

State Water Resources Control Board

Division of Drinking Water

November XX, 2018

**Sanitary Survey Report
For
Morro Bay Water Division
San Luis Obispo County**

**State Water Resources Control Board
Division of Drinking Water
Southern California Field Operations Branch
Ingrid Salazar, Water Resource Control Engineer**

I. INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this report is to document the findings of the recent Sanitary Survey. Sanitary Surveys are required every three years, at a minimum, and consist of a discussion and survey of eight elements (*Source, Treatment, Distribution System, Finished Water Storage, Pumps/Pump Facilities/Controls, Monitoring/Reporting/Data Verification, System Management and Operation, and Operator Compliance with State Requirements*). Each element is comprised of several components. The public water system is required to comply with all regulations pertaining to each element. If the Division of Drinking Water (hereinafter DDW) identifies a *significant deficiency* in any element category during a Sanitary Survey, the public water system will be required to correct the *significant deficiency* in a specified time frame.

1.2 BRIEF DESCRIPTION OF SYSTEM

The Morro Bay Water Division (hereinafter Morro Bay) water system is part of the Morro Bay Public Services Department and serves the city of Morro Bay. Morro Bay operates eight groundwater sources, a Desalination Treatment Plant, a Brackish Water Treatment Plant, two connections to other public water systems, ten reservoirs, and four booster stations to provide potable water to about 10,300 permanent residents and up to 15,000 people seasonally via 5,479 service connections. It is classified as a community water system and operates under the authority of permit number 04-06-09P-005, issued by DDW in 2009. The permit has been amended in 2010 to include chloramination as a disinfectant. The permit includes special provisions regarding compliance with nitrates, chloramines, and the surface water treatment rule. The previous Sanitary Survey of Morro Bay was conducted during February of 2015.

1.3 SOURCES OF INFORMATION

All information included in this report was obtained from DDW files, Morro Bay personnel, and a site visit on September 13, 2018.

1.4 ENFORCEMENT HISTORY

Since the previous Sanitary Survey, no enforcement actions have been issued to Morro Bay.

II. INVESTIGATION AND FINDINGS

2.1 ELEMENT 1: SOURCES

Morro Bay's active sources of water are eight groundwater wells and one connection to the Central Coast Water Authority (hereinafter CCWA). It also has five standby seawater sources, five inactive groundwater wells, and one emergency intertie to California Men's Colony.

2.1.1 GROUNDWATER

Seven of the eight active wells draw from the Morro Valley Groundwater Basin (Morro Valley Wells) and the remaining active well and five inactive wells are located in the Chorro Valley Groundwater Basin (Chorro Valley Wells). The groundwater basins are not subject to critical conditions of overdraft and have been designated with very low priority for management under the Sustainable Groundwater Management Act (SGMA). Seawater intrusion is a predominate concern in both basins. Impairments of the basins include elevated levels of nitrates and total dissolved solids. All wells are secured to prevent unauthorized access. Wells are inspected weekly or monthly by operators. Well production data is recorded at least once a month and reported to DDW annually through the electronic Annual Report (eAR). Morro Bay keeps an adequate supply of spare parts for wells and treatment facilities. The active wells can collectively produce roughly 1,280 gpm or 1.85 MGD, although their use is limited by the capacity of the reverse osmosis treatment plant that is used for nitrate removal. No deficiencies were observed at active wells during inspection.

Drinking water source assessments (DWSAP) were completed for most wells in 2001 determined the wells are most vulnerable to the following: agricultural drainage, dry cleaners, furniture and home repair/manufacturing, gas stations, metal plating/fishing/fabricating, mining operations, pesticide/fertilizer/petroleum storage & transfer areas, plastic/synthetics producers, repair shops, sewer collection systems, and wood preserving/treating. DDW does not have a DWSAP for the high school wells and Flippo Well. **Morro Bay must complete a DWSAP for the both High School and Flippos wells within 60 days. A blank DWSAP document is attached as Enclosure 3.**

MORRO VALLEY WELL

The Morro Valley Basin is utilized via Wells 03, 04, 14, 15, Flippos Well, and High School Wells 01 and 02. All of the Morro Valley Wells have annual seal depth less than the recommended 50 feet. Wells 03, 04, 14, and 15 are located along Highway 1, between a hotel and park. The high school wells are located at the local high school, and Flippo Well is located in an industrial neighborhood. No sewer line or septic systems are located within 50 feet or 100 feet from well site respectively, except for Flippos Well. All of the Morro Valley Wells are equipped with a submersible pump. Both high school wells and Flippos well are also equipped a pressure tank to reduce water hammer. Well 03, 04 and Flippos are also equipped with a variable frequency drive (VFD). Morro Bay's main source of local water comes from Wells 03, 04, 14 and 15. Wells are turned on once a week, typically on Tuesday. The high school wells and Flippos well are utilized in conjunction with Wells 03, 04, 14 and 15 when water from CCWA is not available.

A review of water quality sampling of the wells indicates that wells have various water quality concerns. In November 2014 the two high school wells showed elevated levels of iron, chloride, and other minerals that indicate the entry of saltwater into the aquifer. Iron levels have decreased since 2014. However, concentrations of chloride and other minerals remain high. In addition, all of the Morro Valley Wells exceed the nitrate MCL of 10 mg/L as N. The wells are treated for nitrates at the Brackish Water Reserve Osmosis Treatment Plant and discharge directly to the Kings Tanks where they blend with water from CCWA and Well 11A.

