Publication No. 79-e02
WA-49-1010

STATE OF WASHINGTON
Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

MEMORANDUM
January 12, 1979

To: John Hodgson

From: John Bernhardt

Subject: Brewster Well Contamination

INTRODUCTION

During October 1977 a sample collected from one of Brewster's community wells was found to contain 5 ppb phenol. The fact that this amount exceeded the 1 ug/l safe limit recommended for domestic waters by EPA (EPA, 1976) caused concern with the DOE Central Region Office which initiated an investigation. This investigation also included several inspections of Brewster STP which, at the same time that the possibility of well contamination was noted, was experiencing periodic problems with bacterial die-off and reduced efficiency.

The results of the regional investigation and recommendations for further study were summarized in a 7 August 1978 memorandum by Harold Porath entitled "Study Needs for Apple Packing Problems." This report identified two fungicides used in the apple packing industry, diphenylamine (DPA) and sodium orthophenylphenate (SOPP) as suspects for both the well contamination and problems at the STP. Apple packing businesses in town had for some time been disposing of these two chemicals by both unregulated ground disposal and discharge to the sanitary system. Both are known to be toxic to bacterial life and DPA contains phenols.

The DOE Central Region Office positively identified these chemicals as the cause of bacterial kills at Brewster STP. However, because of manpower constraints, the Region Office could not continue the study past mid-1978. Therefore, the Intensive Survey Unit was requested to continue the study with the purpose being to verify if DPA or SOPP were responsible for the phenols detected in the city's water supply and, if so, determine the extent of such contamination.

METHODS

Twelve sampling stations were established to measure phenol levels of groundwaters and surface waters in and around Brewster. This included

three city wells and the Rat Lake discharge, the Brewster STP effluent, State Highway Department well, and six stations spaced at intervals along the Columbia River near Brewster (Figure 1). Samples also were collected from one of the city's sewage lines and an Oroville city well. These last three samples were collected by DOE Central Region Office staff. The remaining samples (12 stations) were collected by John Bernhardt and Karen Coon (DSHS). All of the samples were analyzed by gas chromatograph.

In addition to the phenol sampling, two sets of seven samples were collected and analyzed for DPA and SOPP. This sampling was conducted in November after an analytical technique was obtained which could specifically identify and quantify these two chemicals.

RESULTS

Phenols were present at most of the monitoring stations throughout the three-month monitoring period. No clear differences in the amount of phenols were detected when the sampling results for the Brewster wells (groundwaters) and surface waters of the Columbia River were compared (Table 1). Similarly, no clear trends were apparent between the wells. City well No. 3 (Station 3) periodically contained about as much phenol as well No. 1 (Station 1) where excessive phenols were first detected. An investigation by geologist Chuck Cline indicated that well No. 3 was a good control with very low probability of contamination if groundwaters in Brewster were contaminated by the discharge of chemicals from apple packers in town (Enclosure 1). These data plus a 9 ug/l phenol level detected in a city well at the nearby community of Oroville, suggest that phenol levels in the vicinity of Brewster periodically exceed the 1 ug/l criterion recommended by EPA.

The seven wells sampled specifically for DPA and SOPP did not contain detectable amounts of these chemicals. The sampling included three city wells in Brewster and the Rat Lake discharge (Stations 1 to 4) plus three other city wells; Okanogan, Omak, and Pateros (Table 1). The lower detection limit for these two chemicals is 1 ug/l.

DISCUSSION AND CONCLUSIONS

The water quality monitoring data indicate that measurable amounts of the two fungicides used by apple packers in Brewster, diphenylamine (DPA) and sodium orthophenolphenate (SOPP), were not present in the

city's municipal wells and similar wells at nearby communities at the time of sampling. It is still not known if any of the SOPP or DPA breakdown products are reaching groundwater. Therefore, these findings do not mean the land disposal used by these companies should be disregarded as a potential source of groundwater contamination. Since it is known that the two fungicides are toxic and thus pose a potential threat to local groundwaters as well as waters of the Columbia River, the industries that discharge these wastes should be required, as part of their discharge permits, to put together engineering reports outlining alternatives for disposal. Such proposals would be submitted to DOE for review and the most acceptable disposal methods selected.

