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Harnessing Energy and Water in The Salton Sea (Segment I) (System for Importing Seawater)

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Keywords

Geothermal Power, Hydro Power, Electricity, Importing Seawater, In-Line-Pump, In-Line-Generator, Solar Power, Renewable Energy, Heat Exchanger, Desalinization, Potable Water, Lithium, Environment, Wildlife Sanctuary, Tourism.

ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (toxic playa) to the elements and facing incoming environmental disaster.

The presented proposal is a long-term solution for the restoration of the Salton Sea. It includes an architectural element which harmoniously incorporates several patented technologies into a self-sustaining organism. The presented proposal includes several options based on the same concept: 1) Dividing the Lake into three sections; 2) Importing seawater from the Ocean; 3) Harnessing prevalent geothermal energy.

By dividing lake into three sections (Central and two smaller Northern and Southern sections) and importing seawater into the central section of the lake it provides a condition for tourism (exclusive real-estate, beaches, resorts, hotels, etc.), and vast wildlife sanctuary. Presented proposal also implement several breakthrough technologies such as a) harnessing solar energy in combination with pipeline system; b) harnessing prevalent geothermal energy which is accessible in the Salton Sea area by using completely closed-loop heat exchange system for generation of electricity, desalinization of the lake and production of the potable water as a free by-product; c) Providing source for extraction of lithium and providing depot for waste by-product material.

1. Introduction

1.1 Overview of the Salton Sea situation:

a) The Salton Sea in California is a terminal lake formed accidentally in 1905-1907 after levy at Colorado River has been breached after a storm. The inflow from the Colorado River has been reduced as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (playa) to the elements precipitating higher salinity levels and facing incoming environmental disaster, health issues of the nearby communities, as well as a serious threat to its multibillion-dollar tourist trade.

b) The lake is 35 miles long, 15 miles wide, and is located south of Palm Springs in a basin 230 feet below sea level.

c) The Earth's crust at the south end of the Salton Sea is relatively thin. The temperature in the Salton Sea Geothermal Field can reach 680 ºF (360 ºC) less than a mile below the surface. (See FIG. 1)

d) On the southern part of the Lake, there is a known geothermal reservoir.

e) The Salton Sea is California's largest lake and is presently over 50 % saltier than the Ocean. The Salton Sea is a "terminal lake," meaning that it has no outflow and salts, nutrients, pesticides, and other contaminants have concentrated in the Lake. Water flows into Lake from several limited sources, but the only way water leaves the Lake is by evaporation.

f) Geothermal energy in the Salton Sea area is prevalent and topography is unique - the lake is 230 feet below the sea-level and is about 160 miles from the Ocean.

g) Under the terms of the Quantification Settlement Agreement (QSA) the lake's decline is set to accelerate starting year, 2018. About the 1/3 of inflow water from the canal will be diverted to San Diego and Coachella Valley.

h) Runoff water from nearby agricultural fields which contains fertilizers, pesticides and other pollutants such as partially treated sewer from Mexicali contaminate the Salton Sea and make it an undesirable tourist destination especially for beachgoers.

i) There have been many studies and complains about consequences for the nearby community if a solution for the Salton Sea is not found.

j) In several decades had been mentioned several proposal for the restoration of the Salton Sea proposing importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require substantial amount of electricity, maintenance of filters, etc.; (ii) not addressing continuation of pollution with pesticides and fertilizers from nearby farmland; (iii) practicality of the projects - proposing canals, tunnels, dozen pipelines - without addressing the practicality of its implementation - extreme cost with difficulties attracting investors for such projects that cannot generate revenue to pay-off initial investment, therefore, deemed unfeasible.

1.2 Five Phases of the Proposal for the Restoration of the Salton Sea:

Phase I - Connecting the Salton Sea with the Ocean with a pipeline 48" (5 pipelines on the uphill routes and 1 pipeline on downhill routes) for importing seawater into the central section of the Lake (several options for pipeline corridors are provided (See FIG. 2 and 9);

Phase II - Dividing lake into three sections by building two main dikes (two-lane roads) strategically positioned - One in northern and one in the southern part of the Salton Sea (See FIG. 4 - 8).

Phase III - Building one power plant using a completely closed loop heat exchange system the (SCI-GHE system) at one of the selected sectors (See segments IV & V).

Phase IV - Building several more power plants using the (SCI-GHE) system - one in each additionally selected sector; and

Phase V - Continuing build-up of many additional power plants using the (SCI-GHE) system at each selected sector;

1.3 The key elements of the presented proposal are:

1) Dividing the Salton Sea into three sections with two main dikes (two-lane roads) to prevent pollution of the larger central section of the lake which would provide the condition for tourism (beachgoers) and wildlife sanctuary in smaller northern and southern sections.

2) If Route 1 (Gulf of California, Mexico - Salton Sea, USA) is selected: To negotiate a treaty with Mexico's officials about diverting the flow of the New River and Alamo River back to Mexico and in return getting corridor for a pipeline for importing seawater from the Gulf of California. The pipeline with maintenance road can have several underpasses to preserve the integrity of Mexico's territory.

3) If Route 1 is selected – then, diverted flow of New River and Alamo Rivers can be treated and used for refilling Laguna Salada or for farmland (See FIG. 2, 3, and 4); (Tips for negotiations with Mexico's officials – in summary: It is in the interest of Mexico to have the flow of New River and Alamo Rivers. It is in the interest of the US to have a corridor for importing seawater from the Gulf of California).

