CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

OHD Comprehensive Performance Evaluation

Appendix C

(503) 731-4317
FAX (503) 731-4077
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OHT

Oregon

DEPARTMENT OF HUMAN RESOURCES

HEALTH DIVISION

CITY549 973700002 1292 07/21/93
FORWARDING TIME EXPIRED
:CITY OF PHILOMATH
PO BOX 400
PHILOMATH OR 97370-0400
RETURN TO SENDER

July 12, 1993

Mr. Beau Vencill
City of Philomath
P.O. Box 549 ~~400~~
Philomath, Oregon 97370

Dear Mr. Vencill:

Thank you for your help in completing the **Comprehensive Performance Evaluation of the water treatment plant for the City of Philomath (PWS #4100624)**. The treatment is considered to be full treatment (disinfection, flocculation, sedimentation, filtration) and is subject to the requirements of the Surface Water Treatment Rule that becomes effective as of July 1, 1993. The rule requires that the surface water treatment achieve 3-log removal/inactivation of Giardia cysts (also, 4-log inactivation of viruses). This is to be the result of the combination of filtration and disinfection. The filtration efficiency must achieve at least 2-log Giardia removal credit with the disinfection process (CTs) demonstrating the remaining log credit.

The evaluation of the WTP revealed that the current filtration operation is credited with 2-log Giardia removal if flow is maintained at $\leq$ 700 gpm through the WTP. Disinfection must achieve 1-log CT effectiveness for Giardia inactivation and must be demonstrated by daily calculation. The contact time to be used was determined by tracer study to be 37 minutes through the WTP (prechlorination), clearwell and mainline to first user at an operation rate of 1000 gpm. This time may be used in doing the CT calculation or if the rate is changed a new tracer study must be completed to determine contact time. We encourage the City to have a tracer study done through the plant to determine the actual contact time for the various flows.

In general compliance with the Surface Water Treatment Rule requires the following by July 1, 1993:

1. Finished water turbidity (combined from all filters) must be measured every 4 hours and recorded. Results must be submitted to the Health Division each month. Individual sample taps must be installed on

Barbara Roberts
Governor

800 NE Oregon Street # 21
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Emergency

each filter discharge and sampled once per day or whenever combined flow turbidity changes. Also, each filter must be profiled for turbidity spiking after backwash once per-quarter. Records of individual filter turbidity measurements must be maintained in WTP files. Finished water turbidity readings must be $\leq$ 0.5 ntu in 95% of the readings and never > 5 ntu. It is recommended that finished water never exceed 0.1 ntu.

2. Total treatment must provide 3-log reduction of Giardia cysts. Filtration is credited with 2-log reduction as long as turbidity MCLs are met. Disinfection CTs are required to meet 1-log inactivation of Giardia (4-log virus inactivation). CTactual $\geq$ CTrequired. Results must be calculated and recorded each day and submitted to the State each month.

3. Free chlorine residual leaving WTP must be measured and recorded 2 times per day.

4. Must calculate and record chemical feed dosages each day or whenever feed dosages change.

The following items are recommendations to help optimize the filtration operation:

1. Recommend tracer study through the WTP to determine actual contact times for all flow conditions.

2. Begin or end filter run with a backwash. Never start a filter run with a dirty filter. Avoid start and stop filter operation.

3. Base backwash on turbidity rather than headloss across filters or time.

4. Consider installation of flow to waste piping (after backwash). WTP could possibly achieve 2.5-log credit with some improvements in operation capability.

5. Limit WTP flow $\leq$ 700 gpm (required to achieve 2 or 2.5 log Giardia removal credit).

6. Test finished water quality for TTHMs. Concern for formation potential with the use of prechlorination.

The water treatment plant is well operated and should meet the requirements of the Surface Water Treatment Rule. We encourage the City to make improvements to the WTP (add flow to waste piping, restrict flow to 700 gpm, eliminate turbidity spiking) that would allow the log reduction credit for the filtration process to achieve 2.5 log.

Please call if there are any questions.

