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STATE OF WASHINGTON

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Governor

DEPARTMENT OF ECOLOGY

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MEMORANDUM
March 15, 1979

To: Ron Robinson

From: Mike Morhous

Subject: Westside Water District STP Class II Inspection

INTRODUCTION

The above-referenced inspection was conducted on December 5-6, 1978. Those persons in attendance during the inspection were Alan Halverson, Plant Operator, and Mike Morhous, DOE, Water and Wastewater Monitoring Section. The Westside Water District Sewage Treatment Plant (STP), is a primary treatment facility comprised of two aerated lagoons operated in parallel. The final effluent is discharged to South Puget Sound. The Westside Water District is in the process of upgrading to secondary or best practical treatment.

Upon request by DOE, S.W. Regional Office, a dissolved oxygen (DO) profile survey of the two lagoons was also conducted on December 5, 1978 by Mike Morhous and Al Halverson (Figures 1 and 2).

FINDINGS AND CONCLUSIONS

At the time of this inspection, the STP's chlorinated effluent was meeting interim effluent limitations for BOD_5 and TSS. However, two grab samples collected on December 6, 1978 showed the STP out of compliance with its fecal coliform limitation (Table I). The rather high total residual chlorine values (2.25 ppm) measured at the time of the coliform sampling, indicates that the underground chlorine contact chamber does not provide sufficient retention time for adequate disinfection.

The STP collects 8-hour manual composites for compliance analyses. The last sample is collected in the afternoon and the composites are stored in the refrigerator until the following morning when the analyses are conducted. The final effluent composite is collected prior to chlorination and consists of samples from both lagoon discharges. DOE's unchlorinated effluent (north lagoon only) BOD_5 result was out of compliance with the permit limitation, but the TSS result was in compliance (Table I).

The flow measuring device (90° V notch weir) was not checked for accuracy because an instantaneous head height could not be safely measured.

A DO profile survey was conducted on the two lagoons using an IBC membrane electrode DO meter. The meter was standardized prior to the survey with an iodometric (Winkler) measurement on a common water sample. The accuracy of the meter was also checked upon completion of the survey and the meter was within 0.2 mg/l of the Winkler result. The STP has had previous odor problems and two floating aerators were installed in the north lagoon where the major odor problems existed. The DO results from this survey appear normal for winter conditions.

Laboratory procedures were reviewed and found unsatisfactory. Although discrepancies were noted during review of procedures and techniques, the major problems were: 1) an inadequate laboratory facility; and 2) a lack of proper lab equipment. The laboratory is small and provides marginal room for operation and storage of lab equipment. Further, the chlorinator is located adjacent to the laboratory and a strong chlorine gas odor existed in the lab during this inspection. Mr. Halverson indicated the chlorine leak was due to worn chlorinator parts which were on order. It appeared, however, that the situation had existed for quite some time because of the corroded condition of metal fixtures and equipment observed in the lab.

In summary, the chlorine leakage situation should be corrected expeditiously for obvious health and safety reasons. In addition, the following areas of concern should be addressed and resolved by the Westside Water District. If these concerns cannot be resolved during the interim, then they should be incorporated in upgrading of the facility:

1. Adequate laboratory work and storage space.

2. Proper laboratory equipment as follows:
   (See Laboratory Procedures)

   a. Equipment and reagents required to conduct the standard BOD_5 test using the dilution technique prescribed in Standard Methods, 14th Edition.

   b. A waterbath incubator of sufficient size to incubate six petri dishes for the fecal coliform analysis.

3. Modification of the existing chlorine contact chamber to provide additional contact time and improve the quality of effluent disinfection, preferrably in an open channel.

4. In relocating the flow measuring device, attention should be given to providing an easily accessible location to measure the head height for accuracy checks and calibration purposes.

In conjunction with the regional followup inspection (beginning of May, 1979), the following recommendations should be reviewed with the operator to ensure that corrective action has been implemented:

Sampling Technique

1. Composite sampling schedule from mid morning to mid morning. This would provide for the collection of 2 or 3 samples on the morning the composites are to be analyzed.

Total Residual Chlorine

1. Obtain an acceptable total residual chlorine test kit; i.e., DPD.

Fecal Coliform

1. Obtain the necessary reagents to prepare phosphate buffer rinse water (DOE's Membrane Filter Procedure for the Fecal Coliform Test, February 1977) for use during the analysis.