4) For any accepted Route of importing seawater from the Ocean in the central section of the Lake – It is recommended to use In-Line-Pump/Generator system which generates electricity in downhill routes which can be used as a supplement to the energy needed for horizontal and uphill routes. (See Segment II - FIG. 6 -8);

5) Optionally, the US can treat water from the New River and Alamo River and use it for farmland or sell it to Mexico;

6) Generation of the electricity by using the pipeline as a foundation for solar panels assembly. Solar energy is prevalent in the area averaging 280 sunny days per year (See Segment III);

7) Implementing pipeline with sprinkler system for farmland (Northern and Southern area of the Lake) to conserve limited source of water from Colorado River, received through All-American Canal, and to prevent the formation of runoff waters from nearby farmland. (See FIG. 4 and 8); That pipeline system can also be used as a foundation for solar panels for generation of additional electricity and increasing revenue for several hundred million dollars per year (See Segment III).

8) Generation of electricity by harnessing prevalent geothermal sources with a new technology using a completely closed loop system that is not limited to a known geothermal reservoir. (See Segments IV & V);

9) Desalinization of the lake by using gravity - pumping out higher salinity water - which has tendency to accumulate at from bottom of the lake - and pumping it into the boilers of a new Power Plants for generation of electricity and for production of potable water as a free by-product (See also Segments IV and V);

10) Providing a source (brine) for extraction of lithium (See Segments IV & V);

11) Providing vast wildlife sanctuary (See FIG. 4, 5, 7 and 8); and

12) Providing condition for tourism - exclusive real-estate, beaches, resorts, hotels, etc.- (See FIG. 8, 10, and 11).

1.4 Preliminary Estimate for Water Needed for Balancing Evaporation in the Salton Sea.

The necessary inflow of water to balance evaporation of the whole lake is about 1,200,000-acre-feet per year. The surface of the southern section of the Lake is about 10% of whole Lake (See FIG. 4 and 5). Water needed to balance evaporation of the southern section is about 120,000-acre-feet per year. Water needed for farmlands south of the lake is about 200,000-acre-feet per year. Water needed for balancing evaporation in the southern section of the Lake and for nearby farmland adds up to about 320,000-acre-feet per year.

The surface of the northern section of the Lake is about 5% of whole Lake (See FIG. 4 and 8). Water needed to balance evaporation of the southern section is about 60,000-acre-feet per year. Water needed for farmlands north of the lake is about 100,000 acre-feet per year.

Water needed for balancing evaporation in the northern section of the Lake and for nearby farmland is about 160,000 acre-feet per year.

Water needed for balancing evaporation in the Northern and Southern sections of the Lake and for nearby farmlands is about 480,000 acre-feet per year.

It means that functional Lake can be achieved with less than 500,000-acre-feet per year from Colorado River through All-American Canal, which means that this proposal is in harmony with restrictions from the Quantification Settlement Agreement (QSA).

2. **Illustrations of the Segment (I) -** Importing Seawater for the Restoration of the Salton Sea.

Segment (I)

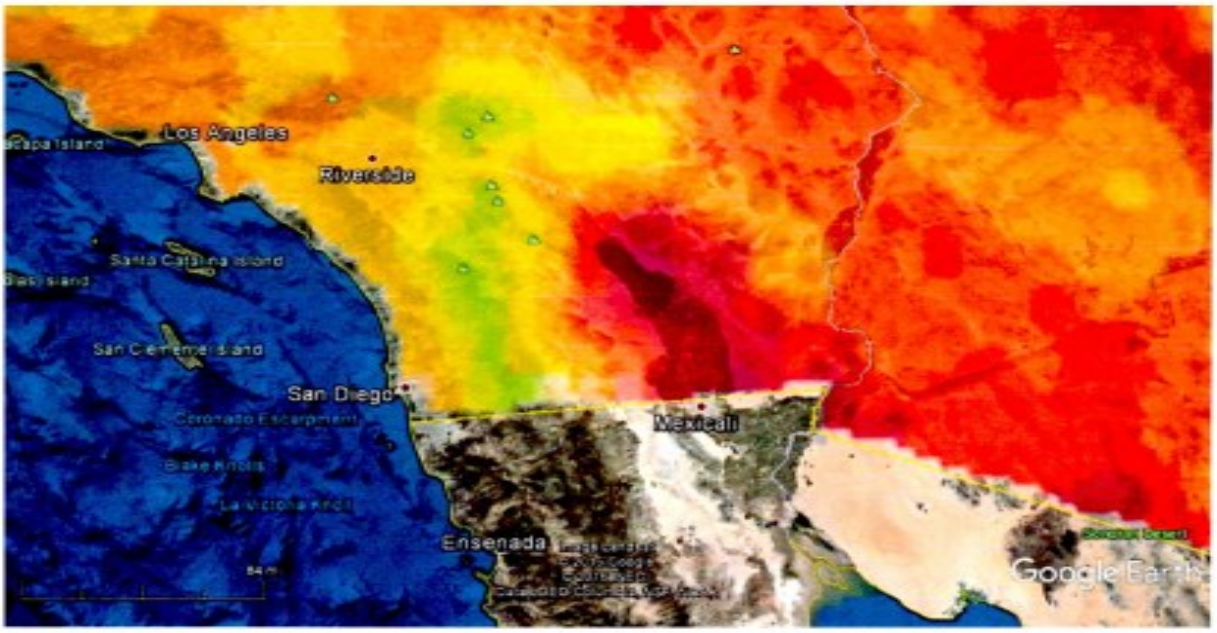

FIG. 1 – Map of Southern California – Temperatures at dept of 3.5 Km

Segment (I)

