Alternative 38 | **Other Foraminifera Studies (Research Proposal)**

HISTORY

This alternative was proposed by Dr. Richard Casey, representing Ocean Research International, of San Diego, California, at the August 1995 workshop.

PROPOSAL DESCRIPTION

This proposal suggested acquiring sediment samples from the Sea to evaluate the microscopic forms of life with shells (foraminifera) which have been preserved in this sediment. The focus of the study would be to determine which pollutants may cause the deformities and abnormalities in the foraminifera. A study of the foraminifera in the Sea was conducted in the early 1950's by Mr. Robert Arnal. This proposal would resample Mr. Arnal's sites to determine the present health of the Sea. Coring the bottom sediment would be accomplished to obtain time correlations.

EVALUATION OF ALTERNATIVE

This alternative was a research proposal. While the research may have merit, it did not directly address elevation or salinity issues.

REASON FOR ELIMINATION

The proposal failed to achieve and maintain the target salinity requirement of 35 to 40 ppt and would not address elevation. It was a research proposal that may have merit in helping to understand the ecosystem. For these reasons, no further consideration of this alternative was warranted.

Alternative 39 | **Other**
Potential Use of Study Ponds
(Research Proposal)

HISTORY

This proposal was submitted by Dr. Richard Casey, representing Float Inc., and Ocean Research International, both of San Diego, California, in a letter dated June 10, 1995.

PROPOSAL DESCRIPTION

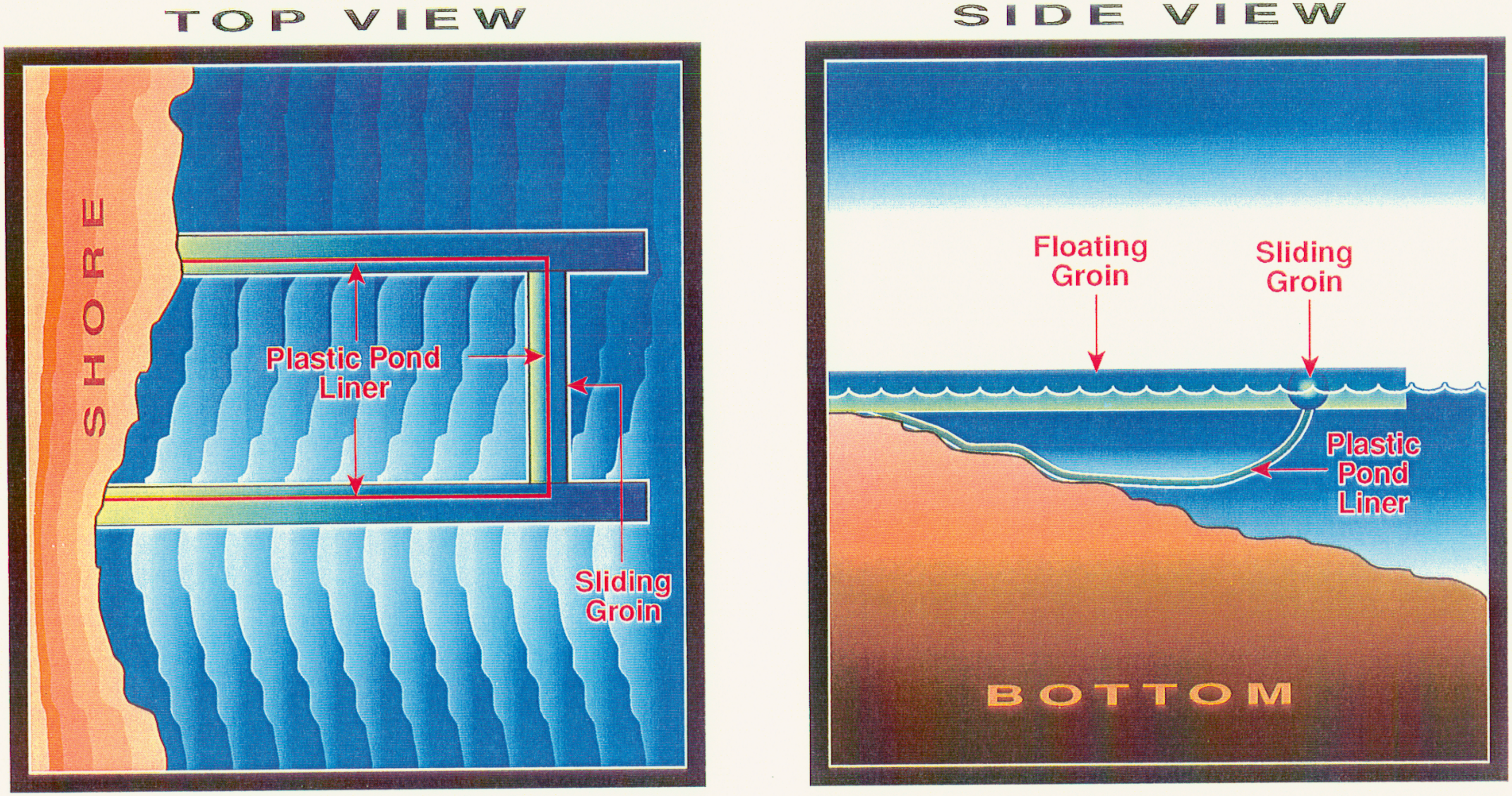
This proposal would use floating platforms placed in the Sea to create several ponds of various sizes; Sea water would be pumped into these ponds for research purposes (see Illustration 33). These research sites could be used to evaluate sports and commercial (including fisheries) aquaculture, recreation, and wildlife. For research purposes, freshwater to dilute the Sea water in the ponds would be transported via plastic floating canals. Experiments regarding evaporation and heat treatment of Sea water for desalination and pollution treatment were also offered for consideration.

EVALUATION OF ALTERNATIVE

This alternative was a proposal for conducting further research at the Sea and did not address elevation or salinity issues directly.

REASON FOR ELIMINATION

The alternative would not achieve and maintain the target salinity requirement of 35 to 40 ppt and would not address elevation. For these reasons, no further consideration of this alternative was warranted.



Alternative No. 39
Illustration No. 33

Alternative 40 | **Other — Injection Well Salt Disposal**

HISTORY

This proposal was first made by Aerospace Corporation in *Salinity Control Study Salton Sea Project*, Report No. ATR-71(S990)-5 (1971). The alternative was resubmitted by Mr. Michael Duffey, of Holtville, California, in response to public workshops held in August and September 1995.

PROPOSAL DESCRIPTION

This alternative would inject Sea water into high-salinity geothermal resource areas (see Illustration 34). Sea water would be pumped to injection wells and either flow down the well by gravity or be injected under pressure. Placing injection wells close to the Sea would minimize the cost of a distribution system. A pipeline distribution system would be used to distribute Sea water to a number of wells that would be dispersed over the injection area. Requirements for pretreatment prior to injection were unknown.

