OBSERVATIONS ON ARRANGEMENTS FOR THE REVISION OF THE DEAD SEA CONCESSION IN ISRAEL

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1. THE CONTEXT FOR THIS REPORT

In 1961, following the enactment of enabling legislation, the Government of Israel signed an agreement granting a concession to the Dead Sea Works Company (DSW) to produce mineral resources from the Dead Sea. In 1986, the concession was extended through an amendment to run until 2030.[1]

In June 2013, the Israeli government appointed a committee – "Sheshinski II" – headed by Professor Eytan Sheshinski to review how the state of Israel should tax and impose royalties for the commercial use of natural resources other than oil and gas,[2] including but not limited to natural resources of the Dead Sea. The committee filed its recommendations in October 2014, and the Israeli government adopted them shortly thereafter.

In 2017, the Israeli government established a team composed of representatives of various ministries to examine how the process of awarding a new concession should be structured and what provisions should be incorporated in the concession. The interagency team's report, "Report on Government Actions Required Prior to the End of the Dead Sea Concession Period," was issued in January 2019. I was subsequently asked by EcoPeace Middle East to review the team's report and assess its adequacy with regard to the environmental consequences of mineral production on Israel's side of the Dead Sea.[3]

I am an economist, not a lawyer, and I have reviewed the Team's report as an economist, focusing specifically on the environmental consequences of Dead Sea mineral production and their economic implications.

2. THE DEAD SEA

The Dead Sea is a natural wonder of tremendous geological, religious and cultural importance. It has been a global attraction since antiquity. However, it is now in severe decline – both physically, in terms of water level, and ecologically.

Evaporation has always caused water to be lost from the Dead Sea. But anthropogenic factors have now assumed the dominant role. From 1900 to the 1930s, the water level was roughly constant at about 389 meters below sea level (mbsl). After the Degania Dam was constructed in the 1930s, there was a small decline, with the water level falling by about 4 meters between 1930 and 1960. Since 1960, the situation has changed dramatically due to massive diversions of water upstream for urban uses and for irrigation, and the annual decline in water level has grown to be an order of magnitude larger than before 1960.

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[1] At the time, DSW was still a government company. In the 1990s, the Israeli government (IG) privatized Israel Chemicals Ltd. (ICL), the parent of DSW.

[2] An earlier committee headed by Professor Sheshinski – "Sheshinski I" – had reviewed how the state of Israel should tax oil and gas extraction. Its recommendations were implemented by legislation enacted in 2011.

[3] EcoPeace provided me with an English translation of the Team's Report, which I will cite below.

Diversions began with the completion of the Israeli National Water Carrier project in 1964 to divert water from the Sea of Galilee, dams built by Syria on the Yarmouk River and its tributaries within Syria, and the King Abdullah Canal which was completed in 1966 to divert water to Jordan from the Yarmouk River. Upstream on the Yarmouk River, construction began in 2004 on the Al-Wehda Dam to store water for Syria and Jordan. According to an estimate by EcoPeace, Israel is responsible for approximately half of the water diverted from the Jordan River and its tributaries, and Jordan and Syria are each responsible for about a quarter, with Palestine accounting for a negligible fraction.[4]

The consequence of the extensive diversions is that the Jordan River's discharge into the Dead Sea is now only 5-10% of the historical level.[5] The Dead Sea's water level has fallen by almost 40 meters since 1960 and is now declining at a rate of 1 – 1.3 meters per year. As a result, the surface area of the Dead Sea shrank by 31% between 1972 and 2004, and it continues to shrink today at a faster rate than ever.

The decline of the Dead Sea also has several inadvertent effects. The drop in water level changed the hydrological balance between the lake and surrounding aquifers, increasing the amount of groundwater flowing into the lake and lowering the water table in those aquifers, which were already under stress because of intensive exploitation. Also, as the Dead Sea's water level drops, sections of previously inundate land become exposed above the waterline. As it recedes, the highly saline water leaves behind a thick layer of underground salt below the surface of the dry ground. When fresh water from winter rains washes down from the mountains it infiltrates the ground, dissolving the salt layer and forming underground cavities. The cavities eventually collapse, creating sinkholes. The first sinkhole appeared in the 1980s. Since 2000, the occurrence of sinkholes has increased rapidly. Over 6,000 sinkholes have now appeared along the Israel side of the Dead Sea, making large sections of the coast too dangerous to enter, and swallowing up a brand new coastal highway, built in 2010 and designed to withstand sinkholes.[6]

3. POTASH PRODUCTION

At the south end of the Dead Sea, there are fewer sinkholes, and there is a stable shoreline. In this part of the Dead Sea, however, the water level is artificially controlled. This is because the southern basin has been turned into a series of shallow evaporation ponds. The evaporation ponds exist on both the Israeli and Jordanian sides of the border but, for the purpose of this report, I will focus only on the Israeli side.

