

**Appendix B: Request for and Approval of Removal of Mechanical
Surface Aeration from Arcadia Reservoir**



**Public Works Department
Water Resources Division**

June 5, 2023

Terry Kim

District Engineer

State Water Resources Control Board – Division of Drinking Water

500 North Central Avenue, Suite 500

Glendale, CA 91203

Subject: City of Santa Monica Request to Remove Mechanical Surface Aeration Equipment from the Arcadia Reservoir Stipulated Under Permit Amendment 1910146PA-003

Dear Mr. Kim,

The City of Santa Monica (City) is requesting to remove Mechanical Surface Aeration (MSA) equipment operating requirements at the City's Arcadia Reservoir located at the Arcadia Water Treatment Plant (WTP) currently required under Permit Amendment 1910146PA-003. This request is supported by historical water quality data collected over the last decade for all volatile organic compounds (VOCs) detected above the detection limit for reporting (DLR) monitored by the City's laboratory for compliance reporting. Total VOC concentrations entering the Arcadia Reservoir have declined significantly since 2010 due to new treatment facilities constructed to address the contamination at the Charnock Well Field. The decarbonation towers or decarbonators, utilized primarily for pH adjustment, have the additional benefit of VOC removal. Decarbonators operate by forcing air through a liquid stream, typically flowing over a packed media to increase surface area, to volatilize constituents in the liquid phase and transfer to the vapor phase. This process has been extensively captured in the compliance data and has rendered the current MSA treatment equipment in the Arcadia Reservoir no longer efficient or effective. Additionally, the removal of the MSA equipment would provide needed increased utilization and operational flexibility of the Arcadia Reservoir, which would provide for better water quality within the distribution system. This letter summarizes the background for this permit requirement's inception, summary of historical water quality parameters, and rationale for the request to remove the MSA operating requirement at the Arcadia Reservoir.

In 1985, the level of trichloroethylene (TCE) in Santa Monica Well 3 and 4 began to exceed the maximum contaminant level (MCL) of 5 micrograms per liter (ug/L). Several other VOCs were subsequently detected above state detection limits for reporting. In 1991, the City responded to the increasing VOC concentrations by providing MSA equipment within the 5-million-gallon Arcadia Reservoir with the installation of 15 floating mechanical surface aerators. The aerators



spray the water up into an airstream, and the air is collected into a square duct for further treatment through the vapor phase activated carbon adsorption unit. Approval for the MSA treatment in Arcadia Reservoir was provided by the California Department of Public Health letter in July 1992. An as-built drawing and schematic representation for the MSA system are included in Attachment A.

In 2010, the City constructed the Charnock Water Treatment Facility as part of the Charnock Well Restoration Project to manage and treat industrial contamination – primarily Methyl tert butyl ether and tert-Butyl alcohol – at the Charnock Well Field. The project also included expanding the Arcadia WTP to include greensand filtration, reverse osmosis, and finally air stripping decarbonator towers and post-treatment chemical stabilization. Permit Amendment 1910146PA-003 adopted by the State Water Resources Control Board Division of Drinking Water (DDW) in February 2014 included these new treatment processes but also maintained utilization of the original MSA system for VOC removal. While decarbonator air stripping towers have an established history as a best management practice for VOC removal, the decarbonator towers were not formally pursued for VOC removal credit under Permit Amendment 1910146PA-003 and were intended solely for the purpose of pH adjustment through excess carbon dioxide removal to streamline permitting efforts at the time.

The City is currently constructing the Olympic Wellfield Restoration Project which will include a new ultraviolet advanced oxidation process and granular activated carbon to treat industrial contamination from the Olympic Well Field before further treatment through the Arcadia WTP. The City tabulated removal efficiencies for various contaminants of potential concern, including VOCs, for the decarbonator system and other treatment processes as part of the 97-005 Process Memo Step 4 and 5 reports submitted to the DDW in September 2022 and July 2022, respectively. The reports identified that the multi-barrier treatment process including new treatment systems and existing reverse osmosis and decarbonator processes effectively remove all VOCs without requiring the MSA system. A permit amendment application for the project was submitted to the DDW in February 2023. Construction is expected to be completed by February 2024. A process flow-diagram of the Arcadia WTP is shown in Figure 1.

