SD Public Utilities

SOUTH BAY OCEAN OUTFALL ANNUAL INSPECTION REPORT

SOUTH BAY WATER RECLAMATION PLANT

NPDES Permit No. CA 0109045
Order No. R9-2017-0023

SOUTH BAY INTERNATIONAL WASTEWATER TREATMENT PLANT

NPDES Permit No. CA 0108928
Order No. R9-2017-0024

2018

Environmental Monitoring and Technical Services
2392 Kincaid Road • Mail Station 45A • San Diego, CA 92101
Tel (619) 758-2300 Fax (619) 758-2309

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Public Utilities Department
Continual Improvement, Prevention of Pollution, Regulatory Compliance
ISO 14001

THE CITY OF SAN DIEGO

M E M O R A N D U M

DATE: May 21, 2019

TO: Peter Vroom, Deputy Public Utilities Director

FROM: Richard Snow, Senior Civil Engineer

SUBJECT: South Bay Ocean Outfall 2018 Annual Inspection Report

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Transmitted herewith is a copy of the report entitled "2018 South Bay Ocean Outfall Annual Inspection Report". This report presents the results from the annual outfall external inspection conducted by staff of the City of San Diego on September 12 and 18, 2018.

In general, the findings of this survey agree with the conclusions of earlier outfall inspections: the ballast, the diffusers and the exterior of the outfall system are in good condition, with isolated areas along the North Diffuser Leg showing reduced rock levels. A side-by-side comparison of this year's video with that from 2017 supports the theory that areas of low ballast are a result of the original rock placement during construction of the outfall. The ballast level along that diffuser leg and the rest of the outfall appears unchanged.

The upgrade to secondary treatment at the South Bay International Wastewater Treatment Plant that occurred in January 2011 has continued to improve the visible quality of discharged effluent and is likely responsible for the subsequent elimination of the white bacterial mats observed near the points of discharge in earlier inspections.

While the accumulation of encrusting organisms around the active heads remains an issue, all active diffuser ports appear to be flowing sufficiently with limited obstruction. However, it should be noted that a project is in the works to remove the encrusting animals and any associated marine growth to ensure that they will not impede future effluent flows.

I conclude that during the 2018 external inspection the South Bay Ocean Outfall appeared to be in overall good condition. Should you have any questions or require additional information, I can be reached at x18321.

Richard Snow, P.E.

Attachment: 2018 South Bay Ocean Outfall Annual Inspection Report

cc: Tim Stebbins, Senior Marine Biologist
Brent Bowman, Senior Chemist
Adriano Feit, Marine Biologist III

Section 1

General Introduction

This report summarizes the results of the 2018 South Bay Ocean Outfall (SBOO) annual inspection. The inspection was completed on September 12 and 18, 2018, by City of San Diego (City) Marine Biology Laboratory personnel using a remotely operated vehicle (ROV) to survey the external portions of the outfall pipe and diffuser structures. This survey and this report were completed to satisfy the maintenance and inspection requirements set forth in Lease No. PRC 7888.9 issued by the State of California State Lands Commission.

1.1 Inspection Method

The SAAB Seaeye Falcon ROV, acquired by the City in September 2011, was used for the SBOO inspection covered by this report. The ROV came equipped with a high sensitivity Seaeye color video camera and an Insite Pacific Mercury ultra-low light black and white video camera. The system is also equipped with a digital sonar and an ultra-short baseline tracking system, which uses acoustic telemetry to locate the position of the ROV relative to the support vessel in real time.

Inspection involved surveying the visible and buried underwater, exterior portions of the outfall, the South Diffuser Leg termination structure (terminus), the South Diffuser Leg, the Wye, the North Diffuser Leg and termination, the Main Barrel and the manhole covers and maintenance access hatches (numbered 6 to 1 proceeding inshore), and the riser assembly shield (see Figure 1 in Appendix A).

