Water Flowing Under the Law: The Role of Water Law in the Planning and Management of a Sustainable Water Supply for the Middle East

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In order to prevent water conflicts from developing into physical contact, societies developed legal norms to channel the conflict into a public forum – often a court of law. These norms evolved over time into the water law principles as we know them today. As the world's water supply decreases and scarcity increases, these principles are constantly being adjusted. This article makes the argument that water law must flow with the hydrological cycle and a cultured forum for debate should be established to preempt conflict rather than "manage" it.

INTRODUCTION

The supply of clean and readily available water is one of the most basic needs of any population and, as such, a ready spark for rivalry, dispute and conflict when in short supply. The Middle East perhaps amplifies this phenomenon. Yet, like a bridge over troubled waters, the law can act to soothe disputes over water use and misuse.

The law at its best acts as an important mechanism for protecting the weak and under-privileged, defending the innocent and compensating the injured, restoring the just balance within the community and insuring its future. Water law provides a compendium of rules that protects a natural resource while providing man with a life force.

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Often rules of law ignore rules of hydrology instead of acting within the framework of the natural water cycle. Throughout history, man has violated the natural flow of the water cycle, often aided by unwise laws, and this has led to water regimes that are unhealthy environmentally, inefficient economically and prejudiced socially. Water scholars today are in agreement that water law must be guided by the logic of the water cycle, respect the demands of the natural systems in addition to satisfying human needs and that it cannot be constrained within artificial political boundaries. This is true within a sovereign nation where surface and groundwater cross a political divide, as well as between countries sharing a water source that crosses national boundaries. It is posited here that for those who wish to manage trans-boundary water resources, political maps hinder the process.

In order to prove the hypothesis set out above, we will first introduce the regional water cycle, its problems and projected developments to insure adequate and sustainable water supply for all stakeholders. Following that, the existing legal and administrative framework for Israel and the Palestinian Authority will be reviewed, with some suggestions how best to harness it to the task ahead.

THE NATURAL WATER CYCLE UNDER DIFFERENT CLIMATE REGIMES

As precipitation falls to the ground, the water is partitioned at the surface into fluxes of surface flow, percolation into the ground followed by groundwater recharge and a return flux into the atmosphere by direct evaporation from water surfaces and transpiration of plants. The relative proportions of these fluxes are dictated by the climate and by the morphology and ecological structure in the atmosphere-lithosphere-biosphere- interface. Moreover, the chemical quality of the water sources is determined to a large extent at this stage of the water cycle. Human activities affect these processes in the surface layer in a number of ways.

One needs to recognize some basic differences between the natural water flow scheme through the atmosphere/land-surface/plant-cover interface under different climate settings. These are schematized in Figs. 1-3 for the temperate/humid, semi-arid

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and arid regions, respectively. Among other effects, the different role of the surface runoff on the groundwater recharge flux is to be noted. In the more humid regions both the transpiration and the runoff detracts from the groundwater recharge; in the semi-arid climate zone where there is a reasonably developed soil and plant cover but a less favorable water balance, the major factor regulating the groundwater recharge flux is the soil-water balance, which is dominated by the evapo-transpiration flux, leaving only the excess of the precipitation input over the evapo-transpiration losses to recharge the groundwater. Surface runoff is normally minor and of secondary importance, unlike the situation in more humid regions. In contrast, in the arid zones the rainfall amounts fall short of the water deficit in the surface layer and any substantial groundwater recharge can take place only following the accumulation of water at a potential infiltration site as a result of surface runoff[1]. It therefore follows that the sensitivity to pollution of groundwater by any surface-accumulated material is not the same under these different hydrologic regimes, and any development scheme must take cognizance of these factors, as discussed below.

In spite of the sparse vegetation, ecology and hydrology are also closely linked under dryland conditions[2]. Obviously the availability of water, in time and space, dictates the extent and nature of the vegetation cover; the latter, due to its influence on the surface water balance, the surface morphology and the stability of the soil cover, in turn controls the hydrological pathways of the incoming precipitation, in particular the relative magnitudes of the surface runoff and the evapo-transpiration losses. These together determine whether there is an excess of water for deeper percolation and for the formation of reserves for the dry period, that are the basis for the survival of perennial plants. One has to realize, moreover, that the inherent salinity buildup under an evaporation-dominated hydrological regime exerts the ultimate control on the survival of the biota. Occasional water excesses for flushing the accumulated salinity are then necessary for maintaining the natural equilibrium in the arid system.

[1] Schoeller,H., "Arid Zone Hydrology; Recent Developments", UNESCO series on Arid Zone Research, No.12 (1959).

[2] Gat,J.R., "The Eco-Hydrological Feedbacks as Constraints on the Development of Drylands", Ecohydrology & Hydrobiology 2:61-65 (2002).

The important role of surface and sub-surface runoff from less arid border regions on the water supply in the downstream arid zone cannot be over-emphasized. In addition to their direct utilization, they play a role, through bank infiltration, as a supplier of water to shallow groundwater pockets (as exemplified in the Nile Valley). As a recipient of drainage streams and as a flushing agent, these large fluxes of water also add to the preservation of water and soil quality.

Based on this scenario, it is evident that in the more humid zones the preservation of water quality requires measures for the prevention of pollution at the source and the employment of mitigation (cleanup) practices of the water resources in-situ or prior to supply. A more holistic approach is required in the dry regions, an approach that encompasses the consideration of the natural eco-hydrological continuum as well as the totality of human activity in the watershed, as outlined below.

ANTHROPOGENIC EFFECTS ON THE WATER RESOURCES WITH SPECIAL REFERENCE TO THE EASTERN MEDITERRANEAN REGION

From the dawn of history the pattern of human settlements was influenced by the availability of drinking water, with the location of preferred sites near the emergence of springs, along the course of a river, or wherever shallow dug-wells encountered fresh underground water. As a rule, this dictated rather low-lying locations far away from the headwaters of the hydrological systems concerned, including places to which water could be conveyed by gravitational flow in aqueducts. Where security or other reasons dictated settlements near the mountain tops, these had to evolve elaborate storage facilities for the seasonally occurring rainfall.

As long as the scale of settlement was modest the natural river flow served as a cleansing tool that ensured a continuous supply of reasonably clean waters. As communities grew in scale, conflict among users erupted between those living on the riverbanks, the riva, which led to the term rivals, or rivalry, meaning those in conflict. The increase and spread of anthropogenic activities, which were made possible by the advent of mechanized pumping and deep drilling techniques, resulted in changes in land use, including on or near the influx areas of the water supply systems, e.g. the headwater of rivers or the groundwater recharge sites. Thus more and more of the

sources of the freshwater were invaded by salinity and other stressful and hazardous components. Groundwater was once thought to be relatively immune to deterioration when compared to surface waters, thus constituting a safe reserve for freshwater supply. In reality, it just takes a little longer before the full impact of the deterioration of the aquifers becomes apparent. Once polluted, underground aquifers are substantially more difficult to restore.