2. Filter a minimum of 3 different sample volumes in an effort to obtain one volume which will yield an optimum plate count of 20 to 60 colonies.

3. The use of blanks during the analysis, as a quality assurance check of proper technique.

   NOTE: Acquisition of a larger incubator may be necessary before recommendations 2 and 3 can be implemented.

Total Suspended Solids

1. Utilize the sample filtration rate as a guide to the optimum volume of sample to be filtered during the test (see Laboratory Procedures).

2. Filter a minimum of 50 mls of sample, utilizing duplicate or triplicate samples, as necessary.

3. After prewashing filter papers, dry in drying oven (103° to 105°C) for 1 hour. Store in dessicator until ready to weigh and use.

4. After sample has been filtered, dried, cooled in dessicator, and weighed, the drying cycle should be repeated until a constant weight is attained or until weight loss is less than 0.5 mg.

Review of Laboratory Procedures and Techniques

Laboratory procedures were reviewed with Al Halverson, Plant Operator. Lab procedures were unsatisfactory primarily due to poor laboratory facilities and a lack of proper equipment. However, the following discrepancies were noted and the respective recommendations provided.

Biochemical Oxygen Demand - Five Day (BOD_5)

The STP runs BOD_5 on the influent and unchlorinated effluent using a Hach manometer. Although the split sample results compared reasonably well, the manometer (respirometer) technique does not comply with the STP's NPDES Waste Discharge Permit, S4f, Test Procedures.

Recommendations

1. The acquisition of equipment and reagents necessary to conduct a standard BOD_5 analysis using the dilution technique in accordance with Standard Methods, 14th Edition.

Total Suspended Solids (TSS)

The STP uses a Gelman filtering apparatus and Gelman A/E glass fiber filter papers. Mr. Halverson indicated that normally 100 mls of influent and 180 mls of unchlorinated effluent are filtered for analysis.

The STP's influent TSS result did not compare well with DOE's result. At the time of analysis, Mr. Halverson indicated he was having trouble with the filtering apparatus. After filtering the influent sample, he could not filter any of the unchlorinated effluent sample. It was later determined that problem lay with filter paper and not the filtering equipment. However, subsequent review of TSS procedures did not provide an explanation for substantial difference of the two influent samples.

As a check for the optimum volume of sample to be filtered during this analysis, the following guideline was recommended. The sample volume should be sufficient to reduce the initial filtration rate by approximately 50-60 percent at the end of the sample filtering period. Sample volumes should be adjusted accordingly. This may necessitate filtering a portion of the sample prior to the analysis to determine the sample volume required. In no case should the total sample volume filtered be less than 50 mls. Duplicate or triplicate filtrations become necessary when the filterable sample volume is less than 50 mls.

Recommendations

1. Utilize the sample filtration rate as a guide to the optimum volume of sample to be filtered during the test.

2. Filter a minimum of 50 mls of sample, utilizing duplicate or triplicate samples, as necessary.

3. After prewashing filter papers, dry in oven (103° to 105°C) for one hour and store in dessicator until ready to weigh and use.

4. After sample has been filtered, dried, cooled in dessicator, and weighed, the drying cycle should be repeated until a constant weight is attained or until weight loss is less than 0.5 mg.

Fecal Coliform (FC)

The STP uses the membrane filter technique for FC analysis. It was noted, however, that distilled water was being used for rinsedowns instead of the required phosphate buffer rinse water. The use of distilled water causes a high FC stress and mortality rate. This can result in substantially lower final results (colonies/100 mls) and may explain why the STP's DMR FC values are considerably lower than the results obtained by DOE during this inspection.

It was also noted that only one sample volume is filtered and incubated. Mr. Halverson explained that the waterbath incubator was not large enough to accommodate more than one petri dish. Subsequently, blanks are not run in conjunction with sample filtering.

Recommendations

1. Obtain the necessary reagents to prepare the phosphate buffer rinse water for rinsing the sides of the filter funnel during the FC analysis.

2. Obtain a waterbath incubator that will hold and properly incubate (44.5°C ± .2°C) 6 petri dishes.

3. Filter a minimum of 3 different sample volumes in an effort to obtain one sample volume which will provide an optimum (ideal) plate count of 20 to 60 colonies.