CHORRO VALLEY WELLS

The Chorro Valley Basin is utilized via Wells 11A and the Ashurst Well Field (Wells 09, 09A, 10, 10A, and 16). All of the wells in the Ashurst Well Field have been inactivated due to nitrate contamination. Well 11A is not in the Ashurst Well Field and is the only Chorro Valley Well that remains active. The well has a 28-foot annular seal. Well 11 is located in a rural neighborhood on the south end of the city. No sewer line or septic systems are located within 50 feet or 100 feet from well site respectively. The well is equipped with an electric motor and a deep well turbine pump. The well water complies with primary and secondary drinking water standards. However, nitrate concentration tends to increase with use. As a result, Morro Bay currently does not utilize the well. DDW recommends Morro Bay to change the status of Well 11A from active to standby or inactive. A permit amendment will be required to change the status of well. A standby source is subject to the following provisions:

- A standby source shall be used only for short-term emergencies of 5 consecutive days or less, and no more than a total of 15 calendar days in a year. Any use during a 24-hour period constitutes a day's use.
- Upon emergency use, the well must be sampled for coliforms and nitrate. Results must be reported to DDW within 24 hours.
- Morro Bay must maintain a production log and make it available to DDW upon request.
- Morro Bay must report the use of standby well in the eAR.
- The well must be sampled for the well for general physical parameters, general minerals, inorganic chemicals, asbestos, radiological chemicals, volatile organic compounds, and synthetic organic compounds once every nine years.

Five inactive wells are located in the Chorro Valley Basin. DDW recommends Morro Bay to comply with Section 115700 of the California Health and Safety Code, which require well owners to maintain **inactive wells** as follows:

- The well shall not allow impairment of the quality of water within the well and groundwater encountered by the well.
- The top of the well or well casing shall be covered to prevent unauthorized access, to prevent a safety hazard to humans and animals, and to prevent illegal disposal of wastes in the well. The cover shall be watertight. A pump or motor, angle drive, or other surface feature of a well, when in compliance with the above provisions, shall suffice as a cover.
- The well shall be marked so as to be easily visible and located, and labeled so as to be easily identified as a well.
- The area surrounding the well shall be kept clear of brush, debris, and waste materials.
- DDW recommends properly abandoning the wells if there are no plans for their use in the future.

Source Name & PS Code	Year Drilled	Well Depth (ft.)	Perforations (ft.)	Annular Seal Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Capacity (gpm)	Water Levels (ft.)
Well 03 4010011-005	1952	65	45-54	30	140	Sub.	250	22 (Static) 25 (Pumping)
Well 04 4010011-006	1962	65	55-65	30	300	Sub.	300	22 (Static) 26 (Pumping)
Well 11A 4010011-016	1979	70	32-70	28	225	DWT	250	22 (Static) Feb 1990

Table 1: Active Well Info								
Source Name & PS Code	Year Drilled	Well Depth (ft.)	Perforations (ft.)	Annular Seal Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Capacity (gpm)	Water Levels (ft.)
Well 14 4010011-019	1972	60	42-60	35	125	Sub.	125	22 (Static) 28 (Pumping)
Well 15 4010011-020	1972	70	40-70	30	113	Sub.	120	21 (Static) 26 (Pumping)
High School 1 4010011-030	2003	75	35-60	20	150	Sub.	VFD	6 (Static) 32 (Pumping)
High School 2 4010011-031	2003	73	35-70	20	90	Sub.	VFD	6 (Static) 37 (Pumping)
Flippos Well 4010011-032	2001	68	37-67	29	140	Sub.	140	6 (Static)

2.1.2 SURFACE WATER

Five saltwater wells are located in vaults south of the Morro Bay's desalination plant along the Morro Bay Harbor. The wells discharge into a common pipeline which transports seawater from the well sites to the Desalination Treatment Plant. The wells are considered one source. The seawater wells are currently listed as a standby source. When wells are active, Morro Bay shall demonstrate compliance with the Surface Water Treatment Rule (SWTR). During the inspection, Morro Bay indicated future use of these wells is highly unlikely. DDW recommends the proper abandonment of the seawater wells.

Table 2: Standby Well Info								
Source Name & PS Code	Year Drilled	Well Depth (ft.)	Perforations (ft.)	Annular Seal Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Capacity (gpm)	Water Levels (ft.)
Seawater Wells 4010011-022	1991	83-95	19-95	14-18	--	Sub.	480	--

2.1.3 PURCHASED WATER

Morro Bay's main source of water comes from the State Water Project (hereinafter SWP) via CCWA. Surface water is treated at CCWA's Polonio Pass Water Treatment Plant (PPWTP) which has a capacity of 43 MGD. The PPWTP is a conventional surface water treatment plant, which includes coagulation, flocculation, sedimentation, filtration, and disinfection. Raw water is pumped to the PPWTP through the Coastal Branch of the SWP, which is operated by the California Department of Water Resources. Treated water is distributed through a pipeline with a capacity of 67 MGD. The SWP turnout for Morro Bay is located near the La Loma and Quintana intersection and enters the distribution system through the Kings Tanks. The availability of Morro Bay's connection to CCWA depends on drought conditions and SWP allocations. The PPWTP is permitted by DDW to meet the SWTR. In 2016, Morro Bay purchased approximately 312 million-gallons (MG) of water from the SWP via CCWA. A review of water quality sampling of CCWA's sources indicates that the water meets all primary and secondary maximum contaminant levels.

2.1.4 INTERCONNECTIONS

Morro Bay has an emergency intertie to obtain treated water from the California Men's Colony (CMC). CMC uses a conventional surface water treatment plant to treat water from the Whale Rock Reservoir, Chorro Reservoir, and from a local well. The surface water treatment plant has a capacity of 3 MGD. Treatment processes include coagulation, flocculation, sedimentation,

filtration, and disinfection. CMC’s surface water treatment plant is permitted by DDW to meet the SWTR. CMC also receives treated surface water from CCWA.