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[4] Gafny, S., S. Talozi, S., Al Sheikh, B. and E. Ya'ari (2010), *Towards a living Jordan River: An environmental flows report on the rehabilitation of the Lower Jordan River,* Amman, JO, Tel Aviv, IL, Bethlehem, PS: EcoPeace Middle East.

[5] EcoPeace Middl East, *Background Report on Dead Sea Concession*, 2020

[6] https://www.abc.net.au/news/2021-06-10/the-disappearing-dead-sea-sinkhole-science-en-gedi/100123858 consulted on 2021-06-28.

To feed these evaporation ponds, water is pumped from the northern part of the Dead Sea via a canal.[7] The evaporation ponds were created to serve the needs of potash production by DSW.[8] The imported water is led through a sequence of ponds, with different minerals precipitating at different stages of the process. Eventually, carnallite is precipitated, which is the main raw product used by DSW. From the carnallite, potash, magnesium and bromine gas are produced through a variety of chemical processes. After mineral extraction is completed, the end-brine is pumped back to the northern basin of the Dead Sea. However, the volume of water returned to the northern basin is only about half of that exported from it, thus contributing to the loss of water in the lake. [9]

4. THE ECONOMIC CONCEPTUALIZATION OF THE ENVIRONMENTAL ISSUE

4.1 The Sheshinski II Committee

The main focus of the Sheshinski II Committee report, and of the IMF report on fiscal regimes for mining commissioned in support of the committee,[10] is how the Israeli government should best tax mineral production – in this case production by DSW. From that perspective, there are two key considerations. Since the resource being exploited belongs to the people of the country the goal is to maximize the revenue received by them, or by the government on their behalf, to compensate them for the use of something they own. On the other hand, the compensation should be designed in a manner that is economically efficient. In this context, economic efficiency is taken to mean that the compensation scheme avoids as much as possible distorting the commercial decisions of the mining company which are otherwise assumed to be in the best public interest.

What is seen as economically valuable in this economic conceptualization are the minerals being extracted – the carnallite and other minerals that are owned by the people of Israel and are being used up by DSW. Implicitly, the use by DSW of water from the Dead Sea is not seen as something that simultaneously (1) is of value, (2) is owned by the people of Israel, and (3) is being used up by DSW. Therefore, no consideration was given to the payment of compensation for the use of Dead Sea water by DSW.[11]

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[7] Without this infusion of water, the southern basin would have completely dried up decades ago.

[8] There is a similar arrangement on the Jordanian side – a canal supplies water to evaporation ponds in the southern basin for potash production by the Jordan-based Arab Potash Company.

[9] EcoPeace estimates the average annual loss of water from the Dead Sea at 1248 million cubic meters (mcm) per year, which is composed of an average of 570 mcm from evaporation, 250 mcm used up in mineral production and abour in diversions from the Jordan river its tributaries and associated groundwater resources.

[10] International Monetary Fund, ISRAEL Technical Assistant Report – Reviewing the Fiscal Regime for Mining, IMF Country Report No. 14/125 May 2014, Washington DC

[11] I understand that the Sheshinski II Committee was aware of this issue in 2014 but felt constrained from addressing it because, the Committee felt, this could violate the terms of the existing concession agreement.

The view that Dead Sea water itself is of no particular significance might perhaps not have been entirely unreasonable in 1961 when the concession agreement was signed. That view would have been less reasonable in 1986 when the concession was extended, since by then the water level in the Dead Sea was persistently declining. And it is blatantly unreasonable today, when the Dead Sea is in crisis.