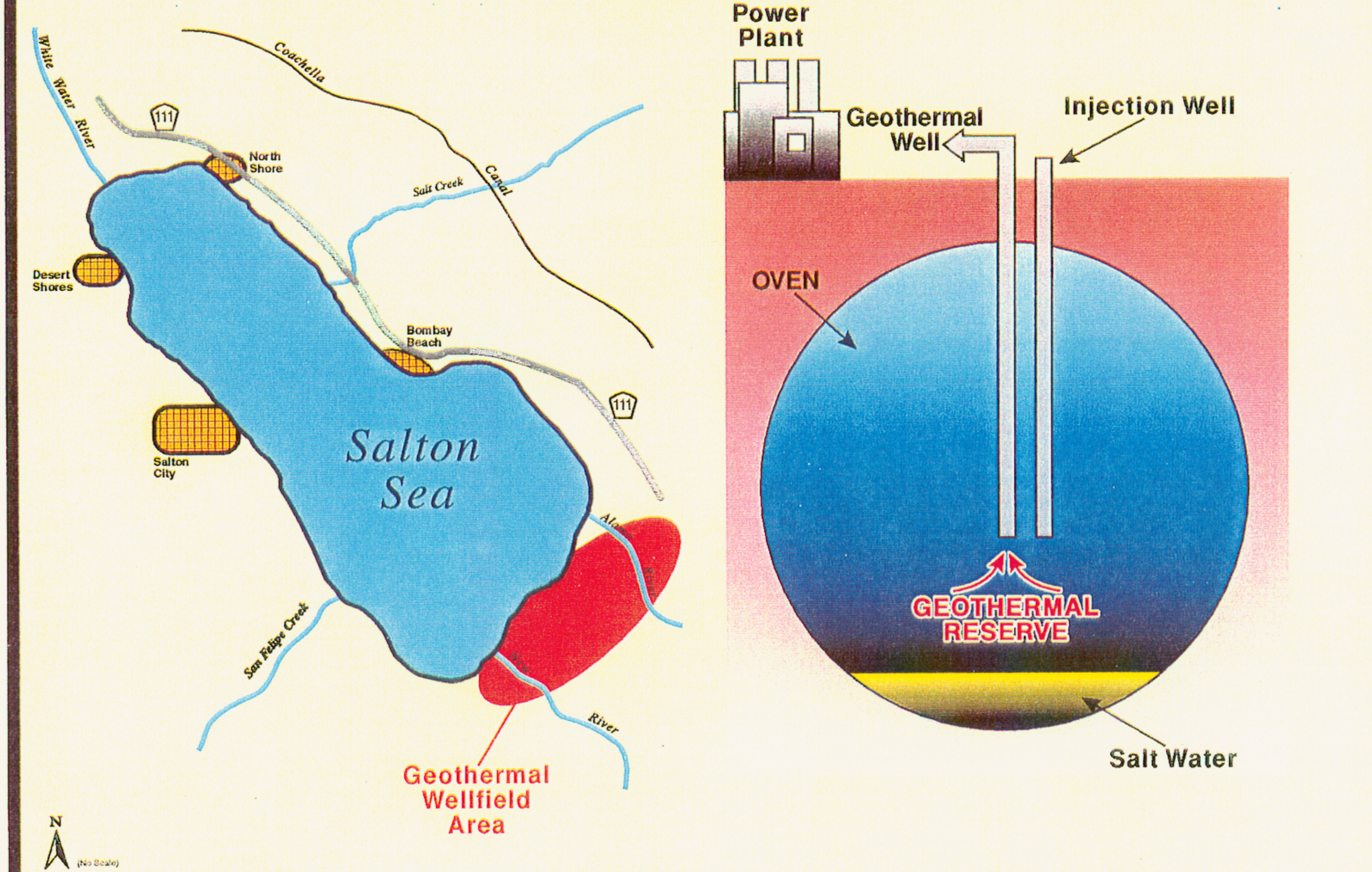
EVALUATION OF ALTERNATIVE

Pumping water from the Sea for injection into the geothermal formation would provide an outlet to the Sea and reduce salinity concentrations. If the system was operated for salinity control, elevation control would not be possible without a replenishment source. Operated only as an outlet, pumping 200,000 AF per year would bring salinity to target levels in a reasonable amount of time (approximately 10 years).

Successful existing injection wells in the Salton Sea Geothermal Field have been drilled into the fractured geothermal fluid host rocks. Loss of circulation while drilling is generally an indication that injection will be successful (Mr. Tim Boardman, California Department of Conservation, Division of Oil, Gas, and Geothermal Resources, El Centro, California, written communication, April 30, 1997). However, locating sufficiently permeable zones would not be a certainty, although they tend to coexist with high temperature geothermal anomalies. Permitting large-scale "cool" water injection in the geothermal resource area would be problematic because of the resultant cooling of the geothermal reservoir. No attempt was made to predict geologic formations or difficulties in drilling injection wells.

Injecting a high solids brine would be extremely expensive because of the resultant injection well plugging. A high solids injectate could cause well plugging within weeks. Therefore, most of the solids would have to be removed from the Sea water before injection at the Salton Sea

Other
Disposal of Salts with Injection Wells



Alternative No. 40
Illustration No. 34

Geothermal Field in order to maintain a reasonable well rehabilitation interval of about 2 years. The solids would be hauled to an approved landfill.

OME&R COSTS

Salton Sea Geothermal Field injection wells are typically rehabilitated every 2 years at a cost of about $370,000 for each well. Typical well head injection pressure is 100 lb/in^2 (Mr. Dennis Downs, Cal Energy Operating Company, Calipatria, California, May 1, 1997). Using a total pumping head of 300 feet, a flow of 3,565 ft^3/s (1,600 gal/min), constant operation, and an energy cost of $0.07 per kWh, the annual energy cost for injection would be $4.3 million. With 78 wells and an average annual rehabilitation cost of $185,000 for each well, total annual rehabilitation costs would be $14.4 million. Additional costs would be associated with pretreatment and well replacement. Those costs were not calculated.

CONSTRUCTION COSTS

This proposal was similar to the Paradox Deep Well Injection conducted by Reclamation at Paradox, Colorado. With this in mind, the cost to drill and complete an injection well in the Salton Sea Geothermal Field would be about $1.5 to $2.0 million. The depths would be about 7,500 feet, and the initial injection rate would be about 2,700 to 2,800 gal/min (Mr. Tim Boardman, 1997). The long-term average injection rate would be around 1,600 gal/min (Mr. Dennis Downs, 1997). The construction cost for a 200,000-AF per year Salton Sea injection well field would be about $156 million. A facility with 78 wells would be needed if the long-term average injection rate was 1,600 gal/min for each well. Construction cost was assumed to be $2.0 million per well. This cost estimate did not include the cost of pre-injection treatment facilities or other infrastructure on the surface. Most of the solids would be removed from the fluid before injection at the Salton Sea Geothermal Field.

REASON FOR ELIMINATION

This proposal exceeded the $10 million annual limitation for OME&R costs. Therefore, the alternative did not warrant further consideration.

Alternative 41	Other Air Diffusion/Ultraviolet Ozone System

HISTORY

This alternative was originally proposed in a letter by Mr. Bill Ryan Free, of Winterhaven, California (June 19, 1991). The alternative was also proposed by Ms. Elaine Thompson and Mr. John N. Hinde, representing Air Diffusion Systems, 465 S. Bluff #214, St. George, Utah 84770, (801) 628-9088, in a letter dated September 28, 1995.

PROPOSAL DESCRIPTION

This proposal would use a diffused air and ultraviolet ozone system installed on the Sea's floor to oxygenate and recirculate water, eliminating toxic substances and restoring its natural balance.

A network of plastic tubing would be weighted and laid along the bottom of the Sea in areas where the water is deepest. The tubing has uniform slits spaced equal distance apart along the top of the tubing which would allow air bubbles to flow upward and thoroughly mix the entire column of water and surrounding water. In addition to circulation, the introduction of oxygen at the lowest levels of the Sea would give oxygen to bottom dwelling animals which constitute a vital link in the living cycle of the Sea and aid in biodegradation of waste (see Illustration 35).

Ultraviolet-based ozone could be suggested as a way of enhancing or accelerating the effects produced by the oxygen when heavy pollutants would be present. Ozone would be produced via an ultraviolet generator and released to the Sea via the same delivery system as noted for the oxygen.

EVALUATION OF ALTERNATIVE

This alternative primarily addressed the organic problems of the Sea, but not salinity requirements. The aeration system proposed would provide a more balanced oxygen supply throughout the lake. As noted in the proposal, ozone is used primarily for purifying water containing materials than can be oxidized. Aeration and ozone treatment of the Sea would not lower or control the salinity levels.

REASON FOR ELIMINATION

This alternative did not meet the requirement of achieving and maintaining the target salinity requirement of 35 to 40 ppt. For this reason, no further consideration of this alternative was warranted.

Alternative No. 41
Illustration No. 35

Alternative 42 — **Other**
Surface Aeration

HISTORY

In a June 19, 1991, letter to the Department of the Interior, Mr. Bill Ryan Free, Winterhaven, California, provided hand-drawn sketches of concepts for improving the condition of the Sea. Of the three concepts he sketched, two were included in other alternatives. The one unique concept that Mr. Free proposed was included in this alternative.