The availability of adequate freshwater of appropriate quality has become a limiting factor for development worldwide. In the more humid regions the major concern is the deterioration of water quality due to pollution inputs. In the semi-arid and arid regions, where water scarcity was always a dominant problem, the interference with the natural system as a result of over-exploitation of both surface and ground waters and the effects of changes in land usage on the groundwater recharge and surface drainage fluxes has a dual effect. Not only does the water quality deteriorate due to pollution from urban, industrial and agricultural practices, but there is also a build-up of salinity in the soil and water resulting in further worsening of the water scarcity.

The effect of human activities on the quantities and quality of the freshwater sources, groundwater in particular, is manifold as enumerated in Table #1 [3]. The full impact of these effects depends on the scale and location of the interfering activity. To what extent such effects are considered beneficial or harmful depends on value judgments (for example whether conservation of the natural condition or benefit to society are rated higher) and on the socio-economic evaluation of alternative scenarios.

The first of these interferences is the result of change of land use, for example deforestation or forestation, agricultural cultivation of land, in particular by irrigated agriculture, and finally the blocking of the surface for water infiltration by urban development. The drainage of wetland and marshes is another activity that was considered beneficial and desirable, but which later was recognized as a source for contamination of nitrates and phosphorus, as exemplified by the cases of Lake Hula in

[3] Based on the CWST Report, "The Management of Water Supply and Effluent Discharge for Urban Development in the Arid Zone", Report on a workshop by the Center for Water Science and Technology, Ben-Gurion University (2001).

the Jordan River Valley and in the coastal plain of Israel[4]. The diversion or damming of the natural water streams, including the operation of storage reservoirs, is another activity with possibly far-reaching effects on the state of the hydrologic system[5], far beyond the original intention of the planner. Finally, the release or recycling of solutes, nutrients and chemicals has both direct and indirect effects on the quality and utility of the water resources.

The lands lining the eastern shores of the Mediterranean Sea are notoriously deficient in water, with a long rainless summer season, a marked geographic disparity of rainfall between the north and south as well as between the highlands and low lying areas. Climate ranges from temperate or semi-arid in the north to arid in the south and the inland valleys. In Israel and the Palestinian Authority there is only one major river system along the northern section of the Rift Valley (the Jordan River) with some minor perennial rivulets along the coastal plain. Occasional transient flashfloods during the rainy season are particularly notable in the drylands. Groundwater, the other major source of water, also originates primarily along the mountainous backbone of the regions and drains into more arid areas.

In the more temperate regions of the area, especially the mountainous backbone along the eastern Mediterranean shores which is composed primarily of limestone, most of the incoming precipitation percolates rather rapidly into the ground. Up to 35% continues to form groundwater[6] and then emerges in springs at lower elevations. Direct surface runoff is usually only a minor component and the mostly perennial rivers that then drain into the coastal plain and the sea are fed by these springs. The extraction of water from the headwaters of the aquifer and the lowering of the water table had an immediate impact, resulting in a severe reduction of the spring

[4]Ronen,D., Kanfi,Y. and Magaritz,M., "Sources of Nitrates in Groundwater of the Coastal Plain of Israel", Water Research 17:1499-1503 (1983).

[5] Adar,E.M., Issar,A.S. and Gev,I. (1991), "Soil salinization process in a semi-arid wetland basin: the effect of reservoirs on a shallow aquifer", In: Hydrological Basis of Ecologically Sound Management of Soil and Groundwater, (H.P.Nachtnebel and K.Kovar, Eds.) IAHS Publ. No.202, pp. 103-112 (1991).

[6] Goldschmidt, M.J. and Jacobs, M., "Precipitation Over and Replenishment of the Yarqon and Nahal Taninim Underground Catchment", Hydrological Paper No.3, Israeli Hydrological Service, Jerusalem (1958).

discharge. This, in turn, caused the riverbeds to run dry, as well as allowing saline water bodies and seawater to enter the aquifer. The latter phenomenon is most prominent in the coastal plain, underlain by a phreatic aquifer, and is accelerated by the urban development whereby part of the local direct groundwater recharge is blocked by the pavements and housing.

The effects enumerated above often become noticeable much later after the dissemination of the contaminants and salinity throughout the water sources, too late for simple remedial actions to be taken. Among the most worrisome developments is the gradual accumulation of salts and chemicals in the soil and water under fields that are irrigated with recycled waters.

Under more arid conditions, the fragile natural balance is endangered by development schemes of all types and sizes, whether agricultural, urban or industrial. This occurs in a number of counts, not the least due to the physical interference with the hydrological pathways, as shown in Fig. 4 (to be compared to Fig. 3).

Deterioration of the water quality results primarily from release of chemicals (fertilizers, sewage effluent or toxic chemicals) beyond the natural remediation capacity of the soils and aquifers. In addition, the advertent and inadvertent release of waters from large-scale development projects that use imported extraneous waters or desalinization schemes for supplying their water demands, may overload the natural drainage channels. Since the water discharge now takes place all year around, replacing the episodic and ephemeral discharges of the natural water cycle, a profound ecological change in the drainage channels can occur, such as enabling perennial plants to take hold. Their presence at the potential infiltration sites of the winter floodwaters will then affect the water balance and, in extreme situations, may curtail the natural groundwater-recharge flux.

REMEDIAL MEASURES AND CONSIDERATIONS FOR PLANNING A SUSTAINABLE WATER SUPPLY

Given the present population distribution and the inheritance of past malpractices, both the continuous operation and any increase in activity within the framework of the existing infrastructure necessitates an adjustment of the water supply

and discharge networks so as to sanitize contaminated sources or substitute an alternative water supply for those affected. However, in the planning of new development projects a more forward-looking approach is indicated, namely one which will not only satisfy the requirements of the planned operation but ensure a continuous sustainable water supply without jeopardizing the surface and groundwater systems. When applied to Israel and the Palestinian Authority, the inseparability of ground water sources and the effect of human activities both on ground and surface water require joint cooperation.

Due to a long period of uncontrolled operation and development, the occurrence of accidental spills, as well as natural calamities such as a consecutive drought years, many of the aquifers have deteriorated to an extent that their utilization is curtailed as a source of potable waters or for indiscriminate use for irrigating sensitive crops[7]. Many streams and other water sources, as well as the plants and animals that depend on them, have been seriously damaged. In dealing with the situation for optimal benefits of all, one must distinguish between:

1. The present state of the aquifers and other water sources and the measures to be taken for their remediation,
2. The operational changes to be introduced into the present system in order to prevent further harmful effects,
3. The planning of future developments in a sustainable manner.

All of these require, first and foremost, a detailed monitoring of the "state of health" of the aquifers and other water sources (a baseline study) in order to identify the problem sites. Secondly, as complete as possible a hydrological model of the aquifers is required, including the transit times and mixing and flow patterns, in order to be able to predict the future dissemination of the salts or pollutants under different operational scenarios.