The phenol levels in the wells have raised some concern based on the EPA 1 ug/l criterion. These findings should be forwarded to the Department of Social and Health Services which is responsible for protecting public water supplies.

JB:cp

Attachments

cc: Dick Cunningham
Harold Porath
Clar Pratt

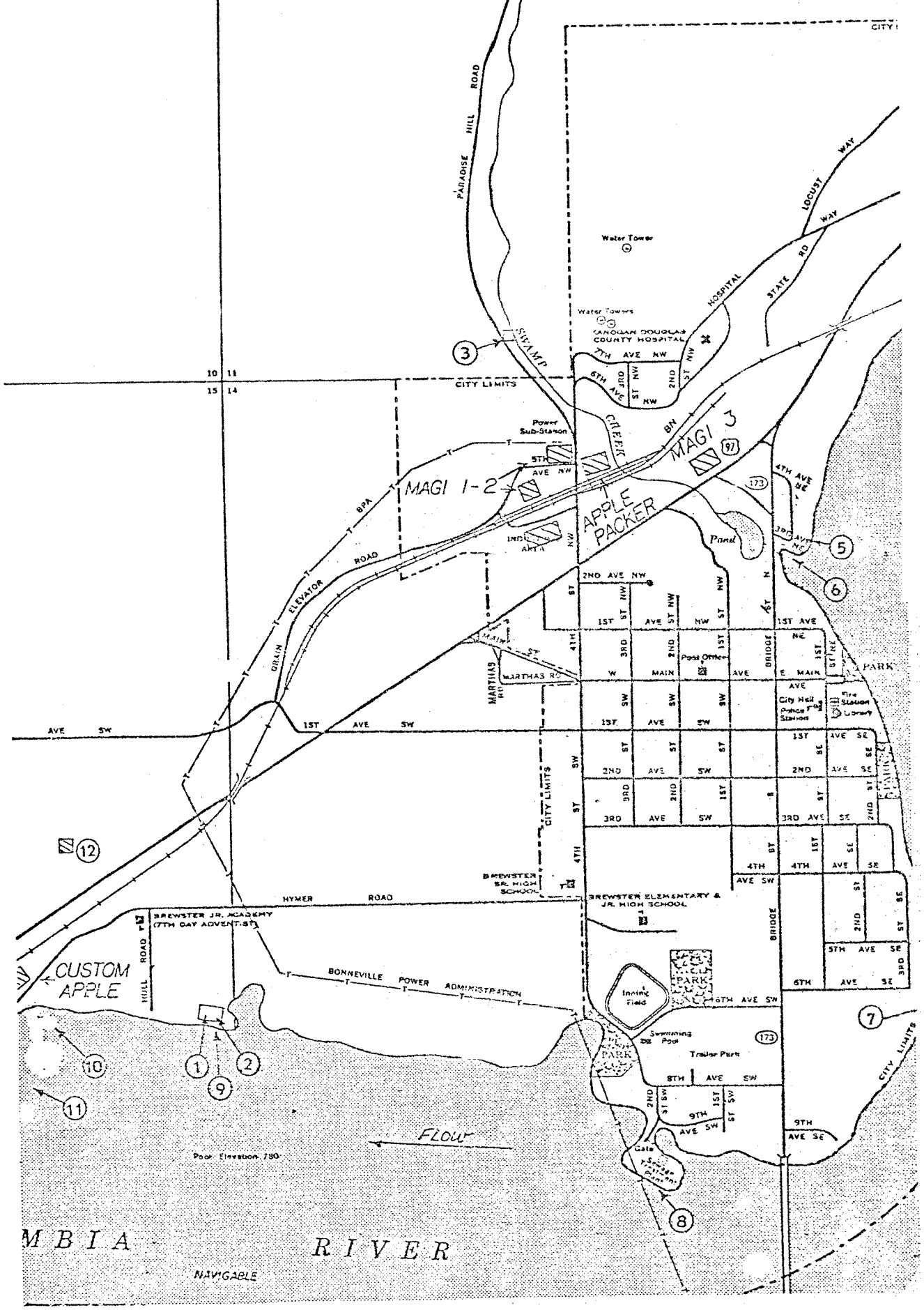

Figure 1. Stations Sampled by DOE and DSHS during Brewster Groundwater Contamination Survey, August 14 to November 30, 1978.

