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MEMORANDUM
November 21, 1985

To: Darrel Anderson, Southwest Regional Office

From: Dale Clark DKC

Subject: Beverly Beach Wastewater Treatment Plant Limited Class II Inspection, June 17-18, 1985

## ABSTRACT

On June 17 and 18, 1985, the Water Quality Investigations Section conducted a limited Class II inspection at the Beverly Beach wastewater treatment plant (WTP). During the inspection, effluent $BOD_5$ and one fecal coliform sample exceeded the NPDES monthly average effluent permit limits. Treated effluent was observed discharging above MLLW level and flowing down the beach to the receiving water.

## INTRODUCTION

On June 17 and 18, 1985, a limited Class II inspection was carried out by the Washington State Department of Ecology (Ecology) at the Beverly Beach WTP. The inspection was requested by the Ecology Southwest Regional Office (SWRO). The study objectives were:

1. Provide a brief description of plant operation and flow scheme.

2. Provide information on plant loadings and treatment efficiency.

3. Compare Class II inspection data with the effluent limitations given in National Pollution Discharge Elimination System (NPDES) permit number WA-003806-7.

Limited Class II facility inspections are designed to meet the above-mentioned objectives and make general observations. In-depth plant design and process control evaluations are not a part of such investigations.

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In conjunction with the Class II inspection, a receiving water study was carried out by the Ecology Intensive Surveys Unit. The results of the intensive survey are documented in a separate report (Kendra and Determan, 1985).

The inspection was conducted by Dale Clark. The SWRO was represented by Darrel Anderson. John Stetson (plant operator) was present during the afternoon of the second day of the inspection.

## SETTING

The Beverly Beach WTP is located on the Cooper Point Peninsula approximately 5 miles north of downtown Olympia, Washington, in Thurston County (Figure 1). The facility treats wastewater from the residential community of Beverly Beach (population approximately 50 persons). Treated effluent is discharged to Budd Inlet (Class A state water).

The WTP is a secondary treatment facility consisting of an aeration basin, secondary clarifier, and a chlorine contact chamber. Wastewater enters the system via a headworks which includes a partially submerged bar screen (Figure 2). Influent flows into the aeration basin where secondary treatment occurs using the extended aeration process. Treated wastewater then enters the secondary clarifier where sludge solids are separated and either returned to the aeration basin or wasted. Clarified wastewater flows into the chlorine contact basin for disinfection prior to discharge. Discharge occurs through a six-inch gravity-feed line. The line discharges onto the beach or into Budd Inlet (depending on the tide level) approximately 100 feet from the plant. Because the facility does not have a flow meter, wastewater flows from the facility are estimated based on the resident population served. A small service building located next to the WTP houses the chlorine storage tank, chlorine-feed regulator, laboratory equipment, and supplies.

## METHODS

Samples collected during the inspection are noted on Table 1. The sampling location for the influent composite (just in front of the bar screen) and effluent composite (at the downstream end of the chlorine contact chamber) are shown on Figure 2.

Physical dimensions and sludge depth were measured during the inspection in the aeration basin, secondary clarifier, and chlorine contact chamber. An effluent flow measurement was attempted using an Ecology Manning dipper meter, but the plant configuration prevented an accurate measurement. Flow was estimated based on the Ecology design criteria of 100 gal/cap/D (Ecology, 1980).

## RESULTS AND DISCUSSION

Table 2 summarizes analytical results of the Ecology sampling effort at Beverly Beach. Composite sampling at the plant was difficult because of the plant configuration and flow pattern. Periods of zero flow were observed during the day. Although the Ecology dipper could not accurately measure total flow, the flow pattern recorded (Figure 3) suggests most flow occurred between 0600 to 1000, 1530 to 2000, and in surges from 1900 to 2430 (field observations suggest that flows of <5 percent on the script chart can be considered as zero).

Table 3 includes physical measurements of the plant and comparison of inspection measurements to Ecology design criteria. Based on physical volumes, the chlorine contact chamber appeared to be the only under-designed unit process at the plant. The shortcoming is not thought critical, but limiting solids accumulation in the contact chamber (one foot of solids noted in a two-foot basin) should be encouraged to make the most of the available chamber volume.