Sincerely,

Tom Charbonneau, P.E.
Regional Manager
Drinking Water Section

cc: Mike Grimm, OHD
John Potts, OHD
Benton County Health Department

COMPREHENSIVE PERFORMANCE EVALUATION (CPE)

Name of Water System: City of Philomath PWS#: 4100624
Date Conducted: 2-24-93
Persons Conducting CPE: T. Charbonneau, J. Potts, Mike Grimm

Operating Flow: 1050 ~~mgd~~ gpm

Maximum Hydraulic Capacity 700 ~~mgd~~ gpm (designed for 1 MGD)

Narrative:

City of Philomath Phi from the Marys River. Have capability o Treatment consists of a WTP (Micro dered full treatment The city supplies ections with a population of 3,000 people The surface wa fective as of July 1, 193. The following reg

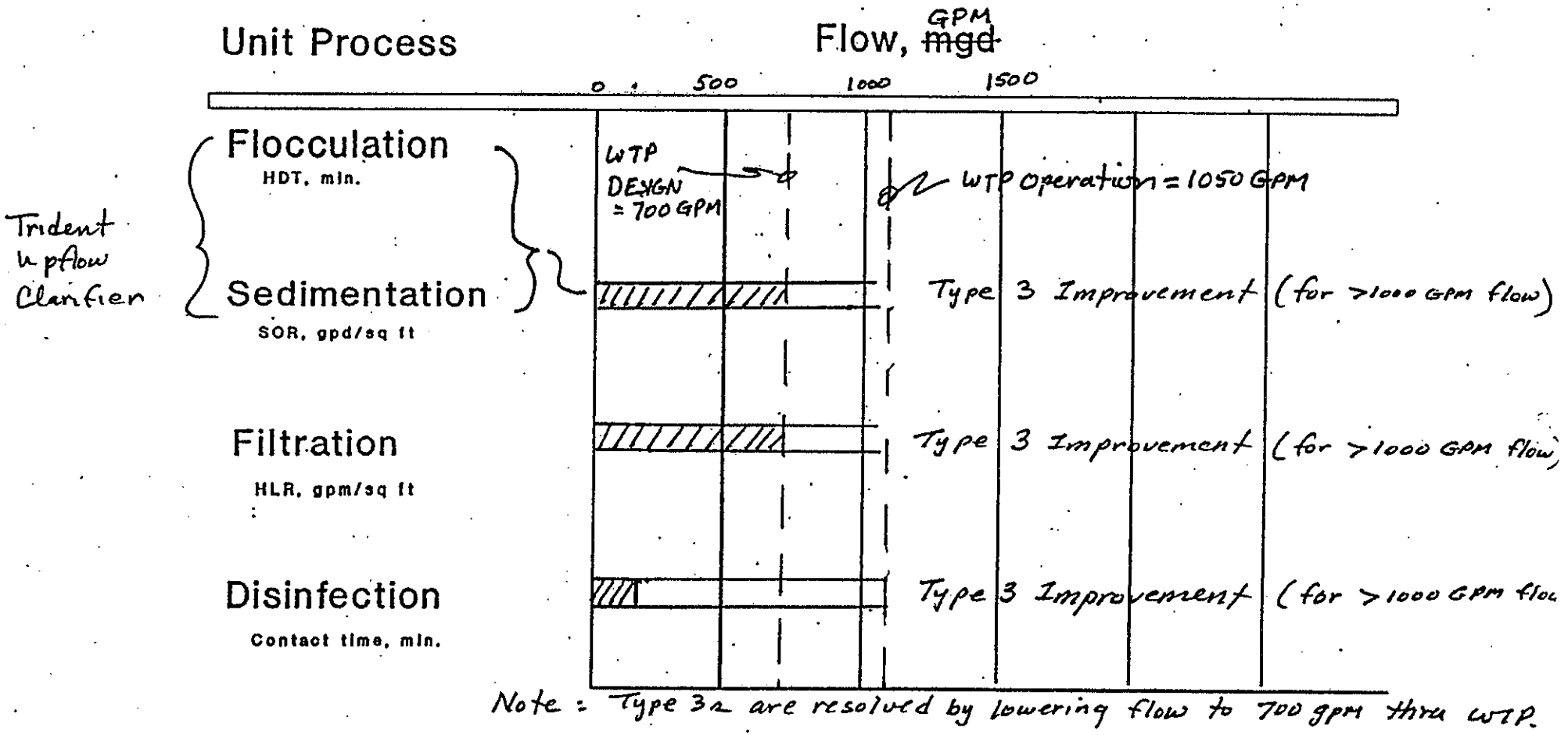
1) Finished w NTU in 95% of readings & can nev inished water @ 0.1 NTU or less
2) Finished v every 4 Hours of WTP operation and re onth to OHD. Recording are finished water (effluent) - Combine . . from both filters.
3) Filter must achieve a 2-log credit for Giardia removal. Current operation achieves that. 2.5 log credit could be obtained if WTP flow keep ≤ 700 GPM, finished turbidity ≤ 0.1 NTU, & flow to waste following back wash piping is added.
4) Must calculate & record actual CTs each day. Total treatment must achieve 3-log Giardia removal/inactivation at all times. Current filtration achieves 2-log. Therefore, CT actual must achieve at least a 1-log credit. Actual CTs must exceed the Required CT values for 1-log inactivation each day. Values must be recorded & submitted to OHD each month.
5) Total treatment must achieve 4 log virus inactivation. If Giardia 3-log (1-log with disinfection) inactivation being achieved then this value is also being complied with.

