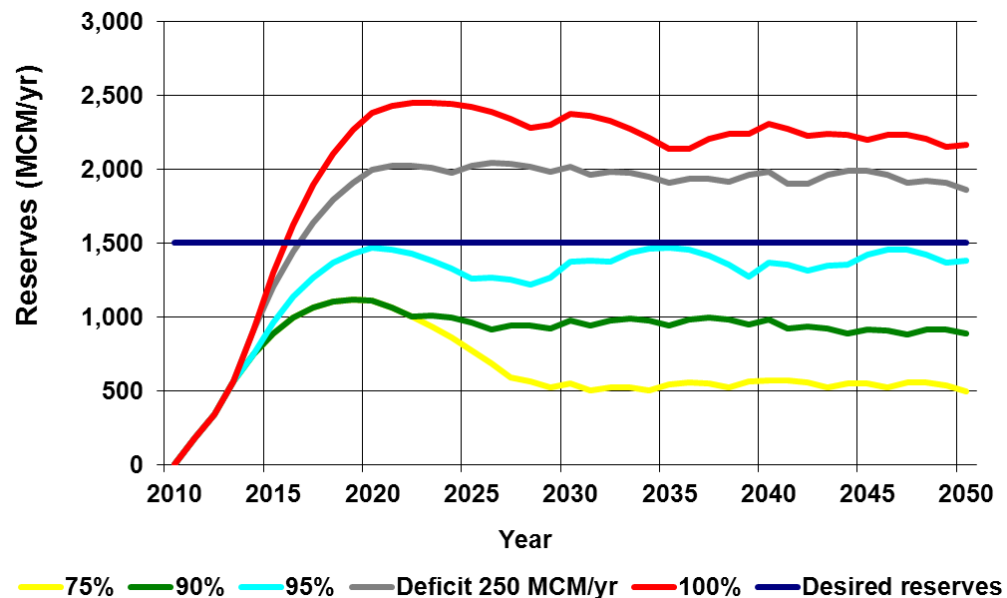
Nevertheless, in this situation the reservoirs will be restored beyond the level required by approximately 1,000 mcm (The difference between the 100% line, and the 'Desired Reserves' in Figure 2). Therefore, it is sufficient to operate within the guidelines decided by the government: desalination of 750 mcm/year to 2020 (reliability of over 95%, and maximum shortages of less than 250 mcm/year).

Figure 2 shows the development of the expected total natural freshwater reserves (the mean value, from which there will be deviations up and down) in the three-basin system over the years. The volume of the total reserves is shown for the development plan which was selected, based on the above reliability criteria. The operational volume of the natural reservoirs that is available to the national water system is estimated at around 3 billion cu.m. (above red lines). In previous reports² the reserves which were found to be suitable for operational purposes (on average above red lines) is only about 1,500 mcm. This figure was taken into account in Table 1 above, in the bottom table as "reservoir storage recovery". In Figure2, one can see an immediate and steep rise of the reserves expected value up to the year 2020, followed by subsequent fluctuations. The initial rise results desalinated production, as required for the different reliability criteria. This sharp rise reflects the initially very low reserves, and a required high level of reliability in the coming decade. Subsequent to accommodating the increased demand and the shortfall in supply with desalinated production, the level of the reserves stabilizes (mainly due to a reduced new desalinated production rate). At this stage, a multi-year regulation capability is formed, as well as sustainable balanced use of the reserves over the years.

Figure 2: Variation of the expected value of storage, for different reliability values

² "Transition Master Plan 2002-2010", and also based on working papers prepared by the Hydrological Service for the Operating Committee in recent years.

הערה [1]: Miki, I found two errors in the numbers here. It is correct now. Please fix the Hebrew version according to what is here.



It is important to note that the scenarios do not take into consideration the physical constraints of the supply system and the hydrological features of the catchment areas. As such, the results are dictated by the assumptions that were set in the scenarios and data models.

Principle conclusions and findings:

- One can see differences in the results along the time axis, between the traditional approach illustrated in the balance (Table 1 above), which is based on assessments and policy, and the probabilistic analysis (Figure 1) which shows integration and an attempt to quantify by explanatory factors, relating to demand and supply, and analysis based on different reliability criteria.
- There is high probability that a combined set of circumstances may result in the loss of part of the natural supplies of the water sector, together with an increase in demand levels beyond the levels forecasted in the status quo scenario. Supply and demand scenarios such as these were defined which, together, create “the scenarios framework” with which the water sector has to contend.
- Given the numerous constraints which were not taken into account in this framework (eg. Some of the water sources are not available due to reasons associated with water quality, limitations on production ability, etc.) the required volume of desalination is likely to be greater than estimated. This merits the adoption of a policy of high reliability.
- Limitations of the method: By selecting values (by randomized repetitions) from a set of scenarios that are represented by probability distributions, the chance of creating an extreme value, simultaneously in all of the scenarios, is very low (fractions of a percent).

Nevertheless, this possibility does exist. One should take note that “100% reliability” is impossible.

- **In view of the aforesaid, a very high level of reliability should be demanded in analyzing the needs of developing desalination in the water system.**
- It should be remembered that the system is currently in a state of low reserve volumes and, therefore, there is an urgent and immediate need to expand the scale of desalination and rehabilitation of the reserves. According to the plan policy, the reserve volumes will stabilize by the year 2020.
- The higher the required levels of reliability the more quickly the reservoirs will be rehabilitated. When the average reserve volumes are high (over 2 billion cu.m.) large losses from storage (leakages) also occur (over 200 mcm/year). In addition, creation of desalination facilities can lead to greater chances for temporary operational shutdowns in order to minimize expenses.
- These analyses and the others that feed it should be revised periodically, whenever additional information or assessments are required. These analyses should also be used as a tool for testing of the sensitivity of various assumptions.

Recommendations Based on the Findings:

1. To adhere to the existing government decision – to attain a desalination capacity of 600 mcm/year by 2013, and 750 mcm/year by 2020.
2. From 2020 to 2050 there will be a need to gradually increase desalination up to a total of about 1,600 mcm/year in order to ensure a high level of supply reliability.
3. Difficulties exist in finding land resources (statutory obstacles) for the construction of sea water desalination plants (which need to be located near the coast). Thus, in cooperation with the planning teams of the Ministry of Interior's Planning Administration, an additional 10% above the planned desalination production is advised per facility. In other words, the total volume of desalination to be taken for securing land areas³ within the National Outline Plan 34/B/2 is estimated at about 1,750 mcm/year in 2050.
4. Expansion of the desalination plan is feasible at intervals of about 5 years – involving assessment of the requirements and implementing construction/production. Periodic re-examination of development requirements will ensure compatibility of the development plan with actual conditions and accumulating knowhow.

Developing desalination along the time axis should be carried out jointly with efforts to rehabilitate and preserve the natural reservoirs as a strategic asset, in order to allow multi-year regulation. Reduction of the storage volume in the sources, for any reason, that is available to the Israeli water system, will necessitate significant additional development of desalination, in addition to the values calculated above.

³ In view of the increasing difficulty in securing areas of land for sea water desalination plants it was assumed that it would be best to recommend designating land, today, with a certain amount of redundancy and to “release” designated areas for other requirements later, if the desalination requirement is adjusted downwards.

i. Recommended Policy on the Various Issues

This section includes a description of the proposed policies on the central issues in the Master Plan. Each issue is described concisely: the main policy elements, the recommended alternative (after being analyzed in relation to other alternatives) and the main recommendations for implementation. Full details of the discussion on the alternatives for each policy component on each issue, the reasons for selecting the recommended alternative and the general background - can be found in the full policy papers prepared by the issue leaders. This material will be included on the Water Authority's web site. This document summarizes all of the detailed documents and, in this context, highlights the main policy areas and the main recommendations.

1. Preparations for Operating under Uncertain Conditions

Main Policy Points

It is important that the short- and medium-term activity is consistent with and is determined by the long term needs. As such, short- and medium-term progress in all areas must be achieved efficiently, and in accordance with the long-term perspective. With long term planning, including the LTN_MP, the level of uncertainty increases with increasing planning-duration into the future. Uncertainty is dealt with at the planning stage, by defining possible scenarios, and analyzing them. The most robust policy and development plans are identified within the domain of possible scenarios, which allow development in stages, and both resilience and flexibility under changing conditions.

One must take into consideration that sometimes addressing uncertainty involves preparing contingency plans. However, in other circumstances it can involve investments that generate redundancy in the system that thereby enhance supply-reliability and preparedness for situations that were not initially anticipated.

For some of the scenarios there is no consensus regarding their quantitative impact. Nevertheless, these scenarios can be quantitatively assessed with regard to their general impact on the system's ability to cope with them. For example, there is agreement that climate change impacts exist. However, there is no consensus regarding the extent of its impact, even when various international and local opinions are considered. Based on the range of these opinions, it is possible to quantitatively arrive at the required preparation for meeting supply-reliability levels, in view of the possible decrease in the supply of available natural water, in rates that are agreed on by the policy makers, while examining the resulting impact, including costs. However, some of the scenarios cannot be quantitatively assessed: for example, the extent of the system's ability to remove obstacles to the development of the water sector, regional geopolitical scenarios, the level of State intervention in the water sector, and its implications.

To ensure long-term relevance of plans in general, and the LTN_MP in particular, procedures under conditions of uncertainty must be defined separately. Uncertainty accommodated by using an integrated approach:

- a. On the national level – This involves mapping the subjects that will have an impact on the activity of the water sector, and analysis of the supply reliability within the range of changing values that impact it (according to the aforementioned approach).
- b. On the level of the subject in question – This relates to issues of uncertainty and topics related to the details of those issues. This part is expressed in the policy document and in the detailing of the issues later in this chapter.

Mapping of the main scenarios topics selected for preparations as part of the LTN-MP:

- **Overall national strategic planning in relation to the State of Israel in the future:** Overall national strategic planning exists in partial form only. These plans should be derived from government decisions, CBS forecasts, national outline plans and guidance by the political leadership. In view of this, the water sector should take measures at the organizational level, and in terms of tools and methods of coping with the lack of total and full guidelines on most of the topics relating to national policy. The following scenarios include areas of national planning policy which, in the absence of such a guideline (or partial guideline), are described here with a view to analyzing, as far as possible, their impact on the water sector, so that they may be addressed.
- **Government intervention in the water sector:** Deployment at the current level of involvement, even though greater government intervention is needed in defining policy, while maintaining the independence of the Water Authority Council.
- **National-economic strength:**
Israel was recently accepted to the OECD, with a high level of national-economic strength relative to developed countries. Its economic strength has provided the means for developing Israel's water sector without outside constraints.
- **Political agreements with neighboring countries and authorities:**
Alternatives to a permanent agreement with the Palestinian Authority are currently under examination, on the assumption that the permanent settlement on the subject of water will be similar to the basic format of the interim agreement. With regard to Jordan, preparations should be made for joint activities with regard to the Red Sea - Dead Sea Water Conveyance project, and rehabilitation of the lower Jordan River area. For now, preparations for arrangements with the other countries will only take place on the level of basic planning and research.
- **Water security:**

Planning considerations will include the premise that our region is not stable, in terms of security and geology and, as such, the water infrastructures are at risk, and preparations should be made for a range of scenarios in this area.

- **Land resources for developing the water sector:**

Planning should be conducted under the premise that there is a shortage of available land. Consequently land use should be minimized for future water infrastructures. This will be carried out by coordinating planning with other infrastructures. Progress will also be made with infrastructure tunnels and feasibility studies for executing part of the production capacity of desalinated water on artificial islands or facilities in the sea, or underground.