2.1.5 ADEQUACY OF SUPPLY

Morro Bay is required to have enough source and storage capacity at all times to meet its maximum daily demand (MDD), as determined from the previous ten years of water demand data. In addition, water systems with more than 1,000 service connections are also required to be able to meet four hours of peak hourly demand (PHD) with source capacity, storage capacity, and/or emergency source connections. The MDD was determined to be 2,433,934 gallons per day or 1,690 gpm. The PHD was determined to be 152,121 gallons per hour. Four hours of PHD is equivalent to 604,484 gallons. Morro Bay’s treatment capacity is 1,380 gpm and an additional 225 gpm can be pumped from Well 11A for a total source capacity of 1,605 gpm. Morro Bay would rely on their connection to CCWA to meet the MDD. Morro Bay’s storage facilities provide a total capacity of 3.68 million gallons; enough to meet four hours of PHD.

Table 3: Water Demand Data for the Previous 10 Years			
Year	Maximum Daily Water Demand (Gallons)	Maximum Monthly Water Demand (Gallons)	Total Annual Production (Gallons)
2007	2,337,344*	47,526,000	459,897,100
2008	2,318,508*	47,143,000	449,793,600
2009	2,433,934*	49,490,000	446,630,000
2010	2,130,295*	43,316,000	411,833,300
2011	2,027,016*	41,216,000	404,790,000
2012	1,964,754*	39,950,000	392,317,000
2013	1,967,213*	40,000,000	405,237,000
2014	1,850,164*	37,620,000	384,890,000
2015	1,630,820*	33,160,000	355,170,000
2016	1,572,570*	31,975,600	323,760,000

*Estimated from annual or monthly data

2.1.6 DROUGHT PREPAREDNESS

The State Water Resources Control Board (Water Board) will continue to update water conservation measures depending on current weather conditions. DDW recommends that Morro Bay stays informed by visiting the Water Conservation Portal at:

https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/

2.1.7 CLIMATE CHANGE

California is making efforts to adapt to a changing climate. A principle of the State’s adaptation strategy document, [Safeguarding California](#), is to prioritize actions that not only mitigate greenhouse gas emissions, but also help the State prepare for climate change impacts. Improved coordination, implementation, and integration of adaptation planning efforts and funding of the state’s climate policies can directly protect the state’s natural and built infrastructure, communities, environmental quality, public health, safety and security, natural resources, and economy from the unavoidable impacts of climate change. Drinking water systems are encouraged to use U.S. EPA’s Climate Resilience Evaluation and Awareness Tool (CREAT):

<https://toolkit.climate.gov/tool/climate-resilience-evaluation-awareness-tool-creat>

2.2 ELEMENT 2: TREATMENT

Morro Bay maintains an active Brackish Water Reverse Osmosis Treatment Plant to remove nitrates from the Morro Valley Wells. At times, Morro Bay is also able to blend groundwater with Well 11A and purchased water from CCWA to reduce nitrate contamination. A desalination treatment plant is maintained on standby. All water is disinfected with chlorine and ammonia.

2.2.1 SURFACE WATER TREATMENT

DESALINATION WATER TREATMENT PLANT

A Desalination Plant was constructed in 1991 and is maintained adjacent to the Brackish Water Reverse Osmosis Treatment Plant. The plant is supplied by five seawater wells. It includes four reverse osmosis trains, iron and manganese treatment pre-filters, a scale inhibitor injection, and the same calcium carbonate contact vessel used for the Brackish Water Reverse Osmosis Treatment Plant. The total plant capacity is 480 gpm. The Desalination Plant is subject to the Surface Water Treatment Rule (SWTR) requirements. The Desalination Plant is currently on standby and would require additional pre-treatment for iron for regular use. Morro Bay does not plan on using the Desalination Plant in the near future due to the equipment's aging technology. Before activating the Desalination Plant, additional information, including sample SWTR contact time calculations shall be submitted to this office and approved. If planned, the use of the Desalination Treatment Plant would require monitoring and reporting to DDW for compliance with the Surface Water Treatment Rule. This would include continuous turbidity and chlorine monitoring, four-hour turbidity reporting, and the daily calculation of chlorine contact time for adequate disinfection. Before activation, an updated Operations Plan, including sample Surface Water Treatment Rule contact time calculations would be required to be submitted to this office for approval.

2.2.2 GROUNDWATER TREATMENT – NITRATE REMOVAL

BRACKISH WATER REVERSE OSMOSIS TREATMENT PLANT

Morro Bay maintains a Brackish Water Reverse Osmosis Treatment Plant (BWRO) to remove nitrate from its groundwater. Two reverse osmosis membrane trains are used at the treatment plant that have a maximum finished water flow rate of 450 gpm each for a total capacity of 900 gpm. The treatment plant treats well water from the Morro Valley Wells. Cartridge filters are used for pre-filtration and a scale inhibitor is added to the water upstream of the reverse osmosis membranes. The treatment plant runs once a week, typically on Tuesday. Only one membrane is used during operation. Morro Bay alternates between membrane trains every week. The finished water is sent through a calcium carbonate contact vessel to be stabilized and made noncorrosive. Lastly, finished water is dosed with sodium hypochlorite prior to discharge at Kings Tanks.

BLENDING

Blending treatment for nitrate may be provided by mixing untreated groundwater with water purchased from CCWA and water treated by the BWRO. However, Morro Bay has not blended water for some time since Well 11A is offline, and water from the BWRO complies with the nitrate MCL. The blending occurs in the two Kings Tanks.

2.2.3 DISINFECTION

Disinfection treatment is provided by the injection of a 12.5% sodium hypochlorite solution and ammonia to create chloramines prior to entering the Kings Tanks. Water purchased from CCWA is treated with chloramines before it enters Morro Bay's distribution system.