STATE OF
WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

MEMORANDUM

October 20, 1978

To: John Bernhardt

From: Chuck Cline

Re: Brewster Ground Water Program

In regards to the possibility of contamination of Brewster city well #3 (up the hill from Brewster) by leachate from apple packing warehouses downslope, it would appear unlikely that such would be the case. The general ground-water flow in this area would be in a southerly or southeasterly direction and any contaminating plume of phenols from the apple packing plant would tend to be elongate in the south or southeast direction. A minor portion of the plume would perhaps be slightly up-gradient but not enough to contaminate a well one-third of a mile away. Pumping the well for a long period would bias the plume in the northerly direction, however well #3 is an auxiliary supply used only when the primary wells along the river cannot supply adequate amounts of water for the town. Well #3, when first tested, was pumped at the rate of 800 gallons per minute (gpm) for 50 days resulting in a water level drawdown of approximately 20 feet after one hour of pumping. No further water level decrease was recorded during the 50 days of testing. This would indicate that recharge equalled discharge after one hour of pumping 800 gpm, stress of the aquifer did not go beyond one hour and the chance of contamination from a source beyond the cone of depression would be unlikely.

Contamination of wells down-gradient of the packing plant is a possibility, however. Shallow wells deriving their water from alluvial or glacial outwash sand and gravel aquifers are more susceptible to contamination than are the deeper wells. The presence of orchards in the area also increases the chance of contamination, considering the number of years herbicides and pesticides have been applied to these orchards and the increased saturation and runoff of irrigation.

CC:ee

cc: Clar Pratt
Lawrence Ashley

ENCLOSURE 1

Table 1. Summary of Water Quality Data Collected at Brewster and Vicinity during Late Fall, 1978.

Station Number	Description	Concentration (ppb) by Parameter and Date Sampled								
		8/14 (phenols)	8/22 (phenols)	8/29 (phenols)	9/11 (phenols)	9/14 (phenols)	9/25 (phenols)	10/3 (phenols)	11/6 (SOPP)*	11/30 (DPA)**
1.	City Well No. 1	23	ND[1/]	320	--	--	24	--	ND	ND
2.	City Well No. 2	--	2	8	14	--	44	--	ND	ND
3.	City Well No. 3	--	14	--	--	--	26	--	ND	ND
4.	Rat Lake Dischg.	--	ND	--	--	--	ND	--	ND	ND
5.	Col. R. @ 4th Ave.	--	70	--	--	--	34	--	--	--
6.	Col. R. @ Swamp Cr.	--	75	--	--	--	3	--	--	--
7.	Col. R. @ 6th Ave.	--	40	--	--	--	40	--	--	--
8.	Brewster STP Eff.	--	ND	--	--	--	23	--	--	--
9.	Col. R. @ Wells Land 2	--	ND	--	--	--	ND	--	--	--
10.	Col. R. above Custom Apple	--	ND	--	--	--	ND	--	--	--
11.	Col. R. below Custom Apple	--	ND	--	--	--	5	--	--	--
12.	State Hwy. Dept. Well	--	ND	--	--	--	6	--	--	--
13.	Sewage Line above Magi	--	--	--	--	13	--	--	--	--
14.	Sewage Line below Magi	--	--	--	--	260	--	--	--	--
15.	Oroville City Well	--	--	--	--	--	--	9	--	--
16.	Okanogan City Well	--	--	--	--	--	--	--	ND	ND
17.	Omak City Well	--	--	--	--	--	--	--	ND	ND
18.	Pateros City Well	--	--	--	--	--	--	--	ND	ND

1/ ND = None Detected
* also indicated no DPA
** also indicated no SOPP

LITERATURE CITED

_____, 1976. "Quality Criteria for Water", U.S. Environmental Protection Agency, Report No. EPA-440/9-76-023, pg. 347-52.

