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STATE OF WASHINGTON

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M E M O R A N D U M

March 14, 1978

To: Jim Oberlander

From: Bill Yake, Ambient & Effluent Monitoring

Re: Flow Measurement at Crystal Mountain STP, Pierce County

Inspection was made of the flow measuring and recording equipment at the Crystal Mountain STP on March 12, 1978. The configuration of the inflow and outfall structures of the plant is presented in Figure 1. The Stevens 61R recorder, which is activated by a float behind a V-notch weir, records instantaneous and totalized flow. The instantaneous flow is indicated by a needle which scribes a strip chart. The instantaneous flow dial is graduated from 0 to .175. The script chart graduation are not denoted. It is assumed that the 0 to .175 graduations are mgd units. The totalizer is provided with a digital readout. One unit represents 50 gallons. The outfall configuration is poorly designed for accurate flow measurement. The following deficiencies were noted:

1) The weir is not a standard 60° weir. The base angle is about 64°, thus real flows are underestimated.

2) The weir is not sharp crested and the nappe does not spring free from the weir in the lower section of the V-notch.

3) The flow through the weir is not allowed enough drop to prevent weir submergence when flows are high.

4) Dimensions of the outfall structure are cramped making accurate calibration almost impossible.

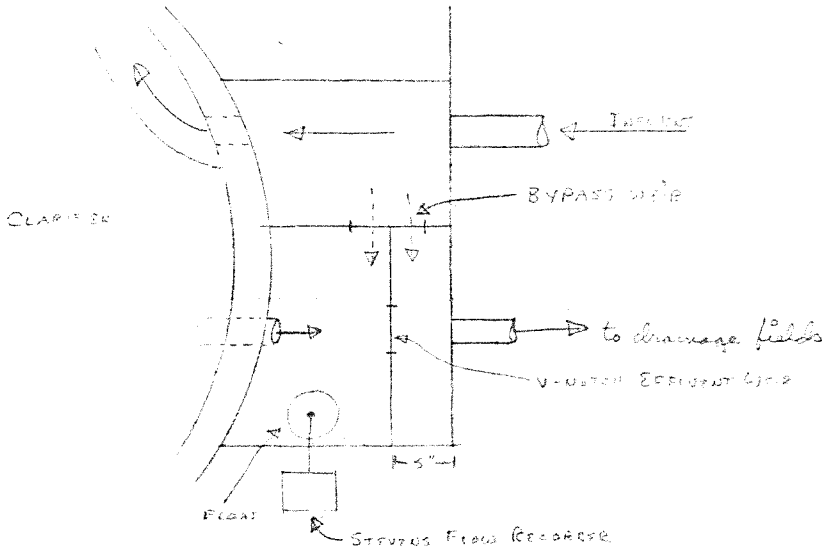
The plant operator's head-flow table is accurate for a properly designed 60° weir.

To determine the approximate accuracy of the flow recordings produced by the plant the weir head was measured and flow derived from a 60° V-notch weir chart. In addition, a bucket-stopwatch flow measurement was taken. These measurements are noted below (Table I).

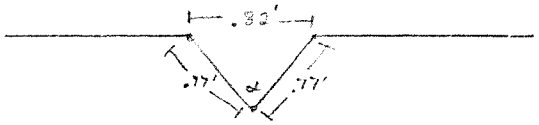
Table I - Flows (MGD) at Crystal Mountain STP

Time	Head	Head-Chart Flow	Bucket-Stopwatch Flow	Stevens Recorder Flow
1000-1015	.27'	.035 mgd	.041 mgd	.007 mgd

Figure 1. Crystal Mt. STP - Configuration of Influent & Effluent Outfalls.



V-Notch Effluent Weir



$\alpha \cong 64°$

Obviously, the flow-recorder was severely out of calibration. I contacted Al Parker, one of the operators. Upon inspecting the unit he noted that the float-counter balance line was not appropriately placed in the wheel which drives the instantaneous flow recorder. After moving the line, the following measurements were obtained.

Time	Head	Head-chart Flow	Stevens Recorder Flow
1130-1140	.29'	.042 mgd	.026 mgd
1210-120	.30'	.046 mgd	.030 mgd

Again, the flow-recorder was indicating flows well below actual flows. The totalizer records for the period between 3/7/78 (0900) to 3/11/78 (0900) indicated a four day flow of 9,500 gallons. This is approximately 2400 gpd or .0024 mgd average flow over the four day period. The lowest daily flow recorded in March of 1976 was 7500 gallons. It appears that the severe miscalibration of the recorder had existed for at least 4 days prior to the inspection.

It should be noted that at the time of the inspection the flow-equalization tank was out of order. Thus the flow noted was higher than flows which the plant would normally experience.

Mr. Parker explained that the unit was normally calibrated by adjusting the head behind a 60° influent weir to 2" (ideally 17 gpm) and then checking the totalizer after several hours to see if it was recording the flow. He did not explain how adjustments to the flow meter were made if it were in error. Mr. Parker displayed only a partial knowledge of flow measurement (both theoretical and as it pertained to the Crystal Mountain STP system).

Conclusions:

1) The flow recording device at the Crystal Mountain STP was severely out of calibration when inspected on 3/11/78. It was recording only approximately 17-20% of the 'actual' flow.

2) After the operator "corrected" the meter it continued to record only approximately 62-65% of 'actual' flow.

3) The 'actual' flows are probably underestimated as the weir's base angle was greater than 60° and head was measured at the weir, rather than upstream.

4) Maintenance and calibration of the flow measuring system by operating personnel is questionable.

5) Very little faith may be placed in the flow measurements recorded by the Crystal Mountain STP due to deficiencies in design, calibration and maintenance.

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cc: Alan Meyers: Horton, Dennis & Assoc., Inc.
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