Table 4: Active Disinfection Treatment Facility Info				
Sources	Type	Chemical	Injection	Residual

Treated		Storage (gal)	Capacity (gph)	(mg/L)
Morro Valley Wells	Chloramine	300	5.07	0.9-1.9
Well 11A	Chloramine	300	5.07	0.9-1.9

Table 5: Active Chemical Treatment Facility Info			
Sources Treated	Parameter	Type	Capacity (gpm)
All Groundwater Wells	Nitrate	Blending	Variable
Morro Valley Wells	Nitrate	Reverse Osmosis	900
Seawater Wells 1-5	Seawater	Reverse Osmosis	480

2.3 ELEMENT 3: DISTRIBUTION SYSTEM

2.3.1 DISTRIBUTION LINES

The distribution system is made up of five pressure zones: Blanca Zone, Nutmeg Zone, Elena Zone, Kings Zone, and the Black Hill Zone. Distribution pipelines are made up of PVC and asbestos cement. Pipelines range from six to fourteen inches in diameter, and are pressurized between 40 to 120 psi. Morro Bay follows AWWA recommendations for disinfection of new and repaired mains. The system includes 60 dead ends and 1,597 valves, which are flushed and exercised annually to maintain water quality. During 2016, Morro Bay experienced 36 service connection breaks/leaks and 2 main breaks/leaks. A brief description of causes and corrective action taken during events must be provided on the electronic annual report (eAR). Morro Bay also received a total of 90 customer complaints in 2016. Complaints were investigated and resolved. Updated maps of the distribution system are maintained.

A total of 346 backflow prevention devices are used to protect the water system from potential cross-connections. During 2016, only 322 devices were tested. **Morro Bay is required to ensure that all of the backflow prevention devices are tested annually.** Jon Williams from the San Luis Obispo's Environmental Health Department coordinates the cross-connection control program for Morro Bay.

2.4 ELEMENT 4: FINISHED WATER STORAGE

Morro Bay maintains ten storage tanks with approximately 3.7 million gallons of storage capacity. All of the tanks are above ground, constructed of steel and are coated with epoxy or coal tar. Sites are fenced and locked to prevent unauthorized access. Surface drainage to tanks is not possible. Reservoirs are equipped with common inlet and outlet lines, except for Kings Reservoir East. Tanks drain or overflow onto the nearby hillside into a storm drain. Tanks can be isolated from the distribution system if needed and are connected to Morro Bay's SCADA system. Operators visit the reservoir sites daily. Half of the tanks have been cleaned or inspected within the last five years. DDW continues to recommend Morro Bay to inspect and clean reservoirs no less than every five years, if necessary. Morro Bay is aware of and follows the DDW Reservoir Coating policy and requirements.

The Kings Street Tanks are the central blending point for all of Morro Bay's sources with the exception of Well 11A. During normal operation, the SPW enters eastern reservoir and local sources enter western reservoir. The outlets from both reservoirs are connected to a common 12-inch distribution line. Water from the Kings Reservoirs is distributed to customers and to other tanks in the system. All other tanks are used for storage and to pressurize the distribution system. During the inspection, majority of the tanks showed signs of corrosion. Severe corrosion was observed at the Kings and Blanca Reservoirs. In addition, the exterior paint at Elena Reservoir East was in poor condition. **DDW recommends Morro Bay to repair corrosion at tanks and**

paint the exterior of Elena East in the near future to prevent further deterioration of reservoirs. Lastly, Morro Bay anticipates replacing Nutmeg reservoir in the near future. DDW recommends Morro Bay to submit preliminary plans for review of new reservoir prior to construction. No other deficiencies were observed.

Table 6: Active Finished Water Reservoir Info				
Name	Type	Year Built	Capacity (Gallons)	Comments
Black Mountain	Welded Steel	1984	180,000	Inspected 2011
Kings West	Welded Steel	1971	1,000,000	Inspected 2011
Kings East	Welded Steel	1996	1,500,000	Inspected 2011
Blanca 1	Welded Steel	2005	220,000	Inspected 2014
Blanca 2	Welded Steel	2005	220,000	Inspected 2014
Blanca 3	Welded Steel	1962	150,000	Inspected 2014
Blanca 4	Welded Steel	1962	150,000	Inspected 2005
Elena 1	Bolted Steel	1962	60,000	Inspected 2014
Elena 2	Bolted Steel	1989	60,000	Inspected 2014
Nutmeg	Welded Steel	1986	140,000	Inspected 2006



Figure 1 and 2 - Air vent (left) and access hatch (right) at Kings Reservoirs.



Figure 3 and 4 – Corrosion on roof at Kings Reservoirs.



Figure 5 and 6 – Corrosion on roof of Blanca Reservoirs.



Figure 7 and 8 – Corrosion on Blanca Reservoir (left) and picture of exterior paint at Elena East Reservoir (right).

2.5 ELEMENT 5: PUMPS, PUMP FACILITIES, AND CONTROLS

Morro Bay maintains four booster stations to maintain pressure and move water between pressure zones. All booster stations are connected to a SCADA system and are signaled to operate by either a pressure transducer or a tank level sensor. Morro Bay has the ability to connect a portable generator at the Elena booster station to power the booster station in case of a power outage. Generator is permitted and inspected annually by governing Air Quality Management District. Booster stations were free of deficiencies during inspection.

Table 7: Booster Pump Station Info				
Name	# of Pumps	Capacity (gpm)	Delivers Water From	Delivers Water To
Vashon	2	250	Elena Zone	Blanca Zone
Elena	2	420	Elena Zone	Nutmeg Zone
King	2	500	Kings Zone	Black Hill Zone
RO	2	1,800	Reverse Osmosis Plant	Kings Zone

2.6 ELEMENT 6: MONITORING, REPORTING, AND DATA VERIFICATION

2.6.1 SOURCE MONITORING

Morro Bay is required to routinely monitor its groundwater sources for general physical parameters, general minerals, inorganic chemicals, asbestos, radiological chemicals, volatile organic compounds (VOCs), synthetic organic compounds (SOCs), total coliform bacteria, and fecal coliform (E.coli). A monitoring schedule is shown in Table 8. A copy of the most recent sampling results of groundwater sources is attached as Enclosure 4.