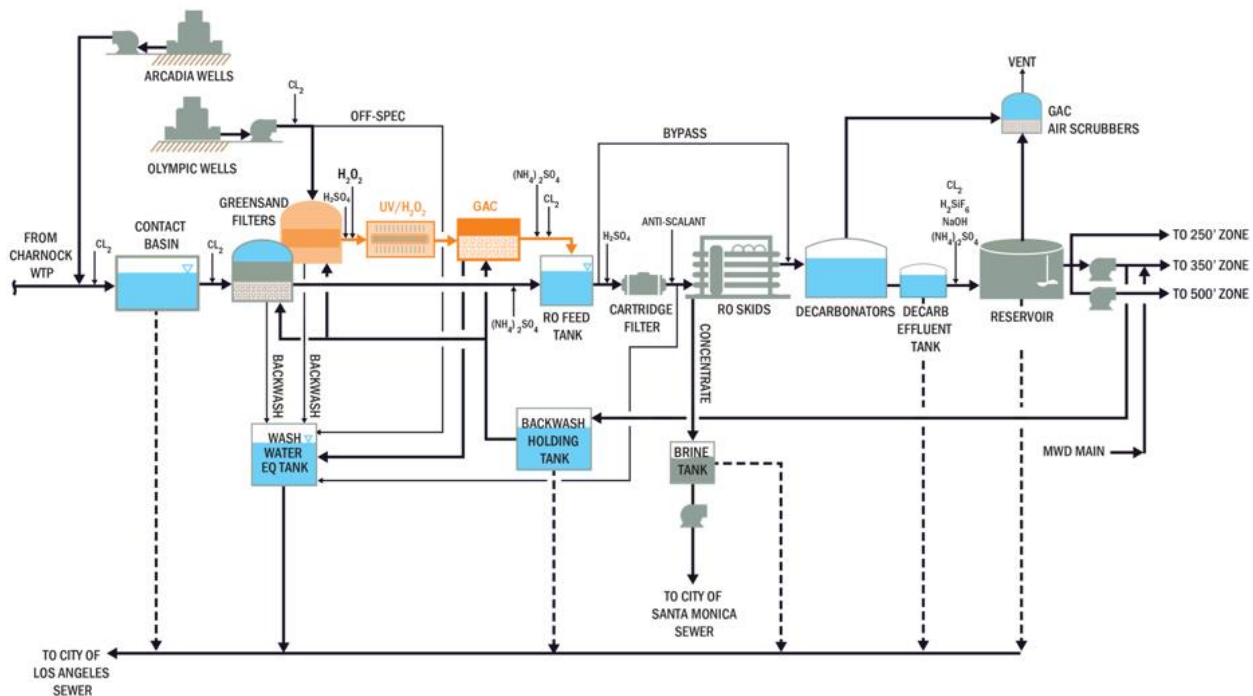


Figure 1. Arcadia WTP Process Flow Diagram (Source: *Olympic Well Field Effective Treatment and Monitoring – Step 4 of 97-005 Evaluation*)

Nearly a decade of water quality data for VOCs from a robust collection of operating conditions, including various well combinations, has shown the decarbonator towers' capability and efficiency in both pH adjustment and VOC removal, while simultaneously illustrating the limited efficacy of the MSA system. Table 1 shows the average VOC concentrations in parts per billion (ppb) for all VOCs detected above the DLR from 2015–2022. Table 2 summarizes the average percent removal by the decarbonator towers alone and the decarbonator towers with the addition of the MSA system with the same distinction made between VOCs above the DLR. Water quality data for the Arcadia WTP is available on the California Safe Drinking Water Information System at the following hyperlink:

https://sdwis.waterboards.ca.gov/PDWW/JSP/NMonitoringSchedules.jsp?tinwsys_is_number=2587&tinwsys_st_code=CA&ReportFormat=SR.