PROPOSAL DESCRIPTION

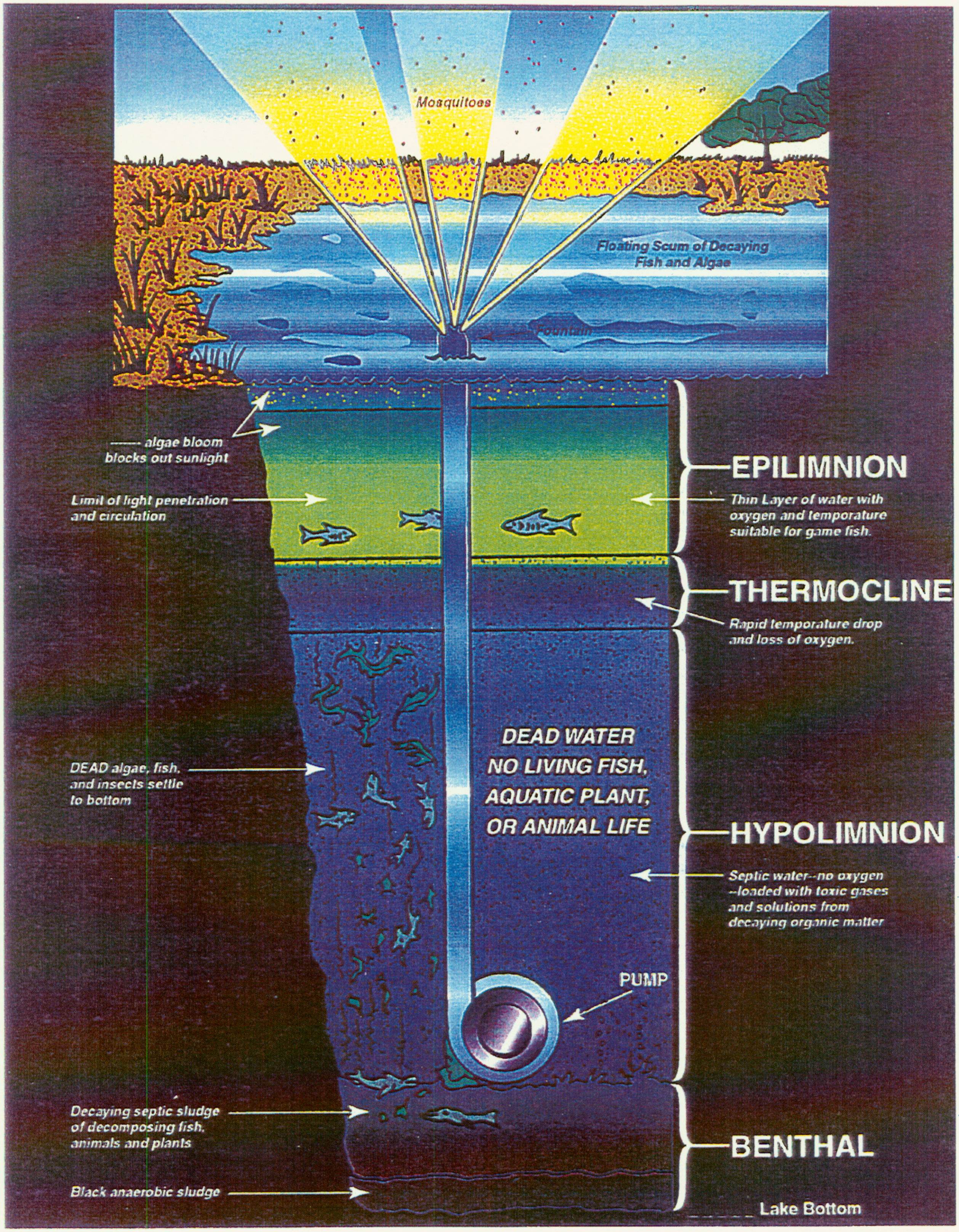
No narrative description of the concept was provided by Mr. Free. A sketch showing a water surface and a fountain along with the words "upward spray and filtration" were the only description available. Presumably, aeration fountains would be built in the Sea, and the quality of water would be improved through oxygenation (see Illustration 36).

EVALUATION OF ALTERNATIVE

Aeration of highly organic water would be an effective way of improving oxygen content and aquatic life. However, this process would not address elevation or salinity issues. While stagnation of water is a concern, it is not one of the criteria. Any beneficial effect of this alternative would soon be overcome by the increasing salinity concentration.

REASON FOR ELIMINATION

This proposal would not achieve the target salinity of 35 to 40 ppt, and it would not address elevation. For these reasons, no further consideration of this alternative was warranted.



Alternative No. 42
Illustration No. 36

Alternative 43	Other Gravel Berm

HISTORY

This proposal was given in an oral presentation by Mr. Sergio Garcia in the August 1995 public workshop.

PROPOSAL DESCRIPTION

This alternative proposed building gravel berms at several points along tributaries to the Sea. These berms would function as coarse filters to remove large solid matter (see Illustration 37).

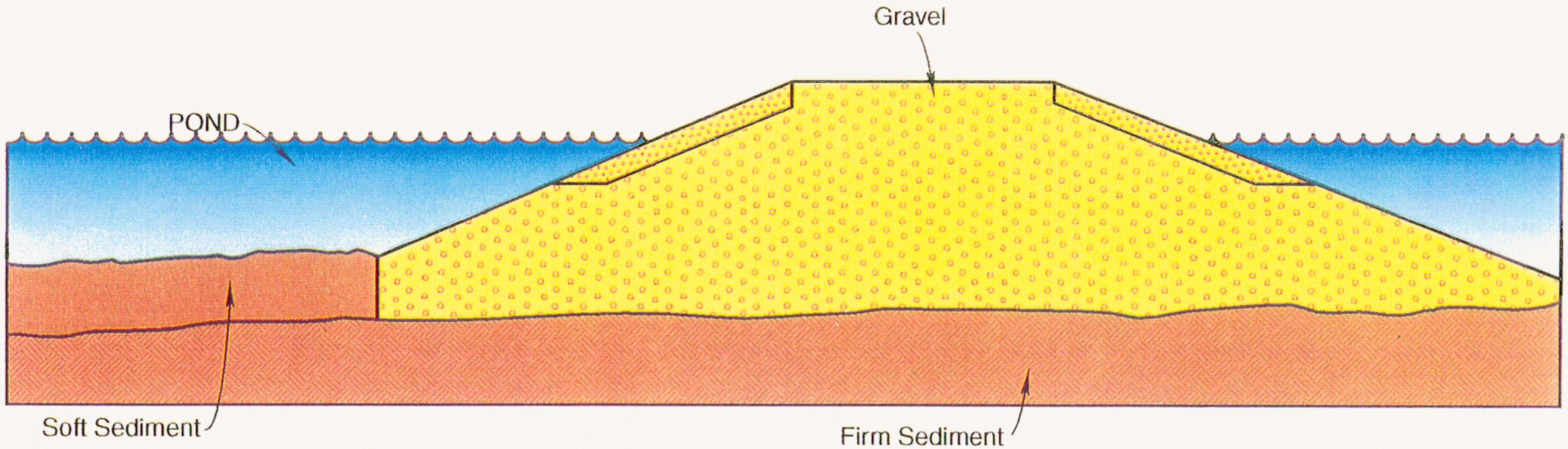
EVALUATION OF ALTERNATIVE

This alternative could provide some benefits in terms of aeration of inflow and removal of some organics, but it did not address elevation or salinity issues.

REASON FOR ELIMINATION

This proposal failed to achieve and maintain the target salinity requirement and did not address elevation. For these reasons, no further consideration of this alternative was warranted.

Typical Dike Section
Dumped Embankment



Depth of water varies from 8' to 35'

Alternative No. 43
Illustration No. 37

NOT TO SCALE

Alternative 44	Other Sea Water Filtration

HISTORY

This proposal was made by Mr. Richard Goralczyk, of the Zitelli Trust, P.O. Box 4986, Palm Springs, California 92263, (619) 320-5621, in a report to Mr. Phillip Meyer, dated January 18, 1990.

PROPOSAL DESCRIPTION

The technology in this proposal used a free energy source which would cause chemicals to separate from one another and from the Sea water (see Illustration 38). In addition, the technology reportedly would kill all bacteria, viruses, and small growth such as algae and parasites.