- **Water potential:** The water potential of the State of Israel, in other words the total volume of water available to the water sector, has changed significantly in the various reports and professional literature relating to the water sector. The potential of renewable natural water noted in the middle of the last century was about 4 billion cu.m./year. The latest reports of the Hydrological Service indicate a drop to less than 1.5 billion cu.m./year. Discussion of this topic incorporates numerous aspects of hydrology topics, such as: is the water renewable or not, hydrological water balances some of which are not secure to this day, water quality, etc.

It should be noted that the natural water potential diminished as the level of hydrological knowhow increased. The potential of water for planning and operational purposes is different from the hydrological potential of the water, as the range of considerations regarding the former is wider and includes the country's commitments to geopolitical agreements, water allocations for nature, reference to the production cost, etc. The chief premise within the plan is that the country's natural water potential has been almost entirely exhausted (some say it has been over-exploited) and stands at 1.2 billion cu.m. from renewable sources that are suitable for drinking water (see Chapter H). Future expectations are that the potential will be impacted downwards, due to climate change (see below).

- **Climate changes:** Addressing climate change will involve preparations for a decline in supply of natural water on the national and regional levels. Climate change expectations are for changes in the amount of precipitation, increases in the long range mean temperature which increases evaporation and transpiration, changes in the distribution of rainy days and rainfall intensity, an increase in the level of the Mediterranean Sea (inland advances in the seawater interface), etc. Accordingly, it was assumed that the natural water supply will decrease by 15% by 2050.
- **Size and distribution of the population:** Preparing the infrastructure that shapes population distributions is conducted in accordance with National Outline Plan 35 (Vision of the Development of the Negev and the Galilee). Water infrastructures are developed on the high realization factor assumption that the national outline plan for regional development (the population distribution) will be implemented as planned. A low realization factor assumption was made of the national outline plan with regard to development in the center of the country. In other words, when planning supply systems

one should take into account that the population in the center of the country will continue to grow based on the current trends.

- **Scale and distribution of agriculture:** The size and distribution of agricultural fields that employ freshwater irrigation will be similar to the current size and distribution. In the future, the amount of freshwater used for agriculture will drop, and the spatial distribution will be similar to the present. The other agricultural activities will be mainly based on treated wastewater, and their distribution will not change substantially, although there will be an increase in the areas irrigated with treated wastewater in the south of the country.
- **Dependence of agriculture on water prices:** In the long term, full adjustment to water prices that change over time, and a suitable increase in the efficiency of agricultural activities.
- **Quality of the natural sources of water:** Preparations for continuing deterioration in the quality of natural water sources, despite rehabilitation efforts (removal of contaminants, eastern drainage, enhancement of the quality of treated wastewater, etc.).
- **Technological developments:** The possible technological changes do not impact, at present, on decision making and will be addressed according to actual developments, and as per the topic, within the framework of periodic updating of the LTN-MP.
- **Cost of water:** The costs of water are dependent on the technological methods used for production and transportation, the cost of raw materials, salaries, the cost of energy, etc. Technological improvements will bring down costs, as well as a certain drop in energy costs with the country's transition to natural gas electricity. On the other hand, there are obstacles of regulation, geopolitical issues, land availability, the cost of raw materials etc., which are liable to generate increases in the cost of production. Today, one cannot assess the overall direction with regard to all topics. The full range of factors that impact the cost of water supplied must be closely monitored. This will be achieved, as noted, by means of periodic updating of the plan.
- **The dependence of the water sector on energy availability:** The Israeli energy sector is undergoing tremendous improvement in light of the numerous discoveries of energy sources in the country. Thus, the working premise is that energy availability is guaranteed, with a price level similar to the current one.

Main Recommendations for Implementation

- A National Planning Council (or inter-ministerial unit) should be created under the aegis of the Prime Minister's Office / Ministry of Water and Energy, which will oversee the needs of national planning and the strategic objectives with the various government ministries, in areas such as the required population distribution, the approach to areas of Judea and Samaria, and Gaza, in planning the degree of inter-regional cooperation on infrastructure topics, preparations for extreme scenarios, the scale of agricultural activity as a national objective, etc. In the absence of such a body, the Water Authority Council will act at its discretion.
- Establishment of a committee is proposed for coordinating national infrastructures (water, gas, transport, fuel, etc.) for the purpose of increasing the efficiency of the development

of the water sector. If there is no such dedicated body, efforts should be maintained to achieve ad hoc coordination of infrastructures with the national infrastructure bodies, and through the Ministry of Water and Energy.

- With regard to water security, the extent of deployment scenarios for expected regional geopolitical and geological threats should be examined. Preparations should also be made for terror threats to the supply systems and the national infrastructures computer systems that are integrated with water supply.
- The gap between supply and demand: Preparations should be carried out for a range of scenarios with regard to the supply of natural water and to the possibility of changes in demand.
- For every development plan in the water sector which is of importance or exceeds a certain determined level of investment analysis of standard engineering alternatives will be made. Extreme scenarios will be mapped and examined (in terms of supply and of demand) as a basic part of the water supply plan. Guidelines will be defined for decision making to incorporate scenarios on all planning levels, to ultimately select a recommended plan.
- Preparations for scenarios and preparedness for them will vary according to the national or local level of the program, and according to the type of infrastructure being examined. For example, mapping the scenarios of preparedness levels for planning water pipeline diameters will be different from determining scenarios for planning the capacity of producing desalinated water. It is generally not possible to lay and enlarge water pipelines in a modular fashion. On the other hand, desalination plants and pumping capacity supplements can be upgraded and expanded relatively rapidly.
- The development plans on the national level and on the regional level will allow for a decline in the supply of freshwater (until other research evidence is available) by 15% until 2050.
- The technological changes required for implementing the LTN-MP will be examined when the plan is periodically updated.

2. Management of the Freshwater System

Main Policy Points

The freshwater system integrates freshwater from the natural sources with water produced from desalination plants. This water serves the domestic sector, part of the agricultural, industrial and nature sectors, and the regional agreements with our neighbors. The definition of natural water as "freshwater" or "potable" is not absolutely clear as, in almost all cases, installation of a treatment system of some level is required between the natural source and the consumers, from chlorination to removal of various pollutants (for example, the water of the Sea of Galilee is considered to be freshwater, but requires filtering before it can be supplied to residents).

When mineral and nutrient concentrations reach a certain level, the water is no longer categorized as "freshwater", although the distinction between these is not always clear. The

premise is that, in a few years' time, we will have more advanced and efficient technologies at our disposal which will allow treatment of water with very high pollutant levels (including effluents, i.e., treated wastewater), and it will be possible to add the water to the freshwater system. On the other hand, it is expected that some of the natural water sources will become contaminated due to human activity, to the point at which it will not be possible to include them in the freshwater system.

The freshwater system management policies and the policies that impact them serve as a key component of the LTN_MP. One of the central objectives of management of the freshwater system is achieving a balance between developing supply and managing consumption, with intelligent and coordinated planning of the required infrastructures.

The main points of the proposed policy are designed to provide a solution for this objective, and for associated aspects:

- Reliability of supply in the freshwater system will be determined as a guiding policy **for all sectors** and at all planning levels, with the ability for periodic updates.
- Determining a very high level of reliability in the water supplies to the domestic and industrial sectors, and lower (but defined and adjusted) reliability levels for agricultural sectors and for supply for nature and landscape.
- Developing sea water desalination plants as a primary supply source, and prioritizing the desalinated water for the urban sector. This will provide added value for consumption itself, and high quality treated wastewater.
- Managing the construction of sea water desalination plants, with advantages of large scale facilities, within the framework of central management and through tenders that involve the private sector.
- Managing a uniform and integrated national system, including:
 - Maintaining fairness in allocating water between the sectors, and equality between all water consumers in the same sector in terms of the water services and prices. This will be based on the principle of social fairness.
 - Full coordination of the water infrastructures with other national infrastructure systems.
 - Connecting consumers with private wells to the national system, to the extent possible.
 - Allowing management independence to different regions, in accordance with defined criteria.
- Designation of the Kineret (Sea of Galilee) – Primarily a water supply source for the northern sections of the country. Desalination plants on the Mediterranean coast provide water to other regions. The north-south connection of the National Water Carrier will be maintained.
- Incorporating the Red Sea Dead Sea Conveyance project in the overall plans of the water sector will be contingent on proving the project's viability. Inclusion in the development

plan will only be possible following final formation of the project and the regional arrangements for it.

Main Recommendations for Implementation

- Criteria for supply reliability for all the sectors should be defined.
- In the long term, the operational scenario with the highest reliability (close to 100%) in the three-basin system, will require a supply of freshwater for agriculture that does not exceed 450 mcm/year, (a scenario of 500 mcm/year in 2010 was taken into account for the basic balance). This is the limit needed as part of the ongoing operational scenarios, although freshwater consumption will be difficult to curtail to this level. . In the medium term the the maximum shortfall should not exceed a threshold of 250 mcm/year. This will occur with a probability below 10% within this scenario framework. If there is any reduction, the gap between supply and demand will be closed by one-time mining from the natural reserves, and a curtailment in the supply.
- Aim to achieve maximum reliability (without supply cuts) in the domestic sector in accordance with the following principles:
 - Advancing circular systems as a guiding principle in regional planning.
 - Analyzing the number of consumer connections for each local authority, with the premise that each authority should have more than one consumer connection (preferably from different supply directions and sources), and that the supply capacity from each connection should match the consumer's situation in terms of local production capacity, storage, the structure of the supply system, the number of consumer connections, etc.
 - Maximum integration of water and sewage infrastructures in neighboring local authorities. This should be conducted within the framework of a joint water and sewage corporation or in coordination between neighboring corporations.
 - The structure of the internal supply/piping systems should be matched to the supply reliability requirements, as defined periodically, and appropriate regulation should be created to provide the incentives for this.
 - Providing the criteria for allocating the internal storage capability and/or the guaranteed storage capacity in the regional system. This is needed for each local authority in order to guarantee the required supply reliability.
- Activity and research should be advanced for establishing a solid basis for determining the optimum/desired value of supply reliability for each sector in relation to the supply costs, and the estimated damage that would be caused by shortages.
- Unifying infrastructures: Steps should be taken to coordinate major plans of other infrastructures with the plans of the Water Authority, prior to or parallel with their transfer to the Planning Administration, the National Infrastructures Committee, etc. It is suggested that a method may be found for the Department of Public Works (DPW), Israel Railways, NTA, Gas Authority, IEC and other national infrastructure companies to secure spaces for water and sewage infrastructures in all of their respective plans (this recommendation also refers to the issue of sewage and treated wastewater management, and other issues).

- Sector service convention should be determined for the water suppliers, including Mekorot Ltd., accompanied by a control and supervision layout, within the framework of regulation system.

3. Management of the Sewage and Treated Wastewater System

Main Policy Points

All of the domestic and industrial sewage (including in the rural sector) must be treated, due to sanitary considerations and for the purpose of removal and reclamation of effluent for all uses. The high rate of reclamation (on the global scale), the scale of effluent use as a principal source of water for agriculture and other purposes, and all the sanitation, environmental and regulatory aspects relating to this issue necessitate the use of a sustaining policy in all areas.