4. Periodically run a blank before and after sample filtering as a quality check of sterile conditions and adequate rinsedowns.

Total Residual Chlorine (TRC)

The STP measures TRC with an orthotolidine colormetric test kit. This method is not in compliance with the STP's NPDES Waste Discharge Permit, S4f, Test Procedures.

Recommendations

1. Obtain an acceptable chlorine test kit; i.e., DPD.

Dissolved Oxygen (DO)

The STP uses a membrane electrode DO meter (YSI, Model 54A) to measure DO. The meter is calibrated using the manufacturer's air calibration technique provided in the operation manual.

MM:cp

Class II Field Review and Sample Collection
24 Hour Composite Sampler Installations

Sampler	Date and Time Installed	Location
1. Influent aliquot - 250 ml/30 min.	12/5 @ 1010	Inf. jct. box to North & South Lagoons
2. Unchlorinated Eff. aliquot - 250 ml/30 min.	12/5 @ 1020	North Lagoon Effluent
3. Unchlorinated Eff.[1/] aliquot - 250 ml/30 min.	12/5 @ 1025	South Lagoon Effluent

4. Chlorinated Effluent - A manual composite was collected at the last manhole prior to discharge to storm sewer line. Aliquots: 12/5 @ 1040-500 mls; 1205-500 mls; 1500-1000 mls; 12/6 @0940-1000 mls.

Grab Samples

	Date and Time	Analysis	Sample Location
1.	12/6 @ 0940	Fecal Coliform	Composite Station #4
2.	12/6 @ 1055	Fecal Coliform	Composite Station #4
3.			
4.			
5.			
6.			

Flow Measuring Device

1. Type - 90° V notch weir with a Manning Ultra Sonic head measuring device.
2. Dimensions -

a. Meets standard criteria /__/ Yes Unable to complete accuracy check

/__/ No Explain:
Location of weir precluded safety measuring on instantaneous head

b. Accuracy check

	Actual Instan. Flow	Recorder Reading	Recorder Accuracy (% of inst. flow)
1.			
2.			
3.			

/__/ is within accepted 15% error limitations

/__/ is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
Total Resid. Chlorine	12/6 @ 0940	Same as Composite Station #4	2.25
Total Resid. Chlorine	12/6 @ 1055	Same as Composite Station #4	2.25

[1/] No composite sample collected, sampler malfunction.

Table 1

The following table is a comparison of laboratory results from 24 hour composite(s) together with NPDES permit effluent limitations. Additional results pertinent to this inspection have also been included.