STATE OF WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

MEMORANDUM
March 22, 1979

To: John Hodgson

From: John Bernhardt and Lawrence Ashley

Subject: Brewster Well Contamination

INTRODUCTION

A sample collected from one of Brewster's community wells during October 1977 contained 5 ppb phenol. The fact that this amount exceeded the 1 ug/l safe limit recommended for domestic waters by EPA (EPA, 1976) caused concern with the DOE Central Region Office which initiated an investigation concerning the possiblity of groundwater and surface water contamination. This investigation also included several inspections of Brewster STP which was experiencing periodic problems with bacterial die-off and reduced efficiency.

The results of the regional investigation and recommendations for further study were summarized in a 7 August 1978 memorandum by Harold Porath entitled "Study Needs for Apple Packing Problems." This report identified two fungicides used in the apple packing industry, diphenylamine (DPA) and sodium orthophenylphenate (SOPP) as suspects for both the well contamination and problems at the STP. Apple packing businesses in town had for some time been disposing of these two chemicals by both unregulated ground disposal and discharge to the sanitary system. Both are toxic.

The DOE Central Region Office positively identified these chemicals as the cause of bacterial kills at Brewster STP. However, because of manpower constraints, the Region Office could not continue the groundwater aspect of the study past mid-1978. Therefore, the Water and Wastewater Monitoring Section was requested to continue the study with the purpose being to verify if DPA or SOPP were responsible for the phenols detected in the city's water supply and, if so, determine the extent of such contamination.

METHODS

Water quality samples were collected at 18 locations (Figure 1). These included three municipal wells in Brewster and the Rat Lake discharge located near town, the Brewster STP effluent, State Highway Department well near town, and six stations spaced at intervals along the Columbia River near Brewster. Samples also were collected from one of Brewster's sewage lines (above and below MAGI) and from four nearby community

wells; Oroville, Pateros, Omak, and Okanogan. The sampling was conducted by John Bernhardt, Harold Porath, and Karen Coon (DSHS). All of the samples were analyzed for phenol by Lawrence Ashley using gas chromatography technique.

In addition to the phenol analysis, assumed to be a breakdown product originally from SOPP and DPA, two sets of seven samples each were collected and analyzed specifically for DPA and SOPP. This sampling was conducted in November after an analytical technique was obtained which could specifically identify and quantify these two chemicals.

RESULTS AND DISCUSSION

Phenol was present at most of the monitoring stations throughout the six-month monitoring period. No clear differences in the amount of phenol were detected when the sampling data for the Brewster municipal wells (groundwaters) and surface waters of the Columbia River were compared (Table 1). Similarly, no clear trends were apparent between the Brewster wells. City well No. 3 (Station 3) periodically contained about as much phenol as well No. 1 (Station 1) where excessive phenols were first detected. An investigation by DOE geologist Chuck Cline indicated that well No. 3 was a good control with very low probability of contamination if groundwaters in Brewster were contaminated by the discharge of chemicals from apple packers in town (Appendix 1). In addition, municipal well waters collected from the nearby communities of Oroville, Okanogan, and Omak contained phenol exceeding the 1 ug/l criterion recommended by EPA.

The seven wells sampled specifically for DPA and SOPP did not contain detectable amounts of these chemicals. The sampling included three city wells in Brewster and the Rat Lake discharge (Stations 1 to 4) plus three other city wells; Okanogan, Omak, and Pateros (Table 1). The lower detection limit for these two chemicals is 1 ug/l.

RECOMMENDATIONS

The water quality monitoring data indicate that detectable amounts of the two fungicides used by apple packers in Brewster, diphenylamine (DPA) and sodium orthophenolphenate (SOPP), were not present in Brewster's municipal wells and similar wells at nearby communities at the time of sampling. A literature search relating to SOPP and DPA did not give specific information relating to breakdown products in the environment. It is still not known if any of the SOPP or DPA breakdown products other than phenol are reaching groundwater. Therefore, these findings do not mean the land disposal used by these companies should be disregarded as a source of groundwater contamination. Since it is known

that the two fungicides are toxic, the industries that discharge these wastes should be required, as part of their discharge permits, to submit engineering reports outlining alternatives for disposal. These proposals should be reviewed by DOE and the most acceptable disposal methods selected.

The high phenol levels detected in the wells at Brewster as well as other communities nearby, raise some concern, based on the EPA 1 ug/l criterion. These findings should be forwarded to the Department of Social and Health Services which is responsible for protecting public water supplies.