Table 1: Average Concentration (PPB) of All Detected VOCs, TTHMs, and Combined Total by Year

Parameter	2015	2016	2017	2018	2019	2020	2021	2022
Decarbonator Influent								
All VOCs (1,1 DCE, CIS1,2 DCE, TCE, PCE)	10.9	9.8	12.4	11.9	12.4	7.5	7.1	10.2
TTHMS	8.2	7.2	6.7	8.3	8.7	11.5	11.2	12.8
Combined Total	19.1	17.0	19.1	20.2	21.0	19.0	18.3	23.1
Arcadia Reservoir Influent (Decarbonator Effluent)								
All VOCs (1,1 DCE, CIS1,2 DCE, TCE, PCE)	1.5	1.0	0.9	0.8	0.9	0.7	0.4	0.5
TTHMS	4.8	4.9	3.7	4.7	4.9	4.8	4.5	4.8
Combined Total	6.3	5.9	4.6	5.5	5.8	5.6	5.0	5.3
Arcadia Reservoir Effluent								
All VOCs (1,1 DCE, CIS1,2 DCE, TCE, PCE)	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.7
TTHMS	5.2	5.2	4.4	5.0	5.2	5.9	7.4	8.0
Combined Total	5.8	5.7	4.9	5.6	5.7	6.4	8.0	8.8

Note: "All VOCs" encompasses only VOCs above DLR with at least one detection during monitoring period. TTHMs separated due to potential change in TTHMs generation from operational changes.

Table 2: Average Percent Removal (%) of All Detected VOCs and Combined Total with TTHMs by Year

Parameter	2015	2016	2017	2018	2019	2020	2021	2022
Decarbonator Towers								
All VOCs (1,1 DCE, CIS1,2 DCE, TCE, PCE)	86.2	90.0	92.7	93.0	92.6	90.6	94.1	95.0
Combined Total with TTHMs	67.2	65.2	76.0	72.8	72.5	70.8	72.8	77.1
MSA within Arcadia Reservoir								
All VOCs (1,1 DCE, CIS1,2 DCE, TCE, PCE)	94.9	94.8	95.9	95.5	95.7	92.8	91.8	93.0
Combined Total with TTHMs	69.8	66.3	74.4	72.5	73.0	66.2	56.1	62.0

VOCs detected above the DLR from 2015-2022 at the decarbonator influent, Arcadia Reservoir influent, and Arcadia Reservoir effluent include TCE, tetrachloroethylene (PCE), 1,1-Dichloroethene (1,1-DCE), and cis-1,2- dichloroethene (cis-1,2-DCE) as well as total trihalomethanes (TTHMs). TTHM generation fluctuates based on operational changes induced by varying chloramine dosing to the Arcadia Reservoir as well as overall system demand affecting water age, which does not affect the other detected VOCs. Therefore, average concentrations for VOCs are summarized in Table 1 and 2 with and without TTHMs included from both decarbonator towers and MSA equipment.

The mass VOC removal rate in pounds through the decarbonators alone compared to the decarbonators and MSA system for 2015 – 2022 is shown including TTHMs in Figure 2 and excluding TTHMs in Figure 3.