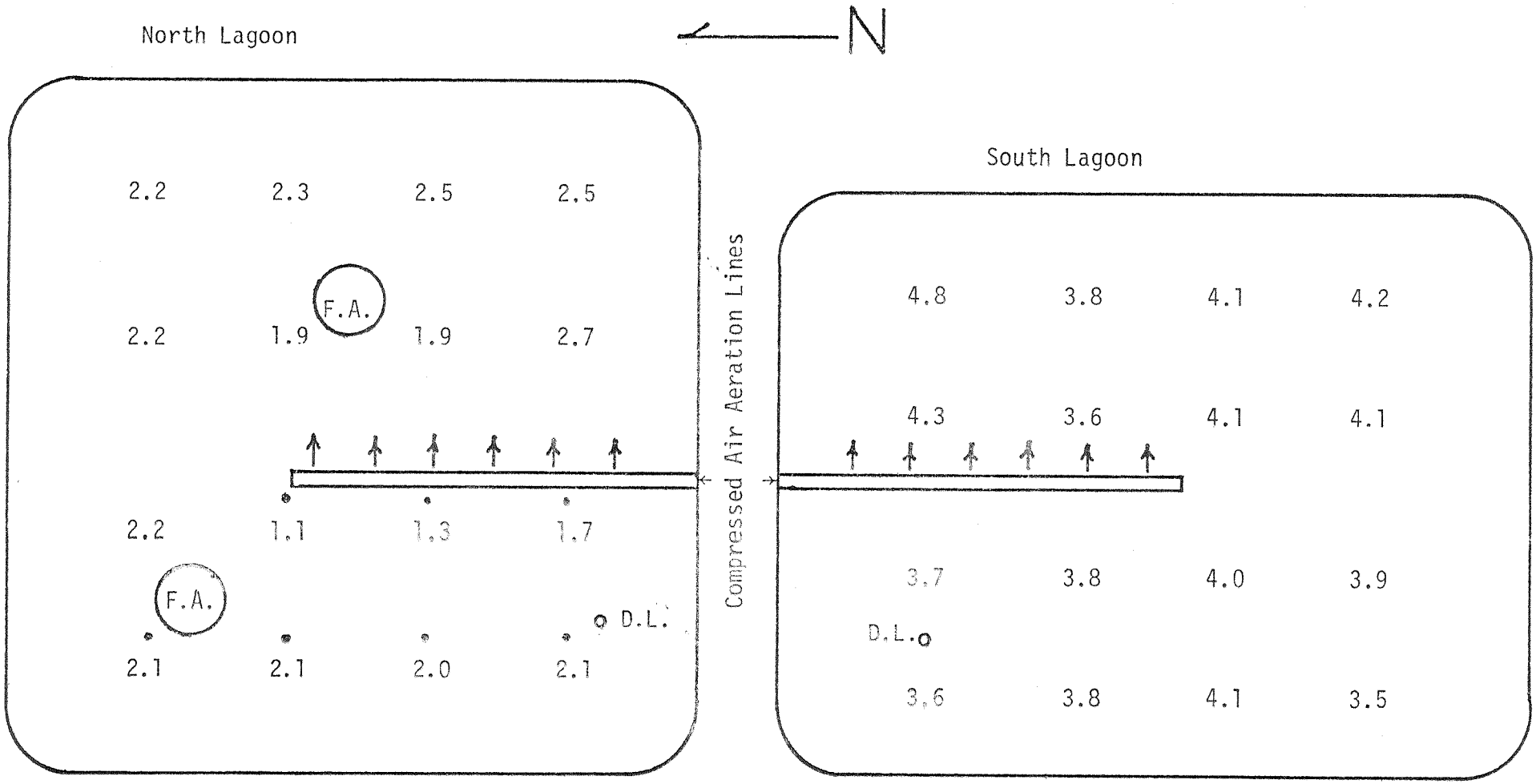
	DOE				STP		
	Influent	Unchl. Eff. N. Lagoon	Unchl. Eff[1/] S. Lagoon	Chl. Eff.	Influent	Unchl. Eff. N. Lagoon	NPDES (Monthly average)
BOD_5 mg/l	220	136	76	88	207	103	94
lbs/day	1064	658	368	426		498	580
TTS mg/l	110	54	30	68	184	[2/]	106
lbs/day	532	261	145	329			654
Total Plant Flow MGD						.58	not to exceed .74
Fecal Coliform Colonies/100 mls							200
@ 0940				1500			
@ 1055				520			
Total Residual Chlorine ppm							
@ 0940				2.25			
@ 1055				2.25			
pH Stand. units	8.1	7.5	7.5	7.0			
Sp. Cond. μmhos/cm	650	677	673	673			
COD mg/l	430	320	190	260			
NO_3-N (filt.) mg/l	1.2	0.3	0.6	0.4			
NO_2-N (filt.) mg/l	<0.1	<0.1	<0.1	<0.1			
NH_3-N (unfilt.) mg/l	24	24	27	27			
O-PO_4-P (filt.) mg/l	6.0	8.6	9.0	9.0			
Total Phos.-P (unfilt.) mg/l	11.0	12.0	12.0	12.0			
Total Solids mg/l	504	485	420	449			
Total Non Vol. Solids mg/l	265	291	279	265			
Total Sus. Non Vol. Solids mg/l	18	16	10	18			

*Field Analysis-DPD Field Kit "<" is "less than" and ">" is "greater than"

[1/] Single grab sample 12/6/79 @ 1020

[2/] No Result.