Table 4 compares inspection data to NPDES permit limits. The effluent $BOD_5$ concentration and load exceeded the monthly average and percent removal NPDES permit limits. One of the fecal coliform samples exceeded the monthly and weekly NPDES permit limit average concentration. Other parameters fell within the average limits described on the NPDES permit.

During the survey it was noted that the facility was not fenced and that the wire panels that cover the treatment basins were not secured. These features would appear to be a safety hazard, particularly to small children. Several young people were observed swimming and playing in close proximity to the facility. Also, treated effluent was being discharged directly onto the beach well above MLLW level. This creates a health hazard in an area used by the public for shellfish collection, swimming, and other recreational activities.

### Laboratory Review

The plant operator collects grab samples as required to check residual chlorine levels for chlorine regulation and NPDES permit requirements. Other tests include settleable solids for process control and FC analysis which is performed on a monthly schedule. The FC analysis is contracted out to the Thurston County Health Department laboratory. $BOD_5$, TSS, and pH analyses are not performed routinely ($BOD_5$ and TSS analyses are not routinely required by the permit).

A grab sample for FC analysis was split with the operator. Results displayed a poor comparison (Ecology - 420 col/100 m L; WTP [Thurston County Health Department] >2,400 col/100 mL).

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## RECOMMENDATIONS AND CONCLUSIONS

1. The influent/effluent flow pattern at the plant includes periods when flow approximates zero. Prior to additional sampling, a sampling scheme to account for these variations should be developed. A series of grabs of four or five aliquots of different volume may be appropriate to obtain a representative composite.

2. $BOD_5$ concentration and load (greater than the monthly average limit and less than required percent removal) and one fecal coliform grab sample concentration (greater than the weekly and monthly average limits) were greater than NPDES average permit limits during the inspection. Measurements of the other parameters fell within the bounds of the permit limits.

3. Sludge buildup in the chlorine contact chamber (50 percent of available depth) was reducing detention time in the contact chamber. Sludge in the contact chamber should be kept to a minimum, particularly since the contact chamber is undersized according to Ecology design criteria (Ecology, 1980).

4. Limiting plant access by fencing the facility or securing the existing covers is suggested to reduce the potential safety hazard.

5. Effluent flow across the beach during certain parts of the tidal cycle should be eliminated. The current situation poses a health hazard.

DC:cp

Attachments

# LITERATURE CITED

Ecology, 1980. Criteria for Sewage Works Design. February 1980.

Table 1. Inspection sampling schedule - Beverly Beach, June 1985.

| | | | Field Analyses | | | | | | Laboratory Analyses | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | Time | pH | Cond. | Temp | Dissolved Oxygen | Sludge Depth | Residual Chlorine | pH | Cond. | COD | $BOD_5$ | Soluble $BOD_5$ | Nutrients (5) | Solids (4) | MLSS | Turbidity | Alkalinity | Oil & Grease | Fecal Coliform |
| **Grab Samples** | | | | | | | | | | | | | | | | | | | | |
| Influent | 6/17 | 0900 | X | X | X | | | | | | | | | | | | | | | |
| | 6/17 | 1030 | X | X | X | | | | | | | | | | | | | | | |
| | 6/17 | 1420 | X | X | X | | | | | | | | | | | | | | | |
| | 6/18 | 0945 | X | X | X | | | | | | | | | | | | | | | |
| | 6/18 | 1105 | X | X | X | | | | | | | | | | | | | | | |
| Aeration Basin | 6/17 | 0855 | | | | X | | | | | | | | | | | | | | |
| | 6/17 | 1035 | | | | X | | | | | | | | | | | | | | |
| | 6/17 | 1925 | | | | X | | | | | | | | | | | | | | |
| | 6/18 | 1125 | | | | X | | | | | | | | | | X | | | | |
| | 6/18 | 1535 | | | | X | X | | | | | | | | | | | | | |
| Clarifier | 6/18 | 1548 | | | | | X | | | | | | | | | | | | | |
| Effluent | 6/17 | 0905 | X | X | X | X | | X | | | | | | | | | | | | |
| | 6/17 | 1030 | X | X | X | X | | X | | | | | | | | | | | | |
| | 6/17 | 1430 | X | X | X | X | | X | | | | | | | | | | | | |
| | 6/18 | 0940 | X | X | X | X | | X | | | | | | | | | | | | |
| | 6/18 | 1050 | X | X | X | X | | X | | | | | | | | | | | | |
| | 6/18 | 1548 | | | | | | X | | | | | | | | | | | | X |
| **Composite Samples** | | | | | | | | | | | | | | | | | | | | |
| Influent* | 6/17 | 1400 | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1440 | X | X | X | | | | X | X | X | X | X | X | X | | X | X | X | |
| Effluent** | 6/17 | 1040 | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1420 | X | X | X | | | | X | X | X | X | X | X | X | | X | X | X | |

