All pocket 7 for enclosures

WM Record File 101

WM Project 10

Docket No.

PDR ✓

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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July 3, 1985

JOB JTC DCM
CFR Giarratana
Bilhorn Linthan

'85 JUL 17 A10:45

Enclosures in DCC

MEMORANDUM FOR: Robert E. Browning, Director
Division of Waste Management

FROM: F. Robert Cook, Senior On-Site Licensing Representative, Basalt Waste Isolation Project (BWIP)

SUBJECT: OBSERVATIONS, COMMENTS AND RECOMMENDATIONS FOR THE PERIOD JUNE 1 TO 27, 1985

1. On June 6, 1985 I attended a briefing for DOE Inspector General (IG) representatives by the Richland Operations Field Office staff, concerning the NWPA activities. Various excerpts from the viewgraph handouts which were presented to the IG were forwarded to you earlier via separate correspondence. (I was provided an entire set of the viewgraphs, which are on file in this office.)

One of the IG representatives, Rod McKim, stationed in Germantown, explained the IG's functions in reviewing the NWPA activities. He noted that the IG was planning to utilize Independent Puplic Auditors (IPA's) to help them in their reviews. He indicated that all areas of the NWPA activities, including technical areas would come under the IG's review. He indicated that the IFA's would have personnel with technical competence as well as fiscal competence. He indicated that by the end of June, 1985, areas which were recommended for audit would be identified. He expected one of the first areas would be cost recovery for DOE previously incurred charges subject to waste fund expense. Another area was the control and use of grant funds. Application of quality assurance was also discussed.

The IG representatives indicated that they would be contacting the OR's to obtain their input regarding the reviews they would be doing in the future.

2. I reviewed the "Methodology for Generating a Q-List for Geologic Repositories" of June 4, 1985 from DOE. I provided comments over the phone to Bilhorn and Kennedy. These comments are included as Attachment A to this memorandum.

3. I initiated review of various loose leaf notebooks, which RHO Site Department maintains, compiling geophysical anomolies which investigators have identified during past investigations under contract to RHO or other DOE prime contractors. (Westbrook briefly reviewed two or three such notebooks during her recent visit in May and had asked me to do some additional review.) I requested copies of three of these documents addressing

1467

aeromagnetic data evaluations and seismic data evaluations. These requests were denyed by DOE.

The information contained in the collection of notebooks consists of concise descriptions of investigators assessments with a statement of RHO assessment of the significance of the particular anomoly being addressed. Most aeromagnetic and seismic anomolies identified in the notebooks which I have reviewed to date (based on RHO's assessments) are not necessairly representative of actual geophysical structures, but are considered by RHO to be the result of errors in the raw data or the evaluation of the raw data or just different interpretation of the data from RHO's interpretation. However, in each case I reviewed (about 75 separate items) the investigator doing the evaluation had identified a structure, considering his own assessment. (Note I concluded there would not be anomolies listed in the notebooks if someone did not interpret the raw geophysical data to be indicative of some structure.)

I recommend that one or more Staff plan a day or two trip to specifically review these notebooks or alternatively formally request copies of the notebooks. The latter option would appear to be the cheapest. There are a total of 13 notebooks of geophysical anomolies which I have seen (about four feet of bookshelf space.) Since RHO considers the notebooks "working files", they may change them at any time as new interpretations and data are accumulated. It would appear that the information in the notebooks would be helpful for Staff hydrologic modeling, as well as improving the Staff's ability to meaningfully comment on future geophysical testing during site screening and site characterization, including the hydrologic testing.

4. On June 6 and 7 DOE presented a briefing to the National Academy of Sciences. I had planned to attend the entire briefing which dealt with environmental issues related to Hanford Site activities and appeared aimed at addressing the issue associated with determining the entire enviromental picture as a result of all projects on-site, including the BWIP project. The day before the briefing I was informed by DOE that I could not attend the entire briefing, but only a one-hour session on the 7th to be given by the DOE BWIP project representative, Saget.