The main points of the proposed policy on this issue include:

- The quality of the treated wastewater:
 - In the coming decade effluent quality will be based on the Inbar Committee standards. In future, the quality will be adapted to the water sector requirements, such as preserving the groundwater sources. The future improvements in quality will be a function of cost benefit analyses, the accumulating knowhow, and the national regulations.
 - The quality will be determined by an inter-ministerial committee (such as the Inbar Committee) headed by the Ministry of Environmental Protection and including the Water Authority, the Ministries of Water and Energy, Health, Interior, Finance and Agriculture, as well as representatives of the agricultural sector and water and sewage corporations.
 - Guidelines for treatment processes of sewage will be formulated, in addition to setting parameters of treated wastewater quality produced by sewage treatment plants.
- Methods of involving the private sector in managing sewage collection and treatment systems will be examined for the purpose of improving them, while maintaining public control.
- Efforts should be made to ensure that the sewage effluent reclamation systems are cost-effective while maintaining national objectives (as dictated by the government) for efficient removal and disposal of treated wastewater.
- If there is governmental support for sewage treatment plants this will incorporate socioeconomic criteria and support of the periphery.
- If there is support for reclamation projects, it will primarily be designated for relatively large-scale inter-regional and regional plants (excluding cases in which the establishment of local plants is justified).

- Industrial sewage will undergo preliminary treatment to the level of urban sewage quality, as is currently required. Industry will be given incentives to recycle water and to use its own treated wastewater or treated wastewater from reclamation systems.
- Removal of saline content from treated wastewater will be ensured prior to use in irrigation in preserved areas. This will be accomplished using an engineering cost-benefit analysis, in order to maximize preservation of the natural water sources.
- Dan Region Sewage Treatment Plant – Alternative treatment processes will be examined for improving effluent quality.
- Treatment of sewage and its reclamation will be implemented on a regional and national basis, with appropriate monitoring. This is a nation-wide large-scale reclamation program. “grey water” and domestic reclamation are not top priorities, given this nation-wide treatment and reclamation program. Nevertheless, in certain cases (primarily in situations where there is no designation of treated wastewater for agriculture in the region) projects will be approved, subject to a cost benefit analysis and approval by the Ministry of Health.
- Decentralization policies against centralized sewage treatment plants will be examined for remote regions. Considerations include the development of new treatment processes, and engineering, financial and environmental factors.

Main Recommendations for Implementation

- The Water Authority will begin to regulate the organizational structure relating to the management of the sewage and treated wastewater system. In this context, the bodies that will establish and manage regional and inter-regional reclamation plants will be defined.
- The Water Authority will examine the need and feasibility of establishing a government-controlled implementation body, that would connect water and sewage corporations to sewage treatment plants, where the local authorities/corporations fail to connect with them.
- All the engineering elements and various constraints should be examined as part of a master plan framework for sewage and treated wastewater. This applies to the level of decentralization of the sewage treatment plants and sewage collection systems, and treated wastewater designations. The feasibility of desalinating treated wastewater should be examined for the purpose of introducing and mixing it with natural water, and full use of the mixture, including for drinking water.
- A comprehensive test of the financial stability of the existing and planned sewage treatment plants, and the conveyance system to them, should be carried out. This test will incorporate financial stability, reliability, upgrading and expansion ability and stability of quality of the produced treated wastewater. In this examination of the various parameters for the long term, consideration should be given to the possibility of managing the sewage treatment plants within a single organizational and financial framework, in a regional or national system.
- Establishing and regulating the sewage treatment plants will take place with proven managerial, technical and financial abilities. Treatment of sewage and regional

reclamation systems will be mainly based on criteria of reliability, efficiency and spatial fairness.

- Planning new sewage treatment plants or upgrading existing ones will include preparation to achieve enhanced treated wastewater quality levels by adding complementary processes, allocating areas for them, connecting to a concentrate removal system, etc.
- Constructing an innovative pilot plant for developing and examining the applicability of treatment processes that bring treated wastewater to the level of potable water (and subsequent reclamation for agriculture).
- It is suggested that the water quality regulations (Inbar Committee standards), in their final format, will be operated unchanged, at least until the year 2020. Any updates and changes required will serve as a basis for an updated version which will be formulated towards the end of the decade.
- Regional reclamation plans will include an evaluation of the saline and the impact of saline content on the natural water sources.
- The design data used in planning sewage treatment plants (design rate for sewage) can serve as the basis for engineering planning of the reclamation plants, but cannot serve as the business plan of the reclamation plant, due to the varying quantities of sewage supplied to the sewage treatment plant, which are not controlled by the plant. The business plan of the entrepreneurs of the reclamation plants should be adapted to the reduced quantities of treated wastewater (in relation to the engineering design) as part of overall risk management, due to various factors (consumption management, savings in consumer water, etc.).
- The treated wastewater tariffs, for sewage treatment plants and for reclamation facilities, will include a fixed component to cover fixed costs (mainly capital and capital renewal), and a changing component which is dependent on the quantity that is treated or supplied.

4. Management of the Natural Water System

Background

The main sources of natural water – the aquifers and the Sea of Galilee – were for many decades the sole sources of drinking water, and mostly required minimal treatment prior to supply to residents. Over time, the quality of the water in the sources declined due to polluting activities near or above them, and the penetration of water with poor quality from neighboring water bodies. This phenomenon occurred mainly in the coastal aquifer and less in the Yarkon-Taninim Mountain aquifer and the aquifers in the Galilee. As a result, a large number of wells went out of use and the availability of adequate freshwater decreased. Partially, more advanced treatment systems were installed which brought the water to usable qualities. At the same time, the water quality standards became stricter.

In addition the replenishment quantities declined, due to several factors. These are, the increasing use of water before it reaches the aquifers and the Sea of Galilee, more intensive use

of land such as construction, which reduces the replenishment of groundwater, human polluting activity, and possibly even climate change. The fossil groundwater reservoirs in the Negev may provide more water than they currently provide, but their development entails high costs and, as such, the level of production from them is contingent on the cost of the desalinating sea water alternative, and the conveyance costs.

In the future, the natural water reservoirs will continue to be an important strategic asset and will act as a significant source of the supply systems to the various consumers. The natural reservoirs had an important role as operational reserves in the overall system of production and consumption. These reserves stabilize the water supply from variable natural replenishment and desalination. The importance of the natural water reservoirs may seem to be declining due to the changes occurring in the water system – particularly due to the entry of desalinated sea water as a main source for urban use, and increasing use of treated wastewater for agriculture. However, this is not the case: They will continue to serve as a crucial component of the water supply system into the future, both as a source and as operational reservoirs. As the production of desalinated water increases the more it will be possible to restore the natural water sources to a stable state of production and supply capability. The rain that falls on the drainage basins, some of which becomes runoff across the basin and downstream, comprises a complementary source of water. It can be used to enrich the natural water sources and, through managing storm water, to achieve financial, environmental and social objectives.

Main Policy Points

- The basic approach to long term management of the natural water sources will be rehabilitation and preservation of the resources as a national strategic asset, with due consideration of complementary financial aspects.
- Management of all the natural water sources will be integrated and coordinated between the sources, based on a general overview. Management will be performed in accordance with quantity and quality targets which stabilize the state of the water sources.
- Correct management of the surface runoff can help to increase the volume of water resources, and to achieve other targets (details later, in managing runoff and drainage water issue).
- The policy on production from the natural reservoirs is designed to achieve stable and sustainable production, after the reservoir has been rehabilitated and stabilized. “Stable” does not necessarily mean “fixed” from year to year. Instead, it means production that does not risk lowering the level in the reservoirs to an undesirable extent.
- The overall responsibility for the quality of the natural water sources is divided between the Water Authority and the Ministry of Environmental Protection (see details of the recommendation for the water quality).

Main Recommendations for Implementation

- Hydrological work will be undertaken by professional working groups, to formulate the necessary detailed recommendations (with explanations). Hydrological experience will be

coordinated with the goal of maximizing replenishment in the Israeli water sector. This will take place within the various constraints, including: operating rules, red and black lines, production limitations, water quality problems, gaps in hydrological knowhow at the different basins, inter-regional agreements, etc.

- A specific approach for each natural water source (according to the division of basins) will be examined, with regard to policy implementation, based on criteria and targets to be defined for each basin.
- Required storage targets will be set for each of the natural water sources (quality and quantity) in accordance with the following: operating considerations, hydrological considerations, the method of attaining the target over time (a range of values), the admissible range of deviation from the targets, and the current and future designated uses of the water source.
- For each of the natural water sources, and for their conveyance systems, a saline balance should be presented. A balance as such should ideally be produced for other contaminants.
- Operating lines will be defined for each of the natural water sources.
- Management of all the water sources will be performed in an integrated manner, and targets will be set for each of the sources within this framework.
- Great importance will be attached to maintaining high stored volumes according to the targets.
- Cost benefit analysis of alternatives which examine the value of the storage in conceptual planning will take into account the value of the water in the source (the shadow value of the water, with regard to quantity and quality). In addition, cost estimates should be made of considerations involving intragenerational and intergenerational equality.
- Plans for monitoring, production, introduction and management of each of the natural sources of water will be devised. The plan will include an estimate of costs and the orders of priority for rehabilitation stages in accordance with the contribution made to achievement of the objectives.
- Use of past data for forecasting and planning will include a safety factor that reflects the level of risk of relying on these figures in light of known and predicted climate changes.
- Significant resources should be invested in development and enhancement of tools that support decision making relating to management of the natural reservoirs. At the same time, there will be an advancement of training of skilled personnel for operations.

5. Water Quality

Main Policy Points

Quality of the water refers to two different aspects: one, quality of the water in the sources, and two, quality of the supplied water. The standards for the quality of supplied water to the various consumers are set by the Ministry of Health. It may be assumed that the standards will become more stringent over time, with the discovery of additional harmful substances, and the ability to identify them in low levels, and with the identification of their negative effect on public health. Improving the quality of the natural sources of water, and maintaining it, are

designed to maximize the production potential. Nevertheless, the using water of originally poor quality has become more feasible by mixing it with water of better quality and/or by means of advanced (and more expensive) treatment methods. These factors, together with constant tightening of supply standards criteria, necessitate management of the sources based on an integrated approach of maintaining the quantitative supply with enhanced reference to aspects of water quality. The recognition of the importance of the quality component, in addition to the quantitative component, is increasing. The importance of quality encompasses all the consumption sectors, both with regard to the water sources and to the supply systems.

The main points of the proposed policy, on this issue, include:

- Responsibility and authority for the quality of the water and prevention of contamination of the water sources will continue to be divided between the Water Authority and the Ministry for Environmental Protection. This is the current setup. However, coordination between the two organizations will increase⁴. The Ministry for Environmental Protection will be responsible for preventing anthropogenic contaminants. The two bodies will establish a joint coordinating team for areas relating to contaminants which threaten active water sources, at the national level and the basin/regional level.
- Setting targets for the quality of the water sources should be based on planned uses for each water source, and in accordance with analysis of the significance of the quality objective for all the relevant factors, such as: health, environment, agriculture.
- Efforts should be made to restore natural water sources which were recently used for drinking water, to drinking water quality.
- Advancing a dedicated monitoring and research plan for managing the quality of water bodies, based on an order of priority and quality targets that need to be set.
- The quality of water supplied will satisfy the regulations. However, the Water Authority will be able to use its discretion, in conjunction with the Ministry of Health, to include water treatment processes (including the addition of chemicals).
- The quality of the supplied water, which varies according to different treatment situations, will be as far as possible adapted to consumers' needs and will be anchored by set criteria.
- Preparation will be made for scenarios in which the quality of the natural water sources are damaged. This includes extreme deterioration in the quality of the water.