Table 8: Chemical Monitoring of Sources								
Source Name & PS Code		General Physical & Minerals	Inorganic & Nitrite	Nitrate	Radio-logical	VOCs	SOCs	Asbestos
Well 03 4010011-005	Last Sample	2018	2018	Aug-18	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2024
Well 04 4010011-006	Last Sample	2018	2018	Aug-18	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2024
Well 11A 4010011-016	Last Sample	2018	2018	2018	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Annually	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	2019	2023	2021	2024	2024
Well 14 4010011-019	Last Sample	2018	2018	Aug-18	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2024
Well 15 4010011-020	Last Sample	2018	2018	Aug-18	2014	2018	2015	2012
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2021
High School Well 01 4010011-030	Last Sample	2018	2018	Aug-18	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2024
High School Well 02 4010011-031	Last Sample	2018	2018	Aug-18	2014	2018	2015	2015
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2024
Flippos Well 4010011-032	Last Sample	2018	2018	Aug-18	2014	2018	2015	2012
	Frequency	3 Years	3 Years	Monthly	9 Years	3 Years	9 Years	9 Years
	Next Sample	2021	2021	Nov-18	2023	2021	2024	2021
Seawater Wells 4010011-022	Last Sample	2012	2012	2018	2012	2012	None	2012
	Frequency	9 Years	9 Years	Annually	9 Years	9 Years	Waived	9 Years
	Next Sample	2021	2021	2019	2021	2021	N/A	2021

2.6.1.1 GENERAL PHYSICAL & MINERAL

A review of the most recent water quality data shows groundwater to be very hard with hardness levels ranging between from 464 – 1,090 mg/L. The high school wells have concentrations over the MCL or “short-term range” for chloride, specific conductance, and total dissolved solids, which can be a sign of seawater intrusion. Lastly, sampling results from Well 11A showed a turbidity concentration of 6.8 NTU, which is over the MCL of 5 NTU.

2.6.1.2 INORGANIC & NITRITE

All groundwater wells were last sampled for inorganic constituents in 2018. During this sampling period, Well 03 and Well 04 showed selenium levels over the MCL of 50 ug/L. **As a result, Morro Bay must begin quarterly monitoring Well 03 and Well 04 for selenium no later than the 4th quarter of 2018 per §64432 (g)(1).** If the average of four consecutive quarters is lower than the selenium MCL, Morro Bay may return to annual or triannual sampling upon request. All other inorganic constituents (excluding nitrate and asbestos) were below their respective MCLs. Sampling is due in 2021.

2.6.1.3 NITRATE

All of the Morro Valley Wells exceed the nitrate MCL of 10 mg/L as N. Wells are treated at the BWRO treatment plant or are blended with other sources at the Kings Tanks. Monitoring for nitrate at Well 11A and seawater wells is due annually. See Section 2.6.2.1 for monitoring frequency of Morro Valley Wells.

2.6.1.4 ASBESTOS

Community and nontransient-noncommunity water systems are required to sample groundwater wells for asbestos once every 9 years. All active groundwater wells were sampled for asbestos in 2015 and the seawater wells (standby) were sampled in 2012. All sample results (active and standby) were non-detect for asbestos.

2.6.1.5 RADIOLOGICAL

After initial monitoring is complete, the sampling frequency for routine radionuclide chemicals is based on the gross alpha sampling result(s) obtained in the most recent compliance period. In addition, monitoring for uranium, radium-226, and radium-228 are required only if triggered by the gross alpha result. During the most recent compliance period, none of Morro Bay's groundwater wells had a gross alpha concentration over the DLR (3 pCi/L). The seawater wells had a concentration of 14.1 pCi/L, which is below the MCL.

2.6.1.6 VOLATILE ORGANIC COMPOUNDS (VOC)

Morro Bay is required to sample wells for all VOC constituents once every three years for active groundwater wells and once every nine years for standby sources. All active groundwater wells were non-detect for all VOC constituents during the 2018 compliance period. Wells are not due for VOC monitoring until 2021.

2.6.1.7 SYNTHETIC ORGANIC COMPOUNDS (SOC)

On December 14, 2017, the California regulation of 1,2,3-TCP MCL and DLR at 0.005 µg/L became effective. The regulation requires public water systems to begin quarterly monitoring for 1,2,3-TCP in their drinking water sources in January of 2018. Water system compliance with 1,2,3-TCP is determined by the average of four consecutive quarterly samples. All active groundwater wells have been sampled during the 1st, 2nd, and 3rd quarters of 2018. All sample results have been below the DLR. Morro Bay shall collect a 1,2,3 TCP sample during the 4th quarter of 2018 to complete initial monitoring requirements. Routine monitoring requirements will be set after initial monitoring has been completed.

2.6.1.8 BACTERIOLOGICAL

Morro Bay is required to sample groundwater wells for raw water coliforms quarterly, prior to chlorination. For compliance with the Groundwater Rule, Morro Bay is also required to test its groundwater sources for bacteria when a routine distribution sample is positive for coliform bacteria. Table 9 below summarizes bacteriological sampling.