This session reviewed basic features of NWPA for the 15-20 member NAS board which addresses radioactive waste issues. Professors Pigford and Parker were in attendance. Saget went into some detail describing the DOE's ranking method used to rank sites relative to guidelings in the EA's. Other basic features of the NWPA and NRC's licensing role were also highlighted. The NAS questioned Saget whether there would be two formal NRC licensing reviews of the project, one at construction and one at operation. Saget indicated there would be two such licensing reviews. The NAS also questioned whether on not the MRS would be an integral part of the repository project and whether it would be licensed. Saget indicated yes to both questions.

After the session NAS (Parker) noted to Saget that the board was familiar with the EA ranking process and had commented on the methodology to DOE in April. Based on the DOE presentation, DOE/RL was not aware of the NAS comments.

This confirms discussions I had with Staff (Linehan and Surmeier) following the NAS briefing.

5. I understand that DOE has indicated to the projects in a recent workshop that siting guidelines, as appropriate, should be ranked according to performance assessments for each guideline for each site. This would appear to suggest a significant revision of the EA's and also reflects the crux of the NAS comments. It would appear appropriate that the Staff plan to comment on the various performance assessments to be incorporated into the EA's--assuming this is DOE's actual objective--in the same context that we commented on the draft EA's, since those performance assessments would logically be the basis for the performance assessment to be described in the SCP's.

6. Drilling and piezometer installation was completed in RRL 2C. Geophysical logs indicate significant spalling in the Cohassett flow, based on caliper measurements. I am attempting to obtain the pertinent geophysical logs for this borehole. RRL 2B is completed into the Rocky Coulee flowtop. No gophysical logs in this flow have been taken. The RRL 2B hole is now cased into the Grande Ronde #1 flow in preparation of large scale pumping tests. Following the first test and deepening of the hole, additional geophysical logging will be accomplished.

7. Reexamination of radiochemistry of groundwater in DB-7 indicated that I(129) has changed only slightly since 1975 measurements were made in the Mabton. The readings were about 100 aCi/l, vs about 230 aCi/l in 1975. This compares to a range of Columbia River water of 2--30 aCi/l, upstream of the Hanford Site, and 80--150 aCi/l downstream in the period 1979 to 1984 (see Attachment B). The increase concentration downstream is explained by PNL in PNL 5407 as being due to I(129) in the ground water flowing into the river from the Site. PNL has indicated the flow is from the unconfined aquifer to the river. I would note that flow may also enter the river from confined aquifers. I am not aware of a I(129) budget analysis which would substantiate the change in concentrations seen in the river. Such an assessment, given known concentrations in the unconfined aquifer, may be useful in helping to establish the actual groundwater discharge to the river and the location of the discharges whether they be confined or unconfined aquifers.

8. One additional note based on my conversations with RHO investigators is that there was no detectable tritium in the DB-7 Mabton recently sampled. This is an anomoly to RHO investigators who expected to observe some tritium along with the I(129). I have not confirmed that the sensitivity of the tritium

measurement is equal to that for the I(129) measurement and, hence, have not justified the conclusion that one would expect to observe tritium, assuming a common source of I(129) and tritium from the Site activities or Yakima River waters. It may be useful for Staff to review detection limits and expected concentrations of I(129) and tritium in the ground water based on actual measurements near the Site sources and assuming neither is removed from the ground water flow except by decay, and that dilution is the same for each isotope.

9. On June 14 and 15 I attended the PACIFIC NORTHWEST REGIONAL CONFERENCE ON GROUWNDWATER at Tacoma. Attachment C is the program for the conference. The conference served to highlight the concern the NW legislators and the public are developing over groundwater allocation and contamination of any kind.

A presentation was made by a USGS representative (L. Mann) concerning the radioisotope contamination at the Idaho Test Site. The information on the relative travel rates of the various isotope plumes in comparison to the rates of travel of comparable Hanford plumes may be of use in judging retardation factors as well as ground water travel rates at Hanford.