Main Recommendations for Implementation

- Setting the specific quality targets for each of the natural water sources. This includes any required references to individual quality parameters, based on work that has been carried out to completion.
- Creating a professional team for preparing a national research program in the field of water quality, and employing outside parties for its implementation.

⁴ An agreement of principles (procedure) was recently achieved for cooperation and division of areas of responsibility on the topic between the Ministry of Environmental Protection and the Water Authority.

- Establishing a professional team for checking possible deterioration scenarios in the quality of the water.

6. Consumption Management

Main Policy Points

Managing consumption (or demand management) deals with the means – legal, technological, financial and informational – which impact different parameters of consumption. Consumption management is designed to complement supply management as described above. This is the case, despite the difficulty of assessing the value to the consumers of the levels of service and willingness to pay for them, and for the external costs and various benefits.

The consumption characteristics which impact the cost of supply include not only the total annual quantity. They also include its distribution over time (months, days of the week, hours), the requirement for reliability (via supply from a number of directions, and suitable reservoirs), the supply pressure and the stability of quality (for example, saline water for irrigation). Just as with the issue of annual quantity the level of service provided to the consumers should be viewed as a variable that is determined by policy decisions. The best value for this variable should be determined by balancing its cost and benefits to consumers

The main points of the proposed policy:

- Setting a goal for the quantity of annual per capita consumption is a policy decision which is equivalent, in terms of its importance, to supply management and it should be taken into account as stable over time. As such, we should advance it in managing the water sector while allocating the resources required for its realization through technological, financial, legal and informational means.
- Savings and efficient use of water are important factors in themselves as values. They should be advanced beyond having to prove the measurable economic benefit.
- Consumption management will be carried out based on considerations of economic efficiency at the system level, but with due consideration for the consumer's ability to pay.
- Managing the other consumption characteristics (time distribution, reliability, pressures, quality stability) will be performed in accordance with cost benefit considerations at the national level, without dropping below given threshold values.
- Management of urban consumption at times of water shortage (drought, a significant and protracted failure) will be implemented through administrative means (allocations, regulations, decrees), in accordance with the preliminary definition of "emergency situations" of different types, and while determining high tariffs for high levels of overuse.
- In situations of shortage, the first priority will be determined for the supply of drinking water and other basic domestic uses, and second priority to supply for animals. Secondary priority will be set for the other uses, in accordance with criteria which take into account economic, social, environmental and other considerations.

Main Recommendations for Implementation

- Work which determines orders of priority of cuts and the extent of cuts that are required during shortages should be implemented for every sector and every type of consumption. The approach to assessing the damage caused by water shortages will be based on normative values which will be published in advance (before the damage occurs). Weighting the damage values in decision making will be integrated with considerations of supply reliability policy.
- Comprehensive work should be maintained on the methodology of demand forecasting which considers demand management and the planning guidelines which derive from them. The planning guidelines, and the discussion about them, should identify the consumption objectives, as determined along the time axis, and set separately the required supply reliability factors for the purpose of planning water systems.
- The suppliers, water and sewage corporations and local authorities, should be obliged to measure water consumption continuously, to collect and arrange the data and to routinely transmit them to the Water Authority.
- Demand management will be performed by the water suppliers in accordance with the guidelines of the Water Authority, within the framework of the service convention to be determined.
- Neighboring authorities and countries should be required to include consumption management in their water sectors' policies.

7. Water and Agriculture

Main Policy Points

Agriculture in Israel is important in terms of rural communities, society and the environment, and its continuance as a national objective. The main topics in this area relate to the planning and management interfaces between the water sector and the agricultural sector: the quantity of water, type of water, quality of water, physical infrastructure and regulation. This also includes combining the policy and the national considerations in economic, social and environmental aspects, which lie at the basis of agricultural development. Agriculture is a large consumer in the water sector, and is integrated in the development of the water sector. It is essential that the policy on water and agriculture relates to these areas extensively.

The main points of the policy, on this issue, include:

- Preserving agriculture and developing it, as a national objective. The government and Ministry of Agriculture determine the objectives, requirements and distribution of agriculture. The water sector will adapt to these objectives and requirements.
- In the short term, the water sector will continue to limit the amount of freshwater for agriculture. After the water system has been rehabilitated and stabilized, the amount of water for agriculture will not be limited and will fully match the needs of the sector's

development. Limitation of the quantity supplied to agriculture will only be considered if a shortage occurs which threatens the supply of drinking water to residents and/or there is concern over irreversible damage to the natural water sources.

- Water provided for agriculture will primarily be marginal water (treated wastewater and saline). Freshwater for agriculture will only be supplied for purposes which require it, or in the absence of another alternative.
- The mechanism for allocating water quotas for agriculture will be updated while maintaining parts of the existing arrangements for a certain quantity of water, and the inclusion of new arrangements for additional quantities.
- The price of water for agriculture (freshwater and treated wastewater) will cover all the recognized costs for agriculture while matching this with the consumer's ability to pay.
- Economic and administrative mechanisms will be devised for increasing efficiency of the use of water for agriculture.
- As part of the new arrangements, new mechanisms and advanced methods will be examined, such as: transferring quotas, issuing regional permits, canceling the quota mechanism entirely, etc. This is designed to simplify the regulation and to increase efficiency while preserving the regional and national limitations.

Main Recommendations for Implementation

- The Ministry of Agriculture will be responsible for preparing a long term master plan for developing agriculture as a national objective.
The plan will include:
 - a. Defining the scale and breakdown of the agricultural areas (non-irrigated and irrigated land) and their division into geographic areas/districts of the Ministry of Agriculture and Rural Development.
 - b. Requirements for determining the quality of water (even if the water sector is not obliged to provide this).
 - c. Requirements for determining water quantities, and their distribution over the year.
 - d. Additional requirements for water connected directly to agricultural production, such as sorting and washing for preparation and marketing of fresh produce (not including water consumption for processing agricultural produce, which shall be considered industrial activity with drinking water quality).
 - e. Trends of changing the designation of agricultural land (in conjunction with the planning institutions at the Ministry of Interior).
- The decrease to the forecasted total of freshwater of 450 mcm/year in the water balances shown above, represents changes based on current trends. One should take into account the need to remove obstacles relating to protection radii of wells, upgrading treated wastewater to a high quality level and creating solutions in areas without an alternative, in order to limit the quantities of freshwater used for agriculture. Dedicated committees should be established to address these obstacles.

- Developing a new and efficient mechanism for allocating water, based on surveys of the status quo and of updated criteria. In this context, mechanisms for transferring quotas will be examined.
- The price of freshwater for agriculture in the coming years will be based on the existing agreement (“the water agreement with the farmers”). In the long term, the price should be suited to new mechanisms which improve efficiency of the use of freshwater in agriculture.
- Determining regulations/guidelines for the quality of water for agriculture.

8. The Urban Water Sector

Main Policy Points

The primary objective of this issue derives from the overall objective of the water sector: to ensure the supply of water, provision of sewage services and designation of treated wastewater as well as management of runoff and drainage water – with appropriate quality, quantity, reliability, and economic efficiency. This will be accomplished for the sustainable benefit of all consumers in the municipal water system, by means of the best possible economic-engineering planning, and with the use of the water supply systems to the city and within the city.

In accordance with the 2001 Water and Sewage Corporation Law, in the last few years the urban water sectors have undergone significant changes following their transition to corporations. Most of the change relates to transferring responsibility for supplying water to residents and transferring the responsibility of collecting and purifying sewage, from the local authorities to the water and sewage corporations. The policy on the issue of the urban water system incorporates numerous components which also relate to other issues addressed by the LTN-MP – managing the freshwater system, managing the sewage and treated wastewater system, consumption management, water quality, etc.

The main points of the policy appear below, although some of them partially overlap policy elements of other issues.

- Strengthening the water and sewage corporations, and their management, on a professional and financial basis.
- Reducing the number of corporations by establishing region-wide corporations based on engineering, geographic, socioeconomic and financial considerations. Urban water associations, if they exist, will be dismantled and will be incorporated within the water and sewage corporations.
- In cases where the private sector is involved in the ownership and/or operation of the corporations, or part of them, control of the corporations will be maintained in the hands of the local authorities.
- Improvement of consumer service: The Water Authority is responsible for defining criteria for services that are provided to consumers, which will be binding on the water

and sewage corporations. The corporations, with the approval of the person in charge for them, may supply additional services to consumers and private networks, including the possibility of charging for these additional services.

- Supply reliability will be achieved, among other ways, through the obligation to provide a number of consumer connections to the regional supply systems (preferably from different supply directions). This will ensure that local production and the volume of local storage are maintained. The required volume of local storage will be determined by the Water Authority. This will be based on criteria that relate to the local authority attributes, such as: the output and quality of self-produced water, the operating critical facilities within the authority's domain which demand a high level of reliability, etc.
- Handling of sewage will include **an obligation to connect most of the consumers** to the central sewage systems. Management of the municipal sewage system will include a preventive maintenance and monitoring plan for the collection system.
- Reducing loss of water in accordance with integrated and fair indexes for calculating losses, incentives for reducing losses and fines for exceeding the maximum permitted loss level.
- Cuts in water consumption will be achieved through activity that combines technological changes (for example: management of pressure in the network), information, rules and guidelines on the national and municipal level, and financial incentives for the local authority/water and sewage corporation and the consumers.
- Upgrading water measuring systems for consumers.
- Responsibility for security of water and water supply in an emergency situation lies with the water supplier, in cooperation with the local authority, with the assistance of the Water Authority, through bodies such as: Mekorot Ltd., the IDF and/or by operating nearby water corporations and suppliers.

Main Recommendations for Implementation

- Work will be undertaken to assess the optimum number of corporations.
- The Water Authority Council will formulate binding service rules that will include the criteria for the service that the water supplier (also including Mekorot Ltd., the water and sewage corporations and other local suppliers) will be obliged to meet, including the sanctions which the Water Authority and consumers can impose if the suppliers fail to do so.
- The Water Authority, in cooperation with the water supplier, will prepare informational promotional material for reducing water usage and increasing water use efficiency across all strata of the population. Rules and guidelines will be defined for the individual consumer to reduce water usage. The Water Authority will make information available to the consumer, for planning and irrigation of private and public gardens, to promote efficient use of water. The water suppliers will adapt to implementation of the Water Authority guidelines with regard to per capita consumption.
- The water suppliers will be required to draft long range plans to reduce water loss in the existing systems, and planning guidelines for reducing water loss in the new or renewed systems. These plans will require approval by the Water Authority.

- The law for water and sewage corporations' will enter into effect. This will enable the breakup of urban water associations and their incorporation into local or regional water and sewage corporations.
- The water and sewage corporations will report number of consumers who are not connected to the sewage systems to the Water Authority. The number of consumers to be connected to the sewage system should be maximized. A detailed examination will be made of the corporations' ability to invest efficiently in the rehabilitation of the supply systems, and to accommodate an increase in the number of consumers.
- For the purpose of achieving the best possible level of planning and operation, and ensuring supply reliability in municipal water systems, continuous monitoring should be carried out on the quantities of water supplied to the consumers, the water levels in the reservoirs, and the quality of the water (based on main parameters to be agreed).
- In conjunction with the water corporations, academy and the Standards Institute, the compulsory measuring standards will be updated to ensure reliable monitoring.

