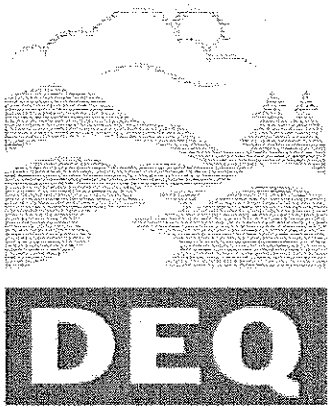
EQCMeeting2of2DOC19841214

12/14/1984

OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS



State of Oregon
Department of Environmental Quality

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

Mailing Address: BOX 1760, PORTLAND, OR 97207
522 SOUTHWEST 5th AVENUE, PORTLAND, OR 97204 PHONE (503) 229-5696

MEMORANDUM

To: Environmental Quality Commission

From: Director

Subject: Agenda Item No. J, December 14, 1984, EQC Meeting

Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County Pursuant to the Provisions of ORS 454.275 et seq. - Summary and Evaluation of Hearing Record

Background

On August 30, 1984, the Commission conducted a hearing at Parkrose High School as part of the process to determine whether a threat to drinking water (as defined in ORS 454.275) exists in an area in Mid-Multnomah County. The hearing was continued and concluded on September 11, 1984, in the DEQ conference room with Commissioner Denecke acting as the Hearings Officer. Written testimony, postmarked September 11, 1984, was accepted for the record.

The Department has summarized and evaluated the Hearing Record. The Department's report is attached.

Requirements for Commission Action

The statute appears to direct the Commission to do the following:

1. Make preliminary findings and recommendations.

2. Publish notice of its findings and recommendations.

3. Allow 15 days for people to petition the Commission to make oral or written arguments on the proposed findings and recommendations.

4. Hear and consider arguments (upon petition).

5. Adopt final findings and recommendations and issue a Final Order. [ORS 454.300.]

Department Evaluation and Conclusion

The Department's evaluation of the record, as reflected in the attached report, focuses on 8 questions or issues that Commission must consider and address.

The questions and the Department's conclusions based on analysis of the record, are as follows:

1. DOES MORE THAN 50 PERCENT OF THE AFFECTED AREA CONSIST OF RAPIDLY DRAINING SOILS?

   The hearing record shows that over 80 percent of the soils in the affected area are rapidly draining.

2. IS THE GROUNDWATER UNDERLYING THE AFFECTED AREA USED FOR DRINKING WATER OR CAN IT BE USED FOR DRINKING WATER?

   The hearing record shows that the groundwater in the Mid-Multnomah County water table aquifer and deeper aquifers underlying the affected area is used and can be used for drinking water.

3. IS MORE THAN 50 PERCENT OF THE SEWAGE IN THE AFFECTED AREA DISCHARGED INTO CESSPOOLS, SEPTIC TANKS, OR SEEPAGE PITS AND DOES THE SEWAGE CONTAIN BIOLOGICAL, CHEMICAL, PHYSICAL, OR RADIOLOGICAL AGENTS THAT CAN MAKE WATER UNFIT FOR HUMAN CONSUMPTION?

   The hearing record shows that more than 80 percent of the sewage in the affected area is discharged into cesspools, septic tanks, or seepage pits. The hearing record further shows that sewage contains microorganisms and organic and inorganic chemicals that can make water unfit for human consumption.

4. DOES ANALYSIS OF SAMPLES OF GROUNDWATER FROM WELLS PRODUCING WATER THAT MAY BE USED FOR HUMAN CONSUMPTION IN THE AFFECTED AREA CONTAIN LEVELS OF ONE OR MORE BIOLOGICAL, CHEMICAL, PHYSICAL OR RADIOLOGICAL CONTAMINANTS WHICH, IF ALLOWED TO INCREASE AT HISTORICAL RATES, WOULD PRODUCE A RISK TO HUMAN HEALTH AS DETERMINED BY THE LOCAL HEALTH OFFICER? ARE SUCH CONTAMINANT LEVELS IN EXCESS OF 50 PERCENT OF THE MAXIMUM ALLOWABLE LIMITS SET IN ACCORDANCE WITH THE FEDERAL SAFE DRINKING WATER ACT?

   Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contain levels of the contaminant nitrate-nitrogen in excess of 50 percent of the U.S. EPA drinking water standard. Nitrate-nitrogen levels, in fact, are in the range of 60 to 70 percent of the U.S. EPA drinking water standard. In addition, total dissolved solids levels are at 48 percent of the U.S. EPA secondary drinking water standard.

   Sufficient data and information is not available in the record to establish a trend and determine whether contaminant levels are increasing, decreasing, or staying the same. If population in the affected area is allowed to increase as projected, using cesspools for sewage disposal, higher contaminant levels would be expected.

   The levels of nitrate-nitrogen (NO_3-N) and organics being observed in the groundwater today pose some level of risk to health.

The Multnomah County Health Officer (A28) has stated that there appears to be a positive increasing trend and that the groundwater does have high levels of health threatening human and industrial waste contamination.

5. BASED ON QUESTIONS 1 THROUGH 4 ABOVE, DOES A THREAT TO DRINKING WATER EXIST IN THE AFFECTED AREA?

Based on the above information, a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions cited, conditions (a), (b), and (c), are found to exist.

6. IF A THREAT TO DRINKING WATER IS FOUND TO EXIST, ARE THE BOUNDARIES OF THE AFFECTED AREA APPROPRIATE, OR SHOULD THE BOUNDARY BE MODIFIED TO DELETE AREA OR INCLUDE ADDITIONAL AREA?

The affected area boundary established by the local governing bodies in the Threat to Drinking Water Findings, June 1984 (B3b2), encompasses the problem area of Mid-Multnomah County where sewage is disposed of to cesspool and seepage pit systems. No justification for modification of boundaries has been established.

7. CAN THE CONDITIONS (THREAT TO DRINKING WATER) IN THE AFFECTED AREA BE ELIMINATED OR ALLEVIATED BY TREATMENT WORKS?

The facilities proposed by the local governing bodies are treatment works within the meaning of ORS 454.275.

The treatment works can eliminate or alleviate the relevant conditions in the affected area that result in the finding of a threat to drinking water. The proposals of the local governing bodies do not establish deadlines for construction of facilities to eliminate all sewage discharges into cesspools, septic tanks, or seepage pits. The proposals do not assure elimination of all cesspools, septic tanks, or seepage pits. Thus the proposals do not provide assurance that the conditions in the affected area that result in the finding of a threat to drinking water will be eliminated or alleviated.

8. ARE THE TREATMENT WORKS PROPOSED BY THE GOVERNING BODIES THE MOST ECONOMICAL METHOD TO ALLEVIATE THE CONDITIONS (THREAT TO DRINKING WATER)?

The treatment works proposed by the local governing bodies are the only alternative that: (1) meets the definition of treatment works contained in ORS 454.275; and (2) can eliminate or alleviate the conditions which result in a finding of a threat to drinking water; and (3) can be implemented in the area; and (4) are consistent with the adopted regional waste treatment management plan.

Cost information and financing alternatives are preliminary and very general. Estimates of costs to homeowners are lacking. Affordable options for financing of homeowner costs are not addressed.

The Department identified and discussed in the report, 3 alternatives for Commission action based on these conclusions as follows:

1. Proceed immediately to adopt findings, recommendations, and a final order pursuant to ORS 454.300, 454.305(2), and 454.310.

   This alternative would result in adoption of findings of a threat to drinking water and issuance of a final order to implement proposals and construct treatment works.

2. Proceed immediately to adopt findings, recommendations, and an order pursuant to ORS 454.300, and 454.305(5).

   This alternative would result in (a) adoption of findings of a threat to drinking water and the need for construction of treatment works; (b) rejection of the submitted plan as incomplete; and (c) issuance of an order directing the local governing bodies to submit revised plans and additional information.

3. Delay adoption of findings and recommendations, request additional information from the local governing bodies based on guidance from the Commission, and reconvene the hearing.

   This alternative would result in direction to the local governing bodies to submit revised plans and information prior to reconvening the hearing on the matter. Following the reconvened hearing, findings and recommendations would be adopted and an order entered pursuant to the statutory process set forth in ORS 454.300 and 454.305.

All three alternatives are based on the conclusion that sufficient information exists in the present record to find that a threat to drinking water as defined in ORS 454.275(5) exists in the affected area, that the boundaries are appropriately described, and that construction of treatment works is necessary to alleviate the conditions in the affected area.

All three alternatives anticipate direction from the Commission regarding a deadline for completing construction of treatment works so as to eliminate the existing cesspool sewage disposal systems in the affected area. The local governing bodies have proposed to complete major trunk, interceptor, and treatment facilities necessary to serve the affected area over a 20-year period, but have proposed no timeframe for construction of all collection sewers and connection of existing structures to the sewers. The local governing bodies expect the Commission to determine how fast the sewage discharge to the groundwater must be eliminated.

The Department is familiar with the magnitude of the construction job involved, the time it takes to complete plans, complete financing arrangements, get project phases organized, bid, constructed, completed, cleaned up, and house connections completed. The Department would recommend that 20 years is a reasonable time limit for completion of all treatment works and elimination of all existing cesspool and seepage pit sewage disposal systems in the affected area.

Alternatives 2 and 3 would require establishment of a deadline for development and submittal of additional information for the record by the local governing bodies. It is desirable to move as rapidly as possible but still allow adequate time to develop the needed information. The Department would recommend that 6 months be allowed in either alternative. Under Alternative 2, the 6 months would begin after issuance of the interim order--a process that will be expected to take 2 to 3 months to complete. Thus the elapsed time would be more like 9 months before the process to issue final findings and an order could be initiated. Under Alternative 3, the 6-month period would begin immediately upon Commission action.

Director's Recommendation

It is recommended that the Commission proceed to implement Alternative 3 as follows:

1. Review the staff evaluation of the record, and preliminarily conclude that:

    a. A threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions necessary to find a threat to drinking water conditions (a), (b), and (c), exist in the affected area;

    b. The affected area as defined by the local governing bodies is appropriate and should not be modified;

    c. Construction of treatment works is necessary to alleviate the conditions in the affected area that result in a finding of a threat to drinking water;

    d. Additional information is needed before findings and recommendations can be adopted.

2. Delay adoption of findings and recommendations until additional information is received.

3. Direct each of the affected local governing bodies to develop and submit by no later than July 1, 1985, information to address the following:

a. Revised treatment works plans, specific schedules, and implementation programs to provide assurance that all discharges of sewage to the groundwater from cesspools or seepage pits in the affected area will be eliminated by no later than December 31, 2005.

b. Complete cost estimates for implementing the revised plan including a display of the total costs to be borne by typical residential and commercial property owners.

c. Equitable and affordable financing options for the costs to be borne by property owners.

4. Establish a date in July 1985 for reconvening the hearing to receive additional testimony on the revised plans and information submitted by the local governing bodies.

Fred Hansen

Attachments: 4

1. Proposal to Determine Whether a Threat to Drinking Water Exists in Mid-Multnomah County, Oregon - Evaluation of the Hearing Record

2. Summary of Oral Testimony from the Environmental Quality Commission Hearing Held at Parkrose High School on August 30, 1984

3. Summary of Oral Testimony from the Environmental Quality Commission Hearing Held in Room 1400 of the Yeon Building on September 11, 1984

4. Testimony received or postmarked after September 11, 1984.

HLS:l
TL3880
229-5324
December 3, 1984

PROPOSAL TO DETERMINE WHETHER A THREAT TO DRINKING WATER EXISTS IN MID-MULTNOMAH COUNTY, OREGON

Evaluation of Hearing Record
By
Department of Environmental Quality
November 18, 1984

On June 27, 1984, certified copies of formal resolutions were filed with the Environmental Quality Commission by the governing bodies of Multnomah County Central County Service District No. 3, the City of Gresham, and the City of Portland (B3b). The resolution of each governing body:

1. Adopted a sewerage facilities plan for providing sewer service to the area presently served by cesspools within it's ultimate sewer service boundary (as designated in the METRO Master Sewerage Plan) and submitted the plan to the Environmental Quality Commission (EQC) as directed by the EQC in OAR 340-71-335(2)(b); and

2. Adopted, pursuant to ORS 454.285, preliminary findings of a threat to drinking water; adopted boundaries of the affected area; and submitted the findings and boundaries to the Environmental Quality Commission for review and investigation, and to hold a public hearing to determine whether a threat to drinking water exists in the affected area.

Figure I displays the affected area. The area is divided into three sub-areas based on the sewage collection and treatment area designations identified in the Regional Sewerage Works Master Plan as adopted by METRO, and approved by the Environmental Quality Commission and the U.S. Environmental Protection Agency.

ORS 454.275 et. seq. establishes the procedure to be followed by the Environmental Quality Commission in response to the resolutions from the local governing bodies. This procedure is summarized as follows:

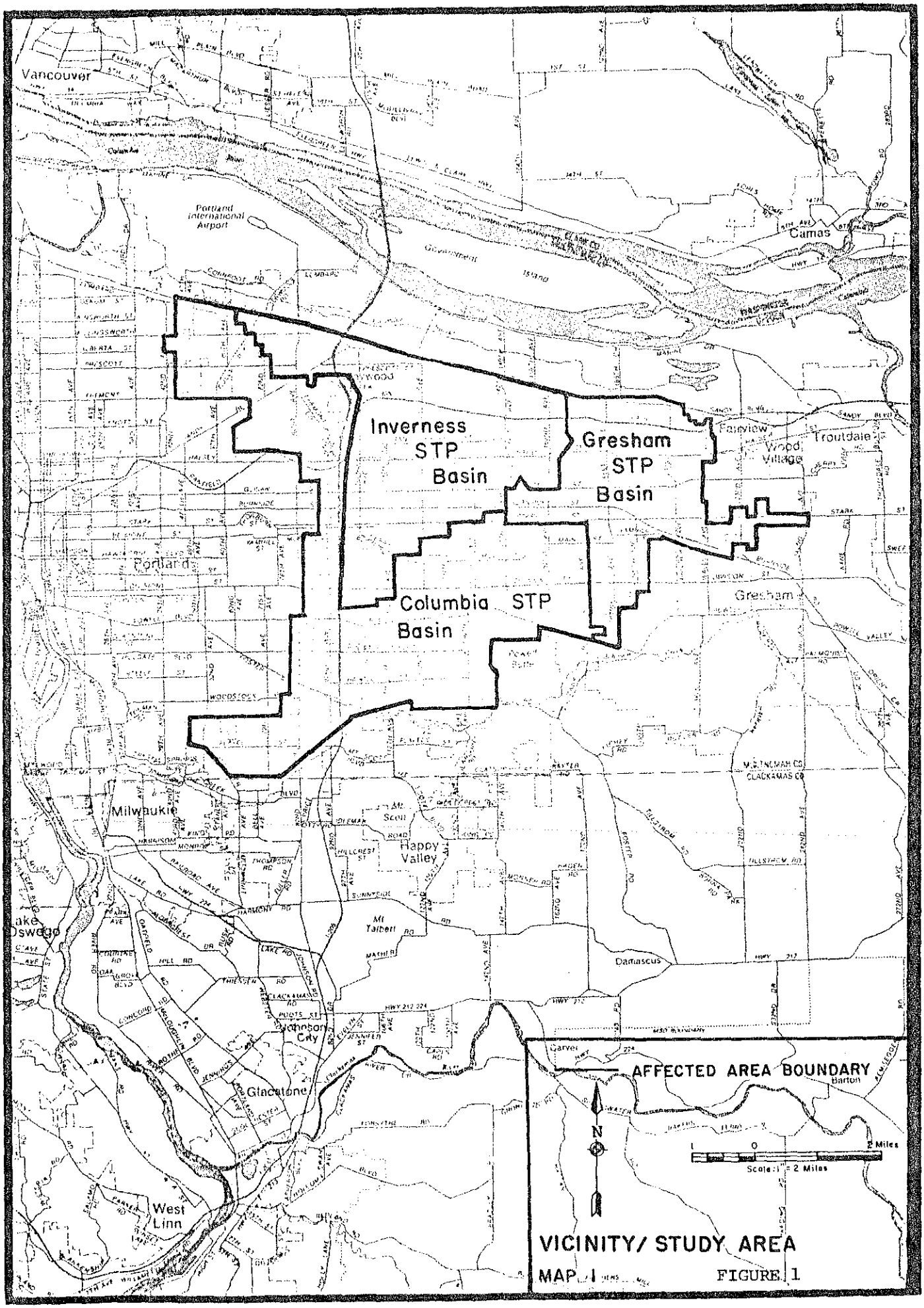
1. The EQC shall review and investigate conditions in the affected area. If substantial evidence reveals the existence of a threat to drinking water, the Commission shall set a time and place for a hearing on the resolution or ordinance. The hearing shall be held within or near the affected area not less than 50 days after the Commission completes its investigation. [ORS 454.295(1)]

2. The EQC shall publish notice of the time and place of the hearing in a newspaper of general circulation within the affected area once each week for two successive weeks beginning not less than four weeks before the date of the hearing. The EQC shall also give notice by such other means as it deems appropriate to give actual notice of the hearing. [ORS 454.295(2)]

Note: References to the hearing record are identified by document index reference shown in parenthesis, e.g. (B3b). The Document Index is attached as Exhibit A.

References to statutes or rules are shown in brackets, e.g. [ORS 454.295].

The Threat to Drinking Water Statute is attached as Exhibit B.


Vancouver
Portland International Airport
Columbia River
Camas
Inverness STP Basin
Gresham STP Basin
Columbia STP Basin
Fairview
Wood Village
Troutdale
Portland
Gresham
Milwaukie
Happy Valley
Mt Talbert
Damascus
Lake Oswego
Johnson City
Gladstone
West Linn
Clackamas Co
Multnomah Co
AFFECTED AREA BOUNDARY
N
1 0 2 Miles
Scale: 1" = 2 Miles
VICINITY/ STUDY AREA
MAP 1
FIGURE 1

3. At the hearing, any interested person shall have the opportunity to be heard or to present written testimony. [ORS 454.300(1)]

4. The hearing shall be for the purpose of determining:

   a. Whether a threat to drinking water exists in the affected area;

   b. Whether the conditions could be eliminated or alleviated by treatment works;

   c. Whether the proposed treatment works are the most economical method to alleviate the conditions. [ORS 454.300(1)]

5. If the EQC finds a threat to drinking water, the EQC must determine whether the boundaries of the affected area are appropriate or whether the boundaries should be modified to exclude area or include additional area. [ORS 454.305]

6. After the hearing, the EQC shall publish notice of issuance of its findings and recommendations in the newspaper used for notice of the hearing. The notice shall advise of opportunity to petition the EQC within 15 days of publication to present written or oral arguments on the findings and recommendations. [ORS 454.300]

7. If petition for arguments is received within 15 days of publication, the EQC shall set a time and place for argument. [ORS 454.300(2)]

8. The EQC, based on its findings, shall issue an order either;

   a. Terminating the Proceedings,

   b. Directing the governing body to proceed with construction of treatment works, or

   c. Referring the matter back to the governing body of the municipality to prepare alternative plans, specifications and financing methods. [ORS 454.305]

9. The EQC shall file its findings and order with the governing body of each affected municipality. [ORS 454.305(7)]

SCHEDULING OF HEARING

As required by the statute, the EQC reviewed and investigated conditions in the affected area. The Commission, at a special telephone conference meeting on July 10, 1984, found substantial evidence reveals a threat to drinking water (B3a). A hearing was authorized to be commenced on August 30, 1984.

NOTICE OF HEARING

Notice of the hearing was given by publication in the Oregonian on August 8, 1984. An amended legal notice of the hearing was published on August 11, 15, 22, 26, and 29, 1984.

The amended legal notice of the hearing was published in the Gresham Outlook on August 8, 11, 15, 22, 29, 1984. Notice was also mailed directly to known interested persons and organizations.

News articles regarding the subject of the hearing provide further evidence of notice of the hearing (B3c).

The first amended legal notice was published in the Oregonian 19 days before the hearing on August 30, 1984, and 30 days before the continuation hearing on September 11, 1984. Subsequent notices were published 15, 8, 4, and 1 days before the hearing on August 30, 1984; or 26, 19, 15, and 12 days before the continuation hearing on September 11, 1984.

The amended legal notice was published in the Gresham Outlook 22 days before the hearing on August 30, 1984 and 33 days before the continuation hearing on September 11, 1984. Subsequent notices were published 19, 15, 8, and 1 days before the hearing on August 30, 1984; or 30, 26, 19, and 12 days before the continuation hearing on September 11, 1984.

Written testimony was received at DEQ offices until September 11, 1984 at 5 p.m. Testimony postmarked on or before September 11, 1984, was also received.

The Oregonian and Gresham Outlook are papers of general circulation in the affected area.

The Department concludes that legal and actual notice of the hearing on August 30, 1984 with continuation and conclusion on September 11, 1984, was given as required by the statute.

HEARING

The hearing on August 30, 1984, was held at Parkrose High School cafetorium, 11717 N.E. Shaver Street, Portland, Oregon. The hearing began at 1 p.m. with Jim Petersen, Chairman of the EQC presiding. Commission members Denecke, Bishop, and Buist were present. Commissioner Brill was absent. The hearing continued until all in attendance who signed up to testify had been heard. The hearing recessed at about 5 p.m. and reconvened at about 6 p.m. The hearing was adjourned at about 10:30 p.m. A total of 62 people presented oral testimony. The hearing was tape recorded. Exhibits (B1-13) were received for the record. A staff summary of hearing testimony (A) was prepared.

The continuation of the hearing was held as scheduled on September 11, 1984. This hearing was held in Room 1400 of the Yeon Building, 522 S.W. 5th Avenue, Portland, Oregon, beginning at 10 a.m. Commissioner Arno Denecke was the hearings officer. The hearing continued until all wishing to testify had been heard. The hearing was adjourned about 11:30 a.m. A total of 18 people presented oral testimony. The hearing was tape recorded. Exhibits (D1-4) were received for the record. A staff summary of hearing testimony (C) was prepared.

Written testimony received up until 5 p.m. on September 11, 1984, or

postmarked September 11, 1984, was included in the record (E1-37). Additional written testimony was postmarked and received after the September 11, 1984 published deadline for closure of the record (F1-2). These documents have not been relied upon by the Department in preparation of this report. However, they will be available to the Environmental Quality Commission as a supplement to this report.

The Department concludes that interested persons have had an opportunity to be heard and to submit written testimony.

EVALUATION OF HEARING RECORD

The statute requires the Environmental Quality Commission to make specific findings in response to the hearing record. The statute in essence poses a series of questions or issues which the Commission findings must address. The questions or issues are as follows:

1. Does more than 50 percent of the affected area consist of rapidly draining soils?

2. Is the groundwater underlying the affected area used for drinking water or can it be used for drinking water?

3. Is more than 50 percent of the sewage in the affected area discharged into cesspools, septic tanks, or seepage pits, and does the sewage contain biological, chemical, physical, or radiological agents that can make water unfit for human consumption?

4. Does analysis of samples of groundwater from wells producing water that may be used for human comsumption in the affected area contain levels of one or more biological, chemical, physical, or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer? Are such contaminant levels in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act?

5. Based on questions 1 to 4 above, does a threat to drinking water exist in the affected area?

6. If a threat to drinking water is found to exist, are the boundaries of the affected area appropriate, or should the boundary be modified to delete area or include additional area?

7. Can the conditions (threat to drinking water) in the affected area be eliminated or alleviated by treatment works?

8. Are the treatment works proposed by the governing bodies the most economical method to alleviate the conditions (threat to drinking water)?

Department staff have reviewed and evaluated the record of the hearing with particular emphasis on the above questions. The evaluation which follows is organized to (a) present the question, (b) summarize the information from the record that relates to the question, (c) analyze the information presented, and (d) draw conclusions from the analysis.

1. DOES MORE THAN 50 PERCENT OF THE AFFECTED AREA CONSIST OF RAPIDLY DRAINING SOILS?

Summary of Significant Information from the Record

Providing Sewer Service to Mid-Multnomah County: Framework Plan. The East County Sanitary Sewer Consortium, June 1984 (B3b1). This plan presents findings that more than 85 percent of the affected area consists of rapidly draining soils, with a range of 70-90 percent on three designated drainage basins (Inverness, Gresham, and Columbia (includes Johnson Creek). This plan states that the highest percentage of rapidly draining soils are within the Inverness and Johnson Creek Basins. The findings are based on other reports, which are not specifically referenced or cited. However, there are several reports included in the bibliography of this plan which provide technical information on soils in Mid-Multnomah County.

Threat to Drinking Water Findings. The East County Sanitary Sewer Consortium, June 1984 (B3b2). This report includes a detailed discussion of the underlying soils and geology throughout the affected area. The report states that the discharge area for cesspools is the Portland terraces which are composed of highly permeable fluviolacustrine deposits. The report also states that the underlying geology is a series of fluviolacustrine and alluvial sand, gravel, silt, and clay deposits. The report presents findings that "Over 85% of the affected areas consist of rapidly draining soils. The range is from over 70% in Gresham's drainage basin to over 90% in both Inverness and Columbia drainage basins." The report includes references to soils and geology studies.

Groundwater Exploratory Program, April 1977, City of Portland Bureau of Water Works (E26i). This report cited explores the feasibility of using groundwater in Mid-Multnomah County as a water supply source for the City of Portland. The fluviolacustrine and younger alluvial deposits which underlay the affected area are discussed on pages 48-49 of the April 1977 report. Both of these deposits are described as rapidly draining.

Groundwater in the East Portland Area, U.S. Geological Survey Water Supply Paper 1793, 1965 (E261). This paper is a basic technical document prepared by the U.S. Geological Survey. It describes the geology and groundwater in the area bordered on the north by the Columbia River, east by the Sandy River, west by the Willamette River, and south by the Clackamas River. The report provides geologic maps which contain the entire "affected area" boundary. These maps show that approximately 90 percent of the "affected area" is underlain by fluviolacustrine deposits. These are unconsolidated gravel, sand, silt, and clay, which are relatively coarse grained in the northeastern part of the area, to finer grained consisting most of clay, silt and sand, near the Willamette River.

The remaining formations in the affected area include the Boring Lava and Troutdale Formations. The Troutdale aquifers are a prime source of drinking water; the Boring Lava Formation is of low permeability.

Soil Survey of Multnomah County, Oregon, Soil Conservation Service, August 1983 (E26m). This report depicts major soil types in Multnomah County. The "affected area" is dominated by the Multnomah-Latourell-Urban Land complex soil units which are well drained loams and moderately well drained silt loams. Soils in the technical literature are distinguished by their location on the land surface.

William H. Young, Director, Water Resources Department (E29), submitted written testimony that reviews the information transmitted by the governing bodies with their resolutions. He agrees with the information presented in the Mid-Multnomah County Framework Plan. The Department mentioned that it had been concerned since the late 1950s about "The widespread practice of subsurface disposal of domestic sewage into the highly permeable gravel aquifers . . ."

ORS Chapters 454 and 468, 1983 (E26c). ORS Chapter 468 establishes the basis for water pollution control and protection of water quality. ORS 468.700(8) defines waters of the state to include "underground waters." ORS 468.710, 468.715, and 468.720 establish policies for protection of waters of the state, and prohibit pollution of such waters.

ORS Chapter 454 contains the statutory language for finding a threat to drinking water as well as statutes regarding on-site (subsurface) sewage disposal and the definitions for a cesspool, seepage pit and septic tank.

Oregon Administrative Rules Chapter 340, Division 41 (E26e). The General Groundwater Protection Policy [OAR 340-41-029] provides the administrative basis for protection of groundwater quality. Section 2 of the rule states that "For areas where urban density development is planned or is occurring and where rapidly draining soils overlay local groundwater flow systems and their associated water table aquifer, the collection, treatment and disposal of sewage, industrial wastes and leachates from landfills will be deemed highest and best practicable treatment and control." Section 3 of the rule gives the procedure for implementing pollution abatement strategies to restore high quality groundwater.

Virginia Punky (C6) questioned whether the soils in the area were rapidly draining and stated there was a need for more information to be gathered on the ability of soil to reduce pollutants.

> In addition to the specifically referenced documents, several people testified and several documents were submitted to the record that contained general comments and references that the soils in East Multnomah County were rapidly draining. Most of this testimony was general comments on whether the statutory conditions existed in the affected area. Some people referred to the technical information submitted by the jurisdictions in the Threat to Drinking Water Reports to support their comments. Others did not provide technical data or references but supported their comments with personal experience. (A6, A19, B3a6, B3a17, E27)

Analysis of Information Presented

Significant information in the hearing record supports the conclusion that more than 50 percent of the affected area consists of rapidly draining soils. In particular, reports by the U.S. Geological Survey (E261) and the U.S. Soil Conservation Service (E26m), provide detailed descriptions of the affected area geology and soils.

The USGS report (E261) is a technical document depicting geology and groundwater in the area bounded on the north by the Columbia River, east by the Sandy River, west by the Willamette River, and south by the Clackamas River. The report provides geologic maps which contain the entire affected area boundary. These maps show that approximately 90 percent of the affected area is underlain by fluviolacustrine deposits. These are unconsolidated gravel, sand, silt, and clay which grades from relatively coarse grained deposits in the northeastern part of the area to finer grained deposits consisting mostly of clay, silt and sand near the Willamette River.

> "The fluviolacustrine deposits greatly facilitate the recharge of ground-water reservoirs in parts of the area. The materials are generally porous and permeable, and precipitation that falls upon surfaces underlain by them readily percolates downward, rather than escaping as surface runoff. Except for a few minor streams, there is no surface drainage from the Portland terraces, although this area receives adequate precipitation, mostly during the winter months when evaporation losses are low. In this part of the area, much of the precipitation that infiltrates the surface materials percolates downward into the gravels of the Troutdale Formation."
> (E261 - page 28)

The SCS Report (E26m) depicts major soil types in Multnomah County and indicates that the affected area is generally covered by well to moderately well drained loams and silt loams.

It should be noted that in the technical literature soils are vertically divided into specific zones or "horizons". The surface soil is that material which would normally extend down through the A-B horizons or root zone and it generally contains a higher percentage of silt clay and organic matter. The subsurface soils extend down through the C-D horizons (geologic strata) to the bedrock. Because the cesspool is installed within the subsurface soils, the physical characteristics of the C-D horizons (geologic strata) are very important. The SCS and USGS reports both described this material as rapidly draining and extending eventually throughout the entire affected area.

The "Threat to Drinking Water Findings" (B3b2) describe the underlying geology as highly permeable fluviolacustrine and alluvium deposits. The report presents findings that "Over 85% of the affected areas consist of these rapidly draining soils. The range is from over 70% in Gresham's drainage basin to over 98% in both Inverness and Columbia drainage basins."

Several people offered general comments and submitted general reference documents to the record that stated the soils in Mid-Multnomah County were rapidly draining and that the cesspools discharge into fluviolacustrine deposits (A6, A19, B3a6, B3a17, E27, E26). Some people referred to technical information submitted by the local and state governments in the "Threat to Drinking Water Report" to support their comments. Others cited knowledge that they have gained through personal experience. The Oregon Water Resources Department (E29), for example, stated that it had been concerned since the late 1950s about "The widespread practice of subsurface disposal of domestic sewage into the highly permeable gravel aquifer."

Although one person (C6) questioned the rapidly draining nature of soils in the area, no documented evidence was submitted to dispute the rapidly draining nature of soils in the area.

Conclusion

The hearing record shows that over 80 percent of the soils in the affected area are rapidly draining.

2. IS THE GROUNDWATER UNDERLYING THE AFFECTED AREA USED FOR DRINKING WATER OR CAN IT BE USED FOR DRINKING WATER?

Summary of Significant Information from the Record

Sewerage Disposal in East Multnomah County: States Report and Proposed Action Regarding On-Site Systems. EQC Staff Report, March 1982 (B3a15). This report describes the capability of the aquifer underlying Mid-Multnomah County to provide 80 to 100 million gallons per day of drinking water on a sustained basis. It also states that some of the cities and water districts presently use the aquifer as a source of drinking water.

Providing Sewer Service to Mid-Multnomah County: Framework Plan. The East County Sanitary Sewer Consortium, June 1984 (B3b1). This basic sewer service framework plan for Mid-Multnomah County states that nine public water systems and an undetermined number of private water wells currently draw drinking water from the groundwater aquifer underlying Mid-Multnomah County.

Threat to Drinking Water Findings. The East County Sanitary Sewer Consortium, June 1984 (B3b2). This report provides the detailed information to support the finding of threat to drinking water action. The report concludes that the groundwater underlying the affected areas can be used for drinking water. At least nine pubic water systems (Hazelwood, Parkrose, Richland, Rockwood, City of Portland, Gilbert, Wood Village, Troutdale, and Fairview) and an undetermined number of private wells draw from the aquifers underlying the affected areas.

Jeanne Orcutt (D3b) presented copies of City Ordinances that allow the Portland Water Bureau to sell Bull Run water to the Region's Water Districts. She also presented documents showing Water District consumption of Bull Run water for which the City charged the Districts. This information was presented to show that the local water districts were depending less on groundwater and using more surface water, specifically water from the Bull Run reservoir.

Dr. Schade (A28) stated, in response to a question as to whether the affected area met the statutory criteria to declare a threat to drinking water, stated that the groundwater is used for drinking water.

William H. Young. Director, Water Resources Department (E29), submitted written testimony which reviewed the hydrogeologic data and information from the Mid-Multnomah County area. This review included an analysis of "public water supply wells" in the affected area. The Water Resources Department also supports the implementation of improved waste disposal practices to protect the aquifer groundwater supply capability.

Joseph L. Miller, Jr., M.D. (B11) submitted written testimony which concludes that the groundwater sources presently being developed for drinking water are likely to become polluted. The major emphasis of his testimony, however, is to expand development of surface water sources particularly the Little Sandy River.

Joseph Miller, M.D. (A50) recommended that a consultant be hired to study the groundwater situation because a Corps report suggested that upper aquifer contamination could be drawn into the deeper aquifer if developed by Portland.

Earl Blumenauer, Multnomah County Commissioner (E16) submitted written testimony which identifies the East County groundwater system as "a precious source of drinking water." He also points out that it is no longer just an East County concern, but since Portland is planning to use the groundwater as a supplemental drinking water supply, it is an areawide concern.

Groundwater Exploratory Program, City of Portland, Bureau of Water Works, April 1977 (E26i). This Portland Bureau of Water Works publication describes the city's groundwater exploratory program. It provides technical information on the availability of groundwater for public drinking water. Portland wants to develop a second water source for additional capacity during days of peak demand that will increase the reliability of the Bull Run system in case of natural disaster. The city wants to develop the groundwater in Mid-Multnomah County as the backup water supply system. On page 6 of this report there is a discussion of the groundwater supply capability in Mid-Multnomah County. The report states that it is feasible to develop 100 mgd from the groundwater in this area.

Pilot Well Study, City of Portland Bureau of Water Works, November 1978 (E26i). This report provides detailed geologic information on the aquifers underlying Mid-Multnomah County. The report (pages 27-77) provides hydrologic and water quality information on the multiple aquifers underlying the area and their capability to provide adequate volumes of good quality water. Information is also provided on how pumping one aquifer affects the recharge into and discharge from surrounding aquifers.

Kristine M. Gebbie, Administrator, Health Division, (E28) submitted written testimony which describes the problem as it impacts the groundwater drinking supplies. This letter states that the data presented in the Threat to Drinking Water Findings (B3b2) regarding extent of use of groundwater by various water districts is accurate.

Bob Bledsoe (B5) discussed drinking water in the region. He stated that the Gilbert, Richland, and Parkrose Water Districts are on wells but the Parkrose system will shortly be going over to Bull Run water. He felt that surface water sources were going to be the dominant source in the future.

General hearing comments were received on the use of groundwater for drinking water. The comments were not so much about whether the groundwater was or was not being used for drinking water or could be used, but whether there was another source (Bull Run Reservoir and the Little Sandy River) which could be used instead of groundwater. In this discussion, several people testified that many of the water districts were now buying City of Portland water and using less groundwater. In the case of the Parkrose District, this means a one hundred percent change to Bull Run water.
(D4, D3b, B11, E16, E30b1, E28, E29)

No factual information was received that states the groundwater was not used or could not be used as a source of drinking water.

Analysis of Information Presented

The information provided in the record clearly identifies that the groundwater in the affected area is currently used for drinking water and has potential for use as drinking water.

The Environmental Quality Commission staff report (B3a15) describes the capability of the aquifer underlying Mid-Multnomah County to provide 80 to 100 million gallons per day on a sustained basis. It also states that some of the cities and water districts presently use the aquifer. The "Threat to Drinking Water Findings" (B3b2), identifies current drinking water usage and the future potential. The City of Portland (E26i) identified considerable potential for drinking water in reports completed in 1977 and 1978 respectively. Based on these reports, Portland concluded that the groundwater in Mid-Multnomah County was a viable backup water supply for the city.

During the past few years Portland has proceeded with the development of an extensive water supply well field in the northern portion of Mid-Multnomah County. Portland has drilled more than 19 wells in the area north of the affected area. These wells are intended for use as a backup water supply for the City of Portland and the suburban districts and cities it supplies. These wells are installed to draw water from the deeper strata or aquifers. They are specifically constructed to exclude tapping water from the shallowest zone (referred to as the water table aquifer) because of the measured pollutant levels in that aquifer. Geologic studies suggest that the water table aquifer and the deeper aquifers are separated. However, there is no assurance that water from the water table aquifer will not be drawn into the deeper strata upon heavy pumping of the deeper aquifers. In fact, the city's Pilot Well Study (E26i - page 75) states:

> "The formation layers that separate the Troutdale Gravel, Troutdale Sandstone and Sandy River Mudstone Aquifers, and also the material which lies under the Sandy River Mudstone Aquifer, were found to be more permeable in the northeasterly portion of the study area than previously concluded. The resultant effect of the higher permeability

> of these semi-confining layers is to permit greater interaquifer transfer of water during the operation of wells, and to increase the estimated capacity of the Sandy River Mudstone Aquifer at the expense of the overlying Troutdale Sandstone Aquifer."

In addition to the public water supply wells in Mid-Multnomah County, there are a number of private individuals who utilize the groundwater. In fact, the right to utilize the groundwater for specific purposes and amounts is expressly identified and protected in state law.

ORS 537.545 states that:

> "No registration, certificate of registration, application for a permit, permit, certificate of completion or ground water right certificate under ORS 537.505 to 537.795 is required for the use of ground water for stockwatering proposes, for watering any lawn or noncommercial garden not exceeding one-half acre in area, for single or group domestic purposes in an amount not exceeding 15,000 gallons a day or for any single industrial or commercial purpose in an amount not exceeding 5,000 gallons a day. The use of ground water for any such purpose, to the extent that it is beneficial, constitutes a right to appropriate ground water equal to that established by a ground water right certificate issued under ORS 537.700. The Water Resources Director, however, may require any person or public agency using ground water for any such purpose to furnish information with regard to such ground water and the use thereof."

Under this law, an individual has a right to use the groundwater for the purposes and in the amounts listed above. An unknown number of individuals in Mid-Multnomah County have exercised this right.

The Department of Environmental Quality also has first hand knowledge that the groundwater is used for drinking water because it has sampled both private and public wells on several occasions over the past 11 years.

No factual information was submitted which would dispute whether the groundwater is used or could be used for drinking water. However, several people testified that the most reliable source of drinking water was the City of Portland's Bull Run Reservoir and that water districts should not be using the groundwater. Bob Bledsoe (B5) stated that Gilbert, Richland, and Parkrose Water Districts are on wells but the Parkrose system will shortly be going over to Bull Run Water.

Conclusion

The hearing record shows that the groundwater in the Mid-Multnomah County water table aquifer and deeper aquifers underlying the affected area is used and can be used for drinking water.

3. IS MORE THAN 50 PERCENT OF THE SEWAGE IN THE AFFECTED AREA DISCHARGED INTO CESSPOOLS, SEPTIC TANKS, OR SEEPAGE PITS AND DOES THE SEWAGE CONTAIN BIOLOGICAL, CHEMICAL, PHYSICAL, OR RADIOLOGICAL AGENTS THAT CAN MAKE WATER UNFIT FOR HUMAN CONSUMPTION?

Summary of Significant Information from this Record.

Dr. Charles P. Schade, Multnomah County Health Officer (A28) concurred in information presented at the hearing that 50 percent or more of the sewage flow in the affected area is discharged to cesspools. Dr. Schade also stated in response to questions that sewage contained agents which would make the groundwater unfit for consumption.

Multnomah County Groundwater Aquifer--Status Report, EQC Staff Report, February 1978 (B3A5). This report describes the Central Multnomah County area as an area of approximately 30 square miles where development has occurred over the past 30-50 years utilizing in individual on-site sewage disposal systems, predominantly cesspools.

Providing Sewer Service to Mid-Multnomah County: Framework Plan, The East County Sanitary Sewer Consortium, June 1984 (B3b1). The framework plan states that there are approximately 65,000 homes and apartments in the affected area which, together with schools and hospitals, discharge an estimated 14 million gallons of sewage flow a day. Over 90 percent of the discharge is put into cesspools.

Threat to Drinking Water Findings, The East County Sanitary Sewer Consortium, June 1984 (B3b2). This is the East County Sewer Consortium's detailed presentation of fact regarding the potential threat to drinking water. There are three subbasins within the affected area including the entire Inverness Basin and portions of the Columbia (including Johnson Creek) and Gresham Basins. The table below provides a distribution of population in the affected area and the percent which is unsewered and therefore discharging sewage into cesspools, septic tanks, or seepage pits.

Basin	Population			Sewage Flow (MGD)		
	Total	Unsewered	%	Total	Unsewered	%
Inverness	36,000	30,600	85	4.5	3.8	84
Columbia	88,000	81,700	93	8.8	8.2	93
Gresham	24,000	17,700	68	3.3	2.3	70
TOTAL	150,000	130,000	87	16.6	14.3	86

The population estimates were taken from 1980 U.S. Census tract data. The Consortium also determined the number of other facilities such as hospitals, libraries, schools, other public service buildings, and businesses which were in the basin and identified the waste inputs and disposal systems.

Paul Yarborough, Director, Department of Environmental Services, Multnomah County, (E27) submitted written testimony which describes the use of cesspools in the affected area. He states "there are approximately 56,000 cesspools in the affected area."

Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County, EQC Staff Report, June 1984 (B3a19). This report describes the sewage discharged into cesspools, septic tanks, or seepage pits. Attachment V to the report identifies some of the biological, chemical, and physical agents in sewage that would make water unfit for human consumption.

John Lang, Director Public Works Department, in his testimony (A6) before the Commission, stated that the Consortium had examined statutory Condition 3, "is more than 50 percent of the sewage in the affected area discharged into cesspools, septic tanks, or seepage pits and does the sewage contain biological, chemical, physical, or radiological agents that can make water unfit for consumption," and believes the condition has been met.

Oregon Administrative Rules (E26e). This document contains the State Administrative Rules for Cesspools and Seepage Pits, OAR 340-71-335. It establishes a statewide prohibition on the use of cesspools except in Multnomah County where a specific schedule was established for phasing out cesspool use. The schedule included a July 1, 1984 date for submittal of plans to sewer the cesspool area and a January 1, 1985 date for prohibition of cesspools in Multnomah County.

Final Report Oregon On-Site Experimental System Program, DEQ, December 1982 (E26j). This technical report provides information on the content of septic tank effluent, including biological oxygen demand, nitrates, fecal coliform and total coliform. Effluent from cesspools contain similar constituents, with higher values.

Mary Ellis (E17) presented general testimony on the extensive use of on-site systems in her area.

Kristine Gebbie, Administrator, Health Division, (E29) submitted written testimony which supports sewering the affected area. She believes that continued disposal of untreated subsurface sewage will result in high levels of volatile organic chemicals and nitrates and unless reversed, the situation will become an increasing hazard to human health.

Sources of Toxic Compounds in Household Wastewater,
Steven W. Hathaway, U.S. Environmental Protection Agency, Cincinnati, Ohio (E26q). This technical paper describes the sources of toxic compounds found in wastes that discharge from the typical household.

William E. Morton, M.D., Oregon Health Sciences University (E36, B9) submitted written testimony which states that there are many texts and journals in public health and environmental sciences which endlessly document the need for safe sewage disposal, particularly in urban

areas as population densities increase, and the need for protection of groundwater from chemical and microbiological contamination. Dr. Morton also presented a written statement (B9) to the Environmental Quality Commission that states that:

> "throughout human history our ability to live in cities and large metropolitan areas has depended on our abilities to provide safe drinking water and to dispose safely of our own wastes. Before we understood how microorganisms and toxic chemicals could cause disease when allowed to contaminate drinking water, there were regular massive cycles of contamination-caused disease in urban populations whose waste disposal systems had been allowed to become inappropriate and over-taxed by increasing population density."

John C. Stoner, R.S., Oregon Water Treatment Certification Program (E37) submitted written testimony which described case studies in East Springfield and River Road-Santa Clara where inadequate on-site waste disposal practices resulted in serious health hazards. He described the situation in East Springfield where rapid development without the benefit of public sewers created one of the most serious public health hazard problems in Oregon, an epidemic of infectious hepatitis throughout Central Lane County in the 1950s. He also discussed a survey of communicable disease records in Lane County which showed conclusively that the rate of water and sewage-borne diseases in the unsewered area of River Road-Santa Clara was double the rate within the sewered area of Eugene, and how similar that area is to Mid-Multnomah County.

The Long Island Ground Water Pollution Study, State of New York Department of Health, April 1969 (E26r). This technical report describes how subsurface sewage disposal practices have lead to the gradual abandonment of a readily available and highly productive groundwater supply in Nassau County. The aquifer was the major available source of individual water supply for homes, commercial establishments, and some public water supply wells in the Nassau-Suffolk area. The report describes the problem of developing a deeper aquifer which poses the risk of increased transfer of contaminated water from the overlying aquifer. The report describes the contaminants found in sewage and how they rendered the water unusable. It states "Groundwater is highly vulnerable to pollution by untreated sewage wastes and possesses poor recuperative capabilities." There is also information provided which states that in areas of Nassau County which have been sewered, the quality of the upper aquifer is improving.

Mid-County Water Safety Needs Sewers, Dr. Charles Schade, Multnomah County Health officer (E23a). This article describes how the inadequate disposal of untreated sewage resulted in widespread human health concern in Oregon's waterways during the 1960s and 1970s. it also goes on to state that the discharge of untreated sewage into the groundwater of Mid-Multnomah County is analagous to what occurred in the surface water.

Harold Osterud, M.D., (E35) submitted written testimony that supports the findings of the Consortium and states that "gross pollution of groundwater from thousands of cesspools, [is] clearly and inevitably contaminating drinking water sources as outlined in the East County Sanitary Sewer Consortium publication." He further states that "the amount of sewage contaminating the groundwater table from 56,000 cesspools certainly presents a hazard to anyone using the water."

Dr. Osterud comments that the amount of sewage introduced to the groundwater table is a hazard to those using the water and that if current practices continue, the upper aquifer in Mid-Multnomah County will be destroyed.

Analysis of Information Presented

The information in the hearing record describes the sewage disposal practices utilized in the affected area. The Consortium report (B3b2) describes in detail the sewage disposal systems used in each of the three basins within the affected area. The report states that 86 percent of the sewage flow in the affected area is discharged to cesspools, seepage pits, and septic tanks with 14 percent collected and transported to sewage treatment facilities. Multnomah County, (E27) the agency with whom the Department has contracted with to provide the on-site waste disposal program in this county, has stated that there are approximately 56,000 cesspools in the affected area. Dr. Charles P. Schade, Multnomah County Health Officer (A28) concurred that 50 percent or more of the sewage flow in the affected area is discharged to cesspools. Several other individuals testified that the dominant waste disposal practice in the area is on-site systems.

Substantial information was submitted to the record supporting a conclusion that sewage does contain microorganisms and organic and inorganic chemicals that can make water unfit for human consumption. This included testimony from Kristine Gebbie, Health Division Administrator, (E28) Harold Osterud, M.D., (E35), William Morton, M.D. (E36, B9) John Stoner, R.S. (E37), Charles Schade, M.D. (A28, E23a), and the Long Island Study (E26r).

No information was presented in the hearing which disputes that "more than 50 percent of sewage in the affected area discharged into cesspools, septic tanks, or seepage pits and the sewage contains biological, chemical, physical, or radiological agents that can make water unfit for human consumption."

Conclusion

The hearing record shows that more than 80 percent of the sewage in the affected area is discharged into cesspools, septic tanks, or seepage pits. The hearing record further shows that sewage contains microorganisms and organic and inorganic chemicals that can make water unfit for human consumption.

4. DOES ANALYSIS OF SAMPLES OF GROUNDWATER FROM WELLS PRODUCING WATER THAT MAY BE USED FOR HUMAN CONSUMPTION IN THE AFFECTED AREA CONTAIN LEVELS OF ONE OR MORE BIOLOGICAL, CHEMICAL, PHYSICAL OR RADIOLOGICAL CONTAMINANTS WHICH, IF ALLOWED TO INCREASE AT HISTORICAL RATES, WOULD PRODUCE A RISK TO HUMAN HEALTH AS DETERMINED BY THE LOCAL HEALTH OFFICER? ARE SUCH CONTAMINANT LEVELS IN EXCESS OF 50 PERCENT OF THE MAXIMUM ALLOWABLE LIMITS SET IN ACCORDANCE WITH THE FEDERAL SAFE DRINKING WATER ACT?

Summary of Information from the Record

Dr. Charles P. Schade (A28) presented oral comments specifically directed towards the question of whether the groundwater from the wells in the affected area contain contaminants which if allowed to increase at historical rates would produce a health risk and whether levels exceed 50 percent of the federal drinking water standards. He stated that nitrate-nitrogen (NO_3-N) levels exceeded 50 percent of the drinking water standard and that this is a significant contamination level. He stated that based on an analysis of 10 years of data, there appears to be a positive increasing trend in nitrate-nitrogen (NO_3-N) contamination, but seasonal variations in the data limit its usefulness for trend analysis. He pointed out that groundwater data had only been systematically collected for the past 1 1/2 years. He is convinced that the groundwater does have high levels of health threatening human and industrial waste contamination. In response to a question on the 10 mg/l nitrate-nitrogen (NO_3-N) standard, Dr. Schade stated that there was very defensible empirical evidence (E33a-f) to support this standard.

Dr. William Morton (B9) noted that he was concerned about the increasing nitrate levels in the groundwater. His own research had indicated that increased blood pressure levels and associated health problems may be linked to nitrate levels. Dr. Morton also expressed concern over the health risk associated with nonbiodegradable chemicals and possible carcinogens that may enter the groundwater.

Environmental Quality Commission Agenda Item Q, February 24, 1978 EQC Meeting (B3a5) presents a background description of the Multnomah County groundwater problem. The report states that monitoring information revealed that nitrate-nitrogen (NO_3-N) levels in groundwater were elevated.

Mid-County Water Safety Needs Sewers, Dr. Charles P. Schade, Multnomah County Health Officer, The Oregonian, Tuesday, September 4, 1984 (E23a). In this article Dr. Schade describes the groundwater contamination in Mid-Multnomah County and the public health ramifications. Dr. Schade compared the threat to groundwater with the water pollution crisis in Oregon's rivers,

lakes, and streams in past years. He also discussed the health implications of high nitrate levels in drinking water and the need to change the unacceptable public health policy of dumping raw sewage into a drinking water source.

Department of Environmental Quality Mid-Multnomah County Data, 1974-1984 (E26a). This reference includes data collected from Mid-Multnomah County wells from 1974-1984. From July 1983 through July 1984, samples were taken on approximately a monthly basis from 10 wells. These samples were analyzed for inorganic or organic contaminants. The data shows that nitrate-nitrogen (NO_3-N) levels in the majority of samples from 8 wells are in excess of 5 mg/l (50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act). The highest level recorded was 7.5 mg/l. One well located on the southeast boundary of the affected area contains nitrate-nitrogen (NO_3-N) levels of 3.6 to 4.2 mg/l. The tenth well was the upgradient background well located at the southern edge of the affected area on the west slope of Powell Butte. This well shows nitrate-nitrogen (NO_3-N) levels of 0.6 mg/l.

Department of Environmental Quality Laboratory Quality Assurance Implementation (E26d). This document describes the quality assurance program for the laboratory. It identifies the standard water sample collection and analysis techniques and methods. Included in this document are those specific collection and analysis methods used for the Mid-Multnomah County groundwater data collection project.

Volatile Organic Chemicals, Department of Environmental Quality Staff Report, December 1, 1983 (E26p). This document describes a series of volatile organic chemicals tested for in groundwater in the affected area. It also describes what different concentration levels mean in terms of human health risk.

The U.S. Geological Survey, 1975-1976, Groundwater Quality Data in Mid-Multnomah County (E26b). The USGS collected groundwater quality samples in Mid-Multnomah County wells during 1975-1976. The sample analyses show that some nitrate-nitrogen (NO_3-N) levels are in excess of 50 percent of the Federal Drinking Water Standard.

Water Quality in Columbia Slough, Oregon, 1971-1973 Report (E26h). This report describes the Department of Environmental Quality early monitoring activities in Columbia Slough which lead to the conclusion that nitrate-nitrogen (NO_3-N) laden groundwater was discharging into the Slough resulting in extensive algae blooms. Data was collected and analyzed in the Slough and the groundwater to the south of the Slough.

Groundwater Exploratory Program, City of Portland, April 1977, Pilot Well Study, City of Portland, November 1978 (E26i). The City of Portland Bureau of Water Works completed two extensive hydrogeologic investigations of areas in Mid-Multnomah County during 1977 and 1978. These documents provide specific information on the groundwater in Mid-Multnomah County. The groundwater quality data presented in Plate 8 of the "Groundwater Exploratory Program" report shows nitrate-nitrogen (NO_3-N) levels exceeding 50 percent of the federal drinking water standard in some wells. The "Pilot Well Study" report also contains data which indicates that the groundwater in the affected area has nitrate-nitrogen (NO_3-N) levels that exceed 50 percent of the federal drinking water standard. This report also provides detailed information from pages 42-77 that describes the hydrogeologic characteristics of the major aquifers underlying the affected area. Specifically the discussion on pages 55-58 provides information on nitrate contamination of the aquifer from cesspools and its expected increasing trend for the future.

National Interim Primary Drinking Water Regulations (E26n). These regulations set the national standards for organic and inorganic parameters and microorganisms in public drinking water. The specific federal standards for nitrate-nitrogen (NO_3-N) and total dissolved solids are 10 mg/l and 500 mg/l respectively.

William H. Young, Director, Water Resources Department (E29) submitted written testimony that reviews the current groundwater data and states that it confirms the nitrate concentrations in the shallow aquifers increase in the direction of groundwater flow.

Mr. Young also stated that the source of the nitrate and the man-made organic chemicals clearly show the effect of on-site waste water disposal practices.

Subsurface Sewage Disposal and Contamination of Groundwater in East Portland, Oregon, E. L. Quan, H. R. Sweet, and J. R. Illian, 1974 (E30b3). This report presents background information on contamination of the Mid-Multnomah County water table aquifer by subsurface sewage disposal techniques. Pages 362-366 provide detailed information on groundwater contamination in the affected area.

Nitrate in Drinking Water, E. F. Winton, R. G. Tardiff, and L. J. McCabe, February 1971 (E30b4). This technical paper provides the basic public health implication from having high levels of nitrate in drinking water.

Frances Hyson (A32) stated that her shallow well was not contaminated according to lab tests which she has had done for 7 years.

Bob Bledsoe (B5) states that the Portland Water Bureau determined before drilling wells that the threat of contamination to the lower aquifer was negligible.

Lee Kennedy, Manager, Richland Water District (E25) submitted a written statement on the location, depth, and quality of the District's three wells. The water quality tests completed to date show no coliform contamination and the latest inorganic analysis are under EPA limits on these approximately 400 feet deep wells.

Mal Johnson (A14) testified that his drinking water had a very strong iodine smell and that all indications point to the need for sewers to eliminate both a health risk and a water quality problem.

Dr. Harold Osterud, Oregon Health Sciences Center (A20) stated how it was unfair that this one area (Mid-Multnomah County) was able to discharge their sewage into the public water supply. He was also concerned that the deeper aquifer may become polluted if the polluted shallow aquifer water was drawn into it.

John Lang, Director, Public Works Department, Portland (A6) testified that he felt Dr. Schade's testimony would show that contamination levels were in excess of 50 percent and show a positive trend exists in the affected area.

Environmental Quality Commission Meeting Minutes, June 25, 1976 (B3a4) discuss in general terms that the aggregate effect of thousands of cesspools in East Multnomah County had been an increase in nitrate concentrations in groundwater drinking water supplies.

Environmental Quality Commission Agenda Item K, March 5, 1982 (B3a15) generally describes the groundwater problem in East Multnomah County. The report states that studies have shown that upper levels of much of the aquifer are contaminated which has been verified by the increased levels of nitrate-nitrogen (NO_3-N).

Earl Blumenauer, Multnomah County Commissioner (E16) discusses the contamination in the groundwater and how it is a concern for present and future groundwater use. He testified that the Board of County Commissioners has recognized this to be a problem and has approved a plan which offers a solution.

Clatsop Plains Ground Water Protection Plan and Groundwater Evaluation Report, Sweet, Edwards, and Associates, Inc., December 1981 (E26k). The report provides specific information on the typical sources of nitrate-nitrogen (NO_3-N) contributions to an aquifer.

Groundwater in the East Portland Area, U.S. Geological Survey Water-Supply Paper 1793, 1965 (E261) discusses the concern that continued development in the densely populated suburban districts of Portland, where household and other wastes are disposed of in cesspools and septic tanks, may pose a threat to the groundwater (pages 52-54) and restrict its use.

Sources of Toxic Compounds in Household Wastewater, Steven W. Hathaway, U.S. Environmental Protection Agency, Cincinnati, Ohio (E26q). This technical paper describes the sources of toxic compounds found in wastes that discharge from the typical household.

The Long Island Groundwater Pollution Study, State of New York, Department of Health, April 1969 (E26r). The State of New York undertook an extensive investigation of the groundwater on Long Island over the past twenty years. This document provides detailed case study information on how cesspools and septic tanks have contaminated the sole source drinking water aquifer on Long Island. It gives very detailed information on the types of constituents found in cesspool wastes and how this pollutes the groundwater.

Dr. William E. Morton (B9) submitted written testimony that discusses the difficulty society in general has had throughout human history to safely dispose of its wastes and provide safe drinking water. The failure to do this has resulted in regular massive cycles of contamination-caused disease in urban populations. He is particularly concerned about the evidence of increasing nitrate levels in groundwater in this region. This he contends is evidence of human waste accumulation in the groundwater, which has implications of human health risk.

Kristine Gebbie, Administrator, Health Division, (E28) submitted written testimony which describes their concern from a public health standpoint about the two primary types of contaminants found in the affected area wells. They believe that volatile organic chemicals and nitrate-nitrogen (NO_3- N) both pose a threat to public health. The U.S. EPA recommends a level of zero for these organic chemicals and a level of 10 mg/l for the nitrate being found in a majority of the wells in levels ranging from 5-8 mg/l. The Health Division believes

there is an increase in risk to the aquifer from continued growth in population, business, industry, and service institutions (such as hospitals, schools, etc.) and the subsequent disposal of wastes into the aquifer.

Congenital Malformations and Maternal Drinking Water Supply in Rural South Australia: a Case-Control Study, Margaret M. Dorsch, Robert K. R. Scragg, Anthony J. McMichael, Peter A. Baghurst, and Kenneth F. Dyer, American Journal of Epidemology, Vol. 119, No. 4, April 1984 (E33a) describes the congenital malformation in children whose mothers consumed principally groundwater. The paper shows statistically significant risk increases occurred and that a nearly threefold increase in risk for women who drank water containing 5-15 ppm of nitrate and a fourfold increase in risk for those consuming 15 ppm of nitrate.

Hypertension and Drinking Water Constituents in Colorado, William E. Morton, M.D., Dr. P.H., American Journal of Public Health, Vol. 61, No. 7, July 1971 (E33b) describes the research to examine the relationship between hypertension and drinking water constituents. The paper suggests that there is reason to suspect a causative relationship between elevated nitrate levels in water and the population hypertension pattern.

Nitrates in Municipal Water Supply Cause Methemoglobinemia in Infant, Joseph Vigil, B.S., Sherman Warburton, B.S., M.P.H., William S. Haynes, M.D., M.P.H., and Leland R. Kaiser, M.A., M.P.H., Public Health Reports Vol. 80, No. 12, December 1965 (E33c) presents information on how nitrates in a municipal water supply caused methemoglobinemia in an infant in a Colorado City.

Cyanosis in Infants Caused by Nitrates in Well Water, Hunter H. Comly, M.D., Journal of the American Medical Association, Vol. 129, No. 2, September 8, 1945 (E33d) describes a case study where cyanosis in infants was caused by nitrates in the drinking water well, in Iowa City.

Methemoglobinemia Associated with Well Water, Louis W. Millen, M.D., Journal of the American Medical Association, Vol. 216, No. 10, June 7, 1971 (E33e) describes the health effect of preparing infant milk formula with well water containing excess nitrates in Texas and the associated methemoglobinemia.

Methemoglobin Levels in Infants in an Area With High Nitrate Water Supply, Lois Ann Shearer, M.P.H.; John R. Goldsmith, M.D.; Clarence Young, B.S.C.E.; Owen A. Kearns, M.D.; and Benjamin R. Tamplin, Ph.D. American Journal of Public Health, 1972 (E33f) compares the health effects of infant populations exposed and not exposed to high nitrate in their drinking water.

Ludmilla Pitkin (A55) raised questions on the source of monitoring and analyses of groundwater.

Gordon Shadburne, Commissioner, Multnomah County (A10) testified that he had reviewed Dr. Schade's report and felt that the information presented did not show any increase in pollutants or that there was a trend to higher levels.

Jeanne Orcutt (A12) questioned the water quality sampling conducted in the area and the results. She did not believe there was a historic pollution trend or a uniform sampling schedule. She asked that if there was a trend, when would the maximum concentrations occur and what those levels would be. Mrs. Orcutt also stated that the aquifer being used for drinking water is too deep to be contaminated. She inferred that because Multnomah County was still permitting cesspools and septic tanks, they did not believe there was any contamination. Finally she stated that EPA did not find any safe drinking water standards violations in the water being used in the area.

Louis Turnidge (A15, C10) questioned the existence of water quality problems in the affected area. He stated that nitrate was used for either explosives or fertilizer and that the problem would not be solved by sewering the area. Mr. Turnidge also testified that the sands and gravels worked very well in filtering wastes.

Chuck Root, Manager, Rockwood Water District (E6) stated that the district's two wells are at least 500 feet deep and that they provide 5 percent of the districts water. Also their water is safe for public drinking.

Herb Brown (C13) testified that he was concerned about the source of pollutants since dye tests of cesspools were not performed nor were soil core samples obtained to pinpoint the sources of pollution. He concluded that there may be pollutant present at scattered points but the sources were unknown.

Henry Kane, Attorney, On Behalf of Citizens United in Action (A11, B4, E31) testified orally and in written statement that the material in the record is not sufficient to meet the threat to drinking water statute. He contends that documents presented in the record do not contain evidence that the sewage contains agents that can make the water unfit for human consumption.

Mr. Kane also states that the nitrate level does not exceed the maximum allowable limit and that "the document (B3b2) does not state that the limit will be exceeded." He wants proponents to show pollution levels above state standards.

His client's position is that the nitrate in the groundwater is not a statutory threat because the problem can be resolved by treating the groundwater or requiring the water districts to obtain water elsewhere. He also presents specific information on treatment and source alternatives. There is also some discussion in this statement on the fate of nitrate in the groundwater and their removal from the affected area (page 6 - E31).

H. Havercamp (B6) submitted written testimony questioning the motives behind sewering the area. He also suggests that the test wells are located in areas that could easily pick up traces of nitrate from many different activities besides cesspools.

Dr. Harold Osterud (E35) submitted written testimony discussing the hazard to groundwater of allowing 56,000 cesspools to discharge into the water table. He stressed the need for taking action before the disease occurs and not wait until an epidemic of malformed infants or a proven case of concern.

Dr. William Morton (E36) submitted written testimony examining the question of how sewage can affect groundwater with respect to health risks. He states "There is not serious credible question about the reality of the need for sewers to protect the publics health in Mid-Multnomah County."

General comments were received on the presence of a threat to drinking water, the need for sewers, concern over the contamination of groundwater, and the use of chemicals to unclog cesspools. A27, B11, C11, E19)

General comments were also received that disputed whether a threat to drinking water existed, disputed that the groundwater was polluted, stated that the groundwater was of good quality, stated that a threat had not been proven, advocated the use of bottled water, the residential population in the affected area could generate 14 mgd of sewage; and raised questions as to the effect of domestic animal wastes and human burial on groundwater quality.
(A52, A57, A26, A17, A21, A32, A33, A50, C18, E5, E9, C12, C14, B13, C2, C9)

Analysis of Information Presented

The following evaluation is divided into separate sections to better focus on the different issues in this complex question.

1. Are Levels of Contamination in Excess of 50 Percent of the Federal Drinking Water Standards?

   The record was first reviewed to determine whether the contaminant levels in the affected area were in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act. This is a critical part of the question because if the contaminant levels do not meet this test, there would be no need to examine the remaining portion of the question.

The primary documents used to determine if the contaminant levels were in excess of 50 percent of the drinking water standards were: the Department of Environmental Quality's groundwater data collected in Mid-Multnomah County (E26a), the U.S. Geological Survey Water Supply Paper (E26b), the City of Portland, Water Bureau report (E26i), and the Columbia Slough report (E26h). These references contain water quality data and data evaluations which provide specific information on the groundwater quality.

The information shows that concentration of nitrate-nitrogen (NO_3-N) in the groundwater in the affected area exceeds 50 percent of the Primary Federal Drinking Water Standard of 10 mg/l. On two occasions the nitrate-nitrogen (NO_3-N) level actually exceeded the 10 mg/l standard.

The data (E26a), also shows that the total dissolved solids (TDS) is approaching 250 mg/l in the lower gradient wells. The Secondary Federal Drinking Water Standard is 500 mg/l (E26n) for total dissolved solids. The upgradient wells to the south (Wettern, Cabler) have the lowest TDS level, with the lowest level of 121 mg/l and averaging approximately 137 mg/l, but in the downgradient wells to the north, the levels rise until they peak at 241 mg/l (Calcagno July 21, 1983). This is characteristic of many other parameters the Department sampled over the past fourteen months. A brief look at the data (E26a) will show that chloride, sulfate, calcium, phosphorus, and conductivity, also increase as the water moves downgradient, through the water table aquifer from the southern wells to the northern wells. This pattern shows that the aquifer gradually picks up contamination as it moves northward through the affected area.

The Department also collected and analyzed samples for volatile organic chemicals in the affected area. The data (E26l) shows the presence of some of these chemicals at very low levels. These man-made chemicals are possible carcinogens and/or are also suspected of other possible health problems (E26o, A28, E28, E26a). The U.S. Environmental Protection Agency (EPA) has not yet established drinking water standards for these chemicals. The EPA does, however, recommend, and is in the process of establishing, a federal maximum contamination level of <u>zero</u> for many of these chemicals. This points to the general concern over having any detectable levels of these chemicals in drinking water.

These chemicals are used in many different industrial and commercial operations (E26a), as solvents, degreasers, refrigerants, etc. Recent research completed by EPA (E26p) has identified the many household products which contain some of these chemicals. Some are degreasers and solvents commonly used

as paint removing/thinning products as well as cesspool and septic system cleaners. People testified during the hearing that they either used or knew others who used cesspool cleaners (E19) and they were concerned over the possible effects these chemicals this might have on the groundwater. Other people felt that if chemicals were a concern, then maybe some restriction should be placed on their use (A11). However, if EPA establishes a recommended maximum contamination level of zero for some or all of these organic chemicals, then there would be more concern over the present organic chemical levels in Mid-Multnomah County.

Testimony was presented to dispute whether there were any water samples in excess of the drinking water standards or that a threat could exist without standards being violated, or that the water was unsafe to drink. (A32, E25, A11, B4, E31)

In order to clarify any misunderstanding on this point, the statutory language should be examined. Under this statute, one or more biological, chemical, physical, or radiological contaminants have to exceed 50 percent of the maximum allowable limits set in the federal drinking water standards. They do not have to exceed the standard. Individuals and public water districts (A32, E25, E6) could have water quality tests performed on their well water which do not show results that exceed the established drinking water standards, but it might still exceed 50 percent of the standard and fall within this statute. This criterion highlights the intended purpose of this legislation which was to prevent contamination from reaching the point where an aquifer would reach or exceed standards and impair its beneficial use. The specific intent was to protect those areas which, because of their physical characteristics (more than 50 percent rapidly draining soils) waste disposal practices (more than 50 percent cesspools and septic systems), potential groundwater use (groundwater is or can be used for drinking water) and present and projected future contamination levels (exceed 50 percent of standard and rates indicate future risk) could develop into a health risk situation unless steps were taken to prevent the problem from getting worse.

Some people view that a problem does not exist or needs to be addressed until the contamination has reached or exceeded the drinking water standards. It is likely that a health risk may not occur until a contaminant reaches or exceeds the drinking water standard. However, is it not desirable to postpone corrective and preventive actions until that state of affairs has been reached. Because groundwater moves so slowly compared to surface water, probably averaging less than 5 feet per day in Mid-Multnomah County (E29), it would probably take a few decades or more for the aquifer to purge itself of the present contamination if all discharges were

eliminated today. Failure to take preventive and corrective actions would render a valuable resource useless, at least as a potential water supply. However, if the problem is addressed in an orderly manner before the resource becomes unfit for beneficial use, the contamination can be lessened over time and the groundwater can remain a viable resource during the period in which the problem is being addressed.

2. The second portion of this question deals with whether "wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical, or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer." The essential point of this part of the question is whether in the absence of preventive and corrective action, contaminant levels can be expected to increase so as to produce a risk to human health.

   Dr. Schade, the local County Health Officer (A28) stated that there appears to be a positive increasing trend in nitrate-nitrogen (NO_3-N) contamination. He also stated that there is not a clear historical trend in nitrate-nitrogen (NO_3-N) levels seen in individual wells (B3b2). The Department interprets the combination of these statements to say that the seasonal variations in the data and the limited years of data available, prevent analysis of the data to establish a statistically significant trend, however, there appears to be an increasing trend.

   The staff examined the data record to see if it would show an increasing trend. The data record is very limited for any information before 1974. There is some data (E26h) on the Hazelwood (Russellville) and Parkrose wells from 1966 and 1972 respectively that contain some nitrate-nitrogen (NO_3-N) level information. The Hazelwood well data shows that nitrate-nitrogen (NO_3-N) levels were 5.7 mg/l and 4.7 mg/l in well Nos. 1 and 2 respectively back in 1966. The Parkrose data has nitrate-nitrogen (NO_3-N) levels at 5.4 mg/l. The 1983 yearly average for the Parkrose wells is 6.8 mg/l and Hazelwood wells Nos. 1 and 2 are 6.7 mg/l and 6.3 respectively. This shows a rise in nitrate-nitrogen (NO_3-N) concentration. A close examination of the 1974-1984 data record for the Mid-Multnomah County wells shows that nitrate levels fluctuated widely during the early years. For example, the range in the Calcagno well during 1974 was from a high of 11.9 mg/l in July to a low of 3.3 mg/l in August. In later years, the values have not shown this type of fluctuation and the range in different wells tends to be very narrow with a 1 mg/l range at the widest, and 0.2 mg/l range at the narrowest. A summary of available nitrate-nitrogen (NO_3-N) data from 5 wells at 3 locations follows:

Year	Parkrose #2	Parkrose #3	Hazelwood #1	Hazelwood #2	Calcagno
1966			5.7(1)	4.7(1)	
1967					
1968					
1969					
1970					
1971					
1972	5.4(1)				
1973					
1974	6.5(6)	5.9(6)	6.6(6)	6.0(6)	7.0(6)
1975	5.8(8)	5.9(7)	5.6(8)	6.0(8)	6.3(5)
1976	6.6(2)		6.4(2)	6.8(2)	
1977					
1978	6.4(6)	6.6(7)	6.8(7)		7.1(6)
1979	7.3(4)	7.0(4)	6.7(3)	6.2(2)	5.9(2)
1980	6.8(8)	7.0(7)			7.2(8)
1981	6.8(9)	6.9(9)			7.2(8)
1982					
1983	6.6(5)	7.0(5)	6.7(3)	6.3(3)	6.4(4)
1984	6.7(8)	6.8(8)			6.5(8)

Note: Average nitrate-nitrogen (NO_3-N) values in mg/l.
Number in parentheses is the number of samples included in the average.

As has been previously noted, the data record is incomplete and not appropriate for reliable statistical analysis. An alternative approach would be to evaluate individual data points in light of factors expected to influence the observed values. This would provide a basis for rejecting or grouping data points to better reflect trends. To do this, information of the following types would be needed.

1. Contaminant loadings - (quantity of sewage being discharged.)

2. Precipitation levels - (quantity of water available for dilution of waste discharged.)

3. Depth, the sample was drawn from within the aquifer - (the deeper the sample is taken in the aquifer, the lower the expected contaminant concentration level.)

4. The duration and rate of pumping the well - (degree of draw down affects vertical mixing and concentration levels.)

Since information of this type is not available in the record, the Department is unable to draw any conclusion on trend, based on the data.

Population levels and projections can also be used as a factor in evaluating actual or potential trends. Population projections have been prepared by Portland, Multnomah County, and Gresham through their respective Master Sewerage Plans (B3b8, B3b3, B3b7). The land area evaluated in these plans includes but extends beyond the boundaries of the affected area. The projections are as follows:

	1980	2000	Saturation
I-205 Corridor and Johnson Creek (B3b8)	89,602	102,940	337,150
Inverness Basin (B3b3)	50,000	64,000	95,000
Gresham Basin (B3b7)	64,332	103,135	218,917
Total	203,934	270,075	651,067

The 1980 population of the affected area was estimated in the Framework Plan to be 129,700 (B3b1): This compares with a 1980 population of 203,993 in the combined areas evaluated through the Master Sewerage Plans. Percentage growth rates were calculated for year 2000 based on population estimates contained in the Master Sewerage Plans. These growth rates are as follows:

1980-2000	32%
1980-Saturation	219%

If the above percentage increases were applied to the affected area, population in the affected area would be as follows:

1980	129,700
2000	171,204
Saturation	413,743

If development was allowed to continue using cesspools and if these population projections prevailed, a 32 percent increase in sewage discharge to the aquifer could be expected by the year 2000. If this produced a corresponding 32 percent increase in the nitrate-nitrogen (NO_3-N) level, a level of 7.5 mg/l in 1980 would increase to 9.9 mg/l in year 2000. A 219 percent increase in population to achieve saturation development would cause even higher levels of nitrate-nitrogen (NO_3-N).

The record also contains information on health risks. Nitrate-nitrogen (NO_3-N) is of concern because it can cause methemoglobinemia in infants if the concentrations are greater than 10 mg/l in their drinking water. Under this condition, the nitrate is converted to nitrite, which is absorbed and in turn oxidizes the hemoglobin to form methemoglobin, thus impairing the blood's ability to carry oxygen. The infant, because of the lack of oxygen, will turn blue ("blue baby") and in some cases the infant may die. A number of references in the record (E33a-f) describe some of the research related to this disease. Some information (E33b) indicates that hypertension may also be related to elevated nitrate-nitrogen (NO_3-N) levels in drinking water.

Also of concern is the health risk associated with organics now being detected in some wells. A health affects standard has not been established. However, as noted before, the U.S. EPA is proposing to adopt a standard of zero for many of these chemicals. If adopted, one could conclude that an actual health risk presently exists. In that event, the U.S. EPA and/or the Health Division may have to order termination of use of the wells pending elimination of the source and natural recovery of the aquifer.

Conclusion

Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contain levels of the contaminant nitrate-nitrogen (NO_3-N) in excess of 50 percent of the U.S. EPA drinking water standard. Nitrate-nitrogen (NO_3-N) levels, in fact, are in the range of 60 to 70 percent of the U.S. EPA drinking water standard. In addition, total dissolved solids levels are at 48 percent of the U.S. EPA secondary drinking water standard.

Sufficient data and information is not available in the record to establish a trend and determine whether contaminant levels are increasing, decreasing, or staying the same. If population in the affected area is allowed to increase as projected using cesspools for sewage disposal, higher contaminant levels would be expected.

The levels of nitrate-nitrogen (NO_3-N) and organics being observed in the groundwater today pose some level of risk to health.

The Multnomah County Health Officer (A28) has stated that there appears to be a positive increasing trend and that the groundwater does have high levels of health threatening human and industrial waste contamination.

5. BASED ON QUESTIONS 1 THROUGH 4 ABOVE, DOES A THREAT TO DRINKING WATER EXIST IN THE AFFECTED AREA?

Analysis Information Presented

The term "Threat to Drinking Water" is defined in ORS 454.275(5) as follows:

> (5) "Threat to drinking water" means the existence in any area of any three of the following conditions:
>
> (a) More than 50 percent of the affected area consists of rapidly draining soils;
>
> (b) The groundwater underlying the affected area is used or can be used for drinking water;
>
> (c) More than 50 percent of the sewage in the affected area is discharged into cesspools, septic tanks or seepage pits and the sewage contains biological, chemical, physical or radiological agents that can make water unfit for human consumption; or
>
> (d) Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer. Such contaminant levels must be in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act.

Questions 1 through 4 above address the conditions noted in this definition in detail. The conclusions reached from analysis of the information in the hearing record are as follows:

1. More than 80 percent of the affected area consists of rapidly draining soils.

2. The groundwater in the Mid-Multnomah County water table aquifer and deeper aquifers underlying the affected area is being used and can be used for drinking water.

3. More than 80 percent of the sewage in the affected area is discharged into cesspools, septic tanks, or seepage pits, and that sewage contains microorganisms and organic and inorganic chemicals that can make water unfit for human consumption.

4. Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contain levels of the contaminant nitrate-nitrogen (NO_3-N) in excess of 50 percent of the U.S. EPA drinking water standard. Nitrate-nitrogen (NO_3-N) levels, in fact, are in the range of 60 to 70 percent of the U.S. EPA drinking water standard. In addition, total dissolved solids levels are at 48 percent of the U.S. EPA secondary drinking water standard.

   Sufficient data and information is not available in the record to establish a trend and determine whether contaminant levels are increasing, decreasing, or staying the same. The population in the affected area is allowed to increase as projected using cesspools for sewage disposal, higher contaminant levels would be expected.

   The levels of nitrate-nitrogen (NO_3-N) and organics being observed in the groundwater today pose some level of risk to health.

   The Multnomah County Health Officer (A28) has stated that there appears to be a positive increasing trend and that the groundwater does have high levels of health threatening human and industrial waste contamination.

Conclusion

Based on the above information, a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions cited, conditions (a), (b), and (c) are found to exist.

6. IF A THREAT TO DRINKING WATER IS FOUND TO EXIST, ARE THE BOUNDARIES OF THE AFFECTED AREA APPROPRIATE, OR SHOULD THE BOUNDARY BE MODIFIED TO DELETE AREA OR INCLUDE ADDITIONAL AREA?

Summary of Significant Information from the Record

Threat to Drinking Water Findings. The East County Sanitary Sewer Consortium, June 1984 (B3b2). This report contains the legal description of the affected area boundary which is utilized throughout the Consortium's framework and sewage facility plan documents. (B3b, B3b1-8)

The affected area described, includes portions of three drainage basins [Inverness, Columbia (includes Johnson Creek Basin), and Gresham] as established in the Region Waste Treatment Management Plan.

Pamelia L. Christian, City Administrator, City of Troutdale (E1) wrote to describe the sewerage policy of the city and why Troutdale's drainage basin does not meet the threat to drinking water statutory conditions. She states that Troutdale is predominantly sewered and that less than 1 percent of the residences are on on-site systems. Troutdale requires that any development must provide sewage collection before any permits are issued.

Jeanne Orcutt (A12) questioned in her testimony why Clackamas County and Troutdale were not required to submit facilities plans as were the other affected cities and counties.

The record shows that no testimony was received which specifically disputed the appropriateness of the boundary established by the Consortium and adopted by the resolutions of the local governing bodies.

Analysis of Information Presented

The Consortium established the affected area boundary after examining the areas under their jurisdiction to determine whether conditions necessary to find that a threat to drinking water existed in any portions of their designated Metro Regional Waste Treatment Management Plan drainage basins.

The City of Portland examined the Columbia Basin which includes the Johnson Creek Basin. The area within the Columbia Basin (excluding Johnson Creek) found to meet these conditions, lies along the west side of the I-205 Corridor from Sandy Boulevard to the Multnomah County line. For the most part, this area is completely developed with single-family residences and some multi-family units, with the commercial development adjacent to major transportation corridors. In the Johnson Creek portion of the Columbia Basin found to meet the conditions lies to the east of I-205 and south of the area. The development is primarily single-family residences.

Both the Central County Service District (CCSD) and the City of Portland examined the Inverness Basin. This basin lies between the cities of Portland and Gresham. There are approximately 17 square miles within the basin, 10 square miles are within CCSD and 6.6 square miles are within the City of Portland. The principal commercial development is along the major transportation corridors with the remaining developed land in single-family units. The Inverness Basin, which lies approximately south of Columbia and Sandy Boulevards, was found to meet those conditions.

The City of Gresham examined the Gresham Basin which lies east of the Inverness Basin and north of the Multnomah County line. The area found to meet the conditions in this basin is primarily low density residential with commercial development adjacent to major transportation routes.

The local jurisdictions examined the area within each of these basins and described the existing sewered and unsewered areas (B3b3, B3b7, B3b8). They presented (B3b1, B3b2) descriptions of the soils and geology, the waste disposal practices, the groundwater use, and the groundwater contamination within these areas.

The City of Troutdale (E1) examined the Troutdale Drainage Basin and concluded that less than 1 percent of the sewage discharged goes into on-site disposal systems.

No information was presented in the record concerning Clackamas County. It should be noted that the definition of municipality in ORS 459.275 limits the applicability of the finding of a threat to drinking water to areas within a county with a population exceeding 4000,000 according to the latest federal decennial census. This definition would exclude from consideration any area in Clackamas County since its 1980 population is 241,911. The Department is aware of a small area adjacent to the Johnson Creek trunk sewer within Clackamas County, but outside the City of Portland, which is presently served by cesspools. No new cesspools are allowed in this area under present Commission rules.

In addition to the material presented by the Consortium, the Department's staff examined the soils, and waste disposal practices in Mid-Multnomah County to determine whether the boundary was appropriate. To our knowledge, the area as defined encompasses the area in Mid-Multnomah County that is serviced by cesspool systems.

No evidence was presented in the record to propose or justify any modification of boundaries of the affected area.

Conclusion

The affected area boundary established by the local governing bodies in the Threat to Drinking Water Findings, June 1984 (B3b2), encompasses the problem area of Mid-Multnomah County where sewage is disposed of to cesspools and seepage pit systems. No justification for modification of boundaries has been established.

7. CAN THE CONDITIONS (THREAT TO DRINKING WATER) IN THE AFFECTED AREA BE ELIMINATED OR ALLEVIATED BY TREATMENT WORKS?

Summary of Significant Information from the Record

Providing Sewer Service to Mid-Multnomah County Framework Plan. The East County Sanitary Sewer Consortium June 1984 (B3b1). This report provides the overall description of the existing sewer systems within the affected area as well as preliminary facilities plans for the sewer system needs within the affected area. The report identified the specific facility requirements and costs for each of the three drainage basins.

Very preliminary schedules for implementing proposed facilities in the affected area have been prepared by the three local governing bodies, as follows:

1. Portland proposes to construct major treatment and conveyance facilities in the Columbia and Johnson Creek Basin within 20 years. Collection system facilities would be dependent on formation of voluntary Local Improvement Districts.

2. Gresham proposes to construct major treatment and conveyance facilities in the Gresham Basin within 20 years. Collection system facilities would be dependent on formation of voluntary Local Improvement Districts.

3. Multnomah County proposes to construct collection system facilities within 20 years.

Central County Service District Master Plan Update. Kramer, Chin and Mayo, Inc., Consulting Engineers, July 1983 (B3b3). This report provides the detailed discussion of the proposed sewer facilities within the Inverness Basin. Included in the report is a discussion of the existing system, the areas of concern, the proposed collection system, and the system's management and implementation. This latter material contains information on the construction phases.

City of Gresham Sewage System Master Plan. Brown and Caldwell, Consulting Engineers, December 1980 (B3b7). This report provides a description of the sewerage facility needs for the Gresham Basin. It includes detailed discussion of the existing facility as well as the sewer system needs to service the affected area. There is information on proposed costs and construction schedules.

Sewage System Facility Plan for I-205 Corridor and the Johnson Creek Basin, City of Portland, June 1984 (B3b8). This report provides a description of the sewerage needs in the Columbia Basin along the I-205 Corridor and the Johnson Creek Basin. It includes a detailed description of the existing sewerage system, the areas of concern, the sewer system design parameters, the proposed facilities needed in the affected area, cost estimates, implementation phases, and a financial plan. It also described the cooperative agreement the city has with Multnomah County for the Inverness Basin.

John Lang, Director, Public Works Department, Portland (A6) testified to the affected area boundaries and specifically described the sewerage facilities needs for the Columbia Basin.

James Keller, Gresham City Manager (A7) described the affected area within the Gresham Basin that the city was assigned responsibility for under the Metro 208 Regional Waste Treatment Management Plan. He discussed the facility needs for Gresham which included improving the existing treatment plant and trunk lines to service the affected area.

Dennis Buchanan, Multnomah County Executive Officer, (A3) testified on the issue of providing sewers to the affected area and the county's difficulty in providing urban services. He stated that the plan submitted was endorsed by the County and the County Citizen Committee.

Mike Lindberg, Commissioner, City of Portland (A5) testified on the need for sewers and Portland's role in providing this service. He specifically addressed that portion of the affected area which lies within the city boundary and for which the city was assigned responsibility under the Metro 208 Regional Waste Treatment Management Plan.

Trudy Jones (A13) testified that she could not believe that an urban area would be on cesspools and that sewers were needed to keep sewage from running across people's basement floors and property. She described how people were forced to modify their activities because they did not want to damage or fill up their cesspools. Ms. Jones advocated sewering the area as quickly as possible.

Lorna Stickel, Planning Director, Multnomah County (E13, E13a) submitted written testimony that describes how the East County Sanitary Sewer consortium Framework Plan (B3b1) relates to the county's acknowledged land use plan. She states that the plan is consistent with the county's Comprehensive Framework Plan and Community Plans and their related land use policies (E13a).

Terry D. Sandblast, Planning Director, City of Portland (E24, E24a) submitted written testimony that states the Framework Plan (B3b1) for providing sewer service to Mid-Multnomah County is consistent with and supports the City of Portland Comprehensive Plan. It also includes as attachments (E24a) the specific land use policy which gives priority to the development of systems in urbanized areas.

ORS Chapters 454 and 468, 1983 (E26c) ORS Chapter 454 contains the statutory language for finding a threat to drinking water. It also provides the following definition:

> (a) "Treatment works" means any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes, of a liquid nature, necessary to recycle or reuse water at the most economical cost over the estimated life of the works, including intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment, and their appurtenances; extensions, improvements, remodeling, additions, and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment units and clear well facilities; and any works, including site acquisition of the land that will be an integral part of residues resulting from such treatment.
>
> (b) In addition to the definition contained in paragraph (a) of this subsection, "treatment works" means any other method or system for preventing, abating, reducing, storing, treating, separating, or disposing of municipal waste, including storm water runoff, or industrial waste, including waste in combined storm water and sanitary sewer systems.

This term is used throughout the Threat to Drinking Water Statute (ORS 454.275 through ORS 454.350).

Clatsop Plains Ground Water Protection Plan and Groundwater Evaluation Report, Sweet, Edwards, and Associates, Inc., December 1981 (E26k). The report provides specific information on the typical sources of nitrate-nitrogen (NO_3-N) contributions to an aquifer in Chapter 11. It describes the various nitrogen loadings from natural vegetation, rainfall, agricultural sources, fertilizer, and domestic on-site disposal. The report models what the nitrate build-up could be in the groundwater in the Clatsop Plains area if the area continued to grow and utilize on-site waste disposal practices.

Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County. EQC Staff Report, June 1984 (B3a19). This report in Attachment V contains a description of the major sources of nitrogen to the groundwater. The report states:

"The chief sources of nitrogen that may enter aquifers include natural vegetation, especially legumes; agricultural fertilizers; domestic waste; lawn and garden fertilizers; and urban runoff.

A comparison of various sources of nitrogen loss to groundwater is presented as follows:

Source	Total Nitrogen, lbs/Acre/Year
A. Vegetative sources (fertilizer applied and Vegetation decayed)	
1. pasture	17.3 a/
2. agriculture	3.0 a/
B. Domestic waste--on-site system (73 pounds of NO -N) per year for an average family of four) a/	365.0 c/
C. Lawn and garden fertilizer 5 lbs. per dwelling unit per year a/	25.0 c/
D. Urban runoff (NO_3-N & NO_2-N)	0.31 b/

a/ After Sweet, Edwards and Assoc. 1981 (E26k)

b/ After U.S.G.S Open-File Report 78-662, 1978

c/ Based upon 5 dwelling units per acre

The comparison above shows that domestic waste contributes a substantial amount of nitrogen to groundwater. Of particular concern to the Department is the total contribution of domestic waste from high density development such as apartment complexes and hospitals."

Louis Turnidge (A15) stated that he did not think sewers would solve the nitrate problem and that solvent recycling was the best answer for the organic problem.

General testimony. Several people and groups testified and written material was submitted in support of sewering the affected area for a variety of reasons including: to protect the groundwater aquifer; to reduce organic chemical contamination; to enhance economic development and provide jobs; to reduce the estimated 14 million gallons of daily sewage discharge to the affected area aquifer; to improve individual home plumbing problems; to reduce the public health risk; and to protect the area's water supplies.
(A19, A20, A22, A26, A27, A29, A31, A39, A40, A42, A43, A45, A47, A59, A60, A61, B1, B2, B3a4-6, B9, B10, C15, E2, E7, E11, E16, E17, E18, E19, E20, E23a, E27, E28, E30b1, E32.)

Analysis of Information Presented

In order to address this question, it is necessary to determine what the local governing bodies propose to construct, whether their proposal meets the definition of treatment works from ORS 454.275, and whether the proposal will eliminate or alleviate the conditions in the affected area that result in the finding of a threat to drinking water.

The facilities proposed by the local governing bodies consist of expanded sewage treatment facilities, interceptor and trunk sewers, pump stations and force mains, and collector sewers (B3b1, B3b3, B3b7, B3b8). These facilities would function to collect all sewage from existing and proposed development in the affected area, convey it to regional treatment facilities for treatment, and discharge of the highly treated effluent to the Columbia River outside the affected area.

ORS 454.275 and 454.010(5) define treatment works to include intercepting sewers, outfall sewers, sewage collection systems, pumping, power and other equipment, as well as any device and system used in treatment, recycling, and reclamation of sewage.

The Department concludes that the facilities proposed by the governing bodies are treatment works within the definition of ORS 454.275.

The next issue is whether the proposed threatment works will eliminate or alleviate the conditions in the affected area that result in the finding of a threat to drinking water.

The treatment works can enhance the future value of the groundwater underlying the affected area for use as drinking water by eliminating the discharge of sewage into the ground where it can move through the soil to the water table and adversely impact the groundwater. The treatment works themselves will not adversely impact the present or potential use of the groundwater for drinking water.

The treatment works can eliminate the discharge of 100 percent of the sewage in the affected area that is discharged into cesspools, septic tanks, or seepage pits. This is accomplished by collection of all

sewage and conveyance outside the area for treatment and discharge to the Columbia River. Such elimination would prevent the biological, physical, chemical, or radiological agents in sewage from causing the groundwater to be unfit for human consumption. The proposals of the jurisdictions do not establish a deadline for installation of all collection sewers and connection of all existing structures (and thus eliminate all cesspool systems). Thus, they have not provided assurance that the elimination of cesspools will be accomplished. They also do not say that complete elimination cannot or will not be accomplished.

The treatment works, by eliminating the discharge of sewage into the ground, can remove a substantial portion of the nitrates presently being discharged. As noted in the summary of testimony above, nitrogen loadings to groundwater are estimated to be between 390 and 407 pounds per acre per year in an urban area with 5 dwelling units per acre density and adjacent agricultural use. Of this total, 365 lbs/acre/year is contributed through on-site sewage disposal systems. Thus, between 89 and 93 percent of the nitrate-nitrogen (NO_3-N) loading to groundwater would be expected to come from on-site sewage disposal systems, such as cesspools, septic tanks, and seepage pits. Removal of the sewage related nitrogen load would thus be expected to result in a substantial reduction of elevated nitrate-nitrogen (NO_3-N) levels in the groundwater in the affected area over time, as the aquifer naturally renews itself.

The treatment works, by eliminating the discharge of sewage into the ground, can remove a portion of the organic chemicals presently being discharged in the groundwater. They will also eliminate those organic solvents utilized to dissolve fats and greases in order to unclog cesspool systems. Removal of the sewage related organic chemicals will reduce the level of these chemicals in the groundwater in the affected area over time.

Conclusion

The facilities proposed by the local governing bodies are treatment works within the meaning of ORS 454.275.

The treatment works can eliminate or alleviate the relevent conditions in the affected area that result in the finding of a threat to drinking water. The proposals of the local governing bodies do not establish deadlines for construction of facilities to eliminate all sewage discharges into cesspools, septic tanks, or seepage pits. The proposals do not assure elimination of all cesspools, septic tanks, or seepage pits. Thus, the proposals do not provide assurance that the conditions in the affected area that result in the finding of a threat will be eliminated or alleviated.

8. ARE THE TREATMENT WORKS PROPOSED BY THE GOVERNING BODIES THE MOST ECONOMICAL METHOD TO ALLEVIATE THE CONDITIONS (THREAT TO DRINKING WATER)?

Summary of Significant Information from the Record

Central County Service District Master Plan Update, Kramer, Chin & Mayo, Inc., July 1983 (B3b3). This report is a Master Sewerage Plan prepared for the Central County Service District No. 3 covering the Inverness Basin. The report was completed in 1983 and includes a proposed collection system and waste water treatment facility expansion needs and cost estimates.

The Economics and Finances of Sewers, Central County Service District, ECO Northwest, July 1984 (B3b4). This report is a financing plan prepared for the Central County Service District No. 3 to implement a portion of the Master Sewerage Plan. The consultants developed and evaluated several financing alternatives and recommended option E - Portland would extend interceptor sewer lines on 102nd and 122nd Streets and would construct a 6 mgd pump station and a pressure line to the Columbia Boulevard Treatment Works. This option is partially implemented.

Final Report, Sewage Facilities Financing Plan, Central County Service District, CH_2M Hill, December 1981 (B3b5). This report was completed in 1981 and is a general financing plan for the Central County Service District for a collection system to serve the Inverness Basin and for a treatment plant expansion. Recommendations were made for preparation of a Master Sewerage Plan which was completed in 1983 (B3b3).

Sewer Facilities Financing Plan Cost Update, Central County Service District, CH_2M Hill, May 1984 (B3b6). This report is a 1984 cost estimate update of the Central County Service District Master Sewerage Plan (B3b3) for the Inverness Basin collection system.

City of Gresham Sewerage System Master Plan, Brown and Caldwell Consulting Engineers, December 1980 (B3b7). This report, prepared in 1980, is a Master Sewerage Plan for the Gresham Basin. It includes proposed sewage conveyance system, sewage treatment plant expansion needs, cost estimates, recommended staging program, and potential sources of funds. Gresham also submitted updated cost information for sewer system installation and the needed treatment plant expansion based on a report completed in June 1984.

Sewage System Facility Plan for the I-205 Corridor and the Johnson Creek Basin, City of Portland, June 1984 (B3b8). This report, completed in June 1984, is a Master Sewerage Plan for the I-205 Corridor and the Johnson Creek Basin. The report includes proposed trunk sewers, pressure mains, 8" gravity sewers and proposed pump stations. Cost estimates for these facilities were prepared along with proposed phasing. A preliminary financing plan was also prepared.

Framework Plan for Providing Sewer Service to Mid-Multnomah County, East County Sanitary Sewer Consortium, June 1984 (B3b1). This plan presents a cost breakdown for sewerage facilities in the affected area and, in addition, provides proposed timeframes for construction of facilities and presents financing mechanisms now available to the local jurisdictions.

1. Cost Breakdown by Basins

The total costs in 1984 dollars for treatment facilities, interceptor/trunk facilities, pump stations/pressure lines, and collection facilities is estimated to be $266,232,000. The breakdown by basins is summarized as follows:

	Inverness Basin	Columbia and Johnson Creek Basins	Gresham Basin	Totals
Treatment Facilities	---	11,710,000	12,226,000	23,936,000
Interceptor/ Trunk Facilities	7,815,000	32,022,700	3,050,300	42,888,000
Pump Stations/ Pressure Lines	18,980,000	2,548,000	---	21,528,000
Collection Facilities	46,200,000	114,000,000	17,680,000	177,880,000
Totals	72,995,000	160,280,700	32,956,300	266,232,000

2. Cost Breakdown by Jurisdiction and Private Property Owners

Portland Disposal System	73,075,700
Gresham Disposal System	15,276,300
Private Property Owners (Collection System)	177,880,000
	266,232,000

Costs of the Portland Disposal System include interceptor/trunk facilities, and pump stations/pressure lines for the Inverness Basin. These facilities are intended to be provided through contract with Multnomah County Central County Service District No. 3. Portland will treat the waste at Columbia Boulevard Sewage Treatment Plant.

3. Timeframe

The timeframe for constructing proposed facilities varies by jurisdiction. The Central County Service District has a twenty (20) year timeframe to construct all collection facilities in Inverness Basin. Both Portland and Gresham anticipate construction of all treatment and conveyance systems within 20 years but construction of sewage collection systems will be accomplished through formation of Local Improvement Districts on a voluntary basis, rather than under a specific schedule.

4. Financing Methods

Portland, Gresham, and the Central County Service District No. 3 are organized and operated as municipal enterprise utilities and as such do not receive property tax support.

Portland will not extend sewer services beyond city boundaries unless by wholesale contract. Collection systems are an obligation of property owners. Further, existing ratepayers do not subsidize sewer service to new customers. Portland relies on grants, revenue bond proceeds and sewage disposal system revenues (user charges) to finance treatment and transportation facilities. Trunk systems and collection system facilities have been financed by property assessments. Portland anticipates changing this practice to provide for financing trunk sewers through system revenues, rather than through property assessments. Collection sewers would continue to be financed by property assessments.

Gresham will not extend sewer services beyond city limits unless there is a significant health hazard or the property has participated in financing a treatment plant expansion. Gresham relies on grants, revenue bond proceeds, and system revenues to finance treatment and transportation facilities. Gresham has also assessed properties which will use treatment capacity to help finance treatment plant improvements. Collection system facilities have been financed by property assessments.

The Central County Service District No. 3 has limited financing capabilities and has relied on grants and Multnomah County general funds for major facilities. Portland and the District have recently executed an agreement whereby Portland will provide treatment facilities for the District and will finance, construct, and own new interceptor and trunk sewers in the Inverness Basin. Collection system facilities will be financed through property assessments.

City of Portland, Bureau of Environmental Services, 9/11/84 (E30). Portland officials submitted additional financing information. This was in response to testimony presented at the September 30, 1984, Public Hearing--at the hearing, several witnesses stressed the need for additional financing information.

1. Seepage Fee

Portland officials recognize concerns regarding the seepage fee but believe that it can be an important tool in financing sewers and further, that the concerns can be addressed within the context of an overall financing plan. Portland officials believe that this could be done within a twelve month period following the declaration of threat to drinking water.

2. Financial Assistance

Portland officials believe there are serious limitations on Portland's ability to maintain its financial position if the Environmental Quality Commission orders an aggressive construction schedule. In this event, city officials believe that the State would have to participate financially. They also believe that the Department of Environmental Quality and Environmental Quality Commission should support the city and the Consortium in pursuing appropriate State and Federal Legislation and federal funding in support of the construction program.

3. Assessment Deferral

Portland officials acknowledge that the Assessment Deferral Program can result in a high interest rate for the property owner and that this program is not well received. Portland may introduce legislation to find a financing mechanism, perhaps State funding, which would result in lower interest rates to the property owner.

J. David Rush, Government Finance Associates, Inc. (E30a) submitted written testimony which indicated Portland would have difficulty in maintaining its current high bond rating in the event it had to support more than $40 million in Bancroft Bonds outstanding at any one time. To maintain its credit rating, additional methods of financing the local improvement portion of needed facilities would be necessary.

Oregon Administrative Rules, Chapter 340, Divisions 71, 72, and 73 (E26e) contain the adopted on-site rules for the state. This would include all those systems which are approved for use as individual on-site systems.

Final Report Oregon On-Site Experimental System Program, Department of Environmental Quality, December 1982, (E26j). This report reviews the Department's experimental on-site program. It identifies the different experimental systems investigated, the performance data and the systems costs.

Henry Kane, Attorney (B4) submitted written testimony stating that there are more economical alternatives to a $255 million sewer system. These could include treatment of domestic well water or water supply from Bull Run.

Henry Kane, Attorney (A11) testified that he was opposed to the Commission declaring a threat to drinking water and that if a problem existed, the Commission had a wide range of options to choose from instead of just requiring sewers. He felt that if organic chemicals were affecting the area's groundwater, then their use could be prohibited. He also stated that if sewage disposal methods were to change, that the alternative waste disposal systems approved in OAR 340-71, 72, and 73 in 1981 should be fully examined.

Jeanne Orcutt (A12) testified that sewers were not needed in the area. She felt only those businesses or commercial properties that wanted sewers should have them. Mrs. Orcutt also felt that people should convert to Bull Run water and not use the groundwater.

Louis Turnidge (A15) stated that he did not think sewers would solve the nitrate problem and the solvent recycling was the best answer for the organic problem.

Bob Bledsoe (A16) stated that he did not think the problem warranted sewers. He said the Parkrose aquifer dilutes and then carries the waste water to the Columbia Slough and that this process should be allowed to continue.

Jean Hood (A23) did not feel that sewers were needed and that most, if not all, the local water districts were obtaining their water from the Bull Run Reservoir. She felt sewers were being forced on the area because Portland and Gresham want dollars for sewers to balance their budgets.

Pat Brown (A46) testified against sewering the affected area. She believes that the most economical solution would be to take the following actions:

1) Install charcoal filters to remove solvents and other impurities from groundwater
2) Stop immediate growth and industrial expansion
3) Stop agriculture use of the land
4) Control industrial use of chemicals
5) Either treat the water or close down the wells.

John Scalise (B12) submitted written testimony which stated his opposition to sewering East Multnomah County. He felt the soil had an outstanding percolation porosity ratio and instead of building sewers, builders have opted for cesspools and septic tank systems. Mr. Scalise stated that these types of systems, if properly maintained, would provide years of service.

Several people and groups testified and submitted written testimony that opposed the need for sewers to protect groundwater as a drinking water source and believed that more economical alternatives were available. These alternatives included drilling deeper wells and using clean aquifers below the contaminated water table aquifer, composting toilets, water supply treatment, and utilization of Bull Run water.
(A11, A12, A16, A33, A53, A59, A62, B13, C1, C3, C5, C6, C13, C14, C16, E4, E5, E9, E20b4, E31, E36, E37)

Representatives from the three jurisdictions presented some general comments regarding the financing of sewerage facilities in the affected area. A summary of these comments follow: (1) Multnomah County's role in the Inverness Basin will be limited to collection sewers only and Portland, by contract, will provide all other needed facilities in the basin; (2) the jurisdictions stressed the need for making improvements affordable; (3) the jurisdictions indicated that financing should be a cooperative federal, state, local effort, and further that projects should receive high priority on the DEQ construction grant priority list; and (4) the jurisdictions will develop and evaluate many different financing options and mechanisms.
(A3, A4, A5, A6, A7, A8, A9)

Considerable written testimony was submitted which stated that the costs to the homeowner were far too high and that private costs e.g., connection charges, were not included in the estimates. Some written testimony stated however, that delays or postponements would only increase the costs. Considerable concern was expressed that the costs would be excessive for homeowners on fixed earnings or retirement income. Much of the written testimony addressed the need for financing methods that would ease the cost burden. This included: (1) the need for federal and state participation in financing, (2) potential for private sector financing, (3) the need for low interest assessment deferral financing, (4) establishment of voluntary Local Improvement Districts, and connections which would become mandatory only after a certain grace period, and (5) utilization of existing cities insofar as they have better bond ratings and ability to secure funds.
(B4, B7, B8, B12, E4, E8, E10, E35, E36, E38)

Many people submitted oral testimony expressing concern about the high costs of providing sewers to the affected area. Generally they believed the costs would be excessive and would adversely affect many people. Some believed, that while sewers might add to home value, it would be difficult to sell the home. Others believed that the high costs would adversely affect home values. One witness commented that the high cost of sewers would lead to excessively high taxes and the residential neighborhoods would become rental property. Some witnesses expressed doubt over the accuracy of the cost estimates and further indicated that the private costs were not fully revealed. There was a wide-range of concern expressed over financing and particularly equity in financing. Some witnesses believed costs should be spread beyond individual property owners within the affected area, and some believed that costs should be spread over the entire region. Conversely, one witness was concerned that current Portland ratepayers might have to participate in paying for new treatment facilities. Many people believed that the costs would impose a severe financial burden on low income residents and the elderly. Further, several witnesses did not believe the tax deferral program was

equitable because of high interest rates and the fact that costs were not reduced but simply shifted forward to the time of property sale or transfer. There was widespread confusion over the tax deferral program. Several witnesses expressed distrust regarding Portland and Gresham. They indicated that annexation, not sewers, were the primary motivation and further that the two cities were trying to secure more revenues. Some witnesses supported sewers at the estimated costs. Generally this testimony indicated that the costs were not too high and that sewers would improve property values, and ultimately create more jobs.
(A13, A16, A17, A21, A23, A25, A29, A30, A31, A32, A35, A36, A37, A40, A42, A46, A51, A54, A58, C2, C4, C5, C6, C8, C11, C12, C15)

Some suggestions were made for developing a workable financial program. These included (1) maximum financing flexibility, (2) federal and state participation through grants, (3) reduced costs and payment extensions and grants for low income and elderly residents, (4) optional hookups or grants to cover hookup charges, (5) Bancrofting or other low cost financing for service laterals, replumbing, etc., and (6) lower interest charges on the tax deferral program.
(A29, A36, A37)

Most of the written testimony was very much opposed to the seepage fee. The primary reason given was lack of a direct connection between fees paid and benefits received, i.e., some people will pay the fee and not receive sewers for a long time period and some will receive sewers, e.g., vacant lots and industrial land, and not pay a fee. Other concerns include no opportunity to vote on the establishment of the seepage fee, the possibility that it may force unwanted annexation, and that it amounts to a subsidy by homeowners to commercial and industrial properties.
(B12, D2b, E34b, E34d, E38)

There was considerable oral testimony expressing opposition to the use of the seepage fee (ORS 454.275 - .340). Some citizens testified that the cost would be too high or that there would be little direct return to those paying the fee. There was also concern that the local governments would misuse the revenues generated from the seepage fee and that fund accountability would be difficult to achieve. Most of the opposition, however, centered on the question of equity. Many believed that they would pay the fee and that sewers would be constructed elsewhere, i.e., there would not be direct connection between costs and benefits. Further, some citizens believed this would amount to double taxation. That is, they would pay for sewers constructed elsewhere and then ultimately have to pay for sewers in their neighborhood, including the connection fee. Finally, some testified that elderly residents might not receive any benefits whatsoever from the seepage charge.
(A14, A15, A17, A21, A23, A24, A25, A31, A32, A33, A38, A42, A46, A51, A54, A58, C2, C6, C11, C12, C15)

Analysis of Information Presented

To facilitate analysis, the written and oral testimony submitted can be grouped into three categories: (1) information pertaining to treatment facilities or alternatives for alleviating the conditions in the area, (2) information pertaining to the economics of alternatives, and (3) general information pertaining to financing. The first two are concerned with evaluating the most economical method to alleviate the conditions in the affected area that result in a finding of a threat to drinking water. The third is concerned with financing mechanisms.

Alternatives The oral and written information suggested four alternatives with potential to alleviate the conditions: (1) utilize Bull Run water or water from deeper wells as an alternative drinking water supply, (2) treat water drawn from the water table aquifer, (3) utilize alternative on-site sewage disposal systems, and (4) provide sewerage collection and off-site treatment facilities.

1. There was considerable testimony pertaining to purchase of water from the City of Portland's Bull Run System. Testimony also suggested use of deeper wells as an alternate water supply. The testimony did not provide specific cost information and did not provide information concerning the ability of Portland to supply the water. In essence, this testimony suggests that the EQC and DEQ should not endeavor to protect the Mid-Multnomah County water table aquifer or underlying aquifer for drinking water beneficial use.

   This alternative would not meet the definition of treatment works in ORS 454.275. The entire thrust of the threat to drinking water statute is that treatment works are the method by which the conditions that result in a finding of a threat to drinking water are eliminated or alleviated.

   This alternative does not eliminate or alleviate the discharge of sewage into cesspools, septic tanks or seepage pits. It does nothing to reduce the concentration of any contaminant in the groundwater that exceeds 50 percent of the drinking water standard and does nothing to reduce a risk to health resulting from present or future use of the groundwater. As noted in the discussion earlier under question 2, ORS 537.545 authorizes the use of groundwater for domestic use without the requirement to obtain permits or approvals. Thus, there is no apparent way to prevent use of the groundwater for drinking water.

   Further, this alternative is in conflict with the intent of ORS 468.710, 468.715, 468.720 (E26c) and OAR 340-41-029 (E26e) to protect the waters of the state, including groundwater, for all beneficial uses.

2. There was some testimony pertaining to treatment of groundwater as a means of removing contaminants at the point of use and thereby alleviating a threat to drinking water. This alternative could perhaps be construed to meet part of the definition of treatment works contained in ORS 454.275. However, as noted above in the discussion on item 1, it would not eliminate or alleviate the discharge of sewage into cesspools, septic tanks or seepage pits. It would do nothing to reduce concentrations of any contaminant in the groundwater that exceeds 50 percent of the drinking water standard and does nothing to reduce health risks from use of the groundwater. Further, this alternative would also be in conflict with the intent of statutes to protect waters of the state, including groundwater, for all beneficial uses.

   Department staff believes that removal of nitrate-nitrogen from water is a very complex and expensive process. There is insufficient information in the record to evaluate the drinking water purification systems suggested for consideration in testimony.

3. Some people testified that they felt there were alternative methods of on-site waste treatment and disposal that could be utilized in the affected area.

   The Department has reviewed the alternative on-site systems listed in OAR Chapter 340, Divisions 71, 72, and 73 (E26d) to determine if there were systems which would accomplish removal or significant reduction in the contaminants being discharged into the water table aquifer of Mid-Multnomah County. The only two systems authorized by rule which might be utilized are the pressure distribution system ([OAR 340-71-275] and the sand filter system [OAR 340-71-290]. However, in each case the rules require a minimum lot size of one-half acre for a single-family dwelling. Data developed on these systems (E26j) indicates that approximately 50 percent of the total nitrogen in the septic tank effluent discharged to these further treatment systems is removed. The costs in 1981 dollars for these systems were between $2,200-$3,500 for the pressure distribution system and between $3,000 and $10,000 for the sand filter system.

   This cost would not include closing out the existing cesspool system or changing, if necessary, the existing plumbing.

   The Department staff concludes that these systems cannot be approved in the affected area under existing rules because the vast majority of the existing lots are smaller than the 1/2 acre minimum required for a single-family residence. Thus, the alternative could not be implemented.

4. The treatment works proposed by the Mid-Multnomah County Sanitary Sewer Consortium in their Framework Plan (B3b1) were discussed in question 7 and include facilities to collect and transport sewage to regional facilities for treatment and discharge of highly treated effluent to the Columbia River.

Previous discussions concluded that this alternative met the definition of treatment works and could alleviate the conditions. Department staff have reviewed the Framework Plan and have concluded that it is consistent with the Regional Waste Treatment management Plan.

In 1976 and 1977, the Columbia Region Association of Governments prepared a Regional Waste Treatment Management Plan under Section 208 of the Federal Clean Water Act. In preparing the plan, several municipal treatment alternatives were developed and evaluated to most economically meet treatment requirements for municipal point sources through the year 2000. The selected regional plan was the most cost-effective alternative, and was largely gravity based, utilized existing facilities, and proposed regionalizing facilities where cost effective. The regional plan included treatment system service areas and designated management agencies for collection, transport, and treatment of municipal waste.

The regional plan was reviewed and approved by the Department of Environmental Quality and was accepted by the Environmental Quality Commission in November 1978 as a part of the Statewide Water Quality Management Plan. The U.S. Environmental Protection Agency (EPA) certified the regional plan in December 1978. The EPA review and approval was based on the requirement that the regional plan be a logical and cost-effective solution. EPA requires that all municipalities receiving Federal Construction Grants within the Metropolitan Service District boundaries prepare plans which are consistent with the regional plan.

The Metropolitan Service District (Metro) adopted the regional plan in 1980 (Metro replaced the Columbia Region Association of Governments as the Regional Waste Treatment Management Planning Agency). Since 1980 the plan has been updated and amended by Metro several times. These amendments have been reviewed and approved by the Department of Environmental Quality and the amended plans have been recertified by EPA. The latest request for recertification of the Regional Waste Treatment Management Plan is Metro Council Resolution No. 83-432.

The Framework Plan for Providing Sewer Service to Mid-Multnomah County is consistent with the recertified Regional Waste Treatment Management Plan. As such, it is accepted as the most economical plan for collection, transport, and treatment of municipal sewage in the affected area.

Economics of Alternatives

Based on the above evaluation, the Department concludes that the treatment works alternative proposed by the local governing bodies is the only implementable alternative that will eliminate or alleviate the conditions which result in a finding of a threat to drinking water. Thus, there is no basis for an economic comparison of alternatives.

It should be reiterated, however, that alternatives were evaluated previously in the process of developing the Regional Waste Treatment Management Plan. The facilities proposed by the local governing bodies are consistent with the selected cost-effective Regional Plan alternative.

Financing. There was a great deal of oral and written testimony pertaining to financing sewers in the affected area. For purposes of analysis, this information can be group as follows: (1) the cost information, and (2) financing methods.

1. Cost information in 1984 dollars was provided for sewerage facilities in the affected area in the Framework Plan (B3b1). This information was given by drainage basin and by each of the three jurisdictions for treatment facilities, interceptor/trunk facilities, pump stations/pressure lines, and for collection systems. In addition to the basic cost information, there was considerable testimony, primarily from individual homeowners that the costs were too high, private costs were not included, and that the costs would have adverse impacts on property values.

   DEQ staff have evaluated the cost information presented and have determined that it should be considered preliminary and subject to considerable refinement as final plans and specifications are developed. There is lack of specificity concerning costs to property owners insofar as collection system costs are aggregate values only and there isn't any information given as to what private costs for on-property improvements will be.

2. Considerable financing information of a general nature was submitted to the record. General financing mechanisms now available to the local governing bodies were set forth. There was an indication that financing ability was limited, particularly if an aggressive sewering schedule were adopted by the EQC. There was testimony submitted that innovative financing mechanisms should be developed and considered and that the state and federal governments should participate in financing sewerage facilities. Local government officials and private citizens stressed the need for a financial plan that would make sewers affordable. Many citizens expressed concern over the seepage fee as an equitable financing mechanism. Concern was expressed over the high cost (interest rates) of the assessment deferral program.

   It should be stressed that all of the financing information submitted to the record was very general in nature. For example, it is not possible to assess affordability or need for innovative financing mechanisms. Nor is it possible to assess the need for state and/or federal financing assistance. There isn't any way, with currently available information, to assess the equity or usefulness of the seepage fee--the fee amount and assessment conditions have not been proposed. No information was submitted which links costs and financing mechanisms with a schedule.

Conclusions

The treatment works proposed by the local governing bodies are the only alternative that: (1) meets the definition of treatment works contained in ORS 454.275; (2) can eliminate or alleviate the conditions which result in a finding of a threat to drinking water; (3) can be implemented in the area; and (4) are consistent with the adopted regional waste treatment management plan.

Cost information and financing alternative are preliminary and very general. Estimate of costs to homeowners are lacking. Affordable options for financing of homeowner costs are not addressed.

Overall Summary of Evaluation

The following summarizes the results of preceding evaluation of the hearing record by the Department staff:

1. DOES MORE THAN 50 PERCENT OF THE AFFECTED AREA CONSIST OF RAPIDLY DRAINING SOILS?

   The hearing record shows that over 80 percent of the soils in the affected area are rapidly draining.

2. IS THE GROUNDWATER UNDERLYING THE AFFECTED AREA USED FOR DRINKING WATER OR CAN IT BE USED FOR DRINKING WATER?

   The hearing record shows that the groundwater in the Mid-Multnomah County water table aquifer and deeper aquifers underlying the affected area is used and can be used for drinking water.

3. IS MORE THAN 50 PERCENT OF THE SEWAGE IN THE AFFECTED AREA DISCHARGED INTO CESSPOOLS, SEPTIC TANKS, OR SEEPAGE PITS AND DOES THE SEWAGE CONTAIN BIOLOGICAL, CHEMICAL, PHYSICAL, OR RADIOLOGICAL AGENTS THAT CAN MAKE WATER UNFIT FOR HUMAN CONSUMPTION?

   The hearing record shows that more than 80 percent of the sewage in the affected area is discharged into cesspools, septic tanks, or seepage pits. The hearing record further shows that sewage contains microorganisms and organic and inorganic chemicals that can make water unfit for human consumption.

4. DOES ANALYSIS OF SAMPLES OF GROUNDWATER FROM WELLS PRODUCING WATER THAT MAY BE USED FOR HUMAN CONSUMPTION IN THE AFFECTED AREA CONTAIN LEVELS OF ONE OR MORE BIOLOGICAL, CHEMICAL, PHYSICAL OR RADIOLOGICAL CONTAMINANTS WHICH, IF ALLOWED TO INCREASE AT HISTORICAL RATES, WOULD PRODUCE A RISK TO HUMAN HEALTH AS DETERMINED BY THE LOCAL HEALTH OFFICER? ARE SUCH CONTAMINANT LEVELS IN EXCESS OF 50 PERCENT OF THE MAXIMUM ALLOWABLE LIMITS SET IN ACCORDANCE WITH THE FEDERAL SAFE DRINKING WATER ACT?

   Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contain levels of the contaminant nitrate-nitrogen in excess of 50 percent of the U.S. EPA drinking water standard. Nitrate-nitrogen levels, in fact, are in the range of 60 to 70 percent of the U.S. EPA drinking water standard. In addition, total dissolved solids levels are at 48 percent of the U.S. EPA secondary drinking water standard.

   Sufficient data and information is not available in the record to establish a trend and determine whether contaminant levels are increasing, decreasing, or staying the same. If population in the affected area is allowed to increase as projected, using cesspools for sewage disposal, higher contaminant levels would be expected.

The levels of nitrate-nitrogen (NO_3-N) and organics being observed in the groundwater today pose some level of risk to health.

The Multnomah County Health Officer (A28) has stated that there appears to be a positive increasing trend and that the groundwater does have high levels of health threatening human and industrial waste contamination.

5. BASED ON QUESTIONS 1 THROUGH 4 ABOVE, DOES A THREAT TO DRINKING WATER EXIST IN THE AFFECTED AREA?

Based on the above information, a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions cited, conditions (a), (b), and (c), are found to exist.

6. IF A THREAT TO DRINKING WATER IS FOUND TO EXIST, ARE THE BOUNDARIES OF THE AFFECTED AREA APPROPRIATE, OR SHOULD THE BOUNDARY BE MODIFIED TO DELETE AREA OR INCLUDE ADDITIONAL AREA?

The affected area boundary established by the local governing bodies in the Threat to Drinking Water Findings, June 1984 (B3b2), encompasses the problem area of Mid-Multnomah County where sewage is disposed of to cesspool and seepage pit systems. No justification for modification of boundaries has been established.

7. CAN THE CONDITIONS (THREAT TO DRINKING WATER) IN THE AFFECTED AREA BE ELIMINATED OR ALLEVIATED BY TREATMENT WORKS?

The facilities proposed by the local governing bodies are treatment works within the meaning of ORS 454.275.

The treatment works can eliminate or alleviate the relevant conditions in the affected area that result in the finding of a threat to drinking water. The proposals of the local governing bodies do not establish deadlines for construction of facilities to eliminate all sewage discharges into cesspools, septic tanks, or seepage pits. The proposals do not assure elimination of all cesspools, septic tanks, or seepage pits. Thus the proposals do not provide assurance that the conditions in the affected area that result in the finding of a threat to drinking water will be eliminated or alleviated.

8. ARE THE TREATMENT WORKS PROPOSED BY THE GOVERNING BODIES THE MOST ECONOMICAL METHOD TO ALLEVIATE THE CONDITIONS (THREAT TO DRINKING WATER)?

The treatment works proposed by the local governing bodies are the only alternative that: (1) meets the definition of treatment works contained in ORS 454.275; and (2) can eliminate or alleviate the conditions which result in a finding of a threat to drinking water; and (3) can be implemented in the area; and (4) are consistent with the adopted regional waste treatment management plan.

Cost information and financing alternatives are preliminary and very general. Estimates of costs to homeowners are lacking. Affordable options for financing of homeowner costs are not addressed.

Alternatives for Commission Action

Based on the analysis of the record, the following potential alternatives for action are identified:

1. Proceed immediately to adopt findings, recommendations, and a final order pursuant to ORS 454.300, 454.305(2), and 454.310.

   Findings would conclude that (a) a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions necessary to find a threat to drinking water are found to exist in the affected area, (b) that the affected area as defined by the local governing bodies is appropriate and should not be modified, (c) that treatment works proposed by the local governing bodies will eliminate or alleviate the conditions, and (d) the treatment works proposed by the local governing bodies are the most economical method to alleviate the conditions.

   The recommendations, to be contained in an order directed to each of the affected local governing bodies, would include (a) a requirement to construct the treatment works proposed by the local governing bodies, (b) a firm deadline for completing all treatment works construction and elimination of all existing cesspools in the affected area of each of the local governing bodies, (c) a requirement to submit to the Department of Environmental Quality within 12 months, final plans and specifications for the proposed treatment works, (d) and a requirement to submit to the Environmental Quality Commission within 12 months, a report of actions taken and proposed to (i) minimize the costs to citizens in the area, and (ii) to develop and implement equitable and affordable financing options for the private costs to be borne by the citizens in the affected area.

   After preparation of findings and recommendations, the Commission would have to publish notice of findings and recommendations in the newspapers, hear arguments upon petition, and issue final findings and a final order.

   Adoption of this alternative must be based on the conclusion that the lack of a definitive timetable for, and assurance of, sewer construction and cesspool elimination in the proposed plans of the local governing bodies is not a material deficiency in their plan and that the minor deficiency can be addressed in the order.

The local governing bodies suggest that the deadline should be established by the EQC after its finding of a threat to drinking water, and that the deadline for completion of facilities should be based on the severity of the problems found to exist. The more detailed aspects of their construction schedules, phasing, and financing, would be developed during the 1-year period allowed by ORS 454.310(2) for preparation of plans and specifications after an order is issued.

2. Proceed immediately to adopt findings, recommendations, and an order pursuant to ORS 454.300, and 454.305(5).

Initial findings would conclude that (a) a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions necessary to find a threat to drinking water are found to exist in the affected area, (b) that the affected area as defined by the local governing bodies is appropriate and should not be modified, and (c) that the Commission is unable to determine whether or not the treatment works proposed by the local governing bodies will remove or alleviate the conditions in the affected area because the proposals lack essential information on schedules for implementation, as well as information on full costs to citizens and economic alternatives for financing the individual citizen costs.

The recommendations, to be contained in an initial order directed to each of the affected local governing bodies, would include (a) a requirement to prepare additional information and complete the submittal of acceptable plans, specifications, costs, and financing methods, to the Environmental Quality Commission by a specified date, (b) a deadline for completing the facilities necessary and eliminating all existing cesspools in the affected area, and (c) a requirement to display all private costs as well as public costs and develop and implement equitable and affordable financing options for the costs to be borne by the citizens in the affected area.

After preparation of initial findings and recommendations, the Commission would have to publish notice of findings and recommendations in the newspapers, hear arguments upon petition, and issue findings and the initial order.

After receipt and evaluation of the information directed to be submitted by the initial order, the Commission would have to prepare additional findings and recommendations, publish notice of additional findings and recommendations in the newspapers, hear arguments upon petition, and issue final findings and a final order to implement an acceptable treatment works plan. An additional public hearing may also be necessary prior to developing the additional findings and recommendations.

This alternative in essence requires that the procedures of the statute be gone through two complete times. It would settle the question of whether a threat to drinking water as defined in the statute exists in the initial order, and would effectively limit arguments in the second pass through the process to the nature, cost, phasing, and financing of the treatment works to be constructed. It would create the potential for legal challenge of each of the two orders that would be issued.

This alternative would afford the opportunity for the Commission to give further direction to the local governing bodies regarding conditions that their resubmitted plan would have to meet to secure Commission approval and issuance of the final order.

3. Delay adoption of findings and recommendations, request additional information from the local governing bodies based on guidance from the Commission, and reconvene the hearing.

   The Commission would review the staff evaluation of the record, and preliminarily conclude that, (a) a threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions necessary to find a threat to drinking water are found to exist in the affected area, (b) that the affected area as defined by the local governing bodies is appropriate and should not be modified, and (c) that the Commission is unable to determine whether or not the treatment works proposed by the local governing bodies will remove or alleviate the conditions in the affected area because the proposals lack essential information on schedules for implementation, as well as information on full costs to citizens and economic alternatives for financing the individual citizen costs.

   Based on the preliminary conclusions, the Commission would identify the deficiencies that must be addressed by the local governing bodies, identify conditions and a deadline for elimination of cesspools that would have to be met to have an acceptable plan, and formally request the local governing bodies to provide additional information to complete their plans.

   The Commission would schedule a reconvened hearing to receive the additional information from the local governing bodies as well as additional input from the public and persons in the affected area.

   At the conclusion of this hearing, the entire record of the proceedings would be evaluated, and the basic process outlined in Alternative 1 for issuance of findings, recommendations, and an order would be implemented.

This alternative affords the most straightforward method for obtaining necessary additional information from the local governing bodies without limiting broader opportunity for public input.

The efforts of the local governing bodies could be clearly focused on the outstanding issues based on preliminary conclusions from the present record.

The adoption of findings and recommendations would be delayed until the record is complete.

All three alternatives are based on the conclusion that sufficient information exists in the present record to find that a threat to drinking water as defined in ORS 454.275(5) exists in the affected area, that the boundaries are appropriately described, and that construction of treatment works is necessary to alleviate the conditions in the affected area.

All three alternatives anticipate direction from the Commission regarding a deadline for completing construction of treatment works so as to eliminate the existing cesspool sewage disposal systems in the affected area. The local governing bodies have proposed to complete major trunk, interceptor, and treatment facilities necessary to serve the affected area over a 20-year period, but have proposed no timeframe for construction of all collection sewers and connection of existing structures to the sewers. The local governing bodies expect the Commission to determine how fast the sewage discharge to the groundwater must be eliminated.

The Department is familiar with the magnitude of the construction job involved, the time it takes to complete plans, complete financing arrangements, get project phases organized, bid, constructed, completed, cleaned up, and house connections completed. The Department would recommend that 20 years is a reasonable time limit for completion of all treatment works and elimination of all existing cesspool and seepage pit sewage disposal systems in the affected area.

Alternatives 2 and 3 would require establishment of a deadline for development and submittal of additional information for the record by the local governing bodies. It is desirable to move as rapidly as possible but still allow adequate time to develop the needed information. The Department would recommend that 6 months be allowed in either alternative. Under Alternative 2, the 6 months would begin after issuance of the interim order--a process that will be expected to take 2 to 3 months to complete. Thus the elapsed time would be more like 9 months before the process to issue final findings and an order could be initiated. Under Alternative 3, the 6-month period would begin immediately upon Commission action.

Director's Recommendation

It is recommended that the Commission proceed to implement Alternative 3 as follows:

1. Review the staff evaluation of the record, and preliminarily conclude that:

    a. A threat to drinking water as defined in ORS 454.275(5) exists in the affected area in that at least 3 of the conditions necessary

to find a threat to drinking water, conditions (a), (b), and (c), exist in the affected area;

b. The affected area as defined by the local governing bodies is appropriate and should not be modified;

c. Construction of treatment works is necessary to alleviate the conditions in the affected area that result in a finding of a threat to drinking water;

d. Additional information is needed before findings and recommendations can be adopted.

2. Delay adoption of findings and recommendations until additional information is received.

3. Direct each of the affected local governing bodies to develop and submit by no later than July 1, 1985, information to address the following:

a. Revised treatment works plans, specific schedules, and implementation programs to provide assurance that all discharges of sewage to the groundwater from cesspools or seepage pits in the affected area will be eliminated by no later than December 31, 2005.

b. Complete cost estimates for implementing the revised plan including a display of the total costs to be borne by typical residential and commercial property owners.

c. Equitable and affordable financing options for the costs to be borne by property owners.

4. Establish a date in July 1985 for reconvening the hearing to receive additional testimony on the revised plans and information submitted by the local governing bodies.

Harold L. Sawyer:l
WL3904

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

A. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD AT PARKROSE HIGH SCHOOL ON AUGUST 30, 1984

B. EXHIBITS ENTERED INTO THE RECORD AT THE AUGUST 30, 1984, EQC HEARING

1. Trudy A. Jones, written testimony

2. Allan F. and Ardyce L. Johnson, written testimony

3. James Petersen, Chairman, Environmental Quality Commission, written statement and attachments.

   a. EQC Agenda items & Minutes Related to On-Site Sewage Disposal in East Multnomah County

      1. Agenda Item No. L, March 22, 1974
      Public Hearing on Adoption of Permanent Rules Pertaining to Standards for Subsurface Sewage and Nonwater Carried Waste Disposal.

      2. Minutes, EQC Meeting, March 22, 1984

      3. Agenda Item I, October 15, 1976
      Consideration of Adoption of Proposed Amendments to Oregon Administrative Rules Chapter 340, Division 7, Section 71, 72, 73, and 74, Pertaining to Subsurface and Alternative Systems of Sewage Disposal.

      4. Minutes, EQC Meeting, October 15, 1976

      5. Agenda Item No. Q, February 24, 1978
      Multnomah County Groundwater Aquifer - Status Report.

      6. Minutes EQC Meeting, February 24, 1978

      7. Agenda Item E, August 25, 1978
      Multnomah County Groundwater Protection Plan.

      8. Minutes, EQC Meeting, August 25, 1978

      9. Agenda item K, April 18, 1980
      Request for Approval of Multnomah County Groundwater Protection Plan.

      10. Minutes, EQC Meeting, April 18, 1980

      11. Agenda Item No. G, March 13, 1981
      Adoption of Proposed Rules Governing On-Site Sewage Disposal, OAR 340-71-100 to 71-600, to Replace Rules Governing Subsurface and Alternative Sewage Disposal, OAR 340-71-005 to 71-045, 340-72-005 to 72-030, 340-74-004 to 74-0255, and 340-75-010 to 75-060.

12. Minutes, EQC Meeting, March 13, 1981

13. Agenda Item No. P, August 28, 1981
Request From Multnomah County for a Six (6) Month Delay in Implementing the Provisions of OAR 340-71-335(2)(a), Cesspool Prohibitions.

14. Minutes, EQC Meeting, August 28, 1981

15. Agenda Item No. K
Sewage Disposal in East Multnomah County: Status Report and Proposed Action Regarding On-Site Systems.

16. Minutes, EQC Meeting, March 5, 1982

17. Agenda Item No. M, April 16, 1982
Public Hearing on Question of Extending Date on Prohibition of Cesspools to Serve New Construction, OAR 340-71-335.

18. Minutes, EQC Meeting, April 16, 1982

19. Special Agenda Item, June 29, 1984
Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County Pursuant to the Provisions of ORS 454-275 etc.

20. Minutes, EQC Meeting, June 29, 1984

21. Special EQC Telephone Meeting, July 10, 1984

22. Minutes, EQC Meeting, July 10, 1984

3. b. Threat to drinking water reports, Sewer facility plans and resolutions submitted by the members of the East County Sanitary Sewer Consortium

1. Providing Sewer Service to Mid-Multnomah County: Framework Plan, June 1984.

2. Threat to Drinking Water Findings, June 1984

3. Central County Service District Master Plan Update, Kramer, Chin & Mayo, Inc., Consulting Engineers, July 1983.

4. The Economics and Finances of Sewers, Central County Service District, ECO Northwest, July 1983.

5. Final Report, Sewerage Facilities Financing Plan, Central County Service District, CH2M Hill, December, 1981.

6. Sewer Facilities Financing Plan Cost Update, Central County Service District, CH2M Hill, May 1984.

7. City of Gresham Sewerage System Master Plan, Brown and Caldwell, Consulting Engineers, December 1980.

8. Sewage System Facility Plan for the I-205 Corridor and the Johnson Creek Basin, June 1984.

3. c. Memo to the Environmental Quality Commission, Subject, Newspaper Articles from The Gresham Outlook and The Oregonian Concerning Public Hearings to be Held August 30 and September 11, 1984, Pertaining to Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County.

4. Statement of Henry Kane, Attorney, On Behalf of Citizens United in Action

5. Bob Bledsoe, written testimony

   a."Geology of the Portland Well Field", W. H. Hoffstetter, Oregon Geology, Volume 46, No. 6, June 1984

6. H. Havercamp, written testimony

7. Emil R. Berg, City of Portland Bureau of Environmental Services, Citizens Advisory Committee, written testimony

8. Elouise M. Bailey, written testimony

9. Wm. E. Morton, M.D., written testimony

10. Douglas Hartman, Powell Hurst/Gilbert Neighborhood Association, written testimony

11. Joseph L. Miller Jr., M.D., written testimony

   a. "Portland-Vancouver Metropolitan Area Water Resources Study - Water Supply Regional Water Supply Plan", U.S. Army Engineers District, Portland, 1979 (page 18, 108, 109)

   b. "Management of Forest Resources in the Bull Run Division", Portland City Club Bulletin for Friday, August 17, 1973, pages 61, 62

   c. Little Sandy Fact Sheets, December 5, 1980, January 16, 1980, and February 1, 1980

   d. Letter from Ron Humphrey, Zigzag Ranger District, Mt. Hood National Forest, to Dr. Joseph L. Miller, Jr., January 29, 1980,

   e. Letter from Donald C. Gipe, U.S. Environmental Protection Agency to Joseph L. Miller, Jr., March 28, 1980

   f. Letter from John Vlastelicia, U.S. Environmental Protection Agency to Robert Hyle, City of Portland, Bureau of Water Works, March 10, 1978

   g. Letter from Robert Hyle, City of Portland, Bureau of Water Works, to John Vlastelicia, U.S. Environmental Protection Agency, Sepotember 13, 1978

h. Letter from Robert F. Willis, P.E., City of Portland, to Joseph L. Miller, Jr., M.D., May 12, 1983

i. Letter from Joseph L. Miller, Jr., M.D., to Robert F. Willis, P.E., City of Portland, June 1, 1983

j. Letter from Robert F. Willis, P.E., City of Portland, to Joseph L. Miller, Jr., M.D., June 15, 1983

k. "Portland Water Bureau Water Supply Development Program", Stevens Thompson & Runyan, Inc., Introduction

l. Letter from Carl E. Green, to Dr. Warren Westgarth, Chairman Bull Run Advisory Committee

12. John J. Scalise, written testimony

13. 126 signed statements against declaring A Threat to Drinking Water and proposing that Bull Run Water be furnished to solve the problem

C. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD IN ROOM 1400 OF THE YEON BUILDING ON SEPTEMBER 11, 1984

D. EXHIBITS ENTERED INTO THE RECORD AT THE SEPTEMBER 11, 1984, HEARING

1. Jean Hood, submitted a newspaper article "Woman's suicide in town stirs widespread repercussions", The Oregonian, September 9, 1984

2. Herb Brown, Chairman, United Citizens in Action, submitted:

a. Statement objecting to the location of the hearing
b. Petition against use of the Seepage Fee

3. Jeanne Orcutt, submitted:

a. Newspaper Article, "Unpaid sewer assessments spur county to start foreclosure", The Oregonian, May 22, 1984

b. Portland City Ordinances No. 148957, 148988, 149644, 150016, 150018, 150121, 152170, 141151, and 156349

c. 1983-84 Consumption and billing records for local water districts

d. Water purchase worksheets for local water districts.

e. Maps of Portland's well fields; Portland's water system; and the Portland Metro Area Water Districts

f. Poem "The Sewer Saga"

4. Donald R. Cook, written testimony

E. LETTERS RECEIVED FOR THE RECORD

1 City of Troutdale, 6/14/84*

2 Multnomah County, Commissioner Biskar, 8/15/84*

3 City of Portland, Commissioner Schwab, 8/21/84*

4 Emmert Development Co., 8/23/84*

5 Kenton Shade, Sr., 8/28/84*

6 Rockwood Water District, 8/29/84*

7 Edward H. Look, 8/24/84*

8 Shearsen Lehman/American Express, Rebecca Marshall, 8/28/84*

9 Mrs. Evelyn A. Dooley, 8/29/84*

10 Harold E. Hansen, 8/29/84*

11 Multnomah County, Commissioner Biskar, 8/30/84*

12 Betty Emery, Phone Message Note, 8/30/84*

13 Multnomah County, Division of Planning & Development, 8/30/84*

a. Land Use Policy 37 - Utilities

14 Carvalho Industries, Inc., 8/31/84*

a. Technical Data of Ozone Water Purification System

15 Betty Emery, 9/4/84*

16 Multnomah County, Commissioner Blumenauer, 9/4/84*

17 Mary Ellis, 9/5/84*

18 Elaine Tush, 9/5/84*

19 Mary Lindquist, 9/5/84*

20 Don Adkins, 9/5/84*

21 Henry Kane with 9/5/84 Response 9/4/84*

---

* Date letter was received for the record

22 Henry Kane to Mike Houston, 9/7/84*

a. "Tainting intensifies DEQ sewer battle", The Oregonian December 16, 1983
b. Henry Kane to Fred Hansen, September 4, 1983
c. Henry Kane to Dennis Buchanan, August 31, 1984

23 Multnomah County Health Officer, 9/10/84*

a. "Midcounty water safety needs sewers", The Oregonian, September 11, 1984

24 City of Portland--Bureau of Planning, 9/10/84*

a. Land Use - Public Facilities Goals & Policies List

26 Richland Water District, 9/11/84*

a. Water Quality Data, September 13, 1982

26 Department of Environmental Quality--Water Quality Division, 9/10/84*

a. Department of Environmental Quality field and laboratory data sheets for samples collected from wells in the Mid-Multnomah County area. Summary reports of these data have been contained in documents submitted previously for the record.

b. U.S. Geological Survey well data sheets for sampling and analysis of selected Mid-Multnomah County wells - 1976.

c. ORS Chapters 454 and 468, which contain Oregon Laws regarding water pollution control and sewage disposal.

d. The Department of Environmental Quality Laboratory, Quality Assurance Implementation Plan, East Multnomah County Groundwater Study, December 1983, and a copy of procedures for collecting and analyzing water samples. This material describes procedures used by the Department for analysis of samples and assuring the quality and validity of the data.

e. Oregon Administrative Rules, Chapter 340 including Divisions 41, 71, 72, and 73, which contain rules adopted by the Environmental Quality Commission for Water Pollution Control and Sewage Disposal. Division 41-029 contains the General Groundwater Quality Protection Policy. Divisions 71, 72, and 73, contain the on-site waste disposal rules.

f. "Groundwater Protection Policy, Background Discussion, Proposed Policy, and Final Adopted Policy", Oregon Department of Environmental Quality, 1980, with revisions made August 1980 and an appendix added 1983.

g. Agenda Item No. I and minutes of the June 29, 1984, EQC meeting.

---

* Date letter was received for the record

h. "Water Quality in the Columbia Slough", Department of Environmental Quality report, April 1974.

i. "Groundwater Exploratory Program", City of Portland Bureau of Water Works, April 1977; "Pilot well Study", City of Portland Bureau of Water Works, November 1978.

j. "Final Report Oregon On-Site Experimental System Program", Department of Environmental Quality, December 1982.

k. "Clatsop Plains Ground Water Protection Plan, Ground Water Evaluation Report", Sweet, Edwards & Associates, Inc., December 1981.

l. "Ground Water in the East Portland Area", Geological Survey Water - Supply Paper 1793.

m. "Soil Survey of Multnomah County, Oregon", Soil Conservation Service, August 1983.

n. Updated rules in the March 12, 1982, Federal Register, "National Interim Primary Drinking Water Regulations"

o. "National Interim Primary Drinking Water Regulations", U.S. Environmental Protection Agency, September 1976.

p. "Volatile Organic Chemicals", Department of Environmental Quality Staff Report, December 1, 1983.

q. "Sources of Toxic Compounds in Household Wastewater", Steven W. Hathaway, Wastewater Research Division, Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

r. "The Long Island Ground Water Pollution Study", State of New York Department of Health, April 1969, and "Proceedings of the Fourth American Water Resources Conference", Proceedings Series No. 6, November 1968.

s. Agenda Item No. H, and proposed minutes of the August 10, 1984, Environmental Quality Commission meeting.

27 Paul Yarborough, Department of Environmental Services, Mult. Co., 9/10/84*

28 Kristine Gebbie, Administrator, 9/11/84*, Health Division

29 William H. Young, Director, Water Resources Department, 9/11/84*

---

* Date letter was received for the record

30 City of Portland, Bureau of Environmental Services, 9/11/84*

a. J. David Rush, Government Finance Associates, Inc.

(1) Virginia Senate Bill No. 229

b. John Lang, City of Portland

(1) "Groundwater Exploratory Program", Department of Public Utilities, Bureau of Water Works, April 1977

(2) "Year 2000 Growth Allocation Workshops", March-April, 1981, Metropolitan Service District

(3) "Subsurface Sewage Disposal and Contamination of Groundwater in East Portland, Oregon", E. L. Quan, H. R. Sweet, and Joseph R. Illian, Groundwater Vol. 17, 1974.

(4) "Nitrate in Drinking Water", E. F. Winton, R. G. Tardiff, and L. J. McCabe, Journal AWWA February 1971

31 Statement, Affidavit and Exhibit of United Citizens in Action, 9/11/84*

32 Gladys McCoy, Multnomah County Commissioner, 9/11/84*

33 Charles P. Schade, M.S., Multnomah County Health Officer, 9/11/84*

a. "Congenital Malformations and Maternal Drinking Water Supply in Rural South Australia: a Case-Control Study", Margaret M. Dorsch, Robert K. R. Scragg, Anthony J. McMichael, Peter A. Baghurst, and Kenneth F. Dyer, American Journal of Epidemology, Vol. 119, No. 4, April 1984

b. "Hypertension and Drinking Water Constituents in Colorado", William E. Morton, M. D., Dr. P.H., American Journal of Public Health, Vol. 61, No. 7, July 1971

c. "Nitrates in Municipal Water Supply Cause Methemoglobinemia in Infant", Joseph Vigil, B.S., Sherman Warburton, B.S., M.P.H., William S. Haynes, M.D., M.P.H., and Leland R. Kaiser, M. A., M.P.H., Public Health Reports Vol. 80, No. 12, December 1965

d. "Cyanosis in Infants Caused by Nitrates in Well Water", Hunter H. Comly, M.D., Journal of the American Medical Association, Vol. 129, No. 2, September 8, 1945.

e. "Methemoglobinemia Associated with Well Water", Louis W. Millen, M.D., Journal of the American Medical Association, Vol. 216, No. 10, June 7, 1971

---

* Date letter was received for the record

f. "Methemoglobin Levels in Infants in an Area With High Nitrate Water Supply", Lois Ann Shearer, M.P.H.; John R. Goldsmith, M.D.; Clarence Young, B.S.C.E.; Owen A. Kearns, M.D.; and Benjamin R. Tamplin, Ph.D. American Journal of Public Health, Vol. 62, No. 9, 1972

34 Jeanne Orcutt, 9/13/84*

a. Excerpt from Rep. Wally Priestly's testimony May 2, 1983 at the House Hearing on the Seepage Bill

b. Letter from Rep. Annette Farmer to Senators, June 7, 1983

c. "Portland, Oregon, Offers Services to Push Case for Annexation" "Eugene Carlson, The Wall Street Journal, May 3, 1983

d. A message from Rep. Lonnie Roberts to citizens regarding sewers and the seepage fee.

e. "Springfield to Auction off Unwanted Lots", The Oregonian, September 1, 1984

35 Harold T. Osterud, M.D., MPH, Oregon Health Sciences University, 9/13/84*

36 Wm. E. Morton, M.D., Dr. PH, Oregon Health Sciences University, 9/13/84*

37 John C. Stoner, R.S., Oregon Water Treatment Certification Program, 9/14/84*

F. TESTIMONY POSTMARKER OR DELIVERED AFTER THE SEPTEMBER 11, 1984 DEADLINE

1 Mrs. Max Bickford, 9/14/84*

2 Louis Turnidge 10/25/84*

---

* Date letter was received for the record

NJM:lt
TL3706
November 29, 1984

CHAPTER 454

1983 REPLACEMENT PART

Sewage Treatment Disposal Systems

CONSTRUCTION OF SEWAGE TREATMENT WORKS

454.275 Definitions for ORS 454.275 to 454.310. As used in ORS 454.275 to 454.350:

(1) "Commission" means the Environmental Quality Commission.

(2) "Governing body" means a board of commissioners, county court or other managing board of a municipality.

(3) "Municipality" means a city, county, county service district, sanitary district, metropolitan service district or other special district authorized to treat or dispose of sewage in any county with a population exceeding 400,000 according to the latest federal decennial census.

(4) "Subsurface sewage disposal system" has the meaning given that term in ORS 454.605.

(5) "Threat to drinking water" means the existence in any area of any three of the following conditions:

(a) More than 50 percent of the affected area consists of rapidly draining soils;

(b) The groundwater underlying the affected area is used or can be used for drinking water;

(c) More than 50 percent of the sewage in the affected area is discharged into cesspools, septic tanks or seepage pits and the sewage contains biological, chemical, physical or radiological agents that can make water unfit for human consumption; or

(d) Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer. Such contaminant levels must be in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act.

(6) "Treatment works" has the meaning given that term in ORS 454.010. [1981 c.358 §1; 1983 c.235 §7]

454.280 Construction of treatment works by municipality; financing. Notwithstanding the provisions of ORS chapters 450, 451 and 454, or any city or county charter, treatment works may be constructed by a municipality and financed by the sale of general obligation bonds, revenue bonds or assessments against the benefited property without a vote in the affected area or municipality or without being subject to a remonstration procedure, when the findings and order are filed in accordance with ORS 454.310. The provisions of ORS 223.205 to 223.295, 223.770 and 287.502 to 287.515 shall apply in so far as practicable to any assessment established as a result of proceedings under ORS 454.275 to 454.350. [1981 c.358 §2]

454.285 Resolution or ordinance. (1) The governing body may adopt by resolution or ordinance a proposal to construct sewage treatment works and to finance the construction by revenue bonds, general obligation bonds or by assessment against the benefited property.

(2) The resolution or ordinance shall:

(a) Describe the boundaries of the affected area which must be located within a single drainage basin as identified in regional treatment works plans; and

(b) Contain findings that there is a threat to drinking water.

(3) The proposal must be approved by a majority vote of the governing body and does not require the approval of the residents or landowners in the affected area or municipality.

(4) The governing body shall forward a certified copy of the resolution or ordinance to the commission. Preliminary plans and specifications for the proposed treatment works shall be submitted to the commission with the resolution or ordinance. [1981 c.358 §3; 1983 c.235 §8]

454.290 Study; preliminary plans. (1) The governing body shall order a study and the preparation of preliminary plans and specifications for the treatment works.

(2) The study shall include:

(a) Engineering plans demonstrating the feasibility of the treatment works and conform-

ance of the plan with regional treatment works plans.

(b) Possible methods for financing the treatment works.

(c) The effect of the treatment works on property in the affected area. [1981 c.358 §4]

454.295 Commission review; hearing; notice. (1) After receiving a certified copy of a resolution or ordinance adopted under ORS 454.285, the commission shall review and investigate conditions in the affected area. If substantial evidence reveals the existence of a threat to drinking water, the commission shall set a time and place for a hearing on the resolution or ordinance. The hearing shall be held within or near the affected area. The hearing shall be held not less than 50 days after the commission completes its investigation.

(2) The commission shall give notice of the time and place of the hearing on the resolution or ordinance by publishing the notice of adoption of the resolution or ordinance in a newspaper of general circulation within the affected area once each week for two successive weeks beginning not less than four weeks before the date of the hearing and by such other means as the commission deems appropriate in order to give actual notice of the hearing. [1981 c.358 §5]

454.300 Conduct of hearing; notice of issuance of findings; petition for argument. (1) At the hearing on the resolution or ordinance, any interested person shall have a reasonable opportunity to be heard or to present written testimony. The hearing shall be for the purpose of determining whether a threat to drinking water exists in the affected area, whether the conditions could be eliminated or alleviated by treatment works and whether the proposed treatment works are the most economical method to alleviate the conditions. The hearing may be conducted by the commission or by a hearings officer designated by the commission. After the hearing the commission shall publish a notice of issuance of its findings and recommendations in the newspaper used for the notice of hearing under ORS 454.295 (2), advising of the opportunity for argument under subsection (2) of this section.

(2) Within 15 days after the publication of notice of issuance of findings any person or municipality that will be affected by the findings may petition the commission to present written or oral arguments on the proposal. If a petition is received, the commission shall set a time and place for argument. [1981 c.358 §6]

454.305 Effect of findings; exclusion of areas; filing of findings. (1) If the commission finds a threat to drinking water does exist but treatment works would not alleviate the conditions, the commission shall terminate the proceedings.

(2) If the commission finds a threat to drinking water exists within the territory and the conditions could be removed or alleviated by the construction of treatment works, the commission shall order the governing body to proceed with construction of the treatment works.

(3) If the commission finds that a threat to drinking water exists in only part of the affected area or that treatment works would remove or alleviate the conditions in only part of the affected area, the commission may reduce the affected area to the size in which the threat to drinking water could be removed or alleviated. The findings shall describe the boundaries of the affected area as reduced by the commission.

(4) In determining whether to exclude any area, the commission must consider whether or not exclusion would unduly interfere with the removal or alleviation of the threat to drinking water and whether the exclusion would result in an illogical boundary for the provision of services.