John Bredehoeft, formerly of the USGS, discussed the nature of hydrology in basalts. He indicated that Columbia River basalts groundwater flows by fractures, primarily, and cannot be explained well on a local scale by assuming porous flow conditions.

One other observation was that the environmentalist groups represented at the conference did not seem to advocate that EPA or other government authorities specify concentration limits on various toxic substances in the environment. I believe thay saw such limits as providing "license to pollute" up to the limits, some of which they saw as unacceptably high. They seemed to prefer no-pollution alternativies for waste management.

10. During the period I revierwed RHO's policy for incorporation of records into their records management system for storage. Various examples revealed that long times expire between creation of a record and incorporation into the formal storage system. This time delay makes it more likely that records will be lost, modified and/or discarded, and, hence, accurate records will not be retained in the formal system. Examples of areas of key importance are subcontractor correspondence, both going and coming, and quality assurance records, for example non-conformance reports. I consider Staff should review the timing associated with sending records to the BWIP/RHO records management for duplication and storage during future meetings on the BWIP records system.

Related to this item on records retention I noted that RHO/BWIP has discontinued using controlled notebooks for documenting raw

data as it is taken. Instead they are using loose, blank data pages, which are not controlled in the same manner as the notebooks were controlled. This practice would appear to make it impossible o verify that pages of data are not lost, modified or discarded after initial data readings are recorded. An example of where this new practice has been invoked is in the recording of hydrology head measurements. Attachment D is a copy of revised procedures pertinent to this issue. I recommend that Staff review this practice to determine if it is an acceptable quality assurance practice for licensing.

Other procedures in the geotechnical area which pertain to sampling or raw data colletion, similarly, do not provide assurance that samples or raw data are not lost, modified or discarded. An example is the collection of chips during recent RRL 2C and RRL 2B drilling operations. Review of QA principles rather than review of all individual procedures is warranted.

11. During the week of June 23 I conducted Site tours for various WM Staff visiting Richland on matters concerning LLW. I believe these were quite useful to the Staff involved.

12. I was informed by Washington State representatives that the US Ecology LLW site witnessed an unusual Spring snow melt, which invaded old resin storage tanks at the site and resulted in transport of various radionuclides from the storage tanks to the ground water and to the ground surface. Plans are being made to re-bury the resin waste, using absorbant material to contain the moisture, in 55 gal. drums in the regular burial ground at the Site.

13. During the period I reviewed the test technique for determining mechanical properties for engineering materials which are basically earthen materials, for example rocks and packing conglomerates. The apparatus is being designed to allow uniaxial loading with specimens under hydrostatic compressive pressures. I note that the stress state produced by the apparatus being developed may not be representative of the entire range of stress states which the materials will be subjected to in a repository. In fact pure biaxial loads (with no hydrostatic pressure loads and the resultant compressive stress state) may occur and be potentially limiting form the standpoint of the stress state that such loading produces and anisotropic properties of the material. Such biaxial loading may occur during certain times prior to resaturation (and potentially after resaturation) of the repository.

I recommend that Staff review this area of the engineered system design and development and determine whether or not uniaxial stress tests will adequately determine limiting material properties for the necessary design analyses, including those being performed for conceptual designs. If not, DOE should be advised of design parameters Staff considers pertinent. This

would assure appropriate conceptual designs, as well as long lead materials test apparatus, are developed in a timely manner.

F Robert Cook

F. Robert Cook
Senior On-Site
Licensing
Representative
BWIP

cf:
JOBunting
HJMiller
MRKnapp
JMHoffman
TRVerma
PTPrestholt
JKennedy
JTGreeves
FRCook

ATTACHMENT: A

COMMENTS ON "METHODOLOGY FOR GENERATING A Q-LIST FOR GEOLOGIC REPOSITORIES

1. The wording of the document does not make it clear whether it is intended to be a specification or not. The mandatory "shall" should be substituted for the frequently used "may" throughout the document.