Table 9: Bacteriological Monitoring of Source												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	12-0-0	9-0-0	12-0-0	12-0-0	14-2-0	12-0-0	12-0-0	13-2-0	13-2-0	13-1-0	13-1-0	16-7-0
2016	13-1-0	15-5-0	14-4-0	13-0-0	12-0-0	13-0-0	12-0-0	14-2-0	12-0-0	12-0-0	12-0-0	13-2-0
2017	11-0-0	12-0-0	14-5-0	10-3-0	8-0-0	8-0-0	8-0-0	8-0-0	7-0-0	7-0-0	9-0-0	8-2-0
2018	11-4-0	11-5-0	10-3-0	11-5-0	10-4-0	11-3-0	9-2-0					

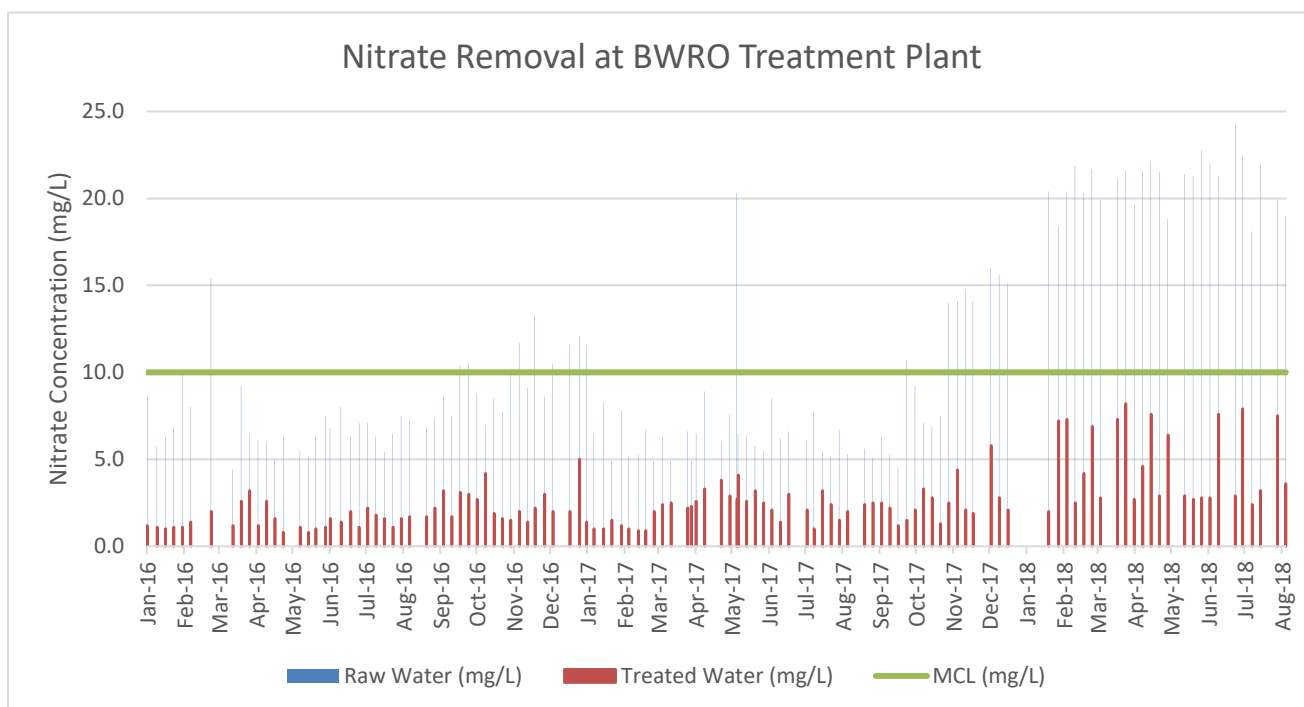
Key: # of samples collected - # of total coliform positive results - # of E. coli positive results

2.6.2 TREATMENT MONITORING

2.6.2.1 BRACKISH WATER REVERSE OSMOSIS TREATMENT PLANT – NITRATE TREATMENT

Morro Bay is required to submit a monthly nitrate report for the BWRO treatment plant. The report is due to DDW no later than the tenth of the following month. The treatment report must include daily production values, daily nitrate analysis of feed and product water using a field kit, and a weekly nitrate analyses, performed by a certified lab, of the feed and product water. Analysis performed by a certified laboratory shall also be EDT'ed to DDW's database using the corresponding PS Codes listed in Table 10.

Table 10: Brackish Water Treatment Plant Monitoring Requirements				
Facility	PS Code	Constituent	Frequency	Comments
Well 03	4010011-005	Nitrate as N	Monthly, when in use.	Individual raw water sources
Well 04	4010011-006			
Well 14	4010011-019			
Well 15	4010011-020			
High School Well 1	4010011-030			
High School Well 2	4010011-031			
Flippos Well	4010011-032			
BWRO - Pretreatment	4010011-034	Nitrate as N	Daily/Weekly (field kit/lab)	Raw water combined
Brackish Water TP Effluent	4010011-035	Nitrate as N	Daily/Weekly (field kit/lab)	Combined membrane effluent



2.6.2.2 KINGS STREET TANKS – NITRATE BLENDING

Morro Bay is required to submit a monthly nitrate blending report during months when sources are blended to lower the nitrate concentration. Morro Bay has not blended water since the previous Sanitary Survey. A blending treatment report is due to DDW no later than the tenth of the follow the month whenever blending treatment is provided. The report shall include the following:

- Daily production numbers from each source and daily theoretical blended water nitrate concentrations.
- A weekly nitrate analyses, performed by a certified lab, of the blended water supplied to the consumers.
- Monthly nitrate analyses, performed by certified lab, of the high nitrate sources.
- Quarterly nitrate analyses of the water used to lower the nitrate concentrations (SWP)
- Field kit nitrate analyses of the blended water shall be made on a weekly basis. The field kit samples shall be collected and analyzed at the same time the sample to the certified lab is taken.

2.6.3 DISTRIBUTION SYSTEM MONITORING

Morro Bay is required to routinely monitor its distribution system for asbestos, total coliform bacteria, fecal coliform bacteria, lead and copper, disinfection byproducts, and chlorine residuals.

