Summary Translations from Hebrew of the Following Items (1991)

1) Israeli Comproller-General's Report on the Condition and Management of Water (November 1990)

2) Response to the C-G's R eport By Water Commissioner Tzemah Ishai 4/91

3) Water Expert Mati Hagai's Views onWater Management (From M.A. Thesis)

4) Water Expert M. Harris on Formulation of Isr. Water Policy (From M.A. Thesis)

5)Ministry of Agriculture, Plan for Agricultural Development to the Year 2000

6) Interview With Water Commission Spokesperson Sima Hetzroni 8/20/91

7) Interview With Water Commissioner Prof. Dan Zaslavsky 8/22/91

8) Interviw With Prof. Raphael BAr-El, Dir., Dev'mnt Study Center, 8/17/91

9) Interview With Prof. Shlomo Aronson, Expert on Isr. Elite, 8/26/91

10) Interview With Tzemah Ishai, Former Water Commmisioner, 8/25/91

11) Interviw With Dr. Moshe Schwartz, Expert on Moshav Mvt.,9/1/91

I. Comptroller's Report (Summary)

Starting in the mid-1960's, there has been a decrease in the water resources in Israel. Today, in November 1990, 1.6 billion CM are missing from the Coastal and Mountain aquifers and Lake Kinnereth. At the end of 1990, there is no operational reserve in Lake Kinnereth and the Mountain aquifer, and in the Coastal aquifer there is a deficit. The proximity to the "red lines" is endangering the water supply of Israel and can lead to the degradation of the aquifers.

The major reason for this situation is the low cost of water for agricultural use. The cost of agricultural water covers only a fraction of the real cost. Because of the low price, an excessive demand for water was created, and this in turn, lead to growing of many water agricultural products that are not suitable for Israel.

The decision to pump from the various sources was based on the estimates of **potentials**, without considering the fact that some of these potentials were not realized yet. The **actual** amount of water in the past ten years was on the average smaller by 200 MCM than the potential. It should be emphasized that from an economic standpoint, it is doubtful whether the country should invest to develop all the potential recourse.

The Coastal aquifer has for the past 25 years been operated in a way that endangers its future. In November 1990, the aquifer lacked 1.1 BCM Although in 1987-89 there was an decrease in pumping of the aquifer and the level went up by 0.8 m to 1.2 m above sea level, this is not adequate enough to create the level of 3-4 meters, so that the operational reserve would be restored.

In addition, the aquifer suffers from a more complex problem, that is amount of chlorides has gone up in the past 25 years from 100 mg/l to 155 mg/l. The level of nitrates went up from 25 mg/l to 50 mg/l.

In the Mountain aquifer there was a deficit of 300-350 MCM in 1990. In April 1990 the Water Commission asked Mekorot to overpump the aquifer below the "red lines".

The level of Lake Kinnereth has reached an unprecedented low; only a few centimeters from the "red line" of 213.00 meters and there is no operational potential left.

Between 1987 and 1989 the Water Commissioner, based on a recommendation from Tahal, decided upon a certain water allocation. In every one of these years, the actual water usage was by 8% to 14% higher than the allocation.

In spite of the difficult water situation, the Water Commission decided in Dec. 1989 to allocate some 1940 MCM in 1990. In doing so, the WC ignored the recommendations of Tahal, the Hydrological service in the Water Commission and Mekorot to cut down water use by 10%.

The allocation of water for domestic use in 1986-89 was 25% lower than the actual usage in this period. This falsification enabled the WC to allocate 75-100 MCM of water more than it was actually possible.

The difference between the actual cost of water and the income received was covered by the state budget. However, only a small fraction of this sum was openly stated as a subsidy. The rest was hidden in two ways: 1) the calculation of the cost of water did not take into account the real cost of capital, 2) cross-subsidies used in the Equalization Fund. This way of calculating the price of water actually goes against the Water Law of 1959.

The Master Plan of 1988 was never discussed in the Water Commission of any other governmental forum. The cabinet did not deal with it, in spite of the fact that it recommended a number of emergency steps to save the water resources of Israel.

The Master Plan predicts that there would be an increase in the amount of domestic allocation from 640 MCM in 1988 to 910 MCM in 2000. As a result, the amount of fresh water for agriculture would go down from 1,200 MCM in 1990 to 740 MCM. The overall amount of water for agriculture (including recycling and brackish) will go down from 1,410 in 1985 to 1,180 in 2000, but in order to hold on to this level, there is a need to invest 90 million dollar annually in developing water resources. At the rate of 30 million dollars in annual investment, the amount of water to agriculture will go down to 980 MCM. These estimates do not include adjustment for the Russian and Ethiopian immigraton.

The Water System in 1990

The overpumping of the water reserves has continued for many years. The year 1979, 1986 and 1990 were particularly difficult, with the year 1990 emerging as the worse ever. This was the first year that the WC had to cut the allocation for agriculture in the middle of the planting season; in March there was a 17% decrease in the North and 7% in the Center. In June there was an across the board cut of 10%. The domestic and industrial cut was 12%.

This situation enforced the main recommendation of the Master Plan that Israel needs a operational reserve in the two main aquifers of 800 MCM; 300 MCM in the Mountain one and 500 MCM in the Coastal one. In Lake Kinnerth there is a need for a 140 MCM operating reserve. According to Tahal this operational reserve is needed to provide a "cushion" in draught years. However, in the past five years, the Mountain aquifer had only 25 MCM of reserve, and the Coastal aquifer had a deficit of 600-800 MCM. In 1990 Lake Kinnereth had a operational reserve of zero, a fact that lead to the reduction of allocation from the Lake.

The last crisis was already predicted at the beginning of the hydrological year 1988-9 (h.y. starts runs from Oc. 1 to Sep.

30). The proper authorities (Mekorot, Tahal and the Hydrological Service) recommended to the WC to cut on the water quotas for the farmers. Based on a number of indicators including the flow in the Dan river which reached the lowest point in 50 years and the meteorological forecast, these authorities warned the WC to decrease the water quotas by 10%.

In spite of these warnings, in December 1989 the WC decided to allocate 1,939 MCM for 1990 which was more than the **available** multi-year water average and 217 MCM more than Tahal recommended. It should be emphasized that the management style of the WC has contributed greatly to the deterioration in the water resources of Israel.

The Main Findings of the Comptroller's Report in 1987

In this report the Comptroller has severely criticized the WC and the Minister of Agriculture (the WC at that time was T.I.)

* The management of the water system since 1970 has severely damaged Israel's water resources. The water reserves were depleted and the quality of water declined.

* For many years the water authorities have allocated more water than the actual **available** quantity; the overpumping in 1986 was some 2 BCM. The overpumping depleted the operational reserve in the aquifers. In particular, the Coastal aquifer was degraded.

* Given the situation, the CR recommended new allocation policies: 1) the annual allocation should not exceed the amount of the average multi-year available; 2) the annual allocation should include a certain amount that is needed to replenish the aquifers.

* The price of water is lower than the cost of production. The government subsidies have lead to overuse and especially to the development of branches that were not feasible from the perspective of the national economy.

* In 1990 the Office of the Comptroller tried to ascertain whether these recommendations were implemented.

Water Sources in Israel

There are two limiting factors on the amount of water for the various uses in Israel.

1. The amount of available water in the various locations.

2. The cost of producing water, including pumping, storage etc. as well as the ability of the users to pay the cost. The latter is a real impediment; for instance, although the quantity of water available for desalination is theoretically limitless, the cost is so prohibitive that it limits the quantity.

<u>The Water Potential in Israel</u>

Some 2/3 of the average renewable water resources comes from rainfall and is stored in three major storage: the aquifers and Lake Kinnereth. The remaining 1/3 is stored in other aquifers or

flows in springs and rivers. In the past 25 years there have been major changes in the water situation.

1. There has been a drastic decline in the water level in the aquifers: in the Coastal A. it went down from 3- 3.5 meter above sea level in the early 1960's to an average level of 1.2 meter in 1989-90. In the Mountain A. the decline was some 4 meter in the time period between early 1970's and 1990. In the Lake Kinnerth, the level in 1990 was only 212.92 meter below sea level, that is only 8 cm above the "red line".

2. As a result, the Coastal A. lost its operational reserve, and in fact, develped a deficit of 600-800 MCM. In the Mountain A. there is a deficit of 30 MCM. In Lake Kinnerth, it is zero.

3. As a result, the aquifers and especially the Coastal one are in a real danger of degradation.

Water Potential

The total amount of annual rain water is estimated to be in the vicinity of 10 billion CM. Only some 20% of it is reaching the aquifers and surface storage areas; the rest evaporates or flows in rivers to the sea and some is used up by vegetation.

The rain fall is highly variable; with the Galilee being relatively wet and the Negev arid (1,100 mm - 600 mm - 50 mm).

the water potential of a water source : means the maximum amount that can be drawn from the source, based on a multi-year average, without harming the source. The national water potential and the water potential of every source are used to decide on the allocations. In draught years it is possible to draw from the reserves that accumulated in the source (the operational reserve) more and in rainfall years less is being withdrawn leaving the same multi-year potential.

The water potential of every source in Israel was fixed in a Water Commission document of 1979.

Table 1. Water Potential in Israel (Short Range 10-15 years) in MCM (Green Line).

The Office of the Comptroller found that in the past decade only 50% of the potential of the flood and reclaimed effluence water was actually available.

Survey of the Major Water Sources

The Office of the Comptroller has surveyed the changes in these sources in the past 25 years.

The Coastal aquifer: Chart 3 indicates that in most of these years there was overpumping of the aquifer. In 1986-7 the level reached 0 (sea level). Even in rainfall years, there was overpumping and in certain areas like around Hedera and Sharon Plain, this caused the creation of craters in which water was at 2-4 meters below sea level. As a result, saline sea water penetrated parts of the

aquifer. The Master Plan emphasized that there is a need to reach a **minimum** level of 3-4 meters above sea level that is to reach 400 -600 MCM of water (every meter in the aquifer level is equivalent to 200 MCM. In order to stabilize the operational reserve, there is a need to add 203 meters onto the minimum level; that is the level should reach 7-5 meters. In 1989-90 the level stood at 1.2 meters.

Table 2: The Potential of the Aquifers and the Amount of Water Pumped in 1985/86 -1989/90.

In 1990 the overpumping of the Coastal aquifer has started again, because of shortage of water in the two other main sources. In 1990 the pumping from the aquifer reached 320-330 MCM that is overpumping of 80-90 MCM. There was no serious recharge in the aquifer either. As a result, the level in 1990 was the same as in 1988-89. According to some hydrologists from Tahal and the Hydrological Service in the Water Commission, this level may be deceptive. They believe that sea water has sipped into the aquifer and took the place of fresh water, thus keeping the level fairly constant. If this hypothesis is true, the actual damage to the aquifer is much more acute than assumed.
In any case, the saline sea water is progressing at the speed of 20-60 meter annually in various parts of the aquifer especially in places where serious overpumping took place. Some of the saline water was found even beyond the 1.5 km strip from the shoreline that was set as a "red line". The Hydrological Service in the Water Commission argued that, today, there is no fresh water barrier along the coastal line that would prevent further encroachment of saline water. In order to create this barrier, there is a need to raise the level in a 3-5 km strip of the coast. This can be achieved by stopping of all pumping there. It should be emphasized that the network of sampling wells which in the past alerted to the encroachment of sea has been destroyed because of neglect and natural causes. Today there is no effective way of monitoring the saline water intrusion.
The Rehabilitation of the Coastal Aquifer: In 1987 the Water Commission decided to rehabilitate the Coastal aquifer, according to the framework suggested in the Master Plan. The plan was approved by the Steering Committee of the Master Plan which recommended to decrease the pumping to 240 MCM; it was hoped that this level will restore the aquifer by the year 2000. However, the Water Commission did not implement the decision and substantial overpumping above this level exists. Moreover, it has been found that the maximum recharge capacity is 60 MCM a year, however, in order to replenish the aquifer, a double recharge capacity is needed. There are a number of reasons for this situation: 1) there is not enough pumping equipment, 2) there are problems in

the actual process of recharging 3) there are special problems with the water from Lake Kinnereth which during the rainy season has a great number of algae that stop up the equipment 4) coordination problems between the various bodies
As a result, the "double recharge" has been used: water from the Kinnerth is charged to the Mountain aquifer and then it pumped out and charged into the Coastal aquifer. There is a serious question as to the economic cost of the "double recharge method.
The Quality of Water in the Aquifer: The 1987 Tahal and 1990 Hydrological Service (Water Commission) survey indicate the
that there is a decline in the quality of water in the aquifer. The content of chlorides has gone up in the past 30 years from 100 mg/l to 155 mg/l. (index for agricultural use) and the content of nitrite went up from 25 mg/l to 50 mg/l (index for drinking water). The upper limit for drinking water in Israel is 90 mg/l but in U.S and Europe it is 45 mg/l.