To be sure, the economic analyses cited above do recognize the possibility of some consideration of environmental issues in the design of a mineral taxation scheme. For example, while stating that this is "not the focus here," the IMF report does note the possibility of "environmental taxes, where mining involves external damage best addressed by taxation rather than regulation."[12]

4.2 The 2019 Interagency Team Report

The report starts out by affirming: "The Dead Sea and environs are a natural resource that belongs to the public and held by the State on behalf of the public as a 'public trust.' The state must safeguard these natural resources and use them in a way that serves the public interest."[13] Accordingly, "the overarching goal before the team in formulating its recommendation is 'maximizing the economic value of the Dead Sea while integrating environmental and social values.'"[14]

The fundamental question is whether the two opening affirmations – the Dead Sea is a public trust, and the goal is maximizing its economic value – are consistent or mutually contradictory.

The report addresses the issue of environmental damage up to a point.

> It affirms the need, in a future contract, for "measures to restrict the scope of negative environmental impact" (p.6).
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> It recommends "leaving the responsibility for drainage and preventing flash flood damage in the hands of the holder of future extraction rights, in light of the tremendous value of these assets versus the substantial danger of flash floods in the area" (p. 12).
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> "For removal of doubt," it affirms that "the extraction of resources from the Dead Sea is similar to all other industrial activities, and the Future Extraction License must ensure that such activity is subject to all laws, including the planning and building laws and environmental protection laws" (p14).
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> It notes: "The area of the Concession presently contains various waste and pollution hazards. … When allocating future extraction rights it is proposed that the responsibility

[12] Op. cit., p. 17.
[13] *Team on Government Actions Required Prior to the End of the Dead Sea Concession Period*. Final Report, January 2019, p. 2.
[14] Ibid.

> of the new holder of the extraction rights be clearly defined with respect to all environmental hazards caused within the scope of its responsibility, including the responsibility to remove, rectify and rehabilitate hazards, without derogating from the provisions of any law. It is recommended that when preparing the Future Extraction License, the reliefs and sanctions available to the State in case of violation of these undertakings be taken into consideration, in addition to the authority given to the State by virtue of environmental and other laws" (pp. 14-15).

However, these commitments go only so far. In my opinion, they are lacking in two key respects.

First, the commitments are framed in terms of compliance with an environmental standard rather than in terms of meaningful financial liability for natural resource damages. There is a fundamental difference between those two approaches. The environmental standard approach promulgates a standard of behavior or of environmental outcomes but then is often vague or unspecific about (i) what exact sanction will be imposed if the standard is violated and (ii) whether the sanction entails monetary payment adequate to cover the costs of remediating and restoring environmental damages caused by the violation. In my experience, those two conditions are often not satisfied in practice when mining and resource extraction operations are supposedly held to an environmental standard, in part because of the long time horizon of the mining or resource extraction concession itself. Successfully holding mining companies to an environmental standard is thus honored more often in the breach than in the observance. Israel may be no exception. Conversely, if a mining company is required to post a bond up-front to cover any future environmental damages, or can be held liable ex post for natural resource damages, that approach is more likely to be effective in preventing environmental damages in the first place and, should those occur, in funding the costs of remediation and restoration.

Second, the proposed treatment of environmental damages views these as incidental to the mineral production operation of DSW. But, at least with regard to the diversion and consumption of water from the Dead Sea and associated groundwater aquifers, this environmental damage lies at the heart of DSW's operations. Therefore, something more forceful is required with respect to the diversion of water.

The 2019 interagency team report did address the issue of water diversions but, again, only up to a point.

> The report acknowledges: "Pumping water from the northern basin is one of the reasons – if not the main reason – for the drop in the water level of the Dead Sea. Therefore, it is proposed that as part of regulating conditions for future activity, and in accordance with the water laws, a ceiling be defined for the total amount of net annual pumping. The purpose of the ceiling would be to reflect a balance between the tremendous economic

value in continued operations at DSW, and the desire to limit the scope of their negative environmental impact" (p. 13).