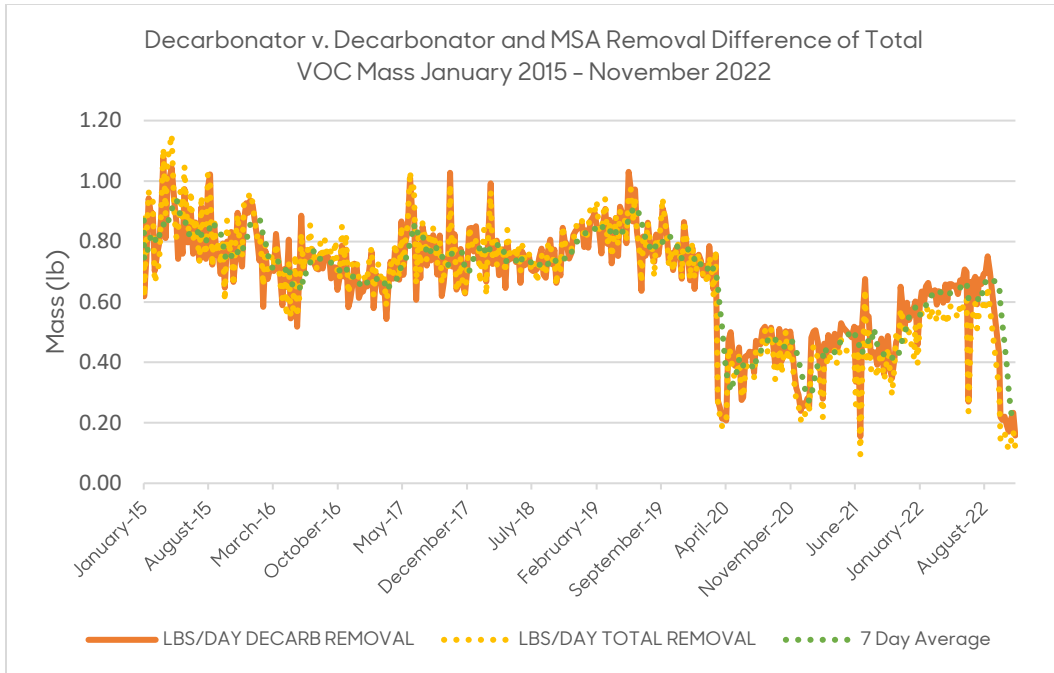


Figure 2. Pounds per Day of VOC Removal from Decarbonator and Decarbonator with MSA

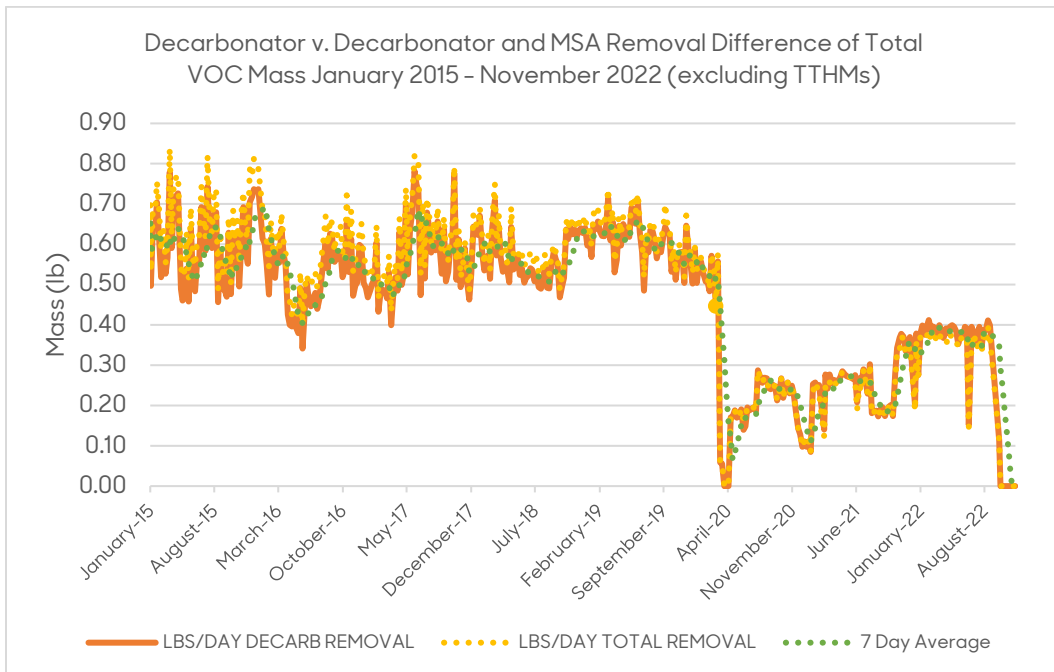


Figure 3. Pounds per Day of VOC Removal from Decarbonator and Decarbonator with MSA (excluding TTHMs)