Possible strategies for dealing with the deterioration of the water quality can then be considered. These are listed in Table No. 2. The water requirement of all users can

[7] See Zaslavsky, D., "Definition of Israel's Water Problems, Or Water As a Metaphor", lecture on the occasion of the inauguration of An Interdisciplinary Project Efficient Use of Limited Water Resources:

obviously be satisfied by proper technical means such as water imports or relocations, desalinization, as well as proper prevention of pollution, remediation, clean up and recycling. However, these measures, if applied locally on an ad-hoc basis as an emergency procedure, may impose an unbearable and unjust economic burden on some of the stakeholders (who are not necessarily those responsible for the problem). Instead, the water quality could be improved by the equitable planning and sharing of the local and regional water resources based on an optimal hydro-economic scenario**.**

In planning for future developments, again the first stage of any rational planning scheme is the study of the natural water cycle, by following it from the precipitation input, through the partitioning into surface runoff, infiltration and groundwater recharge near the land surface and up to the discharge by surface and subsurface flow. This needs to be done both on the local and the regional scale, within the climatic and geo-hydrological context and with due regard to the eco-hydrological feedback[8]. Special attention must be focused on the space and time variability of the precipitation inputs and its expression in the hydrological systems and on the geo-chemical interactions and natural remediation capacity in the subsurface.

The next step is to determine the *safe yield* of an aquatic system and to limit the extraction of water accordingly. Looking at it simplistically, the safe and optimal amount to be extracted should equal the amount of replenishment to the system, whether by natural or artificial recharge. Even this basic concept is not unambiguous, however: the year-to-year fluctuations and especially drought periods need to be considered so as to prevent irreversible damage (such as by encroachment of saline water bodies, especially in a coastal setting, during low water stand)[9]. Curtailing the natural discharge may also adversely affect downstream users. What appears to be a safe procedure for part of the system does not necessarily meet this criterion on a watershed scale. Moreover, as painfully observed in the Israeli Coastal Plain Aquifer, a

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Making Israel a Model State, the Begin-Sadat Center for Strategic Studies, Bar-Ilan University, June 14, 2000.

[8] Gat, J.R., "The Eco-Hydrological Feedbacks as Constraints on the Development of Drylands", Ecohydrology and Hydrobiology, vol.2, 61-65 (2002).

[9] Baer,J., Opening Remarks at the Workshop on Stressed Aquifers, CWST, Ben-Gurion University of the Negev (2002).

geo-hydrologically closed system without outflow (where the water extraction is compensated by an equivalent input of recycled water of poorer quality) will invariably result in the buildup of the salinity. Thus one has to distinguish between a *safe yield in terms of water quantity* and a *safe yield in terms of water quality.*

Development projects, whether urban expansion, agricultural and recreational activities or industrialization, affect the natural water cycle not only because of the extraction of water in order to supply water to them and because of the discharge of salinity or pollutants in the effluent flux. They also interfere with the natural recharge or discharge pathways, due to changes in surface structure and morphology as well as by enhancement or reduction of the evapo-transpiration component in the water balance. When the demand for water of whatever quality exceeds the possibilities of local supply and is satisfied by water imports, one can be faced paradoxically with an amount of water that exceeds the natural drainage and remediation capabilities, resulting in “disasters” such as flooding, soil erosion, etc.

An “ideal planning scheme” would place a new development project at a site with the least sensitivity with regards to the natural environment and in proximity to the supply of water of appropriate quality whether from local water resources, recycled or imported waters. The planning should also ensure that any harmful effluent be contained or treated with a high degree of certainty. Economic considerations that balance the conflicting claims of these different issues, such as the cost of supplying fresh water, the cost of cleanup operations and discharge schemes, as well as the cost of nature rehabilitation will usually be the deciding issue. Different schemes of dealing with pollution problems that can be considered were discussed. Finally a continuous monitoring network needs to be established as part of the operational scheme to verify the safety of the water supply network in the future.

Once there is recognition of the above criteria for water management, a water regime should be installed to implement the criteria. The regime must be holistic, flexible and democratic. Thus it will meet the demands of man and nature.

SOURCES OF WATER LAW

As set out previously, early human settlements naturally gravitated towards areas with easy access to water. This dictated low-lying settlements far away from the headwaters of the hydrological system. In turn, this created customary water use which developed into water norms. Anyone living on the banks of a water source had the right to use it. Over time, the norm developed into law, the law of Riparian Rights: a person owning land along the banks of a river stream or lake has the right to use the water source for a beneficial use including discharge of wastewater back into the source[10].

As logical as the system seems, it is only adequate when there are few riparian users. It resolves the question of who can withdraw from/pollute a water source, but does not resolve the question of how much. With streams flowing by gravitational pull, lower riparians suffer at the expense of upper riparians[11]. Resolution of the conflict between upper and lower riparians is by court decision on an individual basis between the two parties in conflict. This "system" therefore fails to provide a mechanism for water management, instead it requires conflict management in its worst form: first create the conflict and then manage it. It also links land ownership to water use which reduces man's ability to make the Negev bloom or populate Los Vegas.

The Riparian Rights system was, at the time of its creation, a functional system. Over time, however, when water sources were captured and carried over long distances this system no longer had the same importance as it had historically. This led to the second major type of water system, the Prior Appropriation system which encouraged entrepreneurial ingenuity in water rights[12]. The first person, not necessarily the person living on the banks of the river, to make beneficial use of a water source was able to take as much as needed for the beneficial use. Junior appropriators followed suit until a water source reached its conflict level. At that point, regulators stepped in.

These two doctrines, so well ensconced in western countries, make conflict a part of the management system. Palestine, under the control of the Ottoman Empire,

[10] Teclaff, D.A., Water Law in Historical Perspective, William S. Hein Co., p. 6 (1985).

[11] For example see Lux v. Haggin, 10 P. 674 (Cal. 1886), a California Supreme Court Case from 1886. Upstream diversions by Haggin, who owned 400,000 acres of upstream land, combined with a drought, caused the Kern river to dry up and Lux's cattle to die. The Supreme Court ruled that Haggin's prior riparian rights overrode subsequent appropriations, and subsequent appropriations cannot injure riparian rights. A subsequent (1928) amendment to the California Constitution requires reasonable use by riparians.

[12] Supra at 9.

managed surface and ground water under a different set of principles. The Ottoman Empire was ruled under a system of law called the Magelle, which set out the basic principles of water law that were first used in Roman times[13]. Flowing water belonged to the negative community[14]. No one could gain possession over a river or stream and even those using wells had to allow equitable access to short-term users. Due to their mutual inheritance of the Magelle, Israel and the Palestinian Authority are not locked in an historical network of laws managed by conflict and mediation. Israel and the Palestinian Authority owe nothing to "private" owners of water which would prevent flexibility of management, environmental protection and fair allocation. As will be seen in the next chapter, both have legislated water laws that maintain central control over all water sources and all uses including environmental protection.