The Report found that the rehabilitation of the Coastal aquifer is not adequate and that with the exception of 1987-88 where there was a partial improvement, there has little progress. The level stabilized at 1.2 meter and the qualitity of water is still deteriorating.

The Mountain Aquifer

Today this is the most important multi-year water source in Israel as it supplies potable water to major cities. The maximum storage capacity of the aquifer - the difference between the minimum and maximum levels, where there would be excessive water loss at the Yarkon springs - is 800 MCM. The optimum operational reserve (annual replenishment rate) is 330 MCM, at the end of the summer 300 MCM. Thus the optimum level is 3 meters about the "red lines". According to most experts there are two "red line" levels: 1) in the north 9 above the sea level and in the center 12 above the sea level. The major danger in the Mountain aquifer is that a decline of the level below the "red lines" would bring a rapid contamination by sea water and salty deposits around and at the bottom of the aquifer. Because of the rapid flow in the aquifer, the contamination would spread rapidly.

In November 1990, the aquifer was missing some 300-350 MCM of water, and in spite of this, in April 1990 the WC told Mekorot to pump such quantities of water, that in the central part, the level went down below the "red lines".

The Comptroller regards this decision of the WC as especially damaging. It was undertaken against the advise of local and international experts which were invited by the Ministry of Agriculture. The Committee for Hydrological Adjudication of May 13, 1990 in which there were representatives from the Hydrological Service in the Water Commission, has also decided against breaching the "red lines".

The quality of water in the aquifer: The quality is better than in the Coastal aquifer. In 98% of the water the level of chlorides is below 400 mg/l and in 90% of the water it is lower than 250 mg/l. The nitrate level is not higher than 45 mg/l.

Lake Kinnerth

The lake is a seasonal reservoir, the maximum reserve is 700 MCM. Every meter of the 170 sk represents 170 MCM. The upper limit is 208.9 m, above that there is a danger of runoffs. The minimum level, i.e. "red lines" is 213.0; going below it would undermine the biological-chemical balance. By the end of 1990, the level of Kinnerth sank to just 8 cm above the "red line".

The quality of the water in the Kinnerth has deteriorated steadily in the past 25 years. There has been an increase in nitrates and phosphates and organic pollutants. In the winter the water becomes contaminated by algae.

Reclaimed Sewage

Because of the overpumping, it was decided to invest in wastewater reclamation. The 1979 "Water Potentials" paper estimated this source to produce some 240 MCM (short range 10-15 years). The 1988 Master Plan estimates this source to be 350 MCM by the year 2000 and 450 MCM in 2010. These estimates are based on reclaiming 60% of domestic water use. The estimates may change because of the immigration.

As requirements for domestic and industrial water increases, agriculture is expected to use more reclaimed water. The first year when fresh water was substituted was 1987. Some reclaimed water is also used to recharge the Coastal aquifer.
Table A: Reclaimed Waterwaste Usage and Costs.

Allocation and Use of Water According to Various Categories

According to the Water Law of 1959, all water used in Israel has to be approved by the Water Commissioner. The Law also set priorities: domestic, industrial and agricultural. However, the Comptroller found that in reality it was the agricultural sector that got priority use.

It was found that since the early 1970's Israel water resources were depleted because of the need to address the immediate needs of agriculture. In spite of this fact, it was only in 1986 that the Water Commission undertook some reforms. This followed two years of drought (1983-4; 1985-6) an public pressure. According to the various recommendations, it was However, as Table 5 indicates the Water Commission did not follow these recommendations.
Table 5: Planned and Actual Allocatons.

The decision making for water allocation prior to the water year 1990: Already in August 1989 the WC knew that about the depleted state of aquifers and the meteorological forecast that predicated a paucity of rain in 1989/90. In spite of this he announced a total allocation of 1,939 MCM. In January-March 1990, Tahal and Mekorot recommended to cut the allocation by 270-420 MCM (in case of medium to dry winter).

The Comptroller also found that the Water Commission did not follow the decision to limit domestic water use to 75 CM per capita. Table 6 shows the deviations.

Table 6: Deviations from the domestic allocations.

The Cost of Water Production and the Cost to Consumers.

The water shortage in Israel and the investment of millions of dollars into reclamation projects has been created **artificially**, by charging low prices for agricultural use. The demand for agricultural water is a function of the cost of water as part of overall production cost; the lower the price of water the higher the demand. The increase in water prices would have caused a decline in demand, so that the artificial shortage would have disappeared.

The price of water for agriculture is extremely low 13 c per CM as opposed to the "real" price of 35 c per CM (used as a base for calculating the feasibility of investment in reclamation project. But even this price does not reflect the real cost of producing water because it does not include the cost of capital, interest and depreciation. Actually, the fact that these costs are not included amount to a hidden subsidy.

The difference between the cost which is used as a base for calculations and the price to farmers is covered by a complex web of additional subsidies: 1) the cost of electricity which amount to large share of the water cost as calculated by the Water Commission has been in some years subsidized by the government; 2) the Equalization Fund gives subsidies to those water projects where the cost of production is higher than a certain sum, and imposes a users fee on those projects where the production cost is below this figure. The difference between the users fees and subsidies is made up by the government; 3) domestic users are charged more than the actual cost and the difference is used to subsidize the farmers; 4) the cost of producing water in the summer is 40% higher than in the winter, in 1988 the higher charge for the summer months was abolished, creating in effect an additional subsidy for farmers who use water more intensively in the summer months.

The Comptroller's Report found that these practices are at the source of the depletion of the water resources in Israel and the creation of artificial shortage. It has been also found that because the cost of capital is not taken into account in the production of water, the Mekorot

company could not establish a fund for investing in physical plant. Mekorot's plant is old and it would cost significant amount of money to replace it.

The Master Plan and Planning of Agriculture

Following the water crisis of 198506, the WC commissioned Tahal in April 1986 to prepare a comprehensive water plan. The WC stipulated the parameters : 1) ways to provide 1,300 MCM for agriculture ; 2) investment of 50 million dollars; 3) and development of those water resources that would yield water of a cost up to 35 cent for CM. Also there is a division in usage: 26% for domestic, 6% for industrial and 68% for agriculture.
Table 7: Current and Projected Uses

According to Table 7 the projections for 2000 indicate a decline of fresh water for agriculture and a dramatic increase in marginal water. There is also a dramatic interest in domestic use. In order to provide water for agriculture in excess of 1,180 MCM there would be an need to invest an average of 90 million dollars. If, on the other hand, the investment would only be 30 millions, as in the past few years, the amount for agriculture would only be 980 MCM by the year 2000. Also, if order to produce more than 1,180 MCM for agriculture by 2000, there would be an need to invest in expensive technology that would exceed the 35 cent cost.

According to the Comptroller's Report, the changes that occurred in the water system since the Master Plan was commissioned cast doubts on the availability of 1,180 MCM for agriculture by 2000. Among them are the immigration to Israel and the paucity of investment that would be needed to absorb this immigration.

The preperation of the Master Plan cost 1.5 million dollars and involved 40 hydrologists, engineers and economists and took two and half year to complete.

In spite of the fact, the Plan has never been debated in the government and the WC has limited the circulation of the Plan. As a result, professionals have a hard time consulting the Plan. In addition, the Water Commission has held only one debate on one issue (the quality of water) and until November 1990, there was no debate in the Water Commission on any of the other issues and recommendations of the Plan.

Planning of Agriculture

The peak of water use for agriculture was reached in 1985/6; the sector received 1,480 MCM. In the subsequent years, the average allocation was 1,436 MCM, but the actual use was only 1,198 MCM. The reasons were: 1986-7 were rainy years, there was a decrease in agricultural production because of international markets, especially cotton which is water intensive.

Since 1986 the planning of agriculture has been based on the assumption that the annual water allocation for agriculture is going to be 1,300 MCM. This assumption violates the Master Plan that predicts only 1,180 MCM, and only if some 90 million a year will be invested until the year 2000. It has been already stated that there is great doubt that this sum can be found, given other needs of the country.

There is also a change in the type of water that agriculture is going to receive. As opposed to mostly fresh water, by the year 2000 the water would be mostly marginal, reclaimed and brackish. The is a need to adjust the planning of agriculture to this fact.

II. The Comments on the Comptroller's Report by the Water Commissioner Tzemah Ishai

April 1991

General Comments

1. The Water Commission has always regarded itself as being in charge of implementing the policies of the Israeli government. In the past few decades, the Israeli government has elevated the settlement of the country to the highest priority and that meant that water for agriculture was also given a high priority. It is within this context that the Water Commission has operated, and it should be emphasized again that this policy was not evolved by the Water Commission, but by the government. It was the Cabinet and the Minister of Agriculture that decided on the most detailed plans for agricultural settlements, including the number of settlement, their location and the number of settlers.

2. The Comptroller's Report did not discuss the problem of investment in the water system. In the past ten years, the investment has decreased very significantly. Because of the lack of funds, only the most urgent water needs were addressed to the detriment of the more long range development projects.

Chart 1: The Development Budget 1981/2 -1900/1

Chart 2: The Total Water Budget 1981/2 -1900/1

3. Even within the budget allocation, the WC had little freedom of action; the Ministry of Finance supervised most of the projects and often threatened to stop payment on some of the planned projects. Some of the examples: Eshtaol 8 drilling to provide water to Jerusalem, desalination plants in Eilat, the third line to Negev, and the fourth pumping unit in the Kinnereth were all delayed by the intervention of the Ministry of Finance.

4. In order to increase its development budget, the WC had to divert money from subsidies and resort to other budgetary manipulation. Because of it, the Ministry of Finance submitted a complain to the Legal Adviser to the Government.

5. In spite of all the limitations, the Water Commission developed a number of projects, among them the Gush Dan reclamation project that can transfer 120 MCM of Tel-Aviv region effluence to the Negev.

Table 3: The Amount of Water (in MCM) that were developed during the past 10 years.

The budgetary delay in completing the Gush Dan project, had caused the loss of some 80-90 MCM annually, during a number of years. This amounts to a direct "contribution" of 300 MCM to the water deficit. In addition, it was possible to produce an additional 30 MCM an year from the Dan project, if there would be more budget available.

Even today, some 200 MCM of water are flowing into the Mediterranean Sea, the Dead Sea, and the Red Sea because there is not enough storage capacity.

Disregard for the Master Plan

1. The WC objects to the Comptroller's finding that he did not disregarded the recommendations of the Master's Plan. This is patently untrue. The WC had commissioned and financed the Plan, and was involved in the process of preparing the Plan. After the Plan was completed, the WC arranged the various topics according to the degree of urgency and created special teams in order to implement the recommendations. One of recommendations, the creation of a National Effluence Authority was submitted to the Knesset in 1989. The WC is also using the Plan to plan the agricultural settlements in various regions of the country.

The Depletion of the Water Reserves of the Country

1. The decision to lower the level of Kinnerth to 213 meter was taken 12 year ago; it was based on the recommendation of experts and was done in order to save great amounts of water that would have ended in the Dead Sea. The country spend large sum of money to prepare the new infrastructure around the Kinnereth in preparation for the gradual decrease of the level. Without this action, the water system would have lost some 40 MCM on average.
2. In the 1950's Tahal had developed a plan for operating the Coastal aquifer. Under this plan, a large "one shot" withdrawal of water from the aquifer was decided upon which also took into consideration that saline water would intrude into the aquifer. This action was undertaken in order to withdraw the operational reserve until the National Carrier was operational. This plan was continued until 1964 when the Carrier became operational. The plan did not treat this as overpumping, but as a one shot pumping of the reserve.