The system would consist of two or more processing modules installed in a permanent, ground-based wall enclosure close to the Sea. A centrifugal pump would draw Sea water through a screened pipe into the system where it is exposed to an energy source. The energy source was not defined in the proposal. At that point in the processing, all the bacteria would be killed, and the chemicals in the water would separate, creating two separate outputs. One output would consist of irrigation quality water; the other output would consist of a discard stream of highly concentrated chemicals and dead bacteria. The irrigation water stream then would be processed in a second interfaced system which would separate again into two streams, one containing potable water for human consumption and the other containing irrigation quality water.
No details were given of the process or its stage of development.

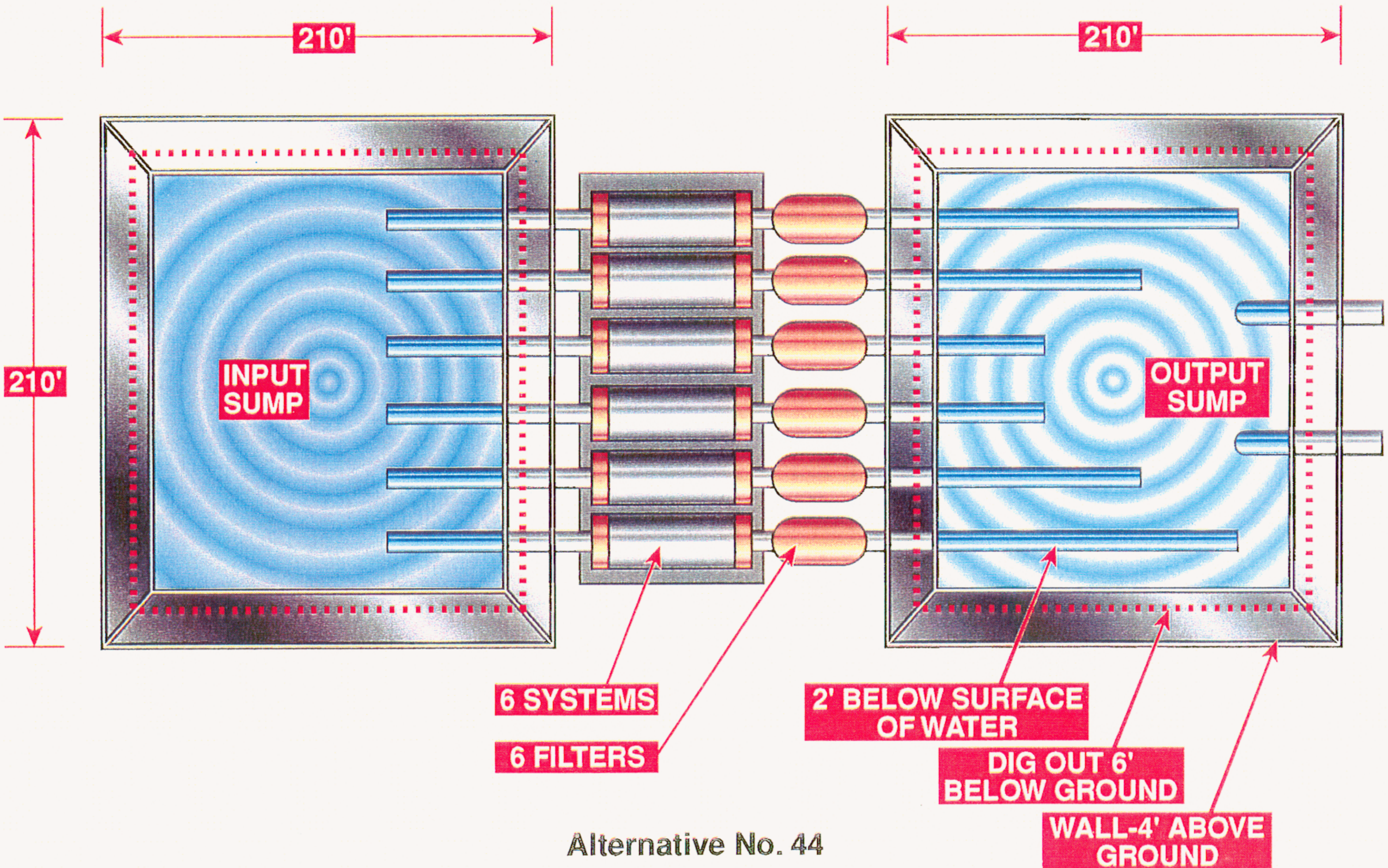
During the processing cycle, the separation and killing effect would be accomplished, and both the first agricultural output and the discard output would be inducted with a heavy concentration of energy so the separation/kill processing would continue between processing stages. If the discard stream were temporarily stored for later processing, the separation/kill process would continue in the storage facility.

EVALUATION OF ALTERNATIVE

This alternative appeared to be conceptual only. No data were available to determine which chemical, biological, or physical processes were being proposed. If there is indeed a process such as the one describe in this proposal, its ability to treat Sea water would have to be confirmed through field testing, and cost estimates would need to meet the cost criteria. There also appeared to be a disposal issue that was not addressed in the proposal.

TYPICAL CLUSTER

50,000 GPH / 1,200,000 GPD
OVER 3 ACRE Ft. PER DAY



Alternative No. 44
Illustration No. 38

REASON FOR ELIMINATION

The proposal involved technology that has not been proven to work. Since one of the elimination criteria was proven technology, no further consideration of the alternative was warranted.

Alternative 45 | **Other Enzyme-Activated Removal**

HISTORY

This alternative was proposed in August 1994 by Mr. Clay Thorne, representing Thorneco Environmental Technologies, P.O. Box 2631, Payson, Arizona 85547, (602) 474-9140, in *Treatability Study Report for the Thorneco, Inc., Enzyme-Activated Cellulose Technology*, dated February 1992, written by PRC Environmental Management, Inc., for the U.S. Environmental Protection Agency.

PROPOSAL DESCRIPTION

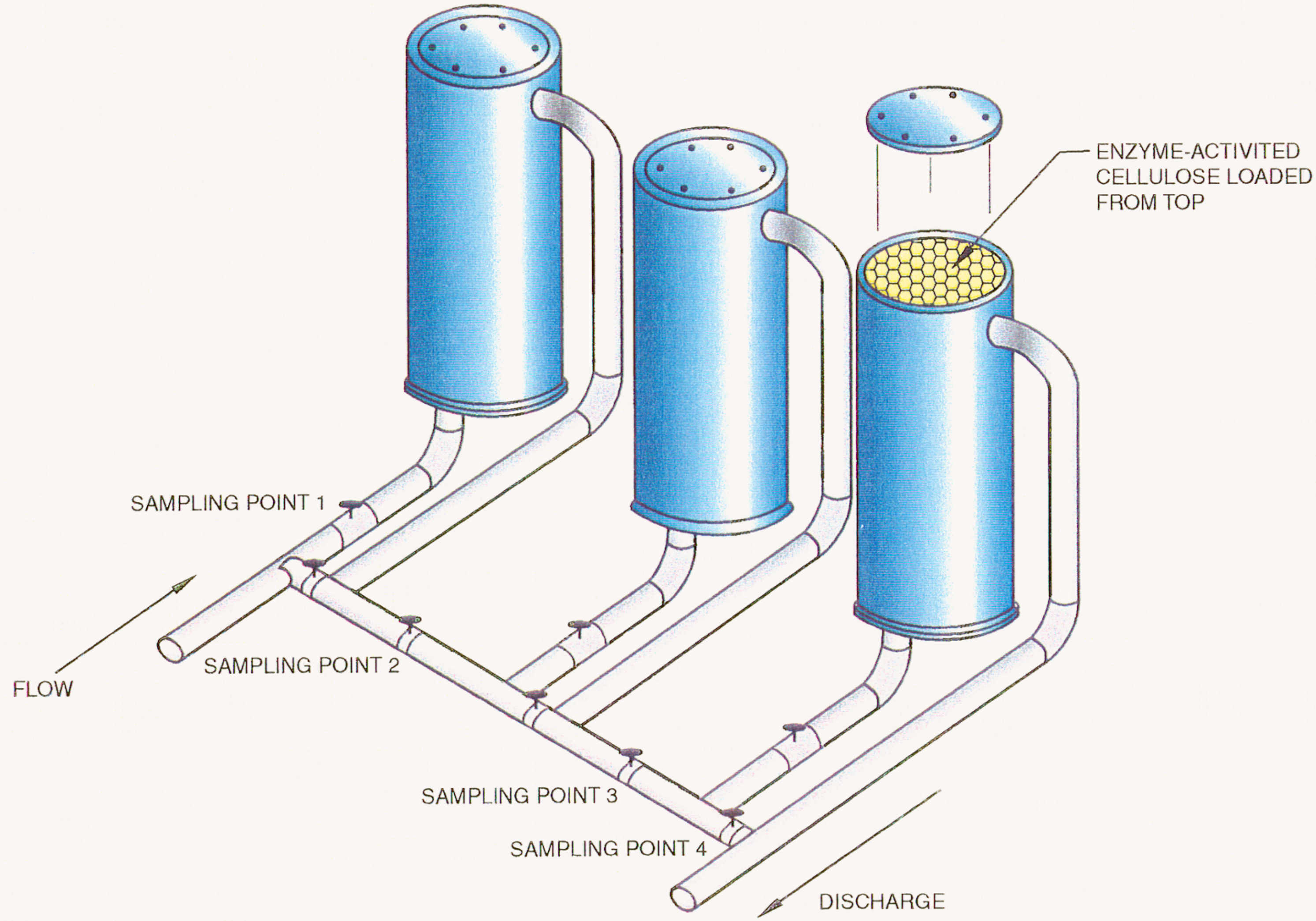
This proposal would use enzyme-treated porous material, such as cellulose (sawdust) or shredded polyurethane, to remove metals and organic or other inorganic compounds from contaminated water by a technology which would combine ion exchange and filtering (see Illustration 39).