If the law is not a hurdle, what prevents these two entities from cooperating for mutual benefit? A number of factors stand in the way of optimizing regional water utilization through the implementation of these laws.

First, the antecedent situation and existing infrastructures in the region impinge on future developments. For example, agriculture is the largest water consumer in the region[15]. Lowering the demands of agriculture is a slow and difficult process, with many political, economic, social and historical obstacles to overcome.

Secondly, the best and apparently optimal scheme may not stand the test of time because of unforeseeable developments that change the physical or economic situation. For example a climate change, in particular a change in the precipitation pattern, will affect the water cycle as a whole and the availability of water resources. New technologies may change our concepts of what can or cannot be done at reasonable costs and make accepted solutions obsolete. A case in point is the reduced cost of desalinized water near the seacoast that can nowadays compete with water

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[13] Wiel, S.C., "Running Waters", 22 Harv.L.Rev. 190 (1909).

[14] The Magelle, Art.1235: "Water flowing in the bowels of the earth are not the property of any man"; Art. 1237: "Oceans and large lakes are ownerless"; Art. 1238: "The many rivers that are no man's property and are not separated into rivulets, i.e. they don't enter into channels that are the property of a recognized group of people, are ownerless…"

[15] In 2003 agriculture consumed 56% of Israel's total water consumption, and is the major water consumer in the Palestinian Authority as well. See:
2003 annual report of the Israel Water Commissioner on Water Usage and Production (December 2004); Assaf, K., Attia, B., Darwish, A., Wardam, B. and Klawitter, S., Water as a human right: The Understanding of Water in the Arab Countries of the Middle East- A Four Country Analysis, Heinrich Böll Foundation (2004) p.149.

conduit schemes from inland water supply sources. Taking such uncertainties into account suggests flexibility in planning and management and may favor the preference of localized and relatively modest solutions to large costly schemes.

Third, socio-political constraints have to be recognized. Israel and the Palestinian Authority are caught in a web of jealousy, fear, honor and hate that inhibits creating a joint system of water management.

Since a conflict resolution managerial system is not endemic in the legal structures of both Israel and the Palestinian Authority, water experts from both entities, motivated by professional concerns, can promote joint collective action. The following chapter will show the way to collective action through the "expert" approach, calling upon drainage basin experts from both entities, working in mirror agencies, to design and implement a joint master plan for trans-boundary waters.

MOVING FROM CONFLICT MANAGEMENT TO COLLECTIVE ACTION

In order to avoid mistakes made in other countries, Israel and the Palestinian Authority need to create a management system that encourages collective action within the hydrological unit[16]. Looking at other management systems in the world for inspiration, one finds an almost unanimous recommendation for integrated water resources management, described in the following chapter. In addition, Europe encourages collective action to the point where sovereignty gives way to subsidiarity[17]. Both concepts put protection of the commons above protection of the individual. Both systems encourage collective action rather than conflict resolution. For Israel and the Palestinian Authority, where conflict is a way of life, taking another tack could only improve the political climate, not to speak of the hydrological cycle.

The Present Regime for Protecting the Hydrological System:

[16] See: Laster, R.E., "Catchment Basin Management of Water", Water, Air, and Soil Pollution, Kluwer Academic Publishers (2000), pp. 437-446.

[17] Treaty on European Union (Maastricht Treaty), article 3b, Title II- "In areas which do not fall within its exclusive competence, the Community shall take action, in accordance with the principle of subsidiarity, only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member states (...)" .

Israel: Israel has one of the most admired compendiums of water laws in the world[18]. Beginning in the 1950's the Israel Knesset passed four water laws to give the state total control over all water sources[19]. Control, not ownership. The water sources of Israel belong to the people, and the government manages them in trust for the people[20]. In charge of this system is a water commissioner appointed by the full cabinet for a designated term, and he is given statutory powers to act using his professional judgment[21]. In addition to the water commissioner, there is a government company (Mekorot) serving as a bulk supplier of water to all towns and cities. Sewage treatment is a local or regional component of the system and the weakest link in the water management system. Drainage and run-off are handled by eleven drainage boards whose borders are drawn along catchment basin lines[22]. There are also two river authorities for the Yarqon and Kishon streams[23]. River authorities, unlike drainage authorities, are responsible for water flows, water quality and amenity uses. Recently, the Ministry of Environment, responsible for the Rivers and Streams Authorities Law, granted power to two drainage authorities to act as river authorities, thereby extending their powers to include amenity uses[24].

The Palestinian Authority

[18] Laster, R.E., "Legal Aspects of Water Quality in Israel", Water Quality Management under Conditions of Scarcity- Israel as a Case Study, Shuval, H. I., ed., Academic Press, N.Y. (1980), p. 263. Laster, R.E., The Legal Framework for the Prevention and Control of Water Pollution in Israel, Jerusalem (1976),

[19] Israel Water Law - 1959, The Drainage and Prevention of Flooding Law- 1957, Water Measurement Law- 1955, Supervision of Water Drilling Law- 1955.

[20] The Israel Water Law of 1959, Art. 1 holds that water is owned by the public, controlled by the state and to be used for the purposes of the habitants of the state and for the development of the country.

[21] Israel Water Law, Art.'s. 11, 138.

[22] The Drainage and Prevention of Flooding Law, 1957 gives the drainage authorities the power to build, change, and maintain drainage systems within their boundaries in order to prevent runoff and health hazards from flooding.

[23] Both of these river authorities were established within the framework of the Streams and Springs Authorities Law, 1965. The Kishon River Authority was established in September 1994, and the Yarqon River Authority in May 1988.

[24] The Order of Streams and Springs Authorities (Granting the Powers of a River Authority on a Drainage Authority), 2003 gave the Southern Jordan and Shikma-Besor Drainage Authorities the authority to act as river authorities.

The Palestinian Water Law also recognizes the government's control over water sources, allowing no private ownership of running waters[25]. Like Israel, there is a bulk supplier of water, while distribution and sewage control are in the hands of local authorities[26]. Unlike Israel, however, the Palestinian Authority has not created drainage boards along catchment basin lines. Instead, the Palestinian Authority is creating a utility system with area-wide water companies owned by municipalities for water supply and sewage control[27]. This, however, leaves the ecological aspects of streams and stream management outside the system.

Back to Israel:

During the last ten years, as Israel has slowly depleted all of its surface waters, the public has demanded more amenity uses from the remaining waters. Several crises added force to the public's demands. In the 1988 several cases of polio were attributed to sewage in the Hadera River. In 1997 an Australian contingent of athletes who came to attend the Maccabiah Games fell into the Yarqon River due to the collapse of a poorly constructed bridge. Claims were made that exposure to the polluted waters was partially to blame for several of the injuries and deaths[28]. In 2003, a government committee was set up to investigate the connection between rates of cancer in young navy "seals" and their diving in the Kishon River near Haifa[29]. The committee

[25]The Palestine Water Law Number (3/2002), Article 3, like the Israeli Water Law, declares all water resources to be public property and gives every person the right to water.