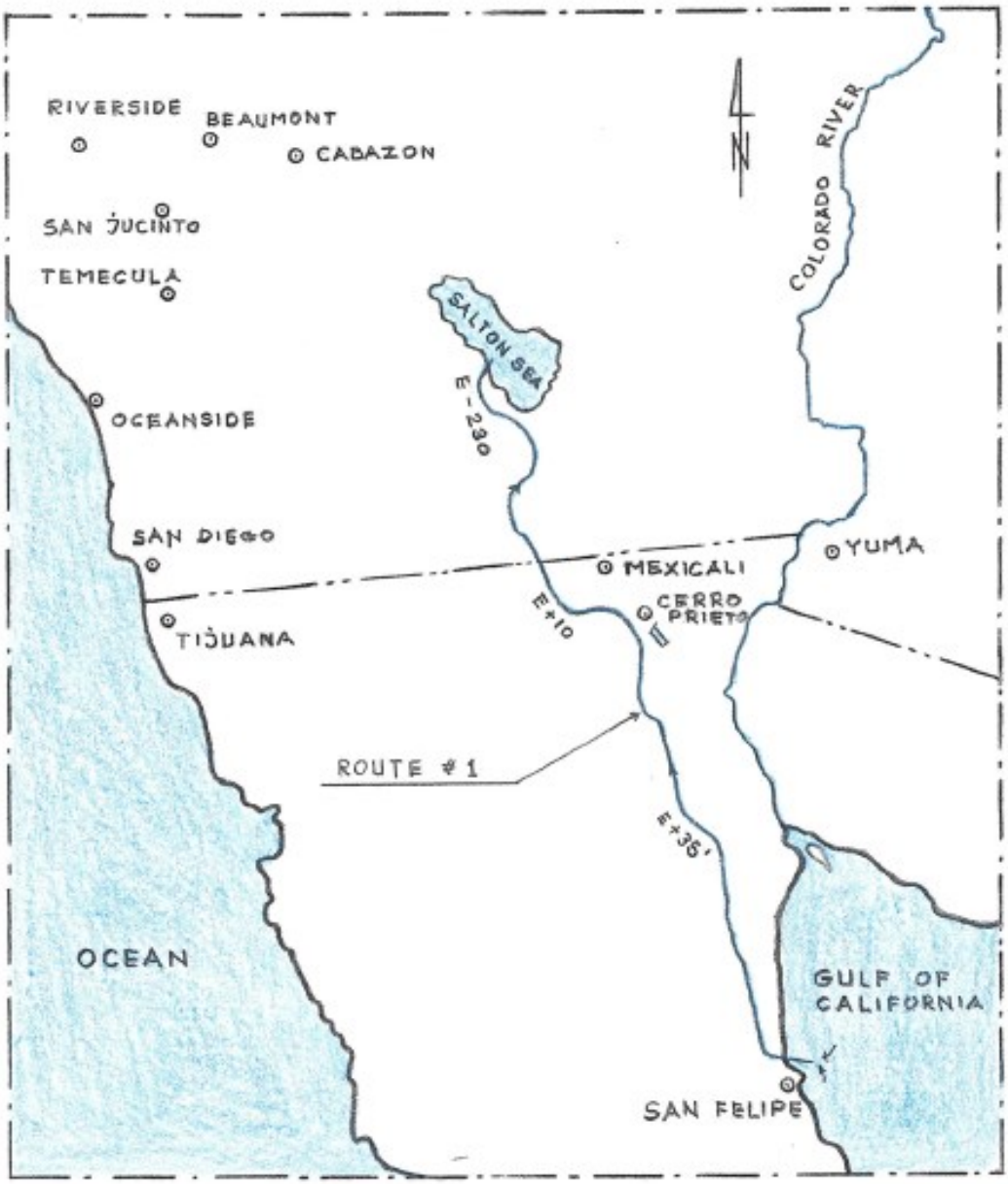

FIG. 2 – Map of the Route #1

Segment (I)