*24-hour time-paced composite. Approximately 200 mLs of sample were taken ever 30 minutes during the compositing period.

**24-hour flow-paced composite attempted. Compositor failed between 1040 and 1500 on 6/17. To compensate for the failure, a 4-liter grab sample collected at 1500 on 6/17 and a 2-liter sample collected at 0930 on 6/18 were added to the composite sample. The compositor was re-started at 1040 on 6/18, and flow-paced samples were added to the composite sample between 1040 and 1420.

Table 2. Grab and composite sample analytical results - Beverly Beach, June 1985. All values are mg/L unless otherwise noted.

| | | | Field Analysis | | | | | | Laboratory Analyses | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Nutrients (5) | | | | | Solids (4) | | | | | | | | | |
| | Date | Time | pH (S.U.) | Cond. (umhos/cm) | Temp (°C) | Dissolved Oxygen | Residual Chlorine | Sludge Depth (ft.) | pH (S.U.) | Cond. (umhos/cm) | COD | $BOD_5$ | Nitrate-N | Nitrite-N | Ammonia-N | O-$PO_4$-P | T-$PO_4$-P | Total Solids | TNVS | TSS | TNVSS | MLSS | Turbidity (NTU) | Alkalinity as $CaCO_3$ | Rec. Oil & Grease | Fecal Coliform (col/100 mL) |
| Influ-ent | 6/17 | 0900 | 7.4 | 440 | 18.5 | | | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1030 | 7.4 | 468 | 18.4 | | | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1420 | 7.4 | 440 | 19.2 | | | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 0945 | 7.7 | 540 | 18.4 | | | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1105 | 7.7 | 460 | 19.0 | | | | | | | | | | | | | | | | | | | | | | |
| Aera-tion Basins | 6/17 | 0855 | | | | 0.0† | | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1035 | | | | 0.2†† | | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1425 | | | | 0.2†† | | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1125 | | | | 0.7†† | | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1535 | | | | 0.9†† | | | | | | | | | | | | | | | | 1200 | | | | | |
| | 6/18 | 1555 | | | | 0.0† | | | | | | | | | | | | | | | | | | | | | |
| Clari-fier | 6/19 | 1500 | | | | | | 2.5 1/ | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | 4.5 2/ | | | | | | | | | | | | | | | | | | | |
| Chlor-ine Contact Chamber | 6/19 | 1530 | | | | | | 1.0 | | | | | | | | | | | | | | | | | | | |
| Effluent | 6/17 | 0905 | 7.2 | 465 | 18.4 | 0.3 | 0.3 | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1030 | 7.2 | 495 | 19.5 | 1.1 | 0.2 | | | | | | | | | | | | | | | | | | | | |
| | 6/17 | 1430 | 7.2 | 480 | 20.5 | 2.4 | 0.5 | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 0940 | 7.3 | 450 | 19.5 | 0.3 | 0.9 | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1050 | 7.4 | 590 | 20 | 2.3 | 1.9 | | | | | | | | | | | | | | | | | | | | |
| | 6/18 | 1548 | | | | 1.0 | | | | | | | | | | | | | | | | | | | | | 3*, 420 |
| Composite Samples | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influ-ent | 6/18 | 1440 | 7.9 | 640 | 4.2 | | | | 6.5 | 643 | 960 | 220 | 0.02 | 0.03 | 12 | 9.7 | 19.0 | 1700 | /400/ | /650/ | 30 | | 370 | 230 | <1 | | |
| Effluent | 6/18 | 1420 | 7.6 | 680 | 10.8 | | | | 7.4 | 468 | 64 | 40 | 3.40 | <0.001 | 0.2 | 7.[illegible] | 9.0 | 400 | 310 | 24 | 3 | | 11 | 140 | <1 | | |

†Aeration off. ††Aeration on. 1/Inlet side. 2/Outlet side. *Estimated. (Note: both samples collected at the same time.)