2. Requirements in Part 20 concerning off-site releases during normal operations and systems for controlling these releases, particularly the monitoring systems, would appear to come under the term "important to isolation" considering the definition of the term "isolation" in Part 60.

DOE has in effect narrowed the definition of "isolation" so as to apply it only to transport of radionuclides AFTER CLOSURE--see the text on page 3. I have not understood the term "isolation" to only apply to system functions or events, i.e. inhibiting transport of radioactive material, to the post-closure time frame, even though this is the time frame to which the term is most frequently applied.

In the same text on page 3 DOE assumes that the only standards for material entering the accessible environment are the EPA environmental standards yet to be issued for integrated long term releases. I note such a limited definition is not contained in the term "isolation" defined in Part 60. Nor are the EPA standards only intended to apply post-closure. In this regard note the requirement of 60.111 which applies during the pre-closure period and cites limits specified in Part 20 and such generally applicable environmental standards for radioactivity as may have been established by EPA. To be sure the definition of "isolation" uses the words "prescribed limits" for "amounts and concentrations" and does not restrict the limits to 40CFR191.03(a) as specified in the subject document in section 4.1.2.

Also from the standpoint of overall logic behind the application of QA principles and criteria of Appendix B, it would be illogical to consider measures to assure 1) unrestricted area exposures during an accident (important to safety) or 2) the long term individual limits on the waste package, the engineered system and the geologic repository, specified in 60.113, more important than the normal day-to-day exposures of the public in unrestricted areas due to direct exposures and exposures from effluents. All are public health and safety issues and will be subject to the same scrutiny at licensing.

All areas in the proposed technical rule (see FR pp35280 &

following, 7/8/81) were covered by the applicability section for the QA. The definition of "important to safety" included actions associated with design and performance assessments requirements, whether or not they were associated with an ACCIDENT condition. As noted in the statement of considerations for the final technical rule, the reason for changing the definition of "important to safety" was not to abridge the applicability of the QA requirements, but to merely bring the usage in line with usage for reactors, which tied the term to accident design considerations. (For rationale concerning the change noted above see pages 26 & 27 of Enclosure A to SECY-83-59, 2/9/83.) There is nothing in these considerations which suggest the final rule implements a major change in the applicability of the QA requirements from that proposed in the rule sent out for public comment--only the mundane action noted. To effect a change in applicability via a change in definition of terms would not be in keeping with acceptable practice for establishing rules.

3. The definitions section should not redefine terms specifically defined in applicable rules and laws nor should it use terms which are close in definition to other defined terms in rules and laws. "site", "repository", "radioactive waste" and "unrestricted area" fall into these categories. If the latter term is intended to be identical with the Part 20 definition, this should be noted. Such practice confuses the reader.

4. DOE makes a distinction between public health and safety and public health and radioactive safety--see section 4.1. NRC's responsibilities have to do with public health and safety. I don't understand DOE's new terminology. Maybe it should be defined.

5. In the discussion under section 4.2, accident probabilities, if used, need confidence levels also identified. In addition, reliability criteria and confidence statement criteria should be identified for all the performance objectives, not just the EPA standard. For example the waste package and the engineered system have performance objectives which should be addressed.

The discussion of "safety class 2" items confuses the reader. They appear to be merely items which are not Q-listed. The discussion should be eliminated. See the following 2 comments which apply to this issue.

6. Section 5.1 suggests that an item could be provisionally placed on a Q-list. Either it should be on the list or not on the list. A provisional category is not necessary and may suggest to personnel that the item will come off the list in the future and result in inappropriate application of requirements. The principle expressed in this section should be "it is on the Q-list unless analyses and justification identify otherwise."

7. In section 5.8 the risk assessment should not be the deciding factor as to whether an item is on the Q-list. The only criteria

is whether the item is important to safety and /or important to waste isolation. Items which effect low risk or prove low risk are only credible through the application of QA. It may be appropriate to grade low-risk items as to applicability of QC actions, however such grading would be part of the overall QA program complying with the Appendix B criteria. It would appear DOE is confusing grading with Q-listing.