"In addition to setting a ceiling for the annual pumping quantity, the team recommends defining an economic incentive that would encourage the future producer for efficient use of the pumped water and would reflect the impact of pumping water from the northern basin and its contribution to lowering the water level and environmental damage. This would be in accordance with the water laws and in coordination with the Government Authority for Water and Sewage ("the Water Authority"). For this purpose, it is necessary to ensure that the Future Extraction License requires the producer to submit a detailed report regarding the quantity of water pumped from the Dead Sea and the amount of water returned. It is emphasized that the purpose of the incentive is not to increase state revenues." (p. 13)

Regulating the use of groundwater by DSW. The Dead Sea Works use a large quantity of groundwater pumped within the area of the current concession. As part of the allocation of future extraction rights, all aspects of this issue must be clearly explained, in accordance with the Water Law and general laws. First, as aforesaid, areas used for groundwater drilling will not be considered, in and of themselves, areas required for the purpose of resource extraction, and shall therefore not be included as part of the Future Extraction License. Second, such drilling must be subject to the water laws applicable throughout the country in connection with water drillings serving as a water source for industrial activity, including imposing a water extraction fee. Third, as the Future Extraction License is expected, as aforesaid, not to include water drilling areas, and also in consideration of the fact that water in the existing drillings may be exhausted in the future, thus requiring water supply from other sources, it is necessary to consider how to prepare for this eventuality.

Two features are striking.

First, while there is a commitment to place a limit on the amount of water being diverted from the northern basin for use in producing minerals in the southern basin, what that limit might be is entirely unspecified. Perhaps it is the same as the net amount of water *currently* being diverted from the basin; perhaps it is less; perhaps it is more. With regard to extraction of groundwater in the southern basin, there is no similar commitment: if the groundwater there runs out, it will be "necessary to consider how to prepare for this eventuality."

Second, there is a commitment to create "an economic incentive that would encourage the future producer for efficient use of the pumped water and would reflect the impact of pumping water from the northern basin and its contribution to lowering the water level and environmental damage." This language is very vague – indeed, coy – regarding how exactly the

incentive would be designed. It sounds a lot like the IMF report's "environmental taxes, where mining involves external damage best addressed by taxation rather than regulation."

These raise more questions than they answer.

If the Israeli government intends to impose a limit on future extraction of water from the northern basin for the purpose of mineral production in the southern basin, why has it not already taken steps – including commissioning any necessary research – to specify what that limit might be? Similarly, if the Israeli government intends to impose an extraction fee for water diverted from the northern basin for mineral production, why has it not already commissioned a study to formally identify the damages and measure their market and nonmarket economic value? What will the baseline be for identifying environmental damages – damages relative to conditions in 1961, or in 1986, or 2019, or 2030?

Contrary to the IMF report, doesn't the 2019 team report commit to *both* regulation – a quantity limit – and also an environmental tax? What is the economic logic of this?

Is the problem really one of inefficient use of water diverted by DSW from the northern basin? Isn't the problem the continuing decline in the water level to which mineral production in the southern basin greatly contributes? If so, why should there be any amount of net water diversion from the northern basin?

The other Israeli water diversions that contribute to the decline of the Dead Sea – those by the National Water Carrier – are done to benefit the people of Israel by providing water for their use. The diversion of water for mineral production in the southern basin is for the private benefit of the mineral production company. This water diversion uses up a public trust resource for a private benefit. Why would there not be a requirement to replace that water?

5. ECONOMIC APPROACHES

There is not one way to answer these questions. Instead, there are several different lines of reasoning in economics that can lead to different answers. Here, I lay out the different approaches and explain the issues involved.

On the table are three interrelated questions: What price should be levied on the diversion of Dead Sea water for mineral production in the southern basin? What limit should be imposed on the volume of Dead Sea water diverted? What amount of revenue should be extracted for the use of Dead Sea water (as opposed to revenue for the use of carnallite and other minerals, a question addressed by the Sheshinski II Committee)?

The answers to these questions necessarily depend on the objectives to be served. With the first question – what price should be set for the diversion of water – possible objectives include (a) promoting the economically efficient use of Dead Sea water, (b) raising revenue, and (c)

reducing the amount of water diverted. Objectives (b) and (c) are generally in conflict – the greater the reduction in the amount of water diverted the less revenue generated, and conversely.

What is economic efficiency, and should maximizing it be the main objective when designing a regulatory system for the use of Dead Sea water?

The common conceptualization of economic efficiency by economists – including the Sheshinski II Committee – is what is known as the Kaldor-Hicks criterion (or the Potential Compensation Principle). This criterion holds that a change is economically efficient (and, therefore, socially desirable) if those who benefit from the change could compensate those who lose from the change in such a manner that the losers then suffer no loss while the winners still enjoy a net gain in the aggregate – or, equivalently, if the aggregate value of the benefit to those who gain exceeds the aggregate value of the loss for those who lose. Note that compensation does not actually need to be paid: it is sufficient for this criterion that compensation *could* be paid.[15] The implied criterion for policy is to maximize the total of benefits minus costs (i.e. damages) regardless of to whom these accrue.