Historical water quality data collected since beginning operations of the Charnock Water Treatment Facility and Arcadia WTP provides compelling evidence that the Arcadia Reservoir MSA system does very little to impact VOC removal. Declining since 2016, the MSA system has removed less than 5% of the combined VOCs, excluding TTHMs. The poor removal efficiency of MSA equipment is in part due to the influent concentration of water entering the Arcadia Reservoir. The influent VOC concentration is rarely above the detection limit for reporting (DLR) of 0.5 ppb for target VOCs designed for MSA removal such as TCE, PCE, and 1,1-DCE. The only VOCs still present after decarbonator towers are TTHMs and TCE. Even then, MSA equipment does not show a significant decrease in TTHM's. From 2020 – 2022, VOC concentrations, although still near the DLR, appear to show a slight increase in the Arcadia Reservoir effluent than the influent. This is attributed to statistical variations within the analysis methods at concentrations near the DLR. Based on the historical data, it is evident that MSA equipment and the operating requirements associated with it provide limited benefit in the way of VOC removal.

The MSA system operating requirements also induce significant constraints on the operational controls for the Arcadia Reservoir. MSA equipment limits the usable storage of the Arcadia Reservoir due to the intake structure of each aerator requiring a minimum water depth of 8 feet to operate. Too low of a reservoir level would render the aerators inoperable or else risk permanent damage to the equipment. The high-water level height in the reservoir is 12 feet which means there is a significant amount of water always required in the tank, regardless of system demand. Requiring over 8 feet of water to support MSA operations has impacted water age, chloramine residual, and disinfection byproduct formation as seen in the data presented in this letter with respect to TTHMs. Removing the MSA system would allow the City the ability to utilize the entire tank volume with regular drawdowns to reduce water age and mitigate the formation of disinfection byproducts, similar to how the City operates its other 3 drinking water reservoirs with a total storage volume of 40 million gallons. With further expansion at the Arcadia WTP underway, the Arcadia Reservoir will also have the expanded capability to supply water to all three distribution zones within the City making any further increased utilization a direct benefit to operations. By removing the MSA operating requirements, the City anticipates the ability to increase operational flexibility, add usable storage capacity, and improve water quality at Arcadia Reservoir and the overall distribution system.

Based on documented historical water quality data and treatment system performance efficiencies, the multi-barrier treatment process analyzed under the 97-005 Step Reports for the Olympic Wellfield Restoration Project, and facility enhancements utilizing new and expanded treatment processes currently under construction, the City is requesting the removal of the MSA system and operating requirements as permitted under Permit Amendment 1910146PA-003 due to limited efficacy and operational hinderances. This request only pertains to the MSA system and subsequent operating requirements. All monitoring requirements associated with Arcadia Reservoir and the compliance point "ARC TP Treated Water" will remain unchanged. The City



City of
**Santa
Monica**

proposes that any VOC concentration increase observed leaving Arcadia Reservoir at or above ½ the MCL would require operational review with a plan submitted to DDW to determine appropriate actions to mitigate the increase.

The City appreciates the DDW's continued support of the Project. If you have any questions, please contact me at (424) 299-6733 or via email at alex.waite@santamonica.gov.

Sincerely,

Alex Waite, P.E.
Supervising Civil Engineer
City of Santa Monica
2500 Michigan Ave, Bldg. 1
Santa Monica, CA 90404

Attachments:

Attachment A – Arcadia Reservoir Mechanical Surface Aeration system as-built drawing and schematic representation