(5) If the commission determines that a threat to drinking water exists but that the proposed treatment works are not the most economical method of removing or alleviating the conditions, the commission may issue an order terminating the proceedings under ORS 454.275 to 454.350, or referring the resolution or ordinance to the municipality to prepare alternative plans, specifications and financing methods.

(6) At the request of the commission the municipality or a boundary commission shall aid in determining the findings made under subsections (3) and (4) of this section.

(7) The commission shall file its findings and order with the governing body of the municipality. [1981 c.358 §7]

454.310 Construction authorized upon commission approval; final plans. (1) When a certified copy of the findings and order approving the proposal is filed with the governing body, the governing body shall order construction of the treatment works and proceed with the financing plan as specified in the order.

(2) Within 12 months after receiving the commission's order the municipality shall prepare final plans and specifications for the treatment works and proceed in accordance with the

time schedule to construct the facility. [1981 c.358 §8]

454.315 [1973 c.424 §2; repealed by 1975 c.167 §13]

454.317 Resolution or ordinance authorizing levy and collection of seepage charge. (1) When a certified copy of the findings and order approving the proposal is filed with the governing body as provided in ORS 454.305, the governing body may adopt a resolution or ordinance authorizing the levy and collection of a seepage charge upon all real properties served by onsite subsurface sewage disposal systems, as defined in ORS 454.605, within the boundaries of the affected area.

(2) A resolution or ordinance adopted under this section shall authorize the levy and collection of a seepage charge only in an affected area located entirely within a single drainage basin as identified in regional treatment works plans.

(3) A resolution or ordinance adopted under this section shall:

(a) Describe the boundaries of the affected area; and

(b) Contain an estimate of the commencement and completion dates for the proposed treatment works and a proposed schedule for the extension of sewer service into the affected area. [1983 c.235 §2]

454.320 Hearing on resolution or ordinance; notice of levy. (1) The governing body shall give notice of the time and place of the hearing on the resolution or ordinance by publishing the notice of the intent to adopt the resolution or ordinance in a newspaper of general circulation within the affected area once each week for four successive weeks and by such other means as the governing body deems appropriate in order to give actual notice of the hearing. The hearing shall be held within or near the affected area described in the resolution or ordinance. At the hearing on the resolution or ordinance, any interested person shall have a reasonable opportunity to be heard or to present written testimony. The hearing shall be for the purpose of determining whether a seepage charge should be levied and collected.

(2) After the hearing held under this section, the governing body shall publish a notice of the levy of the seepage charge and thereafter proceed to levy and collect the seepage charge in such amount as in the discretion of the governing body will provide revenues for the payment of the principal and interest, in whole or in part, due on general obligation bonds or on revenue bonds issued by the governing body to construct the treatment works or to provide capital funds for the construction of treatment works. [1983 c.235 §3]

454.325 [1973 c.424 §3; repealed by 1975 c.167 §13]

454.330 County to collect seepage charge for municipality. (1) The county in which a municipality is levying a seepage charge under ORS 454.317 to 454.350 shall collect the seepage charge for the municipality.

(2) The county shall establish a separate account for each ordinance or resolution adopted by a municipality and imposing a seepage charge within the county. The seepage charges collected under an ordinance or resolution shall be credited only to the account established for that ordinance or resolution.

(3) Moneys in an account established under this section shall be disbursed only to the municipality for which the account was established.

(4) In order to receive funds under this section, a municipality must notify the county that the commission has ordered the governing body to proceed with construction of treatment works as provided in ORS 454.305 (2). Upon such notification, the county shall release funds from the appropriate account to the municipality. [1983 c.235 §4]

454.335 [1973 c.424 §4; repealed by 1975 c.167 §13]

454.340 Use of seepage charge; credit for systems development charge; seepage charge to cease if user fee imposed. (1) Except as provided in this section, all seepage charges levied and collected by the governing body shall be dedicated and pledged to the payment of the principal of and interest due on general obligation bonds or on revenue bonds issued pursuant to ORS 454.285 for the construction of treatment works or to provide capital funds for the construction of treatment works.

(2) Systems development charges shall not be imposed by a municipality in any area in which seepage charges are imposed and collected under ORS 454.317 to 454.350. If an owner of real property against which seepage charges are imposed has already paid a systems development charge for that real property, the owner shall be allowed a credit against the seepage charge otherwise payable in an amount equal to the systems development charge.

(3) When a user fee for the use of treatment works is imposed upon real property, all seepage charges levied against that real property shall cease.

(4) The governing body, by ordinance, may allocate not less than 25 percent of the seepage

charges collected under ORS 454.317 to 454.350 for the purpose of allowing owners of real properties against which the seepage charges are imposed a credit against the future connection charges otherwise due when those real properties are connected to treatment works. [1983 c.235 §6]

454.345 [1973 c.424 §5; repealed by 1975 c.167 §13]

454.350 Effect of ORS 454.317 to 454.350 on contracts between municipalities. Nothing in ORS 454.317 to 454.350 prohibits contracts between municipalities under which a municipality may provide treatment facilities or services to another municipality. [1983 c.235 §5]

454.355 [1973 c.424 §6; repealed by 1975 c.167 §13]

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuant to ORS 454.275 et. seq.

A. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD AT PARKROSE HIGH SCHOOL ON AUGUST 30, 1984

This summary is based on Department of Environmental Quality staff notes taken during the hearing.

1. James Petersen, Chairman, Environmental Quality Commission (EQC), opened the hearing with a brief background statement describing the history of actions taken by the EQC to protect groundwater quality in East Multnomah County.

   He described the process established in the 1981 rule that prohibits cesspools and that requires the local jurisdiction to provide detailed plans, schedules, priorities, phasing and financial mechanisms for sewering the entire cesspool area by July 1, 1984. These governing bodies responded on June 27, 1984, with the required information. In addition, they presented the EQC with resolutions requesting that the formal process for declaring a "Threat to Drinking Water" be initiated by the Commission in the affected area. Chairman Petersen reviewed the "Threat to Drinking Water" legislation, the conditions which constitute such a threat, and what the EQC is required to do in response to the resolutions.

   The chairman also entered several items into the hearing record (Exhibit 3). These included: the Environmental Quality Commission meeting staff reports and minutes, dealing with on-site waste disposal; the resolutions and reports presented to the Department and the Environmental Quality Commission on June 27, 1984, by Multnomah County and the Cities of Portland and Gresham; and the staff memorandum outlining the dates public hearing notice was given in The Oregonian and The Gresham Outlook.

2. John Lang, Director of Public Works, City of Portland, opened the testimony for the local jurisdictions. He introduced the members of the Multnomah County Sewer Consortium (hereafter referred to as the Consortium) and explained that the Consortium was established through the Section 208 Areawide Waste Water Management Planning Program to evaluate waste water treatment strategies for Multnomah County and the cities of Portland, Gresham and Troutdale.

3. Dennis Buchanan, Multnomah County Executive Officer, testified about the difficulty the county is having in providing urban services under what is traditionally considered a rural form of government. He discussed the conflict between providing city services versus county services, and stated that the county cannot afford to do both. In an effort to solve this difficulty, the county has begun to implement a plan to phase out urban services responsibilities and is moving back to providing rural services.

   The county, under this framework plan, has been developing cooperative agreements and service contracts with the local cities. He felt that in the future the county would expand these cooperative agreements and continue to transfer more urban services to the cities in the area.

   On the issue of the threat to drinking water, Mr. Buchanan stated that the plan submitted for resolution of the problem had been endorsed by the county and the County's Citizens Committee. Mr. Buchanan also entered into the record several letters of endorsement from other Multnomah County Commissioners and the County's Citizens Committee.

4. Margaret Weil, Mayor, City of Gresham, testified to the role the City of Gresham had in developing the threat to drinking water report, and the subsequent plans for providing sewers in the affected area. She stated that after reviewing the basic information developed, the city concluded that at least three of the conditions identified in the threat to drinking water legislation existed in the affected area. In response to this, the city passed a resolution requesting that the EQC declare a threat to drinking water in the affected area. The city currently provides urban services within its city boundary but would also extend urban services into the affected area assigned to them. Mayor Weil stated that the major concern was to make the improvements affordable. She stated that there needed to be cooperative federal/state/local financial planning. She also felt that a declaration of a threat to drinking water should be reflected in the priorities established in the state's construction grants program.

5. Mike Lindberg, Commissioner, City of Portland, testified on the city's behalf, supporting the declaration of a threat to drinking water and the implementation of the plan developed by the Sewer Consortium . He covered three points: (1) the need for sewers; (2) Portland's role in providing sewers; and (3) the cost of the sewer improvements.

   Commissioner Lindberg stated that it is not a question of whether sewers are needed, but when sewers will be installed. He testified that the lack of sewers has severely limited economic growth in this section of the Metropolitan Area. He stated that Portland does have a role in addressing this problem because: a portion of the affected area lies within the city boundary; the city also has been assigned the Columbia Basin which includes Johnson Creek, under the 208 Areawide Waste Water Management Plan; and they now have responsibility for the Inverness Basin through cooperative agreement with Multnomah County.

   Commissioner Lindberg felt that the major issue to be resolved was to make sewers affordable to the residents in the area. He stated this might take some special assistance from state/federal/local governments.

6. John Lang, Director, Public Works Department, Portland, testified as to the specifics of the threat to drinking water report and the plan presented by the Consortium to solve the problem. His remarks focused on four areas: (1) why Portland was involved; (2) the findings within the threat to drinking water report; (3) a summary of the sewerage plan presented; and (4) additional issues.

   Mr. Lang described the affected area boundaries and the portion which lies within the City of Portland. He identified responsibilities Portland has under the 208 Areawide Waste Water Treatment Plan, to provide sewer service to the Columbia Basin, which includes Johnson Creek. He also stated that now by contract, the city is responsible for the Inverness Basin described in the 208 plan.

   Mr. Lang reviewed the four conditions in the Threat to Drinking Water Statute, (ORS 454-275) where any three of these conditions exist in an area, the statute defined it as a threat to drinking water. He stated that the data and information collected by the Consortium to address each one of these conditions led them to conclude that at least three of the four conditions had been met.

He also felt that testimony to be offered by Dr. Schade, Multnomah County Health Officer, later in the day, would meet this fourth condition.

In summarizing the sewer facility plan, Mr. Lang described the trunk lines and interceptor sewers that were needed, the routes of these lines, the areas to be served, and the lines now under construction. He described the priorities for connection and how the project was financed to this point. Mr. Lang stated that the cost of sewering the affected area would be approximately $260 million. He emphasized that Portland would continue to look into different funding options and mechanisms, in order to make it affordable. He felt that public participation was a key and there needed to be more public meetings to describe the project cost and the various financing options.

7. James Keller, Gresham City Manager, described the areas to be sewered with particular emphasis on those areas within the City of Gresham. He discussed the sewering schedule and the City of Gresham's responsibility as a designated local management agency under the Areawide 208 Plan. Mr. Keller discussed the facility needs of Gresham which included improving the treatment plant and trunk lines in order to service the affected area. He specifically requested that the Commission declare a threat to drinking water, and that the Department of Environmental Quality reflect this declaration when developing its construction grants priority list so that local projects within the affected area could receive higher priority.

8. Burke Raymond, Multnomah County, presented testimony on the responsibility of the Central County Service District under the 208 Waste Water Treatment Plan to provide sewer service to the Inverness Basin. He stated recent boundary changes within the Inverness Basin that have left the District considerably smaller than it was when the 208 Plan was originally adopted. Mr. Raymond reviewed the sewage bond elections held in the Central County Area, stating that of 19 separate elections, 18 ended in defeat. He discussed the County's position on municipal service, and that most of the cost of providing sewer service to the Inverness Basin will be in constructing the collection sewers.

9. Mark Gardner, Finance Director, City of Portland, testified on the project financing. He stated that the cost is going to be enormous and that making sewers affordable to the property owners should be the major objective. He felt that we needed to explore every conceivable option including such things as flexible construction schedules, packaging individual collection line construction, and city financing of individual hookups. Mr. Gardner felt that the project needed the support of all local governments if reasonable and affordable financing options were to be developed.

At this point in the hearing, the Environmental Quality Commission members questioned representatives of the local jurisdictions on the testimony that they had just presented. The issues covered in the question and answer period included: the clarification of local jurisdictions' annexation policies; the condition of present sewer facilities and trunk lines; the adequacy of the sewering scheduled in the proposed plan; the quantity of water available in Bull Run system and its future capacity; the financing options that have been considered by the city; and the processes that they (the local jurisdictions) have employed to sewer areas within the city. There was an extensive discussion of the project costs and which project costs would be eligible for federal construction grants assistance, and the possibility of approaching Congress for a special appropriation to fund the project.

10. Gordon Shadburne, Commissioner, Multnomah County, testified that the decision the Commission was going to make had several political ramifications. He discussed why this problem was being addressed at this time and that one could not separate the annexation issue from the consideration of a threat to drinking water. He felt that sewers and the seepage fee tended to support annexation to Portland, and if so, the Environmental Quality Commission was being used to promote annexation. Commissioner Shadburne discussed the development of the threat to drinking water legislation and the particular requirements of that legislation. He felt that the Environmental Quality Commission was being put in an awkward position and if there was a health hazard in East County, why did the City of Portland establish a new well field in this area? He reviewed Dr. Schade's report and felt that the information presented did not show any increase in pollutants or that there was a trend to higher levels.

11. Henry Kane, Attorney, 12275 S.W. 2nd, P.O. Box 518, Beaverton, OR, 97075, representing a Mid-County Citizens Group, presented oral testimony and submitted written testimony in opposition to the Environmental Quality Commission declaring a threat to drinking water. He stated that the data does not meet the statutory conditions for establishing a threat to drinking water. He went on to state that proponents should show pollution levels above state standards by September 11, 1984, or else a seepage fee cannot be supported.

    Mr. Kane also questioned the constitutionality of State Statutes (ORS 454.275 and 454.285) which in effect repealed a local charter.

    He felt the Environmental Quality Commission had a wide range of options to choose from if problems existed. For example: if organic chemicals exist in the groundwater, their use could be prohibited; if the groundwater is polluted, the Water Districts could be required to treat the water; and if disposal methods are to change, the alternative waste disposal systems approved in 1981 should be fully examined.

    He testified that the imposition of a seepage fee was unfair and those paying might not see the benefits in their lifetime.

    In summary, he stated that people should treat the groundwater or don't use it.

12. Jeanne Orcutt mentioned that when the 1983 Legislature changed the threat to drinking water standards, they made it possible for the Commission to find a threat to drinking water without making a finding of contaminated water. The Commission only has to find that sewage has the necessary agents to make water polluted. She questions the water quality sampling conducted in the area and the results. She mentioned that at the August 10th Commission meeting, the EQC, in calculating the priorities, funded sewage treatment plant improvements based on a finding of a threat to drinking water, and therefore, its mind was already made up. She believed these were "trumped up" charges to allow local governments to charge the seepage fee. This fee could be as much as $160 per year for some residents. She stated that vacant lots would benefit because they would not have a seepage bill, and the majority of those were commercial and industrial properties. There was no benefit to older people, having to pay this seepage fee, who would not have sewers in their lifetime. She mentioned that Dr. Schade's report never cited a single illness in the area from drinking

polluted water. She did not believe there was an historical trend of pollution. She did not think there had been a uniform sampling schedule, and quoted from Dr. Schade's report that the conditions in the area were not exactly similar to state law. She asked: if there was a trend, when would the maximum concentrations occur and what would those maximum levels be? She also noted that in Department material provided at the hearing that nitrate levels had decreased since 1974.

In reference to an article in The Oregonian, she commented that Mayor Ivancie, the City of Portland, did not think that the well water was contaminated and the water was equal in quality to Bull Run water. She went on to indicate that the article stated that the aquifer is being used for drinking water is too deep to be contaminated. She said the City of Portland did not think there was any contamination, based on The Oregonian article. She said Multnomah County did not believe that there was any contamination because they were still issuing cesspool and septic tank permits. She stated that the DEQ (sic EPA) regional office in Seattle did not find any safe drinking water standards violations in the water being used in the area. She said most of the water is brought in from Bull Run anyway, and even local water districts are using Bull Run water.

She questioned the difference between nitrate-nitrogen and nitrate pollution concentration levels. She wondered if they had been used interchangably in the Department's reports. She cited a City of Portland report that showed nitrate levels were higher in Bull Run water than in some water samples in Mid-Multnomah County. She concluded by stating that the economical way to solve the problem was to give everyone Bull Run water and sewer only those businesses or commercial properties that wanted it. She questioned why Clackamas County and Troutdale were not required to submit facilities plans as the other affected cities and counties were. She mentioned that in Lane County, Bancroft bonding was not very successful and there were people in the County who were going to lose their homes because they are unable to meet payments.

13. Trudy Jones, 11925 S.E. Sacramento, Portland, stated that she moved here 5 1/2 years ago, and was curious when her sewer bill would arrive. Upon quizzing her neighbors she learned that there were no sewers in the area--that the area was on cesspools. She believes the area needs sewers and is disturbed by the smell of sewage and by the impression visitors get knowing the area lacks sewers. She is concerned about sewage running across people's basement floors and across their property. She cited several examples of individuals she knew who were limited in their activities because they did not want to damage or fill up their cesspool. She said continuing to use cesspools would simply continue to contaminate the groundwater and that groundwater was a valuable and precious resource that should be preserved. She advocated that the sewering plans should not be voluntary and it should not be a local improvement district, but we should move ahead and use the 20-year planning period for hookup. The choice is either the seepage fee or mandatory hookup, and she advocated sewers as quickly as possible.

14. Mal Johnson had been distributing annexation petitions and said the major reason people wanted to annex was their concern for water quality. In his own home, the drinking water had a very strong iodine smell. He said he was not an expert but the sewering plan seems reasonable. He had neighbors and had talked with others who had experienced collapsing septic tanks. He said all indications point to the need for sewers to eliminate both a health risk and a water quality problem.

15. Louis Turnidge stated that it was begging the question as to a water quality problems; that the real question was one of economic development, which he did not like. He questioned the trichlorelethylene and 1,1,1 - trichlorelethylene concentrations in the staff report prepared for the Commission's meeting in Newport, Page 3 of Attachment 5. He advocated a solvent recycling program to eliminate TCE concentrations in the water. He said he had researched nitrate and nitrite pollution in the encyclopedia. Nitrogen/nitrate was used for either explosives or fertilizer and that small children who were poisoned from nitrite/nitrate pollution were probably being affected by carbon monoxide poisoning because their noses were closer to the ground. He did not think that sewers would solve the problem. He did not think that the nitrate problem would be solved by sewers, and felt that solvent recycling was best to solve the problem.

16. Bob Bledsoe, 11800 S.W. Walnut, Tigard, stated he was an environmental technician with the City of Portland's Bureau of Environmental Services in its industrial waste section. He stated that he was very familiar with the Clean Water Act, and had worked for the last 14 months in the financial services section of the Bureau. He was on the Tigard Water District Board. He had his BA degree in math from Portland State University and has taken many engineering courses. So although he was a Washington County resident, he was at the hearing out of a sense of fairness and good judgment. He stated that he believed the management of the City of Portland's Environmental Services Bureau was lying to the public, and that building sewers was a loss leader. The City was simply interested in annexation. They were hopeful that the EQC would mandate sewers. City officials had stated several times that they did not want to be the lead agency, that EQC should be, and they were organizing carefully to keep a low profile on the issue. He felt the City's objectives were to annex those areas and build a larger system which would lead to larger glory for the Environmental Services Bureau.

    He did not think that the City was interested in protecting drinking water, only in promoting their own glory, and that they were hiding behind the Environmental Quality Commission and the sewer consortium. He stated that the drinking water in the area all comes from the City of Portland with two small exceptions-- the Gilbert and Richland Water Districts, and they could simply switch to Bull Run water. The central decision in the equation was drilling wells for the City of Portland's emergency supply.

    Upon research, the City of Portland had found that the upper aquifer and lower aquifer were not connected. He urged the Commission to research that report. There were two deep aquifers he said, both the Troutdale and Parkrose aquifer, and if the Parkrose aquifer is contaminated, they should simply drill deeper. wells.

The wells being tested for pollutants were too shallow. He thought it was unreasonable to expect sewers be built and did not accept the notion that cleaning up the environment should be done at all costs. He summarized that water quality was generally maintained for drinking water, for diluting effluents, for recreational purposes, and for wildlife. The last two, recreation and wildlife, did not apply to underground supplies, and in this case, the Parkrose aquifer should be allowed to be polluted in order to dilute and carry the waste water from the cesspools to the Columbia Slough. He felt it was too much energy to have to build sewers and to pump the waste water.

He said the Parkrose aquifer, which carries waste water, discharges to the Columbia Slough which also receives the City of Portland's combined sewer overflows anyway. No one monitors the Slough and there is not much concern about water quality there. He advocated construction of a separate interceptor to collect the combined sewer overflow along the Slough would be a better idea. He felt that the law was passed, giving the Commission extraordinary power through one-sided and untruthful presentations. He urged the Commission either to table the issue and take it up with the Legislature, or to find no threat. He said if sewers were necessary, they should be built along the roads where commercial development will occur, and residential areas should be left out. In closing, he recommends postponing the decision because there is no crisis.

17. Herb Brown, 1546 N.E. 124 "Columbia Ridge", is the Chairman of United Citizens in Action. He stated that 1984 was clearly the year of "big brother." He said Mid-County residents were faced with possibly two threats, one from drinking water, another from the erosion of their voting rights. He wondered which was truly worse for the health of County citizens. He suggested that if sewering was really necessary, a Countywide sewering agency or even the Metropolitan Service District should be used as the mechanism. He was disturbed that sewers could be ordered without a vote of the people. He said that United Citizens were not against sewers someday, but the problems were that: there was no threat to drinking water; government should have solved the problem a long time ago; and this area is in the urban growth boundary for the region and yet they (the citizens) are losing their urban services which were guaranteed in the home rule charter. He felt that the entire issue was tied to annexation. He concluded by saying cesspools and septic tanks were not the source of the problem, political bullshit was.

18. Leonard Walther, 13606 S.E. Knight, is connected to the Johnson Creek sewer and in the Gilbert Water District. He felt that everyone should use Bull Run water and that well water should only be used for irrigation, that areas should be sewered as they are annexed because the bonding authority of an existing city is needed to pay for sewers. He is very familiar with sewers because his family had been assessed $600 for sewers for their home at 33rd Avenue in 1920.

19. Steven R. Schell, Portland, spoke as a private citizen and has participated for the last 15 years in local government problem-solving and environmental issues. He said what was happening in the area was the local governments were using the Clean Water Act, land use planning regulations, and local comprehensive plans to solve one of the largest economic development and environmental problems in the state. He then referenced the four findings the Commission had before them to make. With regards to soils, he stated that clearly the area was very, very rapidly draining soil. On drinking water, he said the Parkrose Water District was using wells which were less than 200 feet deep. He said that there may be layers of rock between the deep and shallow aquifer, but the water in the shallow aquifer is available for use and being used for drinking water now. He said cesspools and septic tanks were in use and felt Dr. Schade's report was excellent in summarizing the health problems related with that. He said that he wanted to point out that the plan put together for the EQC was workable and that sewage treatment was the solution. He summarized some of the controversies surrounding this issue over the years and commended the sewer consortium for their excellent work, cooperation, and success. He said that the EQC held a gun to the consortium's head and could ruin their good efforts by not taking their recommendation.

He said with regard to the schedule, 20 years seems like a long time and he would advocate sewering more than 25 percent of the area in 20 years. He thought the available dollars clearly were inadequate and there needed to be changes in the Bancroft bonding law to allow for hookup financing. And that they needed to continue to levy the development assessment fund. He closed by urging the Commission, from a public point of view and from the point of view of the statutes, to find a threat to drinking water and move ahead. Chairman Petersen questioned him about the possibility of drilling deeper for water supplies. Schell responded by saying that the pollution levels are unacceptable and continuing to pollute is unacceptable. Dr. Schade said that not all the studies which could prove a trend were available and that the trend analysis is probably there but the data is inadequate. But the data was adequate to make the 50 percent of drinking water standard finding, which was required.

20. Dr. Harold Oserud, Oregon Health Sciences Center, stated that the priorities in water quality should be to drink the most clean source available, which he quoted from the National Guidelines for Drinking Water from the U.S. EPA. He reminded the Commission that only 2/10 of 1 percent of the water on the earth is fresh, and even Bull Run water itself is not totally safe, because of its proximity to Mt. Hood. He said that the city had invested money and wants to use a deeper aquifer for drinking water, and it was still unclear whether or not the deeper aquifer would eventually be polluted by the pollution in the shallow aquifer. After the deep aquifer was pumped down, it may draw the pollution from the shallow aquifer to the deeper one. He said that was the function of the recharge rate in a deeper aquifer, which was not known at this time. He said it was unfair that this one area gets to put their sewage down in the ground on top of a public water supply, where other areas of the state had been forced to build sewage treatment plants. He recounted his own experience in the Eugene area in the mid-1950s, and the difficulty of getting that area adequately sewered when Mid-Mulnomah County was not. He commented that the water underneath the ground in the area was a public resource. He reminded the Commission that no methods exist to remove some of the pollutants in drinking water without distillation.

He closed by responding to an earlier comment that the pollutants which were going down into the ground would be going to the Columbia Boulevard Sewage Treatment Plant, which was not true because of the City's pretreatment program.

21. John Woldorf wanted to hook up to Bull Run water. He said that the financing method for sewers is unfair. It may be legal, but it is not just. He said his property is taxed at a rate too high now, and if sewers add to the value, you still can't sell the property. He asked if the Commission was willing to pick up the difference between where each property was appraised and what he could sell it for. He questioned why individuals have to pay for sewers when it will benefit everyone. He stated that sewers should be required for commercial and industrial properties only. He questioned the amount of money which had been spent lobbying the Legislature for this bill and who had paid that expense. He felt that acquiring sewers would ruin his neighborhood. It would turn those neighborhoods into rental neighborhoods. And it would lead to higher property taxes. He did not believe that the water was polluted and advocated people who did think it is, should use bottled water.

22. Mary Elise Ethenscope, 3904 N.E. 134, said she needed to use chemicals in her cesspool to keep it cleared and she had been working on a local improvement district in Argay Terrace. She said she had sewage running across her yard. She has seen people gathering petitions, who had sewage running across their yard, who could not use their appliances, who had to plan their baths; and the subsoil drainage was even worse in winter. She read a letter from a neighbor who had three teenagers and a great deal of problems in managing their waste water. She urged sewers to be built.

23. Jean Hood, 2134 S.E. 174th, questioned the role of the Commission and the Department, which Chairman Petersen explained. She said that Mildred Schwab, a City Commissioner for the City of Portland, had commented once that her neighbor did not have sewers, and wondered where she lived and why the Department is focusing on sewage in Mid Multnomah County, when so much of the pollution comes from the City of Portland. She went through the various water districts and the fact that almost all of them use Bull Run water.

Water District	Percent of Water From Bull Run
Gilbert	14
Hazelwood	100
Scott	100
Clackamas River	100
Parkrose (nitrate 7 ppm)	100
Pal Valley	100
Richmond (400'well S. of Agay Terrace; no nitrate)	100
Rockwood	most all

She referenced a 1975 letter she had from Senator Hatfield who said the federal government would pay for sewering the area, and that the City of Portland wanted sewers in the area because they had taken over the Meadowland Dairy and they wanted sewers in the area to get out of the dairy. She said that Portland had taken the federal dollars for the sewers and the local area was blackmailed. The City of Portland and the City of Gresham want the dollars for sewers to balance their budgets. She then referenced a Wall Street Journal article on annexation which discussed the interesting technique the City of Portland was using for annexation. She felt that Portland just wanted to gobble-up land. She stated that the City was much more concerned about the quality of drinking water than the quality of police protection for Mid-County residents. The city just wanted to leverage the services to gain additional land. She advocated letting people pay for sewers as they can. She felt the seepage charge was unfair. She wondered: if the water was so bad why did the Governor advocate the repeal of the unitary tax, and wanted industry to locate in the area?

24. Bonnie Luce, 3441 S.E. 174th, said that she was a fifth generation Oregonian. She advocates sewers on the pay-as-you-go basis and said she did not like the seepage fee concept because of her age. She would not live to see the benefit from it. She said there was too much rush to address this problem. She said East County had been just fine for many years and now everyone rushed out there. She stated that their well had been located between two cesspools, and the water had been perfectly pure until the casing broke and they had to stop using it. This hearing was a boondoggle. She wondered why there was no interest for people when they paid a seepage fee. She wondered when sewers would be available and where the remainder of 75 percent of the seepage fee was going.

25. Arthur Stephenson, 12507 N.E. Halsey, was a minister for 38 years. He talked about living in the Tacoma Prairie water table and commented on the differences between the soils there and soils in Mid-Multnomah County. He said East Multnomah County had a slower moving water table, which allowed greater potential for pollution. He wanted everyone to get the facts. He wanted to take all the water wells out of East Multnomah County and use Bull Run water.

He did not want to create slums in the County and felt that it would be very difficult to sell houses having huge sewer bills. He advocated that people in East County wanted to decide on their own fate, and he wanted the East County residents to vote on the facts without having biased information from sources like the Boundary Commission. He is concerned that too many decisions affecting East County were made in downtown Portland and that the people in East County wanted the facts in order to decide.

26. Bill Emig, 1940 N.E. 129th Pl, Portland, Oregon, believes that sewers should have been installed in East Multnomah County 20 years ago when the problems were first present and the cost was cheaper. Mr. Emig stated that he has contacted 200 neighbors about annexation to Portland and that 80 percent have accepted the idea of sewers, even with the cost. No one wants to pay the $5,000 - $10,000 assessment for sewers but it is a necessity. He further stated that East Multnomah County is a poor relative to Washington and Clackamas Counties and that East Multnomah County has stagnated--sewers would improve the area economy and would improve the drinking water quality. He recommended that the EQC take positive action on an areawide sewer system for East Multnomah County.

27. Beverly Moffatt, 3418 N.E. 129 Ave., Portland, Oregon, served on the Blue Ribbon Multnomah County Citizens Advisory Committee for Sewers and on the Budget Committee for the Central County Service District. She has served as Chairperson for the Save Our Basements Committee since 1981. Ms. Moffatt urged the EQC to take immediate action on the threat to groundwater. She stated that East Multnomah County residents dump 14 million gallons of sewage daily into the aquifer, and she could not conceive of any area being allowed to do this--East Multnomah County is the largest unsewered area in the United States. Ms. Moffatt mentioned that the DEQ and EQC is strict on air and noise pollution but that groundwater contamination takes the backseat--"out of sight out of mind". She stated that sewers will not be any cheaper in the future and that the Multnomah County Sewer Consortium has saved the area $14 million by securing grants. Further, Portland and Gresham have better financial capability (than the unincorporated areas) and can sell bonds for a lower interest rate. Ms. Moffatt concluded by requesting that the EQC declare a "Threat to Drinking Water".

Commissioner Denecke asked what the cost would be to the average resident. She responded by saying that costs for sewers in her neighborhood had increased from $1,800 to $3,800 in 2 years but that cost estimates would be difficult to get until the sewers are designed.

28. Dr. Charles P. Schade, Multnomah County Health Officer, 420 S.W. Stark St., Portland, Oregon, 97204, gave testimony pertinent to groundwater contamination in East Multnomah County.

Dr. Schade first addressed the question of trends. He stated that, based on an analysis of 10 years of data, there appears to be a positive increasing trend in nitrate-nitrogen contamination. However, seasonal variations in data limit its usefulness for trend analysis. Another limiting factor is that groundwater data has only been systematically collected for the past 1 1/2 years. He concluded that, because of the limitations of the data set, a mathematically sound (linear regression) trend could not be established. He also attempted to determine a trend in nitrate-nitrogen by looking at wells in surrounding areas. This was based on the assumption that contaminated wells would, prior to contamination, have nitrate-nitrogen levels similar to nearby but unpolluted wells. Again, there was some evidence of a trend but he could not prove that the 10 ppm nitrate-nitrogen level (EPA drinking water standard) would be reached.

Dr. Schade then addressed the question of nitrate-nitrogen concentrations. He stated that nitrate-nitrogen levels exceeded 50 percent of the standard and that is a significant contamination level of nitrate-nitrogen. He is convinced that the groundwater does have high levels of health-threatening human and industrial waste contamination.

During a question and answer period, Dr. Schade stated that the 10 ppm standard for nitrate-nitrogen was very defensible and was based on considerable empirical evidence. In response to questions regarding the statutory criteria to determine a threat to drinking water, Dr. Schade concurred that: (1) the groundwater aquifer is used for drinking water, (2) 50 percent or more of the sewage flow is discharged to cesspools, and (3) that the sewage has agents which contaminate groundwater.

29. Emil Berg, 2218 S.E. Cypress Ave., Portland, Oregon, has served as a member of the City of Portland's Environmental Services Advisory Committee, a group that has studied how the city could extend sewerage services. He stated that the Committee felt that: (1) it was most reasonable to extend interceptor sewers into unsewered areas before local improvement districts (LIDS) were formed, thus facilitating creation of voluntary LIDS; (2) rates of connection should take into account individual financial circumstances, therefore, residential connections should be able to be deferred in cases of aged and low income persons; (3) the statutory authority for the deferral of tax assessments for the aged should be expanded to include low income persons; and (4) the interest cost of deferral should be minimized so the burden of deferred cost is not greater than the estate value of the property when sold.

30. Douglas Hartman, 2605 S.E. 118 Ave., Portland, Oregon, 97266, has served as chairman of the Powellhurst Neighborhood Association. He stated that the Association's predominant questions were: when will sewers be provided and at what cost? Representatives of the city of Portland had addressed the Association and provided the answers--although never as specific as he would like--but the Association recognized that the overall health and vitality of the neighborhood depended on sewers. Postponement of sewers would only increase their cost. However, he recommended that a thorough analysis be conducted to discuss costs and other details.

31. Mike Burton, 6937 N. Fisk, Portland, Oregon, serves as Chairman of the North Portland Citizens Committee and is an unopposed candidate for the House of Representatives, District 17. Mr. Burton testified that issues affecting the unsewered areas also affect his North Portland neighborhood, where the City of Portland's treatment plant is located. He expressed concern about the cost impact on all residents, both inside and outside the city, explaining that one benefit of fuller utilization of the plant will be reduced cost burden to city residents.

He raised three issues for the EQC's consideration: (1) the establishment of a clear and strong statement that sewers are needed to protect the environment; (2) a statement of economic benefit, recognizing that industrial development in the northern tier of the mid-county opens up residential development in the southern tier; and (3) the most equitable means to finance sewerage services, both within and outside his area, since city residents have been paying for the infrastructure for many years.

32. Frances Hyson, 16507 S.E. Mill St., Portland, Oregon, explained her confusion over the interest rates which would be applied to individual tax assessments: Were they 6%, 12% or 18%? A combination of 6% and 12%? She stated that people do not explain the real costs, noting that although project costs were reported in Gresham, the City was not informing people of the cost to replumb their homes. She asked why it was not revealed that tax assessment deferral will eliminate the value of the property inherited by their children, stating that people cannot afford that.

Mrs. Hyson resented that the governmental representatives were the first ones to testify and that the residents were limited to 3-5 minutes. She stated, none of the politicians stay to listen to the people. If they (politicians) have other meetings to attend, they should take their choice. We have to stay here until all hours of the night.

She asked why there are still drinking wells in the area if there is a pollution concern; she stated her shallow well was not contaminated according to lab tests which she's had done for 7 years. She understood that the State has to check every well every day, not to order wells closed. She asked how many wells have been checked and for how many years.

She opposed an areawide seepage fee that would pay for improvements in areas other than where the paying residents lived.

33. Alvan Barnetzke, 2322 S.E. 139 Ave., Portland, Oregon, testified that he lives in an area over a gravel bed which should produce pure water, but due to his age, he would not live to see an improvement. He was concerned that he might pay the seepage fee for years before any benefit is received, since it might be 20 years before sewers are installed. He suggested that it was cheaper to buy Bull Run water and indicated that they must prove his water is bad.

34. John Lang, City of Portland, Bureau of Environmental Services, 1120 S.W. Fifth Ave., Portland, Oregon, 97204. An unidentified resident from the audience asked whether a tax assessment deferral was due on sale. John Lang responded that the assessment is due when the property title changes hands. The deferral is a mechanism where certain age and income bracket people can petition the state to pay their assessments, repayable to the state at about an 18 percent interest rate.

35. Ed Benedict, 3055 S.E. 118 Ave., Portland, Oregon, 97266, representing Oregon Fair Share, stated that recently he had sewage seep into his basement and that the installation cost for a new cesspool was $2,000. He said that last year he investigated the possibility of a petition for annexation and found that merchants wished to annex because the number one problem is sewage. He believes that the County Health Department and the EQC have "the welfare of the people at heart". He further stated the need for a meaningful construction finance program. He is concerned that sewers will create financial crisis for families and the Oregon Fair Share calls upon the state legislature and congress to provide necessary revenues to protect people on limited income.

36. Pat Holcomb, 1020 N.E. 131 Pl, Portland, Oregon, represented the East Multnomah County Chapter of Oregon Fair Share. She stated that hookups must be optional or by a grant. She asked the EQC to: (1) be optional on sewer hookups, (2) provide grants to households (if they would lose their homes because of sewers); and (3) give elderly and low income residents the opportunity to extend payments over many years.

37. Robert Miller, an Oregon Fair Share member, addressed project costs. He stated that the EQC must require that workable financial solutions be available to residents before cesspools are banned. Cost estimates for sewers today are about $8,000 but will increase during the 20 years of sewer project development. The costs particularly burden young people starting out and the elderly. He urged that the EQC make available Bancroft funding or other low cost financing for costs such as service laterals and replumbing homes.

38. Karen Luckhaupt, 1025 S.E. 175 Pl, Portland, Oregon, 97233, a member of East County Oregon Fair Share, opposed the seepage fee in the sewerage plan because it: (1) may be abused by any and all governments that collect it; (2) may benefit some but is collected elsewhere, insuring only a 25 percent return of benefit to households; and (3) imposes a double payment, because some residents will pay for a treatment facility for others, while maintaining their own system. Also, they would pay later to hookup their system after paying the seepage fee.

Commissioner Petersen urged Oregon Fair Share to discuss the statute regarding seepage fees with the members of the Oregon Legislature.

39. Dr. William Morton, 3181 S.W. Sam Jackson Rd., Portland, Oregon, who specializes in health problems related to environmental factors, expressed his opinion that historically people have recurringly encountered disease problems in conjunction with changes in urban concentrations, densities, and economic development. He is concerned about the increasing nitrate levels in the groundwater. His own research indicates that increased blood pressure levels and associated health problems may be linked to nitrate levels. In urban areas, there is also the risk that nonbiodegradable chemicals and possible carcinogens will enter the groundwater. These nonbiodegradables would primarily originate from industrial waste disposal; by and large, they would not be the degreasers used in cesspools but there might be a combination of these discharged.

40. Helen Nickum referred to a theory that government originated in the early Tigris-Euphrates River Valley over an issue of water rights and stated that there was no point in having government if water is not fit to drink. She urged the EQC to take early, immediate steps to solve the groundwater problem, no matter what the cost.

41. George Muir emphasized that although the EQC is concerned about pollution, the use of seepage fees elsewhere will be affected by the EQC's decision here. State Senator Glen Otto is recommending use of a seepage fee for an area of groundwater concern near Albany.

42. Howard Willits stated that he is in favor of sewers--they are modern and are needed when so many people are involved. Sewers are relatively trouble free; they are expensive but it is cheaper in the long run than illnesses or public health problems. He stated that sewers are good investments by creating jobs and adding to property values, and that sewers should be installed as soon as possible.

43. Greg Frank, 3210 S.W. Stocksdall Drive, Portland, Oregon, served on the Multnomah County Citizens Advisory Committee for Sewers from 1982-83. He stated that in committee work, the citizens found sewers necessary to stop degradation of groundwater. He requested that the EQC decide sewers be installed as quickly as possible.

44. Ken Bunker, 1825 N.E. 125, Portland, Oregon, 97320, is generally opposed to sewers. He is concerned about the method of financing sewers and is opposed to the seepage fee concept.

45. Warren McPechmar favors annexation. He does not want to see the area blighted. He worked on annexation with the City of Gresham to get sewers and is disappointed with delays. He feels sewers would enhance: property, economic development, and livability.

46. Pat Brown presented cost estimates for sewer hook-ups and Bancroft financing. Pat is concerned about added expense to the elderly who may choose to defer payment for sewers until sale of their property, which may not leave enough funds for old-age care. She is opposed to the seepage fee concept. Ms. Brown believes that proof of a threat to drinking water (4th condition) rests with the Commission.

She believes that the most economical solution would be to take the following actions: 1) install charcoal filters to remove solvents and other impurities from groundwater; 2) stop immediate growth and industrial expansion; 3) stop agricultural use of lands; 4) control industrial use of chemicals; and 5) either treat the water or close down the wells.

She also raised these questions: (1) How was volume of 14 mgd of raw waste derived? (2) Where and when was sewage tested? (3) What would be the effect on property value if a threat to drinking water is declared in the affected area?

47. John Herceg, 7321 S.E. 48 Ave., Portland, Oregon, 97206, stated that Errol Heights experiences 70% failure rate for cesspools. He also stated that new cesspools cost between $1,400 and $2,000. He believes that sewers are the best solution for Errol Heights area.

49. Elsie Chido, S.E. 194, Portland, Oregon, believes the decision to sewer the affected area has already been made, and this hearing is a formality. She stated that residents have paid for sewers, which only benefitted developers and schools. She believes it is more economical to use Bull Run water than to sewer the affected area. She does not want fluoride added to drinking water.

50. Michael Dwyre, 4330 N.E. Maywood Pl., Portland, Oregon, 97220, is opposed to areawide installation of sewers because it encourages population growth and other negative aspects associated with such growth. Mr. Dwyre prefers that sewers be installed to correct only localized problem areas. Mr. Dwyre believes that Parkrose will discontinue use of wells and rely on Bull Run water, so the first criteria of a "threat to drinking water" is not applicable.

51. Joseph L. Miller Jr., M.D., 52815 E. Marmot Rd., Sandy, Oregon, 97055. Dr. Miller's main concern is the Bull Run water supply and the logging activities in the watershed. He feels that the City of Portland is developing a wellfield in east county to avoid building a filtration plant to reduce turbidity in the Bull Run supply. He recommends that Little Sandy River be developed as an alternate source for water supply rather than the groundwater. He also recommends that a consultant be hired to study the groundwater situation in east county because a Corps of Engineers' Report suggests that the deep wells developed by Portland could draw contaminated water from the upper aquifer to the deeper aquifer.

51. Bonnie McKnight, 1617 N.E. 140, Portland, Oregon, believes this hearing is premature because the source of problem has not been identified, and the statute allows the problem to be defined without standards. She believes that the installation of sewers would place a severe economic burden on elderly people and low income families, and upset a stable community. She claims a CH_2M/Hill report states that sewers in Mid-County are not affordable.

52. John Scalise, 2208 N.E. 142 Ave., Portland, Oregon, objects to the seepage fee concept and to the construction of sewers because it disrupts roads. Besides, the installed sewers would invite rats. He claims that 30-40 years ago, the County sanctioned the use of cesspools for waste disposal because of rapidly draining soils. He believes that groundwater quality is not contaminated, otherwise purveyors would not distribute it to the public. He believes the cost of sewers is too high and does not want to be annexed to Portland. He believes that subsoils should be used for waste disposal, and either a reliable surface water supply should be found or deeper wells should be drilled and properly cased.

53. Jackson Douthit, 10321 S.E. Center, Portland, Oregon, 97266, is opposed to annexation and believes that a declaration of a threat to drinking water is a promotion to have citizens pay for commercial development. He does not believe a groundwater quality problem exists and opposes construction of sewers. He believes that safe potable water can be developed from the deeper aquifer.

54. Phil Carrell, 13014 N.E. Morris Ct., Portland, Oregon, believes that sewers in the affected area would benefit public health over the long term and improve property values. He recommends that more methods be found to finance construction of sewers to spread the costs.

55. Ludmilla Pitkin, 16373 S.E. Morrison St., Portland, Oregon, is opposed to annexation to City of Portland. Ms. Pitkin raised questions on source of monitoring and analyses of groundwater.

56. Ralph Holmes, 11505 N.E. Glisan, Portland, Oregon, objects to the seepage fee concept (prepayment for sewers without the benefit of being sewered for many years).

57. Elowise Baily, 24138 S.E. Oak, Troutdale, Oregon, 97060, believes that the whole issue of a "threat to drinking water" should be postponed until a study is done to show conclusively that groundwater is polluted.

58. Patsy M. Pfeifer, 17 N.E. 172, Gresham, Oregon, 97230, agrees that problems need to be addressed but is disturbed with the methods and means to sewer east county. She believes that the "Threat to Drinking Water" Law is sneaky because it requires only 3 out of 4 criteria be met to have an area declared a threat. She asked the EQC to be particular in designating the affected areas (better define the boundaries), and to base their evaluation on facts and not on possibilities. She suggests maximum flexibility in financing methods where projects are needed. She opposes annexation as a method to solve sewerage problems.

59. Jim Worthington, 3232 S.E. 153, Portland, Oregon, is opposed to the political makeup of the consortium and favors the formation of a unified sewerage agency like in Washington County. He believes the City of Portland is interested in only annexing selected property. He favors more economical waste control methods such as those used in Europe. He opposes sewering the affected area as proposed by Multnomah County Sewer Committee.

60. Perry Buck, 4653 N.E. 102 Ave., Portland, Oregon, 97220, is opposed to annexation to City of Portland. He favors sewers and a separate city. He is concerned about the non-voting nature of the "Threat to Drinking Water" statute. He asked the EQC to consider the wishes and interests of the people before making a final decision.

61. Ron O. Weaver, 2639 N.E. 137, Portland, Oregon, 97230, favors the sewerage proposal for the affected area because it would begin to restore groundwater quality. He believes clean water supplies are diminishing.

62. Robert Luce, 3441 S.E. 174, Portland, Oregon, 97236, delivered a petition with about 130 signatures. He does not believe a threat to groundwater exists, and if one did, people should use Bull Run water. He believes that the proposed plan is promoted by special interest groups who have affected property. He asked the EQC to not declare an area-wide solution to benefit only a few people.

63. John F. Vogl, 16410 S.E. Stephens Ct., Portland, OR, objects to the seepage fee concept because he does not trust accountability of the funds. He suggests that communities should use Bull Run water if groundwater is contaminated. He is not against sewers but urged the EQC not to be badgered into making an unjust decision that would favor only a few.

NJM/ALS/JAG/KW/TJL/BJS/ELQ/ERL:tl
TL3652
11/29/84

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuant to ORS 454.275 et. seq.

C. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD IN ROOM 1400 OF THE YEON BUILDING ON SEPTEMBER 11, 1984

This summary is based on Department of Environmental Quality staff notes taken during the hearing.

1. Dean Welch, 1253 S.E. 139, Portland, Oregon 97233, is opposed to the installation of sewers in the affected area. He believes that the quickest way to correct the problem would be to bring in a new source of drinking water. He was also opposed to the meeting place (Room 1400, Yeon Building) because it is outside the affected area and hard to get to.

2. Lucille Bickford, 435 N.E. 131st Place, Portland, represented herself, her husband, and her neighbors and friends.

   She believes that sewers will eventually be needed, but she wants proof that she is contributing to the problem. She also raised the following questions: (1) What waters are being polluted? (2) Whose wastes are causing the problem? (3) What contaminants are present? and (4) Who made the analyses?

   She believes that there is conflicting information on the cost of sewers. She is also opposed to the seepage fee concept. Ms. Bickford asked to be placed on the mailing list for subsequent information.

3. Richard Lozo, 1717 N.E. 137th Ave., Portland, is opposed to construction of sewers based on the evidence presented. He has not experienced any problems with drinking water or with his cesspool. He believes that if a problem exists, the most economical way to solve the problem would be to find another source of drinking water. He also believes that people in the affected area should be able to vote on the issue of sewers. He also estimated that the cost per household could be about $3,900 per unit based on $216 million divided by the number of households in the affected area. He expressed concern about the potential air pollution associated with industrial development, if sewers were installed.

4. W. C. Peebler, 13848 S.E. Rhine, Portland, is a property owner, who wants the people in the affected area to have an opportunity to vote on the issue of sewers. He believes that installation of water mains to deliver water either from Bull Run or from a water treatment plant would be cheaper than to install sewers. He also believes that cost for sewers would make property unsaleable, and that reasonable definite cost for sewers has not been established.

5. Earl Wood, 13535 N. E. Schuyler, Portland, being retired, expressed concern that the cost of sewers is indefinite and likely excessive. He estimates that sewers would cost $10,000 per lot plus $1,000 to $2,000 for a hook-up fee. For such rates at 12.5 percent interest, it would cost him about $100 per month for the interest alone. His general view is that the people in the affected area don't need sewers at such costs. He suggests that if the upper layer of the aquifer is polluted, it doesn't mean that wells tapping deeper from within the aquifer would draw polluted water.

6. Virginia Purkey has lived in the original Parkrose area since 1957. She does not believe many people in her neighbothood--widows, widowers, and single parents with children--can afford from $10,000 to $12,000 for sewers. She also noted that there are added costs to abandon a cesspool and to reverse the plumbing before hooking-up to a sewer.

   She believes more research is needed to understand how soils reduce pollutants. She also believes the county should declare a moratorium on the use of non-biodegradable detergents and should eliminate the use of garbage grinders because these sources contribute to the problem.

   She felt that an alternative method for household sewage disposal would be the use of composting toilets. She reported that one real estate service was buying up homes on 122nd Avenue and renting them.

   She also identified a dilemma as follows: Areas having clay soils are unsuitable for subsurface disposal of waste, leading people to build where soils are rapidly draining, only to discover that these areas are also unsuitable for such disposal methods.

7. C. W. Norton, 419 N.E. 131st Place, Portland, emphasized that the issue to construct sewers should be voted on by the people.

8. Richard G. Peters, is a local builder for the past 35 years. He indicated that 99 percent of the homes with basements in the affected area have cesspools in the backyard. He noted that the installation of sewers would require not only digging up the streets but also the yards, driveways, and basements. Such projects would be extremely costly and be disruptive. He believes that few people can handle this type of indebtedness and that the issue of sewers should be voted on by the people.

9. Bill Lamb, 651 N. Tomahawk Is. Dr., Portland, has been a building contractor for the past 25 years. He agreed with Mr. R. G. Peters' testimony. He believes that the cause of the groundwater quality problem stems from the wide use of caustic soda to clear cesspools and septic tanks. He claims to have a biodegradable cleaner that has been effective in clearing cesspools and septic tank drainfields for the past 16 years. It was his contention that the groundwater quality problem could be alleviated by using his product, thereby eliminating the need for areawide sewers.

10. Louis Turnidge, 18144 S.E. Pine St., Portland, testified that the Department's staff report regarding 1,1-Trichloroethane, used in plumbing systems, was found only at about 1 part per billion in some wells. He believes that the sands and gravels worked very well in filtering wastes except for slippery substances such as solvents. He believes that the source of nitrates and sulfates in groundwater comes from fertilizers like ammonium sulfate.

11. Sharron Kelley, is President of the Rockwood Community Group. She identified two issues as follows: (1) She agrees that groundwater pollution exists in the affected area. She noted that the Community of Rockwood took up this issue which led to the sewering of the Burnside Corridor some years ago. She noted that Rockwood draws its water supply from deeper wells and thus has a lower nitrate-nitrogen content (ca. 2 parts per million); (2) She believes that the Commission should take a deeper look at the pollution level and the high cost to the people. She hopes that the future density development occurs along the Burnside Corridor where sewers are available.

12. Jean Hood, believes that the groundwater used for drinking water is good, and now is not the time to dispute the quality. She asked what the difference is between the sewage emanating from a garbage dump and from her cesspool. She believes Argay Terrace needs sewers because the subsoil drainage is poor. She blames the development of Argay Terrace on planners (imported from the East), who were unfamiliar with the area, and on builders for being allowed to build in Argay Terrace. She also noted that the residents already paid for sewers once but she did not know where the money ended up.

13. Herb Brown, submitted a petition from persons protesting the seepage fee, and written testimony concerning the inconvenience of the September 11, 1984, hearing location at the Yeon Building. He was also concerned about the source of pollutants since dye tests of cesspools were not performed, and soil core samples were not obtained to pinpoint the sources of pollution. He concluded that there may be pollutants present at scattered points but the sources are unknown.

14. Jeanne Orcutt, protested that this (Yeon Building) hearing location, which is 15 miles away, is not considered to be near the affected area. She suggests that this distance may be in violation of state law. She has submitted a number of documents for the record, including City of Portland Ordinances, statements, and maps. She believes the most economical method of solving the problem is to deliver Bull Run water to the few remaining people who rely on groundwater. She expressed concern that under the seepage fee concept, one can be charged more than the eventual sewer connection fee. She is also concerned with the "first source agreement" as not being in the best interest of Mid-County residents.

    She raised the following questions:

    a. What would be the effect on the water table if 14 MGD of waste water is withheld?

    b. What is the effect of domestic animal wastes on the groundwater quality?

    c. What is the impact of human burial on the groundwater quality?

15. Carl Halvorson, 105th Marx, Portland, supports the proposal to sewer the East County area but believes that the high cost will adversely affect many people. He believes that the problem needs to be resolved for future generations, with the least impact on the people in the affected area.

    He suggested that greater support for the project should come from the region because the region will benefit from sewers in the affected area and thus should bear some of the cost. He noted that if sewers had been installed 15 years ago, the federal government would have paid for two-thirds of the project. He concluded that we have reached a point where we cannot continue pouring wastes into the ground.

16. Donald R. Cook, 2006 S.W. Sunset Blvd., Portland, agrees with comments of United Citizens in Action, and believes the most economical solution to the problem is to use Bull Run water. He also believes that the City of Portland's development of a well field may have been a bad investment.

17. Bonnie Luce, 2331 S.E. 174th Ave., Portland, Oregon, 97236, expressed concern that the cost of sewers will be a financial burden on the elderly, and may cause them to defer payment of their taxes. She believes that home values will be adversely affected, and only the affluent will be able to afford sewers. She also noted that the Columbia Basin is not identified in the 208 Basin Plan and may be illegal.

18. Robert Luce, 3441 S.E. 174th Ave., Portland, Oregon 97236, suggested that someone has been distorting the facts. He questioned that 14 MGD of sewage could be generated by the resident population in the affected area. He suggests that body wastes should be separated and disposed of separately from other waste water streams in the home, thereby lessening the adverse effects on groundwater quality. He further noted that most of the Mid-County residents work in Portland and deposit their sewage in the city system.

ELQ/ERL:lt
TL3686
Revised November 29, 1984

F1

September 11, 1984
Portland, Oregon

Ms. Sonia Buist
Ms. Mary Bishop
Mr. Jack Peterson, Chairman
Mr. Wallace Brill
Mr. Arno Denecke

Re: Threat To Drinking Water Decision
Groundwater in Mid Multnomah County

Dear Ladies and Gentlemen:

Permission to include this letter, as additional evidence, was granted by Mr. Denecke, with knowledge of Attorney Mike Huston and Mr. Hal Sawyer, if said letter could be written and received within the week.

On Monday, Sept. 10, I, personally called 29 households on my street and adjoining neighborhood to advise them of this Sept. 11th meeting. With such short notice given them by me, it was impossible for them to attend (with the exception of 4 people who did attend). However, in defense of those not present, I must say deep interest on this matter was not lacking, and they indicated to me to do my best to find out what they could do. Thus, my plea for additional evidence to be accepted.

Now I find it to be physically impossible in the time allotted to get back to these households and explain the type of testimony letters needed from each of them. Hence, so far as I know, mine will be the only letter.

I will attempt to put my file of 9 years down on paper and at your disposal. Again, I know getting it down on paper is impossible, but I will try.

I feel that you will make a fair and impartial decision on the threat to drinking water and subsequent solution, but I also feel that you have not been supplied with enough good evidence either from our people in government or from the people in the affected area, to be able to make that decision. At this time, my husband and I believe there are still too many unanswered questions for you and for us to make such a final, irreversible decision as you are faced to make. Unanswered questions from all sides - government, those in authority, officials, engineers, contractors and taxpaying public of the area.

QUESTION: (To taxpayer) - Are you going to be able to pay for this?

ANSWER: I don't know. You aren't telling me how much I need to pay. Right now, I am told the astronomical figure of $7000 to $10,000. per one house, plus an unknown amount, with no lid, for an eternal seepage fee, plus an unknown assessment charge for making available the line on my property frontage, plus the cost of caving in and re-filling my cesspool, plus a hook up fee. (The hook up fee may be included in the assessment charge. As of today, I do not have time to verify this point.) The total, with or without hook up fee included, is dollars enough to be mind boggling.

QUESTION: Why must the $7M to $10M figure be so high?

ANSWER: I am told, where a 7 ft. or deeper basement is involved, and the plumbing is to the rear of the house, excavation through the front yard, under the basement to the back of the house to meet the present plumbing is necessary -- or, re-plumb to the front of the house, which means jackhammering the basement floor and patching, plus any weakening of structure, disruption of family life,et.al. The reason for going under the basement, I am told, is because I cannot go to one side of my house and right angle to the back center or end to meet present plumbing. Now I can see why such a high cost is given.

POSSIBLE SOLUTION: Moratorium. Find out if there is a better way with verified answers. Isn't there plumbing code that allows a less expensive and affordable way. Why wasn't this information volunteered at any of the meetings I attended? Did I miss hearing it? Surely there were engineers, plumbers, contractors present who could have supplied this possible less expensive way.

I don't know if this brings cost down some, which cost I may or may not be able to afford and handle, but I am still going to be faced with a no ceiling seepage, or what I like to call, maintenance fee. Surely there must be a more equitable, affordable plan for this maintenance.

Why must this fee be collected from the area before actual hook-up, just because there are no funds to build. Whose fault is this?

I am told, because I am polluting with my cesspool and it is getting to the serious deadline, and funds must be accumulted to do this work now and pay later. (The pay later seems to me to be why we are constantly being told our national debt is high and keeps going higher with no solution in sight.) You hold in your hands/the power to control one small portion of a government debt.

QUESTION: (To taxpaper) Are you polluting the ground level water with your cesspool?

ANSWER: I don't know. No one has given me any proof of this. I keep trying to find out. What analysis has been made? Where was it made? Where is the analysis in writing that I can understand? How am I polluting it? What am I doing wrong?? (At the Aug. 30th hearing, for the first time - it must be on the tape as to who said it - someone dared to say that the single family cesspool is not polluting - it is more business and/or industry with their chemicals - dry cleaning solvents, etc. going into cesspools.) Since 1975 the area is hearing that ground level water is being polluted, then I am told, that I am doing it, and now I am told that maybe I am not. I want an honest answer. Why have I been told that sewer is my only answer?

SOLUTION: Upon further inquiry, I did find that if I were a user in my household of certain products (caustic in nature) or certain soaps, yes, I could be a polluter. If this is true - more time is needed - we need verification -- then let's educate proper use of existing cesspools, or if another law (heaven forbid) must be passed, outlaw the use or sale of these polluting products. If Oregon could be first to keep clean with a bottle bill -- couldn't we continue on this same vein?

How can I be sure that by diverting my sewage from a cesspool to a sewer is the best solution? Under this method my household waste goes to a sewer, to be sent to a treatment plant to be deposited from there in the Columbia River. Am I causing more and worse polution to the river? Were those rivers located in the East of our country that ended up in such sad state receiving raw sewage in every case, or was some of it treated sewage and there was just too much of it too soon?

QUESTION: If cost is a factor, why can't you Bancroft?

ANSWER: What is Bancroft? As far as I know, that is the name of someone in my parish. I have since found out it has something to do with funds that I can get. Is this true? Is it available only to me or to everyone? Surely if I get funds, they must be repaid somehow. Can I afford the payments? And if I do go this route, doesn't it mean my property will be saddled with this re-payment until paid? Does this mean I cannot sell my property without the future buyer knowing and accepting these payments? How can I, in reality, find a buyer who can afford to make monthly paymants for my house on today's market and be able to assume this obligation also.

I am sorry, time does not allow me to go on. I must get this letter delivered before 5:00 p.m. this evening.

Please feel free to call me - 253-4682 - if I have given you, or can give you any answers that I may have.

It would seem several additional points need be covered more in detail when the matter is up for consideration.

Please notify me in writing when and where the commission will meet for your final decision.

Thank you.

Sincerely,

Mrs. Max Bickford
(Lucille)

Mrs. Max Bickford
435 N.E. 131st Place
Portland, Oregon 97230

253-4682

P.S. I do not have time to proof read the above. Please excuse all typographical errors and strikeovers.

F52

OCT 25 1984

WATER QUALITY CONTROL

Louis Turnidge
18144 S. E. Pine St.
Portland, Oregon 97233

October 25, 1984

To the Evironmental Quality Commission

I'm the fellow that in testimony before you on a "Threat to drinking water" urged you to examine encyclopedia references relating to the matter to your own satisfaction. Since then I've continued my own examination of the matter. Enclosed are two copies of encyclopedia references to the disease Dr. Shade described his concern about. I ask you to read them and draw your own conclusions. My own opinion is that nutrition deficiencies are a significant contribution to the problem.

Sincerely yours,

Louis Turnidge

ls of cells and organisms vary, not only
lso the synthesis of enzymes must be
e enzymes responsible for muscular ac-
scle must be activated and inhibited at
. Some cells do not need certain en-
l, for example, does not need a muscle
rium does not need enzymes to metab-
hat are not present in its growth medi-
es, therefore, are not formed in certain
ynthesized only when required, and still
in all cells (see also GENE). The forma-
of enzymes are regulated not only by
ms but also by organic secretions (hor-
locrine glands and by nerve impulses.
also play an important role (see below
y and allosteric control).

defective in some respect, disease may
mes represented by the numbers 1 to 4
nust function during the conversion of
tance *A* to the product *E*. If one step is
an enzyme is unable to function, product
ormed; if *E* is necessary for some vital
results. Many inherited diseases of man
ficiency of one enzyme. Some of these
le 1. The disease called albinism, for ex-

es Identified with Hereditary Diseases

	defective enzyme
	tyrosinase
	phenylalanine hydroxylase
	fructokinase
nia	methemoglobin reductase
	galactose-1-phosphate uridyl transferase

om an inherited lack of ability to synthe-
tyrosinase, which catalyzes one step in
which the pigment for hair and eye col-
ee also METABOLISM, DISEASES OF; BIRTH
NGENITAL DISORDERS).

Enzymes play an increasingly important
e. The enzyme thrombin is used to pro-
g of wounds. Other enzymes are used to
kinds of disease, to cause the remission
f leukemia—a disease of the blood-form-
d to counteract unfavourable reactions in
allergic to penicillin. The enzyme lyso-
stroys cell walls, is used to kill bacteria.
erning medical applications of enzymes
eir use as preventives of tooth decay and
ts in the treatment of thrombosis, a dis-
ed by the formation of a clot, or plug, in
Enzymes may eventually be used to con-
iciencies and abnormalities resulting from

The most efficient catalysts known to man,
sed in industrial processes involving the
certain chemical compounds and the tan-
they are valuable in analytical procedures
involving the detection of very small quantities of specific substances. Enzymes are necessary in such food-related industries as cheese making, the brewing of beer, the aging of wine, and the baking of bread. Enzymes also may be used to clean clothes. For industrial use of enzymes see BAKING AND BAKERY PRODUCTS; BREWING; and WINE MAKING.

ciently to be us
regard, three pro
for enzyme classifi
the enzyme, the che
nature of the reacti
about the detailed c
few enzymes does n
indicated above, car
were based on the n
(*e.g.*, enzymes calle
drates), close functi
different groups wer
ment, then, enzymes
substrates and the na

In an attempt to
nomenclature, two
known as the syste
ciples but is often lo
name is short and ge
systematic (see Tab
nomenclature, six
are recognized; each
subdivided on the ba
tion catalyzed and
tion. Enzymes that
is transferred belon
tases; those that c
ments of water at a
hydrolases. The oth
transferases—which
stances other than
the isomerases, ar
transferases account
imately 1,000 enzy
a few enzymes, t
names, and their bi

Chemical nature.
nature of enzymes
tury, although scien
were proteins. In 1
to be crystallized a
in the next few yea
sin, and chymotryp
that time, hundred
have been prepared
ods. Much of the k
fact, resulted from
attempts to unders

Although some e
amino acids (*i.e.*,
nitrogen), most en
chain. Each chain
two, four, or six su
12 to 60 subunits.
tical structures; in
of subunit chains
tailed discussion of

Much of the dry
tributable to prote
act as structural e
ologically active t
zymes. Regardless
tein in an organis
enzymes must be
myriad reactions

Cofactors. Alth
protein, many ar
protein componen
enzyme is called
moved, the prote
called the apoenzy
as iron, copper, o
ganic molecule ca
of substrate molec
may aid in the c
metals and prost
zymatic reaction,

A coenzyme ser
zymatic reactions

GENERAL PROPERTIES

Classification and nomenclature. The first enzyme name, proposed in 1833, was diastase. Sixty-five years later, it was suggested that all enzymes be named by adding "-ase" to a root indicative of the nature of the substrate of the enzyme. Although enzymes are no longer named in such a simple manner, with the exception of a few—*e.g.*, pepsin, trypsin, chymotrypsin, papain—most enzyme names do end in "-ase."

Any systematic classification of enzymes should be based on a common property or quality that varies suffi-

to that of enzymes 5 and 6 determines the quantity of product *E* formed compared with product *G*.

Both the flow of water and the activity of enzymes obey the laws of thermodynamics; hence, water in reservoir *F* cannot flow freely to *H* by opening valve 7, because water cannot flow uphill. If, however, valves 1, 2, 5, and 7 are open, water flows from *F* to *H*, because the energy conserved during the downhill flow of water through valves 1, 2, and 5 is sufficient to allow it to force the water up through valve 7. In a similar way, enzymes in the metabolic pathway cannot convert compound *F* directly to *H* unless energy is available; enzymes are able to utilize energy from energy-conserving reactions in order to catalyze reactions that require energy. During the enzyme-catalyzed oxidation of carbohydrates to carbon dioxide and water, energy is conserved in the form of an energy-rich compound, adenosine triphosphate (ATP). The energy in ATP is utilized during an energy-consuming process such as the enzyme-catalyzed contraction of muscle.

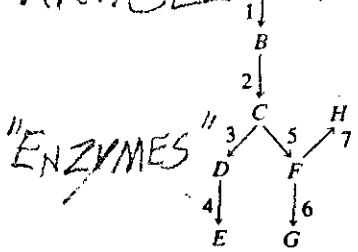
ARTICLE HEADING

"ENZYMES"

ition, the processes of respiration, vision, etc. e indispensable to life.

enzyme is able to promote only one type of cal reaction. The compounds on which it acts are d substrates. Enzymes operate in tightly organized abolic systems called pathways. A seemingly simple ological phenomenon—the contraction of a muscle, r example, or the transmission of a nerve impulse—ctually involves a number of chemical steps in which ne or more chemical compounds (substrates) are con-erted to substances called products; the product of one tep in a metabolic pathway serves as the substrate for he succeeding step.

The role of enzymes in metabolic pathways can be illus-rated diagrammatically. The chemical compound repre-ented by *A* (see diagram) is converted to product *E* in a eries of enzyme-catalyzed steps, in which intermediate ompounds represented by *B*, *C*, and *D* are formed in uccession. They act as substrates for enzymes repre-ented by 2, 3, and 4. Compound *A* may also be converted y another series of steps, some of which are the same as hose in the pathway for the formation of *E*, to products epresented by *G* and *H*.



The letters represent chemical compounds; numbers epresent enzymes that catalyze individual reactions. The elative heights represent the thermodynamic energy of he compounds; *e.g.*, compound *A* is more energy-rich han *B*, *B* more energy-rich than *C*. Compounds *A*, *B*, tc., change very slowly in the absence of a catalyst but lo so rapidly in the presence of catalysts 1, 2, 3, etc.

The regulatory role of enzymes in metabolic pathways an be clarified by using a simple analogy: that between he compounds, represented by letters in the diagram, nd a series of connected water reservoirs on a slope. Similarly, the enzymes represented by the numbers are nalogous to the valves of the reservoir system. The alves control the flow of water in the reservoir; that is, f only valves 1, 2, 3, and 4 are open, the water in *A* lows only to *E*, but, if valves 1, 2, 5, and 6 are open, the vater in *A* flows to *G*. In a similar manner, if enzymes , 2, 3, and 4 in the metabolic pathway are active, prod-ct *E* is formed, and, if enzymes 1, 2, 5, and 6 are active, roduct *G* is formed. The activity or lack of activity of he enzymes in the pathway therefore determines the fate f compound *A*; *i.e.*, it either remains unchanged or is onverted to one or more products. In addition, if prod-cts are formed, the activity of enzymes 3 and 4 relative o that of enzymes 5 and 6 determines the quantity of roduct *E* formed compared with product *G*.

Both the flow of water and the activity of enzymes obey he laws of thermodynamics; hence, water in reservoir *F* annot flow freely to *H* by opening valve 7, because wa-er cannot flow uphill. If, however, valves 1, 2, 5, and 7 re open, water flows from *F* to *H*, because the energy onserved during the downhill flow of water through alves 1, 2, and 5 is sufficient to allow it to force the water p through valve 7. In a similar way, enzymes in the met-bolic pathway cannot convert compound *F* directly to *H* unless energy is available; enzymes are able to utilize nergy from energy-conserving reactions in order to cata-yze reactions that require energy. During the enzyme-atalyzed oxidation of carbohydrates to carbon dioxide nd water, energy is conserved in the form of an energy-ich compound, adenosine triphosphate (ATP). The energy n ATP is utilized during an energy-consuming process uch as the enzyme-catalyzed contraction of muscle.

Because the needs of cells and organisms vary, not only the activity but also the synthesis of enzymes must be regulated; *e.g.*, the enzymes responsible for muscular activity in a leg muscle must be activated and inhibited at appropriate times. Some cells do not need certain enzymes; a liver cell, for example, does not need a muscle enzyme. A bacterium does not need enzymes to metabolize substances that are not present in its growth medium. Some enzymes, therefore, are not formed in certain cells, others are synthesized only when required, and still others are found in all cells (see also GENE). The formation and activity of enzymes are regulated not only by genetic mechanisms but also by organic secretions (hormones) from endocrine glands and by nerve impulses. Small molecules also play an important role (see below *Enzyme flexibility and allosteric control*).

If an enzyme is defective in some respect, disease may occur. The enzymes represented by the numbers 1 to 4 in the diagram must function during the conversion of the starting substance *A* to the product *E*. If one step is blocked because an enzyme is unable to function, product *E* may not be formed; if *E* is necessary for some vital function, disease results. Many inherited diseases of man result from a deficiency of one enzyme. Some of these are listed in Table 1. The disease called albinism, for example, results from an inherited lack of ability to synthesize the enzyme tyrosinase, which catalyzes one step in the pathway by which the pigment for hair and eye colour is formed (see also METABOLISM, DISEASES OF; BIRTH DEFECTS AND CONGENITAL DISORDERS).

Table 1: Enzymes Identified with Hereditary Diseases

disease name	defective enzyme
Albinism	tyrosinase
Phenylketonuria	phenylalanine hydroxylase
Fructosuria	fructokinase
Methemoglobinemia	methemoglobin reductase
Galactosemia	galactose-1-phosphate uridyl transferase

In medicine. Enzymes play an increasingly important role in medicine. The enzyme thrombin is used to promote the healing of wounds. Other enzymes are used to diagnose certain kinds of disease, to cause the remission of some forms of leukemia—a disease of the blood-forming organs—and to counteract unfavourable reactions in people who are allergic to penicillin. The enzyme lysozyme, which destroys cell walls, is used to kill bacteria. Research concerning medical applications of enzymes may lead to their use as preventives of tooth decay and as anticoagulants in the treatment of thrombosis, a disease characterized by the formation of a clot, or plug, in a blood vessel. Enzymes may eventually be used to control enzyme deficiencies and abnormalities resulting from diseases.

In industry. The most efficient catalysts known to man, enzymes are used in industrial processes involving the preparation of certain chemical compounds and the tanning of leather; they are valuable in analytical procedures involving the detection of very small quantities of specific substances. Enzymes are necessary in such food-related industries as cheese making, the brewing of beer, the aging of wine, and the baking of bread. Enzymes also may be used to clean clothes. For industrial use of enzymes see BAKING AND BAKERY PRODUCTS; BREWING; and WINE MAKING.

GENERAL PROPERTIES

Classification and nomenclature. The first enzyme name, proposed in 1833, was diastase. Sixty-five years later, it was suggested that all enzymes be named by adding "-ase" to a root indicative of the nature of the substrate of the enzyme. Although enzymes are no longer named in such a simple manner, with the exception of a few—*e.g.*, pepsin, trypsin, chymotrypsin, papain—most enzyme names do end in "-ase."

Any systematic classification of enzymes should be based on a common property or quality that varies sufficiently to be u
regard, three pro
for enzyme classifi
the enzyme, the che
nature of the reactio
about the detailed c
few enzymes does no
indicated above, earl
were based on the n
(*e.g.*, enzymes calle
drates), close functic
different groups wer
ment, then, enzymes
substrates and the na
In an attempt to d
nomenclature, two n
known as the system
ciples but is often lo
name is short and ge
systematic (see Tabl
nomenclature, six n
are recognized; each
subdivided on the ba
tion catalyzed and c
tion. Enzymes that c
is transferred belon
tases; those that c
ments of water at a
hydrolases. The oth
transferases—which
stances other than h
the isomerases, and
transferases account
imately 1,000 enzym
a few enzymes, th
names, and their bi
Chemical nature.
nature of enzymes
tury, although scien
were proteins. In 1
to be crystallized an
in the next few yea
sin, and chymotryp
that time, hundred
have been prepared
ods. Much of the k
fact, resulted from
attempts to underst
Although some en
amino acids (*i.e.*,
nitrogen), most enz
chain. Each chain i
two, four, or six sub
12 to 60 subunits.
tical structures; in c
of subunit chains
tailed discussion of
Much of the dry
tributable to protei
act as structural el
ologically active ti
zymes. Regardless
tein in an organism
enzymes must be p
myriad reactions c
Cofactors. Alth
protein, many are
protein component
enzyme is called
moved, the protei
called the apoenzy
as iron, copper, o
ganic molecule call
of substrate molec
may aid in the ca
metals and prosth
zymatic reaction, a
A coenzyme serv
zymatic reactions

hydrochloride salt, which is a white, crystalline powder with a bitter taste. It is soluble in water, in alcohol, and in chloroform. Methadone and its salts occur in either of two structural configurations: optical isomers. The levorotatory isomer of the hydrochloride (*l*-methadone hydrochloride) is a more potent analgesic than the dextrorotatory isomer (*d*-methadone hydrochloride). The mixture of the two, *d,l*-methadone hydrochloride (sometimes marketed as Dolophine hydrochloride), and the levorotatory isomer have both been used medicinally. The mixture, however, is in more common use (official in the *British Pharmacopoeia* and the *United States Pharmacopeia*).

Respiratory depression resulting from overdosage of methadone may be treated with nalorphine (*q.v.*).

·drug therapy for opiate addicts 12:843a
·potency, tolerance, and use in addiction therapy programs 5:1054e

methamphetamine, or *d*-DESOXYEPHEDRINE, informally called SPEED, CRYSTAL, or METH, potent stimulant drug of the amphetamine series used in medicine as an appetite suppressant in treating obesity and as a stimulant of the central nervous system in treating anesthetic overdose, mental depression, and narcolepsy, a condition marked by an uncontrollable desire for sleep. Methamphetamine was introduced into medicine in 1944. Its action is similar to that of amphetamine. It may be administered orally or by intravenous injection.

The ability of methamphetamine to overcome fatigue and provide increased energy and a sense of well-being has led to considerable abuse of the drug. Its untoward effects such as increased heart rate and blood pressure render it a dangerous drug when abused; and because of the rapid development of tolerance common to the amphetamines (a condition in which the user requires increased doses for a consistent effect), it is unsatisfactory for prolonged use.

·use and toxic psychosis from abuse 5:1057f

methanal (chemistry): *see* formaldehyde.

methane, a colourless, odourless gas that occurs abundantly in nature as the chief constituent of natural gas, as a component of firedamp in coal mines, and as a product of the anaerobic bacterial decomposition of vegetable matter under water (hence its alternate name, marsh gas). Methane also is produced industrially by the destructive distillation of bituminous coal in the manufacture of coal gas and coke-oven gas. The activated-sludge process of sewage disposal also produces a [illegible] methane.

Methane is the first and simplest member of the paraffin series of hydrocarbons (compounds of hydrogen and carbon). Its chemical formula is CH_4. It is lighter than air, having a specific gravity of 0.554. It is only slightly soluble in water. It burns readily in air, forming carbon dioxide and water vapour; the flame is pale, slightly luminous, and [illegible]. The boiling point of methane is [illegible] C (−263.2° F) and the melting point [illegible] C (−296.5° F). In general, methane is very stable, but a mixture of between [illegible] and 14 percent in air is explosive. Explosions of such mixtures have been frequent in [illegible] and collieries and the cause of [illegible] disasters.

The chief source of methane is natural gas, which, after extraction of the heavier hydrocarbon compounds, contains from 75 percent [illegible] methane. Other sources include the distillation from bituminous coal [illegible] carbonization; these methods of [illegible] are important in locations where [illegible] is not plentiful. The coal carbonization [illegible] is particularly important because [illegible] the coal industry a part of [illegible] field.

[illegible] natural gas is composed largely [illegible] chief use has been as a fuel because of its abundance, low cost, ease of handling, and cleanliness. In the United States, natural gas is distributed through thousands of miles of pipelines to all parts of the country and has made great inroads into the fuel market.

Another use, which became less important after 1950 because of the rising price of natural gas, is in the manufacture of carbon black. Other valuable products include methanol, formaldehyde, chloroform, carbon tetrachloride, and nitromethane.

·acetylene production by cracking 9:87h
·atmospheric chemical composition 2:308d
·black powder explosions in mines 7:84d
·carbanion structure and production 3:817g
·carbon bonding 9:1044b
·carbon dioxide removal in spacecraft 10:922h
·carbonium ion structure 3:861c
·Chinese pond gas collection 1:903b
·cryogenic natural gas as fuel 5:319g
·food source possibilities explored 7:484a
·food synthesis from chemicals 7:485f
·free radical reaction mechanism 15:422d
·gasification of coal 7:924b
·halogen compound derivation 13:682e
·heating values of natural gas paraffins 12:859g; table
·hydrocarbon combustion reactions 9:80c
·hydrogen cyanide production 14:530g
·industrial environment potential hazards 9:531a
·juvenile source and primeval atmosphere 2:315b *passim* to 317g
·life origin and Jovian planet formation 10:901a
·life possibilities studied spectroscopically 10:906b
·molecular orbitals 6:670b; illus. 669
·oil shales' biogenic origin 13:537g
·petroleum composition and properties 14:166e
·Rwanda's natural resources 16:110b
·Saturn's mass, density, and composition 16:274b
·structural formula description 13:707a
·structure and valence angles 17:678c
·urban pollutants and human health 18:1050e

methanol: *see* methyl alcohol.

Methedrine (pharmacology): *see* methamphetamine.

methemoglobin, oxidized form of the respiratory pigment hemoglobin.

·hemoglobin and oxygen transport 2:1116f

methemoglobinemia, inherited or acquired decrease in the oxygen-carrying capacity of the red blood cells. The hemoglobin of the red blood cells must be in the reduced state to bind with oxygen; methemoglobin, the oxidized form of hemoglobin, is useless for oxygen transport. Normally, various organic catalysts or enzymes are active in keeping hemoglobin in the reduced form. Hereditary methemoglobinemia occurs when there is an inborn defect in this enzyme system or when the hemoglobin molecule is abnormally structured (hemoglobin M) and is thereby more susceptible to oxidation. Acquired methemoglobinemia may arise as a result of contact with certain drugs and chemicals that produce oxidant compounds in the circulation, causing the oxidation of hemoglobin faster than the enzyme system can keep it in the reduced state. The severity of the symptoms is related to the quantity of methemoglobin present in the circulation, and range from a bluish discoloration of the skin and mucous membrane to weakness, difficulty in breathing, and dizziness in the more severe cases. Treatment in hereditary methemoglobinemia usually includes the administration of reduction compounds such as vitamin C or methylene blue. Acquired methemoglobinemia usually disappears spontaneously when the cause is removed.

·enzyme abnormality, table 1 6:897
·hemoglobin–oxygen variations in polycythemia 2:1139a

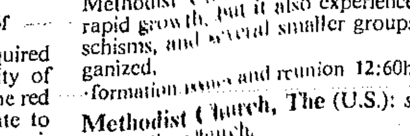
methicillin, semisynthetic penicillin used as a antimicrobial agent.

·antibiotic [illegible]

Methil (Scotland): *see* Buckhaven and Methil.

methionine, a sulfur-containing amino acid found in many common proteins. First isolated from casein in milk (1922), methionine accounts for 5 percent of the weight of egg albumin; other proteins contain much smaller amounts. It is one of several so-called essential amino acids for mammals and fowl; *i.e.,* they cannot synthesize it.

Important in methylation (the process by which methyl, or $-CH_3$, groups are added to compounds), methionine is also a precursor of two other amino acids, cystine and cysteine (*qq.v.*), and facilitates the synthesis of choline, a component both of a substance (acetylcholine) important in nerve function and of lecithins, fats abundant in both plant and animal tissues.



methionine

·alkaloid methyl group origins 1:607d
·cereal and soybean content levels, tables 7 and 13 [illegible]
·disorders of amino acid metabolism 11:1055f; illus.
·Escherichia coli protein synthesis and genetic code 7:999, table
·nutrient needs and alternative source 13:406g; table 405
·structure and occurrence in protein 15:82c

methionine malabsorption syndrome: *see* iminoglycinuria.

method, the (acting): *see* Stanislavsky method.

Methodist Church, The, in the British Isles, Methodist church that developed from the Protestant revival movement that began within the Church of England. It broke with the Church of England in 1795, and subsequently the Methodists were known as the Wesleyan Methodist Church. The church experienced rapid growth, but it also experienced various schisms, and several smaller groups were organized.

·formation, issues, and reunion 12:60h

Methodist Church, The (U.S.): *see* United Methodist Church.

Methodist Episcopal Church (U.S.): *see* United Methodist Church.

Methodist Protestant Church (U.S.): *see* United Methodist Church.

Methodist Revival, 18th-century religious movement begun and sustained by John Wesley.

·Wesley's movement and doctrine 12:60e

Methodists, a group of Protestant churches founded in England in the 18th century on the principles and practices proclaimed by John Wesley, an Anglican revivalist clergyman. Methodist churches differ according to two primary traditions: the British and those of the British Commonwealth that are nonepiscopal and the American and those in areas in which American influence is strong that are episcopally governed.

The text article covers the nature and significance, history, teachings, practices, and organization. The section on nature and significance includes the basic emphases of Methodism: doctrines that indicate the power of the Holy Spirit to confirm a believer's faith and transform his personal life, simplicity of worship, partnership of ordained ministers and laity, concern for the underprivileged and betterment of social conditions, and the formation of small groups for mutual encouragement and edification.

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

A. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD AT PARKROSE HIGH SCHOOL ON AUGUST 30, 1984

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuant to ORS 454.275 et. seq.

A. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD AT PARKROSE HIGH SCHOOL ON AUGUST 30, 1984

This summary is based on Department of Environmental Quality staff notes taken during the hearing.

1. James Petersen, Chairman, Environmental Quality Commission (EQC), opened the hearing with a brief background statement describing the history of actions taken by the EQC to protect groundwater quality in East Multnomah County.

   He described the process established in the 1981 rule that prohibits cesspools and that requires the local jurisdiction to provide detailed plans, schedules, priorities, phasing and financial mechanisms for sewering the entire cesspool area by July 1, 1984. These governing bodies responded on June 27, 1984, with the required information. In addition, they presented the EQC with resolutions requesting that the formal process for declaring a "Threat to Drinking Water" be initiated by the Commission in the affected area. Chairman Petersen reviewed the "Threat to Drinking Water" legislation, the conditions which constitute such a threat, and what the EQC is required to do in response to the resolutions.

   The chairman also entered several items into the hearing record (Exhibit 3). These included: the Environmental Quality Commission meeting staff reports and minutes, dealing with on-site waste disposal; the resolutions and reports presented to the Department and the Environmental Quality Commission on June 27, 1984, by Multnomah County and the Cities of Portland and Gresham; and the staff memorandum outlining the dates public hearing notice was given in The Oregonian and The Gresham Outlook.

2. John Lang, Director of Public Works, City of Portland, opened the testimony for the local jurisdictions. He introduced the members of the Multnomah County Sewer Consortium (hereafter referred to as the Consortium) and explained that the Consortium was established through the Section 208 Areawide Waste Water Management Planning Program to evaluate waste water treatment strategies for Multnomah County and the cities of Portland, Gresham and Troutdale.

3. Dennis Buchanan, Multnomah County Executive Officer, testified about the difficulty the county is having in providing urban services under what is traditionally considered a rural form of government. He discussed the conflict between providing city services versus county services, and stated that the county cannot afford to do both. In an effort to solve this difficulty, the county has begun to implement a plan to phase out urban services responsibilities and is moving back to providing rural services.

   The county, under this framework plan, has been developing cooperative agreements and service contracts with the local cities. He felt that in the future the county would expand these cooperative agreements and continue to transfer more urban services to the cities in the area.

   On the issue of the threat to drinking water, Mr. Buchanan stated that the plan submitted for resolution of the problem had been endorsed by the county and the County's Citizens Committee. Mr. Buchanan also entered into the record several letters of endorsement from other Multnomah County Commissioners and the County's Citizens Committee.

4. Margaret Weil, Mayor, City of Gresham, testified to the role the City of Gresham had in developing the threat to drinking water report, and the subsequent plans for providing sewers in the affected area. She stated that after reviewing the basic information developed, the city concluded that at least three of the conditions identified in the threat to drinking water legislation existed in the affected area. In response to this, the city passed a resolution requesting that the EQC declare a threat to drinking water in the affected area. The city currently provides urban services within its city boundary but would also extend urban services into the affected area assigned to them. Mayor Weil stated that the major concern was to make the improvements affordable. She stated that there needed to be cooperative federal/state/local financial planning. She also felt that a declaration of a threat to drinking water should be reflected in the priorities established in the state's construction grants program.

5. Mike Lindberg, Commissioner, City of Portland, testified on the city's behalf, supporting the declaration of a threat to drinking water and the implementation of the plan developed by the Sewer Consortium . He covered three points: (1) the need for sewers; (2) Portland's role in providing sewers; and (3) the cost of the sewer improvements.

   Commissioner Lindberg stated that it is not a question of whether sewers are needed, but when sewers will be installed. He testified that the lack of sewers has severely limited economic growth in this section of the Metropolitan Area. He stated that Portland does have a role in addressing this problem because: a portion of the affected area lies within the city boundary; the city also has been assigned the Columbia Basin which includes Johnson Creek, under the 208 Areawide Waste Water Management Plan; and they now have responsibility for the Inverness Basin through cooperative agreement with Multnomah County.

   Commissioner Lindberg felt that the major issue to be resolved was to make sewers affordable to the residents in the area. He stated this might take some special assistance from state/federal/local governments.

6. John Lang, Director, Public Works Department, Portland, testified as to the specifics of the threat to drinking water report and the plan presented by the Consortium to solve the problem. His remarks focused on four areas: (1) why Portland was involved; (2) the findings within the threat to drinking water report; (3) a summary of the sewerage plan presented; and (4) additional issues.

   Mr. Lang described the affected area boundaries and the portion which lies within the City of Portland. He identified responsibilities Portland has under the 208 Areawide Waste Water Treatment Plan, to provide sewer service to the Columbia Basin, which includes Johnson Creek. He also stated that now by contract, the city is responsible for the Inverness Basin described in the 208 plan.

   Mr. Lang reviewed the four conditions in the Threat to Drinking Water Statute, (ORS 454-275) where any three of these conditions exist in an area, the statute defined it as a threat to drinking water. He stated that the data and information collected by the Consortium to address each one of these conditions led them to conclude that at least three of the four conditions had been met.

He also felt that testimony to be offered by Dr. Schade, Multnomah County Health Officer, later in the day, would meet this fourth condition.

In summarizing the sewer facility plan, Mr. Lang described the trunk lines and interceptor sewers that were needed, the routes of these lines, the areas to be served, and the lines now under construction. He described the priorities for connection and how the project was financed to this point. Mr. Lang stated that the cost of sewering the affected area would be approximately $260 million. He emphasized that Portland would continue to look into different funding options and mechanisms, in order to make it affordable. He felt that public participation was a key and there needed to be more public meetings to describe the project cost and the various financing options.

7. James Keller, Gresham City Manager, described the areas to be sewered with particular emphasis on those areas within the City of Gresham. He discussed the sewering schedule and the City of Gresham's responsibility as a designated local management agency under the Areawide 208 Plan. Mr. Keller discussed the facility needs of Gresham which included improving the treatment plant and trunk lines in order to service the affected area. He specifically requested that the Commission declare a threat to drinking water, and that the Department of Environmental Quality reflect this declaration when developing its construction grants priority list so that local projects within the affected area could receive higher priority.

8. Burke Raymond, Multnomah County, presented testimony on the responsibility of the Central County Service District under the 208 Waste Water Treatment Plan to provide sewer service to the Inverness Basin. He stated recent boundary changes within the Inverness Basin that have left the District considerably smaller than it was when the 208 Plan was originally adopted. Mr. Raymond reviewed the sewage bond elections held in the Central County Area, stating that of 19 separate elections, 18 ended in defeat. He discussed the County's position on municipal service, and that most of the cost of providing sewer service to the Inverness Basin will be in constructing the collection sewers.

9. Mark Gardner, Finance Director, City of Portland, testified on the project financing. He stated that the cost is going to be enormous and that making sewers affordable to the property owners should be the major objective. He felt that we needed to explore every conceivable option including such things as flexible construction schedules, packaging individual collection line construction, and city financing of individual hookups. Mr. Gardner felt that the project needed the support of all local governments if reasonable and affordable financing options were to be developed.

At this point in the hearing, the Environmental Quality Commission members questioned representatives of the local jurisdictions on the testimony that they had just presented. The issues covered in the question and answer period included: the clarification of local jurisdictions' annexation policies; the condition of present sewer facilities and trunk lines; the adequacy of the sewering scheduled in the proposed plan; the quantity of water available in Bull Run system and its future capacity; the financing options that have been considered by the city; and the processes that they (the local jurisdictions) have employed to sewer areas within the city. There was an extensive discussion of the project costs and which project costs would be eligible for federal construction grants assistance, and the possibility of approaching Congress for a special appropriation to fund the project.

10. Gordon Shadburne, Commissioner, Multnomah County, testified that the decision the Commission was going to make had several political ramifications. He discussed why this problem was being addressed at this time and that one could not separate the annexation issue from the consideration of a threat to drinking water. He felt that sewers and the seepage fee tended to support annexation to Portland, and if so, the Environmental Quality Commission was being used to promote annexation. Commissioner Shadburne discussed the development of the threat to drinking water legislation and the particular requirements of that legislation. He felt that the Environmental Quality Commission was being put in an awkward position and if there was a health hazard in East County, why did the City of Portland establish a new well field in this area? He reviewed Dr. Schade's report and felt that the information presented did not show any increase in pollutants or that there was a trend to higher levels.

11. Henry Kane, Attorney, 12275 S.W. 2nd, P.O. Box 518, Beaverton, OR, 97075, representing a Mid-County Citizens Group, presented oral testimony and submitted written testimony in opposition to the Environmental Quality Commission declaring a threat to drinking water. He stated that the data does not meet the statutory conditions for establishing a threat to drinking water. He went on to state that proponents should show pollution levels above state standards by September 11, 1984, or else a seepage fee cannot be supported.

    Mr. Kane also questioned the constitutionality of State Statutes (ORS 454.275 and 454.285) which in effect repealed a local charter.

    He felt the Environmental Quality Commission had a wide range of options to choose from if problems existed. For example: if organic chemicals exist in the groundwater, their use could be prohibited; if the groundwater is polluted, the Water Districts could be required to treat the water; and if disposal methods are to change, the alternative waste disposal systems approved in 1981 should be fully examined.

    He testified that the imposition of a seepage fee was unfair and those paying might not see the benefits in their lifetime.

    In summary, he stated that people should treat the groundwater or don't use it.

12. Jeanne Orcutt mentioned that when the 1983 Legislature changed the threat to drinking water standards, they made it possible for the Commission to find a threat to drinking water without making a finding of contaminated water. The Commission only has to find that sewage has the necessary agents to make water polluted. She questions the water quality sampling conducted in the area and the results. She mentioned that at the August 10th Commission meeting, the EQC, in calculating the priorities, funded sewage treatment plant improvements based on a finding of a threat to drinking water, and therefore, its mind was already made up. She believed these were "trumped up" charges to allow local governments to charge the seepage fee. This fee could be as much as $160 per year for some residents. She stated that vacant lots would benefit because they would not have a seepage bill, and the majority of those were commercial and industrial properties. There was no benefit to older people, having to pay this seepage fee, who would not have sewers in their lifetime. She mentioned that Dr. Schade's report never cited a single illness in the area from drinking

polluted water. She did not believe there was an historical trend of pollution. She did not think there had been a uniform sampling schedule, and quoted from Dr. Schade's report that the conditions in the area were not exactly similar to state law. She asked: if there was a trend, when would the maximum concentrations occur and what would those maximum levels be? She also noted that in Department material provided at the hearing that nitrate levels had decreased since 1974.

In reference to an article in The Oregonian, she commented that Mayor Ivancie, the City of Portland, did not think that the well water was contaminated and the water was equal in quality to Bull Run water. She went on to indicate that the article stated that the aquifer is being used for drinking water is too deep to be contaminated. She said the City of Portland did not think there was any contamination, based on The Oregonian article. She said Multnomah County did not believe that there was any contamination because they were still issuing cesspool and septic tank permits. She stated that the DEQ (sic EPA) regional office in Seattle did not find any safe drinking water standards violations in the water being used in the area. She said most of the water is brought in from Bull Run anyway, and even local water districts are using Bull Run water.

She questioned the difference between nitrate-nitrogen and nitrate pollution concentration levels. She wondered if they had been used interchangably in the Department's reports. She cited a City of Portland report that showed nitrate levels were higher in Bull Run water than in some water samples in Mid-Multnomah County. She concluded by stating that the economical way to solve the problem was to give everyone Bull Run water and sewer only those businesses or commercial properties that wanted it. She questioned why Clackamas County and Troutdale were not required to submit facilities plans as the other affected cities and counties were. She mentioned that in Lane County, Bancroft bonding was not very successful and there were people in the County who were going to lose their homes because they are unable to meet payments.

13. Trudy Jones, 11925 S.E. Sacramento, Portland, stated that she moved here 5 1/2 years ago, and was curious when her sewer bill would arrive. Upon quizzing her neighbors she learned that there were no sewers in the area--that the area was on cesspools. She believes the area needs sewers and is disturbed by the smell of sewage and by the impression visitors get knowing the area lacks sewers. She is concerned about sewage running across people's basement floors and across their property. She cited several examples of individuals she knew who were limited in their activities because they did not want to damage or fill up their cesspool. She said continuing to use cesspools would simply continue to contaminate the groundwater and that groundwater was a valuable and precious resource that should be preserved. She advocated that the sewering plans should not be voluntary and it should not be a local improvement district, but we should move ahead and use the 20-year planning period for hookup. The choice is either the seepage fee or mandatory hookup, and she advocated sewers as quickly as possible.

14. Mal Johnson had been distributing annexation petitions and said the major reason people wanted to annex was their concern for water quality. In his own home, the drinking water had a very strong iodine smell. He said he was not an expert but the sewering plan seems reasonable. He had neighbors and had talked with others who had experienced collapsing septic tanks. He said all indications point to the need for sewers to eliminate both a health risk and a water quality problem.

15. Louis Turnidge stated that it was begging the question as to a water quality problems; that the real question was one of economic development, which he did not like. He questioned the trichlorelethylene and 1,1,1 - trichlorelethylene concentrations in the staff report prepared for the Commission's meeting in Newport, Page 3 of Attachment 5. He advocated a solvent recycling program to eliminate TCE concentrations in the water. He said he had researched nitrate and nitrite pollution in the encyclopedia. Nitrogen/nitrate was used for either explosives or fertilizer and that small children who were poisoned from nitrite/nitrate pollution were probably being affected by carbon monoxide poisoning because their noses were closer to the ground. He did not think that sewers would solve the problem. He did not think that the nitrate problem would be solved by sewers, and felt that solvent recycling was best to solve the problem.

16. Bob Bledsoe, 11800 S.W. Walnut, Tigard, stated he was an environmental technician with the City of Portland's Bureau of Environmental Services in its industrial waste section. He stated that he was very familiar with the Clean Water Act, and had worked for the last 14 months in the financial services section of the Bureau. He was on the Tigard Water District Board. He had his BA degree in math from Portland State University and has taken many engineering courses. So although he was a Washington County resident, he was at the hearing out of a sense of fairness and good judgment. He stated that he believed the management of the City of Portland's Environmental Services Bureau was lying to the public, and that building sewers was a loss leader. The City was simply interested in annexation. They were hopeful that the EQC would mandate sewers. City officials had stated several times that they did not want to be the lead agency, that EQC should be, and they were organizing carefully to keep a low profile on the issue. He felt the City's objectives were to annex those areas and build a larger system which would lead to larger glory for the Environmental Services Bureau.

    He did not think that the City was interested in protecting drinking water, only in promoting their own glory, and that they were hiding behind the Environmental Quality Commission and the sewer consortium. He stated that the drinking water in the area all comes from the City of Portland with two small exceptions-- the Gilbert and Richland Water Districts, and they could simply switch to Bull Run water. The central decision in the equation was drilling wells for the City of Portland's emergency supply.

    Upon research, the City of Portland had found that the upper aquifer and lower aquifer were not connected. He urged the Commission to research that report. There were two deep aquifers he said, both the Troutdale and Parkrose aquifer, and if the Parkrose aquifer is contaminated, they should simply drill deeper. wells.

The wells being tested for pollutants were too shallow. He thought it was unreasonable to expect sewers be built and did not accept the notion that cleaning up the environment should be done at all costs. He summarized that water quality was generally maintained for drinking water, for diluting effluents, for recreational purposes, and for wildlife. The last two, recreation and wildlife, did not apply to underground supplies, and in this case, the Parkrose aquifer should be allowed to be polluted in order to dilute and carry the waste water from the cesspools to the Columbia Slough. He felt it was too much energy to have to build sewers and to pump the waste water.

He said the Parkrose aquifer, which carries waste water, discharges to the Columbia Slough which also receives the City of Portland's combined sewer overflows anyway. No one monitors the Slough and there is not much concern about water quality there. He advocated construction of a separate interceptor to collect the combined sewer overflow along the Slough would be a better idea. He felt that the law was passed, giving the Commission extraordinary power through one-sided and untruthful presentations. He urged the Commission either to table the issue and take it up with the Legislature, or to find no threat. He said if sewers were necessary, they should be built along the roads where commercial development will occur, and residential areas should be left out. In closing, he recommends postponing the decision because there is no crisis.

17. Herb Brown, 1546 N.E. 124 "Columbia Ridge", is the Chairman of United Citizens in Action. He stated that 1984 was clearly the year of "big brother." He said Mid-County residents were faced with possibly two threats, one from drinking water, another from the erosion of their voting rights. He wondered which was truly worse for the health of County citizens. He suggested that if sewering was really necessary, a Countywide sewering agency or even the Metropolitan Service District should be used as the mechanism. He was disturbed that sewers could be ordered without a vote of the people. He said that United Citizens were not against sewers someday, but the problems were that: there was no threat to drinking water; government should have solved the problem a long time ago; and this area is in the urban growth boundary for the region and yet they (the citizens) are losing their urban services which were guaranteed in the home rule charter. He felt that the entire issue was tied to annexation. He concluded by saying cesspools and septic tanks were not the source of the problem, political bullshit was.

18. Leonard Walther, 13606 S.E. Knight, is connected to the Johnson Creek sewer and in the Gilbert Water District. He felt that everyone should use Bull Run water and that well water should only be used for irrigation, that areas should be sewered as they are annexed because the bonding authority of an existing city is needed to pay for sewers. He is very familiar with sewers because his family had been assessed $600 for sewers for their home at 33rd Avenue in 1920.

19. Steven R. Schell, Portland, spoke as a private citizen and has participated for the last 15 years in local government problem-solving and environmental issues. He said what was happening in the area was the local governments were using the Clean Water Act, land use planning regulations, and local comprehensive plans to solve one of the largest economic development and environmental problems in the state. He then referenced the four findings the Commission had before them to make. With regards to soils, he stated that clearly the area was very, very rapidly draining soil. On drinking water, he said the Parkrose Water District was using wells which were less than 200 feet deep. He said that there may be layers of rock between the deep and shallow aquifer, but the water in the shallow aquifer is available for use and being used for drinking water now. He said cesspools and septic tanks were in use and felt Dr. Schade's report was excellent in summarizing the health problems related with that. He said that he wanted to point out that the plan put together for the EQC was workable and that sewage treatment was the solution. He summarized some of the controversies surrounding this issue over the years and commended the sewer consortium for their excellent work, cooperation, and success. He said that the EQC held a gun to the consortium's head and could ruin their good efforts by not taking their recommendation.

He said with regard to the schedule, 20 years seems like a long time and he would advocate sewering more than 25 percent of the area in 20 years. He thought the available dollars clearly were inadequate and there needed to be changes in the Bancroft bonding law to allow for hookup financing. And that they needed to continue to levy the development assessment fund. He closed by urging the Commission, from a public point of view and from the point of view of the statutes, to find a threat to drinking water and move ahead. Chairman Petersen questioned him about the possibility of drilling deeper for water supplies. Schell responded by saying that the pollution levels are unacceptable and continuing to pollute is unacceptable. Dr. Schade said that not all the studies which could prove a trend were available and that the trend analysis is probably there but the data is inadequate. But the data was adequate to make the 50 percent of drinking water standard finding, which was required.

20. Dr. Harold Oserud, Oregon Health Sciences Center, stated that the priorities in water quality should be to drink the most clean source available, which he quoted from the National Guidelines for Drinking Water from the U.S. EPA. He reminded the Commission that only 2/10 of 1 percent of the water on the earth is fresh, and even Bull Run water itself is not totally safe, because of its proximity to Mt. Hood. He said that the city had invested money and wants to use a deeper aquifer for drinking water, and it was still unclear whether or not the deeper aquifer would eventually be polluted by the pollution in the shallow aquifer. After the deep aquifer was pumped down, it may draw the pollution from the shallow aquifer to the deeper one. He said that was the function of the recharge rate in a deeper aquifer, which was not known at this time. He said it was unfair that this one area gets to put their sewage down in the ground on top of a public water supply, where other areas of the state had been forced to build sewage treatment plants. He recounted his own experience in the Eugene area in the mid-1950s, and the difficulty of getting that area adequately sewered when Mid-Mulnomah County was not. He commented that the water underneath the ground in the area was a public resource. He reminded the Commission that no methods exist to remove some of the pollutants in drinking water without distillation.

He closed by responding to an earlier comment that the pollutants which were going down into the ground would be going to the Columbia Boulevard Sewage Treatment Plant, which was not true because of the City's pretreatment program.

21. John Woldorf wanted to hook up to Bull Run water. He said that the financing method for sewers is unfair. It may be legal, but it is not just. He said his property is taxed at a rate too high now, and if sewers add to the value, you still can't sell the property. He asked if the Commission was willing to pick up the difference between where each property was appraised and what he could sell it for. He questioned why individuals have to pay for sewers when it will benefit everyone. He stated that sewers should be required for commercial and industrial properties only. He questioned the amount of money which had been spent lobbying the Legislature for this bill and who had paid that expense. He felt that acquiring sewers would ruin his neighborhood. It would turn those neighborhoods into rental neighborhoods. And it would lead to higher property taxes. He did not believe that the water was polluted and advocated people who did think it is, should use bottled water.

22. Mary Elise Ethenscope, 3904 N.E. 134, said she needed to use chemicals in her cesspool to keep it cleared and she had been working on a local improvement district in Argay Terrace. She said she had sewage running across her yard. She has seen people gathering petitions, who had sewage running across their yard, who could not use their appliances, who had to plan their baths; and the subsoil drainage was even worse in winter. She read a letter from a neighbor who had three teenagers and a great deal of problems in managing their waste water. She urged sewers to be built.

23. Jean Hood, 2134 S.E. 174th, questioned the role of the Commission and the Department, which Chairman Petersen explained. She said that Mildred Schwab, a City Commissioner for the City of Portland, had commented once that her neighbor did not have sewers, and wondered where she lived and why the Department is focusing on sewage in Mid Multnomah County, when so much of the pollution comes from the City of Portland. She went through the various water districts and the fact that almost all of them use Bull Run water.

Water District	Percent of Water From Bull Run
Gilbert	14
Hazelwood	100
Scott	100
Clackamas River	100
Parkrose (nitrate 7 ppm)	100
Pal Valley	100
Richmond (400'well S. of Agay Terrace; no nitrate)	100
Rockwood	most all

She referenced a 1975 letter she had from Senator Hatfield who said the federal government would pay for sewering the area, and that the City of Portland wanted sewers in the area because they had taken over the Meadowland Dairy and they wanted sewers in the area to get out of the dairy. She said that Portland had taken the federal dollars for the sewers and the local area was blackmailed. The City of Portland and the City of Gresham want the dollars for sewers to balance their budgets. She then referenced a Wall Street Journal article on annexation which discussed the interesting technique the City of Portland was using for annexation. She felt that Portland just wanted to gobble-up land. She stated that the City was much more concerned about the quality of drinking water than the quality of police protection for Mid-County residents. The city just wanted to leverage the services to gain additional land. She advocated letting people pay for sewers as they can. She felt the seepage charge was unfair. She wondered: if the water was so bad why did the Governor advocate the repeal of the unitary tax, and wanted industry to locate in the area?

24. Bonnie Luce, 3441 S.E. 174th, said that she was a fifth generation Oregonian. She advocates sewers on the pay-as-you-go basis and said she did not like the seepage fee concept because of her age. She would not live to see the benefit from it. She said there was too much rush to address this problem. She said East County had been just fine for many years and now everyone rushed out there. She stated that their well had been located between two cesspools, and the water had been perfectly pure until the casing broke and they had to stop using it. This hearing was a boondoggle. She wondered why there was no interest for people when they paid a seepage fee. She wondered when sewers would be available and where the remainder of 75 percent of the seepage fee was going.

25. Arthur Stephenson, 12507 N.E. Halsey, was a minister for 38 years. He talked about living in the Tacoma Prairie water table and commented on the differences between the soils there and soils in Mid-Multnomah County. He said East Multnomah County had a slower moving water table, which allowed greater potential for pollution. He wanted everyone to get the facts. He wanted to take all the water wells out of East Multnomah County and use Bull Run water.

He did not want to create slums in the County and felt that it would be very difficult to sell houses having huge sewer bills. He advocated that people in East County wanted to decide on their own fate, and he wanted the East County residents to vote on the facts without having biased information from sources like the Boundary Commission. He is concerned that too many decisions affecting East County were made in downtown Portland and that the people in East County wanted the facts in order to decide.

26. Bill Emig, 1940 N.E. 129th Pl, Portland, Oregon, believes that sewers should have been installed in East Multnomah County 20 years ago when the problems were first present and the cost was cheaper. Mr. Emig stated that he has contacted 200 neighbors about annexation to Portland and that 80 percent have accepted the idea of sewers, even with the cost. No one wants to pay the $5,000 - $10,000 assessment for sewers but it is a necessity. He further stated that East Multnomah County is a poor relative to Washington and Clackamas Counties and that East Multnomah County has stagnated--sewers would improve the area economy and would improve the drinking water quality. He recommended that the EQC take positive action on an areawide sewer system for East Multnomah County.

27. Beverly Moffatt, 3418 N.E. 129 Ave., Portland, Oregon, served on the Blue Ribbon Multnomah County Citizens Advisory Committee for Sewers and on the Budget Committee for the Central County Service District. She has served as Chairperson for the Save Our Basements Committee since 1981. Ms. Moffatt urged the EQC to take immediate action on the threat to groundwater. She stated that East Multnomah County residents dump 14 million gallons of sewage daily into the aquifer, and she could not conceive of any area being allowed to do this--East Multnomah County is the largest unsewered area in the United States. Ms. Moffatt mentioned that the DEQ and EQC is strict on air and noise pollution but that groundwater contamination takes the backseat--"out of sight out of mind". She stated that sewers will not be any cheaper in the future and that the Multnomah County Sewer Consortium has saved the area $14 million by securing grants. Further, Portland and Gresham have better financial capability (than the unincorporated areas) and can sell bonds for a lower interest rate. Ms. Moffatt concluded by requesting that the EQC declare a "Threat to Drinking Water".

Commissioner Denecke asked what the cost would be to the average resident. She responded by saying that costs for sewers in her neighborhood had increased from $1,800 to $3,800 in 2 years but that cost estimates would be difficult to get until the sewers are designed.

28. Dr. Charles P. Schade, Multnomah County Health Officer, 420 S.W. Stark St., Portland, Oregon, 97204, gave testimony pertinent to groundwater contamination in East Multnomah County.

Dr. Schade first addressed the question of trends. He stated that, based on an analysis of 10 years of data, there appears to be a positive increasing trend in nitrate-nitrogen contamination. However, seasonal variations in data limit its usefulness for trend analysis. Another limiting factor is that groundwater data has only been systematically collected for the past 1 1/2 years. He concluded that, because of the limitations of the data set, a mathematically sound (linear regression) trend could not be established. He also attempted to determine a trend in nitrate-nitrogen by looking at wells in surrounding areas. This was based on the assumption that contaminated wells would, prior to contamination, have nitrate-nitrogen levels similar to nearby but unpolluted wells. Again, there was some evidence of a trend but he could not prove that the 10 ppm nitrate-nitrogen level (EPA drinking water standard) would be reached.

Dr. Schade then addressed the question of nitrate-nitrogen concentrations. He stated that nitrate-nitrogen levels exceeded 50 percent of the standard and that is a significant contamination level of nitrate-nitrogen. He is convinced that the groundwater does have high levels of health-threatening human and industrial waste contamination.

During a question and answer period, Dr. Schade stated that the 10 ppm standard for nitrate-nitrogen was very defensible and was based on considerable empirical evidence. In response to questions regarding the statutory criteria to determine a threat to drinking water, Dr. Schade concurred that: (1) the groundwater aquifer is used for drinking water, (2) 50 percent or more of the sewage flow is discharged to cesspools, and (3) that the sewage has agents which contaminate groundwater.

29. Emil Berg, 2218 S.E. Cypress Ave., Portland, Oregon, has served as a member of the City of Portland's Environmental Services Advisory Committee, a group that has studied how the city could extend sewerage services. He stated that the Committee felt that: (1) it was most reasonable to extend interceptor sewers into unsewered areas before local improvement districts (LIDS) were formed, thus facilitating creation of voluntary LIDS; (2) rates of connection should take into account individual financial circumstances, therefore, residential connections should be able to be deferred in cases of aged and low income persons; (3) the statutory authority for the deferral of tax assessments for the aged should be expanded to include low income persons; and (4) the interest cost of deferral should be minimized so the burden of deferred cost is not greater than the estate value of the property when sold.

30. Douglas Hartman, 2605 S.E. 118 Ave., Portland, Oregon, 97266, has served as chairman of the Powellhurst Neighborhood Association. He stated that the Association's predominant questions were: when will sewers be provided and at what cost? Representatives of the city of Portland had addressed the Association and provided the answers--although never as specific as he would like--but the Association recognized that the overall health and vitality of the neighborhood depended on sewers. Postponement of sewers would only increase their cost. However, he recommended that a thorough analysis be conducted to discuss costs and other details.

31. Mike Burton, 6937 N. Fisk, Portland, Oregon, serves as Chairman of the North Portland Citizens Committee and is an unopposed candidate for the House of Representatives, District 17. Mr. Burton testified that issues affecting the unsewered areas also affect his North Portland neighborhood, where the City of Portland's treatment plant is located. He expressed concern about the cost impact on all residents, both inside and outside the city, explaining that one benefit of fuller utilization of the plant will be reduced cost burden to city residents.

    He raised three issues for the EQC's consideration: (1) the establishment of a clear and strong statement that sewers are needed to protect the environment; (2) a statement of economic benefit, recognizing that industrial development in the northern tier of the mid-county opens up residential development in the southern tier; and (3) the most equitable means to finance sewerage services, both within and outside his area, since city residents have been paying for the infrastructure for many years.

32. Frances Hyson, 16507 S.E. Mill St., Portland, Oregon, explained her confusion over the interest rates which would be applied to individual tax assessments: Were they 6%, 12% or 18%? A combination of 6% and 12%? She stated that people do not explain the real costs, noting that although project costs were reported in Gresham, the City was not informing people of the cost to replumb their homes. She asked why it was not revealed that tax assessment deferral will eliminate the value of the property inherited by their children, stating that people cannot afford that.

    Mrs. Hyson resented that the governmental representatives were the first ones to testify and that the residents were limited to 3-5 minutes. She stated, none of the politicians stay to listen to the people. If they (politicians) have other meetings to attend, they should take their choice. We have to stay here until all hours of the night.

She asked why there are still drinking wells in the area if there is a pollution concern; she stated her shallow well was not contaminated according to lab tests which she's had done for 7 years. She understood that the State has to check every well every day, not to order wells closed. She asked how many wells have been checked and for how many years.

She opposed an areawide seepage fee that would pay for improvements in areas other than where the paying residents lived.

33. Alvan Barnetzke, 2322 S.E. 139 Ave., Portland, Oregon, testified that he lives in an area over a gravel bed which should produce pure water, but due to his age, he would not live to see an improvement. He was concerned that he might pay the seepage fee for years before any benefit is received, since it might be 20 years before sewers are installed. He suggested that it was cheaper to buy Bull Run water and indicated that they must prove his water is bad.

34. John Lang, City of Portland, Bureau of Environmental Services, 1120 S.W. Fifth Ave., Portland, Oregon, 97204. An unidentified resident from the audience asked whether a tax assessment deferral was due on sale. John Lang responded that the assessment is due when the property title changes hands. The deferral is a mechanism where certain age and income bracket people can petition the state to pay their assessments, repayable to the state at about an 18 percent interest rate.

35. Ed Benedict, 3055 S.E. 118 Ave., Portland, Oregon, 97266, representing Oregon Fair Share, stated that recently he had sewage seep into his basement and that the installation cost for a new cesspool was $2,000. He said that last year he investigated the possibility of a petition for annexation and found that merchants wished to annex because the number one problem is sewage. He believes that the County Health Department and the EQC have "the welfare of the people at heart". He further stated the need for a meaningful construction finance program. He is concerned that sewers will create financial crisis for families and the Oregon Fair Share calls upon the state legislature and congress to provide necessary revenues to protect people on limited income.

36. Pat Holcomb, 1020 N.E. 131 Pl, Portland, Oregon, represented the East Multnomah County Chapter of Oregon Fair Share. She stated that hookups must be optional or by a grant. She asked the EQC to: (1) be optional on sewer hookups, (2) provide grants to households (if they would lose their homes because of sewers); and (3) give elderly and low income residents the opportunity to extend payments over many years.

37. Robert Miller, an Oregon Fair Share member, addressed project costs. He stated that the EQC must require that workable financial solutions be available to residents before cesspools are banned. Cost estimates for sewers today are about $8,000 but will increase during the 20 years of sewer project development. The costs particularly burden young people starting out and the elderly. He urged that the EQC make available Bancroft funding or other low cost financing for costs such as service laterals and replumbing homes.

38. Karen Luckhaupt, 1025 S.E. 175 Pl, Portland, Oregon, 97233, a member of East County Oregon Fair Share, opposed the seepage fee in the sewerage plan because it: (1) may be abused by any and all governments that collect it; (2) may benefit some but is collected elsewhere, insuring only a 25 percent return of benefit to households; and (3) imposes a double payment, because some residents will pay for a treatment facility for others, while maintaining their own system. Also, they would pay later to hookup their system after paying the seepage fee.

Commissioner Petersen urged Oregon Fair Share to discuss the statute regarding seepage fees with the members of the Oregon Legislature.

39. Dr. William Morton, 3181 S.W. Sam Jackson Rd., Portland, Oregon, who specializes in health problems related to environmental factors, expressed his opinion that historically people have recurringly encountered disease problems in conjunction with changes in urban concentrations, densities, and economic development. He is concerned about the increasing nitrate levels in the groundwater. His own research indicates that increased blood pressure levels and associated health problems may be linked to nitrate levels. In urban areas, there is also the risk that nonbiodegradable chemicals and possible carcinogens will enter the groundwater. These nonbiodegradables would primarily originate from industrial waste disposal; by and large, they would not be the degreasers used in cesspools but there might be a combination of these discharged.

40. Helen Nickum referred to a theory that government originated in the early Tigris-Euphrates River Valley over an issue of water rights and stated that there was no point in having government if water is not fit to drink. She urged the EQC to take early, immediate steps to solve the groundwater problem, no matter what the cost.

41. George Muir emphasized that although the EQC is concerned about pollution, the use of seepage fees elsewhere will be affected by the EQC's decision here. State Senator Glen Otto is recommending use of a seepage fee for an area of groundwater concern near Albany.

42. Howard Willits stated that he is in favor of sewers--they are modern and are needed when so many people are involved. Sewers are relatively trouble free; they are expensive but it is cheaper in the long run than illnesses or public health problems. He stated that sewers are good investments by creating jobs and adding to property values, and that sewers should be installed as soon as possible.

43. Greg Frank, 3210 S.W. Stocksdall Drive, Portland, Oregon, served on the Multnomah County Citizens Advisory Committee for Sewers from 1982-83. He stated that in committee work, the citizens found sewers necessary to stop degradation of groundwater. He requested that the EQC decide sewers be installed as quickly as possible.

44. Ken Bunker, 1825 N.E. 125, Portland, Oregon, 97320, is generally opposed to sewers. He is concerned about the method of financing sewers and is opposed to the seepage fee concept.

45. Warren McPechmar favors annexation. He does not want to see the area blighted. He worked on annexation with the City of Gresham to get sewers and is disappointed with delays. He feels sewers would enhance: property, economic development, and livability.

46. Pat Brown presented cost estimates for sewer hook-ups and Bancroft financing. Pat is concerned about added expense to the elderly who may choose to defer payment for sewers until sale of their property, which may not leave enough funds for old-age care. She is opposed to the seepage fee concept. Ms. Brown believes that proof of a threat to drinking water (4th condition) rests with the Commission.

She believes that the most economical solution would be to take the following actions: 1) install charcoal filters to remove solvents and other impurities from groundwater; 2) stop immediate growth and industrial expansion; 3) stop agricultural use of lands; 4) control industrial use of chemicals; and 5) either treat the water or close down the wells.

She also raised these questions: (1) How was volume of 14 mgd of raw waste derived? (2) Where and when was sewage tested? (3) What would be the effect on property value if a threat to drinking water is declared in the affected area?

47. John Herceg, 7321 S.E. 48 Ave., Portland, Oregon, 97206, stated that Errol Heights experiences 70% failure rate for cesspools. He also stated that new cesspools cost between $1,400 and $2,000. He believes that sewers are the best solution for Errol Heights area.

49. Elsie Chido, S.E. 194, Portland, Oregon, believes the decision to sewer the affected area has already been made, and this hearing is a formality. She stated that residents have paid for sewers, which only benefitted developers and schools. She believes it is more economical to use Bull Run water than to sewer the affected area. She does not want fluoride added to drinking water.

50. Michael Dwyre, 4330 N.E. Maywood Pl., Portland, Oregon, 97220, is opposed to areawide installation of sewers because it encourages population growth and other negative aspects associated with such growth. Mr. Dwyre prefers that sewers be installed to correct only localized problem areas. Mr. Dwyre believes that Parkrose will discontinue use of wells and rely on Bull Run water, so the first criteria of a "threat to drinking water" is not applicable.

51. Joseph L. Miller Jr., M.D., 52815 E. Marmot Rd., Sandy, Oregon, 97055. Dr. Miller's main concern is the Bull Run water supply and the logging activities in the watershed. He feels that the City of Portland is developing a wellfield in east county to avoid building a filtration plant to reduce turbidity in the Bull Run supply. He recommends that Little Sandy River be developed as an alternate source for water supply rather than the groundwater. He also recommends that a consultant be hired to study the groundwater situation in east county because a Corps of Engineers' Report suggests that the deep wells developed by Portland could draw contaminated water from the upper aquifer to the deeper aquifer.

51. Bonnie McKnight, 1617 N.E. 140, Portland, Oregon, believes this hearing is premature because the source of problem has not been identified, and the statute allows the problem to be defined without standards. She believes that the installation of sewers would place a severe economic burden on elderly people and low income families, and upset a stable community. She claims a CH_2M/Hill report states that sewers in Mid-County are not affordable.

52. John Scalise, 2208 N.E. 142 Ave., Portland, Oregon, objects to the seepage fee concept and to the construction of sewers because it disrupts roads. Besides, the installed sewers would invite rats. He claims that 30-40 years ago, the County sanctioned the use of cesspools for waste disposal because of rapidly draining soils. He believes that groundwater quality is not contaminated, otherwise purveyors would not distribute it to the public. He believes the cost of sewers is too high and does not want to be annexed to Portland. He believes that subsoils should be used for waste disposal, and either a reliable surface water supply should be found or deeper wells should be drilled and properly cased.

53. Jackson Douthit, 10321 S.E. Center, Portland, Oregon, 97266, is opposed to annexation and believes that a declaration of a threat to drinking water is a promotion to have citizens pay for commercial development. He does not believe a groundwater quality problem exists and opposes construction of sewers. He believes that safe potable water can be developed from the deeper aquifer.

54. Phil Carrell, 13014 N.E. Morris Ct., Portland, Oregon, believes that sewers in the affected area would benefit public health over the long term and improve property values. He recommends that more methods be found to finance construction of sewers to spread the costs.

55. Ludmilla Pitkin, 16373 S.E. Morrison St., Portland, Oregon, is opposed to annexation to City of Portland. Ms. Pitkin raised questions on source of monitoring and analyses of groundwater.

56. Ralph Holmes, 11505 N.E. Glisan, Portland, Oregon, objects to the seepage fee concept (prepayment for sewers without the benefit of being sewered for many years).

57. Elowise Baily, 24138 S.E. Oak, Troutdale, Oregon, 97060, believes that the whole issue of a "threat to drinking water" should be postponed until a study is done to show conclusively that groundwater is polluted.

58. Patsy M. Pfeifer, 17 N.E. 172, Gresham, Oregon, 97230, agrees that problems need to be addressed but is disturbed with the methods and means to sewer east county. She believes that the "Threat to Drinking Water" Law is sneaky because it requires only 3 out of 4 criteria be met to have an area declared a threat. She asked the EQC to be particular in designating the affected areas (better define the boundaries), and to base their evaluation on facts and not on possibilities. She suggests maximum flexibility in financing methods where projects are needed. She opposes annexation as a method to solve sewerage problems.

59. Jim Worthington, 3232 S.E. 153, Portland, Oregon, is opposed to the political makeup of the consortium and favors the formation of a unified sewerage agency like in Washington County. He believes the City of Portland is interested in only annexing selected property. He favors more economical waste control methods such as those used in Europe. He opposes sewering the affected area as proposed by Multnomah County Sewer Committee.

60. Perry Buck, 4653 N.E. 102 Ave., Portland, Oregon, 97220, is opposed to annexation to City of Portland. He favors sewers and a separate city. He is concerned about the non-voting nature of the "Threat to Drinking Water" statute. He asked the EQC to consider the wishes and interests of the people before making a final decision.

61. Ron O. Weaver, 2639 N.E. 137, Portland, Oregon, 97230, favors the sewerage proposal for the affected area because it would begin to restore groundwater quality. He believes clean water supplies are diminishing.

62. Robert Luce, 3441 S.E. 174, Portland, Oregon, 97236, delivered a petition with about 130 signatures. He does not believe a threat to groundwater exists, and if one did, people should use Bull Run water. He believes that the proposed plan is promoted by special interest groups who have affected property. He asked the EQC to not declare an area-wide solution to benefit only a few people.

63. John F. Vogl, 16410 S.E. Stephens Ct., Portland, OR, objects to the seepage fee concept because he does not trust accountability of the funds. He suggests that communities should use Bull Run water if groundwater is contaminated. He is not against sewers but urged the EQC not to be badgered into making an unjust decision that would favor only a few.

NJM/ALS/JAG/KW/TJL/BJS/ELQ/ERL:t1
TL3652
11/29/84

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

B. EXHIBITS ENTERED INTO THE RECORD AT THE AUGUST 30, 1984, EQC HEARING

1. Trudy A. Jones, written testimony

2. Allan F. and Ardyce L. Johnson, written testimony

3. James Petersen, Chairman, Environmental Quality Commission, written statement and attachments.

   a. EQC Agenda items & Minutes Related to On-Site Sewage Disposal in East Multnomah County

   1. Agenda Item No. L, March 22, 1974
   Public Hearing on Adoption of Permanent Rules Pertaining to Standards for Subsurface Sewage and Nonwater Carried Waste Disposal.

   2. Minutes, EQC Meeting, March 22, 1984

   3. Agenda Item I, October 15, 1976
   Consideration of Adoption of Proposed Amendments to Oregon Administrative Rules Chapter 340, Division 7, Section 71, 72, 73, and 74, Pertaining to Subsurface and Alternative Systems of Sewage Disposal.

   4. Minutes, EQC Meeting, October 15, 1976

   5. Agenda Item No. Q, February 24, 1978
   Multnomah County Groundwater Aquifer - Status Report.

   6. Minutes EQC Meeting, February 24, 1978

   7. Agenda Item E, August 25, 1978
   Multnomah County Groundwater Protection Plan.

   8. Minutes, EQC Meeting, August 25, 1978

   9. Agenda item K, April 18, 1980
   Request for Approval of Multnomah County Groundwater Protection Plan.

   10. Minutes, EQC Meeting, April 18, 1980

   11. Agenda Item No. G, March 13, 1981
   Adoption of Proposed Rules Governing On-Site Sewage Disposal, OAR 340-71-100 to 71-600, to Replace Rules Governing Subsurface and Alternative Sewage Disposal, OAR 340-71-005 to 71-045, 340-72-005 to 72-030, 340-74-004 to 74-0255, and 340-75-010 to 75-060.

Not Included in Hi's package

Not Included in this package

12. Minutes, EQC Meeting, March 13, 1981

13. Agenda Item No. P, August 28, 1981
Request From Multnomah County for a Six (6) Month Delay in Implementing the Provisions of OAR 340-71-335(2)(a), Cesspool Prohibitions.

14. Minutes, EQC Meeting, August 28, 1981

15. Agenda Item No. K
Sewage Disposal in East Multnomah County: Status Report and Proposed Action Regarding On-Site Systems.

16. Minutes, EQC Meeting, March 5, 1982

17. Agenda Item No. M, April 16, 1982
Public Hearing on Question of Extending Date on Prohibition of Cesspools to Serve New Construction, OAR 340-71-335.

18. Minutes, EQC Meeting, April 16, 1982

19. Special Agenda Item, June 29, 1984
Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County Pursuant to the Provisions of ORS 454-275 etc.

20. Minutes, EQC Meeting, June 29, 1984

21. Special EQC Telephone Meeting, July 10, 1984

22. Minutes, EQC Meeting, July 10, 1984

3. b. Threat to drinking water reports, Sewer facility plans and resolutions submitted by the members of the East County Sanitary Sewer Consortium

Reports not included in this package

1. Providing Sewer Service to Mid-Multnomah County: Framework Plan, June 1984.

2. Threat to Drinking Water Findings, June 1984

3. Central County Service District Master Plan Update, Kramer, Chin & Mayo, Inc., Consulting Engineers, July 1983.

4. The Economics and Finances of Sewers, Central County Service District, ECO Northwest, July 1983.

5. Final Report, Sewerage Facilities Financing Plan, Central County Service District, CH2M Hill, December, 1981.

6. Sewer Facilities Financing Plan Cost Update, Central County Service District, CH2M Hill, May 1984.

Not Included in this package

7. City of Gresham Sewerage System Master Plan, Brown and Caldwell, Consulting Engineers, December 1980.

8. Sewage System Facility Plan for the I-205 Corridor and the Johnson Creek Basin, June 1984.

3. c. Memo to the Environmental Quality Commission, Subject, Newspaper Articles from The Gresham Outlook and The Oregonian Concerning Public Hearings to be Held August 30 and September 11, 1984, Pertaining to Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County.

Attachments not included (Affidavits)

4. Statement of Henry Kane, Attorney, On Behalf of Citizens United in Action

5. Bob Bledsoe, written testimony

   a. "Geology of the Portland Well Field", W. H. Hoffstetter, Oregon Geology, Volume 46, No. 6, June 1984

6. H. Havercamp, written testimony

7. Emil R. Berg, City of Portland Bureau of Environmental Services, Citizens Advisory Committee, written testimony

8. Elouise M. Bailey, written testimony

9. Wm. E. Morton, M.D., written testimony

10. Douglas Hartman, Powell Hurst/Gilbert Neighborhood Association, written testimony

11. Joseph L. Miller Jr., M.D., written testimony

   a. "Portland-Vancouver Metropolitan Area Water Resources Study - Water Supply Regional Water Supply Plan", U.S. Army Engineers District, Portland, 1979 (page 18, 108, 109)

   b. "Management of Forest Resources in the Bull Run Division", Portland City Club Bulletin for Friday, August 17, 1973, pages 61, 62

   c. Little Sandy Fact Sheets, December 5, 1980, January 16, 1980, and February 1, 1980

   d. Letter from Ron Humphrey, Zigzag Ranger District, Mt. Hood National Forest, to Dr. Joseph L. Miller, Jr., January 29, 1980,

   e. Letter from Donald C. Gipe, U.S. Environmental Protection Agency to Joseph L. Miller, Jr., March 28, 1980

   f. Letter from John Vlastelicia, U.S. Environmental Protection Agency to Robert Hyle, City of Portland, Bureau of Water Works, March 10, 1978

   g. Letter from Robert Hyle, City of Portland, Bureau of Water Works, to John Vlastelicia, U.S. Environmental Protection Agency, Sepotember 13, 1978

h. Letter from Robert F. Willis, P.E., City of Portland, to Joseph L. Miller, Jr., M.D., May 12, 1983

i. Letter from Joseph L. Miller, Jr., M.D., to Robert F. Willis, P.E., City of Portland, June 1, 1983

j. Letter from Robert F. Willis, P.E., City of Portland, to Joseph L. Miller, Jr., M.D., June 15, 1983

k. "Portland Water Bureau Water Supply Development Program", Stevens Thompson & Runyan, Inc., Introduction

l. Letter from Carl E. Green, to Dr. Warren Westgarth, Chairman Bull Run Advisory Committee

12. John J. Scalise, written testimony

13. 126 signed statements against declaring A Threat to Drinking Water and proposing that Bull Run Water be furnished to solve the problem

EXHIBIT 1

B1

My name is Trudy A. Jones. I live at 11923 N.E. Sacramento, Portland.

We moved to Portland about 5 1/2 years ago. After 2 months time I asked my husband when we could expect a bill for sewage in this area. He replied that he didn't know. I asked my neighbors "When do we get the sewer bill?" They laughed and told me we didn't get a sewer bill, and went on to explain that we didn't have sewers, we had cesspools. Each and every home in this area has his or her own cesspool. Needless to say, that since then I have learned an awful lot about cesspools, the cost and horrors thereof, and the need for sewers.

As you drive around the area - down 102nd Avenue, you smell sewage, on the way to the airbase on Thursday evenings; down Columbia and the last street beyond the golf course, you smell sewage; in my backyard a couple of weeks ago, we smelled sewage. (This incident was unfortunate, because Portland is a beautiful city and we love it here. However we had company from Germany at the time and he goes back to Germany with the image of a Portland without sewers and smells. If you drive onto Brazee from 102nd, there is a dip in the street. When it rains in the winter time there is literally 3 inches of sewage across the whole street for about 1/4 of a block. There is no way to get into those homes unless you can drive up into the driveway. One home has the gunk flowing in one side of their crawl space and out the other. They try to maintain ditches around their property, sort of the moat idea to keep it out of the crawl space. There is also a dip in the street on Sacramento off of 102nd, where filthy water accumulates and can't drain off during the rainy months because the ground is so saturated.

Many folks out here want sewers and NEED sewers. They try to keep their cesspools going in various way. One little old lady told me over the phone that her cesspool will never fill up. Here's why. I asked her why because when she told me the age of the cesspool, I knew we were having problems soon. She told me she puts nothing in it. Yes, she did put laundry water in, dishwater, and I asked about the bathroom. She told me she puts nothing in. I asked "Not even paper products?" She said I never use paper products, cause I don't want my cesspool to fill up. SHE USES NO PAPER PRODUCTS BECAUSE SHE IS AFRAID HER CESSPOOL WILL FILL UP. How obscene a situation can we get? One man told me NO he wouldn't sign a petition because he had some extra footage on his cesspool and he didn't

care what circumstances other people were in. One gentleman told me he didn't think he would sign. "He comes from the SOUTH and we take care of our own down there." Sacramento Elementary School closed last Dec 5 & 6 because of cesspool problems. The toilets backed up, and the children were sent home. The Southern man's children attend this school along with many many other children in the neighborhood. He takes care of his own. (Barnevelde, Wisconsin, a little town of 607 that was demolished by a Tornado in June was the first in the area to have sewers. It's 1984, we have approximately 70,000 homes, 125,000 people putting 12-14 million gallons of sewage into the ground every single day.) Ground water is polluted all over the U.S. and we don't even care how, when or where we contaminate ours. What are we leaving for ourselves or the next generation?

We need to MANDATE sewers now, not leave it go on on a voluntary LID basis and not over a 20 year period. Why force an added hardship on homeowners whose cesspools are nearing their working cycle. Why not go ahead and put all the lines into the streets now, and use a 20 year period for hookup. At least doing it that way, as cesspools go out folks could hook up to the line, or if they wanted to could hook up immediately. The folks ## that are reluctant could pay the higher seepage fee and higher installation cost later. Sewers are expensive, but in 20 years we will be trading our homes for them at the rate ## inflation is going.

Please lets get into the 20th Century, get us sewers NOW as fast as they reasonably can be installed. This is the largest unsewered area in the U.S. , we don't want to be the largest slum area.

Thank you.

EXHIBIT 1

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

B 2

B2

3717 N.E. 126th Ave.
Portland, Oregon 97230
August 30, 1984

Evironmental Quality Commission

To whom it may concern:

We strongly desire to have sewers in the Parkrose area because we are concerned about:

- -the quality of Parkrose water
- -the longterm status of our cesspools
- -the maintance of property values in Parkrose
- -the increased cost of construction if delayed.

Please support this project and help it to become a reality as soon as possible.

Thank you.

Sincerely,

Allan F. Johnson
Ardyce L. Johnson

EXHIBIT 2

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

B3a

EQC Agenda Items & Minutes
Pertaining to On-Site Sewage Disposal
Related to East Multnomah County

1. Agenda Item No. L, March 22, 1974
Public Hearing on Adoption of Permanent Rules Pertaining to Standards for Subsurface Sewage and Nonwater Carried Waste Disposal.

2. Minutes, EQC Meeting, March 22, 1974

3. Agenda Item I, June 15, 1976
Consideration of Adoption of Proposed Amendments to Oregon Administrative Rules Chapter 340, Division 7, Section 71, 72, 73, and 74, Pertaining to Subsurface and Alternative Systems of Sewage Disposal.

4. Minutes, EQC Meeting, June 15, 1976

5. Agenda Item No. Q, February 24, 1978
Multnomah County Groundwater Aquifer - State Report.

6. Minutes, EQC Meeting, February 24, 1978

7. Agenda Item E, August 25, 1978
Multnomah County Groundwater Protection Plan.

8. Minutes, EQC Meeting, August 25, 1978

9. Agenda Item K, April 18, 1980
Request of Approval of Multnomah County Groundwater Protection Plan.

10. Minutes, EQC Meeting, April 18, 1980

11. Agenda Item No. G, March 13, 1981
Adoption of Proposed Rules Governing On-Site Sewage Disposal, OAR 340-71-100 to 71-600, to Replace Rules Governing Subsurface and Alternative Sewage Disposal, OAR 340-71-005 to 71-045, 340-72-005 to 72-030, 340-74-004 to 74-025, and 340-75-010 to 75-060.

12. Minutes, EQC Meeting, March 13, 1981

13. Agenda Item No. P, August 28, 1981
Request From Multnomah County for a Six (6) Month Delay in Implementing the Provisions of OAR 340-71-335(2)(a), Cesspool Prohibitions.

14. Minutes, EQC Meeting, August 28, 1981

15. Agenda Item No. K, March 5, 1982
Sewage Disposal in East Multnomah County: Status Report and Proposed Action Regarding On-Site Systems.

16. Minutes, EQC Meeting, March 5, 1982

17. Agenda Item No. M, April 16, 1982
Public Hearing on Question of Extending Date on Prohibition of Cesspools to Serve New Construction, OAR 340-71-335.

18. Minutes, EQC Meeting, April 16, 1982

19. Special Agenda Item, June 29, 1984
Proposal for EQC to Declare a Threat to Drinking Water in a Specifically Defined Area in Mid-Multnomah County Pursuant to the Provisions of ORS 454,275 etc.

20. Minutes, EQC Meeting, June 29, 1984

21. Special EQC Telephone Meeting, July 10, 1984

22. Minutes, EQC Meeting, July 10, 1984

NJM:t
WT252
August 29, 1984

B 3c

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

Mailing Address: BOX 1760, PORTLAND, OR 97207
522 SOUTHWEST 5th AVENUE, PORTLAND, OR 97204 PHONE (503) 229-5696

MEMORANDUM

To: Environmental Quality Commission

From: Water Quality Division

Subject: Newspaper Articles from Gresham Outlook and The Oregonian Concerning Public Hearings to be Held August 30 and September 11, 1984, Pertaining to Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County

Gresham Outlook

July 7, 1984) (News Item) — "Group Plans to Fight County Seepage Fee"

July 11, 1984 (News Item) — "State Wants Hearings on Groundwater Threat"

July 28, 1984 (News Item) — "State Sets Hearing Date for Groundwater Pollution"

August 8, 1984 (Paid Public Notice) — PUBLIC NOTICES

Oregon Department of Environmental Quality
A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County"
(Affidavit of Publication to be Submitted by Newspaper)

August 11, 1984 (Paid Public Notice) — PUBLIC NOTICES

Oregon Department of Environmental Quality
A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County"
(Affidavit of Publication to be Submitted by Newspaper)

August 15, 1984 (Paid Public Notice) — PUBLIC NOTICES

Oregon Department of Environmental Quality
A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County"
(Affidavit of Publication to be Submitted by Newspaper)

August 22, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)
August 29, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)

The Oregonian

July 3, 1984 (News Item)	"Residents Question Need for Sewers"
July 11, 1984 (News Item)	"State Board OKs Water Hearings"
July 12, 1984 (News Item)	"Consultants Hired to Brief Public on Sewer Plan"
July 22, 1984 (News Item)	"City Line is also a Battle Line - Johnson Creek Area Target of Annexation"
July 24, 1984 (News Item)	"Gresham to Discuss Sewage Plans"
July 25, 1984 (News Item)	"Study Predicts Growth in Sewer Services"
August 7, 1984 (News Item)	"EQC Hearing on Sewers Scheduled"
August 8, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication Received)

August 11, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication Received)
August 14, 1984 (News Item)	"Portland to Get $21 Million Grant for Sewer Project"
August 15, 1984 (News Item)	"Seepage Fee Plan Discussed"
August 15, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)
August 22, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)
August 26, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)
August 29, 1984 (Paid Public Notice)	PUBLIC NOTICES Oregon Department of Environmental Quality A Chance to Comment On ... "Polluted Underground Water and the Possible Need for Sewers in Mid-Multnomah County" (Affidavit of Publication to be Submitted by Newspaper)
August 29, 1984 (News Item)	"Hearings to Set Stage for Crucial Decision on Sewers"

TJL:1
TL3635
August 29, 1984

Attachments: Copy of Public Notice
Newspaper Tear Sheets
Affidavits of Publication

Oregon Department of Environmental Quality

A CHANCE TO COMMENT ON...

POLLUTED UNDERGROUND WATER AND THE POSSIBLE NEED FOR SEWERS IN MID-MULTNOMAH COUNTY

Date Prepared: July 30, 1984
Date Amended: August 7, 1984
Hearing Date: August 30, 1984

WHO ARE AFFECTED: All residents, businesses and industries of mid-Multnomah County and the cities of Portland and Gresham.

WHAT IS PROPOSED: Multnomah County and the cities of Portland and Gresham have forwarded to the Environmental Quality Commission findings of polluted underground waters below mid-Multnomah County, which is used as a source of public drinking water. The local governments have also forwarded a sewering plan which proposes to construct all trunk sewers and install collector sewers under voluntary Local Improvement District (LID) procedures leading to service of 25 percent of the area in 20 years.

WHAT ARE THE HIGHLIGHTS: Increased nitrate levels and the presence of organic solvents in the underground water may be determined a threat to drinking water. Public water systems presently rely on the underground water as drinking water supply. If a threat to drinking water is found, the Environmental Quality Commission can order existing cesspools (estimated at 56,000 cesspools serving a population of 130,000) to be replaced by a sewerage collection and treatment system. The total cost of sewering the affected area is estimated to be $255 million dollars.

HOW TO COMMENT: A public hearing has been scheduled before the Environmental Quality Commission.

Both oral and written comments will be accepted at the public hearing.

TIMES	DATE	LOCATION
1 p.m. - 5 p.m. 6 p.m. - 10:30 p.m.	Thursday August 30, 1984	Parkrose High School Cafetorium 11717 NE Shaver St. Portland, Oregon

On September 11, 1984, the hearing will be reconvened before a Hearing Officer designated by the Commission to receive testimony from persons who are unable to testify at the August 30, 1984, hearing. This reconvened hearing will begin at 10 a.m. in Room 1400 of the Yeon Building, 522 S.W. 5th Avenue, Portland, Oregon, and will continue until testimony is completed.

In addition, written comments may be sent to:

Department of Environmental Quality
Attention: Water Quality Division
P.O. Box 1760
Portland, Oregon 97207

To be included in the written record, comments must be postmarked by September 11, 1984.

HOW TO GET ADDITIONAL INFORMATION: To receive an informational report on this issue you may contact:

Department of Environmental Quality
Public Affairs Section
Phone: 229-5317

FY170

P.O. Box 1760
Portland, OR 97207

8/10/82

FOR FURTHER INFORMATION:

Contact the person or division identified in the public notice by calling 229-5696 in the Portland area. To avoid long distance charges from other parts of the state, call ~~1-800-452-7813~~, and ask for the Department of Environmental Quality.

1-800-452-4011

B4

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

STATEMENT OF HENRY KANE, ATTORNEY, ON BEHALF OF CITIZENS UNITED IN ACTION

August 30, 1984, Before the Environmental Quality Commission

James E. Petersen, Chairman
and Members
Environmental Quality Commission

Dear Mr. Chairman and Commission Members:

My name is Henry Kane and I appear before you as the attorney for "Citizens United in Action," an unincorporated association of residents of Multnomah County, Oregon with a direct interest on the issue of whether the Commission will order installation of a sanitary sewer system in mid-Multnomah County.

The ssociation and its members have a personal interest in pure drinking water and public health, but submit the following matters to the Commission for its consideration.

This hearing is the first proceeding under the 1983 amendments to ORS 454.275 to 454.310, relating to construction of sewage treatment works. The 1983 amendments purport to allow imposition of a "seepage fee" if the Commission makes a finding of a "threat to drinking water."

The issue, therefore, is whether there is a "threat to drinking water," not whether there is pollution of underground waters in isolation.

In considering the issue, the Commission is reminded that a finding of a "threat to drinking water" does not require a decision to install an expensive sanitary sewer system if a more economical alternative exists.

ORS 454.300(1) requires the Commission to determine:

> " * * * whether the proposed treatment works are the most economical method to alleviate the conditions. * * * "

EXHIBIT 4

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

ORS 454.300(5) provides:

> "(5) If the commission determines that a threat to drinking water exists but that the proposed treatment works are not the most economical method of removing or alleviating the conditions, the commission may issue an order terminating the proceedings under ORS 454.275 to 454.350, or referring the resolution or ordinance to the municipality to prepare alternative plans, specifications and financing methods." (emphasis added)

The association submits that "the most economical method of removing or alleviating the conditions" of impure drinking water is to forbid use of wells for domestic water use without removal of pollutants.

In short, the water districts which use wells should be required to treat water to remove pollutants or shut down the wells. The proposed order would not affect wells used exclusively for non-domestic water consumption purposes.

It is submitted that water treatment and/or use of non-well water will cost millions of dollars less than the proposed $255 million system.

The Commission is not dealing with "deep pocket" corporations that can pay the cost as a small business expense.

Instead, the proposed $255 million system would fall most heavily on thousands of persons least able to pay connection costs of $10,000 or more - homeowners on fixed earning or retirement incomes.

Assuming for the sake of argument a threat to drinking water, Multnomah County for decades issues building permits authorizing cesspools. Now the homeowner is asked to pay for the county's error.

I urge the Commission to insist that proponents of the $255 million system comply with the rules of evidence and submit evidence, not their ipse dixit - "it is so because I say it is so" - to support their recommendations and "findings."

ORS 454.275(5)(c) provides:

> "(5) 'Threat to drinking water' means the existence in any area of any three of the following conditions:
>
> * * *
>
> "(c) * * * and the sewage contains biological chemical, physical or radiological agents that can make water unfit for human consumption; * * *." (emphasis added)

I have examined the documents made available to me by the Department to determine whether there is admissible evidence that the sewage contains agents that can make the water unfit for human consumption.

Among the documents I received is one titled "Threat to Drinking Water Findings," issued by the East County Sanitary Sewer Consortium and dated June 1984.

The closest to a "finding" is paragraph 4 of the summary titled:

"4. Risk to Human Health - ".

No part of the document states that pollutants exceed permissible limits and that the pollutants came exclusively from sewage, e.g.:

> "4. Risk to Human Health - Thirteen wells in or around the affected areas have nitrate levels that exceed the 5.0 mg/l (50% of maximum allowable limit). * * * " (emphasis added)

It is elementary that the findings must pertain solely to the groundwater in the affected area that is the subject of this hearing. To the extent that the document relies on well findings outside the affected area, the document is or should be inadmissible.

The document does not state that the nitrate level now exceeds the "maximum allowable limit."

The document does not state that the limit will be exceeded. It will be difficult for the limit to be exceeded if no additional septic tank permits are issued.

Proponents should be asked to state whether any public health agency

has reported any disease outbreaks in mid-Columbia County attributed to impure drinking water from wells.

Proponents also should be asked to state where we may find the medical literate reporting outbreaks of nitrate/nitrite poisoning attributed to impure well water.

Subject to the testimony and exhibits submitted by the deadline, I submit that the proponents have failed to comply with the "seepage fee" law.

If the proponents fail to meet the statutory standard, the Commission has the option of terminating this proceeding and directing the proponents to submit an alternative plan, e.g., limit well water to non-domestic use and requiring the water districts to treat their well water or use alternative sources such as Bull Run water.

If the proponents meet the statutory standard, then it is submitted that the Commission should reject the proposed $225 million system and favor the more economical method of Bull Run and/or treated water.

Whatever decision is made, the decision must be supported by evidence; an unsupported opinion is insufficient.

Finally, ORS 454.280 purports to allow a public body to issue general obligation bonds to finance sewage treatment facilities without a vote of the people, regardless of a charter requiring the voters to approve a bond issue. The Home Rule Charter of Multnomah County requires voter approval of bond issues, and it is submitted that a charter adopted pursuant to the Home Rule provisions of the Oregon Constitution cannot be repealed by a mere statute.

Henry Kane

B5

EXHIBIT 5

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

My name is Bob Bledsoe. I have worked for the City of Portland's Bureau of Environmental Services for almost 12 years, and my position is Engineering Technician. For about 7 years I worked in the Industrial Waste Section, where one of the main concerns was the control of the pollution of our waterways. I am acquainted with Public Law 92-500 and the laws subsequent to it. I have read many articles and attended several seminars concerning pollution of the waterways, and the control measures that are being used. For the last 14 months I have worked in the present Financial Services Division with the men who are planning and promoting the sewering of middle Multnomah County. Part of my job is to try to explain to concerned citizens what is happening, and how much the sewer will cost them

About 20 months ago I was elected to the board of the Tigard Water District, and during the time since then I have become well acquainted with the issues of water supply, including the use and protection of groundwater. I graduated from Portland State University with a Bachelor of Arts in mathematics and a minor in physics. Since graduation I have taken several courses in engineering, including hydrology. I would like to point out that I am a resident of Washington County, and I have no personal interest in the topic of discussion. It is simply my sense of justice and fairness that compels me to speak today.

It definitely seems to me that the management of the Bureau of Environmental Services of the City of Portland is lying to the public concerning their intentions and activity toward mandating sewers in middle Multnomah County. I have heard them say such things as the following:

> Building sewers to east county is a loss-leader (in order to annex the area eventually).
>
> It's too bad we can't just annex the area like Dallas (Texas) does, and not have to go through all this trouble.
>
> When we get east county sewered, we'll have half again as many accounts as now.
>
> The EQC will mandate a program for us, then its sewers, sewers, sewers.
>
> We'll be like brer rabbit--Oh, don't throw me into that briar patch.
>
> We don't want to appear to be requiring sewers. What we are saying is that we expect the EQC will require a more stringent program than we are proposing.

> We need to organize this (presentation to EQC) very carefully. Once we get the threat (to drinking water) established, . . .
>
> Based on discussions with DEQ staff, they are going to have expert testimony there -- Dr. Shade and others -- we're going to be taking a lower profile role.

I believe that their real objective is to annex east county and to build a much larger sewer system, thus giving them a larger organization with more glory. There was hardly ever any talk of any threat to drinking water until they and their cohorts convinced the legislature to pass a special state law aimed at sewering Mid-Multnomah County. If the criteria had been a local rise in the humidity level, then they would be deploring the danger of moisture in the atmosphere. They don't care about drinking water--what they care about is building sewers.

While the staff of the City of Portland is working fervently to achieve the program of compulsory sewereing of Mid-Multnomah County, they want to avoid the image of doing that very thing. They are hiding behind the EQC and the East County Sanitary Sewer Consortium. This consortium is made up of four governments, but Portland is providing the lion's share of the leadership and labor and finances from their well-healed Sewage Disposal Fund.