[26] According to Water Law Number 2, 1996, and the more recent Water Law Number 3, 2002,articles 6-7, The Palestine Water Authority(PWA) is the official body responsible for water resources in Palestine, whether surface or ground water, including sewage water. Local water authorities include The Water Supply and Sewerage Authority of Bethlehem, Beit Jala and Beit Sahour (*WSSA*) and the Jerusalem Water Undertaking (JWU) in Ramallah and Northern part of East Jerusalem. For an overview of the legal and institutional framework for water management in the Palestinian Authority, see the testimony of Dr. Ihab Bargouthi of the PWA before the U.S. House of Representatives Committee on International Relations from May 5, 2004: http://wwwa.house.gov/international_relations/108/bar050504.pdf (last visited March 10, 2005).

[27] The PWA plan is to create four regional utilities, divided geographically: Northern Utility, Central Utility, Southern Utility, and the Coastal Utility in the Gaza Strip.

[28] Besides several civil actions, the Israel Government brought criminal charges against four men involved in building the bridge- Shalom Court/Tel Aviv, criminal case number 15237/97. Expert testimony stated that the Yarqon was seriously polluted, but this would not in itself have caused the injuries or deaths. See- Levy, M., "Case Study: Maccabiah Bridge Tragedy", Seminar Paper presented to Hebrew University (2004) (Heb.).

[29] "Report of The Investigation Committee for the Consequences of Army Activities in the Kishon River and its Environs, On the Health of Soldiers of the Israel Defence Forces who were Operative On Site", (Part 2), 2003 (Heb.)

produced a divided opinion but depicted in vivid terms the tenure of the river's waters and their polluted quality. These events encouraged the government to rehabilitate the Yarqon and Kishon Rivers.

Rehabilitation of the Yarqon River

In 1993 the Yarqon River Authority embarked on a process of designing a Master Plan for the Yarqon and its environs. A team of experts in planning, ecology, hydrology, landscaping, law, economics, and other fields, together with the Yarqon Authority, developed a plan that covers approximately 38,000 dunams of land in and around the river[30]. The planners coined a phrase for the Master Plan: "Moving the Yarqon from the Backyard to the Front". The Plan was the first of its kind in Israel to take into consideration stream flows, amenity uses and green belts around the river. The plan was first approved by the Yarqon River Authority and subsequently obtained governmental approval in 1996[31]. The Authority then embarked on implementation of the Master Plan under the Planning and Building Law.

Kidron Master Plan

The Yarqon River Master Plan does not extend beyond the Green Line. But with this model in mind, the Dead Sea Drainage Board approached the Palestinian Water Authority to develop a joint master plan for the Kidron River (Hebrew)/ Wadi Nar (Arabic), an intermittent stream that flows from Jerusalem to the Dead Sea[32]. The stream, or wadi, is dry most of the year but for the past several years has carried run-off and sewage from Jerusalem and the surrounding areas to the Dead Sea. Along its banks are historical sites and breathtaking views but due to the stench of the river, breath taking is problematic. In the past, there have been laudable plans to build joint sewage treatment plants in the Kidron hydrological basin but none of these plans were

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[30] Yarkon Master Plan, Aryeh Rachmimov- Architects and Urban Planners, Yarkon River Authority,1996.

[31] Israel Government Decision 753(HM/2) of March 27, 1996.

[32] One of the authors serves as the legal advisor to the Dead Sea Drainage Authority.

executed due in part to the lack of the joint vision and collective action[33]. The new initiative of the Palestinian Authority and the Dead Sea Drainage Board has the advantage of putting the plan before implementation. What kind of stream do we want? What quality of water? To what quality to purify sewage? Who is best suited to receive the treated effluent? What historical sites to develop? What are the needs of the stakeholders? All these questions of water needs are to be discussed and resolved in a joint master plan. The Palestinian Water Authority and the Dead Sea Drainage Board have agreed to embark on the Master Plan using the Yarqon Plan as a model.

With the signing of the Oslo Accords[34], Israel and the Palestinian Authority agreed to cooperate in creating a water development program, developing methods of cooperation in water management, and creating plans for the equitable utilization of joint water resources[35]. The sides set up a Joint Water Committee, whose role is to discuss all issues concerning management of water and sewage, including common management of water sources and their protection[36]. The proposal to create a Kidron Master Plan was brought before the Joint Water Committee and received the Committee's approval. With the JWC's approval in hand, the concept was presented to an international audience at the Stockholm Water Conference in 2003. At that stage, a joint Palestinian/Israeli steering committee was formed. The members include representatives from the Israel Water Commissioner, Israel Ministry of Environment, the city of Jerusalem, the Dead Sea Drainage Authority, the cities of Bethlehem and Beit Sahur and the Palestinian Water Authority.

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[33] Feitelson, E., and Abdul-Jaber, Q. H., Prospects For Israeli-Palestinian Cooperation in Wastewater Treatment and Re-Use in the Jerusalem Region, The Jerusalem Institute for Israel Studies and Palestinian Hydrology Group, Jerusalem (1997).

[34] Declaration of Principles on Interim Self-Government Arrangements, September 13, 1993 (commonly referred to as the Oslo I Accords).
The Interim Agreement on the West Bank and the Gaza Strip of 1995, Between Israel and the PLO (commonly referred to as the Oslo II Accords).

[35] Declaration of Principles, Annex III- Protocol on Israeli-Palestinian Cooperation in Economic and Development Programs, Par. 1: "Cooperation in the field of water, including a Water Development Program prepared by experts from both sides, which will also specify the mode of cooperation in the management of water resources in the West Bank and Gaza Strip, and will include proposals for studies and plans on water rights of each party, as well as on the equitable utilization of joint water resources for implementation in and beyond the interim period."

[36] The Oslo II Accords, Annex III, App.1 (Powers and Responsibilities for Civil Affairs), art. 40 (Water and Sewage), Principle 11-15.

Implementing the Expert System

The Expert System for water management introduced above presupposes several preconditions. A necessary precondition is that experts on both sides of the political map agree to meet and discuss water needs. A second precondition is that the experts recognize that there is a conflict between the two peoples, but in order to meet and exchange ideas they ignore the conflict. Thirdly, the experts must know that government decisions in a democratic country flow from the people to the government, and therefore the experts are imbued with a spirit of change knowing that they will impact on government decisions despite the fact they are working in a voluntary framework.

The Expert System reduces frustration for those persons whose countries are in the midst of a conflict which they cannot resolve, as the experts make a small contribution towards reducing tension. Finally, common sense dictates joint cooperation in a hydrological basin.