/ / = Twice the normal value observed at WTP for influent dissolved solids.

Table 3. Comparison of inspection measurements to Ecology design criteria (1980) - Beverly Beach, June 1985.

Plant Loading: $BOD_5$ - 220 mg/L = 9.2 lbs/D
TSS - 650 mg/L = 27.0 lbs/D

Aeration Basin

| | Process Modification | Flow Regime | Mixed-Liquor Suspended Solids (mg/L) | Detention[1] Time (hr) | Aerator Loading (lb BOD/ 1000 $ft^3$ Tank Volume | Tank Size Length (ft.) | Width (ft.) | Depth[2] (ft.) | Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| Inspection Measurements | extended aeration | complete mix | 1,200 | 36.3 | 9 | 11.25 | 11.25 | 8 | 7,570 |
| Ecology Criteria[3] | | | 2,000-6,000 | 10-24 | 10-25 | | | | |

Secondary Clarifier

| | Flow (MGD) | Surface Overflow Rate Average Flow (gpd/$ft^2$) | Surface Overflow Rate Peak Flow[4] (gpd/$ft^2$) | Solids Loading Rate Average Flow (lbs/day/$ft^3$) | Solids Loading Rate Peak Flow[4] (lbs/day/$ft^3$) | Tank Size Length (ft.) | Width (ft.) | Depth[2] (ft.) | Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| Inspection Measurements | 0.005 | 116 | 345 | 0.12 | 0.35 | 7.75 | 5.5 | 10 | 3,190 |
| Ecology Criteria[5] | | 200-400 | 800 | 25 | 40 | | | | |

Chlorine Contact Chamber

| | Flow (MGD) | Detention Time[1] (minutes) Flow (minimum) | Detention Time[1] (minutes) Peak Flow[4] | Tank Size Length (ft.) | Width (ft.) | Depth[2] (ft.) | Volume (gal) |
|---|---|---|---|---|---|---|---|
| Inspection Measurements | 0.005 | 38 | 13 | 3.5 | 2.5 | 2 | 131 |
| Ecology Criteria[6] | | 60 | 20 | | | | |

[1] Based on a flow of 0.005 MGD.
[2] Depth is depth of water in the tank.
[3] Ecology criteria are included as a general guideline of plant operation. Further testing would be required to determine if process control is inadequate.
[4] Based on a flow three times average flow.
[5] Ecology criteria indicate that at flows determined during the inspection and extrapolated peak flows (three times inspection flow), clarifier is adequate in physical size.
[6] Ecology criteria suggest inadequate volume.

Table 4. Comparison of inspection data with NPDES permit limits - Beverly Beach, June 1985.

| Sample Type | Inspection Measurements: Concentration | Inspection Measurements: Flow (MGD) | Inspection Measurements: lbs/day | NPDES Effluent Limitations: Monthly Average mg/L | Monthly Average lbs/day | Monthly Average col/100 mL | Weekly Average mg/L | Weekly Average lbs/day | Weekly Average col/100 mL |
|---|---|---|---|---|---|---|---|---|---|
| Influent $BOD_5$ | 220 | 0.005 | 9.2 | | | | | | |
| Effluent $BOD_5$ | /40/ | 0.005 | /1.7/ | 30 | 1.25 | | 45 | 2 | |
| Influent S.S. | 650 | 0.005 | 27.0 | | | | | | |
| Effluent S.S. | 24 | 0.005 | 1.0 | 30 | 1.25 | | 45 | 2 | |
| Effluent F.C. | 3 est. | | | | | 200 | | | 400 |
| | /420/ | | | | | 200 | | | 400 |
| Effluent pH (S.U.) | 7.2 | | | shall not be outside the range of 6.0 to 9.0 | | | | | |

/ / = Exceeds NPDES permit limit, either monthly, weekly, or both.