2.6.3.1 NITRIFICATION MONITORING

DDW recommends reservoir monthly sampling to identify possible nitrification problems associated with chloramines. DDW recommends monthly ammonia, nitrate, nitrite, HPC, and chlorine residuals of the reservoir water. Morro Bay should assure that the water in the reservoirs have adequate turnover so that they do not act as dead-end storage points which promote nitrification. Dead end lines should be flushed monthly-quarterly. Morro Bay shall take corrective action if nitrification occurs. The current nitrification treatment report summarizes nitrate, nitrite, HPC, and chlorine analysis at various points in the distribution system. The intent of the nitrification monitoring program is to determine if nitrification is occurring at susceptible locations in the distribution system, such as low usage areas and reservoirs. **Morro Bay should revise current nitrification monitoring locations to reflect the nitrification of reservoirs instead of the distribution system.**

2.6.3.2 ASBESTOS

Asbestos monitoring of the distribution system shall be performed for those systems, which have asbestos cement pipe and serve corrosive water based on an aggressive water index (AI) evaluation under worst-case conditions (AI less than or equal to 11.5). A review of Morro Bay's water quality shows that water is not considered to be corrosive. An asbestos sample from the distribution system is not required for the current compliance period.

2.6.3.3 BACTERIOLOGICAL MONITORING

Morro Bay is required to test at least four sample locations for bacteria per week from its distribution system. A monthly summary of monitoring results and copies of bacteriological monitoring results for all positive routine and repeat samples are required to be submitted to DDW no later than the tenth day of the following month. Table 11 below summarizes the results.

The federal Revised Total Coliform Rule (rTCR) went into effect on April 1, 2016. Morro Bay will need to comply with California's existing Total Coliform Rule (TCR) and the new requirements of the federal rTCR until California can complete the regulatory adoption process for the rTCR. Some of the major revisions include establishing a maximum contaminant level goal (MCLG) and maximum contaminant level (MCL) for *E. coli* for protection against fecal contamination, changing

public notification requirements, and requiring Level 1 and Level 2 Treatment Technique Assessments for total coliform and *E. coli* exceedances. For more information regarding the federal rTCR, please visit:

http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/rtcr.shtml

If you need additional guidance to help comply with California's current TCR and the federal rTCR during this interim period, a summary of the actions to be taken in the event of a positive total coliform or *E. coli* result can be found at:

http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/rtcr/tcr-rtcr_interim.pdf

Table 11: Bacteriological Monitoring of Distribution System

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	16-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0
2016	16-0-0	16-0-0	20-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0
2017	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0	16-0-0	20-0-0	16-0-0	20-0-0	16-0-0	16-0-0
2018	20-0-0	16-0-0	16-0-0	16-0-0	20-0-0	16-0-0	20-0-0	16-0-0				

Key: # of samples collected - # of total coliform positive results - # of *E. coli* positive results

2.6.3.4 LEAD AND COPPER MONITORING

For compliance with the Lead and Copper Rule, Morro Bay tests at least 30 samples collected from its customers' taps triennially (reduced monitoring). Monitoring completed in 2015 shows lead and copper levels are below the action level of 0.015 mg/L for lead and 1.3 mg/L for copper. Lead and copper monitoring is due in this summer during the months of June, July, August or September. Analytical results must be electronically transmitted or EDT'ed to DDW's database. Morro Bay is also required to submit a LCR reporting form summarizing results. Recent results are summarized in Table 12 below.

Table 12: Lead and Copper Monitoring of Distribution System

Sampling Date	# of Samples	90 th % Lead (mg/L)	90 th % Copper (mg/L)
8/4/2009	30	0.011	0.18
6/19/2012	30	0.0034	0.126
5/4/2015	30	0.0027	0.123
Due no later than September 30, 2018			

2.6.3.5 DISINFECTION BYPRODUCTS (DBP) MONITORING

Morro Bay tests four distribution system locations for total trihalomethanes (TTHMs) and haloacetic acids five (HAA5) quarterly to comply with the standard monitoring requirements of disinfection byproducts rule (DBPR). Samples must be collected and analyzed during the months of January, April, July, and October. Analytical results must be EDT'ed to DDW's database using the site-specific PS Code listed in Table 13.

Table 13: Disinfection Byproduct Monitoring in Distribution Summary (µg/L)

Date	Sequoia & Elm		Nutmeg		Hatteras		Morro & Beach	
	4010011-039		4010011-040		4010011-041		4010011-042	
	TTHM	HAA5	TTHM	HAA5	TTHM	HAA5	TTHM	HAA5
4 th QTR 2017	27	8	27	8	23	2	27	8

Table 13: Disinfection Byproduct Monitoring in Distribution Summary (µg/L)								
Date	Sequoia & Elm		Nutmeg		Hatteras		Morro & Beach	
	4010011-039		4010011-040		4010011-041		4010011-042	
	TTHM	HAA5	TTHM	HAA5	TTHM	HAA5	TTHM	HAA5
1 st QTR 2018	50	16	41	17	37	15	49	16
2 nd QTR 2018	41	15	38	13	32	16	44	14
3 rd QTR 2018	33	9	34	10	29	1	29	11
Current OEL	39	12	37	13	32	8	38	13
Current LRAA	38	12	35	12	30	9	37	12

2.6.3.6 MAXIMUM RESIDUAL DISINFECTANT LEVEL (MRDL) AND SURFACE WATER TREATMENT RULE (SWTR)

For compliance with the maximum residual disinfectant level for chlorine of 4.0 mg/L, Morro Bay monitors its distribution system for chlorine residuals in conjunction with bacteriological sampling. Compliance is based on running annual arithmetic average (RAAA), computed quarterly, of monthly averages of all samples collected by the system. If the average covering any consecutive four-quarter period exceeds the MRDL, the system is in violation of the MRDL and shall notify the public. A MRDL summary report is due to DDW on a quarterly basis.