Following enzyme treatment, the cellulose or other porous material would be placed into one or more cylindrical towers. Contaminated water would enter the tower from the bottom and flow upward through the enzyme-activated cellulose to the discharge pipe located at the top of the tower. The flow rate would be varied to achieve the desired retention time for the contaminants targeted for removal.

The enzyme-activated cellulose technology would remove metals and organic compounds from the solution in the form of ions, particulates, or colloidal compounds. The surface of the cellulose would be modified with a proprietary enzyme solution. According to Thorneco literature, the cellulose could reportedly be treated with this enzyme solution to selectively remove specific metals, other inorganic compounds, and organics. One gallon of enzyme solution would be mixed with 20 gallons of water, and the solution would be sprayed on any type of porous material (cellulose or shredded polyurethane). The operating parameters associated with the Thorneco technology include flow rate, cellulose dosage, type of enzyme solution, and pH.

A treatability study on this process was conducted by the EPA Office of Research and Development, Cincinnati, Ohio, at the Engineering-Science, Inc., treatability laboratory in Atlanta, Georgia (PRC Environmental Management, Inc., 1992). Treatability experiments were conducted between August 26, 1991, and September 30, 1991. Personnel from Engineering-Science offices in Pasadena and Riverside, California, collected groundwater for the treatability study from the Stringfellow Superfund site, Glen Avon, California. Samples collected for the

THORNECO ENZYME-ACTIVATED CELLULOSE TECHNOLOGY
3 TOWER SYSTEM



Alternative No. 45
Illustration No. 39

treatability study were analyzed at the Engineering-Science, Inc. laboratories in Berkeley, California, and Atlanta, Georgia.

EVALUATION OF ALTERNATIVE

The proposal did not contain sufficient data needed to analyze it further. The process was purported to be proprietary, so a theoretical evaluation of the process was not possible. Testing by Engineering-Science, Inc., did not confirm process success or show achievement of process claims. Because definite conclusions about certain removal mechanisms (that is, adsorption, ion exchange, and chemical reduction) could not be made, a pilot study would have to be designed to further examine these mechanisms.

REASON FOR ELIMINATION

The proposal would involve unproven technology. For this reason, no further consideration of this alternative was warranted.

Alternative 46 — **Other Power/Freshwater Cogeneration**

HISTORY

This alternative was proposed by Mr. Frank E. DiCola, representing Cogeneration Partners of America, Cherry Hill, New Jersey, in a letter dated January 28, 1992.

PROPOSAL DESCRIPTION

The proposal suggested building an electrical power generation plant using an unnamed heat source to create steam that would power a steam turbine generator. Waste steam from the generator would then be used to generate freshwater by thermal distillation. Details of the thermodynamic process were not included in the proposal.

Cogeneration Partners of America is reportedly currently developing, or has developed, three projects as examples of what can be accomplished: (1) a 117-MW plant in Oldmans Township, New Jersey; (2) a 50-MW plant in Binghamton, New York; and (3) a 44-MW project in Vineland, New Jersey. At the time of the proposal, all three projects were in various stages of development, and no information was available to determine the potential for success at the Sea.

EVALUATION OF ALTERNATIVE

Cogeneration is the production of two types of energy from a single fuel source. The units would consist of a generator (power plant) powered by natural gas, propane, or diesel. The waste heat from the power plant would then be used to heat Sea water for the thermal distillation process.

O&M COSTS

The process of thermal distillation would require the heating of water from the Sea to approximately 200 degrees F (93 degrees C). The cost of power requirements to heat 200,000 AF of water would be on the magnitude of $1 billion per year.

Specific heat of water = 0.53 watt-hrs per pound per degree C
Specific gravity of water = 62.4 lbs per ft^3
7.48 gallons per ft^3
325,892 gallons per AF.

It was assumed that heating water from 80 degrees F (27 degrees C) to 200 degrees F (93 degrees C) would yield a change of 66 degrees C.

0.53 W-hrs/lb degree C * 62.4 lbs/ft^3 * 1 ft^3/7.48 gal * 325,892 gal/AF * 1 kW/1,000 W = 1,440 kWh/AF degree C.

For 200,000 AF: 200,000 AF * 1,440 kWh/AF degree C = 288 million kWh/degree C.

For an increase of 66 degrees K:
288 million kWh/AF degree C * 66 degrees K = 19 billion kWh per year.

Though the fuel source was not identified in the proposal, assuming a rate of $0.05 per kWh, the cost for generating waste heat for heating the water would be nearly $1 billion per year.

REASON FOR ELIMINATION

The proposal failed exceeded $10 million annually in O&M costs. Therefore, the proposal did not warrant further consideration.

Alternative 47 — **Other Water Conservation**

HISTORY

This proposal was contained in IID's *IID/MWD Water Conservation Program Impacts to Salton Sea* (May 1989) and in a Colorado River Board of California publication *Report to the California Legislature on the Current Condition of the Salton Sea and the Potential Effects of Water Conservation* (April 1992).

PROPOSAL DESCRIPTION

This proposal would use water conservation programs to help reduce the amount of water used for irrigation, thereby reducing inflows to the Sea. This would, in turn, produce a decline in water surface elevation and would change the hydrologic balance among the tributary inflows, the salinity level, and the evaporation rate of the Sea, all of which are interrelated.

EVALUATION OF ALTERNATIVE

This proposal addressed increasing elevation only. The alternative would actually accelerate the rise in salinity levels of the Sea.

This alternative, used exclusively, exacerbates the problems with salinity in the Sea. While water conservation is, and will continue to be, used for the foreseeable future, this alternative did not address the salinity requirements necessary to stabilize the Sea.

REASON FOR ELIMINATION

This proposal failed to satisfy the target salinity requirement of achieving and maintaining 35 to 40 ppt. Because of this, no further consideration of this alternative was warranted.