9. The Environment and water for nature

Main Policy Points

In the past, the natural water sources were considered to be a source of water to supply all areas of the water sector. These natural sources were exploited beyond their capacity. Today the natural water resources and landscape are seen (and legislated in the Water Law) as a bona fide water consumer, with similar status as the agriculture, domestic and industrial sectors. In recent years there has been growing recognition that the water needs of nature and the landscape play an integral role in water sector management considerations. The needs of nature have been incorporated, in both the vision and objectives of the water sector, as they appear in the LTN_MP, and with regard to regional and other plans which are led by the Water Sector. Despite this positive development, there is still a need to formalize and devise guiding policy on the subject of water and the landscape. Landscape incorporates all of the topics connected to open areas. Their preservation is a wider issue that is not examined in depth in this context.

The main points of the policy, on this issue, include:

- The requirements of nature and landscape will be determined by a committee that will be appointed by the relevant authority. The Water Authority will be responsible for providing water of suitable quality and quantity to meet these requirements.
- Supplying water to nature will, to an extent, restore the natural flow of water to an agreed level.
- Water flowing downstream will be utilized as far as possible, and as long it is financially viable, while minimizing environmental damage. The channeling of storm water to treated wastewater reservoirs, and the inclusion of treated wastewater in streams should

be minimized. Storm water will be designated for the purposes of increasing the supply of freshwater, and for maintaining nature in riverbeds.

- Storm water and treated wastewater reservoirs will be planned in a way that ensures their utilization as a resource of nature, the landscape, and tourism.
- The Sea of Galilee is a landscape site and a unique ecosystem and tourism resource in Israel, which serves the general public. In parallel with this role, the Sea of Galilee will continue to serve as an operational reservoir of the water system, while ensuring that red lines are not crossed, as was the case in the past.
- Rehabilitation of the Dead Sea will be carried out as part of the Red Sea Dead Sea Water Conveyance project. The drop of the level of the Dead Sea is a regional problem with geopolitical aspects. This problem will be solved within the framework of regional cooperation (and not unilaterally in a way that reduces the sources of water supply for the Israeli national water sector).
- A plan to rehabilitate the lower Jordan River will be prepared and operated, while aiming to achieve regional coordination.
- The costs of supplying water to nature and the landscape will be assigned from the State budget.
- Measures should be taken to reduce the footprint of the water infrastructures (mainly desalination plants, sewage treatment plants and reservoirs) regarding the land-space required for each.
- The number of outlets to the sea that are allocated for removal of concentrates should be increased in order to allow rehabilitation of the natural water sources, while conducting appropriate monitoring of the marine environmental system.

Main Recommendations for Implementation

- Nature's water requirements will be quantified, as described in the Master Plan for water for nature. The plan will be discussed by a wide public forum and will be approved by the Water Authority Council, and by law.
- The committee's recommendations will be taken into account regarding the rate of rehabilitation of the water sector, and orders of priority in water supply.
- Relations between the Water Authority and the "green organizations" will be formalized. This will include the method in which they are integrated in the relevant areas of activity of the Water Authority. An internal committee will be created for the purpose of advancing this topic.
- For every basin with natural water flow, a volume-discharge curve of the groundwater (in the upper part of the spring emission) versus natural flow will be established. This will provide a basis for making planning and operational decisions. The Water Authority will be responsible for its implementation.
- The water flow to the streams by artificial means (by a pipe) will be limited where there is a reasonable natural flow-alternative. The streams and the timetable for stopping the flow as above will be defined, along with progress with rehabilitating the natural water sources. The Water Authority will be responsible for implementation.

- Research and other activities will be carried out for the purpose of devising the levels of rehabilitation and preservation that strike a balance between the ecological needs and the financial burden. This will be accomplished for each stream which once had a natural flow. The authorized bodies (Ministry of Environmental Protection, Israel Nature and Parks Authority) will be responsible for implementation of this work, in coordination with the Water Authority.
- A financial analysis will be conducted to estimate costs of supplying water to nature. The Water Authority, together with other authorized bodies, will be responsible for implementation of this work.
- Coastal land-use for desalination facilities should be maximized. Only after exhausting shoreline options, should alternative options be employed. One alternative is land use east of the shoreline, while ensuring maximum protection of groundwater. Another alternative is the placement of plants and other infrastructures westward on floating platforms and/or artificial islands in the sea.
- The Water Authority will update the LTN_MP for removing brine, and will act to adjust National Plan 34B.
- Preference for environmentally friendly solutions will be examined while comparing planning alternatives. These solutions will be included in the planning guidelines, subject to financial considerations.
- External costs, which are agreed upon will be included in a cost benefit analysis of alternatives for implementing projects.

10. Runoff and drainage management

The quantities of runoff in Israel comprise several hundred mcm/year on an annual average. This is a very significant quantity on an Israeli scale. The domain of runoff and drainage suffers from administrative and professional deficiencies, which negatively impact the economy and society through the loss of high quality water, and other significant benefits. Management of runoff and drainage water is currently mainly led by the Ministry of Agriculture. In administrative terms, this area falls between a number of government ministries, drainage authorities and local authorities. The boundaries of responsibility and authority are not clear, and guidelines and agreements are needed with regard to methods of funding this crucial resource.

In professional terms, for years runoff and its administration were treated as “harmful water” (as defined in the 1957 Drainage Law). Only in the past 10-15 years has there been recognition that runoff is also a resource rather than a nuisance which causes flooding damage in urban areas and harms the fertility of agricultural land. This new approach highlights the many potential benefits offered by runoff for people and nature. It emphasizes the need for managing runoff in the framework of drainage basins, and reflects maximum consideration for local natural and human conditions.

Main Policy Points

- Runoff will be used as potential supplementary water resources, for the purpose of direct utilization for irrigation and for enriching the quantity and quality of groundwater, particularly of the coastal aquifer.
- Managing runoff and drainage water will be oriented towards prevention and limitation of floodwater damage in natural spaces and in urban spaces. It will also involve achieving other objectives through retention, storage, recharge to groundwater and slowing the flow in the upper part of large and small watersheds. This will be accomplished at locations that are as high as possible within the watershed, All of these objectives will be achieved with maximum efficiency, through the use of natural features and suitable facilities.
- Runoff will be used for the preservation and rehabilitation of streams and wet habitats, including their ecosystems and biological diversity, and for the benefit of local residents.
- Runoff management will be oriented toward preserving and nurturing land fertility.
- Management of runoff in the urban domain will be used to enhance its contribution to the quality of life – to cultivate urban nature, to contribute to the health of the residents and for involving the civil society.
- Efforts should be made to integrate basin runoff management and urban runoff management.

Main Recommendations for Implementation

- The subject of runoff and drainage management should be organized from a structural point of view. Discussion will continue, on a government and interministerial level regarding administrative-institutional regulation. This will be guided by considerations of professional effectiveness and of governability and efficiency. The discussion will be guided, but not limited by the government decision from May 2010, to establish a national council and national authority for managing runoff and drainage. This will include possibilities of expanding and deepening the role of the Water Authority Council in this area.
- The organizational structure that is in the process of formation:
 - (1) A national council for managing runoff and drainage water that involve the relevant government ministries, local authorities and other bodies. Alternatively, adding the function of runoff and drainage water management to the Water Authority Council, while expanding it so that it represents the above relevant bodies.
 - (2) A national authority for managing runoff and drainage water which will comprise members of all the relevant professions for managing runoff, and will have the professional ability to recommend policy and implementation tools to the council. The Water Authority will participate in steering and approval of the basin plans.
 - (3) Basin authorities (replacing the current drainage authorities) – are responsible for implementing planning in areas of the basin and for basin management on topics relating to runoff and drainage. Their areas of authority will be expanded, while considering unification of the areas of authority of Runoff and Drainage Water Management Authorities with those of River Authorities (in basins where this has not yet been done).

- The national authority will prepare guidelines for basin master plans, which will be adjusted to the regional plans for land use (including transportation), and will engage in planning and ongoing management of runoff and drainage water. The relevant professionals will be integrated on all levels of planning, including hydrology, drainage, statutory planning, urban planning, landscape architecture, land engineering, etc. Use will be made of best planning practices (BPPs) and best management practices (BMPs).
- Planning and operating the runoff and drainage management systems in urban areas (the channeling systems) will remain the responsibility of the local authorities although, at critical points, they will adhere to the master plans which will be prepared by the basin authorities. A document will be prepared, and approved by the national authority for runoff and drainage water management, in which the demarcation lines and interfaces between the basin authorities and the local authorities in them will be clearly defined. Consideration will be given to transferring responsibility for runoff and drainage water management in urban communities to the water and sewage corporations. This will occur, after the necessary expansion of their areas of authority, reinforcement of their professional personnel and their sources of funding.
- Activities for preserving land fertility should be planned on a basin level, and not only on the level of individual fields, while emphasizing economic considerations and reducing engineering operations.
- Methods should be examined, of involving the private sector in runoff and drainage water management systems on a watershed level and local level, while carefully safeguarding the public interest.
- A plan should be prepared for establishing a stable financial infrastructure for runoff and drainage water management on the level of watersheds and on the levels of urban communities.
- A professional document should be prepared which will provide a basis for the required professional and organizational changes which will include a definition of basic assumptions and the objectives and tools for realizing them. This will be produced in accordance with the expertise accumulated in Israel and in developed countries around the world. The policy will be based on an approach that views runoff as a resource and not just as a nuisance, while paying special attention to urban runoff.
- Guidelines will be issued for including runoff and drainage water considerations in large and small development plans, from the initial stage of spatial planning. This principle will be included in the guidelines issued by every planning committee (district and local) of the Ministries of the Interior, Housing and Transport. These guidelines will primarily be binding on the country's large planning bodies, including the Israel Land Administration and the local authorities.
- The effectiveness and efficiency of capturing floodwater will be re-examined in view of the lessons learned from operating the existing reservoirs (including the ones in the Arava). Consideration will also be given to the possibility of capturing and re-cycling part of the runoff in places near stream outlets to the sea.
- The drainage and water law will be amended and obstacles will be removed that currently prevent application of the new approach of viewing runoff as a resource. Clauses will be

formulated which will enable the creation of the Council and the Authority, as recommended above.

- A plan will be prepared for immediate expansion of training professional personnel in areas of runoff and drainage management. This will occur on all levels and for all the bodies involved in runoff management. The shortage of professional personnel comprises a bottleneck for implementing most of the recommendations.
- Suitable budgets will be designated for increasing the collection and analysis of the required data, for planning and managing runoff and drainage, for applied research in these areas, and for pilot projects. These activities will be monitored and will provide a means for obtaining experience from systematic studies.
- The Water Authority should increase its participation and involvement in the management of professional bodies, and in determining the professional and management requirements. The professional Water Authority guidelines should be incorporated in the structure that is being formed in the area of runoff and drainage management, with the emphasis on urban runoff and drainage.

11. Water and energy

Background

The water sector's development plan has implications for the energy sector, primarily due to the introduction of desalination as a major source of freshwater in the long term. Like most of the national issues included in the LTN_MP (agriculture, nature and landscape), most of the energy aspects are not under the direct responsibility of the Water Authority. The main impact of the water sector on the energy sector, and its financial and environmental implications, is embodied in the ability to enhance efficiency of consumption and supply systems, which are addressed in other chapters of this document. As such, the policy proposal addresses the interfaces between water and energy, and to what degree the water sector development plan should incorporate a desirable format of consumption of energy and its sources.