In addition, since Morro Bay receives water treated surface water from CCWA, Morro Bay is also subject to the SWTR. Per the SWTR a disinfectant chlorine residual must be detectable (> 0.2 mg/L) in at least 95 percent of the samples taken from the distribution system at all times. A heterotrophic plate count (HPC) result of less than 500 CFU/mL can also be used to demonstrate adequate disinfection in the distribution system. Morro Bay is required to submit a monthly SWTR report to DDW summarizing the disinfection process and any water quality and gastrointestinal complaints. In 2017, the distribution chlorine ranged from 0.82 – 1.75 mg/L and had an average level of 1.21 mg/L. The monthly averages of the results are listed in Table 14 below:

Table 14: Chlorine Residuals Monitoring of Distribution System (mg/L)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	1.61	1.11	1.28	1.14	0.80	1.4	1.36	1.04	1.28	1.25	2.29	1.97
2016	2.03	1.45	1.80	1.64	1.12	1.10	1.05	0.80	1.09	1.07	0.77	1.67
2017	1.60	1.12	1.37	1.64	0.83	1.04	1.22	0.82	1.14	1.11	0.82	1.75
2018	1.65	1.18	1.43	1.37	0.95	1.01						

2.6.4 RECORDKEEPING

Morro Bay is required to maintain records on all complaints received and corrective actions taken, water quality, violations and corrective actions taken, sanitary surveys, variances or exemptions, public notices, and monitoring plans. The records are required to be retained for the lengths of time listed in Table 15 below:

Table 15: Water System Recordkeeping Lengths of Retention		
Subject	Documents	Length of Retention
Complaints	Documentation and Action	5 Years
Microbial and Turbidity Analyses	Analyses Info and Results	5 Years

Table 15: Water System Recordkeeping Lengths of Retention		
Subject	Documents	Length of Retention
Chemical Analyses	Analyses Info and Results	10 Years
Violations	Documentation and Action	3 Years
Sanitary Surveys	Reports and Communications	10 Years
Variances or Exemptions	Documentation	5 Years
Public Notices	Copies of Notices	3 Years
Bacteriological Monitoring Plans	Copies of Plans	10 Years
Chemical Monitoring Plans	Copies of Plans	10 Years
Consumer Confidence Reports	Copies of Reports	3 Years
Lead and Copper	Analyses, Reports, Surveys	18 Years

2.7 ELEMENT 7: SYSTEM MANAGEMENT AND OPERATIONS

2.7.1 ORGANIZATION AND PERSONNEL

Morro Bay Water Division is part of the Morro Bay Public Services Department. Rob Livick serves as the Public Services Director, Joe Mueller serves as the Utilities Division Manager, and Damaris Hanson serves as the Environmental Programs Manager. Morro Bay operates with an approximately \$4 million annual budget. Morro Bay charges a flat base rate and variable usage rate to its customers to cover the costs of operation. It also relies on an accumulation fund to cover the costs of capital improvements and operation deficits.

2.7.2 OPERATIONAL PLANS AND REPORTING

Morro Bay's Nitrate Blending Operational Plan and Emergency Notification Plan (ENP) are in need of an update. In addition, Morro Bay has not completed the 2017 electronic Annual Report (eAR), which was due June 1, 2018. The 2017 eAR also requires public water systems to complete a lead service line inventory. Section §116885 of the California Health and Safety Code, Senate Bill 1398, and Senate Bill 427 require all community water systems to compile an inventory of known partial or total lead user service lines in use in its distribution system. The inventory must include all user service lines that are active and those that are reasonably expected to become active in the future. **Morro Bay must update the Nitrate Blending Operational Plan, ENP, and must complete the 2017 eAR within 30 days. Failure to complete the eAR will result in a citation against the water system.** DDW also recommends Morro Bay to develop an Emergency Response and Disinfection Plan in the near future and update maps when possible.

Table 16: List of Documents and Plans		
Document	Document Date	Update Frequency
Treatment Operations Plan	2014	Every 5 years or as needed
Blending Operations Plan	2007	Every 5 years or as needed
Emergency Response Plan	-	Every 5 years or as needed
Emergency Disinfection Plan	-	Every 5 years or as needed
Bacteriological Sample Siting Plan	2010	Every 10 years and as needed
Groundwater Rule Monitoring Plan	2009	As needed
Emergency Notification Plan	2014	As needed
2017 Consumer Confidence Report	2018	Annually
2017 Annual Report	-	Annually

Table 16: List of Documents and Plans		
Document	Document Date	Update Frequency
Maps	2005	As needed

2.8 ELEMENT 8: OPERATOR COMPLIANCE WITH STATE REQUIREMENTS

Morro Bay's distribution system is classified as a D4 distribution system. Both nitrate blending and BWRO treatment plant are classified as T2 treatment facilities. When active, the Desalination Treatment Plant is classified as a T4 treatment facility. Morro Bay meets the standards for operator certification compliance with state requirements. Water system classification and a list of sampling points are provided in the tables below.

Table 17: Water System Facility Operator Certification Classifications		
Facility Name	Sampling Point ID(s)	Classification Required
Distribution System	039, 040, 041, 042	D4
Morro Valley Disinfection		T1 or D1
Well 11A Disinfection		T1 or D1
Nitrate Blending	028	T1
BWRO Treatment	029	T4
Desalination Treatment	023	T2

III. CONCLUSIONS

The review of Morro Bay's domestic water system indicates that it is designed, constructed, operated, and managed well. With few exceptions, the storage tanks and distribution system meet all state requirements. Deficiencies identified include not testing all backflow devices in the distribution system, missing DWSAP for a few active wells, outdated nitrification monitoring program, nitrate blending operational plan, and emergency notification plan, elevated levels of selenium at Well 03 & 04, and severe corrosion at most of the treated water reservoirs.