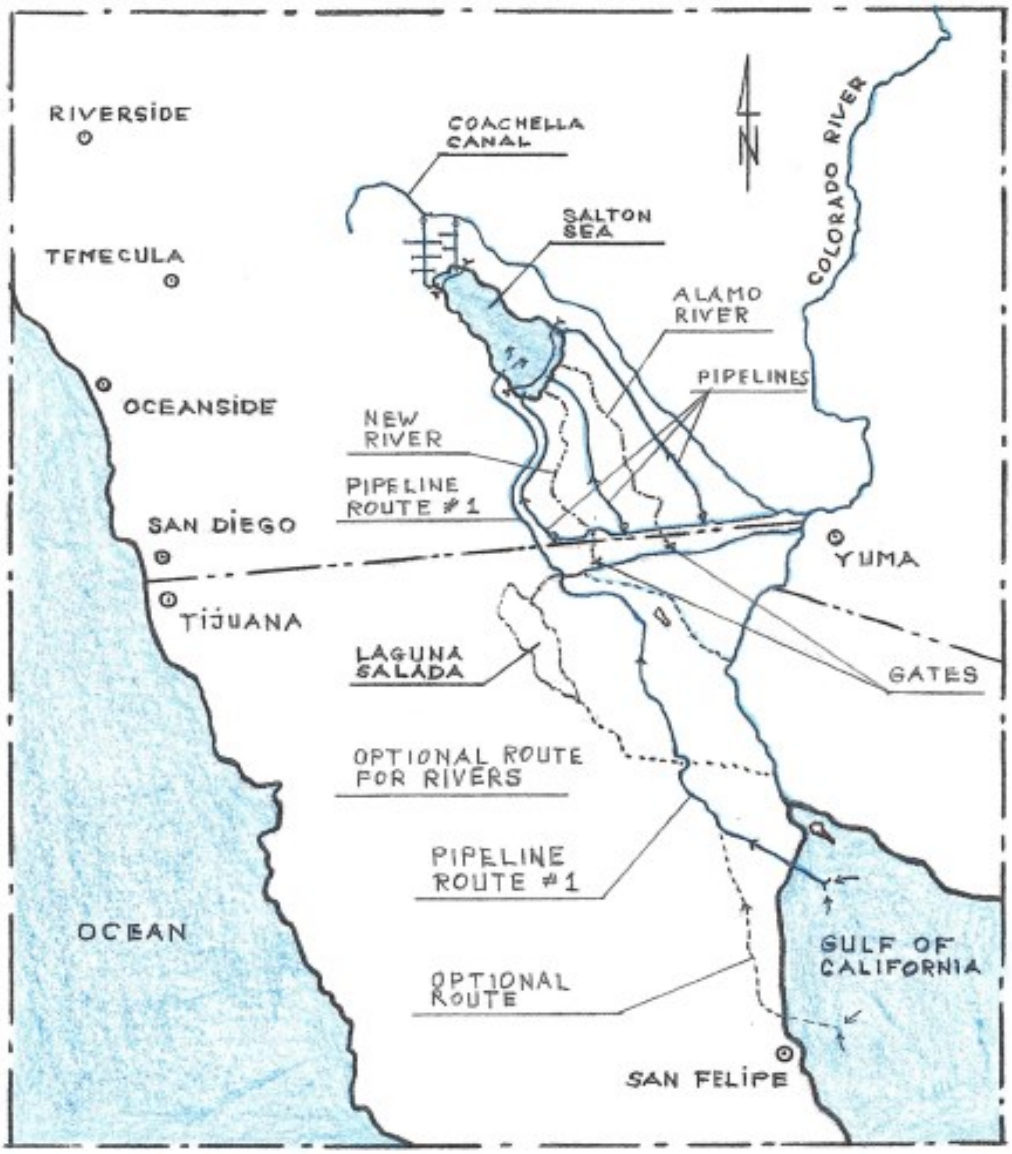

FIG. 3 – Map of redirecting New and Alamo Rivers

Segment (I)

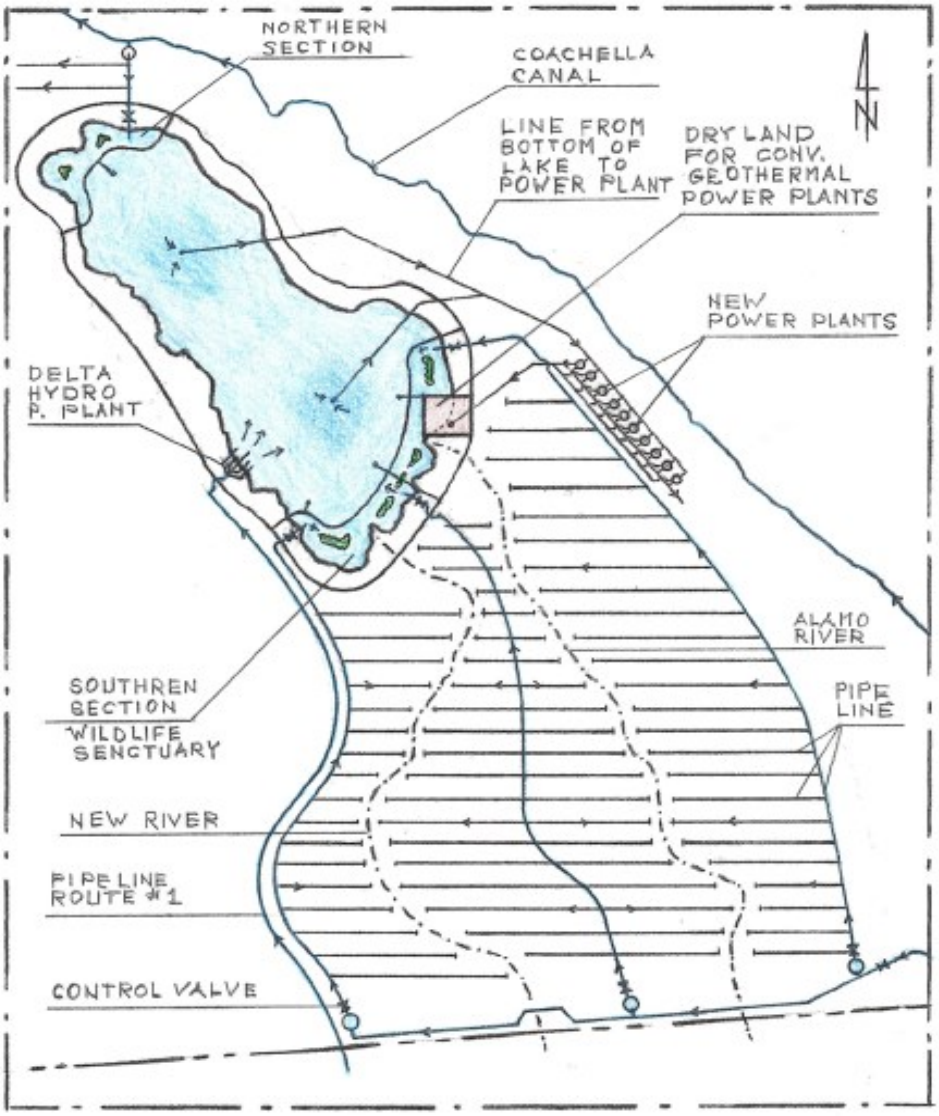

FIG. 4 – Map of redirecting New and Alamo Rivers – South of the Lake

Segment (I)