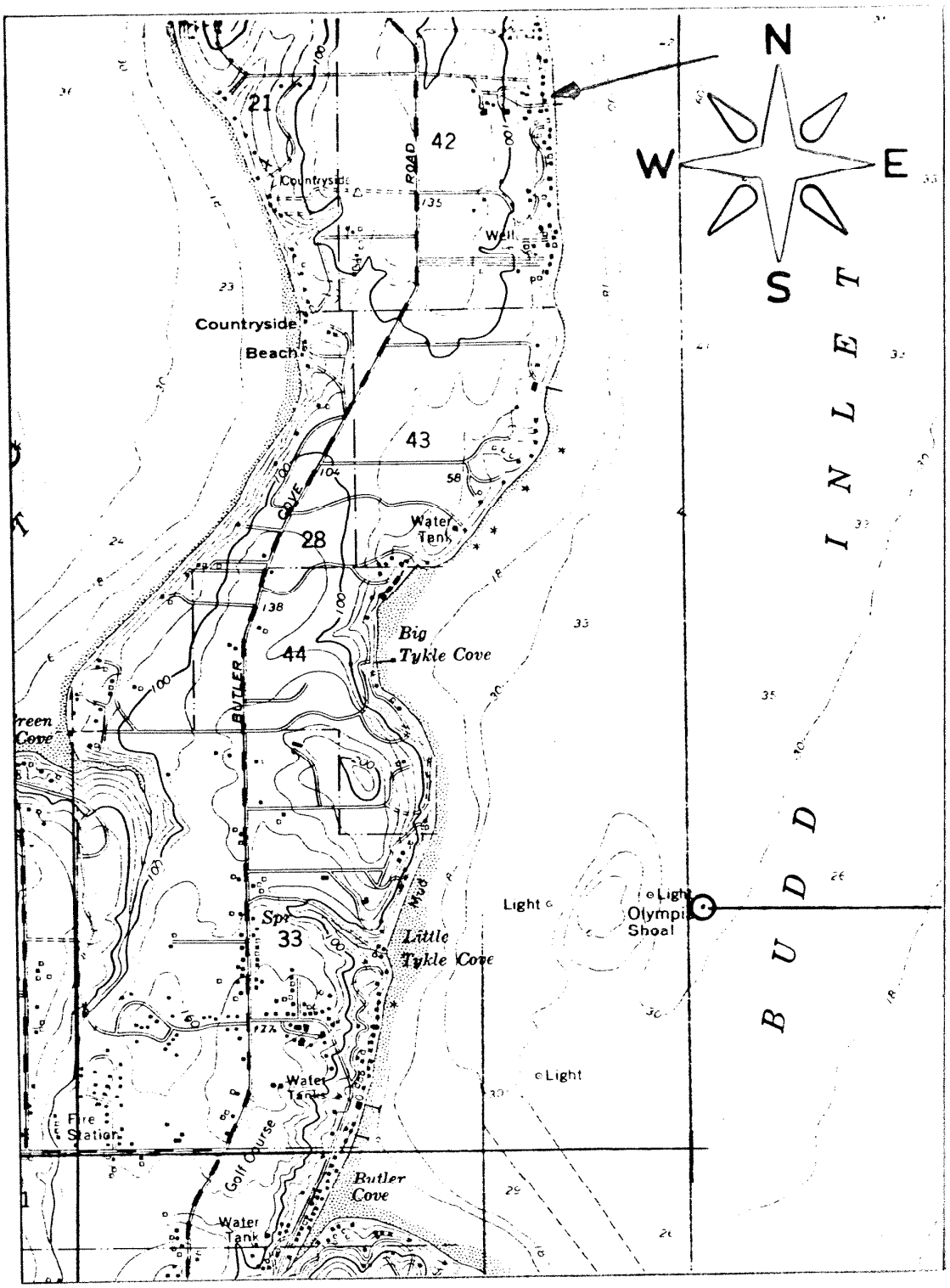


Figure 1. Arrow noting location of the Beverly Beach WTP on Cooper Point Peninsula, 1985.