Main Policy Points

- Increasing coordination of infrastructure development, and coordination of needs between the water sector and the energy sector.
- Partial development of independent sources of energy supply. This refers in particular to the major electricity consumers in the water sector; seawater desalination plants and main pumping stations. This will include considering external costs and preparations for scenarios in which electricity tariffs rise significantly.
- Preference for environmentally friendly solutions in cases of use of independent sources of energy, subject to financial considerations. Increasing the emphasis on the environmental criteria while considering plans for the water sector and selecting concessionaires from the private sector, giving preference in weighting the alternatives to plans with a smaller ecological footprint.

- Advancing research and development for efficient and environmentally friendly use of energy in water and sewage infrastructures, contribution to research grants and furthering the establishment of demonstration facilities.
- Pumped storage and hydroelectric energy – will be promoted through “the market forces”.
- Allowing water and sewage corporations to engage in the field of energy supply with facilities that generate energy production at sewage treatment plants. Activities will be promoted that encourage energy savings and enhanced energy utilization.

Main Recommendations for Implementation

- Enhance coordination between the water sector and the energy sector in all areas that relate to planning and operational requirements (preferably by involving the parties in suitable professional forums).
- Prepare a total master plan for supplying energy to the water sector in the long term, while incorporating considerations of reliability, cost and the environment. The facilities and systems with strategic importance for ensuring supply reliability will be identified, and consideration will be given to minimizing dependence on the national electricity system. In addition, steps to energy savings will be taken at all segments of the water sector.
- Action within the framework of the Ministry of Water and Energy and the Israel Electric Corporation (IEC), to achieve arrangements that are uniquely tailored to the water sector, for reducing energy demands.
- Preparing a guideline document for planning water facilities and systems for optimization of all capital and energy costs, with reference to the mutual impact of storage reservoirs and time and load-related tariffs, and other aspects of efficient use of pumping equipment, etc.
- Action to adapt the water and sewage corporations' law, to allow activity in areas of energy and its sources for corporations, including creating surplus electricity.
- Examination of the possible influences of finding reservoirs of natural gas on the water sector's energy policy. The natural gas resources are expected to reduce the water tariffs and environmental pollution.

Recognition of costs incurred by the water and sewage corporations in achieving energy savings, within the framework of water supply operations.

j. Main elements of the Water Authority Development Plan

1. General

, A process of consolidating and mapping the projects in the water sector development plan was undertaken (project inventory), and divided into different timeframes that focus on the coming five year plan (2012-2016). This is an integral part of the LTN_MP. It also provides greater understanding of the significances of implementing the policy.

After the LTN_MP's policy stage has been approved, the Implementation Plan stage will begin. In the Implementation Phase, the projects will be reviewed more thoroughly, based on a methodology that will include cost benefit analyses and the impact of the projects on the water tariffs. If at the implementation stage it will become apparent that there are projects which have an exceptionally large impact on the tariffs, the matter will be submitted for discussion by the Water Authority Council with regard to their application, prioritization and funding. The development plan is summarized in a separate document, which will be discussed later by the Water Authority Council.

2. Mapping the development plans

Mapping the development plans and estimating their cost serve four main objectives:

- Understanding the meaning of the investments for implementing the LTN-MP Policy. Mapping the potential investments in the water sector will be broken down according to the different areas of activity over the implementation period, the entrepreneur that is running each project, and the time series of the additions of water supplements..
- Guaranteeing resources and funding sources for achieving the goals of future investment requirements in the water and sewage sector.
- Assistance with identifying constraints to developing the water sector, and devising mechanisms for their removal.
- A database and framework for formulating plans: annual, five year and ten-year, for immediate, short and medium timeframes, respectively. In this context all projects in the water sector should be implemented according to their order of priority.

Table 2: Summary of the Development Framework for the Water Sector

Time	Required investment for the period (in NIS b.)	Total artificial freshwater production (mcm/year)*	Total treated wastewater reclamation (mcm/year)
By the end of 2011		341	428
Supplement as part of the coming five year (2012-2016)period	25	322	110
Total	25	663	538

* Expected annual desalination of seawater and saline.

- ✓ Total investment in the framework of the coming five year period (2012-2016) is estimated at approximately NIS 25 billion, subject to approval of the plan by the Water Authority Council. The investments may change according to the basic assumptions.
- ✓ The requisite mean annual investment level is about NIS 5 billion per year.
- ✓ Investment by Mekorot Ltd. accounts for approximately 22% (NIS 1.1 billion per year), of the total investment required for the coming five year period.

Table 3 – Main Projects for Implementation in the Different Fields with Different Timescales

Field of Activity in the Water Sector	Main Projects in the Current Five Year Period	Medium and Long Term Activity
Increasing efficiency of water use	<ul style="list-style-type: none"> • Reducing losses in municipal systems (technology-based activities and replacing old systems as part of investment in water and sewage corporations). • Enhancing efficiency of water usage for irrigating gardens (public and private) and using runoff to improve the urban landscape • Continued implementation of the multi-year plan for treated wastewater reclamation, for agricultural use and for irrigating gardens 	Further work along the existing lines until the possible level of savings is fully achieved (suppressing demand levels)
Seawater desalination	<ul style="list-style-type: none"> • In the current five year period – investment in desalination plants in Sorek and Hadera 	Investment in a desalination plant in the Western Galilee and in additional plant/s for meeting the target set by the government according to its decision.
Water supply and development of the national water conveyance system	<ul style="list-style-type: none"> • Developing the national water conveyance system to accommodate 600 mcm/year of seawater desalination. • Developing main regional water systems: <ul style="list-style-type: none"> ○ A fifth system to Jerusalem ○ Western Galilee Region, Eastern Galilee Region, Southern and Northern Sharon Region ○ Master plan for the Negev ○ Water quality – monitoring natural water sources and supply systems; rehabilitation of contaminated parts of the coastal aquifer 	<ul style="list-style-type: none"> • Developing the national water conveyance system to accommodate 1,750 mcm/year of seawater desalination. • Adapting regional systems • The western water carrier • Master plan for the Arava
Municipal water and sewage corporations	<ul style="list-style-type: none"> • Continued incorporation – about 59 corporations • Renewal and enhancement of water, sewage and drainage systems in the local authorities/corporations. 	Merging corporations (to about 20)
Sewage treatment	<ul style="list-style-type: none"> • Investing in expanding and upgrading sewage treatment plants (with reference to the quality of the treated wastewater as per the Inbar Committee standard). At this stage, focusing on expanding and upgrading existing sewage treatment plants (50-60) in the Sewage Infrastructure Development Administration master plan. 	Completing the activity defined for the short term. Upgrading the sewage treatment plants for quaternary treatment (treatment of 50% of the treated wastewater to potable water quality) to be examined as part of the sewage and reclamation

	<ul style="list-style-type: none"> Connecting sewage producers to the treatment systems, including IDF bases. 	master plan.
Wastewater reclamation and reuse	<p>Plants by Mekorot Ltd:</p> <ul style="list-style-type: none"> Dan Region sewage treatment plant – continued upgrading and expansion of the system Kishon combined plant Treated Wastewater North – utilization of treated wastewater of Carmiel ‘Geulat Hayarkon’ project Plants for processing sewage from the West Bank <p>Principle private sector projects:</p> <ul style="list-style-type: none"> Lower Galilee – Mei LG (plant-based and inter-plant) Menasheh Treated Wastewater (plant-based and inter-plant) Jordan Valley Treated Wastewater Gush Zevulun Treated Wastewater (Asher reservoirs) 	Further utilization of treated wastewater potential
Water quality	<ul style="list-style-type: none"> Rehabilitation of the coastal aquifer – salt removal desalination plants at Lahat and Granot The Kineret saline water aqueduct Upgrading sewage treatment plants to meet Inbar Committee standards (water quality activities) Connecting sewage producers to existing systems (plan to connect army camps) 	<p>Rehabilitation of half of the coastal aquifer (about 125 mcm/year)</p> <ul style="list-style-type: none"> Continued upgrading of sewage treatment plants to meet Inbar Committee standards Quaternary treatment of 50% of the treated wastewater to potable water quality, for agricultural use
Runoff and drainage management	<ul style="list-style-type: none"> Management of the Ayalon Stream and its tributaries, the Sea of Galilee, Jordan River – stream management. Western Galilee – moderating the flow rates of the Gaaton Stream + Yehiam Reservoir Implementing basin plans for all the western basins, including integrating of the existing and planned development areas 	Doubling the scale of required investment as part of the basin master plans to be formulated
Management of streams	<ul style="list-style-type: none"> Increasing the allocation of water for nature (with rehabilitation of the water levels) Adapting the future operating policy to sustainable production/replenishment. 	

3. (Void)

4. Criteria and Indices for Priorities for Developing the Water Sector and Implementation Objectives

This topic will be discussed at length, in great detail at the implementation stage of the plan. On the policy level, one can identify policy guidelines with regards to a number of topics:

The order of priority of projects for developing the water sector will be determined according to the following criteria:

- Supply reliability and ensuring drinking water.
- Achieving financial efficiency.
- Implementing government policy decisions.
- Contributing to implementing the policy decisions of the Water Authority Council, and the aims and objectives of the water sector.
- Connecting desalination plants to the national water conveyance system.
- Completing development of the national water conveyance system, to accommodate 600 mcm/year of desalinated water.
- Advancing projects connected to water security, and preparing for them.
- Fairness and equitable conditions for infrastructures in the periphery, compared to those in the center of the country.
- Further advancement of activity relating to enhancing efficiency of water usage and savings in water usage (consumption management).
- Increasing supply of treated wastewater, while improving its quality.

The following are some of the indices according to which projects in the development plan will be examined and prioritized.

- Cost benefit analyses (including financial viability for the water sector), of engineering and other alternatives (quantitative and/or qualitative).
- Financial practicability: funding limitations, constraints on the ability to change tariffs.
- Professional practicability: speed of the provision of solutions, ability to overcome obstacles, capability of implementing performance factors.
- Providing a solution for emergency needs.
- Providing a solution for planning uncertainty factors.

The following are the principal objectives which must be met by the water sector during the current decade.

- Continued suppression of the rise in consumption, and maintaining the present level of urban per capita consumption (around 90 cu.m. per capita a year).
- Producing water (desalinating seawater and salty water) at a level of 650 mcm a year by 2015.

- Completing deployment for the national system for accommodating desalinated water.
- Rehabilitating the natural reservoirs by raising levels by the end of the decade, to at least 1.5 billion cu.m. above red lines.
- Supply of water to agriculture at a level that allows irrigation of 1,150 mcm a year of all qualities.
- Increasing the quantity of freshwater that is allocated for natural flows (wildlife) to an annual mean of 50 mcm.
- Matching Mekorot Ltd.'s annual performance capacity (estimated at 1.2 billion cu.m. a year in the coming five year period) with the development plan, as approved by the Water Authority Council.
- Increasing the average performance capacity of the water and sewage corporations to 3% of the value of the assets base.
- Advancing projects for removing contaminants from the coastal aquifer in the Dan Region.
- Where possible, all sewage producers will be connected to a treatment facility.
- Upgrading 90% of the treatment plants to the Inbar Committee standard by 2016.
- Incorporation of all the local authorities that are not yet incorporated, by the end of the five year period.
- Reducing the total number of water and sewage corporations to 20 by the end of the decade.
- Completing the organizational structure of the Water Authority and the Water Authority Council by 2013.
- Completing structural reforms in the management of runoff and drainage by 2016.
- Significantly increasing the scope of research and development in the water sector.