Alternative 48 **Other**
Drainage Water Reuse or Blending

HISTORY

This proposed was made by Mr. J.D. Rhoades, U.S. Department of Agriculture, in the following publications:

J. D. Rhoades, *Blending Saline and Non-Saline Waters Reduces Water Usable for Crop Production*, approximately 1989;

J. D. Rhoades, *Intercepting, Isolating, and Reusing Drainage Waters for Irrigation to Conserve Water and Protect Water Quality*, 1988;

J. D. Rhoades, *Salt Problems from Increased Irrigation Efficiency*, 1985;

J. D. Rhoades, *Potential for Using Saline Agricultural Drainage Waters for Irrigation*, 1977;

J. D. Rhoades, *Evidence of the Potential Use of Saline Water for Irrigation*, undated;

J. D. Rhoades, *Reusing Saline Drainage Waters for Irrigation: A Strategy to Reduce Salt Loading of Rivers*, undated;

J. D. Rhoades, *New Strategy for Using Saline Water for Irrigation*, undated;

J. D. Rhoades, et al., *Reducing Water Quality Degradation through Minimized Leaching Management*, 1996;

J. D. Rhoades, et al., U.S. Department of Agriculture, Agricultural Research Service, *Reuse of Agricultural Drainage Water to Maximize the Beneficial Use of Multiple Water Supplies for Irrigation*, 1991; and

J. D. Rhoades, et al., *Use of Salinity Drainage Water for Irrigation: Imperial Valley Study*, 1988.

PROPOSAL DESCRIPTION

This proposal suggested collection of agricultural drainage water for reuse on salt-resistant crops. Drainage water could be used directly, or it could be blended with fresher water prior to use. After being used to irrigate the salt-tolerant crop, the more concentrated drainage would have to be disposed of through evaporation, desalination, transport to the ocean, or some other means.

EVALUATION OF ALTERNATIVE

This proposal presented a method of increasing overall efficiency of an irrigation project. Applied to the Imperial Valley, this increase in efficiency would reduce agricultural drainage flow and result in declines in the water surface elevation of the Sea. As the Sea elevation dropped, salinity concentration would increase because the existing salt load would be contained in a smaller water volume.

REASON FOR ELIMINATION

This proposal failed to satisfy the target salinity requirement of achieving and maintaining 35 to 40 ppt. For this reason, no further consideration of the alternative was warranted.

Alternative 49 — **Other**
Pulsed Plasma

HISTORY

This alternative was proposed by AURIX, Inc., of El Cajon, California, in the article "Pulsed Power Discharge Wastewater Treatment Technology," undated.

PROPOSAL DESCRIPTION

This proposal would use pulsed plasma discharge wastewater treatment technology to remove metals and toxic substances from the Sea. This technology would involve the generation of bursts of high energy shock waves as well as free radicals, ultraviolet radiation, and x-rays, all in a microsecond, to kill bacteria and reportedly would cause most dissolved and suspended solids in the water to settle.

As provided in the proposal, operating costs for a plasma discharge treatment system module capable of treating over 300,000 gallons of wastewater per day would be $150,000. This system would treat wastewater to secondary standards.

EVALUATION OF ALTERNATIVE

The pulsed plasma technology has been demonstrated to effectively remove bacteria and suspended solids from wastewater. However, additional research would be required to determine if it would be effective in achieving the target salinity levels at the Sea. In addition, its costs would be very prohibitive. The proposal reported that to treat 300,000 gallons (about 1 AF) per day would cost $150,000. Operating costs to treat 200,000 AF would run nearly $30 billion per year.

REASON FOR ELIMINATION

This proposal would require further research before it could be determined to be a feasible option. In addition, operating costs would exceed the $10 million annual limit. For these reasons, this alternative did not warrant further consideration.

Alternative 50 — **Other**
Hydropower/Filtration System Resort

HISTORY

This proposal was submitted by Mr. Steven Queen, of Rancho Cucamonga, California, in a letter dated March 7, 1994.

PROPOSAL DESCRIPTION

The proposed filter/energy system would use a combination of solar cells and fuel cells to power a primer pump to pump Sea water up through a vapor desalting chamber into a concrete storage tank 150 feet above msl (see Illustration 40). The water in the storage tank would fall through a dual-purpose turbine system to recover energy used to pump the Sea water into the system. The water leaving the turbine system would flow through a reverse osmosis process, removing the salt and producing freshwater. Because of pressure used in the turbine system, relatively little additional energy would be needed to force the water through the reverse osmosis membranes.

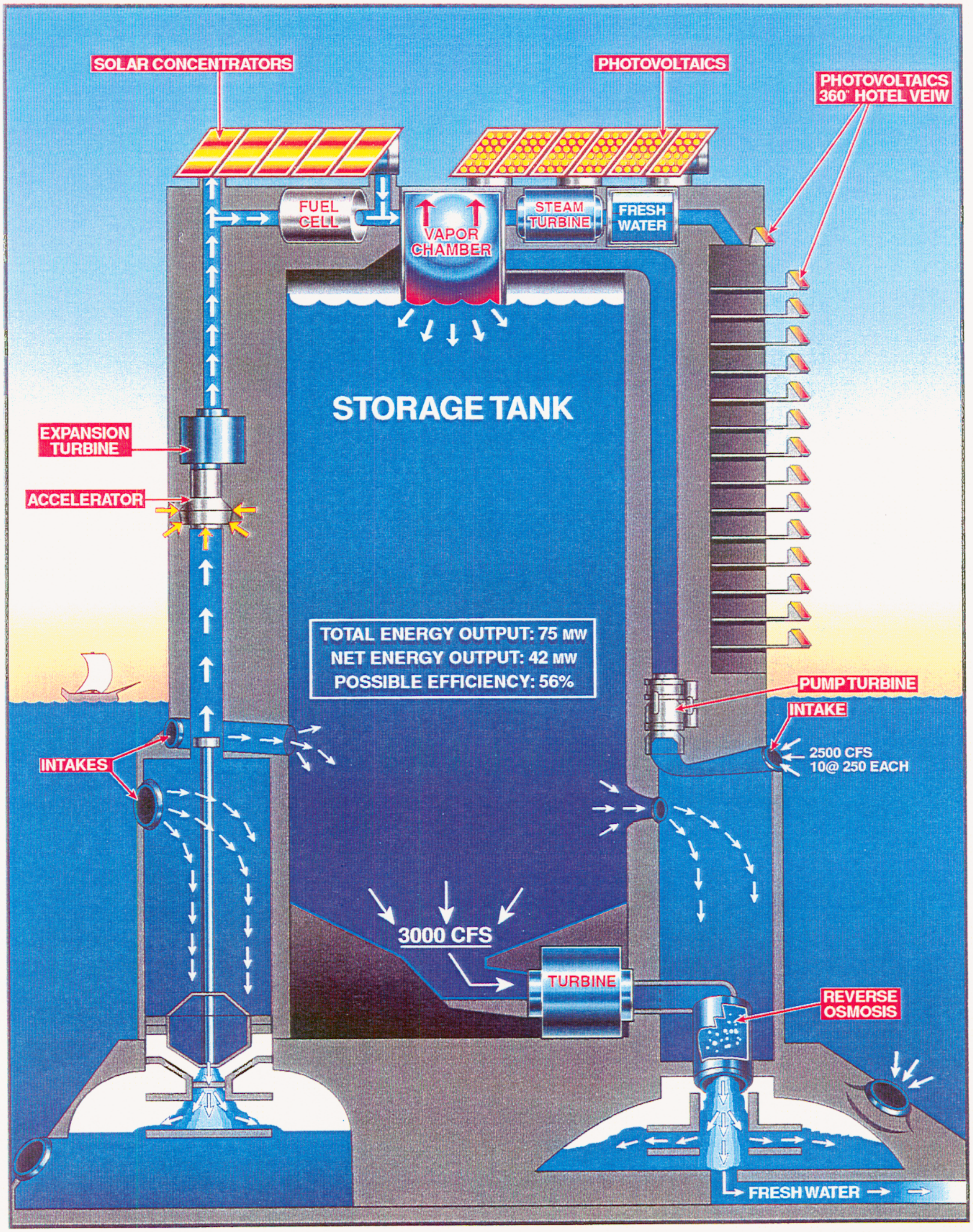
To clean up the 6 to 7 million AF of water the Sea holds, it would take approximately 30 filter/energy systems stationed around the Sea and an additional 40 to 50 secondary circulation systems stationed between 1 and 2 miles offshore. Each filter/energy system would be connected to a planned development project (planned development projects include resorts, amusement parks, water parks, and other commercial development projects).

EVALUATION OF ALTERNATIVE

The Hydro Power/Filtration Resort alternative combined cutting-edge technology in a significantly new way. The energy system suggested in this proposal was a conceptual system only. It was stated in the proposal that the turbines within the filter/energy systems would generate more energy than required to pump the water to the systems. The law of conservation of energy and operating efficiencies of the various components would make this a highly unlikely occurrence. Additional research would be required to determine if the filter/energy system would perform as suggested in the proposal.