8. The concept of identifying basic components (as defined in Part 21) as items which are to be Q-listed should be included in the methodology.

ATT. B

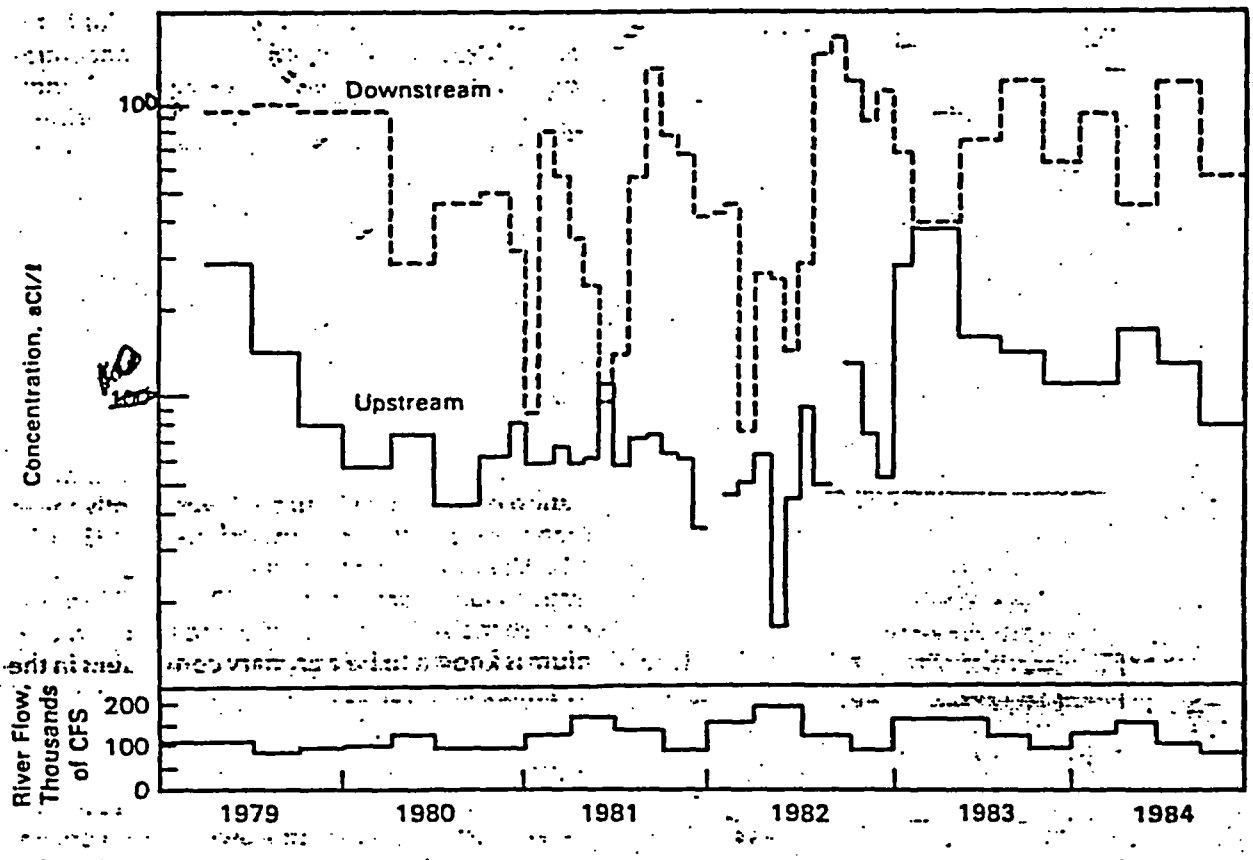


FIGURE 14. Columbia River Flow Rates and I-129 Concentrations

FROM. #25407 5/85

Institute for Environmental Studies, FM-12
University of Washington, Seattle, WA 98195

ATT & Madge Watson. 943 9934

DRAFT (GENERAL) PROGRAM OUTLINE as of 3-22-85:

PACIFIC NORTHWEST REGIONAL CONFERENCE ON GROUNDWATER: THE INVISIBLE RESOURCE
(Idaho, Oregon, Washington)

June 13, Field Trip, Vicinity of Tacoma & Pierce County

Friday, June 14, & Saturday, June 15, 1985 Conference
Bicentennial Pavilion/Sheraton-Tacoma Hotel, Tacoma WA

CONFERENCE PROGRAM

* Confirmed, § Invited, pending, + To be invited

Friday, June 14, 1985

8:30 AM NOVA film re Ground Water

Introducer: Polly Dyer, Continuing Environmental Education Director, Institute for Environmental Studies, UW

Welcome: § Honorable Booth Gardner, Governor of Washington
* Douglas (Doug) Sutherland, Mayor of Tacoma
* Norma Jean Germond, League of Women Voters Ground Water Task Force

Keynotes: WHAT IS GROUND WATER? / WHY WE ARE HERE?
§ John Bredehoeft, U.S.G.S., Menlo Park, CA
§ Elizabeth Frenkel, LWV of Oregon/ Sierra Club

GROUND WATER PROBLEMS EXPERIENCED IN THE Pacific Northwest

Overview/Moderator, John Beare, MD/MPH, Dept. Social/Health Services, WA

Biological Contamination Problem - Fords Prairie Aquifer

* Ciitzen Experience--

* Reason--Jim Goude, Lewis County Health District, Washington

Chemical (inorganic &/or organic) Contamination Problem
(e.g. pesticides, nitrates, solvents, etc.)

* Citizen Experience--David Bricklin, Attorney

* Reason--Larry West, Sweet Edwards & Associates

Petroleum Contamination Problems

+ Citizen Experience--(a hospital in Boise, Idaho)

* Reason--Michael Warfel, Hydrogeologist, Hart-Crowser & Associates

Groundwater Problems Experienced (cont.)

Depletion Problems

§ Citizen Experience--Mr. Pat Kilgore, Stage Coach Gulch Ranch, Pendleton, Umatilla County, OR

+ Reason--(Oregon geologist)

AUDIENCE QUESTION & ANSWERS/COMMENTS

"Its My Water!" (Groundwater Rights & Ownership!)

Moderator: (Suggested: Wick Dufford, Attorney)

* Private Interest Groups--Mary Burke, Washington Cattlemen's Assn.

+ Tribal Interests--Roger Jim, Chair, Yakima Tribal Council

+ Public Interest Groups in the PNW--

+ How Water Rights Are Handled in the PNW--Attorney or Law Professor (several suggested including Philip Rossier, Idaho Atty General and Western States Water Council)

AUDIENCE QUESTION/ANSWERS & COMMENTS

LUNCH

WHO DOES WHAT IN GOVERNMENT

Moderator: (Suggested) Ernesta Barnes, Administrator, Region X, U.S. EPA

National Perspective on Ground Water
(To include mandate, budget, etc.)

§ Honorable Bruce Babbitt, Governor of Arizona invited for this or alternate spot, several alternates suggested)

What State Legislatures Are Doing and Roles

§ Senator Mary Lou Reed, Idaho State Legislature

Who Is Doing What in States and What Is Done to Coordinate Among State Agencies

+ Groundwater Quantity--

+ Groundwater Quality--

Who Is Doing What in States and
What Is Being Done to Coordinate
Among State Agencies (cont.)

Citizen Response Representing all environmental organizations--

David Ortman, Friends of the Earth

Local & Tribal Governments

Ground Water Quality Issues and Quantitative Issues

+ Municipal--

+ County--

* + Tribal--

Wrap Up/Overview

AUDIENCE QUESTION/ANSWERS AND COMMENTS

(Dinner on own)

EVENING 7:30 or 8:00 pm: Radioactivity/Groundwater: A special program is being planned (also to be open to public who may not be registered for the conference.)

Saturday June 15:

8:15 AM + SPOKANE FLOOD PRESENTATION Narrative slide program
(Set stage for G.W. quantity and quality.)