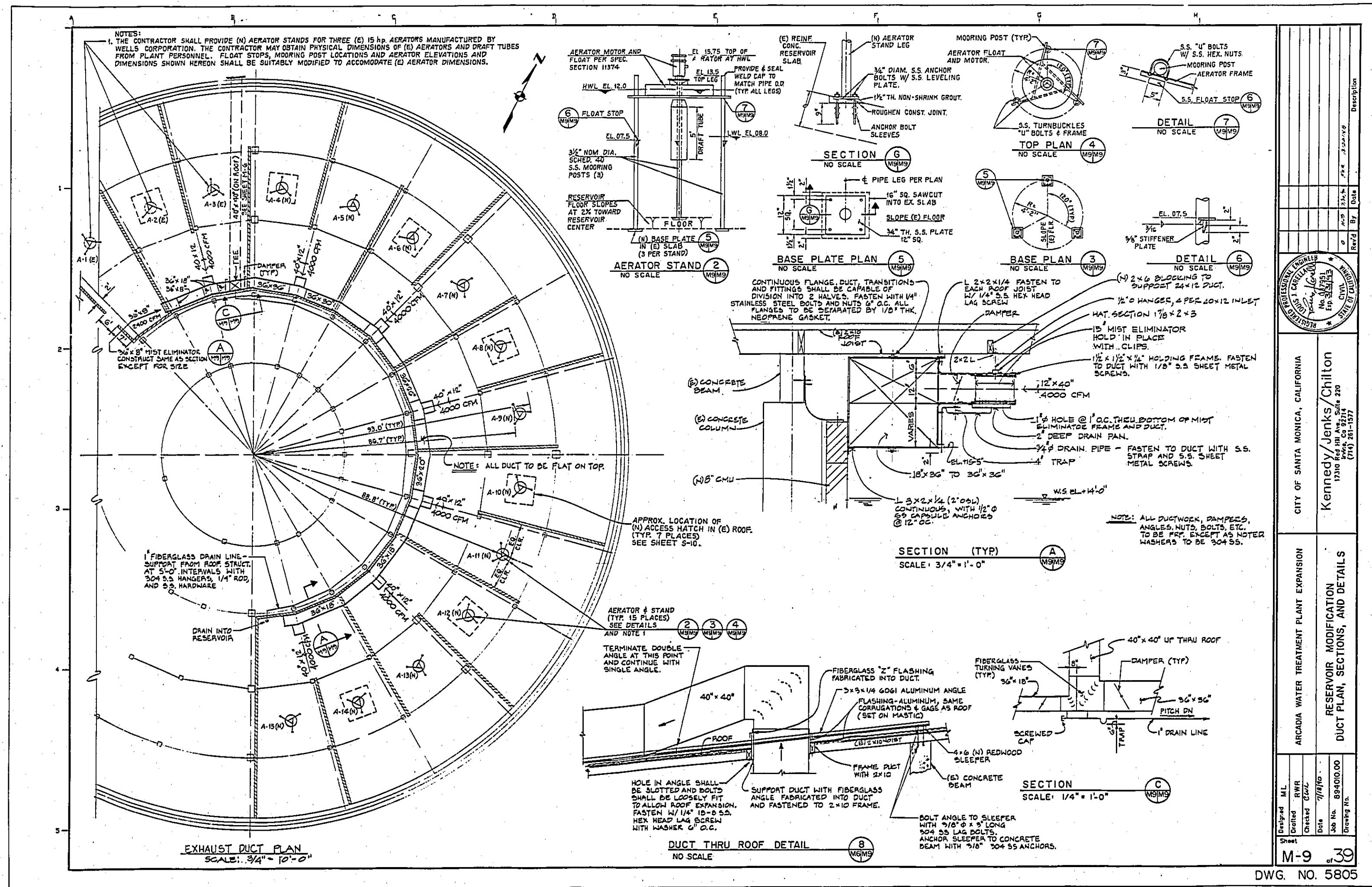
CC: Kurt Souza, State Water Resources Control Board – Division of Drinking Water
(via email)

Matthew Megill, State Water Resources Control Board – Division of Drinking
Water (via email)

Saeed Hafeznezami, State Water Resources Control Board – Division of Drinking
Water (via email)

Scott Coffin, State Water Resources Control Board – Division of Drinking Water
(via email)

Attachment A –
Arcadia Reservoir Mechanical Surface
Aeration system as-built drawing and
schematic representation