The fact that there was a large deficit in the Coastal aquifer was know to the WC who in 1984 ordered a survey of the aquifer. In 1986 the level of the aquifer was 0.4 above sea level and as a result of the various actions taken by the Water Commission, the level stabilized at 1.2, in spite of two draught years in 1989 and 1990. The Comptroller's Report makes only a

passing mention of this tremendous effort and even emphasizes that the rehabilitation has been stopped last year (which was a third draught year).

It should be emphasized that, if it was not for the three consecutive draught years, the improvement of the aquifer would have been much more pronounced.

3. The fact that the quality of water in the Coastal aquifer has deteriorated should not be attributed to overpupming only. Part of it derived from the fact that the catchment of large amount of water in the center of the country, which would have normally flown into the sea, has increased salinity around the Coastal aquifer.

In addition, the rapid urbanization of the center of the country has interfered with the natural recharge of the aquifer. In addition, there were other causes of contamination, from irrigation water, fertilization etc.

Mountain Aquifer

1. The claim in the Comptroller's Report that the "red lines" in this aquifer were compromised is not true. This claim was make by one of the officials form the Office of the Comptroller, who does not understand the hydrological facts. In reality, the "red lines" in this aquifer are based on +9 in the Menashe drilling near Benyamina, and after three years of draught, the level in this drilling is still +9.
2. It should be also emphasized that Tahal has changed on a number of occasions its findings and recommendations, and as a result, it was difficult to adhere to the various changes.
3. The principle of conserving the water resources of the country has been always dominant in all the activities of the WC. Already in 1983, the WC had issued policy guidelines - based on an advisory panel of foreign experts - how to operate the water system under conditions of scarcity.

During all this years, the WC had worked hard to preserve the splendid water system of Israel.

Compromising the "'Red Lines" in the Water Reservoirs

1. The Comptroller's Report uses the term "red lines" and criticizes the WC for breaching these lines. However, in reality, the "red lines" in Lake Kinnereth were recommended by experts and the level was lowered in a planned way. With regard to the Coastal aquifer, the damage was done during the big immigration in the 1950's and early 1960's and was already described as "planned damage".

The situation today is an outcome of a prolonged draught that is an extraordinary event (one in a hundred years). According to the WC. there are two ways of dealing with extraordinary events:

to keep the "internal ecology" in order, i.e. to adjust the water allocation to the changing conditions or to proceed with the planned water allocations because of the constant nature of our commitment to society and the economic system. According to the WC the latter option is the more proper, since it is impossible to change standing societal and economic needs.
2. The Comptroller's Report argues that Tahal recommended to keep a operational reserve of 140 MCM in the Kinnereth. Such a recommendation means that the "red line" in the lake has to be risen by .80 m above the one that was decided, but the WC was not aware of such a recommendation and there was never a debate to increase the level of the "red line".
3. The Comptroller's Report chose a arbitrary number of years in order to analyze the water system. A more logical one would have been to chose a comparison of levels in autumn of 1979 and autumn of 1990: both were draught years. Even this period was chosen, if would have shown that during the entire decade, the level have increased with the exception of the Jordan valley and Gaza. The comparison between the different levels in the last decade is included in Table 4.

Table 4: Comparison Between the Levels of the Aquifers at Various Locations (between Oct. 1979 and Oct. 1989).

<u>The Allocation of Water Quotas Above the Available Levels</u>

1. The Comptroller's Report used a new term "planned allocation" which has no base in reality. The numbers in the "planned allocation" columns were culled from various working proposals and recommendations of Tahal, but the WC objects to such use, because these "planned allocations" have never been debated or recommended by anyone in the Water Commission or the government. This category was used in order to obscure the fact that the WC has strived very hard to decrease the actual allocations in the past decade. The extent of these reductions is indicated in Table 5.

Table 5: Reduction in Actual Allocations by Category.

2. It should be emphasized that the current WC was the first to start the policy of decreasing the water quotas. For 25 years now, it has been known that there is a need to do this. In 1979 the then WC Meir Ben-Meir recommended to the then Minister of Agriculture Ariel Sharon to decrease the water quotas, but then he was notified by Tahal that it would not be needed because of the rainfalls.

The first time that the water was cut down was in 1986: 160 MCM in agriculture and 40 MCM in domestic use. The decision was debated in the cabinet which empowered the MA to carry it out. It should be emphasized that the decision was reached only a long and detailed debate about the water system in which both the Ministry

of Finance and the Ministry of Agriculture including the WC participated.

In 1987 there was another cut, which the WC recommended. The WC insisited on the cut in spite of the fact that it was a rainy year and the gates of the Degania dam were opened to release some 100 MCM to the Dead Sea. I defended the cuts against the demands of the farmers who wanted to get it back, on the ground that it was a rainy year. My decision was based on the overall welfare of the water system and long -term planning. 2. It should be also emphasized that the WC actually used these reductions for the farmers in order to increase the domestic allocation. The Comptroller's Report states that the WC had shortchanged the domestic sector, so as to please the farmers. Table 6 demonstrated the various allocations by sector.

Table 6: Allocations by Sector

Damages to the Farmers as A Result of Delaying the Decision on Allocation

1. The Comptroller's Report argued that because the WC had not notified the farmers in time about their quotas for 1990, the farmers proceeded to plan the season on the basis of inadequate data. This caused grave financial damages to the farmers.
This finding is totally unfounded. Normally, the farmers are notified in December of every year about their allocations, when the Licensing authority in the Water Commission issues the annual water licenses. The farmers knew in December that there is a good chance for reduction, but asked the WC to delay the allocation decision, on the basis that there would be more rain in January-March. The WC agreed, on the conditions that all the necessary steps for a cut can be made. The WC personally travelled across Israel and discussed the situations with the farmers. The WC is totally surprised by the findings of the Comptroller's Report that the farmers lost because they planned the season on the basis of unreduced allocations. There is no base for such a finding, since the farmers have not complained to the Comptroller. It is well known that the farmers are extremely sensitive to their water needs; every time there is a reduction, they immediately petition the political system and file complaint in the courts. However, there were no protest that year, which indicates that the Report falsely claims to protect the farmers.
2. The Comptroller's Report totally ignores all the other dimension of reduction in water allocation: the decrease in output in the year of the cut, decrease in output in future years, especially in multi-year branches. By concentrating on water only, the Report ignores all the other aspects of national agricultural economy. In order to affect cuts, there is a need to change the entire farming policy of Israel.

The Policy of Substituting Fresh Water with Reclaimed Water in Agriculture

1. The Report decided that the pace of the program is not satisfactory and that the WC has not acted energetically enough. This is not true, on the contrary the WC started the project and also financed the many purification and other marginal water projects. The officials who wrote the Report neglected to learn the subject.

The Cost of Water Production and its Consumer Price

1. The Report tried to provide a picture of the complexities in calculating the real cost of water, emphasizing the economic aspects. However, the cost of water is decided upon based on many different considerations, whereby the economic consideration is not the top priority.
2. Economic considerations only would have mandated farming only in the north of the country, where the cost of water is relatively low. However, because of security and national consideration, the map of the agricultural settlements is very different.
3. The Comptroller's Report argues that the Water Commission ignores the real cost of water production in calculating consumer prices, but it should be emphasized that sect. 112 of the Water Act 1959 stipulates that the price should be calculated on the basis of the ability of the consumers to pay for the water.
4. The Report argues that under pressure to develop more alternative water resources, economic considerations were ignored in many projects. This is simply not true, as every project was scrutinized for economic feasibility.
2. The Report notes that in calculating water costs, the Water Commission ignores the cost of capital and depreciation of plant. This is not entirely correct, since Mekorot, which receives 95 percent of the subsidies, uses a large part of the real costs as a base for its calculations. The company has to pay the interest and index cost for all development loans since 1979.
3. There is a debate among the economists whether to include the cost of depreciation in the investment into infrastructure, or not. There is also a problem in defining the limits of infrastructure investment: according to some experts all costs of infrastructure should not be related to the calculations of water prices, but rather should be put in a category of national infrastructure development that the national rather than water budget should pay for.

The current WC was the first one to ask that investment in water projects should be linked to CPI , so that private investment can be encouraged. This proposition was brought to the Water Council in 1984, but in spite of two years of debates the proposition was not approved because of the opposition by the farmers who were supported by the MA. At the same time, the WC

does not consider the stand of the Report and the Ministry of Finance, which the Report reflects to include the total cost of infrastructure in the calculation of water prices. This is not applicable because of the reality of Israeli agriculture.

It should be emphasized that in most the Western countries, including the United States and Western Europe, farming is heavily subsidized in a variety of ways. In the United States, the state provides and pays for the capital needed for infrastructure to develop water resources. The Israeli agriculture cannot compete with farming in the Western countries that are heavily subsidized by the government. The Israeli government needs to decide whether the Israeli agriculture would be subsidized through water prices, and thus can compete in Western markets, or would operate like agriculture in Third World countries, which is based on human backwardness.

In treating the price of water as if it is only a question of proper economic management, the Report writers reveal their ideological (paradigmatic) preference. (this is a reference to the fact that many in the Ministry of Finance in Israel and the Office of the Comptroller are advocates of free- market principles).

4. In spite of my opinion that Israel should subside the price of water, the Water Commission has labored over the years to decrease the subsidies and increase the efficiency of water use. Table 7 portrays the changes that have occurred in the price of water over the years.

Table 7: Changes in Water Prices and the Process of Approving the Changes

In 1988 there was an agreement between the Water Commission and the Ministry of Finance which linked the increase in the price of water to an increase in the development budgets. This agreement was fully implemented because of reasons beyond the control of Water Commission. In 1989 there was an 54% in the price of electricity, and the MA and the Water Commission in the Knesset did not approve the water rates increases.

Instead, the WC developed a new plan, which was based on a differential rate scale: this plan was to enable the individual farmer to decide how much of his quota he wants to use. The less water he uses, the less the price that he pays. The new scheme brought a reduction in demand for water. In spite of the reductions in allocations and the draught, the has been a steady decline in water use since then. Chart 8 shows that the price of water in dollars has increased in the last decade.

Chart 8: Prices of Water in Dollars

Conclusions

The conclusions of the Report are a reflection of the policy preference of its authors. Some of the findings are not based on facts, and others are based on facts that are not relevant. In other cases the Report did not provide an adequate emphasis to the more general aspects of the water system in Israel. The two dominant perspectives in the Report are too narrow (a reference to the hydrological and economic). The Report is based on various experts, and working papers; the Comptroller is trying to dictate a new policy which is not based on the policy of the government.

It is known that in a complex field like the water system, there is more than one policy option. The Report adopts one school of thought, whether it is in the economic field, the engineering field, or hydrological field. The Report does not analyze the management process, but tries to dictate a policy.

It should be emphasized that the actions that were undertaken by the Water Commission were based on various research and modelling activities, including cost-benefit analyses and monitoring consequences of various policies. Then the policies were recommend to the government, which was the final decision maker. It should be clear that it is the government that decided on how large should the agricultural sector in Israel be.

Even according to the Report, there is enough of water in Israel: only 20% percent of the rainfall water is retained and stored in the various surface and ground reservoirs. More water can be retained if there is more investment in the infrastructure, thus making the amount of water a function of how much is invested. However, the government should decide whether it wants to invest heavily in infrastructure in order to keep the current agricultural sector.

The Water Commission would carry out any decision of the government.

The Appendix List

1. The budget for basic development 1981/2 - 1990/1
2. The budget for subsidies 1981/2 -1990/1
3. The gross investment in developing water resources as a percentage of GNP 1960-1989
4. The investment in water as a percentage of GNP 1960-1989
5. The general plan for the waster system -the steering committee April 8, 1986
6. A proposal for a National Effluence Authority, June 1989
7. A decree approving the level of the Kinnerth , the Water Act 1989
8. Lake Kinnerth - summary of activities for 1986

9a. The lowering of the Kinnerth level to 213 - 6, 7 1979 - 7, 3 1979.

