AFFINITY ENGINEERING

**TECHNICAL MEMORANDUM**

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To: Garrett Haertel, Marina Coast Water District
Jim Crowley, Zanjero

From: Jim Carson, P.E., Affinity Engineering Inc.

Subject: Marina Coast Water District – Desalinization Plant Evaluation

Date: October 3, 2023

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This Technical Memorandum (TM) by Affinity Engineering (Affinity) provides an evaluation of Marina Coast Water District's (MCWD) Desalinization Plant (Plant) located at 11 Reservation Road in Marina, CA. This TM will provide a background, facility assessment, and recommendations, and preliminary cost estimate for MCWD to move forward with providing a reliable water supply using desalinated sea water.

## Background

In 1997, MCWD constructed a 300,000 gallon per day Plant. The Plant's equipment was manufactured by Ionic, Inc. There is no information available about which contractor built the building, installed the equipment, and commissioned the facility. At the time when this facility was built, Ionics, Inc. was a leading water purification company that invented and patented desalination membranes in the 1950s. The company was acquired by GE Infrastructure in 2005. GE Infrastructure was later renamed GE Water & Process Technologies, and then again to Veolia Water Technologies in 2014. Today, the Ionics brand is still used by Veolia Water Technologies for its line of desalination and water treatment products and services. However, Ionics, Inc. no longer exists as a separate entity.

When the Plant went online in 1997, it operated continuously for approximately two years and after that time it operated intermittently. There was no information available why the change from a continuous to intermittent operation was made. In 2003, when the Plant had been operating for approximately 6 years, it was shut down. The Plant has not operated since that time.

In 2007, CH2M Hill prepared a condition assessment report that looked at starting up the Plant. Their assessment stated that because the Plant was last operated approximately four years ago, lack of use and exposure to the corrosive marine environment has caused the condition of the existing equipment to deteriorate. CH2M Hill recommended that the Plant's equipment could be rehabilitated. The rehabilitation focused on replacing and/or repairing corroded equipment. Their 2007 cost to rehabilitate was $1,439,600. Calculating this cost to today's dollars using ENR cost index is as follows:

ENR October 2007 – 8045
ENR October 2023 – 13497.97
Ratio = 1.678

Update Cost would be 1,439,600 x 1.678 = $2,415,649 ≈ $2,415,700

In August 2023, Affinity was asked to assess the condition of the Plant to determine if it was possible to repair the Plant and enable it to operate again. On August 29, 2023, Affinity visited the Plant to assess its condition.

**Facility Assessment**

1. CH2M Hill Assessment

   Affinity reviewed CH2M Hill's 2007 condition assessment of the Plant. At that time, the Plant was not operating due to the intake pump being burned up. The following is a summary of their findings:

   - Pumps and motors showed signs of corrosion with some pumps needing rehabilitation and some pumps were not operable and would require replacement
   - Valves and their operators showed signs of corrosion and many valve operators needed replacement
   - All electric actuator needed replacement due to corrosion
   - PVC pipe was in good condition except for piping located outside showed signs of UV damage
   - Stainless-steel Pipe (316) required replacement due to corrosion. Specialized stainless-steel pipe was recommended that was better suited for the corrosive environment

Outside Instrumentation Panel

2. Affinity's Assessment

   Affinity visited the Plant on August 29, 2023. This assessment was performed approximately 16 years after CH2M Hill's assessment and 20 years since the Plant had last operated. At some point after CH2M Hill's assessment, the building's interior rooms were exposed to the corrosive marine environment over an extended period.

   a. Desalinization Equipment

      As stated in the Background section of this TM, Ionic, Inc. no longer exists with

its brand now being sold under Veolia Water Technologies. Since the Ionic Company no longer exists and due to the age of their equipment, servicing the existing equipment would be difficult. Veolia Water Technologies would most likely require MCWD to upgrade their equipment to newer equipment where they could readily supply replacement parts. This would be a complete replacement of the existing equipment or a new desalinization plant.

b. Plant Piping

The internal PVC shows no signs of corrosion. The external PVC shows UV damage. All the stainless-steel pipes, valves actuators, and valves show extensive corrosion.

VFD Panel

c. Chemical Feed Pumps

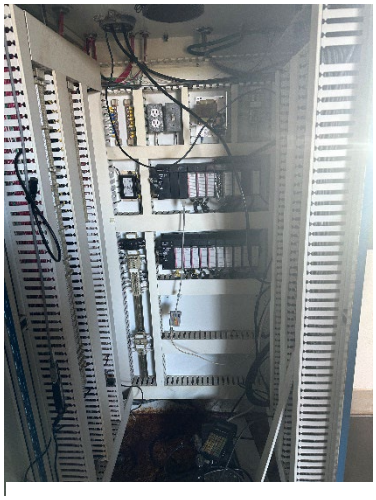
The chemical feed pumps have deteriorated and do not appear to be operational or salvageable.

d. Pumps

The pumps and their motors have deteriorated and do not appear to be operational or salvageable.

e. Electrical Equipment

The electrical equipment including the electric service, meter main, motor control centers have deteriorated and require replacement. The electric service is the only thing active at the Plant because it also supplies power to the adjacent MCWD building. This electrical service should be replaced immediately due to its severe corrosion.