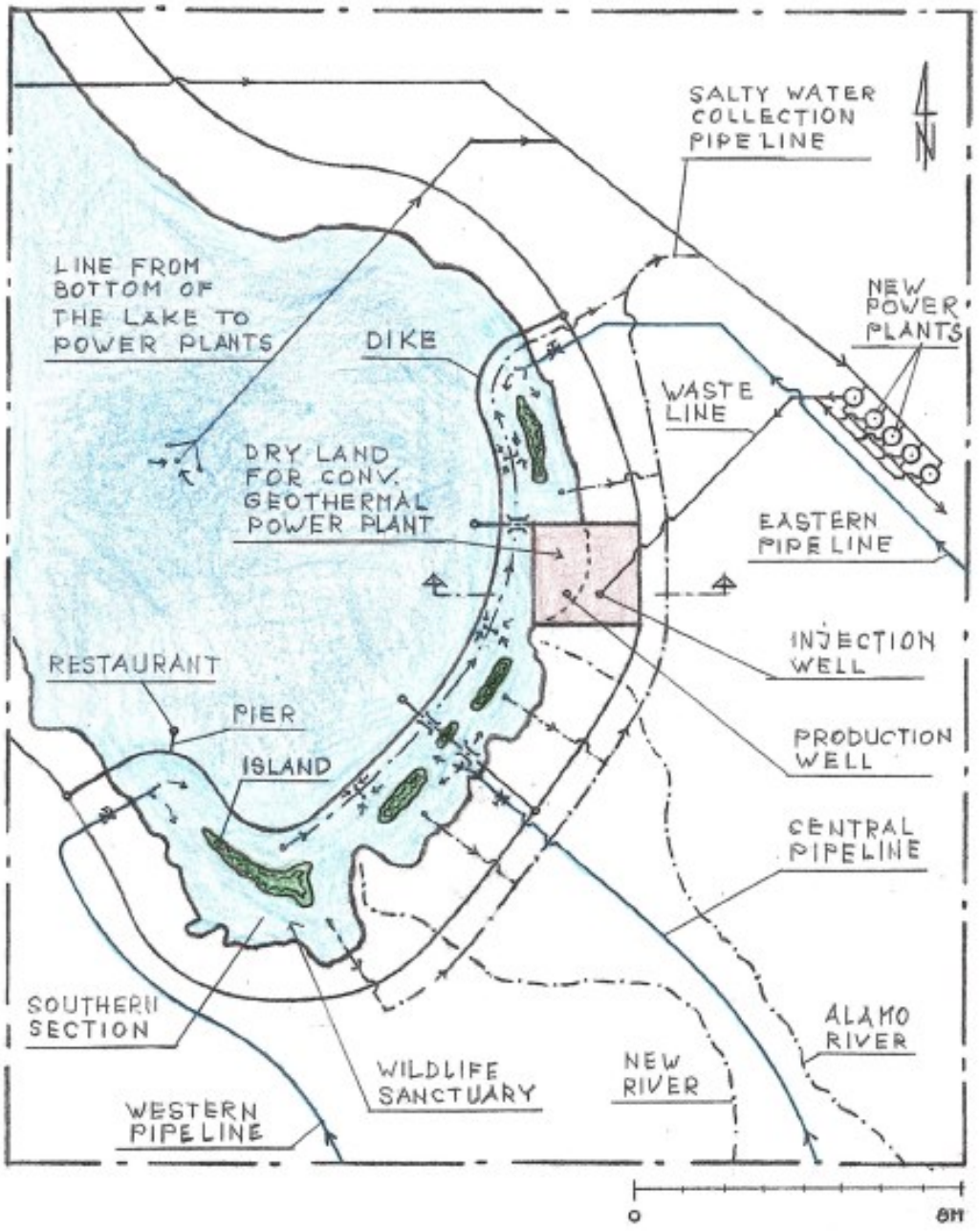

FIG. 5 – Enlarged Southern Part of the Salton Sea – Wildlife Sanctuary

Segment (I)