The inspection began at the South Diffuser Leg terminus and proceeded north toward the Wye over each of the diffusers to inspect the structural condition and function of the riser assemblies. At the Wye, the three gate covers were inspected and then ROV was flown offshore to the end of the rock pile covering the short three pipe section terminal extension of the outfall. The vehicle was then returned to the Wye to begin the survey of the North Diffuser Leg. As the ROV was flown over the diffuser leg, it was paused briefly to inspect each of the blind flanged riser assemblies. At the end of the diffuser leg the condition of the terminus was inspected. From there the ROV was repositioned at the center Wye where it was directed inshore to inspect condition of the ballast rock and the manhole covers and access hatches spaced at uniform intervals along the main barrel.

The video records are being provided on a USB flash drive to enable a reviewer faster access to all aspects of each survey. This format assists in the evaluation of the condition of the outfall being reviewed to that observed in other surveys.

1.2 Monitoring Vessel

The City's *M/V Oceanus* is a 48-foot, twin diesel engine-powered, aluminum hull, modified crew boat, with a rear-mounted hydraulic A-frame and a bow winch from which the clump weight is deployed. The vessel is used by the Public Utilities Department's Environmental Monitoring and Technical Services Division primarily as an ocean monitoring and outfall inspection platform.

1.3 Positioning

The vessel was initially moved near the outfall during each survey to deploy the ROV using a Global Positioning System (GPS). Once in the water, the ROV was kept on the surface and moved to a distance of about 200 ft from the bow. The umbilical tethered to the ROV was incrementally fastened to a wire holding a 200 lb. clump weight. As the clump weight was slowly lowered to depth of 30 ft above the bottom, the ROV simultaneously descended to the seafloor. The ROV's sonar was then used to locate the outfall structure and then it was moved to the terminus of the South Diffuser Leg to begin the inspection.

1.4 Potential Survey Limitations

Certain limitations can be associated with any underwater inspection, which may ultimately reduce survey image quality and accessibility to fine structural detail. Some of these limitations may include reduced water clarity, technical issues with the ROV, and visual obstruction of specific structural features. Such factors may reduce detection capabilities, and therefore the ability to fully analyze, assess, and make the correct judgments and recommendations.

Section 2

South Bay Facility Description and Background

The SBOO discharges commingled effluent from the City's South Bay Water Reclamation Plant (SBWRP) and the South Bay International Wastewater Treatment Plant (SBIWTP) that is owned and operated by the U.S. Section of the International Boundary and Water Commission (USIBWC). The areas served by these facilities include eastern Tijuana, tributary to Tijuana's Pump Station Number One, San Ysidro, and other local South Bay communities, tributary to the Grove Avenue Pump Station.

Construction of the South Bay Land Outfall (SBLO) began in 1991 and was finished in 1994. Building the offshore portion of the SBOO commenced during the fourth quarter of 1995 and effluent began discharging from the SBIWTP on January 13, 1999. The SBWRP went online and began discharging effluent via the SBOO on May 6, 2002.

The SBOO discharges the combined effluent at a location of approximately 3.5 statute miles off the coast of Imperial Beach, CA, at an approximate depth of 90 feet below mean sea level and at a minimum initial dilution of 100:1 (see Figure 1 in Appendix A). The partial tunnel/partial conventional seafloor configuration was chosen because overall construction and environmental mitigation costs were lower than other available options. It is important to note that the tunnel

does not extend all the way to the diffusers due to the westerly drop off of the San Diego Formation (SDF), a favorable tunneling geology. Lowering the tunnel to remain within the SDF would have exceeded the realm of tunneling technology at the time of construction. Therefore, the decision was made to construct a riser assembly conduit at one of the offshore boring locations and to also build a conventional seafloor configuration in order to achieve the desired depth and location for effluent discharge.

Construction of the SBOO consisted of three contracts as follows: (1) the special upstream structures; (2) the drop shaft, tunnel and riser assembly; and (3) the offshore portion beyond the riser assembly. In contrast, the SBLO consisted of one construction contract.

Some of the capabilities of the SBOO include: effluent distribution; emergency and controlled Tijuana River channel effluent discharge; return of effluent to Mexico; excess potential energy dissipation; back-flow prevention and conduit isolation for energy dissipation baffle and conduit maintenance; enhanced entrained air and gas removal; SBLO back-flow prevention during high-tide and low-flow conditions; maintenance access, corrosion monitoring and reduction measures; outfall back pressure detection, monitoring and recordation capabilities; conduit flushing; and outfall extension.