Procedures for analyzing specifically for DPA and SOPP did not become available until late in the study. Another sampling point earlier in the season would be desirable. Therefore, as a final check, it is recommended that Brewster wells 1, 2, and 3 (Control) be sampled one more time during September 1979 to provide these data for early fall.

JB:cp

Attachments

cc: Dick Cunningham
Harold Porath
Clar Pratt
Karen Coon

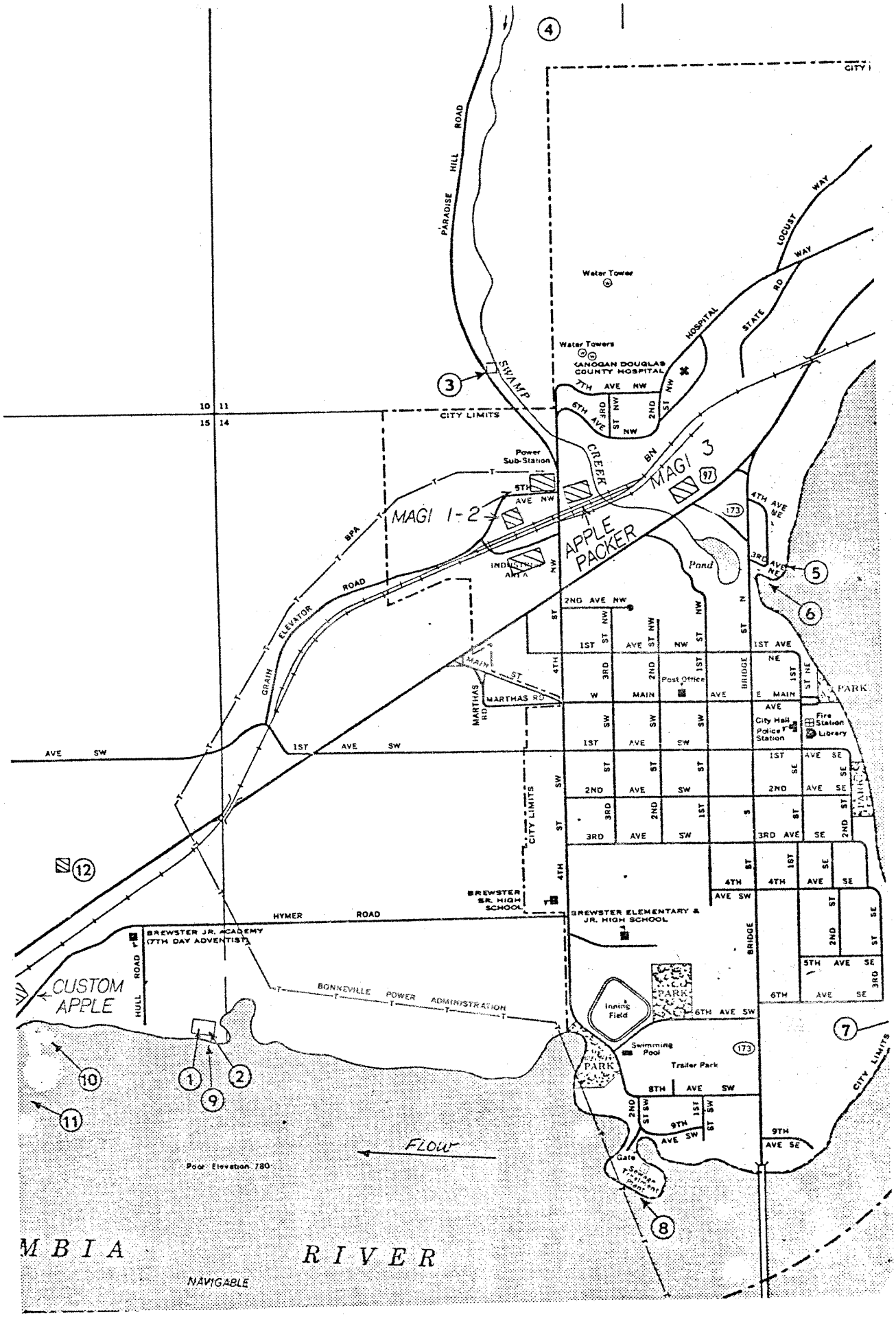

Figure 1. Stations Sampled by DOE and DSHS during Brewster Groundwater Contamination Survey, August 14 to November 30, 1978.