WHERE DO WE GO FROM HERE? INTEGRATED WATER RESOURCE MANAGEMENT

One of the driving forces behind Europe's success in improving surface water quality is the adoption of the principle of collective action. The Rhine Commission, created over fifty years ago, is a model of cooperative action among sovereign states[37]. Recently the European Union passed a Directive requiring catchment basin management as a rule and not a guideline for all transboundary water resources in Europe.[38]

What is Integrated Water Resource Management?

[37]The International Commission for the Protection of the Rhine (ICPR) was founded on July 11, 1950 by the countries bordering the Rhine: Switzerland, France, Luxembourg, Germany and the Netherlands. It was created as a common forum, where questions relating to the pollution and management of the Rhine could be discussed, and solutions sought after. See: http://www.thewaterpage.com/rhine_convention.htm (last visited 9 March, 2005).

[38] Directive 2000/60/EC- EU Water Framework Directive, requires Member States to establish river basin districts and for each of these a river basin management plan. They will be based on catchment areas rather than political borders. Thus, some will traverse national frontiers.

One definition describes IWRM as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"[39].

Integrated Water Resource Management (IWRM) brings together all the different uses, studying in depth how they interact with one another, and deriving the optimal sustainable benefits. This includes recognizing nature's and humans' right to an adequate supply of clean water for legitimate uses, rather than the conventional approach based on historical rights or location within the watershed (upstream vs. downstream location).

Putting IWRM into practice requires a clearly delineated institutional structure that best suits the needs of the parties. These institutions can be within each country or they can be international. They may be strictly for the purpose of information collection, coordination and distribution; a full-fledged governing body; or something in between. For any institution to be effective, it must have[40]:

- Diverse and comprehensive sources of information which are up to date.
- Logical data for determining water needs, including quantity and quality of water entering, remaining and leaving an aquifer, stream, and other water bodies within the catchment basin. This requires constant monitoring of water quality and quantity.

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[39] .Global Water Partnership, Technical Advisory Committee, Background Paper No. 4, Stockholm, March 2000.
For a concise overview of IWRM, see:Snellen, W.B., Schrevel, A., "IWRM: For Sustainable use of Water- 50 Years of International Experience with the Concept of Integrated Water Management", Background document to the FAO/Netherlands conference on Water for Food and Ecosystems, Wageningen, October 2004.

http://www.fao.org/ag/wfe2005/docs/IWRM_Background.pdf (last visited March 9, 2005).

[40] These principles are taken from treaties and agreements, literature on the subject, and the authors' knowledge. See:
Agenda 21, UN Conference on Environment and Development, Rio De Janeiro, 1992, Sec. 18.9;
'Dublin Principles', created at The 1992 International Conference on Water and the Environment in Dublin;
Convention on the Law of the Non-Navigational Uses of International Watercourses (NUIW);
Sinclair, Ian C., "Institutional and Legal Aspects of Water Management", International Seminar on Institutional and Legal Aspects of Water Management, Madrid, 29-31 May, 1985;
Benvenisti, Eyal, *Sharing Trans-Boundary Resources: International Law in Optimal Resource Use*, Cambridge University Press (2002), Ch. 6., p.133.

- Scientific criteria for determining water quality and quantity, and economic criteria for determining cost and income.
- An efficient forum for exchange of that information.
- Public access and involvement.
- Transparency by creating appropriate mechanisms for a public overview.

If it is a governing body, it must also contain:

- An agreed-upon charter describing its powers and responsibilities, and its decision making process. The powers include setting the quantity and quality of water entering, remaining and leaving water bodies, and deciding on the permitted uses and distribution of these waters.
- Planning and decision-making bodies.
- Enforcement mechanisms.
- Dispute resolution mechanisms.
- A source of income to carry out its activities.

All these need to be responsive to changes, whether the changes are local or regional, short or long term, political, economic, natural, or technical (for example drought years or other natural disasters, desalination and other technological developments, population increase or decrease).

Bringing IWRM to Israel and the Palestinian Authority

The expert system and the Master Plan for the Kidron/Wadi Nar nudges Israel and the Palestinian Authority closer to catchment basin management. In order to reach IWRM, however, Israel and the Palestinian Authority need to make certain structural changes as described below.

To create an Israeli/Palestinian governing body for carrying out the above principles, both Israel and the Palestinian Authority should have back to back drainage boards or hydrological basin boards. Once created and in operative effect, the governments could then think in terms of creating an overall water management authority that would be an integrated program. This would serve as a function for future discussion, consideration, deliberation, arbitration and decision making on water issues in the region.

Israeli water law has created drainage authorities as described above, throughout the entire country. The law must be refined, however, in order to give the Israeli drainage authorities the powers described in the axioms above. Yet, they can still serve as a platform for joint management of a transboundary river. What is needed, however, is a mirror authority on the Palestinian side. With such a mirror authority, the two authorities could then work in tandem in one of two ways, either as a river basin authority for information exchange or as a river basin commission with decision-making and policing powers[41]. SEE TABLE 3.

Conclusion

Homo-sapiens' ability to adapt to change has enabled him to develop principles of social change in order to avoid physical combat. Over the centuries, laws were created to enable water users and misusers to exploit water resources without causing physical conflict. These laws, however, were designed by legislators to manage a conflict and not a water source. As a result, water resources depleted in quantity and deteriorated in quality. With the evolution of environmental principles, natural systems of water flow came to the attention of legislators who developed rules for management of a catchment basin to avoid conflict rather than to manage it.

Today, these rules have broadened to include integrated water resource management, a holistic view of a catchment basin using the precautionary principle to prevent adverse effects of the water source on its environment and cumulative effects of the environment on the water source. How can the modern principles of water law be integrated into the management of water resources crossing the border between Israel and the Palestinian Authority? By encouraging each entity to create a catchment basin authority within its territory and then a joint commission of both authorities. It is suggested that by using the "expert" approach, this can be done even during a time of conflict between the two entities. Within a regional platform, discussions and decisions can be based on scientific criteria rather than political interests, with basin protection and optimal utilization as the common goal.

[41] See Mostert, E., Van Beek, E., Bouman, N.W.M., Hey, E., Savenije, H.H.G., Thissen, W.A.H. (1999), "River Basin Management and Planning", Keynote paper for International Workshop on River Basin Management, The Hague, 27-29 October, 1999.

Table #1. ANTHROPOGENIC ACTIVITIES THAT AFFECT WATER QUALITY

1. Land use changes that affect the natural water balance and the rate and location of the groundwater recharge flux;

2. Water extraction that affects the pressure distribution, flow rates and pathways in the aquifer;

3. Introduction of chemical and other noxious materials on the surface or into the subsurface, in the pathway of the recharge waters;

4. The application of water inputs additional to the precipitation, such as irrigation water, sewage effluents or water imports, especially during the dry season;

5. Changes in the microclimate, affecting the water balance and/or the precipitation regime.

6. Effects on the self-cleaning capability of the system by microbial or chemical remediation processes.

Table #2. POSSIBLE STRATEGIES FOR DEALING WITH POLLUTION

a)- Prevention of release to the environment and/or cleanup of effluent before discharge.

b)- Separation of "clean" and "dirty" pathways of recharge; (distinguishing between protected and sacrificial aquifers).

c)- in-situ natural or enforced remediation (e.g. by reactive barriers).

d)- Pump , treat and recharge of treated water

e)- Treatment and cleanup at pump head, prior to distribution

f)- Replacement, dilution or flushing of system by imported water

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Choice is dictated by the nature of the pollution, its spread or containability, the geo-hydrological setting, availability of alternate water sources, economic considerations and societal constraints.