2.1 Outfall Description

The SBOO initiates from a drop shaft on land approximately 1 mile inland from the ocean. The shaft drops vertically to a depth of 159 feet below sea level (MLLW; top of pipe) and proceeds offshore in an underground tunnel. The tunnel is 132 -inch in diameter and follows the seabed grade at a slope of -0.3522% to a depth of approximately 214 feet (MLLW; top of pipe). The tunnel ends approximately 19,000 feet from the drop shaft, where the riser structure begins and heads to the surface.

The seafloor portion of the SBOO was constructed by excavating a trench, then simultaneously placing the bedding stone and the pipe. Once that was completed, ballast and armor rock were added to the structure. The only visible features of the outfall include the armor rock, the riser assembly shield, the six hatches along the main barrel, the gate covers of the wye structure, the diffuser riser assemblies, and the diffuser leg termination structures.

The outfall is approximately 4,691 feet long from the center of the riser shaft to the center of the diffuser wye (see Figure 2 in Appendix A). The 120-inch inside diameter (I.D.) seabed pipe was constructed by excavating a trench, then simultaneously placing the bedding stone and the pipe sections. The pipe sections are constructed of reinforced concrete, bell and spigot pipe of the raised bell type, with two gaskets at each joint. The bells of the pipe face offshore. The pipe sits on a bedding of class 3 stone which is covered with a minimum of 1-foot of class 2 ballast/filter stone, followed by a 3.5-foot armor layer of class 1 stone (see Figure 3 in Appendix A). The alignment of the main barrel of the outfall is approximately 210° - 215°, starts at a depth of 71 feet (MLLW) and ends in approximately 90 feet (MLLW).

The main barrel is completely covered in ballast rock, with the exception of the Inshore Riser Cover, the six maintenance access hatches (manholes), the diffuser risers, and the diffuser termination structures. The first manhole (Station 190 + 30) is located in the center of the first

pipe section next to the riser shaft (see Figure 4 in Appendix A). There is a 2-foot diameter opening with a lid in the center of the riser. Armor stone is piled over the outfall pipe to just below the riser cover. Inside the riser is an air relief assembly that bleeds off excess air from the outfall pipe. There is a maintenance access hatch inside the riser that opens to the seabed pipe. The rest of the manholes are built the same and accessed through risers (see Figure 5 in Appendix A). A 10-inch thick reinforced concrete cover seals the 7-foot 6-inch outside diameter (O.D.) riser. Three lifting hooks are used to open the cover. The maintenance access hatch is located inside the riser. Approximately 5 feet of stone covers the seabed pipe around the riser cover.

The distance between each manhole is 926 feet (± 10 feet) (Table 1). The last manhole is located on the first pipe section inshore of the diffuser wye (W).

Table 1. Manhole locations on the South Bay Ocean Outfall

Manhole*	Latitude	Longitude
1	32° 32.3439	117° 10.0918
2	32° 32.3255	117° 10.2855
3	32° 32.3089	117° 10.4636
4	32° 32.2930	117° 10.6414
5	32° 32.2760	117° 10.8197
6	32° 32.2591	117° 10.9988

* Manhole No. 1 is offshore of the Inshore Riser Cover and Manhole No. 6 is immediately inshore of the diffuser at the Wye.

The diffuser legs branch off from the main seabed pipe at the diffuser wye (Station 236 + 98.67) (see Figure 6 in Appendix A). The length of the diffuser wye section from bell end to bell end is 52 feet along the main axis of the seabed pipe. The angles between the north and south diffuser leg centerlines on the offshore ends and the wye structure centerline is 77° and 74° respectively. The approximate alignments of the north and south diffuser legs are 340° and 185° respectively.

A 40-foot long offshore extension is connected to the diffuser wye and is completely buried under rock armor. A concrete pipe end plug seals the end of the pipe at Station 237 + 63.54. If the outfall were ever to be extended, it would begin at this section.

There are three gates that can be used to stop flow between the main seabed pipe and diffuser legs and pipe end. The North Diffuser Leg and Offshore Extension gates are currently in place. Two Monel lifting hooks (1.5-inch diameter, 6-inch radius) are provided on each gate for their removal.