Westside Water District STP Dissolved Oxygen Profile - Surface[1/]



Max. - 2.7
Mean - 2.0
Min. - 1.1

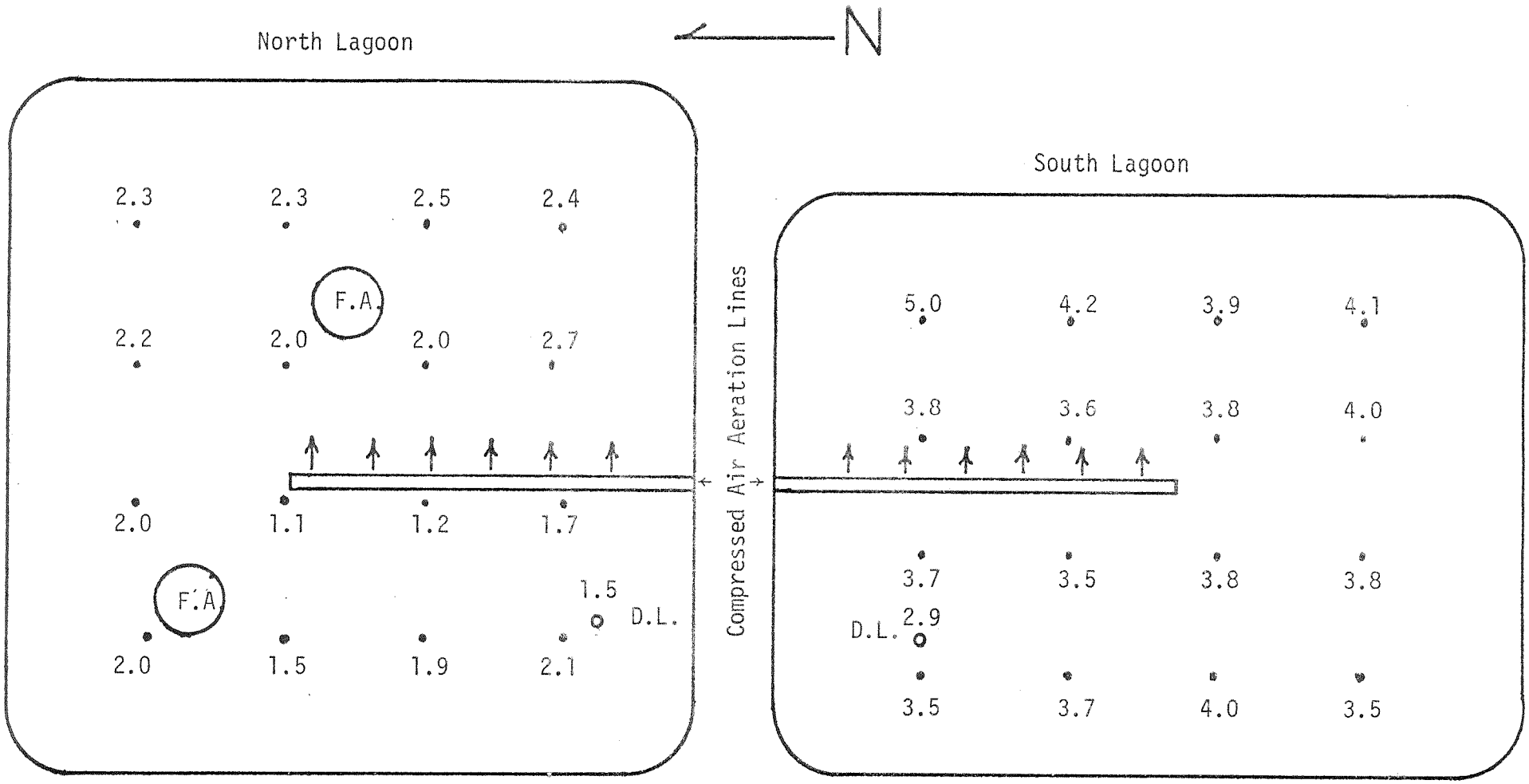
Max. - 4.8
Mean - 4.0
Min. - 3.5

[1/] All results are mg/l
F.A. = Floating Aerator
D.L. = Discharge Line

Figure 1

Not to Scale

Westside Water District STP Dissolved Oxygen Profile at Depth[1/]



Max. - 2.7
Mean - 2.0
Min. - 1.1

Max. - 5.0
Mean - 3.8
Min. - 2.9

[1/] DO Measured 0.5 feet off bottom, all results are mg/l
F.A. = Floating Aerator
D.L. = Discharge Line

Figure 2

Not to Scale