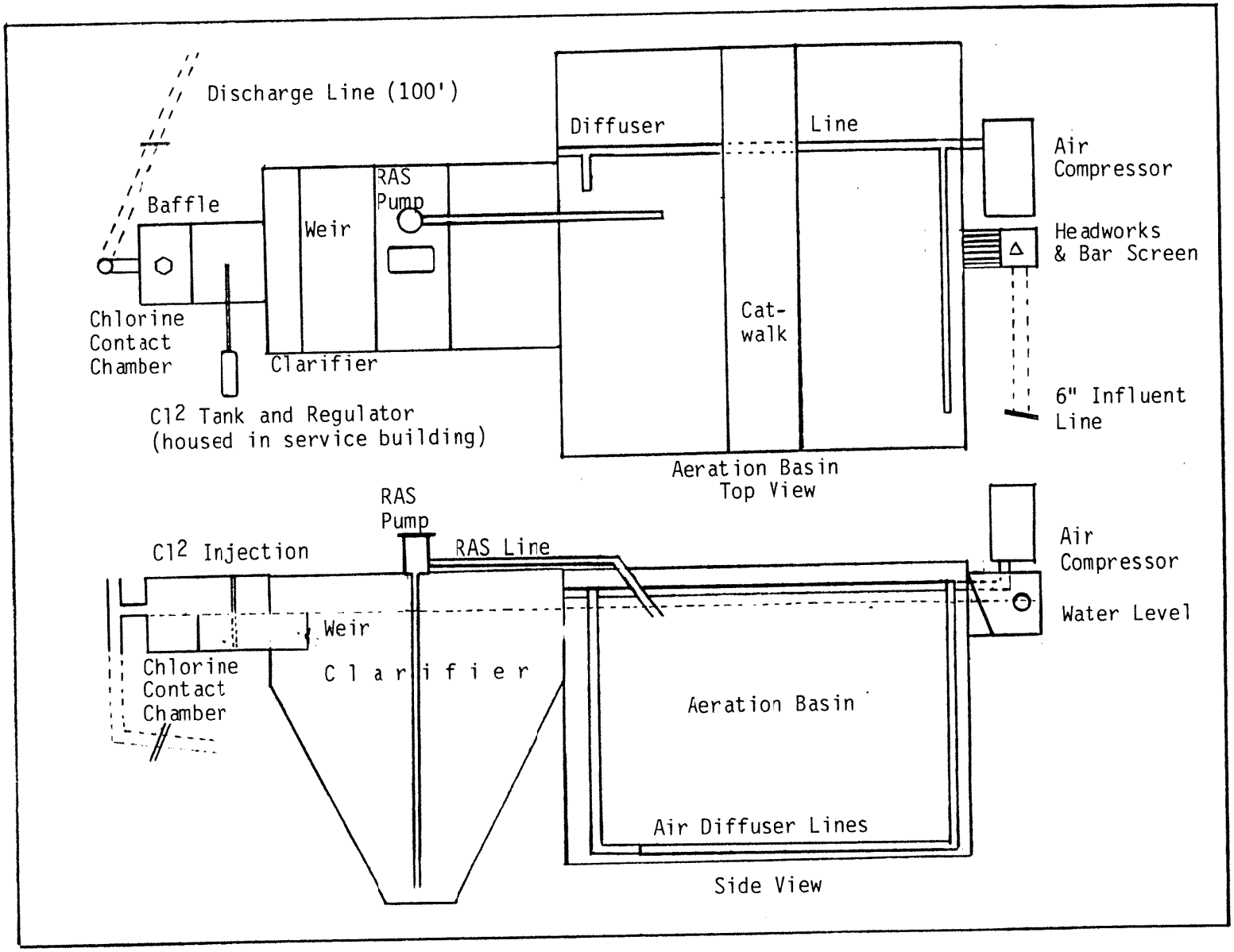


Figure 2. Flow scheme - Beverly Beach, June 1985.