The length of each diffuser leg is 1,981 feet from the end of the termination structure to the Wye centerline. The diffuser sections are 84-inch I.D. where they connect to the diffuser wye (Station 0 + 00). At Station 6 + 00 a 24-foot transition section reduces the pipe diameter to 72 inches I.D. Another 24-foot transition section at Station 12 + 24 further reduces the pipe diameter to 52-inch I.D. The north and south diffuser legs end at Station 19 + 81.00 and Station 19 + 80.98, respectively. A 30-foot termination structure seals the end of each diffuser leg (see Figure 7 in Appendix A) and a flap gate seals the 42-inch I.D. pipe section of the termination structure. Rock

ballast covers all of the termination structure, except for the flap gate and concrete support for the termination pipe.

Since the diffuser legs are buried, effluent from the outfall enters the ocean through diffuser riser assemblies which are bolted to the top of the diffuser leg conduits and to the wye structure. The effluent rises vertically through the high-density polyethylene diffuser risers and transitions to horizontal discharge from a 1-foot 7.5-inch diffuser head with four ports. Each diffuser riser assembly is provided with a surrounding canister which protects it from the adjacent rock, and vessel anchors (see Figure 8 in Appendix A).

There are 165 diffuser riser assemblies on the outfall; 82 on each diffuser leg and the one at the wye structure. The risers are numbered sequentially, beginning at the wye structure and referred to with either "N" or "S" prefixes to indicate placement on the north or south diffuser legs. Thus, N1 is located adjacent to the wye structure and N82 is located at the far end of the north diffuser leg. The diffuser riser at the wye structure is simply designated as "W". The riser assemblies can be open (a head with four open and free-flowing ports), capped (a head with four temporarily-closed ports), or blind flanged (no head with a blind flange bolted to the upper flange of the riser assembly (Table 2).

Table 2. Current Diffuser Riser Configuration

	Open (Flow)	**Capped (Temporarily Closed- No Flow)**	**Blind Flanged (No Flow)**
North Diffuser Leg			N1 - N82
South Diffuser Leg	S26, S52, S68 - S82	S51, S53 - S67	S1 - S25, S27 - S50
Wye Structure	W		
Number	18 Diffuser Risers (72 ports)	16 Diffuser Risers (64 ports)	131 Diffuser Risers (no ports)
Percentage	10.91 %	9.70 %	79.39 %

2.2 Flowrate Allocation and Ownership

The as-designed allocation of outfall flowrates and outfall ownership are as follows:

	SBIBWC	City of San Diego	Total
Average Flowrate	100 mgd	74 mgd	174 mgd
Peak Flowrate	200 mgd	133 mgd	333 mgd †
Ownership *	60.06 %	39.94 %	100 %

* Ownership of the South Bay Ocean Outfall is as shown, and is based upon the peak flowrates, however, ownership of the South Bay Land Outfall is shared equally.

† The total peak flowrate is based upon the addition of a future pump station. At present, the maximum gravity flowrate through the outfall is 258 mgd.

2.3 Operation and Maintenance Responsibilities

A Memorandum of Understanding (and two subsequent Amendments) between the USIBWC and the City was drafted which summarizes the outfall–related operation and maintenance responsibilities. Briefly, the USIBWC is responsible for the land outfall east of the drop shaft, including the anti-intrusion structure and two valves which are located on top of the drop shaft hatch cover, and the City is responsible for the drop shaft and everything west of it, including all of the offshore components.

2.4 Post Start-up Corrective Work

Since the initial start-up of the outfall in early 1999, the City has administered two offshore corrective work sessions and one onshore corrective work session. The offshore work sessions involved: (1) the installation of two Monel plugs, each, in the maintenance access hatch covers 2, 3, and 4 to halt effluent leakage; and (2) the temporary closure of 64 ports along the South Diffuser Leg. Corrective work onshore included sealing the hatch covers on the anti-intrusion structure and the drop shaft, sealing the concrete at the anti-intrusion structure, improving overall structural anti-corrosion measures, and finally, conducting minor induced pressure testing.