+ MANAGEMENT STRATEGIES: Overview:

Ground Water Quantity (case histories)

+ Columbia Basin
Ground water depletion in terms of agriculture, irrigation & recharge (has appliction to quality, but major emphasis on quantity.)

+ Coastal Areas (groundwater limits on growth, or growth pressures on groundwater). Vashon Island (King County, WA) and San Juan Isalnd, WA (ground water depletion & population growth--land use decisions; salt water intrusion.)

Management Strategies (cont.)

Ground Water Quality (Management Case Studies)
(Discuss technical aspects and what management alternatives are available.)

* Non Point Sources--Ken Lustig, Director
Panhandle Health District, Idaho

--Waste treatment:
Septic tanks
Land application of waste
Water & sludge
--Agriculture:
Pesticides, herbicides, fertilizer
--Home Owner:
Fertilizer/weed killer/waste oil dumping,
Storm water runoff

+ Commercial/Industrial. Operations and waste water handling disposal. (Tacoma-Pierce County speaker)

+ Underground storage tanks and Solid Waste
Fuels/hazardous materials, etc.

AUDIENCE RESPONSE with QUESTIONS & ANSWERS/with morning panelists, and

+ Citizen--(Oregon Environmental Council)

+ Small Government--

+ Small Business--

+ Tribal Representative--

LUNCH

+ THE FUTURE IS NOW (e.g. Global Aspects) (National Speaker)
Possibly from Environmental & Energy Study Institute, E & E Study Conference (Wash. DC) or Conservation Foundation (see note).

(Cont. page 5)

How To Prevent Ground Water Contamination & Depletion

e.g + High Tech Industry--

+ Chemical Industry--

+ Stewardship (Tribal)--

+ Agriculture (e.g. Integrated Pest Management)--

* Legislative/Political--Representative Ebersole, Washington State

+ Citizen--Jean Auer, LWV of California

+ Water Purveyor--

AUDIENCE QUESTIONS/ANSWERS & COMMENTS/IDEAS)

CLOSING ADDRESS (National speaker/?) (see note)

NOTE: Possible national speaker: Senator Slade Gorton is co-chair of the Environmental and Energy Study Conference; Congressman Tom Foley is lead sponsor of HR 944 (to protect groundwater).

Copy

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

Institute for Environmental Studies
Engineering Annex, FM-12
(206) 543-1812

April 2, 1985

MEMORANDUM TO: Ground Water Conference Distribution List

Polly Dyer

FROM: Polly Dyer, Continuing Environmental Education Director

You have received copies of various program outlines for the Regional Conference on NORTHWEST GROUND WATER - THE INVISIBLE RESOURCE, as they have evolved during the last year. Enclosed is the final program, together with a copy of the Advance News Release being sent to editors of monthly and quarterly newsletters, journals, magazines, and calendars. (You are welcome to make copies for distribution to agency and organizational publications you know about.) The conference will be June 14 and 15, in Tacoma's Bicentennial Pavilion, operated by the Sheraton-Tacoma Hotel.

The final registration fee will be determined by mid-April. Financial assistance is being sought to enable the fee to be low enough so that more people can afford to attend and become informed, or at least aware, that ground water is a major resource area needing more attention. (a registration fee not to exceed $25 is the goal; meals would be extra. To cover all conference costs a minimum registration would need to be around $100 to $150.) Contributions from your agency or organization, or others you think would be willing to help, are tax deductible, made to the University of Washington. To date the Tacoma Department of Public Utilities is contributing $2500, part of which may help defray the planned June 13th field trip, with a separate fee.

Overnight Accomodations: The Sheraton-Tacoma Hotel will offer a special rate, somewhat lower than its regular room rates. In addition, members of the League of Women Voters of Tacoma will open their homes for Bed & Breakfast, at a cost to be determined. We are also talking to some other groups in the Tacoma area about "sleeping bag space" for conference attendees.

