

MEMORANDUM

March 4, 1977

To: John Spencer

From: Douglas Houck

Subject: Secondary Review of Snohomish County's RWMSCI Mathematical Model as it Applies to the Lower Snohomish River

State of
Washington
Department
of Ecology

This memo gives the results of my further review of RWMSCI as you requested in the meeting of February 9. The review was to determine the difference between the new conditions and the original assumptions used in the model.

My conclusion is that depending on the dissolved oxygen content of the treated effluent and that the city discharges only on an outgoing tide, the Lower Snohomish River can meet Class A criteria for dissolved oxygen. I also feel that the mathematical model is not significantly wrong even though some of its original assumptions are. What appears to be the crucial factor is the D.O. concentration of the effluent. This was not looked at closely in the model.

What I have done is to calculate what would be the expected dissolved oxygen depletion due to the BOD of the river and STP and the dilution of the effluent with the receiving water. The following tables show the results of those calculations and the assumptions used. It was also assumed that the treatment plant would only discharge on an outgoing tide. This makes the calculations uncomplicated and is considered a good practice. Using this assumption means that the treatment plant has only eight hours in a twenty-four hour period in which it can discharge.

Possible D.O. Depletions

Worst Possible Condition:

Q (River)	=	700 cfs	Q (STP)	=	297 cfs/8 hr.
L (River)	=	11.7 mg/l	L (STP)	=	35 mg/l
D.O. (River)	=	9.0 mg/l	D.O. (STP)	=	1.0 mg/l
		K = 0.20	t = 2 hrs.		
Dilution (STP)	=	2.4 mg/l	Final D.O.	=	9.0-3.9
BOD (STP)	=	1.3 mg/l		=	5.1 mg/l
BOD (River)	=	0.2 mg/l			

Normal Treatment - Low Flow

Q (River)	=	700 cfs	Q (STP)	=	297 cfs/8 hr.
L (River)	=	1.5 mg/l	L (STP)	=	35 mg/l
D.O. (River)	=	9.0 mg/l	D.O. (STP)	=	8.0 mg/l
		K = 0.15	t = 1 hr.		
Dilution (STP)	=	0.2	Final D.O.	=	9.0-0.72
BOD (STP)	=	0.5		=	8.28 mg/l
BOD (River)	=	0.02			

Normal Treatment - Normal Flow

Q (River)	=	4,300 cfs	Q (STP)	=	297 cfs/8 hr.
L (River)	=	1.5 mg/l	L (STP)	=	35 mg/l
D.O. (River)	=	11.0 mg/l	D.O. (STP)	=	8.0 mg/l
		K = 0.15	t = 1 hr.		
Dilution (STP)	=	0.2	Final D.O.	=	11.0-.72
BOD (STP)	=	0.5		=	10.28 mg/l
BOD (River)	=	0.02			

Q = Flow

L = UBOD

K = BOD decay rate

t = travel time of effluent in Lower Snohomish River

Q (River) = 50% of total flow of Snohomish River

Q (STP) = Total flow of Group A + B + C + D of Year 2000
Design Criteria

As can be seen from the above tables the dissolved oxygen concentration of the effluent discharge is critical at low flow conditions. The model used a D.O. concentration of 5.0 mg/l. Although the average D.O. value of Everett's present treatment system is 8.0 mg/l it has dropped to 0.6 mg/l.

I hope that this answers most of the questions you had. If you have any questions or would like me to verbally present my findings please feel free to call me.

DH:ee

cc: D. Burkhalter
D. Provost
D. Cunningham
R. Pine