Concerning the alleged threat to drinking water, everyone knows that the regional source of drinking water is Portland's Bull Run watershed. This is the only or primary source for almost all of the public water districts in this region. Only two water districts in the concerned region use wells as their primary source: Gilbert and the tiny Richland. (Parkrose will be going onto Bull Run water, since that area has now mostly been annexed by Portland.) Those districts that use well water instead of Bull Run do so to save money by avoiding Portland's high rate charged on water from this regional resource. There is enough water in the Bull Run to supply all of the concerned region's needs. So the first thing I'd like to point out is that there is not really much dependence upon wells in the concerned region, and those who are now depending upon wells can switch to Bull Run water if they're willing to pay the extra cost. This is also true for those using private wells.

Of great significance in evaluating the alleged threat to drinking water is the decision by the City of Portland to construct one of the nation's largest well fields in the concerned region. Portland has built 20 wells already, and has begun construction on the second 20 wells. Before drilling these wells, the Portland Water Bureau determined that the

threat of contamination to the lower aquifers was negligible. W.A. Hoffstetter of the Portland Water Bureau discusses the geology of the region in the June, 1984 edition of Oregon Geology. From this study one can see that the seepage from the cesspools would travel through the terrace gravels to the top of the Parkrose Aquifer. The Parkrose Aquifer is separated from the Troutdale Aquifer by the Parkrose Aquitard, and the Troutdale Aquifer is separated from the still deeper Rose City Aquifer by the Rose City Aquitard. These aquitards "are composed of lenticular and interbedded zones of fine-grained, lacustrine deposits of consolidated sand, silt, and clay that act as hydraulic confining layers preventing the rapid movement of water between the . . . aquifers." p.67 Oregon Geology, Volume 46, Number 6, June 1984.

The seepage that finds its way to the Parkrose Aquifer will be confined almost entirely to that aquifer, which flows along to the northwest and emerges to form the Columbia Slough. Some people have expressed fears that when suction is applied to the lower aquifers, the result would be to draw down the contaminated water through the aquitards to the lower aquifers. The study shows that the Parkrose Aquitard is completely severed by the Columbia River Sands Aquifer, and that possibly the Rose City Aquitard is penetrated in some places. Since the Columbia River Sands Aquifer is very permeable and the Parkrose Aquitard is relatively impermeable, a suction applied to the Troutdale Aquifer will result in drawing water from the Columbia River Sands Aquifer instead of through the Parkrose Aquitard. The Columbia River Sands Aquifer is constantly being recharged from the huge Columbia River above it. There is the possibility of the introduction of some contaminants at the interface of the Parkrose Aquifer with the Columbia River Sands Aquifer, but, considering the recharge from the river, such contamination likely would be diluted by a factor of at least 100 to one by the time the water reached the Troutdale Aquifer. What we have in essence is a natural system similar to the Ranney Collectors used in Gladstone and St. Helens and designed in the 1930's by Leo Ranney of Northwestern University. These Ranney Collectors use the aquifer under a river to filter the water, saving treatment costs. So the second major point to be made is that if contamination is encountered in wells drawing from the Parkrose Aquifer, then those people or that district could choose to drill deeper to the Troutdale or Rose City Aquifers to obtain clean water, as the City of Portland has done. It should be noted that the wells cited in "Threat to Drinking Water Findings" by the East County Sanitary Sewer Consortium, are in the top of the Parkrose Aquifer and/or even above it in the terrace gravels.

Considering that those who use these shallow wells have two other options for obtaining drinking water, and that most of those wells are currently within the federal drinking water standards, and that the people served by these wells represent a very small percentage of the population of the region, it seems unreasonable to require thousands of people to spend thousands of dollars each in an 'urgent' multimillion dollar program to sewer east Multnomah County. Where is the urgency? Isn't it ludicrous? Before the push in the 70's to clean up the environment at all costs, it was taught in hydrology that our water courses could serve four basic functions: drinking water and irrigation, waste removal (with natural treatment), recreation, and wildlife habitat. Wise management was considered to be the balancing of these uses. In this case the last two uses do not apply. Since there are two aquifers that can serve for drinking water, what is wrong with allowing the Parkrose Aquifer to continue to carry the wastewater from east county? Presently this is a natural gravity system, providing some treatment en route, which is proposed to be replaced by an expensive network of sewers that will collect all the wastewater to pump it to the Columbia Boulevard sewage treatment plant, using considerable energy that could well be put to other uses.

It is known that this wastewater bearing aquifer flows northwest and emerges into the Columbia Slough, which also receives some surface water and the overflow of 13 of Portland's combination storm-sanitary sewer trunk lines. The Columbia Slough does not flow very much, with much of the flow being caused by the tide. For over 12 years the City of Portland, DEQ, and METRO have sampled and analyzed the water of the Columbia Slough monthly at several points. As far as I know, no one has considered these measurements in the present discussion, even though the major impact of sewering east county would be a partial improvement of water quality in the Columbia Slough. However, if the City of Portland wishes to spend millions of dollars to improve the quality of the environment, wouldn't it be better to construct a second interceptor system to catch more of the raw sewage dumped into the Willamette River and the Columbia Slough? Wouldn't that be a better use of the capacity of the Columbia Boulevard sewage treatment plant?

These observations may not fully answer the criteria of ORS 454.275-310, but these are some of the observations and questions that should have been considered before passage of this law aimed at only one locality in Oregon. The lobbyists convinced the legislature that this one region had a problem which requires extraordinary coercion--taxes and seepage fees without a vote of the people affected. It is obvious that the lobbyists presented only selected facts in a one-sided, if not false, presentation. The legislature needs to carefully

reexamine this law. Meanwhile, there is enough evidence to show that there is no real urgent threat to drinking water, and the Environmental Quality Commission should either render the verdict of "no threat", or else table the issue for further study until the legislature can reconsider this law. The EQC could make a recommendation to the legislature to amend or delete the law. In ORS454.275(5)(b) and (d), the question the EQC should consider is "which groundwater aquifer?" The upper aquifer--the Parkrose Aquifer--is subject to pollution not only from cesspools, but from agricultural chemicals and other surface sources of pollution. (Portland's studies show that in the first hour or two of a storm, the pollution concentrations of the storm runoff are frequently six or more times that of normal sewage.) The lower aquifers are more suitable for a long-term source of drinking water because they are protected by the aquitards.

There is a precedent for the present attempt to mandate sewers in Mid-Multnomah County, and there are several parallels between that precedent and the present case. There was an area of predominantly farmland and residences between Columbia Slough and the Columbia River. This land was desired for industrial development by the City of Portland. Upon finding a half dozen or so failures in septic systems, a health hazard was declared. The area was annexed to Portland as the Gertz-Schmeer area and sewers were built throughout. The land was zoned industrial and development proceeded. What I would like to point out is that the development has not been nearly so fast-paced as those who planned this venture had envisioned. Much of the original character remains. Several people have not been able to sell or develop their land to recoup the costs of that sewer construction. Likewise in the present situation a rapid development of the area to commercial, industrial, and higher density uses is envisioned, which may not materialize. These type of uses are planned along the arterial and collector roads, with most of the existing single family homes on the local roads. If it is determined that sewers are necessary in this region, they should be built primarily along the arterial and collector road system where they will have the greatest impact and also serve the properties that would potentially have the greatest impact on the groundwater as they are developed. Sewers should not be required on local roads serving existing single family residences, because the cost is not at all justified by a reasonable expectation of improvement in drinking water by sewering those properties.

In conclusion, it is inappropriate to require a massive investment from over 100,000 people to safeguard the presently federally approved drinking water of a few. If their wells for drinking water become threatened, they have two options--dig

deeper wells or switch to Bull Run water. Other expenditures of less than this magnitude would have more impact in cleaning up the environment. Data which could have a bearing on determining the progression of water quality has not been considered. Since there is no urgent crisis, this decision should be postponed, or else only a limited application should be made at this time.

B5a

Geology of the Portland Well Field

by W.H. Hoffstetter, Portland Water Bureau, 1120 SW 5th Ave., Portland, OR 97204

INTRODUCTION

The Portland Well Field (Figure 1) is one of the nation's largest ground-water development programs. It is designed to provide emergency water in case something happens to the Bull Run Watershed, the current major source of water, and to meet peak demand for water during periods of heavy usage. Water-right applications have been filed for over forty production wells with a combined yield of over 150 million gallons per day. Twenty production wells have been constructed with capacities ranging from 1,000 to 10,000 gpm (gallons per minute), producing from fluvial-lacustrine aquifers 100 to 600 ft below ground level. The water rights are being obtained by several municipal suppliers including the Portland Water Bureau, the Parkrose Water District, and the Rockwood Water District. The water will be used for both residential and industrial purposes.

The well field is located in east Portland along the ancestral Columbia River flood plain between the Portland Airport and Blue Lake Park. The area is generally below 30 ft in elevation and contains several sloughs and lakes. Aquifers being developed consist of alluvium with particle sizes of fine sand to coarse gravel with boulders. The ages of the deposits range from Miocene to Recent. Transmissivities range from 20,000 to over 1 million gpd/ft (gallons per day per foot).

The water quality has proven to be good for the intended use. Specific conductivities are mostly from 150 to 400 μohms/cm, with calcium, silica, sodium, magnesium, and potassium as the dominant ions. The ground water reportedly has a very good taste.

Geologic and geophysical logging, combined with hydraulic testing, have allowed delineation of the sedimentary deposits. Prior

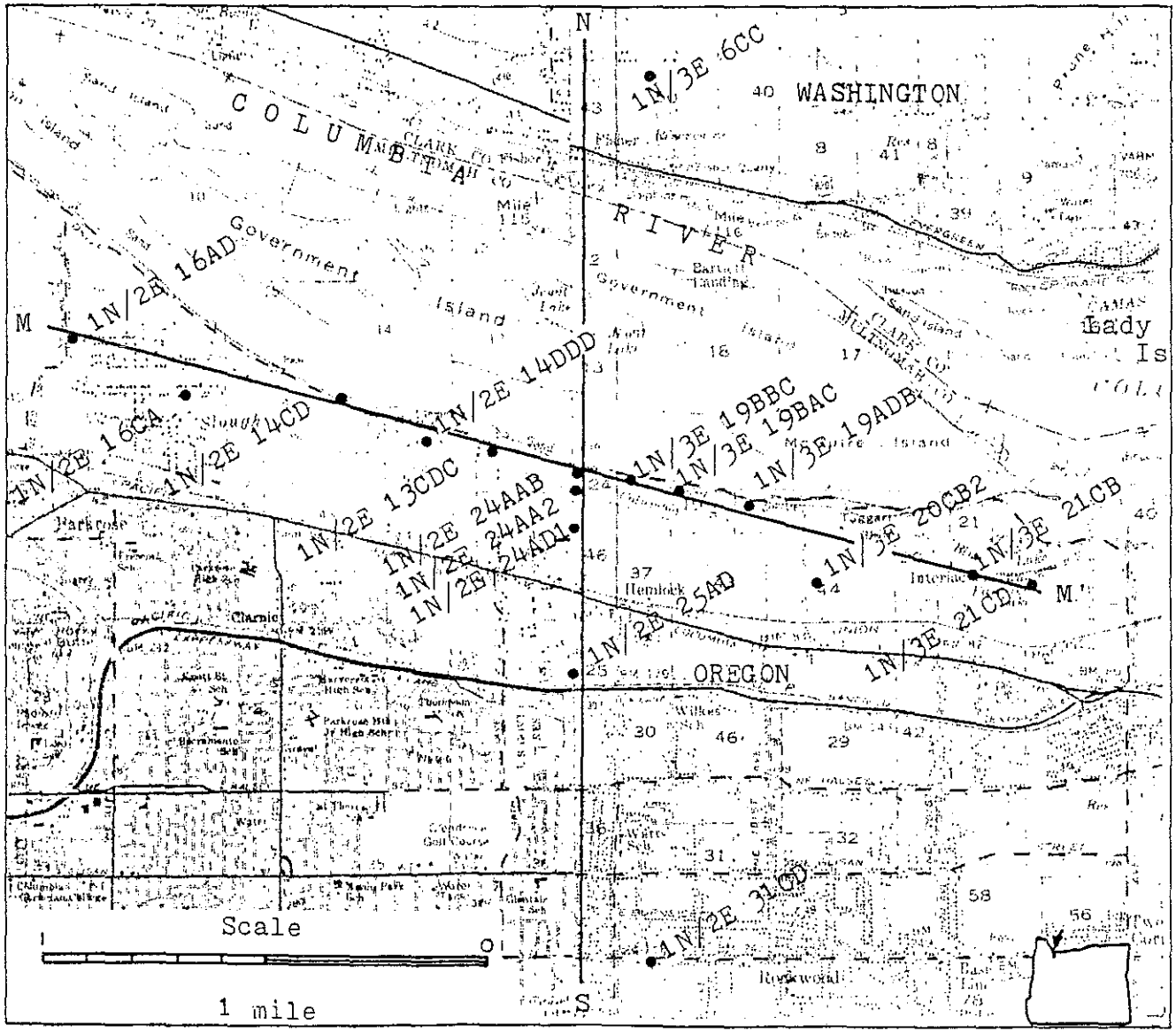


Figure 1. Map showing well locations in the Portland Well Field. Cross sections M-M' and N-S are shown in Figure 3.

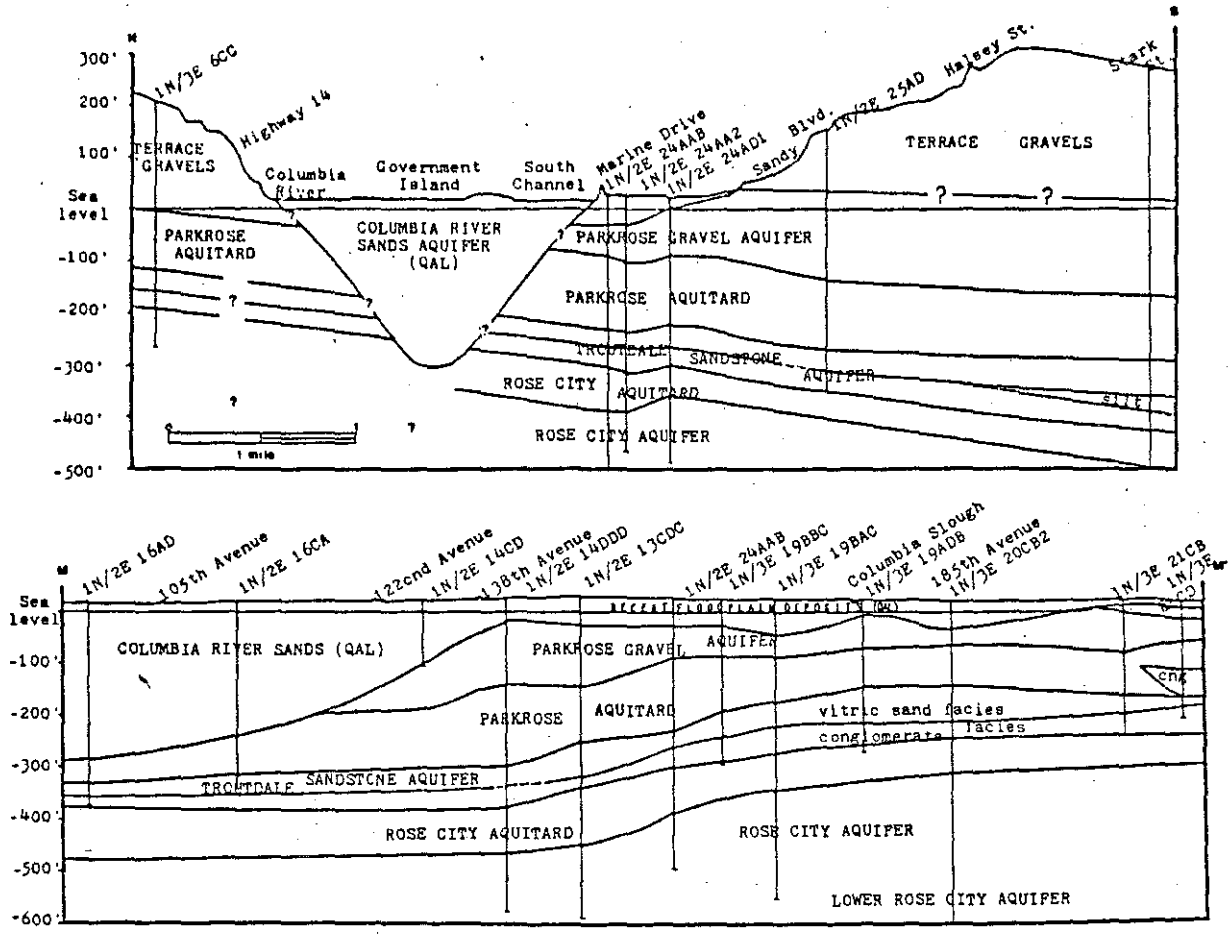


Figure 3. Cross sections N-S and M-M' of the Portland Well Field. Locations of cross-section lines are shown in Figure 1. The unmarked well on the right side of N-S line is well 1N/2E 31CD.

approximately 200 ft thick (Hogenson and Foxworthy, 1965). However, a Portland Water Bureau pilot well (1N/2E 15BC) encountered a thickness of approximately 300 ft. The elevation of the bottom of the CRSA in this well is about 300 ft below MSL, which correlates well with the elevations of Fraser Glaciation erosional valleys along coastlines in other areas (Milliman and Emery, 1968). The CRSA consists of medium sand, with occasional layers of silt, clay, and gravelly zones. The sand is quartzose in composition, and the gravel is basalt, andesite, dacite, and quartzite. A carbon-14 age for a wood sample from Portland Water Bureau well 1N/2E 15BC, depth 200-300 ft, was 8,910±115 years (Willis, 1979).

Blue Lake aquifer: This coarse-grained fluvial deposit contains mostly coarse gravel with some cobbles and boulders. The large grain sizes in the aquifer, combined with the lack of cementing and matrix material, provide a very high permeability, and several wells with yields of up to 10,000 gpm are planned. The thickness of the aquifer increases to the north from Blue Lake to the Columbia River, with a maximum recorded thickness of about 200 ft. The Blue Lake aquifer deposits are distinguishable from older deposits by higher percentages of clasts from the High Cascades, the lack of cementation, and the absence of the thin secondary mineralization present on older clasts. An aquifer of similar composition to the Blue Lake aquifer is used extensively by the Crown Zellerbach paper mill in the Camas-Washougal, Washington, area (Hoffstetter, 1981).

Parkrose gravel aquifer (PGA): This unit consists of a thick layer of coarse-grained fluvial deposits. The unit underlies most of the well field area to the east of NE 122nd Avenue. In the vicinity of the Portland airport, the PGA has been partially to entirely eroded by the Pleistocene Columbia River. The PGA generally thickens from east to west, with the maximum thickness of 125 ft recorded at Portland Water Bureau well 11(1N/2E 14DDD). The aquifer consists of coarse sand and gravel, with zones containing cobbles and boulders. A silty matrix which is present in some areas severely limits the amount of water obtainable from some wells. In other areas, the gravels are open and yield several thousand gallons per minute. The lower portion of the aquifer is commonly partially cemented, and the clasts are similar to those of the Pleistocene terrace gravels. The upper portion of the aquifer has been reworked locally by the Columbia River, and numerous clasts of High Cascade composition occur in some of the reworked gravels.

Troutdale Formation (Miocene-Pleistocene)

Introduction: The Troutdale Formation in the well field consists of Pleistocene, Pliocene, and upper Miocene fluvial-lacustrine deposits of partially cemented sand, sandstone, and conglomerate, with indurated silts and clays. The formation underlies Recent and upper Pleistocene deposits throughout the study area. Two major aquifers and two major aquitards (semiconfining units of low permeability) have been delineated within the Troutdale Formation. The maximum thickness of this sequence in the well field is over 600 ft.

This sequence is identified as part of the Troutdale Formation because of the presence of basalt and quartzite gravels and clasts of vitric composition, the partial cementation, and the low percentage of High Cascade andesite-dacite clasts. Carbon-14 dates show well-

field samples from the units identified as Troutdale Formation to be over 40,000 years old, which is the age limit for carbon-14 dating. No fossil correlations have been attempted in the well-field area, and there is some controversy about whether or not the sediments may be younger than the Troutdale Formation. This controversy stems from the fact that the well samples appear less weathered and do not have the yellowish matrix typical of Troutdale Formation outcrops. The absence of the yellowish matrix is possibly caused by the relative reducing environment in the wells as compared to the oxidizing environment at outcrops.

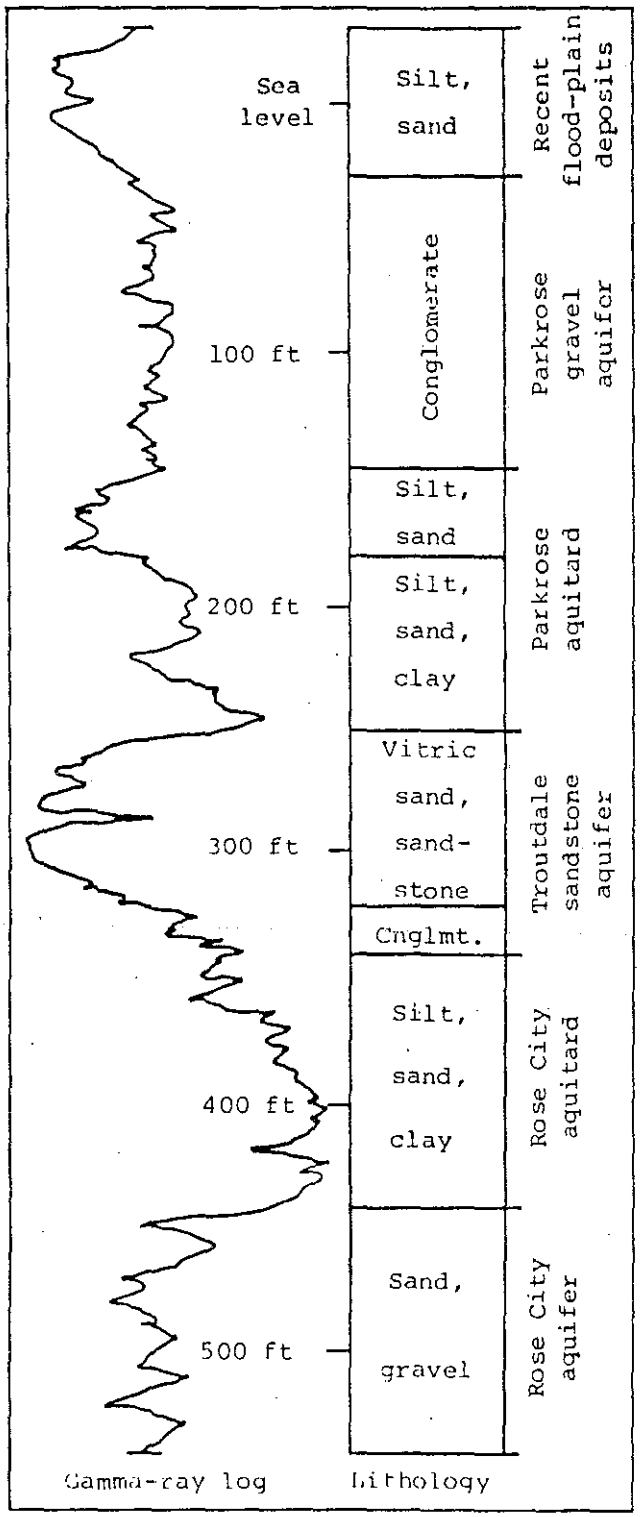


Figure 4. Typical lithologic section located near NE 148th Avenue and Marine Drive.

There is some question about the distinction between Troutdale Formation, Sandy River Mudstone, and younger deposits. Hodge (1938) believed that micaceous sands found in the Ladd well near SE 39th Avenue and Glisan Street indicated that the sequence was post-Troutdale because, as he stated, "Micaceous sands are not found in the Troutdale Formation but are characteristic of the present load of the Columbia River." Trimble (1963) determined that the sequence in this well represented Troutdale Formation underlain by Sandy River Mudstone, with the micaceous sand belonging to the Sandy River Mudstone. Tolan and Beeson (1984) reported micaceous arkosic sands in what they termed the lower member of the Troutdale Formation.

The findings from the well drilling possibly correlate with Tolan and Beeson's (1984) interpretation. That is, the units that are identified as the upper Troutdale Formation contain sand of mostly vitric, basalt-andesite, and quartzite composition, while the lower Troutdale Formation contains mostly micaceous quartzose or arkosic sand. Basalt and quartzite gravels were found in Portland Water Bureau well 1N/3E 20CB2 to a depth of over 1,000 ft below MSL. These findings indicate a possible maximum thickness of over 1,500 ft of Troutdale Formation in the Portland Basin.

The gravels in the well-field samples identified as Troutdale Formation are different from younger gravels in that they have a low percentage of dacite-andesite clasts of the High Cascade composition.

Troutdale sandstone aquifer (TSA): This unit is a relatively uniform deposit of fluvial conglomerate and fluvial-lacustrine vitric sand and sandstone that probably extends throughout a large portion of the basin. The wells proposed for the TSA have yields of 1,000 to 2,000 gpm. Thickness of the TSA varies from 70 to 140 ft, with the lower third of the unit typically consisting of conglomerate and the upper two-thirds consisting of vitric sand and sandstone. Roughly at the midpoint vertically in the aquifer is a thin layer of silt that shows distinctly in gamma-ray logs. This bed separates the aquifer in depositional mode; the vitric sand and sandstone layer above the silt represents a fluvial-lacustrine hyaloclastic deposit, and the lower layer consists of a fluvial conglomerate. The vitric beds interfinger with fine-grained material of the overlying Parkrose aquitard, and it is common for well logs to show several layers of vitric sand or sandstone with silt and clay interbeds in the aquitard. The vitric beds increase in number and thickness in the lower portion of the aquitard.

The vitric beds are composed of clasts of volcanic glass and volcanic crystalline rock ranging in composition from basalt to andesite, with a minor amount of quartz, quartzite, and mica. The glass is usually relatively dense; however, a vesicular, scoriaceous material is occasionally present. Samples of the sand from boreholes typically have a thin, bluish- to greenish-gray coating. The coating is similar to that on the nonvitric basaltic clasts, and beds of over 50 percent vitric material have been passed over in geologic logging in the well field and discovered later by review of gamma logs. Cementing is highly variable. In some boreholes, the vitric material is cemented so tightly that underreaming* must be done to advance casing, while in another zone the sand may be so loose that it heaves up into the casing. The vitric clasts are believed to have originated when lava flowed into water, chilling quickly into glassy fragments that were transported and then deposited by the ancestral Columbia River and its tributaries (Trimble, 1963). An easily seen example of this process is present at an outcrop along

*Underreaming is a drilling operation done when the formation becomes so consolidated that steel casing cannot be driven through it. A special drilling bit that drills an oversize hole is used, thereby allowing the casing to be moved farther down the hole.

Interstate I-84 west of the town of Hood River, where a large volume of lava flowed into the Columbia River, forming a palagonitic tuff that was later partially eroded by the Columbia River (Waters, 1973).

The lava that formed the vitric sand in the well field is probably of early High Cascade and Boring Lava origin; analysis of samples of the vitric sand show that the chemical composition is similar to that of the Boring Lavas (Beeson, personal communication, 1983).

The conglomerate zone of the TSA is composed of basalt and quartzite gravel, with varying amounts of sand. Some cementing is usually visible on the gravel particles, and the same thin, bluish- to greenish-gray coating that occurs on the vitric sand is also present on the gravel clasts.

Although the sand is mostly well sorted and at least partially rounded, both the sorting and rounding vary from one well to another. This is believed to have been caused by variable distances to local volcanic vents contributing material to the sand. This finding is generally in agreement with the conclusions made on the origin of the vitric sand by Trimble (1963).

A wood sample from the TSA was dated by the carbon-14 method at over 40,000 years B.P.

Parkrose and Rose City aquitards: These units are composed of lenticular and interbedded zones of fine-grained, lacustrine deposits of consolidated sand, silt, and clay that act as hydraulic confining layers preventing the rapid movement of water between the Troutdale and Rose City aquifers.

The Parkrose aquitard, which ranges in thickness from about 70 to 150 ft, underlies most of the well field. Consolidation tests were run on samples from the Parkrose aquitard for the Interstate I-205 bridge foundation (CH_2M-Hill, 1979). These tests show that this unit had been previously loaded by at least an additional 700 ft of overburden. The thickness of the ancestral overburden indicates that the Parkrose aquitard was deposited prior to the time the Troutdale Formation reached its maximum thickness in the Portland Basin. The Troutdale Formation is considered to have filled the Portland Basin to a present elevation of approximately 700 ft.

The other major confining layer is the Rose City aquitard, which separates the Troutdale sandstone aquifer and the Rose City aquifer with an average of about 75 ft of consolidated silt, sand, and clay.

Rose City aquifer: This unit consists of discontinuous lenses of sand, gravel, silt, and clay. Pump tests have shown the unit to be continuous throughout the study area, but each well shows a different sequence of materials. Well yields for the Rose City aquifer range from 2,000 to 3,000 gpm.

The unit is several hundred feet thick, and the well samples generally become finer grained with depth. Various mixtures of gravel and sand usually dominate the upper 100 ft of the aquifer, while thick layers of sand with occasional silt and clay beds predominate in the lower portion of the aquifer. This deeper, finer grained portion of the aquifer is referred to as the lower Rose City aquifer.

Most of the sand in the Rose City aquifer is greenish-gray to gray and quartzose, with a minor amount of mica. Vitric sand is found in several wells completed in the Rose City aquifer, but it generally occurs in separate layers rather than being dispersed within the quartzose sand. Two wells (9 1N/3E 19BAC and 16 1N/2E 24CAC) have logs showing a large amount of vitric sand in the Rose City aquifer. Both wells are in the southern portion of the well field, and the presence of more vitric sand in the Rose City aquifer in this location could indicate a nested fill. The distinct difference between the two sands indicates that two separate sources were providing the sand, and the lack of quartzose sand in the Troutdale sandstone aquifer indicates that the source for the quartzose sand may have become unavailable or was highly diluted by vitric sand during the time of deposition of the Troutdale sandstone aquifer.

The gravel in the Rose City aquifer is similar to other gravels in the Troutdale Formation. It consists almost entirely of basalt and quartzite clasts. Some cementing is usually evident on the gravel clasts, and the thin, bluish- to greenish-gray coating is visible. A minor amount of pyrite has been found in samples from the deeper portions of the aquifer. The cementing is apparently less tight than in the Troutdale sandstone aquifer, and the zones that are predominantly sand have caused problems for the drillers because of sand heaving up into the well casing when the hydraulic head is reduced during drilling. The quartzose sand is subrounded to rounded and very well sorted. The sorting is better and more consistent than that of the vitric sand.

CONCLUSIONS

The drilling of over 40 wells in the East Portland area has provided new data on the geology of the Portland Basin and has allowed the definition of several major units. Further work defining the ages and characteristics of the Troutdale Formation, the Sandy River Mudstone, and younger units in light of these new findings will enhance our understanding of the geology of the Portland area.

ACKNOWLEDGMENTS

The writer would like to thank J.E. Allen, M.H. Beeson, L.A. Palmer, and T.L. Tolan for reviewing this paper and making many valuable comments.

REFERENCES CITED

Allen, J.E., 1975, Volcanoes of the Portland area, Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no. 9, p. 145-157.

Beeson, M.H., and Nelson, D.O., 1979, A model for the geologic history of Mount Tabor, Kelly Butte, and Powell Butte in southeast Portland: Proceedings of the Oregon Academy of Science, v. xiv, p. 142-143.

CH_2M-Hill, 1979, Foundation investigation, I-205 Columbia River bridge: Unpublished report to Sverdrup and Parcel and Associates, 47 p.

Hodge, E.T., 1938, Geology of the lower Columbia River: Geological Society of America Bulletin, v. 49, no. 6, p. 869-929.

Hoffstetter, W.F., 1981, Blue Lake aquifer development potential study: Portland Water Bureau unpublished report, 17 p.

Hogenson, G.M., and Foxworthy, B.L., 1965, Ground water in the east Portland area, Oregon: U.S. Geological Survey Water-Supply Paper 1793, 78 p.

Milliman, J.D., and Emery, K.O., 1968, Sea levels during the past 35,000 years: Science, v. 162, p. 1121-1123.

Mundorff, M.J., 1959, Geology and ground-water resources of Clark County, Washington: U.S. Geological Survey open-file report, 268 p.

Tolan, T.L., and Beeson, M.H., 1984, Intracanyon flows of the Columbia River Basalt Group in the lower Columbia River Gorge and their relationship to the Troutdale Formation: Geological Society of America Bulletin, v. 95, no. 4, p. 463-477.

Trimble, D.E., 1963, Geology of Portland, Oregon, and adjacent areas: U.S. Geological Survey Bulletin 1119, 119 p.

Waters, A.C., 1973, The Columbia River Gorge: basalt stratigraphy, ancient lava dams, and landslide dams, *in* Beaulieu, J.D., field trip chairman, Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 133-162.

Willis, R.F., 1977, Ground-water exploratory program, Bureau of Water Works, Portland, Oregon: Portland Water Bureau unpublished report, 287 p.

– – – 1979, Pilot well study, Bureau of Water Works, Portland, Oregon: Portland Water Bureau unpublished report, 150 p. □

Facts your geology professor never taught you

In "The Geologic Column" (*Geotimes*, August 1982), Robert L. Bates quotes a report by Edwards and Anderson of a recent industrial-minerals Congress: "Unobtainium trioxide is a 'derivative of the ore mineral bewilderite, an accessory mineral in many enigmatite bodies. It is a by-product of enigmatite mining in central Erewhon, and from the new deep-sea mining venture in the republic of Atlantis. It is, withal, a compound of rare provenance.' " [ ]

to the construction of the well field, a geologic study of the northeast Portland area was completed by Robert Willis and Diane Partch for the Portland Water Bureau exploratory well study (Willis, 1977). Results of this study indicated that the best potential for production wells existed along the ancestral flood plain of the Columbia River. Eleven pilot wells were drilled and test-pumped by the Portland Water Bureau. Detailed cross sections and a geologic study were made by this writer and included in the Portland Water Bureau's pilot well study (Willis, 1979). The cross sections and geology contained in this report include results of more recent well-drilling and test-pumping programs.

WELL-FIELD GEOLOGY

Older bedrock units in the east Portland area consist of Miocene Columbia River Basalt Group flows and Eocene Skamania Volcanics (Figure 2). The Skamania Volcanics crop out on Lady Island to the east of the well field. Although Columbia River basalt has been interpreted to underlie the well field at depth, drilling has reached a depth of over 1,100 ft below mean sea level (MSL) in the well field without encountering any of the flows. The basalt probably underlies the area at a greater depth, unless it is not present due to erosion or initial exclusion from this area. During the deposition of the basalt, a topographic high of Skamania Volcanics which may have existed in the north part of the well-field area could have caused the flood basalts to flow around it to the south. By the end of Columbia River basalt deposition in the Portland area (about 14 million years ago), the topography of the east Portland area probably consisted of a small range of Skamania Volcanics to the north surrounded by a plain of Columbia River basalt. Because of the lack of deep drilling in the Portland Basin, the actual contact between the Skamania Volcanics and the Columbia River basalt has not been located. The contact could be as far north as the Columbia River or slightly farther to the south. The Ladd well (circa 1885, located several miles to the west of the well field) encountered a unit at 1,100 ft below MSL that was originally logged as solid granite. This unit has been interpreted subsequently to be Columbia River basalt and is the basis for Trimble's (1963) cross section of the Portland Basin.

During or after the deposition of the Columbia River basalt, a basin was formed in the Portland area. The basin is structural in origin but could have been locally deepened by erosion along the contact between the basalt and the less competent Skamania Volcanics. The depth of the basin is unknown but is at least 1,100 ft, based on the Ladd well located near SE 39th and Glisan (Hodge, 1938) and on the Portland Water Bureau exploratory well near NE 185th and Marine Drive.

The Portland Basin was filled by fluvial-lacustrine deposits and local lava flows during the Miocene and Pliocene. These deposits, in order of deposition, are the Sandy River Mudstone, the Troutdale Formation, and the Boring Lavas. The sedimentary deposition filled the basin to an elevation of about 700 ft, based on erosional remnants including Mount Tabor, Rocky Butte, and Powell Butte (Allen, 1975).

Erosional forces took control once again in the late Pliocene or early Pleistocene. Much of the Troutdale Formation deposits was removed to an elevation of roughly 100 to 200 ft above present sea level (Mundorff, 1959). Erosion and deposition alternated in the basin as the base level rose and fell during the Pleistocene.

Boring Lava eruptions continued into the Pleistocene, producing numerous volcanic vents and lava flows in the eastern portion of the Portland Basin (Allen, 1975). The lava flows also contributed hyaloclastic material that formed the numerous vitric sand beds in the well field. The Boring Lava flows resisted later erosion and contributed to the formation of the buttes and hills in the eastern portion of the basin. Boring intrusions are associated with these buttes in east Portland. Beeson and Nelson (1979) suggested that geothermal convection within the Troutdale Formation around these vents caused solution and precipitation of silica in the Troutdale Formation, making the vent areas more resistant to erosion.

The most recent episode of erosion and deposition is illustrated by logs of several wells located near the east end of the Portland Airport. These wells encountered a Fraser Glaciation river valley that had been eroded to 300 ft below MSL approximately 15,000 years ago and then had been filled with sand as the sea level rose during the Holocene.

Alluvium	Recent to upper Pleistocene
Boring Lava	Pleistocene to Pliocene
Troutdale Formation	Pleistocene to Miocene
Sandy River Mudstone	Pliocene to Miocene
Columbia River Basalt Grp.	Miocene
Skamania Volcanics	Eocene

Figure 2. Major geologic units found in the Portland Well Field and vicinity. Several of these units are subdivided in the text.

The present river geography is similar to that found by the Lewis and Clark expedition and other early explorers. The main channel of the river is controlled to some extent by bed rock in the area to the east of NE 185th Avenue. Resistant beds of the Troutdale Formation and coarse gravel and boulders of the Blue Lake aquifer force the main channel of the river to the northwest near Blue Lake Park. The river is entrenched between outcrops of the Skamania Volcanics near Washougal, Washington. In the study area, the Columbia River is presently an aggrading stream, and tidal fluctuations are measurable in the river adjacent to the well field.

Cross sections and outcrops in the well-field area (Figure 3) indicate a general southwest dip to the older units. It should be noted, however, that part of the apparent structural deformation on the cross sections may be due to normal fluvial processes such as nesting of fills. Outcrops of the Troutdale Formation which occur from Blue Lake to NE 185th Avenue show only poorly developed, wide-spaced jointing without displacement. The jointing is probably from stress release and is not of the magnitude that would indicate faulting in this locality.

GEOLOGIC UNITS

Introduction

The following geologic units were delineated in the well field on the basis of lithology, geophysical logging, and hydraulic testing. Gamma-ray logs were especially useful for differentiating units (Figure 4) and for correlating between wells.

Recent and upper Pleistocene alluvium

Younger alluvium: This unit is represented by (1) flood-plain deposits, (2) a late Pleistocene river valley that was backfilled during the Holocene, and (3) a deposit of coarse-grained fluvial deposits located to the north and east of Blue Lake.

Recent flood-plain deposits: These deposits consist of unconsolidated layers of silt, clayey silt, and sand. The thickness of these deposits is variable, but the unit generally thickens to the north from Sandy Boulevard to the Columbia River. The maximum recorded thickness is 70 ft at well 1N/3E 19BAC. The lower portion of the flood-plain deposits is probably related to the Columbia River sands group as described by Willis (1979).

Columbia River sands aquifer (CRSA): This unit that fills a Pleistocene Columbia River valley is composed of late Pleistocene and Holocene sand. The aquifer was previously considered to be

B6

EXHIBIT 6

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

H. Havercamp
6900 N.E. Alberta
Portland Oregon 97218
August 30, 1984

State of Oregon
Environmental Quality Department
522 S.W. 5th
Portland Oregon

Subject: Fact Sheet in opposition to the forced construction of sewers in the Columbia Ridge Area located between Burnside and the Columbia River and the Willamete River East to Troutdale.

The Department of Environmental Quality does not have a valid case for forcing the people living in Columbia Ridge to pay more than 10,000 dollars each for the installation of sewers for the following reasons:

1. The Department of Environmental Qqality (DEQ) and other testing agencies have been testing wells and seepage water in the Columbia Slough Area for more than ten years. None of these test for nitrates has exceeded the U.S. Environmental Protection Agencies U.S. Standard of 10 parts/million. Further, tests for drycleaning solvents (Tetrachloreethe soaps, degreasers reveals no presence of these substances or when found were in extremely small amounts.

2. The test wells are located in areas that could easily pick up traces of nitrates from agricultureal lands near by, lawn and garden fertilizers, decaying vegetationx, storm drain runoff as well as from sewers and cesspools.

3. The DEQ proposes that nitrates may be hazardous to infantx children because it could cause "cyanosis" in very young children. Any standard medical reference will explain that cyanosis is a congenital heart deformation found in some babies at birth and this condition is associated with inheritance of this condition.

4. The DEQ's proposed solution to their proposed nitrate problem is to build sewer treatment plants that will process 14,000,000 gallons of sewage per day. Sewage will be treated for 36 to 72 hours and then it will be dumped into the Columbia River thus polluting the Columbia River with high concentrations of nitrates and other substances.

The current situation in the Columbia Ridge Area is far Superior to this quick fix sewer treatment process. Consider: Columbia Ridge is located on a tremendous gravel bed that extends the full east/west length of this area. (Drive along Columbia Boulevard and look at the deep gravel pits all along this area) These gravel beds provide the same type of sewage treatment that is being proposed by the DEQ and it does a far better job of purifying the sewage because it takes many months for the sewage water to percolate through this tremendous gravel bed into the ground water flowing towards the ocean.

5. The DEQ's proposal to force citizens to pay for sewers in this area has nothing to do with protecting the qualify of well water along the Columbia Slough. Their real purpose is to assist the LCDC to change land use policies inorder to industrialize the Columbia Sough Agricultural Area.that is located between Columbia Boulevard and Marine Drive and from the WillsmetteRiver to Troutdale. This area contains the best farming land in the state and it is conveniently located to the City of Portland. This prime farm land has been zoned for agriculture for many years. Now Portland wants to increase its bureaucratic tax base by converting this land to industrials uses. They are prohibited from doing so because the water table is only a few feet below the surface. Industrial developers are unwilling to pay the added cost of sewer pumping stations to pump sewage out of this low area between Columbia Ridge and the Columbia River.

6. Portland and Gresham have another reason for trying to accomplish thier annexation goals through this sewer swindle. For many years Portland has tried to annex the Columbia Ridge Area but the people have almost always voted down their proposals. Not they are trying to force annexation by denying the people the freedom to vote on this issue.

The Department of Environment Quality should not conspire with the Cities of Portland and Gresham just so they can complete the destruction of prime farm land along the Columbia Slough and increase their bureaucratic tax base at great expense to the people.

Yours truly,

H. Havercamp

EXHIBIT 7 B7

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

CITY OF PORTLAND BUREAU OF ENVIRONMENTAL SERVICES

CITIZENS ADVISORY COMMITTEE - PRESENTATION TO

ENVIRONMENTAL QUALITY COMMISSION REGARDING

MID-MULTNOMAH COUNTY FRAMEWORK PLAN FOR SEWER SERVICE

Presented by Emil R. Berg

My name is Emil Berg and I'm testifying on behalf of the City of Portland Environmental Services Citizens Advisory Committee. We met extensively this past Spring with personnel of the Bureau to study the problem of how the City could extend sewer service to the mid-County area. It was clear to us that this situation of a densely populated urban area of 130,000 people discharging 14 million gallons of raw sewage daily into the ground and underlying groundwater presents a serious problem which needs to be addressed.

Most of our discussions concerned planning the most economic method of installing sewers and my comments are accordingly directed mostly to that question. We decided that it would make most sense to have a new City policy to finance the construction of trunk sewers in advance of formation of local improvement districts to connect individual neighborhoods and residences. It appears this may also expedite the formation of LID's. Mandatory LID's should not be imposed initially. Emphasis should be on education and persuasion to form voluntary LID's.

We also decided that the schedule for individual connections should take into account the great expense to individual families. Thus, our Committee does not favor use of mandatory connections without a grace period except for institutions and businesses that generate large volumes of sewage.

The Committee also supports the concept of a cost deferral program for aged and low-income property owners and likewise supports investigation of developing low-interest loan programs, so long as subsidies of high-income persons by existing rate payers are avoided.

Finally, we would like the Commission to be aware that throughout our consideration of this problem, we received assistance from the staff of the Portland Bureau of Environmental Services. We were extremely impressed by their preparation, their knowledge of the problem and their capability to deal with it, and with their sensitivity toward the concerns of residents in the affected area.

Thank you.

To Item B/8

TO: Oregon Department of Environmental Quality

FROM: Elouise M. Bailey
24138 S.E. Oak
Troutdale, OR 97060

EXHIBIT 8

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

DATE: August 30, 1984

First, I have been told that the amount of nitrate in the Bull Run Water Supply is very high. I don't understand, if this is true, what you are accomplishing?

Second, no discussion of MUD's as a financing, governmental organization has been held or examined which would obviate annexation I am very much against the policies and government of Gresham. They do not have the public's interest in mind and I cite the example of the intersection of 242nd and Stark (SE) as an example of the lack of interest in the public and the safety of citizens. They have taken on a sewage plant with a Portius (spelling?) system which was a mistake. I feel that the entire condemnation of east county, in the manner it is occuring, is happening before the sewage plants are capable of handling the effulence. and we are hostages to their need for funds.

I feel that the cost of sewers to the householders, and the cost of hookups, is outlandish in comparison to the costs we bore in the 1960's in New York. The increase is approxximately 700% from what I can see. This is the area that must be addressed before I could countenance the step the DEQ proposes because I do not feel that the health threat has been sufficiently exposed. to warrant outlandish EXPENSE

Elouise M. Bailey

B9

DEQ Hearing, Parkrose H.S., Aug. 30, 1984

Need For Sewers In Mid-Multnomah County

by WM. E. Morton, MD
3181 SW Sam Jackson Rd.
Portland, Ore. 97201

I am a physician specializing in public health and preventive medicine, certified by the American Board of Preventive Medicine, with 34 years of experience with health problems due to environmental factors. I have personally conducted research on the epidemiology of cardiovascular diseases in relation to ground water contamination by human and animal wastes. I am a professor of environmental medicine at the Oregon Health Sciences University, but the opinions I express are my own and do not represent an official position by the university.

Throughout human history our ability to live in cities and large metropolitan areas has depended on our abilities to provide safe drinking water and to dispose safely of our own wastes. Before we understood how microorganisms and toxic chemicals could cause disease when allowed to contaminate drinking water, there were regular massive cycles of contamination-caused disease in urban populations whose waste disposal systems had been allowed to become inappropriate and over-taxed by increasing population density. Now that we understand such relationships, there is no need to undergo such cycles of contamination-related diseases because we can foresee the need for waste disposal improvements and prevent such diseases by installation of adequate sewage disposal systems.

I am particularly concerned about the evidence of increasing nitrate levels in ground water in this region. This is evidence of human waste accumulation in ground water. My own research has shown evidence of increased high blood pressure risk among persons who consume water with excessive nitrate contamination. Increased blood pressure levels in turn increase the risks of heart attacks, strokes, kidney infection, and kidney failure. If household wastes in Mid-Multnomah County are carried away by sewers, the ground-water nitrate levels

EXHIBIT 9

will fall, and that problem will disappear.

As economic development continues and more industries locate in this region, there is increasing risk of ground-water contamination by chemicals which are not biodegradeable. Some of these chemicals increase the risk of cancer or birth defects in persons who consume such contaminated water. Although we have no evidence that such has happened to date, it would be wise to avoid that possibility by installing sewers.

An indirect health effect of sewer construction relates to the positive effect of the presence of sewers on the possibilities for regional economic development. It has been documented that economic deterioration in a community will cause both immediate and delayed increases in death rates in that community. Thus, the widespread provision of adequate sewer services in Mid-Multnomah County would be expected to encourage economic development there, and would have a nonspecific favorable effect on a wide variety of health problems in addition to those deriving directly from water contamination.

EXHIBIT 10 B 10

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

POWELLHURST/GILBERT NEIGHBORHOOD ASSOCIATION

Douglas Hartman
2605 S.E. 118th
Portland Ore. 97266

Environmental Quality Commission

Dear Commission Members:

During my tenure as chairman of the Powellhurst/Gilbert Neighborhood Association the subject of sewers in our area was frequently discussed. Those conversations revolved primarily around two issues: When will we have to have sewers? and How much will they cost? Understandably both questions are hard to answer. As a group we have invited such individuals as Burke Raymond, and representatives of the City of Portland to our meetings and asked for answers to these questions. The responses to these questions have never been answered as specifically as most people would like.

From my perspective several things have become apparent as we have talked with experts in finance and sewers.

* For the future health, development, and overall vitality of our area, the eventual development of sewers is a reality.

* The cost to individuals, of sewer development is a primary concern.

* Postponement of sewers will most likely increase the eventual cost.

My recommendation would be for an analysis and planning effort sufficient enough to provide a timeline for sewer development and identification of costs and revenues such that residents of the area will better understand the situation.

Due to the economic demography in our particular neighborhood, I would emphasize that creative and flexible options for financing must be provided.

Let's get the job started and finished before it cost us more!

Sincerely yours;

Douglas Hartman
Past Chairman

0, 11

This copy the most documentation attached. Also attached is City Club ref to a 1969 report tying filtration to logging

B11

Before Oregon Dep't of Environmental Quality - Aug, 30,1984

Testimony of Joseph L. Miller Jr., M.D. (retired Portland physician)
52815 E. Marmot Rd, Sandy, Or., 97055 (668-4497)

I appreciate the studies you have done; your concern for the public health safety of the water nearly one-third of Oregon's population will be drinking, and the informational material your office gave me this morning. I also appreciate this opportunity to be heard.

For thirteen years I have been seeking information concerning Portland's water supply. Increasingly, my efforts have been focusing, along with others in the Bull Run Interest Group, in trying to disseminate pertinent information that the public has not been told; so as to make it possible as well as interesting, for citizens to participate meaningfully in planning for our water supply.

In the case of the present dilemma of threatened water pollution and consequent call for sewers, there has been a serious lack of public information, and consequently, of meaningful participation in planning.

I think, if the public were told, now, of the following facts and expert opinions, and of an alternative solution, the urgency of installing sewers might be lessened.

(1) The City of Portland could make it's Bull Run supply more pure, more reliable, and probably less expensive than groundwater. A back-up, separate source, is available in the Bull Run area; namely, the Little Sandy sub-watershed of Bull Run.

(2) The key is protection of the paths the water takes from where it starts, in the clouds, as distilled, very pure water, to the pipes. Water from a protected watershed is not subject to the seepage of pollutants mentioned in your informational material. Expensive pumping and filtration may not be necessary.

(3) The Little Sandy produces about one-fifth as much water as the presently used part of Bull Run does. It could have the same degree of

protection as the rest of Bull Run has. If separate conduits were laid, along a course designed to resist volcanic flows in the Sandy River canyon, that precaution, plus the high ridge separating it from the presently used part of Bull Run, could make it a separate, reliable,, back-up water source.

(4) Even though Oregon law gives the Little Sandy water rights to Portland, and the Oregon Water Policy Review Board says the highest and best use of Little Sandy water would be exclusively by the City of Portland, no in-depth studies have ever been done of the feasibility of Portland developing this as a future water source.

(5) The City of Portland is developing groundwater sources in the area under consideration at this hearing, which is likely to become polluted. Portland is doing this in order to escape having to filter Bull Run water. The reason Bull Run water would have to be filtered is because of increased turbidity caused by logging. If the logging were controlled as it was under the 1904 Trespass Act - i.e., only protective logging allowed - the turbidity would be reduced, and perhaps filtration avoided. Then there would be no need for the deep wells.

(6) There is danger that Portland's deep wells may cause contamination of other wells in the area.

(7) The only report by an outside consultant that Portland has, concerning the water quality that is expected to be obtained from it's deep wells was in 1974, was by Stevens, Thompson and Runyan, and they did not recommend groundwater sources.

(8) Carl Green, for 13 years Oregon State Sanitary Engineer, suggested, in 1979, while still a member of the Bull Run Advisory Committee, (quote)

> "...Before committing millions of dollars for development of a groundwater supply in an area in which sanitary sewage, industrial wastes, and surface water run-off has been disposed of by means of discharge into underlying ground and sand formations over a period of seventy-five or more years, careful and thorough analysis of a <u>separate</u> alternative-auxiliary supply from the Little Sandy River should be undertaken. I am not convinced that an objective, unbiased, thorough study yet has been made..."

I think trying to purify ground water under mid-Multnomah County will be like pouring water down a rat hole. It will be wasting money, and the water still will not be reliable for purity. What the area needs is a reliably pure, and at the same time inexpensive, water source. If the Bull Run gets it's Trespass Act protection restored, and has it's boundary enlarged (which can feasibly be done) so as to include all of the protectable Little Sandy watershed, it will have an excellent source and a reliable back-up.

In summary, a crash program for sewering mid-Multnomah County, at a cost of $255 million should not be undertaken, at least not until:

(a) Competent outside, independent, consultants have studied the reliability, from a public health standpoint, as well as the costs of expected water treatment, of using groundwater in this area as a future source of drinking water; and

(b) In-depth studies have been done, by competent, independent consultants, of the feasibility of the Little Sandy being developed as a safe, reliable, protected water source for the Portland area; and

(c) Citizens who are going to be drinking water in this area, and who might have to pay for it (and perhaps for sewers), have been fully informed of all pertinent facts, and given a chance to influence the decision, and have been offered all reasonable alternatives.

Respectfully submitted, Joseph L. Miller, Jr.

Joseph L. Miller Jr., M.D.
Participant, Bull Run Interest Group

References are attached.

REFERENCES

(Note: Numbers in parentheses refer to numbered paragraphs, above.

"BRIG#____ " refers to document number in Bull Run Interest Group open file, Social Science room, Public Library, S.W. 10th and Taylor, Portland.)

(1) Little Sandy Fact Sheets (copy attached if time permits)

(2) U.S. Army Corps of Engineers, "Portland-Vancouver Metropolitan Area Water Resources Study", 1979 (BRIG# 224) pp. 108,109

Donald Gipe, Coordinator, Safe Drinking Water Program, EPA, correspondence, 19

(3) U.S. Geological Survey, Water Resources Data for Ore., Part 1. (BRIG# 227) Surface Water Records - 1973 (pp. 181,2) (BRIG# 155)

(4) (Water rights) Robert C. Irelan, Deputy City Attorney, Portland, letter to Bob Hyle, 10-12-76 (BRIG# 219)
(highest and best use) Oregon Water Policy Review Board, "In the Matter of Formulating an Integrated Program for the Use and Control of the Water Resources of the Lower Willamette River Basin", Dec. 9,1980 (pp. 7,8) (BRIG# 235)

(5) Correspondence: John Vlastelicia, Director, Oregon Operations Office, E.P.A., letter of Mar. 10,1978 to Robert Hyle, Manager, Portland Water Bureau. Robert Hyle, Manager, Portland Water Bureau, reply, dated Sep't. 13, 1978
U.S. Army Corps of Engineers (same ref. and pages as (2) above.
James M. Burns, U.S. District Judge, "OPINION", Civil ?73-609, Mar, 1976 (BRIG# 96a)

(6) U.S. Army Corps of Engineers, same ref as (2) above, p. 18

(7) Correspondence, Robert F. Willis, P.E., Water Engineer Supervisor, Portland Water Bureau, with Joseph L, Miller Jr., Feb. 10,1983 to July 8, 1983. Excerpts enclosed from Stevens, Thompson & Runyan, Study of Portland Water Supply Development Program, including Introduction to Technical Supplement, 1974

(8) Carl E. Green & Associates, Consulting Engineer, letter to Dr. Warren Westgarth, Chairman, Bull Run Advisory Committee, Dec. 17,1979 (If time permits, I will attach a copy)

Note: If you desire copies of any of the above references, or pertinent portions of them, please let me know.)

Joseph L. Miller Jr

B11a

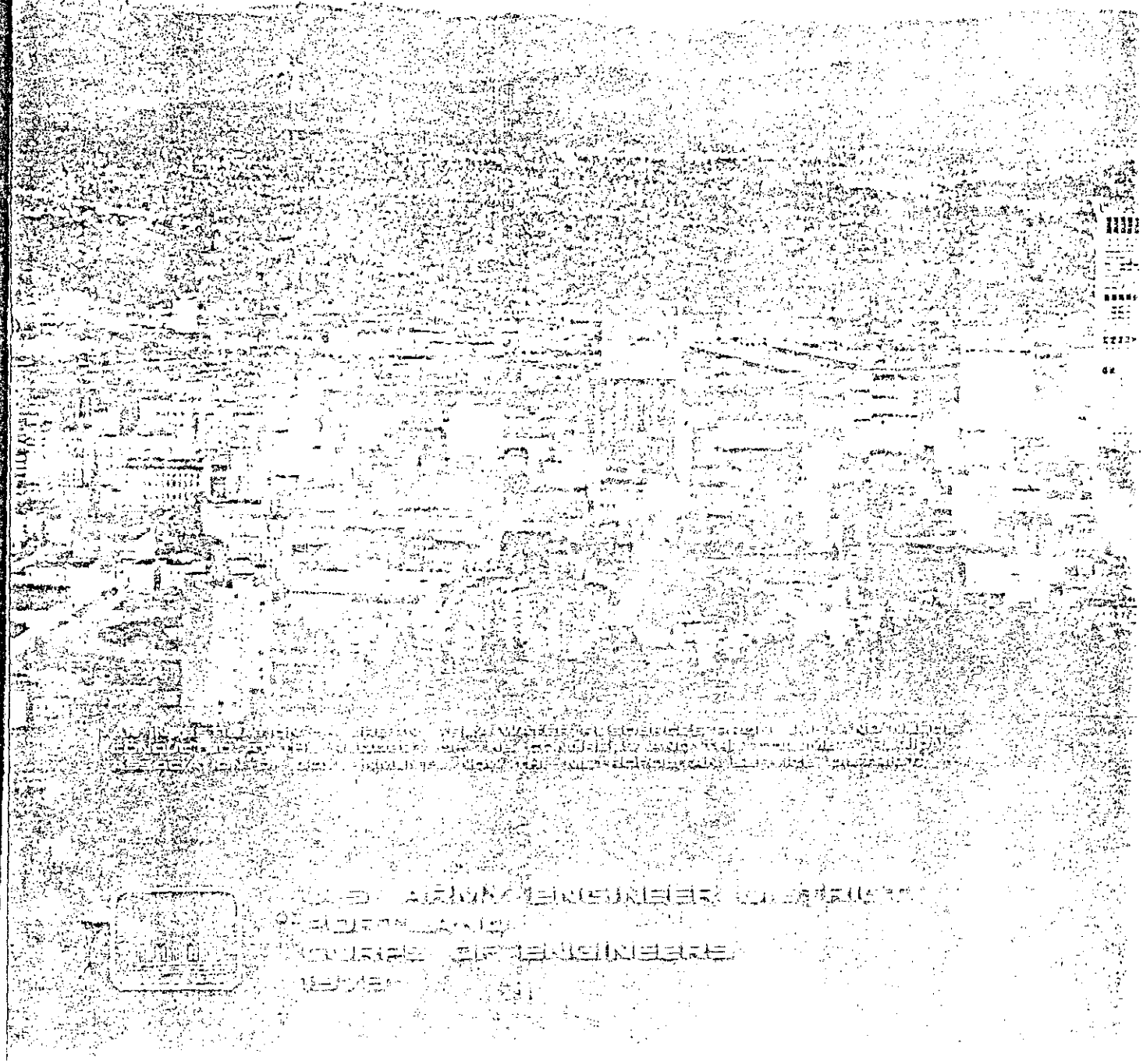
PORTLAND - VANCOUVER
METROPOLITAN AREA
WATER RESOURCES STUDY

224

WATER SUPPLY

rec'd from Army Corps of Engrs 1-14-81 (+ appendices 1-16)

REGIONAL WATER SUPPLY PLAN



eastern Washington County. Existing water rights for water supply are over-allocated relative to the available supply and several rights far exceed the projected needs of the holders.

Groundwater

Groundwater is used as a source of water by several water purveyors, as shown in Figure 4-1, and by private water users in several areas of the region. In addition, several purveyors listed below use groundwater as a partial source, supplemented by surface sources:

- Tigard Water District
- City of Beaverton
- Gilbert Water District
- Clairmont Water District
- Hazelwood Water District

In 1975, less than 10 mgd of groundwater was used by public water purveyors, representing about 6 percent of the total municipal water use in the study area. No data are available on quantities of groundwater withdrawn by private users. Although groundwater is abundant in many parts of the study area, there are groundwater supply problems in the two most rapidly growing areas, eastern Washington County and eastern Multnomah County.

In eastern Multnomah County much of the groundwater is withdrawn from shallow aquifers which, in many areas, has a high potential for contamination by subsurface disposal systems. Continued on-site disposal of wastewater in this rapidly growing area will probably continue to degrade this source. The underlying Troutdale Formation provides some very high yielding wells, although yields are spatially variable and unpredictable at this time for any given site. There is concern that the pumpage of large quantities of groundwater by the City of Portland will draw contaminated water from these shallow aquifers, resulting in contamination of the Portland wells and nearly all wells utilized by other purveyors.

In Washington County, large withdrawals from the Columbia River basalt aquifer have led to rapidly declining water levels in the Cooper Mountain-Bull Mountain area. In 1974, the state engineer designated certain areas as critical groundwater areas and placed severe limitations on future pumping from this area which contains the municipal wells of Cooper Mountain, Beaverton, Wolf Creek and Tigard Water Districts. Groundwater is also pumped from alluvial deposits adjacent to major streams in the Tualatin Basin, although yields are restricted by rapid declines in water levels during dry periods.

Although these problems are important on a local basis, the principal problem on a regional basis is the lack of definitive hydrologic

PORTLAND - VANCOUVER
METROPOLITAN AREA
WATER RESOURCES STUDY

(224)

rec'd from Army Corps of Engrs 1-14-81 (Appendices 1-16)

WATER SUPPLY

REGIONAL WATER SUPPLY PLAN

A REPORT OF URBAN AREA WATER RESOURCES PROBLEMS AND NEEDS
CONDUCTED AT THE REQUEST OF THE CONGRESS AND THE COLUMBIA REGION
ASSOCIATION OF GOVERNMENTS BY THE CORPS OF ENGINEERS

U.S. ARMY ENGINEER DISTRICT
PORTLAND
CORPS OF ENGINEERS
1979

eventually include GAC treatment for sources subject to contamination by synthetic organics.

To indicate the effect of such future regulations on the water supply alternatives, costs for GAC treatment were estimated (see Appendix 2, Chapter 3). Assumed GAC requirements for each major source are presented in Table 11-1.

TABLE 11-1

ASSUMED GRANULAR ACTIVATED CARBON TREATMENT REQUIREMENTS*

Bull Run River	No activated carbon treatment would be required because of limitations on watershed use.
Trask-Tualatin Rivers Clackamas River Colubmia River Alluvium Groundwater	Although not needed immediately, carbon treatment may be required as federal regulations become more stringent.

*The evaluation of alternatives using the Willamette River already include the cost of GAC. Given the degree of urban and agricultural activity, it is assumed GAC will be required.

The addition of GAC would cause a very significant increase in cost ranging from 0.14-0.16 $/CCF, a 25 to 40 percent increase. Capital costs for addition of GAC treatment would increase the cost of an existing filtration treatment plant by 50 percent and would triple the annual operation and maintenance (O&M) cost.

For the Trask-Tualatin River, it is possible GAC could be avoided simply by moving the intake upstream above Dilley, at approximately river mile 58. This would cost only 0.02 to 0.03 $/CCF, a considerable savings.

Filtration of Bull Run

Up to this point in the analysis, it was assumed Bull Run River water would not require either filtration or GAC treatment within the study period because the watershed is protected from contamination-causing development and is expected to remain protected. However, treatment by filtration may be required in the future to remove turbidity which presently exceeds federal interim drinking water standards during short time periods, as discussed in Chapter 4.

The future need for this treatment will depend on two factors. The first is the management policies adopted for the Bull Run Reserve and

the effect of those policies on water quality. The main issue is whether or not extensive logging should be continued within the watershed, and whether this logging activity will increase turbidity. Secondly, dilution or substitution of water from Bull Run by water from the proposed well field near the Columbia River during high turbidity periods may allow filtration of the Bull Run to be avoided.

The additional unit cost for filtration would be approximately 0.10 to 0.12 $/CCF.

These costs are nearly equal to GAC treatment for the same service area. A significant difference does exist in the components of these costs. Annual costs for filtration treatment are about 80 percent capital related. In contrast, about 70 percent of the annual cost for GAC is O&M related and 35 percent of this total incremental cost is for energy to regenerate spent carbon. Recent trends have shown the inflation of energy cost to far exceed general inflation. These factors would tend to favor Bull Run alternatives over other sources which may require GAC treatment.

Conclusions

For many of the purveyors, the level of treatment will not affect their choice of a source of surface water. Their present surface service will continue to be the most economical, regardless of the level of treatment. Those whose source decision is affected by treatment levels are the purveyors of eastern Washington County. These purveyors must choose between the Willamette, Bull Run, and Trask-Tualatin Rivers. Because the various alternatives utilizing the Willamette River already include consideration of GAC, any additional treatment for either the Trask-Tualatin or Bull Run Rivers would improve the relative position of the Willamette River. However, the addition of 0.02 to 0.03 $/CCF for the Trask-Tualatin Rivers and 0.10 to 0.12 $/CCF for the Bull Run River will not significantly modify the position of these three sources. Thus, it can be concluded the purveyors need not take future treatment levels into consideration in making a decision as to their source of surface water.

What the foregoing does point out is that additional costs to existing users of the Trask-Tualatin, Bull Run and Clackamas Rivers can be avoided if local and regional governments are able to properly manage society's land use activities in those three watersheds.

FUTURE WATER DEMAND

Future water demand is calculated by multiplying population projections by per capita water use. The population projections used were provided by CRAG (1977). Per capita water use was assumed to remain constant through the planning period. Facilities were then sized by the use of a peaking factor. The details of this methodology and the

B11b

★ NEWSPAPER SECOND CLASS POSTAGE PAID AT PORTLAND, OREGON ★

25

PORTLAND City Club BULLETIN

Mayfair Room • Benson Hotel
Friday . . . 12:15 p.m.

Portland, Oregon • August 17, 1973 • Vol. 54, No. 12

~~Arthur J. Harlewicz~~
~~711 S. W. 14th Ave.~~
~~Portland, Oregon 97205~~

Printed herein for presentation, discussion and action on Friday, August 17, 1973:

REPORT

ON

MANAGEMENT OF FOREST RESOURCES IN THE BULL RUN DIVISION

* * *

The Committee: John Eliot Allen, George F. Brice, III, Albert B. Chaddock, Robert T. Huston, Robert T. Jett, E. Barry Post, Hubert E. Walker, John L. Frewing, *Chairman* and Philip A. Briegleb and Thornton T. Munger, *Consultants.*

This report printed
with the assistance of the
PORTLAND CITY CLUB FOUNDATION, Inc.
505 Woodlark Bldg.
Portland, Oregon 97205

(Additional copies $1.00)

"To inform its members and the community in public matters and to arouse in them a realization of the obligations of citizenship."

public health standards for treated water allow up to 5 percent of the samples to show existence of any coliform bacteria.

Actual counting of incubated coliform colonies is used to measure raw water bacteriological quality. During the past year, Portland's raw water has averaged four coliform colonies per 100 milliliter samples. EPA standards for raw water indicate that sources with up to 100 coliform colonies per 100 milliliters may be used for drinking water with disinfection being the only treatment. Thus, for Bull Run water, the only treatment required to meet state and federal health requirements has been chlorination.

Drinking Water Standards

Federal public health standards for drinking water supplies go back to 1914. The current applicable standards date from 1962.[54] In the past several years, the responsibility for these criteria has shifted to the EPA. The EPA is in the process of re-evaluating these standards and drafts of revised standards indicate more restrictive limits on turbidity. Some typical levels for present and proposed standards are given below:

CHANGES IN TREATED DRINKING WATER STANDARDS

Water Quality Parameter	Portland Water	Present Standard	Proposed Standard
Color, CU	<5	15	15
Turbidity, JTU	0.3	5	1
Taste and odor	—	3	2
Chloride, ppm	2.6	250	250
Cyanide, ppm	—	0.01	0.2
Lead, ppm	—	0.05	0.05
Mercury, ppm	—	—	0.005
Nitrate nitrogen, ppm	0.02	45	10
Sulfate, ppm	1.2	250	250

One important point to note is that the public health standards do not recognize or tolerate even "temporary" or "inevitable" degradation of water quality below the level of standards, for any reason whatever.

In January 1972 a local debris blockage in the North Fork of the Bull Run River caused a mineral washout which increased the turbidity to values as high as 120 JTU at the headworks.[55] As can be seen below, the normal winter peak is only in the range of 5 JTU (barely visible in comparison with distilled water).

TURBIDITY AT BULL RUN HEADWORKS

	January Avg., JTU	February Avg., JTU	Winter Peak, JTU
1968	.5	2.5	6.6
1969	1.5	.7	3.2
1970	1.3	.7	3.4
1971	1.1	.5	2.6
1972	24	20	120
1973	2.7	1.2	8

In 1969, the EPA and State Health Division personnel conducted a survey of Portland's municipal water supply to determine suitability for interstate use. After

[54] See Footnote 51.

[55] Smith, Arthur W., "Portland Bureau of Water Works Water Quality Laboratory 1972 Annual Report"; 1973.

discussing their inspection of the system in a report[56] they summarize their findings regarding Bull Run watershed management in the final five paragraphs:

> "Logging practices are adhered to which minimize the erosion from a logged area but some increase in turbidity is to be expected in any event. Along with the turbidity, the addition of nutrients to the water from these logged off areas must also be considered. Undoubtedly, these nutrients will make algae control in the Bull Run reservoirs much more difficult in the coming years.
>
> "A similar problem relates to the logging roads in the area. Although providing the benefit for increased access for fire control, they contribute to increased turbidities in the basin. The roads also represent an 'attractive nuisance' in opening up the watershed to unauthorized recreational use. There are 10 points of entry to the watershed that generally are unattended by watchmen, and routine surveillance to apprehend and prosecute trespassers is lacking. Without changes, it is expected that undesirable levels of recreational use of the basin may be reached.
>
> "A discussion has already been presented on the need for changing the analytical techniques for examining the bacteriological characteristics of the raw waters. This change is necessary to determine if the coliform levels are less than 100 coliform per 100 ml of water. This is the limit for disinfection to be acceptable as the only treatment.
>
> "Chemical characteristics of the raw water have always been acceptable and should continue to be so. The physical characteristics, however, have at times presented problems. Earlier in this report, for example, it was noted that turbidities have been in excess of the limits of the Drinking Water Standards on several occasions. In addition to reducing the aesthetic characteristics of a water, particles causing turbidity also *impair the disinfection process*. With continued logging of the basin and increasing mileage of access roads, the turbidity problem can only worsen.
>
> "Summarizing, the raw water of the Portland water system is only marginally acceptable for treatment by chlorination only at present. It appears that the future will bring a deterioration of the present quality and that treatment by filtration will be required in the not too distant future. For the most orderly development of those treatment facilities, it is recommended that planning begin for further treating this water supply."

In late 1972, upon resurvey of the water supply, the EPA through the state agency, "provisionally" accepted the Portland water supply, based on a general lack of progress in meeting deficiencies found in the earlier survey. These deficiencies included the fact that occasionally the turbidity of the water increases above federal standards. Part of the slowness in Portland Bureau of Water Works reaction stems from a lack of historical knowledge about the watershed. Turbidity data as presently gathered only extend back to 1967. For the past decade, periodic sampling at the headworks has been utilized. At present, continuous recording at the headworks plus daily sampling at 12 watershed locations has been instituted. Thus, part of the Portland Bureau of Water Works response has been to increase its watershed monitoring and study in order to determine possible options to develop a water supply which meets Federal standards.

At present, some of the options might be listed as follows:

1. Filter Portland water supply in the vicinity of the Bull Run headworks so as to handle a maximum flow of 225 mgd.

2. Filter a portion of the City water supply at the Bull Run headworks so as to meet the winter typical water demands of 75 mgd. This would serve to dilute turbid water with filtered water in order to lower the turbidity to comply with EPA standards.

3. Provide separated headworks structures within the Bull Run watershed so

---

[56] Report of a Survey of the Portland Municipal Water Supply, Initial Survey—August to December 1968, Resurvey—October 1969; Joint Survey Conducted by Oregon State Board of Health, Office of Public Health Engineering and Bureau of Water Hygiene, U.S. Public Health Service.

B11c

Aug. 30,1984

Little Sandy Fact Sheets

Note: These are not arranged in chronological order.

Since the last sheets, dated Dec. 5, 1980, the Oregon Water Policy Review Board came out with a Statement: "In the Matter of Formulating an Integrated Program for the Use and Control of the Water Resources of the Lower Willamette River Basin", Dec. 9, 1980. An excerpt from pages 7 and 8:

> "...The maximum economic development of this state, the attainment of the highest and best use of the waters of the lower Willamette Basin,... will be furthered through utilization of the aforementioned waters as follows:
>
> "... The tributaries of the Bull Run and Little Sandy Rivers only for the exclusive use of the City of Portland..."

(BRIG# 235)

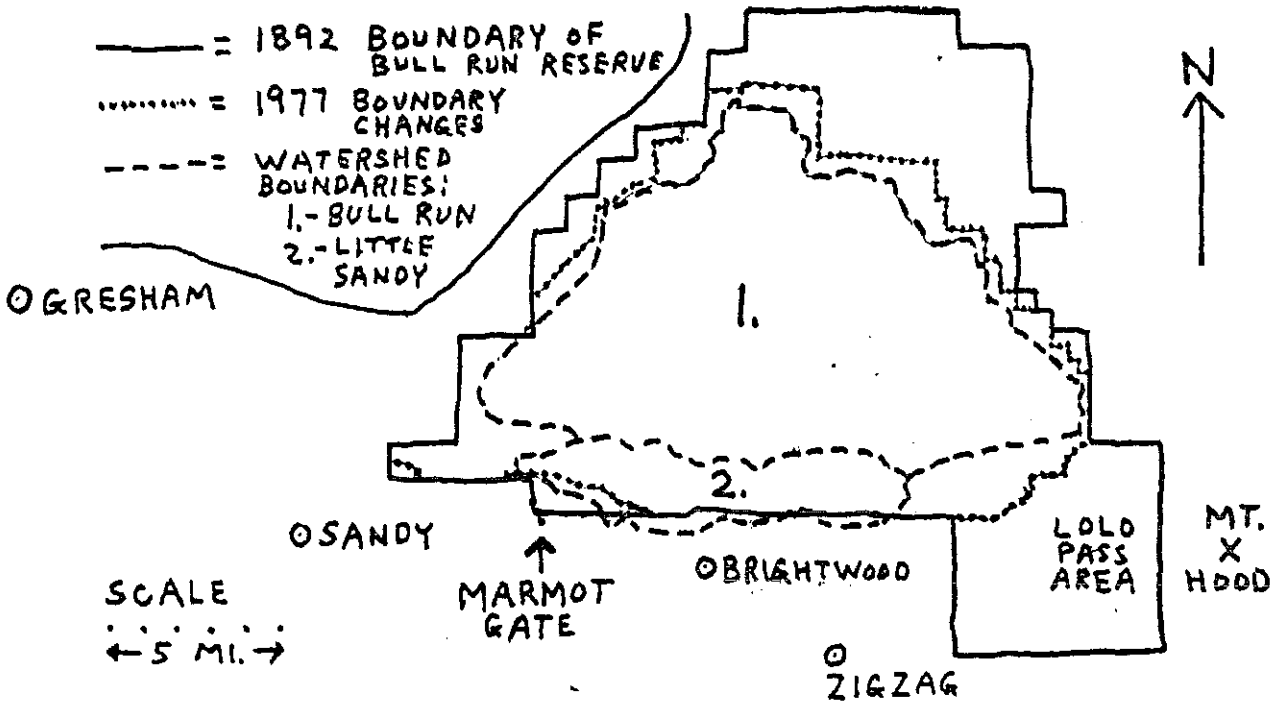
Joseph L. Miller Jr.

Note regarding attached Fact Sheets on Little Sandy (Dec.5 ,1980)

The Little Sandy watershed, adjacent to the Bull Run watershed, is an ignored future water source for the Portland metropolitan area. It could provide one-sixth as much high elevation, pure, water as Bull Run does. Bull Run provides water to 30 % of Oregon's population.

By being ignored, these things have happened, or could happen:

(1) Congress, in 1977, changed the 1892 Bull Run Reserve boundary so as to open the vitally important lower part of the Little Sandy watershed to the prospect of multiple use (i.e., admittance of the public; and intensive sustained yield logging).



(2) The 1981 State Legislature could transfer Portland's existing statutory water rights to the Little Sandy, to Portland General Electric, or to the City of Sandy (which wants to use only the upper part of the drainage).

(3) The U.S. Forest Service could terminate an existing de facto closure of this area, by a still-locked gate at Marmot, thereby admitting the public, which would foreclose a future option for this to be managed as a closed, protected, watershed (like Bull Run).

There is still an option - though fleeting - to gain total protection for both the lower and upper Little Sandy watershed, equal to what the Bull Run now enjoys. Under the 1977 Bull Run law, the Secretary of Agriculture, by ordering a simple boundary change in the southwestern part of the new "Bull Run Watershed Management Unit", could gain such protection; and by so doing give Portland a consultative role with the Forest Service in determining management policy.

Since the entities that are in the logical position to ask for such a change (the Portland City Council and U.S.F.S.) are precisely the ones who persist in ignoring the Little Sandy as a Portland area water source, the only way action will take place is as a result of public knowledge and public pressure. Hence these Fact Sheets. - - - - Jos. L. Miller Jr. Jos. L. Miller Jr.

Joseph L. Miller Jr.,
52815 E. Marmot Rd.,
Sandy, Ore., 97055

Jan. 16,1980

To: People who may be able to supply or publicize needed information concerning the potential or lack of potential of the Little Sandy watershed as a valuable future water source for the Portland metropolitan area:

It appears that the above potential is about to be lost without regard for available facts, and without public knowledge of what is at stake. The Forest Service, which manages this area, says it will listen to recommendations based on fact.

A fact sheet will be prepared. I need your help.

All presently available facts seem to point to a lack of sound basis for giving up available protection of this resource. If you know of any facts pointing the other way, or contrary to those listed below, please let me know by Jan. 30, and send supporting documentation. Reference to them will be included in the fact sheet, and a copy sent you inviting suggestions for changes or additions. All documentation will be placed in the Bull Run Interest Group open file in the central Public Library in Portland.

If no contrary information is received, one could assume there is no valid reason for Portland giving up its water rights or for the Forest Service to open nearly one half of this watershed to public recreation and multiple use; and that there is a valid basis for working for a boundary change that can give complete protection.

UNIQUE VALUES of this watershed include:

(1) It is protectable, like Bull Run, so the water could probably avoid a need for filtration.

(2) From it, one-sixth as much water as Bull Run produces, could be available at a high enough elevation to avoid need for pumping.

(3) Since filtration and pumping would be required for all other sources, and since both are energy consuming, thereby escalating costs, use of the Little Sandy in the future will become increasingly a bargain, compared to other sources.

(4) Because of its high elevation and protectability from human and industrial contamination, the water can be of far higher quality than well water from near the Columbia - which is presently planned as a supplemental source.

PRESENTLY ACCUMULATED, DOCUMENTED, FACTS INDICATE:

(1) Portland intends to give up its water rights to the City of Sandy (or to P.G.E. by default). The City of Sandy would use only the upper drainage, leaving no one to argue for continued protection of the lower drainage.

(over)

(2) Under the new Bull Run law, Portland is the only municipality mentioned as having any say in the future management of this area.

(3) The major media and the Forest Service have given no publicity concerning the potential value of the lower Little Sandy as a municipal water source.

(4) In the absence of demand that it be regarded as a municipal water source, the Forest Service plans to open the lower drainage to multiple use, including to public recreation.

(5) Options exist to enlarge the boundary of the Bull Run Watershed Management Unit, which is closed to the public, so as to protect all of the Little Sandy watershed above an elevation of about 880 ft.

(6) No in-depth studies have been made of the following:

(a) a dam site that would impound all protectable water.

(b) the geology of the lower Little Sandy area.

(c) feasibility of using this as an alternate or supplemental source to Bull Run, specifically, of conduit or tunnel routes and costs to avoid the geologic hazards of the present conduits in the Bull Run canyon.

(d) economic feasibility of development, taking into consideration spiraling energy costs, as compared to other sources.

(e) comparison of the quality of Little Sandy water, with that from other sources.

- -

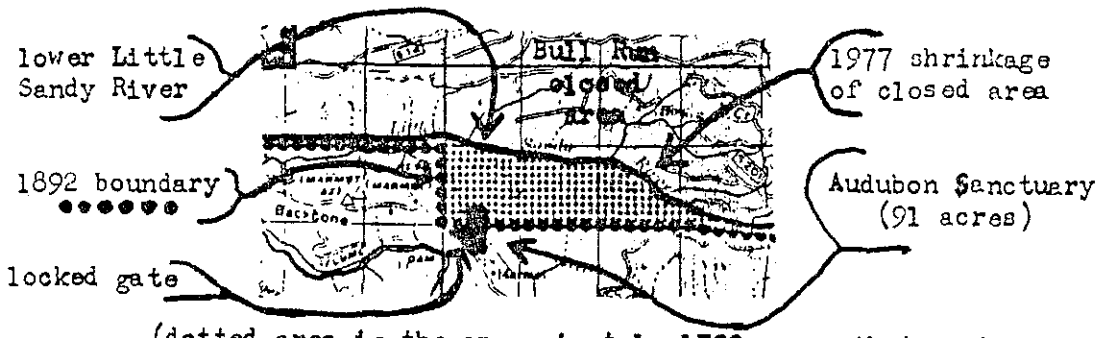
Any documentable facts you may be able to send me, or publicize, on any side of this issue, will be much appreciated. This can help to insure that decisions to be made soon for the Little Sandy, will have a better chance of being wise and far sighted.

Sincerely, Joseph L. Miller Jr.

Joseph L. Miller Jr.

Copies to: People in government, planning, timber industries, P.G.E. and the media. To engineers, geologists, environmentalists, recreationists and others. Complete mailing list available on request.

- -



(dotted area is the approximately 1700 acres that could be opened unless boundary is changed.)

Joseph L. Miller Jr.,
52815 E. Marmot Rd.,
Sandy, Ore., 97055

Feb. 1, 1980

To: People who may be able to supply or publicize needed information (pro or con) concerning opening the lower Little Sandy watershed to multiple use. To same people to whom my letter dated Jan. 16,1980 was addressed.

The "Fact Sheet" alluded to in my Jan. 16 letter, follows. My reason for compiling this and sending it to you, is that I believe this is an important issue concerning which very significant decisions may soon be made; and many facts that could influence these decisions have not yet come out in the open.

I hope you may be able to add facts or statements from your perspective. If so, I will incorporate them in a revised "Fact Sheet", and mail it to anyone on request. Please feel free to seek or disseminate information without going through me. I will be glad to send you my mailing list. You may wish to place your material directly in the Bull Run Interest Group open file, in the central Public Library, in Portland.

Sincerely, Joseph L. Miller Jr.

Joseph L. Miller Jr.

FACT SHEET ON LITTLE SANDY RIVER WATERSHED

as future Portland area water source;

as protected natural wildlife habitat

History and geography: Above its gauging station, the area of the Little Sandy watershed is 22.3 sq. miles, compared to 107 sq. miles for the adjacent Bull Run watershed(1). From 1892 until 1977 all but 4.5 sq. miles of the Little Sandy watershed was closed to the public by virtue of being within the boundary of the Bull Run Reserve. In 1977, a new Bull Run law(2), (sponsored by Rep. Robert Duncan), among other things, changed the boundary of the closed area so as to open to the public, and to multiple use, about 1700 acres of the lower Little Sandy watershed.

A map, showing these relationships, accompanied the Jan. 16 letter.

The immediate issues: Portland is on the verge of giving up its water rights to the waters of the Little Sandy. This could happen in the State Legislature this year. The City of Sandy wants the rights, but would use only the upper part of the drainage (3). Portland General Electric claims they have prior rights (4). Loss of rights would destroy an existing option for Portland or some other entity to develop the upper and lower drainage as a metropolitan area water source.

Under the management plan authorized under the new Bull Run law, the Forest Service can, at any time, open the lower part of this watershed to public entry and to intensive sustained yield logging (5). These actions also would nullify a future option to secure for this watershed protection equal to that of Bull Run.

The Forest Service could, at any time, after consultation with the Portland Audubon Society, open the present locked gate at Marmot and allow hunters and others through their natural wildlife sanctuary, to hunt beyond (6).

(over)

An option exists to restore the old Bull Run boundary and obtain protection, including closure to the public, of the lower Little Sandy watershed (7). In the mean time, a "Code of Federal Regulations" permits "CFR" closure.

"Reasons" that have been offered for Portland wanting to give up its Little Sandy water rights; and for opening the lower drainage - - with rebuttals:

(A) L.S. yields insufficient water, especially in the dry season.
Rebuttal: Average annual flow: Bull Run - 771 cu.ft/sec L.S. - 146 cu.ft/sec (1)
Flow for June-Sep't.,yr 74/75: B.R.-1222 cfs L.S. - 234.9 cfs (8)

(B) L.S. is at too low an elevation to permit gravity flow to Portland.
Rebuttal: Elevation of gauge on B.R. River: 567.9 ft.; L.S.: 720 ft.(1)
Elevation B.R. headworks (lower dam spillway): 750 ft.(9)
Elevation, proposed dam on L.S., a little above Aschoff Creek: approx. 1200 ft.(10)

(C) It is open to the public and human contamination.
Rebuttal: The only private land holdings in the drainage above the entrance of Aschoff Creek (which comes in at an elevation of about 880 ft.), are large blocks owned by the timber industry.(7)

(D) The planning process has shown a lack of demand - no one wants the lower Little Sandy to be regarded as a watershed.
Rebuttal: Portland, having water rights under Oregon Statutes(3)(Irelan), is the only municipality likely to demand this, and their reasons for not doing so remain a mystery. The public at large is not likely to demand it because they were not informed during the planning process that the Little Sandy was a potential domestic water supply(11).

(E) Other alternate sources to Bull Run would be better because they would be independent and not subject to the hazards that Bull Run is subject to - specifically, wells near the Columbia would not be subject to fire, earthquake and volcanic activity.
Rebuttal: These may be valid arguments for going to wells, but they do not justify throwing away the L.S.source. The well water would be subject to human contamination from septic tanks (12) and to radioactive wastes(13) and industrial wastes from the Columbia. Filtration would be required(12)(and p.160) and this would pose an additional hazard due to breakdown, sabotage, etc.

(F) Could get more water out of impounding Blazed Alder.
Rebuttal: Blazed Alder is in the Bull Run watershed. If this is a viable future source, the Little Sandy should be also. (This supports rebuttal (E))

(G) Geologic problems would interfere with developing the Little Sandy.
Rebuttal: Detailed geologic studies of the Bull Run area have not been done(14). Until these are done, the possibility should be kept in mind that conducting Little Sandy water by a different route than the Bull Run canyon, might provide an alternate route that was less geologically hazardous(15)

(H) Developing Little Sandy as future Metropolitan area water resource would be too expensive.
Rebuttal: The studies that have concluded this EVIDENTLY do not take into account spiralling energy costs that will make the Little Sandy increasingly a bargain in the long range future. L.S. water can avoid filtration and, being at high elevation, will not need to be pumped; both of which consume energy. The alternative, ground water from near the Columbia, would need both(16).

(I) Little Sandy water will have to be filtered, so why protect it?
Rebuttal: Where is the evidence that L.S. water would need to be filtered if logging and public access were controlled? Control of these factors can keep Bull Run water from needing filtration(17). L.S. water is thought to be of as high quality as Bull Run water(18).

(J) Studies show it would not be a feasible future source.
Rebuttal: Where are any in-depth studies of the feasibility of use of the

(con't.)

maximum protectable yield of the L.S. for the Portland metropolitan area? Available evidence indicates no such studies have ever been done (19).

(K) BRAC (Bull Run Advisory Committee) has taken no action regarding the lower L.S. issue. Clackamas County Commissioners were not interested in lower L.S.

Rebuttal: In 1978 BRAC recommended that the Little Sandy River drainage be considered in total as a source of municipal water supply(20). In May,1979 BRAC unanimously voted to table a statement on the Little Sandy River(21). In 1979 the Clackamas County Water Policy Advisory Commission recommended to the Board of Commissioners that the Little Sandy River Watefshed remain closed to public ingress pending a study of its water supply potential(22).

(L) Limited recreation wont hurt much. Management practices wouldn't change much if the entire L.S. were declared a watershed, because it is Class I stream.
Rebuttal: Admitting the public even in a limited way would be a foot in the door that would jeopardize an existing option to change the boundary to close the area. The Class determines the care with which logging is done, Class I having the highest priority. While the main L.S. River is designated Class I, Bow Creek, a major tributary, is Class II; and several streams in the area are Class IV (23). Water from undisturbed forests is generally of the highest quality available (24)

(M) The L.S. River is a natural boundary (and thereby presumably easy to control).
Rebuttal: It would seem easier to control entry where the access road leaves a public road, with a locked gate, than to expect people to stop on the south side of a three and one half mile stretch of river, and not cross it.

(N) People want to fish in the Little Sandy River.
Rebuttal: Any expression of such a wish during the planning process is meaningless because people were not told this is a potential future domestic water source.(11)It is well known that Portlanders do not wish the public admitted to the Bull Run watershed (25). As of March, 1979, no strong interest on the part of the public had been shown that the area be opened to recreation (3)(BRAC minutes).

(O) Congress has opened the area and people can enter. The issue has been resolved; it should not be re-opened.
Rebuttal: If a mistake is made, without public knowledge of what has happened, we are entitled to redress and to ask for the mistake to be corrected.

(P) What happened was unfortunate, but it was dictated by political reality.
Rebuttal: If political reality produces unfortunate results we should try to correct the situation. Maybe our politics can be improved.

(Q) The City of Sandy will use the upper L.S., and what is left wont be enough for Portland.
Rebuttal: Portland hasn't transferred the rights, as yet,to the City of Sandy. There is still time FOR PORTLAND to retain the opportunity to use the entire L.S. Legally, Sandy is not in as good a position to control management of that watershed as Portland is. The new law gives a consultative voice to Portland, and to no other community. No formal memo of understanding exists between the Forest Service and the City of Sandy for the management of the L.S.(26)

Recent contribution: T.J.Starker, forester, writes,1-26-80: "Prior to 1917 I worked for the U.S.F.S. for several years and I believe it was about 1910 to 1915 we were asked to patrol the west end of the watersheds on Sundays to keep out the public. In other words early protection toward the protection of the purity the drainages were designed to deliver in regard to usability. Another young forester that I believe had a similar assignment was George Bright. But I believe he has gone over the hill."

References: (BRIG # = Ref. in Bull Run Interest Group open file)

(1) U.S. Geological Survey,"Water Resources Data for Ore, Part 1. Surface Water Records - 1973"(pp. 181,2) BRIG # 155
(2) Oregonian, "New Bull Run bill seen as less rigid", 11-3-77 (BRIG # 165; No.28,p.2)
Public Law 95-200, Nov. 23,1977 (BRIG # 182 a)

(continued, over)

References, con't.

(3) Robert Hyle, Manager, Portland Water Bureau, 9-22-76, letter to J.L.Miller Jr., Robert C. Irelan, Deputy City Attorney,Portland, 10-12-76, letter to Bob Hyle. BRIG #219 BRIG # 118

Bull Run Advisory Committee, Mar. 15,1979, minutes

(4) Robert M. Lee, Manager of Hydro Production, P.G.E., Mar. 1,1979, letter to Jos. L. Miller Jr.

(5) U.S. Forest Service, E.A.R., Little Sky Timber Sale, pp. 11,13. BRIG # 218

(6) The Marmot gate is so situated that the access road to the lower Little Sandy, beyond the gate, goes through the Audubon sanctuary.

(7) Option under 1977 law (P.L. 95-200; see ref. (2) above) - permits boundary changes by Secretary of Agriculture. Land exchanges with timber industry and B.L.M. would permit enlarging Bull Run Watershed Management Unit to include all of the Little Sandy drainage above an elevation of about 880 ft. It would contain, then, no private holdings. (For details, see Open letter to BRAC, 11-3-78, p.8 -BRIG #208)

(8) Francis J. Ivancie, Portland Commissioner, Mar. 3,1977 letter to Commissioner Schwab. BRIG # 164 b

(9) Portland City Club,1973,"Management of Forest Resources in the Bull Run Division," p. 48 BRIG # 25

(10) David W. Browne, Environmental Engineer, URS Co., 11-20-78,map. BRIG #208

(11) J.L.Miller Jr., Nov. 3,1978, open letter to BRAC, p. 5 BRIG # 208

(12) URS Company, part of U.S. Army Corps of Eng'rs Portland-Vancouver Metropolitan Area Water Resources Study - Draft Water Supply Plan, Jan.,1979, p.33

Oregonian,"East Multnomah County Wells' nitrate levels increasing", 12-18-77 BRIG # 223

Oregonian, "DEQ's lab chief blew whistle on peril to area ground water", 12-31-79

(13) Carl Green, Dec. ___, 1979 letter to Dr. Warren Westgarth, Chairman, BRAC

(14) Stevens, Thompson and Runyan, Engineering consultants, Engineering Study for Portland Water Bureau, 1974,Tech. Supplement, p. B-4. BRIG #163

(15) Ibid., Tech Supp., Introduction, and p. B-5

(16) URS Company(same as (12) above), pp. 160,161

(17) same as (16); also:

Staff Paper, Portland Water Bureau, April, 1976 (re possibility of variance), pp. 37,38. BRIG # 96 e

Harold T. Osterud, M.D., Professor and Chairman, Dep't. Public Health and Preventive Medicine, UOHSC,School of Medicine,8-15-77. BRIG # 190

(18) Engineering Division, Portland Water Bureau, letter to Robert Hyle, Nov. 2, 1978, p. 2 BRIG # 211-121

(19) Stevens, Thompson and Runyan (1974) Engineering study evaluated only the 4.5 sq. mi. portion of the L.S. drainage lying outside the Bull Run Reserve (i.e.,the unprotected part). (p. 39) BRIG # 163

URS Company, Memorandum to Clyde Barnhill, Corps of Engineers, July 27,'78.

David W. Browne, Environmental Engineer, URS Company,11-20-78 BRIG # 208 letter to J.L. Miller Jr. BRIG # 208

(20) BRAC Status Report to Portland City Council, Exec. Summary, Oct.,1978.BRIG # 211-118

(21) BRAC Minutes, May 14,1979 meeting

(22) Water Policy Advisory Commission,Clackamas County, letter to Board of County Commissioners, June 29,1979

(23) U.S.F.S., E.A.R., Little Sky Timber Sale, Aug., 1978, p. 8. BRIG # 218

(24) Jack Rothacher, forest hydrologist, U.S.F.S.,quoted in Portland City Club Bulletin,"Report on Management of Forest Resources in the Bull Run Division," 1973, p. 67, BRIG # 25.(orig.reprint:BRIG # 1)

R.L.Fredriksen, Research soil scientist, p. 1 of: "A Plan of Research to provide Information for Water Quality Management on the Bull Run Watershed", Mar. 19, 1975 BRIG # 133 b

(25) Lloyd Anderson, Commissioner, City of Portland, report to City Council, July 1, 1971 BRIG # 21

(26) BRAC minutes, Mar. 15,1979 meeting

J.L.M.Jr.

Joseph L. Miller Jr.,
52815 E. Marmot Rd.,
Sandy, Or., 97055

Dec. 5, 1980

To: People interested in the potential or lack of potential of the Little Sandy River watershed serving as a valuable future water source for the Portland metropolitan area:

My communications of Jan. 16 and Feb. 1, 1980 sought information from people who might be interested, on the above issue. I said I would incorporate any information received in a revised "Fact Sheet" and mail it to anyone on request. Here is the "revision".

What has happened has been interesting. The above two mailings each went to over 300 people. The only rebuttal or additional information that I have received has been a letter from Ron Humphrey, Acting District Ranger, Zigzag Ranger District. This letter was dated Jan. 29,1980, but was not received until Feb. 1, after my Feb. 1 communication had been typed.

A copy of Mr. Humphrey's letter in its entirety is attached.

Some of the points raised in his letter may have been responded to in the Feb. 1 Fact Sheet, under "Reasons" L, D, I and C .

His assumption, in his next to last paragraph, is incorrect. The protectable area I refer to would be all of the Little Sandy drainage <u>above</u> the entrance of Aschoff Creek. It would not include Aschoff Creek.

In his third paragraph, Mr. Humphrey refers to inquiries of EPA that seemed to point out that filtration would be necessary with any open water source. (This question is raised on the Fact Sheet under "Reason"(I))

Correspondence, stimulated by Mr. Humphrey's letter, between myself and Mr. Donald Gipe of EPA between Feb. 4 and Mar. 28, 1980 does not reveal any blanket requirement that any open water source will need to be filtered. A variance from strict compliance with water quality standards may be applied for; in fact the City of Portland has asked that the turbidity limitation be relaxed. In determining whether to permit relaxation of the turbidity standard, one factor which EPA considers is the degree of protection of the source. Among items considered in this regard are: degree of control of logging; and public access, including whether access is controlled by fencing. (This corrspondence is in the BRIG open file under ref. # 227).

- - - - - - - - - - - - - - - -

There is additional information on "Reason" (K). Efforts to clarify BRAC's position on the Little Sandy are documented in the BRIG open file under Ref. # 228. My interpretation is that there is no basis that is substantiated by any BRAC vote, for a different recommendation than the 1978 one that is referred to under "Reason"(K) rebuttal.

Sincerely, Joseph L. Miller Jr.

Copies: to interested people
Encl: copy Ron Humphrey letter(1-29-80)

Joseph L. Miller Jr.

B11d

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Zigzag Ranger District
Mt. Hood National Forest
Zigzag, OR 97049

Postmarked 31 Jan. Rec'd Feb 1 '80 after deadline Typed up post sheet

January 29, 1980

Dr. Joseph L. Miller, Jr.
52815 E. Marmot Road
Sandy, OR 97055

Dear Dr. Miller:

In response to your letter asking for information regarding the Little Sandy issue, I have a couple of points relevant to your inquiry.

The first deals with water quality and the need for filtration. While doing research and planning for future potential timber sales in the lower Little Sandy River area, we (Forest Service) recognize that high water quality was an important objective to maintain. That is, the stream is designated as a Class I stream (highest ranking) for stream and watershed protection. There was no public record or expression of interest for the water as a municipal watershed. Since we started planning, recommendations have been placed before different local governments to do just that, but no official government body has taken up or acted on these recommendations to protect, preserve or save the low Little Sandy River as a municipal watershed. This does not mean that we (Forest Service) plan to take action to compromise the water quality of the River to jeopardize future water needs. In fact, our timber management plans call for carefully protecting the watershed and to meet water quality standards specified in State Guidelines.

Regarding filtration, our inquiries with the EPA (personal conversation between Ron Humphrey, Forest Service, and Don Gipe, EPA), seem to point out that filtration would be necessary with any open water source. It seems that in any watershed there are natural events and climates occurences that cause conditions when water quality standards will not be met. I don't have the records, but from what I understand the State and Federal water agencies won't permit new open-source water systems without some filtration system.

(over)

(Letter Cont'd:)
TO: Dr. Joseph L. Miller, Jr.
RE: Little Sandy Issue
Date: 1-29-80

A second point regards the opening of the area for multiple use and public recreation. The Bull Run legislation (PL 95-200) changed the boundary of the Bull Run Reserve and created the Bull Run Watershed Management Area (BRWMA). The law, not the Forest Service, changed the boundary and indicates that this area should be open for resource management and use by the public. However, we have postponed fully implementing this to allow the Audubon Society to complete a two year inventory and study of Wildlife values in the area and to prepare recommendations on how to manage the area. The gates have remained in place to prevent access by vehicles by the general public. We are allowing public entry, on foot, and have permitted some firewood gathering, one timber sale, road maintenance, and other administrative activities. When the Audubon completes its study, we shall decide on the gate issue. We also are seeking input from the Oregon Department of Fish and Wildlife.

I also assume, when you talk about protecting the lower Little Sandy above 880', you include Aschoff Creek. This involves significant amounts of private lands, including your own and the Audubon Sanctuary, but gives a great deal more storage and supply.

I hope these points assist you putting together information about the lower Little Sandy issue.

Ron Humphrey

RON HUMPHREY
Acting District Ranger

B11e

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

OREGON OPERATIONS OFFICE

522 S.W. 5TH AVENUE

YEON BUILDING, 2ND FLOOR

PORTLAND, OREGON 97204

rec'd 3-31-80

REPLY TO ATTN OF: 10000

MAR 2 8 1980

Joseph L. Miller, Jr.
52815 E. Marmot Rd.
Sandy, Oregon 97055

Dear Mr. Miller:

This is in response to your March 20 inquiry. As I noted in my March 17 letter, when EPA evaluates whether or not a turbidity relaxation (pursuant to section 141.13 of the National Interim Primary Drinking Water Regulastions) is appropriate, one factor which EPA considers is the degree of protection of the source. Because each situation must be judged on its own merits, we have not established definitive criteria for evaluating the degree of protection. Some of the items which we do consider in this regard include the degree of control of logging, whether the logging could be expected to have an adverse impact and the public access (including the physical isolation of the watershed and whether access is controlled by fencing or often barriers).

I hope this clarifies my earlier letter.

Sincerely,

Donald C. Gipe

Donald C. Gipe, Coordinator
Safe Drinking Water Program

B11f

10000

MAR 10 1978

Robert Hyle, Manager
City of Portland Bureau of Water Works
1800 S.W. Sixth Avenue
Portland, Oregon 97201

Dear Mr. Hyle:

The results of your December and January finished water turbidity reports indicate that you are in violation of the maximum contaminant levels for turbidity as established by the National Interim Primary Drinking Water Regulations published pursuant to the Safe Drinking Water Act of 1974 (Section 141.13(a) and 141.13(b)). Our analysis of your reports reveals a monthly average turbidity of 4.8 for December and 1.8 for January. Additionally, your data shows that the allowable two consecutive day average of 5 TU was exceeded at least 4 times in December.

From an examination of this data, it is apparent that your Bull Run watershed has been unable to supply water which meets the maximum contaminant levels for turbidity during the periods of heavy rainfall which are normal during the winter months. The public notice which you enclosed with your letter of December 15 makes this clear to your customers. The Safe Drinking Water Act, however, also requires a resolution of the problem. As I am sure you are aware, water systems which are in violation of the Act or the Regulations are subject to both Federal enforcement action and individual citizen's suit.

For systems working toward compliance, the regulations provide for a possible exemption from the turbidity limitations until necessary construction can be completed. I have enclosed a copy of the National Interim Primary Drinking Water Regulations: Implementation, in case you may wish to pursue this option (see § 142.51). If so, please note the information that must be provided to EPA when an exemption

is requested. If a proposed compliance schedule can be provided at the same time an exemption is requested, the compliance schedule should include the following milestones at a minimum:

(1) Completion of financing by _____;
(2) State plan review by _____;
(3) Initiation of construction by _____;
(4) Completion of construction by _____; and,
(5) Achieve compliance with the maximum contaminant level for turbidity by _____.

The regulations also provide for a possible relaxation of the turbidity MCL for the monthly average by an increase from 1 TU to 5 (or fewer) TU if the water supplier can demonstrate that the higher turbidity does not:

(1) Interfere with disinfection;
(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or
(3) Interfere with microbiological determinations.

Systems which exceed the two-day average 5 TU limit will not be considered for a turbidity relaxation unless the system can demonstrate that by modifying its operation, the two-day 5 TU limit will not be exceeded in the future.

If you wish to pursue this option, please submit the following information for our evaluation:

(1) Water quality records for at least the past 3 years. The records should include at a minimum, bacteriological results, turbidity measurements, chlorine feed rates, chlorine residual, and chlorine demand;

(2) Description of monitoring equipment and procedures;

(3) List of laboratories used; and

(4) Reported incidents of waterborne disease outbreaks, if any.

After review of the submitted information, we may identify a need for increased monitoring or special tests. These tests may include such items as standard plate counts, fecal coliform measurements, production, etc.

Please submit your plans for providing water which meets the criteria of the Interim Primary Drinking Water Regulations to this office within 30 days.

We appreciate your continued concern for safe drinking water. If you have any questions or comments, or if we can be of assistance, please contact Don Gipe at the address listed above, or at 221-3250.

Sincerely,

John Vlastelicia, Director
Oregon Operations Office

cc: Sharrel Davison, Oregon State Health Division
Paul Norseth, Chief Engineer, City of Portland, Bureau of Water Works

DGipe/de 3/3/78
JVlastelicia

THE CITY OF
PORTLAND
OREGON

DEPARTMENT OF
PUBLIC UTILITIES
FRANCIS J. IVANCIE
COMMISSIONER

BUREAU OF
WATER WORKS
ROBERT C. HYLE
MANAGER

1800 S.W. SIXTH AVE.
PORTLAND, OR. 97201

B11g

September 13, 1978

Mr. John Vlastelicia, Director
U. S. Environmental Protection Agency
Oregon Operations Office
522 S. W. 5th Avenue
Portland, Oregon 97204

Re: Turbidity Relaxation Request for the Bull Run Surface Water Supply to the City of Portland, Oregon

Dear Mr. Vlastelicia:

In regard to your letter of March 10, 1978 and subsequent communication with Mr. Don Gipe, Coordinator, Drinking Water Program, of your office, the Bureau of Water Works requests a relaxation of the 1.0 ntu turbidity standard to 5.0 ntu as set forth in PL 93-523, the Safe Drinking Water Act.

This request is based on the following data:

1. Turbidity in excess of 1.0 ntu occurs during inclement winter periods for a short duration.
2. Turbidity in excess of 5.0 ntu occurs during said periods when storm runoff exceeds 10 year frequency intervals.
3. The Bureau is actively developing a groundwater source of sufficient quantity and quality to mitigate those inclement periods when turbidity in the Bull Run exceeds the desired limits and to improve the reliability of the system.
4. The Bureau and the U. S. Forest Service are actively engaged in on-going maintenance programs to enhance the stability of the Watershed stream channels to reduce overall turbidity.
5. Turbidity emitting from the Bull Run Watershed does not interfere with the disinfection process, and the Bureau is improving the existing system to enhance its disinfection efficiency and reliability.
6. Turbidity does not adversely affect the microbiological determinations, and the entire system is adequately monitored by a competent water quality staff.
7. Turbidity does not adversely affect chlorine residuals in the distribution system, and the Bureau is presently designing and will construct new postchlorination facilities in the distribution system to insure chlorine residual reliability.

8. Turbidity does not provide sediment deposits within the distribution system. Those present sediments found in the mains stem from operations prior to the construction of Dam #2 (1961), and the Bureau has a budgeted main cleaning program to remove these sediments.

9. Financing of said improvements will be accomplished by revenue bonds.

10. Construction and start-up of groundwater facilities for 50 mgd will be complete in 1981, with expansion to 100 mgd at a later date. A summary report with list of facilities, location plan and project schedule is enclosed.

11. Completion of groundwater facilities for 100 mgd is not necessary to meet turbidity standards except on a 10 year storm interval.

12. Enclosed list of monitoring equipment, test procedures and water quality data.

13. Water Quality Laboratories used are:

Umpqua Research:	Inorganic and organic chemical analyses.
Multnomah County:	Microbiological analyses of distribution system.
Bur. of Water Works:	Microbiological, biological, inorganic chemical, organic chemical and physical analysis of total system.

14. No incidents of waterborne disease outbreaks have been reported to our knowledge.

Supporting data is enclosed in the form of a loose-leaf binder.

Your favorable response to our request would be appreciated. Should you have any further questions, please contact us at your convenience.

Very truly yours,

Robert Hyle
Manager

RH:GEP:mka
Encls.
ccs: Commissioner Francis J. Ivancie
Paul Norseth
G. E. Paulson

B11h

CITY OF
PORTLAND, OREGON
BUREAU OF WATER WORKS

Francis J. Ivancie, Mayor
Carl Goebel, Administrator
1120 S.W. 5th Avenue
Portland, Oregon 97204-1926
(503) 796-7402

May 12, 1983

Joseph L. Miller Jr, MD
52815 E. Marmot Road
Sandy, Oregon 97055

RE: Groundwater Program Consultant Use - G.W. 0.2

Dear Dr. Miller:

The City has used both private and public consulting services to obtain expert services that are not available from Bureau staff and also to simply complete work that the Bureau does not have sufficient staff to perform. The consultants that have had an input into the project to date are:

STR Engineers (now CRS Group)	- Provided an extensive water supply plan that was completed in 1974. Contact person is Gilbert Meigs.
R.C. Newcomb	- Provided an expert review of the Bureau's initial reports on the viability of the program and a review of some of the specific drilling operations.
U.S. Geological Survey	- Provided another review of the initial Bureau reports and are developing a computer hydraulic model of the well fields for the Bureau.
Keith Anderson	- Provides a review of our drilling operations now that Mr. Newcomb has retired.
CRS Group Engineers and Engineering Design Assocs.	- Providing professional engineering services for the design and construction of the project's pump station and other related electrical facilities.

These are all the major consultant services we have used, other than for several geologists that we have hired to supervise the well drilling contractors. All other skills required for the project, the Bureau has been able to obtain from it's staff.

I hope this provides the information you requested.

Sincerely,

Carl Goebel, Administrator
Robert F. Willis

Robert F. Willis, P.E.
Water Engineer Supervisor

RW:kk c. P. Norseth B. Niss

Bill

Joseph L. Miller Jr.,
52815 E. Marmot Rd.,
Sandy, Or., 97055

June 1, 1983

Robert F. Willis, P.E.,
Water Engineer Supervisor,
Portland Water Bureau,
1120 S.W. 5th Ave.,
Portland, Or., 97204-1926

Dear Mr. Willis:

Re: Groundwater Program Consultants Reports
(your May 12,1983 letter to me)

Thank you for supplying me with the names of the Consultants the Water Bureau has used in developing its ground water program.

Could you please send me any written reports they have submitted relating to water quality or/and quantity that they anticipate will be obtained? Also, any recommendations re possible treatment needed.

I will expect to pay for copying costs. If this will amount to more than $20., I would appreciate your letting me know the approximate cost, in advance.

Thank you.

Sincerely,

Joseph L. Miller Jr.

Joseph L. Miller Jr.

BIIj

CITY OF
PORTLAND, OREGON
BUREAU OF WATER WORKS

Francis J. Ivancie, Mayor
Carl Goebel, Administrator
1120 S.W. 5th Avenue
Portland, Oregon 97204-1926
(503) 796-7402

June 15, 1983

Dr. Joseph L. Miller Jr.
52815 E. Marmot Road
Sandy, OR 97055

Subject: Groundwater Consultant Reports - GW 0.0

Dear Dr. Miller:

The only significant report prepared by Bureau consultants which relates to potential treatment of groundwater sources is the 1974 Water Supply Study produced by Stevens, Thompson & Runyan, Inc. (now CRS Group). The other consultants that we have hired have performed a function of reviewing our work and have not produced reports as such.

I have had the STR reports copied and have enclosed them with this letter for your use.

Sincerely,

Carl Goebel, Administrator

Robert F. Willis

Robert F. Willis, P.E.
Water Engineer Supervisor

RFW:rjm

Enclosures

c: P. Norseth
B. Niss

Note by J M Jr:
Enclosed with the original of this letter were (bulky) copies of the 1974 STR Reports. Attached to this copy of the letter, are copies of sealed pages of those reports

B11k

Portland Water Bureau

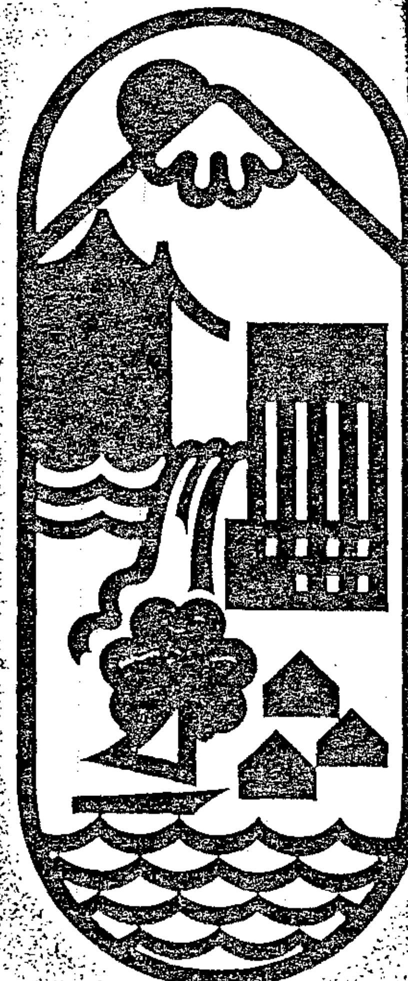
Water Supply Development Program

rec'd July 5 '83 with covering letter from Robert Willis dated June 15 '83 (postmarked July 1 '83)

Stevens Thompson & Runyan, Inc.
Bartle Wells Associates

this consists of 47 sheets ~~the~~ ~~most~~ most printed on both sides

Technical Supplement



THE CITY OF
PORTLAND
OREGON

BUREAU OF
WATER WORKS

1800 S.W. SIXTH AVE.
PORTLAND, OR. 97201

INTRODUCTION

This volume is a technical supplement to the Portland Water Plan. It is assumed that the reader is familiar with water supply engineering terminology and the contents of the Engineering Report, which is bound separately.

Section A, dealing with the yield of the Bull Run watershed, has a strong influence on all plans. Information presented in this section determines the timing of additional dams in the Bull Run watershed.

The study of the geology and cost of a tunnel out of the Bull Run watershed is of interest because the cost of a tunnel appears in all water supply proposals. Before the final design of a tunnel can take place, it will be necessary to undertake additional field investigations, including a subsurface drilling program. Additional reconnaissance for a tunnel from the vicinity of the Little Sandy River to Dodge Park is in progress at the time of this publication.

The report on groundwater in the Portland area (Section C) explains in some detail the limitations on groundwater in the Portland area. As a result of this initial survey, a test drilling program on Ross Island was undertaken. A summary report on this program is included as Section D. On the basis of these two reports, groundwater sources are not recommended and, therefore, receive only brief mention in the engineering report.

Section E, on distribution storage in other cities, may be of interest to those who wish to compare Portland's facilities with those of other cities. It was found that if it were not for the problem of the reliability of the Bull Run Supply system, Portland would be in an excellent position with regard to distribution storage.

Sections F and G describe the manner in which total costs and unit costs were derived. The total cost information was used for alternative ranking according to cost. The unit cost information was used for informal discussion during plan formulation. Section H contains material prepared by the Oregon State Health Division. This material describes that agency's position with regard to the filtration of surface water supplies.

B11

CARL E. GREEN & ASSOCIATES
CONSULTING ENGINEERS

5570 S. W. Menefee Dr.
Portland, Oregon 97201
246-3441

Delivered to Sally Stone in presence of Carl Gocbel on 12-17-79 for transmittal to all BRAC members
Carl E. Green

Dr. Warren Westgarth, Chairman
Bull Run Advisory Committee
5220 S.W. Shattuck Road
Portland, Oregon 97221

RE: ALTERNATIVE SOURCES OF WATER SUPPLY

Dear Dr. Westgarth:

We have had before us a number of times matters pertaining to the Little Sandy River as a possible source of supply and to a lesser extent, some discussions related to a proposed groundwater auxiliary supply from an area easterly of the City's central area. I am not convinced that the proposed program for additional supply has been adequately investigated insofar as the Little Sandy River is concerned. The approach to the use of the latter source of supply has been diversion and transmission via a tunnel to deliver water which would enter pipe lines at the existing Bull Run Headworks below Dam #2.

Before committing millions of dollars for development of a groundwater supply in an area in which sanitary sewage, industrial wastes, and surface water run-off has been disposed of by means of discharge into underlying ground and sand formations over a period of seventy-five or more years, careful and thorough analysis of a separate alternative-auxiliary supply from the Little Sandy River should be undertaken. I am not convinced that an objective, unbiased, thorough study yet has been made. The City has a long-standing water right granted by the legislature; the City cannot itself transfer that right to the City of Sandy or some other public agency.

Possible controversy regarding Portland General Electric Company's use of the Little Sandy River for power protection can be resolved. I have neither heard nor read of any proposal which would permit Portland General Electric to divert water to their hydro plant during months of high run-off when power demands are high and when hydro power from the Columbia River is reduced by low stream flows from east of the Cascade Mountains. The water supply needed by the Portland system is greatest when hydro power from the Columbia River is high and electric loads lower than in winter months.

I have previously called attention to the imminent possibility of pollution of Columbia River water by radioactive wastes from underground formations and aquifers up stream. Reports continue to emerge pertaining to this serious hazard related to operations in both the Snake River and Columbia River drainages. I doubt that it can be proven that no Columbia River water can ever enter aquifers in the area east of the City and which are proposed for groundwater development. BRAC members need not be reminded of the thousands

of years half life of radioactive wastes being stored or discharged underground in areas drained by the Columbia and Snake Rivers.

Currently the City is involved in negotiations with Portland General Electric regarding power production and use of energy from the units to be installed at Bull Run Dams #1 and #2. Before any contract is finalized, a possible Little Sandy River supply development by the City should be recognized and included in an agreement between the City and Portland General Electric. Hopefully such an agreement could avoid litigation over water rights.

At present, and more so in the future, conservation of energy is a serious matter. A gravity water supply without need for pumping has great advantages over a groundwater supply which will require substantial amounts of electric energy.

A pipe line from a headworks on the Little Sandy River should not parallel existing conduits but follow a different route to deliver water to the large storage reservoir now under construction.

I am of the opinion that BRAC has an obligation and responsibility to make recommendations to the Mayor and City Council pertaining to the matters herein briefly discussed and that it should do so in its annual report which presumably will be prepared and transmitted in the near future.

Respectfully submitted,

Carl E. Green by BM

Carl E. Green

CEG/BN:jj

cc: Members of BRAC

B12

EXHIBIT 12

FILED WITH THE OREGON ENVIRONMENTAL QUALITY COMMISSION, August 30, 1984

My name is JOHN J. SCALISE and together with my wife we own our home at 2208 NE 142nd.

My statement here is to share my observations, information and recommendations and to voice my objection to the Sewage Seepage Tax and the construction of sewers in East Multnomah County. This matter of sewer construction has come before the voters several times and by the will of the people, was defeated with the exception of small blocks of land, i.e. Argay terrace.

This problem has two major aspects, namely water quality and waste water disposal.

Waste Water Disposal - Twenty - thirty years ago when subject area (E. Mult. Cnty) was expanding rapidly, builders found the soil had an outstanding percolation, -porosity ratio. Instead of building an expensive sewer system, builders opted for the installation of cesspools and septic tanks, a common practice in those days. It was determined by the county and the builders the best way to go. What about cesspools and septic tanks? How efficient and how durable are they? If properly installed and maintained cesspools and septic tanks will provide an indefinite period of service. Should problem occur, the system can be pumped or rebuilt at a much lesser cost than the projected cost of sewer installation and construction of a multimillion dollar treatment plant and infinitum monthly payments or assessments and frequent rises in cost,

(1)

7. Also of prime importance, It seems strange that all this furror over water quality means very little when the city of Ptlnd plans on using Bull Run water or city wells instead of Water District wells.

Water Quality – Authorities including D.E.Q. E.P.A. etc. have stated that wells in E. mult. Cnty were attaining high nitrate levels. The claims of impure water are false Our local water service districts would not provide impure water. If they found levels of impurities approaching a high level of concentration, would certainly make arrangements for an alternate supply. All water districts use wells with levels of nitrates ~~levels~~ well below the maximum, Additionally all wells have shown no significant increase in nitrate levels in the past 10 years.

*What are the solutions to the problem? Go for the sewers, If sewers were installed tomorrow nitrate would still be leaching in the soil for 30-40 years hence. The water disposal decision was made for us years ago and no amount of sewage treatment is going to change the fact that the acquifer has some nitrates and will continue to have them. What about sewage costs? The seepage tax of $160 a year is an 'iffy' figure. And, no immediate benefits. Then there are the property assessments for trunk lines. These estimates range from $1,000 to $8,000. Feeder lines across owners property are at the expense of the property owners. Connection fee is $600 together with a monthly sewage fee, Also to be considered are rising costs, maintence costs, etc. Another problem to contend with is rats. Sewers bring rats, Passageways for colonies of them. Any big city with sewers has rats. Construction of sewers bring

disruption. Consider the Light Rail Project on Burnside and the Banfield or the constant digging and rerouting of traffic, lines etc. in downtown Portland. Property owners will lose their landscape. Removal of trees, shrubs, lawns, etc.

Another solution is to correct the water problem at its source - the well. If in fact wells are accumulating a high concentration of pollutants then the wells should be drilled deeper and properly cased or if necesary a greater use of Bull Run water or the new wells drilled by the City of Ptlnd.

The logical solution is to relegate the ground to waste water disposal as originally designed and seek a water supply elsewhere.

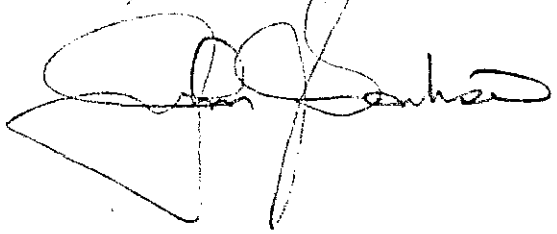
These are the alternatives as I see them. Cost analysis should be made before taxpayers are asked to shoulder the burden. For some, the retired, the elderly, the unemployed the costs will be high and most difficult to meet this obligation, particullarly in this day of high costs and tight money. Priorities should be evaluated

Additionally we should not succumb to the pressures of D.E.Q. when such testimony of water impurity is questionable or untrue. We should not give in to the politics of threat of annexation to the city of Portland if we do not follow their dictates. And, not we should be asked to subsidize the proposed commercial development at the expense of the private landowner.

Finally I strenuously object to the manner in which

this important issue is being handled. No opportunity was given the public to vote on the issue.

I close with this last statement. Having worked in the field of natural resources and teaching for over 30 yea I would be the first to support a safe disposition of waste water. But after the decision was made for us long ago, I balk at being badgered into a financial burde I think an unwise approach to the solution of the problem. Thank you for your patience.



(A)

B 13

nvironmental Quality Commission
22 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Oscar L Burns

Address: 12621 S.E. Salmon St
Portland, Or. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Pat Holcomb

Address: 1020 NE 131st Pl.
Portland, OR 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: R.M. McCulley

Address: 4737 S.E. 13L th Ave

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Leonard F. Hanson

Address: 12807 S.E. Lincoln St
Portland Ore
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Francis L. Speakman

Address: 13645 S.E. Stark #121
Portland Or 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Earl Oetelger
Lorne J. Gruber

Address: 44 N.E. 188
Portland OR 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: C. R. Wille

Address: 3266 SE 177th

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Frances Hefson

Address: 16507 S.E. Mill st
Portland, 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: E. J. Gilger

Address: 2246 S.E. 90th AVE
PORTLAND, OR. 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: RONALD B. GLYNN Holly B. Glynn

Address: 1021 S.E. 84th Ave
Portland 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature:

Address:

Charles & Evelyn Ottoboni
13726 SE Mill St.
Portland Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Clarence Montgomery

Address: 237 N.E. 169 ave
Portland, Or. 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs. Ray McMullan

Address: 9935 S.E. Grant Ct.
Portland, Ore.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Dorothy M. Smith

Address: Peter M. Smith
13230 N E Sacramento Dr
97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Adam Werner

Address: 9824 S.E. Grant St
Portland Oregon 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Jackson M Bartlett

Address: 10321 S.E. Cutler
Portland OR 97266

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Willard Burnett

Address: 1916 SE 130
Portland Oregon

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Marvin L Brault

Address: 341 N.E. 108 PL.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs. Marian Alger

Address: 2246 S.E. 95th Ave
Portland, Oregon 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ed and Anna Strain

Address: 13717 S.E. 122 St.
Portland, OR 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: E R. JOHNSON

Address: 1821 S.E 174TH
PORTLAND ORE
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Hiram E. Ramsey

Address: 2068 S.E. 101 Ave
Portland, OR.
97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Evelyn Arns

Address: 12439 SE. Salmon Ct.
Portland, Or. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Raymond E Arns

Address: 12439 SE Salmon Ct
Portland, Ore
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Edna Ouellet

Address: 10921 SE Oates
97266

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Edward Landstrom
Address: 437 N.E. 94th Portland Ore 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ralph & Kitty McCord
Address: 2080 S.E. 101 Ave. 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mr & Mrs. W.L. Tötte
Address: 11325 S.E. Yamhill
97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Verna Gratke
Address: 10524 N.E. PACIFIC ST.
PORTLAND, OR 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Leonard W Ark
Address: 12434 SE Sherman St
Portland Oreg. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs Wayne D. McCartney

Address: 738 SE 139th
Portland Oregon 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 1253 S.E. 128th
Portland Or. 97233
253-6317

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: C. L. [illegible]

Address: 2821 S.E. 112th

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ray K. Reynolds

Address: RAY K. Reynolds
219 N.E. 100th Ave
Portland Or 97220

Cliff & Linda Kruper 1314 SE [illegible] 761-[illegible]426

HAZEL BLAKELY 2121 N.E. 142 255-8332

BETSY EDWARDS [illegible] NE. [illegible] 252-3777

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Laurence L Broschart

Address: 1424 NE KNOTT
PORTLAND OR 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Howard Simons

Address: 2736 S.E. 112th
Portland Ore. 97266

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Orlan E. Ice

Address:
ORLAN & Helen ICE
10636 NE Flanders
Portland 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Frank M Benham

Address: 12741 SE Salmon st portland ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Leona D. McNett

Address: 753 S.E. 139th Ave
Portland, Oregon 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Blanche Tallstrom

Address: 15834 S.E. Stark St.
Portland, Oregon
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Richard J Burgess

Address: 2625 SE 181Th R
Gresham OR
97030

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature:

Address:

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Frank Clays

Address: 13511 S.E. Taylor Ct.
Portland Oregon
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: James Faubion

Address: 305 N.E. 99th Ave
Portland, OR 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Cora L Jenkins

Address: 12741 S.E. Salmon
Portland, 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Laura J. Hopkins

Address: 12528 NE Russell Portland 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Alan C. Daugherty
Irene E. Daugherty

Address: 12015 SE ASH ST.
97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Frank J. Nelson

Address: 27-NE-94th Ave - Port. Ore. 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

We do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Wesley M. Kent + Alice D. Kent

Address: 255 NE 94th Ave.
Portland, Oregon - 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Edith M. Summerfield

Address: 109 N.E. 108th Ave
Portland Oregon 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: DENNIS GALLAGHER

Address: 2532 N.E. 131st AVENUE
PORTLAND, OR 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: W.A. Sherman, Jr.

Address: 14060 N.E. Eugene Ct.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Verna E. Kellar

Address: 12675 S.E. Main
Portland, Ore. 97233

I own two houses in Parkrose

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Maria Van Der Zandin

Address: 15749 S.E. Alder
Portland, Ore. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Helen Osborne

Address: 1335 N.E. 118th
Portland — 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Margaret Jurhs

Address:
1324 N.E 118th
Portland, Or.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: David D. Watkins

Address: 2631 S.E. 187th Pl.
Gresham, Ore 97030

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Marilyn Flinn Alfred Flinn

Address: 121 NE 108
Portland, Or
97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Norman Summerfield

Address: 109 N.E. 108 Ave. 254-7573
97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: L. C. Lee

Address: 3195 SE 126 Ct
Portland, OR 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mikel R. James

Address: 13041 S.E. Alder
Portland Ore.
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Betty L. Erwin

Address: 16308 SE. Stephens
Portland Or - 97233

August 23, 1984

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Calvin M. Wyatt

Address: 1715 S. E. 100th
Portland, Or. 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Virginia Seidel

Address: 14711 N.E. Knott Court
Portland, Ore.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Alan M. Peck

Address: 9005 S.E. 139
Portland
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Gene Coy

Address: 1154 S.E. 151st
Portland, Ore.
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Marguerite Leibham

Address: 3225 SE. 152nd Ave.
PDX 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Rita A. Barkett

Address: 3215 S E 152nd Ave
Portland 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 1757 S.E. 101st Ave.
Portland, OR 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: June Lettbaen

Address: 18943 S.E. Lincoln
Portland 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Dorothy J. Ball

Address: 12345 S.E. Main
Portland, Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Katherine L Gregg

Address: 2210 SE 138th
Portland, Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ali K. Partow

Address: 16701 S.E. Division #15
City 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Phyllis S. Laird

Address: 2212 S.E. 98 Ave.
Portland, Oregon 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Alphonse N. Bovet

Address: 18326 S.E. Brooklyn Ct
Gresham Oregon 97030

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Richard E. [illegible]

Address: 14430 S.E. [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs. Nellie Jeffrey

Address: 1620 N.E. 178th
Portland 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Earl D. Jeffrey

Address: 1620 N.E. 178th
Portland, Ore. 97220
252-8071

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Emily R. Grider

Address: 16901 S.E. Division sp42
Portland Ore 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Laura Frye

Address: 9921 S.E. Grant St.
Portland, Ore. 97216

August 23, 1984

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Wesley M Weygandt

Address: 9923 E. Burnside 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Henry H Hartt.

Address: 13724 S.E. - center
Portland Oregon

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: M. Partlow

Address: 16901 S.E. DIVISION SP15
CITY 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Dorothy Lambert

Address: 13156 S.E. Alder
Portland Ore 97233

(over)

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Lloyd Fulker

Address: 1148-SE 135th Ave

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: James D Littlemore

Address: 5929 S.E. 149th
Bellona Cir. 97236
761-5734

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature:

Address:
Portland 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Lucille J Sweetland

Address: 12530 SE Market St
Portland, Or 97233
254-6107

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Edward P. Sweetland

Address: 12530 SE Market St
Portland Or 97233
254-6107

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs. Mrs. William Coupal

Address: 13838 S.E. Taylor
Portland
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Leslie T. White

Address: 222 NE. 103rd
Portland, Oregon 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Helen H. White

Address: 222 N.E. 103rd Ave.
Portland, Oregon 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Kenneth E Bassett

Address: 98 NE 113TH
97220
254-0171

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 3239 S.E. [illegible]
[illegible] 97236

761-5734

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ms Maris Race

Address: 12291 SE SALMON ST
PORTLAND ORE
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mr Mrs Arnold Hawkins

Address: 4209 SE 136
Portland Oregon 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible] SE 176th Place
Portland Ore. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Robert E. Newton

Address: 13610 S.E. Clay
Portland, Oregon
97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 12421 NE Russell
254-5433

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: John F. Doyle

Address: 16410 SE STEPHENS CT.
PORTLAND 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 2950 SE [illegible]
131st.

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: William L. Kuhl
15132 S.E. Francis
Portland, Or. 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Wm. C. Headley

Address: 13137 S.E. Mill St.
Portland - 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Hal K Shade

Address: 2542 NE 196 drive
Portland - Oregon
97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Steven C Graves

Address: 12639 SE Sherman St
Portland Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ollie MURRAY

Address: 9704 SE ASH St
Portland Oregon 97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Ilana Kniss

Address:
1823 S.E. 131st
Portland, 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Hans N Johnson

Address: 10560 NE Davis
Portland 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mary L Frommelles

Address: 12124 SE Mill St
Portland - 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Earl Kniss

Address: 1823 SE 131 St.

August 23, 1984

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: William E. Erwin

Address: 16368 SE. Stephens
Portland Or. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature:

Address:

Brady A. Robinson
12739 S.E. Pine

Dan Hanks
2405 S.E. 132nd

[illegible]
10543 SE Market

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Carson C. Carter

Address: [illegible] Skidmore Ct.
97216

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible]

[illegible]
[illegible]

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: 16316 SE Stephens St
Portland Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Tom Hansen

Address: 10548 N.E. Davis
Portland Ore. 97220

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Richard Shindewolf

Address: 16308 SE Stephens
Portland Ore

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Doris McIlroy

Address: 17810 N.E. Everett Ct
Portland Ore 97230

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: [illegible]

Address: [illegible] SE 152nd
Port Ore 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Eleanor A. Burton

Address: 12675 S.E. Main
Portland, Ore. 97233

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

We do not want a seepage fuel it is not fair!!

Signature: Richard S. Hopman
Bertha E. Hopman

Address: 2547 SE 131st Ave
Portland Oregon 97236

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mary Jennings

Address: 17141 SE Stephens
Portland Ore
97233

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

C. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD IN ROOM 1400 OF THE YEON BUILDING ON SEPTEMBER 11, 1984

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuant to ORS 454.275 et. seq.

C. SUMMARY OF ORAL TESTIMONY FROM THE ENVIRONMENTAL QUALITY COMMISSION HEARING HELD IN ROOM 1400 OF THE YEON BUILDING ON SEPTEMBER 11, 1984

This summary is based on Department of Environmental Quality staff notes taken during the hearing.

1. Dean Welch, 1253 S.E. 139, Portland, Oregon 97233, is opposed to the installation of sewers in the affected area. He believes that the quickest way to correct the problem would be to bring in a new source of drinking water. He was also opposed to the meeting place (Room 1400, Yeon Building) because it is outside the affected area and hard to get to.

2. Lucille Bickford, 435 N.E. 131st Place, Portland, represented herself, her husband, and her neighbors and friends.

   She believes that sewers will eventually be needed, but she wants proof that she is contributing to the problem. She also raised the following questions: (1) What waters are being polluted? (2) Whose wastes are causing the problem? (3) What contaminants are present? and (4) Who made the analyses?

   She believes that there is conflicting information on the cost of sewers. She is also opposed to the seepage fee concept. Ms. Bickford asked to be placed on the mailing list for subsequent information.

3. Richard Lozo, 1717 N.E. 137th Ave., Portland, is opposed to construction of sewers based on the evidence presented. He has not experienced any problems with drinking water or with his cesspool. He believes that if a problem exists, the most economical way to solve the problem would be to find another source of drinking water. He also believes that people in the affected area should be able to vote on the issue of sewers. He also estimated that the cost per household could be about $3,900 per unit based on $216 million divided by the number of households in the affected area. He expressed concern about the potential air pollution associated with industrial development, if sewers were installed.

4. W. C. Peebler, 13848 S.E. Rhine, Portland, is a property owner, who wants the people in the affected area to have an opportunity to vote on the issue of sewers. He believes that installation of water mains to deliver water either from Bull Run or from a water treatment plant would be cheaper than to install sewers. He also believes that cost for sewers would make property unsaleable, and that reasonable definite cost for sewers has not been established.

5. Earl Wood, 13535 N. E. Schuyler, Portland, being retired, expressed concern that the cost of sewers is indefinite and likely excessive. He estimates that sewers would cost $10,000 per lot plus $1,000 to $2,000 for a hook-up fee. For such rates at 12.5 percent interest, it would cost him about $100 per month for the interest alone. His general view is that the people in the affected area don't need sewers at such costs. He suggests that if the upper layer of the aquifer is polluted, it doesn't mean that wells tapping deeper from within the aquifer would draw polluted water.

6. Virginia Purkey has lived in the original Parkrose area since 1957. She does not believe many people in her neighbothood--widows, widowers, and single parents with children--can afford from $10,000 to $12,000 for sewers. She also noted that there are added costs to abandon a cesspool and to reverse the plumbing before hooking-up to a sewer.

   She believes more research is needed to understand how soils reduce pollutants. She also believes the county should declare a moratorium on the use of non-biodegradable detergents and should eliminate the use of garbage grinders because these sources contribute to the problem.

   She felt that an alternative method for household sewage disposal would be the use of composting toilets. She reported that one real estate service was buying up homes on 122nd Avenue and renting them.

   She also identified a dilemma as follows: Areas having clay soils are unsuitable for subsurface disposal of waste, leading people to build where soils are rapidly draining, only to discover that these areas are also unsuitable for such disposal methods.

7. C. W. Norton, 419 N.E. 131st Place, Portland, emphasized that the issue to construct sewers should be voted on by the people.

8. Richard G. Peters, is a local builder for the past 35 years. He indicated that 99 percent of the homes with basements in the affected area have cesspools in the backyard. He noted that the installation of sewers would require not only digging up the streets but also the yards, driveways, and basements. Such projects would be extremely costly and be disruptive. He believes that few people can handle this type of indebtedness and that the issue of sewers should be voted on by the people.

9. Bill Lamb, 651 N. Tomahawk Is. Dr., Portland, has been a building contractor for the past 25 years. He agreed with Mr. R. G. Peters' testimony. He believes that the cause of the groundwater quality problem stems from the wide use of caustic soda to clear cesspools and septic tanks. He claims to have a biodegradable cleaner that has been effective in clearing cesspools and septic tank drainfields for the past 16 years. It was his contention that the groundwater quality problem could be alleviated by using his product, thereby eliminating the need for areawide sewers.

10. Louis Turnidge, 18144 S.E. Pine St., Portland, testified that the Department's staff report regarding 1,1-Trichloroethane, used in plumbing systems, was found only at about 1 part per billion in some wells. He believes that the sands and gravels worked very well in filtering wastes except for slippery substances such as solvents. He believes that the source of nitrates and sulfates in groundwater comes from fertilizers like ammonium sulfate.

11. Sharron Kelley, is President of the Rockwood Community Group. She identified two issues as follows: (1) She agrees that groundwater pollution exists in the affected area. She noted that the Community of Rockwood took up this issue which led to the sewering of the Burnside Corridor some years ago. She noted that Rockwood draws its water supply from deeper wells and thus has a lower nitrate-nitrogen content (ca. 2 parts per million); (2) She believes that the Commission should take a deeper look at the pollution level and the high cost to the people. She hopes that the future density development occurs along the Burnside Corridor where sewers are available.

12. Jean Hood, believes that the groundwater used for drinking water is good, and now is not the time to dispute the quality. She asked what the difference is between the sewage emanating from a garbage dump and from her cesspool. She believes Argay Terrace needs sewers because the subsoil drainage is poor. She blames the development of Argay Terrace on planners (imported from the East), who were unfamiliar with the area, and on builders for being allowed to build in Argay Terrace. She also noted that the residents already paid for sewers once but she did not know where the money ended up.

13. Herb Brown, submitted a petition from persons protesting the seepage fee, and written testimony concerning the inconvenience of the September 11, 1984, hearing location at the Yeon Building. He was also concerned about the source of pollutants since dye tests of cesspools were not performed, and soil core samples were not obtained to pinpoint the sources of pollution. He concluded that there may be pollutants present at scattered points but the sources are unknown.

14. Jeanne Orcutt, protested that this (Yeon Building) hearing location, which is 15 miles away, is not considered to be near the affected area. She suggests that this distance may be in violation of state law. She has submitted a number of documents for the record, including City of Portland Ordinances, statements, and maps. She believes the most economical method of solving the problem is to deliver Bull Run water to the few remaining people who rely on groundwater. She expressed concern that under the seepage fee concept, one can be charged more than the eventual sewer connection fee. She is also concerned with the "first source agreement" as not being in the best interest of Mid-County residents.

She raised the following questions:

a. What would be the effect on the water table if 14 MGD of waste water is withheld?

b. What is the effect of domestic animal wastes on the groundwater quality?

c. What is the impact of human burial on the groundwater quality?

15. Carl Halvorson, 105th Marx, Portland, supports the proposal to sewer the East County area but believes that the high cost will adversely affect many people. He believes that the problem needs to be resolved for future generations, with the least impact on the people in the affected area.

He suggested that greater support for the project should come from the region because the region will benefit from sewers in the affected area and thus should bear some of the cost. He noted that if sewers had been installed 15 years ago, the federal government would have paid for two-thirds of the project. He concluded that we have reached a point where we cannot continue pouring wastes into the ground.

16. Donald R. Cook, 2006 S.W. Sunset Blvd., Portland, agrees with comments of United Citizens in Action, and believes the most economical solution to the problem is to use Bull Run water. He also believes that the City of Portland's development of a well field may have been a bad investment.

17. Bonnie Luce, 2331 S.E. 174th Ave., Portland, Oregon, 97236, expressed concern that the cost of sewers will be a financial burden on the elderly, and may cause them to defer payment of their taxes. She believes that home values will be adversely affected, and only the affluent will be able to afford sewers. She also noted that the Columbia Basin is not identified in the 208 Basin Plan and may be illegal.

18. Robert Luce, 3441 S.E. 174th Ave., Portland, Oregon 97236, suggested that someone has been distorting the facts. He questioned that 14 MGD of sewage could be generated by the resident population in the affected area. He suggests that body wastes should be separated and disposed of separately from other waste water streams in the home, thereby lessening the adverse effects on groundwater quality. He further noted that most of the Mid-County residents work in Portland and deposit their sewage in the city system.

ELQ/ERL:lt
TL3686
Revised November 29, 1984

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

D. EXHIBITS ENTERED INTO THE RECORD AT THE SEPTEMBER 11, 1984, HEARING

1. Jean Hood, submitted a newspaper article "Woman's suicide in town stirs widespread repercussions", The Oregonian, September 9, 1984

2. Herb Brown, Chairman, United Citizens in Action, submitted:

   a. Statement objecting to the location of the hearing
   b. Petition against use of the Seepage Fee

3. Jeanne Orcutt, submitted:

   a. Newspaper Article, "Unpaid sewer assessments spur county to start foreclosure", The Oregonian, May 22, 1984

   b. Portland City Ordinances No. 148957, 148988, 149644, 150016, 150018, 150121, 152170, 141151, and 156349

   c. 1983-84 Consumption and billing records for local water districts

   d. Water purchase worksheets for local water districts.

   e. Maps of Portland's well fields; Portland's water system; and the Portland Metro Area Water Districts

   f. Poem "The Sewer Saga"

4. Donald R. Cook, written testimony

Woman's suicide in town stirs widespread repercussions

By WENDY LEE

BLAND, Mo. (UPI) — On a warm July morning Christial Branson sat amid the scattered debris of her life and ended a nightmare with a conflagration that awoke far more than the residents of this tiny farming community.

The 63-year-old leather cutter is remembered by her neighbors as a decent, caring, fiercely independent maverick with a fondness for African violets, movie stars and Harlequin romances.

In the end she was also a bitter woman gone mad, a powerless soul conquered by a state of affairs repugnant to her nature, and of which she felt she had no release but death.

Less than eight hours before she was to lose the home she loved in a public auction, she chose suicide because of a Missouri law geared to protect a business more than a home, a law that would force her to sell her house to pay for a $1,200 central air conditioner she already had paid for once in cash.

"It's a shame a person has to kill herself to wake us up (to the fact that) we have a very bad law," said Missouri legislator Dewey Crump.

Branson's nightmare began four years ago, in the fall of 1980, when she contracted to have central air conditioning installed in her home. When the job was completed, she paid the contractor and considered the matter closed.

It was not.

The contractor, Elmer Buehrlen, disappeared with the money and did not pay his supplier for the work. Under Missouri law, the supplier, Maciejewski Plumbing and Heating Co., exercised its right to file a lien action against Branson and collect through the sale of her house.

In later court proceedings, both Branson and the contractor won judgments against Buehrlen, whose whereabouts still remain unknown. Maciejewski was awarded a $1,200 judgment against Buehrlen for the materials and Branson won more than $17,000 in damages and attorney's fees.

But since Buehrlen was still at large, neither Maciejewski nor Branson could collect from him. Maciejewski, however, could collect from Branson.

The morning before her house was to be sold, Branson reached a decision: No one would take her home, absolutely no one.

Seated in a chair, she pitched a match into 25 gallons of gas, 30 quarts of motor oil, papers she accumulated over the past four years, a cord of wood, a few old tires and $30 worth of fireworks.

The blast knocked out neighborhood windows. Debris was scattered as far as four blocks away. She died at a Columbia, Mo., hospital a month later of the burns that covered nearly 85 percent of her body.

> "She had been hurt in her life, and she was afraid she would be hurt again."

Bland is a community of 700 about 90 miles west of St. Louis. Residents describe it as a close-knit town in which "everybody knows everybody else's business."

Many of the streets are made of dirt and bear no street signs. There's no need for addresses. You can find a person's home by just asking someone on the street.

With the July 9 explosion and fire, it was propelled into prominence. Reporters and camera crews quickly descended upon this once-obscure town in search of why this woman sought such a desperate end.

What they found was that no one was aware of the depth of Branson's mental anguish and of the ultimate, irreversible path she chose.

"She talked about (her situation) quite a bit, but I still didn't think anything would come of it," said Jodie Weeks, a friend who lives in nearby Jefferson City.

Most of the people who knew Branson remembered her as a hard-working woman who wanted nothing more than to be left alone. They also will tell you that she was wary of almost everyone, that she rarely let anyone venture past her doorstep and that she paid cash for everything she bought.

There was a softer side to her.

"She was a very caring person," Weeks said. "Everybody was friendly in a place like that."

Weeks was one of the select few allowed inside her friend's private sanctuary. She remembers pictures of horses that graced the walls of Branson's modest frame home, of a "what-not" shelf that housed figurines and other small items, and of the baskets of colorful flowers that she hung to adorn her home.

Branson liked going to garage sales, canning fruits and vegetables and passing her leisure time doing embroidery work. She loved watching movies on television and propping herself up in bed during the evenings to read romance novels, mysteries and autobiographies.

And, according to Weeks, she valued nothing more than her home and car.

"I think they were the most important things to her because she knew how hard it was to get them," Weeks said.

It took a year of saving and living in a trailer park before Branson had enough money to build her home.

"She had been hurt in her life, and she was always afraid she'd be hurt again," said Rose Rogers, a step-cousin.

As a teen-ager, she went to work at what then was the International Shoe Co. An unhappy marriage ended in divorce a few years later.

"Her husband was always wanting to do something at the farm, but he wasn't the best in the world to stay at the farm," Weeks said.

Branson occasionally confided in Weeks about her problems with the contractor, but while she knew her friend was worried about losing her house, she had no idea, as did anyone else, the concern was running so deep.

But in four suicide letters she left, the bitterness and frustration Branson had been harboring spewed forth in unleashed fury.

"The hassle of living just isn't worth the effort. Now is a good time to put an end to it all. Nothing worth living for anyway. I can't have anything no matter how hard I work," she wrote.

"Being blamed for what someone else does isn't new to me, either. But this is the time I'm not going to hand it over. I'll burn all and go in the fire myself. Then you thieving ------- can sift the ashes, or look elsewhere for the money you want.

"I signed a contract and I honored it. I paid for what I got once. I don't intend to pay again."

"She felt she had her back to the wall and that's just as far as she was going to go," said Bob McKee, a news editor for the Gasconade County Republican, which received one suicide letter.

D,2a

Fr Brown 9/11

September 11, 1984

United Citizens in Action object to the time and location of this, the second hearing held by the Environmental Quality Commission on the "threat to drinking water". We have received many calls from people who were unable to be here today because they had to work or because the location of this hearing made it impossible for them to attend. As we stated before, many of the people who reside in our area are older people, and although the Commission has stated that it is within the law by holding this hearing within the city of Portland, it is simply too great a trip for many older people. Some must rely on the bus for transportation and, due to the present constructing going on along the light rail, the Banfield freeway and sewer trunk installation, the trip would involve too many transfers and take too long. Many of our senior residents have not been to the city of Portland for years and are afraid of getting lost. We have all read in the newspaper about the purse snatchings, muggings and terrorism that takes place in Pioneer Square. We understand, that as a result, Pioneer Square is going to be closed at nights.

Herb Brown

Herb Brown, Chairman
UNITED CITIZENS IN ACTION
1546 S.E. 138TH AVENUE
PORTLAND, OREGON 97233
255-6478

From [illegible] 9/11

D, 2, b

D2b

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Norm Hansen 10598 NE Davis Portland Or

[illegible] 17810 NE [illegible] Portland Or

Richard [illegible] [illegible] NE [illegible] Portland, Or.

Charlotte [illegible] 10445 NE Davis Portland OR

[illegible] 10450 N.E. Davis 97220

Maria Kraus 1823 S.E. 131st Portland 97233

Earl Kraus 1823 SE 131 " "

Mary Fromueller 13134 SE Mill " 97233

[illegible] 13137 SE Mill " 97233

[illegible] 15847 SE STARK #18 " 97233

[illegible] Virginia [illegible] 14711 NE [illegible] Ct. [illegible]

[illegible] 12413 SE Mill St 2550785

[illegible] 2950 SE 131st. Portland OR [illegible]

[illegible] 11119 SE Stephens St Port Ore. 97233

[illegible] 435 NE 102nd PCY 97220

[illegible] 1924 S.E. 139th Ave. Portland, Ore.