Table #3. PROPOSED MODEL FOR JOINT ISRAELI- PALESTINIAN BASIN MANAGEMENT

A. Basic Axioms:

1. Understanding the water cycle.
2. Understanding water quality.
3. Understanding historic needs.
4. Understanding future needs.
5. Allocations according to needs, not rights, provided that population is controlled.

B. Requirements of the Management Regime:

1. Agreed upon.
1. Based upon accepted international principles.
2. Flexible, open, public oriented, basin oriented, non-corrupt.

C. To Assist in Meeting These Requirements:

1. The governing body must be representative of political organizations, but the members themselves do not necessarily have to be politicians, although they should be.
2. The governing body must be guided by professionals.
3. A third party (an international organization) should be monitoring and commenting on the progress of the governing body.

D. The Proposed Model

1. A drainage authority is created in one country with a mirror drainage authority created in the adjacent country for the same basin.
2. The joint authority develops a Master Plan for the basin, to be created by one combined group of scholars.
3. Discussions are held among professionals who are to be guided by the Helsinki Rules when it comes to decision-making.
4. The plan includes all aspects of integrated water resources management, all potential beneficial users of water, and all points and non-points of pollution, with a scheduled time frame of twenty years for implementation.
5. The plan is submitted to the stakeholders in the basin, on both sides of the border, by each authority. Changes and additions are then brought back to the joint planning committee for fine-tuning and then submitted to the individual drainage boards for approval and budgeting.