△ Influent grab and composite sampling location.
⬡ Effluent grab and composite sampling location.

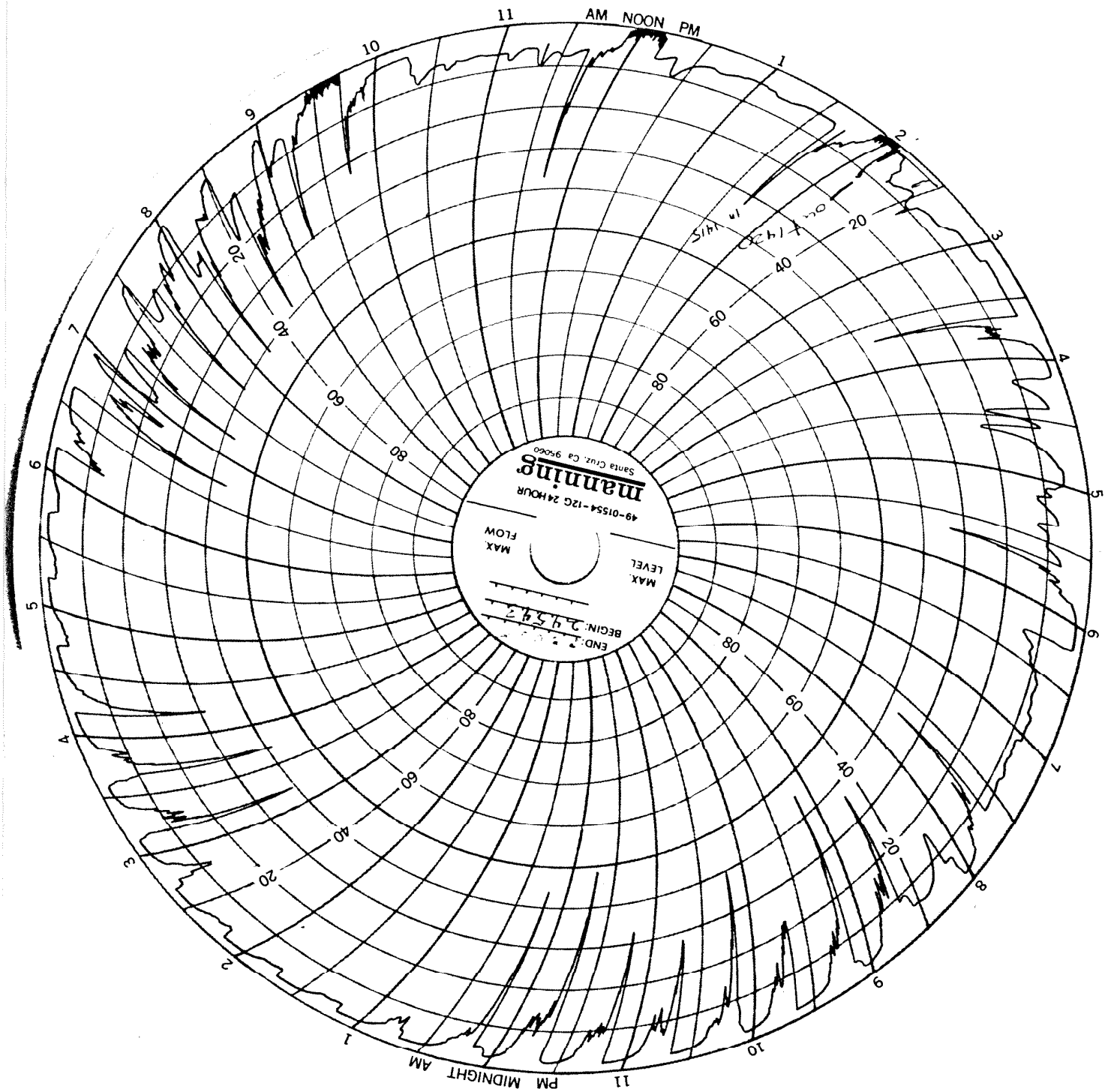


Figure 3. WDOE Manning dipper flow meter script chart - Beverly Beach, June 1985.