PLC Cabinet

f. Plant Controls and Instrumentation

The VFD cabinet cannot close and is exposed to the corrosive marine environment. Looking into the cabinet all the PLC equipment was wet with high corrosion. The PLC and controls are not operable and require replacement. All instrumentation that was seen at the Plant appears to be unusable and requires replacement.

g. Building

The external building supports show signs of corrosion along with the metal support fasteners. Due to the visible corrosion seen on the building, it is recommended that a structural review of the building by a qualified inspector be done before there is any continued use of the building.

**Recommendations**

All equipment at the Plant is heavily corroded and looks to be inoperable. Most of the equipment would not be economically repairable, due to the age of the equipment being 28 years old, it is reasonable to believe that no replacement parts are available. It is recommended that all equipment at the facility be removed and disposed of, and a new facility be constructed in its place. A new Plant would have the latest controls and equipment that could be easily maintained. A new separate electrical service should be installed as soon as possible to keep the adjacent building in power.

Existing Electric Service

A separate electric service should be installed to power the new Plant when it is constructed. The new electrical service should be sized to meet the power needs of the new Plant.

After talking with several desalinization plant manufacturers, the District has two Plant replacement options for this size of Plant that would provide the best benefits to MCWD as follows:

1. <u>Modular Treatment Plant</u>

A modular system would include two 40-ft long cargo containers. The steel containers would require annual painting with marine level paint. The inside of the containers would be temperature and humidity controlled. Some larger storage tanks would be located outside in corrosion resistant tanks such as


Modular Treatment Plant

fiberglass or polyethylene. A small 8-ft by 8-ft chemical resistant building would also be required for the chloring storage, containment, and feed room.

The disadvantage of this setup is that the metal containers would require annual maintenance and the space around the piping would be limited due to the width of the containers. The advantage is that it would have the lowest construction cost than the Block Building Treatment Plant and could be easily relocated to another location if the current location would be unusable due to the coastal erosion from the sea.

2. <u>Block Building Treatment Plant</u>

A corrosion resistant concrete masonry unit (CMU) building designed to house all the treatment equipment. CMU Building are resistant to corrosive marine environment and be approximately 40-ft x 40-ft. The building would include temperature and humidity control, fiberglass doors, and stainless-steel hardware to minimize corrosion and include separate rooms as follows:

CMU Block Building

- Electrical Room: electric service, motor controls, transformer, and PLC
- Operator Room: facility monitoring by operators
- Laboratory Room: water sampling and chlorine residual analyzer
- Chemical Room: chlorine and corrosion control equipment
- Treatment Room: reverse osmosis equipment and booster pumps

The larger chemical tanks and water storage tanks would be located outside and designed as either fiberglass or polyethylene to minimize corrosion.

The disadvantage of this setup is that it is permanent and only the treatment equipment could be moved if required. This alternative would have a higher construction cost than the Modular Treatment Plant.

The advantage is that this treatment Plant could have a customized layout that would provide good accessibility to all the equipment for maintenance. The building would require little maintenance and would provide a high degree of corrosion protection for all the equipment located inside the building.

**Preliminary Cost Estimate**

The cost to replace the existing Plant with a new desalinization treatment Plant at the same location would be approximately $2,032,000 for the Modular Treatment Plant and $3,179,000 for the Block Building Treatment Plant. This is a very high-level cost and includes a 40 percent contingency. See Appendix A, for a breakdown of costs.

The next step for MCWD to move forward on this project is to prepare a preliminary design report that would provide a layout and more refined project cost. This cost would be based on the type of treatment plant MCWD would decide to build.

Appendix A
Cost Estimate Detail

| Table 1 - Opinion of Probable Cost no Building | | |
|---|---|---|
| **Item** | **Description** | **Cost ($)** |
| **1** | Mobilization/Demobilization | 100,000 |
| **2** | Demolition | 50,000 |
| 3 | Treatment Equipment | 700,000 |
| 4 | Grading and Paving | 50,000 |
| 5 | Storage Tanks, Containment | 75,000 |
| 6 | Chemical Building | 25,000 |
| 7 | Chlorine Feed Pump and Tank | 20,000 |
| 8 | Electrical Service Nema 4x Outside | 50,000 |
| 9 | Additional associated electrical | 100,000 |
| 10 | Misc. Equipment and Material | 25,000 |
| | **Subtotal** | **1,195,000** |
| | **Administration (5%)** | 59,800 |
| | **Engineering (15%)** | 179,300 |
| | **CM Services (10%)** | 119,500 |
| | **Contingency 40%** | 478,000 |
| | **Total (Rounded Up)** | **2,032,000** |

| Table 2 - Opinion of Probable Cost with Building | | |
|---|---|---|
| **Item** | **Description** | **Cost ($)** |
| **1** | Mobilization/Demobilization | 150,000 |
| | Demolition | 50,000 |
| 2 | Treatment Equipment | 700,000 |
| 3 | Grading and Paving | 50,000 |
| 4 | Building 50-ft x 50-ft | 650,000 |
| 4 | Storage Tanks, Containment | 75,000 |
| 5 | Chemical Building | 25,000 |
| 6 | Chlorine Feed Pump and Tank | 20,000 |
| 7 | Electrical Service Nema 4x Inside | 25,000 |
| 8 | Additional associated electrical | 100,000 |
| 9 | Misc. Equipment and Material | 25,000 |
| | **Subtotal** | **1,870,000** |
| | **Administration (5%)** | 93,500 |
| | **Engineering (15%)** | 280,500 |
| | **CM Services (10%)** | 187,000 |
| | **Contingency 40%** | 748,000 |
| | **Total (Rounded Up)** | **3,179,000** |