This is a point of view that dispenses with notions of a property right: whether the winners have a right to win, or the losers a right not to lose, warrants no consideration. In my view, it is questionable whether that is an admissible position in the case of Dead Sea water. If the Dead Sea is a public trust resource that belongs to the people of Israel, then it is inappropriate to compare benefits of mineral production alongside damages to the Dead Sea. An analysis based on the maximization of economic efficiency, as conventionally conceived, would thus be out of place.

If raising revenue is to be a goal when imposing a price on the diversion of Dead Sea water, how is the revenue to be used? The 2019 team report states emphatically that the policy objective "is
not to increase state revenues." Another possibility is raising revenue in order to be able to pay for remediating the damage caused by the diversion of Dead Sea water. But, at this point the Israeli government does not appear to have committed itself to such remediation activity. Indeed, as noted above, it does not appear to have committed itself to any position on what level
of water in the Dead Sea is optimal or even acceptable.

An approach sometimes proposed in circumstances like this is to set a price per unit of water diverted that equals the marginal damage caused by the diversion and then let the market (or, in this case, DSW or its successor) decide how much water to divert with whatever

[15] The Kaldor-Hicks criterion was famously denounced by Little (1957) as morally questionable because actual payment of compensation was not required.

consequences that arise.[16] That approach is problematic for at least three reasons. First, at this point, no reasonably comprehensive estimate exists of the marginal damage per unit of water diverted from the northern basin. If an estimate did exist, the approach would be viable if the marginal damage per unit of water diverted were (approximately) constant, regardless of the magnitude of the diversion. However, this seems unlikely given the Dead Sea's geometry – the more water diverted, the greater the incremental shrinkage of the lake's surface area and the more incremental shoreline exposed. In the event that the marginal damage from an additional quantum of diversion is not constant, then conceptually the government must first form a judgment of the optimal amount of water to be diverted and then set the diversion tax equal to the marginal damage at that optimal volume; otherwise, the approach would not be viable. Thirdly, even if viable, the rationale for this approach is rooted in the Kaldor-Hicks criterion which, as noted above, seems inappropriate in the case of the Dead Sea.

Another line of reasoning in economics focuses on regulating water diversions from the northern basin by imposing a quantity limit rather than by setting a fee or otherwise creating a financial incentive to induce the mineral operator to reduce diversions. The choice between those two archetypal approaches was famously framed by Weitzman (1974) in an analysis known as "prices versus quantities."[17] The essential idea is as follows. A regulator seeks to control the use of a resource by an industry, and the criterion is maximization of aggregate net benefit (i.e., the Kaldor-Hicks criterion). The regulator would like the outcome to be that the industry chooses to use the amount of resource that the regulator thinks will maximize aggregate net benefit. To accomplish this, the regulator could set a price or a quantity limit. But, in each case something could go wrong. This arises from the fact that the regulator does not know the industry's internal economics of production *exactly*. The industry may respond to the price set by the regulator by using a different amount of the input than the regulator had expected due to the regulator's incomplete knowledge of the industry. In a worst case, they price may turn out to have been too low, causing excessive use of the input as far as the regulator is concerned. Something also could go wrong with setting a quantity limit, namely that, due to incomplete information, the regulator miscalculates and selects a quantity limit for input use that does *not* maximize net benefit. Here the firm complies, but the regulator had erred.

[16] I am being imprecise here. Economists distinguish between a *flow* externality, where what causes harm is the instantaneous activity, and a *stock* externality, where the source of harm is cumulative activity. Since the Dead Sea is hardly being replenished by inflow from the Jordan River, net withdrawal of water from the northern basin is a stock externality which lowers the water level and shrinks the water surface area. Therefore a price should be placed on the cumulative volume of water diverted. To match the pattern of increasing damage, the price would rise with the cumulative amount of the net diversion.

[17] Weitzman's analysis was developed in the context of a flow externality. However, it has since been extended to deal with a stock externality, most notably by Karp and Traeger (2018).