[illegible] 44 N.E. 188 Port. 97230

[illegible] 44 N.E. 188 Portl 97230

[illegible] 13525 S.E. Mill St Portland 97233

[illegible] 12732 SE Wash. Ct. Portland 97233

Hal K. [illegible] 2542 NE 176 [illegible] Portland 97230

Violet L. Wyatt 1715 SE 100 Portland 97216

Calvin M. Wyatt 1715 S.E. 100 Portland 97216

John T. [illegible] 16410 SE STEPHENS CT. PORTLAND 97233

[illegible] 39 SE 109 Portland 97216

Mr + Mrs E. L. [illegible] 224 S.E. 90 Portland 97216

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Mr. & Mrs. W. Fiscla[illegible]	14724 SE Bush	Portland
Marjorie M. Shull	1840 N.E. 126 Pl.	Ptld Or. 97230
Henry H Harter	13724 S.E. Center	Port oregon
Frances Harter	13724 SE Center	" " "
Tom Garrett	4124 SE 136	Port Ore 97236
Charles Ottoboni	12720 SE Mill	Port Ore 97233
Evelyn Ottoboni	12720 SE Mill	Port. Ore 97233
[illegible]	1144 SE 151 Ave	Port 97233
Jane Coy	1154 S.E 151st	" "
Ken & Edna Barrett	98 NE 113th	Portland 97220
Evelyn Marcell	1330 SE 179th	Portland 97233
[illegible] Jorgensen	2407 NE 144th Ave	Port Or 97230
Laura Frye	9921 S.E. Grant court	Portland ore 97216
Gladys Mullan	9935 S.E. Grant Ct.	Portland, Ore. 97216
E. L. Alger	2246 SE 90 Av	Portland, OR 97216
Marian Alger	2246 S.E. 90 Ave.	Portland Or 97216
Wesley M. Kent	255 NE 94TH AVE.	" " 97220
Alice G. Kent	255 NE 94th Ave	" " 97220
Frank J. Nelson	27 NE - 94th Ave.	" " 97220
Ethel Nelson	27 N.E 94th	" 97220
Edward Sandstrom	43 N.E. 94th	" 97220
Dean E Welch	1253 S.E. 139th	" " 97233
Helen Ice	10636 N.E. Flanders	- - 97220
Allan Eby	10636 NE Flanders	- - 97220
Henry D Bolling	14232 NE Brazee	" " 97230
Larry Brockhart	14124 NE KNOTT	" " 97230

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

15847 SE [illegible] 2565652
Barbara Albright 7155 SE Harrison Port
Earl & Nelda Jeffrey 1620 N.E. 118th 97220
Helen [illegible] 1335 NE 118th Portland 97220
[illegible] NE [illegible] Pl [illegible] Ore 97230
Clarence Montgomery 237 NE 102 [illegible] Portland OR 97220
[illegible] 16507 SE Mill St Port. 97233
Leona G. McNett 753 SE 139th Portland, Oregon 97233
Pat Holcomb, 1020 NE 131st Pl. - Portland, OR 97230
Keith W Rollins 3230 SE 118 Portland, OR 97266
Peter M. Smith 13230 NE Sacramento Drive Portland, OR 97230
Frank Clegg 1354 S.W. TAYLOR CT. PORTLAND 97203

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Edna E. Race 12241 S.E. Salmon St. Portland Or.
[illegible] 1920 S.E. Madison — —
Margaret [illegible] 1334 NE 118th " "
[illegible] McCartney 738 SE 130th Portland Ore
Edna [illegible] 10331 S.E. Center, Portland Ore 97266
[illegible] 13321 S.E. Center Portland Or 97266
Dorothy M. Smith 13230 NE Sacramento Dr. 972
[illegible] 2625 SE 182nd Pl Gresham OR 97030

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Emery & Betty Denbo 2715 S.E. 141 st 97236 761-1
Louise Reikert 2929 SE 112 Portland 761-86
Stanley VanDerZanden 15749 S.E. Alder Portland ore 253-2
Mary VanDerZanden 15749 S.E. Alder Portland 253-
Blanche Tollstrom 15834 S.E. Stark St Portland 2535
Stephen M. Davis 12441 N.E. Morris Portland 255-
Jean M. Davis 12441 NE Morris Portland
Wilma A. Wehmeier 3114 SE 134th Portland 761-7581
Adrienne M. Meyer 13110 SE Alder Portland 97233 252-36
Walt Meyer 13110 SE Alder Portland 97233 252-36
Ruth Jensen 3808 S.E. 130 97236 761-966
Jacob H. Jensen 3808 SE 130th 97236 761-9666
Margaret Jurbs 1324 N.E. 118 97220 253-1658
Helen Osborn 1335 N.E. 118th 97220 254-3765
Cliff D Kruger 13740 SE Center 97236 761-0426
Linda Kruger 13740 SE Center 97236 7610426
Linda E. Squires 824 S.E. 139 97233 253-10
Leina G McNett 753 SE 139th 97233 254439
Jolean McCartney 738 SE 139th 97233 253-163
Wayne D McCartney 738 SE 139th 97233 253 163
Thomas P. [illegible] 11121 NE Halladay 97230 252-57
Alana J. Eckert 13848 S.E. Rhine 97236 761-8418
W C Peebles 13848 SE Rhine 97236
Ruby Eckert 13848 SE Rhine 97236
Henry H Harter 13774 SE Center 97236 761315
Frances Harter 13774 SE Center 97236 - 1

Called later - Thursday - 9 pm
Jack Ambrose
760-1644

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Bob Luce	3441 S.E. 174	761-5209
[illegible]	4201 N.W. 3rd ST 97233	666 1161
[illegible] Hand	2134 SE 174	761-8865
Robert E [illegible]	2215 SE 154th	761-8303
Marian & Robert [illegible]	1360 SE Clay	255-0499
Marion A. Atkins	2915 SE 1?th	761-1978
Billie E. Atkins	"	"
Leila L Atwood	2123 SE 101	253-1032
Kitty M. McCord	2080 SE. 101	254-2455
[illegible] L. Beard	1633 SE 138th	256-1605
Merle Collins	1314 S.E. Salmon	253-6591
Ruth Collins	1314 SE Salmon	253-6591
Glenda Bitney	18029 S.E. Pershing Ct.	760-4740
Robert Bitney	18029 SE Pershing Ct	760-4740
[illegible]	2111 SE 139	254-2916
Janet Boyd	4734 SE Sherman	223-2981
R. A. Pelton	3845 S.E. 136 Ave.	761-2685
Robert Miller	12310 S.E. Bush	761-5730
Marie Miller	12310 NE Bush St	761-5730
Melvin Halvas	1812 S.E. OAK ST.	235-0800
Marie Beckert	13209 SE Alder	257-9386
Douglas M. Kelsay	13529 S.E. Clay	254-3089
Pat Holcomb	1020 N.E. 131st Pl	254-7057
Martin Stevens	14702 SE Rhone	760-3808
Marion Schmidt	13525 S.E. Mill St.	253-4196
Barbara Albright	15841 SE Stark - Apt 18	2565652
Helen Coverdill	2317 S.E. 135 Ave	2539589

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Robert A Mayr 13746 SE RHONE, 97236 761-0772
John Elkkema 11430 SE Hawthorne 97216 255-5173
Dick A. Deppema 13626 SE Taylor 97233 253-4893
[illegible] 250 SE 139 97233 - 253-6608
[illegible] Johnson 1821 S.E. 174th 97233
George Harshel 2535 S.E. 89 97266 774-0344
James E Craft 14115 SE Harrison 97233 253-5844
Lewis B. Timmons 11800 S.E. Rhone St 97266 761-3005
Frances O. Timmons 11800 SE Rhone 97266 761-3005
Charles C. Ferrera 14021 SE Harrison 97233 255-1895
Carmen J. Embree 1531 SE 143rd 97233 254-5963
Robert J. Embree 1531 SE 143" 97233 254-5963
Dorothy M Smith 13230 NE Sacramento Dr 97230 254-7560
Peter M Smith 13230 NE Sacramento Dr 97230 254-7560
F Tupper 14040 SE Mill St. 97233
L [illegible] Hays 3537 SE 128th 97236 761-6784
P.C. Murphy 3612 SE 128th 761-7677
Eldon E. Edwards 1107 S.E. 112th 252-4702
[illegible] Conwell 10020 SE GRANT 97216 254-9814
Courtney A Allen 2223 SE 101st 97216 256-9906
Lee Yehmer 8222 S.E. 162nd Ave. 97236 760-8787
David G. Osmundson 14636 S.E. Bush St. 97236 760-2220
[illegible] 13909 SE CENTER 97236 760 1355
[illegible] 2157 SE 136th Place 97233 253-7714
Wm A. Ramcke 1431 SE 143rd 97233
Eunice Marlen Maler 14600 SE Powell 97236

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Barry McKnight 1617 NE 140; Ptld 97230 253-1677
Steven O. Whitmore 11506 NE Siskiyou PTLD 97220
Stephannie Starcourt 11506 NE Siskiyou PTLD 97220
Herb Brown 15465 E 138 Ave 255647?
Pat Brown " " "
George Muir
Keith Robbins
Don McIntyre
Elsie Chiodo
Rep. Annette Farmer
Comm. Gordon Shadburne
Staff Cynthia Hubbard
M.C.A. John Yondell

WE, THE UNDERSIGNED, OPPOSE THE USE OF THE SEEPAGE FEE BECAUSE IT IS AN ASSESSMENT OR "TAX" THAT FORCES US TO PAY FOR A "SERVICE" THAT WE MAY NOT RECEIVE FOR 20 YEARS OR MORE. IT IS A PENALTY FOR USING OUR CESSPOOLS AND SEPTIC TANKS WHEN THERE IS NO ALTERNATIVE AVAILABLE.

Walter W Hota 131 SE 108 97216 252-2093
Willard Burnett 1916 SE 130 97233 Portland Ore
Dick & Lea Bragg 2625 SE 187th Ave Gresham

Orcutt 9/4

John Bopp
Richard Margaret Sellers

2ME 4M THE OREGONIAN, TUESDAY, MAY 22, 1984

Unpaid sewer assessments spur county to start foreclosures

By MALCOLM BOYD
Correspondent, The Oregonian

Visions of booming real estate developments on Mount Hood have turned to a bad dream for nine property owners in the Mount Hood corridor.

Clackamas County officials have begun foreclosure proceedings against 39 parcels of land because sewer assessments have gone unpaid to the county-operated Hoodland Service District.

The nine property owners to whom the parcels are registered have not paid any of their regular assessment installments since the Hoodland sewer service district was formed in the summer of 1982.

For the 39 parcels, past-due assessments amount to $322,766 of a total construction cost of $1,656,833, said Van F. Zitek, operative services administrator for the county. Individual back assessments range from $990 up to $118,303 on nearly 300 acres. Assessments for the cost of the sewers range from $3,853 to $160,000.

"Because they have not responded to our warnings that these installments, overdue for over a year, must be paid, we have now demanded these property owners make an 'accelerated payment' of their total sewer assessment," Zitek said.

"That means they have to pay their entire assessment obligation immediately, or we will start proceeding to sell their property.

"We have sent them warning letters, and we have contacted them personally by phone," Zitek said. "Now, under the law, we must proceed with foreclosure. Demanding accelerated payment is one step in the process."

Most of the property involved is in the Cedar Ridge area of Brightwood, which has been attractive to real state developers because of its proximity to U.S. 26 and the Salmon River.

But the Mount Hood real estate market fell flat and died just as the Hoodland Service District was formed two years ago, and the district had trouble collecting assessments.

The Hoodland Service District was absorbed into Clackamas County Service District 1 early this year. But the county was not legally free to begin foreclosure proceedings until a year of continuous delinquencies had expired. The first warning letters were sent out three months ago, Zitek said.

"We had 25 property owners delinquent then, and now we have narrowed it down to nine," he said.

Despite the assessments that the Cedar Ridge property owners are obligated to pay, the area still is not served by a sewer line, and the nearest hookup points would be at one of two district stub lines, Zitek said.

"One is near the intersection of Miller Road and U.S. 26, and the other is along U.S. 26 about 2,000 feet east of its western intersection with the Mount Hood Loop highway," he said.

The cost of joining any property with one of these lines would have to be borne by the property owner, and the cost is not covered by the sewer district assessment, he said.

"We are paying $32,000 in sewer assessments, and we can't even flush a toilet," said John Bopp, who owns 6.2 acres and owes $6,370 in back assessments and $32,000 as his share of the total cost.

"As far as our property is concerned, we wouldn't mind paying the assessment if we really had reasonable access to a sewer line. But as it is, it's two miles from our property and we can't use it."

Bopp said that he and other Cedar Ridge-area property owners have been considering taking legal action against the county.

"But we are wondering if it would be worthwhile," he said. "You know, when you go up against the county on something like this, it can be very expensive for a private citizen."

Richard and Margaret Sellers also are considering legal action over their $217,200 assessment. They owe $55,800 in back payments, according to the Clackamas County records.

"We have 25 acres, but we were going to use all of the 100 sewer connections we were allowed in the front 10 acres that face the Rippling River/Bowman's Golf Course," Sellers said. "We had arranged to sell the property for $1 million, but then the county came along and declared that 4 or 5 acres of it were part of a newly discovered 'wetland' and that we couldn't develop that part.

"That, in reality, meant we couldn't develop the property as we had planned at all, and there is no way we could pay the county's sewer assessment," Sellers said.

D3a

D36

ORDINANCE No. 148957

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the Pleasant Home Water District for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.
2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to changes in language but not substance, to each of the existing and potential purchasers of Bull Run water for their approval and execution.
3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.
4. The Pleasant Home Water District Board approved and executed on September 19, 1979 said contract from the City of Portland, marked Exhibit A, attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Mayor is hereby authorized to accept and execute the contract with Pleasant Home Water District for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, DEC 26 1979

Mayor of the City of Portland

Commissioner Ivancie
C. Goebel/lo
December 12, 1979

Attest:

Auditor of the City of Portland

ORDINANCE No. 148988

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the Hazelwood Water District for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.
2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to changes in language but not substance, to each of the existing and potential purchasers of Bull Run water for their approval and execution.
3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.
4. The Board of the Hazelwood Water District approved and executed on December 13, 1979 said contract from the City of Portland, marked Exhibit A, attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Mayor is hereby authorized to accept and execute the contract with Hazelwood Water District for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council,

Mayor of the City of Portland

Commissioner Ivancie
C. Geobel/lo
December 19, 1979

Attest:

Auditor of the City of Portland

ORDINANCE No. 149644

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the Rose City Water District for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.
2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to changes in language but not substance, to each of the existing and potential purchasers of Bull Run water for their approval and execution.
3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.
4. The Board of the Rose City Water District approved and executed on April 8, 1980, said contract from the City of Portland, marked Exhibit A, attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Commissioner-in-Charge of the Bureau of Water Works and the Auditor are hereby authorized to accept and execute the contract with Rose City Water District for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, MAY 21 1980

Mayor of the City of Portland

Commissioner Ivancie
Carl Goebel/lo
April 14, 1980

Attest:

Auditor of the City of Portland

ORDINANCE No. 150016

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the Rockwood Water District for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.
2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to changes in language but not substance, to each of the existing and potenital purchasers of Bull Run water for their approval and execution.
3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.
4. The Board of the Rockwood Water District approved and executed on May 10, 1980 said contract from the City of Portland, marked Exhibit A, attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Commissioner-in-Charge of the Bureau of Water Works and the Auditor are hereby authroized to accept and execute the contract with Rockwood Water District for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, JUL 16 1980

Commissioner Ivancie
C. Goebel/lo
July 10, 1980

Mayor of the City of Portland

Attest: George Yuhnick

Auditor of the City of Portland

A RESOLUTION authorizing execution of agreement between Rockwood Water District and City of Portland relating to the sale and purchase of domestic water.

BE IT RESOLVED by the Board of Commissioners of the Rockwood Water District that:

SECTION #1:

THE PRESIDENT and SECRETARY be, and they hereby are authorized to execute that certain Agreement between Rockwood Water District, "PURCHASER", and CITY OF PORTLAND, "CITY", June 30, 1980, a copy of which is marked exibit "A", attached hereto and by this reference incorporated herein:

INTRODUCED and adopted this 30th day of June 1980.

ROCKWOOD WATER DISTRICT
Purchaser

Donald L. Marshall

Chairman
Title

Attest Mike Weatherley

Secretary
Title

ORDINANCE No. 150018

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the Powell Valley Road Water District for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.

2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to change in language but not substance, to each of the existing and potential purchasers of Bull Run water for their approval and execution.

3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.

4. The Board of the Powell Valley Road Water District approved and executed on July 9, 1980, said contract from the City of Portland, marked Exhibit A attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Commissioner-in-Charge of the Bureau of Water Works and the Auditor are hereby authorized to accept and execute the contract with Powell Valley Water District for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, JUL 16 1980

Mayor of the City of Portland

Commissioner Ivancie
C. Goebel/lo
July 10, 1980

Attest: George Yerkovich

Auditor of the City of Portland

ORDINANCE No. 150121

An Ordinance authorizing the acceptance and execution of a contract between the City of Portland, Bureau of Water Works, and the City of Gresham, for the sale of a firm supply of surplus water for a twenty-five year period, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Resolution No. 32479 approved on August 2, 1979 by the City Council, authorized the Water Bureau to seek twenty-five year contracts with existing and potential purchasers of Bull Run water.
2. The Commissioner-in-Charge of the Bureau of Water Works was authorized to sign and send copies of the contract, subject to changes in language but not substance, to each of the existing and potential purchasers of Bull Run water for their approval and execution.
3. As a result of a meeting between the Portland City Attorney and attorneys representing major users of the Bull Run system, revisions in language but not substance were incorporated in the contract.
4. The Board of the City of Gresham approved and executed on July 1, 1980 said contract from the City of Portland, marked Exhibit A, attached to the original only.

NOW, THEREFORE, the Council directs:

a. The Commissioner-in-Charge of the Bureau of Water Works and the Auditor are hereby authorized to accept and execute the contract with the City of Gresham for the sale of a firm supply of surplus water for a twenty-five year period.

b. The contract effective date shall be the date the ordinance is approved by Council.

Section 2. The Council declares that an emergency exists in order to commence with planning to preserve the public health and safety of the City of Portland and its water purchasers; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, JUL 30 1980

Mayor of the City of Portland

Commissioner Ivancie
C. Goebel/lo
July 24, 1980

Attest: George Yerkovich

Auditor of the City of Portland

ORDINANCE No. 152170

An Ordinance accepting a Bill of Sale from Gilbert Water District for water service lines and meters, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Areas in the Gilbert Water District have been annexed to the City of Portland.

2. Said District, pursuant to the resolution of its Board of Commissioners, has executed a Bill of Sale from District conveying title to the City of Portland of water service lines and meters within the Gilbert Water District.

3. Consideration for the transfer of the water service lines and meters to the City of Portland is the assumption by the City of the responsibility for maintenance of same.

NOW, THEREFORE, the Council directs:

a. The Mayor is hereby authorized to accept on behalf of the City of Portland a Bill of Sale from Gilbert Water District, attached to the Original only, marked Exhibit "A".

Section 2. The Council declares that an emergency exists in that transfer of title to the water service lines and meters should be made as soon as possible; therefore, this Ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, AUG 26 1981

Mayor Ivancie
August 17, 1981
Jean L. Bostwick:py

Attest: George Yerkovich

Auditor of the City of Portland

ORDINANCE NO. 141151

An Ordinance amending Ordinance #140034 which authorized the Portland Water Bureau to commence negotiations, and to execute long-term agreements with certain Public Water Districts and Cities for the sale of a firm supply of surplus water to change the form of agreement to remove certain provisions and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds that pursuant to Ordinance #140034, the Water Bureau has been negotiating long-term agreements for the sale of a firm supply of surplus water with certain Public Water Districts and Cities; that based on those negotiations, the Water Bureau has recommended certain amendments to the form of agreement authorized by Ordinance #140034 as follows:

1. That the paragraph relating to increases in future water rates and system development charges be expanded to provide that the future increase to Purchaser will be fair and reasonable in relation to increases inside the City.

2. That the reference to Purchaser maintaining its present level of purchases from City at a certain ratio be clarified.

3. That the effective date of the contracts be changed from October 1, 1975 to April 1, 1976.

A copy of the form of agreement now proposed for execution is marked Exhibit A, attached to the original only of this ordinance and by this reference made a part hereof.

NOW, THEREFORE, Ordinance #140034 is hereby amended by substituting for the form of agreement attached to that Ordinance, the form of agreement attached hereto as Exhibit A. The Mayor and the Commissioner in charge of the Bureau of Water Works are authorized to execute on behalf of the City, agreements substantially in that form, and to execute on behalf of the City amendments to contracts already entered into under Ordinance #140034 to conform those agreements to this ordinance, to the end that all neighboring cities and water districts contracting with the City will be treated equally.

Section 2. Inasmuch as this ordinance is necessary for the immediate preservation of the public health, peace, and safety of

ORDINANCE No.

the City of Portland in this: In order that the agreements may be entered into without undue delay, therefore an emergency hereby is declared to exist and this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, JAN 14 1976

Commissioner Ivancie
DN:mb
January 14, 1976

Mayor of the City of Portland

Attest:

Auditor of the City of Portland

ORDINANCE NO. 156349

An Ordinance amending Contract No. 15690 between the Parkrose Water District and the City of Portland to provide for the sale of additional surplus water and a new water connection, under certain conditions, authorizing execution, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. Contract No. 15690, authorized by City Council and effective April 1, 1976, authorized the City of Portland to sell and the Parkrose Water District to purchase a firm supply of surplus water for a ten year period.

2. The contract stipulated the amount of water and the connections through which it would be supplied by the City of Portland, such water being a minor portion of the total water supplied within the Parkrose Water District.

3. The Parkrose Water District is now desirous of purchasing additional water than that allowable under the terms of the contract, and making a new connection to the City's water system to serve its remaining customers and the annexed City customers it serves with Bull Run water.

4. Pursuant to the terms of Section 3 of Contract No. 15690, Parkrose can and has petitioned the City for an increased water allocation for a one (1) year period.

5. The City's annexation program has resulted in major annexations and withdrawals of areas and customers previously in the Parkrose Water District.

6. The Parkrose Water District and the City of Portland have entered into an intergovernmental agreement which provides a process for orderly withdrawal of additional annexed areas from the Parkrose Water District, transfer of water service to the City and the eventual dissolution of the District.

7. The Bureau of Water Works recommends and the Commissioner-in-Charge concurs that Contract No. 15690 be amended as outlined in Exhibit A, attached to the original only, that Parkrose Water District be allowed to make a new connection to the City's system and to purchase one hundred (100%) percent of its water from the City until July 1, 1985, without penalty until the outcome of annexations within the District boundaries is known.

ORDINANCE No.

NOW, THEREFORE, the Council directs:

a. The Mayor and City Auditor are hereby authorized to accept and execute the Amendment to Agreement No. 15690, marked Exhibit A and attached to the original only.

b. The amendment effective date shall be the date the ordinance is passed by the City Council.

Section 2. The Council declares that an emergency exists in order to continue with planning to preserve the public health and safety of the City of Portland and its water purveyors; therefore, this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, AUG 1 1984

Mayor Ivancie
July 25, 1984
SS:ca

JEWEL LANSING
Auditor of the City of Portland
By Edna Carew
Deputy

ORDINANCE NO. 141151

An Ordinance amending Ordinance #140034 which authorized the Portland Water Bureau to commence negotiations, and to execute long-term agreements with certain Public Water Districts and Cities for the sale of a firm supply of surplus water to change the form of agreement to remove certain provisions and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds that pursuant to Ordinance #140034, the Water Bureau has been negotiating long-term agreements for the sale of a firm supply of surplus water with certain Public Water Districts and Cities; that based on those negotiations, the Water Bureau has recommended certain amendments to the form of agreement authorized by Ordinance #140034 as follows:

1. That the paragraph relating to increases in future water rates and system development charges be expanded to provide that the future increase to Purchaser will be fair and reasonable in relation to increases inside the City.

2. That the reference to Purchaser maintaining its present level of purchases from City at a certain ratio be clarified.

3. That the effective date of the contracts be changed from October 1, 1975 to April 1, 1976.

A copy of the form of agreement now proposed for execution is marked Exhibit A, attached to the original only of this ordinance and by this reference made a part hereof.

NOW, THEREFORE, Ordinance #140034 is hereby amended by substituting for the form of agreement attached to that Ordinance, the form of agreement attached hereto as Exhibit A. The Mayor and the Commissioner in charge of the Bureau of Water Works are authorized to execute on behalf of the City, agreements substantially in that form, and to execute on behalf of the City amendments to contracts already entered into under Ordinance #140034 to conform those agreements to this ordinance, to the end that all neighboring cities and water districts contracting with the City will be treated equally.

Section 2. Inasmuch as this ordinance is necessary for the immediate preservation of the public health, peace, and safety of

ORDINANCE No.

the City of Portland in this: In order that the agreements may be entered into without undue delay, therefore an emergency hereby is declared to exist and this ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, JAN 14 1976

Commissioner Ivancie
DN:mb
January 14, 1976

Mayor of the City of Portland

Attest:

Auditor of the City of Portland

1983-84 CONSUMPTION - WATER DISTRICTS

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
GILBERT	4,280	88	4,287	6,766	-2,133	4,213	3,164
GNR	165	147	189	196	171	160	174
GREEN VALLEY	23	18	15	18	15	16	20
GRESHAM	171,171	146,403	182,575	157,626	119,705	123,580	111,850
HAZELWOOD	84,342	76,750	124,040	69,645	27,830	73,515	75,654
HIDEAWAY HILLS	133	105	131	103	81	83	84
LORNA	832	821	985	825	681	702	690
LUSTED	8,414	4,701	10,916	6,860	1,941	11,696	11,304
PLEASANT HOME	6,814	2,385	7,071	5,863	4,243	4,307	4,531
POWELL VALLEY	131,528	128,959	156,064	131,302	103,162	103,976	119,283
ROCKWOOD	214,739	191,274	240,200	210,906	171,805	169,615	187,427
SKYVIEW ACRES	315	300	634	703	531	227	220
WESTSIDE	130	121	76	130	113	119	156
SUBTOTAL 1000'S	622,886	552,072	727,183	590,943	428,145	492,209	514,557
CLACKAMAS							
MILWAUKIE	4	-41	1		-54		
PALATINE HILL	8,044	15,299	12,305	8,181	6,793	5,747	8,053
ROSE CITY	27,576	33,409	34,496	30,129	32,159	34,106	40,235
WICHITA	5,476	4,781	6,169	4,969	4,003	4,600	3,810
SUBTOTAL 2000'S	41,100	53,448	52,971	43,279	42,901	44,453	51,098
LAKE GROVE	9,824	14,131	11,482	10,043	10,516	9,585	11,554
METZGER	74,581	110,074		134,700	44,949	523	7,103
SYLVAN	12,249	16,079	9,363	12,972	14,256	4,159	15,342
TIGARD							
VALLEY VIEW	4,296	7,740	4,869	5,520	3,740	2,364	5,258
WEST SLOPE	45,355	63,012	67,703	49,879	52,558	52,341	27,778
WOLF CREEK	138,370	190,069	175,915	134,282	147,995	162,947	152,355
SUBTOTAL 3000'S	284,675	401,105	268,332	346,396	274,014	231,719	219,490
BARBER	46	43	42	47	47	54	46
BEDFORD PARK	268	296	282	275	224	247	279
BURLINGTON	1,037	1,749	1,433	1,466	1,813	2,252	3,435
COMMUNITY	5,577	5,174	6,459	5,336	4,773	4,664	5,118
DARLINGTON	2,161	2,040	2,718	1,728	1,827	2,019	1,646
EAST 72ND ST.	23	15	51	23	20	22	65
PARKROSE	-52	-44	-1,907	-252	-25	-1,164	-231
SUBTOTAL 4000'S	9,060	9,293	9,078	8,617	8,679	8,094	10,358
METZGER						98,100	74,264
RALEIGH	11,007	43,534	0	37,113	21,469	20,366	22,067
TUALATIN						23,074	50,802
WOLF CREEK	209,906	213,061	391,296	239,171	257,098	221,350	247,907
SUBTOTAL 5000'S	220,913	256,595	391,296	276,284	278,567	361,890	394,960
TOTAL-WTR DST	1,178,634	1,272,513	1,448,860	1,265,519	1,032,306	1,138,365	1,190,463

FEBRUARY	MARCH	APRIL	MAY	JUNE	TOTAL
555	3,194	3,394	-1,576	4,340	30,572
201	212	177	131	146	2,069
30	21	18	17	18	229
142,048	109,367	131,815	117,094	126,117	1,639,351
119,015	84,779	79,407	96,141	99,596	1,010,714
107	84	99	88	103	1,201
982	688	826	550	723	9,305
4,522	2,002	3,201	5,038	10,454	81,049
6,271	4,403	4,691	4,030	4,433	59,042
131,367	98,547	90,765	108,748	72,266	1,375,971
232,605	176,650	182,093	174,203	106,970	2,258,487
370	188	203	189	234	4,114
210	149	138	146	65	1,553
638,295	480,286	496,827	504,799	425,465	6,473,657
	1				1
	1				-89
5,163	6,190	5,585	3,385	8,882	98,617
31,511	28,989	28,819	32,545	33,175	387,150
5,711	3,770	3,343	5,580	3,728	54,940
42,385	38,941	37,747	46,511	45,785	540,619
10,039	7,026				94,200
30	33	38	25,131	40	347,302
10,420	2,250	9,927	16,196	4,896	121,009
			51,230		51,230
3,069	3,293	3,328	3,715	3,703	49,695
49,662	54,575	50,065	52,524	59,184	625,637
118,069	99,647	89,078	64,692	57,555	1,530,973
191,288	165,824	154,337	207,488	125,378	2,870,046
37	40	63	32	44	542
312	228	186	191	242	3,030
2,617	4,533	4,658	4,926	6,550	36,483
6,389	5,096	4,439	5,219	5,156	63,400
2,244	2,002	1,453	1,971	1,738	23,447
35	19	17	20	25	335
-1,481	-138	-130	-141	0	-5,565
10,153	11,780	10,686	12,119	13,755	121,672
62,665	44,969	44,700	42,599	70,615	471,912
17,178	18,267	18,620	18,133	20,665	248,459
42,860	47,299	42,047	42,029	61,522	314,633
217,634	259,318	260,681	286,590	351,363	3,155,275
340,337	389,853	386,048	389,351	504,185	4,190,279
1,222,448	1,086,684	1,085,645	1,160,268	1,114,568	14,196,273

1983-84 BILLINGS WATER DISTRICT

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	SUB-TOTAL
GILBERT	$1,320.49	($370.50)	$1,279.50	$1,507.50	($72.29)	$929.40	$4,594.10
GNR	$55.00	$48.82	$60.31	$62.34	$55.09	$51.90	$333.46
GREEN VALLEY	$10.75	$9.37	$8.20	$9.07	$8.20	$8.49	$54.08
GRESHAM	$51,566.60	$43,006.83	$53,162.05	$45,926.84	$34,929.75	$35,357.50	$263,949.57
HAZELWOOD	$25,509.33	$22,568.95	$36,179.10	$20,403.21	$17,508.90	$21,496.16	$143,665.65
HIDEAWAY HILLS	$49.80	$41.24	$47.89	$39.77	$33.39	$33.97	$246.06
LORNA	$263.80	$255.03	$299.85	$253.45	$211.69	$217.78	$1,501.60
LUSTED	$2,606.05	$784.17	$3,247.49	$2,071.25	$644.74	$3,473.69	$12,827.39
PLEASANT HOME	$2,058.40	$1,388.72	$2,064.79	$1,714.47	$1,244.67	$1,263.23	$9,734.28
POWELL VALLEY	$39,722.20	$37,960.40	$45,521.44	$38,341.08	$30,083.80	$30,417.59	$222,046.51
ROCKWOOD	$64,662.90	$56,102.22	$69,859.20	$61,363.94	$50,024.65	$49,389.55	$351,402.46
SKYVIEW ACRES	$104.40	$98.22	$193.76	$213.77	$163.89	$75.73	$849.77
WESTSIDE	$41.10	$37.60	$24.14	$39.80	$34.87	$36.61	$214.12
SUBTOTAL 1000'S	$187,970.82	$161,931.07	$211,947.72	$171,946.49	$134,871.35	$142,751.60	$1,011,419.05
CLACKAMAS	$59.20	$55.50	$55.50	$59.20	$55.50	$55.50	$340.40
MILWAUKIE	$26.13	$1.84	$23.05	$24.05	($4.45)	$22.55	$93.17
PALATINE HILL	$4,132.93	$7,687.50	$6,189.43	$4,128.50	$3,434.50	$3,050.00	$28,622.88
ROSE CITY	$14,437.99	$16,783.05	$17,346.42	$15,163.00	$16,177.97	$17,153.99	$97,062.42
WICHITA	$2,906.72	$2,458.76	$3,140.00	$2,543.70	$2,057.00	$2,355.50	$15,461.68
SUBTOTAL 2000'S	$21,562.97	$26,986.65	$26,754.42	$21,918.45	$21,720.52	$22,637.54	$141,580.55
LAKE GROVE	$6,943.83	$9,914.25	$8,059.95	$7,052.65	$7,383.75	$6,732.05	$46,086.48
METZGER	$52,638.48	$77,152.40		$94,451.77	$31,562.32	$565.11	$256,370.08
SYLVAN	$8,313.30	$10,838.29	$1,199.13	$8,785.86	$9,676.52	($772.40)	$38,040.70
TIGARD	$55.00	$59.20	$55.50	$55.50	[illegible]	$61.05	[illegible]
VALLEY VIEW	$3,036.56	$5,427.50	$3,414.99	$3,873.90	[illegible]	$1,451.72	[illegible]
WEST SLOPE	$32,166.84	$44,163.90	$47,451.30	$34,270.85	$36,846.10	$36,699.75	[illegible]
WOLF CREEK	$98,337.00	$133,419.70	$123,536.23	$94,368.40	$103,867.50	$114,471.00	[illegible]
SUBTOTAL 3000'S	$201,491.01	$260,975.64	$183,717.10	$242,858.88	[illegible]	$159,208.22	$1,250,401.?5
BARBER	$40.88	$39.84	$37.45	$41.45	$41.43	$47.44	$248.51
BEDFORD PARK	$227.94	$242.96	$231.10	$225.50	$184.70	$203.65	$1,315.85
BURLINGTON	$868.55	$1,429.40	$1,160.74	$1,182.20	$1,444.60	$1,316.36	$7,402.??
COMMUNITY	$4,668.11	$4,193.98	$5,203.95	$4,308.00	$1,982.55	$3,769.37	$24,125.96
DARLINGTON	$1,817.68	$1,662.71	$2,196.95	$1,406.45	$1,484.15	$1,637.75	$10,205.69
EAST 72ND ST.	$21.19	$14.27	$42.90	$20.50	$18.10	$19.91	$136.87
PARKROSE	$50.34	$64.53	($1,432.10)	($108.10)	($24.90)	($837.70)	($2,287.??)
SUBTOTAL 4000'S	$7,694.69	$7,647.69	$7,440.99	$7,076.00	$5,150.65	$6,657.28	$41,667.30
METZGER						$31,383.54	$31,383.54
RALEIGH	$3,708.95	$14,860.86		$10,041.26	$7,462.12	$6,885.29	$42,958.48
TUALATIN						$9,642.68	$9,642.68
WOLF CREEK	$69,201.79	$72,505.75	$133,129.29	$81,406.79	$87,501.97	$75,356.52	$519,102.11
SUBTOTAL 5000'S	$72,910.74	$87,366.61	$133,129.29	$91,448.05	$94,964.09	$123,268.03	$603,066.81
TOTAL-WTR DST	$491,630.23	$564,907.66	$562,989.52	$535,247.87	$448,857.65	$454,522.73	$3,059,155.??

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	TOTAL
GILBERT	$1,333.65	($206.51)	$961.55	$710.25	$308.03	$997.50	$8,698.57
GNR	$55.96	$64.34	$66.98	$56.83	$43.49	$47.84	$668.90
GREEN VALLEY	$9.65	$12.94	$9.94	$9.07	$8.78	$9.07	$113.53
GRESHAM	$32,651.80	$41,430.76	$31,931.73	$38,141.65	$34,172.56	$36,789.23	$479,067.30
HAZELWOOD	$22,145.96	$34,742.60	$24,793.41	$23,235.08	$28,088.39	$29,090.34	$305,761.43
HIDEAWAY HILLS	$34.26	$41.92	$34.26	$38.61	$35.42	$39.77	$470.30
LORNA	$214.30	$300.40	$213.72	$253.74	$173.70	$223.87	$2,881.33
LUSTED	$3,360.01	$1,401.43	$662.43	$1,010.14	$1,542.87	$3,113.51	$23,917.78
PLEASANT HOME	$1,328.19	$1,834.21	$1,291.07	$1,374.59	$1,182.90	$1,299.77	$18,045.01
POWELL VALLEY	$34,857.12	$38,384.72	$28,842.10	$26,584.77	$31,798.38	$21,217.08	$403,730.68
ROCKWOOD	$54,555.03	$67,676.77	$51,429.70	$53,008.17	$50,720.07	$31,222.50	$660,014.70
SKYVIEW ACRES	$73.70	$118.19	$64.42	$68.77	$64.71	$77.76	$1,317.32
WESTSIDE	$47.34	$63.21	$45.31	$42.12	$44.44	$20.95	$477.49
SUBTOTAL 1000'S	$150,666.97	$185,864.98	$140,346.62	$144,533.79	$148,183.74	$124,149.19	$1,905,164.34
CLACKAMAS	$59.20	$55.20	$59.70	$55.50	$55.50	$55.50	$681.00
MILWAUKIE							$93.17
PALATINE HILL	$4,068.30	$2,619.50	$3,129.06	$2,830.50	$4,230.50	$4,482.80	$49,982.54
ROSE CITY	$20,222.00	$15,857.76	$14,593.46	$14,507.89	$16,371.47	$16,694.43	$195,309.43
WICHITA	$1,464.20	$2,911.00	$1,944.20	$1,727.66	$2,845.50	$1,919.50	$28,273.08
SUBTOTAL 2000'S	$25,813.70	$21,443.46	$19,726.42	$19,120.89	$23,502.97	$23,152.23	$274,346.22
LAKE GROVE	$8,112.61	$7,049.85	$4,942.25	$22.55	$22.55	$24.81	$66,261.10
METZGER	$5,092.55	$138.16	$1,580.46	$936.09	$16,577.77	$144.16	$220,359.21
SYLVAN	$10,464.84	$6,972.82	($1,715.45)	$6,557.72	$6,855.63	$471.62	$67,647.90
TIGARD	$55.50	$55.50	$55.50	$55.50	$35,920.20	$55.50	$36,570.90
VALLEY VIEW	$3,761.49	$2,158.20	$1,612.21	$2,339.50	$2,610.40	$2,602.69	$34,917.76
WEST SLOPE	$40,590.10	$34,819.50	$38,238.00	$36,501.70	$38,826.30	$41,494.30	$461,987.65
WOLF CREEK	$107,919.50	$83,018.60	$70,123.90	$62,725.60	$45,690.13	$40,569.50	$1,077,237.06
SUBTOTAL 3000'S	$175,006.59	$134,212.03	$114,856.89	$109,138.66	$146,492.68	$85,352.82	$2,025,461.62
BARBER	$40.65	$33.71	$35.85	$54.25	$30.51	$39.05	$492.33
BEDFORD PARK	$223.70	$235.47	$187.70	$154.30	$198.67	$199.10	$2,496.99
BURLINGTON	$2,762.20	$2,107.80	$3,640.38	$3,740.60	$3,995.95	$5,254.05	$29,427.33
COMMUNITY	$4,132.65	$5,147.95	$4,116.30	$3,587.95	$4,211.85	$4,162.97	$49,485.43
DARLINGTON	$1,340.85	$1,817.75	$1,625.65	$1,184.95	$1,519.35	$1,412.75	$19,107.19
EAST 72ND ST.	$54.10	$30.24	$17.30	$13.70	$19.24	$22.10	$294.55
PARKROSE	($81.95)	($16.90)	($1,091.30)	($10.50)	($19.30)	($1,285.15)	($4,793.05)
SUBTOTAL 4000'S	$8,477.20	$9,376.02	$8,531.78	$8,727.25	$9,915.37	$9,805.07	$96,499.99
METZGER	$25,304.79	$21,361.65	$20,702.17	$21,261.62	$15,681.84	$24,063.74	$159,759.35
RALEIGH	$7,568.56	$5,898.39	$6,269.44	$6,389.81	$6,182.84	$7,052.72	$82,320.24
TUALATIN	$17,361.33	$14,661.05	$16,170.31	$14,384.63	$14,384.42	$21,006.13	$107,210.55
WOLF CREEK	$84,343.03	$74,084.21	$88,256.77	$88,720.19	$97,535.16	$119,552.07	$1,971,593.54
SUBTOTAL 5000'S	$134,577.71	$116,005.30	$131,398.69	$130,756.25	$133,784.26	$171,674.66	$1,421,283.68
TOTAL-WTR DST	$494,542.17	$466,901.79	$414,860.40	$412,276.84	$461,879.02	$414,133.97	$5,722,749.85

FOR FIGARO WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82	4TH PRECEDING YEAR 1980 - 81	5TH PRECEDING YEAR 1979 - 80	PRECEDING 5-YEAR AVERAGE
Portland Water consumption, per Bureau billing records (including credit for Portland Customers)		51,230	40,539				
Deduct: Approved sales to other distributors		-	-				
Add orDeduct: Adjustment for annexation or withdrawal		+ -	+ -				
Net Portland water consumption		= 51,230	= 40,459				
Add: Water from alternate sources		+ 1,503,279	+ 1,963,640				
Deduct: Water from alternate sources used during curtailment or emergency		-	-				
Add or Deduct: Adjustment for annexation or withdrawal		+ - 236,354	+ - 615,654				
Total water consumption		= 1,318,155	= 1,388,525				
Purchase Ratio (Net Portland water consumption/Total water consumption)		3.89%	2.92%	5.00%	5.00%	5.00%	4.36%

aranteed purchase ratio = Five (5) preceding Year Average Purchase Ratio = 4.36%

nimum purchase payment = ![(Guaranteed purchase ratio - year of calculation purchase ratio) x Year of calculation total water consumption - .01 x (Portland water consumption)] x Year of calculation water rate.

= _____

= _____

D&P

:rlm ADA:MPW-fwd85 08-20-84

MINIMUM PURCHASE WORKSHEET
FOR HAZELWOOD WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82	4TH PRECEDING YEAR 1980 - 81	5TH PRECEDING YEAR 1979 - 80	PRECEDING 5-YEAR AVERAGE
Portland Water consumption, per Bureau billing records (including credit for Portland Customers)		1,010,714	1,068,615	1,086,608	1,199,516	1,268,683	1,126,827
Deduct: Approved sales to other distributors	-	-	-	-	-	-	
Add or Deduct: Adjustment for annexation or withdrawal		+ -	+ -	+ -	+ -	+ -	
Net Portland water consumption		= 1,010,714	= 1,068,615	= 1,086,608	= 1,199,516	= 1,268,683	1,126,827
Add: Water from alternate sources		+ 188,915	+ 360,436	+ 287,348	+ 113,462	+	190,032
Deduct: Water from alternate sources used during curtailment or emergency		-	-	-	-	-	
Add or Deduct: Adjustment for annexation or withdrawal		+ -	+ -	+ -	+ -	+ -	
Total water consumption		= 1,199,629	= 1429,051	= 1,373,956	= 1,312,978	= 1,268,683	1,316,859
Purchase Ratio (Net Portland water consumption/Total water consumption)		84.25%	74.78%	79.09%	91.36%	100.00%	85.57%

ranteed purchase ratio = Five (5) preceding Year Average Purchase Ratio = 85.57%
imum purchase payment = [(Guaranteed purchase ratio - year of calculation purhase ratio)
x Year of calculation total water consumption - .01 x (Portland water consumption)]
x Year of calculation water rate.

= ____________________

= ____________________

-lm ADA:MPW-h-485 08-20-84

FOR ROCKWOOD WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82	4TH PRECEDING YEAR 1980 - 81	5TH PRECEDING YEAR 1979 - 80	PRECEDING 5-YEAR AVERAGE
Portland Water consumption, per Bureau billing records (Including credit for Portland Customers)		2,258,487	2,421,050	2,727,593	2,346,025	2,358,920	2,422,415
Deduct: Approved sales to other distributors	-	-	-	-	-	-	
Add orDeduct: Adjustment for annexation or withdrawal		+ - -	+ - -	+ - -	+ - -	+ - -	
Net Portland water consumption		= 2,258,487	= 2,421,050	= 2,727,593	= 2,346,025	= 2,358,920	2,422,415
Add: Water from alternate sources		+ 119,571	+ 113,982	+	+ 85,714	+ 212,279	106,309
Deduct: Water from alternate sources used during curtailment or emergency		-	-	-	-	-	
Add or Deduct: Adjustment for annexation or withdrawal		+ - -	+ - -	+ - -	+ - -	+ - -	
Total water consumption		= 2,378,058	= 2,535,032	= 2,727,593	= 2,431,739	= 2,571,199	2,528,724
Purchase Ratio (Net Portland water consumption/Total water consumption)		94.97%	95.50%	100.00%	96.48%	91.74%	95.80%

Guaranteed purchase ratio = Five (5) preceding Year Average Purchase Ratio = 95.80%

Minimum purchase payment = [(Guaranteed purchase ratio - year of calculation purchase ratio)
x Year of calculation total water consumption - .01 x (Portland water consumption)]
x Year of calculation water rate.

= _____

= _____

Form ADA:MPW-rwd85 08-20-84

FOR WOLF CREEK WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82	4TH PRECEDING YEAR 1980 - 81	5TH PRECEDING YEAR 1979 - 80	PRECEDING 5-YEAR AVERAGE
Portland Water consumption, per Bureau billing records (including credit for Portland Customers)		4,686,248	5,395,670	5,758,392	5,284,240	5,123,916	5,249,693
Deduct: Approved sales to other distributors	-	-	-	-	-	-	
Add or Deduct: Adjustment for annexation or withdrawal		+ - -	+ - -	+ - -	+ - -	+ - -	
Net Portland water consumption		= 4,686,248	= 5,395,670	=5,758,392	= 5,284,240	= 5,123,916	5,249,693
Add: Water from alternate sources		+ 0	+ 214,455	+ 197,427	+ 193,201	+ 126,727	146,362
Deduct: Water from alternate sources used during curtailment or emergency		-	-	-	-	-	
Add or Deduct: Adjustment for annexation or withdrawal		+ - -	+ - -	+ - -	+ - -	+ - -	
Total water consumption		= 4,686,248	= 5,610,125	= 5,955,819	= 5,477,441	= 5,250,643	5,396,055
Purchase Ratio (Net Portland water consumption/Total water consumption)		100.00%	96.18%	96.69%	96.47%	97.59%	97.29%

Guaranteed purchase ratio = Five (5) preceding Year Average Purchase Ratio = 97.29%

Minimum purchase payment = [(Guaranteed purchase ratio - year of calculation purchase ratio)
x Year of calculation total water consumption - .01 x (Portland water consumption)]
x Year of calculation water rate.

= _____

= _____

rlm ADA:MPM-wcw85 08-20-84

FOR LAKE GROVE WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82	4TH PRECEDING YEAR 1980 - 81	5TH PRECEDING YEAR 1979 - 80	PRECEDING 5-YEAR AVERAGE
Portland Water consumption, per Bureau billing records (Including credit for Portland Customers)		94,200	73,833	90,186			
Deduct: Approved sales to other distributors	-	-	-	-			
Add orDeduct: Adjustment for annexation or withdrawal		+ -	+ 3,959 -	+ 4,692 -			
Net Portland water consumption		= 94,200	= 77,792	= 94,878			
Add: Water from alternate sources		+ 35,396	+ 55,387	+ 62,183			
Deduct: Water from alternate sources used during curtailment or emergency		-	-	-			
Add or Deduct: Adjustment for annexation or withdrawal		+ -	+ -	+ -			
Total water consumption		= 129,596	= 133,179	= 157,061			
Purchase Ratio (Net Portland water consumption/Total water consumption)		72.69%	58.41%	60.41%	60.00%	60.00%	62.30%

Guaranteed purchase ratio = Five (5) preceding Year Average Purchase Ratio = 62.30%

Minimum purchase payment = [(Guaranteed purchase ratio - year of calculation purchase ratio)
x Year of calculation total water consumption - .01 x (Portland water consumption)]
x Year of calculation water rate.

= _____

= _____

Form ADA:MPW-1qw85 08-20-84

FOR FISCAL YEAR ENDING 06/30/85

	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82
Portland Water consumption, per Bureau billing records (including credit for Portland Customers)		30,572	82,194	94,641
Deduct: Approved sales to other distributors	-	-	-	-
Add or Deduct: Adjustment for annexation or withdrawal	+ / -	+ / -	+ / - 136	+ / - 271
Net Portland water consumption	=	= 30,572	= 82,058	= 94,370
Add: Water from alternate sources	+	+ 170,874 *	+ 140,559 *	+ 127,434 *
Deduct: Water from alternate sources used during curtailment or emergency	-	-	-	-
Add or Deduct: Adjustment for annexation or withdrawal	+ / -	+ / -	+ / -	+ / -
Total water consumption	=	= 201,446	= 222,617 / 222,753	= 212,804 / 222,075
Purchase Ratio (Net Portland water consumption/Total water consumption)		15.18%	36.86%	42.55%

Guaranteed purchase ratio = Lower of preceding three (3) years = **15.18%**

Minimum purchase payment = [(Guaranteed purchase ratio - year of calculation purchase ratio) x Year of calculation total water consumption - .01 x (Portland water consumption)]
x Year of calculation water rate.

= _____

= _____

FOR PARKROSE WATER DISTRICT
FOR FISCAL YEAR ENDING 06/30/85

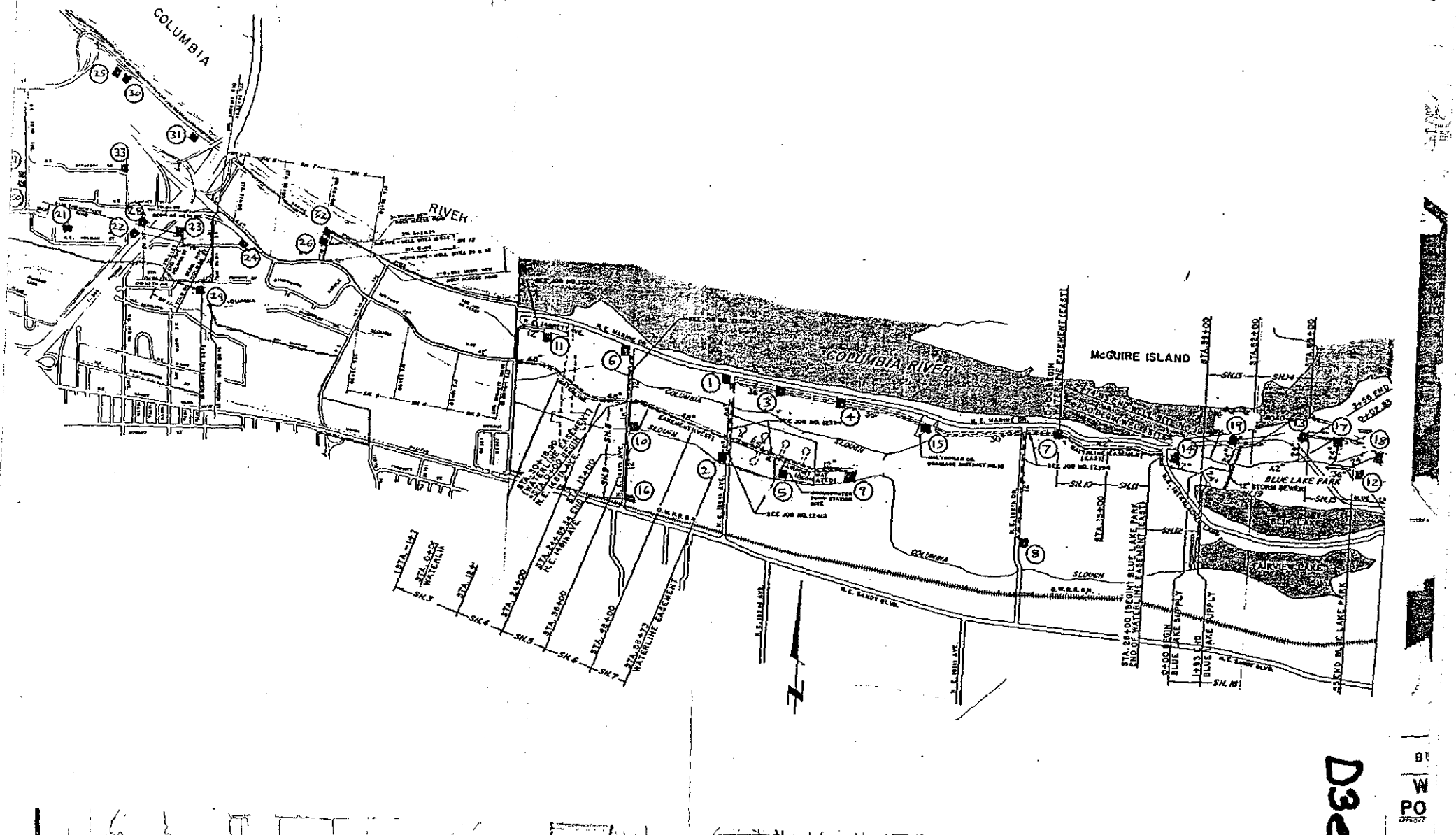
	YEAR OF CALCULATION 1984 - 85	1ST PRECEDING YEAR 1983 - 84	2ND PRECEDING YEAR 1982 - 83	3RD PRECEDING YEAR 1981 - 82
Portland Water consumption, per Bureau billing records (including credit for Portland Customers)		0	16,877	138,876
Deduct: Approved sales to other distributors	-	-	-	-
Add or Deduct: Adjustment for annexation or withdrawal	+ -	+ -	+ -	+ -
Net Portland water consumption	=	= 0	= 16,877	= 138,876
Add: Water from alternate sources	+	+ 1,073,618	+ 1,119,444	+ 955,592
Deduct: Water from alternate sources used during curtailment or emergency	-	-	-	-
Add or Deduct: Adjustment for annexation or withdrawal	+ -	+ -	+ -	+ -
Total water consumption	=	= 1,073,618	= 1,036,321	= 1,094,468
Purchase Ratio (Net Portland water consumption/Total water consumption)		0.00%	1.49%	12.69%

Guaranteed purchase ratio = Lower of preceding three (3) years = **0.00%**

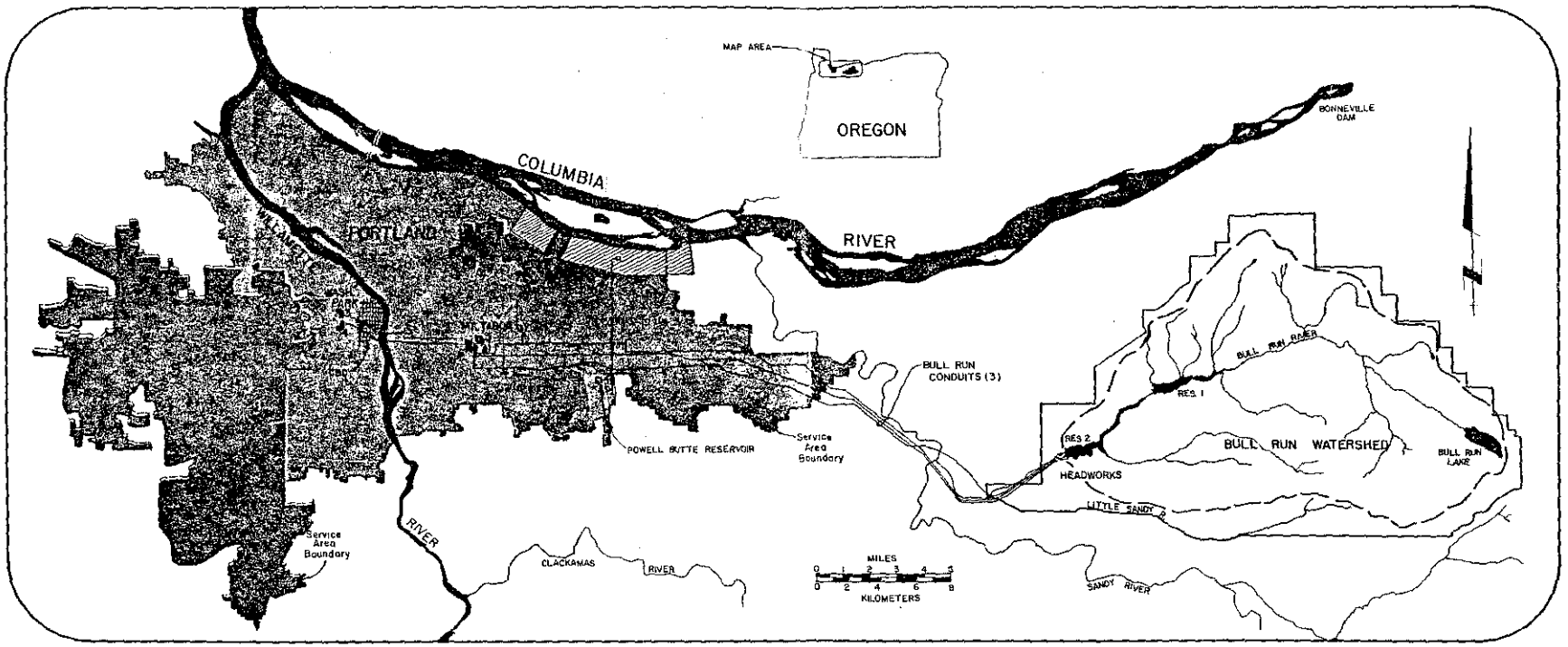
Minimum purchase payment = [(Guaranteed purchase ratio - year of calculation purchase ratio) x Year of calculation total water consumption - **.01** x (Portland water consumption)]
x Year of calculation water rate.

= _____

= _____


COLUMBIA
RIVER
COLUMBIA RIVER
McGUIRE ISLAND
BLUE LAKE PARK
N.E. MARINE DR.
N.E. SANDY BLVD.
COLUMBIA
SLOUGH
SEE JOB NO. 12445
SEE JOB NO. 12394
SEE JOB NO. 12331
STA. 29+00 BEGIN BLUE LAKE PARK END OF WATERLINE EASEMENT (EAST)
STA. 0+00 BEGIN BLUE LAKE SUPPLY
STA. 1+33 END BLUE LAKE SUPPLY
42" RCP BLUE LAKE PARK
42" STORM SEWER
2+58 END
0+02.83
SN.1
SN.2
SN.3
SN.4
SN.5
SN.6
SN.7
SN.8
SN.9
SN.10
SN.11
SN.12
SN.13
SN.14
SN.15
SN.16
SN.17
SN.18
SN.19
SN.20
SN.21
SN.22
SN.23
SN.24
SN.25
SN.26
SN.27
SN.28
SN.29
SN.30
SN.31
SN.32
SN.33
SN.34

PORTLAND WATER SYSTEM

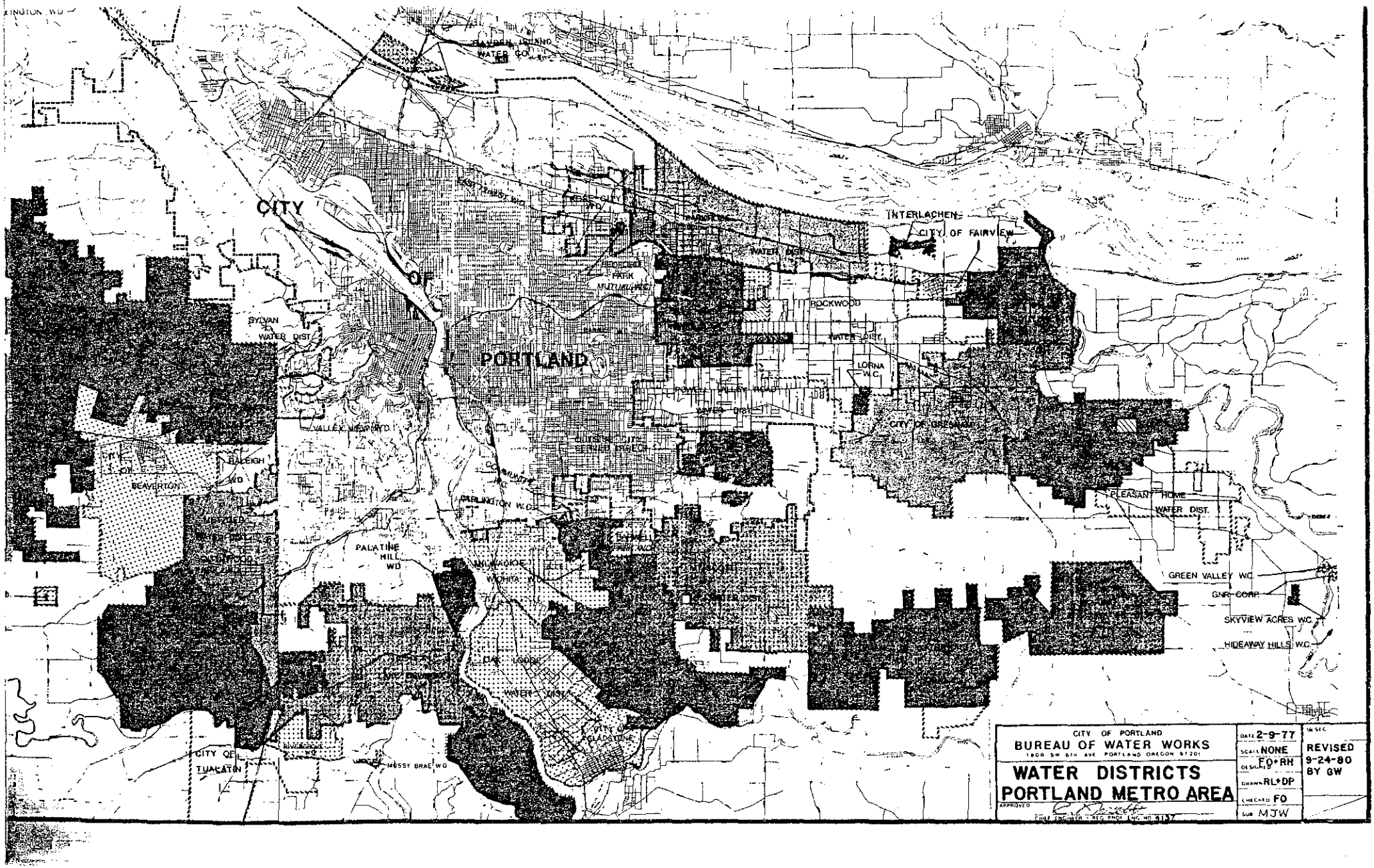


Sources Of Supply

City Of Portland Service Area

Other Purveyors Supplied By Portland

CITY OF PORTLAND
BUREAU OF WATER WORKS


CITY OF PORTLAND
INTERLACHEN
CITY OF FAIRVIEW
ROCKWOOD WATER DIST.
LORNA W.C.
CITY OF GRESHAM
PLEASANT HOME WATER DIST.
GREEN VALLEY W.C.
GNR CORP.
SKYVIEW ACRES W.C.
HIDEAWAY HILLS W.C.
BYLVAN WATER DIST.
VALLEY VIEW W.D.
RALEIGH W.D.
CITY OF BEAVERTON
ARLINGTON W.D.
PALATINE HILL W.D.
OAK LODGE WATER DIST.
CITY OF GLADSTONE
CITY OF TUALATIN
RIVERGROVE W.D.
MOSSY BRAE W.D.
CITY OF PORTLAND
BUREAU OF WATER WORKS
1900 SW 6TH AVE PORTLAND OREGON 97201
WATER DISTRICTS
PORTLAND METRO AREA
DATE 2-9-77
SCALE NONE
DESIGNED FO•RH
DRAWN RL•DP
CHECKED FO
SUB MJW
APPROVED
CHIEF ENGINEER REG ENGR LIC NO 4137
1N 1E SEC
REVISED
9-24-80
BY GW

D3f
Jeanne Orcutt

THE SEWER SAGA

I ain't got no sewer
But somebody cares for me.
Otto went to Salem
And brought back the "seepage fee".

Bev Moffatt was a help you know
She formed the S.O.B. to show.
Save our Basements was their cry
Give us sewers before we die!

Buchanan heard ~~her~~ their desperate plea
And then consulted Ivancie.
A sewer contract they did make
Of course it's for Mid-County's sake.

Buchanan lamented, We have no money
To him that wasn't very funny.
Ivancie said, Now that's ok
Bonds we'll issue right away.

You can pay us back in time
A "seepage fee" will be just fine.
No vote or remonstrance is required
But the referendum might be tried.

So it may be the right solution
To pass this charge by resolution.
No voter referral will there be
To stop this wonderful "seepage fee".

South shore properties will be sewered
The "seepage fee" must be endured.
Dr. Schade's report insisted
A "threat to drinking water" existed.

Ivancie is not so sure
He thinks well water's mighty pure.
The "seepage fee" is a dandy tool
But the people may be hard to fool.

Don't underestimate mid-county folk
We believe in the right to vote.
Affected property owners we fear
Won't get sewers for many a year!

-- Author Anonymous

D,4

September 11, 1984
PUBLIC TESTIMONY

Thank you for holding public hearings here in Portland.

I agree with the United Citizens in Action that the most economical solution to the possible problem of well water polution in mid-Multnomah County is for the area to recieve Portland's Bull Run water!

Parkrose is already using Bull Run water and the Interlaken water district has been given the assurance that Portland water will be available in case their wells become drawn down because of the Portland wells.

Testimony from the City of Portland may be contradictory about the Portland wells and their relation to the mid-Multnomah County wells. First, they claim that there is an impermiable layer of clay between the deep and shallow wells, while at the same time, they are championing sewer construction in order to protect their political investment in the Portland wells.

Either there is no seepage from shallow wells or there is seepage, the City can not have it both ways! If we follow their political assumption that the wells are separate, that means our emergency water supply is a non-renewable resource. If we follow their other assumption that sewers are needed, that means there could also be seepage from possibly radio-active Columbia River water. In either case, the Portland wells may have been a bad investment. This means that the ground water in mid-Multnomah County may not be suitable for use. According to Dr. Schade, the unsuitablity of the groundwater has been a concern for over ten years and is only now being made public.

Sincerely,

Donald R. Cook

Donald R. Cook
2006 S.W. Sunset Blvd.
Portland, OR 97201
(503) 244-5026

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

E. LETTERS RECEIVED FOR THE RECORD

1 City of Troutdale, 6/14/84*

2 Multnomah County, Commissioner Biskar, 8/15/84*

3 City of Portland, Commissioner Schwab, 8/21/84*

4 Emmert Development Co., 8/23/84*

5 Kenton Shade, Sr., 8/28/84*

6 Rockwood Water District, 8/29/84*

7 Edward H. Look, 8/24/84*

8 Shearsen Lehman/American Express, Rebecca Marshall, 8/28/84*

9 Mrs. Evelyn A. Dooley, 8/29/84*

10 Harold E. Hansen, 8/29/84*

11 Multnomah County, Commissioner Biskar, 8/30/84*

12 Betty Emery, Phone Message Note, 8/30/84*

13 Multnomah County, Division of Planning & Development, 8/30/84*

a. Land Use Policy 37 - Utilities

14 Carvalho Industries, Inc., 8/31/84*

a. Technical Data of Ozone Water Purification System

15 Betty Emery, 9/4/84*

16 Multnomah County, Commissioner Blumenauer, 9/4/84*

17 Mary Ellis, 9/5/84*

18 Elaine Tush, 9/5/84*

19 Mary Lindquist, 9/5/84*

20 Don Adkins, 9/5/84*

21 Henry Kane with 9/5/84 Response 9/4/84*

---

* Date letter was received for the record

22 Henry Kane to Mike Houston, 9/7/84*

a. "Tainting intensifies DEQ sewer battle", The Oregonian December 16, 1983
b. Henry Kane to Fred Hansen, September 4, 1983
c. Henry Kane to Dennis Buchanan, August 31, 1984

23 Multnomah County Health Officer, 9/10/84*

a. "Midcounty water safety needs sewers", The Oregonian, September 11, 1984

24 City of Portland--Bureau of Planning, 9/10/84*

a. Land Use - Public Facilities Goals & Policies List

26 Richland Water District, 9/11/84*

a. Water Quality Data, September 13, 1982

26 Department of Environmental Quality--Water Quality Division, 9/10/84*

a. Department of Environmental Quality field and laboratory data sheets for samples collected from wells in the Mid-Multnomah County area. Summary reports of these data have been contained in documents submitted previously for the record.

b. U.S. Geological Survey well data sheets for sampling and analysis of selected Mid-Multnomah County wells - 1976.

c. ORS Chapters 454 and 468, which contain Oregon Laws regarding water pollution control and sewage disposal.

d. The Department of Environmental Quality Laboratory, Quality Assurance Implementation Plan, East Multnomah County Groundwater Study, December 1983, and a copy of procedures for collecting and analyzing water samples. This material describes procedures used by the Department for analysis of samples and assuring the quality and validity of the data.

e. Oregon Administrative Rules, Chapter 340 including Divisions 41, 71, 72, and 73, which contain rules adopted by the Environmental Quality Commission for Water Pollution Control and Sewage Disposal. Division 41-029 contains the General Groundwater Quality Protection Policy. Divisions 71, 72, and 73, contain the on-site waste disposal rules.

f. "Groundwater Protection Policy, Background Discussion, Proposed Policy, and Final Adopted Policy", Oregon Department of Environmental Quality, 1980, with revisions made August 1980 and an appendix added 1983.

g. Agenda Item No. I and minutes of the June 29, 1984, EQC meeting.

Not included in this package

---

* Date letter was received for the record

Not Included h. "Water Quality in the Columbia Slough", Department of Environmental Quality report, April 1974.

Selected pages included i. "Groundwater Exploratory Program", City of Portland Bureau of Water Works, April 1977; "Pilot well Study", City of Portland Bureau of Water Works, November 1978.

Not Included in this package

j. "Final Report Oregon On-Site Experimental System Program", Department of Environmental Quality, December 1982.

k. "Clatsop Plains Ground Water Protection Plan, Ground Water Evaluation Report", Sweet, Edwards & Associates, Inc., December 1981.

l. "Ground Water in the East Portland Area", Geological Survey Water - Supply Paper 1793.

m. "Soil Survey of Multnomah County, Oregon", Soil Conservation Service, August 1983.

n. Updated rules in the March 12, 1982, Federal Register, "National Interim Primary Drinking Water Regulations"

o. "National Interim Primary Drinking Water Regulations", U.S. Environmental Protection Agency, September 1976.

Included p. "Volatile Organic Chemicals", Department of Environmental Quality Staff Report, December 1, 1983.

Text less Appendix Included q. "Sources of Toxic Compounds in Household Wastewater", Steven W. Hathaway, Wastewater Research Division, Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Not Included r. "The Long Island Ground Water Pollution Study", State of New York Department of Health, April 1969, and "Proceedings of the Fourth American Water Resources Conference", Proceedings Series No. 6, November 1968.

s. Agenda Item No. H, and proposed minutes of the August 10, 1984, Environmental Quality Commission meeting.

27 Paul Yarborough, Department of Environmental Services, Mult. Co., 9/10/84*

28 Kristine Gebbie, Administrator, 9/11/84*, Health Division

29 William H. Young, Director, Water Resources Department, 9/11/84*

---

* Date letter was received for the record

30 City of Portland, Bureau of Environmental Services, 9/11/84*

a. J. David Rush, Government Finance Associates, Inc.

(1) Virginia Senate Bill No. 229

b. John Lang, City of Portland

(1) "Groundwater Exploratory Program", Department of Public Utilities, Bureau of Water Works, April 1977

(2) "Year 2000 Growth Allocation Workshops", March-April, 1981, Metropolitan Service District

(3) "Subsurface Sewage Disposal and Contamination of Groundwater in East Portland, Oregon", E. L. Quan, H. R. Sweet, and Joseph R. Illian, Groundwater Vol. 17, 1974.

(4) "Nitrate in Drinking Water", E. F. Winton, R. G. Tardiff, and L. J. McCabe, Journal AWWA February 1971

31 Statement, Affidavit and Exhibit of United Citizens in Action, 9/11/84*

32 Gladys McCoy, Multnomah County Commissioner, 9/11/84*

33 Charles P. Schade, M.S., Multnomah County Health Officer, 9/11/84*

a. "Congenital Malformations and Maternal Drinking Water Supply in Rural South Australia: a Case-Control Study", Margaret M. Dorsch, Robert K. R. Scragg, Anthony J. McMichael, Peter A. Baghurst, and Kenneth F. Dyer, American Journal of Epidemology, Vol. 119, No. 4, April 1984

b. "Hypertension and Drinking Water Constituents in Colorado", William E. Morton, M. D., Dr. P.H., American Journal of Public Health, Vol. 61, No. 7, July 1971

c. "Nitrates in Municipal Water Supply Cause Methemoglobinemia in Infant", Joseph Vigil, B.S., Sherman Warburton, B.S., M.P.H., William S. Haynes, M.D., M.P.H., and Leland R. Kaiser, M. A., M.P.H., Public Health Reports Vol. 80, No. 12, December 1965

d. "Cyanosis in Infants Caused by Nitrates in Well Water", Hunter H. Comly, M.D., Journal of the American Medical Association, Vol. 129, No. 2, September 8, 1945.

e. "Methemoglobinemia Associated with Well Water", Louis W. Millen, M.D., Journal of the American Medical Association, Vol. 216, No. 10, June 7, 1971

---

* Date letter was received for the record

f. "Methemoglobin Levels in Infants in an Area With High Nitrate Water Supply", Lois Ann Shearer, M.P.H.; John R. Goldsmith, M.D.; Clarence Young, B.S.C.E.; Owen A. Kearns, M.D.; and Benjamin R. Tamplin, Ph.D. American Journal of Public Health, Vol. 62, No. 9, 1972

34 Jeanne Orcutt, 9/13/84*

a. Excerpt from Rep. Wally Priestly's testimony May 2, 1983 at the House Hearing on the Seepage Bill

b. Letter from Rep. Annette Farmer to Senators, June 7, 1983

c. "Portland, Oregon, Offers Services to Push Case for Annexation" "Eugene Carlson, The Wall Street Journal, May 3, 1983

d. A message from Rep. Lonnie Roberts to citizens regarding sewers and the seepage fee.

e. "Springfield to Auction off Unwanted Lots", The Oregonian, September 1, 1984

35 Harold T. Osterud, M.D., MPH, Oregon Health Sciences University, 9/13/84*

36 Wm. E. Morton, M.D., Dr. PH, Oregon Health Sciences University, 9/13/84*

37 John C. Stoner, R.S., Oregon Water Treatment Certification Program, 9/14/84*

E1

City of Troutdale

104 Kibling Street (503)665-5175
Troutdale, Oregon 97060

June 14, 1984

Hal Sawyer
Department of Environmental Quality
1120 SW 5th
Room 730
Portland, OR 97204

Dear Mr. Sawyer:

The City of Troutdale, as a member of the Multnomah County Sewer Consortium is requesting that the City be excluded from the need to set a seepage fee within the Troutdale Drainage Basin. The City of Troutdale, at this time, does not meet any of the four conditions set forth as conditions for the seepage fee. There is less than one percent of the sewage discharge that goes into on-site disposal systems.

Troutdale's policies, as established by the Council, require that any development provide sewage collection before any permits are issued. It is also the policy of the Council that we do not extend service outside the City limits of Troutdale except for unusual or special circumstances. The sewage system financial plan for Troutdale is based on a Systems Development Charge imposed on all development that occurs within the City limits. The Systems Development Charge is set aside for Capital Improvements and/or expansion. At this time we are estimating that by the year 1990 we will begin actual expansion of the plant to serve future growth.

Plant expansion will be accomplished using the reserve fund of the SDC's and also a GO Bond. Since the majority of the area lying within Troutdale's drainage basin but outside the City limits is now undeveloped, we are anticipating that if there are future requests for newly developed areas in our Basin that we would require annexation before that service is extended.

Sincerely yours,
CITY OF TROUTDALE

Pamelia L. Christian
City Administrator

PLC:vjk

(E2)

EQC
Hansen
Sawyer
Gillaspie
Wolniakowsk

ARNOLD BISKAR
Multnomah County Commissioner
District One

Room 605, County Courthouse
Portland, Oregon 97204
(503) 248-5220

August 13, 1984

Fred Hansen, Director
D.E.Q.
522 SW 5th
Box 1760
Portland, OR 97207

Dear Mr. Hansen:

Thank you for your letter of August 6, regarding testimony on the findings of a threat to drinking water in the unsewered areas of mid-Multnomah County.

We appreciate the efforts of the D.E.Q. to resolve this problem. Our staff manager, Burke Raymond, will be coordinating a presentation with the City of Portland and City of Gresham for your hearing on August 30, 1984.

Please call my office if we can provide any additional information.

Very truly yours,

Arnold Biskar

Arnold Biskar
Presiding Officer

AB:jn

cc: Burke Raymond
John Lang, City of Portland
Charles Schade, M.D.
Jim Keller, City of Gresham
Board of County Commissioners

PRESIDING OFFICER
Board of
County Commissioners

E3

CITY OF
PORTLAND, OREGON
OFFICE OF PUBLIC ~~AFFAIRS~~ SAFETY

Mildred A. Schwab, Commissioner
1220 S.W. Fifth Ave.
Portland, Oregon 97204
(503) 248-4180

EQC
Hansen
Sawyer
G. Haspiel
Wolniakowski

August 17, 1984

Fred Hansen, Director
Department of Environmental Quality
Box 1760
522 S.W. Fifth Avenue
Portland, OR 97207

Dear Fred:

Thank you for your letter of August 6th related to the EQC's hearing on the findings of a threat to drinking water in the un-sewered areas of mid-Multnomah County.

I have forwarded a copy of your letter to Commissioner Mike Lindberg, who is in charge of the Bureau of Environmental Services. I'm sure he will work with staff to provide the necessary coordination you request.

Thank you again.

Sincerely,

Mildred A. Schwab
COMMISSIONER OF PUBLIC SAFETY

MAS.cp

cc: Commissioner Lindberg

Attachment

(E3)

CITY OF

PORTLAND, OREGON

INTEROFFICE MEMORANDUM

Office of Commissioner
Mildred A. Schwab

DATE: August 17, 1984

TO: Commissioner Lindberg

FROM: Commissioner Schwab

SUBJECT: Letter from Fred Hansen, Director of Department of Environmental Quality

Mr. Hansen has written me the attached letter related to the public hearing on the threat to drinking water in the un-sewered areas of mid-Multnomah County.

I don't know if you received a letter as well, so I'm sending you a copy of mine.

Thank you for your attention to this matter.

MAS.cp

cc: Fred Hansen

Attachment

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
AUG 21 1984
OFFICE OF THE DIRECTOR

E4

EMMERT DEVELOPMENT COMPANY

August 31, 1984

Department of Environmental Quality
Water Quality Division
P.O. Box 1760
Portland, OR 97207

RE: Polluted underground water, Mid Multnomah County

To Whom it may concern:

We are writing in response to your notice of a public hearing on August 30, 1984, at Parkrose High School regarding the above noted underground water and the possibility of sanitation sewers.

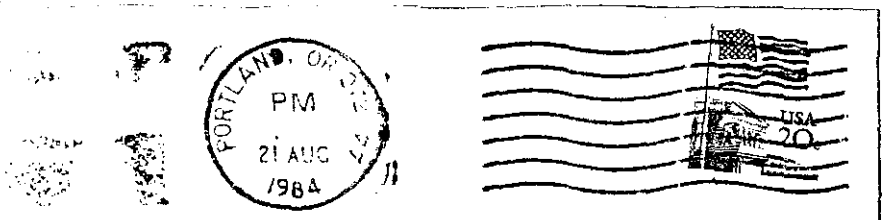
We, as many of the citizens of the Multnomah County area, have been faced in the past with increased costs of just living. In this specific proposal we are looking at 56,000 Multnomah County residents absorbing the cost of a $255 million sanitary sewer. Many of the residents of this area are still attempting to recover from the lack of work and other economic hard times of the past few years. We would suggest that the department look at other alternatives if the water is found to contain pollutants. This might also be in the form of searching out new forms of water as a cost effective alternative.

Please put in your records that we are opposed to costly sanitation alternatives at this time.

Sincerely,

Terry W. Emmert,
President

TWE/s1



97015 (503) 655-9933

E5

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Hunter Carl Shade SR

Address: 2245 N.E. 13 CT.
Portland, Oregon
97230

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
AUG 28 1984
OFFICE OF THE DIRECTOR

MR HAL K SHADE
2542 NE 146TH DR
PORTLAND, OR 97230

PORTLAND, OR
PM
27 AUG
1984

USA 20c

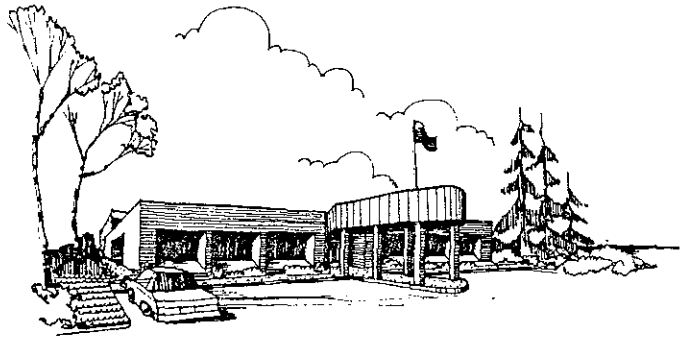
Environmental Quality Commission
522 S.W. Fifth Ave
Box 1760
Portland - Or
97207

AUG 28 1984

AUG 28 1984

Water Quality Division
Dept. of Environmental Quality

E6



ROCKWOOD WATER DISTRICT

19601 NE Halsey
Portland, Oregon 97230
(503) 665-4179

August 28, 1984

Environmental Quality Commission
Post Office Box 1760
Portland, Oregon 97207

Dear Commissioners:

In order to set the record straight regarding your public hearing scheduled for June 29, I would like to offer the following.

Our water is available to all residents of the Rockwood Water District area. This water is safe for public drinking. We test the water on a monthly basis and do everything within our power to ensure its continued high quality.

Other information that may be of interest is that the depth of our wells is at least 500 feet, one located on our property at 196th and Halsey and the other south of Sandy on 185th Street. Only 5 percent of our water comes from these sources. The remaining 95 percent is purchased from the Bull Run water supply.

Please let us know if we can be of any assistance in your deliberations.

Sincerely,

ROCKWOOD WATER DISTRICT

C Chuck Root

Chuck Root
Manager

CLR:ph
cc: Mrs. Jean Orcutt

E7 EQC
Hansen
Sawyer
Wolniakowski
Gillaspie

August 24, 1984

Environmental Quality Commission
520 SW Fifth
Portland, Oregon 97204

Members of the Commission:

I am writing to stress the urgency of the Commission taking decisive action to avert a potential threat to drinking water in mid-Multnomah County.

For years, EQC has wrestled with the sewage problem in mid-County. For years, solutions there have been hampered by the County's lack of capability to deliver sewer services.

Now, the County has wisely stepped out of the urban service business, and handed the job to Portland and Gresham. The cities have developed a workable plan to provide the needed sewage collection and treatment systems, at a price that is affordable to area property owners. As a long-time observer of Multnomah County affairs, it is gratifying to be on the verge of solving such a critical and persistent regional problem.

Although I will be unable to attend the August 30 hearing, please accept my support for strong action by EQC to remedy this problem at the earliest possible date.

Sincerely,

Edward H. Look
1703 SW Myrtle Street
Portland, Oregon 97201

EHL/kah

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
AUG 24 1984
OFFICE OF THE DIRECTOR

Shearson Lehman/American Express Inc
Foster & Marshall Division

INVESTMENT BANKERS AND BROKERS
KOIN Center • 222 S.W. Columbia Street, Suite 801, Portland, Oregon 97201-6615 • (503) 241-7243

E8

Environmental Quality Commission
c/o Dept. of Environmental Quality
P.O. Box 1760
Portland, OR 97207

August 27, 1984

RE: SEWERS IN THE UNINCORPORATED AREA OF MULTNOMAH COUNTY

Dear EQC Members:

I served as vice-chairman of the Citizens Advisory Committee on Financing Sewers in Unincorporated Urban Multnomah County from June 1982 through August 1983. We reviewed reports, took substantial testimony from various sources, held a public hearing and made findings which were presented to the County Commissioners.

The committee did not begin with a particular bias regarding either the need for further sewers or the method by which they should be financed. After the hours of testimony, pro and con, we collectively determined that there is a problem which must be addressed as quickly as possible, both for the preservation of the water quality and for economic development in the area. This problem is not new and development has been allowed to proceed without adequate planning or control for too long, thus compounding the problem. Further delays could only result in increasing pollution, slowed or lost economic development, and escalated costs in constructing the comprehensive system which ultimately must be installed.

The committee further studied various methods of financing the sewer system. From the analysis presented to us by the economic consulting firm, from the clear financing advantage that established cities with good bond ratings can provide, and from the enhanced ability of these cities to acquire needed Federal grant funds, the least expensive and most expeditious method was the plan which is now referred to as the "framework plan." We did not consider the political ramifications to be within the scope of our charge; instead we focused solely upon expense and timeliness. Given these criteria, we found the choice obvious.

I am sure that members of the committee would be happy to answer any questions that you may have regarding our deliberations. Thank you for your attention.

Sincerely,

Rebecca Marshall

Rebecca Marshall
Vice President

Aug 25, 1984 (E9)

I have lived around various parts of Portland ever since I was 3 yrs. old. I was 77 yrs old Aug 1st. It seems mighty strange to me that all of a sudden this Seepage Problem seems to have come to life.

There is a different breed of Politions on the job now. It looks like they want to squeeze every last penny they can get from the little guy - under dog - the poorer class of people or whatever you want to call them.

Most of the people that the squeeze is being put on will not live long enough to reap any of the benefits. Anyway the Powers that be will find something else to use the money for. Just like the gas tax. It was suppose to be used for road upkeep only.

What all is it being used for?

P3

I think it is about time
the public rose up in arms
and make these beggars
account for every penny of
that money and exactly what
it was spent for.
What are the politicians
going to dream up next to
take the money away from
the poor class and the little
guy that doesn't hardly make
enough money to have ample
food in the house?

Yours truly
Mrs. Evelyn A. Dooley
4113 S.E. 103 Ave
Portland, Or 97266

Environmental Quality Commission
522 S.W. Fifth Ave., Box 1760
Portland, OR 97207

August 23, 1984

I do not feel there is a proven threat to our drinking water. Most of the people within the "affected area" are served by the Bull Run Water Supply, therefore, the most economical solution would be to furnish Bull Run water to the few remaining customers.

Signature: Mrs. Evelyn A. Dooley

Address: 4113 S.E. 103 Ave
Portland, Or 97266

Troutdale, Ore.
August 17, 1984

E10

Department of Environmental Quality
Water Quality Division
P.O. BOX 1760
Portland, Ore. 972707

Environmental Quality Commission:

There is no argument against sewers. In the same manner you can't argue against Mercedes Benz automobiles. But the fact remains that a good many people in the unsewered area cannot afford either one.

A project currently under consideration in Gresham would cost the average homeowner nearly $9,000.00 just to bring the sewer to the property. This part of the cost could qualify for Bancroft bonding.

All work needed on the home and property to accomodate the new sewer could cost additional thousands of dollars. This part apparently would not qualify for Bancroft bonds.

It is extremely difficult to sell a house in the area because the monthly payments are so high. I shudder to think what would happen to the housing

market if all these additional charges were added on.

When you drive around the area you see many substandard homes. It would seem very difficult to get anyone to put large amounts of money for sewer services into this type of property.

It would seem that any massive project would sink of its own weight unless there is a massive infusion of State or Federal Funds.

The possibility of private enterprise doing the job should be thoroughly explored. There have been reports of sewering companies making the investment and then charging for the service.

We live in the Brentmoor subdivision which contains 76 homes. At an average (conservative) cost of $13,000.00 per home this translates into over $800,000.00. It is difficult to see how this area could carry that kind of cost even over a 20 year period (over $200,000.00 of the total wouldn't qualify to Bancroft bonds).

You are faced with some very tough decisions and I wish you well. Much as sewers are needed I would hope that no action is taken that could possibly drive people out of their homes.

Very truly yours
Harold E. Hansen
2410 S.E. OAK ST.
TROUTDALE, ORE. 97060

TELEPHONE 666-4919

EQC E11
Hansen
Sawyer

ARNOLD BISKAR
Multnomah County Commissioner
District One

Room 605, County Courthouse
Portland, Oregon 97204
(503) 248-5220

August 29, 1984

Environmental Quality Commission
520 SW Fifth
Portland, OR 97204

Dear Commission Members:

At hearings in August and September, the Environmental Quality Commission will consider once again the mid-County subsurface sewage problem. The Commission will determine whether the lack of sewers and sewage treatment for 55,000 households in mid-County poses a potential threat to ground resources, and whether the plan developed by a consortium of local jurisdictions provides a cost-effective answer to the threat.

The EQC has been working toward an affordable solution to mid-County sewer needs for over a decade. Now that a plan has finally been reached through countywide cooperation, I anticipate the Commission's strong affirmation of the unified approach.

I am writing to endorse the EQC's action and express Multnomah County's commitment to solving this serious and persistent problem, as a partner with EQC, area jurisdictions, and property owners in mid-County.

As the consortium's Framework Plan indicates, Multnomah County's role is to serve as an intermediary. The County will ensure that the two most capable service providers -- the cities of Portland and Gresham -- can devote their considerable resources and expertise to designing, financing, and building sewer systems in mid-County.

I would urge the Commission move quickly in its deliberations, enabling the cities to get on with the job.

Sincerely,

Arnold Biskar
Presiding Officer

PRESIDING OFFICER
Board of
County Commissioners

AB:jv
cc: Dennis Buchanan

E 12

While You Were Out

To Sawyer

Date 8/30/84 Time 4:16

Betty Emery called

of 2659 S. E. 166

Phone Portland 97236 761-4022

- [x] Telephoned
- [ ] Please call
- [ ] Will call again
- [ ] In person
- [ ] Wants to see you
- [ ] Returned your call

Message Said she spent all morning calling people to get them to come to meeting - when they got their speakers back facing audience

Taken by and they couldn't

FORM CS 51619

Recyled Paper

hear anything that was said. She thought this very rude & has never been to a meeting where she has been treated so rudely.

By 3:30 everyone was leaving & not a single person was allowed to testify. She cannot come back at 6.

(I told her to put complaint in writing)

Anna

E 12

E 12

8/20/84 AA

E 13

MULTNOMAH COUNTY OREGON

DIVISION OF PLANNING AND DEVELOPMENT
2115 S.E. MORRISON
PORTLAND, OREGON 97214
(503) 248-3047

DENNIS BUCHANAN
COUNTY EXECUTIVE

August 29, 1984

Harold Sawyer
c/o DEQ
522 SW Fifth Avenue
Portland, Oregon 97204

RE: East County Sanitary Sewer Consortium Framework Plan

Dear Mr. Sawyer:

I have been asked to respond to the question of how the East County Sanitary Sewer Consortium Framework Plan relates to the County's acknowledged land use plan. The County's land use plan consists of both an overall document, the Comprehensive Framework Plan and the individual Community Plans. In all cases there are certain policies which deal with the issue of services in both documents afftecting certain communities in mid-East County. Policy No. 13 deals with Air and Water Quality, in the overall document it was stated that it is the County's policy to work with DEQ for the development of a Groundwater Quality Plan to meet the needs for development. In individual community plans this Policy No. 13 is separated and strategies are mentioned outlining the need for sanitary sewers in Cully/Parkrose. Other Community Plans reference the need to continue planning efforts and to the appropriate measures to prevent degeneration of ground water quality. Policy No. 37 on Utilities specifically refers to the DEQ liason on groundwater quality (see attached) and contains a strategy for maintenance of groundwater quality by noting that full development potentials may not be realized before sewering is available and outlining how such interim development should take place. This Policy is included in the other Community Plans and the Cully/Parkrose, Hazelwood, and Powellhurst Plans make Findings on the need for sewering.

In general, the County's Comprehensive planning and zoning for mid-East Multnomah County has been based upon full services being made availabvle in the future. The Plans reference problems with groundwater due to subsurface sewage disposal and specific provisions have been made for interim development to continue, but at a reduced level than what would be possible under full sewer service. In fact, one part of the Zoning Code refers specifically for the need in current development projects to make provisions for future hook-ups to sewers by either building dry sewers or designing the site so as to facilitate

future line hook-ups. The Comprehensive Frameowrk Plan and Community Plans together are certainly not inconsistent with the provisions of Sewer Framework Plan prepared by the East County Sanitary Sewer Consortium.

Sincerely,

MULTNOMAH COUNTY DIVISION OF PLANNING AND DEVELOPMENT

Lorna Stickel

Lorna Stickel, Planning Director

LS:sec/0141L

cc: Burke Raymond
Jim Throckmorton, City Planning Bureau

Enclosure - Policy No. 37 - Utilities Framework Plan - 1983 Update

DRAINAGE

E. THERE IS ADEQUATE CAPACITY IN THE STORM WATER SYSTEM TO HANDLE THE RUN-OFF; OR

F. THE WATER RUN-OFF CAN BE HANDLED ON THE SITE OR ADEQUATE PROVISIONS CAN BE MADE; AND

G. THE RUN-OFF FROM THE SITE WILL NOT ADVERSELY AFFECT THE WATER QUALITY IN ADJACENT STREAMS, PONDS, LAKES OR ALTER THE DRAINAGE ON ADJOINING LANDS.

ENERGY AND COMMUNICATIONS

H. THERE IS AN ADEQUATE ENERGY SUPPLY TO HANDLE THE NEEDS OF THE PROPOSAL AND THE DEVELOPMENT LEVEL PROJECTED BY THE PLAN; AND

I. COMMUNICATIONS FACILITIES ARE AVAILABLE.

FURTHERMORE, THE COUNTY'S POLICY IS TO CONTINUE COOPERATION WITH THE DEPARTMENT OF ENVIRONMENTAL QUALITY, FOR THE DEVELOPMENT AND IMPLEMENTATION OF A GROUNDWATER QUALITY PLAN TO MEET THE NEEDS OF THE COUNTY

STRATEGIES

A. The following strategies should be addressed in the ongoing planning process:

1. The planning program should address provisions for services related to the Broad Land Use Categories and should include such factors as:

a public sewer and water facilities,

b. individual subsurface sewage disposal systems,

c. individual water systems,

d. on-site and off-site drainage,

e. energy and communications facilities.

B. To maintain groundwater quality in unsewered urban areas, and to preserve the potential for full housing densities when sewers are installed, and to permit a reasonable increase in the supply of needed housing in the interim, all residential development proposals shall comply with the following:

1. In the event the maximum number of dwelling units allowable by the Comprehensive plan, the Land Division Code and the Zoning Code is not possible due to Department of Environmental Quality subsurface sewage

disposal limitations, the site development plan shall designate the manner in which the additional allowable units may be located on the property when public sewer service is available. Review and action, including appeal methods on each such site development plan, shall be taken under the applicable Design Review, Land Division or Zoning administration procedures.

2. Conditions of approval, supported by findings of need, may include, among other things:

   a. the clustering of lots as interim building sites,

   b. a plan for the future re-division of lots,

   c. reservation and interim use of portions of the site pending the future location of additional dwelling units,

   d. connection of all units to a public sewer then available, or

   e. installation of dry sewers at the time of initial development.

E14

CARVALHO INDUSTRIES, INC.
P.O. BOX 7149, KLAMATH FALLS, OR 97602 — 503-883-1531

August 28, 1984

Christina Wolinakowski
Public Affairs Section, DEQ
P.O. Box 1760
Portland, Oregon 97207

Dear Ms. Wolniakowski:

The purpose of this letter is to provide you with information about Carvalho Industries and our water purification systems; that may help the State Environmental Quality Commission at Thursday's meeting dealing with East Multnomah County water problems.

Carvalho Industries can solve your water contaminate problems effectively and economically. Our treatment of Nitrates and solvents is very successful. We have taken 61.6 ppm nitrate levels and reduced the nitrates to zero in two minutes. Solvents are oxidized and removed by filtration.

Carvalho Industries Water Purification Systems have a low capital cost; low energy cost (one seventh the cost of other ozone generators); no heat or cooling problems or limitations; no moisture limitations; and no production of nitrous compounds.

We are currently working with Mr. Bernie Court, Water Supervisor, for the city of Hemet in California; dealing with their nitrate contamination of their wells. We are in the process of installing an Ozone Pilot Demonstration System that will be hooked up to well #2 to enable the city to conduct their own tests before accepting our bid to purify their water.

Enclosed is a brochure on our Well Water Purification Systems along with test results. We hope that this information will be helpful in finding an acceptable solution to your water problems. Please contact me if you have any questions or need further information about our water purification systems. Thank you.

Sincerely,

Steven L. McKeag

Steve McKeag
Field Representative

SM;elw
Enc.

CARVALHO INDUSTRIES INC.

TECHNICAL DATA

CARVALHO INDUSTRIES, INC.
P.O. BOX 7149, KLAMATH FALLS, OR 97602 — 503-883-1531

NITRATE TEST RUN ON MAY 7, 1984

SAMPLE

Private well system (5 homes) Aromas, Monterey County
15 GPM well
Total nitrates: 61.6 ppm

TEST

Bubbled ozone from eight tube ozone generator into 48 ounce container for 2 minutes.

RESULTS

After two minutes and carbon filtration: nitrates--0--.

TEST EQUIPMENT

Hach Model NI-11 High Range Nitrate Test Kit
Analysis Method: Colorimetric (color disc)

CARVALHO INDUSTRIES INC.

TECHNICAL DATA

CARVALHO INDUSTRIES, INC.
P.O. BOX 7149, KLAMATH FALLS, OR 97602 — 503-883-1531

Chemicals Tested as of June 1978

	Parameters	Results	
1.	SS (Suspended Solids).....	126.0	mg/l
2.	COD (Chemical Oxygen Demand).....		mg/l
3.	PH.....	4.9	
4.	Grease/oil (Hexane soluable).....	16.0	mg/l
5.	Cadmium.....	2.14	mg/l
6.	Total Chromium.....	13.05	mg/l
7.	Hexavalent Chromium.....	.76	mg/l
8.	Copper.....	4.49	mg/l
9.	Cyanide (Total).....	8.80	mg/l
10.	Iron.....	21.43	mg/l
11.	Lead.....	1.75	mg/l
12.	Mercury.....		mg/l
13.	Nickel.....	16.6	mg/l
14.	Zinc.....	12.41	mg/l
15.	Phenols.....		mg/l
16.	Solvents (Most types).....		
17.	Readily Released Cyanide.....	3.75	

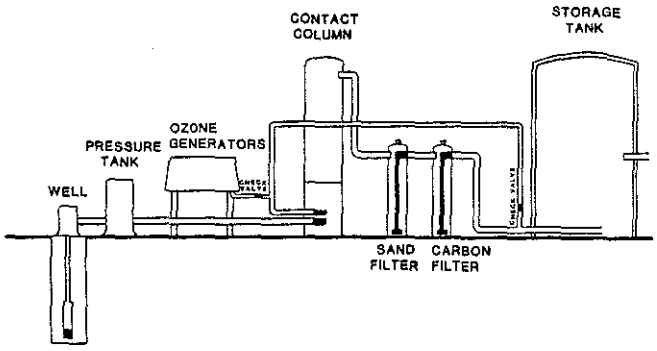
1. Most can be oxidized out. Those that cannot be oxidized will filter out after Ozone treatment and caught in a sand filter.
2. Will stop chemical oxygen demand, also will increase D.O.
3. Will level off at PH 7.
4. Will oxidize most grease and oils.
5. Will change the ions to molecules and are caught in the sand filter.
6. Chromium + ions will be changed to molecules by negative ozone and caught by the sand filter.
7. Will be oxidized, changed from + ions to molecules and caught in a sand filter.
8. The copper + ions will be attracted to the negative field made by the ozone and changed to molecules and trapped by the sand filter.
9. Cyanide is oxidized to cyanate and by continuous oxidization changed to harmless gas.
10. The + iron ion is changed to molecules which are larger and caught in the sand filter.
11. Lead is also changed from + ions to molecule size that can be caught in a sand filter.
12. Mercury responds to + ions trapping in a sand filter after treating with negative ozone.
13. + nickel ions are attracted to negative ozone field and are changed to molecules which are caught in a sand filter.
14. Zinc is oxidized and its + ions in a negative ozone field become molecules which can be caught in a sand filter.
15. Phenols will oxidize away.
16. Most solvents will oxidize.
17. All cyanide is oxidized into cyanate and continuous oxidizing turns cyanate into a harmless gas.

CARVALHO INDUSTRIES INC.

WELL WATER PURIFICATION SYSTEMS

CARVALHO INDUSTRIES, INC.

P.O. BOX 7149, KLAMATH FALLS, OR 97602 — 503-883-1531



UNUSUALLY LOW EQUIPMENT AND OPERATING COSTS

EFFECTIVE IN REMOVING:

* Bacteria, Viruses & Other Micro-Organisms. 100% Polio Virus Kill
* Obnoxious Odors
* Nitrates & Phosphates
* Metals such as Iron, Lead, Mercury, Zinc, Chromium, Magnesium, & Cadmium
* Pesticides
* Chlorine & Chlorine Compounds
* Arsenic & Cyanides
* Hydrocarbons (Oil based chemicals)
* Other Contaminents

OZONE AS A WATER PURIFIER

Ozone is activated or tri-atomic oxygen. It has been used as a purifier of potable and waste water since 1884. Its use in Europe is widespread. Up until now ozone has experienced a limited use in the U.S. because equipment and operating costs have been much greater than those for chlorine.

Ozone is a much more powerful disinfectant than chlorine. It destroys bacteria and viruses, including polio virus, on contact. Ozone does not destroy natural water flavoring agents as chlorine does. It does not leave a disagreeable taste or odor as chlorine does. In fact, ozone improves the taste of potable water by increasing its oxygen content. Ozone eliminates odors and most contaminents commonly found in water without combining to produce carcinogenic compounds that have caused serious concerns on the part of the EPA and FDA in their studies of chlorine treatment.

OZONE BASED WELL PURIFICATON SYSTEMS

The various water purification systems described in this brochure are relatively simple in terms of concept and operation. Water from a well is pumped to a contact column into which ozone is dispersed. Contact time with the ozone is engineered to suit the types and concentrations of contaminents. The water then passes on to sand and/or charcoal filters which trap most of the now physically changed contaminents. If heavy metals are present in the water source, a trap may be provided for their periodic removal. Finally, the water is pumped into a holding tank which is also ozonated to preserve its purity until drawn from the tap. The size of the ozone generator is based on the concentration of contaminents and the volume of water pumped during peak periods of the day.

THE CARVALHO DIFFERENCE IN OZONE SYSTEMS

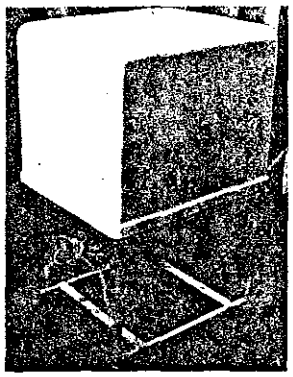
While ozone has long been recognized as an effective water purifier, the cost of equipment needed to produce it as well as the electrical costs to generate it have limited its use to the most difficult of applications. Ozone generators have traditionally required expensive cooling systems as well as air dryers. All Carvalho ozone systems use a patented generating tube called the Ozotron™ which operates without waste heat and without the need for dry air except for very large systems used in some municipal plants. Laboratory tests have shown that the Ozotron™ tube produces ozone with approximately one seventh of the electrical energy required for traditional tubes and without the nitrogen compounds normally associated with ozone production. The drastic reduction in both equipment and operating costs make Carvalho systems practical for a host of applications that would not have been seriously considered a few short years ago.

INSTALLATION AND SERVICE

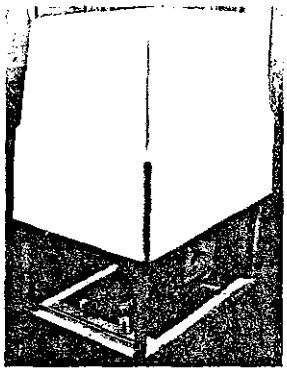
Carvalho ozone systems are sold by experienced well drillers and water purification companies at the local level. Each installation is engineered to meet the specific needs of the local area and the individual user. Continuing service is provided by the company that engineers and installs the system.

While the availability of qualified local service is and should be a real concern to the purchaser of a water purification system, the potential need for ozone generator service is minimal. The Industry's standard warranty for ozone generating tubes is 90 days. The Ozotron™ carries a full two year warranty. The expected life of each tube is considerably longer than two years. The warranty period for all other components is one year.

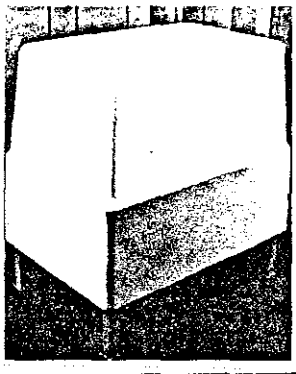
OZONE GENERATORS CURRENTLY AVAILABLE



Model D-8 includes 8 Ozotron™ tubes and purifies up to 10,000 gallons of water each day, depending on type and concentration of contaminents. It produces 60 grams of ozone per day and consumes 345 watts per hour.



Model D-20 includes 20 Ozotron™ tubes and purities up to 37,500 gallons of water each day, depending on type and concentration of contaminent. It produces 96 grams of ozone per day and consumes 736 watts per hour.



Model D-40 includes 40 Ozotron™ tubes and purifies up to 75,000 gallons of water each day, depending on the type and concentration of contaminents. It produces 230 grams of ozone per day and consumes 1,840 watts per hour.

NOTE: The contaminents for which ozone is described as as being effective on the reverse side of this brochure are those which have been tests and proven. For information regarding contaminents not tested contact your local dealer or Carvalho Industries.

Carvalho Industries also manufactures water purification systems for swimming pools, spas, hot tubs, Jacuzzis and municipal and industrial waste water as well as a variety of air purification systems.

WARRANTY: Ozotron™ tubes are warranted for a period of two years against defects in material or workmanship. All other components are warranted for a period of one year. Any Carvalho Industries' system or component will be repaired or replaced at the Company's option within the warranty period in the event of failure. Repair or replacement will be accomplished at the Factory or the appropriate authorized service center, or at the installation site if covered by a service contract.

CARVALHO INDUSTRIES INC.

WATER & AIR PURIFICATION SYSTEMS

CARVALHO INDUSTRIES, INC.
P.O. BOX 7149, KLAMATH FALLS, OR 97602

STEVE McKEAG
Field Representative
503-883-1531 (Office)
503-884-1918 (Home)

E15

EQC
Sawyer
Hansen

Portland Ore.
Aug 31, 84

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 04 1984
OFFICE OF THE DIRECTOR

Mr. Fred Hansen
E.Q.C.
Portland, Oregon

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 4 1984
WATER QUALITY CONTROL

Dear Mr. Hansen,

Thursday Aug. 30 I attended a meeting at Parkrose High School. It was to have been for the people of East County to study the problem of sewer seepage.

I took the time to call 34 people to remind them of the meeting.

I have never gone to a meeting that the speaker sat with his back to the people. We were unable

to hear and I really believe it was done to let us know that we as citizens and tax payers have nothing to say about our future: it was rude and crude

I would also like to add that I stayed until 2:30 and at that time everyone was leaving and not one person from the Community was able to speak -

I was interviewed by one of the T.V. stations outside of the building because they wanted to know how the people felt. They said they wanted to hear from the people not the politicians. I might add that I followed one of the press cars when I left, and again the politicians played the game and won.

These meetings are a sham You don't intend to listen to us.

many of us will lose our homes unless we are able to sell out now. Believe me, if I am able to sell I will never step my foot back in Oregon again - & will continue telling people in other states what a terrible place Oregon is - In fact I am going to send out some letters today.

with complete disgust
Mrs. Betty Emery
2629 N.E. 166
Portland, Oregon
97236

E16 EQC Sawyer Hansen

EARL BLUMENAUER
Multnomah County Commissioner

County Courthouse
Portland, Oregon 97204
(503) 248-5218

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 04 1984
OFFICE OF THE DIRECTOR

August 29, 1984

Environmental Quality Commission
520 S.W. Fifth
Portland, Oregon 97204

Dear Commission Members,

While I am unable to attend the August 30 public hearing before the Environmental Quality Commission, I wanted to submit comments for the public record as I feel strongly about the threat to drinking water in the unsewered areas of East Multnomah County.

The East County groundwater system is a precious source of drinking water for many County residents, yet it has been described as a septic time bomb. Since 1971, studies have shown water quality is deteriorating due to contamination from nitrates. While surface water runoff and soil fertilization no doubt contribute to the problem that is minimal and the major concern is the amount of untreated sewage disposed into the ground. An estimated 10 million gallons of sewage is disposed daily from 56,000 cesspools in the unincorporated area.

The issue is no longer just a concern of East County. The City of Portland is using East County groundwater for a supplemental drinking water supply. Since Portland supplies most of the water in the Tri-County area, everyone in the region has a direct interest in this water quality issue.

For over 15 years, the County Board has been concerned about this problem and has encouraged sewer development in the area. Specific steps have included construction of the Inverness Sewage Treatment Plant and sewer lines, studies by private consultants and citizen advisory committees, and approval of fees or charges which will help to finance further plant and line expansion.

The following steps have been taken over the past two years:

- In July, 1982, the Board of County Commissioners approved an arrangement with the State and Metro Service District which made the construction of sewers along the Burnside segment of the light rail corridor possible.

- The East County Sewer Consortium received a $5.6 million grant from the federal government for sewer construction projects in sewer basins which are the responsibility of Gresham, Troutdale, Portland and Multnomah County.

- Multnomah County Central County Service District and Portland approved an agreement in September of 1983 regarding the planning, construction and financing of a sewage disposal system which will allow additional residential, commercial and industrial hookups in mid Multnomah County

- Recent analysis by the County Health Officer has determined the existence of a threat to drinking water.

- In June, the County Board approved a framework plan to finance and install sewage systems throughout mid Multnomah County during the next 20 years.

The issue of sewers in East Multnomah County is of great importance to the County and the affected residents. The problem of contaminated drinking water is real and needs immediate attention. To maintain the status quo is to increase the danger dramatically. The Board of County Commissioners has recognized the problem and has approved a plan which offers a solution. I hope that you, too, will agree that the threat to drinking water in the unsewered areas is fact not fiction.

Sincerely,

Earl Blumenauer bg

Earl Blumenauer

cc - Dennis Buchanan

EB:bg

EM

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 05 1984
OFFICE OF THE DIRECTOR

EQC
Hansen
Sawyer

Mary Ellis
3908 NE 134
Port

I have lived in East Mult County for 20 years, and for the last 5 years I have been using Chemical in my failing cess pool to keep my home working!

I realize that this solves one problem, my failing cesspool, but in term it my cause another

I been work at getting people to sign a L.I.D in Argay Terace area and have talk to a lot of people with cesspool failures

There are people letting sewage run across there yards & familes that can't use washer or dishwasher,

There a family ~~with~~ with a son in a wheel chair, that the mother has to wait for a family menber to come home so she can go to the laundry mat, because of a cess pool failure

I know of families that have to plan on when they take baths or showers by how much water that been put in the failing

cess pool.

These things I have seen or heard far to offensive the pass 6 months.

I could go on & on, but I would like to share a letter with that a neighbor ask me to bring

Read Letter

Thank you

EQC E18
Hansen
Sawyer

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 05 1984
OFFICE OF THE DIRECTOR

3928 NE 134th
Portland, Oregon
August 29, 1984

To the EQC:

I am writing to tell you of some of the problems I've had with my cesspool. I'm writing not only to share my misery (which always makes one feel better) but to enable people to get a perspective of what it's like living on a day by day basis with a waste problem.

I live in my home on NE 134th with my three children. I have been divorced for ten years. If you work outside the home, cook, clean and care for three children, and try to take care of a big yard, life is a struggle. I don't need cesspool problems. But I've had them for the last five years.

I can't use my dishwasher and haven't been able to for three years. My drains won't take the water away. The last time I used it, it leaked all over the kitchen floor and seeped through the ceiling of the laundry room below.

RECEIVED
SEP 05 1984
WATER QUALITY CONTROL

Now you can survive without a dishwasher, but you cannot survive without clean clothes. This is the way we do laundry. All four of us get involved because the process is so frustrating, one person can't be left at the post alone or he or she will go bonkers. We wait for the washing machine to fill up and wash. We have to watch it constantly because when it starts to drain, we have to be on patrol. If we don't stop the cycle at least three times, it backs up into the machine. If we don't catch the cycle at the right time, we have a flood in our laundry room. Then we have to repeat the process while the machine goes through a rinse cycle. To do the laundry for a weekend outing could turn into a lifetime project.

Our greatest fear is that by some horrible happenstance two parties might flush a toilet at the same time. I shudder to think of the consequences.

We haven't been able to use our shower for three years.

Do you know what this is like for three teenagers? They feel like they are living in an underdeveloped country.

I would get in my car and head for the Columbia Slough with my laundry and look for some smooth stones to beat it against like they do in Central America, but I'm afraid someone from the EQC would see me and arrest me.

Please - whatever you can do to speed up the arrival of sewers to East County - please do it.

Sincerely,

Elaine Tuck

EQC (E19)
Hansen
Sawyer

To whom it may concern:

We are very anxious to receive sewers in our neighborhood as our situation is becoming very frustrating with our cesspool system. I have three small children and at this time can only do one load of wash daily as my bathtub fills up with sewage. In the past year we have had to put chemicals in our cesspool six times with little relief. I am very concerned as to what this may be doing to our ground water as all of our neighbors have had to do the same. We have had to replace our toilet due to it's cracking under pressure with excess sewage coming up. I feel it is only being responsible to deal with the problem!! that means a sewer system!!

Thank you
Mary Lindquist
3919 NE 134th
Portland, 97230

E 20 EQC

8-24-84 Hansen Sawyer

Environmental Quality Control

Sirs :

Just a short letter to let you know of some of the problems I have been having with my sewage disposal. For the last 2 years I have had a septic cleaner co dumping liquid caustic into my disposal system. That is the only way I can control the amount of sewage that backs up into my bath tub or into my back yard, every time we do a load of wash. This is a deplorable situation to have to live with. I understand my area is due for a sewage system in the near future, but the whole area needs help if we are ever going to clean up our water system. Thank you.

Don Adkins
15232 N.E. Failing ct.
Portland, Oregon,
97230

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

Sept. 4, 1984

E21

HAND-DELIVERED

Fred Hansen, Director
Department of Environmental Quality
522 S.W. 5th Ave.,
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Hansen:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

Attached is a copy of my August 31, 1984 letter to Multnomah County Executive Dennis Buchanan, listing 23 categories of documents sought to be inspected prior to the Sept. 11, 1984 deadline set by the Commission.

Pursuant to the Public Records Law, I request that I be allowed to inspect the documents listed in the attachment with the exception of category (14).

There may be a misapprehension as to the burden of proof governing the hearings. It is submitted that the Department of Environmental Quality and other proponents have the burden of meeting the statutory burden of proof that would permit the Commission to order installation of a sewage system and imposition of a "seepage fee."

In other words, more than the proponents' desire is required; evidence is required.

One factor is whether contamination is increasing or is expected to increase. The record to date appears to be silent on that vital issue, and, furthermore, apparently overlooks the expected decline in groundwater contamination as the City of Portland, the City of Gresham, and perhaps other entities in mid-Multnomah County, remove cesspools and septic tanks in favor of their expanding sewage collection systems. And of course, the DEQ has issued an order halting approval of septic tank/cesspool systems in the affected area of mid-Multnomah County.

Because of the Sept. 11, 1984 deadline for comment, I request that I be allowed to inspect the documents, and order copies of document I select, as soon as feasible. The response will be made part of the hearings record prior to the Sept. 11, 1984 deadline.

Sincerely,

Henry Kane

cc: Spencer Heinz, The Oregonian

HENRY KANE
ATTORNEY AT LAW
12275 S W. 2ND
P O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

August 31, 1984

HAND-DELIVERED

Honorable Dennis Buchanan
County Executive
1500 Portland Building
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Buchanan:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

I request that I be allowed to inspect the documents listed below, and to order copies I designate at my cost, as soon as feasible, so that the documents and my findings may be presented to the Environmental Quality Commission prior to September 11, 1984.

It is submitted that it is in the interest of Multnomah County, as a proponent, to produce the documents that would support its position.

Pursuant to the Oregon Public Records Law, and at my cost, I request that I be allowed to inspect and order copies of the following documents:

(1) All documents indicating that since 1960 the underground water in east or mid-Multnomah County contained "agents" in excess of the maximum state and/or federal limits

(2) As to each "agent" deemed in excess of any such limit, the state/federal statute or regulation imposing the limit

(3) All documents reflecting that since 1970, on an annual basis, there has been a significant increase in the amount of pollutants in east or mid-Multnomah County groundwater

(4) all documents indicating that within the preceding 20 years there were outbreaks of disease, illness or disability caused by drinking or using polluted groundwater in east or mid-Multnomah County

(5) all documents indicating that since 1945 any person has suffered illness, injury or death because of drinking water containing nitrate

(6) all documents indicating what a water district can do to remove nitrate from drinking water

(7) all documents supporting Dr. Schade's claim in Threat to Drinking Water Findings that "values above the Environmental Protection Agency's maximum contaminant level (MCL) of teen milligrms per liter of nitrate nitrogen have been reported in the area (1)."

(8) All documents indicating that the following chemicals mentioned by Dr. Schade caused disease, illness or death when consumed in drinking water:

(a) tetrachlorethylene

(b) trichlorethylene

(c) trichlorofluoromethane

(d) trans-1, 2 dichloroethene.

(9) All documents supporting Dr. Schade's claim that "A typical compound is tetrachloroethylene which has been found in two of the ten wells studied at levels of up to three parts per billion."

(10) All documents supporting any claim that the amount of nitrate in groundwater in east or mid-Multnomah County has increased during the past 20 years

(11) All documents reflecting the amount of rainwater that enters the groundwater annually in east or mid-Multnomah County and the diluting effect, if any, on the groundwater of such rainwater

(12) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines now under construction or under contract by a public body in east or mid-Multnomah County

(13) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines to be constructed with the $21 million federal grant the Environmental Quality Commission approved for that purpose

(14) All documents pertaining to HB 2784, Chapter 235, Oregon Laws 1983, relating to construction of sewage treatment works, including but not limited to documents presented to legislative committees, announcements by the Board of Commissioners of support of HB 2784, Board of Commissioner minutes approving sponsorship of what became HB 2784, and the invoices reflecting the County's payments to any law firm that drafted what became HB 2784

(15) All documents reflecting the amount of reduced groundwater pollution after homes and other facilities now using septic tanks, cesspools, etc., in east or mid-Multnomah County are hooked into sewers now under contract and to be constructed by the City of Portland with the $21 million grant approved by the Environmental Quality Commission

(16) A summary-type document, if any exists, indicating how many homes that would be compelled to pay a "seepage fee" would receive sewage service by

(a)	Dec. 31, 1985	(e)	Dec. 31, 1989	(i)	Dec. 31, 1993	(m)	2005
(b)	Dec. 31, 1986	(f)	Dec. 31, 1990	(j)	Dec. 31, 1994	(n)	2010
(c)	Dec. 31, 1987	(g)	Dec. 31, 1991	(k)	Dec. 31, 1995	(o)	2015
(d)	Dec. 31, 1988	(h)	Dec. 31, 1992	(l)	Dec. 31, 2000	(p)	2020

and (q) would never receive sewage service

(17) Any document indicating the geographic area of east or mid-Multnomah County that would not receive sewer service under the $255 million sewage program

(18) All documents evidencing that a pollutant found in groundwater taken from one well is found uniformly in the groundwater throughout the east or mid-Multnomah County area

(19) All documents evidencing that the groundwater in the following four drainage basins contain the same pollutants in the same quantities:

(a) the Inverness Basin

(b) the Columbia Basin

(c) the Johnson Creek Basin

(d) the Gresham Basin

(20) All documents supporting the claim in Threat to Drinking Water Findings that:

> "Thirteen wells in or around the affected area have nitrate levels that exceed the 5.0 mg/l (50% of maximum allowable limit). Statistical analysis indicates an increase in contamination levels in wells of the lower reaches of the groundwater aquifer compared to the wells of the upper reaches. This means the lower reaches are affected by a greater quantity of contributing seepage. * * *

(21) All documents that indicate that any of the 13 wells referred to in paragraph (2), supra, are used by any water district to obtain drinking water for their patrons

(22) Any document that indicates that there is at present, a clear and present danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County

(23) Any document that indicates that if the $255 million sewage program is not implemented, within the next five years there will be a clear danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County.

Thank you for your courtesies in this matter.

Sincerely,

Henry Kane

cc: DEQ

VICTOR ATIYEH
GOVERNOR

Department of Environmental Quality

E21

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 ~~PHONE (503) 229-5696~~

CLEARANCE		
TO		DATE
		9/5
		9/5
Huston	MH	9/5

September 5, 1984

Henry Kane
Attorney-at-Law
12275 S. W. Second St.
P. O. Box 518
Beaverton, OR 97075

Dear Mr. Kane:

We have reviewed your letter dated September 4, 1984 concerning your request to inspect and copy documents pertaining to hearings now being held before the Environmental Quality Commission to determine whether a threat to drinking water exists in Mid-Multnomah County.

All the information collected by Department staff or submitted for the public hearing is available. This includes well data, information and reports concerning contamination to groundwater and proposed sewering of the area, and all exhibits submitted to the hearing record.

The agency file and record generated to date on the hearings are public information. Please feel free to review these files and the record.

The information is available at the Department offices, 2nd floor of the Yeon Building, 522 S. W. Fifth Ave., Portland, from 8 a.m. to 5 p.m., Monday through Friday. The fee for copies is 10¢ per copy, if you use our copying machine, or 25¢ per copy, if agency staff does the copying.

Please contact Anna Kingsfather at 229-6493 so the information may be conveniently located for your review.

Sincerely,

Original Signed By
Fred Hansen

SEP 05 1984

Fred Hansen
Director

TJL:ak

Recd from Mike Houston
9/7/84

E22

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

Sept. 4, 1984

Michael Huston, Asst. Atty. Gen.
500 Pacific Building
520 S.W. Yamhill
Portland, OR 97204

Re: Environmental Quality Commission hearings on whether to compel installation of sanitary sewers and impose a "seepage fee" in East Multnomah County

Dear Mr. Huston:

This note confirms our telephone discussion this date concerning the above matter.

Enclosed please find your information copy of my Sept. 4, 1984 Public Records Law request to the Department of Environmental Quality. It is attached to an August 31, 1984 request to Multnomah County Executive Dennis Buchanan.

There is a question as to whether there is evidence, sufficient or otherwise, to support a finding under the 1983 law that there is a threat of drinking waster in East Multnomah County.

The enclosures reflect my intention to review the documentary evidence, and then to inform the Commission of my findings. Based on what a heard at the hearing last week, there was much language and insufficient evidence.

And I do not recall any of the proponents giving consideration to the ORS 454.300 alternative, particularly subsection (5) of ORS 454.300.

My reading of the statute indicates that the Commission must make findings of fact as to the most economical method of removing or alleviating a threat to drinking water. The most economical method, and one costing less than $160 million, is to compel the water districts and the City of Portland (1) treat ground water or (2) not use ground water.

There is a question in my mind of the "neutrality" of the Department of Environmental Quality. Enclosed is a copy of a Dec. 16, 1984 Oregonian article titled "Tainting intensifies DEW sewer battle. It states in part:

> "As a result of recent well-water tests in East Multnomah County, the Oregon Department of Environmental Quality is more determined than ever to force the installation of sanitary sewers in East Multnomah County, a DEQ official says.

> "Harold L. Sawyer, manager of the DEQ water-quality division, said the sewers are needed to protect fragile underground water supplies.
>
> * * *
>
> "'There will be lots of discussion of what the numbers means, whether there is any reason to change the course of action we are on in trying to get the east county area sewered,' the DEQ's top water-quality official said.
>
> "'It confirms our view that sewers are needed,' he said. 'We have been pushing to get that done. That is the only way to protect the ground water.'"

The article and the above-quoted excerpts indicate that the DEQ staff has decided the issue pending before the Commission.

If Multnomah County and the DEQ cannot produce the documents prior to September 11, 1984, I shall move the Commission for an appropriate extension of time within which to submit written comments and documents, including this one and enclosures.

Because the Commission is operating under a 1983 statute, it is submitted that the Commission record must contain evidence that is more than unsupported language/claims. Were I the attorney for a proponent I would have my witnesses testify under oath, identify exhibits such as laboratory reports, and have the Commission formally admit the documents as numbered sequence exhibits.

My recollection is that after presentation of the proponents' case-in-chief, Chairman Petersen indicated that members of the audience would have an opportunity to question witnesses.

I would like to do so on behalf of my client, and by this means ask when I may do so. I particularly would like to question Multnomah County Health Officer Schade.

Sincerely,

Henry Kane

encls.

...anything ... cause cancer in ... assumption for- | water districts and the DEQ to question officials about the chemical's health effects, Mullane and water district officials said. | ... "a few calls" from customers about the DEQ report, he said.

E22a

Oregonian 12/16/83

Staff photo by MARY BONDAROWICZ

outdale.

Tainting intensifies DEQ sewer battle

By PAUL KOBERSTEIN
of The Oregonian staff

As a result of recent well-water tests in East Multnomah County, the Oregon Department of Environmental Quality is more determined than ever to force the installation of sanitary sewers in East Multnomah County, a DEQ official says.

Harold L. Sawyer, manager of the DEQ water-quality division, said the sewers are needed to protect fragile underground water supplies.

Test results showed that small amounts of a industrial solvent that has caused cancer in laboratory animals — tetrachloroethene — were found in east county water wells in two samplings, the DEQ reported Monday.

However, officials of the Hazelwood Water District — owner of two wells the DEQ says may be contaminated — said the DEQ report appears to be false.

Although the reported concentrations are small, they are high enough to concern the U.S. Environmental Protection Agency, which enforces federal drinking water laws in Oregon. The concentrations also are high enough to concern Sawyer.

"There will be lots of discussion of what the numbers mean, whether there is any reason to change the course of action we are on in trying to get the east county area sewered," the DEQ's top water-quality official said.

"It confirms our view that sewers are needed," he said. "We have been pushing to get that done. That is the only way to protect the ground water."

DEQ orders sewer plans

The DEQ has ordered Portland, Gresham and Multnomah County to write plans to build and pay for sewers in parts of east county under the control of each jurisdiction.

The plans are due by July 1, 1984, Sawyer said. If the plans do not satisfy the DEQ, the agency may halt construction in east county after Jan. 1, 1985, he said.

By 1990, the DEQ wants 90 percent of east county on sewers, Sawyer said.

He said the DEQ is checking the top of the east county water table — an underground supply 50 feet below the surface fed mainly by rainwater soaking through the gravel and soil.

Wayne R. Bryan, manager of the Hazelwood Water District, disputed a statement by the coordinator of the DEQ's ground water study program, Neil J. Mullane, about the depth of the wells tested.

Bryan said the two sampled Hazelwood wells are 252 and 300 feet deep while Mullane said Hazelwood's tested wells are only 50 feet deep. Mullane also said he doubted the validity of the DEQ's test results.

Burt Bailey, chairman of the Hazelwood board of directors, challenged the DEQ results.

"There is no reason for the wells to be endangered in any way," Bailey said.

Bryan believes the DEQ is seeking publicity "to justify its existence." He plans to conduct a separate study of Hazelwood water.

The DEQ has tested east county ground water for various substances for nearly 10 years, but only since October has it had the kind of equipment needed to check for toxic chemicals such as tetrachloroethene, Mullane said.

85 percent without sewers

About 85 percent of east county households in the Inverness basin between Southeast Division Street and 82nd and 146th avenues are without sewers, said Burke N. Raymond, county sewer supervisor.

The area dumps about 10 million gallons of sewage daily — or 3.65 billion gallons yearly — into the ground, he said.

By state law, the DEQ protects surface and underground water supplies, but until recent years virtually ignored the underground water, Sawyer said.

"It is imporant to protect it for a couple of reasons," he said. "One, I am quite confident that future generations are going to be looking to that ground water for their needs. We are finding more and more that ground water is very valuable.

"The second reason is that one of the things the Legislature has done is (say) that ground water is a resource that needs to be protected. We have a mandate to protect all of the ground water in the state," Sawyer said.

Environmentalists are becoming more concerned about east county underground water pollution, said John A. Charles, executive director of the Oregon Environmental Council.

"It seems almost inevitable that (the pollution) will become a more serious problem in the future," he said. "What you are talking about is a long-term, irreversible contamination of a water source."

E225

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

Sept. 4, 1984

Rec'd 9/4/84 to

HAND-DELIVERED

Fred Hansen, Director
Department of Environmental Quality
522 S.W. 5th Ave.,
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Hansen:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

Attached is a copy of my August 31, 1984 letter to Multnomah County Executive Dennis Buchanan, listing 23 categories of documents sought to be inspected prior to the Sept. 11, 1984 deadline set by the Commission.

Pursuant to the Public Records Law, I request that I be allowed to inspect the documents listed in the attachment with the exception of category (14).

There may be a misapprehension as to the burden of proof governing the hearings. It is submitted that the Department of Environmental Quality and other proponents have the burden of meeting the statutory burden of proof that would permit the Commission to order installation of a sewage system and imposition of a "seepage fee."

In other words, more than the proponents' desire is required; evidence is required.

One factor is whether contamination is increasing or is expected to increase. The record to date appears to be silent on that vital issue, and, furthermore, apparently overlooks the expected decline in groundwater contamination as the City of Portland, the City of Gresham, and perhaps other entities in mid-Multnomah County, remove cesspools and septic tanks in favor of their expanding sewage collection systems. And of course, the DEQ has issued an order halting approval of septic tank/cesspool systems in the affected area of mid-Multnomah County.

Because of the Sept. 11, 1984 deadline for comment, I request that I be allowed to inspect the documents, and order copies of document I select, as soon as feasible. The response will be made part of the hearings record prior to the Sept. 11, 1984 deadline.

Sincerely,

Henry Kane

cc: Spencer Heinz, The Oregonian

E 22 e

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

August 31, 1984

HAND-DELIVERED

Honorable Dennis Buchanan
County Executive
1500 Portland Building
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Buchanan:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

I request that I be allowed to inspect the documents listed below, and to order copies I designate at my cost, as soon as feasible, so that the documents and my findings may be presented to the Environmental Quality Commission prior to September 11, 1984.

It is submitted that it is in the interest of Multnomah County, as a proponent, to produce the documents that would support its position.

Pursuant to the Oregon Public Records Law, and at my cost, I request that I be allowed to inspect and order copies of the following documents:

(1) All documents indicating that since 1960 the underground water in east or mid-Multnomah County contained "agents" in excess of the maximum state and/or federal limits

(2) As to each "agent" deemed in excess of any such limit, the state/federal statute or regulation imposing the limit

(3) All documents reflecting that since 1970, on an annual basis, there has been a significant increase in the amount of pollutants in east or mid-Multnomah County groundwater

(4) all documents indicating that within the preceding 20 years there were outbreaks of disease, illness or disability caused by drinking or using polluted groundwater in east or mid-Multnomah County

(5) all documents indicating that since 1945 any person has suffered illness, injury or death because of drinking water containing nitrate

(6) all documents indicating what a water district can do to remove nitrate from drinking water

(7) all documents supporting Dr. Schade's claim in Threat to Drinking Water Findings that "values above the Environmental Protection Agency's maximum contaminant level (MCL) of teen milligrms per liter of nitrate nitrogen have been reported in the area (1)."

(8) All documents indicating that the following chemicals mentioned by Dr. Schade caused disease, illness or death when consumed in drinking water:

(a) tetrachlorethylene

(b) trichlorethylene

(c) trichlorofluoromethane

(d) trans-1, 2 dichloroethene.

(9) All documents supporting Dr. Schade's claim that "A typical compound is tetrachloroethylene which has been found in two of the ten wells studied at levels of up to three parts per billion."

(10) All documents supporting any claim that the amount of nitrate in groundwater in east or mid-Multnomah County has increased during the past 20 years

(11) All documents reflecting the amount of rainwater that enters the groundwater annually in east or mid-Multnomah County and the diluting effect, if any, on the groundwater of such rainwater

(12) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines now under construction or under contract by a public body in east or mid-Multnomah County

(13) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines to be constructed with the $21 million federal grant the Environmental Quality Commission approved for that purpose

(14) All documents pertaining to HB 2784, Chapter 235, Oregon Laws 1983, relating to construction of sewage treatment works, including but not limited to documents presented to legislative committees, announcements by the Board of Commissioners of support of HB 2784, Board of Commissioner minutes approving sponsorship of what became HB 2784, and the invoices reflecting the County's payments to any law firm that drafted what became HB 2784

(15) All documents reflecting the amount of reduced groundwater pollution after homes and other facilities now using septic tanks, cesspools, etc., in east or mid-Multnomah County are hooked into sewers now under contract and to be constructed by the City of Portland with the $21 million grant approved by the Environmental Quality Commission

(16) A summary-type document, if any exists, indicating how many homes that would be compelled to pay a "seepage fee" would receive sewage service by

(a)	Dec. 31, 1985	(e)	Dec. 31, 1989	(i)	Dec. 31, 1993	(m)	2005
(b)	Dec. 31, 1986	(f)	Dec. 31, 1990	(j)	Dec. 31, 1994	(n)	2010
(c)	Dec. 31, 1987	(g)	Dec. 31, 1991	(k)	Dec. 31, 1995	(o)	2015
(d)	Dec. 31, 1988	(h)	Dec. 31, 1992	(l)	Dec. 31, 2000	(p)	2020

and (q) would never receive sewage service

(17) Any document indicating the geographic area of east or mid-Multnomah County that would not receive sewer service under the $255 million sewage program

(18) All documents evidencing that a pollutant found in groundwater taken from one well is found uniformly in the groundwater throughout the east or mid-Multnomah County area

(19) All documents evidencing that the groundwater in the following four drainage basins contain the same pollutants in the same quantities:

(a) the Inverness Basin

(b) the Columbia Basin

(c) the Johnson Creek Basin

(d) the Gresham Basin

(20) All documents supporting the claim in Threat to Drinking Water Findings that:

> "Thirteen wells in or around the affected area have nitrate levels that exceed the 5.0 mg/l (50% of maximum allowable limit). Statistical analysis indicates an increase in contamination levels in wells of the lower reaches of the groundwater aquifer compared to the wells of the upper reaches. This means the lower reaches are affected by a greater quantity of contributing seepage. * * *

(21) All documents that indicate that any of the 13 wells referred to in paragraph (2), supra, are used by any water district to obtain drinking water for their patrons

(22) Any document that indicates that there is at present, a clear and present danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County

(23) Any document that indicates that if the $255 million sewage program is not implemented, within the next five years there will be a clear danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County.

Thank you for your courtesies in this matter.

Sincerely,

Henry Kane

cc: DEQ

E23a

MULTNOMAH COUNTY OREGON

DEPARTMENT OF HUMAN SERVICES
DISEASE CONTROL OFFICE
426 S.W. STARK STREET
PORTLAND, OREGON 97204
(503) 248-3406

DENNIS BUCHANAN
COUNTY EXECUTIVE

M E M O R A N D U M

TO: HAROLD SAWYER, ADMINISTRATOR
DEQ, WATER QUALITY

FROM: CHARLES P. SCHADE, M.D.
HEALTH OFFICER

DATE: SEPTEMBER 7, 1984

RE: THREAT TO DRINKING WATER--HEARING RECORD

Enclosed is a copy of a recently published "In My Opinion" article. Please include it in the Threat to Drinking Water hearing record.

Midcounty water safety needs sewers

By CHARLES P. SCHADE

In my opinion

FOR MORE THAN 10 years, public health officials in Oregon have been concerned that increasing amounts of pollution brought about by use of cesspools in East Multnomah County might endanger the health of residents in that area.

The problem is sewage. Each day, 135,000 midcounty residents dispose of 14 million gallons of raw sewage into the ground. Midcounty groundwater is becoming contaminated by waste discharges, posing a potential threat to human health.

Presently, the Oregon Environmental Quality Commission is holding public hearings to determine if there is a threat to drinking water in mid-Multnomah County. If the commission concludes a threat exists, as I believe it must, then an order to construct sewers likely will follow.

According to geologists, midcounty sits on top of large aquifers, underground rivers that flow through gravel from the Cascade Mountains to the Willamette and Columbia rivers. The gravel, which extends several hundred feet below the surface, provides excellent drainage. Unfortunately this has led to widespread use of cesspools — deep pits that receive sewage and let it seep into the ground without treatment — for sewage disposal. Enough raw sewage is being flushed into the ground each day in midcounty to fill a five-story tank the size of a football field.

The threat to the aquifers in midcounty recalls another water pollution crisis not so long ago. Raw sewage used to be dumped directly into Oregon's rivers, lakes and streams. Many were unsafe for drinking or swimming. In the 1960s and 1970s, widespread concern about the environment and human health resulted in construction of sewage treatment plants. As a result, our local waterways are safe again.

The contamination of surface waters that occurred in the past is analogous to what is now occurring to ground water. Sewage being dumped into the ground in midcounty does not just go away. Inevitably, it reaches water that can be used by Multnomah County residents for other purposes.

Data gathered by the Department of Environmental Quality and the U.S. Geologic Survey show that the shallower aquifers beneath the unsewered parts of midcounty contain substantial amounts of the chemical by-products of human waste disposal, as well as traces of industrial chemicals. The major contaminant is nitrate, a product of decomposing wastes. Its principal harmful effect is the production of methemoglobinemia, a serious disease in small infants that inhibits the blood's ability to carry oxygen, causing asphyxiation. Nitrates also can harm people who require kidney dialysis.

Recent studies suggest that even low levels of nitrate in water may aggravate high blood pressure and cause birth defects. While nitrate levels in wells in midcounty generally meet federal safe drinking water standards, some are now at 70 percent of the allowable limits and occasionally have exceeded them.

From other parts of the country we hear reports of dangerous solvents finding their way into groundwaters. These kinds of pollutants now are beginning to appear in some midcounty wells. Organic solvents such as tetrachloroethylene have been detected in several wells. These substances are known to cause liver damage and nervous system damage in high doses, and are suspected of causing cancer.

At the moment, we do not have a public health emergency in midcounty. But steps need to be taken now to ensure we do not face one in the future. It is unacceptable public health policy to continue dumping raw sewage into an aquifer used by 50,000 people as their source of drinking water.

The answer to groundwater pollution in mid-Multnomah County is a program to install sewers. Sewers will provide two critical public health benefits. First, sewers will allow urban development without further degradation and contamination of groundwater, thus benefiting existing residents and allowing future growth. Second, sewers will enable homeowners to replace failing cesspools with a permanent and safe means of waste disposal.

The Environmental Quality Commission hearings are an opportunity for the public to learn all of the facts about groundwater pollution and the threat to human health that subsurface sewage causes. If the commission finds that a threat to drinking water does exist in midcounty, Oregon law calls for it to order a remedy. That remedy likely will be installation of sewers. Sewer service providers — Portland, Gresham and the Central County Service District — then will have 12 months to prepare the necessary engineering and financial plans to start building sewers.

It is in everyone's interest to see that a sewer program begins as soon as possible. Action by the commission will be critical to achieving that result.

Charles P. Schade, M.D., is Health Officer for Multnomah County.

E24

CITY OF

PORTLAND, OREGON

BUREAU OF PLANNING

Francis J. Ivancie, Mayor
Terry D. Sandblast, Director
Room 1002, 1120 S.W. Fifth Avenue
Portland, Oregon 97204-1966
(503) 796-7701

Code Administration 796-7700 Land Use 796-7700 Urban Design 796-7702

August 28, 1984

Harold Sawyer, Administrator
Water Quality Division
Department of Environmental Quality
522 SW 5th Avenue
Portland, OR 97204

Dear Mr. Sawyer:

The Framework Plan for Providing Sewer Service to Mid-Multnomah County, as proposed by the East County Sanitary Sewer Consortium (June 1984), is consistent with and supports the City of Portland Comprehensive Plan. In particular, the plan is in direct support of the City's Urban Services Policy (Comprehensive Plan Policy 11.1.B) and Policy 11.24, which gives priority to the development of sewer systems in urbanized areas that are not sewered. It also appears that the sewer plan provides adequate capacity to serve the land uses contemplated in the appropriate comprehensive plans.

Sincerely,

Terry D. Sandblast
Planning Director

TDS:JT:mh

cc: John Lang, Sewerage System Administrator

007

attachments

E24a

SECTION XI: PUBLIC FACILITIES GOALS AND POLICIES LIST

GENERAL GOAL:

11 A PROVIDE A TIMELY, ORDERLY AND EFFICIENT ARRANGEMENT OF PUBLIC FACILITIES AND SERVICES THAT SUPPORT EXISTING AND PLANNED LAND USE PATTERNS AND DENSITIES.

GENERAL POLICIES:

11.1 SERVICE RESPONSIBILITY

A. WITHIN ITS BOUNDARIES OF INCORPORATION, THE CITY OF PORTLAND WILL PROVIDE, WHERE FEASIBLE AND AS SUFFICIENT FUNDS ARE AVAILABLE FROM PUBLIC OR PRIVATE SOURCES, THE FOLLOWING FACILITIES AND SERVICES AT LEVELS APPROPRIATE FOR ALL LAND USE TYPES:

(1) STREETS AND OTHER PUBLIC WAYS;
(2) SANITARY AND STORMWATER SEWERS;
(3) POLICE PROTECTION;
(4) FIRE PROTECTION;
(5) PARKS AND RECREATION;
(6) WATER SUPPLY;
(7) PLANNING, ZONING, BUILDINGS AND SUBDIVISION CONTROL.

THE CITY OF PORTLAND SHOULD ENCOURAGE THE PLANNING EFFORTS OF THOSE AGENCIES PROVIDING THE FOLLOWING SERVICES:

(8) PUBLIC SCHOOLS;
(9) PUBLIC HEALTH SERVICES;
(10) JUSTICE SERVICE;
(11) SOLID WASTE DISPOSAL;
(12) ENERGY AND COMMUNICATION SERVICES;
(13) TRANSIT SERVICES.

B. OUTSIDE ITS BOUNDARIES OF INCORPORATION, THE CITY OF PORTLAND SHALL:

(1) ACKNOWLEDGE THE CITY'S ROLE AS PRINCIPAL PROVIDER OF URBAN SERVICES WITHIN THE CITY'S ESTABLISHED URBAN SERVICES BOUNDARY AND PLAN FOR THE EVENTUAL DELIVERY OF URBAN SERVICES ACCORDING TO A PHASED PROGRAM OF IMPROVEMENTS MEETING THE SERVICE NEEDS OF INDIVIDUAL AREAS.

(2) COORDINATE CLOSELY WITH OTHER JURISDICTIONS PROVIDING SERVICES WITHIN THE ESTABLISHED PORTLAND URBAN SERVICES BOUNDARY TO ENSURE CONTINUING DELIVERY OF EFFECTIVE AND EFFICIENT URBAN SERVICES.

(3) CONSIDER REQUESTS FOR DELIVERY OF SERVICES WITHIN THE URBAN SERVICES BOUNDARY WHEREVER THE FOLLOWING CONDITIONS EXIST:

- o RESIDENTS OR PROPERTY OWNERS WITHIN AN AREA TO BE SERVED DESIRE DELIVERY OF SERVICES BY THE CITY OF PORTLAND.
- o THE CITY CAN MEET THE NEW DEMANDS WITHOUT DIMINISHING ITS ABILITY TO SERVE EXISTING CITY OF PORTLAND RESIDENTS AND BUSINESSES.

- o THE CITY CAN SUPPLY THE NEEDED SERVICES MOST EFFECTIVELY AND EFFICIENTLY.

- o THE CITY CAN EXPECT TO RECAPTURE ITS SERVICE INVESTMENT.

(4) DELIVER SERVICES WITHIN THE URBAN SERVICES BOUNDARY BY MEANS OF ANNEXATION TO PORTLAND OR, ON AN INTERIM BASIS, THROUGH ALTERNATIVE APPROACHES THAT ARE DEMONSTRATED TO BE IN THE BEST LONG-TERM INTEREST OF BOTH THE CITY AND FUTURE SERVICE AREAS.

(5) CONSIDER DELIVERY OF SERVICES TO AREAS OUTSIDE THE ESTABLISHED CITY OF PORTLAND URBAN SERVICES BOUNDARY ONLY WHERE THE CITY DETERMINES THAT THERE IS A CLEARLY DEFINED NEED FOR EACH SERVICE, THAT EXPANSION OF THE URBAN SERVICES BOUNDARY AND FULL-SERVICE PROVISION BY THE CITY ARE NOT APPROPRIATE, THAT THE CONDITIONS IN NUMBER (3), ABOVE, ARE MET AND THAT IMPROVED SERVICES MAY BE EXPECTED TO ENHANCE THE CITY'S ABILITY TO MEET THE SERVICE NEEDS OF EXISTING CITY RESIDENTS AND BUSINESSES.

C. THE CITY SHALL INITIATE AND MAINTAIN A PUBLIC EDUCATION PROGRAM WITHIN THE PORTLAND URBAN SERVICES BOUNDARY TO INFORM RESIDENTS AND PROPERTY OWNERS OF THE NEED, BENEFITS AND COSTS TO DELIVER CITY OF PORTLAND SERVICES WITHIN THAT AREA. THE CITY WILL COORDINATE THIS PUBLIC EDUCATION PROGRAM WITH SIMILAR EFFORTS BY SERVICE PROVIDERS AND COMMUNITY ORGANIZATIONS OPERATING IN THE PORTLAND METROPOLITAN AREA.

D. THE CITY SHALL PROVIDE FOR A PROCESS OF PUBLIC PARTICIPATION IN THE IMPLEMENTATION OF THIS POLICY, ASSURING THAT PROPERTY OWNERS, RESIDENTS, AND EXISTING COMMUNITY ORGANIZATIONS IN AREAS AFFECTED BY PROPOSED CHANGES IN SERVICE DELIVERY HAVE OPPORTUNITY TO REVIEW AND COMMENT ON PLANS FOR SUCH CHANGES.

11.2 ORDERLY LAND DEVELOPMENT
URBAN DEVELOPMENT SHOULD OCCUR ONLY WHERE URBAN PUBLIC FACILITIES AND SERVICES EXIST OR CAN BE REASONABLY MADE AVAILABLE.

11.3 ORDERLY SERVICE EXTENSION
THE IMPROVEMENT AND EXPANSION OF ONE URBAN PUBLIC FACILITY OR SERVICE SHOULD NOT STIMULATE DEVELOPMENT THAT SIGNIFICANTLY PRECEDES THE CITY'S, OR OTHER APPROPRIATE JURISDICTION'S, ABILITY TO PROVIDE ALL OTHER NECESSARY URBAN PUBLIC FACILITIES AND SERVICES AT UNIFORM LEVELS.

11.4 CAPITAL EFFICIENCY
MAXIMUM USE OF EXISTING PUBLIC FACILITIES AND SERVICES SHOULD BE SUPPORTED THROUGH ENCOURAGING NEW DEVELOPMENT TO OCCUR AT THE MAXIMUM DENSITIES ALLOWED BY THE COMPREHENSIVE PLAN AND THROUGH THE DEVELOPMENT OF VACANT LAND WITHIN PRESENTLY DEVELOPED AREAS.

SANITARY AND STORMWATER FACILITIES

GOAL:

11 C INSURE AN EFFICIENT, ADEQUATE AND SELF-SUPPORTING WASTEWATER COLLECTION TREATMENT AND DISPOSAL SYSTEM WHICH WILL MEET THE NEEDS OF THE PUBLIC AND COMPLY WITH FEDERAL, STATE AND LOCAL CLEAN WATER REQUIREMENTS.

POLICIES:

11.19 MAINTENANCE
MAINTAIN AND IMPROVE THE EXISTING SANITARY AND STORM SEWER SYSTEM THROUGH PREVENTIVE MAINTENANCE AND ON-GOING APPRAISAL.

11.20 IMPROVEMENT
REQUIRE IMPROVEMENT OF THE EXISTING SEWER SYSTEM IN THOSE AREAS ADVERSELY AFFECTED BY OVERLOADED SEWER SYSTEMS.

11.21 COMBINED SEWER OVERFLOWS
CONTROL AND REDUCE COMBINED SEWER OVERFLOWS.

11.22 SUB-SURFACE DISPOSAL
DISCOURAGE THE DEVELOPMENT OF ON-SITE SUB-SURFACE WASTE DISPOSAL SYSTEMS ON LOTS SMALLER THAN TWO ACRES IN SIZE.

11.23 SEWER CONNECTIONS
REQUIRE ALL NEW DEVELOPMENTS WITHIN THE CITY LIMITS TO BE CONNECTED TO SANITARY SEWERS EXCEPT THOSE THAT CAN BE PROVIDED WITH ACCEPTABLE SUB-SURFACE DISPOSAL, IF A SEWER IS NOT AVAILABLE.

11.24 NEW CONSTRUCTION
IN THE DEVELOPMENT OF NEW SEWER SYSTEMS, GIVE PRIORITY TO THOSE UNSEWERED AREAS DEVELOPED AT URBAN DENSITIES WHERE HEALTH HAZARDS OR DEMAND EXIST.

11.25 TREATMENT
OPERATE CITY TREATMENT FACILITIES TO MEET OR EXCEED STATE EFFLUENT STANDARDS.

11.26 STORMWATER MANAGEMENT
INTEGRATE MASTER PLANNING FOR STORMWATER MANAGEMENT WITH OTHER CITY ACTIVITIES TO ACHIEVE ADEQUATE DRAINAGE AND TO MINIMIZE POLLUTION AND EROSION PROBLEMS.

11.27 IMPERVIOUS SURFACES
WHERE NECESSARY, LIMIT THE INCREASE OF PORTLAND'S IMPERVIOUS SURFACES WITHOUT UNDULY LIMITING DEVELOPMENT IN ACCORDANCE WITH THE COMPREHENSIVE PLAN.

SOLID WASTE

GOAL:

11 D PROVIDE FOR ADEQUATE SOLID WASTE DISPOSAL.

E25

RICHLAND WATER DISTRICT
14151 N. E. SAN RAFAEL
PORTLAND, OREGON 97230
PHONE 253-9555

September 6, 1984

Environmental Quality Commission
P. O. Box 1760
Portland, OR 97207

RE: SEEPAGE FEE

Some concerned customers of the Richland Water District would like the following information sent to your department.

Our district has 3 wells, each approximately 400 feet deep. Located at NE 137th & San Rafael, NE 140th near Halsey Street, and 14151 NE San Rafael.

The bacteriological testing shows no coliforms, and a copy of our latest inorganic analysis is enclosed showing everything under the EPA limit.

Our district is only ½ mile square, but our deep wells show no contamination.

Yours very truly,

RICHLAND WATER DISTRICT

Lee Kennedy

Lee Kennedy
Manager

Enclosure

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

September 13, 1982

Richland Water District
14151 NE San Rafael
Portland, OR 97220

Analysis Requested: EPA Inorganic Analysis

EPA Inorganic Analysis

	Sample (mg/liter)	EPA Limit (mg/liter)
Arsenic	< 0.001	0.050
Barium	< 0.5	1.0
Cadmium	< 0.001	0.010
Chromium	0.002	0.050
Lead	< 0.001	0.050
Mercury	< 0.0004	0.002
Selenium	< 0.001	0.010
Silver	< 0.001	0.050
Nitrate	0.013	10.0
Flouride	0.20	1.4-2.4

< denotes "less than"

Sincerely,
Susan M. Coffey
Susan M Coffey

SC:hs

E26

a-5

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

Mailing Address: BOX 1760, PORTLAND, OR 97207
522 SOUTHWEST 5th AVENUE, PORTLAND, OR 97204 PHONE (503) 229-5696

September 11, 1984

MEMORANDUM

To: Environmental Quality Commission

From: Harold Sawyer, Administrator, Water Quality Division

Subject: Transmittal of Information From Department Records for Incorporation in Record of Threat to Drinking Water Hearing for Mid-Multnomah County

Department staff have reviewed notes taken during testimony presented at the hearing on August 30, 1984. Staff believe the following documents, reports, or records from Department files relate to testimony presented or questions raised at the hearing and should be incorporated into the record.