Table 1 Summary of Phenol, SOPP, and DPA Data Collected at Brewster and Vicinity during Late Fall, 1978

Station Number	Description	Concentration (ppb) by Parameter and Date Sampled											
		PHENOL										SOPP* & DPA**	
		8/14	8/22	8/29	9/11	9/14	9/25	10/3	10/10	11/30	1/15	11/6	11/30
1.	City Well No. 1	23	ND[1/]	320	--	--	24	--	55	ND	28	ND	ND
2.	City Well No. 2	--	2	8	14	--	44	--	40	ND	62	ND	ND
3.	City Well No. 3	--	14	--	--	--	26	--	ND	ND	--	ND	ND
4.	Rat Lake Dischg.	--	ND	--	--	--	ND	--	15	480	--	ND	ND
5.	Col. R. @ 4th Ave.	--	70	--	--	--	34	--	67	--	--	--	--
6.	Col. R. @ Swamp Cr.	--	75	--	--	--	3	--	16	--	--	--	--
7.	Col. R. @ 6th Ave.	--	40	--	--	--	40	--	ND	--	--	--	--
8.	Brewster STP Eff.	--	ND	--	--	--	23	--	ND	--	--	--	--
9.	Col. R. @ Wells Land 2	--	ND	--	--	--	ND	--	ND	--	--	--	--
10.	Col. R. above Custom Apple	--	ND	--	--	--	ND	--	--	--	--	--	--
11.	Col. R. below Custom Apple	--	ND	--	--	--	5	--	ND	--	--	--	--
12.	State Hwy. Dept. Well	--	ND	--	--	--	6	--	7	--	--	--	--
13.	Sewage Line above Magi	--	--	--	--	13	--	--	109	--	--	--	--
14.	Sewage Line below Magi	--	--	--	--	260	--	--	--	--	--	--	--
15.	Oroville City Well	--	--	--	--	--	--	9	--	--	--	--	--
16.	Okanogan City Well	--	--	--	--	--	--	--	--	--	77	ND	ND
17.	Omak City Well	--	--	--	--	--	--	--	--	--	91	ND	ND
18.	Pateros City Well	--	--	--	--	--	--	--	--	--	ND	ND	ND

1/ ND = None Detected
* also indicated no DPA
** also indicated no SOPP

STATE OF
WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

MEMORANDUM

October 20, 1978

To: John Bernhardt

From: Chuck Cline

Re: Brewster Ground Water Program

In regards to the possibility of contamination of Brewster city well #3 (up the hill from Brewster) by leachate from apple packing warehouses downslope, it would appear unlikely that such would be the case. The general ground-water flow in this area would be in a southerly or southeasterly direction and any contaminating plume of phenols from the apple packing plant would tend to be elongate in the south or southeast direction. A minor portion of the plume would perhaps be slightly up-gradient but not enough to contaminate a well one-third of a mile away. Pumping the well for a long period would bias the plume in the northerly direction, however well #3 is an auxiliary supply used only when the primary wells along the river cannot supply adequate amounts of water for the town. Well #3, when first tested, was pumped at the rate of 800 gallons per minute (gpm) for 50 days resulting in a water level drawdown of approximately 20 feet after one hour of pumping. No further water level decrease was recorded during the 50 days of testing. This would indicate that recharge equalled discharge after one hour of pumping 800 gpm, stress of the aquifer did not go beyond one hour and the chance of contamination from a source beyond the cone of depression would be unlikely.

Contamination of wells down-gradient of the packing plant is a possibility, however. Shallow wells deriving their water from alluvial or glacial outwash sand and gravel aquifers are more susceptible to contamination than are the deeper wells. The presence of orchards in the area also increases the chance of contamination, considering the number of years herbicides and pesticides have been applied to these orchards and the increased saturation and runoff of irrigation.

CC:ee

cc: Clar Pratt
Lawrence Ashley

ENCLOSURE 1

LITERATURE CITED

_____, 1976. *Quality Criteria for Water*, U.S. Environmental Protection Agency, Report No. EPA-440/9-76-023, 347-52 pp.