Both setting a price and imposing a quantity limit can go wrong in the face of incomplete information on the part of the regulator. Which failing is the more serious? Weitzman showed that the answer depends on how the marginal damage responds to greater input use compared to how the industry's production costs respond. If marginal damage responds more sharply, a quantity limit is superior. More generally, if the damage prevented by avoiding excessive use of the input is a more important consideration than the money that might be wasted by setting the wrong target for input use, then a quantity limit is preferred; otherwise, the price instrument is preferred. However, the conclusion depends heavily on the assumed criterion of maximizing aggregate net benefit. If, instead, the criterion were a public trust obligation to maintain some water level in the Dead Sea, then the quantity limit would be the preferred instrument.

If the policy goal is to maintain a particular water level in the Dead Sea, and the criterion is not maximization of net benefit from use of the Dead Sea, water, another approach could be that adopted in the US and the EU for natural resource damage assessment.

6. THE NATURAL RESOURCE DAMAGE PERSPECTIVE

To explain this perspective, I quote extensively from a report submitted to the EU's REMEDE Project (Resource Equivalency Methods for Assessing Environmental Damage in the EU).[18]

"In the United States and in Europe, various environmental laws have been enacted to provide for compensation for damage to natural resources. …

"When natural resources are damaged by releases of hazardous chemicals or physical destruction of the environment, actions can be undertaken to remediate the resources and to compensate the public for the loss of those resources during the time that the resources are impaired. …

"Generally, two approaches have been used to calculate the amount of required compensation: determining the monetary value of the damages; and calculating the amount of natural resource remediation or restoration needed to compensate for the harm. When a monetary valuation approach is used, the value of the loss is used to define the scope of remediation needed to complement and compensate for the damage. When a resource equivalency approach is used, the benefits of remediation projects are scaled to be equivalent to the damage. Recent European Union (EU) Directives covering environmental compensation state a preference for resource equivalency approaches over monetary valuation. …

[18] Stratus Consulting, *Deliverable No. 6A: Review Report on Resource Equivalence Methods*, Boulder CO, July 2007, pp. 1-3.

“In the US, equivalency methods are used to determine the type and amount of remediation needed to make the public whole for past, current, and anticipated future losses related to an incident. …

“In the US, environmental damages initially were expressed in economic terms, primarily using non-market economic valuation approaches. … These methods include travel cost, hedonic, contingent valuation, and conjoint analysis (choice modelling). …

“Each of these four methods is a value-to-cost equivalency approach: the value of a loss is used to scale the remediation. That monetary value is then collected and used to undertake remediation.

“Because of dissatisfaction with the difficulties of non-market valuation approaches and with value-to-cost compensation, alternative service-to-service equivalency methods were developed in the US in the 1990s. Under this alternative paradigm, if services provided by public resources are lost, the public theoretically can be made whole through replacement of the same or similar services. Services provided by natural resources include both human and ecological functions … Under the service-to-service equivalency approach, remediation is scaled so that the service gains provided through remediation equal the service losses caused by the environmental harm.

“The method initially developed to implement this service-to-service approach is called habitat equivalency analysis (HEA). By scaling remediation based on units of habitat rather than money, the services provided by habitats (which can include human use and ecosystem services) can be adequately replaced, regardless of the cost of the replacement.

“One of the key benefits of HEA is that it allows users to bypass the evaluation of economic damages resulting from natural resource damage and to proceed directly to remediation. In addition, HEA explicitly creates a connection between units of services lost because of damage and units of services gained through remediation, when the services provided by proposed remediation actions are of similar type, quality, and value as the services lost.

“HEA is appropriately applied when the service of the damaged area is ecologically similar to the service that will be provided by the replacement habitat. …

“As the use of HEA expanded, cases arose where the damage was more appropriately measured in numbers of individuals lost, such as birds or fish, than in habitat units. In such cases, the remediation was scaled to provide equivalent numbers of replacement individuals, on the theory that the replaced individuals would compensate for the full suite of ecological and human use services lost. This application of resource-to-resource scaling came to be called resource equivalency analysis (REA). The methods of REA are fundamentally the same as for HEA, but the units of quantification differ.

“In 1996, the US National Oceanic and Atmospheric Administration (NOAA) formalized the use of HEA in environmental regulations. Subsequently, HEA became the most common equivalency

scaling method. It has been used to scale compensatory remediation in such diverse habitats as Florida coral reefs, salmon habitat in the Northwest, and estuarine wetlands in south Texas."