1. Copies of Department of Environmental Quality field and laboratory data sheets for samples collected from wells in the Mid-Multnomah County area. Summary reports of these data have been contained in documents submitted previously for the record.

2. Copies of U. S. Geological Survey well data sheets for sampling and analysis of selected Mid-Multnomah County wells - 1976.

3. A copy of ORS Chapters 454 and 468, which contain Oregon Laws regarding water pollution control and sewage disposal.

4. A copy of the Department of Environmental Quality Laboratory, Quality Assurance Implementation Plan, East Multnomah County Groundwater Study, December 1983, and a copy of procedures for collecting and analyzing water samples. This material describes procedures used by the Department for analysis of samples and assuring the quality and validity of the data.

5. A copy of Oregon Administrative Rules, Chapter 340, including Divisions 41, 71, 72, and 73, which contain rules adopted by the Environmental Quality Commission for Water Pollution Control and Sewage Disposal. Division 41-029 contains the General Groundwater Quality Protection Policy. Divisions 71, 72, and 73 contain the on-site waste disposal rules.

6. A report entitled, "Groundwater Protection Policy, Background Discussion, Proposed Policy, and Final Adopted Policy," Oregon Department of Environmental Quality, 1980, with revisions made August 1980 and an appendix added 1983. This report presents background information for the General Groundwater Quality Protection Policy adopted August 28, 1981, and the appendix includes the adopted policy.

7. A Staff Report and minutes of the June 29, 1984, EQC meeting where the General Groundwater Quality Protection Policy was amended.

8. A Department of Environmental Quality report entitled, "Water Quality in the Columbia Slough," April 1974, which contains Columbia Slough water quality information form 1971 to 1973.

9. Two reports presenting information on the City of Portland well field in East Multnomah County, entitled: "Groundwater Exploratory Program," City of Portland Bureau of Water Works, April 1977; "Pilot well Study", City of Portland Bureau of Water Works, November 1978.

10. A report entitled, "Final Report Oregon On-Site Experimental System Program," Department of Environmental Quality, December 1982, which contains information in the development of alternative on-site sewage disposal systems and includes some information on the costs of such systems in Oregon.

11. A report entitled, "Clatsop Plains Ground Water Protection Plan, Ground Water Evaluation Report," Sweet, Edwards & Associates, Inc., December 1981, which generally reviews the various nitrate sources that could contribute to the nitrate level in groundwater. Section II (Pages 1-21) of the report discusses nitrogen contamination from natural and induced (related to man's activities) sources.

12. A report entitled, "Ground Water in the East Portland Area," Geological Survey Water - Supply Paper 1793, which describes the basic geology of East Multnomah County.

13. A report entitled, "Soil Survey of Multnomah County, Oregon," Soil Conservation Service, August 1983, that describes which soils are present and their physical characteristics.

14. Updated rules in the March 12, 1982, Federal Register, "National Interim Primary Drinking Water Regulations," which gives the federal drinking water standards. Standards for nitrate-nitrogen and other parameters are included.

15. A manual entitled, "National Interim Primary Drinking Water Regulations," U.S. Environmental Protection Agency, September 1976, which gives background information on why the standard was set for nitrate-nitrogen.

16. A Department of Environmental Quality Staff Report entitled, "Volatile Organic Chemicals," which describes organic chemicals found in East Multnomah County wells.

17. A report entitled, "Sources of Toxic Compounds in Household Wastewater," Municipal Environmental Research Laboratory, which is a reference document describing sources of toxic chemicals in household wastewater.

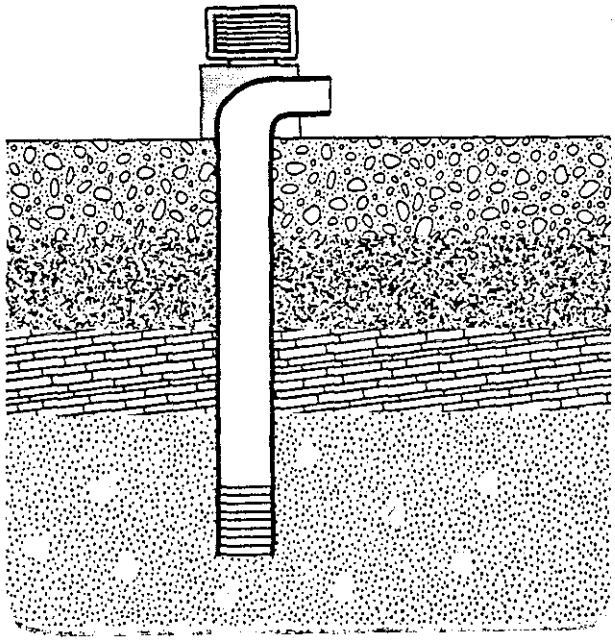
18. Two reports describing groundwater pollution of Long Island, New York, entitled, "The Long Island Ground Water Pollution Study," State of New York Department of Health, April 1969, and "Proceedings of the Fourth American Water Resources Conference," Proceedings Series No. 6, November 1968.

19. Staff Report and proposed minutes of the August 10, 1984, Environmental Quality Commission meeting in Pendleton regarding adoption of the FY1985 Priority List for Federal Sewerage Works Construction Grants.

from E26i

E26i

GROUND WATER EXPLORATION WELL



CITY OF PORTLAND

BUREAU OF WATER WORKS

A REPORT ON THE

GROUND WATER EXPLORATORY PROGRAM

for the

DEPARTMENT OF PUBLIC UTILITIES
CITY OF PORTLAND, OREGON

prepared by

Senior Engineer

under the supervision of

Supervising Engineer

April 1977

BUREAU OF WATER WORKS

Fluviolacustrine Deposits

The Fluviolacustrine Deposits supply little of the ground water used in the study area. Even though the aquifer in the eastern portion of the area is quite permeable, in most instances the formation lies above the regional water table and therefore it does not contain appreciable amounts of water to provide to wells. There are a few wells used for domestic purposes that are drilled into the formation near the Columbia River. Mundorff (1964, p. 52-54) states that although the lacustrine gravels may be slightly cemented in areas, they are not cemented enough to greatly reduce the permeability of the formation. Mundorff considers the deposits to be extremely permeable and has indicated that the wells in this formation in Clark County yield very large quantities of water where they have a source of recharge from the Columbia River. Wells drilled into this formation where it is in communication with the Columbia River rarely yield less than 1,000 gpm, and some yield 1,000 gpm per foot of drawdown. Mundorff (1964, p. 85) suggests a coefficient of transmissivity for the formation gravels of 2 to 3 mgd per foot.

Younger Alluvium

The Younger Alluvium is composed of sands and gravels lying either in the Columbia Riverbed or in the river's flood plain, defined here as the land adjacent to the river lying below the elevation of 40 feet above sea level. The Younger Alluvium yields large

quantities of water to wells where the formation consists primarily of gravel and where a sufficient recharging source is available. At least two wells in the study area produce significant quantities of water from this formation, those being well 1N/3E 21AC in the area north of Blue Lake which produces over 1,000 gpm with 7 feet of drawdown and the newer Parkrose Water District well, 1N/2E 23BA1, which produces 2,325 gpm with 24.5 feet of drawdown. The wells for the Crown-Zellerbach plant near Camas, Washington, supply 20 mgd from aquifers in the Younger Alluvium and are recharged by the Columbia and Washougal Rivers. The Crown-Zellerbach wells are drilled in a very small area and achieve this high flow with very little interference among the wells, indicating a very high transmissibility for this formation.

Static water levels in wells using aquifers in the Fluviolacustrine Deposits and Younger Alluvium tend to fluctuate with the water level in the Columbia River and are considered by Hogenson and Foxworthy (1965, p. 31) to be in direct hydraulic balance with the river in most areas. However, it is probable that shallow wells drilled near the Columbia River sloughs, such as the newer Parkrose Water District well, may be influenced more by the water levels in the sloughs than by the Columbia River.

GENERAL MOVEMENT OF GROUND WATER

The general movement of ground water in the area is north toward the Columbia River and its system of sloughs. Evidence of this general direction of ground water flow can be seen by the gradual decline of static water levels in wells as the location of the well approaches

From E26i

GROUNDWATER
DEVELOPMENT PROGRAM

P I L O T W E L L S T U D Y

Conducted for the

CITY OF PORTLAND
BUREAU OF WATER WORKS

by

Submitted to

Fredrick H. Whitfield
Engineer V

Approved by

orseth, P.E.
ef Engineer

Robert Hyle
Manager

C O N C L U S I O N S

The geologic, hydrologic, and water quality data provided by the 10 pilot wells constructed for this study and other data gathered after the completion of the earlier Exploratory Program have permitted the drawing of several conclusions concerning the groundwater resources which lie east of the City of Portland.

AQUIFERS SUITABLE FOR DEVELOPMENT

Information provided by this study has shown that all four of the aquifers recommended for development in the Bureau's Exploratory Study report have a sufficiently high quality of water to meet the U.S. Environmental Protection Agency's Primary Drinking Water Standards. Also, suitable data is now available to permit the determination of an aquifer capacity for two of these four aquifers within the East Well Field and to estimate a capacity for the other two aquifers, one of which is the primary water source of the West Well Field.

The formation layers that separate the Troutdale Gravel, Troutdale Sandstone and Sandy River Mudstone Aquifers, and also the material which lies under the Sandy River Mudstone Aquifer, were found to be more permeable in the northeasterly portion of the study area than previously concluded. The resultant effect of the higher permeability of these semi-confining layers is to permit greater interaquifer transfer of water during the operation of wells, and to increase the estimated capacity of the Sandy River Mudstone Aquifer at the expense of the overlying Troutdale Sandstone Aquifer.

The Sandy River Mudstone Aquifer is an excellent source of water which can provide 36 mgd for periods of time up to 90 consecutive days if the aquifer is not discontinuous outside the study area.

The quality of water produced by the aquifer is excellent and would generally be considered a soft water. Unfortunately, the water from this aquifer contains entrained hydrogen sulfide gas at a low, but significant, concentration and its removal may be required to meet future drinking water standards.

The Troutdale Sandstone Aquifer is a good source of water whose capacity is limited by both the loss of water to wells in the Sandy River Mudstone Aquifer and by hydraulic boundaries in or near the study area. The aquifer's capacity is limited to 6.5 mgd for periods in which wells in the underlying Sandy River Mudstone Aquifer are operating. The Troutdale Sandstone Aquifer is a source of fine quality groundwater. Its water is slightly harder than water of the Sandy River Mudstone Aquifer, but was not found to contain entrained hydrogen sulfide gas.

As previously predicted by the Bureau, the Troutdale Gravel Aquifer's permeability is too great in the area of the West Well Field to allow an accurate determination of its full capacity and the reliability of its water quality from the testing of the relatively small capacity pilot wells. However, an analysis using transmissivity values obtained from the pilot wells, and an approximation of the aquifer boundaries indicates that an estimated 20 mgd can be withdrawn from this aquifer in the West Well Field. An accurate total capacity can be determined for this aquifer if a production well is constructed and tested at a sufficiently high rate (5-10,000 gpm) to permit an analysis of the aquifer's boundary conditions. The aquifer's water quality is similar to that of the Troutdale Sandstone Aquifer, but may be susceptible to future increases in the concentration of nitrate to a level which may exceed the maximum allowable concentration for drinking water.

The Blue Lake Aquifer was found to be more extensive than previously estimated, and also proved to be so permeable that a determination of its capacity could not be made from the test

data provided by the pilot well constructed in the aquifer. The aquifer's water quality is the poorest of the four aquifers investigated and is considered moderately hard. The aquifer also contains a nitrate concentration near the maximum permitted for drinking water and will require blending with Bull Run water, or other groundwaters with a lower nitrate concentration, to assure a nitrate concentration suitable for drinking water.

Land subsidence, which is normally attributed to the dewatering of unconsolidated clay or clayey strata, is unlikely to occur due to the operation of the proposed facility as an emergency water source since no clay or clayey strata will be permanently dewatered. In addition, except for the surface materials, all the clays or clayey formations which overlie the aquifers investigated by this study have been at least partially consolidated by the weight of the Troutdale Formation which is estimated by Trimble (1963, p. 31) to have been 800 to 900 feet thick prior to its erosion.

The shallow gravels in the East Well Field, the Columbia River Sands, and the Columbia River are all potential sources of additional water within the study area which could be utilized in the future, if additional capacity is required.

METHODS OF DEVELOPMENT

Analysis of drill cutting samples taken from the Sandy River Mudstone, Troutdale Sandstone, and Troutdale Gravel Aquifers indicates that the gravels which make up these aquifers contain medium to fine sands which will require well screens and possibly gravel packed screens to hold this sand out of the wells. The necessity for well screens and the anticipated 200- to 500-foot depth for wells in these aquifers makes the use of high capacity, widely spaced, screened wells the most economical method of development.

The coarse gravels and boulders which comprise the Blue Lake Aquifer were not found to contain an appreciable percentage of fine sand. Combined with an anticipated depth of less than 150 feet, these sand-free gravels will make the use of closely spaced wells more economical if the development of the aquifer to its maximum capacity is determined from future testing to be necessary to obtain the desired 10 mgd production rate from the aquifer.

WATER RIGHTS

Extensive development of the four primary aquifers investigated by this study will affect several existing wells within the study area. The degree to which the existing wells are affected will depend upon the number of wells operated simultaneously in each aquifer and the length of time these wells are continuously operated. Operating demands of less than full capacity, which would permit alternating and/or cycling of the wells being used, will produce a minimal impact on existing wells in the vicinity of the proposed well fields. However, a 90-day period of operation at a full capacity by wells in the East Well Field which utilize the Sandy River Mudstone and Troutdale Sandstone Aquifers may lower the water levels in 12 existing wells by more than 70 feet, and dewater one existing well. Continuous operation of these wells for a period greater than 90 days can be expected to dewater several existing wells which are not drilled completely through the aquifer supplying the well.

The operation of wells constructed in the Blue Lake and Troutdale Sandstone Aquifers may affect the natural recharge of Blue and Fairview Lakes, respectively. If wells in these aquifers were operated for an extensive period of time, it may be possible to induce recharge to the aquifers from the lakes. The likelihood of withdrawing water from the lakes may depend as much upon the

E26p

VOLATILE ORGANIC CHEMICALS

Attached is a list and description of Volatile Organic Chemicals that the U. S. Environmental Protection Agency has surveyed in drinking water supplies. These are the same organic chemicals which the Department of Environmental Quality is testing for in the East Multnomah County wells.

The description attached contains, if they are available, the water quality criteria for the chemical or the risk factors and corresponding concentrations for these chemicals. However, standards for most organic chemicals have not been established. Very little data exists on which to develop satisfactory standards for organic chemicals. In the case of inorganic parameters (iron, lead, nitrate, etc.) maximum limits have been developed and established over time which should not be exceeded. For example, in the case of iron, when the 0.3 mg/l maximum limit is exceeded there is a distinct taste problem and a rust color may appear in sinks and on clothing. Some organic chemical standards are similar such as chlorobenzene (48 ug/l) and trichloroethane (0.1 mg/l).

However, in the case of most organic chemicals, a single maximum limit has not been established. This is because insufficient data is available and because for the maximum protection of human health from exposure to these chemicals, the water quality criterion should be zero. This level may not be attainable at the present time. Therefore, in order to develop a contamination level for inorganic chemicals, a conservative model was developed to indicate risk factors which identify the statistical probability for an individual to contract cancer from these chemicals when they are present in the water at different levels. For example, methylene chloride has risk factors of 10^{-5}, 10^{-6}, and 10^{-7} for concentrations of .0019 ug/ml, .00019 ug/ml, and .000019 ug/ml respectively. This means that a methylene chloride concentration of .0019 ug/ml has a cancer risk of 10^{-5}, or that one person in 100,000 has a chance of contracting cancer at this level. At a concentration of .000019 ug/ml the cancer risk is 10^{-7} or one person in 10,000,000.

The U. S. Environmental Protection Agency intends to develop, for most of the organic chemicals attached, a maximum concentration level (MCL) in the near future.

Risk Factors 10^{-5} = 1 person in 100,000
10^{-6} = 1 person in 1,000,000
10^{-7} = 1 person in 10,000,000

ug/ml = ppm (part per million)

NJM:g
TG2958
12-1-83

VOLATILE ORGANIC CHEMICALS SURVEYED IN GROUNDWATER SUPPLIES

Organic Chemical	Uses and Formulations	Risk Factors	Concentrations (Units ppm) [2]	Comments
Benzene (C_6H_6)	Manufacturing of styrene, phenol, detergents, organic chemicals, pesticides, plastics, resins, synthetic rubber, aviation fuel, pharmaceuticals, dye, explosives, PCB, gasoline, tanning, flavors and perfumes, paints and coatings; nylon intermediates; food processing; photographic chemicals	10^{-5} 10^{-6} 10^{-7}	.0066 .00066 .000066	Please read footnote [1]
Bromodichloromethane ($CHBrCl_2$)	Fire-extinguisher fluid ingredient, solvent for fats, waxes, and resins; heavy liquid for mineral and salt separations. Results from chlorination of finished water	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1] " " " [3]
Bromoform ($CHBr_3$)	Manufacturing of pharmaceuticals; ingredient in fire resistant chemicals; solvent for waxes, greases and oils; gage fluid	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1] " " " [3]
Bromomethane (CH_3Br)	Used widely as a fumigant, fire extinguisher, refrigerant, and insecticide	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1] Also known as methyl bromide and monobromomethane
Carbon Tetrachloride (CCl_4)	Dry cleaning operations; fumigant; metal degreasing; solvent; veterinary medicine; manufacturing of refrigerants, aerosols and propellants	10^{-4} 10^{-5} 10^{-6}	.04 .004 .0004	Please read footnote [1]
Chlorobenzene (C_6H_5Cl)	Solvent recovery plants, intermediate in dyestuffs manufacturing; used in the manufacturing of aniline, insecticide, phenol and chloroniatrobenzene		.488 .020	Also known as monochlorobenzene. Two approaches were used to derive criteria: (1) toxicity data for the protection of human health, the level of .488 ug/ml, (2) for controlling undesirable taste and odor the level of .020 ug/ml.
Chloroethane (C_2H_5Cl)	Refrigerant, solvent, alkylating agent, starting point in the manufacturing of tetraethyl lead			Also known as ethylchloride, hydrochloric ether, and monochloroethane. Due to insufficiency of available data for this chemical, a satisfactory criterion cannot be derived at this time.
2-Chloroethylvinyl Ether ($ClCH_2CH_2OCH = CH_2$)	Used in the manufacturing of anesthetics, sedatives, cellulose ethers, and polymers			

[1] For maximum protection of human health from the potential carcinogenic effects due to exposure to this chemical, the ambient water concentration should be zero. However, the zero level may not be attainable at the present time. Therefore, the levels which may result in an incremental increase of cancer risk over the lifetime and corresponding concentrations are listed. It should be noted that these concentrations were established based on a conservative model which is conservative on the side of public health. EPA intends to establish maximum contaminant levels for most of these organic chemicals in the near future.

[2] ppm = parts per million

[3] Bromodichloromethane, bromoform, chloromethane, and dibromochloromethane are halomethanes and the U.S. Environmental Protection Agency has established a maximum concentration level (MCL) of 100 parts per billion for the total of the four concentrations.

Organic Chemical	Uses and Formulations	Risk Factors	Concentrations (Units ppm) [2]	Comments
Chloroform ($CHCl_3$)	Manufacturing of fluorocarbon refrigerants, propellants and plastics; manufacturing of anesthetics and pharmaceuticals; fumigant; solvent; sweetener; analytical chemistry; insecticide; manufacturing of of fire extinguishers and electronic circuitry	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1]
Chloromethane (CH_3Cl)	Used in the manufacturing of fumigants, organic chemicals, synthetic rubber, refrigerant, and silicones; low temperature solvent; medicine, propellants herbicide	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1] [3]
Dibromochloromethane ($CHBr_2Cl$)	Manufacturing of fire extinguishing agents, aerosol propellants, regrigerants, and pesticides			
1,3-Dichlorobenzene ($C_6H_4Cl_2$) ("1,3 DCB")	Air deodorizer, fumigant and insecticide		.40	Please read footnote [3]
1,2/1,4-Dichloro-benzene ($C_6H_4Cl_2$) ("1,2 DCB") ("1,4 DCB")	Manufacturing of moth repellants, air deodorizers, dyes, and pharmaceuticals; soil fumigant; pesticide, general purpose organic solvent		.40	
1,1-Dichloroethane ($CHCl_2CH_3$)	Used for the production of tetraethyl lead and vinyl chloride; industrial solvents; intermediate product in the production of other organic chlorine compounds			Due to the insufficiency in the available data a satisfactory criteria cannot be derived for 1,1-dichloroethane
1,2-Dichloroethane ($CH_2\ ClCH_2Cl$)	Constituent in paint, varnish and finish removes metal degreaser, and soaps and scouring compounds; manufacturing of vinyl chloride; intermediate insecticidal fumigant (peachtree borer, Japanese Beetle, root-rot nematodes)	10^{-5} 10^{-6} 10^{-7}	.0094 .00094 .000094	Please read footnote [1]
1,1-Dichloroethene (CH_2CCl_2)	Chemical intermediate in the synthesis of methylchloroform and in the production of polyvinylidene chloride copolymers; interior coatings for ship tanks, railroad cars and fuel storage tanks	10^{-5} 10^{-6} 10^{-7}	.00033 .000033 .0000033	Please read footnote [1]

[1] For maximum protection of human health from the potential carcinogenic effects due to exposure to this chemical, the ambient water concentration should be zero. However, the zero level may not be attainable at the present time. Therefore, the levels which may result in an incremental increase of cancer risk over the lifetime and corresponding concentrations are listed. It should be noted that these concentrations were established based on a conservative model which is conservative on the side of public health. EPA intends to establish maximum contaminant levels for most of these organic chemicals in the near future.

[2] ppm = parts per million

[3] Bromodichloromethane, bromoform, chloromethane, and dibromochloromethane are halomethanes and the U.S. Environmental Protection Agency has established a maximum concentration level (MCL) of 100 parts per billion for the total of the four concentrations.

Organic Chemical	Uses and Formulations	Risk Factors	Concentrations (Units ppm) [2]	Comments
Trans-1,2-Dichloroethene ($CHClCHCl$)	Solvent for fats, phenols, camphor, etc.; retards fermentation; rubber manufacturing; refrigerant; additions to dye and lacquer solutions; constituent of perfume and thermoplastics	10^{-5} 10^{-6} 10^{-7}	.00033 .000033 .0000033	Please read footnote [1]
1,2-Dichloropropane ($CH_2ClCHClCH_3$)	Soil fumigants for the control of nematodos; solvents for oil and fat, and in dry cleaning and degreasing processes; when heated to decomposition; emits highly toxic fumes of phosgene		.483	A valid ambient water quality criterion for dichloropropane cannot be derived from the limited data base. Based on the results of a 30-day study in rats, a water concentration of .483 ug/ml can be calculated.
Cis-1,2-Dichloropropene ($CHClCHClCH_3$)	Soil fumigants for the control of nematodes		.087	An ambient water quality criterion of 87 ug/l can be calculated for dichloropropanes based on a six-month oral study in rats, however, isomer-specific criteria were not devised.
Trans-1,2-Dichloropropene ($CHClCHClCH_3$)	Soil fumigants for the control of nematodes		.087	(Same comment as Cis 1,2,-Dichloropropene)
Ethyl Benzene ($C_6H_5C_2H_5$)	Solvent; constituent of asphalt and naphtha; manufacturing of styrene, acetophenone and gasoline		1.4	
Methylene Chloride (CH_2Cl_2)	Paint stripping and solvent degreasing; manufacturing of aerosols, photographic film, synthetic fibers, refrigerant, textile and leather coatings; pharmaceutical, used in plastic processing, and in dewaxing; remove caffeine from coffee	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1]
1,1,2,2-Tetrachloroethane ($CHCl_2CHCl_2$)	Solvent for chlorinated rubber and various organic materials; paint, varnish, rust remover manufacturing; soil fumigant; cleansing and degreasing metals; photofilms, resins and waxes	10^{-5} 10^{-6} 10^{-7}	.0017 .00017 .000017	Please read footnote [1]
Tetrachloroethene ($Cl_2C = CCl_2$)	Dry cleaning and metal degreading industries, solvent for fats, greases, waxes, rubber, gums; removes caffeine from coffee, removes soot from industrial boilers, manufacturing paint removers	10^{-5} 10^{-6} 10^{-7}	.008 .0008 .00008	Please read footnote [1]

[1] For maximum protection of human health from the potential carcinogenic effects due to exposure to this chemical, the ambient water concentration should be zero. However, the zero level may not be attainable at the present time. Therefore, the levels which may result in an incremental increase of cancer risk over the lifetime and corresponding concentrations are listed. It should be noted that these concentrations were established based on a conservative model which is conservative on the side of public health. EPA intends to establish maximum contaminant levels for most of these organic chemicals in the near future.

[2] ppm = parts per million

[3] Bromodichloromethane, bromoform, chloromethane, and dibromochloromethane are halomethanes and the U.S. Environmental Protection Agency has established a maximum concentration level (MCL) of 100 parts per billion for the total of the four concentrations.

Organic Chemical	Uses and Formulations	Risk Factors	Concentrations (Units ppm) [2]	Comments
Toluene ($C_6H_5CH_3$)	Manufacturing benzene, saccharin, medicine, dyes, perfumes, TNT; component of gasoline; solvent for paints and coatings, gums, resins; adhesive solvent in plastic toys and model airplanes		14.3	
1,1,1-Trichloroethane (CH_3CCl_3)	Used for the production of tetraethyl lead and vinyl chloride; industrial solvent, metal degreasing; solvents for fats, greases, (septic tank cleaners)		.01	Maximum Contaminant Level (MCL) established in the national drinking water program. Also known as methyl chloroform and methoxychlor
1,1,2-Trichloroethane (CH_3CCl_3)	Manufacturing of 1,1-dichloroethylene; solvent for chlorinated rubber and various organic materials, (i.e. fats, oils, resins, etc.)	10^{-5} 10^{-6} 10^{-7}	.006 .0006 .00006	Please read footnote [1]
Trichloroethene (CCl_2CHCl)	Dry cleaning operations and metal degreasing; solvents for fats, greases, waxes; (septic tank cleaners) solvents for greases and waxes from cotton, wool, etc. to remove caffiene from coffee, solvent for dyeing; refrigerant; fumigant; anesthetic	10^{-5} 10^{-6} 10^{-7}	.027 .0027 .00027	Please read footnote [1]
Trichlorofluoromethane (CCl_3F)	Refrigerant, on a limited basis as a solvent-degreaser	10^{-5} 10^{-6} 10^{-7}	.0019 .00019 .000019	Please read footnote [1]
Vinyl Chloride (CH_2CHCl)	Used in producing polyvinyl chloride, the most widely used material in the manufacturing of plastics, including PVC piping, electrical wire insulation, packaging for food products and medical supplies	10^{-5} 10^{-6} 10^{-7}	.02 .002 .0002	Please read footnote [1]

References: Handbook of Environmental Data on Organic Chemicals
Karel Verschueren, 1977

Environmental Protection Agency Ambient Water Quality Criteria Publications

NJM:1
TL2901
Revised 12/1/83

[1] For maximum protection of human health from the potential carcinogenic effects due to exposure to this chemical, the ambient water concentration should be zero. However, the zero level may not be attainable at the present time. Therefore, the levels which may result in an incremental increase of cancer risk over the lifetime and corresponding concentrations are listed. It should be noted that these concentrations were established based on a conservative model which is conservative on the side of public health. EPA intends to establish maximum contaminant levels for most of these organic chemicals in the near future.

[2] ppm = parts per million

[3] Bromodichloromethane, bromoform, chloromethane, and dibromochloromethane are halomethanes and the U.S. Environmental Protection Agency has established a maximum concentration level (MCL) of 100 parts per billion for the total of the four concentrations.

E268

SOURCES OF TOXIC COMPOUNDS IN HOUSEHOLD WASTEWATER

by

Steven W. Hathaway
Wastewater Research Division
Municipal Environmental Research Laboratory
Cincinnati, Ohio 45268

Municipal Environmental Research Laboratory
Office of Research & Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

DISCLAIMER

This report has been reviewed by the Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution, and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for preventing, treating, and managing wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for preserving and treating public drinking water supplies, and for minimizing the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research and is a most vital communications link between the researcher and the user community.

This report described a literature search which identifies consumer products, containing toxic pollutants, used in an around the home. The occurrence of toxic chemicals in the household wastewater is of great concern not only for municipal wastewater treatment plant discharges but more importantly for small community systems and single dwelling wastewater treatment systems which may have an impact on the ground water quality.

Francis T. Mayo, Director
Municipal Environmental Research
Laboratory

ABSTRACT

This report presents the results of a literature search into the occurrence of EPA's selected 129 priority pollutants in household wastewater and is the forerunner to further research projects designed to actually measure the concentration of toxic pollutants in domestic wastewater treatment and disposal systems. Although it is assumed that the largest contribution of toxic pollutants if from industrial discharges, the identification and concentration of these pollutants from strictly domestic wastewater sources is largely unknown.

The study identifies consumer product categories and general types of products containing the toxic compounds used in and around the home which may eventually end up in the wastewater.

The most frequently used products containing toxic chemicals are household cleaning agents and cosmetics. Solvents and heavy metals are the main ingredients of these products which are used on a daily basis. Deodorizers and disinfectants, containing naphthalene and phenol and chlorophenols, are also high on the frequency list. Pesticides, laundry products, paint products, polishes, and preservatives are wasted infrequently but are commonly wasted in large volumes. Thus, the fate of low level frequent discharges and high level infrequent discharges of toxic chemicals must be addressed in further research work with individual wastewater treatment systems or small community systems.

This report covers a period from January 1979 to January 1980 and work was completed as of March 1980.

CONTENTS

TABLES

SECTION 1

INTRODUCTION

Most Americans are priveleged to enjoy an abundant supply of water which is used for a variety of functions in and around the home. The amount of water used depends on the source of supply, the means of wastewater disposal, and most importantly, the family habits. An average value for the volume of water used per person each day is about 160l (42 gallons). This value includes such events as toilet flushing, bathing, laundering, washing dishes, running the garbage disposal, and general cleaning. Nearly all of these events involve the use of chemicals which are present in products and disinfectants, soaps, etc. Using these products eventually produces a chemically complex wastewater. Americans use a multiplicity of products for personal hygiene and household maintenance which contain organic and inorganic chemicals specifically tailored to do a certain job. After the products are used they become part of the daily waste flow and are forgotten. The final product, the chemically complex wastewater, is to be returned to the environment from where it came to ultimately be recycled. The ultimate goal for disposal is to produce a wastewater that has been adequately treated to remove harmful chemicals and micro-organisms which might risk human health or damage the environment. Traditional parameters such as BOD, COD, dissolved oxygen, TKN, phosphorus, total and fecal coliform are gross measurements for evidence of pollution. Although these parameters are rarely monitored in wastewater from individual homes, well-designed, and well maintained on-site treatment systems are capable of greatly reducing most of these values to low levels. The use of diverse household products, however, raises the question of toxic pollutants discharged to the waste system and the capability of removal by various on-site treatment systems. Chapter 3 of the "Innovative and Alternative Technology Assessment Manual" discusses possible alternatives for the removal of toxic compounds but does not report on the level of concentration expected to be found in household waste. The complex wastewater from a household contains very low levels of organic and inorganic compounds at the ppb concentration level which are not detected by the gross measurements of pollution and some may not be removed by conventional processes. The EPA has an extensive on-going program to identify toxic compounds in the effluent of POTWs. Under the Consent Decree (1) EPA was to develop regulations on 65 classes and specific compounds which must be considered with respect to sewage treatment plant discharge. EPA was required to publish a list of toxic pollutants concerning "the toxicity, persistence, degradability, the usual or potential presence of the affectved organisms and the nature and extent of the effect of the toxic pollutant on such organisms". The actual list of 129 toxic compounds (appearing in Appendix) was developed as a result of finding analytical standards to be used as reference compounds in the analysis of water, wastewater, and sludge for toxic substances.

The first step of producing a list of priority pollutants is completed. The next step of defining the "toxicity" of these compounds is underway by a special task force set-up within EPA. The fate of the toxic compounds through the various treatment systems has only been touched upon at this date, and research efforts are beginning to question the degradability, chemical conversion, and other ways the compound can be transported or degraded out of the system (2), (3), (4). The Office of Pesticides and Toxic Substances has a group responsible for locating the sources of these compounds that are found in the wastewater and they are to eventually recommend procedures for controlling the chemical at the source (5).

Although it is assumed that industrial discharges are the major contributors of toxic compounds in municipal wastewater, the household wastewater discharge can not be ignored. Many of the consumer products used daily contain some of the toxic compounds on the EPA priority pollutant list. If a homeowner is having a chronic problem with his septic tank, he may begin using a cleaning product regularly which contains several solvents on the priority pollutants list. These low level toxic concentrations from domestic discharges are likely to go unnoticed if industrial and domestic wastes are combined into one central collection system. From this standpoint the household with an on-site waste treatment system which discharges the wastewater into a stream or subsurface into the groundwater may be an important source of pollution and a possible risk to public health. The possibility of a health risk, however, depends on a number of factors including: density of septic tank systems, distribution of wastewater, ground water level and flow, etc. There are a number of approaches to health risk assessment by various environmental contaminants but the important first step in all of these approaches is to determine the level or concentration of the contaminant present in the source. Subsequently the environmental pathway or distribution and the dose-response will then determine the degree of potential hazard. Since many rural homes have their own water supply and on-site waste disposal system, contamination of the groundwater with unsafe levels of toxic chemicals is a condition that must be avoided. If a community has a densely populated area with on-site disposal systems, so called "short circuiting" of the soil disposal system could result in ground water contamination or well water contamination (6).

There are many household products used on a continuous basis which contain some of the toxic compounds listed in EPA's list of priority pollutants. This paper identifies specific products and compounds contributing to the total wastewater flow from a home.

SECTION 2

CONCLUSIONS

This research has attempted to predict the types of products used by the typical American household that contain the toxic compounds listed in the EPA Priority Pollutants List. The ultimate goal, scientifically, is to identify the compounds actually present in the raw wastewater, detect the concentration, determine effect of the anaerobic septic tank or aerobic treatment unit, determine the effect of soil absorption, and finally determine the quality of ground water or surface water. The overlying research to determine the health and ecological effects of these compounds is being done by several researchers, both government and non-government. At the present time the toxic compounds listed in Table 5 represent the most frequently occurring compounds of the products used and wasted into domestic wastewater of small community or individual wastewater treatment systems. Obviously, not all of these compounds will be found in household wastewater since a number of factors come into play such as changes in product usage within individual homes and even entire communities, and sampling techniques which may miss low concentration peak flows of certain chemicals wasted only periodically. The overall concern is actually focused on the treated wastewater re-entering the environment. Although instances of solvents such as trichloroethylene in ground water are cropping up in several areas of this nation, it is not certain that the contamination results from disposal of domestic waste through such processes as the septic tank- soil absorption system. Further research into the existence of toxic compounds in domestic wastewater and the travel of these compounds through the soil layers to the ground water is being performed through a research grant by the University of Washington and at the RSKERL (a Cooperative Agreement) with the Ground Water Research Center.

All available literature was searched in an attempt to obtain amounts of chemicals (the most abundantly used) produced for use in consumer products. The production of these chemicals for industrial use is so high that it was impossible to predict the amount actually used or occurring in consumer products. Only a careful consumer product survey could adequately determine the amount of the chemicals used in the home.

SECTION 3

SEARCH FOR CHEMICAL SOURCES LITERATURE

Identifying Toxic Compounds

Since contamination of the household wastewater with toxic compounds was the major problem to be addressed in this study, a search of the literature was expected to provide detailed information on the production and use of each toxic compound.

Information on each of the 129 toxic compounds was needed to begin a search for household products which use various toxic chemicals for a specific job or are present as impurities in chemicals of particular products. The Chemline database was used to obtain Chemical Abstract Registry Numbers, other chemical names, synonyms, and trade names for each of the 129 compounds. Appendix A is a publication of the Chemline database output used for further investigation of the 129 toxic compounds. Databases such as Toxline and Medline do not contain information pertaining to chemical production and uses in consumer products. Therefore, other chemical sources were persued based on Chemline information of chemical names, synonyms, and trade names.

Most of the information presented in this paper was extracted from three sources of chemical reference literature: Kirk-Othmer Encyclopedia of Chemical Technology (8); Handbook of Environmental Data on Organic Chemicals (9); and Clinical Toxicology of Commercial Products (10). The Kirk-Othmer Encyclopedia was a good reference for identifying the major uses of the toxic compounds, although the number of compounds found was limited. The handbook of Environmental Data on Organic Chemicals had limited information on uses of most of the compounds. Of these three references, the Clinical Toxicology of Commercial Products Manual was the most informative for identifying commerical products. The basic purpose of this manual is to recommend products. In order to recommend specific medical treatment, the manual is set up in stepwise fashion to direct a physician or hospital personnel to the specific toxic compound responsible for acute poisoning or long-term exposure to dangerous chemicals. The Commercial products manual contains an ingredients index which has several categories of consumer products. Specific "brand name" products were given in the products section but were not arranged in easily accessible product categories.

SECTION 4

CONSUMER PRODUCTS AND GENERAL CATEGORIES

Categorizing

Categories consumer products commonly used in the household was accomplished by the use of a Canadian report on toxic metals (11) in wastewater. This report supplied a comprehensive list of consumer products used in and around the home. For the purpose of this paper this list was actually broekn down into several categories which could be used to locate products ending up in wastewater. Some categories of consumer products were judged as not part of the home wastewater flow. The list of general categories and associated products appearing in Table 1 were extracted from the Ontario report with a few exceptions such as automotive products, caulking compounds, fuels, inks, etc. Some of the categories have been combined into fewer major groups. For instance, bleaches and dyes are combined into laundry products. There were 13 major categories identified as sources for domestic wastewater. Each major category has several types of products listed as contributors to a wastewater stream. The major categories are:

1) cleaners
2) cosmetics
3) deodorizers
4) disinfectants
5) house and garden pesticides
6) laundry products
7) ointments
8) paint and paint products
9) photographic products
10) polish
11) preservatives
12) soaps
13) medicines

Once the consumer products were identified as shown in Table 1, the ingredients index of the commercial products manual was consulted to find specific types of compounds present. In an attempt to categorize the consumer products in a more detailed fashion, the household wastewater stream was broken into eight separate events. These are: toilet flush; garbage disposal; kitchen sink; automatic dishwashing; laundry waste; bath and shower; utility sink waste; and bathroom sink. Each household event was characterized by the types of consumer products placed into the wastewater. A summary was then prepared itemizing specific compounds likely to be found in particular events.

Products

In Table 1 each of the major categories have been divided into basic products and even more detailed specific products. Although all 13 categories have been listed as typical consumer products, only a few are actually used on a routine or daily basis around the house.

Cleaners

This category of household products is used daily or as a minimum several times per week. Products normally used on a daily basis include: denture cleaner, dishwashing detergents, diaper cleaners, disinfectants, and porcelain cleaners. The products used less frequently are: metal cleaners, toilet bowl cleaner, drain pipe cleaner, general cleaner, paint cleaner-remover, rug and upholstery cleaner, sewer, cesspool, septic tank cleaner and stove and oven cleaner.

Cosmetics

The category including all types of cosmetics and personal products is the highest daily contributor of consumer products to the disposal system. Facial make-up and related products are disposed daily. Several products used in bath and shower including soap, shampoo, antiperspirant, and cologne, are used daily. Although these cosmetics are used daily, the concentration entering the wastewater is very low. Hair preparations such as hair dyes, tints, sets, and permanents are not used daily but represent a high concentration when used.

Deodorizers

Deodorizing products are used frequently in the home, but in most cases they do not become part of the wastewater flow. Aerosols or airborne deodorants do not enter the wastewater. Bathroom deodorants can enter the waste stream with every toilet flush, since some deodorant-disinfectant products are constantly dispensed in the tank or are hung inside the toilet rim.

Disinfectants

Household disinfectant products are likely to be used frequently or even daily. Many of the disinfectants are sprayed in the bathroom into or around the tub, sink, or toilet. The disinfectant becomes part of the wastewater flow only when the unit is used or rinsed out.

House and Garden Pesticides

Pesticides may enter the wastewater by indirect transport or directly. Fruits and vegetables commonly have pesticides sprayed on them to avoid damage by insects. The pesticide becomes part of the waste stream as these foods are washed in the kitchen sink or ground up in the garbage disposal. Pesticides are also commonly placed around or in basement drains or utility sinks to kill various insects and mice. Occasionally the pesticide used near sinks and drains is washed into the wastewater disposal system. Indirectly pesticides and insecticides are washed from clothes and become part of the laundry waste. The concentration level of pesticides or insecticides is undoubtedly very low in this case and possibly not detectable with present analytical methods.

Laundry Waste

Laundry products are used frequently but not daily. Several studies (13), (14) and (15), have characterized the volume of waste from clothes washing. Daily variations of clothes washing flows are significantly higher on Monday but throughout the week remain nearly constant. (~40 /cap/day). Toxic compounds present in the laundry products will obviously be at the highest level on washday but may exhibit a rather constant concentration throughout the week.

Medical Ointments

These products are not used daily but do have rather frequent use. Foot powders and skin creams will probably occur in the wastewater seasonally as outdoor activity increases or decreases, depending on the local climate.

Paint Products

Paint and other painting products may only be wasted into the disposal system three or four times per year from a single home. However, the volume of paint products discharged is likely to be quite high compared to other products wasted on a daily basis. As much as 2-3 liters of paint, paint remover, thinner, or brush cleaner may be poured down the drain in one day's painting session. There are several types of paint normally used around the house. Antialgal and anticorrosion paints are used outside the house or in damp areas.

Photographic Products

Printing pictures is a rather popular hobby for many Americans. Most hobbyists do not recycle chemicals but usually pour spent solutions into the wastewater. The frequency of wastage is sporatic but large volumes are placed in the disposal system.

Polish

The polish category contains a broad spectrum of products. Shoe polish, furniture polish, floor wax, and various metal polishes are disposed in the wastewater system at least once per week.

Preservatives

Chemicals used as preservatives are not likely to enter the wastewater system regularly. Brush, canvas, floor, wood and waterproofing chemicals are wasted in large volumes and highly concentrated when disposal does occur. Preservatives for food and shampoo (used daily) will enter the disposal system in very low concentration.

Soap

This product is used frequently each day and may represent a fairly high concentration of toxic compounds depending on the type of soap used. Disinfectant soaps and acne soaps contain chemicals on the toxic list. Normal face, hand, and body soaps contain toxic compounds which are in the perfume.

Medicine

It is very difficult to predict the frequency of disposal for this category of products. Medicines used externally are washed off and directly enter the wastewater. Medicines taken internally may be altered or accumulated by the body. Some will not be altered and will be discharged in urine or feces.

SECTION 5

DISCUSSION OF TOXIC COMPOUNDS IN PRODUCTS

Solvents and Heavy Metals

A comprehensive list of the 129 priority pollutants and typical products containing them are given in Table 2.

The most frequent contribution of toxic compounds to the household wastewater occurs with the use of cleaning products and cosmetics. Toxic compounds in cleaning products are present in higher concentration than are found in cosmetics, but are not used as frequently. The major toxic compounds found in household cleaners are solvents. Products used often, but not daily, are: toilet bowl cleaners, drain pipe cleaners, septic tank cleaners, bath, sink, tile cleaners, stove and oven cleaners, and pet cleaners (containing pesticides). Most of these products contain solvents such as benzene, toluene, dichlorobenzene, trichloroethane, phthalates, dichloropropanes, dichloroprophylene, isophorone, trichloroethylene, carbon tetrachloride. Some cleaners; tile, tub and toilet products, contain disinfectants such as phenol and chlorophenols which are used daily. Other cleaning products, rug and upholstery cleaners, paint brush cleaners and paint thinners, are used only a few times per year. However, the volume of these cleaners placed in the wastewater in a single day may be as much as 2 to 3 liters of any of the following solvents: benzene, dichloroethane, chlorethylether, dichlorobenzene, dichloroethylene, isophorone. In addition to the solvents contained in paint cleaning products, the waste fluid contains the paint pigments of heavy metals such as: antimony, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Cosmetics used daily contain many of the toxic compounds in the 129 list. The cosmetics category contains a variety of personal products most of which are used on a daily basis. Toxic compounds contained in make-up largely consist of heavy metals (pigments), perfumes (containing aromatics) and antibacterial agents (phenol and chlorophenols). Other cosmetics used on a daily basis include shampoo, soap, shaving creams and lotions, perfumes and colognes, antiperspirants, and douches. Toxic compounds present in these products are as follows: Shampoo - antiseborrheic compounds and perfumes (benzene, dimethphenol, fluoranthene, naphthalene, PAH's, toluene, selentium); Hairdyes - nitrobenzene, Sb, Ed, Cr, Cu, Pb, Ni, Zn; Soap perfumes (containing aromatics), medicated soaps (coal tar - PAH's); shaving creams, lotions, colognes - antiseptics (chlorophenol, dichlorobenzene, phenol), perfumes (phenols, aromatics); perfumes and colognes (containing essential oils); antiperspirants - antibacterial agents (dichlorophenol, Zn), perfumes (essential oils), solvents (benezene); propellants (trichlorofluoromethane, dichlorodifluoromethane); douches - antiseptics (phenol), perfumes (essential oils); diaper cleaners - dichlorobenzene, phenol.

Products Containing Undefined Ingredients

Many consumer products list ingredients which are not clearly defined as specific compounds. A definition of some of these generally defined ingredients is necessary to understand the chemical components of some products. As an example, dandruff shampoo and eczema-psoriasis medication list coal tar, coal tar distillates, or coal tar derivates as active ingredients. The basic components of coal tar and derivatives are: benzene, toluene, xylene, phenols, cresols, naphthalene, anthracene and other polyaromatic hydrocarbons. The concentration of each chemical component is not known. Some medicinal ointments also list coal tar products as active ingredients. A major component of perfumes and scenting fragrances is "essential oils". This component contains several aromatic hydrocarbons, phenols and nitrobenzene adding various aromas to the products. Many cleaning agents contain "petroleum distillates" which are a blend of several aliphatic hydrocarbons and some aromatic compounds of various molecular weights. Petroleum distillates contain a mixture of benzene, toluene and other components found in gasoline. Petroleum naphtha and petroleum solvents have similar components but are more specific with respect to higher or lower molecular weight fractions. Mineral oils are mostly saturated hydrocarbons with a very low concentration of phenols. Mineral spirits contain aliphatic hydrocarbons similar to kerosene and a fraction of benezene, toluene, and xylene. Pine oil, which is a common ingredient for household disinfectants, contains terpenes (turpentine derivatives - not in the 129 toxics list), cyclic hydrocarbons, and phenols. The Consent Decree [1] lists 12 additional classes of compounds not formally part of the 129 list. These classes and compounds are: acetone, n-alkanes (C_{10}-C_{30}), Biphenyl, Chlorine, diakyl ethers, dibenzofuran, diphenylether, methylethyl ketone, nitrites, secondary amines, styrene, and terpenes.

Toxic Chemicals in Preservatives

Preservatives are a component of many consumer products which are used frequently or even daily. The most frequently encountered products containing preservatives are: shampoo, canvas and textile waterproofing compounds, wood, clothing, floors, cosmetics and food. Shampoo is a product used daily which contains parachlorometacresol. Canvas and textile waterproofing compounds contain: chlorethyl vinyl ether, dichlorobenzene, pentachlorophenol, chromium, copper and mercury. Wood preservatives are mainly composed of: hexachorobenzene, parachlorometacresol, dichlorophenol, pentachlorophenol, arsenic, chromium, copper, and zinc. Clothing preservatives are usually insect repellents: naphthalene, phthalates, BHC, toxaphene. Cosmetics contain preservatives not included in the 129 list. Food contains preservatives not included in the 129 list except for traces of chloroform and acrolein.

Pesticides, Herbicides, and Insecticides

Pesticides can enter household wastewater from washing fruits and

vegetables in the kitchen sink or placing fruit and vegetable scraps in the garbage disposal. Insecticides and pesticides are often placed in utility sinks or near basement floor drains which are likely to be washed into the wastewater periodically. Indirectly, insecticides, pesticides, and herbicides are washed out of clothes and can become part of the laundry waste. The concentration of the pesticide in this case will probably be too low to measure.

Impurities and By-Products

Although Table 2 lists each priority pollutant by products and uses, the toxic compound may not be a specific commercial product additive. Many of these industrial chemicals are used in the manufacture of other more useful compounds or the compound is used strictly for industrial application. The chemicals listed in Table 2 which have no product (N.P.) listed are those which are not relevant to the household waste in terms of traceable sources. However, any of these toxic compounds may be part of the household waste stream as by-products of other chemicals and products used. Chemicals used for manufacturing rubber and plastics may leach out of an item in very low concentration especially if the item is in contact with flowing water.

Distribution of Toxic Compounds Throughout the Home

Table 3 is a tabulation of consumer products, wastewater event, and the toxic compounds expected from each event. The total wastewater flow is shown as eight events: toilet flush, garbage disposal, kitchen sink, automatic dishwasher, laundry waste, bath/shower waste, utility sink waste, and bathroom sink waste. Because of the enormous diversity of consumer products not all of the toxic compounds listed in each waste will be present in a single family house. The toxic compounds listed are probably candidates for particular events based on general formulations of generic products. From this inference, Table 4 was tabulated to summarize these toxic compounds occurring most often in a particular event. Each compound listed under a specific event occurred as an ingredient in more than one type of product. Compounds common to all the wastewater unit events are: benzene, toluene, phenol, trichloroethane, naphthalene, and nearly all inorganics. Toxic compounds listed under kitchen sink waste, utility sink waste, and toilet waste are likely to be of higher concentration than the compounds in the other event categories since the usual wastewater flow is lower and the products are disposed of more frequently (13). A home having some difficulty with the septic tank system or sewer pipe clogging is likely to have a high concentration of benzene, trichloroethane, or trichloroethylene since drain and pipe cleaners have these ingredients, along with a highly caustic inorganic such as sodium hydroxide, to help solublize grease and reduce microbial slimes.

REFERENCES

1. Legal Reference - Natural Resources Defense Council vs. Train - 8 ERC 2120 (D.D.C. 1976)

2. Dobbs, Richard A.; Middendorf, Richard J.; Cohen, Jesse M., "Carbon Adsorption Psotherms for Toxic Organics", Municipal Environmental Research Laboratory, Office of R&D, U.S. EPA, Cincinnati, Ohio 45268, May 1978

3. Schwartz, Jr., Henry G.; Buzzell, Jr., James C., "The Impact of Toxic Pollutants on Disposal From Wastewater Systems"

4. Strier, Murray P., "Treatability of the Organic Priority Pollutants" - Parts C & D, Office of Quality Reviews, Effluent Guidelines Division, EPA, June 1978

5. Chapter 3 - Improved Toxics Management, "Innovative and Alternative Technology Assessment Manual", MCD, Draft, U.S. EPA, Office of Water Program Operations

6. Fabryka, June, "Septic Systems and Groundwater Quality", May 1978, New Castle County Areawide Waste Treatment Management Program, Newark, Delaware

7. Scalf, R. M.; Dunlap, W. J., "Environmental Effects of Septic Tank Systems", EPA 600/3-77-096, August 1977

8. Kirk and Othmer, Encyclopedia of Chemical Technology - Second Edition

9. Verschueren, "Handbook of Environmental Data on Organic Chemicals"

10. Gosselin, Hodge, Smith, Gleason, "Clinical Toxicology of Commercial Products", Fourth Edition

11. Ontario Agreement on Great Lakes Water Quality - Research Report No. 80, "Sources of Metals and Metal Levels in Municipal Wastewater"

12. "Sampling and Analysis Procedures for Screening Industrial Effluents for Priority Pollutants", U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268, April 1977

13. "Management of Small Waste Flows", University of Wisconsin, EPA 600/2-78-173, September 1978

14. Bennett, E. R. and Lindstedt, K. D., "Individual Home Wastewater Characterization and Treatment", Completion Report Series No. 66, Environmental Resources Center, Colorado State University, Ft. Collins, Colorado, 1975

15. Cohen, S. and Wallman, S., "Demonstration of Waste Flow Reduction from Households", EPA 670/2-74-071, 1974

TABLE 1

GENERAL CATEGORIES FOR HOUSEHOLD PRODUCTS

1. Cleaners

   a. abrasive cleaner
   b. metal cleaner
   c. toilet bowl cleaner
   d. denture cleaner
   e. dishwashing detergents - solid and liquid
   f. diaper cleaners
   g. disinfectant cleaners
   h. drain pipe cleaner
   i. general cleaner
   j. paint cleaner-remover
   k. porcelain cleaner
   l. rug and upholstery cleaner
   m. sewer, cesspool, septic tank cleaner
   n. stove and oven cleaner

2. Cosmetics

   a. powders - dusting
   b. barrier creams (protective)
   c. face creams
   d. skin lotion
   e. dentifrices - liquid, paste, powder
   f. deodorants, and antiperspirants - creams, stick, roll-on, spray, gel
   g. eye make-up - pencil, cream, shadow, liner, mascara
   h. face make-up, powders, wax, creams
   i. hair preparations - dyes, tints, lacquers and sets, permanents, straighteners, cream removers
   j. mouthwash
   k. nail cosmetics - cuticle softener, bleach, whites, polish remover, polish
   l. perfumes and colognes
   m. rouge - cake, cream, liquid, paste
   n. shampoo
   o. shaving preparations
   p. lipstick

3. Deodorizers

   a. bathroom deodorant
   b. cleanser type
   c. spray type

4. Disintectants

   a. alkalis
   b. halogens
   c. phenols
   d. pine oil
   e. ammonium compounds

5. House and Garden Pesticides

   a. ants
   b. roaches
   c. termites
   d. mouse
   e. garden
   f. grass and week killer
   g. moth spray
   h. fruit trees and bushes
   i. fruits

6. Laundry Products

   a. bluing
   b. starch
   c. detergents
   d. bleach

(continued)

TABLE 1 (CONTINUED)

7. Medical Ointments

   a. skin creams
   b. foot powders and creams

8. Paint

   a. antialgae paint
   b. anticorrosion
   c. lacquers
   d. removers
   e. brush cleaner

9. Photographic Products

10. Polish

   a. general purpose
   b. metal polish
   c. wax
   d. shoe polish

11. Preservatives

   a. brush
   b. canvas
   c. floor
   d. wood
   e. waterproofing
   f. shampoo

12. Soaps

   a. hand, face, body

13. Medicine

TABLE 2

PRODUCTS AND USES OF PRIORITY POLLUTANTS

	USES	PRODUCTS
1.	Acenaphthene	
	manufacture of insecticides, fungicides, dyes, plastics	N.P.*
2.	Acrolein	
	intermediate for chemical manufacturing, food products	fungicides, trace concentrates in modified starch
3.	Acrylonitrile	
	chemical manufacturing	N.P.
4.	Benzene	
	organic chemicals, solvents	fabric adhesives, antiperspirants, deodorants, detergents, oven cleaners, paint brush cleaner, dandruff remover and shampoo, tar remover, eczema and psoriasis remedies, solvents and thinners
5.	Benzidine	
	manufacture of chemicals manufacture of rubber manufacture of dyes	N.P.
6.	Carbon Tetrachloride	
	manufacture of chlorinated hydrocarbons, solvents, dry cleaning	household liquid degreaser, garden pesticides
7.	Chlorobenzene	
	manufacture of chemicals, solvents	household liquid degreaser
8.	1,2,4-Trichlorobenzene	
	manufacture of chemicals, solvents, heat transfer	heat transfer lubricant

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
9.	Hexachlorobenzene	
	fungicide, preservatives manufacture of aromatic fluorocarbons	fungicide for wood preserving
10.	1,2-Dichloroethane	
	solvents	rug and upholstery cleaners, tar removers, wax removers
11.	1,1,1-Trichloroethane	
	solvents, manufacture of pesticides	drain and pipe cleaners, oven cleaners, shoe polish, household degreasers, deodorizers, leather dyes, photographic supplies
12.	Hexachloroethane	
	insecticides	moth repellant
13.	1,1 Dichloroethane	
	solvent	degreasers
14.	1,1,2-Trichloroethane	
	solvent	waxes, cleaning compounds, drain and pipe cleaner, shoe polish, deodorizer, dyes, photographic products
15.	1,1,2,2-Tetrachloroethane	
	solvent, fumigant	garden sprays
16.	Chloroethane	
	solvent	waxes, cleaners
17.	Bis (chloromethyl) Ether	
	manufacture of pesticides industrial	N.P.

(continued)

TABEL 2 (CONTINUED)

USES	PRODUCTS
18. Bis (2-chloroethyl) Ether	
solvents	dry cleaning chemicals, paints, thinners, varnish, paint removers, callus removers
19. 2-Chloroethyl Vinyl Ether	
manufacture of textile coatings	waterproofing compounds
20. 2-Chloronaphtalene	
engine oil additive	N.P.
21. 2,4,6-Trichlorophenol	
insecticide, disinfectants	book binding glue, paste, detergents, household disinfectants, toilet-bowl cleaners, acne creams, housepaint, laundry starch, swimming pool disinfectant
22. P-Chloro-M-Cresol	
germicides, preservatives	glue preservative, paint preservative, wood preservative, shampoo
23. Chloroform	
solvent, medical, food processing, preservatives	liniments, solvent for sweetener manufacturing, household liquid degreaser, cough medicine
24. 2-Chlorophenol	
fungicide, bactericide, antiseptics, disinfectants	detergents, household cleaners, disinfectants, toilet bowl cleaners, house paint, swimming pool water treatment, acne creams
25. 1,2-Dichlorobenzene	
solvent, polish, pesticides, herbicides, preservatives, disinfectants	waxes, shoe polish, canvas preservative, toilet bowl cleaner, cleansing lotions, deodorizer, diaper cleaners, leather dyes, upholstery cleaner, metal polish

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
26.	1,3-Dichlorobenzene	
	solvent, insecticides, disinfectants, preservatives	waxes, shoe polish, canvas preservative, deodorizer, upholstery and rug cleaner, household disinfectants
27.	1,4-Dichlorobenzene	
	insecticides, solvents cleaners, dyes, disinfectants	fruit spray (apples, peaches, vegetables, grapes, berries, citrus, mushrooms, nuts) household cleaners, bathroom deodorants, toilet bowl cleaner, spray household deodorants, diaper cleaner, fabric dyes, upholstery and rug cleaner
28.	3,3-Dichlorobenzidine	
	manufacture of dyes	N.P.
29.	1,1-Dichloroethylene	
	plasticizer	N.P.
30.	1,2-Dichloroethylene	
	solvent, cleaners	contact cement, perfumes, make-up (perfume), upholstery and rug cleaner
31.	2,4-Dichlorophenol	
	germacides, insecticides, preservatives, cosmetic	wood preservatives, moth repellant, insect repellant, household cleaners, deodorants, antiperspirants
32.	1,2-Dichloropropane	
	solvent, cleaners	tar removers, wax, degreaser, scouring compounds
33.	1,3-Dichloropropylene	
	manufacture of fumigants, solvent cleaners	scouring compound, wax, tar remover

(continued)

TABEL 2 (CONTINUED)

	USES	PRODUCTS
34.	2,4-Dimethyphenol (2,4-xylenol)	
	solvent, manufacture of pesticides, manufacture of surfactants, coal tar ingredient, manufacture of plastics	asphalt products, antiseborrheic preparation, detergents, shampoo eczema and psoriasis remedies, plasticizer, athlete's foot remedies
35.	2,4-Dinitrotoluene	
	manufacture of TNT	N.P.
36.	2,6-Dinitrotoluene	
	manufacture of TNT	N.P.
37.	1,2-Diphenyl Hydrazine	
	manufacture of chemicals	N.P.
38.	Ethylbenzene	
	solvent, manufacture of plastic	N.P.
39.	Fluoranthene	
	coal tar ingredient	antibiotic creams, antiseborrheic preparations, athletes foot remedies, dandruff shampoo, eczema and psoriasis remedies
40.	4-Chlorophenyl Phenyl Ether	
	electric components	dielectric fluid
41.	4-Bromophenyl Phenyl Ether	
	electric components	N.P.
42.	Bis (2-Chloroisopropyl) Ether	
	solvent, manufacture of dyes, manufacture of textiles	wax, paint remover, degreaser

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
43.	Bis (2-Chloroethoxy) Methane	
	manufacture of adhesives, sealants	N.P.
44.	Methylene Chloride	
	solvents, manufacture of plastics, cleaners	oven cleaners, tar removers, wax, degreaser, spray deodorants
45.	Methyl Chloride	
	manufacture of chemicals, manufacture of herbicides, low temperature solvents	N.P.
46.	Methyl Bromide	
	manufacture crop fumigant (agricultural)	N.P.
47.	Bromoform	
	solvent, manufacture of pharmaceuticals	waxes, greases, oils
48.	Dichlorobromomethane	
	fire extinguisher fluid, solvent, chlorination of drinking water	drinking water, waxes, greases, etc.
49.	Trichlorofluoromethane	
	propellant for aerosols	perfumes, deodorants
50.	Dichlorodifluoromethane	
	propellant for aerosol	perfumes, deodorants
51.	Chlorodibromemethane	
	propellant for aerosols	perfumes, deodorants, fire extinguishers

(continued)

TABLE 2 (CONTINUED)

USES	PRODUCTS
52. Hexachlorobutadiene	
solvent, by-product of trichloroethylene manufacturing	low concentration in general purpose solvents
53. Hexachlorocyclopentadiene	
manufacture of pesticides	N.P.
54. Isophorone	
solvent, manufacturing of pesticides	household degreasers, tar remover, wax remover, paint remover, thinner
55. Naphthalene	
manufacture pesticides, insecticides, coal tar ingredient	antiseborrheic preparation, bathroom deodorants, pet cleaners, detergents, upholstery and rug cleaners, shampoo, eczema and psoriasis remedies, moth repellant
56. Nitrobenzene	
manufacture of dyes, solvent	textiles, dyes, shoe polish, hair dye, degreaser
57. Nitrophenol	
manufacture of dyes, manufacture of chemicals	N.P.
58. 4-Nitrophenol	
manufacture of pesticides	N.P.
59. 2,4-Dinitrophenol	
manufacture pesticides, manufacture fungicides, preservatives	photographic products
60. 4,6-Dinitro-O-Cresol	
pesticide	tree sprays

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
61.	N-Nitrosodimethylamine	
	manufacture of dyes	N.P.
62.	N-Nitrosodiphenylamine	
	manufacture of rubber	rubber products
63.	N-Nitrosodi-N-Propylamine	
	manufacture of organic chemistry	N.P.
64.	Pentachlorophenol	
	preservative	wood preservative, canvas preservative
65.	Phenol	
	disinfectants, antiseptics, medical ointments, perfumes	general purpose glue, fabric adhesives, antibiotic creams, flavor oils, athlete's foot remedies, baby preparations, bed bug pesticides, laundry products, callus and corn removers, pet cleaners, drain and pipe cleaners, paint brush cleaner douches, eczema and psoriasis remedies, hemmorrhoidal preparations, house paint, liniments, shaving creams and lotions, pine oil, household disinfectants
66.	Bis (2-Ethylhexyl) Phthalate	
	plastics, chemicals, pesticides	plasticizer, gasoline, synthetic lubricants, insect repellants, cosmetics, fragrances
67.	Butylbenzyl Phthalate	
	plastics, chemicals, pesticides	plasticizer, gasoline, synthetic lubricants, insect repellants, cosmetics, fragrances
68.	Di-N-Butyl Phthalate	
	plastics, chemicals, pesticides	plasticizer, gasoline, synthetic lubricants, insect repellants, cosmetics, fragrances, china cement

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
69.	Dioctyl Phthalate	
	plastics, chemicals, pesticides	plasticizer, gasoline, synthetic lubricants, insect repellants, cosmetics, fragrances, china cement
70.	Diethyl Phthalate	
	solvent, perfumes, insect repellant, plasticizer	food packaging, perfumes, mosquito repellant, fabric glue, make-up powder, silver polish, nail polish
71.	Dimethyl Phthalate	
	solvent, perfumes, insect repellant, plasticizer	food packaging, perfumes, mosquito repellant, fabric glue, make-up powder, silver polish, nail polish
72.	Benzo (a) Anthracene (1,2 Benzanthracene)	
	coal tar ingredient, cigarette smoke	antiseborrheic preparation, dandruff shampoo, eczema and psoriasis remedies, asphalt products
73.	Benzo (a) Pyrene (3,4 Benzopyrene)	
	coal tar ingredient, cigarette smoke	antiseborrheic preparation, dandruff shampoo, eczema and psoriasis remedies, asphalt products
74.	3,4 Benzofluoranthene	
	coal tar ingredient, cigarette smoke	antiseborrheic preparation, dandruff shampoo, eczema and psoriasis remedies, asphalt products
75.	11,12 Benzofluoranthene	
	coal tar ingredient, cigarette smoke	antiseborrheic preparation, dandruff shampoo, eczema and psoriasis remedies, asphalt products
76.	Chrysene	
	coal tar ingredient cigarette smoke	antiseborrheic preparation, dandruff shampoo, eczema and psoriasis remedies, asphalt products

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
77.	Acenaphthylene	
	manufacture dyes, manufacture plastics, manufacture pesticides	no direct use
78.	Anthracene	
	coal tar ingredient, manufacture dyes	same as other PAH's
79.	Benzo (Ghi) Perylene (1,12-Benzoperylene)	
	same as other PAH	same as other PAH
80.	Fluorene	
	same as other PAH	same as other PAH
81.	Phenanthrene	
	same as other PAH	same as other PAH
82.	Dibenzo (a,h) Anthracene	
	same as other PAH	same as other PAH
83.	Indeno (1,2,3-cd) Pyrene	
	same as other PAH	same as other PAH
84.	Pyrene	
	same as other PAH	same as other PAH
85.	Tetrachloroethylene (Perchloroethylene)	
	solvent, pesticide	contact cement, degreasers, wax removers, shoe dye, shoe polish, garden (vegetable) pesticide, upholstery and rug cleaner
86.	Toluene	
	solvents, cleaning, cosmetics, manufacture of saccharin	contact cement, detergents, paint brush cleaner, perfume, degreasers, dandruff shampoo

(continued)

TABLE 2 (CONTINUED)

USES	PRODUCTS
87. Trichloroethylene	
solvent	upholstery, cleaner, degreaser, tar remover, waxes
88. Vinyl Chloride (Chloroethylene)	
PVC resins manufacture	PVC pipe, PVC pipe glue, contact cement
89. Aldrin	
insecticide, pesticide	used on bush and vine fruits, citrus fruits, cucurbits, nuts, pome fruits, stone fruits, tropical fruits, vegetables, animal bait
90. Dieldrin	
insecticides	used on bush and vine fruits, citrus fruits, cucurbits, nuts, pome fruits, stone fruits, tropical fruits, vegetables, animal bait
91. Chlordane	
insecticides	used on bush and vine fruits, citrus fruits, cucurbits, nuts, pome fruits, stone fruits, tropical fruits, vegetables, animal bait
92. 4,4' DDT	
not currently used by homeowners--industrial only	insect repellants
93. 4,4' DDE	
impurity in DDT	
94. 4,4' DDD	
impurity in DDT	
95. Endosulfan-Alpha	
pesticides	acaricides, industrial insecticide

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
96.	Endosulfan-Beta	
	pesticides	acaricides, industrial insecticide
97.	Endosulfan Sulfate	
	pesticides	acaricides, industrial insecticide
98.	Endrin	
	pesticides	insecticides, rodenticides
99.	Endrin Aldehyde	
	pesticides	insecticides, rodenticides
100.	Heltachlor	
	pesticides	insecticides, rodenticides
101.	Heptachlor Epoxide	
	pesticides	insecticides, rodenticides
102.	BHC-Alpha	
	pesticides	industrial insecticide, home insecticide, fungicide, insect repellant
103.	BHC-Beta	
	pesticides	industrial insecticides, home insecticide, fungicide, insect repellant
104.	BHC-Gamma	
	pesticides	industrial insecticides, home insecticide, fungicide, insect repellant
105.	BHC-Delta	
	pesticides	industrial insecticides, home insecticide, fungicide, insect repellant

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
106.	PCB 1242	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
107.	PCB 1254	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
108.	PCB 1221	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
109.	PCB 1232	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
110.	PCB 1248	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
111.	PCB 1260	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
112.	PCB 1060	
	electric components, automotive, asphalt, inks, plastics	miscellaneous electrical appliances
113.	Toxaphene	
	pesticides	insecticides, fungicide, insect repellant

(continued)

TABLE 2. (CONTINUED)

	USES	PRODUCTS
114. Antimony (Total)		
	electronic applications, semi-conductor, dye industry, fireworks and matches, medicines, paints	drugs for care of parasitic diseases, paint pigments
115. Arsenic		
	agricultural, electrical, medicine	cotton plant defoliant, weed killer, wood preservatives, cattle and sheep dip, aquatic weed control, electronic--semi-conductors, medicine--treatment for amebic dysentery
116. Asbestos (Fibrous)		
	floor tiles, building products, flames resistant products, automotive brake linings, wine, juices, beer, whiskey	paints, caulking compositions, textiles
117. Beryllium		
	inertial guidance systems, casting materials	aircraft wing coating no consumer products
118. Cadmium		
	aluminum soldering, manufacture of plastic, fungicide, photography	solder, lawn treatment, luminescent materials, photo chemicals, textile printing, batteries, ascaricide, paints, pigments
119. Chromium		
	various metallic applications	abrasives, tanning chemicals, water repellant textiles, pigments, photo chemicals, textile printing, paints, wood preservatives
120. Copper		
	plumbing, electrical	fungicides, pigments, textile preservatives, wood preservatives, varnish, paint, photo chemicals

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
121. Cyanide (Total)		
	manufacture of organic chemicals manufacture of dyes, pesticides	black cyanide (insecticide, rodenticide) blue dyes
122. Lead		
	electrical, plumbing	batteries, pigments, paints, glaze, stabilizers for plastic, matches
123. Mercury		
	agriculture, amalgamation, catalysts, dental preparations, electrical laboratory, paint products, paper manufacture, pharamaceuticals (medicines)	insecticides and rodenticides, weed killers, textile preservatives, batteries, antiseptic, pearlescent paint
124. Nickel		
	alloys, plating, catalysts, ceramics, textiles	coins, jewelry , zippers, plumbing fixtures, corrosion, coverings, dyes, pigments, PVC pigment, fungicide for vegetables, photographic, skin treatment, diuretics, ointments (skin, eyes), crabgrass control
125. Selenium		
	electrical, optical, Xerox copy machines, manufacture glass and porcelain, color for glass and plastics, manufacture of rubber lubricants	photographic chemicals, silver compound antiseptics
126. Silver		
	photography, electrical, silverware, jewelry, mirror coatings, medicines, fungicides	photographic chemicals, silver compound antiseptics
127. Thallium		
	no commercial uses, rodenticide (not for home use)	

(continued)

TABLE 2 (CONTINUED)

	USES	PRODUCTS
128.	Zinc	
	zinc galvanizing, ceramics (colors), medical, vulcanizing rubber, manufacture of textiles (rayon)	luminescent materials, pigments, rubber compounding, ointments (antiseptic), deodorant, disinfectants, paint, wood preservative
129.	2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)	
	impurity in 2,4,5 T	pesticide

TABLE 3

DISTRIBUTION OF COMMON CONSUMER PRODUCTS

CONSUMER PRODUCTS	TOXIC COMPOUND
Toilet Flush	
medical-ointments	benzene, bis (2-chloroethyl) ether, 2,4,6-trichlorophenol, chloroform, 2-chlorophenol, 2,4-dimethylphenol, napthalene, phenol, antimony, Cu, Hg, Zn, arsenic Cd
disinfectants	2,4,6-trichlorophenol, 2-chlorophenol, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, phenol, Hg
deodorizer	benzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenol, methylene chloride, trichlorofuoromethane, dichlorodifluoromethane, chlorodibromomethane, naphthalene, Zn
cleaner	benzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, chloroethane, 2,4,6-trichlorophenol, 2-chlorophenol, 1,2-cichlorobenzene, 1,4-dichloropropane, 1,3-dichloropropylene, phenol, Cr, Cu, Zn
Garbage Disposal	
pesticides	carbon tetrachloride, 1,1,2,2-tetrachloroethane, tetrachloroethylene, aldrin, dieldrin, chlordane, 1,4-dichlorobenzene, arsenic, Cd, Cr, Cu, Pb, Hg, Zn, cyanide
deodorizer	benzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenol, methylene chloride, trichlorofluoromethane, dichlorodifluoromethane, naphthalene, Zn

(continued)

-TABLE 3 (CONTINUED)

Kitchen Sink	
hand soaps and cleaners	1,2-dichloroethylene, phenol, diethylphthalate, dimethylphthalate, toluene, asbestos
polish	1,2-dichlorobenzene, 1,2-dichloroethane, chloroethane, 1,3-dichlorobenzene, 1,2-dichloropropane, 1,3-dichloropropylene, methylene chloride, bromoform, dichlorobromomethane, isophorone, diethylphthalate, dimethylphthalate, tetrachloroethylene, trichloroethylene, Zn
pesticides	carbon tet, 1,1,2,2-tetrachloroethane, tetrachloroethylene, aldrin, dieldrin, chlordane, 1,4-dichlorobenzen, arsenic, Cd, Cr, Cu, Pb, Hg, Zn, cyanide
cosmetics	benzene, p-chloro-m-cresol, 2,4-dimethylphenol, napthalene, phenol, PAH's, toluene, 1,2-dichlorobenzene antimony, Cd, Cu, Pb, Hg, Ni, Ag, Zn
cleaners	benzene, carbon tet, chlorobenzene, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1-dichloroethane, chloroethane chloroform, 2-chlorophenol, 1,2-dichlorobenzene, 1,3-dichlorobenzene,1,4-dichlorobenzene, 1,2-dichloroethylene, 2,4-dichlorophenol, 1,2-dichloropropane, 1,3-dichloropropylene, bis (2-chloroisopropyl) ether, methylene chloride, hexabutadiene, isophorone, napthalene, nitrobenzene, phenol, tetrachloroethylene, toluene, trichloroethylene, Cr, Cu, Zn
Automatic Dishwasher Waste	
detergents	benzene, 2,4,6-trichlorophenol, 2-chlorophenol, 2,4-dimethylphenol, napthalene, phenol, toluene
silver polish	diethylphthalate, dimethyl, phthalate, Ag

(continued)

TABLE 3 (CONTINUED)
Laundry Waste

polish (laundered clothes soiled with polish)	1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, chloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichloropropane, 1,3-dichloropropylene, bis (2-chlorisopropyl) ether, methylene chloride, bromoform, dichlorobromomethane, isophorone, nitrobenzene, tetrachloroethylene, trichloroethylene
fabric adhesives	benzene, phenol, diethylphthalate, dimethylphthalate
dyes and textile coatings	1,1,1-trichloroethane, 1,1,2-trichloroethane, 2-chloroethyl vinyl ether, 1,2-dichlorobenzene, 1,4-dichlorobenzene, nitrobenzene, asbestos, cyanide
medical ointments	benzene, bis (2-chloroethyl) ether, 2,4,6-trichlorophenol, chloroform, 2-chlorophenol, 2,4-dimethylphenol, fluoranthene, napthalene, phenol, PAH's, Hg, Zn
laundry products	2,4,6-trichlorophenol, 2-chlorophenol, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol, napthalene, toluene
pesticides and insecticides	carbon tet, hexachloroethane, 1,1,2,2-tetrachloroethane, 2,4,6-trichlorophenol, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenol, naphthalene, bis (2-ethylhexyl) phthalate, diethylphthalate, dimethylphthalate, tetrachloroethylene, aldrin, dieldrin, chlordane, heptachlor, BHC's, toxaphene, arsenic, Cd, Cr, Cu, Pb, Hg, Zn, cyanide
disinfectants	2,4,6-trichlorophenol, 2-chlorophenol, phenol, Hg
bleach and starch	2,4,6-trichlorophenol, Hg

(continued)

TABLE 3 (CONTINUED)

Bath and Shower Waste	
soaps (perfumed)	1,2-dichloroethylene, phenol, diethylphthalate, dimethyl-phthalate, toluene
medical ointments	benzene, bis (2-chloroethyl) ether, 2,4,6-trichlorophenol, chloroform, 2-chlorophenol, 2,4-dimethyphenol, fluoranthene, napthalene, phenol, PAH's, Cu, Hg, Zn
shampoo	benzene, p-chloro-m-cresol, 2,4-dimethylphenol, fluoranthene, naphthalene, PAH's, toluene, Cd, Cu, Pb, Ni, Ag, Zn
disinfectants	1,1,2-trichloroethane, chloroethane, 2,4,6-trichlorophenol, 2-chlorophenol, 1,4-dichlorobenzene, 2,4dichlorophenol, 1,2-dichloropropane, 1,3-dichloropropylene, naphthalene, phenol, Hg
cosmetics (make-up, anti-perspirants) (hair dyes)	benzene, 1,4-dichloroethylene, 2,4-dichlorophenol, nitrobenzene, bis (2-ethylhexyl) phthalate, butylbenzylphthalate, diethylphthalate, dimethylphthalate, antimony, Cd, Cu, Pb, Hg, Ni, Se, Ag, Zn
Utility Sink Waste	
preservatives and dyes	hexachlorobenze, 1,1,1-trichloroethane, 2-chloroethyl vinyl ether, p-chloro-m-cresol, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenol, pentachlorophenol, Cd, Cr, Cu, Db, Ni, asbestos, cyanide
polish	1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, nitrobenzene, diethylphthalate, dimethylphthalate, Zn
photographic products	1,1,1-trichloroethane, 1,1,2-trichloroethane, 2,4-dinitrophenol, Cr, Pb, Hg, Ag

(continued)

TABLE 3 (CONTINUED)

paint products	benzene, bis (2-chloroethyl) ether, 2,4,6-trichlorophenol, 2-chlorophenol, bis (2-chlorosopropryl) ether, iosphorone, phenol, toluene, antimony, arsenic, Cd, Cr, Cu, Pb, Hg, Ni, Se Zn, asbestos
pesticides	carbon test, 1,1,2-tetrachloroethane, tetrachloroehylenes, albrin, dieldrin, chlordane, endrin, heptachlor, BHC, toxaphene, TCDD, arsenic, Cd, Cr, Cu, Pb, Hg, Zn, cyanide
cleaners	1,1,1-trichloroethane, 1,1,2-trichloroethane, Cr, Zn
bleach	2,4,6-trichlorophenol
Bathroom Sink Waste	
medicine	benzene, bis (2-chloroethyl) ether, 2,4,6-trichlorophenol, chloroform, 2-chlorophenol, 2,4-dimethylphenol, fluoranthene, naphthalene, phenol, PAH's, antimony, arsenic, Cu, Hg, Zn
soaps (hard and body)	1,2-dichloroethylene, phenol, diethylphthalate, dimethylphthalate, toluene
disinfectants	2,4,6-trichlorophenol, 2-chlorophenol, phenol, Hg
cosmetics	p-chloro-m-creso, 1,2-dichlorobenzene, phenol, bis (2-ehtylhexyl) phthalate, diethylphthalate, dimethylphthalate, antimony, Cd, Cu, Pb, Hg, Zn
shampoo	benzene, p-chloro-m-cresol, 2,4,-dimethylphenol, fluoranthene, naphthalene, PAH's, toluene, Cd, Cu, Ag, Zn
cleaner	1,1,1-trichloroethane, 1,1,2-trichloroethane, Cu

(continued)

TABLE 3 (CONTINUED)

Compounds in Waste Flow not Specifically Added as a Product to the Waste Flow

	public chlorinated drinking water	carbon tet, dichlorobromomethane
	PVC water supply piping	bis (2-ethylhexyl) phthalate, tetrachloroethylene, toluene, vinyl chloride

TABLE 4

TOXIC COMPOUND DISTRIBUTION IN HOUSEHOLD WASTE EVENTS

Toilet Flush

benzene (4)
phenol (65)
2,4,6-trichlorophenol (21)
2-chlorophenol (24)
1,2-dichlorobenzene (25)
1,3-dichlorobenzene (26)
1,4-dichlorobenzene (27)
1,1,1-trichloroethane (11)
1,1,2-trichloroethane (14)
Naphthalene (55)
Sb (114), Cu (120), Hg (123)
Zn (128), Cr (119)
Trichloroethylene (87)
1,2-dichloroethane (10)

Kitchen Sink

phenol (65)
toluene (86)
1,2-dichlorobenzene (25,26,27)
1,3-tetrachloroethylene (85)
1,2-dichloroethylene (30)
diethylphthalate (70)
dimethylphthalate (71)
1,2-dichloroethane (10)
1,1,2,2-tetrachloroethane (15)
1,2-dichloropropane (32)
1,2-dichloropropylene (33)
isophorone (54)
trichloroethylene (87)
carbon tetrachloride (6)
arsenic (115)
Cd (118), Cr (119)
Cu (120), Pb (122)
Hg (123), Zn (128)
Sb (114), Ni (124)
Ag (126)

Garbage Disposal

1,4-dichlorobenzene (27)
aldrin (89)
dieldrin (90)
chlordane (91)
arsenic (115)
Cd (118)
Cr (119)
Cu (120)
Pb (122)
Hg (123)
Zn (128)

Automatic Dishwasher

phenol (65)
benzene (4)
toluene (86)
2,4,6-trichlorophenol (21)
Ag (126)

Laundry Waste

2,4,6-trichlorophenol (21)
1,2-dichlorobenzene (35)
benzene (4)
phenol (65)
1,4-dichlorobenzene (27)
2,4-dimethylphenol (34)
naphthalene (55)
1,1,1-trichloroethane (11)
1,1,2,2-tetrachloroethane (15)
1,3-dichlorobenzene (26)
nitrobenzene (56)
tetrachloroethylene (85)
diethylphthalate (70)
dimethylphthalate (71)
chlorophenol (24)
arsenic (115)
Cd (118), Cr (119), Cu (120),
Pb (122), Hg (123), Zn (128)

( ) denotes number of toxic ~~compund~~ Compounds on Priority Pollutant List - Appendix 4

(continued)

TABLE 4 (CONTINUED)

Utility Sink

1,1,1-trichloroethane (11)
1,1,2-trichloroethane (14)
1,2-dichlorobenzene (25)
2,4,6-trichlorophenol (21)
arsenic (115), Sb (114),
Cd (118), Cr (119), Cu (120),
Pb (122), Hg (123), Ni (124),
Sc (125), Zn (128), Ag (126)

Bathroom Sink

phenol (65)
toluene (86)
benzene (4)
2,4,6-trichlorophenol (21)
2-chlorophenol (24)
p-chloro-m-cresol (22)
2,4-dimethylphenol (34)
fluoranthene (39)
naphthalene (55)
PAH's (72)
diethylphthalate (70)
dimethylphthalate (71)
Sb (114), Cd (118), Cu (120),
Pb (122), Hg (123), Ag (126),
Zn (128), arsenic (115)

Bath/Shower

phenol (165)
benzene (4)
naphthalene (55)
1,2-dichloroethylene (30)
diethylphthalate (70)
dimethylphthalate (71)
toluene (86)
2,4,6-trichlorophenol (21)
2-chlorophenol (24)
2,4-dimethylphenol (34)
fluoranthene (39)
PAH's (72)
2,4-dichlorophenol (31)
Sb (114), Cd (118), Cu (120),
Pb (122), Hg (123), Ni (124),
Se (125), Ag (126), Zn (128)

( ) denotes number of toxic compound on Priority Pollutant list - Appendix

TABLE 5

PREDICTED PRIORITY POLLUTANTS IN HOUSEHOLD WASTEWATER

Organics	Inorganics
benzene	arsenic
phenol	cadmium
2,4,6-trichlorophenol	chromium
2-chlorophenol	copper
1,2-dichlorobenzene	lead
1,4-dichlorobenzene	mercury
1,1,1-trichloroethane	zinc
naphthalene	antimony
toluene	silver
diethylphthalate	
dimethylphthalate	
trichloroethylene	
aldrin	
dieldrin	

E27

MULTNOMAH COUNTY OREGON

DEPARTMENT OF ENVIRONMENTAL SERVICES
2115 S.E. MORRISON
PORTLAND, OREGON 97214
(503) 248-5000

DENNIS BUCHANAN
COUNTY EXECUTIVE

September 6, 1984

Mr. Fred Hansen, Director
Department of Environmental Quality
P.O. Box 1760
Portland, OR 97207

Dear Mr. Hansen:

In your letter of August 24, regarding the E.Q.C. hearings of August 30 and September 11, you have asked a number of questions of me. Please be advised as follows:

- The soil characteristics and classifications contained in the report Threat to Drinking Water, on file with your department, is correct insofar as I am aware.

- There are approximately 56,000 cesspools in the affected area discussed in the report.

- In the rural areas of Multnomah County outside the Urban Growth Boundary established by the Metropolitan Service District, sewers are not permitted. The density of development is very low and structures do use on-site disposal systems, but almost all are septic tanks and drain fields.

- The failure rate of cesspools in the affected area averages about 1% to 3% per year on the base of 56,000 cesspools in use.

- The common method of rehabilitation of cesspools experiencing problems is to introduce commercial solvents to disolve grease and solids buildup. If that fails, cesspools are often pumped out to extend the life. Upon cesspool failure, the only alternative is to dig a new pit. You should know that most of the lots in the affected area are 7,000 square feet or less and most of the cesspools are 20 to 30 years old. We would expect the failure rate to increase as the cesspools reach their expected average life usage of 25 to 30 years. Given the urban lot size, there is not a lot of room left on individual lots for replacement more than once.

- Statistics of new installation are not available for the last 10 years. For the past four years, they are as follows:

	New	Replacement	Total
1980	332	441	773
1981	321	380	701
1982*	170	399	569
1983*	112	290	402

*In August, 1982, a Sewer Systems Development Charge was implemented by the County in the unsewered urban area east of the Willamette River. The charge, which constitutes a pre-payment toward sewer construction, is $500. Our records have indicated a decrease in the number of replacement permits issued; however, we feel that this is more an indication of a desire on the part of property owners to avoid the charge (thus the replacement systems are installed illegally), rather than a decrease in the rate of cesspool failures.

- The soil conditions still allow the use of on-site systems. The issue is the further degradation of the underground water. Until sewers are built, replacement should be allowed. No requirement for septic tanks in front of cesspools or replacement, however, should be in force, since this adds costs of $2,000 to $3,000 for the homeowner and makes no contribution to the permanent solution, which is sewers. I would suggest a cap on the number of cesspools allowed, replacement and new, with an annual review by the E.Q.C. to hopefully reduce the allowable number as sewers are built. I would also suggest the E.Q.C. make sewer connections mandatory in the affected area when sewer facilities are within 100 feet of the property.

If you have any further questions, please feel free to contact me.

Sincerely,

Paul Yarborough, Director
Department of Environmental Services
Multnomah County

PY:rj

VICTOR ATIYEH
Governor

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

CLEARANCE		
TO	INITIAL	DATE
		8/24

August 24, 1984

C. Paul Yarborough, Director
Department of Environmental Services
Multnomah County
2115 S.E. Morrison St.
Portland, OR 97212

Dear Mr. Yarborough:

Legislation enacted by the Oregon Legislature in 1981 and amended in 1983 (ORS 454.275 et seq) provides a process for the formal declaration of a Threat to Drinking Water by the Environmental Quality Commission.

On June 27, 1984, the governing bodies of Multnomah County Central County Service District No. 3, the City of Gresham, and the City of Portland, initiated the process for declaration of a threat to drinking water in an area of Mid-Multnomah County by filing with the Environmental Quality Commission, formal resolutions, preliminary findings of a threat to drinking water, and plans for facilities to alleviate the threat. The facilities proposed include construction during the next 20 years of all trunk sewers, interceptor sewers, pump stations, and treatment work necessary to provide sewer service to the affected area. Collection sewers would be constructed through a voluntary Local Improvement District (LID) process. The jurisdictions estimate that approximately 25 percent of the present population of the area would be connected to sewers within 20 years, based on past experience in voluntary LID formations.

The statute requires the Environmental Quality Commission to schedule a hearing within or near the affected area to provide interested persons an opportunity to present oral or written testimony. The Commission has scheduled a hearing for this purpose on August 30, 1984, at Parkrose High School Cafetorium, 11717 N.E. Shaver Street, Portland, Oregon. The hearing will begin at 1 p.m. and continue until 10:30 p.m. with a recess for dinner between 5 and 6 p.m. The hearing will be reconvened before a hearings officer on September 11, 1984, at 10 a.m. in Room 1400 of the Yeon Building, 522 S.W. 5th Avenue, Portland, Oregon, to hear testimony from persons who are unable to testify at the August 30, 1984, hearing. Written testimony postmarked by September 11, 1984, will be included in the record.

The hearing is for the purpose of gathering evidence to determine whether a threat to drinking water exists in the affected area, whether the conditions could be eliminated or alleviated by the treatment works and whether the proposed treatment works is the most economical method to alleviate the conditions. Additional questions to be addressed are whether the affected area is properly defined and whether the proposed schedule for construction of facilities is adequate to eliminate or alleviate a threat to drinking water.

The statute (ORS 454.275) defines a "Threat to Drinking Water" to mean the existence in any area of any three of the following conditions:

"(a) More than 50 percent of the affected area consists of rapidly draining soils;

(b) The groundwater underlying the affected area is used or can be used for drinking water;

(c) More than 50 percent of the sewage in the affected area is discharged into cesspools, septic tanks or seepage pits and the sewage contains biological, chemical, physical or radiological agents that can make water unfit for human consumption; or

(d) Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer. Such contaminant levels must be in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act."

The Environmental Quality Commission requests your assistance in evaluating the information presented by the local governments in the attached documents entitled Threat to Drinking Water Findings and Providing Sewer Service to Mid-Multnomah County: Framework Plan. These documents will be a part of the record in the hearing.

Based on your agency's particular knowledge and expertise, as the agent for the State of Oregon for the issuance of permits for on-site sewage disposal systems in Multnomah County, it would be most helpful if you could specifically address the following in addition to your general evaluation and comments:

- Characteristics and classification of soils in the affected area as they relate to on-site sewage disposal;
- Extent of use of cesspools, seepage pits and septic tank systems for sewage disposal within the described affected area;
- Areas where cesspools or seepage pits are used for sewage disposal outside of the described affected area;
- Statistics on the frequency of failure of cesspools;
- Methods used for repair or rehabilitation of failed cesspools;
- Statistics on new cesspool installation over the last 10 years.
- Potential for use of approved on-site sewage disposal systems in the affected area recognizing that cesspool and seepage pit systems are not approved for installation after January 1, 1985.

The Commission will appreciate any information you can provide by the closing date for the record on September 11, 1984.

Sincerely,

Fred Hansen
Director

HLS:l
WL3629
Enclosures

VICTOR ATIYEH
GOVERNOR

Department of Human Resources
HEALTH DIVISION
1400 S.W. 5th AVENUE, PORTLAND, OREGON 97201 PHONE

E2B

September 10, 1984

Fred Hansen
Director
Department of Environmental Quality
522 SW Fifth Avenue
Portland, Oregon 97207

Dear Fred:

Thank you for the opportunity to comment on the threats to drinking water in Mid-Multnomah County. We have reviewed the Threat to Drinking Water Findings and Providing Sewer Service to Mid-Multnomah County: Framework Plan and wish to comment on the public health concerns.

It is the opinion of the Health Division that there is a potential risk that continued untreated subsurface sewage disposal will result in high levels of volatile organic chemicals and nitrates, and that these increased contaminant levels may lead to human disease. Unless some measures are taken to reverse the increase of untreated human and industrial/business waste in the soil and water environment, the situation will become an increasing hazard to human health. Based on the trend of continued population growth and commercial/industrial development in this area, it is appropriate to assume that the levels of contaminants already present in the ground water will, likewise, continue to increase and become a greater threat to humans and the environment. Continued contamination of groundwater drinking supplies threaten not only this valuable aquifer and the health of those local residents who draw from it, but it would be a threat to any other population which might need to use this as a source of drinking water in the future.

In addition to the health implications and impact on groundwater usage discussed above, you requested our comment on other specific questions. We believe the data contained in the "Consortium" report regarding extent of use of the groundwater by various districts is accurate. The potential for on-site disposal systems to adversely impact the City of Portland wells is difficult to assess. Portland has stated that these wells are in a lower aquifer separated from the upper levels by an impervious layer. We are concerned that high volume, continuous pumping of this aquifer may induce flow from the upper to lower levels. Portland may have additional recent tests that may answer this question.

We cannot answer the question about the adequacy of the proposed timetable. The Framework Plan indicates that the area will not be completely sewered before the end of the century. It is not possible to predict how soon the use of groundwater from this aquifer will be essential to the area, or how soon the present contamination will be "flushed out" once sewers are installed. Because of these uncertainties, the discharge of contaminants to the groundwater from on-site sewage disposal should be stopped, and the provision for sewer service in the area should get underway.

I hope these comments will be of value to you. For additional information please see the attached Issue Paper.

Sincerely,

Kristine M. Gebbie
Assistant Director, Human Resources
Administrator, Health Division

KMG:bo

HEALTH DIVISION

ISSUE PAPER

GROUNDWATER THREAT IN MID-MULTNOMAH COUNTY

From a public health standpoint, there are two primary types of contaminants of concern observed in well water in the unincorporated Mid-Multnomah County area. The first is a group of man-made products known as volatile synthetic organic chemicals (VOCs). The specific VOCs reported to be present in area drinking water include tetrachloroethylene, trichloroethylene, trichlorofluoromethane, and trans-1, 2 dichloroethene. They are used as solvents, degreasing agents and refrigerants(1). These are man-made products, found in the environment as a direct result of human activity.

The Environmental Protection Agency has established Recommended Maximum Contaminant Levels for VOCs, under the Safe Drinking Water Act(2). A level of zero has been recommended because of the potential of these compounds to cause cancer. The implication is that none of these products should be present in drinking water.

The second contaminant is nitrate, an inorganic ion which is present in human and animal wastes in high quantities. Studies have indicated that unsewered human wastes have contributed nitrogenous wastes to soil and water environments. Nitrate is of concern because of high water solubility of this ion and the consequent leaching and environmental mobility in soil and water(3). Unchecked subsurface sewage disposal can cause contamination of ground water to unacceptable levels. The maximum contaminant levels set by the Environmental Protection Agency in drinking water is ten milligrams per liter (mg/l) nitrate nitrogen. While the majority of test results from drinking water wells in Mid-Multnomah County have been in the range of 5 mg/l to 8 mg/l, levels above the maximum contaminant level have been reported for the area.

Health concerns regarding elevated levels of nitrates in drinking water focus primarily on a condition effecting children, called methemoglobinemia. This is a condition in which the oxygen transport capability of the blood is impaired. Other health concerns about nitrates include possible association with birth defects, effects on the heart and blood vessels, and cancer. It should be noted that, at present, none of these conditions have been observed in the people living in the affected area, that can be positively traced to the drinking water.

Trend data showing changes in the nitrate levels in the drinking water over time are not available. However, by examining changes in the population of the area over time suggests a pattern of increase in the amount of untreated subsurface sewage disposal in the urban unincorporated Mid-Multnomah County area. During the last three

decades the population in the affected area has grown by 360%. In 1950, there were approximately 33,787 people living in the current boundaries of urban unicorporated Mid-Multnomah County(4). In 1980, that figure stood at 121,761--an increase of approximately 88,000 inhabitants.

There has been a concomitant growth in business, industry, and service institutions (such as hospitals, schools, etc.) in the area. Today there are 1,918 businesses and industries, employing over 33,000 people(5). Not only has the amount of untreated human waste continued to grow unchecked, waste from these businesses, industries and other institutions has been flowing into the soil beneath the affected area.

Given the fact that volatile organic chemicals are not normally occurring in the environment and they are used by businesses and industries (and to a lesser extent in homes) in the affected area, it is logical to presume that these contaminants are reaching the aquifer through subsurface sewage disposal. Further, the absence of contamination of the aquifer upstream from the populated area of Mid-Multnomah County strongly suggests that the high nitrate levels are, to a large extent, due to subsurface sewage disposal.

The plan for installing sewers in the area seems to be an appropriate and inevitable step for curtailing the contamination and preserving the aquifer. However, this is a long range solution which will take some years to complete. In the interim, there are steps which should be taken to stop the discharge of the more serious contaminants. One approach would be to identify the major sources of waste in the area and establish a system of on-site waste containment, and transport of the stored wastes to an appropriate disposal or treatment facility.

REFERENCES

1. Patty's Industrial Hygiene and Toxicology, Vol. I, Clayton & Clayton, 3rd ed., 1977.

2. Federal Register, Vol. 49, No. 114. June 12, 1984.

3. Casarett and Doull's Toxicology: The Basic Science of Poisons, John Doull, M.D., 2nd ed., 1975.

4. Figures based on census tract data which are located wholly within the urban unincorporated area of Mid-Multnomah County. Source: 1950, 1960, 1970, 1980 Census of Population, U.S. Bureau of the Census, U.S. Department of Commerce.

5. Multnomah County Comprehensive Framework Plan, Vol. 1, Findings, 1983.

VICTOR ATIYEH
Governor

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

CLEARANCE		
TO	INITIAL	DATE
Sawyer		8/24
Hallock		
Sawyer		

August 24, 1984

Kristine Gebbie, Administrator
Health Division
State Office Bldg.
1400 S.W. Fifth Ave.
Portland, OR 97204

Dear Ms. Gebbie:

Legislation enacted by the Oregon Legislature in 1981 and amended in 1983 (ORS 454.275 et seq) provides a process for the formal declaration of a Threat to Drinking Water by the Environmental Quality Commission.

On June 27, 1984, the governing bodies of Multnomah County Central County Service District No. 3, the City of Gresham, and the City of Portland, initiated the process for declaration of a threat to drinking water in an area of Mid-Multnomah County by filing with the Environmental Quality Commission, formal resolutions, preliminary findings of a threat to drinking water, and plans for facilities to alleviate the threat. The facilities proposed include construction during the next 20 years of all trunk sewers, interceptor sewers, pump stations, and treatment work necessary to provide sewer service to the affected area. Collection sewers would be constructed through a voluntary Local Improvement District (LID) process. The jurisdictions estimate that approximately 25 percent of the present population of the area would be connected to sewers within 20 years, based on past experience in voluntary LID formations.

The statute requires the Environmental Quality Commission to schedule a hearing within or near the affected area to provide interested persons an opportunity to present oral or written testimony. The Commission has scheduled a hearing for this purpose on August 30, 1984, at Parkrose High School Cafetorium, 11717 N.E. Shaver Street, Portland, Oregon. The hearing will begin at 1 p.m. and continue until 10:30 p.m. with a recess for dinner between 5 and 6 p.m. The hearing will be reconvened before a hearings officer on September 11, 1984, at 10 a.m. in Room 1400 of the Yeon Building, 522 S.W. 5th Avenue, Portland, Oregon, to hear testimony from persons who are unable to testify at the August 30, 1984, hearing. Written testimony postmarked by September 11, 1984, will be included in the record.

The hearing is for the purpose of gathering evidence to determine whether a threat to drinking water exists in the affected area, whether the conditions could be eliminated or alleviated by the treatment works and whether the proposed treatment works is the most economical method to alleviate the conditions. Additional questions to be addressed are whether the affected area is properly defined and whether the proposed schedule for construction of facilities is adequate to eliminate or alleviate a threat to drinking water.

The statute (ORS 454.275) defines a "Threat to Drinking Water" to mean the existence in any area of any three of the following conditions:

"(a) More than 50 percent of the affected area consists of rapidly draining soils;

(b) The groundwater underlying the affected area is used or can be used for drinking water;

(c) More than 50 percent of the sewage in the affected area is discharged into cesspools, septic tanks or seepage pits and the sewage contains biological, chemical, physical or radiological agents that can make water unfit for human consumption; or

(d) Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer. Such contaminant levels must be in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act."

The Environmental Quality Commission requests your assistance in evaluating the information presented by the local governments in the attached documents entitled Threat to Drinking Water Findings and Providing Sewer Service to Mid-Multnomah County: Framework Plan. These documents will be a part of the record in the hearing.

Based on your agency's particular knowledge and expertise, it would be most helpful if you could specifically address the following in addition to your general evaluation and comments:

- Extent of present usage of groundwater in the affected area for drinking water;
- Health implications of the use of groundwater in Mid-Multnomah County as drinking water;
- Impact of man-made organic chemicals on use of groundwater for drinking water;
- Potential for cesspools or other on-site sewage disposal systems to adversely impact the City of Portland emergency water supply wells;
- Adequacy of the proposed timetable for sewer construction and connections to alleviate groundwater pollution.

The Commission will appreciate any information you can provide by the closing date for the record on September 11, 1984.

Sincerely,

S/ [illegible]

Fred Hansen
Director

HLS:l
WL3628
Enclosures

E29

VICTOR ATIYEH
GOVERNOR

Water Resources Department

MILL CREEK OFFICE PARK
555 13th STREET N.E., SALEM, OREGON 97310 PHONE 378-8456

September 10, 1984

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY
RECEIVED
SEP 1[illegible] 1984
OFFICE OF THE DIRECTOR

Fred Hansen, Director
Department of Environmental Quality
522 SW 5th Avenue
Box 1760
Portland, OR 97207

Dear Mr. Hansen:

A member of my hydrogeology staff has reviewed the East Multnomah County Consortium report dated June 1984, as requested in your letter of August 24, 1984. The report entitled "Threat to Drinking Water Findings" makes a crisp, straightforward summary of the geology, hydrogeology and general ground water quality information for the County area. In examining the criteria listed under ORS 454.285, the report strongly supports the Mid-Multnomah County Frame Work Plan for providing sewer service to the threatened East County areas.

Hydrogeologists in this office have been very concerned, since the late 1950's, about the rapid growth and subtle changes from rural to suburban and urban community developments in East Multnomah and Clackamas Counties. The widespread practice of sub-surface disposal of domestic sewage into the highly permeable gravel aquifers was of most concern. The area has received increased attention from numerous citizen groups and governmental agencies since 1960.

The U.S. Geological Survey in cooperation with this office prepared a ground water report for the East Portland area in 1965. In 1974, H.R. Sweet and Joseph Illian, geologists with this office, joined with Ed Quan of DEQ in preparing a report discussing sub-surface sewage disposal and ground water contamination in East Portland. In 1965, it was reported that 8 million gallons per day of raw sewage were discharged into the gravels of the area by cesspools, seepage pits, and septic drain fields. By 1974 the sewage loading had increased to approximately 10 million gallons per day. Now, in 1984, the latest report estimates the sub-surface sewage waste disposal to be 14 million gallons per day. An increase of 6 million gallons per day over the past 19 years indicates an annual gain of about 316,000 gallons per day.

The coarse gravel deposits are 300 to 400 feet thick and in 1977 they were identified as sensitive aquifers on the statewide water table aquifer maps by Sweet, Edwards and Associates. Subsequently, the General Ground Water Quality Protection Policy was adopted by the Department of Environmental Quality.

The most recent water quality analysis of public water supply wells now indicates increases in nitrate nitrogen concentrations in deeper wells. Organic compounds manufactured by man for use as degreasers, solvents, and stripping agents are also entering the ground water supply. None of these chlorinated organic products belong in the public drinking water supply. Yet, we find methylchloride and trichloroethylene (septic tank cleaners) in trace amounts entering public well fields.

The direction of regional ground water movement in the East County area has been described as southeast to the northwest in several ground water reports of this area. The water table contours, shown on Map 6 of the current report, agree with previous field data for the area. Water levels in wells near Gresham stand above elevations 200 feet mean sea level. Ground water moves north and west toward elevations of 13 feet m.s.l. near the Columbia River.

Study of the rate of ground water movement in this area has not been made. To estimate the average rate of movement, we have used pumping data presented on Plate 6 of the Bureau of Water Works report dated April 1977. The average permeability of 10 representative wells was found to be 1320 gallons per square foot per day (176.2 square feet per day). A water table gradient of 200 feet in six miles (.0063 foot per foot) and a storage coefficient of .25 were used in calculating the average velocity of ground water flow. Based on these figures, the fastest rate is 10 feet per day. The slowest rate is about 0.6 feet per day. The average rate of water movement is 4.4 feet per day.

Data for estimating recharge in this area is not available. Yet, we know that much of the area is made up of highly permeable alluvium and terrace gravels that facilitate direct ground water infiltration and recharge. Streams and local drainage channels are sparse or non-existent in the area. This indicates that most of the annual precipitation is transmitted directly to the water table. Coastal dune sands have a similar characteristic and often absorb 65 to 85 percent of the annual precipitation. (USGS E. Hampton, WSP 1539-K) We expect that the permeable surface gravels in East Portland will recharge at least 60 percent of the annual precipitation. However, with future growth, new paving, and improved drainage plans, the amount of annual recharge could be reduced.

It is reported that some deep aquifers are partially confined by clay beds. However, these beds are not expected to be continuous over the entire area and may not protect the deep aquifers from long term sewage waste disposal practices. Some deep wells now show trace contaminants. The City of Portland is continuing to study various anomalies of water bearing zones. The practice of setting multiple screens or perforating opposite several aquifer zones will create problems in identifying sources of aquifer contamination.

Water quality data confirm that nitrate concentrations in the shallow aquifers increase in the direction of ground water flow, to the northwest. The source of the nitrate and the associated man-made organic chemicals clearly demonstrates the effect of sub-surface sewage waste water disposal practices. It seems only prudent that a responsible effort be made immediately to reverse and improve waste disposal practices in the area. Otherwise, only long term degradations of the area's surface and ground water supply can be expected.

In summary:

1. The geology and hydrologic conditions are accurately described for the East County Area.

2. Ground water movement is from southeast toward the northwest with an average gradient of 33.3 feet per mile. We estimate the average rate of ground water flow to be about 4.4 feet per day.

3. Ground water quality of the area will be further degraded if present practices of sewage waste disposal are not corrected.

4. The gravel aquifers of the area are highly sensitive to man's activities. Every septic tank, cesspool, or waste facility contributes chemical and biological contaminants to the local water body. It is not financially feasible to monitor all sources of pollution in such areas.

5. A hydrologic water budget has not been estimated for this area. Evaporation and transpiration losses are most difficult to measure accurately and determinations are fraught with problems. Several years of accurate records are needed for a wide range of evaporation, transpiration, precipitation and stream run-off data. Therefore, only a gross estimate of total recharge has been made. We estimate that 60 t0 70 percent of the annual precipitation moves into the gravel aquifers.

Providing sewer service to the East County area will reduce a threat to the Public Health and preserve the ground water quality for future generations.

Sincerely,

Bill

WILLIAM H. YOUNG
Director

WHY:wpc
4444C

VICTOR ATIYEH
Governor

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

CLEARANCE		
TO	INITIAL	DATE
Sawyer		8/24

August 24, 1984

William H. Young, Director
Water Resources Department
555 13th N.E.
Salem, OR 97310

Dear Mr. Young:

Legislation enacted by the Oregon Legislature in 1981 and amended in 1983 (ORS 454.275 et seq) provides a process for the formal declaration of a Threat to Drinking Water by the Environmental Quality Commission.

On June 27, 1984, the governing bodies of Multnomah County Central County Service District No. 3, the City of Gresham, and the City of Portland, initiated the process for declaration of a threat to drinking water in an area of Mid-Multnomah County by filing with the Environmental Quality Commission, formal resolutions, preliminary findings of a threat to drinking water, and plans for facilities to alleviate the threat. The facilities proposed include construction during the next 20 years of all trunk sewers, interceptor sewers, pump stations, and treatment work necessary to provide sewer service to the affected area. Collection sewers would be constructed through a voluntary Local Improvement District (LID) process. The jurisdictions estimate that approximately 25 percent of the present population of the area would be connected to sewers within 20 years, based on past experience in voluntary LID formations.

The statute requires the Environmental Quality Commission to schedule a hearing within or near the affected area to provide interested persons an opportunity to present oral or written testimony. The Commission has scheduled a hearing for this purpose on August 30, 1984, at Parkrose High School Cafetorium, 11717 N.E. Shaver Street, Portland, Oregon. The hearing will begin at 1 p.m. and continue until 10:30 p.m. with a recess for dinner between 5 and 6 p.m. The hearing will be reconvened before a hearings officer on September 11, 1984, at 10 a.m. in Room 1400 of the Yeon Building, 522 S.W. 5th Avenue, Portland, Oregon, to hear testimony from persons who are unable to testify at the August 30, 1984, hearing. Written testimony postmarked by September 11, 1984, will be included in the record.

The hearing is for the purpose of gathering evidence to determine whether a threat to drinking water exists in the affected area, whether the conditions could be eliminated or alleviated by the treatment works and whether the proposed treatment works is the most economical method to alleviate the conditions. Additional questions to be addressed are whether the affected area is properly defined and whether the proposed schedule for construction of facilities is adequate to eliminate or alleviate a threat to drinking water.

The statute (ORS 454.275) defines a "Threat to Drinking Water" to mean the existence in any area of any three of the following conditions:

"(a) More than 50 percent of the affected area consists of rapidly draining soils;

(b) The groundwater underlying the affected area is used or can be used for drinking water;

(c) More than 50 percent of the sewage in the affected area is discharged into cesspools, septic tanks or seepage pits and the sewage contains biological, chemical, physical or radiological agents that can make water unfit for human consumption; or

(d) Analysis of samples of groundwater from wells producing water that may be used for human consumption in the affected area contains levels of one or more biological, chemical, physical or radiological contaminants which, if allowed to increase at historical rates, would produce a risk to human health as determined by the local health officer. Such contaminant levels must be in excess of 50 percent of the maximum allowable limits set in accordance with the Federal Safe Drinking Water Act."

The Environmental Quality Commission requests your assistance in evaluating the information presented by the local governments in the attached documents entitled Threat to Drinking Water Findings and Providing Sewer Service to Mid-Multnomah County: Framework Plan. These documents will be a part of the record in the hearing.

Based on your agency's particular knowledge and expertise, it would be most helpful if you could specifically address the following in addition to your general evaluation and comments:

- Geologic and Hydrologic conditions in the affected area;
- Direction and rate of groundwater movement;
- Interpretation of groundwater quality;
- Identification of potential sources of nitrates and other pollutants;
- Aquifer recharge area and rates.

The Commission will appreciate any information you can provide by the closing date for the record on September 11, 1984.

Sincerely,

Fred Hansen
Director

HLS:1
WL3627
Enclosures

E 30

CITY OF
PORTLAND, OREGON
BUREAU OF ENVIRONMENTAL SERVICES

Mike Lindberg, Commissioner
John Lang, Administrator
1120 S.W. 5th Ave.
Portland, Oregon 97204-1972
(503) 796-7169

September 11, 1984

Environmental Quality Commission
522 SW 5th Avenue
PO Box 1760
Portland, OR 97207

Dear Commission Members:

We have been asked by the staff of the Department of Environmental Quality to comment on a number of subject areas pertinent to the Commission's public hearing concerning a threat to drinking water in the cesspool areas of Mid-Multnomah County pursuant to ORS 454. We request that this letter and its attachments be placed within the record of testimony and written information to be kept as a matter of public record on the hearing.

SEEPAGE FEE

The ability to establish and levy a seepage fee along with other financing measures is provided for in ORS Chapter 454 after the Environmental Quality Commission finds a threat to drinking water and orders construction of treatment works. The seepage fee and other financing tools allowed under the statute can be important resources in implementing an affordable sewer program in mid-County.

The financing plan submitted by the City of Portland proposes a voluntary sewer construction program and does not rely on the extraordinary financing tools allowed under the statute. This reflects statutory provisions that the Commission must make a finding of a threat to drinking water and order construction of treatment works before the financing mechanisms identified in ORS Chapter 454 are available to a municipality. In terms of the seepage fee, the statute further requires the municipality to hold public hearings prior to adopting a seepage fee.

During the August 30 public hearing, much concern was expressed about the seepage fee. The City believes that these concerns can best be addressed in context of an overall financing plan for sewers in mid-County, assuming the EQC finds that a threat to drinking water exists and orders construction of treatment works. With a declaration of a threat, several processes are set in motion which lead to a final plan for constructing sewers.

Specifically, the statute grants the municipalities affected by a threat to drinking water declaration a twelve month period to prepare final plans for alleviating the threat.

The twelve month planning period offers opportunity to assemble an equitable and affordable plan for installing sewers in mid-County. The statute requires part of that planning process to be public, requiring public hearings in consideration of a seepage fee. The City intends to make the entire financial planning program a public process, and would be willing to return to the Commission to review and discuss final financing arrangements following the twelve month period.

In conclusion, the City believes the threat to drinking water process, as defined in the statute, is best served by first focusing public discussion on the issue of 1) whether a threat to drinking water exists; 2) whether the sewer facility plans submitted will alleviate the threat; and 3) whether the plans submitted are the most economical solution. If a threat is declared, local jurisdictions should be allowed maximum flexibility in formulating an equitable and affordable financial plan for providing sewers. The twelve month planning period provided for in the statute will allow time for this to occur, in addition to allowing opportunity for public involvement.

12 month period.

FINANCING IMPLICATIONS OF SEWER CONSTRUCTION SCHEDULES

The primary consideration when developing a schedule for the construction of sewer facilities to serve mid-County should be the severity of a threat to drinking water. Important, but secondary concerns, involve the local jurisdiction's ability to finance the construction program.

Financial impact and ability to pay by property owners is only remotely related to any construction schedule prescribed by an order. Generally, property owners are not affected by construction schedules because they are financially obligated on a unit cost basis, i.e., regardless of the speed at which sewers are constructed, property owners will individually pay for only the facilities that serve them. Since sewers which serve individual properties are discrete in nature, they are paid for only once and, theoretically, regardless of when they are provided, at the same cost. By way of example and discounting the effects of inflation, if sewage facilities to serve a typical residential home cost $4,500 today and require 70 feet of pipe to be located in front of the property, the same cost and length of pipe would be required if the property were to be provided sewers in 5, 10 or 20 years.

Although the initial cost to property owners is not affected by the construction schedule, there is a relationship between schedule and the ability of the local jurisdiction to provide low cost financing or loans to property owners. This stems primarily from how quickly the jurisdiction is required to accumulate debt in support of the program. We have asked the City's financial advisor to provide certain information regarding the limitations on the City's ability to maintain its financial position and thereby continue to offer the lowest possible financing cost to property owners. Their response is contained in an attached letter.

Because there are limitations on the City's ability to maintain its current financial position if an aggressive schedule for sewer construction is ordered, the State must be willing to participate financially at a level which insures the affordability and success of the program. In addition, the Department of Environmental Quality and the Commission must join the City and other Consortium members in pursuing appropriate State and federal legislation and federal funding in support of the program.

RECOMMENDED REGULATORY ACTIONS

In the event the Commission finds that a threat to drinking water exists in the proposed Affected Area, and orders the construction of sewers, there are a number of regulatory actions which the City and the Consortium recommends for consideration by the EQC. These actions, in the form of rules adopted by the Commission, would focus on the time before sewer services are available to individual properties and would have two objectives. First, they would support and expedite construction of sewers. Second, they would assist in alleviating the threat to drinking water pending provision of sewer services.

The following are recommended topic areas for new EQC Administrative Rules.

1. New and replacement cesspools and seepage pits should be installed in a location which facilitates connection to a sewer system, as shown on facility plans for the Affected Area. To the extent possible, additional on-site private plumbing, including installation of a dry line to the connection point with the public sewer, should be required.

2. Construction standards for cesspools should reflect the temporary status of subsurface sewage disposal systems in the Affected Area. Property owners with subsurface systems which have failed and who are scheduled to receive sewer services should be allowed to construct a replacement subsurface facility at the least possible

cost, pending installation of sewers. Construction standards for cesspools and seepage pits should reflect their anticipated service lives.

3. Sale and use of chemical compounds used to maintain subsurface disposal systems should be evaluated, in light of a declaration of a threat to drinking water. Where appropriate, restrictions on the sale and use of these kinds of chemicals should be applied.

4. Standards should be re-examined for requiring construction of and/or connection to a sewer system, based on a property's proximity to existing sewage collection and transportation facilities. Standards and enforcement procedures should be set by the EQC for the entire Affected Area to ensure uniform requirements to property owners among all sewer service provider jurisdictions.

5. Construction of sewer collection facilities should be required in all new commercial and residential developments, pending provision of downstream sewer facilities. Where appropriate, requirements should be set for construction of sewer collection facilities at such time that major transportation or utility improvements are made, regardless of the availablity of downstream facilities.

AVAILABILITY OF SEWER SERVICES

Under the City's proposed plan for providing sewer services within the Columbia and Inverness basins, Portland would finance and construct all sewage transportation facilities (interceptor and trunk sewers) regardless of property owner interest or involvement. With installation of these facilities, local sewage collection services will be obtainable anywhere within the two basins. Additionally, as is provided for in the wholesale service agreement between Portland and the Central County Service District, scheduling of sewage transportation facilities can be modified or accelerated to meet demands of property owners who desire sewer services prior to established schedules for construction of sewage transportation facilities designed to serve their neighborhoods.

Portland, as well as other Consortium members, has also established a policy for phasing of sewer service extensions which gives priority to meeting property owner requests for sewers. That policy, which is stated in the Framework Plan, gives highest priority to completion of major facilities that will enable installation of collection systems and provide service to areas with failing subsurface disposal systems.

Because of the design of gravity sewer systems and the requirements of economic construction phasing, it will not be possible to serve individual properties irrespective of logical engineering and financing considerations. However, given new policies for extending sewage transportation facilities and phasing construction, the majority of property owners within the proposed Affected Area can be assured of sewer service delivery within a reasonable time from request for service extensions.

DEFERRAL OF SPECIAL ASSESSMENTS

The State of Oregon offers a special assessment deferral program to homeowners who are 62 or older with annual household incomes of less than $17,500. Under the deferral program, qualified homeowners must first finance their special assessment through the Bancroft bond program. The State of Oregon then makes the semi-annual installment payments for the homeowner, charging a 6 percent interest rate per year, and establishing a lien against the property for the payments made by the State. All deferred assessment payments, plus interest, become due when the homeowner dies, the ownership of the property changes, or if the homeowner no longer lives on the property.

The special assessment deferral program has not been well received by senior citizens in neighborhood meetings in mid-County. The reason, in part, is the ultimate cost to participating homeowners. Requiring homeowners to first "bond" their assessments means that the interest charged by the State for the deferral program is added to the interest rate charged under the Bancroft bond program. With Bancroft bond interest rates ranging from 9% to 12% and the State's payment deferral rate of 6%, the effective interest rate on a deferred assessment is in the range of 15% to 18% annually.

Although not currently allowed by State law, there are alternatives to the way the program is presently structured. One alternative would have the State pay the entire assessment and then charge the property at a interest rate equivalent to existing interest rates on Bancroft bonds, or some similar index representing the cost of borrowed funds. Funding for the program could come through the State's General Fund, or the Pollution Control Bond Fund. In any case, the objective would be to offer assessment deferral financing at a reasonable interest rate, commensurate with current market rates for Bancroft bonds.

If ordered to construct sewer facilities with mid-County, the City intends to pursue this issue further, possibly introducing legislation

at the 1985 Legislative Session and will request the support of the Environmental Quality Commission in improving upon the existing Special Assessment Deferral Program.

Sincerely,

John Lang
Administrator

RWR/DJG:al
16:eqc

Enc.

Government Finance Associates, Inc.

E30a

September 11, 1984

Environmental Quality Commission
State of Oregon
895 Summer Street N.E.
Salem, OR 97310

Dear Sirs:

My firm, Government Finance Associates, Inc., serves as financial advisor to the City of Portland, Oregon. We have acted in this capacity since December of 1981. Because of our work with the City we have become intimately familiar with the City's financial condition, including the City's general obligation debt and Sewage Disposal Fund. We have reviewed the City's current financial condition and projected financial condition for the foreseeable future. In addition, we have reviewed the basic assumptions regarding the potential $255 million sewer program for the sewering of the unsewered area of "mid-Multnomah" County (the "Project"). Based on our review and analysis we make the following comments:

1. It is our opinion that the City's Sewage Disposal Fund is capable of financing the required trunk lines and other major facilities associated with the Project through the use of revenue bonds.

2. The City, based upon current and projected debt ratios and the City's adopted debt management plan, can support no more than $40 million of Bancroft bonds outstanding at any one time without affecting the City's credit quality (i.e., bond rating).

3. In order to not affect the City's credit rating, assuming a level of $40 million in Bancroft bonds outstanding at any one time, it is necessary that all "Bancrofted" properties be included in the City's tax base.

4. In the event that the Project requires more than $40 million of Bancroft bonds outstanding at any one time, additional methods of financing the local improvement portion of the Project will have to be found in order to avert a credit quality deterioration of the City.

5. Nationally, a precedent has been set for State assistance in the development of large sewer programs similar to the Project. Attached please find an example of a state authority, the Virginia Water and Sewer Authority, which was formed to aid in the development of local water and sewer systems.

Please note that our comments and assumptions will have to be reviewed and possibly changed if the voter initiative known as Measure 2 is passed in the November election.

Sincerely,

J. David Rush
Vice President

JDR:k11

E30a1

LD2736582

SENATE BILL NO. 229

AMENDMENT IN THE NATURE OF A SUBSTITUTE

(Proposed by the House Committee on Conservation and Natural Resources on February 29, 1984)

(Patron Prior to Substitute–Colgan)

A BILL to amend the Code of Virginia by adding in Title 62.1 a chapter numbered 21, consisting of sections 62.1-197 through 62.1-223 establishing a Virginia Water and Sewer Assistance Authority.

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding in Title 62.1 a chapter numbered 21, consisting of sections 62.1-197 through 62.1-223 as follows:

CHAPTER 21.

VIRGINIA WATER AND SEWER ASSISTANCE AUTHORITY.

§ 62.1-197. Short title.—This chapter shall be known and may be cited as the Virginia Water and Sewer Assistance Authority Act.

§ 62.1-198. Legislative findings and purposes.—The General Assembly finds that there exists in the Commonwealth a critical need for additional sources of funding to finance the present and future needs of the Commonwealth for water supply and wastewater treatment facilities. This need can be alleviated in part through the creation of a state water and sewer assistance authority. Its purpose is to encourage the investment of both public and private funds and to make loans and grants available to local governments to finance water and sewer projects. The General Assembly determines that the creation of an authority for this purpose is in the public interest, serves a public purpose and will promote the health, safety, welfare, convenience or prosperity of the people of the Commonwealth.

§ 62.1-199. Definitions.—As used in this chapter, unless a different meaning clearly appears from the context:

"Authority" means the Virginia Water and Sewer Assistance Authority created by this chapter.

"Board of Directors" means the Board of Directors of the Authority.

"Bonds" means any bonds, notes, debentures, interim certificates, bond, grant or revenue anticipation notes, lease and sale-leaseback transactions or any other evidences of indebtedness of the Authority.

"Capital Reserve Fund" means the reserve fund created and established by the Authority in accordance with § 62.1-215.

"Cost," as applied to any project financed under the provisions of this chapter, means the total of all costs incurred by the local government as reasonable and necessary for carrying out all works and undertakings necessary or incident to the accomplishment of any project. It includes, without limitation, all necessary developmental, planning and feasibility studies, surveys, plans and specifications, architectural, engineering, financial, legal or other special services, the cost of acquisition of land and any buildings and improvements thereon, including the discharge of any obligations of the sellers of such land, buildings or improvements, site preparation and development, including demolition or removal of existing structures, construction and reconstruction, labor, materials, machinery

and equipment, the reasonable costs of financing incurred by the local government in the course of the development of the project, carrying charges incurred before placing the project in service, interest on local obligations issued to finance the project to a date subsequent to the estimated date the project is to be placed in service, necessary expenses incurred in connection with placing the project in service, the funding of accounts and reserves which the Authority may require and the cost of other items which the Authority determines to be reasonable and necessary.

"Local government" means any county, city, town, water and sewer authority, sanitary district or any other state or local authority, board, district or political subdivision created by the General Assembly or pursuant to the Constitution and laws of the Commonwealth.

"Local obligations" means any bonds, notes, debentures, interim certificates, bond, grant or revenue anticipation notes, leases or any other evidences of indebtedness of a local government.

"Minimum capital reserve fund requirement" means, as of any particular date of computation, the amount of money designated as the minimum capital reserve fund requirement which may be established in the resolution of the authority authorizing the issuance of, or the trust indenture securing, any outstanding issue of bonds.

"Project" means any water supply or wastewater treatment facility located or to be located in the Commonwealth by any local government. The term includes, without limitation, water supply and intake facilities; water treatment and filtration facilities; water storage facilities; water distribution facilities; sewage collection, treatment and disposal facilities; related office, administrative, storage, maintenance and laboratory facilities; and interests in land related thereto.

§ 62.1-200. Creation of Authority.—The Virginia Water and Sewer Assistance Authority is created, with the duties and powers set forth in this chapter, as a public body corporate and as a political subdivision of the Commonwealth. The exercise by the Authority of the duties and powers conferred by this chapter shall be deemed to be the performance of an essential governmental function of the Commonwealth.

§ 62.1-201. Board of Directors.—A. All powers, rights and duties conferred by this chapter or other provisions of law upon the Authority shall be exercised by a Board of Directors consisting of the State Treasurer, the Executive Director of the State Water Control Board, the State Health Commissioner, and six members appointed by the Governor, subject to confirmation by the General Assembly. The members of the Board of Directors appointed by the Governor shall serve terms of four years each, except that the original terms of three members appointed by the Governor shall end on June 30 1985, 1986, and 1987, respectively, as designated by the Governor. Any appointment to fill a vacancy on the Board of Directors shall be made for the unexpired term of the member whose death, resignation or removal created the vacancy. All members of the Board of Directors shall be residents of the Commonwealth. Members may be appointed to successive terms on the Board of Directors. Each member of the Board of Directors shall be reimbursed for his or her reasonable expenses incurred in attendance at meetings or when otherwise engaged in the business of the Authority and shall be compensated at the rate provided in § 2.1-20.3 of the Code of Virginia for each day or portion thereof in which the member is engaged in the business of the Authority.

B. The Governor shall designate one member of the Board of Directors as chairman; he shall be the chief executive officer of the Authority. The Board of Directors may elect one member as vice-chairman; he shall exercise the powers of chairman in the absence of the chairman or as directed by the chairman. The State Treasurer, the Executive Director of the State Water Control Board and the State Health Commissioner shall not be eligible to serve as chairman or vice chairman.

C. Meetings of the Board of Directors shall be held at the call of the chairman or of any four members. Five members of the Board of Directors shall constitute a quorum for the transaction of the business of the Authority. An act of the majority of the members of the Board of Directors present at any regular or special meeting at which a quorum is present shall be an act of the Board of Directors. No vacancy on the Board of Directors shall impair the right of a majority of a quorum of the members of the Board of Directors to exercise all the rights and perform all the duties of the Authority.

D. Notwithstanding the provisions of any other law, no officer or employee of the Commonwealth shall be deemed to have forfeited or shall have forfeited his or her office or employment by reason of acceptance of membership on the Board of Directors or by providing service to the Authority.

§ 62.1-202. Appointment and duties of Executive Director.—The Governor shall appoint an Executive Director of the Authority, who shall report to, but not be a member of, the Board of Directors. The Executive Director shall serve as the ex officio secretary of the Board of Directors and shall administer, manage and direct the affairs and activities of the Authority in accordance with the policies and under the control and direction of the Board of Directors. He shall attend meetings of the Board of Directors, shall keep a record of the proceedings of the Board of Directors and shall maintain and be custodian of all books, documents and papers of the Authority, the minute book of the Authority and its official seal. He may cause copies to be made of all minutes and other records and documents of the Authority and may give certificates under seal of the Authority to the effect that the copies are true copies, and all persons dealing with the Authority may rely upon the certificates. He shall also perform other duties as instructed by the Board of Directors in carrying out the purposes of this chapter. He shall execute a surety bond in a penalty sum determined by the Attorney General. The surety bond shall be executed by a surety company authorized to transact business in the Commonwealth and shall be conditioned upon the faithful performance of the duties of the office.

§ 62.1-203. Powers of Authority.—The Authority is granted all powers necessary or appropriate to carry out and to effectuate its purposes, including the following:

1. To have perpetual succession as a public body corporate and as a political subdivision of the Commonwealth;

2. To adopt, amend and repeal bylaws, rules and regulations not inconsistent with this chapter for the administration and regulation of its affairs and to carry into effect the powers and purposes of the Authority and the conduct of its business;

3. To sue and be sued in its own name;

4. To have an official seal and alter it at will although the failure to affix this seal shall not affect the validity of any instrument executed on behalf of the Authority;

5. To maintain an office at any place within the Commonwealth which it designates;

6. To make and execute contracts and all other instruments and agreements necessary or convenient for the performance of its duties and the exercise of its powers and functions under this chapter;

7. To sell, convey, mortgage, pledge, lease, exchange, transfer and otherwise dispose of all or any part of its properties and assets;

8. To employ officers, employees, agents, advisers and consultants and to determine their duties and compensation;

9. To procure insurance, in amounts and from insurers of its choice, against any loss in connection with its property, assets or activities, including insurance against liability for its acts or the acts of its directors, employees or agents and for the indemnification of the members of its Board of Directors;

10. To procure insurance, guarantees, letters of credit and other forms of collateral or security from any public or private entities, including any department, agency or instrumentality of the United States of America or the Commonwealth, for the payment of any bonds issued by the Authority, including the power to pay premiums or fees on any such insurance, guarantees, letters of credit and other forms of collateral or security;

11. To receive and accept from any source aid, grants and contributions of money, property, labor or other things of value to be held, used and applied to carry out the purposes of this chapter subject to the conditions upon which the aid, grants or contributions are made;

12. To enter into agreements with any department, agency or instrumentality of the United States of America or the Commonwealth for the purpose of planning, regulating and providing for the financing of any projects;

13. To collect, or to authorize the trustee under any trust indenture securing any bonds to collect, amounts due under any local obligations owned by the Authority, including taking the action required by § 15.1-225 to obtain payment of any sums in default;

14. To enter into contracts or agreements for the servicing and processing of local obligations owned by the Authority;

15. To invest or reinvest its funds as provided in this chapter or permitted by applicable law;

16. Unless restricted under any agreement with holders of bonds, to consent to any modification with respect to the rate of interest, time and payment of any installment of principal or interest, or any other term of any local obligations owned by the Authority;

17. To establish, and revise, amend and repeal, and to charge and collect, fees and charges in connection with any activities or services of the Authority; and

18. To do any act necessary or convenient to the exercise of the powers granted or reasonably implied by this chapter.

§ 62.1-204. Power to borrow money and issue bonds.—The Authority shall have the power to borrow money and issue its bonds in amounts the Authority determines to be necessary or convenient to provide funds to carry out its purposes and powers. The total amount of bonds outstanding at any one time, issued by the Authority, shall not exceed the sum of $300,000,000 without prior approval of the General Assembly.

§ 62.1-205. Power to issue refunding bonds.—The Authority shall have the power: (i) to

issue bonds to renew or to pay bonds, including the interest, (ii) whenever it deems refunding expedient, to refund any bonds by the issuance of new bonds, whether the bonds to be refunded have or have not matured, and (iii) to issue bonds partly to refund bonds then outstanding and partly for its corporate purposes. The refunding bonds may be exchanged for the bonds to be refunded or they may be sold and the proceeds applied to the purchase, redemption or payment of the bonds to be refunded. The amount of the refunding bonds issued by the Authority shall not be included in the total of outstanding bonds for purposes of the limit on the amount of bonds issued by the Authority as provided in § 62.1-204.

§ 62.1-206. Sources of Payment and Security for Bonds.—The Authority shall have the power to pledge any revenue or funds of the Authority to the payment of its bonds, subject only to any prior agreements with the holders of particular bonds pledging money or revenue. Bonds may be additionally secured by a pledge of any local obligation owned by the Authority, any grant, contribution or guaranty from the United States of America, the Commonwealth or any corporation, association, institution or person, any other property or assets of the Authority, or a pledge of any money, income or revenue of the Authority from any source.

§ 62.1-207. Liability of Commonwealth, political subdivisions and members of board of directors.—No bonds issued by the Authority under this chapter shall constitute a debt or a pledge of the faith and credit of the Commonwealth, or any political subdivision thereof other than the Authority, but shall be payable solely from the revenue, money or property of the Authority as provided for in this chapter. No member of the Board of Directors or officer, employee or agent of the Authority or any person executing bonds of the Authority shall be liable personally on the bonds by reason of their issuance or execution. Each bond issued under this chapter shall contain on its face a statement to the effect (i) that neither the Commonwealth, nor any political subdivision thereof, nor the Authority shall be obligated to pay the principal of, or interest or premium on, the bond or other costs incident to the bond except from the revenue, money or property of the Authority pledged and (ii) that neither the faith and credit nor the taxing power of the Commonwealth, or any political subdivision thereof, is pledged to the payment of the principal of or interests or premium on the bond.

§ 62.1-208. Authorization, content and sale of bonds.—The bonds of the Authority shall be authorized by a resolution of the Board of Directors. The bonds shall bear the date or dates and mature at the time or times that the resolution provides, except that no bond shall mature more than fifty years from its date of issue. The bonds may bear interest at the rate or rates, including variable rates, be in the denominations, be executed in the manner, be payable in the medium of payment, be payable at the place or places, and be subject to the terms of redemption, including redemption before maturity, that the resolution authorizing their issuance provides. Bonds may be sold by the Authority at public or private sale at the price or prices that the Authority approves. The Authority may bring action pursuant to Article 6 (§ 15.1-213 et seq.) of Chapter 5 of Title 15.1 of the Code of Virginia to determine the validity of any issuance or proposed issuance of its bonds under this chapter and the legality and validity of all proceedings previously taken, or proposed in a resolution of the Authority to be taken, for the authorization, issuance,

sale and delivery of bonds and for the payment of the principal of and premium, if any, and interest on bonds.

62.1-209. Provisions of resolution or trust indenture authorizing issuance of bonds.—A. Bonds may be secured by a trust indenture between the Authority and a corporate trustee, which may be any bank having the power of a trust company or any trust company within the Commonwealth. A trust indenture may contain provisions for protection and enforcing the rights and remedies of the bondholders that are reasonable and proper and not in violation of law, including covenants setting forth the duties of the Authority in relation to the exercise of its powers and the custody, safekeeping and application of all money. The Authority may provide by the trust indenture for the payment of the proceeds of the bonds and all or any part of the revenues of the Authority to the trustee under the trust indenture or to some other depository, and for the method of their disbursement with whatever safeguards and restrictions as the Authority specifies. All expenses incurred in carrying out the trust indenture may be treated as part of the operating expenses of the Authority.

B. Any resolution or trust indenture pursuant to which bonds are issued may contain provisions, which shall be part of the contract or contracts with the holders of such bonds as to:

1. Pledging all or any part of the revenue of the Authority to secure the payment of the bonds, subject to any agreements with bondholders that then exist;

2. Pledging all or any part of the assets of the Authority, including local obligations owned by the Authority, to secure the payment of the bonds, subject to any agreements with bondholders that then exist;

3. The use and disposition of the gross income from, and payment of the principal of and premium, if any, and interest on local obligations owned by the Authority;

4. The establishment of reserves, sinking funds and other funds and accounts and the regulation and disposition thereof;

5. Limitations on the purposes to which the proceeds from the sale of the bonds may be applied, and limitations pledging the proceeds to secure the payment of the bonds;

6. Limitations on the issuance of additional bonds, the terms on which additional bonds may be issued and secured, and the refunding of outstanding or other bonds;

7. The procedure, if any, by which the terms of any contract with bondholders may be amended or abrogated, the amount of bonds, if any, the holders of which must consent thereto, and the manner in which any consent may be given;

8. Limitations on the amount of money to be expended by the Authority for operating expenses of the Authority;

9. Vesting in a trustee or trustees any property, rights, powers and duties in trust that the Authority may determine, and limiting or abrogating the right of bondholders to appoint a trustee or limit the rights, powers and duties of the trustees;

10. Defining the acts or omissions which shall constitute a default, the obligations or duties of the Authority to the holders of the bonds, and the rights and remedies of the holders of the bonds in the event of default, including as a matter of right the appointment of a receiver; these rights and remedies may include the general laws of the Commonwealth and other provisions of this chapter;

11. Requiring the Authority or the trustees under the trust indenture to file a petition with the Governor and to take any and all other actions required under § 15.1-225 of the Code of Virginia to obtain payment of all sums necessary to cover any default as to any principal of and premium, if any, and interest on local obligations owned by the Authority or held by a trustee to which § 15.1-225 shall be applicable; and

12. Any other matter, of like or different character, relating to the terms of the bonds or the security or protection of the holders of the bonds.

§ 62.1-210. Pledge by Authority.—Any pledge made by the Authority shall be valid and binding from the time when the pledge is made. The revenue, money or property so pledged and thereafter received by the Auhority shall immediately be subject to the lien of such a pledge without any physical delivery thereof or further act. Furthermore, the lien of any such pledge shall be valid and binding as against all parties having claims of any kind in tort, contract or otherwise against the Authority, irrespective of whether the parties have notice of the pledge. No recording or filing of the resolution authorizing the issuance of bonds, the trust indenture securing bonds or any other instrument, including filings under Article 9 of the Uniform Commercial Code of Virginia (§ 8.901 et seq. of the Code of Virginia), shall be necessary to create or perfect any pledge or security interest granted by the Authority to secure any bonds.

§ 62.1-211. Purchase of bonds by authority.—The Authority, subject to such agreements with bondholders as may then exist, shall have the power to purchase bonds of the Authority out of any available funds, at any reasonable price. If the bonds are then redeemable, this price shall not exceed the redemption price then applicable plus accrued interest to the next interest payment date.

§ 62.1-212. Bonds as negotiable instruments.—Whether or not in form and character of negotiable instruments, the bonds of the Authority are hereby made negotiable instruments, subject only to provisions of the bonds relating to registration.

§ 62.1-213. Validity of signatures of prior members or officers.—In the event that any of the members of the Board of Directors or any officers of the Authority cease to be members or officers before the delivery of any bonds signed by them, their signatures or authorized substitute signatures shall nevertheless be valid and sufficient for all purposes as if the members or officers had remained in office until delivery.

§ 62.1-214. Bondholder Protection.—Subsequent amendments to this chapter shall not limit the rights vested in the Authority with respect to any agreements made with, or remedies available to, the holders of bonds issued under this chapter before the enactment of the amendments until the bonds, together with all premium and interest thereon, and all costs and expenses in connection with any proceeding by or on behalf of the holders, are fully met and discharged.

§ 62.1-215. Establishment of capital reserve funds.—A. 1. The Authority may create and establish one or more capital reserve funds and may pay into each capital reserve fund (i) any moneys appropriated and made available by the Commonwealth for the purpose of such a fund, (ii) any proceeds of the sale of bonds of the Authority, to the extent provided in the resolution authorizing the issuance of, or the trust indenture securing, the bonds, and (iii) any other moneys which may be made available to the Authority for the purpose of such a fund from any other source. All moneys held in any capital reserve fund, except

as hereinafter provided, shall be used solely for the payment when due of the principal of and premium, if any, and interest on the bonds secured in whole or in part by such a fund. If, however, moneys in any such fund are ever less than the minimum capital reserve fund requirement established for the fund, the Authority shall not use the moneys for any optional purchase or redemption of bonds. Any income or interest earned on, or increment to, any capital reserve fund due to its investment may be transferred by the Authority to other funds or accounts of the Authority to the extent it does not reduce the amount of the capital reserve fund below its minimal requirement.

2. The Authority shall not at any time issue bonds secured in whole or in part by any capital reserve fund, if upon the issuance of the bonds, the amount in the capital reserve fund will be less than its minimal requirement unless the Authority, at the time of issuance of the bonds, deposits in the fund an amount which, together with the amount then in the fund, will not be less than the fund's minimal capital reserve requirement.

B. In order to assure further the maintenance of capital reserve funds, the chairman of the Authority shall annually, on or before December 1, make and deliver to the Governor and the Secretary of Administration ~~and Finance~~ a certificate stating the sum, if any, required to restore each capital reserve fund to its minimal requirement. Within five days after the beginning of each session of the General Assembly, the Governor shall submit to the presiding officer of each House of the General Assembly printed copies of a budget including the sum, if any, required to restore each capital reserve fund to its minimal requirement. All sums, if any, which may be appropriated by the General Assembly for any restoration and paid to the Authority shall be deposited by the Authority in the applicable capital reserve fund. All amounts paid to the Authority by the Commonwealth pursuant to the provisions of this section shall constitute and be accounted for as advances by the Commonwealth to the Authority and, subject to the rights of the holders of any bonds of the Authority, shall be repaid to the Commonwealth without interest from available operating revenues of the Authority in excess of amounts required for the payment of bonds or other obligations of the Authority, the maintenance of capital reserve funds, and operating expenses.

C. The Authority may create and establish other funds as necessary or desirable for its corporate purposes.

D. Nothing in this section shall be construed as limiting the power of the Authority to issue bonds not secured by a capital reserve fund.

§ 62.1-216. Purchase of local obligations.—The Authority shall have the power and authority, with any funds of the Authority available for such a purpose, to purchase and acquire, on terms which the Authority determines, local obligations to finance the cost of any project. The Authority may pledge to the payment of any bonds all or any portion of the local obligations so purchased. The Authority may also, subject to any such pledge, sell any local obligations so purchased and apply the proceeds of such a sale to the purchase of other local obligations for financing the cost of any project or for any other corporate purpose of the Authority.

The Authority may require, as a condition to the purchase of any local obligation, that the local government issuing an obligation covenant perform any of the following:

A. Establish and collect rents, rates, fees and charges to produce revenue sufficient to

pay all or a specified portion of (i) the costs of operation, maintenance, replacement, renewal and repairs of the project; (ii) any outstanding indebtedness incurred for the purposes of the project, including the principal of and premium, if any, and interest on the local obligations issued by the local government to the Authority; and (iii) any amounts necessary to create and maintain any required reserve;

B. Create and maintain a special fund or funds for the payment of the principal of and premium, if any, and interest on any local obligations and any other amounts becoming due under any agreement entered into in connection with the local obligation, or for the operation, maintenance, repair or replacment of the project or any portions thereof or other property of the local government, and deposit into any fund or funds amounts sufficient to make any payments as they become due and payable;

C. Create and maintain other special funds as required by the Authority; and

D. Perform other acts, including the conveyance of real and personal property together with all right, title and interest therein to the Authority, or take other actions as may be deemed necessary or desirable by the Authority to secure payment of the principal of and premium, if any, and interest on the local obligations and to provide for the remedies of the Authority or other holder of the local obligations in the event of any default by the local government in the payment.

All local governments issuing and selling local obligations to the Authority are authorized to perform any acts, take any action, adopt any proceedings and make and carry out any contracts with the Authority that are contemplated by this chapter.

§ 62.1-217. Grants from Commonwealth.—The Commonwealth may make grants of money or property to the Authority for the purpose of enabling it to carry out its corporate purposes and for the exercise of its powers, including deposits to the capital reserve funds. This section shall not be construed to limit any other power the Commonwealth may have to make grants to the Authority.

§ 62.1-218. Grants to local governments.—The Authority shall have the power and authority, with any funds of the Authority available for this purpose, to make grants or appropriations to local governments. In determining which local governments are to receive grants or appropriations, the State Water Control Board and the Department of Health shall assist the Authority in determining needs for wastewater treatment and water supply facilities.

§ 62.1-219. Exemption from taxation.—As set forth in § 62.1-200, the Authority will be performing an essential governmental function in the exercise of the powers conferred upon it by this chapter. Accordingly, the Authority shall not be required to pay any taxes or assessments upon any project or any property, or any taxes or assessments upon any project or any property or local obligation acquired or used by the Authority under the provisions of this chapter or upon the income therefrom. Any bonds issued by the Authority under the provisions of this chapter, and the income therefrom shall at all times be free from taxation and assessment of every kind by the Commonwealth and by the local governments and other political subdivisions of the Commonwealth.

§ 62.1-220. Bonds as legal investments and securities.—The bonds issued by the Authority in accordance with the provisions of this chapter are declared to be legal investments in which all public officers or public bodies of the Commonwealth, its political

subdivisions, all municipalities and municipal subdivisions; all insurance companies and associations and other persons carrying on insurance business; all banks, bankers, banking associations, trust companies, savings banks, savings associations, including savings and loan associations, building and loan associations, investment companies, and other persons carrying on a banking business; all administrators, guardians, executors, trustees and other fiduciaries; and all other persons who are now or may hereafter be authorized to invest in bonds or other obligations of the Commonwealth, may invest funds, including capital, in their control or belonging to them. The bonds of the Authority are also hereby made securities which may be deposited with and received by all public officers and bodies of the Commonwealth or any agency or political subdivision of the Commonwealth and all municipalities and public corporations for any purpose for which the deposit of bonds or other obligations of the Commonwealth is now or may be later authorized by law.

§ 62.1-221. Deposit of money; expenditures; security for deposits.—A. All money of the Authority, except as otherwise authorized or provided in this chapter, shall be deposited in an account or accounts in banks or trust companies organized under the laws of the Commonwealth or in national banking associations located in Virginia. The money in these accounts shall be paid by check signed by the Executive Director or other officers or employees and designated by the Authority. All deposits of money shall, if required by the Authority, be secured in a manner determined by the Authority to be prudent, and all banks or trust companies are authorized to give security for the deposits.

B. Notwithstanding the provisions of subsection A the Authority shall have the power to contract with the holders of any of its bonds as to the custody, collection, securing, investment and payment of any money of the Authority and of any money held in trust or otherwise for the payment of bonds and to carry out such a contract. Money held in trust or otherwise for the payment of bonds or in any way to secure bonds and deposits of money may be secured in the same manner as money of the Authority, and all banks and trust companies are authorized to give security for the deposits.

§ 62.1-222. Annual reports; audit.—The Authority shall, following the close of each fiscal year, submit an annual report of its activities for the preceding year to the Governor. The Clerk of each House of the General Assembly may receive a copy of the report by making a request for it to the chairman of the Authority. Each report shall set forth a complete operating and financial statement for the Authority during the fiscal year it covers. An independent certified public accountant or the Auditor of Public Accounts shall perform an audit of the books and accounts of the Authority at least once in each fiscal year.

§ 62.1-223. Liberal construction of Act.—The provisions of this chapter shall be liberally construed to the end that its beneficial purposes may be effectuated. No proceedings, notice or approval shall be required for the issuance of any bonds of the Authority or any instruments or the security thereof, except as provided in this chapter. Insofar as the provisions of this chapter are inconsistent with the provisions of any other law, general, special or local, the provisions of this chapter shall be controlling.

Official Use By Clerks	
Passed By The Senate	**Passed By The House of Delegates**
without amendment ☐	without amendment ☐
with amendment ☐	with amendment ☐
substitute ☐	substitute ☐
substitute w/amdt ☐	substitute w/amdt ☐
Date: _____	Date: _____
_____	_____
Clerk of the Senate	Clerk of the House of Delegates

CITY OF
PORTLAND, OREGON
BUREAU OF ENVIRONMENTAL SERVICES

Mike Lindberg, Commissioner
John Lang, Administrator
1120 S.W. 5th Ave.
Portland, Oregon 97204-1972
(503) 796-7169

E 306

September 11, 1984

Harold Sawyer, Administrator
Water Quality Division
Department of Environmental Quality
522 SW 5th Avenue
PO Box 1760
Portland, OR 97207

Dear Mr. Sawyer:

Attached are four documents we would like to be placed into the public record pursuant to public hearings held on August 30, 1984 and September 11, 1984, concerning a threat to drinking water in mid-County.

The document titles are:

1. Ground Water Exploratory Program (Bureau of Water Works)

2. Year 2000 Growth Allocation Workshops - Summary (Metropolitan Service District)

3. Subsurface Sewage Disposal and Contamination of Ground Water in East Portland, Oregon (Ground Water Magazine)

4. Nitrate in Drinking Water (Winton, Tardiff, McCabe)

Thank you.

Sincerely,

John Lang

John Lang
Administrator

DJG:al
16:dgsawyer

Enc.

Engineering
Bill Gaffi
796-7181

System Management
Joe Niehuser
796-7128

Wastewater Treatment
Jack Irvin
285-0205

Solid Waste
Delyn Kies
796-7010

E3061

A REPORT ON THE

GROUND WATER EXPLORATORY PROGRAM

for the

DEPARTMENT OF PUBLIC UTILITIES
CITY OF PORTLAND, OREGON

prepared by

REGISTERED PROFESSIONAL ENGINEER 8388 Robert F. Willis OREGON June 20, 1975 ROBERT F. WILLIS

Senior Engineer

under the supervision of

REGISTERED PROFESSIONAL ENGINEER 6217 Fredrick H. Whitfield OREGON July 12, 1968 FREDRICK H. WHITFIELD

Supervising Engineer

April 1977

BUREAU OF WATER WORKS

E CITY OF
RTLAND
REGON

PARTMENT OF
BLIC UTILITIES
NCIS J. IVANCIE
OMMISSIONER

BUREAU OF
ATER WORKS
OBERT C. HYLE
MANAGER

S W. SIXTH AVE.
LAND, OR 97201

April 1977

Francis J. Ivancie
Commissioner of Public Utilities
City of Portland, Oregon

Dear Commissioner Ivancie:

An engineering study to determine the feasibility of obtaining a supplemental and emergency water source for the Water Bureau from local ground water resources was authorized by the City Council in the 1975-76 Budget of the City of Portland. This engineering study is now complete and the report covering the study is presented herein.

The study has determined that it is feasible to obtain a 100-million gallon per day water source from ground water aquifers recharged by the Columbia River, that the present worth construction cost of the new system is $14,130,000, and that the ground water source is the most cost-effective method to obtain a supplemental and emergency water source adequate to meet the water system's needs.

It is the recommendation of the Water Bureau that this report be accepted and that the proposed ground water development program be expeditiously pursued.