9b. The proceedings from the meeting of the level committee 4, 21-27, 1982

9c. Activities involving the lowering of the level of Kinnerth

10. The encroachment of sea water in the coastal region
11. The recommendations of the Hydrological Service for the operation of the Kinnerth, and the aquifers, May 22. 1990
12. The Five Year Plan for Developing of the Water Resources, July 1, 1986
13. Report of the review group on water resources management in Israel July 8, 1983
14. The Policy of Water Utilization in Israel in 1987/8
15. The Water system : Goals, policy and development, March 23, 1988
16. The "red lines" and their management in 1990, May 5, 1990
17. The Characteristics of the rains in the rainy season 1990/91 until the end of December 1990 Compared to the multi-year trends
18. The Decision # 1657 of the Cabinet Meeting of June 8-11, 1986
19, Estimates for Cutting of Water Rates in the Golan, January 10, 1991
20. A letter from the water management in the Galilee about the impeding water cuts in Upper Galilee, Feb. 15, 1990
21. The Report of the Comptroller on the Management of the Water System in Israel, June 2, 1991
22. An Announcement to the Producers, Suppliers and Consumers of Water -March 1990
23. An Ad in Ha'aretz about the Cuts in Water Quotas, May 9, 1990
24. An Ad in Ma'ariv about a Drastic Decline of Water in the Coastal Aquifer June 17, 1990
25. An Economic Feasibility Analysis of a Number of Water Projects
26. The Policy of Linking Investment in Water Projects to the Index
27. The Cost of Water Supply in Public Water Projects in the United States
28. The Policy of Water Pricing for 1987/8, 1989, and 1990 - as Explained to the Water Council
29. An Agreement Between the Water Commission and the Finance Ministry with Regard to the Cost of Water and the Development of the Water System, December 13, 1988

III. Water Management in Israel: Views on National Planning

Mati Hagai

Introduction

Water in Israel in a strategic resource; in the past water was a precipitating factor in conflicts with the Arab states and they are expected to play the same role in the future, unless ways can be found to avert the shortages. Today, Israel is pumping in the territory of the Green Line a third of its fresh water (500 MCM) from ground water that originates in the West Bank. This dependency on a water resource that is located in a territory that is deeply disputed is worrisome. In addition, the overpumping has created a deficit of some 1.8 billion CM, and the degradation of parts of the ground water reservoirs.

This problems can only be rectified if there is a national water policy. However, there is some doubt whether such policy existed in the past and whether it can be created in the future. This work is based on the premise that, in spite of some steps like the 1988 Master Plan, there is no national water policy in Israel. This work will try to explain why such policy has not evolved, and make some recommendations for the future.

National Planning and Decision Making

There is a substantial body of theoretical and empirical writing about national planning in Israel. The gist of most of this writing is that in Israel there are a number of forces that work to defeat national planning. Yehezkel Dror argued that these forces include the personal background of the elite, the ad hoc nature of the decision making process, the limited professional input into decision making, lack of coordination between the various government departments and **the preference for ideological and social goal as opposed to rational-economic considerations.**

There are also severe problems in what is known as Planning-Programming-Budgeting, the so called PPB. Even when a plan is approved, the budgeting needed for its implementation may not be available. This is a major shortcoming of the system, as in Western countries, planning and budgeting is coordinated.

Because of these various characteristics, the decision process in Israel in general, as well as in matters of water, resembles most closely the Charles Lindbloom's model of "muddling through". Such a model of decision making is based on ad hoc, and random decision making, absence of long term planning, and lack of optimization in budgetary allocations, and the **basic difficulty**

of the decision makers to separate between facts and values. In addition, there is a tendency to make marginal decisions, since this mode enables the policy makers to avoid solving complex or hard problems that would require a great deal of value or administrative changes.

There are additional factors that national planning in Israel difficult: 1) there is a high level of uncertainty built into the system, because of wars and the unsettled question of borders and control over resources, and especially water. 2) there is a high degree of politization of the process of decision making, due to the coalitional nature of the system; 3) there is a general agreement among policy-makers to stick to tactical decisions and operations rather long-term planning and problem solving.

Management of Water Resources as a Case -Study in "Muddling Through"

The water situation in Israel is fairly unique among countries because of three factors: 1) the location of Israel in semi-arid region which limits the water potential to about 1,8 billion MC; 2) the precipitation is limited to about three months and the north and center of the country; 3) overproduction can cause irreversible damage to the resources; 4) the nation-security needs that mandate settlements throughout the state: 5) sharing of water resources with enemy states.

The major problem of the water management in Israel is the lack of balance between the available resource and the use of the resource. This problem is caused because of a lack of national planning that could reduce the imbalance between the supply and demand for water.

<u>The History of Water Management</u>

1) From the early years of the century until 1948. In the early stages of settlement limited water projects including the Jordan Valley water-hydroelectric project.
2) 1948 - late 1960's. This period featured a rapid expansion in water management both at the administrative and operational level, including the creation of the Water Department in the Ministry of Agriculture, the Committee for the Planning of Water Projects, and later Tahal, and the National Water Carrier. In 1959 the Water Act was passed which created the Water Commission. At the end of the 1960's, Israel has reached the end of its natural water potential and there was an increasing need to find new water sources.
3) Early 1970 - to 1990. In this period there was an effort to develop more water resources, especially by developing "marginal", effluence, run-offs and brackish water. There were also corresponding efforts to develop new water saving irrigation techniques, and etc. In spite of all these efforts, the demand had continued to exceed supply.

The Structure of the Water Management System

The Water Act 1959 had defined the structure of the water management system in Israel.
Chart 1: The Structure of the Water Management System

As Chart 1 indicates, there are numerous bodies involved in the water management process, without a clear definition of authority and domains of activity. There is also a tendency for duplicating services and activities which also increases the clash of interest among them.

The Water Legislation in Israel

The water rights in Israel were declared to be national property by the Israeli government, after it was established in 1948. In addition, the government has nationalized all land in Israel.

Since then a great number of laws have been passed in order to manage the water resources.

1) Water Measurement Act -1955
2) Supervision over Drilling Act -1955
3) Drainage and Defence from Floods Act - 1957
4) The Water Act- 1959

The Water Act provides the most comprehensive framework for the management of the water system. 1) the Act sets the priorities: domestic, agriculture, industry, public services; 2) it sets the operation of the water projects; 3) it sets the basis for water usage; 4) it sets the parameters for calculating the price of water; 5) it sets the parameters for organizing the water system.

One of the most important parts of the Act is to ensure the efficiency of the use of water. To ensure this, the Act devised a procedure of consultations between the Minister of Agriculture, the Water Council, a licensing system whereby a consumer has to obtain a license from the Water Commissioner, who can also cancel the license if the consumer does not fulfill the conditions.

The Minister of Agriculture can also declare, in coordination with the Water Council, any region to start rationing water. Any time a region is declared as being a "rationed region" new norms of consumption can be imposed.

<u>Water Projects</u>

The Act defined the water projects as the main tools for implementing the government's water policy. The National Water Carrier is operated by the national water authority, and there are provisions for the creation regional water authorities that are cooperatives which have to be approved by the Minister of Agriculture. The regional water authorities are charged with the building of water projects within their jurisdiction, and their

maintenance. Any plan to build a new water project has to be approved by the Minister of Agriculture.

The Price of Water

One of the major instruments for implementing the water policy of the government is the price of water. There are extremely detailed procedures for setting water prices, which include inputs from the Minister of Agriculture, Finance Minister, the Water Council, and the Water Committee of the Knesset. (overall, the complexity and the rigidity of the system discourages the input of market mechanisms to fixing the price. In addition, the process is so long that the prices do not reflect the often inflationary character of Israeli economy. By the time the price has been approved, the inflation has made it outdated.

Overall, there are two types of prices: those which are charged to the consumers of Mekorot, and those that are charged to the consumers of local authorities. The prices also vary according the geographical region.

The Equalization Fund.

In order to equalize the water prices between the relatively rainy north and center and the arid south, an Equalization Fund was created. The Fund was created in 1962, and it is based on a number of premises: 1) the prices for the three sectors are calculated differently; 2) only 20% of the Fund income can be used for production; 3) there are two types of water projects- projects that pay a surcharge and projects that receive a subsidy. The former are located where the cost of production is below a certain level, and the latter are located where the cost of production are above a certain level.

The difference between the income of the Fund and what it pays out is covered by the government. This subsidy was estimated to by some $50 million in 1988. In calculating the cost of production of water, the factor of capital is effectively limited, which does not allow to calculated the depreciation of on the investment and limits the ceiling on the interest that can be calculated. This type of calculating the cost of producing water, creates a subsidy that amount to some $150 million a year covered by the government. The Fund is also based on the principle that the domestic and industrial sector subsidize the agricultural sector.

The Equalization Fund, which had some logic when it was created has contributed greatly to the gap between the cost and price of water. The consumers of "cheap" water, i. e. the farmer pay only for the current operating cost of producing water without having to pay for the investment in developing the water resources, which are all covered by the government. Because the process of pricing water it so long, the Water Commission has used the Fund as an alternative means for pricing water, as opposed to its original mission of equalizing the water availability between regions.

A further analysis of the water pricing policy in Israel suggests that it is totally inadequate: by the time the new prices are approved the inflation has eroded the increase. The fact that the Minister of Agriculture has used his emergency power to decree prices, also shows that the legal and organizational system is not working.

There are a number of weakness in the legal and organizational framework: 1) there is too much input from the public groups represented in the Water Council; the make-up of the Water Council is based on the level of consumption which gives the farmers an automatic edge; 3) the is a certain amount of ambiguity in the division of functions between the Minister of Agriculture and the Water Commissioner.

Water Rationing

In 1988, the Water Act of 1959 was amended to include a decree that if the hydrological or atmospheric conditions are negative, the Water Commissioner can ration water or change the allocations between the different regions.

Water System- Problems in Resource Management and Uses

The water potential in Israel is equivalent to the volume of the operational potential, that is the volume of water between the upper "red lines" i.e. the level of the aquifer of lake Kinnerth above which there would be a water loss to the sea, or flooding and the lower "red line", where withdrawing below this line would damage the aquifer. The total operational potential of the three main water reservoirs has been estimated to Tahal experts to be 2.3 billion CM: 1.0 billion in the Coastal aquifer, 0.8 billion in the Mountain aquifer and 0.5 billion in Kinnerth. Overall, according to Tahal experts there is a need of a volume of 2.5-3 billion CM in order to be able to operate on a multi-year basis which will include draught years. But the overpumping in the last decade has created a deficit that can be replenished through natural means.

In 1979 the short range potential of water in Israel (10-15 years has been estimated to stand at 2,095 MCM. This includes 241 MCM of reclaimed effluence, 169 MCM of flood waters, and 252 MCM of saline water. However, these alternative resources have not been fully developed because of budgetary and other constrains. However, as Table 1 shows the total amount of the alternative resources were included in the calculations of the annual quotas in the last decade.

Table 1: The Water Allocations and the Share from Natural Sources

According to the Comptroller's Report, there was an average gap of 240 MCM in the years 1977-1985 between the allocation and the actual available amount.

The Consequences of Overpumping

The Coastal aquifer: it is the largest in the system and its average potential is estimated at 240 MCM. The production form this aquifer started at the turn of the century and in 1948 it already reached 250 MCM. In 1955, it stood at 400 MCM and it then peaked at 493 MCM in 1958. In 1964, because of the National Water Carrier, the production went down, but it soon started going up, and by 1984/5 it stood at 470 MCM. Above the aqufier there is a population of some 1,7 million, that is expected to go up to 3 million by the end of the century. Since the 1960 there has been an effort to recharge the aquifer, in the last decade the recharge was some 60 MCM a year, but the level has gone down to the point of danger.

The Mountain aquifer: it has a potential of 360 MCM in the short range and 340 MCM in the long range. Ever since the 1950's there has been an increase in drawing from the aquifer and in the past years it has reached 400 MCM. There was also a recharge: in the 60's the recharge was 65 MCM annually, but more recently only 10 MCM.

Lake Kinnerth: Some 70% of the water of Kinnerth comes from the Jordan River to the north and the rest from small rivers and runoffs on the west and east side. The operational reserve is contained between the upper "red line" of -208.9 m and the lower "red line" of -212.5 m below the sea level which translates into 570 MCM. In 1980 the WC decided to bring down the level of the lower "red line" to -213 m in order to increase the operational reserve to 650 MCM. The average multi-year operational reserve is 515 MCM.