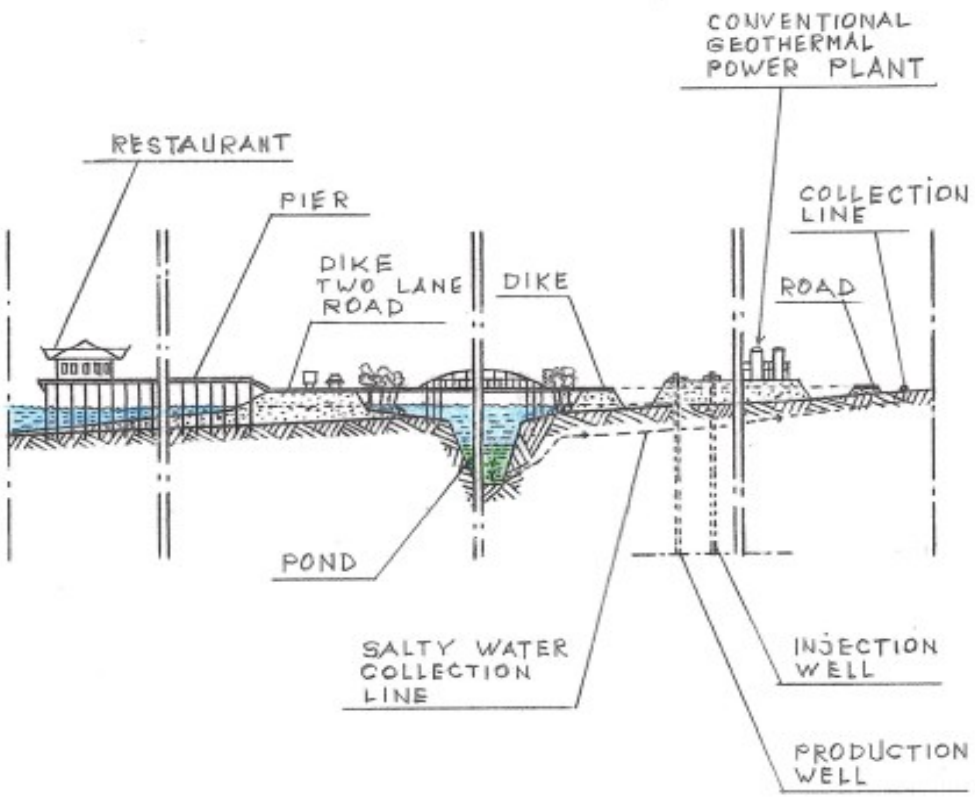

FIG. 6 – Cross-sectional view taken near a typical dike-pier intersection

Segment (I)

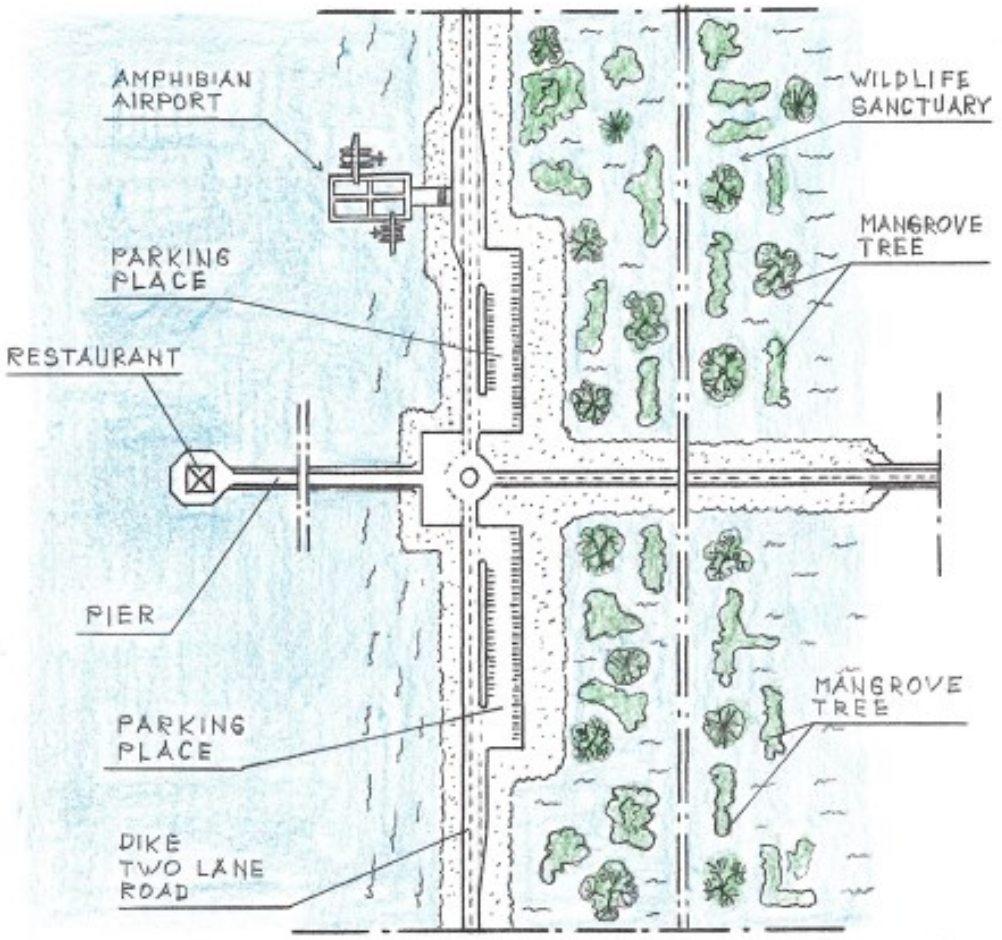

FIG. 7 – Plain view of a typical dike-pier intersection

Segment (I)