Respectfully submitted,

K. P. Norseth

P. Norseth, P.E.
Chief Engineer

SUMMARY

INTRODUCTION

The Bureau of Water Works began a Ground Water Exploratory Program during the 1975-76 fiscal year to investigate the feasibility of developing a new water source from ground water in eastern Multnomah County. This additional water source is required to increase the reliability of the water system due to the sole reliance of the present system on the Bull Run River which infrequently exceeds the maximum turbidity levels established for drinking water by State and Federal regulatory agencies. In addition, the three 25 mile long pipelines which carry water to the City from intake facilities on the river are susceptible to damage by landslides and vandalism. A future benefit of a second water source located near the City will be the provision of additional capacity during days of peak demand when the existing pipelines from the Bull Run River will be inadequate to meet the needs of the City.

The geographical area chosen for investigation was the area bounded on the north by the Columbia River, on the south by an east-west line through Powell Butte, and extending from the Portland International Airport east to the Sandy River. This area has been noted as being capable of producing large quantities of water from aquifers recharged by the Columbia River as early as 1956 by the U.S. Geological Survey (Griffin, et al, p. 31). More recently, Newcomb, in a 1974 study for the Water Bureau (Stevens, Thompson

& Runyan, 1974, p. C2), recommended this area for further investigation to obtain an alternate water source. The area chosen also contains the location of planned storage reservoirs on Powell Butte where the new water source could be blended with water from the Bull Run River when additional capacity is required.

The methodology employed to develop the conclusions and recommendations offered in this report was to gather and review data from existing wells and prior studies concerning the geology, hydrology, and water quality of the area; collect and chemically analyze additional water samples from existing wells; and to collect and analyze data provided by eight exploratory wells constructed for this study.

CONCLUSIONS

1. The general direction of flow in the aquifers of the study area is north toward the Columbia River and its sloughs. The natural recharge for the ground water system is not sufficient to support a 100 million gallon per day (mgd) withdrawal desired by the City. The only feasible means of developing a 100 mgd water source from ground water is to utilize aquifers which are in hydraulic communication with and can be recharged by the Columbia River.

2. The geology of the study area is conducive to the development of inland well fields which will ultimately draw water from the

Columbia River. The present river channel is underlain by a deposit of sand varying in thickness from 180 to over 200 feet. The formations underlying the study area slope upward in a northeasterly direction toward the river. This incline permits aquifers within these formations to interconnect with the sands underlying the river channel and makes available recharge from the river through these sands. However, during intermittent operation of inland wells it is unlikely that Columbia River water would reach the point of withdrawal until local water sources recharging the aquifer are exceeded.

3. The formations adjacent to the Columbia River contain three extensive aquifers designated as the Troutdale Gravel, the Troutdale Sandstone, and the Sandy River Mudstone Aquifers. These aquifers and one apparently local aquifer, designated as the Blue Lake Aquifer, appear, upon analysis of the available data, to hydraulically interconnect with the river and to be sufficiently permeable to support wells with estimated capacities of 1,500 to 3,500 gallons per minute (gpm).

4. The water quality of the Columbia River will satisfy the U.S. Environmental Protection Agency's National Interim Drinking Water Regulations after filtration through the riverbed sands and is an adequate alternate water source for the water system in an emergency. The quality of the existing ground water in the aquifers proposed for development is similar to the quality

of filtered Columbia River water. Blending analyses on the mixtures of Columbia River water and existing ground water with Bull Run River water indicate that both potential new water sources are compatible with the existing water supply. The blending analyses further indicate that blending of Bull Run River water at a 4 to 1 ratio with filtered Columbia River water or the existing ground water will produce a quality of water not recognizably different from the present water supply to the general public.

5. Protection of the aquifers recommended for development from potential contamination by polluted surface water is provided by the extensive clayey gravel and clay layers within the Troutdale Formation and by the layer of clay which underlies much of the recent Columbia River flood plain which lies north of N.E. Sandy Boulevard.

The primary sources of potential pollution of the upper ground water aquifers and surface waters within the area are the land applied effluents from individual home sewer systems and direct discharges to the Columbia River from the Inverness and City of Gresham sewage treatment plants. Bureau investigations support the conclusions of prior studies (Quan, et al, 1974) that the contaminants from land applied effluents and fertilizers remain in the waters of the upper aquifers, are carried northward

by the upper, perched ground water, and eventually enter the Columbia Sloughs which remove the contaminants from the study area. The direct discharges to the Columbia River from sewage treatment plants are carried out of the area by the river before sufficient mixing occurs to allow contaminants to enter the deeper ground water aquifers.

6. Development of a 100 mgd ground water source is most feasible in the two general areas designated as the Rocky Butte and North Fairview Well Fields on Plate 17 at the back of this report. Each well field has been located in a manner such that it can utilize at least two aquifers and produce 50 mgd. The use of multiple aquifers in separate well fields will further increase the water system's reliability. The full development will require a minimum of 28 wells, 13 miles of major pipelines, and one pump station; all at a present worth cost of $14,130,000.

RECOMMENDATIONS

1. The Water Bureau should develop the ground water resource available in eastern Multnomah County to produce the desired 100 mgd capacity emergency and supplemental water supply. The resource could be developed in four phases supplying approximately 25 mgd over an eight year construction period.

2. Construction of each phase of the development program should

commence with the construction and test pumping of small diameter pilot wells (test wells) to verify the hydraulic characteristics and uniformity estimated for the aquifers in this report. If possible, the pilot wells should be located at sites suitable for the later construction of production wells. The production wells could then be constructed near the locations of the most successful pilot wells. If an aquifer proves to be too productive to be tested adequately by a pilot well, then a large test well should be constructed which could be later used as a production well.

3. The collector and transmission pipelines for each phase of construction should be designed for full development of the desired 100 mgd capacity. Construction of the pipelines should not begin until completion of the test pumping of the production wells in the area they are to serve.

4. The Water Bureau should obtain the permit to appropriate the ground waters of the State of Oregon for which application was made for a nominal withdrawal of 100 mgd and a maximum withdrawal of 250 mgd from the aquifers recommended for development.

5. The City Council should enact ordinances that prohibit further private ground water development of the aquifers to be utilized in the Ground Water Development Program within the City. The City should seek at the State level to limit development by

others of the recommended aquifers unless such developers can establish that their withdrawals will not deplete the capability of the aquifers to provide the maximum 250 mgd withdrawal previously requested from the State by the City.

6. The City should support measures which will limit the potential for contamination of ground water within the study area. These activities should include but not be limited to the extension of community sewer systems to all existing homes in the area, mandatory connection of homes to community sewer systems when they are available, and support for the enforcement of existing State laws prohibiting the waste or contamination of ground water by wells due to the nature of their construction.

ALTERNATIVES CONSIDERED

Several alternatives were considered which would provide the emergency and supplemental water source desired by the City, or would provide a lesser benefit at a lower cost. The alternatives and their estimated costs are outlined below:

	Alternative	Comment	Estimated Total Cost (Present Worth)
1.	100 mgd Ground Water Development Program	Recommended alternative. Provides for a 100 mgd development of the Rocky Butte and North Fairview well fields and a pipeline to reservoirs on Powell Butte. Project would be	$14,130,000

YEAR 2000 GROWTH ALLOCATION WORKSHOPS

Summary

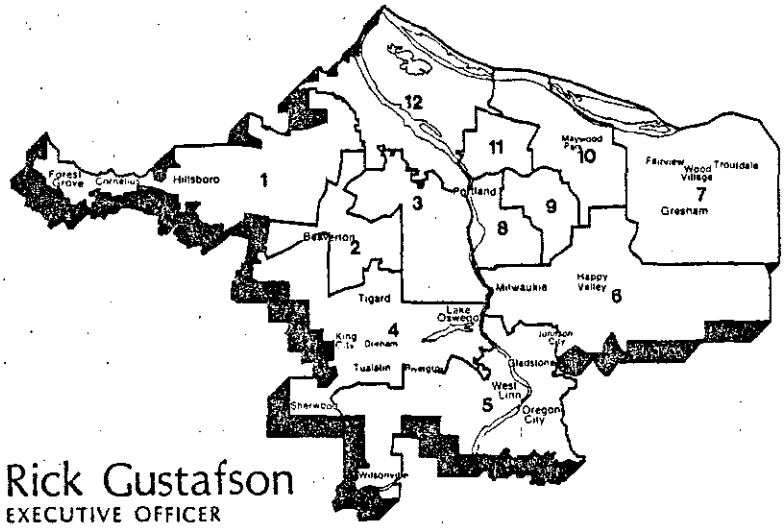
March-April, 1981

METROPOLITAN SERVICE DISTRICT
Providing Zoo, Transportation, Solid Waste and other Regional Services

METRO

Second printing $3.00

METROPOLITAN SERVICE DISTRICT



Rick Gustafson
EXECUTIVE OFFICER

C O U N C I L

Corky Kirkpatrick
PRESIDING OFFICER
DISTRICT 4

Ernie Bonner
VICE-PRESIDING OFFICER
DISTRICT 8

Bob Oleson
DISTRICT 1

Sharron Kelley
DISTRICT 7

Richard Waker
DISTRICT 2

Cindy Banzer
DISTRICT 9

Charlie Williamson
DISTRICT 3

Bruce Etlinger
DISTRICT 10

Jack Deines
DISTRICT 5

Marge Kafoury
DISTRICT 11

George VanBergen
DISTRICT 6

Gary D. Hansen
DISTRICT 12

A D D I T I O N A L P R I N T I N G

SUMMARY OF
YEAR 2000 GROWTH
ALLOCATION WORKSHOPS

MARCH-APRIL, 1981

METROPOLITAN SERVICE DISTRICT
527 S.W. Hall Street
Portland, Oregon 97201

STAFF PRINCIPALLY RESPONSIBLE FOR THIS REPORT

Andrew Cotugno	Transportation Director

Research Team and Authors

Keith Lawton	Project Manager
Dick Bolen	Planner
Rod Sandoz	Planner
Michael Ogan	Planner
Jeff Booth	Programmer
Terry Bolstad	Planning Technician
John Cullerton	Planning Technician
Linda Goffredi	Planning Technician

Report Production

Gloria Logan	Word Processing
Sherrie Blackledge	Word Processing
John Willworth	Offset Printing
Alan Holsted	Graphics Coordinator
Lois Kaplan	Secretary

The preparation of this report has been financed with funds from the U.S. Department of Transportation, Urban Mass Transportation Act of 1964 as amended; by funds from the Oregon Department of Transportation in cooperation with the Federal Highway Administration, U.S. DOT and by funds from the Tri-County Metropolitan Transit District and the Metropolitan Service District.

WORKSHOP PARTICIPANTS

MULTNOMAH COUNTY

Bob Baldwin	Multnomah County
Bebe Rucker	Multnomah County
Duncan Brown	Multnomah County
Janice Newton	Multnomah County
Colleen Acres	Multnomah County
Steve Dotterrer	Portland
Bruce Halperin	Portland
Kerry Hampton	Portland
Val Southern	Portland
Elizabeth Radigan	Portland
Rick Daniels	Gresham
Rick Walker	Gresham
Phil Grillo	Gresham
R. Scott Pemble	Troutdale
Ed Murphy	Troutdale

WASHINGTON COUNTY

Edgar Storms	Washington County
Arthur Schlack	Washington County
Martin Nizlek	Washington County
Michael Kronenberg	Beaverton
Dick Bewersdorff	Forest Grove
Dave Lawrence	Hillsboro
Kevin Martin	Hillsboro
Todd Dugdale	Sherwood
Elizabeth Newton	Tigard

CLACKAMAS COUNTY

Tom VanderZanden	Clackamas County
Norm Scott	Clackamas County
Topaz Faulkner	Milwaukie
David Richey	West Linn

CLACKAMAS COUNTY
(continued)

John Bustraan	Lake Oswego
Pat Barnum	Lake Oswego
Sandi Young	Lake Oswego
Ben Altman	Wilsonville

CLARK COUNTY

Anne Sylvester	Clark County RPC
Gil Mallery	Clark County RPC
Glenn Gross	Clark County RPC

AGENCIES

Sarah Salazar	Port of Portland
Steven Fisher	Tri-Met
Leo Huff	ODOT
David Peach	WSDOT
John Price	FHWA

TABLE OF CONTENTS

INTRODUCTION

This report summarizes a series of population and employment growth workshops hosted by Metro and attended by planners from local jurisdictions and agencies. The general level of information in this report will be supplemented by a more detailed technical report which will document the procedures and assumptions used in detail.

The results of the workshops represent a prediction of what the region will look like in 20 years, assuming a continuation of past economic trends and current governmental policies as reflected in local comprehensive plans. Collectively, the comprehensive land use plans of the region's 25 cities and four counties form a composite plan for the region. This composite offers a picture of what the region would look like if all local plans were "built-out." The role of the workshop participants was to determine the degree to which each of these plans will be developed in the next 20 years.

Determining the 20-year growth increment of the composite regional plan provides a year 2000 land use pattern to serve as the basis for predicting future travel demands to finalize the Regional Transportation Plan (RTP). It is intended that the RTP will recommend a transportation system tailored to serve the travel demand generated by this future arrangement of land development. However, in cases where future transportation deficiencies due to growth remain, despite the projects recommended in the RTP, further analysis will be necessary. This may entail identification of additional projects, modifying the land uses planned for an area, or a combination of both.

A new population/employment forecast and allocation for the year 2000 became necessary for several reasons:

1. The availability of 1980 census data, providing a reliable update to the data base describing existing conditions and past trends.

2. Newly completed comprehensive plans by a majority of jurisdictions in the region describing planned locations and densities for new development.

3. New population and employment projections for the region as a whole by the Federal Bureau of Economic Analysis.

4. Population and employment projections developed for the Banfield Transit Station Area Planning Program (TSAP) by Economic Research Associates (ERA) for the region as a whole and along the Banfield LRT Corridor.

5. A new 1980 Employment Estimate. In 1976, an employment survey was conducted by CRAG to obtain the number of firms and employees by SIC code by census tract. To determine the existing distribution and concentration of differing employment sectors, this study has been updated to 1980 by Metro using Oregon Employment Services data.

6. A recently completed update of Metro's Land Use/Vacant Land Inventory. The 1977 inventory has been revised using the most current comprehensive plans (to establish planned use of vacant lands) and 1977 to 1980 land development data.

7. A continuing need for regional consensus on a year 2000 growth allocation to serve as the basis for finalizing the Regional Transportation Plan.

In this report, the use of the word forecast refers to a projection of the entire region's growth in population and employment by the year 2000. Allocation refers to the subsequent process of geographically distributing this forecasted growth control total to smaller sub-areas throughout the region.

The workshop process used to develop this year 2000 growth allocation represents a significant departure from past methods. Previous regional growth allocations have been developed in-house by Metro or CRAG staff and local liaisons representing local jurisdictions. Local planners were then asked for review and comment. The major problem with this process has been an inability to achieve overall agreement on a regional control total or particular allocation of future growth. As a result, a workshop method was developed to directly involve local planners as a means of building consensus while utilizing their collective expertise.

Metro staff provided technical data and services to the workshop participants, including current population, employment and land use information. In addition, relevant data such as past growth trends and comprehensive plan designations of vacant land were made available for predicting future development in each of the region's 20 sub-areas.

At the beginning of the allocation process, each of the workshop participants presented their jurisdiction's comprehensive plan and discussed major issues relative to plan implementation; for example, the availability of public facilities, long-term private investment, private development schedules and land availability. These presentations served to inform the participants of each jurisdiction's expectations about the amount and types of development they are planning to accommodate.

The first step required the participants at the initial workshop on March 31 to decide upon a forecasted control total for population and employment growth. This process began with a projection of the region's future economic growth in terms of its expected share of total U.S. economic growth over the next 20 years. Arriving at an employment forecast first is necessary because the majority of population growth in this region will result from new people being attracted to new jobs rather than a net gain in births over deaths. In the past 10 years, 77 percent of the region's population growth has resulted from in-migration.

To develop a regional employment forecast, Metro staff relied heavily upon two recently completed independent forecasts. These were prepared by Economic Research Associates (ERA) for the Banfield Transit Station Area Planning Program and by the Federal Bureau of Economic Analysis (BEA). As indicated on Figure 1, the year 2000 employment level selected by the workshop participants was closest to the BEA projection. This is because the BEA methodology which forecasted the region's growth as a related component of the national economy was found preferable to the ERA approach, which was essentially a straight line projection of trends observed in the decade 1970 to 1980.

A related population forecast was developed by estimating the level of job participation or the employment to population ratio. The ERA and BEA forecasts both predict a higher employment to population ratio than exists in 1980 and than had been predicted by earlier studies. The ERA ratio is much higher, reflecting a projection of past trends. The BEA projection is lower than ERA because it takes into account expected demographic changes, especially the aberrations caused by the post World War II baby boom. The selected ratio is shown on the following table.

Table 1
Employment/Population Ratios

	Previous Metro Forecasts	BEA	ERA	Workshop Selected Ratio
1980	.49	.50	.45	.50
2000	.52	.55	.61	.56

By the end of the first workshop, the employment forecast of 351,000 new jobs had been finalized with the associated population increase of 495,000. Added to the region's current employment and population of 619,000 and 1,245,000 respectively, this results in a year 2000 control total of 970,000 employees and 1,740,000 people.

Once the forecasted control totals were developed, the workshop participants were prepared to allocate this growth to geographic subdivisions within the region (see 20-district map, Figure 2). These districts follow census tract and county boundaries and divide the region into areas having similar growth related characteristics (new growth areas, mature areas, transition areas).

For the purpose of this allocation of population and employment growth, it was necessary to make a number of general assumptions regarding existing and future conditions:

1. The composite of all city and county comprehensive plans will comprise the regional land use plan. Future land development will be consistent with these plans.

2. Currently adopted policies of jurisdictions influencing regional growth and development will not change significantly in the future.

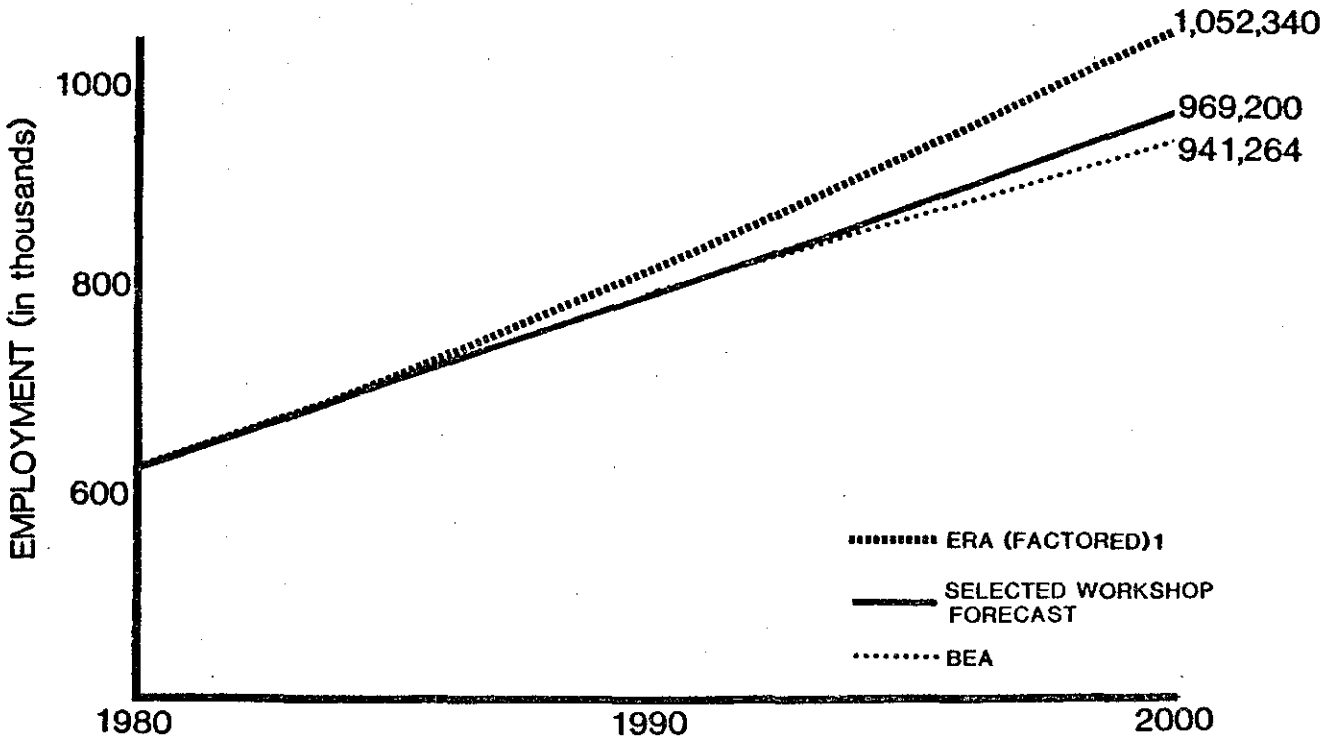
3. Current or projected transportation deficiencies were not considered as a constraint on the future land development pattern.

4. The growth trends of the past decade are a primary indicator of how and where the next two decades' growth will occur.

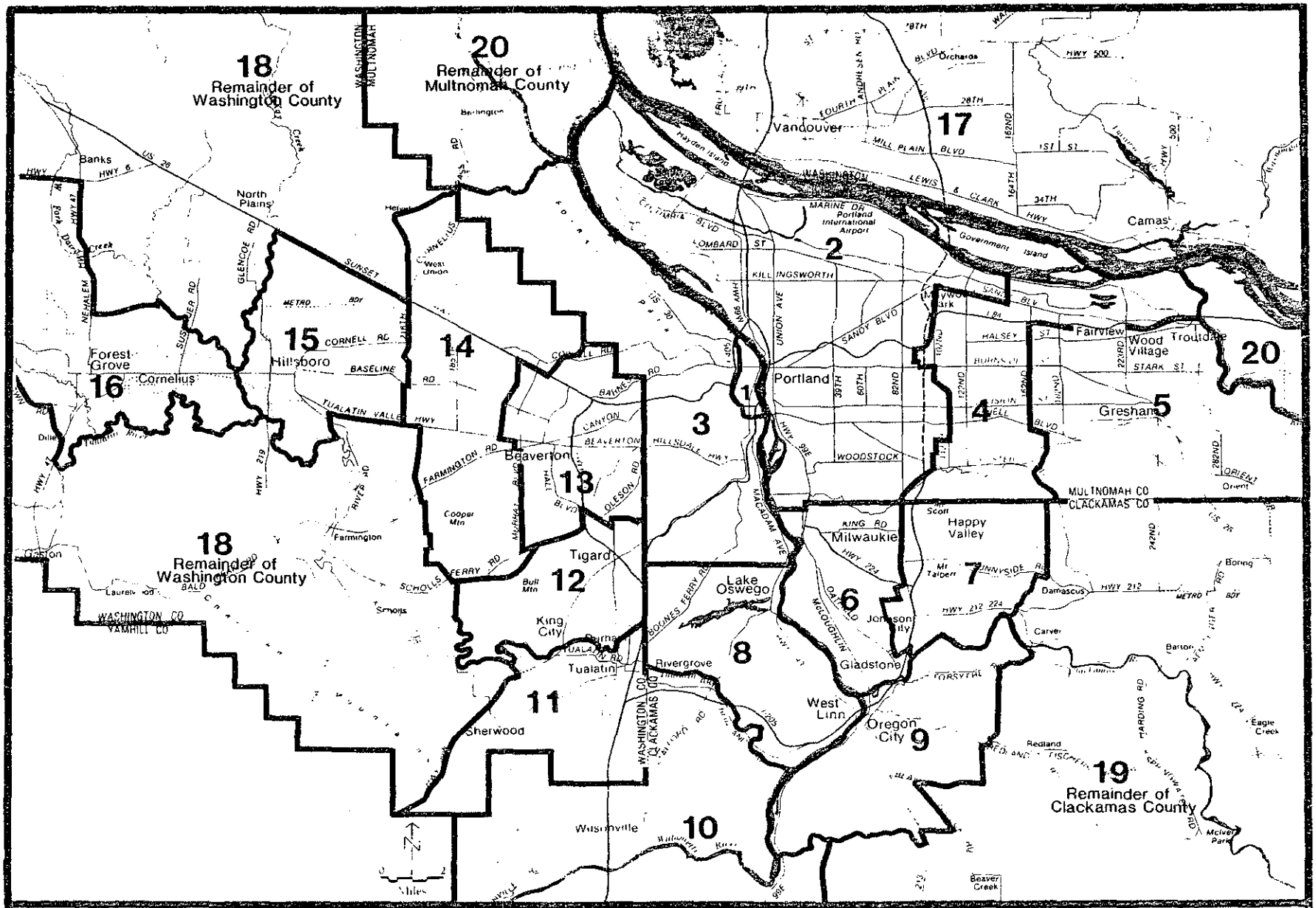
5. Study Area Boundaries - The study area consists of the Portland/Vancouver SMSA which consists of Multnomah, Washington and Clackamas Counties in Oregon and Clark County in Washington.

FIGURE 1

YEAR 2000 EMPLOYMENT FORECASTS



[1] This forecast has been factored upward from the ERA report because the base year did not include employees not covered by unemployment insurance



Growth Allocation Workshop
Portland Metro Area: June 1981

20 DISTRICTS

FIG. 2

POPULATION GROWTH ALLOCATION

The second workshop was held on April 7 to allocate the regional population forecast to the 20 districts. This involved a multi-step process which began with converting the population forecast to housing units.

Since this allocation is based on local comprehensive plans which control dwelling unit growth and location through density and housing type restrictions, it was first necessary to convert the population forecast to dwelling units. To determine the number of housing units required to accommodate the projected population, it was necessary to estimate what the average household size would be in the future.

Historically, the household size in the region has been decreasing since 1960. Previous extrapolations of this trend had predicted a year 2000 household size of 2.5 persons. However, the 1980 census recorded a much more rapid drop during the 1970s than expected, with a regional average household size in 1980 of 2.59. It, therefore, became necessary to revise the 2000 figure below 2.50. The trend curve represented on Figure 3 was determined most likely by the participants, producing a year 2000 household size of 2.30.

After estimating the total number of households, a conversion to dwelling unit demand was necessary. This was accomplished by making an allowance for a normal vacancy in the overall dwelling unit supply. A figure of three percent vacancy for single family and six percent vacancy for multi-family dwelling units, which is representative of a normal vacancy rate in the region, was assumed. Using this figure, it was determined that 261,800 new dwelling units will be needed to house the year 2000 population.

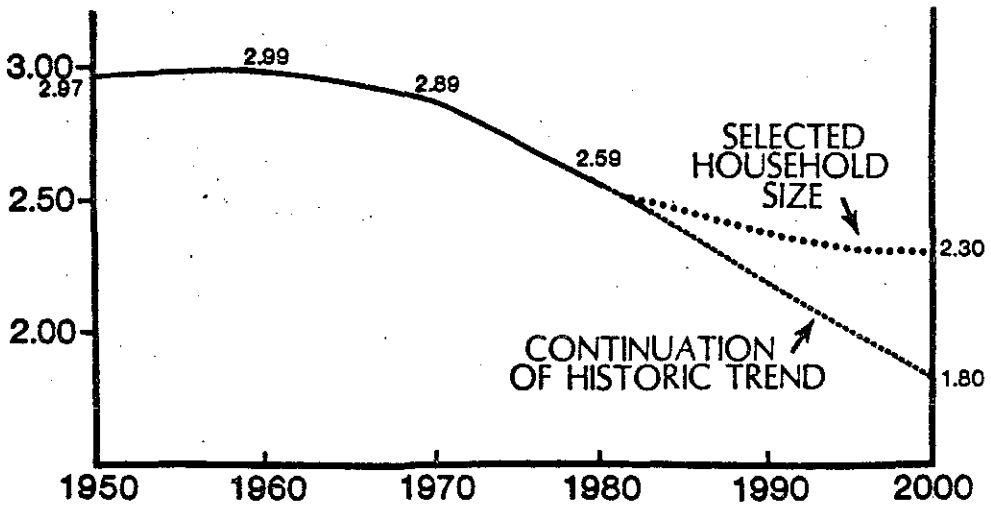
In addition to knowing the number of new dwelling units, it is also necessary to determine the mix of single family and multi-family units the new population will require. Consistent with regional policy and the urban growth boundary findings, a 50/50 split between the two unit types for new development was used, with the exception of Clark County and rural areas. This is based upon the assumption that rising housing costs will render single family home ownership more difficult, requiring a higher ratio of apartment or condominimum construction in the future than has occurred in the past. This trend can be observed over the past two decades, going from a 80/20 single to multi-family split in 1960 to a 72/28 split in 1980.

Although some housing units are demolished each year, no adjustments were made because their small number is negligible in the context of a regional allocation.

Having completed the preceding steps, the participants proceeded to allocate the total number of single and multi-family dwelling units to each of the 20 districts. The methodology for accomplishing this

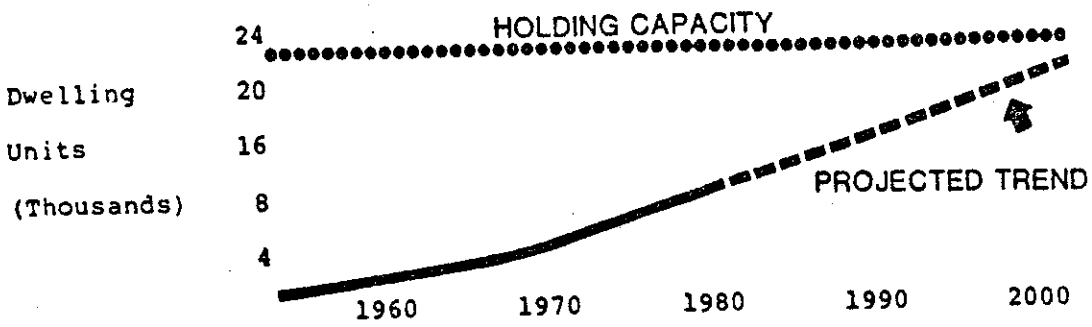
FIGURE 3

AVERAGE HOUSEHOLD SIZE



was primarily based upon past growth trends for the two types of dwelling units. For each of the 20 districts, the 1960 to 1980 growth was plotted on a graph in the manner shown on Figure 4.

FIGURE 4



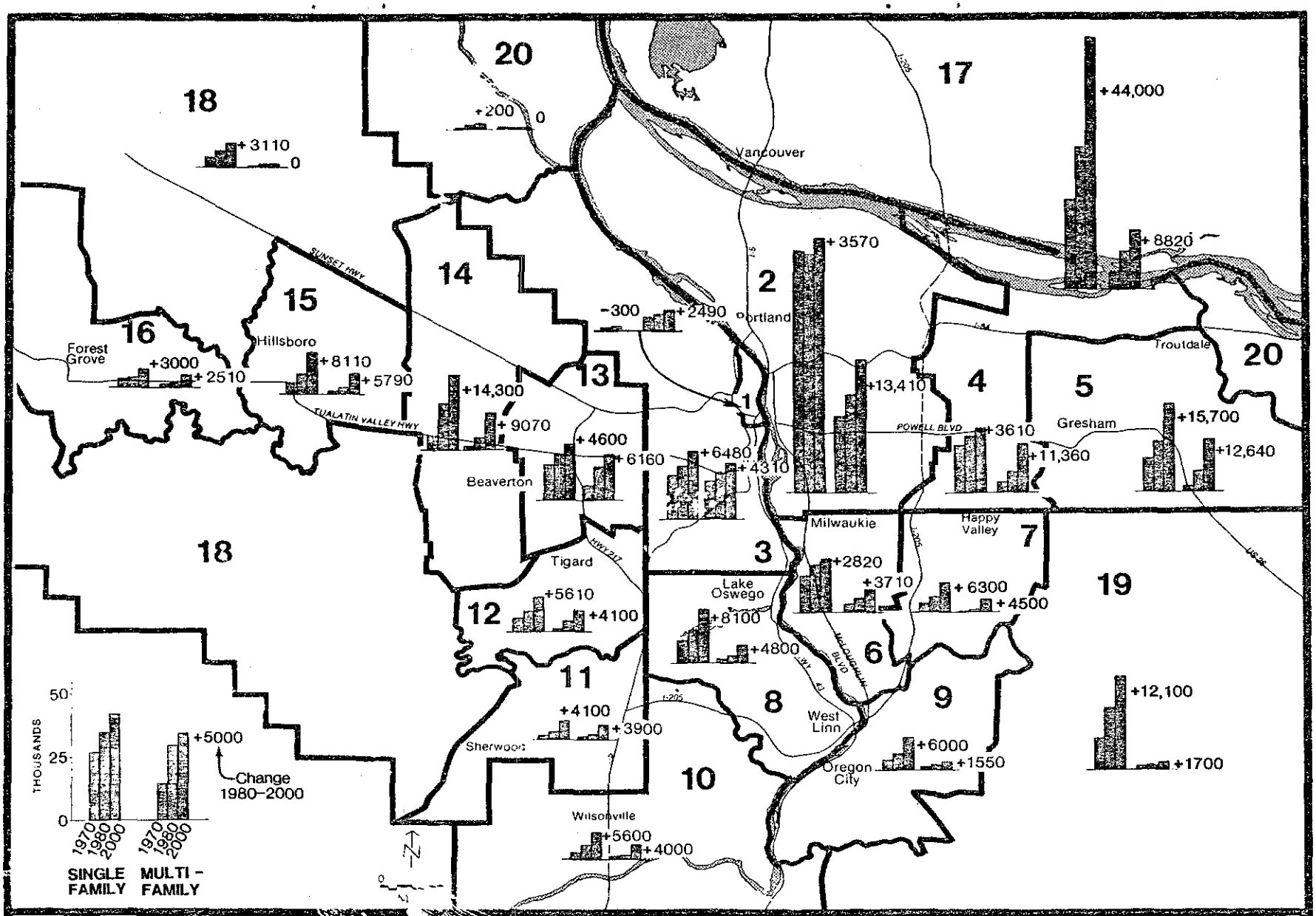
Example

Using the projected trend line as the topic of discussion, the workshop participants considered what factors had resulted in the past trend and the likelihood that this trend would continue into the future. The trend line was then adjusted upward, downward or left alone depending upon the groups' determination of incentives or contraints upon future growth in the district under consideration.

The trend line was also affected in cases where a continuation of the past growth rate would consume all of a district's vacant buildable residential land before the year 2000. The holding capacity line shown on Figure 4 represents the total number of single or multi-family dwelling units that can be built on available vacant land at the densities permitted by the controlling comprehensive plan. The land in the district was considered "filled up" when 95 percent of the single family holding capacity had been reached, and when 100 percent of the multi-family holding capacity had been used. This process was repeated for each district until all of the single and multi-family growth had been distributed. These results were then converted to total population for the district based upon the appropriate vacancy rate and family size. The result of the allocation of both dwelling units and population is displayed on the following maps and tables.

The allocation shows continued rapid population growth in the suburbs. Older established areas such as the City of Portland, Vancouver and parts of Multnomah County are slated to grow more slowly by the year 2000 and to house a smaller share of the total population. While Portland and Multnomah County will grow by 116,000 and continue to have the largest share of regional population, 39 percent, this share is down by six percent from its 1980 share of 45 percent. This six percent loss is equally distributed among the three other counties.

Washington County will attract the largest share of the growth--138,000 people--and will house 22 percent of the regional population, up two percent from its share in 1980. Clackamas County is expected to increase by 123,000, going from 19 percent to 21 percent of the regional population. Clark County is expected to add 118,000 people, also increasing its share of regional population by two percent. The fastest growing district is number five, the Gresham area, which gains 56,000 new residents.



METRO

Growth Allocation Workshop
Portland Metro Area: June 1981

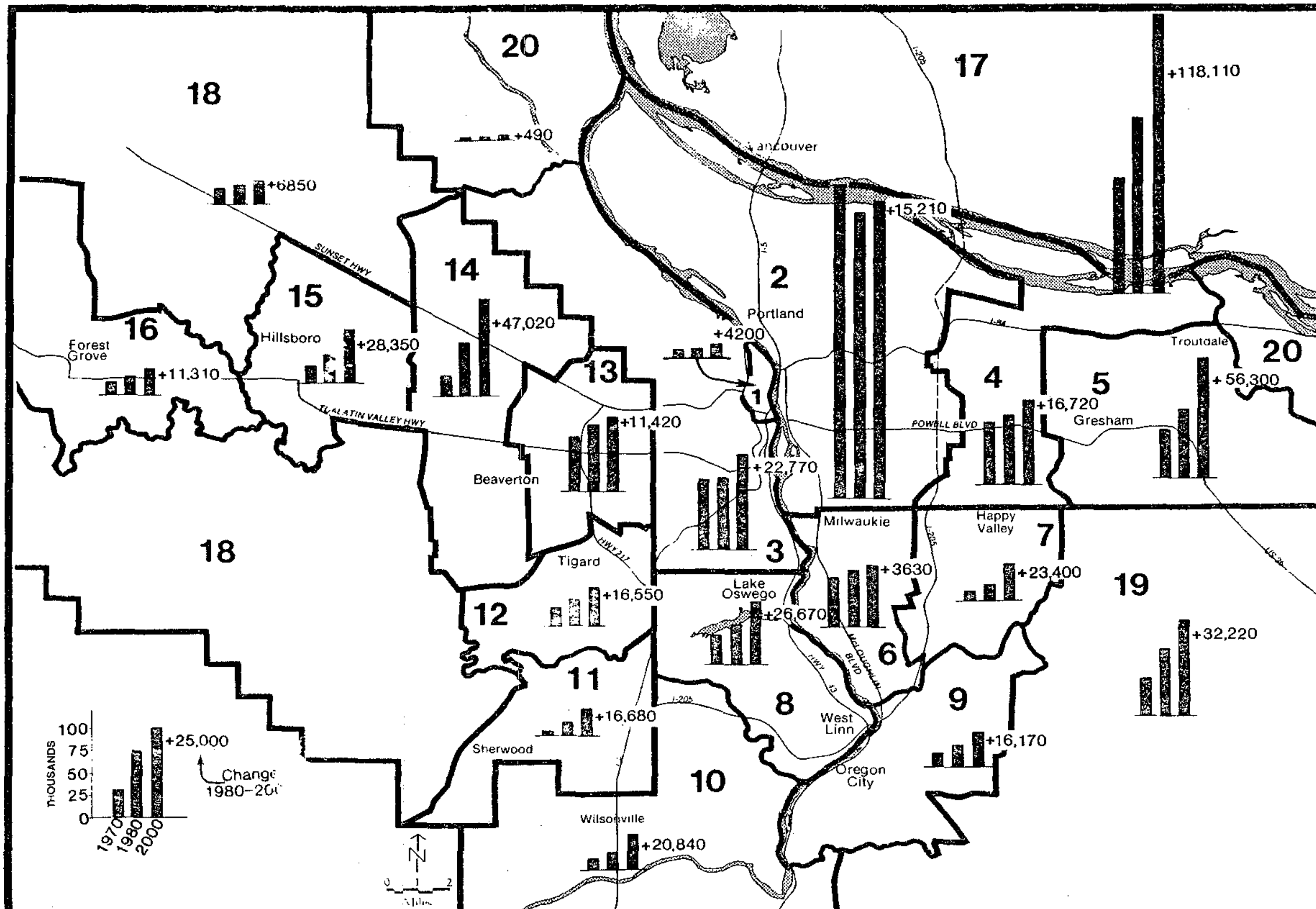
YEAR 2000 DWELLING UNIT GROWTH

FIG. 5

TABLE 2

1970 - 1980 - 2000 DWELLING UNITS

	SINGLE-FAMILY				MULTI-FAMILY				
DIST	1970	1980	2000	80-2000 CHANGE	1970	1980	2000	80-2000 CHANGE	2000 TOTAL
1	170	300	0	-300	5290	6140	8630	2490	8630
2	98420	98140	101710	3570	31390	40060	53470	13410	155180
3	17570	20860	27340	6480	15160	18380	22690	4310	50030
4	18710	22340	25950	3610	3840	9120	20480	11360	46430
5	13590	20690	36390	15700	2580	8600	21240	12640	57630
20	1390	2110	2310	200	80	70	70	0	2380
MULTCO	149850	164440	193700	29260	58340	82370	126580	44210	320280
6	15150	18980	21800	2820	3100	6240	9950	3710	31750
7	3600	5920	12220	6300	200	650	5150	4500	17370
8	8730	13420	21520	8100	1090	2730	7530	4800	29050
9	4290	7030	13030	6000	890	1830	3380	1550	16410
10	3050	5590	11190	5600	350	1490	5490	4000	16680
19	12610	24790	36890	12100	540	1600	3300	1700	40190
CLACKCO	47430	75730	116650	40920	6170	14540	34800	20260	151450
11	1590	3410	7510	4100	220	1910	5810	3900	13320
12	5290	8440	14050	5610	2110	4240	8340	4100	22390
13	14480	18370	22970	4600	5450	13040	19200	6160	42170
14	6160	16180	30480	14300	600	5050	14120	9070	44600
15	5250	8560	16670	8110	1120	2740	8530	5790	25200
16	3790	4770	7770	3000	950	2630	5140	2510	12910
18	4860	7330	10440	3110	140	180	180	0	10620
WASHCO	41420	67060	109890	42830	10590	29790	61310	31520	171200
CLARKCO	36140	57430	101430	44000	6700	15410	24230	8820	125660
SMSA	274840	364660	521670	157010	81800	142110	246920	104810	768590


20
18
17
+118,110
+490
ancouver
+6850
+15,210
14
2
15
SUNSET HWY
16
+47,020
Portland
Forest Grove
Hillsboro
+28,350
+4200
20
Troutdale
13
4
5
+11,310
+56,300
1
+16,720
TUALATIN VALLEY HWY
+11,420
POWELL BLVD
Gresham
+22,770
Beaverton
Milwaukie
Happy Valley
18
3
7
Tigard
HWY 217
+3630
+23,400
19
Lake Oswego
+16,550
12
+26,670
+32,220
6
11
8
9
+16,680
West Linn
+16,170
Sherwood
Oregon City
10
100
75
50
25
0
THOUSANDS
1970
1980
2000
+25,000
Change 1980-20
Wilsonville
+20,840
N
0 1 2
Miles

METRO

Growth Allocation Workshop
Portland Metro Area: June 1981

YEAR 2000 POPULATION GROWTH

FIG. 6

TABLE 3

POPULATION TRENDS

DIST	1970	1980	2000	CHANGE 80-2000
1	8290	10690	14890	4200
2	343070	314500	329710	15210
3	76410	79400	102170	22770
4	69720	76950	93670	16720
5	52690	77970	134270	56300
20	4490	5840	6330	490
MULTCO	554670	565350	681040	115690
6	53610	64300	67930	3630
7	12350	17650	41050	23400
8	31190	43390	70060	26670
9	15650	24560	40730	16170
10	10340	19450	40290	20840
19	42960	72590	104810	32220
CLACKCO	166100	241940	364870	122930
11	5270	13270	29950	16680
12	20330	29470	46020	16550
13	58680	72910	84330	11420
14	22490	57720	104740	47020
15	19430	30970	59320	28350
16	14620	19440	30750	11310
18	17090	21650	28500	6850
WASHCO	157910	245430	383610	138180
CLARKCO	128450	192300	310410	118110
SMSA	1007130	1245020	1739930	494910

EMPLOYMENT GROWTH ALLOCATION

Employment growth was distributed to the 20-District level at two workshops on April 14 and 28, using a procedure similar to that used for the previous allocation of population.

In order to simplify the allocation process, Metro staff grouped the estimated 351,000 increase in employment into seven different categories, each category representing employment with similar density and locational requirements (see Table 4).

One category, comprising 98,000 or 28 percent of the total projected employment growth, was determined to seek locations in or near newly developing residential areas. This "population-related" employment (e.g., dentists, attorneys, teachers and neighborhood businesses) was "automatically" distributed based on each District's share of projected population growth. The fastest growing areas in the suburbs and outlying cities received the majority of this type of new employment.

A second group, comprising 50,000 or 14 percent of new employment, was projected to be "absorbed" at existing employment centers or sites and would not require new "undeveloped" land (and, therefore, not consume any of a district's available vacant holding capacity); for example, a manufacturing plant currently operating at less than full capacity or an existing facility which could be expanded. These employees were also "automatically" allocated based on each District's share of existing employees. Portland and other older employment centers received a larger portion of these new jobs due to their larger share of existing employment.

The three remaining employment types--office, retail and industrial employees--comprised the majority of new growth and were the focus of the workshop activities.

TABLE 4

CROSS CLASSIFICATION MATRIX
EMPLOYMENT SECTORS TO LOCATIONAL CATEGORIES

	Population Related	Existing Sites	Regional Retail	Regional Office	High Density	Industrial Medium Density	Low Density
Manuf. Elec.	---	10%	---	5%	70%	10%	5%
Manuf. Other	---	10%	---	5%	10%	65%	10%
F.I.R.E.	25%	10%	---	65%	---	---	---
T.C.P.U.	---	25%	---	5%	5%	40%	25%
Contruction	25%	50%	---	5%	---	10%	10%
Service	40%	10%	---	40%	---	10%	---
Retail	50%	10%	40%	---	---	---	---
Wholesale	---	10%	---	50%	---	40%	---
Govt.	50%	25%	---	25%	---	---	---
Emp./Land Use	97,840	50,400	22,100	89,860	37,660	43,250	10,060

At the April 14 allocation workshop, a significant amount (32 percent) of the anticipated office, retail and industrial employment growth was distributed based on each local planner's knowledge of "committed" development. In many cases, reliable estimates of future employment growth could be assumed from development plans and/or site plan review applications submitted to local jurisdictions.

The remaining projected employment growth was distributed within the 20 Districts at the final workshop based on a consideration of each District's share of past commercial and industrial construction activity and amount of vacant commercial and industrial acres.

To account for the amount of vacant commercial and industrial land consumed and to determine employment holding capacity, an employee per acre ratio was assumed for each employment category.

The allocation of employment growth, presented on Figure 7 and in Table 5, shows the most rapid employment growth occurring in the suburban districts. Again, the Portland/Multnomah County share is reduced--in this case, from 60 percent of the region's employment in 1980 to 51 percent in 2000. However, in spite of their reduced share of all employment, this area is still expected to experience the largest absolute increase, 125,000 new jobs.

3254B/233

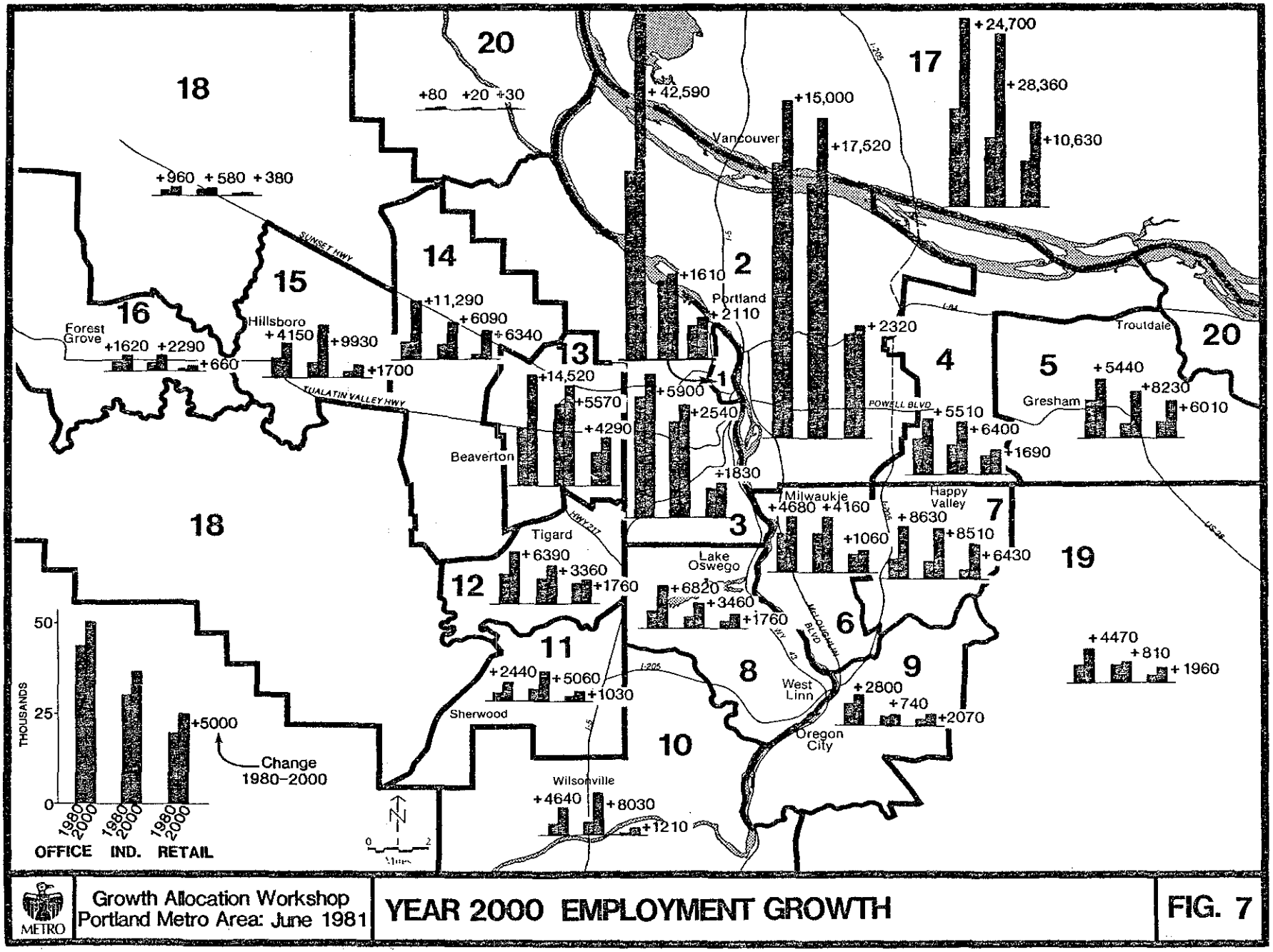

20
18
+80 +20 +30
+ 42,590
+15,000
+17,520
Vancouver
17
+24,700
+28,360
+10,630
+960 +580 +380
SUNSET HWY
14
15
16
Forest Grove
+1620 +2290 +660
Hillsboro
+4150 +9930 +1700
+11,290
+6090
+6340
+1610
2
Portland
+2110
+2320
Troutdale
20
4
5
+5440
+8230
+6010
Gresham
+5510
+6400
+1690
POWELL BLVD
3
+14,520
+5570
+4290
+5900
+2540
+1830
1
TUALATIN VALLEY HWY
Beaverton
18
Tigard
+6390
+3360
+1760
HWY 217
12
Lake Oswego
+6820
+3460
+1760
Milwaukie
+4680 +4160
+1060
Happy Valley
+8630
+8510
+6430
7
19
6
11
+2440
+5060
+1030
Sherwood
8
9
West Linn
+2800
+740
+2070
Oregon City
+4470
+810
+1960
10
Wilsonville
+4640
+8030
+1210
50
25
0
THOUSANDS
+5000
Change 1980–2000
1980 2000
OFFICE
IND.
RETAIL
0 1 2 Miles
METRO
Growth Allocation Workshop
Portland Metro Area: June 1981
YEAR 2000 EMPLOYMENT GROWTH
FIG. 7

TABLE 5

EMPLOYMENT GROWTH 1980 - 2000

DIST	OFFICE 1980	OFFICE 2000	OFFICE CHANGE	INDUSTRIAL 1980	INDUSTRIAL 2000	INDUSTRIAL CHANGE	RETAIL 1980	RETAIL 2000	RETAIL CHANGE	TOTAL 1980	TOTAL 2000	TOTAL CHANGE
1	51630	94220	42590	21390	23000	1610	9120	11230	2110	82140	128450	46310
2	76460	91460	15000	70030	87550	17520	29070	31390	2320	175560	210400	34840
3	33430	39330	5900	28640	31180	2540	8090	9920	1830	70160	80430	10270
4	10500	16010	5510	8730	15130	6400	5520	7210	1690	24750	38350	13600
5	10400	15840	5440	4400	12630	8230	4700	10710	6010	19500	39180	19680
20	400	480	80	250	270	20	150	180	30	800	930	130
MULTCO	182820	257340	74520	133440	169760	36320	56650	70640	13990	372910	497740	124830
6	11010	15690	4680	10790	14950	4160	5190	6250	1060	26990	36890	9900
7	5640	14270	8630	5140	13650	8510	2630	9060	6430	13410	36980	23570
8	5040	11860	6820	3180	6640	3460	2070	3830	1760	10290	22330	12040
9	6030	8830	2800	2250	2990	740	1840	3910	2070	10120	15730	5610
10	2860	7500	4640	3680	11710	8030	860	2070	1210	7400	21280	13880
19	4610	9080	4470	4550	5360	810	1940	3900	1960	11100	18340	7240
CLACKCO	35190	67230	32040	29590	55300	25710	14530	29020	14490	79310	151550	72240
11	2480	4920	2440	3460	8520	5060	1510	2540	1030	7450	15980	8530
12	7630	14020	6390	7160	10520	3360	6560	8320	1760	21350	32860	11510
13	16110	30630	14520	22490	28060	5570	9730	14020	4290	48330	72710	24380
14	4820	16110	11290	3930	10020	6090	1290	7630	6340	10040	33760	23720
15	5460	9610	4150	4350	14280	9930	1980	3680	1700	11790	27570	15780
16	2750	4370	1620	1850	4140	2290	930	1590	660	5530	10100	4570
18	1270	2230	960	1500	2080	580	200	580	380	2970	4890	1920
WASHCO	40520	81890	41370	44740	77620	32880	22200	38360	16160	107460	197870	90410
CLARKCO	27060	51760	24700	19350	47710	28360	12730	23360	10630	59140	122830	63690
SMSA	285590	458220	172630	227120	350390	123270	106110	161380	55270	618820	969990	351170

1980, 1980-2000, AND 2000 DWELLING UNITS AND POPULATION

CENSUS TRACT	20 DIST	1980 SFDU	1980 MFDU	1980 POP	1980 - 2000 SFDU	1980 - 2000 MFDU	1980 - 2000 POP	2000 SFDU	2000 MFDU	2000 POP
51.00	1	190	860	2740	-190	390	1290	0	1250	4030
53.00	1	10	1580	3010	-10	600	1460	0	2180	4470
54.00	1	10	380	650	-10	0	200	0	380	850
56.00	1	30	2330	2810	-30	600	550	0	2930	3360
57.00	1	60	990	1480	-60	900	700	0	1890	2180
DIST	1	300	6140	10690	-300	2490	4200	0	8630	14890
1.00	2	1470	1060	5310	30	370	450	1500	1430	5760
2.00	2	2210	880	5480	30	140	1330	2240	1020	6810
3.01	2	950	1100	4500	50	60	720	1000	1160	5220
3.02	2	2670	20	6710	50	60	-180	2720	80	6530
4.01	2	1320	180	3390	50	60	200	1370	240	3590
4.02	2	1310	150	3350	50	60	170	1360	210	3520
5.01	2	1230	230	3410	50	140	160	1280	370	3570
5.02	2	1220	500	3800	50	140	210	1270	640	4010
6.01	2	1440	270	4360	50	140	-230	1490	410	4130
6.02	2	1360	250	4210	50	140	-300	1410	390	3910
7.01	2	1270	640	4340	50	140	210	1320	780	4550
7.02	2	1570	220	4210	50	60	60	1620	280	4270
8.01	2	1530	440	4490	50	140	150	1580	580	4640
8.02	2	1230	820	4310	50	140	150	1280	960	4460
9.01	2	1110	690	4020	50	140	90	1160	830	4110
9.02	2	740	1210	3950	50	140	40	790	1350	3990
10.00	2	1430	1110	5520	50	140	-120	1480	1250	5400
11.01	2	110	960	1660	0	140	300	110	1100	1960
11.02	2	330	430	1470	0	140	190	330	570	1660
12.01	2	540	1980	4390	30	140	390	570	2120	4780
12.02	2	1060	460	3400	50	140	130	1110	600	3530
13.01	2	830	840	3660	50	60	250	880	900	3910
13.02	2	1030	260	3000	50	60	90	1080	320	3090
14.00	2	1430	740	4760	50	60	-50	1480	800	4710
15.00	2	1120	310	3460	50	60	-50	1170	370	3410
16.01	2	1760	500	5420	150	140	510	1910	640	5930
16.02	2	1380	160	3510	50	60	190	1430	220	3700
17.01	2	1960	690	6010	50	60	290	2010	750	6300
17.02	2	1000	400	3790	30	60	320	1030	460	4110
18.01	2	900	900	3570	30	370	680	930	1270	4250
18.02	2	840	680	3080	50	60	190	890	740	3270
19.00	2	1840	170	5290	30	60	-440	1870	230	4850
20.00	2	930	2280	5400	30	60	500	960	2340	5900
21.00	2	180	1080	2070	0	140	450	180	1220	2520
22.01	2	30	170	410	0	140	140	30	310	550
22.02	2	0	110	180	0	140	200	0	250	380
23.01	2	420	440	2320	30	140	-390	450	580	1930
23.02	2	150	510	1080	0	370	640	150	880	1720
24.01	2	970	210	3190	30	60	-430	1000	270	2760
24.02	2	290	1470	2690	0	370	800	290	1840	3490
25.01	2	1770	70	4910	30	60	-480	1800	130	4430
25.02	2	670	1420	3810	0	370	490	670	1790	4300
26.00	2	1100	50	2750	30	60	80	1130	110	2830
27.01	2	1250	30	3230	30	60	-60	1280	90	3170
27.02	2	740	980	2460	30	370	1410	770	1350	3870
28.01	2	1090	230	3040	30	60	30	1120	290	3070
28.02	2	1100	260	2870	30	370	740	1130	630	3610
29.01	2	1870	190	4510	30	60	340	1900	250	4850
29.02	2	1700	900	5940	30	60	-420	1730	960	5520
29.03	2	1480	140	4200	130	370	780	1610	510	4980
30.00	2	1760	220	4320	30	60	320	1790	280	4640
31.00	2	1620	290	4860	30	60	-440	1650	350	4420
32.00	2	1490	240	4330	30	60	-300	1520	300	4030
33.01	2	750	310	2870	30	140	-360	780	450	2510
33.02	2	900	170	2940	30	140	-240	930	310	2700
34.01	2	780	540	3340	30	140	-400	810	680	2940
34.02	2	650	400	2960	30	140	-550	680	540	2410
35.01	2	1110	400	3480	30	60	-40	1140	460	3440
35.02	2	660	210	2240	30	60	-200	690	270	2040
36.01	2	1430	170	4250	50	140	-300	1480	310	3950
36.02	2	2150	210	6220	50	60	-310	2200	270	5910
36.03	2	680	20	1670	30	60	220	710	80	1890
37.01	2	1240	290	3820	50	140	70	1290	430	3890
37.02	2	720	270	2640	50	140	-160	770	410	2480
38.01	2	950	240	2590	50	140	350	1000	380	2940
38.02	2	1220	150	2930	50	140	510	1270	290	3440

1980, 1980-2000, AND 2000 DWELLING UNITS AND POPULATION

CENSUS TRACT	20 DIST	1980 SFDU	1980 MFDU	1980 POP	1980 - 2000 SFDU	1980 - 2000 MFDU	1980 - 2000 POP	2000 SFDU	2000 MFDU	2000 POP
38.03	2	1280	460	3960	30	60	-60	1310	520	3900
39.01	2	1960	310	5850	50	140	-410	2010	450	5440
39.02	2	1160	230	3150	30	140	270	1190	370	3420
40.01	2	1530	880	6170	50	140	-880	1580	1020	5290
40.02	2	1610	150	4840	50	140	750	1660	290	5590
41.01	2	1580	610	5570	50	140	-500	1630	750	5070
41.02	2	1440	490	4480	50	140	30	1490	630	4510
42.00	2	700	640	2840	50	140	100	750	780	2940
44.00	2	0	0	200	50	0	230	50	0	430
72.00	2	1180	430	3020	0	140	660	1180	570	3680
73.00	2	540	60	1130	0	0	240	540	60	1370
74.00	2	770	420	2580	310	560	1440	1080	980	4020
75.00	2	1500	290	4150	50	110	230	1550	400	4380
76.00	2	1180	210	2950	20	10	210	1200	220	3160
77.00	2	680	100	1790	0	0	-30	680	100	1760
78.00	2	480	70	1800	0	0	-180	480	70	1620
82.01	2	730	210	2520	20	1900	2550	750	2110	5070
83.00	2	1750	220	4790	100	840	1410	1850	1060	6200
86.00	2	1120	200	2990	20	50	90	1140	250	3080
87.00	2	1560	100	3900	50	0	40	1610	100	3940
88.00	2	1350	60	3470	50	0	-70	1400	60	3400
DIST	2	98140	40060	314500	3570	13410	15210	101710	53470	329710
43.00	3	360	40	990	20	0	120	380	40	1110
45.00	3	330	430	1520	0	100	50	330	530	1570
46.01	3	860	440	2680	0	120	200	860	560	2880
46.02	3	640	160	1870	40	0	-30	680	160	1840
47.00	3	410	1900	3770	0	0	480	410	1900	4250
48.00	3	90	1990	2740	0	50	750	90	2040	3490
49.00	3	100	2030	2820	0	50	790	100	2080	3610
50.00	3	50	340	590	0	50	110	50	390	700
52.00	3	110	2710	3480	0	100	1260	110	2810	4740
55.00	3	110	780	1370	0	100	210	110	880	1580
58.00	3	1420	1210	5190	60	200	840	1480	1410	6030
59.00	3	660	960	2850	30	700	1270	690	1660	4120
60.01	3	330	250	1170	80	50	250	410	300	1420
60.02	3	720	190	2010	150	50	400	870	240	2410
61.00	3	640	140	1740	100	50	300	740	190	2040
62.00	3	1160	80	2770	100	0	320	1260	80	3090
63.00	3	1160	110	4210	320	0	900	1480	110	5110
64.00	3	2230	1360	7640	1580	1500	5630	3810	2860	13270
65.01	3	1610	120	4510	350	0	290	1960	120	4800
65.02	3	1010	770	3690	280	270	910	1290	1040	4600
66.01	3	700	140	2210	320	0	600	1020	140	2810
66.02	3	1200	920	4450	270	270	800	1470	1190	5250
67.01	3	880	240	2760	320	100	720	1200	340	3480
67.02	3	670	480	2520	230	270	870	900	750	3390
68.01	3	630	260	2170	320	150	680	950	410	2850
68.02	3	1150	190	3370	320	130	570	1470	320	3940
69.00	3	880	130	2330	320	0	690	1200	130	3020
70.00	3	750	10	1980	1270	0	2790	2020	10	4770
DIST	3	20860	18380	79400	6480	4310	22770	27340	22690	102170
79.00	4	1010	610	3490	0	320	410	1010	930	3900
80.01	4	890	480	3000	0	0	-180	890	480	2820
80.02	4	1040	100	2870	10	0	-140	1050	100	2730
81.00	4	1590	990	5630	0	450	660	1590	1440	6290
82.02	4	1600	340	4650	20	290	140	1620	630	4790
84.00	4	790	300	2590	20	220	100	810	520	2690
85.00	4	1010	100	3050	0	0	-470	1010	100	2580
89.00	4	1640	390	5330	1610	420	3620	3250	810	8950
90.00	4	1380	690	5200	120	720	790	1500	1410	5990
91.00	4	1740	1010	6900	610	110	350	2350	1120	7250
92.01	4	1550	710	5370	20	800	770	1570	1510	6140
92.02	4	1170	210	3680	0	50	-560	1170	260	3120
93.00	4	1710	1050	6720	20	730	140	1730	1780	6860
94.00	4	1850	150	5310	170	2040	2800	2020	2190	8110
95.00	4	1450	1320	6840	600	3590	5610	2050	4910	12450
97.01	4	1250	570	4700	20	0	-870	1270	570	3830
102.00	4	670	100	1620	390	1620	3550	1060	1720	5170
DIST	4	22340	9120	76950	3610	11360	16720	25950	20480	93670

1980, 1980-2000, AND 2000 DWELLING UNITS AND POPULATION

CENSUS TRACT	20 DIST	1980 SFDU	1980 MFDU	1980 POP	1980 - 2000 SFDU	1980 - 2000 MFDU	1980 - 2000 POP	2000 SFDU	2000 MFDU	2000 POP
96.01	5	1370	1060	6170	510	1910	4040	1880	2970	10210
96.02	5	1650	960	6580	250	620	1200	1900	1580	7780
97.02	5	1950	550	6300	30	890	1430	1980	1440	7730
98.01	5	570	530	2710	80	970	1790	650	1500	4500
98.02	5	1880	510	6680	540	680	1860	2420	1190	8540
99.00	5	3070	780	10850	3550	0	7890	6620	780	18740
100.00	5	1460	520	5170	490	4020	8440	1950	4540	13610
101.00	5	1290	510	4890	1390	1230	5190	2680	1740	10080
103.00	5	2070	680	7520	4630	1520	14360	6700	2200	21880
104.01	5	4030	2460	17030	3740	800	9270	7770	3260	26300
104.02	5	1350	40	4070	490	0	830	1840	40	4900
DIST	5	20690	8600	77970	15700	12640	56300	36390	21240	134270
208.00	6	840	1000	3770	0	1110	1570	840	2110	5340
209.00	6	1280	370	3830	60	0	-150	1340	370	3680
210.00	6	1610	280	4780	140	0	-290	1750	280	4490
211.00	6	1630	500	5220	190	0	-120	1820	500	5100
212.00	6	570	820	3620	0	570	1090	570	1390	4710
213.00	6	1700	370	5250	290	160	190	1990	530	5440
214.00	6	1250	320	4140	270	130	120	1520	450	4260
215.00	6	940	330	3700	300	210	20	1240	540	3720
216.00	6	2410	590	7690	320	740	780	2730	1330	8470
217.00	6	1680	340	4750	310	150	650	1990	490	5400
218.00	6	2480	740	8670	780	220	380	3260	960	9050
219.00	6	870	260	2680	90	220	310	960	480	2990
220.00	6	1720	320	6200	70	200	-920	1790	520	5280
DIST	6	18980	6240	64300	2820	3710	3630	21800	9950	67930
221.00	7	3570	490	10550	3500	2490	13210	7070	2980	23760
222.00	7	2350	160	7100	2800	2010	10190	5150	2170	17290
DIST	7	5920	650	17650	6300	4500	23400	12220	5150	41050
201.00	8	1180	380	3750	300	380	1510	1480	760	5260
202.00	8	1580	510	4890	100	300	930	1680	810	5820
203.00	8	1660	760	6400	2520	3330	12000	4180	4090	18400
204.00	8	3730	190	11460	740	100	720	4470	290	12180
205.00	8	3110	490	10350	3060	340	7480	6170	830	17830
206.00	8	1370	270	4150	950	160	2670	2320	430	6820
207.00	8	790	130	2390	430	190	1360	1220	320	3750
DIST	8	13420	2730	43390	8100	4800	26670	21520	7530	70060
223.00	9	1750	180	5800	910	340	2070	2660	520	7870
224.00	9	1030	580	3840	0	100	450	1030	680	4290
225.00	9	1730	740	6440	190	450	740	1920	1190	7180
226.00	9	2520	330	8480	4900	660	12910	7420	990	21390
DIST	9	7030	1830	24560	6000	1550	16170	13030	3380	40730
227.00	10	2040	510	7450	2850	2650	12140	4890	3160	19590
228.00	10	1550	120	4260	350	350	1530	1900	470	5790
229.00	10	2000	860	7740	2400	1000	7170	4400	1860	14910
DIST	10	5590	1490	19450	5600	4000	20840	11190	5490	40290
320.00	11	1170	1570	6200	400	3480	6870	1570	5050	13070
321.00	11	2240	340	7070	3700	420	9810	5940	760	16880
DIST	11	3410	1910	13270	4100	3900	16680	7510	5810	29950
306.00	12	1350	330	4100	430	170	840	1780	500	4940
307.00	12	380	220	1390	290	610	1460	670	830	2850
308.00	12	2180	1310	7810	2230	1770	7410	4410	3080	15220
309.00	12	730	950	3560	80	250	200	810	1200	3760
319.00	12	3800	1430	12610	2580	1300	6640	6380	2730	19250
DIST	12	8440	4240	29470	5610	4100	16550	14050	8340	46020

1980, 1980-2000, AND 2000 DWELLING UNITS AND POPULATION

CENSUS TRACT	20 DIST	1980 SFDU	1980 MFDU	1980 POP	1980 - 2000 SFDU	1980 - 2000 MFDU	1980 - 2000 POP	2000 SFDU	2000 MFDU	2000 POP
301.00	13	1080	1300	5870	1590	1380	4500	2670	2680	10370
302.00	13	1850	820	5980	160	120	200	2010	940	6180
303.00	13	1510	510	4820	150	70	-70	1660	580	4750
304.00	13	1470	1340	7320	580	1610	2230	2050	2950	9550
305.00	13	2040	1040	7110	440	1330	2640	2480	2370	9750
310.00	13	4140	2870	17740	1340	380	190	5480	3250	17930
311.00	13	530	630	2260	20	20	30	550	650	2290
312.00	13	1040	1740	5370	50	170	500	1090	1910	5870
313.00	13	1230	1390	5130	120	770	1430	1350	2160	6560
314.01	13	3270	1010	10270	150	250	-380	3420	1260	9890
314.02	13	210	390	1040	0	60	150	210	450	1190
DIST	13	18370	13040	72910	4600	6160	11420	22970	19200	84330
315.00	14	4990	2170	18990	4210	1750	11990	9200	3920	30980
316.00	14	4330	1370	15490	4810	5960	21470	9140	7330	36960
317.00	14	3810	1160	13880	1840	920	4580	5650	2080	18460
318.00	14	3050	350	9360	3440	440	8980	6490	790	18340
DIST	14	16180	5050	57720	14300	9070	47020	30480	14120	104740
324.00	15	3550	1250	13320	3040	2180	10070	6590	3430	23390
325.00	15	1570	450	5120	570	290	2080	2140	740	7200
326.00	15	3440	1040	12530	4500	3320	16200	7940	4360	28730
DIST	15	8560	2740	30970	8110	5790	28350	16670	8530	59320
329.00	16	1490	470	5210	460	480	1570	1950	950	6780
331.00	16	1420	580	5180	220	510	1440	1640	1090	6620
332.00	16	500	1140	4170	170	1110	2430	670	2250	6600
333.00	16	1360	440	4880	2150	410	5870	3510	850	10750
DIST	16	4770	2630	19440	3000	2510	11310	7770	5140	30750
401.00	17	1250	40	3640	690	0	1490	1940	40	5130
402.00	17	2030	60	6230	1230	30	2560	3260	90	8790
403.00	17	1000	70	3040	550	30	1240	1550	100	4280
404.00	17	3450	270	10910	2160	80	4690	5610	350	15600
405.01	17	1670	10	5710	1350	0	2350	3020	10	8060
405.02	17	1040	60	3170	610	40	1310	1650	100	4480
405.03	17	1570	440	4690	520	220	1940	2090	660	6630
406.00	17	2360	50	7210	2860	0	6500	5220	50	13710
407.00	17	4010	140	11910	1900	80	3900	5910	220	15810
408.00	17	3220	350	10110	2580	240	6090	5800	590	16200
409.00	17	3840	850	13610	3550	780	8640	7390	1630	22250
410.01	17	3520	900	11600	800	540	2380	4320	1440	13980
410.02	17	1430	520	4420	160	240	1170	1590	760	5590
411.01	17	2680	820	9080	870	710	2900	3550	1530	11980
411.02	17	1470	160	4240	1000	110	2680	2470	270	6920
412.00	17	3800	980	13160	2050	480	5150	5850	1460	18310
413.00	17	7080	1260	25340	18900	4230	52200	25980	5490	77540
414.00	17	1040	170	3150	480	80	1320	1520	250	4470
415.00	17	740	290	2440	270	80	1040	1010	370	3480
416.00	17	410	630	2230	1010	260	3060	1420	890	5290
417.00	17	760	720	2960	-90	0	70	670	720	3030
418.00	17	1130	460	3290	-130	0	140	1000	460	3430
419.00	17	530	330	1860	-80	0	120	450	330	1980
420.00	17	630	40	1470	0	0	240	630	40	1710
421.00	17	710	430	2470	-10	0	120	700	430	2590
422.00	17	500	220	1860	0	0	-160	500	220	1700
423.00	17	660	780	2770	-20	0	290	640	780	3060
424.00	17	20	520	710	-20	0	250	0	520	960
425.00	17	320	360	1210	0	0	260	320	360	1470
426.00	17	770	1000	3560	-50	0	550	720	1000	4110
427.00	17	460	1320	3130	30	280	990	490	1600	4120
428.00	17	860	240	2920	50	90	320	910	330	3240
429.00	17	580	470	2410	140	140	550	720	610	2960
430.00	17	570	200	1890	130	20	330	700	220	2220
431.00	17	1320	250	3900	510	60	1430	1830	310	5330
DIST	17	57430	15410	192300	44000	8820	118110	101430	24230	310410

1980, 1980-2000, AND 2000 DWELLING UNITS AND POPULATION

CENSUS TRACT	20 DIST	1980 SFDU	1980 MFDU	1980 POP	1980 - 2000 SFDU	1980 - 2000 MFDU	1980 - 2000 POP	2000 SFDU	2000 MFDU	2000 POP
322.00	18	1090	20	3130	1350	0	3390	2440	20	6520
323.00	18	730	20	2150	280	0	570	1010	20	2720
327.00	18	1320	30	3320	0	0	240	1320	30	3560
328.00	18	460	0	1520	160	0	130	620	0	1650
330.00	18	1560	50	5000	1320	0	3170	2880	50	8170
334.00	18	690	30	2110	0	0	-220	690	30	1890
335.00	18	810	20	2440	0	0	-250	810	20	2190
336.00	18	670	10	1980	0	0	-180	670	10	1800
DIST	18	7330	180	21650	3110	0	6850	10440	180	28500
230.00	19	1870	30	6220	400	0	-100	2270	30	6120
231.00	19	1600	10	5030	400	0	300	2000	10	5330
232.00	19	1990	20	6250	600	0	770	2590	20	7020
233.00	19	1450	40	4520	500	0	730	1950	40	5250
234.00	19	2640	320	8380	2700	450	7410	5340	770	15790
235.00	19	1870	40	5080	400	0	1030	2270	40	6110
236.00	19	1060	40	3220	200	0	200	1260	40	3420
237.00	19	1420	40	4390	350	0	380	1770	40	4770
238.00	19	2180	30	6790	400	0	150	2580	30	6940
239.00	19	1470	280	4770	1300	350	3860	2770	630	8630
240.00	19	750	10	2240	150	0	170	900	10	2410
241.00	19	1390	30	4460	300	0	180	1690	30	4640
242.00	19	1330	140	3690	1200	200	3650	2530	340	7340
243.00	19	3770	570	7550	3200	700	13490	6970	1270	21040
DIST	19	24790	1600	72590	12100	1700	32220	36890	3300	104810
71.00	20	890	10	2130	80	0	430	970	10	2560
105.00	20	1220	60	3710	120	0	60	1340	60	3770
DIST	20	2110	70	5840	200	0	490	2310	70	6330

1980, 1980-2000, AND 2000 EMPLOYMENT

CENSUS TRACT	20 / DIST	1980 OFFICE	1980 RETAIL	1980 IND	1980 - 2000 / OFFICE	1980 - 2000 RETAIL	1980 - 2000 IND	2000 / OFFICE	2000 RETAIL	2000 IND
51.00	1	3760	1000	2710	10710	990	220	14470	1990	2930
53.00	1	23630	5560	9760	13330	450	740	36960	6010	10500
54.00	1	7170	1200	2280	10340	380	170	17510	1580	2450
56.00	1	7970	570	1420	1660	70	100	9630	640	1520
57.00	1	9100	790	5220	6550	220	380	15650	1010	5600
DIST	1	51630	9120	21390	42590	2110	1610	94220	11230	23000
1.00	2	1050	340	530	210	70	10	1260	410	540
2.00	2	920	250	5330	120	30	10	1040	280	5340
3.01	2	1680	110	1340	170	20	80	1850	130	1420
3.02	2	400	190	380	30	10	0	430	200	380
4.01	2	240	250	80	20	10	0	260	260	80
4.02	2	70	70	130	10	0	0	80	70	130
5.01	2	160	150	120	10	10	0	170	160	120
5.02	2	270	460	240	20	20	0	290	480	240
6.01	2	290	210	100	20	10	0	310	220	100
6.02	2	330	210	200	30	10	20	360	220	220
7.01	2	370	30	90	30	0	0	400	30	90
7.02	2	210	150	130	50	20	0	260	170	130
8.01	2	700	130	190	60	10	0	760	140	190
8.02	2	360	240	170	30	10	0	390	250	170
9.01	2	430	260	190	80	30	80	510	290	270
9.02	2	320	330	220	30	20	80	350	350	300
10.00	2	3800	2820	3490	310	150	100	4110	2970	3590
11.01	2	2970	1450	3190	250	80	20	3220	1530	3210
11.02	2	1650	370	2860	130	20	20	1780	390	2880
12.01	2	1430	120	530	120	10	0	1550	130	530
12.02	2	880	150	180	70	10	0	950	160	180
13.01	2	830	300	410	70	20	0	900	320	410
13.02	2	280	140	100	20	10	0	300	150	100
14.00	2	800	210	270	70	10	0	870	220	270
15.00	2	340	60	90	30	0	0	370	60	90
16.01	2	1800	260	410	170	20	0	1970	280	410
16.02	2	310	300	220	30	20	20	340	320	240
17.01	2	1220	550	480	110	30	0	1330	580	480
17.02	2	410	70	170	50	10	10	460	80	180
18.01	2	2840	190	380	230	10	0	3070	200	380
18.02	2	390	70	100	30	0	0	420	70	100
19.00	2	260	210	340	20	10	0	280	220	340
20.00	2	1390	730	1790	130	50	10	1520	780	1800
21.00	2	3450	810	4220	290	50	30	3740	860	4250
22.01	2	2640	40	600	220	0	0	2860	40	600
22.02	2	1580	310	1900	130	20	30	1710	330	1930
23.01	2	180	90	230	40	20	0	220	110	230
23.02	2	4730	1520	2590	2950	80	10	7680	1600	2600
24.01	2	140	20	30	10	0	0	150	20	30
24.02	2	3580	2560	530	950	220	10	4530	2780	540
25.01	2	150	30	140	10	0	0	160	30	140
25.02	2	580	300	690	50	20	10	630	320	700
26.00	2	310	130	160	30	10	0	340	140	160
27.01	2	170	50	40	10	0	0	180	50	40
27.02	2	590	710	410	320	50	0	910	760	410
28.01	2	90	270	70	10	10	0	100	280	70
28.02	2	440	110	310	340	10	0	780	120	310
29.01	2	160	230	50	20	10	0	180	240	50
29.02	2	640	190	350	50	10	0	690	200	350
29.03	2	880	70	340	70	0	30	950	70	370
30.00	2	130	140	90	20	10	0	150	150	90
31.00	2	110	30	80	10	0	0	120	30	80
32.00	2	220	30	100	20	0	0	240	30	100
33.01	2	490	100	140	40	10	0	530	110	140
33.02	2	30	50	40	0	0	0	30	50	40
34.01	2	640	60	320	50	0	0	690	60	320
34.02	2	330	60	180	30	0	0	360	60	180
35.01	2	910	170	260	70	10	0	980	180	260
35.02	2	200	50	190	20	0	0	220	50	190
36.01	2	480	310	470	40	20	0	520	330	470
36.02	2	640	160	350	50	10	0	690	170	350
36.03	2	80	40	140	10	0	0	90	40	140
37.01	2	380	120	1060	30	10	0	410	130	1060
37.02	2	420	90	60	30	10	0	450	100	60
38.01	2	440	350	940	40	20	0	480	370	940
38.02	2	870	50	140	80	0	0	950	50	140

1980, 1980-2000, AND 2000 EMPLOYMENT

CENSUS TRACT	20 DIST	1980 OFFICE	1980 RETAIL	1980 IND	1980 - 2000 OFFICE	1980 - 2000 RETAIL	1980 - 2000 IND	2000 OFFICE	2000 RETAIL	2000 IND
38.03	2	180	90	140	20	10	0	200	100	140
39.01	2	240	190	170	30	10	0	270	200	170
39.02	2	1100	70	270	90	0	0	1190	70	270
40.01	2	560	70	200	50	0	0	610	70	200
40.02	2	910	110	820	80	10	0	990	120	820
41.01	2	740	100	2040	70	10	500	810	110	2540
41.02	2	350	500	170	30	30	0	380	530	170
42.00	2	770	280	630	60	20	0	830	300	630
44.00	2	2510	1270	8400	200	320	5490	2710	1590	13890
72.00	2	4320	2260	6750	1080	140	6730	5400	2400	13480
73.00	2	4550	940	4870	1880	50	2870	6430	990	7740
74.00	2	140	60	470	2020	80	380	2160	140	850
75.00	2	380	190	240	30	10	20	410	200	260
76.00	2	700	170	800	60	10	60	760	180	860
77.00	2	350	110	260	50	30	80	400	140	340
78.00	2	140	100	90	10	30	40	150	130	130
82.01	2	610	890	400	270	150	370	880	1040	770
83.00	2	1240	810	290	100	40	290	1340	850	580
86.00	2	200	100	100	30	10	10	230	110	110
87.00	2	170	60	70	10	0	10	180	60	80
88.00	2	220	70	1180	30	10	90	250	80	1270
DIST	2	76460	29070	70030	15000	2320	17520	91460	31390	87550
43.00	3	3410	440	11260	280	20	840	3690	460	12100
45.00	3	1420	670	3830	120	40	280	1540	710	4110
46.01	3	520	160	80	50	10	10	570	170	90
46.02	3	240	50	160	20	0	10	260	50	170
47.00	3	930	450	450	130	50	40	1060	500	490
48.00	3	2720	410	480	320	60	50	3040	470	530
49.00	3	1480	290	1520	220	60	130	1700	350	1650
50.00	3	1550	330	3140	130	20	240	1680	350	3380
52.00	3	3490	1810	1340	440	160	110	3930	1970	1450
55.00	3	300	70	160	40	10	10	340	80	170
58.00	3	7540	110	500	650	20	50	8190	130	550
59.00	3	2570	1300	2750	410	160	230	2980	1460	2980
60.01	3	140	140	120	20	10	10	160	150	130
60.02	3	320	260	90	40	20	10	360	280	100
61.00	3	260	70	70	20	10	10	280	80	80
62.00	3	140	10	50	50	20	10	190	30	60
63.00	3	840	130	260	70	10	20	910	140	280
64.00	3	1970	240	470	1420	570	190	3390	810	660
65.01	3	100	80	70	460	200	60	560	280	130
65.02	3	400	350	340	190	90	50	590	440	390
66.01	3	160	0	40	100	40	10	260	40	50
66.02	3	870	390	460	130	50	40	1000	440	500
67.01	3	320	70	210	110	40	20	430	110	230
67.02	3	200	10	150	60	20	20	260	30	170
68.01	3	240	60	70	130	50	20	370	110	90
68.02	3	110	40	70	100	40	20	210	80	90
69.00	3	1150	120	440	100	10	30	1250	130	470
70.00	3	40	30	60	90	40	20	130	70	80
DIST	3	33430	8090	28640	5900	1830	2540	39330	9920	31180
79.00	4	670	250	220	290	30	360	960	280	580
80.01	4	770	380	160	60	10	40	830	390	200
80.02	4	180	80	100	20	0	40	200	80	140
81.00	4	1290	1160	680	310	130	100	1600	1290	780
82.02	4	880	920	200	340	180	20	1220	1100	220
84.00	4	150	120	130	20	10	10	170	130	140
85.00	4	180	150	170	20	10	10	200	160	180
89.00	4	720	80	880	520	300	510	1240	380	1390
90.00	4	470	270	290	110	20	30	580	290	320
91.00	4	270	120	220	560	320	420	830	440	640
92.01	4	1020	350	180	260	70	40	1280	420	220
92.02	4	200	120	160	80	40	30	280	160	190
93.00	4	820	580	200	180	40	20	1000	620	220
94.00	4	490	230	230	270	50	10	760	280	240
95.00	4	280	320	420	140	160	10	420	480	430
97.01	4	390	70	140	30	0	10	420	70	150
102.00	4	1720	320	4350	2300	320	4740	4020	640	9090
DIST	4	10500	5520	8730	5510	1690	6400	16010	7210	15130

1980, 1980-2000, AND 2000 EMPLOYMENT

CENSUS TRACT	20 DIST	1980 OFFICE	1980 RETAIL	1980 IND	1980 - 2000 OFFICE	1980 - 2000 RETAIL	1980 - 2000 IND	2000 OFFICE	2000 RETAIL	2000 IND
96.01	5	350	600	330	240	410	1020	590	1010	1350
96.02	5	670	400	1030	280	200	1480	950	600	2510
97.02	5	420	270	150	450	270	190	870	540	340
98.01	5	1360	160	290	700	80	650	2060	240	940
98.02	5	810	210	200	440	260	1140	1250	470	1340
99.00	5	710	160	250	50	30	0	760	190	250
100.00	5	2540	640	1190	1480	2700	0	4020	3340	1190
101.00	5	480	340	180	150	620	0	630	960	180
103.00	5	720	310	250	700	1010	2380	1420	1320	2630
104.01	5	1930	1580	420	950	420	1370	2880	2000	1790
104.02	5	410	30	110	0	10	0	410	40	110
DIST	5	10400	4700	4400	5440	6010	8230	15840	10710	12630
208.00	6	2570	580	2530	650	140	1010	3220	720	3540
209.00	6	380	20	470	30	0	40	410	20	510
210.00	6	300	120	910	30	10	160	330	130	1070
211.00	6	300	290	130	100	30	60	400	320	190
212.00	6	830	180	230	130	50	30	960	230	260
213.00	6	540	340	320	220	50	30	760	390	350
214.00	6	260	480	200	230	40	20	490	520	220
215.00	6	2970	1150	4100	1240	180	2140	4210	1330	6240
216.00	6	580	370	780	670	160	180	1250	530	960
217.00	6	540	660	430	270	150	310	810	810	740
218.00	6	650	450	330	210	60	30	860	510	360
219.00	6	160	330	110	120	40	10	280	370	120
220.00	6	930	220	250	780	150	140	1710	370	390
DIST	6	11010	5190	10790	4680	1060	4160	15690	6250	14950
221.00	7	4310	1500	4390	3270	1010	7820	7580	2510	12210
222.00	7	1330	1130	750	5360	5420	690	6690	6550	1440
DIST	7	5640	2630	5140	8630	6430	8510	14270	9060	13650
201.00	8	420	210	230	250	160	30	670	370	260
202.00	8	1220	840	740	360	170	60	1580	1010	800
203.00	8	450	240	370	3890	540	2120	4340	780	2490
204.00	8	1430	380	690	390	70	430	1820	450	1120
205.00	8	810	100	250	1290	550	310	2100	650	560
206.00	8	510	190	810	450	190	480	960	380	1290
207.00	8	200	110	90	190	80	30	390	190	120
DIST	8	5040	2070	3180	6820	1760	3460	11860	3830	6640
223.00	9	330	240	370	390	220	130	720	460	500
224.00	9	3030	820	1330	370	50	90	3400	870	1420
225.00	9	490	410	220	130	880	30	620	1290	250
226.00	9	2180	370	330	1910	920	490	4090	1290	820
DIST	9	6030	1840	2250	2800	2070	740	8830	3910	2990
227.00	10	1690	410	2900	1810	680	6850	3500	1090	9750
228.00	10	690	110	150	1580	110	50	2270	220	200
229.00	10	480	340	630	1250	420	1130	1730	760	1760
DIST	10	2860	860	3680	4640	1210	8030	7500	2070	11710
320.00	11	1390	890	2530	1420	600	3670	2810	1490	6200
321.00	11	1090	620	930	1020	430	1390	2110	1050	2320
DIST	11	2480	1510	3460	2440	1030	5060	4920	2540	8520
306.00	12	300	640	200	130	160	30	430	800	230
307.00	12	2840	1120	2430	2250	130	820	5090	1250	3250
308.00	12	2140	670	1680	1330	780	870	3470	1450	2550
309.00	12	1300	3460	2190	1740	280	1480	3040	3740	3670
319.00	12	1050	670	660	940	410	160	1990	1080	820
DIST	12	7630	6560	7160	6390	1760	3360	14020	8320	10520

1980, 1980-2000, AND 2000 EMPLOYMENT

CENSUS TRACT	20 DIST	1980 OFFICE	1980 RETAIL	1980 IND	1980 - 2000 OFFICE	1980 - 2000 RETAIL	1980 - 2000 IND	2000 OFFICE	2000 RETAIL	2000 IND
301.00	13	2470	530	680	1560	0	100	4030	530	780
302.00	13	1660	460	210	260	90	20	1920	550	230
303.00	13	620	420	270	270	150	30	890	570	300
304.00	13	3340	2240	2770	1680	500	260	5020	2740	3030
305.00	13	330	320	290	610	310	70	940	630	360
310.00	13	1190	460	1080	4320	330	120	5510	790	1200
311.00	13	830	170	390	80	250	40	910	420	430
312.00	13	1100	540	570	3070	250	60	4170	790	630
313.00	13	1430	3450	810	2060	2140	90	3490	5590	900
314.01	13	530	310	440	210	120	500	740	430	940
314.02	13	2610	830	14980	400	150	4280	3010	980	19260
DIST	13	16110	9730	22490	14520	4290	5570	30630	14020	28060
315.00	14	1210	410	760	1730	420	930	2940	830	1690
316.00	14	2520	680	1750	7100	5020	4680	9620	5700	6430
317.00	14	810	190	1190	1730	570	400	2540	760	1590
318.00	14	280	10	230	730	330	80	1010	340	310
DIST	14	4820	1290	3930	11290	6340	6090	16110	7630	10020
324.00	15	850	500	580	2160	960	2310	3010	1460	2890
325.00	15	2040	910	1090	290	70	900	2330	980	1990
326.00	15	2570	570	2680	1700	670	6720	4270	1240	9400
DIST	15	5460	1980	4350	4150	1700	9930	9610	3680	14280
329.00	16	670	380	810	440	190	300	1110	570	1110
331.00	16	1070	310	410	410	160	1710	1480	470	2120
332.00	16	590	110	400	330	130	220	920	240	620
333.00	16	420	130	230	440	180	60	860	310	290
DIST	16	2750	930	1850	1620	660	2290	4370	1590	4140
401.00	17	320	70	760	700	0	700	1020	70	1460
402.00	17	100	10	50	580	0	480	680	10	530
403.00	17	410	90	310	960	0	960	1370	90	1270
404.00	17	1600	600	560	690	1980	1510	2290	2580	2070
405.01	17	100	10	60	610	0	490	710	10	550
405.02	17	60	10	230	880	0	520	940	10	750
405.03	17	300	280	640	1250	50	850	1550	330	1490
406.00	17	50	40	60	470	230	310	520	270	370
407.00	17	1820	820	590	480	680	1540	2300	1500	2130
408.00	17	1510	250	940	1130	2150	1500	2640	2400	2440
409.00	17	990	280	510	3000	770	3170	3990	1050	3680
410.01	17	2140	1160	3200	350	310	0	2490	1470	3200
410.02	17	1570	430	370	130	1050	1210	1700	1480	1580
411.01	17	380	350	520	200	400	10	580	750	530
411.02	17	470	1350	130	0	790	270	470	2140	400
412.00	17	1150	870	500	50	260	600	1200	1130	1100
413.00	17	3750	420	1750	6110	1530	7330	9860	1950	9080
414.00	17	400	50	2520	4770	60	2240	5170	110	4760
415.00	17	370	560	340	580	280	870	950	840	1210
416.00	17	450	180	180	290	20	500	740	200	680
417.00	17	50	60	30	10	0	20	60	60	50
418.00	17	120	90	40	0	0	60	120	90	100
419.00	17	1280	230	170	0	0	260	1280	230	430
420.00	17	70	20	10	0	0	10	70	20	20
421.00	17	100	60	30	0	0	20	100	60	50
422.00	17	200	150	600	280	0	0	480	150	600
423.00	17	300	360	470	130	0	0	430	360	470
424.00	17	1450	1240	1020	50	10	360	1500	1250	1380
425.00	17	880	1130	160	0	10	260	880	1140	420
426.00	17	3510	460	2270	860	20	1750	4370	480	4020
427.00	17	100	320	70	80	10	100	180	330	170
428.00	17	370	410	110	60	0	290	430	410	400
429.00	17	400	320	50	0	20	80	400	340	130
430.00	17	190	10	50	0	0	50	190	10	100
431.00	17	100	40	50	0	0	40	100	40	90
DIST	17	27060	12730	19350	24700	10630	28360	51760	23360	47710

1980, 1980-2000, AND 2000 EMPLOYMENT

CENSUS TRACT	20 DIST	1980 OFFICE	1980 RETAIL	1980 IND	1980 - 2000 OFFICE	1980 - 2000 RETAIL	1980 - 2000 IND	2000 OFFICE	2000 RETAIL	2000 IND
322.00	18	120	40	90	620	270	230	740	310	320
323.00	18	100	10	200	240	100	120	340	110	320
327.00	18	340	30	430	50	10	90	390	40	520
328.00	18	40	0	50	0	0	10	40	0	60
330.00	18	370	50	300	30	0	50	400	50	350
334.00	18	20	0	0	0	0	0	20	0	0
335.00	18	170	60	100	10	0	20	180	60	120
336.00	18	110	10	330	10	0	60	120	10	390
DIST	18	1270	200	1500	960	380	580	2230	580	2080
230.00	19	580	40	170	50	0	10	630	40	180
231.00	19	140	30	100	10	0	10	150	30	110
232.00	19	250	200	210	50	30	40	300	230	250
233.00	19	320	50	350	50	60	60	370	110	410
234.00	19	730	490	600	1460	730	240	2190	1220	840
235.00	19	90	30	180	10	0	10	100	30	190
236.00	19	30	10	40	0	0	0	30	10	40
237.00	19	140	20	130	10	0	50	150	20	180
238.00	19	130	40	230	10	0	20	140	40	250
239.00	19	780	360	1390	860	350	190	1640	710	1580
240.00	19	10	0	0	0	0	0	10	0	0
241.00	19	260	20	380	20	0	30	280	20	410
242.00	19	740	300	520	810	290	130	1550	590	650
243.00	19	410	350	250	1130	500	20	1540	850	270
DIST	19	4610	1940	4550	4470	1960	810	9080	3900	5360
71.00	20	80	10	130	60	20	10	140	30	140
105.00	20	320	140	120	20	10	10	340	150	130
DIST	20	400	150	250	80	30	20	480	180	270

Subsurface Sewage Disposal and Contamination of Ground Water in East Portland, Oregon[a]

by E. L. Quan[b], H. R. Sweet[c], and Joseph R. Illian[d]

ABSTRACT

Over the past 30 years East Portland and central Multnomah County have metamorphosed from a rural-suburban to a locally urban community. Services, including community water and sewer have been extended to most of the area. However, a 30-square-mile (80 km^2) area within central Multnomah County remains unsewered today. This area reportedly disposes of 8 to 10 mgd (34,400 m^3/day to 38,000 m^3/day) sewage via subsurface systems, i.e. cesspools, seepage beds, and drainfields. These methods of waste disposal have resulted in the degradation of the ground-water resource within the study area.

Most of the developed area is located on a relatively level terrace made up of Pleistocene fluviolacustrine sediments. Partially cemented gravels of the Pliocene Troutdale Formation underlie the terrace deposits. Both of these units are generally excellent aquifers where saturated. The depth to water in the unsewered area ranges from about 100-200 feet (30 to 60 m) in the southern terraced area to less than 10 feet (3 m) in much of the northern area underlain by younger, floodplain, terraces adjacent to the Columbia River.

Central Multnomah County is situated within a regional ground-water discharge zone. It receives ground-water recharge from the Cascade Mountains to the east and intermediate recharge from the Cascade foothills and other isolated hills bordering and within the study area. The major surface drains receiving ground water from the regional and intermediate flow systems are the Willamette, Clackamas, and Columbia Rivers.

The fluviolacustrine terraces constitute a local recharge zone. The primary ground-water recharge source is infiltrating precipitation as evidenced by the paucity of natural surface drainage, although the area receives in excess of 40 inches (100 cm) of precipitation per year. However, due to development and its attendant reduction in area for infiltration, e.g. paving and building, there has been a decrease in natural recharge. The estimated 8 to 10 mgd (34,400 m^3/day to 38,000 m^3/day) of domestic waste which is disposed of via the subsurface is thus introduced as supplemental local recharge.

Infiltrating precipitation and sewage effluent migrates downwards through the water table. The depth to which the local recharge can penetrate the water table is limited by its hydraulic potential and the vertical hydraulic conductivity of the substrata. Therefore, the NO_3-N contaminated recharge is effectively buoyed up and migrates laterally along the upper portion of the water table to its eventual surface drain, Columbia Slough South Arm.

Water samples from wells developing water in adjacent or upgradient sewered areas and/or from deeper aquifers within the unsewered area generally have NO_3-N concentrations of less than 1 mg/l. Shallower wells and springs within the unsewered area and South Arm Slough, downgradient from the unsewered area, had NO_3-N concentrations ranging from 4.7 to 11.86 mg/l, with a mean value of 7.74 mg/l in July 1974.

INTRODUCTION

The Columbia Slough is a small dead-ended waterway located in North Portland and North Multnomah County, Oregon. The entire length of the slough lies in a flat valley that is bordered by minor agricultural areas, industries, swampy lands, and the northern sector of the Portland Metropolitan area. It is fed by large spring flows, area surface water and subsurface drainage. The slough has a flat gradient which causes it to flow slowly, and its lower section is substantially influenced by responses in the Willamette and Columbia Rivers to tidal changes in the Pacific Ocean.

---

[a]Presented at the Second National Ground Water Quality Symposium, Denver, Colorado, September 25-27, 1974.

[b]Water Quality Division, Oregon Department of Environmental Quality, 1234 S.W. Morrison, Portland, Oregon 97205.

[c]Hydrogeologist, Oregon State Engineer, 1178 Chemeketa Street, N.E., Salem, Oregon 97310.

[d]Hydrogeologist, Oregon State Engineer, 1178 Chemeketa Street, N.E., Salem, Oregon 97310.

Discussion open until April 1, 1975.

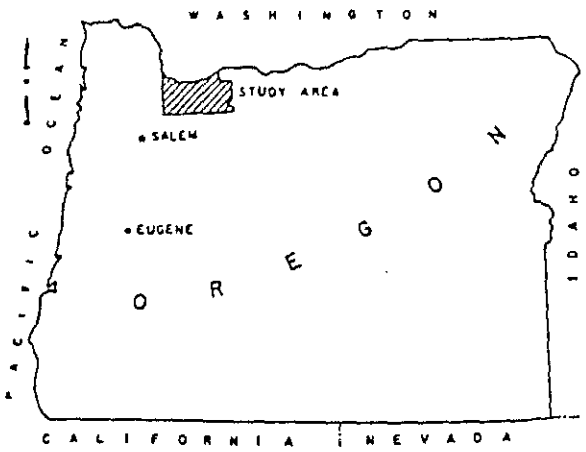


Fig. 1. Location of East Portland study area.

The study area (see Figure 1) in East Portland of Multnomah County, Oregon, has received wide attention from governmental agencies and citizen groups for many years. During 1972, the City of Portland, Multnomah County, Port of Portland, Corps of Engineers, and the Department of Environmental Quality formed the Columbia Slough Environmental Improvement Task Force for the purpose of bringing together the land-use plans proposed for the Columbia Slough area. Numerous meetings were held with members of the public and organized citizen groups. The major topics considered by the Task Force and the public involved flood control, land-use patterns, fish and wildlife, recreation, and water quality improvement for the development of the Columbia Slough area.

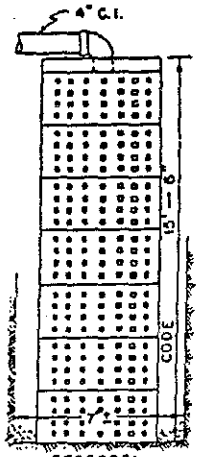
Water quality studies in the Columbia Slough were started in 1971 and completed in 1973 by the Department of Environmental Quality. Most of the data were collected during the dry weather period. The chemical data indicated that the spring sources forming the headwaters of the South Arm Slough were unusually high in nitrate-nitrogen (NO_3-N) and sulphate ion concentrations. It was suspected that the area lying directly south of the South Arm Slough was contributing much of the NO_3-N via subsurface disposal of domestic waste. The State Engineer's Office was requested to assist in the interpretation of the data.

The area lying directly south of the Columbia Slough drainage system changed from an agricultural to suburban-urban area over the past 30 years. Household waste disposal is primarily by means of cesspools (see Figure 2), and septic tanks and seepage beds. The area estimated to be served by subsurface waste disposal in central Multnomah County covers about 20 square miles (50 km²) (Moffatt and Taylor, 1965). In addition, about 7 square miles (18 km²) along the eastern border of Portland are currently served by cesspools and septic tanks (see Figure 3). Several square miles along the west boundary of Gresham are also served by subsurface disposal systems. The population within this area served by subsurface systems was estimated to be 102,000 persons in 1972, discharging an estimated 10 million gallons per day (mgd) (38,000 m³/day).

The purpose of this paper is to describe the study area geology, hydrology, hydrogeology, and to compare the water quality in wells within the unsewered area to those in the sewered area of east Multnomah County, Oregon. The study is also concerned with developing general recommendations for alleviation of the contamination problem.

GEOLOGY

The geology of the East Portland area has been described by Treasher (1942), Trimble (1957, 1963) and more recently by Hogenson and Foxworthy (1965) (see Figure 4). Underlying the area are older volcanic and sedimentary rocks ranging from Eocene to early Miocene in age. Only one well in the East Portland area has penetrated these older rocks. This well derived little water from the older rocks.



MINIMUM BASIC REQUIREMENTS FOR TEMPORARY SEWAGE DISPOSAL SYSTEMS

NOTE: Any system other than a community sanitary sewage system is considered to be temporary

TYPE OF UNIT	PRIMARY USE	SOIL CONDITIONS	SIZE OR DEPTH*	LOCATION
CESSPOOL	Individual and multiple Residential. Limited Commercial Use	Coarse, Loose Gravel & Stone Four feet above Water Table.	A. Single Residence 15'	A. 10' from Building
			B. Multiple Residence 20'	B. 10' from Property Line.
			C. Commercial 20'	C. 20' center to center (Two or more)
			Note: Add soil overburden for total depth of hole.	

*Cesspool depth indicates depth of rings or gravel.

STANDARD
CONCRETE CESSPOOL

Fig. 2. Typical cesspool design for East Portland.

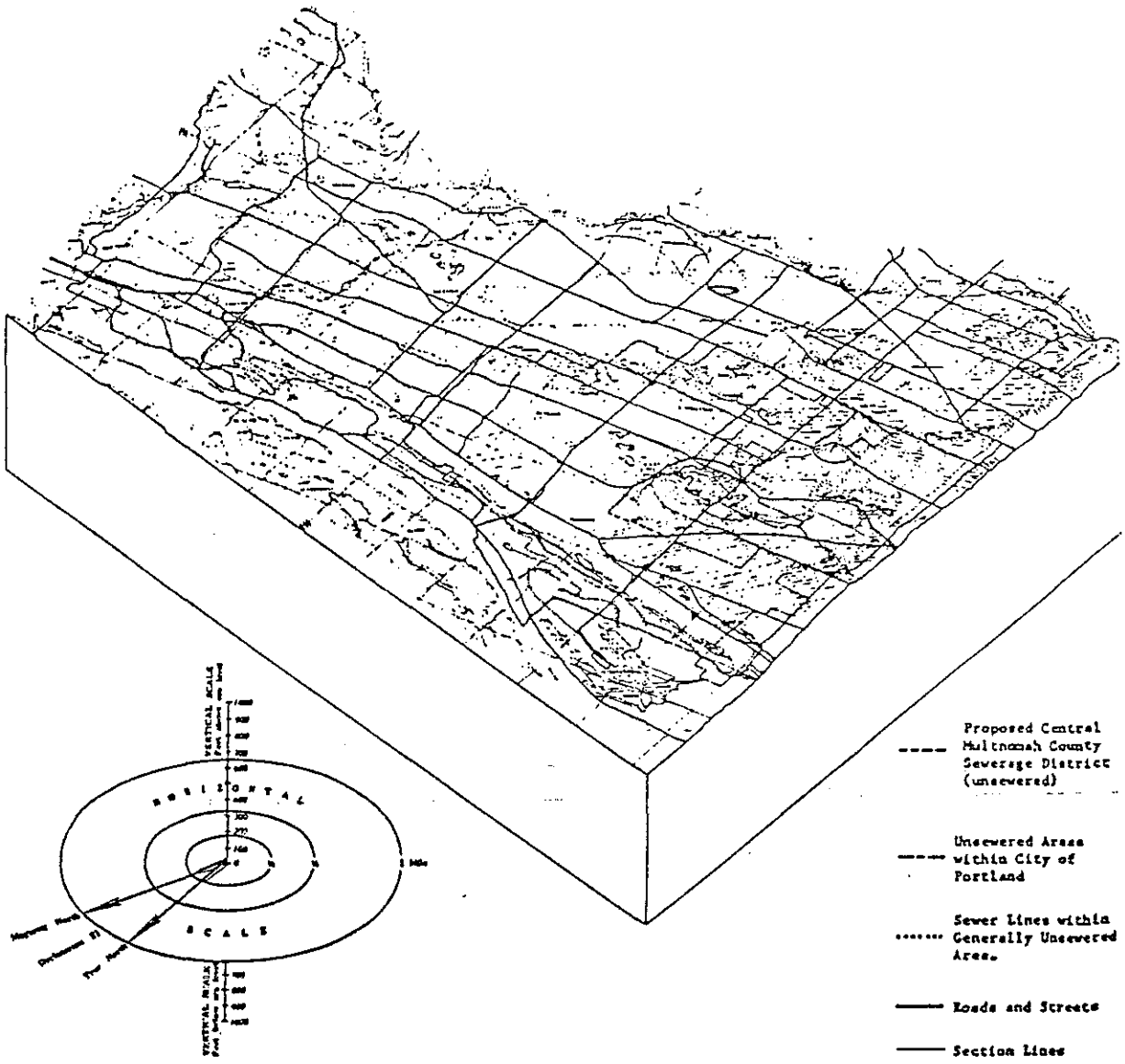


Fig. 3. Topography, major roads, sewered, and unsewered area in East Portland.

Unconformably overlying the older rocks are a sequence of accordantly layered basaltic lava flows of the Columbia River Group of early Miocene age. Individual flows in this unit range in thickness from about 10 to 150 feet (3 to 45 m) and can be traced laterally for distances ranging from less than one to as much as three miles (8 km). The thickness of the Columbia River Basalt in the study area ranges from about 120 feet (37 m) in the Fairview area to perhaps several hundred feet (90 m) in the west portion of the study area. Columnar, cubic or "brickbat," and platy jointing are present in the various flows. These together with the scoriaceous and fractured materials in the interflow zones are the major avenues for water movement. Water wells penetrating these interflow zones yield moderate to large quantities of water.

The Columbia River Basalt is unconformably overlain by the Sandy River Mudstone of early (?) Pliocene age. This unit is primarily made up of indurated clay and silt, probably of lacustrine origin. It also includes minor amounts of sand and fine gravel, especially near the base of the unit. The maximum known thickness of the unit in the study area is about 900 feet (270 m). Though most of the unit is saturated with ground water, it does not readily yield water to water wells, because of its relatively low hydraulic conductivity.

Unconformably overlying the Sandy River Mudstone is the Troutdale Formation of early Pliocene age. This unit consists mostly of well-indurated sandy conglomerate with local layers of stratified claystone and siltstone. The thickness of the Troutdale Formation in the study area ranges from about 150 feet (46 m) near Sandy to about 360 feet (110 m) at Fairview. Bedding in the Troutdale Formation dips slightly towards the west as a result of initial deposition by westward-flowing streams and subsequent tilting during the deformation that formed in Portland structural basin. This unit is the major aquifer in the study area.

Overlying and in places intruding the Troutdale Formation are basaltic lava, tuff, and volcanic cinders of the late Pliocene to late (?) Pleistocene Boring Lava. This unit crops out at Kelly Butte, Rocky Butte, and Mount Tabor in the study area (see Figure 4). The Boring Lava was deposited on an undulating erosional surface developed on top of the Troutdale Formation. The Boring Lava is primarily unsaturated.

A unit mostly made up of clay, silt, sand, gravel, and mudflow deposits underlies much of the area to the southeast of the study area. Hogenson and Foxworthy (1965) refer to this unit as "piedmont deposits." The thickness of these deposits is commonly less than 100 feet (30 m) but at places nearly 200 feet (60 m). The materials in this unit generally have a low hydraulic conductivity and do not readily yield water to wells.

Poorly consolidated and unconsolidated gravel, sandy silt, and clay, deposited by the ancestral Columbia River and its tributaries on the eroded surface of the Troutdale Formation during the late Pleistocene make up the Portland terraces. The materials were deposited during a time when the surface drainage system was at a level several hundred feet above its present channels. These fluviolacustrine deposits are relatively coarse-grained and include boulders in the northeastern part of the study area. They grade into predominantly finer-grained materials to the west. Throughout the area the gravels are poorly sorted and commonly include a fine-grained matrix. These terrace materials feather-out in places but are as thick as 250 feet (76 m) in much of the area. They are not generally saturated but are moderately permeable and yield small to large quantities of water to wells where they extend below the water table.

The broad plain along the Columbia River is underlain by Recent alluvial materials. The depth of this Recent fill is as great as 175 feet (54 m) in the study area. The upper portion of this unit is composed mainly of sand, silt, and clay, while deeper parts include some gravelly layers. Shallow wells, tapping the finer-grained materials yield only small to moderate amounts of water. Deeper wells which tap the gravelly layers yield larger quantities.

HYDROLOGY

Major surface-water drains in the East Portland area include the Columbia River to the north; Johnson Creek, a tributary of the Willamette River, to the south; and the Sandy River and its tributary, Beaver Creek, to the east (see Figures 3 and 5). Although the Portland area receives over 40 inches (100 cm) per year of precipitation, there is a noticeable paucity of surface drainage systems on the terrace area. This is due to the high hydraulic conductivity of the terrace materials and was the case even before extensive development of the area took place.

Fairview Creek flows from Grant Butte to Fairview Lake. The out-flow from Fairview Lake forms the upper Columbia Slough and the main drainage canal of Columbia Slough which flows west, subparallel to the Columbia River. South Arm Slough begins as spring flow about 2½ miles west of Fairview Lake. South Arm Slough flows parallel to and is located immediately south of the main drainage canal of Columbia Slough (see Figure 3). South Arm Slough is connected to Columbia Slough by a small channel located nearly 2 miles below its headwaters. Its main confluence with the slough is southwest of Portland International Airport. Perennial flow in upper South Arm Slough is through the small channel. During the dryer summer months, flow from lower South Arm is also through the smaller channel into Columbia Slough. On the other hand, during wet, winter-weather periods, the flow is generally through South Arm to its main confluence with Columbia Slough. In addition to natural surface runoff, 12 storm sewers ranging from 12 to 60 inches (30 to 150 cm) in diameter discharge to Fairview Lake, South Arm, and Columbia Slough in the study area. The study area does not have extensive storm drain development. Most of the drains are associated with the primary roads in the area. Spring discharge, base flow, and bank storage are the major sources of water during the summer months when this system is made up of gaining streams. Flow measurements in Columbia Slough range from about 70 to 176 cubic feet per second (cfs) (2 to 5 m^3/sec) and it has been estimated that the upper 1¾ miles (3 km) of South Arm Slough (primarily

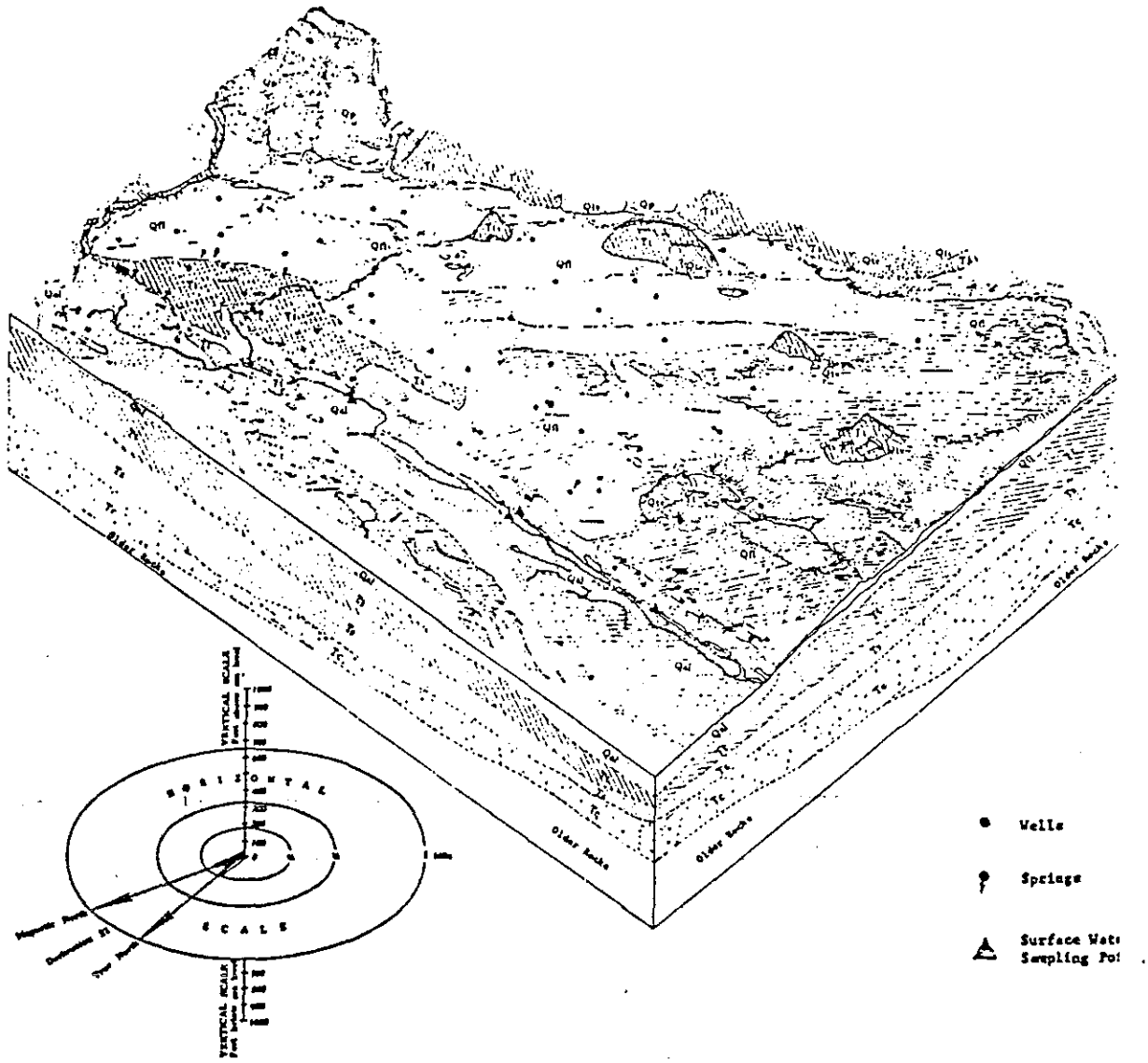


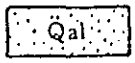
Fig. 4. Geology, selected water wells, and surface-water sampling points in East Portland (see legend on facing page).

spring discharge) contributes about 26 percent of the total flow in upper Columbia Slough during dry weather.

HYDROGEOLOGY

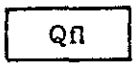
Stratigraphic relationships and aquifer characteristics in the study area are outlined in the earlier text with the geology and summarized in the legend on Figure 4. The major aquifers in the study area include the fluviolacustrine deposits where saturated and the more transmissive portions of the Troutdale Formation. Because of its general low hydraulic conductivity, the Sandy River Mudstone does not readily provide water to wells. Some wells in the Portland area develop water from interflow zones in the Columbia River Basalt. However, its great depth in the study area and the availability of wat in the shallower Troutdale Formation has resulted in little development of this deeper aquifer.

The Columbia River and its floodplain, inclu ing the Columbia Slough system is situated in a ground-water discharge area. The Cascade Mounta to the east are the major source of recharge to the regional flow system. Most of the water movemen in this regional system probably takes place in the deeper substrata, i.e. the older rocks and perhaps the Columbia River Basalt. Although potential gradients may be great, actual movement of the water in the regional system is probably extremely slow, primarily because of the low hydraulic con-



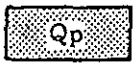
YOUNGER ALLUVIUM

Gravel, sand, silt, and clay; slightly stratified. Mostly well sorted beneath flood plains of larger rivers; less sorted near smaller streams. Thickness generally a few feet near small streams, about 20 or 30 feet along Sandy and Clackamas Rivers, 75 to 100 feet along Willamette River, and as much as 200 feet along Columbia River. Layers of well-sorted gravel and sand yield large amounts of water to wells; less sorted and finer grained materials yield smaller amounts.



FLUVIOLACUSTRINE DEPOSITS

Unconsolidated gravel, sand, silt, and clay; slightly stratified. Generally bouldery and coarser grained to the east and progressively finer grained to the west side of the area but contains some gravel layers throughout most of the area. Thickness generally less than 100 feet; locally, it may be as great as 150 feet. Gravel and sand beds are permeable but are mostly above regional water table and are unsaturated or yield only small amounts to wells from perched water. Where permeable beds extend below the regional water table, they yield moderate to large quantities to wells.



PIEDMONT DEPOSITS

Mostly silt and clay, but includes some sand gravel, and mudflow deposits. Underlies the Kelso slope and old upland valleys to depths generally less than 100 feet. Generally non-water bearing or yields only small quantities to wells and springs from perched water.

BORING LAVA

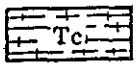
Mostly gray massive basaltic lava; contains lesser amounts of tuff and volcanic cinders. The lava occurs mostly as flow layers but includes sills and feeder dikes. Total thickness ranges from 5 to about 800 feet. Generally is above regional water table and yields only small to moderate amounts to wells and springs from perched water.

TROUTDALE FORMATION

Unconsolidated and partly consolidated gravel, sand, silt, and clay, commonly in the form of well-indurated sandy conglomerate. Thickness generally more than 100 and locally more than 800 feet. Layers of permeable gravel and sand below regional water table yield moderate to large amounts of water to wells and springs; similar beds above regional water table yield smaller less dependable supplies from perched ground water.

SANDY RIVER MUDSTONE

Principally mudstone, claystone, and partly consolidated silt and clay but includes minor beds of sand and gravel. Total thickness is at least 900 and probably more than 1,000 feet. Generally impermeable and non-water bearing, but a few wells obtain small amounts of water from local layers of sand and gravel.



COLUMBIA RIVER BASALT

Dark basalt in accordantly layered flows that range from about 10 to 150 feet in thickness; total thickness 800 feet or more. Permeable zones at contacts between some flows yield moderate to large amounts of water to wells that penetrate the basalt below the regional water table and yield lesser amounts to springs and wells from perched ground water above the water table.

(geology after Hogenson and Foxworthy, 1965)

Legend for Figure 4.

ductivity of the older rocks and the differences in the horizontal and vertical hydraulic conductivities of the Columbia River Basalt.

Superimposed on this regional system are intermediate and local ground-water flow systems. The Cascade foothills and other isolated hills bordering and within the study area may be sources of recharge to the intermediate flow system. Ground-water movement in the intermediate system probably takes place in the upper portion of the previously described Columbia River Basalt and the Sandy River Mudstone, as well as in the deeper portions of the fluvial sediments of the Troutdale Formation. Major surface drains receiving ground water from the regional and intermediate flow systems are the Sandy, Willamette, Clackamas, and Columbia Rivers.

Within the study area, a local ground-water flow system can also be outlined. A local ground-water divide is formed by coalescing ground-water mounds under Mt. Tabor, Kelly, Powell, and Grant Buttes. Precipitation is the major natural source of recharge to the local flow system. The ground-water divide is underlain by the previously described Boring Lava and associated remnants of the Troutdale Formation. The generally low hydraulic conductivity of the lava results in a great deal of surface runoff to the adjoining terrace. Much of the runoff toward the north apparently infiltrates into the fluviolacustrine materials as well

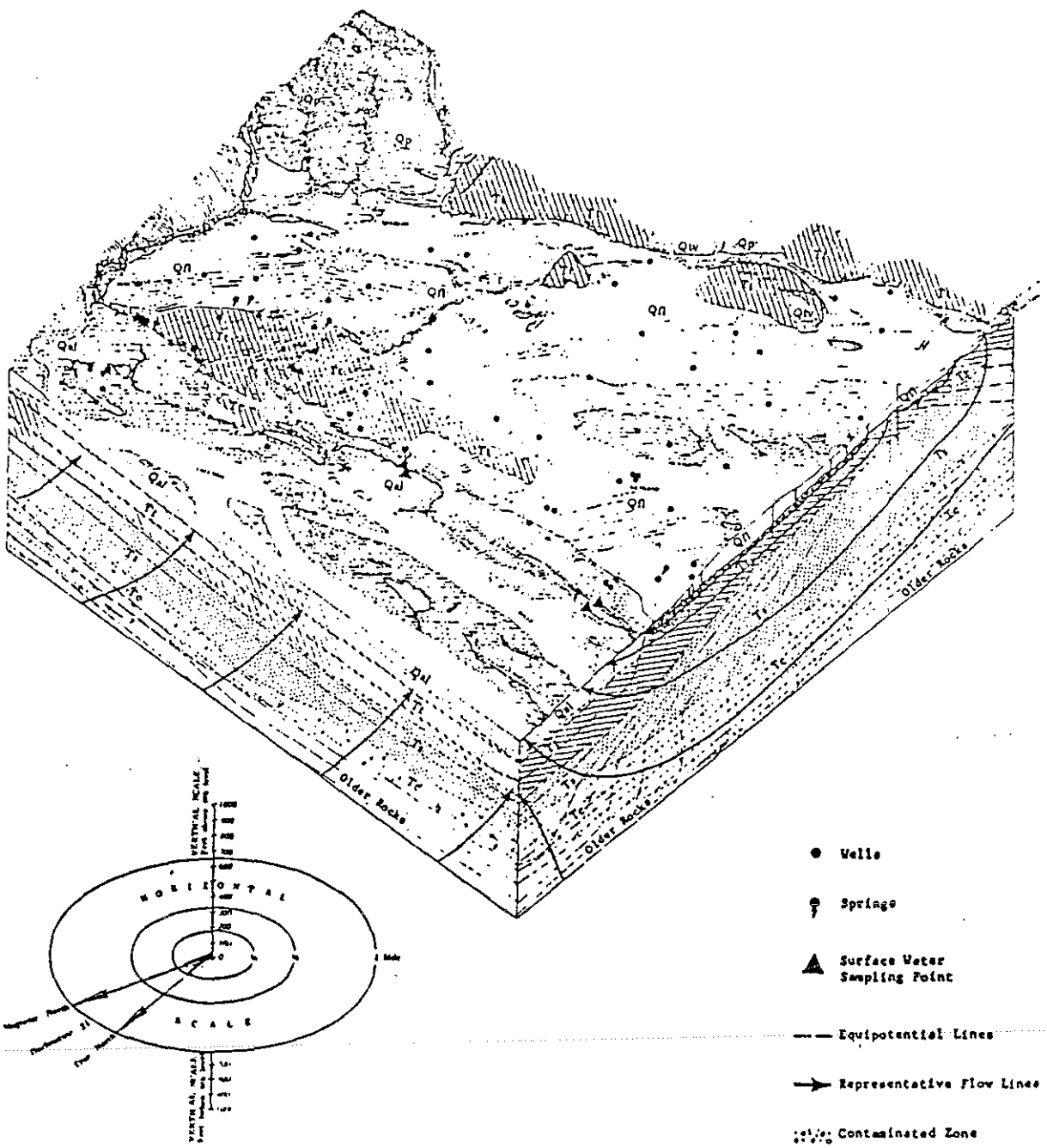


Fig. 5. Representative flow lines and contaminated ground-water zone in East Portland.

as the Troutdale Formation underlying the terrace and is a source of recharge to the local flow system. Flow from these recharge areas is directed downward and away from this divide toward Johnson Creek on the south and the Portland terraces and Columbia Slough South Arm on the north. Johnson Creek may provide some recharge to the ground-water flow system. Most local flow is apparently restricted to the saturated portions of the fluvio-lacustrine materials and the upper part of the Troutdale Formation.

A few representative flow lines have been added to the ends of the basic isometric diagram of the study area on Figure 5. These lines are added in order to qualitatively show the relative directions of ground-water movement in the area. Contaminated

ground-water zones are also outlined on this Figure.

Hogenson and Foxworthy (1965) have also described some perched ground-water bodies within the unsaturated zone of the fluviolacustrine material and the Troutdale Formation. Other presumably perched ground-water discharges in springs and seeps in the Boring Lava at several of the buttes in the area.

Many authors, recently including Schwartz and Domenico (1973), have discussed natural water quality patterns in ground-water flow systems. Hughes and Cartwright (1972) generally, and Freeze (1972) more specifically, have pointed out some of the ramifications of waste disposal relative to ground-water flow systems.

Bouma *et al.* (1972) and Dudley and Stephenson (1973) have outlined some water quality problems associated with the subsurface disposal of domestic wastes. Their studies, like most others, are primarily concerned with waste disposal in areas with shallow water tables and/or high hydraulic conductivities. They have pointed out the practicality of using nitrate concentrations as a measure of chemical contamination resulting from the subsurface disposal of domestic wastes. Domestic sewage is often characterized by high concentrations of nitrogen compounds including ammonia, organic nitrogen, and minor amounts of nitrate and nitrite. However, during the disposal and percolation of the effluent through unsaturated aerobic materials, rapid nitrification of the effluent takes place and that effluent reaching the ground-water table contains nitrogen almost exclusively as nitrate. Nitrogen serves as a good tracer because it is not generally susceptible to hydrogeochemical retardation, such as adsorption by clays; it mixes well; and it travels with ground water. Therefore, the nitrate content of the ground water can be used as an indicator of its degree of contamination.

Extensive development and its attendant disruption of natural drainage, paving of recharge areas, and subsurface disposal of wastes has resulted in some changes in the water quality within the study area. In 1965 it was estimated that 8 mgd (34,400 m³/day) of domestic waste water was being disposed of via subsurface systems in the study area (Moffatt and Taylor, 1965). Since that time, there has been an increase in population in the area and perhaps as much as 10 mgd (38,000 m³/day) of waste water is disposed of in subsurface systems. These disposal systems include standard septic tank and drainfields, seepage beds, and cesspools. Perhaps 80 percent of the systems are cesspools (see Figure 2). The cesspool disposal in the fluviolacustrine deposits results in very little loss of the waste water to evapotranspiration and consequently most of the liquid percolates downward as local recharge to the water table. This takes place even though the depth to water ranges from 100 to 200 feet (30 to 60 m) in the terrace area. As this contaminated local recharge reaches the water table, it migrates a short distance downwards, through the water table, and then merges with the local flow system. The depth to which the contaminated recharge will penetrate the water table is primarily dependent upon its hydraulic potential and the vertical hydraulic conductivity of the substrata. From this point the primary means of movement for the contaminated recharge is convective transfer, that is with the ground water. Some dispersion of the contaminant can be expected as it randomly interacts with particles in its flow path.

In the study area, it appears that only those wells which tap the upper portions of the saturated zone, local flow system, have significant nitrate contamination. This indicates that as a result of the position of the local flow system above the deeper intermediate and regional systems and the vertical/horizontal differences in hydraulic conductivity, the contaminated ground water is effectively buoyed up. Figure 6 is a plot of the elevation of the

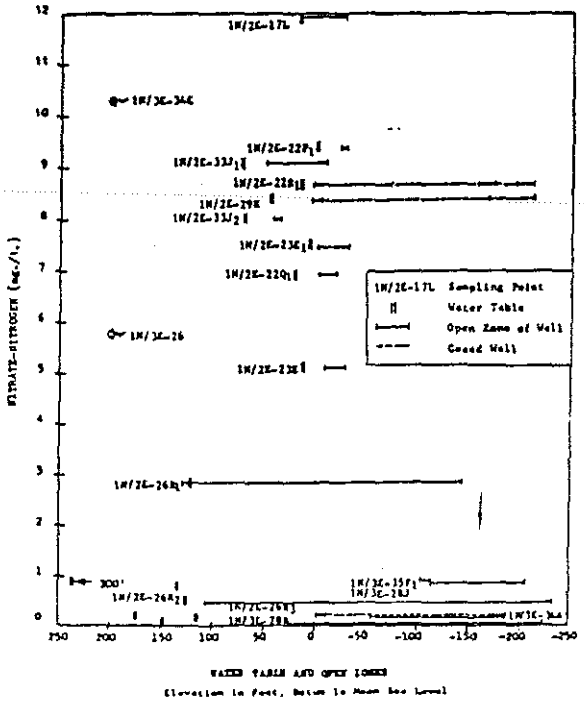


Fig. 6. Nitrate-nitrogen concentrations relative to water table and open-zone elevations in selected wells and springs, July 1974.

Table 1. East Portland Water Quality Data

WELL	OWNER	SOURCE[1]	LABORATORY[2]	DATE	TEMPERATURE °C	pH	CONDUCTANCE (mc mho/cm)	TOTAL DISSOLVED SOLIDS[3]	ALKALINITY (Total as $CaCO_3$)	HARDNESS[4] (as $CaCO_3$)	CHLORIDES[5]	PHOSPHATES (Soluble Ortho)	SULFATES[6]	NITRATE-NITROGEN[7]
1N/2E-17L	Calcagno	Well	a	7/19/74	13.5	7.0	285	206	53	90.1	7.3	0.33	14.5	11.[illegible]
22P1	Hopwood	Well	a	7/19/74	12.0	7.1	248	180	47	74.4	6.8	0.30	10.6	9.3[illegible]
22Q1	Parkrose #1	Well	a	3/3/55	-	7.1	-	195	47	83.0	7.5	0.30	8.5	-
			a	3/9/55	-	7.1	-	195	-	135.0	7.0	-	8.5	-
			b	12/8/58	-	6.9	-	179*	57	70.0	8.2	-	7.0	-
			a	7/17/74	14.0	7.4	260	190	41	48.3	7.8	0.48	3.6	6.8[illegible]
22R1	Fremont School	Well	a	7/18/74	12.5	7.2	248	194	47	78.1	6.2	0.28	11.2	8.6[illegible]
23E1	Parkrose #2	Well	c	3/16/72	-	7.3	-	188	54	27.0	11.0	-	14.0	5.4[illegible]
			a	7/17/74	12.0	7.6	254	190	45	74.8	7.3	0.35	11.7	7.4[illegible]
23E	Parkrose #3	Well	a	7/17/74	12.0	7.2	248	189	44	76.0	6.8	0.34	12.1	5.1[illegible]
26R1	Richland #1	Well	a	10/27/60	-	7.9	165	143*	81	88.2	3.4	0.32	2.2	0.11
			a	3/10/71	-	7.2	144	129*	73	68.2	2.2	0.48	3.4	1.5[illegible]
			a	7/16/74	12.0	7.4	206	-	72	72.3	2.1	0.52	2.5	2.8[illegible]
26R2	Richland #2	Well	d	4/22/58	11.1	7.2	167	151	101	72.0	2.0	-	4.1	0.00
			a	10/27/60	-	8.0	190	148	96	91.2	3.6	0.41	2.2	0.1[illegible]
			a	3/10/71	-	7.4	165	130*	89	75.2	1.9	0.56	2.5	0.24
			a	7/16/74	12.0	7.8	225	142	92	77.7	1.6	0.66	1.4	0.44
26R3	Richland #3	Well	a	10/27/60	-	8.0	191	142	96	92.0	4.2	0.28	1.4	0.15
			a	3/10/71	-	7.9	182	129*	102	82.0	2.0	0.46	3.4	0.17
			a	7/16/74	13.0	8.0	244	142	103	83.9	3.1	0.47	1.5	0.16
26R4	Richland #4 (Abandoned)	Well	a	10/27/60	-	8.0	162	133	71	72.2	4.2	0.28	6.0	0.60
29K	City of Portland Bureau of Parks	Well	a	7/19/74	12.5	7.1	267	192	55	88.8	5.2	0.25	15.4	8.3[illegible]
33J1	Russellville #1	Well	a	1/5/66	-	7.3	210	204*	49	85.0	7.4	0.58	6.5	5.7[illegible]
			a	7/18/74	13.0	7.5	279	213	63	93.4	5.7	0.50	8.7	9.0[illegible]
33J2	Russellville #2	Well	a	1/5/66	-	6.9	205	184*	53	83.4	6.3	0.69	5.5	4.7[illegible]
			a	7/18/74	12.5	7.3	279	194	61	90.5	6.2	0.30	9.2	8.0[illegible]
1N/3E-21G1	Latter Day Saints,	Well	d	6/7/54	-	7.4	423	281	231	163.0	9.0	-	20.0	1.2[illegible]
23B1	Bonneville Power Ad.	Well	d	6/7/54	17.2	7.8	726	454	132	158.0	156.0	-	7.8	0.4[illegible]
23H1	Reynolds Metal Co. (4)	Well	d	6/7/54	12.2	-	184	152	87	67.0	11.0	-	4.8	1.0[illegible]
23K1	Reynolds Metal Co. (12)	Well	e	9/2/52	-	8.0	-	153	-	34.0	6.0	-	-	-
26	Troutdale Spring	Spring	a	2/16/61	-	7.9	155	151	35	68.9	10.5	0.12	12.4	3.60
			a	1/5/66	-	7.4	169	194*	28	57.0	7.3	0.29	9.0	5.70
			a	7/16/74	12.0	7.1	213	152	40	61.2	4.7	0.30	11.6	5.74
26N1	Multnomah Co. Farm	Well	d	2/2/58	12.2	7.9	182	130	106	78.0	2.2	-	1.6	3.30
34D1	Multnomah Kennel Club	Well	d	5/5/58	14.4	7.9	182	155	115	73.0	2.0	-	3.3	0.00
27M1	Fairview #3	Well	a	2/14/73	-	7.8	229	147*	94	87.4	2.1	0.17	2.6	0.00
28R	Fairview #4	Well	a	2/16/73	-	7.7	222	150*	93	82.0	2.1	0.10	3.5	0.03
			a	7/16/74	13.0	8.0	244	144	101	84.3	2.6	0.38	1.9	0.06
28J	Fairview #5	Well	c	6/18/73	-	7.7	-	170	95	-	4.5	-	2.0	0.82
			a	7/16/74	14.0	8.2	241	147	100	84.7	2.1	0.31	1.2	0.09
1N/3E-34A	Woodvillage #1	Well	a	6/16/54	-	8.1	-	144*	101	79.0	1.9	0.50	2.4	-
			a	1/5/66	-	7.6	189	166*	77	77.4	4.9	0.53	1.0	0.02
			a	7/16/74	13.5	7.9	231	141	95	80.6	2.6	0.50	1.4	0.20
35F	Woodvillage #2	Well	c	12/30/69	-	8.1	-	120	101	74.6	3.7	-	3.4	0.25
			a	7/16/74	13.0	8.0	238	123	91	74.0	3.1	0.10	2.5	0.90
34E	Kennel Club	Spring	a	7/19/74	18.5	8.0	211	157	26	61.6	3.6	0.02	12.1	10.30
1N/1E-13C		South	a	8/18/71	20.5	-	-	-	-	-	-	-	-	-
		Arm	a	5/2/72	-	-	261	-	-	-	-	<0.01	-	4.20
		Slough @	a	6/19/72	20.0	8.2	259	234*	92	119.5	6.4	0.01	22.2	3.60
		N.E.33rd	a	7/5/72	21.0	8.5	324	236*	90	122.1	7.5	0.02	21.1	5.90
			a	8/2/72	18.0	6.9	320	235*	88	108.1	6.1	0.39	18.6	3.90
			a	9/12/72	17.0	7.6	324	233*	86	116.8	7.3	0.03	24.6	3.60
			a	11/17/72	10.0	7.1	273	-	-	-	5.0	0.19	-	6.00
			a	9/4/73	19.0	7.6	325	233*	93	116.0	8.2	<0.01	22.2	4.50
			a	7/18/74	17.0	7.1	322	209	85	113.2	4.7	0.04	16.4	4.00
1N/2E-14N		Columbia	a	8/18/71	22.0	6.9	183	199*	73	76.0	5.2	<0.01	11.1	1.40
		Slough @	a	5/2/72	15.0	6.9	206	166*	61	72.0	4.9	0.01	10.8	2.40
		N.E.	a	6/19/72	19.5	7.6	192	183*	69	87.3	7.8	0.05	13.3	2.90
		122nd	a	7/5/72	-	-	-	-	-	-	-	-	-	-
			a	8/2/72	20.0	7.1	230	192*	78	75.1	5.5	0.09	10.5	0.80
			a	9/12/72	16.0	7.1	236	200*	71	77.2	7.0	0.12	11.2	1.10
			a	11/17/72	-	-	200	-	-	-	-	-	-	-
			a	9/4/73	21.0	7.5	208	191*	65	69.2	6.9	0.02	9.4	1.60
			a	7/18/74	18.0	7.1	223	130	44	72.3	4.2	0.03	5.4	1.71
1N/2E-17G		South	a	8/18/71	20.0	7.3	-	-	-	-	-	-	-	-
		Arm	a	5/2/72	17.0	7.1	292	238*	72	95.8	9.0	0.01	17.3	5.30
		Slough @	a	6/19/72	21.0	7.8	-	-	-	-	-	-	-	-
		N.E.	a	7/5/72	22.0	8.1	304	224*	76	101.0	10.1	0.06	15.3	6.60
		Alderwood	a	8/2/72	17.0	7.1	259	215*	72	89.3	9.2	0.29	15.9	5.50
		Drive	a	9/12/72	15.0	7.0	293	218*	68	93.7	8.7	0.26	15.0	4.40

Table 1. (continued)

WELL	OWNER	SOURCE[1]	LABORATORY[2]	DATE	TEMPERATURE °C	pH	CONDUCTANCE (mc mho/cm)	TOTAL DISSOLVED SOLIDS[3]	ALKALINITY (Total as $CaCO_3$)	HARDNESS[4] (as $CaCO_3$)	CHLORIDES[5]	PHOSPHATES (Soluble Ortho)	SULFATES[6]	NITRATE-NITROGEN[7]
		s	a	11/17/72	-	-	-	-	-	89.7	-	-	-	-
		s	a	9/4/73	18.0	7.0	293	212*	70	-	10.3	0.11	15.4	6.80
		s	a	7/18/74	17.5	6.9	298	195	70	91.3	7.8	0.23	11.3	6.89
1N/2E-22D		South	a	8/18/71	14.0	6.7	195	188*	46	74.9	6.6	0.16	12.7	5.30
		Arm	a	5/2/72	13.0	6.5	225	173*	49	74.2	6.5	0.29	11.9	5.60
		Slough @	a	6/19/72	14.0	6.9	190	171*	50	76.3	7.0	0.24	13.3	3.50
		N.E.	a	7/5/72	-	-	-	-	-	-	-	-	-	-
		122nd	a	8/2/72	14.0	6.8	228	198*	49	81.0	7.6	0.33	21.6	5.10
			a	9/12/72	12.0	6.3	257	193*	43	79.2	12.4	0.25	13.8	3.60
			a	11/17/72	11.0	6.4	204	-	-	-	6.8	0.33	-	7.00
			a	9/4/73	15.0	6.4	236	185*	50	72.4	9.1	0.17	12.6	7.20
			a	7/18/74	14.0	6.6	242	181	47	74.0	5.7	0.31	8.7	8.50
1N/3E-20N		Columbia	a	8/18/71	20.0	7.5	200	205*	80	78.8	6.8	<0.01	8.8	0.64
		Slough @	a	5/2/72	15.0	7.1	190	166*	54	64.8	4.7	0.04	10.8	2.00
		N.E.	a	6/19/72	18.5	7.4	181	178*	54	78.7	5.6	0.05	9.6	1.20
		185th	a	7/5/72	-	-	-	-	-	-	-	0.04	-	-
			a	8/2/72	19.0	7.1	242	190*	85	79.9	6.1	-	8.6	1.00
			a	9/12/72	17.0	7.6	238	220*	78	84.8	6.2	0.20	9.4	0.61
			a	11/17/72	9.0	7.1	188	-	-	-	4.7	0.02	-	2.30
			a	9/4/73	20.0	7.1	216	178*	74	70.8	7.3	0.11	9.7	0.87
			a	7/18/74	20.0	8.6	217	107	72	73.6	4.2	0.04	5.2	1.14

1. w - well; s - spring; sl - slough
2. a - Department of Environmental Quality; b - Pittsburg Testing; c - Charlton Lab; d - U. S. Geological Survey; e - Reynolds Metal Co.
3. U.S. Public Health recommended maximum 500 mg./l.; total solids where *
4. Noncarbonate where *
5. U.S. Public Health recommended maximum 250 mg./l.
6. U.S. Public Health recommended maximum 250 mg./l.
7. U.S. Public Health maximum allowable 10 mg./l.

open zone or zones of some wells in the study area versus the NO_3-N concentrations of water samples collected during July of 1974. It appears that those wells which are in the unsewered portion of the study area, developing water primarily from the upper portion of the local flow system, are significantly higher in NO_3-N, that is having concentrations above 5 milligrams per liter (mg/l). Samples from these wells ranged as high as 11.86 mg/l of NO_3-N. This is in excess of the Public Health Service maximum allowable concentration for drinking water of 10 mg/l of NO_3-N. On the other hand, wells from the unsewered areas and deeper wells, either not developing water from the upper portion of the flow system and/or mixing water from deeper portions of the aquifer generally have NO_3-N concentrations of less than 3 mg/l and most are less than 1 mg/l (see Figure 6 and Table 1).

Other water quality parameters were also considered in the study area. Figure 7 is a plot of nitrate-nitrogen versus sulphate ion concentrations in spring and well-water samples. Although more data points at particular sampling stations are necessary for valid statistical analysis, a general trend showing increased sulphate concentrations with increased NO_3-N concentrations is apparent. Soluble orthophosphate ion concentrations were also measured in well, spring, and surface-water samples. However, the susceptibility of the phosphate ions to sorption has apparently resulted in low levels of this constituent.

Some sampling points outside the unsewered area shown on Figure 3 have also been relatively high in NO_3-N concentrations. The most obvious of these are the Troutdale and Kennel Club springs, 1N/3E-26 and 1N/3E-34E, respectively. The Troutdale spring is immediately downgradient from a small area, about one square mile, which

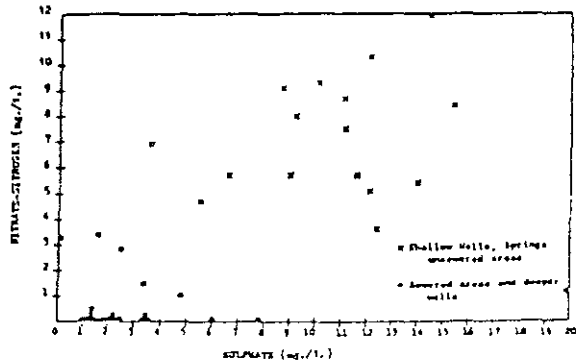


Fig. 7. Nitrate-nitrogen versus sulphate ion concentrations in East Portland wells and springs.

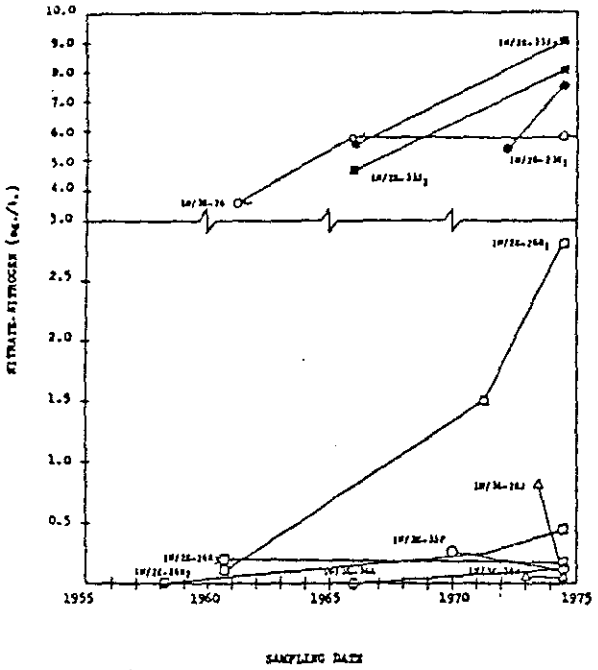


Fig. 8. Trend of temporal changes in nitrate-nitrogen concentrations.

has been sewered in the past 2 to 5 years. Figure 8 shows that the NO_3-N concentration in samples taken from the spring did not increase significantly between the 1966 and 1974 sampling dates. The Kennel Club spring is in a small as yet unsewered, but proposed to soon be sewered, area. Contamination problems may be complicated in these areas by the previously mentioned locally perched ground-water bodies described by Hogenson and Foxworthy (1965).

Although abundant data is not available, there appears to be a temporal change or historic increase in the NO_3-N content of the ground water in the study area. Figure 8 shows this increase graphically. There are not sufficient data points to quantify the contaminant increase, but the trend is apparent. Water samples from shallow wells in the unsewered area continue to increase in NO_3-N concentrations while the wells outside the unsewered area, deeper wells, and/or wells developing from several aquifers remain relatively low in NO_3-N content.

COLUMBIA SLOUGH SYSTEM

As described earlier, the Columbia River is a main surface drain for the regional and intermediate ground-water flow systems. Columbia Slough and its South Arm receive recharge not only from the Columbia River and bank storage, but also from the ground-water flow system. The dynamic hydraulic balance between the river, slough, and ground-wate flow system results in seasonal fluctuations in the spring discharge. Innumerable small seeps and springs with measured discharges ranging from less than one to about 700 gpm (0.06 to 44 l/sec) are located along the sloughs.

South Arm Slough is situated upgradient from the Columbia Slough, with respect to the water table. As such it acts as a cutoff or interceptor drain to the upper portion of the water table and picks up much of the shallow local ground-water discharge. This is reflected in the water quality data. During the most recent, July 1974, sampling period, 9 well-water samples apparently taken from the upper portion of the water table in the unsewered area had NO_3-N concentrations ranging from 5.1 to 11.86 mg/l and averaging 8.3 mg/l. Six samples taken from the deeper water wells in the unsewered area and from the sewered area ranged from 0.06 to 0.90 mg/l of NO_3-N with a mean value of 0.31 mg/l. Three samples taken from South Arm ranged from 4.7 to 7.8 mg/l of NO_3-N with a mean value of 6.1 mg/l. At the same time 2 samples taken from the downgradient Columbia Slough had concentrations of 1.14 and 1.71 mg/l. The distance between the South Arm and Columbia Slough sampling points is only about 1,000 feet (300 m) (see Figure 4).

CONCLUSIONS AND RECOMMENDATIONS

Subsurface disposal of domestic waste in central Multnomah County has contaminated the ground-water resource. Nitrate-nitrogen, one of the end products of decomposed domestic waste, was found to be significantly higher in content within the unsewered area than in adjacent sewered areas. This was particularly apparent in wells which develop water from only the upper portion of the saturated zone. A historic increase in the NO_3-N concentration of the ground water in the unsewered area is apparent.

This study determined that the subsurface disposal of waste also affected the quality of surface water adjacent to the study area. South Arm Slough, whose primary source is shallow ground-water discharge, was also found to be significantly high in NO_3-N content, especially in those areas downgradient from the unsewered area.

Sewerage of the area is imperative if the quality of the ground water is to be maintained or improved. As an interim precaution, water wells developing drinking water from the upper portion of the aquifer should mix contaminated well water with water having a relatively low NO_3-N content.

This can be accomplished by adding imported water prior to its distribution or deepening wells in order to mix low NO_3-N water from the uncontaminated portion of the saturated zone with shallower contaminated ground water.

ACKNOWLEDGMENTS

The authors wish to thank the staff of the Oregon Department of Environmental Quality and the Oregon State Engineer for their assistance in the development of this paper. Also acknowledged is Jim Hickman of the State Engineer's Office for his work on the included graphics.

REFERENCES

Bouma, J., W. A. Ziebell, W. C. Walker, P. G. Olcott, E. McCoy, and F. D. Hole. 1972. Soil absorption of septic tank effluent. University of Wisconsin Ext., Informational Circular No. 20, 235 pp.

Dudley, J. G. and D. A. Stephenson. 1973. Nutrient enrichment of ground water from septic tank disposal systems. Upper Great Lakes Regional Commission, Inland Lake Renewal and Shoreland Demonstration Project Rept., 131 pp.

Freeze, R. A. 1972. Subsurface hydrology at waste disposal sites. IBM Jour. Res. Develop. v. 16, pp. 117-129.

Hogenson, G. M. and B. L. Foxworthy. 1965. Ground water in the East Portland area, Oregon. U.S. Geol. Survey Water-Supply Paper 1793, 78 pp.

Hughes, G. M. and Keros Cartwright. 1972. Scientific and administrative criteria for shallow waste disposal. Civil Engineering ASCE. v. 42, no. 3, pp. 70-73.

Moffatt, Nichol and Taylor, Consult. Engrs. 1965. Master plan of sewerage in East Multnomah County. 110 pp. + Apps. A-F.

Schwartz, F. W. and P. A. Domenico. 1973. Simulation of hydrochemical patterns in regional ground-water flow. Water Resources Res. v. 9, no. 3, pp. 707-719.

Treasher, R. C. 1942. Geologic map of the Portland area, Oregon. Oregon Dept. Geology and Mineral Indus. map.

Trimble, D. E. 1957. Geology of the Portland quadrangle, Oregon-Washington. U.S. Geol. Survey Quad Map GQ–104.

Trimble, D. E. 1963. Geology of Portland, Oregon, and adjacent areas. U.S. Geol. Survey Bull. 1119, 119 pp.

DISCUSSION

The following questions were answered by H. R. Sweet after delivering his talk entitled "Subsurface Sewage Disposal and Contamination of Ground Water in East Portland, Oregon."

Q. by Rein Laak. *Was surface runoff evaluated?*
A. On the isometric block diagrams I pointed out that there is a paucity of surface runoff from the terrace area, primarily because of the high hydraulic conductivity of the fluviolacustrine materials underlying the terrace. Pavement runoff which may have affected the NO_3-N content in the study area of the slough system was not a factor because all surveys were conducted under dry weather conditions.