The following items are required or recommended to help the WTP (filtration) operation be optimized:

1) Operator must measure each filter turbidity once per day (minimum) or whenever combined (clearwell) turbidity changes. Record data.
2) Operator must profile individual filter effluent turbidity following backwash once per quarter to check for spiking.
3) Operator must calculate & record chemical feed dosages at least once per day or whenever dosages change.
4) Recommend that filter run begin or end with backwash. Never start run with dirty filter.

(over)

Performance Potential Graph



Note = Type 3s are resolved by lowering flow to 700 gpm thru WTP.

To maintain 2-log credit WTP flow must be kept @ ≤ 700 gpm.
If 1000 GPM flow to be continued additional improvements might be required.
Need to prechlorinate to provide for CTs. Need additional tracer study info to determine contact times for ~~rotation~~ various flow thru WTP.

5) Avoid Start/stop filter operation

6) Base backwash on turbidity, instead of Head loss across filters.

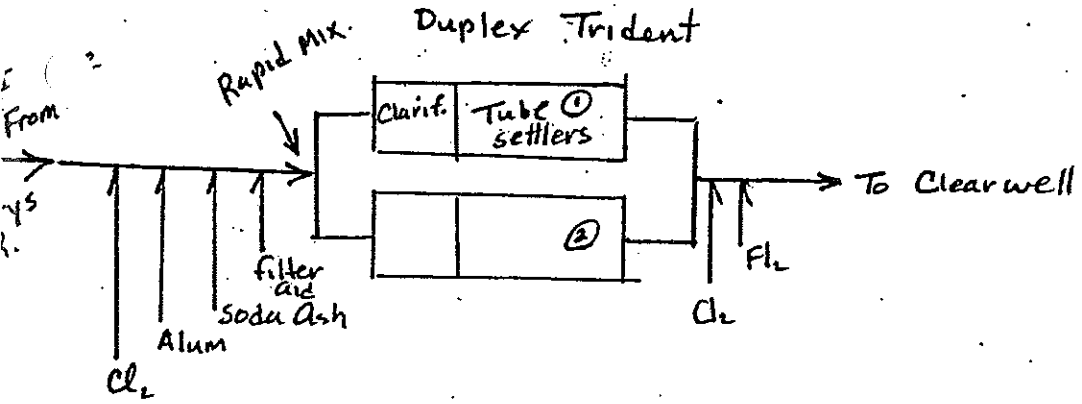
7) Never recycle backwash water (recommended).

The WTP current operation should be able to comply with Surface Water Treatment Rule requirements if pre-Chlorination is practiced in order to obtain the additional contact time for CTs. *Strongly recommend that flow rate be kept @ ≤ 700 gpm & that by adding flow to waste piping the WTP operation strive for 2.5 log removal credit.

Reminder that for lower flow rates Tracer study for contact time must be repeated. Also, if pre-chlorination is practiced testing should be done for TTHMs.