2.5 Administrative Details

The SBOO as-built Mylar drawings are located on the Fifth Floor of the City of San Diego Development Services Department - Engineering Maps and Records Office, which is located at 1222 First Avenue; Mail Station 501; San Diego, CA 92101. Access can be arranged for reproduction capabilities, as require

Section 3

External Survey Observations

3.1 General Observations

After careful review of the video recordings for the 2018 inspection and a side by side comparison of the 2017 survey video, it appears that few if any changes in the overall condition of the outfall have taken place over time. The water clarity varied between the surveys as did the type and extent of algal and invertebrate growth on the ballast rock, the riser assemblies and the other exposed features of the outfall., but the distribution of ballast rock along the outfall and indeed the placement of individual stones surrounding each riser assembly seemed nearly identical. The canting, or leaning of certain riser heads on the North Diffuser Leg observed in 2017 also seemed unchanged.

3.2 Annual Survey

This survey was conducted on September 12 and 18, 2018. The water clarity was generally less than optimal on September 12, averaging 10-15 feet of horizontal visibility in the offshore area on the south leg and wye. The water clarity improved on September 18, averaging 15-20 feet of horizontal visibility in the offshore area and gradually decreasing to 15 feet or less while moving inshore. The outfall was generally found to be in very good condition, exhibiting few if any detectable differences from that observed in earlier inspections.

South Diffuser Leg: The termination structure and the flap gate remained overgrown by algae and invertebrate growth, but overall it appeared to be in good condition. The gate did not exhibit any visible signs of leaking. The anode on the crossbar could not be evaluated because it continues to be obscured by encrusting marine growth. The southeast diffuser port on riser S82 was completely blocked, but the other three ports were flowing normally. The other active diffuser heads had accumulated more invertebrate and algal growth since the last inspection, but their diffuser ports all looked to be flowing freely. The inactive risers were all in good condition and appeared to be sealed properly. The ballast coverage along this structure was unchanged. Some of the risers are not centered on their cans S68.

Wye: The situation here was nearly identical to the previous survey: the gate covers were in good condition and were sealed properly; the offshore rock pile was partially generally free of any algal coverage, but the ballast coverage was complete. The diffuser W had accumulated more encrusting growth, but the ports were all flowing freely.

North Diffuser Leg: The ballast covering this structure had not visibly changed. The risers were all in good condition and sealed properly except for riser N69. This structure continued to exhibit the telltale signs of leaking, a white patina of bacteria and the absence of sediment in the riser can, but it otherwise looked to be structurally sound. The persistent intrusion of sand along the northern half of the diffuser leg seemed no different from past years. The termination structure

remained in good condition and was properly sealed. The anode on the crossbar was difficult to see, thus its condition could not be evaluated.

Main Barrel: Understory algae was present but in low densities. The ballast coverage was complete and seemed no different from earlier surveys. The condition of all seven concrete access covers and their lifting eyes also seemed unchanged.

Section 4

Conclusions

Based on the findings summarized in Section 3 of this report for the South Bay Ocean Outfall,
the specific conclusions reached as a result of the investigations are as follows:

- The SBOO has remained in overall good condition since the last annual survey and continues to be structurally and functionally sound;

- Ballast coverage on the SBOO has remained adequate and appears unchanged;

- The side by side comparison of the 2017 and the 2018 ROV inspection videos confirms that there has been no detectable change in the rock distribution over the North Diffuser Leg and also supports the notion that the localized areas of low rock distribution observed on this structure was likely an artifact of the construction process and not the result of external oceanographic forces;

- Sand intrusion from offshore along the northern half of the North Diffuser Leg has persisted throughout the inspection period and continues to not appear to have posed any functional impairment to the outfall structure;

- As in past surveys active diffuser heads continue to accumulated larger colonies of invertebrate organisms, but their diffuser ports have remained generally unobstructed and all appear to be functioning properly; City engineers are currently developing a scope of services for divers to clean the diffuser ports of the encrusting organisms and the request for proposal RFP should be issued soon.

- The capped and blind flanged riser assemblies were observed to be in good condition and appear unchanged;

- The cosmetic damage to some of the concrete cover structures noted in earlier surveys had not changed and the structures appeared fundamentally sound;

- The upgrade to secondary treatment at the IWTP in January 2011 has continued to markedly improve the visible quality of discharged effluent and

may have also been responsible for the virtual elimination of the bacterial mats seen near all points of discharge in the years predating the current review period.