All the aforementioned topics will be discussed in detail in the next stage of the LTN-MP implementation.

k. Limitations of Implementation Capacity, Obstacles and Recommendations

1. Limitations of Implementation Capacity and Obstacles

There are numerous obstacles and constraints which limit the capacity to implement the plans in the water sector. **Without addressing each of them in depth and eliminating them, at least partially, the objectives of the water sector cannot be attained.** In some cases, government decisions on the water sector are not backed by an allocation of resources and the removal of obstacles, which are required for implementation. The harmful effects of this on the water sector's capacity for implementation encompasses all areas within the chain of organizational processes that are necessary for achieving and implementing a recommended plan.

Three principal groups of obstacles that limit the water sector's implementation ability were identified (all of them are associated with the problem of governability in the water sector):

- **Management and organizational obstacles**
- **Limitations and obstacles relating to investment budgets and the funding of existing projects**
- **Human resources limitations in the water sector and their implications**

The State Committee of Inquiry (Bein Committee) indicated some of the obstacles with regard to management of the water sector. A report by the governmental Director General for implementing the Bein Committee report recommended reinforcing the organizational structure of the water sector through: extending the Water Authority Council's membership (adding a representative of the Ministry of Health), establishing a public council for the water sector under the Minister of Water and Energy (without authority), separating the role of the Chairman of the Water Authority Council from the role of Director General of the Water Authority, preparing the LTN_MP which will determine the framework for management of the water sector by the Water Authority, incorporating the plan implementation costs in the water tariffs, etc.

The obstacles presented here are only general. Individual discussion of them, and the various alternatives for their removal, will take place later as part of the implementation plan.

a. Management and Organizational Obstacles

- **Planning guidance on the national level:** Long range national planning objectives, on topics such as: peace agreements with the neighbors, development of settlements, the size of the various types of agricultural land, support for the periphery, the environment, the water industry, the size of the population in the future and its distribution, etc. should be determined by the political leadership. In the complex Israeli political reality, it is not easy to achieve a guiding policy that can be agreed upon.
- **Coordinating infrastructures on the national level:** There is statutory regulation of the infrastructures in the National Planning Council within the Ministry of Interior, and areas are designated in accordance with the needs of the economy/specific sectors which submit plans to the National Planning Council. However, there is no body that coordinates the strategic needs of developing the country in the long term, while coordinating national infrastructures within a cohesive overview (water, transport, gas, electricity, fuel, housing, etc.). In view of this, the ability to develop the water sector efficiently is limited. A "planner's forum" was recently established at the Ministry of Water and Energy which will handle this task.
- **The Water Authority's standing, structure and abilities:**
 - **Organization of the Water Authority** – the structure of the Water Authority and its areas of authority should be examined as part of organizational regulations. This will include examination of the regulatory ability, project management, planning, and allocating professional manpower to these tasks.

- **Regulation** – The Water Authority is a body which must regulate thousands of consumers, dozens of water and sewage corporations, hundreds of suppliers of water and sewage services, Mekorot Ltd., and must coordinate activities with dozens of other bodies. The current ability to manage all of this is greatly limited.
- **Water and sewage corporations and supervised bodies** – The water and sewerage corporations carry a significant share of the responsibility of implementing the development plan. Their ability is limited for a range of reasons. The foremost of these are problems relating to the organizational structure of the corporations, organizational abilities, and ability to obtain resources.
- **Limitations on advancing the development plan:**
 - Advancing development plans for water supply plants – The Water Authority is not currently structurally or professionally prepared, and does not have the resources, for implementing projects without Mekorot Ltd. (see below).
 - On areas relating to desalination – Carrying out decisions on constructing new desalination facilities are made by The Inter-Ministerial Committee for Establishing Seawater Desalination Facilities under the Accountant General. Activity with respect to existing desalination facilities is undertaken by the WDA (Water Desalination Authority). The chairman of the WDA is a representative of the Water Authority (Desalination Division manager). In certain areas the Water Authority's ability to advance projects is limited.
 - Reclamation of treated wastewater – The Water Authority does not have independent budgetary sources to advance this area.
 - Increasing efficiency of water usage and water savings – The Water Authority does not possess independent ability to promote investments and information campaigns in the area.
 - In the field of rehabilitation of groundwater, rehabilitation of wells, and removing pollutants, there are currently insufficient resources to advance this area.
- **Ability to choose the implementing body and to manage it** – a basic component of managing the water sector is determining the body which is to be responsible for implementing the development projects. The Water Authority is authorized to decide whether Mekorot Ltd. or another body will carry out a particular project (as part of a tender). If the Water Authority decides that bodies other than Mekorot Ltd. will participate in the development procedures, the Authority does not have the organizational ability, professional knowhow, ability to initiate, project management resources, and suitable human resources.
- **Planning ability** – The core of the activity in the water sector must be based on planning on the various levels. The water Authority does not currently have the personnel and budgets required to plan the national water sector appropriately. This obstacle is connected to all activities in the water sector and, in particular, to the LTN_MP. The Director General's team for implementing the Bein Committee recommendations illustrated this by, among other things, noting the need to designate budgets for

planning within the framework of the water tariffs. Care should be taken to ensure that this is implemented.

- **Ability to manage the budget for the Water Authority activity** – As a government unit the Water Authority does not have the ability to operate independently or determine orders of priority among the budget clauses, within the general budget designated to it, without approval. Efforts should be made to reduce the number of budget regulations within the Water Authority budget.
- **Complex planning processes** – (Administered by the Ministry of Interior as part of the National Planning and Construction Council and regional planning committees) Planning processes are complex and protracted and required large resources of personnel. The transition to working in accordance with the Planning and Construction Law, rather than the Water Law, requires enormous resources for preparing professional opinions, handling objections and taking part in meetings/discussions of the regional committees of the Ministry of Interior. According to the Water Law the procedure is generally shorter but requires a management mechanism which does not currently exist in the Water Authority.
- **Advancing reclamation projects in the well protection radius region** – Some public health regulations (Ministry of Health) relating to water that undergoes desalination were recently moderated. However, this topic constitutes an obstacle to reclaiming treated wastewater for use instead of potable, particularly in agriculture, as the volume of desalinated water that is allocated to these areas is relatively small.
- **Dumping of concentrate into the sea** – There are few outlets to the sea and it is difficult to obtain permits from the Sea and Beaches Division of the Ministry of Environmental Protection, to discharge concentrate into the sea via other outlets. The outlet approval process, as part of National Plan 34, is complex and lengthy. As a result, dozens of well rehabilitation projects are not being advanced, and rehabilitation work on the natural water sources also suffers.

b. Limitations and Obstacles Relating to Investment Budgets and Funding Existing Projects:

- **Competition with other budgets:** The investments in the development plan are supposed to be incorporated into the water tariffs, but there are projects which are low in the order of priorities that serve to realize national objectives. Projects that are not funded within the framework of the tariffs compete for government budgets (grants, loans, guarantees) with other government expenses.
- **Lack of an ability to guarantee a sustainable budget:** Certain budgets are only provided when a crisis occurs instead of on a fixed basis based on the principle of sustainable development. For example: renovation of wastewater treatment plants or water saving projects need regular investment, and not only at times of crisis. Mechanisms which regulate this within the framework of water tariffs can solve this problem.
- **An ability to update water costs agreements:** The Water Authority is bound by the principle that costs are to be incorporated into the water tariffs, but sometimes it is not possible to include development costs, as some of the water prices are blocked by agreements, regulations and norms that are not within the control of the water sector. For

example, the water agreement with the farmers, decisions by outside committees on the water tariffs/levies.

- **Transition from State budgeting to funding by water tariffs:** A transition from assigning all the water system costs to the tariffs seemingly offers the ability to budget projects in the long term, but there is an investment/capital raising problem in the short term.
- **The implementation ability limitation of Mekorot Ltd.:** Implementation ability is dependent on the company's ability to raise resources, and its financial rating. Mekorot Ltd. claims that it does not currently realize its implementation ability, in order not to damage its financial rating. There is a complementary relationship between a relatively low water tariff (which leads to Mekorot's high debt rating) and the timely implementation of development projects. Deferring implementation of the projects, due to argument of a high financial rating, is damaging and threatens supply reliability.
- **Minimizing risks by private bodies:** Private bodies raise capital at a higher cost, without State guarantees, and generally do not take financial risks, compared with funding projects that are implemented by the State.

c. Human Resources Limitations in the Water Sector and their Implications

In addition to the requisite structural regulation, one of the most pressing problems in the Israeli national water sector, in most areas of the profession, is the shortage of sufficient human resources with appropriate professional standing. There are areas in which Israel has lost most of its professional capability, due to experts retiring, without leaving a suitable professional and knowhow management infrastructure. In some of the growing areas in the water sector, there were insufficient numbers of experts to begin with. All the governmental bodies connected to the national water sector and planning and regulation lack human resources. Few trained water professionals, and even those who complete their studies do not easily find their place in the water sector, primarily due to poor remuneration and the limited planning market. This has immediate impact on the quality of planning, quality of implementation of infrastructure systems and system maintenance. The main reasons for the human resources problem include:

- **Difficulties with preserving knowhow and continuity:** The field of water involves professional experience gained over many years by professionals in a wide range of topics. There is difficulty with integrating and training young manpower.
- **Lack of attractiveness** of the field of water to professionals: there is no financial incentive and governmental salaries are low.
- **Loss of planning expertise:** TAHAL Ltd. was privatized in the early 1990s and it retained all the professional expertise it accumulated. Only a few planners stayed with the Water Authority, compared with hundreds who worked in areas of the Israeli water sector in the past. The vacuum was only very partially filled by the Planning Division (which mostly works on an outsourcing basis) and planning orders by Mekorot Ltd. (which is supposed to be an implementing body only). Professionals retire without a process of continuity and preservation of knowhow.

- **Limited planning market:** The professional level of the national planning is determined by the amount of resources allocated for it. Only few planning companies can survive on the planning budgets designated for the Israeli national water sector.
- **Excessive centralization in the planning market:** TAHAL, which at the time was the government planning arm, retained control over much of the planning market, at all levels, and leads by some distance over any other planning office. As a result, and based on some of the company's advantages, competition, expansion of the knowhow base and opening and refreshing the planning market, all suffer.

Due to a structural problem in the water sector, and in some of the units, there is a shortage of professional personnel. The Water Authority, which is responsible for managing and regulating the water sector, is limited in its ability to carry out the tasks for which it is responsible, including:

- Central staff work for the Water Authority Council.
- Regulation activities – Monitoring professional and financial activity in the supervised bodies.
- Initiating, planning and issuing tenders in a wide range of professional areas efficiently and within a defined timeframe.
- Examining professional plans and closely monitoring their implementation.
- Coordinating planning with other government ministries and private entrepreneurs.

The difficulty is the result of several factors, including:

- Difficulty with achieving an agreed structure for regulating the water sector.
- Great dependence on outsourcing (the knowhow does not remain within the Authority's control).
- Inability to preserve and manage organizational knowhow.
- Lack of means and resources for recruiting and training professionals.
- Lack of resource allocation for developing professional knowhow within the organization.
- Lack of resources for investing in the development of the future generation for the water sector (support through scholarships, participation in research work, scientific publication and initiating research work, maintaining links with professional bodies around the world).
- Lack of attention to coordination and inculcation of topics relating to R&D, in industry and academic spheres.