REASON FOR ELIMINATION

This proposal would require further research before it could be determined to be a feasible option; therefore, it did not satisfy the requirement for utilization of proven technology.



Alternative No. 50
Illustration No. 40

For this reason, no further consideration of this alternative was warranted. Should additional information become available which satisfies the elimination criteria, further consideration would be given to this alternative to determine its feasibility.

Alternative 51 | **Other — Slow Sand Reverse Osmosis Filtration**

HISTORY

This concept was first proposed by Mr. C. Brent Cluff, in a paper titled *John F. Long Foundation TOXFP and THMFP Reduction Study at Consolidated Water Utility, Apache Junction Slow Sand/Nanofilter Pilot Plant Using Central Arizona Project Water*, November 1990. It was resubmitted with additional information in the paper *Slow Sand/Nanofiltration Treatment for Secondary Treated Wastewater*, December 1991, Water Resources Research Center, University of Arizona, Tucson, Arizona 85721. The latest submission was from Wastewater Resources, Inc., in a paper *Slow Sand/Nanofiltration, Reverse Osmosis, Salton Sea Project*, December 1992.

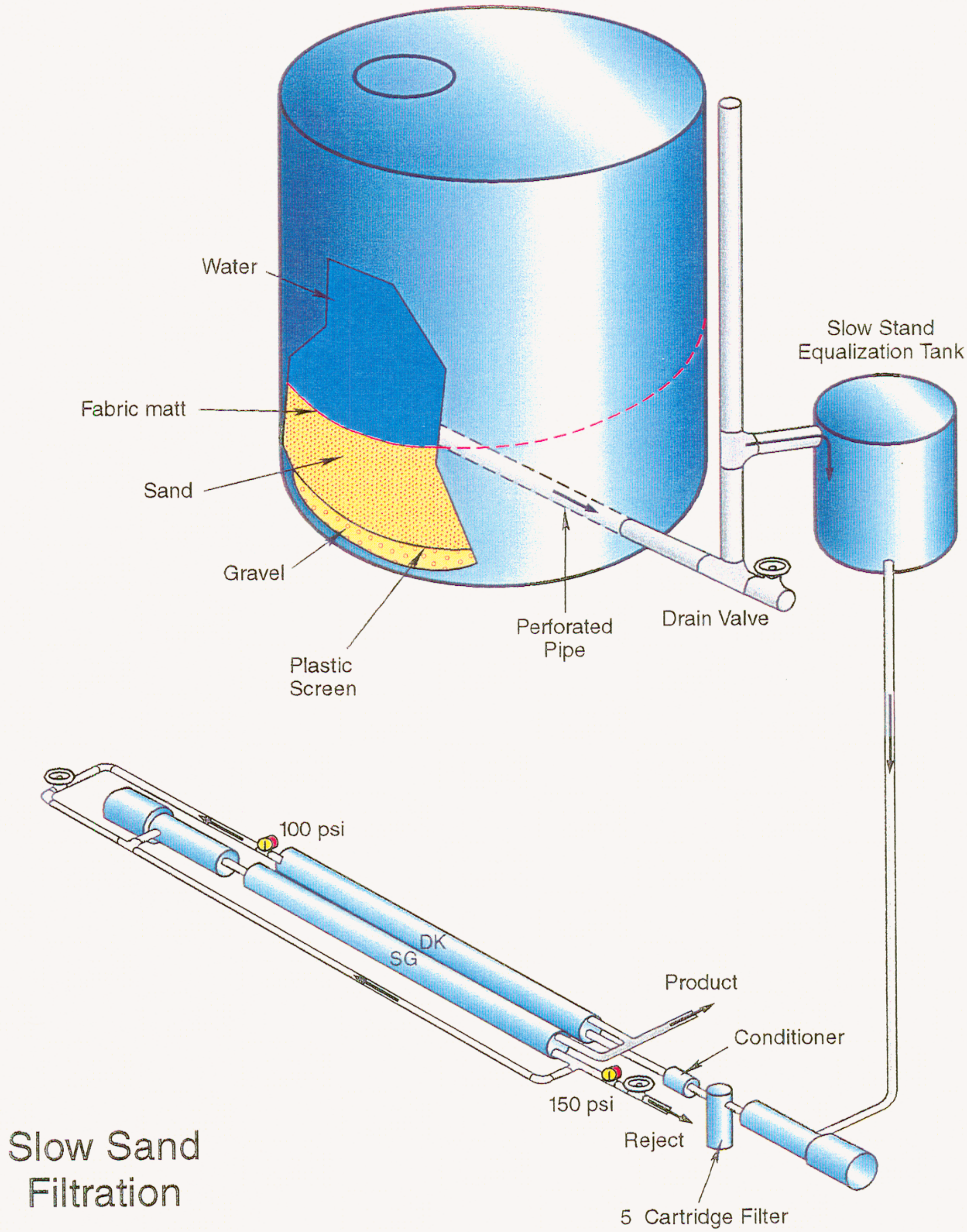
PROPOSAL DESCRIPTION

This proposal involved the use of slow sand filtration, and/or nanofiltration, and reverse osmosis to remove salt. The slow sand filtration would remove the organic material associated with surface water (see Illustration 41). Nanofiltration uses a low-pressure, thin-film membrane that delivers a higher flux rate than reverse osmosis. Nanofiltration has the ability to reject macro molecules, with molecular weights as low as 200 to 300, at relatively low operating pressure (70 to 100 lb/in^2). As a pretreatment for reverse osmosis, nanofiltration would eliminate the major fouling problems associated with most high total dissolved solids applications. The reverse osmosis unit, with this pretreatment, would be able to run with a much higher efficiency (higher recovery rates on less energy) and have a longer membrane life.

EVALUATION OF ALTERNATIVE

The combination of slow sand filtration and reverse osmosis using thin film elements was developed by the University of Arizona and Dr. Brent Cluff. The commercial manufacturing, development, and distribution of this process was licensed to Wastewater Resources, Inc. This combination process is presently patent-pending because of its uniqueness and potential in potable, wastewater, and ocean water treatment.

The use of slow sand filtration as a pretreatment to further processes is well documented. However, use of reverse osmosis or other membrane processes was covered in Alternative 30 and has been eliminated because of high OME&R costs associated with treating such large volumes of highly saline water.



Slow Sand
Filtration

Alternative No. 51
Illustration No. 41

REASON FOR ELIMINATION

The proposal did not meet the requirement that OME&R costs not exceed the $10 million annual limitation. For this reason, the alternative did not warrant further consideration.

Alternative 52 — **Other Electrochemical Extraction**

HISTORY

This alternative was proposed, in a letter dated August 8, 1995, by Mr. Ernie Brown, North Shore, California, in response to public workshops held in August and September 1995.

PROPOSAL DESCRIPTION

This process would apply low voltage direct current to metal plates suspended in the Sea. Charge differential on the plates would attract and collect oppositely charged ions (see Illustration 42). The metal plates would be made of a top grade stainless steel to prevent electrolysis damage.

The proponent of this process tested the concept in the Sea on a small scale. Two amps of direct current at a potential of 2 volts per square foot was applied to two small metal plates. The test was conducted for about 24 hours. During this time, 25 to 30 grams of material were obtained on the plates. An assay revealed only traces of gold and silver.

The proposal would increase the scale of application to a size that would remove enough salt to meet project salinity targets. Extraction of precious metals as a by-product would provide an economic return, helping to offset the costs.