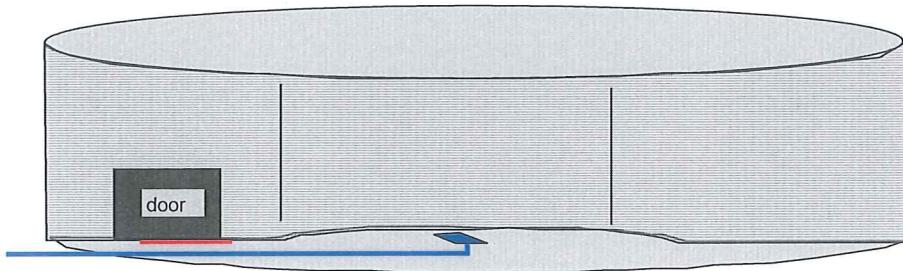
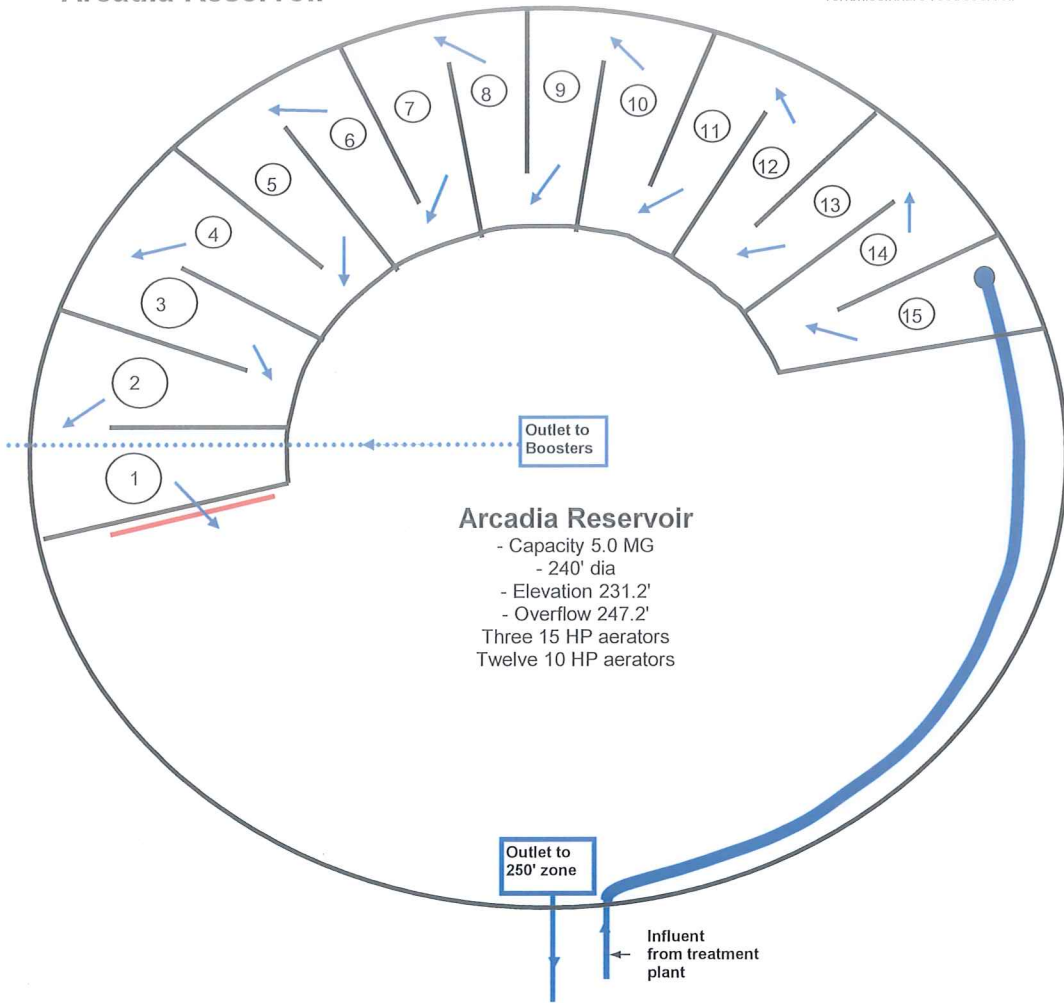