2. Recommendations for Implementation and Removal of Obstacles

Areas to be Addressed	Recommendations for Implementation
Defining national policy for development of the water sector, in conjunction with all	<ul style="list-style-type: none"> • The water sector will serve as a supportive factor in realizing Israel's national goals (development and settlement, industry, agriculture, nature and landscape, regional agreements, etc.) • The Water Authority Council will guide the development goals for which preparations are to be made as part of the development of

national infrastructures	<p>the water sector. It will also guide the procedures for realizing national goals, for the purpose of implementing the Government policy and its guidelines and resolutions.</p> <ul style="list-style-type: none"> • In addition, it is suggested that a committee for coordinating national infrastructures (water, gas, transport, fuel, etc.) be established for the purpose of achieving more efficient development of the national water sector, which will include coordination between all of the bodies responsible for supervision and development of infrastructures, within the boundaries of their authority.
Regulation of statutory topics	<ul style="list-style-type: none"> • Implementation of the team report for the removal of statutory obstacles in the water sector, including recommendations for the Water Authority, Ministry of Interior, Israel Land Administration and others, to moderate the processes involved in approving plans, and their implementation, by updating the Water Law, updates to National Plan 34/B/5, land use regulation, etc. • Approval of additional outlets for brine to the sea, and alleviating the process of obtaining approval for flow permits. • The manner in which well protection radii are determined, and the body authorized to determine them, should be examined. It is suggested that they should be determined on the basis of land use by the Water Authority, in conjunction with the Ministry of Health. • Looking into possibilities for limiting the amount of land use for desalination facilities, and fully utilizing land allocation along the coast. At the same time, consideration should be given to advancing the construction of desalination plants via floating platforms or artificial islands in the sea.
Organization of the Water Authority and management of human resources in the water sector	<ul style="list-style-type: none"> • Preparation of a long term organizational strategic plan by the Water Authority will determine the Authority's objectives and organizational vision, in order to realize all its objectives, including realization of the master plan for the national water sector. Before the Authority's plan is realized, preparation should be made to implement the master plan for the water sector within the existing constraints. • The Water Authority is responsible for organizing the structure and resources, and internal organizational processes, to administer the fields under its responsibility, based on the current needs and the LTN-MP. • Based on the Government decision from October 24, 2010, it is suggested that the costs of preparing and implementing the LTN-MP and the development plan should be incorporated into the water tariffs. • As part of a structural change, the requisite resources should be

	<p>earmarked for strengthening and adapting the professional human resources of the water sector sufficiently to meet the challenges resulting from the recommendations in this document. A national plan will be formulated in coordination with the training institutions for assessing the scale of the personnel shortage in the various fields, and for training them.</p> <ul style="list-style-type: none"> • Preparation of a professional knowhow development plan, and its retention by the Water Authority, on the organizational level and on the individual level.
Planning ability and regulation of the planning market	<ul style="list-style-type: none"> • Strengthening the general planning and strategic planning capability in the Water Authority. • Establishing a committee for devising recommendations for expanding the market of planning companies in the national water sector. • Examining the need to increase the professional human resources available to the water sector, including by means of raising fees paid to planners and other professionals in the water sector based on criteria to be set, in accordance with the Water Authority's professional needs.
Ability to advance projects	<ul style="list-style-type: none"> • Dedicated committees should be set up to address each of the groups of obstacles that were mapped herein. • Incorporation of incentives in the regulation rules for implementing projects on time with Mekorot Ltd., and other parties. • Developing abilities in the Water Authority and allocating resources for delegating tasks to various contractors, to implement projects in the water sector, with appropriate control. • Consideration should be given to transferring the WDA's management responsibility to the Water Authority, while maintaining the current membership of the committee, and allocating suitable positions and resources for its management. An increase is needed in the number of Water Authority representatives in the Inter-Ministerial Committee on establishing desalination plants. • Appointment of project managers in the Water Authority, for plans with special importance, whose job it is to initiate the project, remove obstacles and advance execution.
Sustainable development budget	<ul style="list-style-type: none"> • Formulating funding mechanisms so that they enable development stability along a time axis (this will include examination of budgetary frameworks for capital renewal, and a dedicated multi-year budget for developing the water sector in certain areas). Allocating a multi-year budget for the water sector,

	for realizing projects in the various fields.
Investment in research and development	<ul style="list-style-type: none"> Determining the scale of required investments in the field, via the Water Authority Council, based on analysis of the connection between investment in R&D and the savings ability in all areas of activity.

I. Summary of activity to date, and outline of the way forward

It should be noted that this document is viewed as part of a process which is due to proceed continuously over the years. The report is a policy document which contains a summary of the issues and topics which have already been formulated and are sufficiently well defined to submit them to the Water Authority Council, and to present them to the Minister of Water and Energy and to the Government, after being exposed to a wide range of experts and stake holders. The products of the current paper constitute the realization of the initial phase of the LTN-MP only – **formulation of the policy document**. The current state of the water sector is highly problematic and, in fact, the water sector is currently operating under an emergency plan. After drafting the vision, objectives and policy within this framework, to indicate the desired target status, it will be necessary to present and analyze the manner of the transition from the current situation to the desired situation. This stage will be undertaken within the framework of the **implementation plan** in which the outline will be indicated along the time axis and will include a presentation of quantitative and qualitative objectives to be realized in the water sector. The full LTN-MP defines policies, guides operation, and creates an infrastructure for implementation. The plan will be implemented when there is an adequate infrastructure for it, and this is the primary aim of the next stage.

1. What was achieved and agreed in the current summary policy document (this document):

- The vision of the water sector was analyzed and processed, the objectives of the water sector were defined and the main principles of the policy and recommendations for implementation were detailed.
- The water sector data were analyzed and processed, as were the basic assumptions of planning and application of the water policy by means of a forecast of the water balance for the coming decades which presents a “business as usual” scenario (the basic scenario). In addition, analysis was performed of the impact of uncertainty on policy variables and the variables which determine the growing discrepancy over time between demand and supply of natural water, a gap which needs to be closed through on the one hand, intelligent management of consumption and also through production of water (desalination).
- Mapping was performed of the issues that together, constitute the policy topics of the water sector. The issues which were denoted as being “core” underwent detailed processing. Initial work was carried out on others (which are no less important). However, this work is not described in detail in this report.

- During the course of processing the core issues, all their elements were mapped. Policy alternatives which cover a range of apparently reasonable decisions were identified for each component, a preferred/recommended policy alternative was identified on the basis of various arguments and indexes, and recommendations were drawn for the actions and/or decisions required for acceptance and implementation, in order to realize the vision, and the policy and all its issues.
- Initial coordination and integration were performed between all the components and recommendations for implementation.
- The work was carried with broad public transparency. Numerous discussions were held with working groups and wide forums of specialists and interested parties, and with various government ministries. The summaries and policy papers were published on the Water Authority's web site, and these documents constituted an important element in formulating the alternatives, components and recommendations.
- Within the framework of the plan, discussions were held with the Authority management and with the Subcommittee of the Water Authority Council for LTN-MP steering. Some were attended by the Minister of Water and Energy, and the guidelines were taken into consideration in devising the documents.
- The recommendations for implementation in the various issues created the outline for a table of work and actions (which are not included in this document, see section 2 below) which are necessary for converting the policy into an implementation plan.
- The framework of the water sector's development plan was processed – The projects are to be implemented with different timeframes, total investments and quantities of water along the time axis. The development plan data was analyzed according to the funding source, areas of activity, etc. The expected water tariffs were calculated accordingly, based on this development plan and the amount of funding required from the State budget.
- Obstacles to implementation of the development plan in the water sector were identified and initial recommendations for their removal, or coping with them, were devised.

What was performed in the work on the LTN-MP and is not described in detail in this document:

- **Policy:** Previous master plans were reviewed with a view to learning from them, and drawing conclusions from them. A number of discussions were held on important political issues which have not been fully explored/publicized at this stage (for example: a policy document was drafted on political arrangements, the institutional structure and financial regulation – tariffs). Tools for decision making and scenario analysis were developed and advanced. A report was drafted which provides in-depth details of the methods of uncertainty analysis, the essence of which appears in this report (published on the Water Authority web site). A survey for mapping the professional manpower requirements of the Water Authority, and the existing and developing shortages, has been initiated.
- **Planning plan** – A draft of the operational plan for professional tasks and planning work was prepared. This is mainly based on recommendations determined at the policy making stage for the various issues. This is a work plan for tasks which include a table of

approximately 250 planning tasks and professional operations which need to be carried out in order to advance the policies into an execution plan. This plan includes mapping a large number of planning tasks that required for the activities of the coming years. For example: a master plan for developing the national system, a master plan for sewage and treated wastewater, project prioritization, a master plan for nature and landscape, a master plan for management of surface runoff, etc.

The plan also includes mapping management and organizational operations, such as: establishing interministerial and internal committees for managing defined areas, changes in the laws and regulations. These tasks and operations will comprise the link between the policy level and actual execution of the development plan alongside the routine management operations. The operations and work were priced based on an initial estimate (which seems to be underestimated) of planning budget of around NIS 13 million in each of the coming five years, in order to prepare the implementation plan derived from the initial stage of the LTN-MP, and comprises a complementary stage of the policy document. Later, additional budgets will be required on a similar scale, in order to provide a solution for the updated planning requirements. **Non-allocation of the resources for the planning work will delay the Water Authority recommendations with regard to the development needs, while inflicting certain damage on the efficiency of the management of the water sector.**

- **Development plan** – A detailed five year plan was prepared for 2012-2016. The plan is detailed in an auxiliary report to this document which presents an analysis of the development plan of the water sector in greater detail, with regard to the current document, focusing on the five year period of 2012-2016. In this context, the investment costs for the projects and the project data were updated. Data was collected and analyzed for all the development plans (including long range initiatives) of the water sector, in the chapter on the topic. In addition, basic maps of the water sector development plan were devised.

2. Setting out further work on the LTN-MP:

The implementation stage will be carried out over several years, as a continuous and ongoing process. It will act as the basis for proposals and requirements from government and organizational aspects. It will also act in terms of providing a professional infrastructure for decisions in the water sector which relate to planning and the development policy, and to decision making in other fields of activity. To this end, **organizational integration is needed by means of structural compatibility between the Water Authority's departments and the introduction of work processes for implementation of the LTN-MP.**

The LTN-MP will progress, simultaneously, on three fronts. The principal operations for each activity are:

- **Policy update**
 - Completing analysis of issues on the policy level (as has been the case to date) – completing analysis and processing of issues that have not yet been addressed.

- Completing the integration process – examining compatibility and coordination between the recommendations of the various issues and elements, in order to ensure internal consistency of all the policy parts.
 - Setting as precise and quantitative goals as possible, for achieving the objectives of the water sector.
 - Developing a set of indexes for assessing the realization of the goals and objectives of the water sector.
- **The implementation plan, the planning plan**
 - Completing the planning infrastructure and the organization for managing the water sector. Activating and managing a set of the planning tasks based on the work plan derived from the policy document.
 - Formulating regional master plans based on the LTN_MP, on a national level, and implementing them on the regional level.
 - Executing major planned projects, including: a master plan for developing the national water system, a master plan for developing the sewage and treated wastewater system, a master plan for nature and landscape, a system of indexes for realizing the water sector goals, regional master plans for select regions: Dan region, Arava and Western Galilee.
 - Developing a set of data and necessary tools as an infrastructure and as a basis for decision making in the water sector.
 - **The implementation plan, the development plan**
 - Periodic updating of the development plan and preparing development plans for different time scales.
 - Project prioritization, etc. according to the periodically updated needs of the water sector.
 - Detailed development plans based on a cost benefit analysis of each project, analysis of the effect on the tariffs, determining the financing source and the executing body.
 - Identifying and removing obstacles.