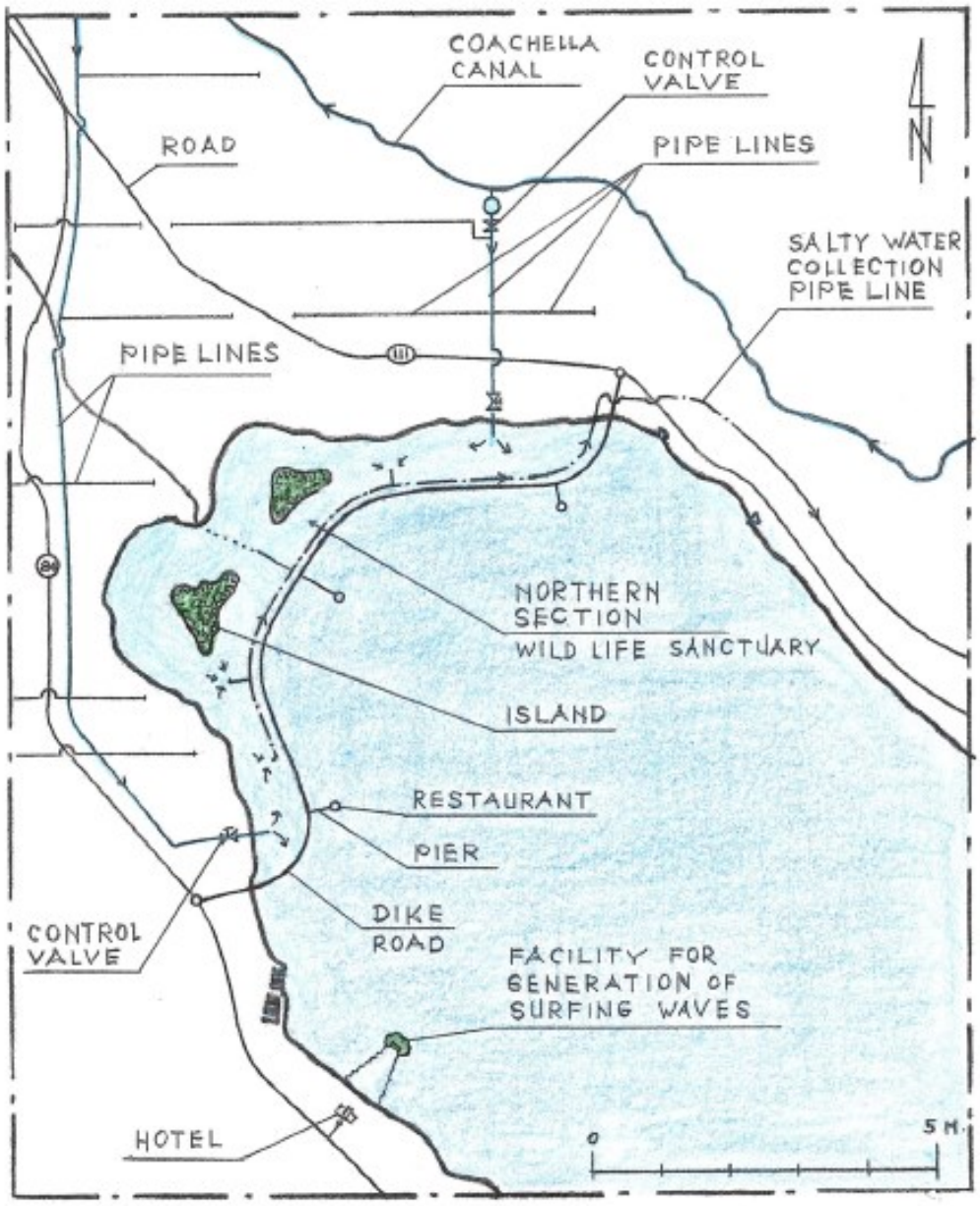

FIG. 8 – Enlarged northern part of the Salton Sea
– Wildlife Sanctuary -

Segment (I)

FIG. 9 – Map of the Route #2

Segment (I)