DESIGN DATA

A. PLANT FLOW DIAGRAM



B. FLOW DATA

Design Flow

Average Daily Flow 700 ~~mgd~~ gpm
Maximum Hydraulic Capacity 1 mgd

Operating Flow

Peak Instantaneous Operating Flow 1050 ~~mgd~~ gpm

C. UNIT PROCESSES

Flow Stream Measured	Meter Type	Calibration Frequency	Comments
Raw Water:	Rockwell (turbine) mea. total flow & flow rate	2-yrs	
Finished Water:	Sparling (Propeller) mea total flow & flow rate		
Backwash:	none		
Backwash Recycle:	none — backwash is not recycled sent to backwash pond.		
Other (designate):	none		

DESIGN DATA

C. UNIT PROCESSES (cont.)

PRESEDIMENTATION

None

Presedimentation:

Type (concrete or earthen-sketch below): _____
Number of Basins _____ Surface Dimensions _____
Water Depth (shallowest) _____ ft. (deepest) _____ ft.
Weir Location _____
Weir Length _____ ft.
Total Surface Area _____ ft2 Total Volume _____ ft3
Total Volume _____ mg

Flow:

Theoretical _____ mgd Operating _____ mgd

Detention Time:

Theoretical _____ hr Operating _____ hr

Weir Overflow Rate:

Theoretical _____ gpm/ft Operating _____ gpm/ft

Surface Settling Rate:

Theoretical _____ gpm/ft2 Operating _____ gpm/ft2

Chemical Feed Capability:

Type of Chemicals _____
Operating Range (describe) _____

Sketch:

DESIGN DATA

C. UNIT PROCESSES (cont.)

RAPID MIX

apid Mix:

Type
(mechanical, inline mechanical, (inline static))

Number of Mixers 1 Water Depth _____
Number of Basins _____ Surface Dimensions _____
Horsepower _____ Total Volume _____ gallons

Flow:

Theoretical _____ mgd Operating 1050 ~~mgd~~ gpm

Detention Time:

Theoretical _____ mgd Operating _____ mgd

G Value

Theoretical _____ mgd Operating _____ mgd

Operating Problems: _____

COAGULATION / FLOCCULATION

.occulation:

Type (e.g., paddle wheel, turbine, hydraulic) Trident (upward) clarifier
Control (e.g. constant speed or variable speed) _____
High Temp. 47°C Low Temp. 4°C High pH 7.5 Low pH 6.8
Stages (sketch below)

(See Sedimentation Process)

STAGE/BASIN	SURFACE DIMENSIONS	DEPTH	VOLUME	HORSEPOWER	G VALUE
1					
2					
3					
Total					

low:
heoretical _____ MGD Operating _____ MGD
cion Time:
heoretical _____ MGD Operating _____ MGD

alculations/Assumptions: _____

DESIGN DATA

C. UNIT PROCESSES (cont.)

SEDIMENTATION

Sedimentation Basins:
Type: ___ Conventional ___ Tube Settlers ✓ Upflow Clarifiers (absorption)

Number of Basins 2 Surface Dimensions 8'-4" x 4'-2"/unit = 34.7
Water Depth (shallowest) ___ ft. (deepest) 6'-6" ft.
Weir Location ___
Weir Length 5 ft./filter
Total Surface Area 69.4 ft2 Total Volume ~~4715~~ 451 ft3
Total Volume 33777 ~~mg~~ gallons

Flow:

Theoretical 1.0 mgd Operating 1.5 mgd

Detention Time:

Theoretical 4.9 ~~hr~~ min. Operating 3.2 ~~hr~~ min.