Sea water intrusion

Because of overproduction, there has been a gradual sea water intrusion in the Coastal aquifer, which has been estimated at 20 -70 meters per annum. The water encroached between 500 meters and 3 km. along the coastal line. If the process will continue, it has been estimated that there would be an average intrusion of 2.5 km along the coastal line by the year 2000. This will result in the loss of 594 drillings, that provide 168 MCM that constitute 13.5% of the water supply of the aquifer. In the year 2010, 739 drillings will be lost, that is 203 MCM of water, i.e. 16.3% of the production. That means that the potential for storage in the aquifer will be diminished and there would be a millions of cubes of fresh water.

Water contamination

In addition, there is a steady decline in the quality of the water, that is an increase in the chlorides and nitrates. There are other sources of contamination, and especially the lack of effective treatment of effluence. The waste purification project is under the control of the Interior Ministry and gets minimal attention, thus further contributing to the contamination. In particular, the Arab regions in Israel and the West Bank have no effective purification system and they contaminate both the Coastal and Mountain aquifers. The Comptroller's Report of 1988

speaks of an increase in bacteriological and other contamination. It found that since 1976 more than 21,000 people suffered from mass epidemics related to the contamination. In addition, in 1985 there was an outbreak of dysentery near Haifa, and in 1988 there was another epidemic in the North of the country. Also there was the outbreak of the polio epidemic in Or-Akiba in 1989. In all of these cases the culprit was untreated sewage that seeped into the drinking water supply.

The loss of storage in the aquifers

Because of the overproduction, there is also a problem of loss of storage in the aquifers, especially in the Coastal aquifer. Also, there is doubt whether all of the aquifer can be restored to its previous capacity for storing fresh water. There is a growing assumption in Tahal that there special areas in the aquifer should be designated for storing fresh water. But overall, the loss of storage capacity in the aquifer is so great that new and more expensive sources for fresh water production have to be created in the future. This heavy investment could have been prevented, if the water authorities in Israel acted according to a comprehensive and rational strategy.

The devastation of the aquifer is an outcome of twenty years of overpumping. Even when there is an rainy season, as in 1986/7, it is hard to recharge the aquifers, because there is not enough capacity to pump water from the Kinnereth and transfer it to the aquifers and the actually recharge capability is not high enough to meet the needs.

Water Policy in Israel

In spite of the early successes of Israel in dealing with water shortages and developing a successful agriculture, there was a marked regression in the past twenty years. The major problem was that the water policy in Israel could not cope with the problem of adjusting the supply-demand equation.

The supply-demand equation is a function of a complex set of factors which include ideology, culture and market considerations. These considerations can be best understood when looked at from a historical perspective.

The Initial Stage of Water Policy 1948-and until the Opening of the National Water Carrier 1964

Even before the State of Israel was established, there was a very strong ideological emphasis on the supremacy of agriculture and, as a result, of water in the society. After independence, the state, like in many other countries was deeply involved in water issues. However, unlike in other countries, there was a continuation of the supremacy of the agricultural settlement. Agriculture was seen not only as ideologically superior way to industry and urban settlement, but a quick way to disperse the population and settle remote border areas that were considered primary security risks.

This ideological-security emphasis on agriculture had a major impact on water demands, in the sense that there was little differentiation between the **normally rigid water demand for domestic use and the water for agriculture, which was perceived as almost equally rigid.** At this stage, it was the ideology that dictated the water policy and no plan for agricultural settlement was ever canceled because of the cost of water. This was also the background for the decision to build the National Water Carrier, to transfer the water from the north to the more arid parts of the country. Because there was a national consensus on the Carrier issue, there was a full correspondence between the planning and budgeting stages of the project.

However, after the National Carrier was build, it become evident that the growing demand for water would not be met by the natural available water resources. Already at this stage a gap was created between the demand for water and the capacity of the state to supply it. In order to close the gap, there was a need to change the water policy, but as the next stage will show, this change never came about.

The Water Policy from the National Water Carrier and until 1990

When the gap between the demand and supply became apparent, there was a move to evaluate the real potential of water in Israel. It should be emphasized that in the early 60's, it was estimated that the potential stands at 3 billion CM, then the estimates started going down - 2.5 billion, 2 billion, 1.8 billion and then in 1965 it was finally estimated at 1.5-1.6 billion CM. It were these early erroneous estimates that were used for planning of more agricultural settlements, and there were some who felt that even if mistakes were committed there were for "ideological good".

The growing gap between supply and demand made the confrontation between the ideology and the hydrological and economic reality inevitable. However, **instead of changing the ideology of agricultural supremacy, every afford was made to demonstrate that the ideology and the limited water resources are compatible.**

The first plan was to desalinate water in conjunction with the American government. However, the United States withdrew because of economic considerations.

In the wake of the collapse of desalination plans, there was an effort by the various water authorities to come up with partial solutions to the problem. Since 1965, Tahal prepared a number of plans in order to increase water production, but these were not comprehensive plans, nor did they reflect government thinking on the issue. At the same time, the government decreased drastically its investment in water development. In spite of it, there was an addition of some 200 MCM to the water potential, from effluence and other marginal water projects. Today, most of the effort is centered on purification projects. However, the use of purified

sewage water in agriculture can be problematic. The European markets for Israeli vegetable may not be receptive to this type of irrigation.

Quotas and the Price of Water

The two major tools for setting the demand-supply equation are administrative: the quotas and the price of water. The way in which these two tools were used are responsible for the sorry state of the water resources in Israel, but can be also used to correct the situation.

Allocations for agriculture

There is a basic difference between the quotas for planned settlements (kibbutzim and moshavim) and private farmers. In the former, the allocation is are global. They are based on a set estimate of the demand of one family unit, and then multiplied by the number of units. The set estimates are in turn based on past the previous year quotas. New moshavim or kibbutzim are allocated functional equivalents. Private farmers receive water allocations on the basis of the branches that they cultivate and the ecology of the location.

The planned settlements use 73% of the water for agriculture. The water allocations were based on the recommendations of the committees that were appointed by the government in 1963 (the Horin and Hazani committees). In 1971 the Minister of Agriculture decided to cut these quotas to 70%, but in some settlements the allocation was not reduced and they still receive 100% of the original quota.

In spite of the many changes in all the facets of agricultural production, the Water Commissioner has not used his authority to change them. As a result of using a 28 year old system, there is a lack of balance between the various settlements and worse, the gap between the demand and supply has not been addressed.

The Comptroller's Report reveals that the Department of Allocations and Licensing in the Water Commission has submitted numerous plans and recommendations for change. In one plan submitted to the Water Commissioner in 1986, the Department of Allocations and Licensing suggested that the entire system of allocations should be changed to reflect the long term water balance in Israel, but nothing has been done.

In the privet sector, the allocation is based on what is known as "norms". The "norms" are based on an allocation of water per dunam, and according to the crop and the year in which it was planted. The "norms" were set in 1961 and have not been changed in spite of the tremendous changes in agricultural technology and production techniques.

It should be also mentioned that in the many cases where the moshavim were converted to suburban communities, the is no clear policy with regard to changing the allocation. In some cases, the status of agricultural consumer has been withdrawn, but not in others.

Decision Making on Water Allocations and Pricing

In spite of the information that the Water Commissioner had for many year about the degrading of the aquifers, he did not use his power effectively to cut on water and increase the price. The Comptroller's Report looked at the transcripts of 18 meetings of the Water Council, between 1980-1986 and found that only on two occasions the was a discussion on decrease in allocations. One was in 1980 after the draught in 1979 and the second one in 1986, after the disastrous draught in that period. It was in March of 1986 that the Minister of Agriculture had to use the emergency regulations to declare a reduction. The use of emergency regulation indicate that the Minister of Agriculture could not persuade the Water Council and the agricultural lobby to do it in an orderly way.

As for the pricing policy, it has reflected the old debate in Israel between those who argue that the farmers should not pay the full price of water, especially the cost of the capital for investment and those who think that the price should be increased to reflect the real cost of water production. The former view is expressed by the farmers and their supporter in the various parties. The argument here is that the pattern of settlement reflects the security needs of Israel and thus the farmers should not be asked to pay for investments that benefitted the country as a whole. Also they point out that the farmers save dollar reserves, by producing locally. On the other hand, the Finance Ministry and academic experts argue that prices of water should reflect real costs. They point out that cheap water prices caused the farmer to grow crops that were not suitable to the region. This in turn, prompted the farmers to press the water authorities to allocate more water that was available, and degraded the water resources in Israel.

The major bone of contention between the Finance Ministry and the water authorities is the way in which the cost of water is calculated by Mekorot.

The calculation of water cost: cents/ MC

Elements	Mekorot	Finance
Electricity	8.1 - 57%	8.1 - 27%
Operational Costs	5.4 - 38%	5.4 - 18%
Interest and Appreciation	0.7 - 5%	16.2 - 55%
Total	14.2 100%	29.7 100%

It is quite clear that if the cost of capital is included the cost of water increases substantially. Those who advocate the increase in price to reflect the real cost of water production, point out that the various subsidies have contributed to wasteful water uses

and the resulting water deficit. Although there are undoubtedly some merit to the national and security consideration arguments, it is clear that there is a need for a comprehensive debate about the optimal way of calculating the cost and the price of water.

However, it has been already pointed out that the style of policy making of Israel mandates against such a debate. All along, there have been powerful obstacles to breaking the mold of "muddling through". For instance, the former and perhaps most powerful Minister of Agriculture, Haim Givati who was also pivotal in water issue in the early days of the state, said that he does not believe in long-term planning. More recently, Yeshua Schwartz from Tahal and a leader of the team that produced the Master Plan, argued that the government finds it very difficult to come up with a comprehensive water plan. Among the difficulties that Schwarz mentioned are: the complexities of the water issue, the need for organizational revision etc. According the Schwartz, the government did not deal with water policy in recent years.

Among the greatest obstacles to any reform in water policy is the agricultural lobby and its advocates in the water establishment. For instance, when Likud came to power in 1977, it tried to transfer the Water Commission from the Ministry to Agriculture to the Ministry of Energy and Infrastructure. However, the enormous pressure that was applied against the plan by the agricultural lobby, defeated any idea of a reform. Even an seemingly simple move, like the plan to appoint as the head of Mekorot a person outside the water establishment created enormous pressure. Moreover, all the disputes in the water establishment had to be solved by bringing in foreign arbitrators. In some instances, appealing to foreign experts was undertaken in order to bolster the position of one or the other side to the conflict.

It is also significant that Tahal itself, rather than the government initiated most of its plans. At the beginning of the 1980's, the Tahal leadership, reacting to the deterioration of the water system decided to approach the government with an idea for a comprehensive survey of facts. This survey was submitted to international experts, but it did not lead a more planned approach to water issues.

It is quite clear from the above discussion that there are major shortcomings with regard to the way water issues are dealt with in Israel. The system of policy making is extremely complex and inefficient. Ultimately, it is influenced by the major consumers, that it the agricultural sector. The farmers' lobby is either unwilling or incapable to view the water problems from a national perspective. To make things worse, there are also parallels between the general economic paralysis and the water problems: the big water crisis of 1985/6 coincided with the economic crisis in the same year.

Integration of the Water Resources Management

In spite of the fact that there are isolated wells and independent water projects here and there, the Israeli water system should be considered an integrated one. There are a number of reasons for this: the overpumping which created a need to look at the whole system, the lack of balance between the north and the south, and the long ways in which water is transferred from one place to another.

The overpumping of the wells in the peak season and during draught years have created a need to recharge the aquifers. However, because of the cost of recharging, the actual cost of production should go up. Since the integration of the system, all the consumers should participate in the costs. In practice, thought, there are deep division between the farmers in the north that are unwilling to underwrite the costs of integration, and the farmers in the south that demand this type of integration.