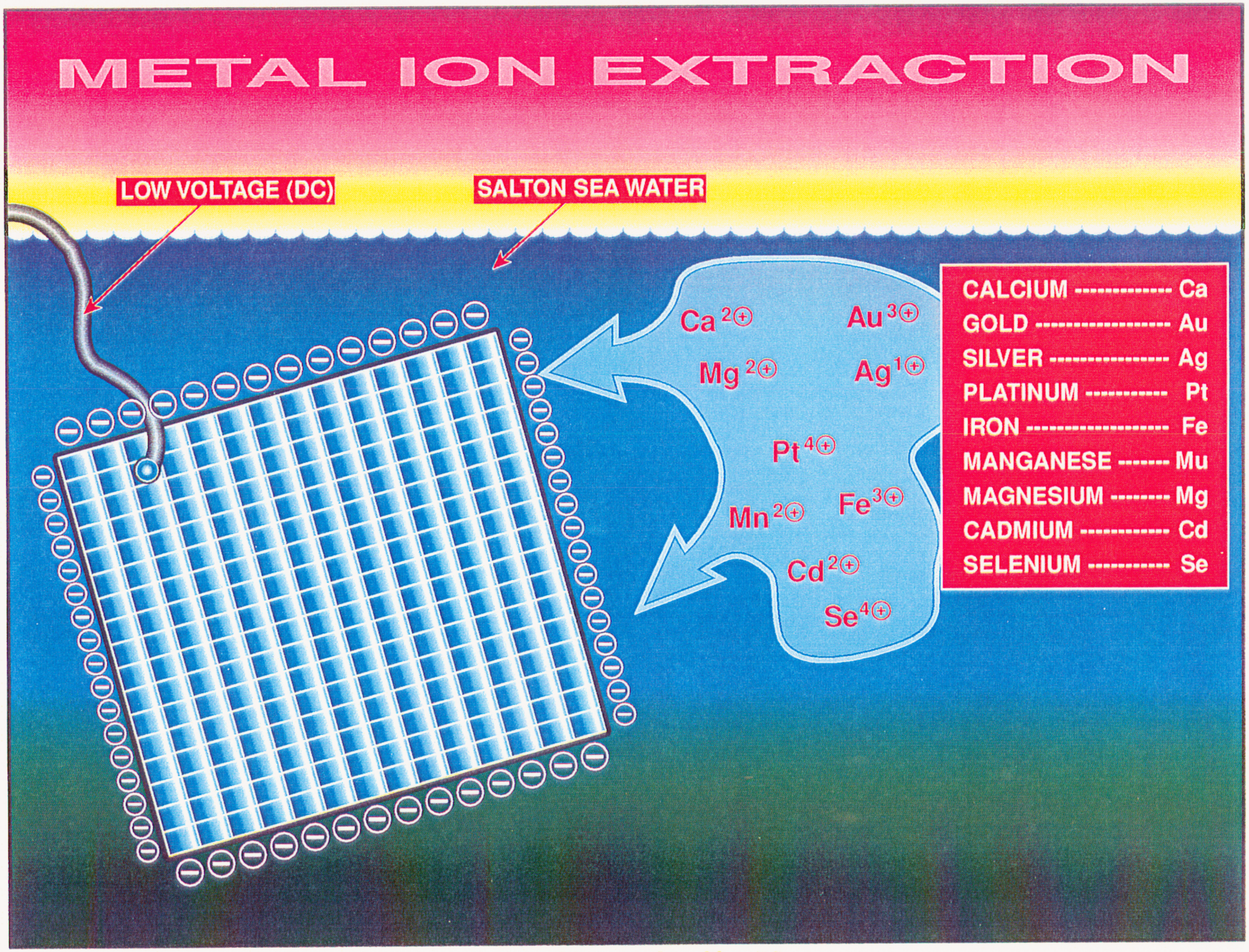
EVALUATION OF ALTERNATIVE

Corrosion would be a major problem associated with this proposal. Use of expensive and exotic materials would be required to minimize the corrosion problem. Removal of material from the plate could also be a challenge. Mechanical removal would be time consuming and expensive; chemical removal would create an additional disposal problem.

Electrochemical extraction does not address elevation issues and is, as yet, unproven on this scale. It was doubtful that any valuable mineral could be extracted in quantities that would prove profitable.

OME&R COSTS

No costs were provided in the proposal, and no attempt was made to calculate costs specific to this alternative. However, costs for use of electrodialysis technology were available. Electrodialysis also would use an electrical potential to extract ions from water, but, in that



Alternative No. 52

Illustration No. 42

process, a charge is applied across a membrane which would separate good quality product from concentrated reject. Desalination costs for electrodialysis would be typically higher than treatment by reverse osmosis—in the order of $3,000 per AF (personal communication with Dr. Charles Moody, Reclamation, Denver, Colorado, May 1, 1997). At that unit cost, electrodialysis treatment of 200,000 AF per year would cost in the order of $600 million per year. Costs of electrodialysis would not necessarily compare with costs of the proposal considered here, but it did show the exhorbantly high cost of similar treatment and would indicate that costs for this proposal would far exceed $10 million per year.

CONSTRUCTION COSTS

Construction costs were not calculated since OME&R costs would exceed $10 million annually.

REASON FOR ELIMINATION

Since water would be neither withdrawn from nor discharged to the Sea, this proposal did not allow for management of water surface elevations. Further research and development would be necessary to apply this technology to the large scale salt removal—about 12 million tons per year—required to meet salinity criteria. Costs were expected to far exceed the $10 million per year limit for OME&R. For these reasons, no further consideration of this alternative was warranted.

Alternative 53 — **Other**
Mexican Cleanup of New River

HISTORY

This alternative was presented by Mr. Narenda N. Gunaji, Commissioner, International Boundary and Water Commission, United States and Mexico, in a letter dated July 31, 1991.

PROPOSAL DESCRIPTION

This proposal included the following elements:

1. Rehabilitation and expansion of the Mexicali sewage system to serve some design population;

2. Rehabilitation or replacement with larger lines, where needed, at the major wastewater collectors along the banks of the New River near the international boundary;

3. Diversion of drains and construction of new lines to convey industrial and domestic wastewaters from these drains into the main collection systems;

4. Improvement of the existing sewage lagoon treatment system in Mexicali to enable use of the summer effluent for irrigation and construction of facilities to remove from the New River basin the portion of sewage effluent which cannot be used for irrigation;

5. Purchase of equipment for a comprehensive sewer line inspection and cleaning program;

6. Diversion of the Alamo River to prevent pollution from the growth expected with the opening of port of entry facilities east of Calexico, California;

7. Construction of collectors, pumping stations, and lagoon treatment systems to convey and treat domestic and industrial wastewaters removed from drains;

8. Construction of works to convey the effluent from the lagoons for reuse in irrigation or disposal away from the New River Basin; and

9. Development of a comprehensive operation and maintenance program for the Mexican system. This concept was envisioned as a 5-year program.

Mexico would undertake New River floodplain cleanup, build erosion control works, and implement Mexico's laws regarding pretreatment of industrial wastewaters.

In addition to the above-mentioned components, the Mexican Government would seek to control the New River problem at the source with works in Mexicali, Baja, California; propose a number of construction/action projects that could be undertaken over the next 5 years; and provide a 6-month period for the United States and Mexico to arrange financing.

EVALUATION OF ALTERNATIVE

This alternative basically addressed the water quality problem in the New River at the Mexican border. While better quality water would discharge into the Sea, salinity of the Sea itself was not addressed in this proposal.

REASON FOR ELIMINATION

The proposal failed to satisfy the target salinity requirement of achieving and maintaining 35 to 40 ppt. For this reason, no further consideration of this alternative was warranted.

Alternative 54 | **Other — Land Speed Racetrack**

HISTORY

This concept was presented in a letter dated April 4, 1994, to the Salton Sea Authority by Mr. Ken Mack, representing Southern California Timing Association (1995). The association is a non-profit racing organization whose sole purpose is to verify land speed records for all types of motorized vehicles from the family sedan to jet cars.

PROPOSAL DESCRIPTION

Many suggestions for improving the salinity in the Sea involved the disposal of salt or a concentrated brine. This could be an expensive problem with limited opportunities. This alternative suggested the use of salt from these sources to build a race course for setting land speed records. No further information was provided.

EVALUATION OF ALTERNATIVE

As a brine and salt disposal alternative, this proposal contained several attractive features. Other brine disposal methods include piping to Mexico, which has international and economic ramifications; trucking out of the area, which has logistic, traffic, and cost implications; and evaporation, which would be expensive and require large tracts of land. A race track would, of course, have its own unique issues. Depending upon the frequency of use, the track could be a source of economic revenue for local residents.

This proposal was a brine disposal option only. It did not address the issues of salinity or elevation of the Sea. However, it could be used for salt disposal once the salt had been removed by other means.

REASON FOR ELIMINATION

The proposal failed to achieve and maintain the target salinity requirement of 35 to 40 ppt and would not address elevation. For these reasons, no further consideration of the alternative was warranted.