E. Implementation

1. The Master Plan will have a timetable for implementation and a budget allocated by each party.

Figure 1-Temperate/Humid Climate

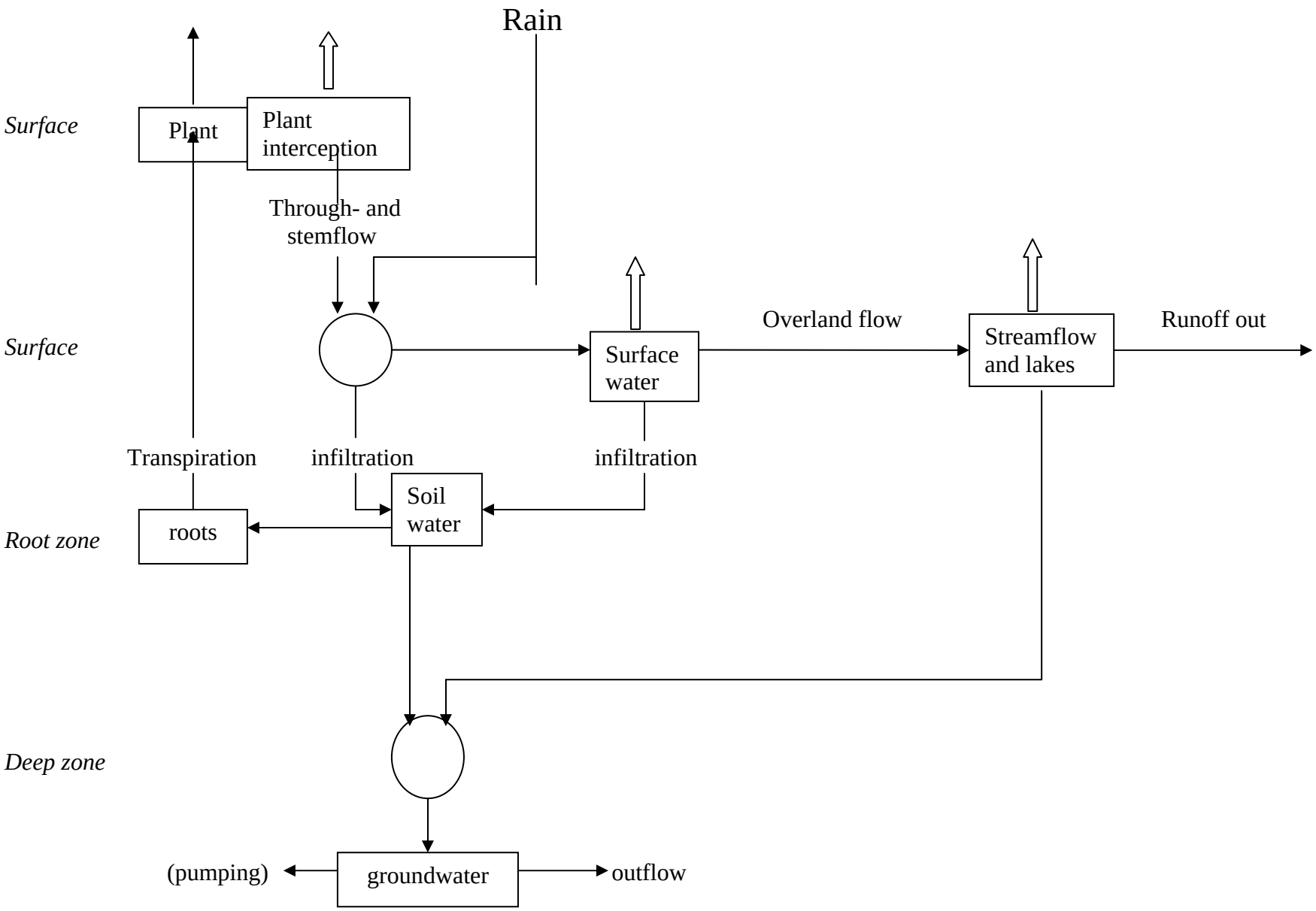

Figure 2- Semi-arid Climate

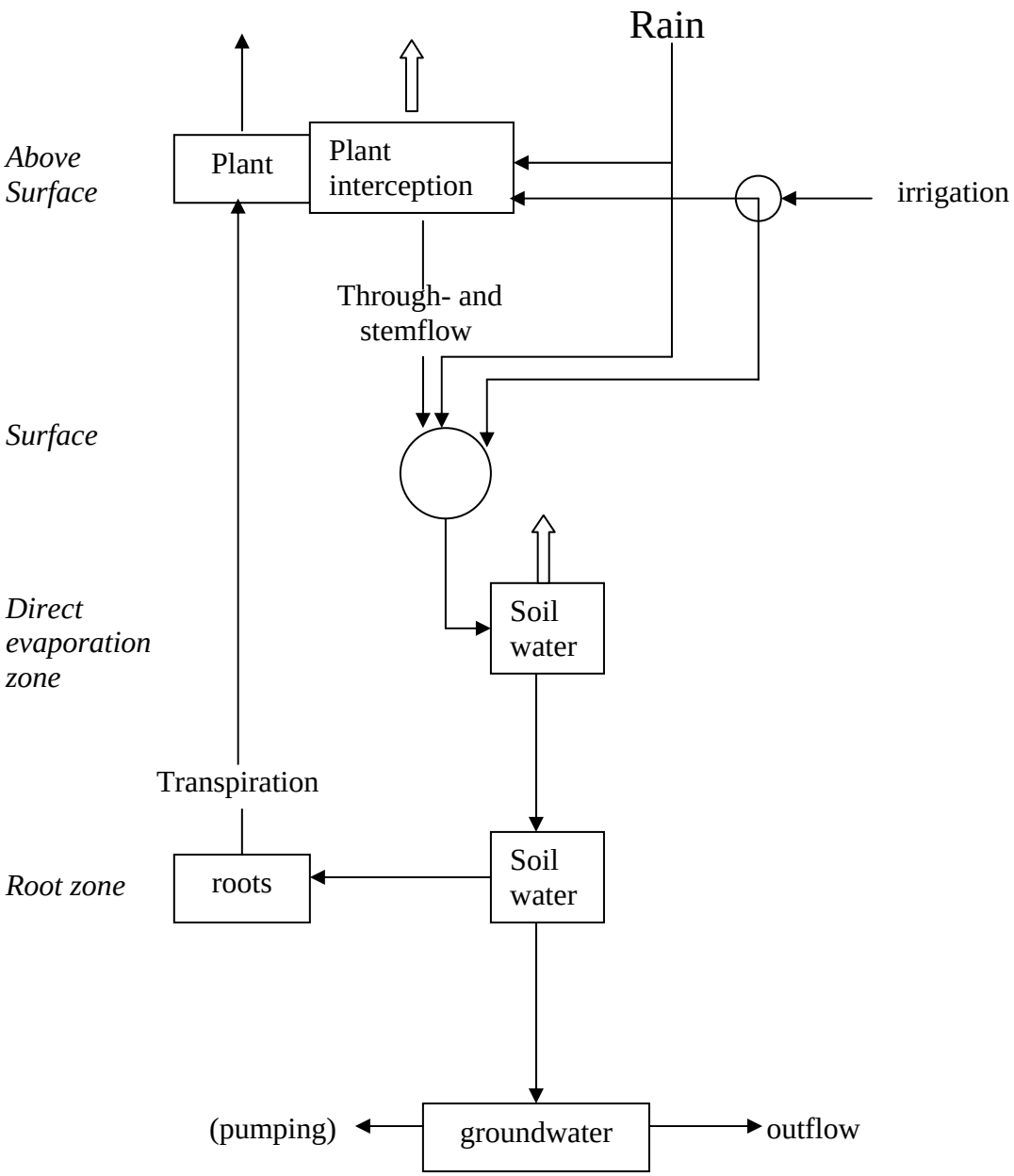

Figure 3- Arid Climate (natural)

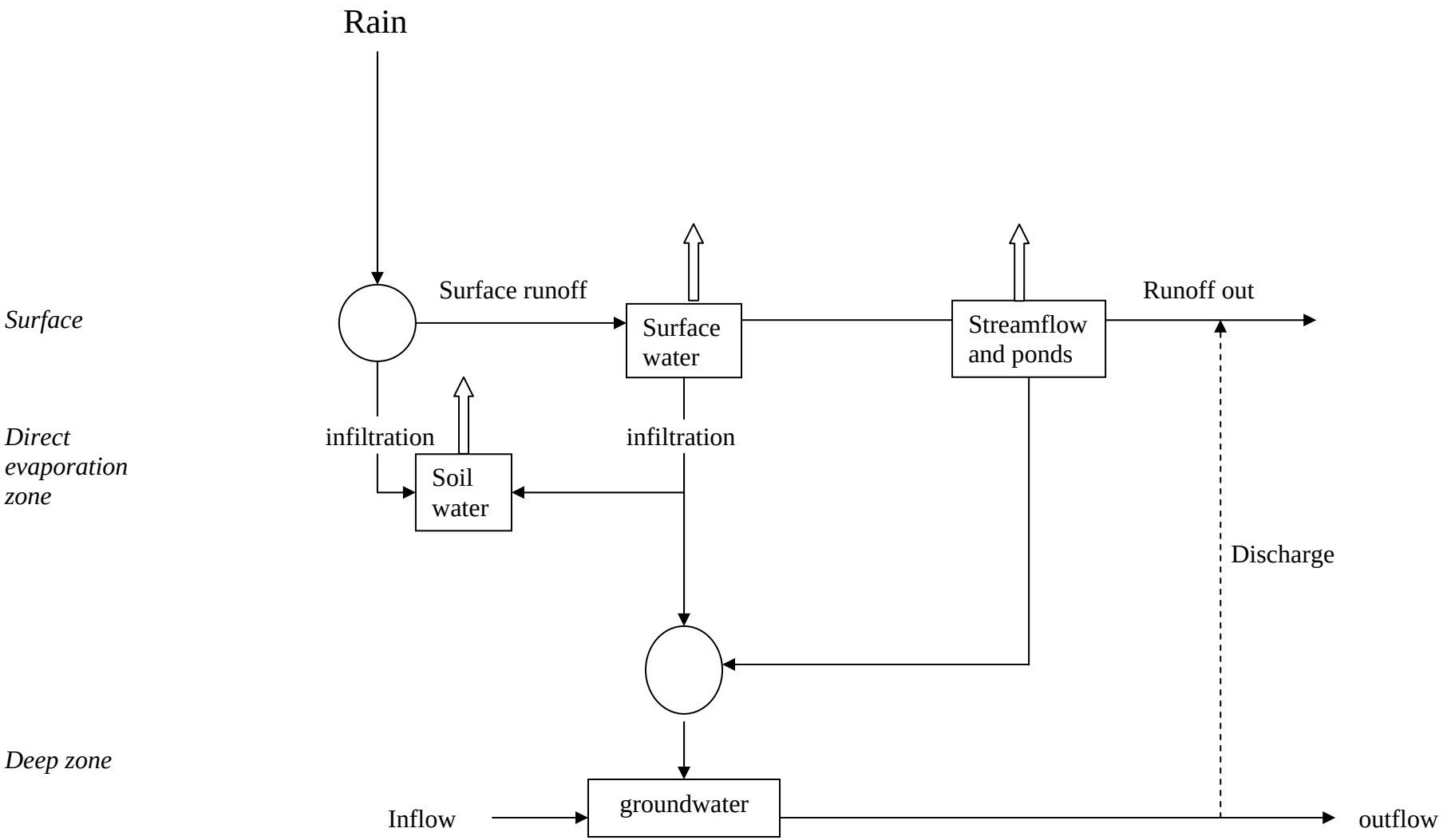

Figure 4- Arid Climate (urban)