Another facet of integration pertains to the process of substituting fresh water with reclaimed one. In theory this is the only way to continue supplying water to agriculture without totally destroying the dwindling resources. However, there are instances where farmer object to the substitutes because of economic and other reasons. Perhaps the primary example are the farmers in the south of Sharon, whose local wells have been grossly overpumped. Yet, the farmers objected to receiving reclaimed water as a substitute and they also rejected the option of buying the more expensive water from Mekorot. As a result, they continue to overpump their wells, thus contributing to the degradation of the Coastal aquifer.

The lack of integration is also evident in the management of the various purification projects, and especially those that are managed by the local authorities. According to the Comptroller's Report of 1988, the quality of the reclaimed water varies and there is a danger that the land and the crops may become contaminated.

To make matters worse, a substantial amount of urban sewage is not purified at all. Some 42 MCM of sewage is not purified at all, especially in the Arab municipalities and villages but also in some Jewish towns including most of Jerusalem. The sewage flows into the rivers and the sea and threatens the water supply of Israel. In addition, there is 15.8 MCM of sewage from 270 municipalities and villages that have been treated in communal septic tanks; in some cases even this effluence can pose a danger to the water supply. In one case, the Arab village of Beit Zarzir has been built exactly on top of the Shimron Tunnel of the National Carrier. The building of the village was approved by the Israeli authorities, and yet the village is using septic tanks.

Since 1984, Mekorot officials have warned about the danger of contamination of the National Water Carrier from untreated sewage. Only in June 1988, four years after the initial warning and six month after contamination has been discovered in the water of the

Carrier, did the Water Commissioner asked the village to rectify the problem.

It has been already indicated that the lack of control over the effluence and the contamination that it has caused resulted in an increase of illness of the digestive system and occasional outbreaks of epidemics.

Conclusions

The discussion of the various aspects of the water resources management, bears out quite clearly our theoretical hypothesis that the system corresponds to what Lindbloom calls the "muddling through" model of policy making. The lack of decision at the top level, i.e. the government has lead the "secondary actors", the Water Commissioner, Tahal and Mekorot to engage in a series of conflicts and clashes.

In addition, since 1970 the Ministry of Agriculture and the Water Commissioner have received a large number of reports about the increasing degradation of the water reservoirs and the decline in the quality of water. The reports have called to cut the water allocations to the agricultural sectors and to undertake other measures necessary to save the aquifers. However, with the exception of the 1986 cut of water quotas, neither the Ministry of Agriculture of the Water Commissioner have taken any steps to rectify the situation.

Worse, the Master Plan of 1988 predicted that under optimal conditions the allocation for agriculture up the year 2000 would reach 1,300 MCM, but under adverse conditions it will constitute 800 MCM. Yet, the Department for Planning and Development of Agriculture in the Department of Agriculture has decided to use the upper number of 1,300 MCM. In opting for this optimal estimate, the Department has not left itself any room to maneuver. Moreover, after the relatively rainy years of 1987 and 1988, the Water Commission forgot about the crisis of 1986 and increased the water allocation. It is only because of the crisis in agriculture that the allocations have not been used up.

IV. Difficulties and Obstacles in Formulating Water Policy for Israel and Their Impact on the Crisis in Israel's Water System

Michael Harris

Introduction

The major hypothesis of this study is that Israel has never developed a comprehensive water policy, in spite of the fact that water is a relatively scarce resource. The secondary hypothesis is that the current water crisis is not ecological in nature, but rather an outcome of the lack of comprehensive national policy. In addition, the assumption of this work is that the water policy makers in Israel have two tools which could have been used to prevent the water crisis. These two tools are water quotas and water price. However, because these tools have been used in a non-rational manner they contributed to the water crisis.

Water: A Scarce Resource

The theoretical model for dealing with problems of resource scarcity is based on the classic work of Garrot Hardin, The Tragedy of the Village Commons. In his essay, Hardin was one of the first to point out that seemingly rational individual choice can cause nonrational and even tragic collective outcomes at the community level. It was in the rational self-interest of the British villages to raise as many sheep as possible. However, the overgrazing of the village commons has caused to the gradual erosion of the top soil, a process that is, by and large not reversible. In order to prevent this type of outcomes, a society has to institute policies and processes that would limit the overuse of a resource.

Water is theoretically a renewable resource, but there is a need to limit the pumping to a certain level of the reservoir. In the absence of national control, every consumer would try to overuse the water resources, creating the tragedy of the village commons. Hence, in cases of semi-renewable resources like water, there is a need for a strenuous and complex system to keep the individual consumers to do what it in their best individual interests, i.e. overusing.

The History of the Water System in Israel

In order to understand why the water resources become so depleted, there is a need to survey the history of the water usage in Israel.

1. The British Mandate Period- 1917-1948

In this period, the Ottoman law was strictly observed by the British Mandatory administration. The principle of Ottoman style of water usage was that water rights and usage is related to land ownership and usage, thus precluding any large transfer schemes. As a result, the Jewish authority is the Yishuv has the right to land,but could not efficiently utilize the water resources. Even though, the Jewish authorities found ways around: in the north of the country the water engineer Simcha Blass had created a number of local water projects, and in the Coastal plain deep well sunk around Kfar Saba and Kirkur were able to supply quite ample quantities of water. In 1936 Mekorot was founded; 50% of the stock was owned by the Jewish Agency and the National Fund, and other 50% by the Histadrut and the settlements.

2. From Independence to 1959

Independence changed the water problematics drastically: both land and water were now owned by the state of Israel. In 1948 the Department for Water Issues was created in the Ministry of Agriculture. In 1952, the Water Authority was created: it was decided that it would constitute an independent administrative unit within the Ministry of Agriculture. In 1959 in the basis of the Water Act, the Water Commission was established. It is quite evident that even in these early years, it was recognized that water is of supreme importance to Israel, hence the water authority enjoyed a measure of independence from the Ministry of Agriculture.

Water Legislation

The most important law is the Water Act of 1959. It provides a comprehensive framework for managing the water system in Israel. It stipulates that water is a national resource and it should be treated as a means of production. The Act also provides the framework for supervising the production of water, including the price and allocation setting mechanism. The water allocation was based on the amount of land and crops that each farm unit cultivated. In this way, the Act institutionalized an already existing situation: those who were already farming had an advantage over future farmers.

The Water Commissioner was given a great deal of authority to allocate water quotas and to set prices. He was also given, under emergency regulations, the authority to cut on all water allocations.

The Act created the Water Council, which was expected to advise the Minister of Agriculture on pricing and allocation issues. The number of seats for the consumers on the Council exceeded the number of seats for government representatives.

Other water legislation: 1) Supervision over Water Drilling -1955; which mandates obtaining a license for every well; 2) Measurement of Water Act-1959; 3) Act of and Protection

From Floods -1957. In addition, the Minister of Agriculture has issued dozens of decrees and regulations.

The Water Management System in Israel

There are a great number of definitions of the water system in Israel. On the one hand, there is the narrow definition: it includes only the organizations and policy makers who deal with water issues. On the other hand, there is the broad -holistic definition of the system. This definition includes not only the organizations and the policy makers who deal with water, but also the **interaction** of these elements with the larger social system. As a result, the exact domains of the water system in Israel are difficult to delineate, as the interaction varies across time and space. This is an open system and the assumption here is that is includes hierarchial arranged subsystem:

* production and supply subsystem
* marketing and management of consumption subsystem
* research and development subsystem
* organizational subsystem
* inputs and outputs subsystem

The aim of these subsystems is to supply the amount of water needed for the welfare of the society and it is also assumed that the subsystems have to operate together: the amount of **fit** between the various subsystems would dictated the success of the whole system.

The Organizational Structure of the Water Management System

One of the reasons for the lack of fit between the various subsystem is the organizational structure. The organizational structure is an outcome of historical processes rather than the of functional planning. In theory, the structure is expected to reflect functional consideration. There should be a division of functions between policy setting (Minister of Agriculture), management of the water system (Water Commissioner), the implementation of policy of water supply and maintenance (Mekorot) and planning (Tahal). In such a system, it is expected that the head of the authority would assume responsibility for policy articulation and the those lower in the hierarchy would deal with managing and implementing.

In practice, though there is a lot of overlap between the various bodies. Especially, the Water Commission, Mekorot and Tahal are all equally engaged in traying to set policy. These three bodies also influence other parts of the system, like the planning authority, the local water associations and the water employees trade union. The division of functions and authority among the three bodies is not clear at all and at times they compete. This competition is accentuated because there is a lack

of an overall planning strategy: small projects are planned and implemented by each one of them, without much thinking about the broader perspective. It is well known in organizational theory, that any organization that wants to succeed has to have a fit between its goals and the organizational structure.

There is little chance that a better fit will be accomplished because: 1) there is a built-in conservative tendency in any organization; 2) there is an active resistance of different elements in the organization to change.

The Implementation of Water Policy In Israel

The shortcomings of the organizational structure are most visible in the way water policy is implemented with regard to the two most crucial elements: pricing and quotas.

1. Pricing

The pricing policy is based on three elements: 1) the Water Act-1959; 2) the Report of the Commission on the Secondary Water Legislation of Water Pricing (the Yaacobi Commission -1971); 3) the changes that were introduced over the years via administrative regulations and decrees.

The various elements reflect the complex reality of pricing, as embodied by the Equalization Fund. It is well documented that the Fund does not perform its original function of spreading the actual cost of water between the different regions. The Yaacobi Committee of 1971 indeed recommended large scale reforms in the pricing system, so as to bring the price of water in line with the cost of production, but actually little has been done since then. The only recommendation of the Committee that was implemented was not to use intersector subsidies.

One of the major debates that has never been solved is how to calculate the real cost of producing water. A review of the debate indicates that after so many years and in spite of the fact that the water system is in a desperate situation, **there is no agreed way to calculate the cost of water.** In 1986, the farmers paged 10 cent per CM, domestic water is sold to local authorities for 15 cent per CM and they charge their consumers 50 cents per CM and the industry pays 10 cent for water from wells and Mekorot and 14 cent for water supplied by the local authorities.

The major problem with pricing in Israel, is that the price of water in Israel is seen as a tool for achieving political and social goals, rather than as a tool for efficient allocation of a scarce resource. All the water legislation and practices reflect this goal. The complex process for deciding on the price of water is subject to pressures from the farmers lobby.

2. Water Quotas

The quotas are based on planning principles that were developed in the 1950's. It was based on a social principle which was designed to provide a decent standard of living for every family of a farmer. To achieve this, the farmer was given a certain amount of land and water that was deemed as adequate by the agricultural authorities. The size of the unit has varied between various regions, according to the quality of the land and its availability. The water allocation was based on the ecological region, i.e. temperature, precipitation, evaporation, the size of the unit, crop, etc. Based on the various elements, "profiles" of farms were developed. Some common "profiles" were: dairy farms, citrus farms, mixed farm etc. These various categories received a different amount of water.

In spite of the tremendous changes in agricultural and irrigation technology, these basic "profiles" still serve as a base for allocating water.

The amount of water for a settlement was allocated on the basis of the number of units in the settlement. At the beginning of the 1960's it became obvious that there is not going to be enough water for all the extant and planned units. The then Minister of Agriculture, Moshe Dayan acted to change the criteria, and it was decided that the total amount of allocated water serve as a final goal, whereas in the meantime the settlements would receive only 70-77% of this allocation.

At the beginning of the 70's, it became clear that it would never be possible to supply the total amount and thus, the 70% recent became the final goal of allocation. Since then, every settlement is receiving this "70" level allocation, even if they are new settlements that enjoy a higher level of technological know-how. The only exception to this rule are the veteran settlements that already received the 100% of the allocation, at the time when the quotas were created.

It should be emphasized that in spite of the many and dramatic changes in the character of agriculture, the criteria for allocation that have been created so many years ago are still used. This usage does not reflect some of the most profound changes in farming in Israel, including the introduction of new corps, new irrigation techniques and quite widespread part-time farming practices.

Conclusion

The above analysis makes it clear that the catastrophic water situation in Israel is not an outcome of the draught, but rather a result of the "tragedy of the village commons" syndrome.
Five factors are responsible for the outcome.
1. the structure of the water management system; multiplicity of bodies that manage the system, the lack of hierarchy, duplication of functions and competition between the various bodies.