The essence of the equivalency analysis as it has evolved in the US is the following. Remediation or restoration is not a cost-benefit test; the criterion is not that one remediates or restores only if the value of what is remediated or restored exceeds the cost of doing so. Instead, when a natural resource damage occurs, there is a direct obligation to remediate or restore, and the responsible party is required to pay the cost of doing this. The habitat or resource equivalence analysis is conducted to determine the type and amount of remediation or restoration needed to make up the damage.

The purpose of the REMEDE Project was to develop a methodological toolkit for performing HEA and REA analyses in the European Union in the context of various EU Directives, including the Environmental Liability Directive, the Habitats Directive, the Wild Birds Directive, and the Environmental Impact Assessment Directive. The common element of those Directives is the need to remediate damages to natural resources and to compensate the public for the loss of those resources during the time when they are impaired.[19]

How could this perspective relate to the Dead Sea?

If a diversion of water that lowers the water level in the northern basin is viewed as an injury to a natural resource which the government has a public trust obligation to protect and preserve, the approach under both US and EU law would be to conduct a resource equivalency analysis to determine the amount of compensation to be paid by the responsible party causing this injury. In this context, the most natural resource equivalency would be obtaining a replacement supply of water of similar quantity and quality as that diverted. The responsible party would be required to pay the cost of this replacement supply. The replacement supply could be water obtained through water market purchases, or water obtained through the development of a supply of suitably treated wastewater, or desalinated seawater, or water from another source, or a reduction in other water diversions or losses from the Dead Sea.

That arrangement has some resemblance to a version of the quantity limit approach where the limit is set at a net diversion of zero from the northern basin. The difference is the allocation of responsibility and decision making with respect to the replacement supply of water. In the natural resource damage context, the government performs those tasks – the government identifies the replacement equivalent, implements it, and bills the responsible party for that cost. In the case of a quantity limit, it is left to the mineral producer (the responsible party) to identify a replacement supply, implement it, and cover the cost. Given the transboundary nature of water usage in the Jordan River Valley, the government of Israel might be better placed to be the actor who designs and implements the replacement supply rather than the operator of the mineral production facility.

[19] The toolkit developed by the REMEDE Project for the EU, including case studies of HEA and REA analyses, is described in Lipton et al. (2018).

7. CONCLUSIONS

Two distinct strands of thought are invoked in the preamble to the 2019 interagency team report that, as a matter of economics, are mutually incompatible. One strand of thought rests on the Kaldor Hicks criterion which is often applied by economists: the objective, then, is to maximize net revenue for the people of Israel, regardless of how that is best accomplished – including, as a hypothetical, by draining the Dead Sea and endowing a massive sovereign wealth funded with mineral royalties and water revenues earned from potash production. The other strand of thought is that the government of Israel has a public trust obligation to maintain and protect the Dead Sea. It is the public trust notion that underlies the concept and implementation of natural resource damages in the US and the EU. The country's natural resources are to be maintained in their current condition; if release of a hazardous substance impairs them, there has to be an equivalent degree of restoration.

A trustee has to act in the best interests of the beneficiary and may not sacrifice the beneficiary's interests to those of other parties. Merely asserting a public trust obligation without taking any concrete action to identify the degree of protection to be afforded to the beneficiary and then to implement that protection is a meaningless exercise. My understanding is that, to this point, successive Israeli governments have failed to adopt a position on whether, if at all, the Dead Sea must be maintained at some level and, if so, what that level might be – the level in 1960, the level today, the level expected to occur in 2030, or some other level. A trustee has a fiduciary obligation to the beneficiary of the trust. Not doing anything – perhaps because you are not exactly sure what you should do – and permitting the beneficiary's situation to deteriorate over time is a dereliction of duty and a betrayal of the fiduciary obligation.

If the government of Israel were to define its public trust obligation towards the Dead Sea, the issues discussed above – should a price be used to regulate the diversion of water for potash production or a quantity limit? If a price, what purpose is it intended to serve? If a quantity limit, at what level? – could readily be resolved. Defining what the public trust obligation is and what it entails is the necessary first step towards developing a coherent approach for a new concession for potash mining in the Dead Sea.

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