Q. by R. G. Knight. *What was the difference between horizontal and vertical permeabilities?*
A. Because of the stratification in the fluviolacustrine materials and in the Troutdale formation, it does not seem unreasonable to assume that the horizontal permeability or hydraulic conductivity is at least an order of magnitude greater than the vertical. In the deeper Columbia River Group, this difference may be as great as several orders of magnitude.

Q. by Dennis Gray. *Were cesspools used without septic tanks?*
A. Generally, yes.

Q. by Stephen Ragone. *What conclusive studies can you cite that show nitrogen in excess of 10 mg/l (as N) is a health hazard?*
A. The U.S.P.H.S. established 10 mg/l NO_3-N as the maximum allowable limit for drinking water because of its potential health hazard to infants. For further reference to the use of this limit and the rationale behind it, I would suggest: Winton, Tardiff, and McCabe, 1971, Nitrate in Drinking Water: Feb., Jour. A.W.W.A., pp. 95-99.

Q. by John Wilson. *Is 8 mg/l NO_3-N high? Do you need to import water to dilute concentrations this low?*
A. The title of our paper indicates contamination, not pollution. In this case, 8 mg/l is high with respect to background levels of less than 1 mg/l. However, our main point is that there is a temporal increase in NO_3-N concentrations in the area and we hope that this increase will be halted before a "pollution" problem develops. The second part of

A study was undertaken to determine whether the present public health specification for the nitrate content in tap drinking water is too arbitrary. Results are not definitive, but it appears that the present recommended nitrate limit provides a valid safety margin when the water is used for infant intake.

E. F. Winton, R. G. Tardiff, and L. J. McCabe

NITRATE IN DRINKING WATER

NITRATE in drinking water was first associated in 1945 with a temporary, but sometimes fatal, blood disorder in infants. Since then, approximately 2,000 cases of this disease, infantile methemoglobinemia, have been reported from North America and Europe [1] and about 7–8 per cent of the infants died.[2-4] Because the disease is not required to be reported, we have no idea of its true incidence, but one investigator estimates that the reported cases represent only 10 per cent of the ones observed.[3]

In an effort to prevent this disease, public-health officials have set recommended limits for nitrate in water that is to be used for infant feeding. When limits such as the nitrate recommendation are exceeded in public water supplies, it is the water suppliers along with local health officials who are out front in the "firing line."

Nitrate, Nitrite, and Methemoglobin

A basic knowledge of the development of methemoglobinemia is essential to understand the rationale behind protective measures (Fig. 1). The development of the disease, largely confined to infants less than three months, is caused by the bacterial conversion of the relatively innocuous nitrate ion to nitrite. Nitrite then converts hemoglobin, the blood pigment that carries oxygen from the lungs to the tissues, to methemoglobin. Because the altered pigment no longer can transport oxygen, the physiologic effect is oxygen deprivation, or suffocation.

There are several physiological and biochemical features of early infancy that explain the susceptibility of infants that are less than three months of age to this disorder. First, the infant's total fluid intake per body weight is approximately three times that of an adult's.[5] In addition, the infant's incompletely developed capability to secrete gastric acid allows the gastric pH to become high enough (pH of 6–7) to permit nitrate-reducing bacteria to reside in the high gastrointestinal tract. From this position, the bacteria are able to reduce the nitrate before it is absorbed into the circulation.[6] The predominant form of hemoglobin at birth, hemoglobin F (fetal hemoglobin), is more susceptible to methemoglobin formation than the adult form of Hemoglobin A,[7] and this fact further predisposes the infant. Finally, there is decreased activity in the enzyme (NADH-dependent methemoglobin reductase) responsible for the normal methemoglobin reduction.[8]

The variables involved in the development of a case of methemoglobinemia can be grouped into (1) factors that influence dose of NO_3^-, (2) factors that influence the bacterial reduction of nitrate to nitrite, and (3) factors involved in the biochemical eqilibrium of hemoglobin and methemoglobin. Control over any one of the groups of variables would reduce the incidence or even prevent the disease. But from a practical standpoint, preventive measures are centered on factors that determine the dose of nitrate. Because the level of nitrate in drinking water is the initial factor determining dose, the recommended limit for nitrate in drinking water is of prime importance in preventing the disease.

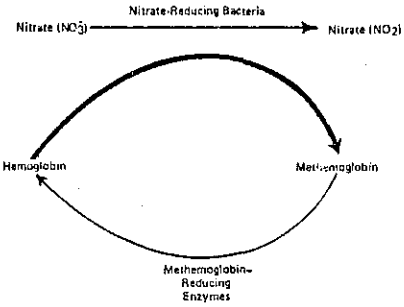


Fig. 1. Basic Reactions in the Development of Methemoglobinemia from Nitrate in Water

Ideally, the most appropriate recommended limit would be one that offers maximum protection to infants but does not impose unnecessary, stringent burdens on water suppliers or owners of private wells. Of the number of ways to determine how much protection is offered at various levels of nitrate in water, three will be discussed.

Retrospective Epidemiology

The retrospective epidemiologic method has been used most extensively and consists of collecting reported cases of infantile methemoglobinemia and noting the level of nitrate in the water associated with each case. In 1962, Sattelmacher [3] compiled all the reported cases from 14 different countries. Of the 1,060 cases that he collected, nitrate levels were recorded in only 467 (44.0 per cent). Of these 467, 10.5 per cent were associated with nitrate concentrations that registered less than 100 mg/l H_2O; 89.5 per cent were associated with concentrations over 100 mg/l (Table 1).

In another retrospective study, Simon [4] collected by questionnaire 745 cases that had occurred in Germany from 1956 to 1964. Of the 249 cases for which nitrate data were recorded, 4.4 per cent of the cases were associated with water containing nitrate in an amount less than 50 mg/l, 11.8 per cent with nitrate between 50 and 100 mg/l, and the remaining 83.8 per cent with nitrate over 100 mg/l. In this series, 2.7 per cent of the 249 cases were associated with municipal water supplies (Table 2).

Retrospective studies such as these have been useful and to a large extent have been the bases for the USPHS recommended limit. These studies, however, have serious shortcomings. The main problem is that, because methemoglobinemia is so rare, one physician probably will not see more than a few cases; collections of

A paper presented on Jun. 23, 1970, at the Annual Conference, Washington, D.C., by E. F. Winton, M.D., R. G. Tardiff, Ph.D., and L. J. McCabe (Active Member, AWWA), all of the Bureau of Water Hygiene. [Q]

cases comprise observations of many different persons. The result is a lack of data uniformity. For example, some cases were not documented by methemoglobin determinations, whereas, in other cases, the possibility of exposure to methemoglobin-forming medicines was not ruled out. There are hereditary defects that reduce production of methemoglobin-reducing enzymes, which results in increased susceptibility to nitrite-methemoglobinemia. In cases that are associated with very low levels of nitrate in the water, it would be especially interesting to have information on the activity of these methemoglobin-reducing enzymes. Finally, the water for nitrate analysis is sometimes collected weeks or months after the disease occurs, and the nitrate content in that time can change considerably.[2] This situation compounds the determination problem because in some instances reproducibility is poor.

TABLE 1

Distribution of Reported Cases of Infantile Methemoglobinemia by Nitrate Concentration in the Water—Sattelmacher, 1962

	Reported Cases	Deaths	Nitrate Conc. in Water, mg/l					
			Unknown	Known	0–40	41–80	81–100	>100
Numerical	1,060	83	593	467	14	16	19	418
Per Cent	100	7.8	56.0	44.0	3.0*	3.4*	4.1*	89.5*

* Per cent of cases with nitrate concentration known.

TABLE 2

Distribution of Reported Cases on Infantile Methemoglobinemia by Nitrate Concentration in Water—Simon, 1964

	Reported Cases	Deaths	Nitrate Conc. in Water, mg/l				
			Unknown	Known	<50	50–100	>100
Numerical	745	64	496	249	11	29	209
Per Cent	100	8.6	66.5	33.5	1.4*	11.8*	83.8*

* Per cent of cases with nitrate concentration known.

TABLE 3

Method Used to Calculate the Hypothetical Dose of NO_3^- (mg/kg) Capable of Converting 10 Per Cent Hemoglobin (Hgb) to Methemoglobin (Mhgb)

1. Hgb/Body weight (gms/kg)
$$= \frac{\text{Hgb Concentration (gms/100 ml)} \times \text{Blood volume (ml)} \times 0.01}{\text{Body weight (kg)}}$$

2. NO_2^- (mg) to Convert 1 gm Hgb
$$= \frac{1 \text{ gmw } NO_2^-}{1 \text{ gmw Hgb}} = \frac{46{,}000 \text{ mg}}{68{,}000 \text{ gm}} = 0.7 \text{ mg } NO_2^-/\text{gm Hgb}$$

3. NO_2^-(mg/kgm) necessary to convert 10 per cent Hgb
$= 0.1 \times$ Hgb/Body weight (gm/kg) $\times$ 0.7 mg NO_2^-/gm Hgb

4. NO_3^-(mg/kgm) dose capable of converting 10 per cent Hgb—Mhgb
$= NO_2^-$(mg/kg)* $\times$ 1.7†

* From step (3).
† Correction for molar conversion to NO_3^- (1.35) and correction for 80 per cent efficiency of bacterial reduction (1.25) = 1.7.

TABLE 4

Hypothetical Dose of NO_3^- (mg/kg) Capable of Converting 10 Per Cent Hgb → Mhgb—by Age

Age	TBW, kg	Hgb, gm/100 ml	Blood Volume, l	Hgb/TBW gm/kg	NO_3^- (mg/kg) 10 per cent, Hgb–Mhgb	NO_3^- mg/kgm 10 per cent, Hgb–Mhgb	NO_3^-, mg/kg/24 hrs
Months							
1	3.6	16	500	22.2	1.6	2.7	16.2
2	4.5	12	550	14.7	1.0	1.7	10.2
3	5.4	11	600	12.2	0.9	1.5	9.0
5	6.8	11	750	12.2	0.9		
10	9.5	12	1,000	12.7	0.9		
Years							
3	14.1	13	1,500	13.8	1.0		
5	20.4	13	2,250	14.4	1.0		
Adult	70.0	14	6,300	12.6	0.9		

Hypothetical Approach

Hypothetical toxicology is another useful method for determining safe limits. In the example that follows, the hypothetical dose of NO_3^- (mg/kg body weight) capable of converting 10 per cent of the total hemoglobin to methemoglobin is calculated (Table 3). The 10 per cent methemoglobin level is chosen because it is at this level that the disorder first becomes clinically detectable, since the methemoglobin produces a slate-grey appearance, or "cyanosis." The hemoglobin concentration in the blood (gm/100 ml) in relation to total body weight (Hgb/BW) is calculated from (1) the hemoglobin concentration in the blood, (2) the total blood volume, and (3) the total body weight.[5-9]

Estimates made on the molar ratio of the NO_2^--hemoglobin reaction have varied from one mole NO_2^- for two moles hemoglobin,[10] to four moles NO_2^- for each mole of hemoglobin.[11] Although still a debated topic, on the basis of reports from several investigators,[12-14] a mole-to-mole ratio was chosen for this calculation. Corrected for molecular weight, 0.7 mg of nitrite should convert 1 gm of hemoglobin to methemoglobin. The amount of NO_3^-/kg capable of converting 10 per cent hemoglobin is then calculated from the Hgb/BW. The bacterial reduction of nitrate to nitrite has been estimated optionally to be 80 per cent.[15] Using this factor and correcting for molecular-weight difference of the two anions yields the hypothetical nitrate dose (mg/kg) capable of converting 10 per cent hemoglobin to methemoglobin (Table 4). The average dose calculated at various ages is approximately 2-mg NO_3^-/kg.

Because enzymes in the red cells continuously reduce methemoglobin, this dose must be delivered periodically to keep the methemoglobin level elevated. The rate of methemoglobin reduction in an infant is hard to evalu-

TABLE 5

The Variables That Determine the Dose of Nitrate

Total daily fluid intake (l) per body weight (kg) (TDFI): increases in hot, arid climate, or with fever.	
Per cent TDFI comprised of tap water, (per cent H_2O)	
Powdered formula: tap water comprises 90 per cent of TDFI	
Concentrated formula Evaporated milk	Tap water comprises 50 per cent of TDFI
Breast feeding "Ready-to-feed" formula	Tap water comprises 10 per cent of TDFI
Nitrate level of water (mg/l), (NO_3^-): Increases substantially with excessive boiling. (rule of thumb: 1 per cent increase/min boiling)	

Daily dose of NO_3^- (mg/kg) = TDFI (l/kg) × per cent H_2O × 100 × NO_3^- (mg/l).

[16] but for purposes of this calculation it is assumed that half of this nitrite-produced methoglobin can be reduced every 4 hr. This 4-hr interval corresponds approximately to the time between feedings, and if the 2-mg/kg NO_3^- dose is given with each bottle, it is theoretically possible that the infant will remain "barely blue." Based on a maximum of six feedings per day, a 4-hr dose of approximately 10–15 mg NO_3^-/kg is derived.

With so many assumptions, such calculated doses must be interpreted with caution. There are some variables that, for lack of data, have not been entered into the calculation. One such factor, the renal loss of NO_2^-, would make the calculated dose too low, whereas another, the increased susceptibility of fetal hemoglobin to methemoglobin formation, would tend to make the dose too high for the first few months. The hypothetical dose should be considered a very rough estimate and by itself cannot serve as a sound basis for a recommended limit.

Prospective Epidemiology

Although expensive and time consuming, the prospective epidemiologic method has the potential of yielding the most meaningful information. With this approach, a planned program of information collection is conducted in the real-life setting. Therefore, pertinent to the nitrate recommendation, the authors recently have conducted a study [17] to determine the dose of nitrate (mg/kg) that infants received from various concentrations of nitrate in the drinking water and to ascertain the minimum dose of nitrate that can produce detectable methemoglobin elevations.

The study, conducted in both southern California and central Illinois, involved 111 infants in an age group ranging from less than two weeks to six months. The mother of each infant was questioned about (1) fluid intake of the infant in the previous 24 hr, (2) method of formula preparation, (3) inclusion of any other source of nitrate in the diet (such as vegetables), and (4) administration of possible methemoglobin-forming medicines. The infant then was examined and weighed, and a sample of blood was obtained for analysis. In addition, a sample of water used in the preparation of formula was taken and analyzed quantitatively for nitrate and bacteria.

For each infant, the dose of nitrate received from water during the previous twenty-four hours was calculated. The variables that determined the dose were the total daily fluid intake per body weight (TDFI), the per cent of water comprising that intake, and the NO_3^- level in the water (Table 5). The TDFI is known to increase in hot climates [18] and with fever.* The per cent TDFI attributable to water intake varied greatly depending on feeding practices. The infants who were fed formula made with powder received about 90 per cent of their TDFI from tap water; ones fed formula made with concentrate or evaporated milk received about 50 per cent; and babies who were breast-fed or given "ready-to-feed" formulas usually received less than 10 per cent of TDFI from tap water. In a few cases, mothers boiled the water excessively before mixing it with the formula, increasing the nitrate concentration of the water by as much as 40 per cent. Considering the combined effect of all these variables (Fig. 2), a daily dose of over 10 mg/kg was obtained from water with nitrate as low as 50 mg/l.

In the study group, there were 63 infants who were exposed to less than 1.0 mg NO_3^-/kg, 23 infants exposed to between 1.0–4.9 mg NO_3^-/kg, twenty between 5.0–9.9 mg NO_3^-/kg, and five infants exposed to 10.0–15.5 mg NO_3^-/kg. There were three infants who appeared to have methemoglobin levels above normal due to nitrate in water. These infants were the three youngest of the five receiving a nitrate dose of over 10 mg/kg. The highest methemoglobin level (5.3 per cent compared to a normal range of 0–2.9 per cent, mean 1.6 per cent) found in a 30-day-old baby receiving 15.5 mg NO_3^-/kg from the water. When these infants were switched to low-nitrate water, their methemoglobin levels fell to within normal range. The infants had no signs of methemoglobinemia and also had no clinical

* Factors not measured in this study.

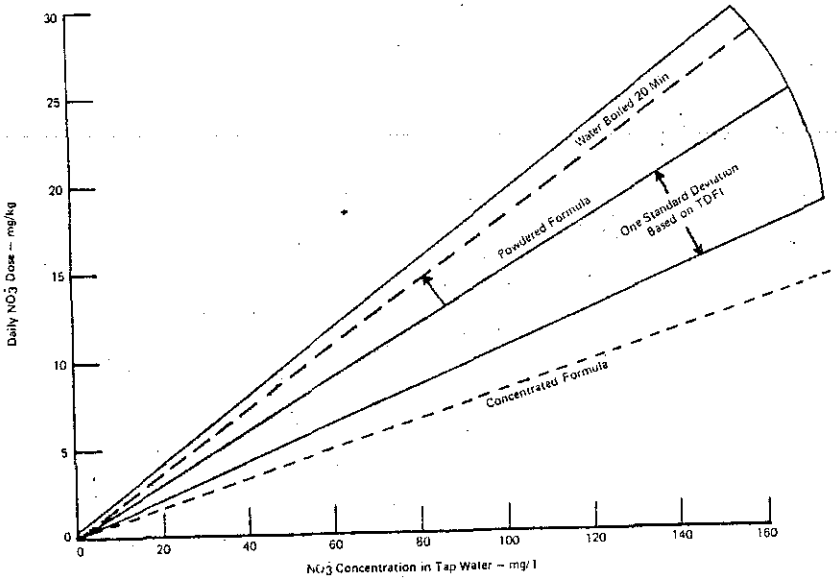


Fig. 2. Daily NO^{3-} Dose (mg/kg) of Infants up to Three Months of Age, as Influenced by NO^{3-} Concentration in Water (mg/l), Type of Formula, and Boiling of Water

evidence of a gastrointestinal upset. (Were gastrointestinal disturbances present, the children would be expected to be more susceptible to methemoglobinemia from nitrate.[6])

The Recommended Limit

The lack of reported cases of infantile methemoglobinemia in some locales with public water supplies exceeding the recommended limit, sometimes by a factor of two, had suggested that the 45-mg/l recommendation on nitrate was too conservative and placed an unnecessary burden on water suppliers. When the authors' review of the nitrate recommendation was initiated, it was hoped that a higher level might be reasonable from the public health standpoint. At this time, however, there is insufficient evidence to permit raising the recommended limit, and there are some indications that the current recommendation may offer the respectable safety-factor needed to cover all reasonable situations. A final decision awaits the results of further research.

Despite the shortcomings of the retrospective studies, it is hard to ignore evidence suggesting that some cases of infantile methemoglobinemia may have been associated with nitrate levels only slightly above, and even below, the current recommended limit.

The authors' studies suggest that daily NO_3^- doses of 10–15 mg/kg given to infants less than three months of age can cause above normal methemoglobin. Where powdered formula and excessively boiled water are used, water with as little as 50 mg NO_3^-/l yields this 10–15 mg/kg/day dose. Compounding the problem further are nitrate-rich vegetables given to the infants at an early age and common medicines capable of producing methemoglobinemia (e.g., the antipyretic, acetophenetidine; the expectorant, quaiacolate).

The development of a case of methemoglobinemia from nitrate in drinking water is a complicated process depending on a number of steps and many variables. At each step—whether the formula preparation, bacterial reduction of nitrate, or the reactions of nitrite with hemoglobin—there are variables that determine whether methemoglobinemia occurs or does not occur. The content of nitrate in drinking water is the initial, or index, variable in this disease process; and the lower the nitrate level, the more things have to go wrong at various steps before the disease develops. The USPHS recommendation for a limit on nitrate in drinking water is based on the premise that we have little control over feeding practices or any of the other variables. The fact that there are no reported cases from some areas with nitrate routinely exceeding the recommended limit may be explained by protective factors that have occurred incidentally. For example, in areas that had high nitrate levels in the water studied by the authors, use of powdered formula was quite rare. In addition, there is a trend toward increased use of "ready-to-feed" formulas, requiring no added water. In the study area with the highest water nitrate, the water was objectionable mainly because of hardness, and all who could afford to do so used bottled water.

The application of the recommended limit to public water supplies understandably creates problems. Water suppliers and public health officials not only are faced with enforcing a recommendation that some regard as arbitrary, but, if they do enforce it, new questions arise. There currently is no well-proven, relatively economic method for removing nitrate from drinking water, and enforcing the limit eventually requires warning parents to substitute an alternate source of water for tap water used in infant feeding.

Who assumes the responsibility for the warning? Within two water supplies in southern California, for example, a warning is printed on every water bill, and a further warning is sent to new parents from the county health department.

And who is responsible for supplying an alternate source of water? A citizen served by a public water supply may reason that the water utility has the obligation.

The long-range solution to the problem of nitrate in water, from both public health and ecologic standpoints, is served best by enforcing the recommended limit and by solving the immediate problems created.

However, because of the water industry's goal to supply high-quality water that can be used for any reasonable purpose, warnings on the water bill or the supply of an alternate source of water for infant feeding can only be viewed as undesirable, although necessary, temporary measures. Our energies should be directed to developing economic nitrate-removal processes and, most important, to preventing further nitrate pollution.

References

1. Shuval, H. I. Personal Communication.
2. Walton, E. Survey of Literature Relating to Infant Methemoglobinemia Due to Nitrate Contaminated Water. *Am. Jour. Pub. Health*, 41:986 (1951).
3. Sattelmacher, P. G. Methemoglobinemia from Nitrates in Drinking Water. *Schriftenreiche des Vereins fur Wasser Boden und Lufthygiene*, no. 21 (1962).
4. Simon, C.; Mazke, M.; Kay, H.; & Mrowitz, G. Uber Vorkommen, Pathogenes und Moglichkeiten zur Pronylaxe der durch Nitrit Verusachten Methamoglobinamia. *Z. Kinderheilk.*, 91:124 (1964).
5. Hansen, A. E. & Bennett, M. J. *Textbook of Pediatrics*. W. E. Nelson & W. B. Saunders Co. (1964), p. 109.
6. Cornblath, M. & Hartmann, A. F. Methemoglobinemia in Young Infants. *Jour. Pediat.*, 33:421 (1948).
7. Betke, K.; Kleihauer, E.; & Lipps, M. Vergleichende Untersuchungen uber die Spontanoxydation von Nabelschnur und Edwachsenenhamoglobin. *Ztschr. Kinderh.*, 77:549 (1956).
8. Ross, J. D. & Des Forges, J. F. Reduction of Methemoglobin by Erythrocytes from Cord Blood. Further Evidence of Deficient Enzyme Activity in Newborn Period. *Pediatrics*, 23:218 (1959).
9. Demenz, M. Van N. *Introduction to Anesthesia, The Principles of Safe Practice*. R. Dripps, J. E. Eckenhoff, and L. D. Vanda (Eds.).
10. Greenberg, L. A.; Lester, D.; & Haggard, H. W. Reaction of Hemoglobin and Nitrite. *Jour. Biol. Chem.*, 151: 665 (1943).
11. Harly, J. D. & Robin, H. The Effect of Nitrate Ion on Intact Human Erythrocytes. *Blood*, 20:710 (1962).
12. Stolk, J. M. & Smith, R. P. Species Differences in Methemoglobin Reductase Activity. *Biochem. Pharmacol.*, 15:343 (1966).
13. Van Slyke, D. D. & Vollmund, E. Studies of Methemoglobin Formation. *Jour. Biol. Chem.*, 66:415 (1925).
14. Meier, R. Methemoglobin Formation. (VII. Nitrite.) *Arch Exptl. Path. Pharmakol.*, 110:241 (1926).
15. Bodo, T. Uber alimentare Nitrat-Methamoglobinamien im fruken Saugleng-salter. *Mschr. Kinderheilk*, 103:8 (1955).
16. Ross, J. D. Personal Communication.
17. Winton, E. F.; Tardiff, R. G.; & McCabe, L. J. To be published.
18. Galagan, D. J.; Vermillion, J. R.; Nevitt, G. A.; Stadt, G. M.; & Dart, R. E. Climate and Fluid Intake. *US Public Health Report*, 72: 484 (1957).

E 31

E31

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

OF THE STATE OF OREGON

In the Matter of)
)
POLLUTED UNDERGROUND WATER AND THE POSSIBLE)
NEED FOR SEWERS IN MID-MULTNOMAH COUNTY)
)
)

STATEMENT, AFFIDAVIT AND EXHIBITS OF UNITED CITIZENS IN ACTION, an Oregon corporation.

Statement

Attached to this document is the Affidavit of Henry Kane, Attorney for United Citizens in Action, an Oregon corporation opposed to proponents's request that the Commission order imposition of a "seepage fee" and a sewer system in east or mid-Multnomah County, on the ground that proponents have failed to meet the statutory standards.

The "problem" is solving itself as the City of Portland and other public bodies annex unincorporated territory in the county and install a centralized sanitary sewer system.

If the Commission believes there is a need to remove a "threat" to pure or clean drinking water, the economical means of doing so is at hand - order treatment of water or use of Bull Run system water.

United Citizens in Action believes that the failure of the proponents to prove a threat to drinking water requires the Commission to terminate the proceeding, grant proponents additional time to submit admissible evidence, or make an ORS 454.300(5) that the proposed sewer system is "not the most economical method of removing or alleviating the conditions," and that the most economical method of removing "a threat to drinking water" is to order treatment

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

of drinking water or that water districts and others obtain their water from the Bull Run system.

The groundwater appears to be good enough for the City of Portland, which noted that the groundwater contaminants are removed to Columbia River sloughs (Exhibit 9 to the Kane affidavit).

Part of the record is a September 4, 1984 "Opinion" article by Charles P. Schade, Multnomah County Public Health Officer, who expresses opinions but does not cite the documents containing any evidence to support his opinions. Opinions are not evidence, particularly when not accompanied by laboratory reports and other admissible evidence. Also inadmissible is unsupported suspicion.

Dr. Schade's article refers to groundwater, but the issue before the Commission is whether there is a present threat to drinking water backed by evidence instead of supposition, opinion and guesses.

DATED: September 11, 1984.

Henry Kane, OSB No. 61045
Attorney for United Citizens in Action

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

AFFIDAVIT OF HENRY KANE

STATE OF OREGON)
) ss.
County of Washington)

I, Henry Kane, being first duly sworn, depose and say:

1. I am an attorney admitted to practice law in the State of Oregon (OSB 61045) am the attorney for United Citizens in Action, an Oregon corporation, in the within proceeding, and I make this affidavit on my personal knowledge in support of the position that proponents have not submitted sufficient evidence to warrant imposition of a "seepage fee" and an Order for mandatory replacement of septic tanks, etc. in mid-Multnomah County.

2. I incorporate by this reference my August 30, 1984 prepared statements and my summary of my statement at the August 30, 1984 public hearing on the issue, noting that the correct name and identifcation of my client is United Citizens in Action, an Oregon corporation.

3. Exhibit 1 to this affidavit is a true copy of my Sept. 4, 1984 letter to Fred Hansen, Director, Department of Environmental Quality, and attachment, copy of my August 31, 1984 letter to Multnomah County Executive Dennis Buchanan.

4. I state that I examined the documents made available to me by Mr. Hansen on September 11, 1984, and made copies of certain documents, but that I was told September 11, 1984, by Judy Mandt, of Multnomah County, that the documents I requested would not be available until 10 a.m. Wednesday, September 12, 1984.

5. Exhibit 2 to this affidavit is a true copy of my Sept. 4, 1984 information letter to Michael Huston, Assistant Attorney General and DEQ attorney.

6. On September 11, 1984 I examined Department of Environmental Quality records, including exhibts the Department has made part of the record in this proceeding.

7. None of the two cardboard cartons of documents I examined contained

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0565

evidence sufficient to allow the Commission to order imposition of a seepage fee and/or to order installation of the proposed sanitary sewer system, and some of the documents reflect lack of need for the fee and system.

8. Exhibit 3 to this affidavit is a true copy of the June 14, 1984 letter to the DEW signed by Pamelia L. Christian, City Administrator, City of Troutdale, requesting that the City of Troutdale be excluded because:

> "The City of Troutdale, at this time, does not meet any of the four conditions set forth as conditions for the seepage fee. There is less than one percent of the sewage discharge that goes into on-site disposal systems."

9. Exhibit 4 to this affidavit is a true copy of the August 28, 1984 letter to the Commission signed by Chuck Root, Manager, Rockwood Water District, stating in part:

> " * * * This water is safe for public drinking. We test the water on a monthly basis and do everything within our power to ensure its continued high quality.
>
> " * * * Only 5 percent of our water comes from these sources. The remaining 95 percent is purchased from the Bull Run water supply.

10. Exhibit 5 to this affidavit consists of two pages, the cover and page 5 of Commission Exhibit 15: "National Interim Primary Drinking Water Regulations," U.S. Environmental Quality Protection Agency (EPA), September 1976

11. Page 5 of Exhibit 5 states that the maximum level for Nitrate (as N) in milligrams per liter is "10."

12. No document in the DEQ record or the Commission record indicates that any groundwater in Mid-Multnomah County exceeds "10."

13. My client's position is that the nitrate in underground water used for

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

domestic drinking water is not a statutory "threat" because the nitrate problem can be resolved by:

(1) treating the groundwater, or

(2) requiring water districts and others using wells to obtain their drinking water from sources other than east or mid-Multnomah County groundwater.

14. Exhibit 6 to this affidavit is a true copy of an August 28, 1984 letter to Christine Wolinakowski of the DEQ Public Affairs Section signed by Steve McKeag, Field Representative, Carvalho Industries, Inc., Klamath Falls, OR 97602. Accompanying Exhibit 6 were a number of documents supporting Mr. McKeag's statement that his company has equipment to remove nitrate from well water effectively and economically:

> " * * * We have taken 61.6 ppm nitrate levels and reduced the nitrates to zero in two minutes. Solvents are oxidized and removed by filtration."

15. Exhibit 7 to this affidavit is a true copy of pp. 2-6 of Commission Exhibit 9, "Groundwater Exploratory Program, City of Portland, Bureau of Water Works (1977), pertaining to groundwater in east or Mid-Multnomah County, Oregon, and states in part at page 5:

> "Protection of the aquifers recommended for development from potential contamination by polluted surface water is provided by the extensive clayey gravel and clay layers within the Troutdale Formation and by the layer of clay which underlies much of the recent Columbia River flood plain which lies north of N.E. Sandy Boulevard."

16. Exhibit 7 then states at pp. 5-6:

/

/

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

> " * * * Bureau investigations support the conclusions of prior studies (Quan, et al, 1974) that the contaminants from land applied effluents and fertilizers remain in the waters of the upper aquifers, are carried north by the upper, perched ground water, and eventually enter the Columbia Sloughs which remove the contaminants from the study area. * * * " (emphasis added)

17. Therefore, the City of Portland report states that groundwater contaminants are carried north and eventually end the Columbia Sloughs. It is significant that the report does not state that groundwater contaminants remain; instead, it states that the contaminants are carried from the groundwater.

18. Exhibit 8 to this affidavit is a true copy of an April 1977 letter from Chief Engineer P. Norseth to Francis J. Ivancie, Commissioner of Public Utilities, part of Exhibit 7, stating that "The study has determined that it is feasible to obtain a 100-million gallon per day water source from ground water acquifers recharged by the Columbia River * * *. (emphasis added)

19. Exhibit 9 to this affidavit is a true copy of the November 13, 1978 letter from P. Norseth, Chief Engineer, Department of Public Utilities, City of Portland, to Commissioner Ivancie, stating:

> "Information provided by the test wells has shown that sufficient high quality groundwater is available in the area investigated to provide, at a minimum, the 50 million gallon-per-day water supply facility * * * . All four of the groundwater bodies which these wells were intended to test were found to meet the Federal standards for drinking water without treatment." (emphasis added)

20. No document produced by the DEQ which I examined contradicted the Exhibit 9 conclusion that the groundwater from the wells "meet the Federal standards for

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND - P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

drinking water without treatment."

21. Your affiant attended the August 30, 1984 Commission public hearing on the issue and did not hear any representative from the City of Portland or any other agency contradict Exhibit 9, nor did I hear any public agency representative claim the groundwater at issue failed to meet state and/or federal drinking water standards.

22. The Department of Environmental Quality on September 11, 1984 produced a large number of documents that are exhibits in the proceeding before the Commission, but few, if any, responsive to the specific requests, e.g.,

> "(1) All documents indicating that since 1960 the underground water in east or mid-Multnomah County contained 'agents' in excess of the maximum state and/or federal limits."

or

> "15) All documents reflecting the amount of reduced groundwater pollution after homes and other facilities now using septic tanks, cesspools, etc., in east or mid-Multnomah County are hooked into sewers now under construction and to be constructed by the City of Portland with the $21 million grant approved by the Environmental Quality Commission."

23. None of the documents your affiant examined addressed the statutory issue of the more economical method of meeting the problem - requiring treatment of drinking water or requiring use of water from the Bull Run system.

24. None of the documents your affiant examined addressed the issue of whether the "problem" will be reduced as the City of Portland and other public bodies install sewers in mid-Multnomah County.

25. Proponents have the burden of proving their claims; the exhibits in the Commission file reflect failure of the proponents to prove their claims.

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND · P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

26. The public interest would be served were the Commission to order the proponents and the Department of Environmental Quality to submit in one document admissible evidence that meets statutory standards, e.g., by submitting exhibits contradicting the allegations of fact in this affidavit and demonstrating by admissible evidence that proponents have met their statutory burden.

27. After examining documents to be produced by Multnomah County your affiant may submit a supplemental affidavit and exhibits on behalf of United Citizens in Action, relevant to the issues before the Commission.

Henry Kane

SUBSCRIBED AND SWORN TO BEFORE ME THIS SEPTEMBER 11, 1984.

Notary Public for Oregon
My Commission expires: 10-2-87

HENRY KANE
ATTORNEY AT LAW
12275 S.W. SECOND · P.O. BOX 518
BEAVERTON, OR. 97075
(503) 646-0566

EXHIBIT 1

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

Sept. 4, 1984

rec'd 9/4/84 to

HAND-DELIVERED

Fred Hansen, Director
Department of Environmental Quality
522 S.W. 5th Ave.,
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Hansen:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

Attached is a copy of my August 31, 1984 letter to Multnomah County Executive Dennis Buchanan, listing 23 categories of documents sought to be inspected prior to the Sept. 11, 1984 deadline set by the Commission.

Pursuant to the Public Records Law, I request that I be allowed to inspect the documents listed in the attachment with the exception of category (14).

There may be a misapprehension as to the burden of proof governing the hearings. It is submitted that the Department of Environmental Quality and other proponents have the burden of meeting the statutory burden of proof that would permit the Commission to order installation of a sewage system and imposition of a "seepage fee."

In other words, more than the proponents' desire is required; evidence is required.

One factor is whether contamination is increasing or is expected to increase. The record to date appears to be silent on that vital issue, and, furthermore, apparently overlooks the expected decline in groundwater contamination as the City of Portland, the City of Gresham, and perhaps other entities in mid-Multnomah County, remove cesspools and septic tanks in favor of their expanding sewage collection systems. And of course, the DEQ has issued an order halting approval of septic tank/cesspool systems in the affected area of mid-Multnomah County.

Because of the Sept. 11, 1984 deadline for comment, I request that I be allowed to inspect the documents, and order copies of document I select, as soon as feasible. The response will be made part of the hearings record prior to the Sept. 11, 1984 deadline.

Sincerely,

Henry Kane

cc: Spencer Heinz, The Oregonian

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

August 31, 1984

HAND-DELIVERED

Honorable Dennis Buchanan
County Executive
1500 Portland Building
Portland, OR 97204

Re: Public Records Law request to inspect and copy documents

Dear Mr. Buchanan:

This letter is written pursuant to ORS 192.400 to 192.500, the Public Records Law and pertains to the hearings before the Environmental Quality Commission on whether there is a threat to drinking water in mid-Multnomah County.

I request that I be allowed to inspect the documents listed below, and to order copies I designate at my cost, as soon as feasible, so that the documents and my findings may be presented to the Environmental Quality Commission prior to September 11, 1984.

It is submitted that it is in the interest of Multnomah County, as a proponent, to produce the documents that would support its position.

Pursuant to the Oregon Public Records Law, and at my cost, I request that I be allowed to inspect and order copies of the following documents:

(1) All documents indicating that since 1960 the underground water in east or mid-Multnomah County contained "agents" in excess of the maximum state and/or federal limits

(2) As to each "agent" deemed in excess of any such limit, the state/federal statute or regulation imposing the limit

(3) All documents reflecting that since 1970, on an annual basis, there has been a significant increase in the amount of pollutants in east or mid-Multnomah County groundwater

(4) all documents indicating that within the preceding 20 years there were outbreaks of disease, illness or disability caused by drinking or using polluted groundwater in east or mid-Multnomah County

(5) all documents indicating that since 1945 any person has suffered illness, injury or death because of drinking water containing nitrate

(6) all documents indicating what a water district can do to remove nitrate from drinking water

(7) all documents supporting Dr. Schade's claim in Threat to Drinking Water Findings that "values above the Environmental Protection Agency's maximum contaminant level (MCL) of ten milligrms per liter of nitrate nitrogen have been reported in the area (1)."

(8) All documents indicating that the following chemicals mentioned by Dr. Schade caused disease, illness or death when consumed in drinking water:

(a) tetrachlorethylene

(b) trichlorethylene

(c) trichlorofluoromethane

(d) trans-1, 2 dichloroethene.

(9) All documents supporting Dr. Schade's claim that "A typical compound is tetrachloroethylene which has been found in two of the ten wells studied at levels of up to three parts per billion."

(10) All documents supporting any claim that the amount of nitrate in groundwater in east or mid-Multnomah County has increased during the past 20 years

(11) All documents reflecting the amount of rainwater that enters the groundwater annually in east or mid-Multnomah County and the diluting effect, if any, on the groundwater of such rainwater

(12) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines now under construction or under contract by a public body in east or mid-Multnomah County

(13) All documents evidencing the number of houses now using cesspools, septic tanks, etc., which will be hooked into sewer lines to be constructed with the $21 million federal grant the Environmental Quality Commission approved for that purpose

(14) All documents pertaining to HB 2784, Chapter 235, Oregon Laws 1983, relating to construction of sewage treatment works, including but not limited to documents presented to legislative committees, announcements by the Board of Commissioners of support of HB 2784, Board of Commissioner minutes approving sponsorship of what became HB 2784, and the invoices reflecting the County's payments to any law firm that drafted what became HB 2784

(15) All documents reflecting the amount of reduced groundwater pollution after homes and other facilities now using septic tanks, cesspools, etc., in east or mid-Multnomah County are hooked into sewers now under contract and to be constructed by the City of Portland with the $21 million grant approved by the Environmental Quality Commission

(16) A summary-type document, if any exists, indicating how many homes that would be compelled to pay a "seepage fee" would receive sewage service by

(a)	Dec. 31, 1985	(e)	Dec. 31, 1989	(i)	Dec. 31, 1993	(m)	2005
(b)	Dec. 31, 1986	(f)	Dec. 31, 1990	(j)	Dec. 31, 1994	(n)	2010
(c)	Dec. 31, 1987	(g)	Dec. 31, 1991	(k)	Dec. 31, 1995	(o)	2015
(d)	Dec. 31, 1988	(h)	Dec. 31, 1992	(l)	Dec. 31, 2000	(p)	2020

and (q) would never receive sewage service

(17) Any document indicating the geographic area of east or mid-Multnomah County that would not receive sewer service under the $255 million sewage program

(18) All documents evidencing that a pollutant found in groundwater taken from one well is found uniformly in the groundwater throughout the east or mid-Multnomah County area

(19) All documents evidencing that the groundwater in the following four drainage basins contain the same pollutants in the same quantities:

(a) the Inverness Basin

(b) the Columbia Basin

(c) the Johnson Creek Basin

(d) the Gresham Basin

(20) All documents supporting the claim in Threat to Drinking Water Findings that:

> "Thirteen wells in or around the affected area have nitrate levels that exceed the 5.0 mg/l (50% of maximum allowable limit). Statistical analysis indicates an increase in contamination levels in wells of the lower reaches of the groundwater aquifer compared to the wells of the upper reaches. This means the lower reaches are affected by a greater quantity of contributing seepage. * * *

(21) All documents that indicate that any of the 13 wells referred to in paragraph (2), supra, are used by any water district to obtain drinking water for their patrons

(22) Any document that indicates that there is at present, a clear and present danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County

(23) Any document that indicates that if the $255 million sewage program is not implemented, within the next five years there will be a clear danger to the public health caused by pollutants in the groundwater of east or mid-Multnomah County.

Thank you for your courtesies in this matter.

Sincerely,

Henry Kane

cc: DEQ

EXHIBIT 2

HENRY KANE
ATTORNEY AT LAW
12275 S.W. 2ND
P.O. BOX 518
BEAVERTON, OREGON 97075

AREA CODE 503
TELEPHONE 646-0566

Sept. 4, 1984

Michael Huston, Asst. Atty. Gen.
500 Pacific Building
520 S.W. Yamhill
Portland, OR 97204

Re: Environmental Quality Commission hearings on whether to compel installation of sanitary sewers and impose a "seepage fee" in East Multnomah County

Dear Mr. Huston:

This note confirms our telephone discussion this date concerning the above matter.

Enclosed please find your information copy of my Sept. 4, 1984 Public Records Law request to the Department of Environmental Quality. It is attached to an August 31, 1984 request to Multnomah County Executive Dennis Buchanan.

There is a question as to whether there is evidence, sufficient or otherwise, to support a finding under the 1983 law that there is a threat of drinking waster in East Multnomah County.

The enclosures reflect my intention to review the documentary evidence, and then to inform the Commission of my findings. Based on what a heard at the hearing last week, there was much language and insufficient evidence.

And I do not recall any of the proponents giving consideration to the ORS 454.300 alternative, particularly subsection (5) of ORS 454.300.

My reading of the statute indicates that the Commission must make findings of fact as to the most economical method of removing or alleviating a threat to drinking water. The most economical method, and one costing less than $160 million, is to compel the water districts and the City of Portland (1) treat ground water or (2) not use ground water.

There is a question in my mind of the "neutrality" of the Department of Environmental Quality. Enclosed is a copy of a Dec. 16, 1984 Oregonian article titled "Tainting intensifies DEW sewer battle. It states in part:

> "As a result of recent well-water tests in East Multnomah County, the Oregon Department of Environmental Quality is more determined than ever to force the installation of sanitary sewers in East Multnomah County, a DEQ official says.

> "Harold L. Sawyer, manager of the DEQ water-quality division, said the sewers are needed to protect fragile underground water supplies.
>
> * * *
>
> "'There will be lots of discussion of what the numbers means, whether there is any reason to change the course of action we are on in trying to get the east county area sewered,' the DEQ's top water-quality official said.
>
> "'It confirms our view that sewers are needed,' he said. 'We have been pushing to get that done. That is the only way to protect the ground water.'"

The article and the above-quoted excerpts indicate that the DEQ staff has decided the issue pending before the Commission.

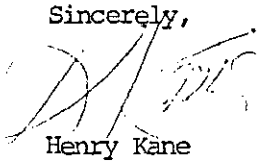
If Multnomah County and the DEQ cannot produce the documents prior to September 11, 1984, I shall move the Commission for an appropriate extension of time within which to submit written comments and documents, including this one and enclosures.

Because the Commission is operating under a 1983 statute, it is submitted that the Commission record must contain evidence that is more than unsupported language/claims. Were I the attorney for a proponent I would have my witnesses testify under oath, identify exhibits such as laboratory reports, and have the Commission formally admit the documents as numbered sequence exhibits.

My recollection is that after presentation of the proponents' case-in-chief, Chairman Petersen indicated that members of the audience would have an opportunity to question witnesses.

I would like to do so on behalf of my client, and by this means ask when I may do so. I particularly would like to question Multnomah County Health Officer Schade.

Sincerely,



Henry Kane

encls.

City of Troutdale

104 Kibling Street (503)665-5175
Troutdale, Oregon 97060

June 14, 1984

EXHIBIT 3

Hal Sawyer
Department of Environmental Quality
1120 SW 5th
Room 730
Portland, OR 97204

Dear Mr. Sawyer:

The City of Troutdale, as a member of the Multnomah County Sewer Consortium is requesting that the City be excluded from the need to set a seepage fee within the Troutdale Drainage Basin. The City of Troutdale, at this time, does not meet any of the four conditions set forth as conditions for the seepage fee. There is less than one percent of the sewage discharge that goes into on-site disposal systems.

Troutdale's policies, as established by the Council, require that any development provide sewage collection before any permits are issued. It is also the policy of the Council that we do not extend service outside the City limits of Troutdale except for unusual or special circumstances. The sewage system financial plan for Troutdale is based on a Systems Development Charge imposed on all development that occurs within the City limits. The Systems Development Charge is set aside for Capital Improvements and/or expansion. At this time we are estimating that by the year 1990 we will begin actual expansion of the plant to serve future growth.

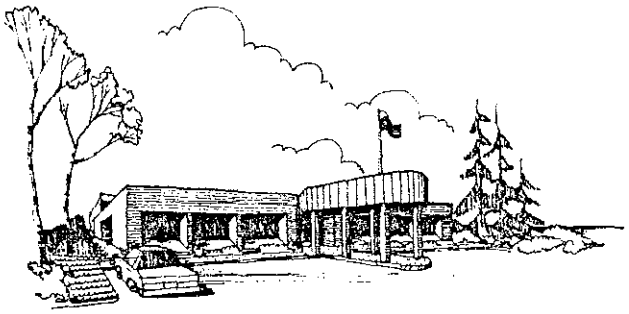
Plant expansion will be accomplished using the reserve fund of the SDC's and also a GO Bond. Since the majority of the area lying within Troutdale's drainage basin but outside the City limits is now undeveloped, we are anticipating that if there are future requests for newly developed areas in our Basin that we would require annexation before that service is extended.

Sincerely yours,
CITY OF TROUTDALE

Pamelia L. Christian
City Administrator

PLC:vjk

EXHIBIT 4



ROCKWOOD WATER DISTRICT

19601 NE Halsey
Portland, Oregon 97230
(503) 665-4179

August 28, 1984

Environmental Quality Commission
Post Office Box 1760
Portland, Oregon 97207

Dear Commissioners:

In order to set the record straight regarding your public hearing scheduled for June 29, I would like to offer the following.

Our water is available to all residents of the Rockwood Water District area. This water is safe for public drinking. We test the water on a monthly basis and do everything within our power to ensure its continued high quality.

Other information that may be of interest is that the depth of our wells is at least 500 feet, one located on our property at 196th and Halsey and the other south of Sandy on 185th Street. Only 5 percent of our water comes from these sources. The remaining 95 percent is purchased from the Bull Run water supply.

Please let us know if we can be of any assistance in your deliberations.

Sincerely,

ROCKWOOD WATER DISTRICT

Chuck Root

Chuck Root
Manager

CLR:ph
cc: Mrs. Jean Orcutt

AUG 29 1984

WATER QUALITY CONTROL

EXHIBIT 5

15

NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS

EPA-570/9-76-003

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF WATER SUPPLY

WH—550
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER SUPPLY
401 M Street S.W.
Washington, D.C. 20460

POSTAGE AND FEES PAID
ENVIRONMENTAL PROTECTION AGENCY
EPA—335

Official Business

If your address is incorrect, please change on the above label; tear off; and return to the above address.
If you do not desire to continue receiving this technical report series, CHECK HERE ; tear off label, and return it to the above address.

Subpart B–Maximum Contaminant Levels

Section 141.11 Maximum contaminant levels for inorganic chemicals.

(a) The maximum contaminant level for nitrate is applicable to both community water systems and non-community water systems. The levels for the other inorganic chemicals apply only to community water systems. Compliance with maximum contaminant levels for inorganic chemicals is calculated pursuant to § 141.23.

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

Contaminant	*Level, milligrams per liter*
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

(c) When the annual average of the maximum daily air temperatures for the location in which the community water system is situated is the following, the maximum contaminant levels for fluoride are:

Temperature Degrees Fahrenheit	Degrees Celsius	Level, milligrams per liter
53.7 and below	12.0 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

Section 141.12 Maximum contaminant levels for organic chemicals.

The following are the maximum contaminant levels for organic chemicals. They apply only to community water systems. Compliance with maximum contaminant levels for organic chemicals is calculated pursuant to § 141.24.

	Level, milligrams per liter
(a) Chlorinated hydrocarbons:	
Endrin (1, 2, 3, 4, 10, 10-hexachloro-6,7-epoxy-1, 4,	0.0002

EXHIBIT 6

CARVALHO INDUSTRIES, INC.
P.O. BOX 7149, KLAMATH FALLS, OR 97602 — 503-883-1531

August 28, 1984

Christina Wolinakowski
Public Affairs Section, DEQ
P.O. Box 1760
Portland, Oregon 97207

Dear Ms. Wolniakowski:

The purpose of this letter is to provide you with information about Carvalho Industries and our water purification systems; that may help the State Environmental Quality Commission at Thursday's meeting dealing with East Multnomah County water problems.

Carvalho Industries can solve your water contaminate problems effectively and economically. Our treatment of Nitrates and solvents is very successful. We have taken 61.6 ppm nitrate levels and reduced the nitrates to zero in two minutes. Solvents are oxidized and removed by filtration.

Carvalho Industries Water Purification Systems have a low capital cost; low energy cost (one seventh the cost of other ozone generators); no heat or cooling problems or limitations; no moisture limitations; and no production of nitrous compounds.

We are currently working with Mr. Bernie Court, Water Supervisor, for the city of Hemet in California; dealing with their nitrate contamination of their wells. We are in the process of installing an Ozone Pilot Demonstration System that will be hooked up to well #2 to enable the city to conduct their own tests before accepting our bid to purify their water.

Enclosed is a brochure on our Well Water Purification Systems along with test results. We hope that this information will be helpful in finding an acceptable solution to your water problems. Please contact me if you have any questions or need further information about our water purification systems. Thank you.

Sincerely,

Steve McKeag
Field Representative

SM;elw
Enc.

EXHIBIT 7

SUMMARY

INTRODUCTION

The Bureau of Water Works began a Ground Water Exploratory Program during the 1975-76 fiscal year to investigate the feasibility of developing a new water source from ground water in eastern Multnomah County. This additional water source is required to increase the reliability of the water system due to the sole reliance of the present system on the Bull Run River which infrequently exceeds the maximum turbidity levels established for drinking water by State and Federal regulatory agencies. In addition, the three 25 mile long pipelines which carry water to the City from intake facilities on the river are susceptible to damage by landslides and vandalism. A future benefit of a second water source located near the City will be the provision of additional capacity during days of peak demand when the existing pipelines from the Bull Run River will be inadequate to meet the needs of the City.

The geographical area chosen for investigation was the area bounded on the north by the Columbia River, on the south by an east-west line through Powell Butte, and extending from the Portland International Airport east to the Sandy River. This area has been noted as being capable of producing large quantities of water from aquifers recharged by the Columbia River as early as 1956 by the U.S. Geological Survey (Griffin, et al, p. 31). More recently, R.C. Newcomb, in a 1974 study for the Water Bureau (Stevens, Thompson

& Runyan, 1974, p. C2), recommended this area for further investigation to obtain an alternate water source. The area chosen also contains the location of planned storage reservoirs on Powell Butte where the new water source could be blended with water from the Bull Run River when additional capacity is required.

The methodology employed to develop the conclusions and recommendations offered in this report was to gather and review data from existing wells and prior studies concerning the geology, hydrology, and water quality of the area; collect and chemically analyze additional water samples from existing wells; and to collect and analyze data provided by eight exploratory wells constructed for this study.

CONCLUSIONS

1. The general direction of flow in the aquifers of the study area is north toward the Columbia River and its sloughs. The natural recharge for the ground water system is not sufficient to support a 100 million gallon per day (mgd) withdrawal desired by the City. The only feasible means of developing a 100 mgd water source from ground water is to utilize aquifers which are in hydraulic communication with and can be recharged by the Columbia River.

2. The geology of the study area is conducive to the development of inland well fields which will ultimately draw water from the

Columbia River. The present river channel is underlain by a deposit of sand varying in thickness from 180 to over 200 feet. The formations underlying the study area slope upward in a northeasterly direction toward the river. This incline permits aquifers within these formations to interconnect with the sands underlying the river channel and makes available recharge from the river through these sands. However, during intermittent operation of inland wells it is unlikely that Columbia River water would reach the point of withdrawal until local water sources recharging the aquifer are exceeded.

3. The formations adjacent to the Columbia River contain three extensive aquifers designated as the Troutdale Gravel, the Troutdale Sandstone, and the Sandy River Mudstone Aquifers. These aquifers and one apparently local aquifer, designated as the Blue Lake Aquifer, appear, upon analysis of the available data, to hydraulically interconnect with the river and to be sufficiently permeable to support wells with estimated capacities of 1,500 to 3,500 gallons per minute (gpm).

4. The water quality of the Columbia River will satisfy the U.S. Environmental Protection Agency's National Interim Drinking Water Regulations after filtration through the riverbed sands and is an adequate alternate water source for the water system in an emergency. The quality of the existing ground water in the aquifers proposed for development is similar to the quality

of filtered Columbia River water. Blending analyses on the mixtures of Columbia River water and existing ground water with Bull Run River water indicate that both potential new water sources are compatible with the existing water supply. The blending analyses further indicate that blending of Bull River water at a 4 to 1 ratio with filtered Columbia River wa or the existing ground water will produce a quality of water not recognizably different from the present water supply to the general public.

5. Protection of the aquifers recommended for development from potential contamination by polluted surface water is provided by the extensive clayey gravel and clay layers within the Troutdale Formation and by the layer of clay which underlies much of the recent Columbia River flood plain which lies north of N.E. Sandy Boulevard.

The primary sources of potential pollution of the upper groundwater aquifers and surface waters within the area are the land applied effluents from individual home sewer systems and direct discharges to the Columbia River from the Inverness and City of Gresham sewage treatment plants. Bureau investigations support the conclusions of prior studies (Quan, et al, 1974) that the contaminants from land applied effluents and fertilizers remain in the waters of the upper aquifers, are carried north

by the upper, perched ground water, and eventually enter the Columbia Sloughs which remove the contaminants from the study area. The direct discharges to the Columbia River from sewage treatment plants are carried out of the area by the river before sufficient mixing occurs to allow contaminants to enter the deeper ground water aquifers.

6. Development of a 100 mgd ground water source is most feasible in the two general areas designated as the Rocky Butte and North Fairview Well Fields on Plate 17 at the back of this report. Each well field has been located in a manner such that it can utilize at least two aquifers and produce 50 mgd. The use of multiple aquifers in separate well fields will further increase the water system's reliability. The full development will require a minimum of 28 wells, 13 miles of major pipelines, and one pump station; all at a present worth cost of $14,130,000.

RECOMMENDATIONS

1. The Water Bureau should develop the ground water resource available in eastern Multnomah County to produce the desired 100 mgd capacity emergency and supplemental water supply. The resource could be developed in four phases supplying approximately 25 mgd over an eight year construction period.

2. Construction of each phase of the development program should

THE CITY OF
PORTLAND
OREGON

DEPARTMENT OF
PUBLIC UTILITIES
FRANCIS J. IVANCIE
COMMISSIONER

BUREAU OF
WATER WORKS
ROBERT C. HYLE
MANAGER

1800 S.W. SIXTH AVE.
PORTLAND, OR. 97201

EXHIBIT 8

April 1977

Francis J. Ivancie
Commissioner of Public Utilities
City of Portland, Oregon

Dear Commissioner Ivancie:

An engineering study to determine the feasibility of obtaining a supplemental and emergency water source for the Water Bureau from local ground water resources was authorized by the City Council in the 1975-76 Budget of the City of Portland. This engineering study is now complete and the report covering the study is presented herein.

The study has determined that it is feasible to obtain a 100-million gallon per day water source from ground water aquifers recharged by the Columbia River, that the present worth construction cost of the new system is $14,130,000, and that the ground water source is the most cost-effective method to obtain a supplemental and emergency water source adequate to meet the water system's needs.

It is the recommendation of the Water Bureau that this report be accepted and that the proposed ground water development program be expeditiously pursued.

Respectfully submitted,

P. Norseth, P.E.
Chief Engineer

THE CITY OF
PORTLAND
OREGON

DEPARTMENT OF
PUBLIC UTILITIES
FRANCIS J. IVANCIE
COMMISSIONER

BUREAU OF
WATER WORKS
ROBERT C. HYLE
MANAGER

1800 S.W. SIXTH AVE.
PORTLAND, OR. 97201

November 13, 1978

EXHIBIT 9

Francis J. Ivancie
Comissioner of Public Utilities
City of Portland, Oregon

Dear Commissioner Ivancie:

Presented herein is the Water Bureau report requested by the City Council which contains the findings and resulting recommendations obtained from the test water wells recently constructed as part of the Groundwater Development Program of the Water Bureau. Included in Appendix B of this report is the recommendation by Mr. R. C. Newcomb, Consulting Geologist, for acceptance of the report. Mr. Newcomb is retained by the Water Bureau to provide a continuing review of this program.

The test wells were constructed for a total cost of $230,230, which is 0.1% under the estimated cost of the wells.

Information provided by the test wells has shown that sufficient high quality groundwater is available in the area investigated to provide, at a minimum, the 50 million gallon-per-day water supply facility which has been authorized by the City Council. All four of the groundwater bodies which these wells were intended to test were found to meet the Federal standards for drinking water without treatment.

The 50 million gallon-per-day facility recommended in the report is estimated to have a present worth cost of $11,600,000 to build and will cost $2,600 per month to operate on a standby basis when completed.

It is the recommendation of the Water Bureau that this report be accepted and that Groundwater Development Program continue to be expeditiously pursued.

Sincerely,

Carl Goebel
Assistant Manager

P. Norseth, P.E.
Chief Engineer

Gladys McCoy
Multnomah County Commissioner
District Two
County Courthouse, Room 605
Portland, Oregon 97204 (503) 248-5219

E32

September 10, 1984

Mr. Fred Hansen, Director
Department of Environmental Quality
P.O. Box 1760
Portland, Oregon 97207

Dear Mr. Hansen:

Since I have been on the Multnomah County Board, one of my major interest and concerns has been the delivery of urban services to the mid-county area. A key concern has been the installation of sewers.

I have supported the sewer program as the only reasonable way to eliminate the growing pollution problem in mid-county, and feel that the Framework Plan and Threat to Drinking Water reports adopted by the Board in June of this year are the correct response to the E.Q.C. order of April, 1982.

I, too, am concerned about the costs of such a program, but am confident that a partnership between federal, state, county and the Cities of Portland and Gresham can and will find a solution.

The time to commence is now and I urge you and the Commission to approve the Framework Plan and to adopt the Threat to Drinking Water Findings.

I stand ready to support such a decision by the E.Q.C., and look forward to working with you to achieve the funding required to make the program a reality.

Sincerely,

Gladys McCoy
Multnomah County Commissioner

GM:vb

E33

MULTNOMAH COUNTY OREGON

DEPARTMENT OF HUMAN SERVICES
DISEASE CONTROL OFFICE
426 S.W. STARK STREET
PORTLAND, OREGON 97204
(503) 248-3406

DENNIS BUCHANAN
COUNTY EXECUTIVE

September 11, 1984

Department of Environmental Quality
522 SW Fifth
Portland, OR 07204

RE: Threat to Drinking Water East Multnomah County

Gentlemen:

Attached are representative references from the medical literature on the adverse impact of nitrates in drinking water.

Sincerely,

Charles P. Schade, M.D.
Health Officer

CPS/vc

Attachments

AMERICAN
Journal of Epidemiology
Formerly AMERICAN JOURNAL OF HYGIENE

VOL. 119 APRIL 1984 NO. 4

E332

Original Contributions

CONGENITAL MALFORMATIONS AND MATERNAL DRINKING WATER SUPPLY IN RURAL SOUTH AUSTRALIA: A CASE-CONTROL STUDY

MARGARET M. DORSCH,[1] ROBERT K. R. SCRAGG,[2] ANTHONY J. McMICHAEL,[2] PETER A. BAGHURST[2] AND KENNETH F. DYER[1]

Dorsch M. M. (NH&MRC Road Accident Research Unit, U. of Adelaide, Adelaide, South Australia 5001), R. K. R. Scragg, A. J. McMichael, P. A. Baghurst and K. F. Dyer. Congenital malformations and maternal drinking water supply in rural South Australia: a case-control study. *Am J Epidemiol* 1984;119: 473-86.

A case-control study, carried out in the Mount Gambier region of South Australia, investigated the relationship between mothers' antenatal drinking water source and malformations in offspring. It was prompted by earlier descriptive findings of a statistically significant, and localized, increase in the perinatal mortality rate in Mount Gambier, due principally to congenital malformations affecting the central nervous system and multiple organ systems. Available for statistical analysis were 218 case-control pairs, from the period 1951–1979, individually matched by hospital, maternal age (±2 years), parity and date of birth (±1 month). Compared with women who drank only rainwater during their pregnancy (relative risk (RR) = 1.0), women who consumed principally groundwater had a statistically significant increase in risk of bearing a malformed child (RR = 2.8). Statistically significant risk increases occurred specifically for malformations of the central nervous system and musculoskeletal system. Reanalysis of the data by estimated water nitrate concentration demonstrated a nearly threefold increase in risk for women who drank water containing 5–15 ppm of nitrate, and a fourfold increase in risk for those consuming >15 ppm of nitrate. A seasonal gradient in risk was evident among groundwater consumers, ranging from 0.9 for babies conceived in winter, 3.0 in autumn, to

Received for publication January 3, 1983, and in final form August 11, 1983.

[1] Centre for Environmental Studies, University of Adelaide, Adelaide, South Australia.

[2] Commonwealth Scientific and Industrial Research Organization, Division of Human Nutrition, Adelaide, South Australia.

Reprint requests to Dr. M. M. Dorsch, National Health and Medical Research Council Road Accident Research Unit, University of Adelaide, GPO Box 498, Adelaide, South Australia 5001.

This investigation was supported in part by a grant from the Channel 10 Children's Medical Research Foundation of South Australia, Inc.

The assistance of the doctors and hospitals' staff in the Mount Gambier region in facilitating this research is gratefully acknowledged. The authors also thank Paul Harvey and Don Bursill of the Engineering and Water Supply Department and Fred and Jan Aslin of the Mines and Energy Department, for assisting with water supply information.

7.0 and 6.3 for spring and summer conceptions, respectively. Linear logistic regression analysis, controlling for risk factors not accounted for in the study design, showed that maternal water supply, infant's sex, and mother's area of residence all contributed significantly to the risk of malformation. These results are discussed in relation to previous experimental and human descriptive studies, suggesting a plausible mechanism for nitrate-induced teratogenesis.

abnormalities; environmental health; neural tube defects; nitrates; retrospective studies; teratogens; water supply

Descriptive epidemiologic studies of congenital malformations rates in different populations have suggested an environmental component in the etiology of these anomalies, especially defects of the neural tube (1). This evidence, and that from animal experimental work, has stimulated analytic studies which may implicate various specific factors present in the maternal environment as human teratogens (2, 3). Deficiencies of certain factors, such as maternal dietary vitamin deficiencies (4–6), have been found to be associated with neural tube defects.

Penrose (7) first proposed that large variations in the rates of neural tube defects across the British Isles might be attributed to differences in the softness of local drinking water supplies. Subsequently, numerous correlation studies of neural tube defects in different population groups have addressed the potential etiologic role of various mineral elements present in tap water, including inter alia: calcium, magnesium, chromium, zinc, copper, cadmium, lead, mercury and molybdenum (8–13). Overall, these correlation studies have failed to yield consistent or conclusive findings and all have shared a similar shortcoming: namely, the necessary application of mineral concentration estimates for whole communities to individual mothers within those communities (13).

Two case-control studies have attempted to correct the latter deficiency (14, 15). Each compared the mean measured concentrations of minerals in tap water consumed by mothers of infants with neural tube defects (cases) with those in water consumed by mothers of normal babies (controls). No differences were observed in the earlier study (14). However, in the more recent study, a statistically significant difference was observed only for zinc, the mean concentration of this metal being 0.06 ppm lower in the water of cases than in that of controls. Nevertheless, the authors argued that this difference seemed biologically unimportant and could well have arisen by chance (15).

In an earlier paper we reported findings from a descriptive survey of perinatal mortality due to congenital malformations in various local government areas within South Australia (16). This study showed a statistically significant localized increase in the fetal death rate, attributable to defects of the central nervous system and multiple organ systems, in the Mount Gambier district (figure 1). No such increase was apparent in the surrounding regions.

The City of Mount Gambier (present population about 20,000) is situated on the edge of an extinct volcano complex, and is the major center for a predominantly rural region known as the Lower South East. Sheep for meat and wool, dairy products, beef cattle, and soft wood timber (which forms the basis of a considerable manufacturing industry) are the major products of the region. Mount Gambier is also an important transport and tourist center (17).

Most of the Lower South East is underlain by thick limestone beds, the Gambier

FIGURE 1. Map showing
Australia).

Limestone, frequently
tinctive karst feature
and other solution fea
quence of its effect
drainage and generall
the Lower South Eas
surface water and only
face water storage
water in the area is a
from rainwater tan
ground sources.

There are two majo
bearing rock formati
South East, namely:
bier Limestone, which
from only a few met
Mount Gambier to ov
the coast; and 2) the

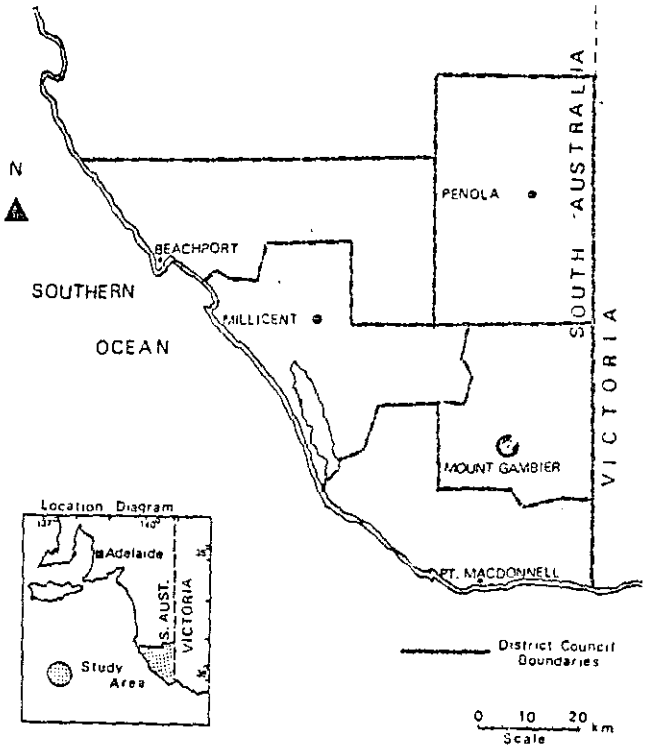


FIGURE 1. Map showing location, boundaries and principal townships of the Lower South East (South Australia).

Limestone, frequently punctuated by distinctive karst features (caves, sinkholes and other solution features). As a consequence of its effective underground drainage and generally flat topography, the Lower South East has virtually no surface water and only a few sites for surface water storage (18). All domestic water in the area is accordingly derived from rainwater tanks and/or underground sources.

There are two major aquifers (water bearing rock formations) in the Lower South East, namely: 1) the upper Gambier Limestone, which varies in thickness from only a few meters north west of Mount Gambier to over 300 meters near the coast; and 2) the lower Dilwyn Formation, consisting of interbedded clay, sand and gravel sediments (19).

These aquifers typically yield very hard water, ranging from 100 to 500 ppm as calcium carbonate (18). With respect to other water quality parameters, surveys carried out to date indicate that the hydrochemistry of the two aquifers is broadly similar (18, 19). However, there are several important differences, most notably the presence of significant contamination by dissolved nitrate in the upper limestone aquifer. The distribution of water containing high concentrations of nitrate in this aquifer coincides with the areas where large amounts of wastes have been disposed of directly underground within a confined area (18). On

the other hand, the high concentrations of iron and hydrogen sulfide gas sometimes encountered in the lower Dilwyn aquifer are not present in water derived from the Gambier Limestone (18). Up to the present time there has been little exploitation of the lower aquifer for domestic purposes, because of the greater effort and cost involved in drilling bores or wells to these depths (19).

Mount Gambier City and its immediate surroundings have a municipal (mains) water supply derived from the Blue Lake which lies in the remnants of an extinct volcano cone. About 80 per cent of the Lake's water comes, under pressure, from the lower aquifer. Rainfall and water from the upper limestone aquifer each contribute to a smaller extent. Other major townships in the region also have municipal supplies of groundwater (usually from the upper limestone aquifer). All municipal supplies are maintained by a single government water authority. Wherever there is no mains supply, households rely for their domestic water on privately owned bores or wells (which draw on the upper aquifer) and/or rainwater tanks.

Our observation of a localized excess of congenital malformations in the Mount Gambier district (16) suggested a need to seek a causal factor in the local environment.

Of the potential causal factors considered, one in particular seemed plausible: namely, groundwater nitrates. The reasons for this were twofold. First, nitrate levels in the Blue Lake and heavily utilized limestone aquifer of the Mount Gambier region are high by comparison with those in most other South Australian drinking water supplies, and, in certain local bores, greatly exceed the World Health Organization recommended limit of 45 mg/liter (20). Nitrate levels in the Blue Lake average about 15 ppm (19). Second, a descriptive study carried out in the United Kingdom had demonstrated statistically significant correlations between the per capita consumption of nitrate/nitrite cured foods and both spatial and temporal variations in the prevalence of anencephalus (21).

A case-control study was therefore carried out.

Materials and methods

Sources of data

Cases and controls were identified in the delivery registers of the three general hospitals serving the Lower South East obstetric population. All cases of congenital malformations (defined as structural defects present at birth), recorded between 1951 and 1979 in a total of 22,989 registered births, were noted. (It is unlikely that any malformed infants were missed as a result of home deliveries, since the proportion of hospital births in South Australia has approximated 100 per cent for at least the last 30 years.) A total of 258 (94 per cent) of the malformed babies were subsequently matched on an individual basis with seemingly normal control babies by hospital, maternal age (±2 years), parity, and date of birth (±1 month). Malformations were classified according to the Eighth Revision of the *International Classification of Diseases* (22).

For each mother, the address recorded at the time of admission to hospital was noted and assumed to be identical with her residence for the duration of pregnancy. These addresses were combined into a single alphabetic listing. Each address was then visited by one of us (MD), and details on whether the household consumed water from the Blue Lake, bore water, or rainwater at the time of the pregnancy were collected. Since the householders interviewed were not aware of the hypothesis under test, and because the interviewer also did not know their identities (as cases or controls), the findings reported here should be free from recall and interviewer bias. Actual or esti-

mated levels of nitr
hold wat r sour
individual private
the government wa

Satisfactory inf
water source duri
available for 40
thereby leaving 2
statistical analysis

Statisti

The matched pai
in univariate anal
relative risk, and
confidence interva
the binomial dist
tional linear logist
for a multivariate
latter, the method
was employed fo
regression coefficie
ratio test was used
ness-of-fit of alter

Re

Univari

The paired relati
for the occurrence
the offspring of w
Lake or bore water
cent confidence in
and 2.8 (CI = 0.
compared with w
rainwater (table
overall increase
groundwater cons
tently present wh
amined for each of
cades (1951–196
1979).

The relative ris
well water consun
vary according to
privately owned
trolled. For women
private bores (mos
levels in excess of
risk of malformati
unmatched analys

mated levels of nitrate ion in these household water sources, including each individual private bore, were supplied by the government water authority.

Satisfactory information on maternal water source during pregnancy was not available for 40 case-control pairs, thereby leaving 218 matched pairs for statistical analysis.

Statistical methods

The matched pairs odds ratio was used in univariate analyses as an estimator of relative risk, and its exact 95 per cent confidence intervals were computed using the binomial distribution (23). Conditional linear logistic regression was used for a multivariate analysis (24). With the latter, the method of maximum likelihood was employed for estimation of the regression coefficients, and the likelihood ratio test was used to determine the goodness-of-fit of alternative models (23).

RESULTS

Univariate analyses

The paired relative risk (RR) estimates for the occurrence of a malformation in the offspring of women consuming Blue Lake or bore water were 2.8 (exact 95 per cent confidence interval (CI) = 1.6–5.1) and 2.8 (CI = 0.8–11.8), respectively, compared with women exposed only to rainwater (table 1). Furthermore, this overall increase in risk, associated with groundwater consumption, was consistently present when the data were examined for each of the three calendar decades (1951–1960, 1961–1970, 1971–1979).

The relative risk estimate for bore or well water consumers was also found to vary according to whether the bore was privately owned or government controlled. For women consuming water from private bores (most of which had nitrate levels in excess of 15 ppm), the relative risk of malformations in offspring in an unmatched analysis was 4.1 (CI = 1.7–10.0), compared with 1.0 for women who drank rainwater. On the other hand, the relative risk was only 1.4 (CI = 0.6–3.4) for those women who consumed municipal water supplies derived from government bores with nitrate levels ≤1 ppm.

Since estimated water nitrate concentrations were available for most individual households, these data were subsequently reanalyzed, ignoring water source, to look for evidence of a dose-response relationship with nitrate. It was found in a matched analysis that compared with women who consumed water with nitrate levels below 5 ppm, those drinking water containing 5–15 ppm and more than 15 ppm of nitrate experienced a nearly threefold (RR = 2.6; CI = 1.6–4.1) and a fourfold (RR = 4.1; CI = 1.3–13.1) increase in risk, respectively (table 2).

Effect modification due to maternal age and season of conception

Stratification of the matched pairs on the basis of case mother's age (≤24, ≥25 years) showed an increase in risk in both groups. Although there was a suggestion of interaction with maternal age, the relative risk for women in the older age group being higher (RR = 3.4) than that for those aged 24 years or less (RR = 2.3), this difference in risk between the two groups was not statistically significant.

The odds ratios associated with maternal groundwater exposure, by season of conception, are shown in table 3. This table was generated by assuming a nine-month gestation period for both case and control. For babies conceived in winter, the relative risk of malformation, given prior maternal groundwater exposure, varied little from unity. However, babies conceived in autumn, and whose mothers drank groundwater, had a greater risk of being malformed (RR = 3.0). In both spring and summer conceptions the relative risk was substantially elevated (RR = 7.0 and 6.3, respectively).

TABLE 1

Relationship between maternal water source and risk of congenital malformations for babies born in the Lower South East of South Australia, 1951–1979

Source of groundwater	Controls	Cases		Relative risk (95% confidence interval)
		Groundwater +	Rainwater −	
Blue Lake	+	75	18	2.8
	−	50	34*	(1.6– 5.1)
Private or government bores	+	3	4	2.8
	−	11	34*	(0.8–11.8)
All sources of groundwater†	+	101	22	2.8
	−	61	34*	(1.6– 4.4)

* These pairs are identical and appear in each category.

† Table excludes 23 matched pairs in which both case and control consumed water containing a groundwater component, where one member of the pair drank Blue Lake water and the other member drank water from a private or government bore.

TABLE 2

Dose-response relationship between maternal water nitrate exposure and risk of malformations in babies born in the Lower South East of South Australia, 1951–1979

Nitrate level (mg/liter)	Relative risk*	95% confidence interval	No. of cases	No. of controls
<5	1.0		70	107
5–15	2.6	1.6– 4.1	138	106
>15	4.1	1.3–13.1	10	5

* Individual pair matching retained.

Since many malformed babies are born prematurely, and also because the present case-control pairs were matched individually on date of birth, an unmatched analysis by season was subsequently carried out, this time taking account of gestational age at delivery. The results obtained by examining the data in this manner were little different from those cited above.

Variations in risk by affected organ system

A stratification of the matched pairs data by the organ system affected again revealed variations in the basic relative risk estimate (table 4). Analyzing the data by affected organ system was predicated on the assumption that prior exposure to groundwater (and, possibly, dissolved nitrates) might not necessarily entail an increased risk for all types of defects. Although the relative risk was found to be elevated in all groups examined, this increase was statistically significant only for defects of the central nervous system (RR = 3.5; CI = 1.1–14.6) and abnormalities of the musculoskeletal system (RR = 2.9; CI = 1.2–8.0).

A further categorization by more specific groups of defects (e.g., neural tube defects, oral clefts, gastrointestinal fistulas or atresia, talipes) demonstrated a statistically significant association with maternal groundwater consumption only for the neural tube defects, anencephalus and spina bifida (RR = 3.5), and the oral clefts (RR = 4.0). In these comparisons, all babies with, for example, oral clefts were considered as a group disregarding coincident anomalies.

Relationship between

Season of conception	Con
Spring	+
	−
Summer	+
	−
Autumn	+
	−
Winter	+
	−
Overall	+
	−
Total	

Multivaria

The results of th
ysis, employing a li
sion model, are pres
logistic function wa
the relative risk asso
categories of the foll
variables: infant's se
status, nationality, a
water supply; and p
For each of these ris
ative risk was calcul
for simultaneous con
other factors, none
counted for in the stu

As table 5 shows,
included in the anal
tistically significant
under test, namely
supply, infant's sex, a
residence. The elevat
risk associated with n
expected, given tha
have suggested that

TABLE 3

Relationship between maternal water source and risk of malformation by season of conception, for babies born in the Lower South East of South Australia, 1951–1979

Season of conception	Controls	Cases		Total	Relative risk	95% confidence interval
		Groundwater +	Rainwater −			
Spring	+	30	2	32	7.0	1.6–63.5
	−	14	10	24		
		44	12	56		
Summer	+	15	4	19	6.3	2.2–24.7
	−	25	8	33		
		40	12	52		
Autumn	+	26	4	30	3.0	0.9–12.8
	−	12	8	20		
		38	12	50		
Winter	+	29	12	41	0.9	0.4– 2.3
	−	11	8	19		
		40	20	60		
Overall	+	100	22	122	2.8	1.7– 4.8
	−	62	34	96		
Total		162	56	218		

Multivariate analysis

The results of the multivariate analysis, employing a linear logistic regression model, are presented in table 5. The logistic function was used to determine the relative risk associated with different categories of the following measured risk variables: infant's sex; maternal marital status, nationality, area of residence and water supply; and paternal occupation. For each of these risk variables, the relative risk was calculated after controlling for simultaneous confounding by all the other factors, none of which was accounted for in the study design.

As table 5 shows, only three variables included in the analysis produced a statistically significant effect in the model under test, namely: maternal water supply, infant's sex, and mother's area of residence. The elevation in malformation risk associated with male sex was not unexpected, given that previous studies have suggested that the male fetus is more vulnerable than is the female (25, 26). As regards mother's area of residence, the present data indicate that women living in the rural districts immediately adjacent to the City of Mount Gambier have the greatest risk of bearing a malformed child (RR = 3.4; CI = 1.4–8.5), compared with Mount Gambier urban residents (RR = 1.0), other townships (RR = 2.2), and other rural districts (RR = 1.8).

A significant elevation in risk of malformations in offspring was apparent for those women who consumed Blue Lake or bore water (RR = 4.9 and 4.3, respectively). The fact that these point estimates clearly exceed those from table 1 suggests that the multivariate analysis has controlled for some otherwise negative confounding effects. The risk of malformations in offspring was also apparently increased, after controlling for other measured risk factors, in those women whose water supply source could not be determined. In general, these women

TABLE 4

Variations in malformation risk associated with maternal groundwater consumption by organ system in babies born in the Lower South East of South Australia, 1951–1979

Affected organ system (ICD8)*	Controls	Cases		Total†	Relative risk	95% confidence interval
		Groundwater +	Rainwater −			
Central nervous system	+	19	15	34	3.5	1.1–14.6
	−	4	5	9		
		23	20	43		
Oroalimentary system	+	16	8	24	2.7	0.6–15.6
	−	3	3	6		
		19	11	30		
Musculoskeletal system	+	30	20	50	2.9	1.2– 8.0
	−	7	13	20		
		37	33	70		
Multiple systems	+	10	9	19	2.5	0.6–10.0
	−	4	6	10		
Total		14	15	29		

* *International Classification of Diseases*, Eighth Revision. Categories shown are mutually exclusive.

† Organ system categories containing too few case-control pairs for meaningful analysis (e.g., genitourinary and cardiovascular systems) have been excluded.

were residents of the rural districts on the outskirts of Mount Gambier whose exact place of residence could not be located.

DISCUSSION

The results of this case-control study suggest that consumption of local groundwater by Lower South East women during pregnancy is associated with a significantly increased risk of malformations in offspring. For women who consumed Blue Lake water (predominantly groundwater, albeit from the lower aquifer), or bore water, the crude estimate of relative risk was 2.8, compared with the relative risk of 1.0 assigned to those drinking only rainwater. To our knowledge, no similar analytical findings have been reported elsewhere.

When the neural tube defects were considered in isolation an even stronger effect with maternal groundwater consumption was demonstrated (RR = 3.5). This finding is the reverse of what one might expect on the basis of earlier descriptive work suggesting a positive correlation between high incidence of these anomalies and softness (or calcium concentration) of local drinking water supplies (7, 8, 10). Groundwater supplies in the Lower South East, being derived from a predominantly limestone aquifer, are typically very hard with a high calcium and magnesium content (18, 19). Hardness levels in the Blue Lake over the past five years have averaged 200 mg/liter as calcium carbonate (Engineering and Water Supply Department, personal communication, 1983).

Given that the present association with groundwater is based upon retrospectively inferred data concerning maternal water supply in the first trimester, the findings should be interpreted with caution. The assumption that the address given by a mother at the time of admission to hospital is identical with her place of residence during the relevant phase of pregnancy may not always be justified. Inquiries at the hospitals concerned revealed that up to 5 per cent of all births registered there in the study period were to women who had resided outside the Lower South East during the first

Results of multivariate supply and five other c

Baby's sex
Male
Female
Mother's marital st
Married
Single
Other
Mother's nationality
Australian
British
European
Other
Father's employmen
Class 1
Class 2
Class 3
Class 4
Mother's area of resi
Mt Gambier urban
Mt Gambier rural
Other urban
Other rural
Mother's water suppl
Rainwater
Blue Lake
Bore
Other mains
Not known

* G^2 denotes twice the model, and is distributed

trimester. In the pres
bias of this kind woul
underestimate the re
erstate it.

Sampling bias is
source of systematic e
considered in the inl
findings. A small nun
have transferred to h
study area to obtain s
erally, the study hosp
handling all save the r
stetric emergencies.) S
reasonably be expecte
tial cases more often
trols. Furthermore,

TABLE 5

Results of multivariate logistic regression analysis of risk of malformations in relation to maternal water supply and five other covariables, for babies born in the Lower South East of South Australia, 1951–1979

	β ± standard error	Relative risk (approximate 95% confidence interval)	$p(G^2 > \chi^2 df)$*
Baby's sex			0.016
Male	0.48 ± 0.20	1.6 (1.1– 2.4)	
Female		1.0	
Mother's marital status			0.950
Married		1.0	
Single	−0.12 ± 0.54	0.9 (0.3– 2.6)	
Other	0.15 ± 0.68	1.2 (0.3– 4.4)	
Mother's nationality			0.490
Australian		1.0	
British	0.16 ± 0.42	1.2 (0.5– 2.7)	
European	−0.31 ± 0.38	0.7 (0.4– 1.5)	
Other	−1.16 ± 0.93	0.3 (0.1– 1.9)	
Father's employment			0.530
Class 1		1.0	
Class 2	0.13 ± 0.34	1.1 (0.6–2.3)	
Class 3	−0.23 ± 0.40	0.8 (0.4–1.7)	
Class 4	0.13 ± 0.41	1.1 (0.5–2.6)	
Mother's area of residence			0.046
Mt Gambier urban		1.0	
Mt Gambier rural	1.23 ± 0.46	3.4 (1.4– 8.5)	
Other urban	0.79 ± 0.51	2.2 (0.8– 5.9)	
Other rural	0.59 ± 0.48	1.8 (0.7– 4.7)	
Mother's water supply			0.00011
Rainwater		1.0	
Blue Lake	1.59 ± 0.45	4.9 (2.1–11.7)	
Bore	1.46 ± 0.59	4.3 (1.4–13.8)	
Other mains	0.38 ± 0.55	1.5 (0.5– 4.3)	
Not known	1.53 ± 0.47	4.6 (1.8–11.6)	

* G^2 denotes twice the change in the log-likelihood statistic when a particular variable is fitted to the model, and is distributed as χ^2_f where f is the number of degrees of freedom lost in fitting that variable.

trimester. In the present study, exposure bias of this kind would be more likely to underestimate the relative risk than overstate it.

Sampling bias is another potential source of systematic error which must be considered in the interpretation of our findings. A small number of women may have transferred to hospitals outside the study area to obtain specialist care. (Generally, the study hospitals are capable of handling all save the most exceptional obstetric emergencies.) Such transfers could reasonably be expected to involve potential cases more often than potential controls. Furthermore, some babies with malformations may not have been reported in the delivery registers. However, sampling bias, leading to a spurious estimate of the relative risk, would only occur if the exposure profile of the missed cases is unrepresentative of that for all mothers of malformed infants. In the present study, there are no grounds for believing that this might be so.

There is a need also to consider misclassification bias, i.e., the erroneous placement of malformed infants in the control group or vice versa. Infants might have been incorrectly classified as controls simply because their malformations were not detected and/or reported. Thus,

if some component of maternal groundwater exposure is causally associated with the risk of producing a malformed child, then the effect of such misclassification would be to underestimate the true relative risk. Whereas it is probable that some misclassification occurred in respect to mild cases of certain anomalies (e.g., talipes), and in cases of malformations not readily identifiable in the newborn period (e.g., congenital heart and renal defects), it is most unlikely that this would occur for gross (and often fatal) defects such as spina bifida and anencephalus.

Despite the failure of several of the trends in relative risk revealed by the present stratification procedures to attain statistical significance (at the conventional 5 per cent level), given the internal consistency of these trends, and their general agreement with the findings of our earlier descriptive study (16), we believe that these results provide evidence for a real association between the consumption of Lower South East groundwater and congenital malformations.

Assuming that greater quantities of water are imbibed during the warmer, drier months than during winter, then the demonstrated seasonal variation in relative risk could be regarded as consistent with the hypothesis that some factor present in groundwater is causally associated with the occurrence of malformations. This assumption is not unreasonable given the summer conditions experienced in South Australia. In January (the hottest month), the average daily maximum temperature in Mount Gambier is 26 C, although air temperatures may often well exceed 30 C for days at a time. It has been reported that the amount of water ingested by children is primarily influenced by air temperature (27) but we cannot be certain that this relationship holds true for pregnant women in the Lower South East. There have been no demonstrated seasonal variations in the levels of various chemical agents (including nitrates) in the groundwaters of the Lower South East that might explain the observed gradation in relative risk across seasons. (Municipal groundwater supplies in the region are monitored at weekly intervals by the government water authorities.)

The suggestion of an elevation in risk for a variety of malformation categories (table 4) seemingly militates against the hypothesis that some factor present in groundwater is causally associated with these anomalies. One might expect such an effect to be more specific. Thus we cannot entirely exclude the possibility that other unidentified maternal or environmental variables may be correlated with water supply.

Nevertheless, the marked association between neural tube defects and groundwaters with elevated nitrate levels in Mount Gambier is consistent with the demonstrated correlations between per capita consumption of nitrate-cured foods and the incidence of these defects in the United Kingdom (21). It is noteworthy also, that the N-nitroso compounds particularly produce malformations of the central nervous and musculoskeletal systems in experimental animals (28–30). Furthermore, the conversion of nitrates to nitrosamines or nitrosamides in humans, with subsequent transplacental transfer, is certainly biologically plausible (31–35).

The gradient in risk of malformations yielded on reanalysis of our data by estimated water nitrate concentrations, and ignoring water source, further supports the contention that dissolved nitrate may be the causal agent in this association. Compared with water in the range of less than 5 ppm of nitrate (relative risk set at 1.0), nitrate concentrations of 5–15 ppm were associated with a near trebling of risk, whereas those of more than 15 ppm resulted in a fourfold increase in risk. These three quantitative groupings of ni-

trate exposure corresp
the qualitative water st
rainwater, Blue Lake
water, respectively.

This finding naturall
tion of whether there a
fied agents present in
water, that are correla
and which are responsil
relationship with malf
stage, we cannot answ
conclusively.

Previous groundwa
suggested that the mo
significant indicator of
tion in the region (wh
municipal, agricultur
sources) is the nitrate i
our earlier report (16).
water authority has
water quality investiga
in attempts to determi
correlates of water nitra
plain our results (Engin
Supply Department, pe
cation, 1983). Attentior
marily on the organic
larly the trihalometh
nated/chlorinated phe
since many of these sub
to have mutagenic or t
experimental species (
these studies have not
there is as yet no eviden
compounds investigated
correlated with nitrate.

Some epidemiologic s
the possibility of a cau
organic halides in treat
and human cancer (36,
aware of any similar r
to congenital malforma
that the relative risk wa
of the three calendar dec
gests that chlorination
not involved: the Blue
chlorinated only since
groundwater supplies
not disinfected. This d

trate exposure correspond broadly with the qualitative water supply categories of rainwater, Blue Lake water, and bore water, respectively.

This finding naturally raises the question of whether there are other unidentified agents present in the local groundwater, that are correlated with nitrate, and which are responsible for its apparent relationship with malformations. At this stage, we cannot answer this question conclusively.

Previous groundwater studies have suggested that the most consistent and significant indicator of manmade pollution in the region (whether it be from municipal, agricultural or industrial sources) is the nitrate ion (18, 19). Since our earlier report (16), the government water authority has mounted special water quality investigations in the area, in attempts to determine if there are any correlates of water nitrates that might explain our results (Engineering and Water Supply Department, personal communication, 1983). Attention was focused primarily on the organic halides, particularly the trihalomethanes and brominated/chlorinated phenolic compounds, since many of these substances are known to have mutagenic or fetotoxic effects in experimental species (36, 37). Although these studies have not been completed, there is as yet no evidence that any of the compounds investigated are significantly correlated with nitrate.

Some epidemiologic studies have raised the possibility of a causal link between organic halides in treated drinking water and human cancer (36, 38) but we are not aware of any similar reports in relation to congenital malformations. Our finding that the relative risk was elevated in each of the three calendar decades studied suggests that chlorination by-products are not involved: the Blue Lake has been chlorinated only since 1967, and other groundwater supplies in the region are not disinfected. This does not entirely rule out a possible connection between organic halides and the incidence of malformations in the Lower South East. Chloride, fluoride and bromide all occur naturally in groundwaters of the region. (In the Blue Lake, the concentrations of these ions average about 92, 0.3 and 0.2 mg/liter, respectively.) However, in contrast with most other South Australian drinking water supplies (which are of surface origin), the groundwaters of the Lower South East are low in the organic precursors (humic and fulvic acids) required for trihalomethane formation.

Since bromine is chemically more reactive than chlorine, brominated organics tend to be the predominant halogenated species formed in the Lower South East groundwaters. Bromoform levels in the Blue Lake have averaged 23 μg/liter over the past five years, with a maximum recorded concentration of 42 μg/liter (Engineering and Water Supply Department, personal communication, 1983). For comparison, bromoform levels in water supplied to Adelaide, the capital city of South Australia, have averaged 19 μg/liter in the same period. Bromoform levels of up to 289 μg/liter have been recorded in surface water supplies to northern towns used as control areas for Mount Gambier in our earlier descriptive study (16). Total trihalomethane levels in drinking water are also considerably higher in other parts of South Australia than in the Lower South East.

It is possible that biologically more active but as yet undetected brominated compounds are distributed in the groundwaters of the Lower South East in a pattern consistent with the present case-control findings. Although traces of brominated phenols have occasionally been detected in the waters of the Blue Lake, these substances are not habitually present. It is thought that these isolated instances are the result of aerial contamination from timber preservation plants nearby (Engineering and Water Supply

Department, personal communication, 1983). Clearly, this is one area of investigation that merits detailed research.

The results of our multivariate analysis may cast doubt on the groundwater and nitrate hypotheses. Although the contribution of water supply to risk of malformations was apparently greater than that of mother's residence (table 5), both seemed to have a significant effect. This suggests that either: 1) some unidentified spatial variable is a determinant of malformation risk, independent of water supply; or 2) there is an unknown third factor associated with both residence and water supply which is responsible for the observed association of each of these risk variables with malformations.

It is difficult to evaluate these two suggestions in retrospect, given our small sample and the limited nature of the data relating to individuals available to us. The long time period covered by the study precluded attempts to trace individual women to obtain reliable and comprehensive antenatal histories. Clearly, individual data on maternal occupation, diet, and other environmental exposures would be valuable. In this context, details of paternal occupational exposures would also be of interest. Such data were not routinely recorded in patient records during the period studied, since the hospitals concerned are general community hospitals with limited resources.

Despite these deficiencies in our data, the results of the multivariate analysis and our knowledge of the local environment lead us to suggest several factors which might be considered as alternatives to the groundwater (and nitrate) hypotheses.

First, since the early 1900s the Lower South East has been extensively planted with softwood timber (principally *Pinus radiata*). There are now approximately 100,000 hectares of forest in the region. Concomitant with this afforestation there has grown a significant timber processing and paper manufacturing industry. About 6000 people are employed in these industries which comprise 11 sawmills, four pressure treatment plants (for timber preservation), two chipboard plants and two paper mills (18). A wide range of chemical agents or processes known to be mutagenic, or to adversely affect reproductive outcomes in experimental animals, are used in these industries (41). These include: phenols, cresols and xylenols found in creosote (a highly complex mixture of organic chemicals used in the preservation of timber); the multisalt timber preservative, copper-chrome-arsenic; and urea formaldehyde, which is used in the manufacture of chipboard. Since we know little of individual parents' occupational exposures to such agents in the periconceptional period we cannot determine their effects (if any) on the results of this study.

It is possible that the presence of these industries is in some way related to the effect of mother's residence on risk of malformations, as revealed by the multivariate analysis. Certainly, residents' complaints of objectionable odors emanating from the timber treatment plants in Mount Gambier are not uncommon under particular meteorologic conditions. As mentioned earlier, aerial contamination from these works is believed to be responsible for the periodic detection of brominated phenols in nearby Blue Lake. However, if this were so, then one might expect the risk of malformations to be greatest in the urban areas of the Lower South East which are closest to the sources of contamination (e.g., Mount Gambier City). This suggestion is not borne out by the results of the multivariate analysis (table 5). Yet without precise information on the siting of individual case or control homes in relation to these industries, and in the absence of detailed meteorologic data at the local level, we cannot reach any firm conclusions about the effects of this variable.

C

This may be one facte
ronment which deser

Agricultural pestic
responsible for the obs
residence and/or wate
formations. While thi
plain the greater risl
for mothers resident i
the outskirts of Mour
bore water consumer
likely to be an explan
tion in risk experience
sumers since this wa
tively isolated from si
pesticide contaminati

Other factors which
with residence or wa
and be relevant in the
clude maternal infl
Toxoplasma gondii) a
ever, neither of these
credible given the ty
studied, the strength
the demonstrated as
variations in relati
and water nitrate lev

In summary, given
tified teratogenic fac
lated with water su
or outside the water
premature to interp
findings exclusively i
trate exposure. Neve
that the internal coh
and their consisten
study and experime
weight to the possib
ation between groun
sumption and malfor

Although two other
examined the relatio
sumption of high-nit
fetal or infant morta
of these studies has s
the possible relations
malformations.

Since high levels o
water have been rep
of the world, incl

This may be one factor in the local environment which deserves further study.

Agricultural pesticides might also be responsible for the observed association of residence and/or water supply with malformations. While this variable might explain the greater risk of malformations for mothers resident in the rural areas on the outskirts of Mount Gambier, and for bore water consumers (table 5), it is unlikely to be an explanation for the elevation in risk experienced by Blue Lake consumers since this water supply is relatively isolated from significant sources of pesticide contamination.

Other factors which could be correlated with residence or water supply, or both, and be relevant in the present context include maternal infections (e.g., with *Toxoplasma gondii*) and inbreeding. However, neither of these possibilities seems credible given the types of anomalies we studied, the strength and consistency of the demonstrated associations, and the variations in relative risk with season and water nitrate levels.

In summary, given that other unidentified teratogenic factors could be correlated with water supply—either within or outside the water source—it would be premature to interpret our case-control findings exclusively in terms of water nitrate exposure. Nevertheless, we believe that the internal cohesion of our findings, and their consistency with our earlier study and experimental evidence, lend weight to the possibility of a real association between groundwater nitrate consumption and malformations.

Although two other investigations have examined the relationship between consumption of high-nitrate well water and fetal or infant mortality (39, 40), neither of these studies has specifically addressed the possible relationship with congenital malformations.

Since high levels of nitrate in groundwater have been reported in many parts of the world, including the United Kingdom, Israel and the United States, we suggest that the relationship reported here should be investigated in populations elsewhere.

References

1. Leck I. Correlations of malformation frequency with environmental and genetic attributes in man. In: Wilson JG, Fraser FC, eds. Handbook of teratology. Vol. 3. New York: Plenum Press, 1977:243-324.
2. Miller JR, Yasuda M. Environmental factors in the aetiology of congenital malformations in man. In: Emery AEH, ed. Modern trends in human genetics. Vol. 2. London, UK: Butterworths, 1975:308-36.
3. Klingberg MA, Papier CM. Teratoepidemiology. J Biosoc Sci 1979;11:233-58.
4. Smithells RW, Sheppard S, Schorah CJ. Vitamin deficiencies and neural tube defects. Arch Dis Child 1976;51:944-50.
5. Smithells RW, Sheppard S, Schorah CJ, et al. Possible prevention of neural tube defects by periconceptional vitamin supplementation. Lancet 1980;1:339–40.
6. Holmes-Siedle M, Lindenbaum RH, Galliard A. Vitamin supplementation and neural tube defects. (Letter.) Lancet 1982;1:276.
7. Penrose LS. Genetics of anencephaly. J Ment Defic Res 1957;1:4-15.
8. Fedrick J. Anencephalus and the local water supply. Nature 1970;227:176-7.
9. Fielding DW, Smithells RW. Anencephalus and water hardness in south-west Lancashire. Br J Prev Soc Med 1971;25:217-9.
10. Lowe CR, Roberts CL, Lloyd S. Malformations of the central nervous system and softness of local water supplies. Br Med J 1971;2:357-61.
11. Morton MS, Elwood PC, Abernethy M. Trace elements in water and congenital malformations of the central nervous system in South Wales. Br J Prev Soc Med 1976;30:36-9.
12. Bound JP, Harvey PW, Brookes DM, et al. The incidence of anencephalus in the Fylde peninsula 1956-76 and changes in water hardness. J Epidemiol Community Health 1981;35:102-5.
13. Elwood JM, Coldman AJ. Water composition in the etiology of anencephalus. Am J Epidemiol 1981;113:681-90.
14. Wilson TS, Watson RS, Richards IDG. Anencephaly and water supply—a study of the problem in Glasgow. Health Bull (Edinb) 1973;31:76-8.
15. St Leger AS, Elwood PC, Morton MS. Neural tube malformations and trace elements in water. J Epidemiol Community Health 1980;34:186-7.
16. Scragg RKR, Dorsch MM, McMichael AJ, et al. Birth defects and household water supply: results of epidemiological studies in the Mount Gambier region of South Australia. Med J Aust 1982;2:577-9.
17. State Planning Authority. South East planning

area development plan. Adelaide, South Australia: State Planning Authority, 1970.
18. Harvey PD. Water quality management in the South-East of South Australia. Master's thesis, Centre for Environmental Studies, University of Adelaide, 1979.
19. Waterhouse JD. The hydrogeology of the Mount Gambier area. Parkside, South Australia: Department of Mines and Energy, 1977. (Department of Mines Geological Survey of South Australia, Report of Investigations 48.)
20. World Health Organization. International standards for drinking water. 3rd ed. Geneva: WHO, 1971.
21. Knox EG. Anencephalus and dietary intakes. Br J Prev Soc Med 1972;26:219–23.
22. World Health Organization. Manual of the international statistical classification of diseases, injuries and causes of death. 8th rev. Vol. 1. Geneva: WHO, 1965.
23. Breslow NE, Day NE. Statistical methods in cancer research. Vol. 1. The analysis of case-control studies. Lyon: IARC, 1980.
24. Thomas DC. General relative-risk models for survival time and matched case-control analysis. Biometrics 1981;37:673–86.
25. Heady JA, Heasman MA. Social and biological factors in infant mortality. London: HMSO, 1959.
26. Stevenson AC. Evidence from nuclear sexing relating to the primary sex ratio in man. Proc Roy Soc Med 1961;54:897-9.
27. Hart BT. A compilation of Australian water quality criteria. Canberra, A.C.T.: Australian Government Publishing Service, 1974. (Aust. Water Resources Council technical paper no. 7).
28. Von Kreybig T. Die wirkung einer carcinogen methylnitroso-harnstoff-dosis auf die embryonalentwicklung der ratte. Z Krebsforschung 1965;67:46-50.
29. Druckrey H, Ivankovic S, Preussman R. Teratogenic and carcinogenic effects in the offspring after a single injection of ethylnitrosourea to pregnant rats. Nature 1966;210:1378-9.
30. Givelber H, Di Paolo JA. Teratogenic effects of N-ethyl-N-nitrosourea in the Syrian hamster. Cancer Res 1969;29:1151-5.
31. Hawksworth GM, Hill MJ. Bacteria and the N-nitrosation of secondary amines. Br J Cancer 1971;25:520-6.
32. Hawksworth GM, Hill MJ. The in vivo formation of N-nitrosamines in the rat bladder and their subsequent absorption. Br J Cancer 1974;29:353-8.
33. Inui N, Nishi Y, Taketomi M, et al. Transplacental mutagenesis of products formed in the stomach of golden hamsters given sodium nitrite and morpholine. Int J Cancer 1979;24: 365-72.
34. Inui N, Nishi Y, Taketomi M, et al. Transplacental action of sodium nitrite on embryonic cells of Syrian golden hamster. Mutat Res 1979;66:149-58.
35. Shuval HI, Gruener N. Epidemiological and toxicological aspects of nitrates and nitrites in the environment. Am J Public Health 1972;62:1045-52.
36. Wilkins JR III, Reiches NA, Krusé CW. Organic chemical contaminants in drinking water and cancer. Am J Epidemiol 1979;110:420-48.
37. Allen JR, Barsotti DA, Lambrecht LK, et al. Reproductive effects of halogenated aromatic hydrocarbons on nonhuman primates. Ann NY Acad Sci 1979;320:419-25.
38. Wilkins JR III, Comstock GW. Source of drinking water at home and site-specific cancer incidence in Washington County, Maryland. Am J Epidemiol 1981;114:178-90.
39. Gelperin A, Moses VK, Bridger C. Relationship of high nitrate community water supply to infant and fetal mortality. Illinois Med J 1975;147:155-7, 186.
40. Super M, De V Heese H, MacKenzie D, et al. An epidemiological study of well-water nitrates in a group of south west African/Namibian infants. Water Res 1981;15:1265-70.
41. US Environmental Protection Agency. Creosote, inorganic arsenicals, pentachlorophenol. Washington, DC: US EPA, 1981 (Position Document 2/3, 1981).

EPIDEMIOI

Jorde, L. B
Fineman and
1979. *Am J E*

The preval
were born in
is 1.00 per 1
the western
10 years, alt
period. Exan
fects were n
ratio is 0.67.
distribution,
significant n
and the perc
the Mormon
in Utah and
analysis den

anencepha

As part of a com
epidemiology and
defects, virtually
defects who were
from 1940 through
tained. These cas
the 1.2 million-m
ical Data Base (1)
clustering of neu
provide pedigrees
inheritance. In thi
data collection an
alence, sex ratio,

Received for publica
[1] Department of Hu
Utah School of Medicin
(Reprint requests to D
[2] Division of Medical
diatrics, University of
Lake City, UT.
This research was
number 6-291 from th
fects Foundation.

Reprinted from AMERICAN JOURNAL OF PUBLIC HEALTH, Vol. 61, No. 7, July, 1971

E336

Mortality and prevalence rates indicated a region of Colorado where the hypertension risk was greater. Study of municipal water supplies suggested an association with nitrate concentrations, particularly organic nitrates. The possibility of a causative relationship is examined and the need for further investigation of these phenomena emphasized.

HYPERTENSION AND DRINKING WATER CONSTITUENTS IN COLORADO

William E. Morton, M.D., Dr.P.H.

IN 1960 Schroeder showed an apparent inverse correlation between the hardness of drinking water and the hypertensive heart disease death rate by state in the United States in 1949–51.[1,2] A subsequent report in 1966 described a similar relationship between water hardness in the same 1950–51 water data and the hypertensive heart disease death rate by state in U.S. whites in 1960.[3] In Oklahoma, Lindeman and Assenzo were unable to confirm Schroeder's observation in a study of 1949–53 water analysis data and 1950–59 hypertensive heart disease mortality by county.[4] In rebuttal, Schroeder stated that the proposed hypertension-hard-water inverse relationship was "not evident in smaller geographic areas with lesser populations."[3]

In England, Morris and co-workers confirmed Schroeder's correlation between water hardness and ischemic heart disease mortality in the 45–64 age group but showed that the association between water hardness and hypertension mortality was *not* significant.[5] In Sweden, Biörck and co-workers also showed no significant correlation between water hardness and hypertension mortality.[6] In Russia, Moscow with hard water and Leningrad with soft water were reported to have identical hypertension incidence rates.[7]

Statewide studies of hypertension mortality and prevalence in Colorado have suggested the emergence in about 1960, of an area of relatively higher hypertension risk in comparison to the rest of the state.[8,9] These hypertension data are summarized in Table 1 which shows that the distribution of hypertension is nonuniform in Colorado. In the top half of Table 1, altitude did not affect hypertension mortality in 1950 or 1960, but it seemed to be inversely related to hypertension prevalence in Selective Service registrants. In the bottom half of the table, when the counties were regrouped by river basin, the Republican River group was the only one to show persistence of its 1950 hypertension mortality rate into 1960, matched by a distinctly higher hypertension prevalence rate among Selective Service registrants at about the same time. Together, the lowest altitude stratum and the Republican River basin represent a band of counties along Colorado's eastern edge. This region did *not* have a shortage of physicians or hospital beds nor was there evidence of major socioeconomic deprivation.[10]

In 1961, Gregg and co-workers with

Table 1—Hypertension mortality and prevalence rates in Colorado

Elevation (ft)	Hypertension and hypertensive heart disease, 440–447. Age-adjusted 3-yr mean annual mortality rates per 100,000. 1949–51	1959–61	Hypertension diagnosed in Selective Service registrants born in 1939, 1940, and 1941, examined during 1957–64. Prevalence rates per 1,000.
A. Colorado counties grouped by mean population elevation.			
8,000–10,152	70	24	4.3
7,000– 7,999	60	24	3.6
6,000– 6,999	45	22	5.7
5,000– 5,999	57	24	7.5
4,000– 4,999	42	24	11.3
3,489– 3,999	72	66	21.9
Total	54	25	8.2
B. Colorado counties grouped by river basin.			
Platte R.	57	24	8.5
Republican R.	58	57	16.0
Arkansas R.	43	26	8.1
Rio Grande R.	73	31	4.4
San Juan R.	69	18	7.8
Colorado R.	47	25	5.8
Total	54	25	8.2

For county groupings and methodologies see Arch. Environ. Health 20:690, 1970.

the U. S. Geological Survey published a statistical report describing the public water supplies of Colorado in 1959–60.[11] Although Schroeder's proposed inverse relationship between hard water and hypertension had never been corroborated by other investigators, the availability of a recent statewide water survey and Colorado's broad range of water hardness made this an appropriate place to begin the search for an explanation for Colorado's 1960 geographic pattern of hypertension distribution.

Methods

The methods of water data collection are described by Gregg, et al., as follows: "All communities in Colorado having a population of 100 or more were considered in the investigation, and data were compiled from all known publications and sources of information pertaining to municipal water supplies in the state. Using these data, a file for each community was started. The file was augmented by data collected from a personal visit during which one or more city officials were interviewed, their records reviewed, and the water system was visited. To supplement available information on chemical quality of water, 175 water samples were collected and analyzed, and field measurements of conductivity and temperature were made at nearly every community. Some communities where the water supply was subject to substantial seasonal variation in quality were revisted expressly for the purpose of obtaining additional water samples."[11]

Since Gregg and co-workers had omitted the Denver water system from

their study, mean water constituent values for Denver were averaged from the 1960 monthly Denver water analyses on file in the Colorado Department of Public Health (courtesy of W. N. Gahr). For all other Colorado counties, population-weighted mean water constituent values were computed. When the counties were combined into the altitude and river basin classification systems used for the mortality and morbidity data analyses, population-weighted mean values were computed for each classification category and for the state as a whole.

Results

Table 2 presents the two geographic distributions of the population served and of selected water constituent concentrations. It is apparent that municipal drinking water in Colorado tends to be softer at higher altitudes and harder at lower altitudes and that the Arkansas River basin has the hardest water in the state. In comparison to the hypertension pattern in Table 1, the water hardness pattern in Table 2 actually exhibits a positive correlation rather than Schroeder's postulated inverse relationship. On water hardness, the correlation coefficient (r) is +0.65 for the 1960 hypertension mortality and +0.86 for the hypertension prevalence rates. In view of the published experience of others, these correlation coefficients are not regarded as significant. Neither did the sodium nor chloride concentration patterns in Table 2 match or reciprocate with the 1960 hypertension pattern in Table 1.

The water constituent whose distribution showed the greatest similarity to the hypertension pattern was nitrate. In regressions on mean nitrate concentrations, correlation coefficients are +0.12 for 1950 hypertension mortality, +0.90

Table 2—Colorado municipal water supply constituents in 1959–1960. Population-weighted mean values in parts per million.

Elevation (ft)	Population served: Number	Population served: % of census	Total hardness	Na	NO_3	Cl
A. Colorado counties grouped by mean population elevation.						
8,000–10,152	11,475	56	79	3.0	0.1	0.3
7,000– 7,999	41,502	57	95	12.2	0.8	1.2
6,000– 6,999	143,650	63	94	9.8	0.4	7.3
5,000– 5,999	1,010,880	95	100	33.3	1.9	22.8
4,000– 4,999	211,652	67	325	38.5	4.1	12.9
3,489– 3,999	34,745	59	591	91.2	10.2	26.0
Total	1,453,904	83	158	32.3	2.2	19.1
B. Colorado counties grouped by river basin.						
Platte R.	1,040,372	93	144	33.2	3.0	23.4
Republican R.	13,325	49	167	17.4	13.7	12.4
Arkansas R.	278,795	71	257	32.8	1.9	10.8
Rio Grande R.	14,192	37	61	23.0	1.0	1.1
San Juan R.	22,910	59	173	7.4	0.6	5.0
Colorado R.	84,310	61	86	5.1	0.4	2.9
Total	1,453,904	83	158	32.3	2.2	19.1

Figures based on data provided by D. O. Gregg, et al. Public Water Supplies of Colorado, 1959–1960, Colorado State University Press, Fort Collins, 1961.

for 1960 hypertension mortality, and +0.89 for hypertension prevalence. In general, nitrate concentrations are low in surface waters but may rise above the recommended limit of 44 ppm in certain ground waters. A high nitrate level is usually regarded as indicative of pollution because it represents the final stage in the oxidation of organic nitrogen compounds from human and animal wastes, from plant wastes, and from fertilizer residues.[12] The usual test for nitrate concentration in water in 1959–60 was the phenoldisulfonic acid method, a colorimetric procedure sensitive to nitrate levels as low as 0.1 ppm at that time but rendered less sensitive by chloride levels above 10 ppm.[13] Because of interfering chloride levels in much of eastern Colorado, probably actual nitrate levels were even higher than indicated here. Eighteen communities were represented by nitrate levels over 22 ppm, three communities by levels over 44 ppm: Brighton 59, Gilcrest 75, and Nunn 126.

Nitrates in soil and ground water occur as a wide spectrum of organic and inorganic compounds which varies in composition in different places and at different times.[14,15] Toxicity of organic nitrates is similar to that of nitrites. High nitrate levels in drinking water are well established as a cause of methemoglobinemia in infants.[16,17] An association between high nitrate intake and endemic goiter occurrence has been suggested, but not proved.[18,19] Both infant methemoglobinemia and endemic goiter are believed to be much commoner in eastern Colorado than elsewhere in the state, although systematic morbidity data are unavailable.

Less well-known are the chronic cardiovascular toxic effects which have been reported among workers exposed to organic nitrates in the explosives industry.[20-28] These toxic effects include: elevated diastolic blood pressure, lowered pulse pressure, and increased risk of angina pectoris and/or sudden death most apt to manifest on nitrate withdrawal, typically Sunday night and Monday morning. In Pennsylvania, male explosives workers aged 20–54 years have been reported to have a coronary artery disease mortality rate about 15 times greater than that of the general male population in that age group.[26]

Because of the association of hypertension and sudden "coronary" deaths in explosives workers, the ischemic heart disease mortality rates in Colorado would be of great interest in our pursuit of an apparent recent relationship between hypertension and nitrate levels in the state. The data in Table 3 show that Colorado's ischemic heart disease mortality bears no relation to the hypertension pattern which has emerged between 1950 and 1960 (Table 1). Perhaps a lower exposure to organic nitrates via water ingestion than via occupational pulmonary and percutaneous absorption would account for a possible differential manifestation of nitrate toxicity as of 1960. Neither does the 1960 ischemic heart disease mortality rate have any direct or reciprocal relationship to the pattern of water hardness seen in Table 2. On the mean water hardness values, correlation coefficients with the 1960 ischemic heart disease death rate are −0.50 for the altitude classification, +0.56 for the river basin classification, and −0.12 overall. This variation is ample evidence of the variability of the relationship. In this matter our data agree with negative reports from Oklahoma,[4] Sweden,[6] and Ireland,[29] although I did not separate from the total the sudden coronary deaths which might be the only component of coronary artery disease mortality to be affected according to reports from Ottawa,[30] and Washington State.[31]

Table 3 shows further that the 1960 region of persistent hypertension mortality risk has not increased the overall risk of death due to cerebrovascular ac-

cidents. In fact, the modest decline in CNS vascular disease mortality between 1950 and 1960 in eastern Colorado (lowest altitude stratum and Republican River basin) probably accounts for some of the persistence of hypertension mortality in that region, since it is a "competitive" primary cause of death. When the 1960 hypertension mortality rates are adjusted for regional changes in the CNS vascular disease death rates, correlation with nitrate levels drops from +0.90 to +0.73. On this basis we might discard the proposal of an emergent region of higher hypertension risk in 1960 if it were not for the independent hypertension prevalence data whose correlation with nitrate remains unaffected by the CNS vascular mortality variable. On water hardness, the over-all r values were −0.22 for 1960 CNS vascular disease mortality and −0.51 for 1960 death rates for general arteriosclerosis and peripheral vascular disease. These are not regarded as significant.

Discussion

The limitations of the mortality and morbidity data have been discussed elsewhere,[9] but we need to consider the shortcomings of the water analysis data which this paper and many others have used. First, in different regions of the state, from 5 per cent to 63 per cent of the local populations obtained drinking water from individual sources not represented here. Second, water samples were *not* obtained by a random sampling method geographically, and the temporal representations can be assumed to be inadequate (this study does not differ from any of the others published). Third, we have no knowledge of the actual amount of sodium consumed in water because of the widespread use of house-

Table 3—Chronic cardiovascular disease mortality in Colorado. Age-adjusted 3-yr mean annual rates per 100,000*

	Ischemic heart disease 420		Vascular lesions of the C.N.S. 330–334		Gen'l. arteriosel. and periph. vasc. disease 450–456	
Elevation (ft)	1949–51	1959–61	1949–51	1959–61	1949–51	1959–61
A. Colorado counties grouped by mean population elevation.						
8,000–10,152	174	262	97	106	24	35
7,000– 7,999	191	204	97	96	25	33
6,000– 6,999	189	232	88	97	33	27
5,000– 5,999	226	231	92	89	24	27
4,000– 4,999	187	224	82	88	21	19
3,489– 3,999	188	207	89	71	17	21
Total	209	228	90	87	24	25
B. Colorado counties grouped by river basin.						
Platte R.	222	233	92	88	25	26
Republican R.	194	203	80	68	27	12
Arkansas R.	190	229	83	82	22	21
Rio Grande R.	167	183	94	99	29	30
San Juan R.	194	203	97	103	25	33
Colorado R.	192	216	91	95	27	29
Total	209	288	90	87	24	25

* For method see Arch. Environ. Health 9:21, 1964.

hold cation-exchange (Na+ for Ca++ and Mg++) water softeners, particularly in the regions where the water is hardest. Sodium consumption from this source must be significant in many areas, and household surveys would be needed to obtain cross-sectional and follow-up data. Increasing use of cation-exchange water softeners might explain the lack of decline in hypertension mortality between 1950 and 1960 in Colorado's hard water regions, but it would not explain Schroeder's observation of an apparent inverse relationship between water hardness and hypertension mortality.

With the foregoing reservations in mind, I regard this proposed association between nitrate concentration in water and a hypertension mortality and prevalence pattern which seemed to have emerged in 1960 as a promising basis for further investigation. The correlation coefficients cited here should not be regarded too highly until other investigations confirm or refute them. However, two factors add weight to this apparent relationship: (a) the observations in Europe, Japan, and the United States that explosives workers exposed to organic nitrates tend to develop diastolic hypertension, and (b) the continued increase in utilization of intensive agricultural production methods, particularly fertilizers and irrigation.[14] Rural and suburban water sources would seem to be at particular risk of increasing nitrate levels in the future. There is currently no economical method for removing nitrate from drinking water.[32] This may constitute a major ecological problem.

The cardiovascular manifestations of organic nitrates in explosives workers are not widely known among clinicians, whose awareness is usually limited to the hypotensive effects of the nitrites and organic nitrates used for relief of angina pectoris. Von Oettingen has suggested that the diastolic hypertension may represent a vasomotor adaptation to the hypotensive effect of the organic nitrates which act directly on peripheral vascular smooth muscle.[36] These chronic toxic effects might have a bearing on the failure of establishment of the efficacy of the long-acting coronary vasodilator drugs,[33-35] and they actually raise the possibility that therapy with long-acting organic nitrates might hasten the progress of coronary artery disease rather than alleviate it. Clearly, this possibility must be investigated. Most investigators of occupational exposures to organic nitrates have mentioned the wide individual variations in susceptibility and in ability to develop tolerance to continued exposure, and they have cautioned about the need for careful study design to insure reliable interpretations.

Summary

Mortality and prevalence rates indicated that in about 1960 there existed on Colorado's eastern plains a rural region in which the hypertension risk was significantly higher than in the rest of Colorado, urban or rural. This could not be ascribed to known variations in socioeconomic factors or availability of physicians, and the pattern had not existed in 1950. A 1960 statewide study of municipal water supplies showed that the hypertension pattern could not be explained by water hardness, but might be associated with nitrate concentration. Since the organic nitrates have been associated with increased risk of diastolic hypertension in explosives workers, there is reason to suspect a causative relationship between high nitrate levels in water and Colorado's emergent hypertension pattern. With continuing utilization of more and more intensive agricultural methods, particularly the use of water and nitrogenous fertilizers, nitrate concentrations in ground water can be expected to rise in many regions. We need to know if increased hypertension risk

is one of the ecological consequences of modern intensive agricultural procedures.

REFERENCES

1. Schroeder, H. A. Relation Between Mortality from Cardiovascular Disease and Treated Water Supplies. J.A.M.A. 172: 1902–1908 (Apr. 23), 1960.
2. ————. Relation Between Hardness of Water and Death Rates from Certain Chronic and Degenerative Diseases in the United States. J. Chronic Dis. 12:586–591 (Dec.), 1960.
3. ————. Municipal Drinking Water and Cardiovascular Death Rates. J.A.M.A. 195:81–85 (Jan. 10), 1966.
4. Lindeman, R. D., and Assenzo, J. R. Correlations Between Water Hardness and Cardiovascular Deaths in Oklahoma Counties. A.J.P.H. 54:1071-1077 (July), 1964.
5. Morris, J. N.; Crawford, M. D.; and Heady, J. A. Hardness of Local Water Supplies and Mortality from Cardiovascular Disease. Lancet 1:860-862 (Apr. 22), 1961.
6. Biörck, G.; Böström, H.; and Widström, A. On the Relationship Between Water Hardness and Death Rate in Cardiovascular Diseases. Acta Med. Scandinav. 178:239–252 (Aug.), 1965.
7. Miasnikov, A. L. Discussion Following Paper by H. A. Schroeder, p. 113 in: Symposium on the Pathogenesis of Essential Hypertension (J. H. Cort, et al., eds.). Prague: State Medical Publishing House, 1961.
8. Morton, W. E.; Davids, D. J.; and Lichty, J. A. Mortality from Heart Disease at High Altitude. Arch. Environ. Health 9: 21–24 (July), 1964.
9. Morton, W. E. Geographic Pattern of Hypertension in Colorado. Ibid. 20:690–695 (June), 1970.
10. Morton, W. E., and Lichty, J. A. Rheumatic Heart Disease Epidemiology II. Colorado's High-Risk Low-Socioeconomic Region in 1960. Am. J. Epidemiol. 92: 113–120 (Aug.), 1970.
11. Gregg, D. O.; Meyer, E. L.; Targy, M. D.; and Moulder, E. A. Public Water Supplies of Colorado, 1959-61. Ft. Collins, Colo., Colorado State University Press, 1961.
12. American Public Health Association. Standard Methods for the Examination of Water and Wastewater (12th ed.). New York: The Association, 1965: pp. 195–205, 392–400.
13. Ibid. (10th ed.). 1955; pp. 159–163.
14. Wright, M. F., and Davison, K. L. Nitrate Accumulation in Crops and Nitrate Poisoning in Animals. Adv. Agronomy 16: 197–247, 1964.
15. Stewart, B. A. Volatilization and Nitrification of Nitrogen from Urine Under Simulated Cattle Feedlot Conditions. Environ. Sc. Technol. 4:579–582 (July), 1970.
16. Comly, H. H. Cyanosis in Infants Caused by Nitrates in Well Water. J.A.M.A. 129: 112–116 (Sept. 8), 1945.
17. Vigil, J.; Warburton, S.; Haynes, W. S.; et al. Nitrates in Municipal Water Supply Cause Methemoglobinemia in Infants. Pub. Health Rep. 80:1119–1121 (Dec.), 1965.
18. Wyngaarden, J. B.; Wright, B. M.; and Ways, P. The Effect of Certain Anions Upon the Accumulation and Retention of Iodide by the Thyroid Gland. Endocrinology 50:537–549 (May), 1952.
19. Moore, E. W. "Water and Its Relation to Disease." In: Preventive Medicine and Public Health (9th ed.). P. E. Sartwell, ed. New York: Appleton-Century-Crofts, 1965, p. 958.
20. Weiner, J. S., and Thomsen, M. L. Observations on the Toxic Effects of Cordite. Brit. J. Indust. Med. 4:205–215 (Oct.), 1947.
21. Barsotti, M. Attachi stenocardi nei lavoratori addetti alla produzione delle dinamiti con nitroglicole. Med. Lavoro 45: 544–548 (Oct.), 1954.
22. Forssman, S.; Masreliez, N.; Johansson, G.; et al. Untersuchungen des Gesundheitszustandes von Nitroarbeitern bei drei schwedischen Sprengstoffabriken. Arch. Gewerbepath. Gewerbehyg 16:157–177 (2) 1958.
23. Maccherini, L., Camarri, E. L'intossicazione da nitroderivati dei glicoli. Med. Lavoro 50:193–201 (Mar.), 1959.
24. Sakoda, A. A Clinical Study on Nitroglycol Poisoning (English summary accompanying paper in Japanese). Japan J. Indust. Health 4:583, 1962.
25. Einert, C.; Adams, W.; Crothers, R.; et al. Exposure to Mixtures of Nitroglycerin and Ethylene Glycol Dinitrate. J. Am. Indust. Hyg. A. 24:435–447 (Sept.–Oct.), 1963.
26. Carmichael, P. and Lieben, J. Sudden Death in Explosives' Workers. Arch. Environ. Health 7:424–439 (Oct.), 1963.
27. Trainor, D. C. and Jones, R. C. Headaches in Explosive Magazine Workers. Ibid. 12:231–234 (Feb.), 1966.
28. Lund, R. P.; Häggendal, J.; and Johnsson, G. Withdrawal Symptoms in Workers Ex-

posed to Nitroglycerin. Brit. J. Indust. Med. 25:136–138 (Apr.), 1968.
29. Mulcahy, R. The Influence of Water Hardness and Rainfall on the Incidence of Cardiovascular Mortality in Ireland. J. Irish M. A. 55:17–18 (July), 1964.
30. Anderson, T. W.; LeRiche, W. H.; and MacKay, J. S. Sudden Death and Ischemic Heart Disease. Correlation with Hardness of Local Water Supply. New England J. Med. 280:805–807 (Apr. 10), 1969.
31. Peterson, D. R.; Thompson, D. J.; and Nam, J. M. Water Hardness, Arteriosclerotic Heart Disease and Sudden Death. Am. J. Epidemiol. 92:90–93 (Aug.), 1970.
32. Public Health Service Publ. No. 956. Public Health Service Drinking Water Standards (revised 1962). Washington, D.C. Gov. Ptg. Office, 1962, pp. 47–51.
33. Weisse, A. B. and Regan, T. J. The Current Status of Nitrites in the Treatment of Coronary Artery Disease. Progr. Cardiovasc. Dis. 12:72–82 (July), 1969.
34. Mason, D. T., et al. Physiologic Approach to the Treatment of Angina Pectoris. New England J. Med. 281:1225–1229 (Nov. 27), 1969.
35. NRC Drug Efficacy Study, Panel on Cardiovascular Drugs: Statement on Criteria for Evaluation of Long-Acting Coronary Vasodilators in Treatment of Angina Pectoris. Circulation 41:149–151 (Jan.), 1970.
36. Von Oettingen, W. F. The Effects of Aliphatic Nitrous and Nitric Acid Esters on the Physiological Functions with Special Reference to Their Chemical Constitution. National Institutes of Health Bull. No. 186. 1946.

Dr. Morton is Professor of Public Health and Preventive Medicine, University of Oregon Medical School, Portland, Oregon 97201.

This study was conducted during the author's tenure as research epidemiologist for the Colorado Heart Association. Financial support was provided by the Colorado Department of Public Health and the Colorado Heart Association.

This paper was presented before the Epidemiology Section of the American Public Health Association at the Ninety-Eighth Annual Meeting in Houston, Texas, October 28, 1970.

E33c

NITRATES IN MUNICIPAL WATER SUPPLY CAUSE METHEMOGLOBINEMIA IN INFANT

Joseph Vigil, B.S., Sherman Warburton, B.S., M.P.H.,
William S. Haynes, M.D., M.P.H., and Leland R. Kaiser, M.A., M.P.H.

A 4-WEEK-OLD INFANT was stricken with methemoglobinemia in the city of B, Colo., on December 3, 1962, and the Tri-County District Health Department was notified. It was provisionally assumed that the infant had developed the disease from ingesting water with a relatively high nitrate content. Serious and occasionally fatal poisonings of infants attributed to ingestion of well water containing nitrates above the Public Health Service recommended standard of 45 mg. of nitrate per liter of water have been reported (*1*). However, few, if any, documented reports of such occurrences incriminate a U.S. municipal water supply, even though many such supplies have exceeded the recommended standard.

Laboratory findings confirmed the provisional diagnosis of methemoglobinemia. The nitrate content of the water ingested by the infant was shown to exceed the Public Health Service recommended standard of 45 mg. per liter, and epidemiologic investigation indicated that the municipal water was the source of the infant's illness.

Water Supply

The city of B is located in the South Platte River Drainage Basin. Traditionally a rural area, with a population of 7,500, it is part of a rapidly expanding metropolitan area. For 75 years the city has depended on the alluvium of the South Platte River aquifer for its water supply. This productive aquifer has wells which yield from 500 to 1,000 gallons of water per minute. The static water table is from 20 to 25 feet below the ground surface. Ten shallow wells from 40 to 60 feet deep were drilled into this aquifer, and the well casings are solid to a depth ranging from 12 to 42 feet. Below the solid casings, perforated casings extend to depths of 60 feet.

Each well is pumped individually, and the water flows directly from the wells into the distribution system. After the demand throughout the distribution system has been satisfied, additional water is stored in concrete storage reservoirs and elevated steel storage tanks located throughout the city. The water is not pretreated, but each well is supplied with chlorination facilities and generally a residual of 0.1 ppm of free chlorine is maintained throughout the system. At times and in certain sections of the city, however, there is insufficient contact time before the water is used by the consumers. All bacteriological samples have been negative for coliform organisms. However, the water is highly mineralized and is contaminated with synthetic detergents. There is also the possibility of organic pollution.

Sources of Pollution

The wells, storage reservoirs, and distribution system are fairly well constructed and protected from surface contamination.

The authors are members of the Tri-Country District Health Department, Aurora, Colo. Mr. Vigil is a supervisor and Mr. Warburton is director, environmental health division. Dr. Haynes is the medical director. Mr. Kaiser is director of community health education.

The city has maintained a good sewage collection system for several years. An excellent complete-treatment sewage plant was completely modernized in 1958. Not all residential units, however, are connected to the municipal sewage system. There are still 121 individual residents using cesspools, septic tanks with leaching wells, and tile leaching fields. These are located in the older section of town near the residence of the infant who contracted methemoglobinemia.

The city of B is situated so that it receives the pollution load from a metropolitan area of approximately 1 million people. This pollution is in the form of sewage and industrial wastes, which receive little pretreatment and are discharged into the Platte River. The water from the river is diverted into numerous canals and irrigation ditches and is used for agricultural irrigation. A number of the ditches flow directly through the city and are so grossly polluted that their stench creates a nuisance.

The aquifer from which the city of B derives its water supply is highly permeable and easily contaminated from surface pollution. It has suffered severe damage from various contaminating substances. These substances generally originate from both sewage and industrial wastes. Sources of wastes include individual sewage-disposal systems; chemicals from chemical industrial plants, oil refineries, and agricultural processes; and stockyards and feedlots. Synthetic detergents, nitrates, chlorides, chlorates, and sometimes chemicals resembling common herbicides have been identified. The nitrates in this aquifer could, therefore, originate from several sources: the river which is highly polluted with biological waste material and is used for extensive agricultural irrigation; nitrogen, urea, and other biological waste products used in commercial fertilizers; and individual cesspools. All of these are potential sources of nitrates and may be contributing factors in the contamination of the aquifer.

Because of the vulnerability of the aquifer and its potential hazard to public health, the Tri-County District Health Department had been concerned for some time. In 1958 the department developed an accelerated sampling and testing program to determine (*a*) the extent of the aquifer damage, (*b*) the main sources of pollution, and (*c*) to what extent this shallow aquifer could be used as a source of domestic water supply. The results indicated that severe damage was occurring in the aquifer and that more intensified efforts were necessary.

Consequently, in 1959 a series of 22 surveillance wells were uniformly established throughout the aquifer. The wells were sampled and a complete analysis was made every 7 months. Two city wells within two blocks of the affected infant's residence were incorporated into this network. In February 1961 one of these wells had a nitrate content of 35 mg. per liter and the other 40 mg. per liter. In September 1961 the same wells showed a nitrate content of 40 mg. and 44 mg. per liter. In April 1962 both wells showed a nitrate content of 52 mg. per liter. At this time a meeting was held with the State health department, and it was agreed to increase the frequency of sampling of the water supply. In October 1962 the medical director of the Tri-County District Health Department notified the city's health officer, city council, and all local physicians and hospital personnel of the danger of using the municipal water for preparation of infants' formula and feeding. By November 1962 the nitrate content of these wells had risen to 62 mg. per liter.

Epidemiologic Investigation

When the Tri-County District Health Department was notified of the case on December 3, a sanitarian was dispatched to the home to determine the circumstances.

The infant's family, of Spanish-American descent, consisted of the parents and two older children. The baby was on a formula of 2 ounces of evaporated milk and 2 ounces of boiled water. The mother (Mrs. L) said the baby had been progressing well while the family lived in another city. When they moved to the city of B, Mrs. L prepared the formula with the same brand of milk and this city's water.

After a few feedings the baby seemed upset and had diarrhea, which the mother attributed to the change of water. Mrs. L felt that this city's water "was hard because when she boiled the water it would leave a film on pans and bottles." To compensate for this she boiled

the water longer, but she thought that this resulted in even more film.

When the infant became quite ill and seemed to have difficulty in breathing, Mrs. L told her husband that they should take the baby to a physician. However, they had no way to get there because their car was not operating. The baby would take only a little water, and Mrs. L gave him some every half hour or so until he quieted down. Later that night when Mrs. L went to check on the baby, he had stopped breathing and was turning blue. Mrs. L picked up the baby and ran to the home of her husband's parents who rushed them to the hospital.

On admission to Colorado General Hospital at 2 a.m. on December 3, the infant was suffering with cyanosis and diarrhea, and the illness was diagnosed as methemoglobinemia. After administration of methylene blue, the baby improved, but he relapsed later and had to be retreated.

Mrs. L was asked to prepare some formula water, and she did this by boiling the water for approximately 20 minutes. The sanitarian took a sample of this water, a sample of previously prepared formula water, and a sample of tapwater.

The tapwater showed a nitrate content of 63 mg. per liter, and the two samples of formula water showed a nitrate content of 73 mg. per liter. The samples were not analyzed for the nitrite ion. It is assumed the rise in nitrates was caused by evaporation, thereby concentrating the nitrates in a smaller volume of water. However, a contributing factor might have been some conversion of nitrites during the boiling process.

When the infant was released from the hospital on December 12, the parents were given a supply of distilled water to be used for his feeding. Since then the child has progressed satisfactorily.

Conclusions

The diagnosis of methemoglobinemia was confirmed by laboratory findings. The infant had not ingested anything other than evaporated canned milk and water, and the water contained a relatively high level of nitrates. Water containing such levels of nitrates has been previously reported to produce serious and sometimes fatal poisonings in infants. We therefore concluded that the infant was stricken with methemoglobinemia by ingestion of water from a municipal water supply which exceeded the Public Health Service recommended standard for nitrates in drinking water.

Followup

Since all wells used by the city of B as a source of municipal water were highly mineralized and were above the Public Health Service recommended standard of 45 mg. of nitrate per liter of water, the Tri-County District Health Department recommended that the city obtain a new source of water which would meet the recommended standards for drinking water. Also, the department, in cooperation with the city council, notified the public and all physicians and hospitals by mail and through the newspapers that the city of B's drinking water exceeds the recommended standards for nitrate content, and it should not be used to prepare formula or for drinking by infants under 6 months of age.

The Tri-County District Health Department has obtained both financial and technical assistance from the State health department and the Public Health Service to perform an extensive survey on underground pollution in the area of the city of B.

REFERENCE

(1) Walton, G.: Survey of literature relating to infant methemoglobinemia due to nitrate-contaminated water. Amer J Public Health 41: 986–996, August 1951.

E33d

cent of his 798 cases of otitis media mastoiditis developed and in 1.8 per cent intracranial complications developed. The mortality rate in his survey of otitis media cases was 3.7 per cent and in the cases of mastoiditis 5.8 per cent. The first seven years of Engler's survey period was previous to the advent of chemotherapy for ear diseases, and during this time mastoiditis developed in 20.2 per cent of the cases of otitis media, while during the last three years of his survey sulfanilamide was administered in the otitis media cases and mastoiditis developed in only 14 per cent.

Table 5 gives a comparison of the results in this series of cases I have reported with those of Engler's survey. In noting the difference in morbidity and not a death among my cases it must be realized that the incidence of ear complications following scarlet fever is greater in young children from the ages of 1 to 8 years than in adults. In his survey 76.4 per cent of all the otitis media cases were in this age group. Nevertheless to observe these sick men (and most of them were very sick) from day to day and see the pronounced and rapid improvement, one must give much credit to penicillin. I am sure that some of them would have died and the morbidity would have been much greater without its use.

SUMMARY

Penicillin was used intramuscularly in the treatment of 511 cases of scarlet fever otitis media. It cured 27 cases of scarlet fever mastoiditis without surgery. It was used intramuscularly and locally in 33 cases of scarlet fever mastoiditis requiring surgery, in 2 of which meningitis was present. It was administered by the same methods in the postoperative treatment of 14 non-scarlet fever cases of mastoiditis. Ten of these were acute and 4 were chronic. Penicillin kept the morbidity to a minimum and there were no deaths.

520 Commonwealth Avenue.

CYANOSIS IN INFANTS CAUSED BY NITRATES IN WELL WATER

HUNTER H. COMLY, M.D.
IOWA CITY

Two examples of a previously unrecognized condition which may be confused with congenital heart disease are cited in this report. The condition may occur anywhere in rural areas where well water is used in infant feeding.

REPORT OF CASES

CASE 1.—C. H., a white female baby, was born two weeks before the expected date by cesarean section because of toxemia of pregnancy, which had been severe for one month. The birth weight was 3,870 Gm. (8 pounds 8 ounces). There was no known neonatal distress. On the twelfth day after birth, when she left the hospital, she weighed 3,720 grams (8 pounds 3 ounces). The formula she was receiving at that time was evaporated milk 210 cc. and water 540 cc. with 30 Gm. of a dextrin-maltose preparation.

She was admitted to a local hospital at 18 days of age because of vomiting, excessive crying and failure to gain weight. After admission an acidified skim milk formula was substituted and, because diarrhea followed, 1 teaspoon of a kaolin-pectin powder was added to each bottle of formula. The baby was discharged at the age of 27 days, having gained 360 Gm. (12 ounces).

She was seen again because of diarrhea at 31 days of age, at which time it was suspected that she might be allergic to the milk formula. A proprietary food mixture with soy bean powder as its principal ingredient was prescribed. The formula consisted of 80 Gm. of this mixture and 840 cc. of boiled water.

Two days later, after nine to twelve hours of irritability, the infant was noticed to be decidedly cyanotic and drowsy. So alarming were the signs that the parents rushed the baby again to the local hospital. Physical examination at that time revealed no evidence of pneumonia, atelectasis or pneumothorax; the heart sounds were good and the temperature was normal. A defective oil burner was in use in the home, and although the picture was not consistent with carbon monoxide poisoning a peculiar gaseous poison producing methemoglobinemia was suspected. Preliminary treatment with oxygen for thirty minutes resulted in no change. Therefore 1 per cent methylene blue, 1.1 cc. for each kilogram of body weight, was administered under the scalp, and the local area was massaged vigorously. Within thirty minutes the color, respirations and heart rate were normal. The cyanosis did not recur in the hospital, and the baby was discharged in a week, asymptomatic and taking the soy bean formula satisfactorily.

Forty-eight hours later the baby again was taken to the hospital with similar signs, and the same treatment was employed. (This time the aforementioned oil burner had not been in use.) She was hospitalized for sixteen days and at the time of discharge weighed 4,545 grams (10 pounds), had normal stools and was taking her soy bean and water formula in a normal, healthy fashion.

Two days later the parents suspected the onset of the same condition and returned with her to the hospital. This time the signs evidently were not convincing, for the baby was not admitted or treated. The parents were assured that she was well and were told to take her home.

Much to every one's disappointment, the baby was readmitted the next day suffering the worst attack of any. Two hours were required for the methylene blue treatment to relieve her distress.

It was realized that the only significant change in the infant's environment from hospital to farm home was in the water. Sulfhemoglobinemia being a remote possibility, the water was analyzed but no sulfides were found. The water was not tested bacteriologically. Nevertheless, the parents were warned not to give any more well water, and a formula of acidified whole milk was substituted.

The infant's father was dissatisfied with this incomplete explanation and also was loath to accept the possibility that his daughter was abnormal. Therefore arrangements were made to have her admitted to the Children's Hospital of the University of Iowa. The father believed that a peculiar reaction occurred between the well water and the soy bean preparation, producing a poison which caused her distress. Hence he asked the admitting physician if it would be desirable to bring samples of the water and powdered formula to the hospital for analysis. An open minded attitude on the part of the latter in accepting this "cock and bull" theory as plausible resulted in the father's bringing the water, which yielded the answer to the problem.

Physical examination on admission to the Children's Hospital revealed no abnormalities. The urine was normal. The red blood cell count was 3.2 million, with 11 Gm. of hemoglobin. The white blood cell count was 6,750, with a normal differential count. The blood Wassermann and Kline reactions were negative. A roentgenogram of the chest showed no abnormality. An analysis of the baby's blood for methemoglobin yielded a high normal value[1] of 0.18 Gm. for each hundred cubic centimeters.

From the Department of Pediatrics, State University of Iowa College of Medicine.

Dr. Robert L. Jackson admitted the first patient to the Children's Hospital and gave the author the opportunity to study his patient. The second patient was admitted, and the diagnosis was made, by Dr. Julia McElhinney.

The methemoglobin determinations in the 2 cases were carried out by Mr. George Dubey Jr., research assistant in the Department of Internal Medicine, State University of Iowa, using the method of Michel and Harris (J. Lab. & Clin. Med. 25:445 [Feb.] 1940).

The analyses of the samples of well water were made by Dr. J. Garth Johnson, principal water analyst, State Hygienic Laboratory, Iowa State Department of Health. The nitrate determinations were carried out by means of the phenol-disulfonic acid method (Standard Methods for Examination of Water and Sewage, American Public Health Association, Lancaster, Pa., Lancaster Press, Inc., 1936, p. 48).

1. Paul, W. D., and Kemp, C. R.: Methemoglobin: A Normal Constituent of Blood, Proc. Soc. Exper. Biol. & Med. 56:55-56 (May) 1944.

Reports in the literature of infantile methemoglobinemia caused by bismuth subnitrate suggested that nitrates might be the causative agent in this case. It was thought that the well water might contain toxic amounts of nitrates. An analysis of the water confirmed this suspicion. An unboiled sample of water had a nitrate nitrogen value of 140 parts per million, which is equivalent to 0.619 Gm. of nitrate ion to the liter. One Gm. of potassium nitrate (saltpeter) in a liter of water approximates this nitrate ion concentration. The sample contained 0.4 mg. of nitrite ion to the liter.

A second sample of water collected from the well several days later and boiled the same length of time as that given the baby contained 0.530 Gm. of nitrate ion to the liter, which approximates the amount found in the first sample analyzed. Culture of water from the well revealed the water to be highly polluted, as an M. P. N. (most probably number of coliform organisms for each hundred cubic centimeters) of 240 was obtained. U. S. Public Health Service drinking water standards allow an M. P. N. of not more than 5.

The baby was sent home on the fifth hospital day, receiving a half-skimmed, acidified milk formula to which no water was to be added. When seen by the family physician at the age of 4 months, no evidence of any permanent central nervous system damage from cerebral anoxia was found.

CASE 2.—S. M., a white female baby, was born normally after an uneventful pregnancy. The birth weight was 3,400 Gm. (7 pounds 8 ounces). There was no neonatal distress, and she had almost regained her birth weight when she left the hospital on the ninth day after birth. A formula of evaporated milk, water and corn syrup was prescribed. The baby developed diarrhea with eight to ten loose, green stools a day but did not vomit. At 27 days of age she became "blanched out," cyanotic and drowsy and was taken to the family physician. On this day she weighed 4,140 Gm. (9 pounds 2 ounces) in her clothing. The physician informed the parents that they had a blue baby. After an adjustment of the formula was made, the baby was sent home. At 31 days of age a formula of evaporated milk 210 cc., boiled water 510 cc. and corn syrup 45 cc. was given.

Decrease in Methemoglobin Content After Administration of Methylene Blue

Sample	Time	Methemoglobin Content
1	4:30 p. m.	2.65 Gm. for each 100 cc.
2	7:20 p. m.	2.72 Gm. for each 100 cc.
3	9:10 p. m.	2.70 Gm. for each 100 cc.
	10:13 p. m.	Methylene blue
4	10:45 p. m.	0.18 Gm. for each 100 cc.
5	11:54 p. m.	0.25 Gm. for each 100 cc.
6	11 a. m. (next day)	0.22 Gm. for each 100 cc.

The cyanosis never again became so noticeable as on the twenty-seventh day after birth, but it remained obvious and caused the parents to bring the baby to the Children's Hospital at the age of 38 days. Physical examination on entry revealed that the infant was well developed and well nourished, with a moderately cyanotic skin. Crying intensified the cyanosis. The fontanel was soft. The heart rate was not rapid, and no murmur was heard. The chest was clear to percussion and auscultation. Neither the liver nor the spleen seemed enlarged. The buttocks were moderately excoriated, attesting the persistent diarrhea. Laboratory data included negative blood Wassermann and Kline reactions. The Haden-Hausser hemoglobin value was 13 Gm., the red blood cell count was 2.95 million and the white blood cell count was 10,000, with a normal differential count.

Blood samples were collected at 4:30 p. m. (just before a boiling), at 7:20 p. m. and at 9:10 p. m. At 10:13 p. m. 6 cc. of a 1 per cent solution of methylene blue was administered intravenously (a dosage of approximately 1.5 mg. for each kilogram of body weight). Blood samples were then collected at 10:45 p. m., at 11:45 p. m. and at 11 a. m. the next day. These were taken immediately to the laboratory, and within one-half hour in each case the quantitative determination of methemoglobin was carried out. The results are given in the table.

The first three samples of blood when drawn were of a peculiar chocolate color. One-half hour after the methylene blue was given, the blood was normal in color. The change in the infant's appearance was especially dramatic. Unfortunately, accurate measurements of pulse and respiration were not made, but two observers noted that the infant's cry and behavior were more vigorous and that the skin color was excellent.

A sample of the well water used in preparing the infant's formula had a nitrate nitrogen value of 90 parts per million, which is equivalent to 0.388 Gm. of nitrate ion to the liter. This is roughly two-thirds the amount present in case 1. The nitrite ion content was 1.314 mg. to the liter. An attempt to analyze the formula to determine the exact amount of nitrate ion contained was unsuccessful because of caramelization. It would appear that the baby ingested approximately 0.20 Gm. of nitrate ion a day, roughly equivalent to ⅓ Gm. of potassium nitrate.

The well water was tested bacteriologically and found to be as badly polluted as the well in case 1.

Samples of blood from the mother and father, both of whom drank the unboiled well water, revealed no abnormal quantities of methemoglobin.

The baby was sent home, asymptomatic, on the second hospital day and has continued to do well. No further attacks of cyanosis have occurred.

COMMENT

Since these patients were seen by us, the Iowa State Hygienic Laboratory has received from similar wells five other samples of water containing large amounts of nitrates. The analyses were made because infants who drank the water were cyanotic. Four of these five definitely became blue after formulas containing the water were given. In the fifth case an accurate history was not obtainable; the infant in question was noted to have a "rattle in the chest," and he experienced difficulty in breathing. Thus it is possible that methemoglobinemia existed alone, that true anoxemic cyanosis was present or that the two conditions coexisted. This last infant had a bad start in life and was hospitalized at the age of 10 months at the Children's Hospital because of chronic diarrhea, stomatitis, bronchitis and malnutrition. One can only speculate as to the effect of prolonged ingestion of such water by infants.

Dr. Morgan J. Foster [2] of Cedar Rapids, Iowa, states that he has seen 5 similar cases in his practice. All the infants tended to be irritable and had diarrhea. Four were treated with methylene blue, and 1 infant died before the methylene blue treatment was known. From his records he noted that all the infants were receiving diluted milk formulas and that they came from farms in southeastern Iowa.

Dr. Roland Stahr,[2] formerly of Fort Dodge, Iowa, reported 5 cases of idiopathic cyanosis at the annual meeting of the American Academy of Pediatrics in San Francisco during May 1941. All of the infants had gastrointestinal disturbances. Twin infants, 26 days old, had mild cyanosis while receiving a diluted milk formula. Because of diarrhea a dried skim milk and water mixture was given. Deep cyanosis followed within a few hours in both infants. Methemoglobinemia was proved to be the source of the cyanosis. It cannot be stated definitely that these babies received well water, but 4 of the patients lived in northern rural Iowa.

2. Personal communication to the author.

Schwartz and Rector [3] reported the occurrence of methemoglobinemia of unknown origin in an infant aged 2 weeks. This baby was receiving a diluted evaporated milk formula. Their report does not state whether or not the infant came from a farm home where well water was used, but the general picture is similar. The infant was treated effectively with methylene blue.

Members of our staff, after having learned of this condition, saw 2 babies who were cyanotic without obvious cause. Both infants improved when the well water was removed from the feedings. In retrospect it was realized that 2 other infants, both from the same family, had been seen in consultation because of a peculiar cyanosis. Checking back, it was found that they both were taking evaporated milk feedings diluted with well water. Both of them had recovered when feedings containing less well water were given.

Thus it would seem that this condition is not rare, and a discussion of certain of its aspects may be helpful:

Cyanosis is due ordinarily to the presence of unusually large amounts of reduced hemoglobin in the subpapillary venous plexuses of the skin. Conditions such as cardiac or pulmonary disease, polycythemia or occlusions of major vessels in the extremities commonly result in cyanosis.

Abnormal compounds of hemoglobin, possessing differing absorption spectrums, may impart a peculiar hue to the skin. Thus, carbon monoxide reacts with hemoglobin to form carboxyhemoglobin, which in sufficient amount produces the striking "cherry red cyanosis." Likewise, methemoglobinemia may be associated with an unusual brown-gray skin color, sufficiently different from the color of reduced hemoglobin to arouse the suspicion that the primary difficulty is not common anoxemia.

Methemoglobinemia may follow the administration of such chemicals as aniline, nitrophenol, sulfanilamide, potassium chlorate and nitrates. That nitrates may be associated with serious or fatal methemoglobinemia in infants has been realized since bismuth subnitrate first was used as a contrast medium by roentgenologists. Roe [4] in 1933 reported the death of a 1 month old infant with diarrhea who had received 0.6 Gm. of bismuth subnitrate every two hours "until the stools became black." Cyanosis occurred in twenty-four hours. Thirteen Gm. of the drug was given in forty-four hours, and despite oxygen therapy death occurred sixty hours after the drug first was given. Roe emphasized the dangers inherent in the use of this bismuth compound and recommended the use of bismuth subcarbonate in the treatment of diarrhea.

Nitrate methemoglobinemia in adults has been reported less frequently. Eusterman and Keith [5] administered ammonium nitrate orally for diuretic purposes to a large series of adults; 2 patients developed methemoglobinemia. In 1, extreme cyanosis occurred when 54 Gm. was given in eight days. These workers gave ammonium nitrate intravenously to dogs and failed to produce methemoglobinemia. They concluded that the nitrate ion was transformed to nitrite by some abnormal metabolic process present in the 2 patients, both of whom had intestinal stasis.