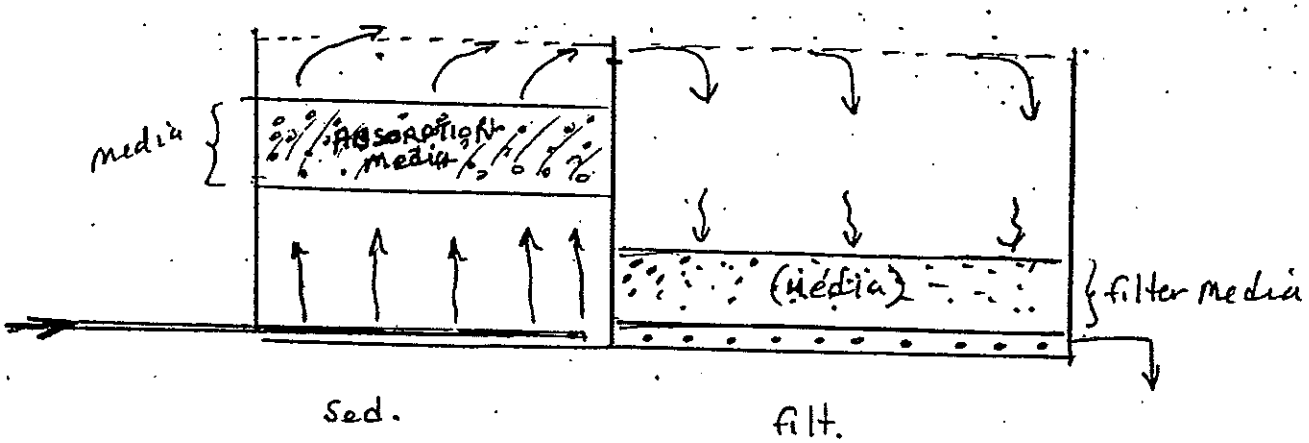
Weir Overflow Rate:

Theoretical 69.4 ≈70 gpm/ft Operating 105 gpm/ft

Surface Settling Rate:

Theoretical 10 gpm/ft2 Operating 15.1 gpm/ft2

Inlet Conditions (Describe and/or sketch)



Operating Problems:
* From Water Treatment Plant Design by ASCE/AWWA pg 141-143

DESIGN DATA

C. UNIT PROCESSES (cont.)

FILTRATION

Type of Filters (sand, (mixed media), dual media, pressure gravity, etc.)

Number of Filters 2 Surface Dimensions 138.9 SF
(8'-4" × 8'-4") = 70 SF e

Media Charachteristics:

MEDIA TYPE	DEPTH	EFFECTIVE SIZE	SPECIFIC GRAVITY
Anthracite	9"		
Silica	↕ 21"		
Garnet			
Gravel			

Total Surface Area 138.9 ft2

Filtration Rate: Theoretical Flow = 1 MGD (694 GPM) Operating flow = 1.5 MG
1050 GP

Theoretical 5.0 gpm/ft2 Operating 7.6 gpm/ft2

Filter Control (e.g., constant rate, declining rate, constant level)

Avaliable Headloss 7 ft. (Backwash Initiated at this head).

Surface Wash:

Type (e.g., (rotary) fixed, manual)
Water Flow Rate _____ gpm Surface Wash Rate _____ gpm
Duration (Operating) _____ min

Backwash:

Water Wash Rate:
Theoretical _____ gpm/ft2 Operating 17 gpm/ft2

Duration:
Theoretical _____ gpm/ft2 Operating 9 min. ~~gpm/ft2~~

Air Wash Rate:
Theoretical _____ scfm/ft2 Operating scfm?ft2
→ used on upward clarifier. Raw water backwash used on upward clarifier.

Control/Operating Problems:

	Yes	No		Yes	No
Mud Balls		X	Hydraulic Loading		X
Dirty Media		X	Air Bubbles		X
Uneven Media		X	Surface Wash Control	X	
Backwash Rate Gradual	X		Filter Rate Control	X	

Comments:
WTP is operating at too high of a flow rate.
Plant designed for 1 MGD.

DESIGN DATA

C. UNIT PROCESSES (cont.)

DISINFECTION

Contact Basin(s) (e.g. clearwell):

BASIN NO.	SURFACE DIMENSIONS	DEPTH	(gallons) VOLUME	CHANNEL LENGTH TO WIDTH	THEORETICAL AVAILABLE EFFECTIVE CONTACT VOLUME
1			40,000		
	Total Volume		40,000		*

* Tracer Study info

Chlorinator(s):
No. of Chlorinators 2 Capacity 20#/day
Flow Proportioned ? yes

Feed Rate:
Design 20#/day Operating

Flow:
Design 700 gpm Operating 1050 gpm

Dosage:
Design 2.4ppm Operating 1 ppm (free residual)

Operating Problems:

ulating approximate CT:

maximum pH 7.6 minimum temp. 5°

~~Maximum~~ Minimum free Cl2 residual 1ppm expected log removal of plant 2 log

Required CT using above assumptions 60 (1 log Inactivation)
(3 log 186)

Has a tracer study been done ? yes

If yes, what was the T10 ? 7 (min.) (thru clear well) & transmission line to first user.