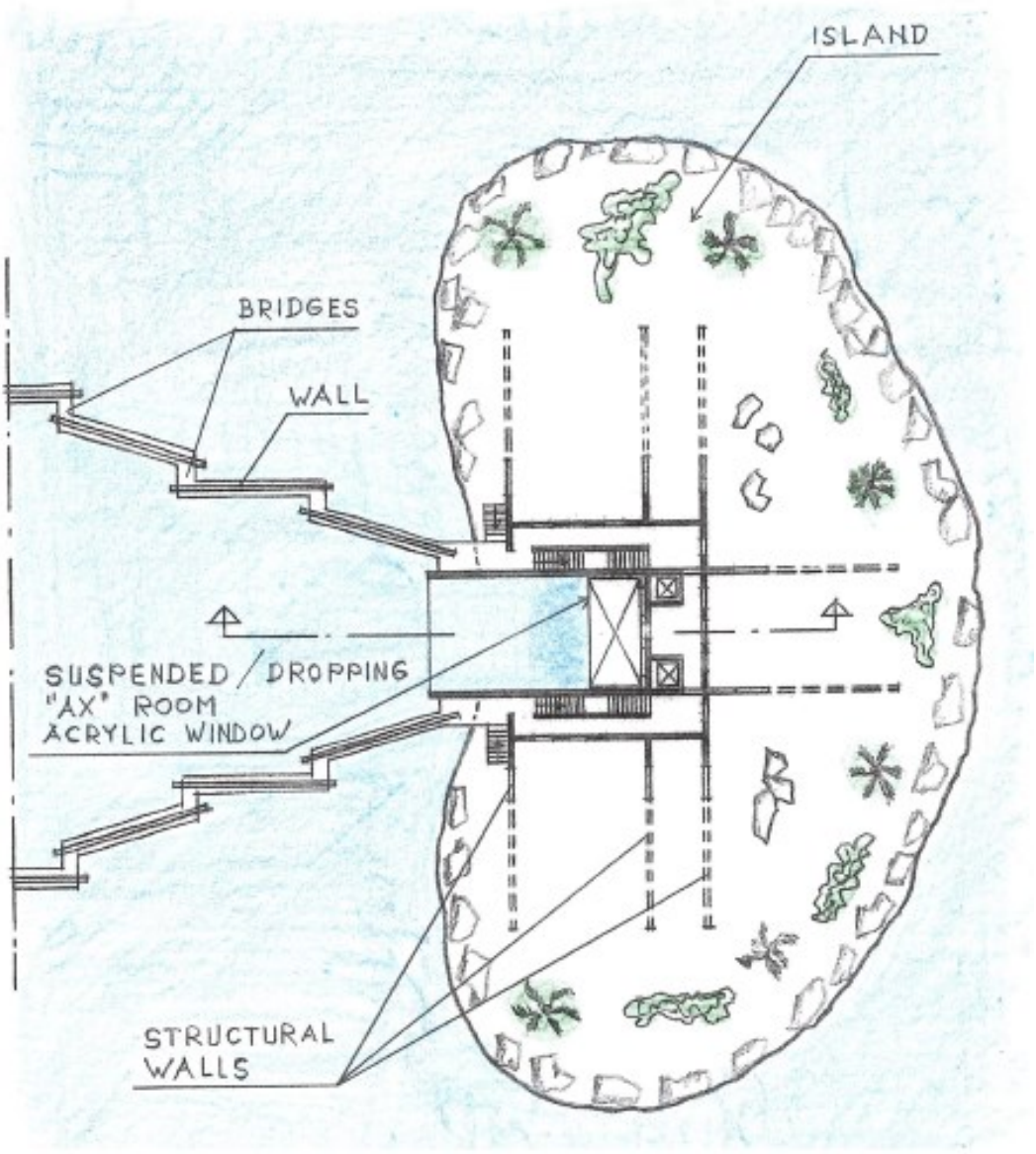

FIG. 10 – Plain cross-sectional view of a wave generation facility

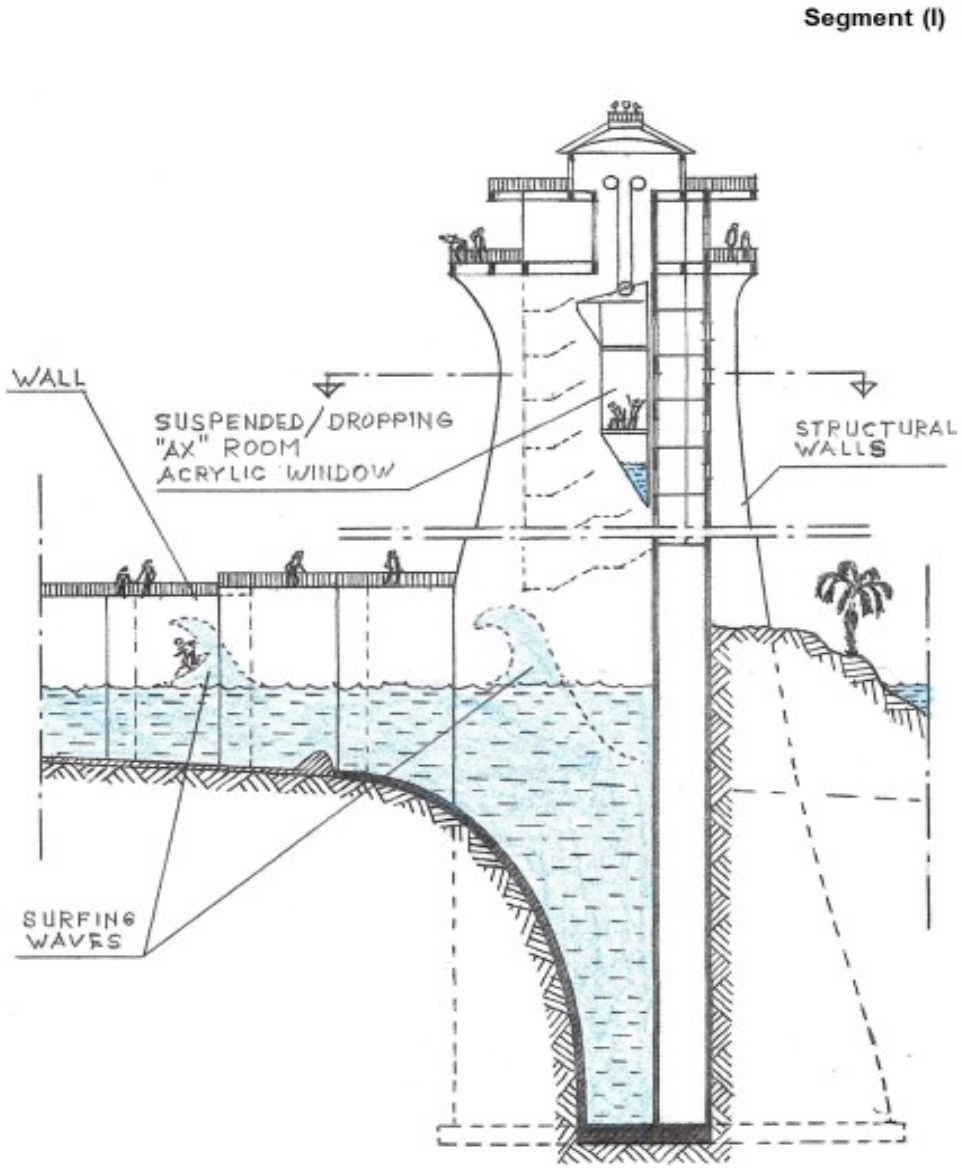

FIG. 11 – **Cross-sectional view of a wave generation facility**

3. Conclusion:

Importing seawater is a fundamental phase of the presented comprehensive proposal on which other phases depend. Also, importing seawater is an essential element in providing the necessary water for harnessing geothermal energy in the area and is an essential element for the restoration of the Salton Sea.

Presented pipeline with diameter only 48" through Route #1 can import about 1 million acre-feet per year which is enough for the balancing evaporation of the Lake. The pipeline through Route #2 can import about 2 million acre-feet per year meaning that 1 million acre-feet can be used for other purposes including replenishing geothermal reservoirs.

Presented proposal for the restoration of the Salton Sea is a long-term solution which includes an architectural element which harmoniously implements several breakthrough technologies into a self-sustaining organism. Each of the segments (phases) is essential for the final result.

Presented proposal transforms the situation of the Salton Sea from the liability which would exceed $70 billion (environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds billion dollars in revenue) – costing only about $10 billion for building it.

Acknowledgment

The 3.5 km Temperature Map is courtesy of the SMU Geothermal Laboratory and Dr. David Blackwell, Dallas Texas.

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