2. The inclusion of the Water Commission in the Ministry of Agriculture makes it a tool in the hands of agricultural interests. The Water Commission should be moved to the Ministry of Energy and Resources.
3. The is a need to change the criteria for calculating water costs. The system which is currently used is outmoded and based on unrealistic criteria. Because the price of water is low, reflecting outmoded ideological goals, the has been an overuse of water. Only after the real cost of producing water is known, it would be possible to decide on the amount of subsidies. Today, subsidies are built into every step of water production and some are so hidden that one seems to know to what extent water is subsidized.
4. The process of water management, the various rules, regulations and decision making is too complex and arbitrary. There is a need to simplify the procedure.
5. The political interference in the process of water management, especially from the agricultural lobby is highly damaging to the process.
5. The absence of a comprehensive national water policy is perhaps the most damaging feature of the system. In the absence of such a policy, the partial solutions that have been undertaken are not sufficient and sometimes even contradictory.

V. A Plan for Agricultural Development 2000
Ministry of Agriculture

General Situation

The situation of agricultural in Israel is fairly bleak. Up the current year (1991), agriculture has consumed some 70% of annual water allocation, the debt of the sector represents 20% of the balance of the major banks, and yet it only represents 2.8% of the NGP. By any economic measure, agriculture is the least viable sector of the Israeli economy.

To change this situation, there is a need to defined the goals of agriculture in national life. There are two major goal: 1 to produce maximum food in Israel ; 2) to preserve Jewish control of land and to prevent its transfer to others.

Both goals are a function of the unique geo-political situation in Israel.

There are three major obstacles in fulfilling this goal: water and land. The shortage of water means that agriculture in the future would be less extensive, and thus there is need to find ways to keep the land in use. As a result there is a need to plan for two types of agriculture: 1) intensive but localized, i.e. greenhouses etc. 2) extensive, i.e. using up major track of land, i.e. pasture and forestation, but little water (mostly brackish and other marginal).

The limitation of capital stem from the national priorities at the end of the century: security and absorption of immigrants. Agriculture would have to compete for the reminder of the national budget with other legitimate priorities such as education, welfare and the road infrastructure. As a result, it is impossible to expect the Finance Ministry to pay for the transition to the "agriculture of the future".

The Parameters for Shaping the Agriculture of the Future

There are three elements involved:

1. <u>Water</u>

Because of the expected increase in the population and the expected increase in the standard of living of this population, the natural water resources are not adequate. There is a need to add to this resources:

1) water purification would become an important element in future water supply. The capital for building sewage reclamation plants should be raised through a fee from the local authorities that produce sewage. There are also many corporations that could operate sewage purification plants on the basis of the own and operate principle.

2) desalination is the only way to create a water resource that actually **adds** to the water potential of Israel. There are two modes for achieving this goal. Some desalination can be underwritten by the government, if the government would commit itself to baying the water and pay real prices. The desalination plants can be build alongside the extant utility plants. An additional way would be through private initiative.

3) water import is not a highly feasible alternative because it includes countries that are political not stable. However, some private initiative can be encouraged.

2.Water Prices

The past pricing policies have come under enormous criticism. In response, the government in its decision of Nov. 17, 1990, has decided to bring the prices of water in line with its production costs. The price increase has two goals: to reduce water use and to provide investment capital badly needed to develop and maintain the system. There is also the public perspective: to achieve an equitable sharing of the costs of water productions.

3. Capital

Today the government provides incentives that amount to 20-40% of the total capital for any agricultural project that aims at producing for export. This means, among others, that every project has to be scrutinized and approved that the relevant ministries. This system is not compatible with the goals of agricultural production outlined in this plan. Since the goal is to produce the maximum amount of food in the country, there is no logic in subsidizing food exports. Instead, the plan proposes to adopt the system used in industry: for every shekel spent on an agricultural project by a farmer, the government will provide loan guarantees for two shekel in every new project. The guarantee will be given after the investor pays a small fee and commit himself to use the credit in a responsible way. This system would eliminate the bureaucracy needed to approve all new plans. It was also mean that the capital to start a new venture will be lower than currently needed (33.5%). Also the proposed system would mean that select regions can be encouraged.

The new system would mean creating new **cooperatives**.

One of the problems of agriculture is the a lack of capital for investment, because the sector can not provide for guarantees. The answer to this problem is to establish a system of **buying guarantees** which would be used, together with the agricultural product, as a collateral for the loans. It should be emphasized that this system would give an advantage to the more successful farmers who would be considered as less of a risk by the banks.

Under the current plan the only direct government capital layout for agriculture would be used for R&D and the dissemination of agricultural know-how, especially new technologies.

Solving the Agricultural Debt

In order to succeed in "future agriculture" it is imperative to solve the debt problem. The debt that the moshavim and the kibbutzim accumulated would not able a transition the agriculture of the future. The base for solving the problem is refinancing. The resolutions authority would estimate how much each individual farm unit contribute to the special fund. In the second state, a specially appointed body of bank representatives, Finance Ministry and Ministry of Agriculture, would decide upon the interest to be paid for the historical debt and on a time framework for the total repayment of the debt.

The debt of the kibbutzim would have to solved against the changing background of the special kibbutz mission. The "golden age" of the kibbutz movement is over, as the unique missions that the kibbutz fulfilled in the past - settlement and security - have been overtaken by the society at large. The kibbutz today can still play an important role in a number of fields: to help to preserve Jewish control over the land and develop the extensive agriculture mentioned above, to build a national network of roads, and to invest in developing water projects like sewage purification and desalination plants. In order to finance all the projects, there would be a need to create special consortiums in which the banks, the government and the kibbutzim would participate. The capital would come from the banks and government, the debts of the kibbutzim would be forgiven proportionally to their contribution.

Conclusion: The Characteristics of the Future Agriculture

In order for the agricultural sector to overcome its present crisis and be successful in the future, it needs extensive reorganization. It is most important to create larger units of productions in the moshav sector. Larger units can save on overhead costs and thus decrease the cost of production for a variety of costs. In order to achieve this, some social goals have to be sacrificed, i.e. dispersion of population and providing jobs for large numbers of people.

VI. Interview with the Spokeswomen for the Water Commission
Sima Hetzroni August 20, 1991

1. The personal changes in the Water Commission, i.e. the appointment of Prof. Dan Zaslavsky, was a political move, motivated by the desire of the Minister of Agriculture to take complete control of the water issues. The Tsomet party run its election campaign on the water issue, and as a result, the MA had to show that he accomplished something. Tzemah Ishai became a scapegoat for coalition needs.
2. The personnel changes are not going to accomplish any major changes in the water situation in Israel. The problems are mostly structural; there is not enough water for the country's needs coupled with the immigration.
3. None of the more fancy plans to make up for the expected water deficit are going to be successful (including some of the Master Plan solutions). The most dubious plan is large scale desalination water: the cost of the technology is high and there is doubt whether capital can be raised. Even the most likely investors, wealth Jews, are not expected to be drawn to the plan, because of Israel's poor record of attracting foreign investment. Wealthy Jews prefer to contribute limited sums of money instead of investing.
4. The planned catchment of flood and runoff of water can bring some additional 200 MCM, for a modest investment, but this quantity is not significant in comparison with the needs.
5. Water buying schemes are not realistic for a number of reasons: the relevant countries and especially Turkey are not politically stable. The installations needed in some propsed countries like Bulgaria are too costly.
6. Part of the problems of the Water Commissioner were his style of management; he was surrounded by his three close aides and there was not enough interaction with the other departments in the Water Commission and eventually alienation.
7. There was virtually no protest from the urban and industrial water consumers; the representatives of the local authorities have never raised any objections about the facts that they were asked to subsidize the farmers. After repeated questioning the Spokesmowen was ready to set up an appointment with the representative of the local authorities to verify her claim that there was no objection from the other sectors.

VII. Interview with Water Commissioner Prof. Dan Zaslavsky August 22, 1991

1. Refused to evalute the performance of his predecessor Tzemah Ishai, but implied that the personal performance was not professional, quite poor.
2. As the brand new Commissioner (was appointed on August 19, 1991, had not yet had the opportunity to make any major operational decisions in the Water Commissioner. The only major decision was to cut drastically the overall water use; the brunt of the cut was to be born by the agricultural sector. The total allocation for 1991 is 1470 MCM, the farmers will receive 870 MCM. There would be no cuts in the territories.
3. Refused to provide figures for the water production and usage in the West Bank and Gaza Strip. It is against the policy of the Civil Administration to provide this type of data, because of past misuses.
4. On the whole, the Comptroller's Report provides a fair view of the water problems of Israel as well as the share of the past Water Commissioner in creating the problems. Prof. Zaslavsky suggested that the Comptroller's Report should be used as a basis of any discussion of the water problems in Israel. Since his appointed was so new, he did not have any additional comments on the problems of water in Israel, beyond the very detail discussion in the Comptroller's Report.
5. The major priority of his administration would be to restore the aquifers that were degraded in such during the previous decade. Since the restoration of the aquifer is a national priority, the agricultural sector would have to become secondary in the goals of water management. The drastic cut that the Water Commissioner ordered a first step towards implementing this policy.
6. The overall water planning (needs, goals, etc.) are based on the 1988 Master Plan. There would be some modifications of the assumptions of the Master Plan, because of changing needs due to immigration. However, at this stage (August 1988), the modifications have not been worked out yet. One of the problems in the estimating new needs, and overall planning is the lack of certainty with regard to the total number of new arrival until the year 2000.
7. The Water Commissioner expressed grave reservations with regard to the date used in the paper presented by TN at the World Bank. The paper was related to him by Yeshua Schwartz, and after reviewing the data Prof. Zaslavsky "could not understand the logic in the numbers or the source of the data". In his opinion, the data made no sense from a professional point of view, which lead him to speculate that it was used for "political reasons".

VIII. Interview with Prof. Raphael Bar-El Director of Development Study Center, August 27, 1991

Rehovot

1. Professor Bar-El is a leading expert in developing integrated agricultural- industrial regional centers, the author of numerous books and articles on the subject. The Development Study Center offers courses to students from developing countries on the subject of integrated development.
2. The Center was established in 1962, at the initiative of Ra'an Weitz, the Head of the Settlement Department of the Jewish Agency. The Settlement Department was responsible for most of the planning of agricultural settlements in the Green Line, but is not engaged in settlement in the territories. The budget for research at the Center comes from the Settlement Department.
3. The idea of introducing industry into the moshav was first raised in the early 1970's, by the political authorities in charge of agriculture. Professor Yehuda Don and Bar-El who was at that time an economist teaching at Bar-Ilan University were asked to develop some programs. It should be emphasized that the issue of industrialization was introduced, not within the contex of water shortage per se, but rather with regard to the "second generation" problem, i.e. the fact that sons of the farmers could not find employment in the moshavim because of land limitations.
4. The first discussions took place at the level of the Settlement Department, the Minister of Agriculture, Aharon Uzan and the Secretary of the Moshav Movement Arik Nehemkin. The latter was bitterly opposed to introducing industry to the moshav; the objection being ideological and organizational. According to Bar-El, the leader of the moshav movement and his associate were afraid that the introduction of industry would dilute their power hold, as it would involve sharing power with other elements in the economic system. When the group of Bar-El and other researchers published their first book in 1975 they were "totally unwelcome". At no time, was water raised as a specific issue, but it was rather "implied".
5. In 1978 -80 the first industrial villages were established. The initiative was private, but it was backed on an experimental basis by the Settlement Department. Today there are a number of regional councils that are built around industrial villages, or include industrial villages.
6. When the Likud came to power in 1977, there was hope of major changes with regard to water and the agricultural sector, however,

the hopes were largely dissipated. It is hard to say why the Likud which did not have a following in the moshavim and kibbutzim could not break the hold of the agricultural lobby. There is no good political reason; however, the situation basically has not changed. The lobby found new ways of exerting pressure.

7. Today there is a major problem with the Arab villages that are "spilling over" , there is no land and way of expanding. The industrial village is an ideal solution for the Arab sector within the Green Line. However, it is politically not popular.

8. In spite of the water shortage and the financial crisis of the moshavim, there is little effort to introduce large scale industrialization of the rural sector. The reasons are not entirely clear, but according to Bar-El they include the usual mix in Israeli politics: conservatism, resistance to change, lack of planning and capital. Overall, Bar-Lev does not see large scale prospects for introducing industry into the moshavim.