If no, what is the estimated theoretical contact time ? _____ (min.)

Contact time required = $\frac{\text{Required CT}}{\text{Minimum ~~Maximum~~ Chlorine Residual}}$ $\frac{60}{1}$

Contact time required = 60 minutes

Theoretical flow = $\frac{\text{Theoretical volume}}{\text{Contact time required}}$ $\frac{5{,}000 \text{ gallons (from Tracer Study)}}{60}$

Theoretical flow = ~~83~~ 83 gpm _____ mgd

CT log inactivation = $\frac{3 \times 7}{186} = 0.1$ log ←

Comments:
Discharge from clearwell Max flow (from Tracer Study) = 1,000GPM.
Post chlorination only — contact time = 7 min @ 1,000 GPM, or *10 min (est.) @ 700 gp
With pre-chlorination — contact time = 37 min @ 1,000 GPM, or *53 min (est.) @ 700 g
* Need to run additional tracer study to determine actual time.

DESIGN DATA

CHEMICAL FEED CAPABILITY

Coagulant Aids:

TYPE	DESIGN FEED RANGE	OPERATING FLOW (mgd) min.	OPERATING FLOW (mgd) max.	~~DESIGN~~ DOSAGE (mg/l) min.	~~DESIGN~~ DOSAGE (mg/l) max.
Alum	~240 GPD		1,050 GPM		13.5 mg/l

Polymers:

TYPE	PURPOSE	DESIGN FEED RANGE (GPH)	OPERATING FLOW (mgd)	~~DESIGN~~ DOSAGE
N-101P	filter aid		1,050 gpm	0.61 mg/l
Clarifloc				

Dosage Control (describe):
OIT operation – Jar testing (?).
Must record/calculate dosages daily or whenever changes occur.

Operating Problems:

Conc./Pump Calibration Test:
daily – check calibration.

Stabilization Chemicals:
Chemicals Used: Soda Ash (post feed for pH control)
Dosage Control (describe):

Operating Problems:

Fluoride:
Fluoride Compound Used: hydrofluorosilicic Acid
Dosage (Operating) 1 mg/l
Comments:

Softening:
Chemicals Used:
Dosage Control (describe):

Operating Problems:

TEST DATA

A. TURBIDITY CHECKS AFTER BACKWASH:

Run # 1

Elapsed Time	Reading (NTU)
0	0.2
1	—
2	0.5
3	0.35
4	0.30
5	—
6	0.20
7	0.20
8	0.20
9	0.24
11	0.20
17	0.23
20	0.21
25	0.17
30	0.14
43	0.13
60	0.11

Run # 2

Elapsed Time	Reading (NTU)
0	0.09
2	0.094
3	0.10
4	0.14
5	0.19 .21
6	0.22
7	0.24
8	~~0.24~~
9	0.25
10	0.23
11	0.20
14	0.17
19	0.15
20	0.15
30	0.14
38	0.11
40	0.15
54	0.11

Comments:

Spiking after BW is very minimal. Could be eliminated completely with filter to waste piping. Plant credited with 2-log Giardia removal, but with filter-to-waste & reducing WTP production to 1 MGD, it would achieve 2.5 log credit.

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DEPARTMENT OF
HUMAN
RESOURCES

HEALTH DIVISION

July 22, 1993

Philomath Water Department
Dick Clark
400 S. 16th, Box 549
Philomath, OR 97370

RE: Fluoride Check Samples

Dear Dick Clark:

Thank you for sending in the fluoride check sample. The results were:

Your reading:	1.0
Health Division reading:	1.0
Difference:	0

Since the difference was ≤ 0.3 ppm, your analysis result is acceptable.

Remember the optimal range for fluoride is 0.8 and 1.2 ppm.

If you have any questions please give me a call.

Sincerely,

Patrick Meyer, MPH, RS
Monitoring & Compliance
Drinking Water Section

H:\Home\Mo\Meyer\FI\FindI.ltr

Barbara Roberts
Governor

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24-26 (Rev. 1-92)