That the nitrite ion will bring about methemoglob nemia is well established. In the treatment of cyanid poisoning Chen, Rose and Clowes [6] showed sodiu nitrite (administered intravenously) to be an effectiv agent for producing methemoglobinemia. Greenber Lester and Haggard [7] demonstrated in vitro that on molecule of a nitrite ion reacts with two molecules o hemoglobin to form methemoglobin. In acid mediun the conversion to methemoglobin occurs rapidly; i neutral or alkaline solutions the conversion is delaye

Van den Bergh [8] in 1905 indicated that nitrites coul be formed in the bowel from nitrates and that absorp tion of the nitrite ion was encouraged by the presenc of damaged intestinal mucosa. ZoBell [9] demonstrate in vitro that many organisms commonly found in th gastrointestinal tract were capable of converting nitrate to nitrites.

Thus it would seem that the methemoglobinemia o the infants of this report was produced as the resu of the ingestion of well water containing large amount of nitrate compounds. The nitrate ion was probabl converted to the nitrite ion in the intestine by bacteria action. The nitrite ion, so formed, was absorbed an reacted with hemoglobin to form methemoglobin. Th amount of nitrites already present in the well water wa probably of little significance.

Although the fact that the infant possesses muc less oxidizable hemoglobin than the adult is probabl the most important single factor in making him mor susceptible to nitrate compounds, other factors ma conspire to render nitrates more toxic. Thus the bac terial flora may include more nitrate converters tha in the adult. Gastrointestinal disturbances in infanc are more common than in adulthood, and the delicat mucosa may be injured more easily. In the infan the high fluid turnover and more rapid circulation ma favor more complete absorption of the nitrite ions fro the intestine. It is possible that the nitrite ions ma be more firmly bound by infantile hemoglobin (whic differs from adult hemoglobin) because of immaturity of certain enzymes. Stevenson [10] has shown that car bonic anhydrase, to name one such enzyme, is presen in relatively small quantities in the infant. Further the limited excretory power of the immature kidne may favor retention of the nitrite ion.

The 2 infants who were the subjects of this repor had gastrointestinal disturbances. Whether a separat cause brought about the diarrhea and vomiting in eac case or whether the nitrate salts themselves or othe constituents of the putrid water incited the diarrhe cannot be ascertained. Since the gastrointestinal symp toms were almost universal and in certain cases becam more severe as the formulas were further diluted wit the well water, it seems likely that the cause for th whole difficulty may have been in the water. It cannot however, be stated positively that gastrointestinal dis turbances always accompany this condition, as there was no such complaint by a patient seen recently.

Neither parent of the baby in case 2 had abnormal methemoglobinemia. It is clear that the nitrate intake

3. Schwartz, A. S., and Rector, F. J.: Methemoglobinemia of Unknown Origin in a Two Week Old Infant, Am. J. Dis. Child. 60: 652-659 (Sept.) 1940.

4. Roe, H. E.: Methemoglobinemia Following the Administration of Bismuth Subnitrate: Report of a Fatal Case, J. A. M. A. 101: 352-354 (July 29) 1933.

5. Eusterman, G. B., and Keith, N. M.: Transient Methemoglobinemia Following Administration of Ammonium Nitrate, M. Clin. North America 12: 1489-1496 (May) 1929.

6. Chen, K. K.; Rose, C. L., and Clowes, G. H. A.: Comparative Values of Several Antidotes in Cyanide Poisoning, Am. J. M. Sc. 188: 767-781 (Dec.) 1934.

7. Greenberg, L. A.; Lester, D., and Haggard, H. W.: The Reaction of Hemoglobin with Nitrite, J. Biol. Chem. 101: 665-673 (Dec.) 1933.

8. van den Bergh, A. A. H.: Enterogene Cyanose, Deutsches Arch. f. klin. Med. 83: 80-106 (May 18) 1905.

9. Zobell, C. E.: Factors Influencing the Reduction of Nitrates and Nitrites by Bacteria in Sea Water Media, J. Bact. 24: 273-281 (Oct.) 1932.

10. Stevenson, S. S.: Carbonic Anhydrase in Newborn Infants, J. Clin. Investigation 22: 403-409 (May) 1943.

was too low for a significant amount of hemoglobin to become converted. A minimal degree of methemoglobinemia is physiologic[1] and its reduction to hemoglobin is probably a continuous process. With intermittent, relatively low dosage a clinically detectable level could hardly be built up in the adults, whereas in the infant a relatively large, constant and regularly timed intake may, under certain circumstances, build up a fatal level.

Wendel[11] in 1939 studied the effect of methylene blue in the sodium nitrite-induced methemoglobinemia of dogs. At his suggestion Hartmann and his associates[12] used the dye in the prophylaxis and therapy of sulfanilamide-induced methemoglobinemia. These workers showed that a single intravenous dose of from 1 to 2 mg. for each kilogram of body weight would rapidly clear the cyanosis. Sixty-five to 130 mg. of the dye for each kilogram of body weight given every four hours by mouth would prevent the cyanosis of sulfanilamide administration. They warned that occasionally vomiting, diarrhea, headache and tinnitus occurred when methylene blue was given by mouth. Perivenous infiltration may lead to painful induration or even to necrosis. No serious reactions were encountered.

The mechanism of action of methylene blue in effecting the rapid transformation is not clearly understood. Paradoxically, in high concentration it oxidizes the ferrous iron of reduced hemoglobin to the ferric iron of methemoglobin, as do nitrites. This function has been used in the treatment of cyanide poisoning. In lower concentrations the drug seems to catalyze the physiologic reduction of methemoglobin by the body. It has been suggested by Wendel[11] that the leuko- or reduced form of the dye is formed in the erythrocytes and other body cells by certain cellular enzymes. This form may then act catalytically to promote the reduction of methemoglobin.

The high nitrate water which the cyanotic infants ingested came from very undesirable wells. In many cases the wells were old, dug rather than drilled, had inadequate casings or none at all, and were poorly covered so that surface water, animal excreta and other objectionable material could enter freely. In every one of the instances in which cyanosis developed in infants the wells were situated near barnyards and pit privies. Some of the wells had trees growing nearby, and the roots had penetrated or broken down the casings. In four of the five the water was highly contaminated with coliform organisms, but in the fifth case the water was bacteriologically safe for drinking purposes. This point serves to emphasize the fact that a well may be acceptable with respect to bacterial content and yet be potentially dangerous for use in infant feeding. It is not difficult to visualize how such a situation may arise: water seeping from barnyards and privy pits, heavily laden with bacteria and dissolved nitrogenous materials, becomes increasingly purified by passage through the soil. Certain soil bacteria have the power to oxidize ammonia and other nitrogen compounds to nitrates. The solution of nitrates so formed, rendered free from coliform organisms by the competitive growth of the hardy soil bacteria, may then enter subsurface water channels leading directly into wells used for drinking purposes. In periods of low water table the passage of the water through the earth may be slower. This slow passage may allow more nitrate to be leached from the soil and become concentrated in the wells until toxic amounts are present.

The nitrate content of water taken from wells in Iowa varied from zero to 125 parts per million (as nitrate nitrogen) in a survey made of 2,000 samples taken from domestic and municipal wells in 1934 and 1935.[13] The highest nitrate nitrogen content on record in the State Hygienic Laboratory is 567 parts per million.[14] The nitrate nitrogen of the water given to the infants varied from 64 to 140 parts per million, and the severity of symptoms seemed to parallel roughly the amount of nitrate present. Although no definite statement can be made, it would seem advisable to recommend that well water used in infant feeding possess a nitrate content no higher than 10 or, at the most, 20 parts per million.

Since Jan. 1, 1945, of 91 samples of water from dug wells sent for routine analysis by their owners 18, or roughly 20 per cent, had nitrate nitrogen values above 65 parts per million. These waters might be seriously toxic to infants if fed in any appreciable amounts. Fifty-one samples, or 56 per cent, contained amounts of nitrate greater than 10 parts per million.[15]

This, doubtless, is not a fair sampling of the domestic wells in Iowa, as all the water was sent in because, for one reason or another, its purity was doubted. It does serve to show, however, the frequency with which high nitrate values will be found if the water is suspected for any of the usual reasons.

All but one of the wells with high nitrate water were dug wells, most of which probably had defective casings. All but one of the samples of water causing symptoms in infants came from similar wells. In the latter exception the well was drilled but the condition of the casing was in doubt.

The bacteriologic data accumulated from these wells are typical of those commonly found. From 75 to 77 per cent of the privately owned wells in Iowa are contaminated, as evidenced by the presence of large numbers of coliform organisms.[15]

From the foregoing discussion it is obvious that artificial feeding of the farm baby is fraught with potential danger, and it serves to emphasize the desirability of breast feeding whenever possible. Certainly, in view of the deplorable condition of most wells, the physician should make inquiry regarding the source of water which the infant will receive. (A valuable booklet setting forth the sanitary standards for hand-pumped wells is obtainable.[16]) That all such drinking water should be boiled is clear. However, it must be understood that even boiling the water may not render it safe. If the source is under suspicion, the physician will do well to prescribe a formula containing relatively little water. Thus, a diluted whole milk feeding would be preferable to a diluted evaporated milk mixture. A dried milk and water formula would be most dangerous, whereas an acidified, boiled, undiluted milk feeding would provide the greatest possible margin of safety.

11. Wendel, W. B.: The Control of Methemoglobinemia with Methylene Blue, J. Clin. Investigation 18:179-185 (March) 1939.
12. Hartmann, A. F.; Perley, A. M., and Barrett, H. L.: A Study of Some of the Physiological Effects of Sulfanilamide: II. Methemoglobin Formation and Its Control, J. Clin. Investigation 17:699-710 (Nov.) 1938.
13. Mineral Analysis of the Underground Waters of Iowa, Des Moines, Iowa State Planning Board, 1938.
14. Personal communication to the author.
15. Biennial Reports of the Iowa State Department of Health, 1944, to be published.
16. Sanitary Standards for Hand Pumped Wells, Bulletin of Iowa State Department of Health, November 1942.

SUMMARY

Cyanosis due to methemoglobinemia may occur in infants with gastrointestinal disturbances who receive boiled water which comes from poorly constructed dug or drilled farmyard wells with defective casings. The water may contain large amounts of nitrate compounds which, when ingested, are converted by bacterial action to nitrites. The nitrite ion is absorbed and oxidizes hemoglobin to methemoglobin.

The intravenous administration of methylene blue in the dosage of 1 to 2 mg. for each kilogram of body weight promptly relieves the infant's cyanosis and distress.

The condition is not rare. Ample opportunity for its frequent occurrence exists. The condition may occur in any degree of severity, either acutely, subacutely or chronically. It may possibly lead to a fatal outcome. In all probability certain instances are incorrectly interpreted as being due to congenital heart disease.[17]

17. Since this article was submitted for publication an intensely cyanotic infant was admitted to the Children's Hospital. Because he seemed to be in no particular distress, the methylene blue treatment was withheld. Twenty-four hours after the well water feedings were stopped the baby's color was normal.

E33e LL

Methemoglobinemia Associated With Well Water

Louis W. Miller, MD

A case of infant methemoglobinemia associated with milk formula prepared from well water containing excess nitrates occurred in Texas. The existence of numerous rural wells with high nitrate concentrations has been documented in various areas through the United States in the past and again in Texas in 1969. These private wells and certain rural municipal water supplies represent a possible source for cases of methemoglobinemia.

DRINKING water containing high levels of nitrates has been associated with infant methemoglobinemia since the mid 1940s, but it has received little attention in the medical literature in recent years. In September 1969 the Texas State Health Department investigated a report of an infant with methemoglobinemia, whose milk formula had been prepared with water having a high nitrate concentration. Evidence was gathered which indicated that a large number of infants in Texas were exposed to excessive nitrates in drinking water. This report describes the case of well water associated methemoglobinemia and presents data suggesting that nitrates in drinking water are a serious threat to infants in Texas and elsewhere in the United States.

Under normal circumstances, 99% of the hemoglobin in the blood exists in the reduced ferrous state (Fe^{++}). When hemoglobin is oxidized to the ferric state (Fe^{+++}), methemoglobin is formed, which is not effective in transporting oxygen to the tissues. The normal erythrocyte has reducing mechanisms which are able to reconvert methemoglobin to hemoglobin. However, certain drugs and chemicals oxidize sufficient amounts of hemoglobin to overcome these reducing mechanisms. Silver nitrate,[1] benzocaine,[2] pyridium,[3] and nitrites produced from well water high in nitrates[4] are only a few of the substances implicated in producing methemoglobinemia. Cyanosis occurs when the level of methemoglobin reaches 10%, and symptoms related to hypoxia occur when levels exceed 20%. The signs and symptoms produced are proportional to the amount of methemoglobin formed.

From the Epidemiology Program Center for Disease Control, Health Services and Mental Health Administration, Public Health Service, Atlanta; and the Texas State Department of Health, Austin, Tex.

Reprint requests to Epidemiology Program, Center for Disease Control, Atlanta 30333.

Report of a Case

On Sept 9, 1969, a 1-month-old, white boy was admitted to the Santa Rosa Medical Center, San Antonio, Tex, because of difficulty in breathing. The infant had been in excellent health until the day of admission, when he was noted to be irritable and breathing rapidly. On admission, his heart rate was 160 beats per minute; and respirations, 50 per minute. Except for moderate generalized cyanosis, there were no physical abnormalities.

The child failed to improve when given 100% oxygen. An electrocardiogram and an x-ray film of the chest were unremarkable. Blood-gas studies showed an oxygen saturation of 99%. At this point, physicians bubbled 100% oxygen through a sample of blood. When no color change was noted, methemoglobinemia was suspected. The infant was treated with 0.8 cc of a 1% methylene blue solution, intravenously. His breathing slowed, and his color improved within 15 minutes. Forty-five minutes after the infusion, the infant's color and breathing appeared normal, and he was discharged on the third hospital day.

Laboratory documentation of the diagnosis was made on an initial blood sample. This specimen contained 50% methemoglobin as determined by a spectrophotometric method. The etiology of this case was traced to the child's formula, which was prepared with water obtained from a shallow, private well. Although the well was located only 40 feet from an overflowing cesspool, no bacterial contamination was found. Water samples from this well contained 77 ppm nitrate, an amount considerably above the Public Health Service water standard of 45 ppm.[5]

Comment

The association of infant methemoglobinemia and water high in nitrates was first described in 1945 by Comly.[4] By 1950, a total of 278 cases with 39 deaths had been investigated and, in almost every case, the water source of these patients was a private rural well. Although bacterial contamination of the high nitrate well was often demonstrated, there was no clear relationship between bacteria and the increased nitrates.[6,7]

Infants seem to be the only group susceptible to methemoglobinemia from ingestion of water containing excessive nitrates.[8] Cornblath and Hartmann found that conditions in the uppergastrointestinal tract of some infants enabled the establishment of a nitrate reducing bacterial flora. The nitrate can then be converted to nitrite which is absorbed and in turn oxidizes hemoglobin to methemoglobin. Because many infants exposed to excessive nitrates do not develop methemoglobinemia, additional factors, such as duration of exposure, condition of the mucosa, amount of nitrate consumed, and coexistent disease, must be important in producing the clinical syndrome. Infant susceptibility may also be related to elevated levels of fetal hemoglobin or a transient deficiency of methemoglobin diaphorase, an enzyme important in maintaining iron in its reduced state.

Water contaminated with high concentrations of nitrates is not a problem confined to a rare private well. Commoner[9] cites areas of Southern California where public health authorities have warned physicians about excessive amounts of nitrates in the well water. In 1969, the Texas State Health Department found elevated nitrate levels in 605 of 787 wells (77%) analyzed in a four-county area. Because there is no economical way to remove excess nitrates from well water, infants in these areas continue to be exposed to excessive nitrates.

Municipal water obtained from wells can also have a high concentration of nitrates. A case of infant methemoglobinemia was traced to a municipal water supply in Colorado in 1962.[10] Data from the Texas State Department of Health indicate that 23 separate Texas rural public water supplies contain nitrates in excess of the recommended standard.

The risk that infants exposed to excessive nitrates have of developing symptomatic methemoglobinemia is difficult to evalute. The Public Health Service standard for drinking water concentration was established on empirical grounds. It was based on the fact that a preponderance of the reported cases of methemoglobinemia occurred where the concentration of nitrates was greater than 45 ppm. There are no data available on the number of infants exposed to high nitrate concentrations and, without such denominator data, the risk of infants exposed to high nitrate concentrations cannot be calculated. One can only conclude that there is a risk of well-water-associated methemoglobinemia for infants in certain rural areas that does not exist in communities with low concentrations of nitrates in drinking water.

A recent report of methemoglobinemia in an adult using home dialysis has expanded the problem of well-water-associated methemoglobinemia to the adult population.[11] The continued presence of wells containing high nitrate levels and the possibility of municipal water having a high nitrate concentration emphasizes the importance of all physicians' maintaining a keen awareness of this problem. This is particularly true with present-day rapid transportation of patients from rural areas to urban centers. The solution to this problem depends on early identification of cases and possible sources.

Once the condition is diagnosed, patients should be treated intravenously with methylene blue, 1 mg/kg of body weight for adults and 2 mg/kg of body weight for infants. If a source is discovered, the infant may be protected by the addition of lactic acid to the formula or the substitution of dried buttermilk for other dried milk products.[12] However, the best method of protection continues to be a change of water source to one with a low nitrate concentration.

Enrique Galen, MD, and Robert A Wymar, MD, provided the Texas State Department of Health with the case report used in this communication.

References

1. Ternberg JL, Luce E: Methemoglobinemia: A complication of silver nitrate treatment of burns. *Surgery* 63:328-330, 1968.

2. Haggerty RJ: Blue baby due to methemoglobinemia. *New Eng J Med* 267: 1303, 1962.

3. Sand R, Edelmann CM Jr: Pyridium-induced methemoglobinemia: Report of a case. *J Pediat* 58:845-858, 1968.

4. Comly HH: Cyanosis in infants caused by nitrates in well water. *JAMA* 192:112-116, 1945.

5. *Public Health Service Drinking Water Standards*, publication 956. Washington, DC, Public Health Service, 1962, pp 47-51.

6. Walton G: Survey of literature relating to infant methemoglobinemia due to nitrate contaminated water. *Amer J Pub Health* 41:986-996, 1951.

7. Nitrate in potable waters and methemoglobinemia, American Public Health Association Committee on Water Supply. *Amer J Pub Health* 40:110-115, 1950.

8. Cornblath M, Hartmann AF: Methemoglobinemia in young infants. *J Pediat* 33:421-425, 1958.

9. Commoner B: Threats to the integrity of the nitrogen cycle: Nitrogen compounds in soil, water, atmosphere and precipitation. Read before the American Association for Advancement of Science, Dallas, Dec 26, 1968.

10. Vigil J, Warburton S, Haynes WS, et al: Nitrates in municipal water supply cause methemoglobinemia in infant. *Public Health Rep* 80:119-121, 1965.

11. Carlson DJ, Shapiro FL: Methemoglobinemia from well water nitrates: A complication of home dialysis. *Ann Intern Med* 73:757-759, 1970.

12. Knotek Z, Schmidt P: Pathogenesis, incidence, and possibilities of preventing alimentary nitrate methemoglobinemia in infant. *Pediatrics* 34:78-83, 1964.

E33f Sept. 72

A study of methemoglobin levels in infants from birth through six months showed that even healthy babies not exposed to excessive nitrate levels in diets have higher levels when young. Babies with diarrhea or respiratory illness had the highest levels in this population. Ingestion of water or formula high in nitrates appears to increase the frequency of elevated methemoglobin. More than 60% of formulae showed bacterial contamination. Long-term consequences should be investigated.

Methemoglobin Levels in Infants in an Area With High Nitrate Water Supply

Lois Ann Shearer, M.P.H.; John R. Goldsmith, M.D.; Clarence Young, B.S.C.E.; Owen A. Kearns, M.D.; and Benjamin R. Tamplin, Ph.D.

Introduction

Elevated nitrate levels in community water supplies are of concern because infant methemoglobinemia has been associated with the intake of water with high nitrate concentrations. This was first recognized clinically in 1945.[1] As methemoglobinemia is not a reportable disease in the United States, it is difficult to accurately determine the incidence, but there have been no reported fatalities in the United States since 1960. Since 1945, it is estimated that between 1,500 and 2,000 cases have occurred throughout the world. Because of these findings, the U. S. Public Health Service recommended a drinking water standard of 45 mg/l of nitrate (or equivalent to about 10 mg/l of nitrate nitrogen).[2]

The factors responsible for elevated nitrate contents in well water sources include geography, geology, groundwater hydrology, and the addition of nitrates naturally and from surface contamination by nitrogenous fertilizers or by organic waste of human or animal origin.

No clinical cases of methemoglobinemia have been reported in California. Few or no cases have been reported from any other part of the United States where the water used was from a community water supply. Nearly all of the cases reported in the United States were from rural households with water supplies from wells of questionable sanitary construction. This suggests that heavy bacterial contamination might also have been present. Surveillance of domestic groundwater supplies in California indicates that several communities have community water supplies with nitrate levels exceeding the Public Health Service Drinking Water Standards.

In contrast to the overt clinical cases, little is known or has been reported concerning the subclinical effects from the use of high nitrate waters for infant feeding. We have no information concerning whether health effects do occur, or what they might be when an infant has a high nitrate intake from birth. Nitrate in food or water becomes a hazard to health when the nitrate is converted to nitrite, and this ion when absorbed converts hemoglobin to methemoglobin. The conversion may be carried on by bacterial contaminants, or by bacteria in the digestive tract. Some methemoglobin is present in the normal healthy infant but we do not know whether there is a problem when subclinical elevations of methemoglobin occur in infants under six months of age.

On the basis of experimental studies[3] it is thought that the methemoglobin level fluctuates in response to absorption of nitrite ion and the activity of the enzyme methemoglobin reductase, which reconverts methemoglobin to hemoglobin. It has been suggested that this enzyme is less active in younger babies (less than three months of age) or in those with deficiency of glucose-6-phosphate dehydrogenase.

Bodansky[4] has reported on some of the possible health implications of elevated nitrate ingestion and Knotek and Schmidt[5] in Czechoslovakia have presented data on the effect of differences in the type of dried milk formula (regular and buttermilk), as well as the apparent role of bacteria interacting with the acidity of the formulas. Studies in cattle fed high nitrate and high nitrite diets, have shown inhibition of growth and shortening of the median life span,[6] significant reduction in Vitamin A,[7] increased abortion rate, reproductive difficulties, reduced milk production, and a poor utilization of Vitamin A.[8]

Recent studies by Gruener and Shuval[3] have shown the nitrite ion, when fed to pregnant rats as sodium nitrite ($NaNO_2$), could be transmitted across the placenta, resulting in impaired growth. These investigators have also found abnormalities of the EEG in animals given high doses of sodium nitrite. The evidence of such effects in animals, emphasizes the need to study the long-term health implications of subclinical elevations of methemoglobin for infants and for pregnancy.

Methods

The primary area of study included two communities of 15,000 and 5,000 population, five miles apart, in the south central area of California known to use groundwater with varying levels of nitrate. The area is at an elevation of a little over 350 feet, the rainfall averages 6.44 inches per year and the temperature ranges from an average low of 38°F during the winter months to an average of 90°F in the summer months. The economy of the area is dependent on agriculture, particularly the production and shipping of cotton, grapes,

field crops, and citrus fruits. In 1967, nitrate concentrations in the groundwaters in this vicinity were studied,[9] considering in detail the sources, seasonal variations and water table variations.

Infants from one to six months were examined, and the nitrate-nitrite intake from their formula and water was determined along with an analysis for bacterial contamination of water and formula. In the primary study area, the well waters were tested weekly.

All infants born in the area were invited to clinics for an interview and methemoglobin determination. Clinics were scheduled twice a month. During months when both parents worked, evening as well as day clinics were held. All families were sent appointments, contacted by a health worker before the clinic and afterwards if an appointment was missed. The infant was seen at one month of age and at two, three, four and six months of age when possible.

The interview included a 24-hour dietary intake history of food and formula, a water intake history and an illness history. Methemoglobin and hemoglobin levels were determined from capillary blood samples, and the home of each infant was visited the day of the clinic visit to collect samples of the water supply used by the family and the water and formula used by the infant. Water samples for bacterial counts were taken from home faucets when they were first opened, as well as after flushing for a few minutes. Assessment of findings is based on the opinion that the nitrate content of water at the home is more of a controlling factor than nitrate content of the well sources.

All samples were analyzed at the California State Department of Public Health for nitrate and bacterial concentration. Examination of water and formula used by infants included a determination of nitrite concentration. Because of the instability of methemoglobin in whole blood, its analysis should be started within half an hour. Laboratory equipment and reagents were brought to the clinic by a chemist who measured methemoglobin and hemoglobin concentrations immediately after blood samples had been taken.

Participating infants were given general physical examinations including growth and development measurements at the end of the study.

The study was discussed with physicians practicing in the community prior to the clinic visits. All findings were discussed with the parent and were, in addition, sent to the infant's physician.

Infants receiving prepared formula or bottled water, or those being breast-fed formed a suitable control population within the service area of the community water supply.

Laboratory Methods

Hemoglobin and methemoglobin concentrations were determined on 0.1 ml samples of capillary blood taken by heel prick during the interview. The method used was based on that published by Hainline[10] with modifications suggested by Winton and Tardiff[11] and Hegesh, et al.[12] It was necessary to extend the duration of centrifugation following hemolysis in Tritonborate solution in order to insure a clear supernatant solution.

Water and formula samples were iced or preserved and sent to the headquarter's laboratory for determination of nitrate concentration by the brucine method[13] and for estimation of coliform, fecal coliform, and total bacterial densities. Nitrate-nitrite concentration in milk or formula was determined by a method published by Manning, et al.[14] Nitrite in water was determined following the method of Strickland and Parsons.[15] Coliform and fecal coliform densities (as Most Probable Number, MPN) were estimated by use of the multiple tube fermentation method.[15] A standard plate count (SPC) was also performed on each sample to provide an assessment of the non-coliform contamination levels.

Results

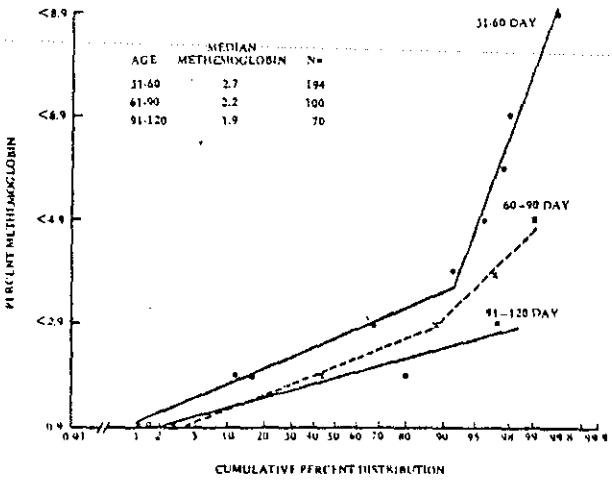
Slightly more than half the infants born in the area were examined at least once. Those who participated and those who did not were similar in ethnic origin and in area of residence. While there may be a selection bias, we were unable to identify any pattern which could be influenced by it.

Half the infants in the nitrate study were on concentrated formula, usually diluted with an equal volume of water. Twenty-four per cent used prepared formula, and ten per cent were on cows' milk to which no water was added. Nine per cent were on evaporated milk formulas with varying concentrations although mostly 1:1 dilutions. Less than three per cent were on dry milk formula and less than three per cent were breast-fed. Commercial formulas generally contain 50 mg/l of Vitamin C, the infant thus receiving 1.5 mg per ounce of formula per day.

Over a period of one year, 487 examinations were completed for 256 infants. One-hundred seventeen of these infants had multiple visits at different ages. Male and female infants were equally distributed in the study group and there did not appear to be any significant difference in methemoglobin levels by sex.

There were age variations in methemoglobin levels, independent of water supply. Figure 1 and Table 1 show that young babies, up to 60 days, who are in good health, are likely to have higher methemoglobin levels than do older babies. This effect appears to be independent of the level of nitrate in water, since it is also found among babies who are breast-fed or whose formulas are made with bottled water.

Figure 1—Cumulative Per Cent of Infants by Age Groups for Per Cent Methemoglobin March 1970-March 1971



The cumulative frequency distribution by age, Figure 1, shows a bimodal distribution, of which the lower portion is below 4% methemoglobin. Accordingly, we have divided the results into those with less than 4% methemoglobin and those with greater. Those with more than 4% methemoglobin we consider to have elevated levels. This occurred in twenty-one infants, one of whom had an elevated level on two successive examinations. There are thus twenty-two positive tests or 4.5% positive.

Babies who have minor illness appear to have higher methemoglobin levels than healthy babies of the same age. One-third of the infants with elevated values (above 4%) had respiratory illness, but the four highest values observed were from infants with diarrhea. Tables 4, 7 and 8.

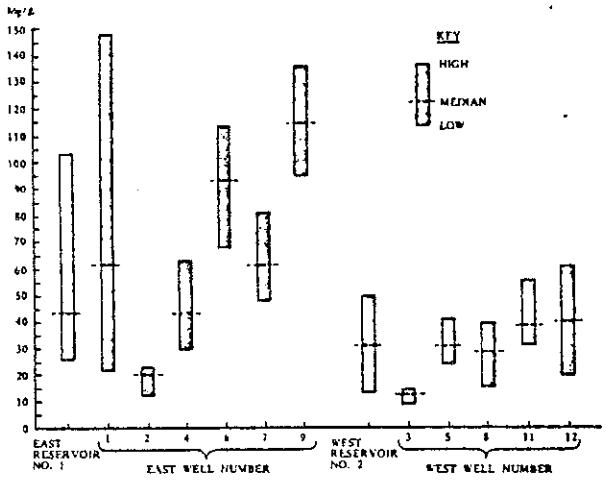
Since it is anticipated that standards for the community water supplies might be based on the total nitrate-nitrite-nitrogen content, the intake of infants was calculated similarly on the basis of total nitrate-nitrite-nitrogen intake in milligrams per liter. This was calculated from the history of ingestion and the measured levels in water and formula. This approach differs from that used by Winton, Tardiff, and McCabe.[16] Table 2 shows the relationship of methemoglobin levels to nitrogen intake by age. Table 3 shows the level of methemoglobin for babies who gave no history of illness. While elevated methemoglobin values (>4%) are about three times as frequent for not ill babies with high nitrogen intake as compared to those with low nitrogen intake, the difference is not statistically significant with this sample size. Among ill infants, elevated methemoglobin levels are five times as frequent in the 5.0 to 9.9 mg per day nitrogen intake group as those with an intake below 5 mg.

Bacteria in significant numbers were found in the water and formulae available to infants based on coliform, fecal coliform and standard plate counts, Table 5. Immediate and flushed samples from the household supply, bottled water, boiled tap water, and the formula often revealed considerable contamination. The least contamination was found in the immediate and flushed samples of the public community water supply.

The various types of commercial formula used by the families were analyzed and all had less than 4.0 mg/l of nitrate and less then 0.05 mg/l of nitrite. Dextrose was used in evaporated milk formula, and this had a level of 0.52 mg/l of nitrate and less than 0.05 mg/l nitrite. Boiling of water for formula for up to 10 minutes produced little change in the concentration, but between 10 and 15 minutes nitrate-nitrogen concentrations began to increase. In a laboratory experiment *nitrite* was produced in greater amounts when the nitrate-containing water was boiled in aluminum, rather than in glass. These observations require further study.

The wells serving the Western side of the larger town have a relatively low nitrate level, whereas those serving the Eastern side of the town fluctuate as shown in Figure 2. On the side with lower nitrate levels, no single well exceeded the 45 mg/l limit, but on the other side, demand for water occasionally required using a well with higher concentrations. Nitrate concentrations in the water from any single well are known to be subject to variation by time and season. Tables 6a, b, and c show the relationship of methemoglobin levels to nitrate exposure by area by age. Tables 7 and 8 list the circumstances in which elevated methemoglobin levels (4.3%) were observed in 21 infants. Table 9 shows the reversibility of elevations when babies were changed from water with a high nitrate-concentration to bottled water.

Figure 2—Well Nitrate Concentrations, High-Low-Median, March 1970-March 1971



The physical examinations on 98 infants did not reveal any findings different than the expected normal variations.

Discussion

Prior studies have shown that only very young babies, usually less than 60 days, became ill with methemoglobinemia and that bacterial contamination was probably necessary to produce this clinical illness. Since we have observed no cases of clinical illness, we can only provide peripheral information concerning these problems. However, many variables play an important role in the determination of methemoglobin levels. The role of age is seen in the clustering of elevated values in the 31-60 day group. No infant over 90 days had a methemoglobin over 3.0 per cent. The majority of illness was due to respiratory infections, however, the highest methemoglobin elevations were in infants with diarrhea. For example one infant had 30 days of loose stools. This infant had a high nitrate exposure and the highest methemoglobin level, 10.7%. Among the other infants there was no consistent correlation between nitrogen-intake and methemoglobin elevation. The only infant hospitalized with diarrhea had a methemoglobin level of 8.4 per cent but had been using bottled water continually.

The presence of bacteria in water and formula may present as much of a problem as the presence of nitrate. Table 5 clearly indicates the need for better education of parents in the handling of infant feeding.

Taken singly the "risk factors" for elevated methemoglobin associated with 1) high nitrate ingestion (more than 5 mg. in 24 hours). 2) illness, 3) location and 4) contamination of formula by fecal coliform organisms are shown in the following contingency tables.

The χ^2 of 9.7 for nitrate ingestion in the table is significant at the 1% level. Because of the small sample size, this was confirmed by using Fisher's exact test. However, the

	Nitrate Ingestion				Illness Status			
	0-5 mg	> 5mg	Total		Not Ill	Ill	Total
Mhgb<4%	410	53	463	Mhgb<4%	359	104	463
Mhgb≥4%	14	8	22	Mhgb≥4%	14	8	22
χ^2	9.7			χ^2	n.s.		

	Location				Fecal Coliform Count in Formula		
	East	Other West	Total		<30	>30	Total
Mhgb<4%	159	131 174	464	Mhgb<4%	165	253	418
Mhgb≥4%	5	8 9	21	Mhgb≥4%	5	17	22
χ^2	n.s.			χ^2	n.s.		

five highest methemoglobin tests occurred in babies with illness, only one of whom had an elevated nitrate ingestion.

These findings represent a set of observations of a rapidly fluctuating set of phenomena. They may not be representative of the maximal potential of these variable processes.

Conclusion

Our data indicate that even healthy babies not exposed to excessive nitrate levels in their diets, have higher methemoglobin levels when they are young, that is, under 60 days, than they do when they are older. We also find the highest levels of methemoglobin (over 6% MHb) in babies who have respiratory illness or diarrhea. Since the babies which we examined were not acutely ill, it is conceivable that acutely ill babies have a much more serious problem from methemoglobinemia.

Compared to the effects of age and state of health in elevation of the methemoglobin level (over 4% MHb) the effect of ingesting nitrate-nitrite-nitrogen in excess of 5 mg. per day from community water supplies is detectable but not impressive. Bacterial contamination of formula may contribute to such elevations.

Table 1—Methemoglobin Levels By Age March 4, 1970 thru March 25, 1971

Methemoglobin per cent	Total		Age in days 0 - 30		31-60		61-90		91-120		>120	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0.0-0.9	6	1.2	–	—	2	1.0	3	3.0	1	1.4	–	–
1.0-1.9	178	36.6	7	15.2	21	10.8	39	39.0	55	78.6	56	72.7
2.0-2.9	214	43.9	28	60.9	107	55.2	46	46.0	12	17.1	21	27.3
3.0-3.9	68	14.0	9	19.6	48	24.8	9	9.0	2	2.9	–	—
4.0-4.9	12	2.5	2	4.3	8	4.2	2	2.0	–	—	–	–
5.0-5.9	4	.8	–	—	3	1.5	1	1.0	–	—	–	–
6.0-6.9	1	.2	–	—	1	.5	–	—	–	—	–	–
7.0-7.9	–	—	–	—	–	—			–	—	–	–
8.0-8.9	3	.6	–	—	3	1.5	–	—	–	—	–	–
9.0-9.9	–	—	–	—	–	—	–	—	–	—	–	–
10.0-10.9	1	.2	–	—	1	.5	–	—				
Total	487	100.0	46	100.0	194	100.0	100	100.0	70	100.0	77	100.0

Table 2—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Age for Total Infants

		Twenty-four hour nitrogen intake					
		<5 mg		5.00-9.99 mg		10.0-20.0 mg	
Age	No. Infants examined	Mhgb level <4%	≥4%	Mhgb level <4%	≥4%	Mhgb level <4%	≥4%
< 30 days	45	38	2	5	0	0	0
31-60 days	194	156	11	19	6	2	0
61-90 days	102	87	1	11	2	1	0
91-120 days	68	64	0	2	0	2	0
>120 days	76	65	0	10	0	1	0
Subtotals	485	410	14	47	8	6	0
Totals		424		55		6	
Per cent with 4% Mhgb or more*		3.3%		14.5%		0.0%	

* 4.52% of the Total Infant Population have Mhgb above 4%
5 mg/l Nitrogen=22.15 mg/l NO_3
10 mg/l Nitrogen=44.3 mg/l NO_3

Table 3—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Age for Infants Without Illness

Age	No. Infants examined	Twenty-four hour nitrogen intake <5 mg Mhgb level <4%	≥4%	5.00-9.99 mg Mhgb level <4%	≥4%	10.0-20.0 mg Mhgb level <4%	≥4%
<30 days	37	30	2	5	0	0	0
31-60 days	156	128	6	17	3	2	0
61-90 days	81	68	1	9	2	1	0
91-120 days	51	48	0	1	0	2	0
> 120 days	48	40	0	7	0	1	0
Subtotals	373	314	9	39	5	6	0
Totals		323		44		6	
Per cent with 4% Mhgb or more		2.78%		11.3%		0.0%	

Table 4—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Age for Infants with Diarrhea and Respiratory Illness

Age	No. Infants examined	Twenty-four hour nitrogen intake <5 mg Mhgb level <4%	≥4%	5.00-9.99 mg Mhgb level <4%	≥4%	10.0-20.0 mg Mhgb level <4%	≥4%
<30 days	8	8	0	0	0	0	0
31-60 days	38	8	5	2	3	0	0
61-90 days	21	19	0	2	0	0	0
91-120 days	17	16	0	1	0	0	0
>120 days	28	25	0	3	0	0	0
Subtotals	112	96	5	8	3	0	0
Totals	112	101		11			
Percent with 4% Mhgb or more		4.9%		27.2%			

Table 5—Fecal Coliform Water and Formula Samples March 1970-March 1971

Sample	Total No.	Fecal coliform (E.C.) Acceptable* No.	%	Not Acceptable† No.	%
Immediate	481	439	91.3	42	8.7
Flushed	476	458	96.2	18	3.8
Tap boiled	253	204	80.6	49	19.4
Bottled	153	98	64.1	55	35.9
Formula	440	170	38.6	270	61.4

Fecal coliform organisms
*<3 Water
<30 Formula
†3 & > Water
30 & > Formula

Table 6a—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Location for Total Infants

Age	No. Infants examined	East Delano Twenty-four hour nitrogen intake <4.99 mg Mhgb level <4%	≥4%	5.00+ mg Mhgb level <4%	≥4%
<30 days	14	12	0	2	0
31-60 days	63	54	1	6	2
61-90 days	40	34	1	4	1
>90 days	47	46	0	1	0
Subtotals	164	146	2	13	3
Totals		148		16	
Per cent with 4% Mhgb or more*		1.4%		18.8%	

*4.52% of the Total infant population have Mhgb above 4%
5 mg/l Nitrogen=22.15 mg/l NO_3
10 mg/l Nitrogen=44.3 mg/l NO_3

Table 6b—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Location for Total Infants

		West Delano			
		Twenty-four hour nitrogen intake			
		<4.99 mg		5.00+ mg	
	No. infants	Mhgb level		Mhgb level	
Age	examined	<4%	≥4%	<4%	≥4%
<30 days	15	14	1	0	0
31-60 days	76	58	8	10	0
61-90 days	36	31	0	5	0
> 90 days	56	50	0	6	0
Subtotals	183	153	9	21	0
Totals		162		21	
Per cent with 4% Mhgb or more*		5.55%		0.00%	

*4.52% of the Total Infant Population have Mhgb above 4%.
5 mg/l Nitrogen=22.15 mg/l NO_3
10 mg/l Nitrogen=44.3 mg/l NO_3

Table 6c—Nitrate-Nitrite Nitrogen Ingestion and Methemoglobin Levels by Location for Total Infants

		Other locations			
		Twenty-four hour nitrogen intake			
		<4.99 mg		5.00+ mg	
	No. infants	Mhgb level		Mhgb level	
Age	examined	<4%	≥4%	<4%	≥4%
<30 days	16	12	1	3	0
31-60 days	55	44	2	5	4
61-90 days	26	22	0	3	1
>90 days	42	34	0	8	0
Subtotals	139	112	3	19	5
Totals		115		24	
Per cent with 4% Mhgb or more*		2.6%		20.8%	

*4.52% of the Total Infant Population have Mhgb above 4%.
5 mg/l Nitrogen=22.15 mg/l NO_3
10 mg/l Nitrogen=44.3 mg/l NO_3

Table 7—Illness By Age With 4.0% Methemoglobin March 1970-March 1971

		Age in days						Type of Illness				
Mhgb	No.	0-30	31-40	41-50	51-60	61-70	71-80	Resp	Diar	None	Med	Unk
4.0-4.9	12	2	2	4	2	1	1	4	1	4	2	1
5.0-5.9	4			3			1	2		2		
6.0-6.9	1		1					1				
7.0-7.9				1								
8.0-8.9	3		2						3*			
9.0-9.9												
10.0-10.9	1		1						1†			
Total	21	2	6	8	2	1	2	7	5	6	2	1

*1 Diarrhea with respiratory illness
1 Diarrhea with medication
†Loose stools for 30 days

Table 8—Comparison of Birth Weight, Illness, Formula, Water and Nitrogen Intake for Five Highest Methemoglobins

%	Birth		Formula				Water Intake		NO_3-NO_2
Mhgb	weight	Illness	Type	Oz.	Contamination		Type	Oz.	Nitrogen/24 hr
6.1	7-5	R*	Evap	11¼	X‡		Term. Steril	0	2.89
8.9	7-6	D*	Prep	12	X		Bottled	0	0.17
8.9	7-6	D	Conc 1:1	14	X		Bottled	0	0.04
8.4	7-3½	D	Dry	18	X		Tap	3½	1.16
10.7	9-6½	D†	Evap Dext	19.3	X		Tap Boiled	8	6.31

*R=Respiratory
D=Diarrhea

†Diarrhea, loose stools for 30 days
‡X=Contaminated

Table 9—Comparison of Methemoglobin Levels After 24 Hours Use of Bottled Water* and After One Month on Former Routine

Clinic Visit-1							Clinic Visit-2			
Age Days	Mhgb % CV-1	Mhgb % 24 hr†	Hgb CV-1	Hgb 24 hr†	Illness	NO_3-NO_2 Nitrogen	Age Days	Mhgb	Illness	NO_3-NO_2 Nitrogen
					Loose Stools					
35*	10.7	4.03	11.6	11.1	x 30 days	6.306	57	3.36	—	0.049
40	2.13	2.35	10.5	9.85	0	1.296	—	—	—	—
42	2.26	2.90	9.3	9.9	0	6.965	—	—	—	—
46	5.23	3.19	11.4	11.2	0	7.762	—	—	—	—
					Diarrhea				Resp	
46	8.2	2.14	10.43	9.1	x 2 days	1.160	74	3.57	x 7 days	1.098
51	2.63	1.57	9.5	10.2	0	6.170	79	1.93	—	8 243
70	2.68	1.56	10.0	10.3	0	4.883			Resp	
							105	1.74	x 2 days	0.597

*Except for 35 day old infant—Mhgb or type of water used not known when mothers asked to participate.
†After 24 hours on bottled water.

References

1. Comly, H.R. Cyanosis in infants caused by nitrates in well water. JAMA 129:112-116, 1945.
2. Public Health Service Drinking Water Standards, Revised 1962. U. S. Department of Health, Education, and Welfare, Public Health Service. Washington 25, D. C.
3. Gruener, N. and Shuval, H. Health aspects of nitrates in drinking water in Developments in Water Quality Research. Shuval, H. (Editor.) Ann Arbor, London, 1970.
4. Bodansky, O. Methemoglobinemia and methemoglobin producing compounds. Pharmacol. Rev. 3:144, 1951.
5. Knotek, Z. and Schmidt, P. Problems of nitrate food methemoglobinemia of infants in Czechoslovakia. Gig. Sanit. 2:13, 1966.
6. Druckery, H. Arzneimittelforschung 12, 1962.
7. London, W. T.; Henderson, W.; and Cross, P. F. An attempt to produce chronic nitrite toxicosis in swine. JAVMA J. Amer. Vet. Med. Ass'n. 150:4 pp 398-402, 1967.
8. Davison, K. L.; Hansel, W.; and Krook, L., et al. Nitrate toxicity in dairy heifers I. Effects on reproduction, growth, lactation and Vitamin A nutrition. J. Dairy Sci. 47, 9:1065-1073, 1964.
9. Delano Nitrate Investigation, State of California Resources Agency, Department of Water Resources, Bulletin No. 143-6, August, 1968.
10. Hainline, A., Jr. Methemoglobin. Standard Methods of Clinical Chemistry. Vol. 5, 1965. Edited by Samuel Meites. New York: Acad. Press, pp. 143-157.
11. Winton, E. and Tardiff, R. Personal communication.
12. Hegesh, E.; Gruener, N.; Cohen, S. et al. A sensitive method for the determination of methemoglobin in blood. In press.
13. Standard Methods for the Examination of Water and Wastewater. 12th edition. 1965. APHA, New York.
14. Manning, P.B.; Coulter, S.T.; and Jenness, R. Determination of nitrate and nitrite in milk and dry milk products. J. Dairy Sci. 51:17-25, 1968.
15. Strickland, J.D.H., and Parsons, T.R. A practical handbook of seawater analysis. Bulletin 167. Fisheries Research Board of Canada, pp 71-80. Ottawa, 1968.
16. Winton, E.; Tardiff, R.; and McCabe, L. Nitrate in drinking water. J.A.W.W.A. 63:95-98, 1971.

ACKNOWLEDGMENTS

The authors are indebted to Janice Nakao and Mary Nee, Public Health Chemists, who did the laboratory work in the field as well as in the California State Department of Public Health Sanitation and Radiation Laboratory, and to Yen Chi Kwan and Paul Baba, Public Health Chemists, who with their workers helped to coordinate and execute the analyses of the laboratory specimens sent from the field; to Rachel Natera, Public Health Nurse, who helped with the field clinic activities; to the officials of the study community for their cooperation in providing space for the clinic activities and to the water system workers for their continual patient collection of well samples; the Kern County Health Department and Tulware County Health Department, and the Berkeley Pediatric Medical Clinic, and their patients. The understanding, support and interest of Senator Walter Stiern, D.V.M., California State Legislature, was greatly appreciated.

Ms. Shearer is Nurse Epidemiologist, Communicable Disease Control, California State Department of Public Health. She was previously Research Specialist with Environmental Epidemiology, CSDPH. Dr. Goldsmith is Head, Environmental Epidemiology, California State Department of Public Health. Mr. Young is Senior Sanitary Engineer, Bureau of Sanitary Engineering, California State Department of Public Health. Dr. Kearns is Health Officer, Kern County Health Department. Dr. Tamplin is Assistant Chief, Sanitation and Radiation Lab, California State Department of Public Health.

This paper was presented before the Epidemiology Section of the American Public Health Association at the Ninety-Ninth Annual Meeting in Minneapolis, Minnesota on October 13, 1971.

E34

Jeanne Orcutt
4201 N.W. Third
Gresham, OR 97030

September 11, 1984

Department of Environmental Quality
P. O. Box 1760
Portland, Oregon 97207

Attention: Water Quality Division

Gentlemen:

Regarding the "threat to drinking water" hearing, please include the following material in the record for consideration by the Environmental Quality Commission.

Excerpt from Rep. Wally Priestly's testimony May 2, 1983 at the House Hearing on the Seepage Bill.

Letter from Rep. Annette Farmer to Senators dated June 7, 1983.

A message from Rep. Lonnie Roberts to citizens regarding sewers and the Seepage Fee. (undated)

A article that appeared in the Oregonian September 1, 1984 "Springfield to auction off unwanted lots".

This is being mailed at the post office on September 11, 1984, your deadline for submitting written comments.

Sincerely,

Jeanne E. Orcutt

Jeanne E. Orcutt

THEY'RE INHABITED OR NOT?

E34a

THEY PROBABLY COULD THAT COULD BE BROUGHT OUT IN THIS ENABLING ORDINANCE. I THINK THAT THAT IS A POSSIBLITY--YES.

1983 May 2 House Hearing Reading #3

STLY: .IT WAS MY INTENTION TO VOTE FOR THIS WHEN I FIRST HEARD ABOUT THE SEEPAGE FEE--I'D NEVER HEARD OF SUCH A THING BEFORE THIS PROPOSAL. WE ALL LIVE ON SUCH A SCATTERING OF INFORMATION AND PERHAPS I LIVE ON LESS INFORMATION THAN MANY OF YOU,BUT LET ME JUST SHARE SOME KIND OF HUNCHES THAT COME TO ME.

REP. OTTO MENTIONED ABOUT THE WELLS THAT ARE BEING DRILLED FOR OUR WATER SUPPLY AND THAT APPARENTLY ARE IN THIS AREA, AND I VISITED A FEW OF THOSE SITES AND I KNOW THAT THERE IS A BIT OF A PROBLEM AND THERE'S A CONTROVERSY IN OUR CITY AS TO WHETHER OR NOT THAT MAKES GOOD SENSE. IT TURNS OUT THAT THERE ARE A FEW PEOPLE THAT ALLEGE THAT THERE'S KIND OF A POLITICAL DEAL GOING ON BETWEEN THE PERSON THAT'S DRILLING THE WELLS AND OUR MAYOR IN OUR CITY OF PORTLAND. A FRIEND OF HIS THAT'S INVOLVED IN THE WELL DRILLING, AND I JUST HAPPEN TO KNOW WHO THAT PERSON IS AND I HAPPEN TO KNOW THAT THAT PERSON ALSO OWNS A LOT OF THIS SOUTH SHORE INDUSTRIAL AREA. I WENT TO GRADE SCHOOL WITH THE GUY, AND I THINK THE FAIR THING--AND THE THING THAT DISTURBS ME IS THAT THE ASSESSMENT BE ON THE BASIS OF THE VALUATION OF THE PROPERTY WITHIN THE DISTRICT. WHILE IT IS DESIRABLE TO ACCOMPLISH THIS END, IT DOESN'T SEEM TO ME TO BE THE FAIR WAY TO DO IT--JUST TO MAKE THE CHARGES ON THE BASIS OF THE RESIDENCE. THE CHARGE OUT TO BE ON THE BASIS OF RECEIVED VALUE, AND IF YOU OWN PROPERTY IN THE SOUTH SHORE INDUSTRIAL AREA, AND I MUST RELATE TO YOU THAT A GOOD DEAL OF THAT PROPERTY HAS BEEN DREDGED IN FROM THE RIVER. IT'S NEWLY CREATED PROPERTY--QUITE A BIT OF IT--THOSE PEOPLE WHO HAVE THOSE OWNERSHIPS OUGHT TO SHARE AND PREFERABLY WE OUGHT TO GO THE TRADITIONAL FORM OF A SPECIAL DISTRICT CREATION. THIS IS VERY NOVEL. I'D NEVER HEARD OF A SEEPAGE CHARGE. MY CURRENT HUNCH IS THAT I'D PREFER THE DISTRICT RATHER THAN THE SEEPAGE CHARGE ALTHOUGH I ASSURED HOME BUILDERS THAT

TLY: I WAS GOING TO VOTE FOR THIS BECAUSE I WANTED TO GET THE SEWAGE
D.) CLEANED UP. BUT THERE ARE QUESTIONS ABOUT FAIRNESS.

ANNETTE FARMER
MULTNOMAH COUNTY
DISTRICT 20

REPLY TO ADDRESS INDICATED:
☐ House of Representatives
Salem, Oregon 97310
☐ 2603 NE. 144th
Portland, Oregon 97230

E346

COMMITTEES
Chairperson:
Education
Member:
Human Resources
Elections

HOUSE OF REPRESENTATIVES
SALEM, OREGON
97310

June 7, 1983

Senators,

House Bill 2784 authorizes the imposition of a seepage fee to fund construction of sewers in East Multnomah County, specifically, in the industrial South Shore area by the Columbia River, NOT in the residential area. This is an unusual method of funding; it has never been tried before in this state. It is grossly unfair for a group of people to pay fees without receiving any services in return. The legislation before you leaves the residents of the area open to taxation without representation. There should be further amendments to HB 2784 before it is passed by the Legislature. Amendments were proposed to the Senate Local Government and Elections Committee. The only reason the bill was not brought for reconsideration on the House floor was because of an agreement between Representative Bauman and Senator Roberts that the Senate Committee would favorably consider the amendments. That was NOT done at the Senate committee hearing.

THE PROBLEM: The situation in East Multnomah County is unusual for several reasons. Although sewer development in the remainder of the metropolitan area was funded through federal grants of up to 75% of the total cost, federal funding for the 50 million dollars worth of projects in this area is uncertain. Second, there is no local representative governing body whose primary responsibility is to the residents of that unincorporated area. Third, the residents are dependent upon other jurisdictions to provide services and issue bonds for local projects. They are vulnerable to Portland on the west and to Gresham on the east. The seepage fee could help force neighborhoods to annex themselves to the cities.

THE PROPOSED SOLUTION: Seepage fees will be levied against Inverness basin residents in unincorporated East Multnomah County and will fund the construction of sewers in the industrial South Shore area just north of their neighborhoods. (See map) This is a transfer of funds from one area to another. The feepayers, having put money up front for this project which benefits the entire metropolitan area will not get sewers, according to Multnomah County, for at least another 15 years. They may pay over $2,000 before they are ever assessed for their own sewers.

The other goal of these sewers is a clean water aquifer supply. Because of the outstanding drainage in the area, the pollution in the water in much of the area is so low that it does not warrant sewers. Thus, the bill proposes to remove one of the provisions of the "Threat to Drinking Water Act" in order to allow Multnomah County to impose sewers and general obligation bonds without a vote of the people regardless of the level of contaminants in the water.

HB 2784
June 7, 1983

ADDITIONAL SAFEGUARDS NEEDED THAT:

1) New housing developments, commercial, industrial and vacant properties pay a fair share.

2) Put a time limit (10 years) on the duration of the charge. Put a cap on the amount of the fee. (At a recent meeting the County Executive suggested that the seepage fee will probably be $10 per month and maybe more.)

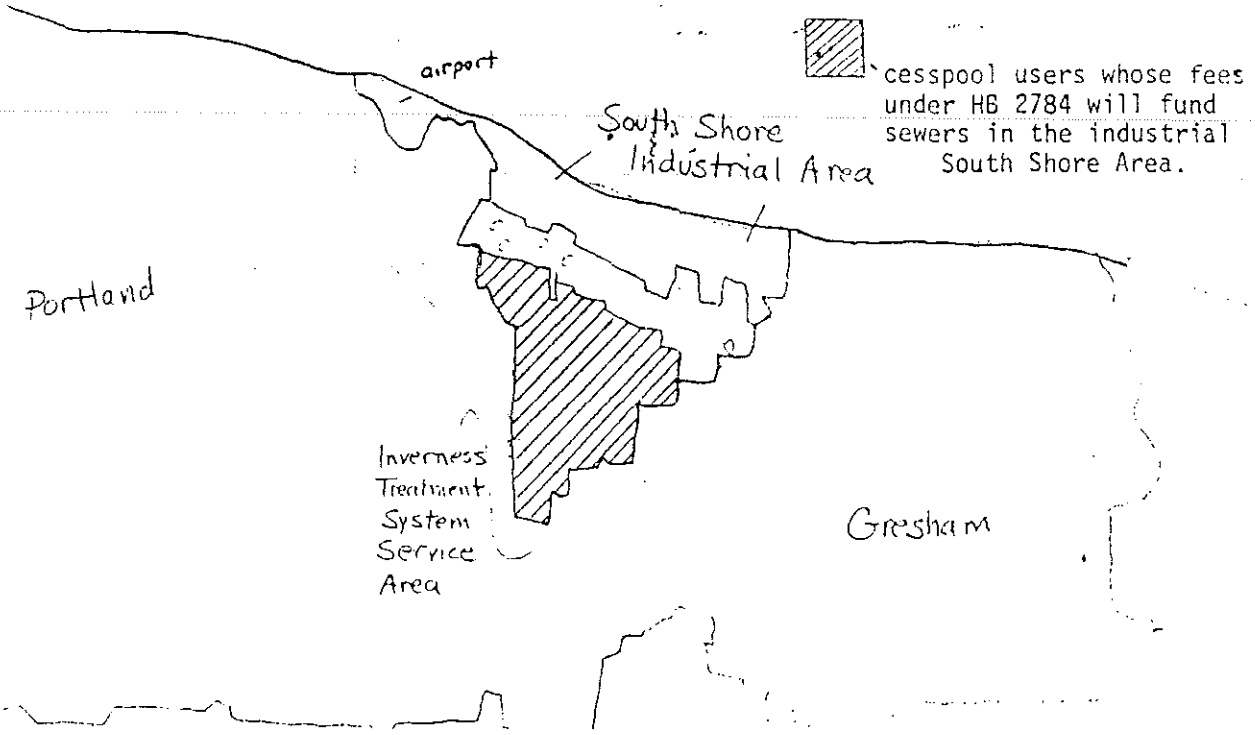
3) Credit for people who have to replace failed cesspools while waiting for 15 years for their sewers and paying seepage fees.

4) Credit given to feepayers when the sewers are completed should be against assessments charges for the actual sewers, not against hook-up charges.

5) Restore the provision in the "Threat to Drinking Water Act" to require a vote of the people on government actions if the pollution levels are below the allowable level.

SUMMARY: This may seem like a small fee, but it has many implications. It may help change the status of the Unincorporated East Multnomah County area. Just because the 90,000 potential feepayers are not as well organized here as the governments of the area, do not ignore them. The cost of protection should be borne by those who benefit as well as those who contribute to the problem. Passing an open-ended bill like this is a bad precedent, it could happen to your county.

The attached Wall Street Journal article speaks for itself. It came one day late, the bill never would have passed on the House floor if we had had it on May 2nd. Please consider carefully what the Legislature is doing by imposing a punitive tax on about 9,000 families. I urge you to send the bill back to committee where the amendments could be adopted.



E34C

RECEIVED

Water Quality Division
Dept. of Environmental Quality

THE WALL STREET JOURNAL.

REGIONS

Portland, Ore., Offers Services To Push Case for Annexation

By Eugene Carlson
Staff Reporter of The Wall Street Journal

WHEN IT COMES to the ease with which a city can annex surrounding land, Mark Gardiner, the finance director of Portland, Ore., admits to casting an occasional envious glance at Houston. Texas has liberal annexation laws, and Houston has exploded geographically by simply grabbing land that looked good.

Oregon has far tougher annexation laws. That complicates things for Portland (pop. 366,000), which has watched its population share of its four-county metropolitan area slip from 50% to 30% since 1950. To regain dominance, Portland has been eyeing a 40-square-mile chunk of unincorporated land in Multnomah County, east of the city. The attraction is 3,000 acres of raw industrial land fronting the Columbia River plus a relatively prosperous population of about 140,000.

Grafting all or part of this prize land onto Portland won't be easy. Unlike Texas, annexation in Oregon requires voter approval. Many of the county residents moved there years ago to escape Portland's government. Even now, many prefer starting a new city, if urban government is inevitable, to being gobbled up by their larger neighbor. Such a city would be the second largest city in Oregon.

So Portland is pushing its case in a novel way. It is trying to create a climate for annexation by offering to expand various municipal services—police, parks, planning and sewers—beyond the city limits.

← TRIPPLE MAJORITY ANNEXATION DOES NOT REQUIRE VOTER APPROVAL! D.O.

IN THE COMING MONTHS, officials of Portland, Multnomah County and two other adjacent counties will gather around detailed maps and lay down an "urban services boundary." Inside this line, Portland will offer to sell a range of municipal services. "We're not going to force the city on anybody. We're going to sell it," says Mr. Gardiner. But he adds: "Ultimately, we would expect that land to become part of the city."

Portland's strategy is made easier by the city's financial health. (Los Angeles and Portland are the only West Coast cities whose general obligation bonds are rated triple-A by Moody's Investors Service.) Multnomah County is in rocky financial shape and has already announced major cutbacks in services. "We don't have a parks program anymore," says County Executive Dennis Buchanan. "We just cut the grass often enough to stay out of trouble with the fire marshal."

The absence of sewers in the county's unincorporated area is Portland's biggest problem if the urban services plan goes through. East Multnomah County may be the most densely populated area in the U.S. without a sewer system. Up to 12 million gallons of raw sewage percolate into the ground every day. Without a sewer hookup, the prize industrial land is unusable.

A sewer system would be a major investment for Portland. Other services would be sold on contract to the adjacent counties. Once the land is annexed, operating expenses "are about a wash," Mr. Gardiner says. "The revenues generated in taxes and user fees ... roughly offset the costs."

Chester Johnson, president of Government Finance Associates in Princeton, N.J., and financial consultant to Portland, calls the plan highly unusual. The bottom line is the city's ability to leverage its services to gain future financial advantage. They aren't doing it ... loss leader."

LONNIE ROBERTS
MULTNOMAH COUNTY
DISTRICT 21

REPLY TO ADDRESS INDICATED:
☐ House of Representatives
Salem, Oregon 97310
☐ 15815 SE. Mill Street
Portland, Oregon 97233

HOUSE OF REPRESENTATIVES
SALEM, OREGON
97310

COMMITTEES
Member:
Agriculture and Natural Resources
Transportation

E34d

Good Evening,

May I first open this statement by saying that I am sorry my schedule will not permit me to be with you in person tonight. However, the subject you are discussing is very important and I have been asked to make comment.

We all know that East Multnomah County is a large unsewered area. We also know that there has been, for some time, concern that this may lead to a health hazard. However, the discussion is based more on the way government is attempting to collect money for the infrastructure that would eventually provide a sewer system. This, as you know, is now known as the seepage fee. The fear is that the people will pay for many years without seeing one pipe laid for sewer service on their behalf. No one should pay for something they will never receive.

We in the East County area must realize that future industrialization of our area will be prohibited unless the proper infrastructure is in place. However, before we talk of industry locating in East County, we must have at least a reasonable assurance that there are business organizations that want to locate here. If indeed we do have the opportunity to broaden our job opportunities and our tax base, the expanding number of industries will have to pay their share of expense.

LONNIE ROBERTS
MULTNOMAH COUNTY
DISTRICT 21

REPLY TO ADDRESS INDICATED:
☐ House of Representatives
Salem, Oregon 97310
☐ 15815 SE. Mill Street
Portland, Oregon 97233

COMMITTEES
Member:
Agriculture and Natural Resources
Transportation

HOUSE OF REPRESENTATIVES
SALEM, OREGON
97310

There has been a discussion centering on preference for hiring Portland people if industry expands in East County. This is absurd and discriminatory, if indeed this discussion is serious. Any expansion of job opportunity must be based on individual qualification and commitment.

In closing allow me to conclude by stating, 1) no one should pay for something they will not receive. 2) if we want more job opportunity and a broader tax base we must accept the need for the necessary infrastructure, where industry pays its fair share and/hiring practices are equal. 3) the most equitable way to pay for it must be agreed upon by all who are affected, and that means you and me.

Thank you very much.

Lonnie

LONNIE ROBERTS
State Representative
District 21

Springfield to auction off unwanted lots

By KATHLEEN MONJE
Correspondent, The Oregonian

SPRINGFIELD — The recession has turned Springfield into an unwilling real estate broker with $25 million worth of residential lots up for bid at a Sept. 7 foreclosure sale.

The 500 lots on the sale list, most of them without houses, represent the city's and developers' unplanned entanglement with Bancroft bonding and the housing market slump.

Their joint misfortune will be a boon for buyers at the sale, Anne L. Pflug, city finance director who inherited the Bancroft bond deficit, said.

The "prime" residential lots in 13 subdivisions will be sold for a fraction of their true cash value even at surplus housing market prices, with price tags set between $500 and $18,000, Pflug said.

The minimum bids represent the delinquent Bancroft loan amounts on each parcel, she said. The lots will go to the first bidder to meet the minimum, with random selection if more than one bid is received.

Some examples from Pflug's list of vacant-lot bargains:

In central Springfield, 6,300-square-foot lots zoned for duplexes will have an approximate sale value of $5,270. Their true cash value is $14,190.

Single-family residential lots in west Springfield, with a true cash value of $13,650 for 7,100 square feet, will sell for about $10,260.

In east Springfield, an uncompleted house on an 8,100-square-foot lot, valued at $31,740 will go for about $8,000.

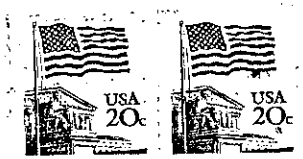
Foreclosed owners have a year to redeem their properties; sale buyers will get 10 percent interest on their investments if the owner pays the bill, Pflug said.

Since the city has been pursuing active collection of the past-due Bancroft accounts since April, redemption possibilities appear fairly slim.

The problem started in the late 1970s and early 1980s, when developers borrowed money to pay for their shares of municipal improvements — streets, curbs, lighting and sewers — just before the recession, when Springfield was the fastest-growing city in Oregon and the market appeared to be insatiable.

When job and population losses contracted

4201 N.W. Third St.
Gresham, OR 97030



DEPARTMENT OF ENVIRONMENTAL QUALITY
ATTENTION: WATER QUALITY DIVISION
P. O. BOX 1760
PORTLAND, OREGON 97207

E 35

THE OREGON HEALTH SCIENCES UNIVERSITY

Department of Public Health and Preventive Medicine
3181 S.W. Sam Jackson Park Road Portland, Oregon 97201 (503) 225-8257

September 7, 1984

Mr. Harold Sawyer
Dept. Environmental Quality
Water Quality Division
522 SW 5th
Portland, Oregon 97201

RE: Mid-Multnomah County Sewer Service

Dear Mr. Sawyer:

On August 30th I testified at the DEQ hearing on the need for sewers in Mid-Multnomah County. I have been deeply interested in water quality and waste water disposal for 35 years, and as county health officer in Wasco, Coos and Lane counties have shared the responsibility of protecting and insuring water quality of community water supply and individual supply sources, working closely with the Oregon State Sanitary Authority engineers, state and local sanitarians. In 1961 I joined the faculty of the Oregon Health Sciences University and have been department chairman of the Department of Public Health and Preventive Medicine since 1967. I have served three terms on the Sanitarian Registration board. In my career I have been involved with epidemiologic studies of disease related to water, and in the development of long range control measures designed to protect the quality of Oregon's surface and ground water supplies. The guiding principle in the selection of the source of potable water supplies is succinctly stated in the National Interim Primary Drinking Water Regulations promulgated by the U. S. Environmental Protection Agency in 1976.

"Production of water that poses no threat to the consumer's health depends on continuous protection. Because of human frailties associated with protection, priority should be given to the selection of the purest source. Polluted sources should not be used unless other sources are economically unavailable, and then only when personnel, equipment and operating procedures can be depended on to purify and otherwise protect the drinking water supply." This principle has been the guiding principle in Oregon for many years, and Oregonians have prided themselves on the protection and conservation of our natural resources.

Water is our greatest natural resource, and great efforts beginning over 80 years ago when the City of Portland and our federal government utilized this concept in developing our world famous Bull Run Watershed, protected by law from pollution. For many years, Oregonians assumed that fresh, unpolluted water was readily available, and carelessly polluted and contaminated both surface and ground

water supplies. Under the state sanitary authority, regulations were promulgated to correct the indiscriminate pollution and contamination of our water supplies. Two engineers, Sy Everts and Kenneth Spies, quietly began to address this problem and Oregon gained the reputation of having the finest water control program in the nation.

It has been my pleasure to have actively participated in the efforts to clean up and protect our surface and ground waters. In 1956, a sanitary survey was conducted in the East Springfield area of 5.5 square miles. Seventy percent of the homes in that area were polluting surface drainage sources with sewage, all of which drained into the MacKenzie River about 100 yards above the intake of the Eugene Water Boards water source serving over 100,000 people. The actions of the City of Springfield and Eugene, the Lane County Health Dept. under John Stoner and me, strongly supported by the State Sanitary Authority, addressed this problem, and eventually the problem of ground water and surface water pollutions in the entire Eugene basin.

The ultimate results were the annexation of 5.5 square miles to the city of Springfield, and the areas of Bethell-Danebo and the large area across the Ferry Street Bridge to Eugene, more than doubling its size. A few citizens in East Springfield sued the City of Springfield to block annexation and the construction of a sewage collection and treatment system. The actions of the City of Springfield, under Mayor Harms, of the Lane County Health Department were upheld, and the area is now sewered and the source of Eugene's water protected. This took nearly eleven years to achieve. The situation in Mid-Multnomah County is the same, gross pollution of ground water from thousands of cesspools, clearly and inevitably contaminating drinking water sources as outlined in the East County Sanitary Sewer Consortium publication.

The amount of fresh water in this world, and in Oregon, is fixed, with only 0.2% of the world's water fresh. The problems with protecting this invaluable resource arise from the concentrations of people, and the continuing growth of their numbers, requiring greater use, and re-use, of available fresh water.

It is difficult for me, and the sanitarians of the state, to understand why the residents of mid-multnomah have been permitted to continue to use cesspools, but it is encouraging that no new permits for construction will be granted. Cesspools have been banned in all other sections of Oregon for years, thus the Mid-Multnomah County residents have been granted preferential treatment not granted to other Oregonians. I note in listening to the testimony given to the commission on August 30th, that many people do not know the difference between cesspools and properly constructed septic tanks and tile field or other secondary treatment methods utilized in on-site experimental systems. Nor do many realize that such systems are often more expensive than are sewers. Properly installed systems do not contaminate ground water. They do require land area for installation which is not available for most homes in mid-county, thus are not a solution to the present problem.

The amount of sewage contaminating the ground water table from 56,000 cesspools certainly presents a hazard to anyone using the water. Many cities now opt for ground water sources as they constitute the "purest" source and do not require expensive filtration and treatment systems. However, such supplies, when polluted with long-lasting synthetic chemicals, may not be usable as present methods of treatment are not directed at such chemicals. Many of these chemicals are found in household water wastes, and protection of ground water from such wastes is the

only practical way to insure that the water will remain usable in the future.

No one can dispute the potential hazard of adding untreated, and unmonitored, sewage to ground water supplies, or to surface water. Simply put, out-of-sight is out-of-mind, but continuing current practices will eventually destroy the upper ground water table in mid-county as a water supply source.

In the event that Bull Run water service is interrupted, the City of Portland has the ability to supplement the supply from the series of wells recently constructed. While these wells draw water from a deeper acquifer, it is conceivable if the demand on the supply is greater than the natural capacity to refill with water from the same strata, draw down of polluted ground water lying above the acquifer is indeed a possibility.

In public health, action is taken before disease occurs, not after you can prove that the polluted water is causing disease. Public health officials would be severely criticized if one waits for an epidemic of malformed infants, or of proven cases of cancers caused by the presence of carcinogens in water, and rightly so.

Action is taken when it becomes resonably apparent that risks of exposure to potential disease agents are identified. Such risks, as outlined by other testimony, exist now, calling for no further delay in correcting the situation in Mid-Multnomah County. In my opinion, if steps to sewer the area had been made when the rest of the state was vigorously addressing sewage disposal problems, the high costs would have been largely avoided. To continue to postpone correction, are simply going to escalate the costs.

To state that the water has never caused illness does not give an area permission to continue to contaminate the ground water. Putting it in another way, can those who oppose correcting a problem of their own creation, guarantee that illness has not already occurred, assuring all residents that the practice of grossly polluting ground water is a safe practice. I would propose that studies be done to determine if illness is not occurring. Such studies are often difficult, often expensive, and currently unfunded. One water sample screened for biological and chemical agents known to be toxic to man when present in water, will cost over $1,000. In these times of scarce funds, it makes infinitely more sense to protect water sources, than to pollute indiscriminately, try to prove that such water has caused disease, and then spend even more to treat the water to remove the offending agents of disease. The hazards of water contaminated with human wastes has been known since biblical days. The hazards have been increased with new risks to health stemming from the chemical revolution. Not to recognize this is folly as numerous outbreaks of water borne disease have occurred when protection of the water source has been neglected.

Sincerely,

Harold T. Osterud

Harold T. Osterud, MD, MPH
Professor and Chairman

HTO/fs

DEPARTMENT OF PUBLIC HEALTH
AND PREVENTIVE MEDICINE

UNIVERSITY OF OREGON

HEALTH SCIENCES CENTER

3181 S.W. Sam Jackson Park Road Portland, Oregon 97201

SEP 19 '83
ORE

Mr. Harold Sawyer
Administrator
Dept. Environmental Quality
Water Quality Division
522 SW 5th
Portland, Oregon 97201

E36

THE OREGON HEALTH SCIENCES UNIVERSITY

School of Medicine
Division of Environmental Medicine
3181 S.W. Sam Jackson Park Road Portland, Oregon 97201 (503) 225-8415

September 10, 1984

Harold Sawyer, Administrator
Water Quality Division
Dept. of Environmental Quality
522 SW Fifth Ave.
Portland, Oregon 97201

RE: Mid-Multnomah County Sewage Problem

Dear Mr. Sawyer,

I have been asked to submit additional information on how sewage can effect ground water with respect to health risks. For background documentation I can refer you to the series "Drinking Water and Health" published by the National Research Council of the National Academy of Sciences in Washington, D.C.: Vol. I, 939 pp., 1977; Vol. II, 393 pp., 1980; Vol. III, 415 pp., 1980; Vol. IV, 299 pp., 1982; Vol. V, and 157 pp., 1983. In addition, there are many many texts and journals in public health and environmental sciences which endlessly document the need for safe sewage disposal, particularly in urban areas as population densities increase, and the need for protection of ground water from chemical and microbiological contamination, and the consequences of failure to institute timely protection. For me to list all appropriate studies would be too time-consuming, while to select a small number for detailed description would create the false impression that these were all that were available, so I have not provided such a list. Oregon's reputation as a desirable place for people to live and for businesses to locate depends on the assumption that these basic sewage disposal and future drinking water protections have been and will be taken care of. There is no serious credible question about the reality of the need for sewers to protect the public's health in Mid-Multnomah County.

There are questions about how individuals can pay their share of the costs. As high as they are, costs will never be any lower in the future than they are now, so that delay on that basis is illogical. Surely, compassionate payment methods can be developed for the low income and elderly householders who need assistance.

Sincerely,

Wm Morton

Wm. E. Morton, MD, DrPH

WEM/fs

DEPARTMENT OF PUBLIC HEALTH
AND PREVENTIVE MEDICINE

UNIVERSITY OF OREGON

HEALTH SCIENCES CENTER

3181 S.W. Sam Jackson Park Road Portland, Oregon 97201

Harold Sawyer, Administrator
Water Quality Division
Dept. of Environmental Quality
522 SW Fifth Ave.
Portland, Oregon 97201

E 37

OREGON WATER TREATMENT CERTIFICATION PROGRAM

1065 High Street • Suite 4 • Eugene, Oregon 97401 • 503/683-2007

September 11, 1984

Mr. Harold L. Sawyer
Water Quality Control Division
Department of Environmnetal Quality
522 SW 5th Avenue
Portland, OR 97204

Dear Mr. Sawyer:

I have watched with interest the controversy that exists in the East Multnomah County area regarding the need for and the installation of community sewerage to serve the area. I sincerely hope that my observations can be of assistance in evaluation of the conditions in the area.

I can recall without difficulty the conditions that existed in East Springfield in the mid and early 1950's. At that time the rapid development of the area without the benefit of public sewers created one of the most serious public health hazards that existed in the State of Oregon. The results of the work done in this area to resolve the problem led to the eventual passage of legislation to correct community health hazards throughout the state (ORS Chapter 222).

The East Multnomah County area in many ways resembles the East Springfield area that became a serious health hazard that resulted in an epidemic of infectious hepatitis throughout central Lane County. The major difference between the two is that in East Springfield the sewage was on the surface of the ground and obvious to sight and smell; East Multnomah County is beneath the ground and which in most instances is out of sight. It is also considered by most as not a problem (e.g., if you can't see it, it won't hurt you).

In Lane County River Road, Santa Clara area, there still exists a situation nearly identical with the East Multnomah County situation--a population of 35,000 people on individual septic tanks discharging waste into the ground water table.

A survey of communicable disease records in the Lane County Health Department in the late 1960's or early 1970's showed conclusively that the rate of water and sewage-borne diseases in the unsewered area of River Road, Santa Clara was double the rate for the same diseases within the sewered area of the City of Eugene.

Further investigation of the records in the Department for installation and repair of septic tanks indicated that even though the soil in the area of River Road, Santa Clara was noted "very good" for drainfields, there existed a continuing failure rate of about 10%. Their continuing failure rate led to continual exposure of the population to raw, untreated sewage. No waste disposal system is so constructed to serve individual households that will not eventually fail as the age of the system progresses.

Further studies of the ground water in this River Road, Santa Clara area indicated an increase in the pollutant levels over a period of time. In some instances the nitrate levels exceeded the state and federal standards.

Upon presentation of these facts to the people, many of the responses were "we don't use the water to drink--so what," and also the strong belief that all of us need to be concerned about the destruction of our natural resources. The ground water, whether in Central Oregon, River Road Santa Clara, or the East Multnomah County area, is a natural resource that does not belong to the populace using it today; and it is our responsiblity to preserve it for future generations as we attempt to do in the conservation of our visible resources.

Historically, from the beginning of the Roman and Greek empires, it was known that the continued disposal of our waste upon our own ground in urban communities was not compatable with communal living.

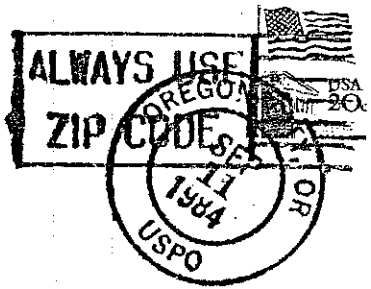
I take this opportunity to urge your favorable consideration of a public sewerage system for the East Multnomah County area.

Very truly yours,

John C. Stoner, R.S.
Sec., Program Manager
Certification Program

JCS/jlm

Mr. John C. Stoner, R.S.
Oregon Water Treatment Cert. Prog.
1065 High Street, Suite 4
Eugene, OR 97401



MR HAROLD L SAWYER
WATER QUALITY CONTROL DIV
DEPT OF ENVIRONMENTAL QUALITY
522 SW 5 AVENUE
PORTLAND OR 97204

Proposal to Declare a Threat to Drinking Water in Mid-Multnomah County
Pursuent to ORS 454, Sections 275 - 310

INDEX OF THE HEARING RECORD

F. TESTIMONY POSTMARKER OR DELIVERED AFTER THE SEPTEMBER 11, 1984 DEADLINE

1 Mrs. Max Bickford, 9/14/84*

2 Louis Turnidge 10/25/84*

---

* Date letter was received for the record

F1

RECEIVED

SEP 1 1 1984

PUBLIC AFFAIRS

September 11, 1984
Portland, Oregon

Ms. Sonia Buist
Ms. Mary Bishop
Mr. Jack Peterson, Chairman
Mr. Wallace Brill
Mr. Arno Denecke

Re: Threat To Drinking Water Decision
Groundwater in Mid Multnomah County

Dear Ladies and Gentlemen:

Permission to include this letter, as additional evidence, was granted by Mr. Denecke, with knowledge of Attorney Mike Huston and Mr. Hal Sawyer, if said letter could be written and received within the week.

On Monday, Sept. 10, I, personally called 29 households on my street and adjoining neighborhood to advise them of this Sept. 11th meeting. With such short notice given them by me, it was impossible for them to attend (with the exception of 4 people who did attend). However, in defense of those not present, I must say deep interest on this matter was not lacking, and they indicated to me to do my best to find out what they could do. Thus, my plea for additional evidence to be accepted.

Now I find it to be physically impossible in the time allotted to get back to these households and explain the type of testimony letters needed from each of them. Hence, so far as I know, mine will be the only letter.

I will attempt to put my file of 9 years down on paper and at your disposal. Again, I know getting it down on paper is impossible, but I will try.

I feel that you will make a fair and impartial decision on the threat to drinking water and subsequent solution, but I also feel that you have not been supplied with enough good evidence either from our people in government or from the people in the affected area, to be able to make that decision. At this time, my husband and I believe there are still too many unanswered questions for you and for us to make such a final, irreversible decision as you are faced to make. Unanswered questions from all sides - government, those in authority, officials, engineers, contractors and taxpaying public of the area.

QUESTION: (To taxpayer) - Are you going to be able to pay for this?

ANSWER: I don't know. You aren't telling me how much I need to pay. Right now, I am told the astronomical figure of $7000 to $10,000. per one house, plus an unknown amount, with no lid, for an eternal seepage fee, plus an unknown assessment charge for making available the line on my property frontage, plus the cost of caving in and re-filling my cesspool, plus a hook up fee. (The hook up fee may be included in the assessment charge. As of today, I do not have time to verify this point.) The total, with or without hook up fee included, is dollars enough to be mind boggling.

QUESTION: Why must the $7M to $10M figure be so high?

ANSWER: I am told, where a 7 ft. or deeper basement is involved, and the plumbing is to the rear of the house, excavation through the front yard, under the basement to the back of the house to meet the present plumbing is necessary -- or, re-plumb to the front of the house, which means jackhammering the basement floor and patching, plus any weakening of structure, disruption of family life, et.al. The reason for going under the basement, I am told, is because I cannot go to one side of my house and right angle to the back center or end to meet present plumbing. Now I can see why such a high cost is given.

POSSIBLE SOLUTION: Moratorium. Find out if there is a better way with verified answers. Isn't there plumbing code that allows a less expensive and affordable way. Why wasn't this information volunteered at any of the meetings I attended? Did I miss hearing it? Surely there were engineers, plumbers, contractors present who could have supplied this possible less expensive way.

I don't know if this brings cost down some, which cost I may or may not be able to afford and handle, but I am still going to be faced with a no ceiling seepage, or what I like to call, maintenance fee. Surely there must be a more equitable, affordable plan for this maintenance.

Why must this fee be collected from the area before actual hook-up, just because there are no funds to build. Whose fault is this?

I am told, because I am polluting with my cesspool and it is getting to the serious deadline, and funds must be accumulted to do this work now and pay later. (The pay later seems to me to be why we are constantly being told our national debt is high and keeps going higher with no solution in sight.) You hold in your hands/the power to control one small portion of a government debt.

QUESTION: (To taxpaper) Are you polluting the ground level water with your cesspool?

ANSWER: I don't know. No one has given me any proof of this. I keep trying to find out. What analysis has been made? Where was it made? Where is the analysis in writing that I can understand? How am I polluting it? What am I doing wrong?? (At the Aug. 30th hearing, for the first time - it must be on the tape as to who said it - someone dared to say that the single family cesspool is not polluting - it is more business and/or industry with their chemicals - dry cleaning solvents, etc. going into cesspools.) Since 1975 the area is hearing that ground level water is being polluted, then I am told, that I am doing it, and now I am told that maybe I am not. I want an honest answer. Why have I been told that sewer is my only answer?

SOLUTION: Upon further inquiry, I did find that if I were a user in my household of certain products (caustic in nature) or certain soaps, yes, I could be a polluter. If this is true - more time is needed - we need verification -- then let's educate proper use of existing cesspools, or if another law (heaven forbid) must be passed, outlaw the use or sale of these polluting products. If Oregon could be first to keep clean with a bottle bill -- couldn't we continue on this same vein?

How can I be sure that by diverting my sewage from a cesspool to a sewer is the best solution? Under this method my household waste goes to a sewer, to be sent to a treatment plant to be deposited from there in the Columbia River. Am I causing more and worse polution to the river? Were those rivers located in the East of our country that ended up in such sad state receiving raw sewage in every case, or was some of it treated sewage and there was just too much of it too soon?

QUESTION: If cost is a factor, why can't you Bancroft?

ANSWER: What is Bancroft? As far as I know, that is the name of someone in my parish. I have since found out it has something to do with funds that I can get. Is this true? Is it available only to me or to everyone? Surely if I get funds, they must be repaid somehow. Can I afford the payments? And if I do go this route, doesn't it mean my property will be saddled with this re-payment until paid? Does this mean I cannot sell my property without the future buyer knowing and accepting these payments? How can I, in reality, find a buyer who can afford to make monthly paymants for my house on today's market and be able to assume this obligation also.

I am sorry, time does not allow me to go on. I must get this letter delivered before 5:00 p.m. this evening.

Please feel free to call me - 253-4682 - if I have given you, or can give you any answers that I may have.

It would seem several additional points need be covered more in detail when the matter is up for consideration.

Please notify me in writing when and where the commission will meet for your final decision.

Thank you.

Sincerely,

Mrs. Max (Lucille) Bickford

Mrs. Max Bickford
435 N.E. 131st Place
Portland, Oregon 97230

253-4682

P.S. I do not have time to proof read the above. Please excuse all typographical errors and strikeovers.

F52

OCT 25 1984

WATER QUALITY CONTROL

Louis Turnidge
18144 S. E. Pine St.
Portland, Oregon 97233

October 25, 1984

To the Evironmental Quality Commission

I'm the fellow that in testimony before you on a "Threat to drinking water" urged you to examine encyclopedia references relating to the matter to your own satisfaction. Since then I've continued my own examination of the matter. Enclosed are two copies of encyclopedia references to the disease Dr. Shade described his concern about. I ask you to read them and draw your own conclusions. My own opinion is that nutrition deficiencies are a significant contribution to the problem.

Sincerely yours,

Louis Turnidge

BRITTANNICA 1984

is of cells and organisms vary, not only lso the synthesis of enzymes must be e enzymes responsible for muscular ac- scle must be activated and inhibited at . Some cells do not need certain en- l, for example, does not need a muscle rium does not need enzymes to metab- hat are not present in its growth medi- es, therefore, are not formed in certain ynthesized only when required, and still in all cells (see also GENE). The forma- of enzymes are regulated not only by ms but also by organic secretions (hor- locrine glands and by nerve impulses. also play an important role (see below *y and allosteric control*).

defective in some respect, disease may mes represented by the numbers 1 to 4 nust function during the conversion of tance *A* to the product *E*. If one step is an enzyme is unable to function, product ormed; if *E* is necessary for some vital results. Many inherited diseases of man ficiency of one enzyme. Some of these le 1. The disease called albinism, for ex-

ies Identified with Hereditary Diseases

	defective enzyme
	tyrosinase
	phenylalanine hydroxylase
	fructokinase
nia	methemoglobin reductase
	galactose-1-phosphate uridyl transferase

om an inherited lack of ability to synthe- tyrosinase, which catalyzes one step in which the pigment for hair and eye col- ee also METABOLISM, DISEASES OF; BIRTH NGENITAL DISORDERS).

Enzymes play an increasingly important e. The enzyme thrombin is used to pro- g of wounds. Other enzymes are used to kinds of disease, to cause the remission f leukemia—a disease of the blood-form- d to counteract unfavourable reactions in allergic to penicillin. The enzyme lyso- stroys cell walls, is used to kill bacteria. rning medical applications of enzymes ir use as preventives of tooth decay and ts in the treatment of thrombosis, a dis- ed by the formation of a clot, or plug, in Enzymes may eventually be used to con- iciencies and abnormalities resulting from

The most efficient catalysts known to man, sed in industrial processes involving the certain chemical compounds and the tan- they are valuable in analytical procedures involving the detection of very small quantities of specific substances. Enzymes are necessary in such food-related industries as cheese making, the brewing of beer, the aging of wine, and the baking of bread. Enzymes also may be used to clean clothes. For industrial use of enzymes see BAKING AND BAKERY PRODUCTS; BREWING; and WINE MAKING.

ciently to be us regard, three prop for enzyme classifi the enzyme, the chem nature of the reaction about the detailed ch few enzymes does not indicated above, early were based on the na (*e.g.*, enzymes called drates), close functio different groups were ment, then, enzymes substrates and the nat

In an attempt to d nomenclature, two n known as the system ciples but is often lon name is short and ge systematic (see Tabl nomenclature, six m are recognized; each subdivided on the ba tion catalyzed and o tion. Enzymes that c is transferred belong tases; those that ca ments of water at a hydrolases. The oth transferases—which stances other than h the isomerases, and transferases account imately 1,000 enzym a few enzymes, th names, and their bio

Chemical nature. nature of enzymes tury, although scien were proteins. In 19 to be crystallized an in the next few year sin, and chymotryp that time, hundred have been prepared ods. Much of the kn fact, resulted from attempts to underst

Although some en amino acids (*i.e.*, s nitrogen), most enz chain. Each chain is two, four, or six sub 12 to 60 subunits. T tical structures; in o of subunit chains tailed discussion of

Much of the dry tributable to protei act as structural ele ologically active tis zymes. Regardless tein in an organism enzymes must be p myriad reactions co

Cofactors. Altho protein, many are protein component enzyme is called moved, the protei called the apoenzy as iron, copper, or ganic molecule call of substrate molec may aid in the ca metals and prosth zymatic reaction, a

A coenzyme serv zymatic reactions

to that of enzymes 5 and 6 determines the quantity of product *E* formed compared with product *G*.

Both the flow of water and the activity of enzymes obey the laws of thermodynamics; hence, water in reservoir *F* cannot flow freely to *H* by opening valve 7, because water cannot flow uphill. If, however, valves 1, 2, 5, and 7 are open, water flows from *F* to *H*, because the energy conserved during the downhill flow of water through valves 1, 2, and 5 is sufficient to allow it to force the water up through valve 7. In a similar way, enzymes in the metabolic pathway cannot convert compound *F* directly to *H* unless energy is available; enzymes are able to utilize energy from energy-conserving reactions in order to catalyze reactions that require energy. During the enzyme-catalyzed oxidation of carbohydrates to carbon dioxide and water, energy is conserved in the form of an energy-rich compound, adenosine triphosphate (ATP). The energy in ATP is utilized during an energy-consuming process such as the enzyme-catalyzed contraction of muscle.

GENERAL PROPERTIES

Classification and nomenclature. The first enzyme name, proposed in 1833, was diastase. Sixty-five years later, it was suggested that all enzymes be named by adding "-ase" to a root indicative of the nature of the substrate of the enzyme. Although enzymes are no longer named in such a simple manner, with the exception of a few—*e.g.*, pepsin, trypsin, chymotrypsin, papain—most enzyme names do end in "-ase."

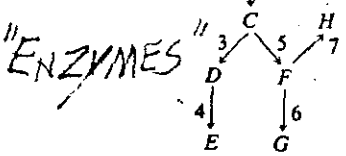
Any systematic classification of enzymes should be based on a common property or quality that varies suffi-

ion, the processes of respiration, vision, etc. e indispensable to life.

enzyme is able to promote only one type of cal reaction. The compounds on which it acts are d substrates. Enzymes operate in tightly organized abolic systems called pathways. A seemingly simple ological phenomenon—the contraction of a muscle, r example, or the transmission of a nerve impulse—ctually involves a number of chemical steps in which ne or more chemical compounds (substrates) are con-erted to substances called products; the product of one tep in a metabolic pathway serves as the substrate for he succeeding step.

The role of enzymes in metabolic pathways can be illus-rated diagrammatically. The chemical compound repre-nted by *A* (see diagram) is converted to product *E* in a eries of enzyme-catalyzed steps, in which intermediate ompounds represented by *B*, *C*, and *D* are formed in uccession. They act as substrates for enzymes repre-nted by 2, 3, and 4. Compound *A* may also be converted y another series of steps, some of which are the same as ose in the pathway for the formation of *E*, to products epresented by *G* and *H*.

ARTICLE HEADING



"ENZYMES"

The letters represent chemical compounds; numbers epresent enzymes that catalyze individual reactions. The elative heights represent the thermodynamic energy of he compounds; *e.g.*, compound *A* is more energy-rich han *B*, *B* more energy-rich than *C*. Compounds *A*, *B*, tc., change very slowly in the absence of a catalyst but lo so rapidly in the presence of catalysts 1, 2, 3, etc.

The regulatory role of enzymes in metabolic pathways an be clarified by using a simple analogy: that between he compounds, represented by letters in the diagram, nd a series of connected water reservoirs on a slope. Similarly, the enzymes represented by the numbers are nalogous to the valves of the reservoir system. The alves control the flow of water in the reservoir; that is, f only valves 1, 2, 3, and 4 are open, the water in *A* lows only to *E*, but, if valves 1, 2, 5, and 6 are open, the vater in *A* flows to *G*. In a similar manner, if enzymes , 2, 3, and 4 in the metabolic pathway are active, prod-ict *E* is formed, and, if enzymes 1, 2, 5, and 6 are active, product *G* is formed. The activity or lack of activity of he enzymes in the pathway therefore determines the fate f compound *A*; i.e., it either remains unchanged or is onverted to one or more products. In addition, if prod-icts are formed, the activity of enzymes 3 and 4 relative o that of enzymes 5 and 6 determines the quantity of product *E* formed compared with product *G*.

Both the flow of water and the activity of enzymes obey he laws of thermodynamics; hence, water in reservoir *F* annot flow freely to *H* by opening valve 7, because wa-er cannot flow uphill. If, however, valves 1, 2, 5, and 7 re open, water flows from *F* to *H*, because the energy onserved during the downhill flow of water through alves 1, 2, and 5 is sufficient to allow it to force the water p through valve 7. In a similar way, enzymes in the met-bolic pathway cannot convert compound *F* directly to *H* unless energy is available; enzymes are able to utilize nergy from energy-conserving reactions in order to cata-yze reactions that require energy. During the enzyme-atalyzed oxidation of carbohydrates to carbon dioxide nd water, energy is conserved in the form of an energy-ich compound, adenosine triphosphate (ATP). The energy n ATP is utilized during an energy-consuming process uch as the enzyme-catalyzed contraction of muscle.

Because the needs of cells and organisms vary, not only the activity but also the synthesis of enzymes must be regulated; *e.g.*, the enzymes responsible for muscular activity in a leg muscle must be activated and inhibited at appropriate times. Some cells do not need certain enzymes; a liver cell, for example, does not need a muscle enzyme. A bacterium does not need enzymes to metabolize substances that are not present in its growth medium. Some enzymes, therefore, are not formed in certain cells, others are synthesized only when required, and still others are found in all cells (see also GENE). The formation and activity of enzymes are regulated not only by genetic mechanisms but also by organic secretions (hormones) from endocrine glands and by nerve impulses. Small molecules also play an important role (see below *Enzyme flexibility and allosteric control*).

If an enzyme is defective in some respect, disease may occur. The enzymes represented by the numbers 1 to 4 in the diagram must function during the conversion of the starting substance *A* to the product *E*. If one step is blocked because an enzyme is unable to function, product *E* may not be formed; if *E* is necessary for some vital function, disease results. Many inherited diseases of man result from a deficiency of one enzyme. Some of these are listed in Table 1. The disease called albinism, for example, results from an inherited lack of ability to synthesize the enzyme tyrosinase, which catalyzes one step in the pathway by which the pigment for hair and eye colour is formed (see also METABOLISM, DISEASES OF; BIRTH DEFECTS AND CONGENITAL DISORDERS).

Table 1: Enzymes Identified with Hereditary Diseases

disease name	defective enzyme
Albinism	tyrosinase
Phenylketonuria	phenylalanine hydroxylase
Fructosuria	fructokinase
Methemoglobinemia	methemoglobin reductase
Galactosemia	galactose-1-phosphate uridyl transferase

In medicine. Enzymes play an increasingly important role in medicine. The enzyme thrombin is used to promote the healing of wounds. Other enzymes are used to diagnose certain kinds of disease, to cause the remission of some forms of leukemia—a disease of the blood-forming organs—and to counteract unfavourable reactions in people who are allergic to penicillin. The enzyme lysozyme, which destroys cell walls, is used to kill bacteria. Research concerning medical applications of enzymes may lead to their use as preventives of tooth decay and as anticoagulants in the treatment of thrombosis, a disease characterized by the formation of a clot, or plug, in a blood vessel. Enzymes may eventually be used to control enzyme deficiencies and abnormalities resulting from diseases.

In industry. The most efficient catalysts known to man, enzymes are used in industrial processes involving the preparation of certain chemical compounds and the tanning of leather; they are valuable in analytical procedures involving the detection of very small quantities of specific substances. Enzymes are necessary in such food-related industries as cheese making, the brewing of beer, the aging of wine, and the baking of bread. Enzymes also may be used to clean clothes. For industrial use of enzymes see BAKING AND BAKERY PRODUCTS; BREWING; and WINE MAKING.

GENERAL PROPERTIES

Classification and nomenclature. The first enzyme name, proposed in 1833, was diastase. Sixty-five years later, it was suggested that all enzymes be named by adding "-ase" to a root indicative of the nature of the substrate of the enzyme. Although enzymes are no longer named in such a simple manner, with the exception of a few—*e.g.*, pepsin, trypsin, chymotrypsin, papain—most enzyme names do end in "-ase."

Any systematic classification of enzymes should be based on a common property or quality that varies sufficiently to be u
regard, three pro
for enzyme classifi
the enzyme, the che
nature of the reactio
about the detailed ch
few enzymes does not
indicated above, early
were based on the nat
(*e.g.*, enzymes called
drates), close function
different groups were
ment, then, enzymes n
substrates and the natu

In an attempt to de
nomenclature, two na
known as the systema
ciples but is often lon
name is short and gen
systematic (see Table
nomenclature, six m
are recognized; each
subdivided on the bas
tion catalyzed and of
tion. Enzymes that ca
is transferred belong
tases; those that cat
ments of water at a s
hydrolases. The othe
transferases—which
stances other than hy
the isomerases, and
transferases account
imately 1,000 enzym
a few enzymes, the
names, and their biol

Chemical nature.
nature of enzymes u
tury, although scienti
were proteins. In 19
to be crystallized and
in the next few years
sin, and chymotryps
that time, hundreds
have been prepared
ods. Much of the kn
fact, resulted from
attempts to understa

Although some enz
amino acids (*i.e.*, si
nitrogen), most enzy
chain. Each chain is
two, four, or six sub
12 to 60 subunits. In
tical structures; in ot
of subunit chains a
tailed discussion of t

Much of the dry
tributable to protein
act as structural ele
ologically active tis
zymes. Regardless o
tein in an organism,
enzymes must be pr
myriad reactions co

Cofactors. Althou
protein, many are
protein component
enzyme is called a
moved, the protein
called the apoenzym
as iron, copper, or
ganic molecule calle
of substrate molecu
may aid in the cat
metals and prosthe
zymatic reaction, as

A coenzyme serve
zymatic reactions

hydrochloride salt, which is a white, crystalline powder with a bitter taste. It is soluble in water, in alcohol, and in chloroform. Methadone and its salts occur in either of two structural configurations: optical isomers. The levorotatory isomer of the hydrochloride (*l*-methadone hydrochloride) is a more potent analgesic than the dextrorotatory isomer (*d*-methadone hydrochloride). The mixture of the two, *d,l*-methadone hydrochloride (sometimes marketed as Dolophine hydrochloride), and the levorotatory isomer have both been used medicinally. The mixture, however, is in more common use (official in the *British Pharmacopoeia* and the *United States Pharmacopeia*).

Respiratory depression resulting from overdosage of methadone may be treated with nalorphine (*q.v.*).

drug therapy for opiate addicts 12:843a
potency, tolerance, and use in addiction therapy programs 5:1054e

methamphetamine, or *d*-DESOXYEPHEDRINE, informally called SPEED, CRYSTAL, or METH, a potent stimulant drug of the amphetamine series used in medicine as an appetite suppressant in treating obesity and as a stimulant of the central nervous system in treating anesthetic overdose, mental depression, and narcolepsy, a condition marked by an uncontrollable desire for sleep. Methamphetamine was introduced into medicine in 1944. Its action is similar to that of amphetamine. It may be administered orally or by intravenous injection.

The ability of methamphetamine to overcome fatigue and provide increased energy and a sense of well-being has led to considerable abuse of the drug. Its untoward effects such as increased heart rate and blood pressure render it a dangerous drug when misused; and because of the rapid development of tolerance common to the amphetamines (a condition in which the user requires increased doses for a consistent effect), it is unsatisfactory for prolonged use.

and toxic psychosis from abuse 5:1057f

methanal (chemistry): *see* formaldehyde.

methane, a colourless, odourless gas that occurs abundantly in nature as the chief constituent of natural gas, as a component of firedamp in coal mines, and as a product of the anaerobic bacterial decomposition of vegetable matter under water (hence its alternate name, marsh gas). Methane also is produced industrially by the destructive distillation of bituminous coal in the manufacture of coal gas and coke-oven gas. The activated-sludge process of sewage disposal also produces a mixture of methane.

Methane is the first and simplest member of the paraffin series of hydrocarbons (compounds of hydrogen and carbon). Its chemical formula is CH_4. It is lighter than air, having a specific gravity of 0.554. It is only slightly soluble in water. It burns readily in air, forming carbon dioxide and water vapour; the flame is pale, slightly luminous, and very hot. The boiling point of methane is −161.5° C (−263.2° F) and the melting point is −182.5° C (−296.5° F). In general, methane is very stable, but a mixture of between 5 and 14 percent in air is explosive. Explosions of such mixtures have been frequent in mines and collieries and the cause of many disasters.

The chief source of methane is natural gas, which after extraction of the heavier petroleum compounds, contains from 75 percent to 90 percent methane. Other sources include the distillation from bituminous coal during carbonization; these methods of production are important in locations where natural gas is not plentiful. The coal carbonization process is particularly important because it makes the coal industry a part of the petrochemical field.

Natural gas is composed largely of methane and its chief use has been as a fuel because of its abundance, low cost, ease of handling, and cleanliness. In the United States, natural gas is distributed through thousands of miles of pipelines to all parts of the country and has made great inroads into the fuel market.

Another use, which became less important after 1950 because of the rising price of natural gas, is in the manufacture of carbon black. Other valuable products include methanol, formaldehyde, chloroform, carbon tetrachloride, and nitromethane.

- acetylene production by cracking 9:87h
- atmospheric chemical composition 2:308d
- black powder explosions in mines 7:84d
- carbanion structure and production 3:817g
- carbon bonding 9:1044b
- carbon dioxide removal in spacecraft 10:922h
- carbonium ion structure 3:861c
- Chinese pond gas collection 1:903b
- cryogenic natural gas as fuel 5:319g
- food source possibilities explored 7:484a
- food synthesis from chemicals 7:485f
- free radical reaction mechanism 15:422d
- gasification of coal 7:924b
- halogen compound derivation 13:682e
- heating values of natural gas paraffins 12:859g; table
- hydrocarbon combustion reactions 9:80c
- hydrogen cyanide production 14:530g
- industrial environment potential hazards 9:531a
- juvenile source and primeval atmosphere 2:315b *passim* to 317g
- life origin and Jovian planet formation 10:901a
- life possibilities studied spectroscopically 10:906b
- molecular orbitals 6:670b; illus. 669
- oil shales' biogenic origin 13:537g
- petroleum composition and properties 14:166e
- Rwanda's natural resources 16:110b
- Saturn's mass, density, and composition 16:274b
- structural formula description 13:707a
- structure and valence angles 17:678c
- urban pollutants and human health 18:1050e

methanol: *see* methyl alcohol.

Methedrine (pharmacology): *see* methamphetamine.

methemoglobin, oxidized form of the respiratory pigment hemoglobin.

- hemoglobin and oxygen transport 2:1116f

methemoglobinemia, inherited or acquired decrease in the oxygen-carrying capacity of the red blood cells. The hemoglobin of the red blood cells must be in the reduced state to bind with oxygen; methemoglobin, the oxidized form of hemoglobin, is useless for oxygen transport. Normally, various organic catalysts or enzymes are active in keeping hemoglobin in the reduced form. Hereditary methemoglobinemia occurs when there is an inborn defect in this enzyme system or when the hemoglobin molecule is abnormally structured (hemoglobin M) and is thereby more susceptible to oxidation. Acquired methemoglobinemia may arise as a result of contact with certain drugs and chemicals that produce oxidant compounds in the circulation, causing the oxidation of hemoglobin faster than the enzyme system can keep it in the reduced state. The severity of the symptoms is related to the quantity of methemoglobin present in the circulation, and range from a bluish discoloration of the skin and mucous membrane to weakness, difficulty in breathing, and dizziness in the more severe cases. Treatment in hereditary methemoglobinemia usually includes the administration of reduction compounds such as vitamin C or methylene blue. Acquired methemoglobinemia usually disappears spontaneously when the cause is removed.

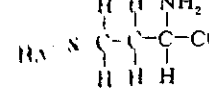
- enzyme abnormality, table 1 6:897
- hemoglobin–oxygen variations in polycythemia 2:1139a

methicillin, semisynthetic penicillin used as a antimicrobial agent.

antibiotic activity and [illegible] 1:988b

Methil (Scotland): *see* Buckhaven and Methil.

methionine, a sulfur-containing amino acid found in most animal proteins. First isolated from casein in milk (1922), methionine accounts for about 5 percent of the weight of casein, whereas other proteins contain much smaller amounts. It is one of several so-called essential amino acids for mammals and fowl; essential because they cannot synthesize it, i.e., they cannot accomplish methylation (the process by which methyl (—CH_3) groups are added to compounds). Methionine is also a precursor of the compound amino acids, cystine and cysteine (*q.v.*), and facilitates the synthesis of choline, both of a substance (acetylcholine) important in nerve function and of lecithins, lipids abundant in both plant and animal tissue.



methionine

- alkaloid methyl group origins 1:607d
- cereal and soybean content levels, tables 7 and 13 1:46d
- disorders of amino acid metabolism 11:1055f; illus.
- Escherichia coli protein synthesis and genetic code 7:998h; table
- nutrient needs and alternative source 13:400g; table 405
- structure and occurrence in protein 15:82c

methionine malabsorption syndrome: *see* iminoglycinuria.

method, the (acting): *see* Stanislavsky method.

Methodist Church, The, in the British Isles, Protestant church that developed from the Methodist revival movement that began within the Church of England. It broke with the Church of England in 1795, and subsequently, the Methodists were known as the Wesleyan Methodist Church. The church experienced rapid growth, but it also experienced various schisms, and several smaller groups were organized.

- formation 10:60e and reunion 12:60h

Methodist Church, The (U.S.): *see* United Methodist Church.

Methodist Episcopal Church (U.S.): *see* United Methodist Church.

Methodist Protestant Church (U.S.): *see* United Methodist Church.

Methodist Revival, 18th-century religious movement begun and sustained by John Wesley.

- Wesley's movement and doctrine 12:60e

Methodists 12:60, a group of Protestant churches founded in England in the 18th century on the principles and practices proclaimed by John Wesley, an Anglican revivalist clergyman. Methodist churches differ according to two primary traditions: the British and those of the British Commonwealth that are nonepiscopal and the American and those in areas in which American influence is strong that are episcopally governed.

The text article covers the nature and significance, history, teachings, practices, and organization. The section on nature and significance includes the basic emphases of Methodism: doctrines that indicate the power of the Holy Spirit to confirm a believer's faith and transform his personal life, simplicity of worship, partnership of ordained ministers and laity, concern for the underprivileged and for betterment of social conditions, and the formation of small groups for mutual encouragement and edification.

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

Mailing Address: BOX 1760, PORTLAND, OR 97207
522 SOUTHWEST 5th AVENUE, PORTLAND, OR 97204 PHONE (503) 229-5696

MEMORANDUM

To: Environmental Quality Commission

From: Director

Subject: Agenda Item No. K, December 14, 1984, EQC Meeting

Request for Authorization to Conduct a Public Hearing on a Proposed Rule Amending Hazardous Waste Rules to Provide That Only Those Liquid Organic Hazardous Wastes Which can be Beneficially Used Will be Banned From Landfilling After January 1, 1985.

Background

The Environmental Quality Commission, at its April 20, 1984 meeting, adopted comprehensive Hazardous Waste Rules. Those rules dealt with a series of practices affecting all aspects of hazardous waste management from generation of such wastes to their eventual disposal. The disposal of hazardous waste is regulated under state law and closely monitored under the Department's regulations and supervision.

A key approach to the management of hazardous waste has been the intent to find ways to handle hazardous wastes in the most environmentally sound fashion. A part of the Department's goals is development of an approach that in many ways is parallel to that used in disposal of low level radioactive waste. Specifically, the proposed Northwest Interstate Compact on Low Level Radioactive Waste Management, ORS 469.930, provides, among other things, that the disposal of low level radioactive waste is a regional concern.

The Compact agreement also contains statements indicating that hazardous chemical waste management is similar in many respects to low level radioactive waste management and that the Compact encourages and promotes the regional concept of hazardous waste management. By this regional approach it is expected that various states within the Compact will provide for the proper handling of low level radioactive and chemical wastes, not only for the industries and activities within their own state, but also for other states within the Compact area. Thus, the Hanford site in Washington is used by the Compact states for the disposal of low level radioactive waste and the Arlington site in Oregon for the disposal of hazardous waste.

The Hazardous Waste Rules adopted by the Commission are identical in most regards to the federal law. There are, however, several areas which the Department felt were particularly significant to protect Oregon's environment but which the federal program did not address. Therefore, the Department recommended, and the EQC agreed, that these additional areas should be addressed within the Oregon Hazardous Waste Rules. One of those areas dealt with the landfilling of certain liquid organic hazardous wastes. The Department was, and is, of the firm belief that the most desirable methods, in order of preference, to properly manage hazardous waste is as follows: 1) non-production; 2) treatment to render nonhazardous; 3) reuse or recycle; 4) incineration; and 5) land disposal.

The landfilling of liquid organics is particularly critical due to two concerns. First, as a result of their liquid nature, there is a greater possibility that those hazardous wastes can, through the soils, migrate off-site and potentially contaminate ground and surface waters. Secondly, many hazardous waste organic materials do not break down in the environment and, consequently, once put into a landfill pose a continuing threat.

As a result of these concerns the Department recommended, and the Commission adopted, a ban on the landfilling of liquid organics at Arlington as of January 1, 1985. The purpose and intent behind the Department recommended action was based on the fact that whenever there is a realistic potential for either (1) beneficially using hazardous wastes or (2) disposing of them in a more environmentally sound fashion than landfilling, that those options should be pursued. Since the time of the adoption of the Hazardous Waste Rules in April, several important developments have taken place.

1. There have been no additional hazardous waste incinerators authorized to operate in the United States. Consequently, the existing three hazardous waste incinerators located in Texas, Arkansas, and Illinois have had trouble keeping up with the amount of waste desired to be incinerated.

2. As the mandate of January 1, 1985 approached, new data were developed on what alternatives were available to landfilling. From this additional information came the conclusion that certain organics, particularly those that were heavily chlorinated, would not be able to be beneficially used. Consequently, the options available to industrial generators of these chlorinated liquid organics would be to either 1) send them to one of the three incinerators for permanent destruction, or 2) send them to another hazardous waste landfill.

   Generally speaking, those companies which will seek to have chlorinated liquid organics incinerated will do so whether or not there is the opportunity to landfill them at Arlington. Those companies have decided that the long-term liability which exists with landfilling is a risk they choose not to take. The Department expects this pattern to continue whether or not the ban at Arlington is in effect. For those companies, however, which are willing to landfill as long as landfilling is possible, the current ban will force those companies to seek landfill options outside the state.

It is the Department's belief that to shift landfilling from one state to another is an unsound approach to hazardous waste regulation. This is particularly the case when that shift will entail transportation of hazardous wastes across additional miles of highways, possibly through population centers, with the inherent hazards of spills.

3. The U. S. Congress enacted amendments to the Resource Conservation and Recovery Act (signed by the President on November 9, 1984) which, among other things, provides for a 24-month phased ban of all liquid hazardous wastes going to landfills. These amendments appear to require the Environmental Protection Agency to evaluate the feasibility of banning the landfilling of listed hazardous waste, liquid and solids, over a 66-month period.

The Department, in evaluating the breadth of the current EQC ban, has concluded that certain liquid organics which would be banned from landfilling after January 1, 1985 will be transported to other landfills. Consequently, the intent of the Department to seek more appropriate environmental disposal options will be defeated. The Department believes that such a shift to other landfills is not a responsible action.

The Department does believe, however, that those liquid organics which can be used beneficially for such things as fuel supplements should, in fact, be encouraged to be so used by ensuring that the ban does apply. The Department recognizes that the cost for such beneficial use will in some cases be greater than the present cost of landfilling. Even in these cases, the Department strongly believes that those costs are, in the long run, highly preferable to landfilling given the liability and risks associated with landfilling.

The Department also recognizes that new markets will develop for the beneficial use of certain other hazardous wastes and that greater capacity for the destruction of such hazardous wastes through incineration will probably be developed. As these options develop the Department believes that more and more hazardous wastes should be prohibited from being landfilled. In the proposed rule, the Department seeks to amend the Hazardous Waste Rules to permit the Department to prohibit the landfilling of any class of hazardous waste materials when, in the Department's judgment, that class of material can and will be disposed of in a more environmentally sound manner.

Alternatives

1. Do nothing, leave Hazardous Waste Rules as presently written. If this option is pursued, the result will be an additional burden on the regulated community which produce chlorinated liquid hazardous wastes, while at the same time not solving an environmental problem other than by shifting that problem from a landfill in Oregon to a landfill in another state.

2. Accept the Department's recommendation. By accepting the Department's recommendation, the Commission will authorize the acceptance of hearing testimony on the desirability of allowing the Department to ban from landfilling hazardous wastes which can be used beneficially or where there is a more desirable disposal option.

3. Eliminate the ban completely. This option would allow the landfilling of hazardous waste materials that could be used for a beneficial use and, in the process, add to the long-term risks and liabilities associated at Arlington when a more desirable disposal option exists.

Director's Recommendation

It is recommended that the Environmental Quality Commission authorize the Department to conduct a public hearing for the purposes of accepting testimony on a proposed rule amendment to OAR Chapter 340, Division 104, which would allow the Department to determine in what circumstances hazardous waste material should be banned from the landfilling at Arlington.

Fred Hansen

Attachments:
I Statement of Need for Modifications
II Land Use Consistency
III Public Hearing Notice
IV Proposed Modifications

Fred Hansen:d
229-5300
December 6, 1984
DO1393.D

Attachment I
Agenda Item No. K
12/14/84 EQC Meeting

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION
OF THE STATE OF OREGON

IN THE MATTER OF MODIFYING OAR CHAPTER 340 DIVISION 104	))	STATEMENT OF NEED FOR MODIFICATIONS

STATUTORY AUTHORITY:

ORS 459.440 requires the Commission to:

(1) Adopt rules to establish minimum requirements for the treatment storage, and disposal of hazardous wastes, minimum requirements for operation, maintenance, monitoring, reporting and supervision of treatment, storage and disposal sites, and requirements and procedures for selection of such sites.

(2) Classify as hazardous wastes those residues resulting from any process of industry, manufacturing, trade, business or government or from the development or recovery of any natural resources, which may, because of their quantity, concentration, or physical chemical or infectious characteristics:

(a) Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or

(b) Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

(3) Adopt rules pertaining to hearings, filing of reports, submission of plans and the issuance of licenses.

(4) Adopt rules pertaining to generators, and to the transportation of hazardous waste by air and water.

ORS 459.455 authorizes the Commission and the Department to perform any act necessary to gain Final Authorization of a hazardous waste regulatory program under the provisions of the federal Resource Conservation and Recovery Act.

NEED FOR THE RULES:

The Department seeks to amend the hazardous waste rules to permit it to ban the land disposal of any hazardous waste when, in the Department's judgment, that waste can and will be disposed of in a more environmentally sound manner. It is believed that such an individual approach can better serve the needs of the regulated community and the environment than the present land disposal ban on specific wastes.

PRINCIPAL DOCUMENTS RELIED UPON:

Existing federal hazardous waste management rules, 40 CFR Parts 260 to 265 and 270, and existing State rules, OAR Chapter 340, Divisions 100 to 110.

FISCAL AND ECONOMIC IMPACT:

Since the rule is an enabling one, the hazardous wastes to which the ban will apply, and hence the regulatory costs, are unknown at this time. However, the Department believes that it will be less encompassing than the rule it is replacing. That rule was expected to increase the present estimated $4 million Oregon hazardous waste disposal bill by about 5%. Affected generators may experience up to a two- to three-fold disposal cost increase. However, the small business impact is not expected to be overwhelming as small businesses generate small quantities of waste.

FSB:c
ZC1685.1

Attachment II
Agenda Item No. K
12/14/84 EQC Meeting

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION
OF THE STATE OF OREGON

IN THE MATTER OF MODIFYING	)	STATEMENT OF LAND USE
OAR CHAPTER 340 DIVISION 104	)	CONSISTENCY

The proposal described appears to be consistent with all statewide planning goals. Specifically, the modifications comply with Goal 6 because they minimize the amount of hazardous waste disposed, and thereby provide protection for air, water and land resource quality.

The modifications comply with Goal 11 by controlling disposal site operations. They also intend to assure that current and long-range waste disposal needs will be accommodated.

Public comment on this proposal is invited and may be submitted in the manner described in the accompanying Public Notice of Rules Adoption.

It is requested that local, state and federal agencies review the proposal and comment on possible conflicts with their programs affecting land use and with statewide planning goals within their jurisdiction. The Department of Environmental Quality intends to ask the Department of Land Conservation and Development to mediate any apparent conflicts thereby brought to its attention.

After public hearing, the Commission may adopt permanent rules identical to the proposal, adopt modified rules on the same subject matter, or decline to act. The Commission's deliberation should come on January 25, 1985, as part of the agenda of a regularly scheduled Commission meeting.

FSB:c
ZC1685.2

Oregon Department of Environmental Quality

A CHANCE TO COMMENT ON...

Public Hearing on Amendments to the Hazardous Waste Rules

Date Prepared: December 4, 1984
Hearing Date: January 2, 1985
Comments Due: January 2, 1985

WHO IS AFFECTED:

Persons who manage hazardous waste including generators and owners and operators of hazardous waste disposal facilities.

WHAT IS PROPOSED:

The Department of Environmental Quality (DEQ) proposes to amend hazardous waste rules that were adopted on April 20, 1984, by repealing the specific ban on the land disposal of certain pesticide, ignitable and listed wastes (OAR 340-104-317) and adopting the following rule:

"340-104-318 The Department may prohibit the land disposal of any hazardous waste if in the Department's judgment there are more environmentally sound beneficial use or disposal options. In making such a decision, the Department shall consider but not be limited to storage, transportation and other appropriate risks."

WHAT ARE THE HIGHLIGHTS:

The Department is seeking authority to ban the land disposal of hazardous wastes on an individual basis rather than on a class basis.

HOW TO COMMENT:

A public hearing is scheduled for oral comments on:

Wednesday, January 2, 1985
9:00 a.m.
DEQ Portland Headquarters
Room 1400
522 S.W. Fifth Avenue

Written comments can be submitted at the public hearing or sent to DEQ, PO Box 1760, Portland, Oregon, 97207, by January 2, 1985.

For more information, call Fred Bromfeld at 229-5913 or toll-free in Oregon 1-800-452-4011.

WHAT IS THE NEXT STEP:

After the public hearing, DEQ will evaluate the comments, prepare a response to comments and make a recommendation to the Environmental Quality Commission on January 25, 1985.

ZB4045

P.O. Box 1760
Portland, OR 97207

8/10/82

FOR FURTHER INFORMATION:

Contact the person or division identified in the public notice by calling 229-5696 in the Portland area. To avoid long distance charges from other parts of the state, call ~~1-800-452-7813~~ and ask for the Department of Environmental Quality.

1-800-452-4011

Attachment IV
Agenda Item No. K
12/14/84 EQC Meeting

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION
OF THE STATE OF OREGON

IN THE MATTER OF MODIFYING	)	PROPOSED MODIFICATIONS
OAR CHAPTER 340 DIVISION 104	)	

Repeal rule 340-104-317 and adopt the following rule:

340-104-318 The Department may prohibit the land disposal of any hazardous waste if in the Department's judgment there are more environmentally sound beneficial use or disposal options. In making such a decision, the Department shall consider but not be limited to storage, transportation and other appropriate risks.

FSB:b
ZB4045.1

Rec'd 12/14/84
Item J

EARL BLUMENAUER
Multnomah County Commissioner

County Courthouse
Portland, Oregon 97204
(503) 248-5218

December 14, 1984

To the Environmental Quality Commission:

This letter concerns the threat to drinking water in mid-Multnomah County, one of the topics to be addressed at your meeting on December 14th.

You are to be commended for your recent decision to require a more detailed examination of the potential financial burden sewers will place on the residents of mid-Multnomah County. We are concerned that effective January 1, 1985, the ban on the installation of cesspools takes effect. Since your body has established a deadline of June, 1985, for submission of more detailed financial plans on the sewering of mid-Multnomah County, we request a similar extension of the County's exemption from the operation of OAR 340-71-335. At that time, when the EQC will likely establish a sewering plan for the mid-county region, it could simultaneously address the process by which the use of cesspools could be phased out as sewers were constructed between the present and the target completion date of 2005.

If you find the above suggestion unworkable, we would request that our three agencies begin work immediately developing a plan for establishing a continuously decreasing cap on the number of cesspools allowed in Multnomah County. We further request that the Commission establish a date now for a hearing on this next step.

We appreciate the difficult job you face, and the consideration our suggestions will be given.

Sincerely,

Earl Blumenauer

Gretchen Kafoury

Dan Bernstein

Rec'd 12/14/84
Item J.

MULTNOMAH COUNTY OREGON

BOARD OF COUNTY COMMISSIONERS
ROOM 605, COUNTY COURTHOUSE
1021 S.W. FOURTH AVENUE
PORTLAND, OREGON 97204

Richard Levy ~~XXXXXXXXXX~~

ARNOLD BISKAR • District 1 • 248-5220
~~GLADYS McCOY~~ • District 2 • 248-5219
CAROLINE MILLER • District 3 • 248-5217
EARL BLUMENAUER • District 4 • 248-5218
GORDON SHADBURNE • District 5 • 248-5213

December 13, 1984

To the
Environmental Quality Commission :

This letter concerns the threat to drinking water in mid-Multnomah County, one of the topics to be addressed at your meeting on December 14th.

Initially, you are to be commended for your recent decision to require a more detailed examination of the potential financial burden sewers will place on the residents of mid-Multnomah County. As you know, another potential crisis, the ban on the installation of cesspools, and thereby a moratorium on all development, takes effect on January 1, 1985.

As your body has established a deadline of June, 1985, for submission of more detailed financial plans on the sewering of mid-Multnomah County, we request a similar extension of the County's exemption from the operation of OAR 340-71-335. At that time, when the EQC will likely establish a sewering plan for the mid-county region, it could simultaneously address the process by which the use of cesspools could be phased out as sewers were constructed between the present and the target completion date of 2005.

If you find the above suggestion unworkable, we would at least hope for a 30-day delay of the expiration of our exemption on cesspool construction, during which time we could develop a plan for establishing a continuously decreasing cap on the number of cesspools allowed in mid-county.

We appreciate the difficult job you face, and the consideration our suggestions will be given.

Sincerely,

Caroline Miller

Richard C. Levy

Portland Association of Sanitary Service Operators

Telephone (503) 760-8944

P.O. Box 66193
Portland, OR 97266

November 6, 1984

FRED HANSEN
Environmental Quality Commission
PO Box 1760
Portland, Oregon 97207

Dear Fred:

YARD DEBRIS IS NOT A VIABLE MATERIAL FOR RECYCLING.

Extensive communications with other states indicate they have come to the same conclusion. See the attched copies for verification.

Studies conducted locally by the Tri-County Association, PASSO, Metro, City of Portland as well as actual yard debris operations have found it is not cost effective to classify yard debris a a recyclable material.

Collection is costly, disposal is costly, processing is costly, markets are unstable. These conclusions were reached after actual trial programs were conducted and failed.

We urge the EQC to evaluate the attached information and to contact our association should you have further questions.

Sincerely,

PORTLAND ASSOCIATION OF SANITARY SERVICE OPERATORS

Joe W. Cancilla Jr.

Joe W Cancilla, Jr
President

JWC:k

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

JUL 16 1984

PASSO

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

July 6, 1984

Mr. Joseph W. Cancilla
Cancilla and Son Sanitary
P.O. Box 66439
Portland, Oregon 97266

Dear Mr. Cancilla:

Ms. Mary Reese of the National Solid Wastes Management Association has requested that this agency confirm in writing information concerning yard debris which she obtained via telephone from this department's staff.

I can confirm that the Florida Department of Environmental Regulation does not have regulations stating that yard debris or yard trash is a recyclable item. We do, however, encourage the practice of composting yard debris whenever feasible. This agency does not require yard debris to be bagged when it is placed on the curb for collection. Requiring yard debris to be bagged or bundled at the curbside is a regulatory option of Florida's local governments and a number of cities in Florida do require this.

The State of Florida, through this Department, in fact does not regulate collection through administrative rules and regulations. It does offer guidelines for solid waste collection however (see enclosed solid wastes regulations).

I hope this answers your questions and please don't hesitate to call should you need any further clarification on this subject.

Sincerely,

Ray Moreau

Ray Moreau
Environmental Specialist
Resource Recovery Program

RM/vls

Encl.

cc: John Reese
Mary C. Reese - NSWMA

FILE COPY

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Capitol Complex
CARSON CITY, NEVADA 89710
Telephone (702) 885-4670

July 5, 1984

Mr. Joseph, W. Cancilla
Cancilla & Sons Sanitary
P.O. Box 66439
Portland, Oregon 97266

Dear Mr. Cancilla:

On June 29, 1984 the Nevada Division of Environmental Protection received a letter from Ms. Mary Reese representing the National Solid Wastes Management Association. In this letter Ms. Reese paraphrased the Divisions policy regarding yard debris as a recyclable material (i.e. composting) and that bagging is required for curb collection.

Unfortunately Ms. Reese's information is incorrect.

The Division has no formal or informal policy regarding recycling of these types of wastes. However in some areas, in specific conditions, burning of yard Debris is allowed. The bagging of yard waste may be a requirement for individual waste collectors or local district health departments but it is not a state requirement. The composting of such material is allowed provided it does not cause a public hazard or nuisance.

Hopefully this clarifies the State or Nevadas position on this issue.

If any further questions arise, please contact me at the above address or phone me at (702) 885-4670.

Sincerely,

Allen Biaggi

Allen Biaggi
Environmental Management
Specialist
Waste Management Section

AB/kc

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6000

July 16, 1984

Mr. Joseph W. Cancilla
Cancilla and Son Sanitary
P. O. Box 66439
Portland, OR 97266

Dear Mr. Cancilla:

This letter is in response to a request for information from Mary C. Reese, of the National Solid Waste Management Association. She inquired about our recycling program and specifically about yard wastes and composting. She asked the department to relay the information to you.

Presently there is no state law recognizing yard wastes as recyclable. Yard wastes are dealt with locally. For instance, the City of Seattle has an extensive ordinance to encourage composting. In Yakima, city road crew pick up leaves with street sweepers if residents rake them to the road. Some cities ask that they be in plastic bags for easy loading.

Our agency encourages composting as a means of waste reduction. I have enclosed a brochure that we distribute to the public on the subject.

Sincerely,

Jay Shepard
Recycling Program

JS:sa

Enclosure

cc: Mary C. Reese

STATE OF IDAHO
DEPARTMENT OF HEALTH
AND WELFARE

DIVISION OF ENVIRONMENT
Statehouse
Boise, Idaho 83720

July 6, 1984

RECEIVED BY
JUL 10 1984
PASSO

Mr. Joseph W. Cancilla
Cancilla and Son Sanitary
P.O. Box 66439
Portland, Oregon 97266

Dear Mr. Cancilla:

In response to Mary C. Reese's letter of June 27 concerning the regulation and recycling of yard debris in Idaho, we offer the following information.

On a state level, the Idaho Solid Waste Management Regulations and Standards define solid waste to "mean all solid material that is considered to be useless, unwanted, or discarded by the person in possession of it". In practice this excludes residential compost piles from being considered solid waste which must be managed under the solid waste regulations. However, if yard debris is set out for collection as a solid waste it must be contained, under the regulations, for the purpose of collection efficiency and to prevent nuisances. However, nothing in the state regulations require composting on an individual or municipal scale.

Individual city and county ordinances then go on to define the kinds of waste and the type of containers (bags, bundles, cans) that are acceptable to their individual waste collection services. Some dities do, however, have a street leaf ordinance and street leaf campaign in the fall of the year that is totally separate from the refuse collection service. In these cities residents are allowed to place their yard leaves in the street during certain times in the fall and usually the Street Department scoops the leaves off the street and hauls then off to selective locations where use can be made of them or to the local landfill.

Should you have any questions please call our office at any time (208-334-4107).

Sincerely,

Jerome E. Jankowski
Solid Waste Specialist
Hazardous Materials Bureau

JEJ/jd

FILE COPY

DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

TED SCHWINDEN, GOVERNOR

COGSWELL BUILDING

STATE OF MONTANA

HELENA, MONTANA 59620

July 2, 1984

Joseph W. Cancilla
Cancilla & Son Sanitary
P. O. Box 66439
Portland, OR 97266

Dear Mr. Cancilla:

This letter is in response to an information request by the National Solid Waste Management Association. Montana regulations do not specify that yard debris is a recyclable material. However, this office does encourage the use of yard debris for composting purposes. Most communities in this state do require that such debris be bagged when placed on the curb for collection.

Sincerely,

WILLIAM J. POTTS
Solid Waste Management Bureau
Telephone: (406) 444-2821

WJP:vc

PASSO

PO BOX 66439 PORTLAND, OREGON
97266

AUGUST 31, 1983

TO THE PRESIDING OFFICER, THE METRO COUNCIL and STAFF:

METRO is seeking a curbside yard debris pickup on a reular basis; they feel it is a viable program.

THE HAULERS DO NOT.

METRO has stated three objectives regarding yard debris:

1. Processing Centers
2. Markets
3. Curbside collection

Two of the three objectives have been met according to Metro media releases.

THIS IS NOT TRUE. The processing facilities are, in fact, operational - excluding the recent closure of Waste By-Products. There is no firm market for yard debris. Nurseries hesitate to use the material because it has not tested satisfactorily.

If yard debris was a proven recyclable material it would be like all other marketable recyclable materials - cost effective. According to Oregon SB 405, if it cannot be picked up, processed, and marketed in a cost effective manner, it should not be considered for recycling.

A local Portland hauler has said his pilot yard debris curbside collection program does not generate enough income to cover collection expenses. Processing centers are unable to purchase the yard debris, which proves it is not a viable recyclable material that could be sold to offset collection costs. This pilot program has also

PASSO feels that Metro must draft a plan for their recycling goals before developing any individual programs. Our suggestions are:

STEP #1 - Work with local jurisdictions to obtain franchised areas thus providing the support the recycling garbage haulers' need to go ahead with recycling.

STEP #2 - Markets - without buyback markets recycling is an unnecessary evil.

STEP #3 - Education - properly prepared recyclables - including compostable material (or yard debris) cannot and will not be prepared by the public and accepted by buyback markets without "how-to" education.

STEP #4 - Start with the most conveniently recyclable item and go from there.

A. Newspapers - once a goal of 75% return of newsprint in the Metro area is reached, proceed to Item B

B. Glass - once your projected goal is reached, proceed to Item C

C. Motor Oil - following the plan, after the goal is reached proceed to Item D

D. Tin, aluminum, scrap metal - your goals are reached, proceed to Item E

E. Plastics - Markets must be found, goals set and met - then proceed to Item F

F. YARD DEBRIS - Now that the public is well acquainted with the "how-tos" and "why-fors" of recycling, the recycling garbage haulers can gear up to handle the yard debris problem, and the public will be ready, willing, and able to do their part. Enough time has elapsed to identify and secure buyback markets for yard debris thus making it a cost effective recyclable material.

After attending your August 18, 1983 meetings and listening to all testimony we feel that this program should be postponed until such time that viable markets are available.

demonstrated that uncontaminated yard debris must be dumped at these centers for a fee to the hauler, while all other viable recyclables are sold to the processor. The processing centers are unable to receive the debris without charging. The haulers are unable to haul the debris to a cost effective market, this inevitably means the public will end up paying for it - one way or another.

In referrence to the EXECUTIVE SUMMARY DRAFT from Metro, a chart on page 2, figure 1, (see attachment), 61% of yard debris is currently being "composted" some way or another in landfills. Metro, or local jurisdiction, could divert this material from the landfill by refusing it at the landfill and providing alternate disposal sites such as McFarlands. PASSO feels that if the exorbitant cost of the curbside collection yard debris program were to be weighed against the current cost factor plus the implementation of SB 405, yard debris will solve it's own problems.

According to Metro's Waste Reduction Plan, 1983, the educational program of compost and yard debris processing should reduce the 26% figure of yard debris currently being hauled by the refuse operator as well as the 13% currently being burned. Carol Brown has stated that it takes four years for the yard debris to decompose from the time of disposal. Our resource, a landfill operator, disputes this time frame and feels that a maximum of one to two year deterioration is more accurate, which is directly related to the heat that yard trimmings generate during deterioration therefore offsetting the slower deterioration of limbs and branches. If the yard debris status remained as it is currently, using our expert's resource figures, only one additional landfill year would be added by 1986.

PUBLISHERS PAPER TIMES MIRROR

December 11, 1984

Mr. James Peterson, Chairman
Environmental Quality Commission
835 N. W. Bond
Bend, Oregon 97701

Dear Mr. Peterson:

I want to take this opportunity to give you several concluding comments with regard to the rules being developed in conjuntion with the Opportunity to Recycle Act.

I am Assistant Manager, Secondary Fibers, for Publishers Paper Co. I also serve as Vice President of the Association of Oregon Recyclers. I am serving as chair of the markets committee for the third year.

There are two major issues of concern I will address. First is the door-to-door collections by non-profit charitable and educational organizations. These groups use recycling as a part of their fund raising efforts. Nothing in the proposed rules should undermine this important effort.

The policy statement (340-60-015) on pages 5 and 6 of the proposed rules appears to limit charitable and other groups that currently use recycling as a fund raiser while not allowing groups that may want to do this in the future to be involved. (Paragraph (7) sub. (a) "Existing ...).

I suggest this language be changed as follows:

"(7) To encourage local governments to develop programs to provide the opportunity to recycle in a manner which increases the level or scope of recycling and does not regulate, limit, adversely impact, or disrupt directly or indirectly the recycling activities or results thereof, of:

(A) Charitable, fraternal and civic groups, and

(B) Recycling collection from commercial and industrial sources."

4000 KRUSE WAY PLACE, LAKE OSWEGO, OREGON 97034 PH: (503) 635-9711

My second major concern lies in the Fair Market Value Exemption (340-60-050 Paragraph (2)) on pages 20 and 21 of the proposed rules. By grouping newspapers with other recyclables, I believe you will actually reduce the amount of waste news currently collected.

As an example, waste news is currently collected by multi-family housing units. They would be required to recycle a number of other items that could result in less actual collections.

Further, it is my belief that the law itself does not allow for grouping recyclables as proposed. The law as restated in Alternative 2 (attachment 2) would be the correct definition of Fair Market Value Exemption.

Thank you for your consideration of these points.

Sincerely,

Angela Brooks

Angela Brooks
Assistant Manager
Secondary Fibers

MULTIFAMILY
HOUSING
COUNCIL
a division of:
Home Builder's Association
of Metropolitan Portland

DECEMBER 14, 1984

SUGGESTED CHANGES FOR
DRAFT RECYCLING RULES
TO PRESERVE MULTIFAMILY
RECYCLING OPPORTUNITIES

340-60-010

(4) "Collection service" means a service that provides for collection of solid waste or recyclable material or both. "Collection service" of recyclable materials does not include a place to which persons [not residing on or occupying the property] may deliver source separated recyclable material.

(11) "Generator" means a person who last uses a material and makes it available for disposal or recycling[.],or a person who provides a depot for such material.

340-60-015

(7)(b) commercial[and],industrial, and depot sources.

Suite 301, 15555 S.W. Bangy Road • Lake Oswego, Oregon 97034 • Phone 684-1880

UNITED CITIZENS IN ACTION
1546 S.E. 138th AVENUE
PORTLAND, OR. 97233

MR. PETERSEN, CHAIRMAN
522 S.W. 5th AVENUE
PORTLAND, OR. 97204
DECEMBER 13, 1984

DEAR MR. PETERSEN,

UNITED CITIZENS IN ACTION HEREBY REQUESTS THAT THE ENVIRONMENTAL QUALITY COMMISSION ADOPT A RULE TO PERMIT CROSS-EXAMINATION OF WITNESSES AT THE MEETING FRIDAY, DECEMBER 14, 1984.

RESOLVED THIS 13th DAY OF DECEMBER, 1984.

SINCERELY, Herb Brown

HERB BROWN, CHAIRMAN

cc: SECRETARY, ENVIRONMENTAL QUALITY COMMISSION
HENRY KANE, ATTORNEY

VICTOR ATIYEH
GOVERNOR

Environmental Quality Commission

Mailing Address: BOX 1760, PORTLAND, OR 97207
522 SOUTHWEST 5th AVENUE, PORTLAND, OR 97204 PHONE (503) 229-5696

MEMORANDUM

To: Environmental Quality Commission

From: Director

Subject: Tax Credit Application T-1694
The Amalgamated Sugar Company

The Application for Certification of Pollution Control Facility T-1694 was placed on the agenda for the EQC meeting to be held Friday, December 14, 1984. This was an oversight by the Department, as the facility has been previously approved. The certification was granted by the EQC on the 29th of June, 1984. Copies of the certificate and the review report were sent to Galan Rogers, the plant engineer in Nyssa. A letter of explanation was sent to Mr. Chertudi, the person authorized to receive the certificate, in Ogden, Utah. These letters were sent December 12, 1984.

It is respectfully requested that Tax Credit Application T-1694 be withdrawn from the agenda.

Fred Hansen

SChew
229-6484
12/13/84

STATE OF OREGON

INTEROFFICE MEMO

TO: Ron Householder

DATE: December 12, 1984

FROM: Bill Jasper

SUBJECT: Update for EQC Meeting, December 14, 1984

In the EQC report for hearing authorization, reference is made to both Chrysler and Honda. Since the report was prepared, several events have transpired.

On December 10, you received a letter from Honda. This letter requests that a key-off/restart procedure be applied to 1984 and 1985 Honda Preludes. Discussion with Brian Gill, yesterday, indicated that Honda uses an idle dump that is triggered by a timer in the CPU. The reset signal is received by the speed sensor, and is such that the air pump dump resets at 12 mph. A copy of the staff report had been forwarded to Honda earlier this week. I will contact Mr. Gill next week after the EQC meeting.

Last Friday, EPA sent out its letter requesting that states seriously consider Chrysler's request for an alternative test procedure. That letter is referenced in the EQC staff report. Yesterday, I talked with Mr. Tracy of Chrysler. Mr. Tracy indicated that replacement component modules (circuit boards) should be available at dealerships by the end of January, 1985.

Mr. Tracy also indicated that at this time, four (4) states had agreed to Chrysler's request. The states are North Carolina, Connecticut, Arizona and Rhode Island. North Carolina has a private garage type of program and its regulations already provide for idle/drive testing. Arizona and Connecticut have contractor operated programs. Both programs use Hamilton Testing as contractor. In Connecticut the procedure is not being officially changed, however, the contractor will reinspect the vehicle in drive upon request. In Arizona all automatics are tested in drive. This appears to be left over from the dynomometer testing. (Arizona requested legislative changes to require testing of all 1971 and newer vehicles and also to do tampering enforcement on all vehicles). Rhode Island will handle the Chrysler request through its waiver procedure.

BJ:dj

HONDA
AMERICAN HONDA MOTOR CO., INC.
P.O. BOX 50 — 100 W. ALONDRA BLVD., GARDENA, CALIF. 90247
CABLE ADDRESS — AMEHON, GARDENA, CALIF. (213) 327—8280

December 4, 1984

Mr. Ron Householder
Department of Environmental Quality
Post Office Box 1760
Portland, OR 97207

Dear Mr. Householder:

Enclosed are two Service Bulletins distributed to Honda automobile dealers which explain the procedures necessary to ensure that certain models will meet state Inspection and Maintenance Standards.

Please note that all vehicles comply with Federal Emissions Standards when tested according to the Federal Test Procedures.

Service Bulletin 84-051 concerns 1984 and 1985 model year Honda Preludes. These vehicles may not meet the two-speed idle emission standard after idling for an extended period. This is because the vehicles are equipped with a system designed to protect the catalyst from overheating. If the engine has been idling for longer than 3 minutes, it is necessary to stop and restart the engine to re-set the system timer.

Service Bulletin 84-053 concerns certain 1982 Honda Accords and Preludes which may fail the standard when tested at high engine speed with the drive wheels stationary. This abnormal operating mode results in activation of the carburetor power valve, a condition which would normally be prevented by the operation of a speed sensor, as described in the bulletin.

A modification was made to later production cars on the assembly line which has the same effect as the procedure described in the bulletin.

We appreciate the importance of state Inspection and Maintenance Programs, and we would like to ensure that Honda owners do not experience any unnecessary problems. As mentioned above, the vehicles do comply with U. S. E.P.A. regulations in their original configurations.

We would greatly appreciate your cooperation in providing this information to the staff at your testing stations. We shall be pleased to provide additional copies of the service bulletins, if you wish.

Please contact me if you have any questions about this material, or call our Emission Tech Line at (213) 604-2679.

Yours truly,

AMERICAN HONDA MOTOR CO., INC.

Brian Gill
Manager
Certification Department

SERVICE BULLETIN

HONDA
AUTOMOBILE SERVICE DEPARTMENT

Model	Applicable To	File Under	Bulletin No.
'84/85 PRELUDE	ALL	ENGINE	84-051
			Issue Date OCT. 1, '84

State Emission Inspection Tests

PROBLEM

1984 and '85 Preludes won't meet state idle or high idle CO standards if tested after the car has been idling for three minutes or more.

CAUSE

To prevent the catalyst overheating, the secondary air and feedback systems shut off automatically after idling for three minutes.

NOTE: These cars *do* meet EPA standards under the Federal Test Procedure (under normal driving conditions, a car will seldom remain stationary for as long as three minutes; thus the secondary air and feedback systems will shut off only infrequently).

SOLUTION

Turn the engine off before testing, then restart and test within three minutes.

IMPORTANT INFORMATION FOR: ☐ *General Manager* ☐ *Parts Manager* ☐ *Technician* ☐ *Service Manager* ☐ *Warranty Clerk* ☐ *Sales Manager*

SERVICE BULLETIN

HONDA
AUTOMOBILE SERVICE DEPARTMENT

Model	Applicable To	File Under	Bulletin No.
'82 ACCORD '82 PRELUDE	ALL	ENGINE	84-053
			Issue Date OCT. 15, '84

State Emission Inspection Tests of '82 Accords and Preludes

PROBLEM

Some '82 Accords and Preludes may fail the high idle (2500 rpm) mode of the emission test used in many states, particularly at high altitude.

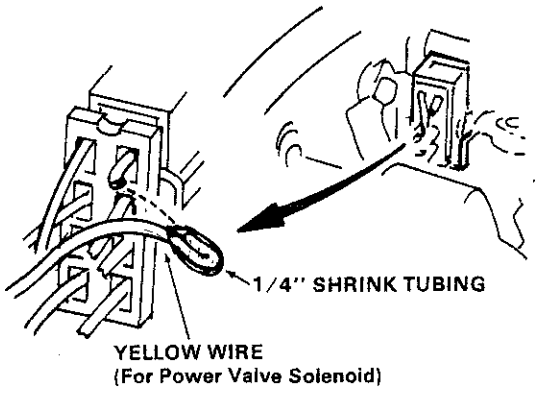
CAUSE

The test procedure results in abnormal operation of the power valve: When in the high idle mode, manifold vacuum to the power valve is cut off, allowing the power valve to open, thereby causing an excessively rich mixture. This condition would normally be prevented by the operation of the speed sensor. In the state inspection, however, the wheels are stationary.

NOTE: All Honda production cars *do* meet the U.S E.P.A. and California emission standards when tested under the E.P.A. test procedure.

SOLUTION

Cut the yellow wire (for the power valve solenoid) at the emission control box. Double the end of the wire over and insulate it with a 1 to 2" length of 1/4" diameter heat shrink tubing.



NOTE:

- A modification was made on later production cars which has the same effect as the procedure above.
- If the car still fails the test, the cause may be:
  - — A ruptured power valve diaphragm.
  - — Fuel boiling in the float bowl (hose it down with cool water).
  - — A clogged air filter.
  - — Incorrect timing or failed timing control (advance/retard diaphragm).
  - — Misfire (spark plugs, wires, etc.).
  - — Dirt in the carburetor.
  - — Vacuum leaks.
  - — Misadjustment of the carburetor idle mixture circuit.

WARRANTY CLAIM INFORMATION

Operation Number: 120025
Flat Rate Time: 0.2
Defect Code: 074
Contention Code: C99
Failed Part H/C: Accord - 112939
Prelude - 119944

IMPORTANT INFORMATION FOR: ☐ *General Manager* ☐ *Parts Manager* ☐ *Technician* ☐ *Service Manager* ☐ *Warranty Clerk* ☐ *Sales Manager*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

OFFICE OF
AIR, NOISE AND RADIATION

December 7, 1984

Ron Householder
Dept. of Environmental Quality
P.O. Box 1760
Portland, OR 97207

Dear Mr. Householder:

My understanding is that your I/M program has probably received a September 14, 1984 letter from James V. Tracy of Chrysler Corporation on the subject of high failure rates for certain 1984 model year 2.2-liter Chrysler vehicles. A copy of this letter is enclosed in case you did not receive one. While your program may not have encountered any unusual difficulty to date with these vehicles, the 1984 models are now coming due for their first annual inspection in significant numbers. I am writing to provide you with additional background on the problem and to inform you that the EPA recommends that you consider Chrysler's request that the affected vehicles be tested in idle-drive.

As indicated in Mr. Tracy's letter, the vehicles in question are 2.2-liter 1984 Chrysler-built cars equipped with automatic transmissions and throttle-body injection (a single-point electronic fuel injection system). These vehicles may not pass your I/M HC and CO limits during short tests that include an idle-neutral or idle-park mode. This is due to an idle-neutral enrichment electronic circuit incorporated in these cars to enhance idle quality. Technical details on the problem may be obtained by contacting my office at (313) 668-4374, or Mr. Tracy's office at (313) 956-5087.

The information provided by the manufacturer and several States indicates that use of idle-drive testing would prevent these particular Chrysler vehicles from failing due to idle enrichment. We anticipate that allowing idle-drive testing for these few vehicles would not have any impact on the emission reductions from your I/M program. Therefore, we will accept idle-drive testing for these vehicles.

We encourage you to consider idle-drive testing of the affected vehicles; you may find that the advantages in terms of owner convenience outweigh any test administration disadvantages. Chrysler has voluntarily committed to provide emissions performance warranty protection for its vehicles that fail an idle-drive short test.

A related approach might be for you to allow idle-drive testing for only those 2.2-liter TBI Chryslers that have failed the normal idle-neutral test. This approach would reduce the number of idle-drive tests that would need to be performed.

Chrysler has eliminated the idle-enrichment problem during the 1985 production cycle through factory use of a new replacement computer module which eliminates the enrichment at idle. The module will also be available as an easily installed fix for early 1985 vehicles produced before the production changeover.

If your I/M program elects to retain its current test procedures for the problem Chrysler vehicles, and if those procedures and associated quality control practices conform to EPA regulations, owners of failed Chrysler 2.2-liter TBI automatics are also eligible for modifications under the emissions performance warranty. However, a different new module, which is not yet available from Chrysler, will be required as a fix for the 1984 vehicles.

You may be aware that Chrysler petitioned EPA in October for an alternative test rulemaking to establish idle-drive as a required short test for these vehicles. In subsequent discussions, EPA informed Chrysler that we wished to avoid a proliferation of required special short tests which I/M programs would be forced to adopt or lose warranty protection for some vehicles. Chrysler has agreed to cooperate with EPA's desire by withdrawing its petition. In fairness to Chrysler and owners of Chrysler vehicles, EPA is encouraging you and other I/M States to carefully consider adopting the idle-drive short test. EPA and Chrysler agree that the decision should be each State's.

You should, of course, feel free to contact me with your comments on this issue. Questions about enforcement or the legal aspects of the warranty may also be referred to the Field Operations and Support Division:

Richard Friedman
Field Operations and Support Division (EN-397F)
U.S. Environmental Protection Agency
Washington,D.C. 20460

Sincerely yours,

Phil Lorang, Chief
Technical Support Staff

Enclosure

cc: James V. Tracy, Chrysler Corporation
Richard Friedman, FOSD

CHRYSLER CORPORATION

September 14, 1984

All State I/M Program Managers

Dear Sir:

Subject: Inspection/Maintenance (I/M) Idle Testing of Certain 1984 Model Chrysler Built Cars

Models Affected: 1984 Chrysler Laser, LeBaron, New Yorker & E-Class; and Dodge Daytona & 600 cars equipped with automatic transmission and the 2.2L EFI engine (non-turbo charged). This engine is identified by the letter 'D' in the eighth character of the VIN.

Chrysler has recently determined that the above model cars may not pass your state I/M CO requirement when subjected to an idle test in neutral. This is due to a unique neutral idle enrichment electronic circuit incorporated in these cars to enhance neutral idle quality.

These cars do pass the official EPA "Federal Test Procedure" test and will consistently pass your idle CO requirement if tested in drive rather than neutral. We are in the process of resolving this matter with EPA, and Chrysler intends to petition EPA to approve an alternative test procedure for these cars. However, the petition and approval process will take some time to complete and, in the interim, it is likely that a high percentage of these cars may fail an idle test in neutral.

A vehicle which fails an I/M idle test for this reason cannot be corrected by any field repair action. A spark control computer electronic circuit modification is being made early in the 1985 model year to eliminate the condition, but the revised 1985 computer cannot be installed on 1984 model cars.

Chrysler feels, and I am sure you will agree, that it is in the best interest of all concerned (affected vehicle owners, State I/M Programs, Chrysler, and clean air) to not inconvenience vehicle owners regarding an issue that they are not responsible for, cannot have corrected, and does not cause air quality deterioration.

Therefore, we request that you modify your state I/M idle test procedures to allow the affected model cars to be tested in drive. Chrysler will honor its emission performance warranty obligation if a vehicle fails to pass an I/M idle test performed in drive.

We sincerely appreciate your consideration and cooperation on this matter, and request that you inform us regarding your resolution of it as soon as possible.

Sincerely,

James V. Tracy

James V. Tracy
Manager, Product Investigation
and Government Liaison

JVT/dc
cc: Phil Lorang, EPA
Richard Friedman, EPA