IX. Interview With Professor Shlomo Aronson Expert On Israeli Elite August 26, 1991

1. The lack of a clear policy on water, and the tremendous waste in this national resource, should be attributed to the struggle in the early days of the state between the **statists** and the **socialists**. The former were represented by David Ben-Gurion and the latter by Pinchas Lavon, the Secretary General of the Histadrut. Actually, the struggle goes back to the pre-independence period. The left who was in charge had no theory of government, but had a social theory (in the United States the founding father had a theory of government, but not a social theory). Ben-Gurion was the only one that understood that the rights of the state and collective good come before the rights of class or groups. Even after independence, the socialists and especially the Histadrut, objected to putting national considerations above class considerations.

2. Ben-Gurion was also the first to try to establish the norms of the Anglo-Saxon constitutional state. That meant, among others, the personal accountability of politicians for the affairs of their Ministries and Departments. However, Ben-Gurion's effort to reform the system were perceived as a threat from a large segment of the Mapai party and the Histadrut. In the resulting struggle, known as the "Lavon Affair", Ben-Gurion lost power and the statitis reforms were never carried out.

3. The failure of Ben-Gurion to carry out the reforms had direct implications on the water issue. In the summer of 1960, Dayan who was a protege of Ben-Gurion and the Minister of Agriculture tired to reform the agricultural sector. He appointed a committee to look into the entire complex of issues already afflicting the agricultural sector. One of the goals of Dayan's policy was to set a comprehensive agricultural as a prelude to cutting the water allocations to the sector. Dayan sought to change the standard for water allocation and reallocate water from the kibbutzim to the moshavim. However, the Ihud (the organization representing Mapai kibbutzim and moshavim) objected and there were a nubmer of committees established to resolve.

4. Dayan could not prevail because he was caught up in the "Lavon Affair" and subsequently left Mapai with Ben-Gurion to form Rafi. The defeat of Ben-Gurion was not only detrimental to the issue at hand, i.e. cutting the water quotas, but also to the long range problems of public and political accountability in Israel. As a result, Ministers and government officials have not been

accountable for the failures of their ministries and departments, and have been able to continue in office, no matter what the cost to the state or the public. Second, Ben-Gurions's failure to institute statism, made it possible to continue the policy of group or class suprmecy over the needs of the state and collective.

X. Interview With Tzemah Ishai, Former Water Commissioner August 25, 1991

1. Personal background: immigrated from Tunisia in 1946, high school education in Tunisia. After immigrating he was involved in the small moshav movement of the Progressive Party called the Zionist Worker Moshav movement. He was among the founders of the Ihud Haklai, which included moshavim of the Zionist Worker and private farmers. His background in water issues: represented the Ihud Haklai moshavim in the Water Council, and the various water committees and hearings. When Simcha Erlich was appointed as the Minister of Agriculture, he was picked to be the Water Commissioner (Sept. 8, 1981). He replaced Meir Ben-Meir.
2. This was a political appointment, but according to Tzemah Ishai, he was supported by the entire agricultural sector, although he did not come from the Labor party. It should be emphasized that some of his strongest supporters came were from the Mapam kibbutzim (Yoram Tamari, the representative of the Hashomer Hatzair and others). He was also supported by the agricultural right: the Ihud Haklai and the Farmers Association. Pesah Gruper was the President of the Farmers Association and he was also a Knesset Member, largely active in water issues.
3. He had a friendly relation with Moshe Nissim for more than 30 years. (Moshe Nissim the senior politician from the Liberal section of the Likud party) was the major sponsor of Tzemah Ishai. It was Nissim who recommended Ishai to Erlich when he was Minister of Agriculture and Nissim continued to defend him against his various critics). Ishai defined his relation with Nissim as friendly but not extremely close, they did not meet on social occasions, but they would invite each other to weddings and other family ceremonies). According to Tzemah Ishai, Nissim supported him because of his professional qualifications.
4. According to Tzemah Ishai he implemented all the plans for utilizing marginal and additional water resources, including the Gush Dan reclamation project, the Lower Galilee Project and also build the "fourth unit" in Kinnereth. All these projects added to the water potential of Israel, was not specific how much.
The reservoirs on the Golan add some 20 MCM.
5. Pointed out that there have been frequent debates between various experts about the water potential of Israel. For instance, after his appointment, in 1981 there was a big discussion among Tahal, the Hydrological Survey and academia, as to the water potential: they variously estimated it between 1.6 billion CM and

2 billion CM. The variable estimates made it hard for him to make allocation decisions.
6. The "debate with the professors" in 1986 followed the draught in this period. The professors wanted him to cut 400 MCM, but "we went to the government" and reduced it to 200 MCM. We managed to beat the professors. The professors are part of the counter-lobby that, according to the former Water Commissioner, fought against him The other elements in this lobby were the media, the Tsomet party, and the ecological groups. On the other hand, the representatives of the local authorities have always supported the Commissioner.
7. The Water Commissioner hear "something" about the green house effect, but he never thought about including it in long or short term calculations. Could not comment on the possibility that the frequent and unprecedented draughts may be related to global changes.
8. All the figures are included in his response to the Comptroller's Report (the blue book). He does not see himself as responsible for the degradation of the aquifers, asked to comment on the question as to who might have been responsible for the situation in the aquifers, he responded " the professors" , but would not elaborate.
9. The water consumption in the West Bank is 70 MCM for agriculture and 40 MCM for domestic use. In the Gaza strip 80 MCM goes for agriculture and 15 MCM for domestic use. The overall production capacity of the Gaza aquifer is 50 MCM, thus the number represents almost 100% of overpumping. The Israeli authorities offered subsidies to stop pumping of water in the Gaza strip.

XI. Interview with Dr. Moshe Schwartz
Expert on the Moshav Movement
Development Study Center
September 1, 1991

1.The organization of the agricultural system is made up of different layers, dating to the oldest organization to the more recent ones. The reason for this particular structure pertains to the fact that in the Israeli political culture it is hard to abolish any type of framework; as a result, when there is a need to create a new one, it is simply added to the extant ones.
The oldest organizations date to the early days of the Yishuv, were created by the "barons" i.e. the great philanthropist families of the Rotschilds (PICA ICAH). Then there are Jewish National Fund and the organizations created by the World Zionist Organization/Jewish Agency. The third layer was created by the Histadrut, and then there are the organizations created by the political parties, especially the three original settlement movements: Hashomer Hatzair (Mapam), Hakibbutz Hameuhad (Ahdut Ha'avoda) and Ihud Ha'kvuzot veHakibbutizim (Mapai).
2.The legal system that pertains to agriculture is also very complex. There are three layers: 1) the Ottoman law which was used by the British mandatory authorities, 2) British law that dates to the British Mandate, 3) Israeli law. The vestiges of the British influence were very pronounced in the early days of the state. The Israeli government used Mandatory law to nationalize all land. The first Minister of Agriculture created a General Agricultural Council, patterned after the British Mandatory Councils.
3. The representation of the agricultural sector in the Israeli political system in the early days was very strong. The kibbutz was considered the elite social structure of the society, and as a result, membership in a kibbutz was considered necessary for a political career. Thus most of the top political figures in Mapai were kibbutz members. However, it should be emphasized that not all of them represented the agricultural interests. There were two types of kibbutz elites: the pro forma kibbutz member, i.e. politician that had a kibbutz address, but were not professional farmers (Levy Eshkol, Golda Meir, Ben-Gurion, Yigal Alon, Pinhas Lavon), and professional farmers-politicians (Haim Gevati, Moshe Carmel, Avraham Katz-Oz). It was the latter type who fought very hard for the interest of the agricultural sector.
4. In the first decade of Israel's existence, there was a tremendous national effort to develop agriculture. The aim of agriculture was twofold: to make Israel self-sufficient in food and to settle sparsely populated and border regions. The first aim was achieved within this decade: Israel went from producing 30% of food for 700,000 to full supply to a population of 2

million. In order to achieve this two goals, all other considerations were submerged, including the question of water.
5. However, by 1957 there were signs of food overproduction, especially in poultry and vegetables. This food was either given away free of charge, or sold under the cost of production or simply destroyed. **It should be pointed out that in spite of the overproduction, there was no effort to cut on agriculture and water that is used up.** There are no estimates how much water was wasted in this period because of overproduction. When Moshe Dayan became the Minister of Agriculture in 1957 he tried to introduce more planning: he created 13 Production Councils for various crops. He also tried to cut on water quotas, however, Ben-Gurion lost the more general power struggle and Dayan who was his protege was forced to leave the government to join Ben- Gurion's party Rafi. The defeat of Ben-Gurion and Dayan has left the agricultural lobby entrenched.
6. In the early days of the state, water issues were an exclusive domain of the agricultural sector. The only representation problem pertained to whether a member of a kibbutz or moshav would become the Minister of Agriculture. Initially, it was only members of kibbutzim that got the appointment, but later on after member of moshavim pressured Mapai, it was decided to appoint a moshav member to be the Director General of the Ministry of Agriculture. Still later, there was a system of rotation, whereby a kibbutz of moshav member would be appointed to the Ministry of Agriculture. The system is essentially the same today.
7. In the 1970's there was a decline of the quality of bureaucracy , there was less money in the government, the private sector developed, affirmative action was introduced and so on. The poor quality of government bureaucracy has affected the management of the agricultural sector and the water system. Likud's victory in 1977 has made things worse. The Likud did not have the professional cadres needed to replace the entrenched Labor bureaucracy and, initially did not make any major changes. Later on, when replacements were made the quality of the appointments was questionable. The two Water Commissioners under Likud were Meir Ben-Meir and Tzemah Ishai, the latter had no background in water matters. The latter was a protege of Moshe Nissim and the farmers were afraid to protest, because the assumption was that someone who would be hostile to the largely Labor dominated agricultural lobby would be nominated.
8. Even after Likud came to power, the strength of the agricultural lobby was not diminished. The reason has to do with the structure of the political map in Israel. Some 80% of the agriculture, whether kibbutz or moshav is linked to political parties, the vast majority to the labor parties. The few kibbutzim and moshavim that are linked to the Likud or the Religious parties share the same interests as their Labor counterparts. It has been often the case that the Labor agricultural lobby used their right wing counterparts to pressure

for common interests. On the other hand, the is no effective counterpart to the agricultural lobby in the Likud, and the "professor's lobby" has never been powerful enough to lobby for more rational water uses.

9. The debt crisis in the moshavim (the equivalent to the S&L scandal in the United State), has been created because of the structure of the moshav economy. The moshavim are composed of family units, but all the supplies of these units, are bought through a cooperative association. The cooperative associations have decreased the risk for each individual farm unit, and encouraged them to borrow. Since risk taking is not related to profits, they borrowed more than a private farmer would do under similar circumstances. Thus, if there are certain farmers that want to invest, even when the venture seems risky, the risk is basically diminished, there is an understanding that the state would underwrite the risk of default.

10. In the Water Council, there is a large representation of agricultural consumers because they represent the largest sector of water consumption. The representatives that are sent to the Water Council are the best technical and PR people in the kibbutzim and moshavim. They have no problems in organizing an affective lobby. They are normally supported by the Water Commission in the Knesset, that is the Commission that is ultimately in charge of water prices. Currently, the Chairman of the Committee is Edna Solodar, a kibbutz member from one of Mapam kibbutzim. The Water Committee in the Knesset has normally opposed increases in the prices of water.

11. It is important to remember that Israel is not a pluralist democracy in the American sense, but rather constitutes what Philip Schmitter, calls **a corporatist regime**. Politics in a corporatist regime is conducted between the government that represents the state, and powerful corporate groups, in the Israeli case, the most powerful corporate group is the farmers lobby. The most important historical examples of corporatist states can be found in South America, and it is on the basis of the analysis of those regimes that Schmitter derived his ideas. The legitimacy of the government in a corporatist state is derived from the groups and not from people at large.

For more details on the crisis of moshavim see Moshe Schwartz and Neil Sherman, an article in Human Organizations, 1991 and a book by Moshe Schwartz on the subject (in Hebrew, forthoming).