City of Santa Monica, California	Kennedy/Jenks/Chilton
ARCADIA WATER TREATMENT PLANT EXPANSION	RESERVOIR MODIFICATION
	DUCT PLAN, SECTIONS, AND DETAILS
Checked: M.L.	8/14/80
Designed: R.W.R.	7/14/80
Drawn: C.C.Z.	7/14/80
Scale: 1/4" = 1'-0"	
Job No. 894000.00	
Drawing No.	
M-9	39

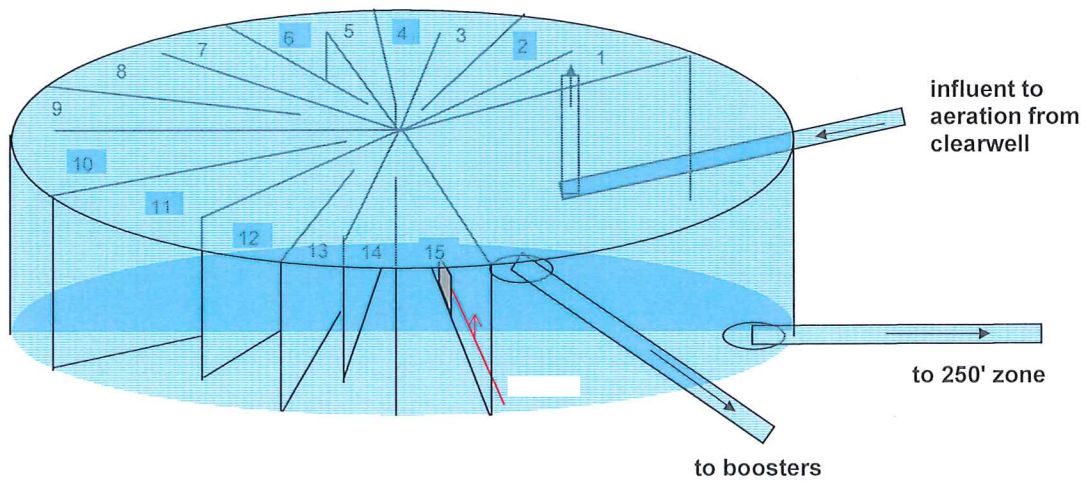
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Arcadia Reservoir

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Arcadia Reservoir





State Water Resources Control Board

Division of Drinking Water

June 22, 2023

Sunny Wang, P.E.
Water Resources Manager
City of Santa Monica
Public Works Department
1212 5th Street
Santa Monica, CA 90401

Dear Mr. Wang:

WATER SYSTEM 1910146 – APPROVAL TO REMOVE MECHANICAL SURFACE AERATION EQUIPMENT

We received the letter, dated June 5, 2023, requesting approval to remove the mechanical surface aeration (MSA) equipment at the Arcadia Reservoir located at the Arcadia Water Treatment Plant (AWTP) (Enclosure 1). You also sent a spreadsheet of an analysis showing how effective the MSA has been at removing volatile organic compounds (VOC) from January 2015 through November 2022 (Enclosure 2) on June 6, 2023.

After reviewing the enclosed documents, the Division of Drinking Water (Division) hereby approves the City's proposal to remove the MSA equipment at the Arcadia Reservoir. The Division also hereby repeals Condition 37 of 1910146PA-003-Revised, which was issued on February 27, 2014. Monitoring of VOCs and other contaminants will continue as normal. If you have any questions, please contact Mr. Matthew Megill at (818) 551-2033 or at Matthew.Megill@waterboards.ca.gov.

Sincerely,

Terrence Kim, P.E.
District Engineer
Central District

E. JOAQUIN ESQUIVEL, CHAIR | EILEEN SOBECK, EXECUTIVE DIRECTOR