EXHIBITS are solicited. Films/slides can be included. Send requests for exhibit space to me, and these will be transmitted to Exhibits Co-Chair Mike Warfel of Hart-Crowser & Associates.

Brochure copying is to go to the printer the third week of April. It would be appreciated if you could let me know how many brochures you could distribute directly, or how many mailing labels you could furnish for mailing from the University of Washington. Target date for mailing brochures at third class, bulk postage rates is the first week of May.

We appreciate the comments and advice of the long-distance committee members, even though you couldn't attend face-to-face meetings. Thanks for your interest. We hope that you can come to the June discussions on Ground Water in the Northwest - the Invisible Resource.

PD:jd
Enc.

*****

P.S. CORRECTIONS TO DRAFT PROGRAM ENCLOSED:

Page 1: correct spelling under Biological Contamination:

Jim Goode

Page 3: Ground Water Quantity (Case histories)

Change Coastal Areas to read:

(groundwater limits on growth, or growth pressures on groundwater)

Vashon Island (King County, WA) and San Juan and Island Counties (WA): (ground water depletion & population growth -- land use decisions; salt water intrusion.)

April 1, 1985

ADVANCE NEWS RELEASE

Institute for Environmental Studies
Mail Stop FM-12
Seattle, Washington 98195
(206) 543-1812

Contact: Polly Dyer/JoAnn Drake

TO: Editors, NEWSLETTERS, JOURNALS, MAGAZINES, CALENDARS

NORTHWEST REGIONAL CONFERENCE ON GROUND WATER--THE INVISIBLE RESOURCE

A public conference on GROUND WATER--THE INVISIBLE RESOURCE, will be held in Tacoma, Washington, June 14 & 15, 1985, at the Bicentennial Pavilion/Sheraton-Tacoma Hotel. A field trip on June 13 will demonstrate some of the ground water problems in the vicinity of Tacoma and Pierce County.

Ground Water, emerging as a nationwide policy issue, is receiving attention in Congress as well as State Legislatures in the Pacific Northwest. Invited to speak at June's N.W. Conference on Ground Water is Governor Bruce Babbitt of Arizona; Governor Babbitt chairs the Ground Water Committee of the National Conference of Governors and is also a member of the newly-formed National Ground Water Policy Forum.

Planned for a broad cross section of the public, this Ground Water Conference will explore what is happening in Idaho, Oregon, and Washington: Where is ground water? How much? Who has rights or ownership to ground water? Is it being depleted (or "mined")? If so, can it be recharged? What about ground water contamination; is pollution a problem; if so, can we clean it up? How do we prevent it from being contaminated? In Idaho 88% of the population depends on ground water; in Oregon it's 56%, and in Washington State ground water supplies 44% of all its fresh water needs. A special session is planned for Friday evening, June 14, about radioactivity in relation to ground water.

CO-SPONSORS (With representatives on the conference planning committee) are the Institute for Environmental Studies and Dept. of Civil Engineering of the University of Washington; Washington

--More--

Institute for Environmental Studies
Mail Stop FM-12
Seattle, Washington 98195
(206) 543-1812

State Departments of Ecology and Social & Health Services; U.S. Environmental Protection Agency, Region 10; Leagues of Women Voters of Washington, Oregon, and Idaho; City of Tacoma Departments of Public Utilities and Planning; Tacoma/Pierce County Health Department; North West Friends of the Earth; City of Moses Lake; Sierra Club; Hart-Crowser & Associates; Spokane's Water Quality Management Program "208"; Confederated Tribes of the Yakima Nation; Chevron USA; Washington Water Research Center; American Planning Association, Washington Chapter; and the Washington Chapter of the American Water Resources Association. A number of other agencies and organizations are Cooperators.

FOR INFORAMATION AND BROCHURES (ready first week of May):

Polly Dyer, Continuing Environmental Education Director
Institute for Environmental Studies, FM-12
University of Washington, Seattle, WA 98195

OR

Telephone Ms. JoAnn Drake, IES, UW, at 206/543-1812

--End--

United States
Environmental Protection
Agency

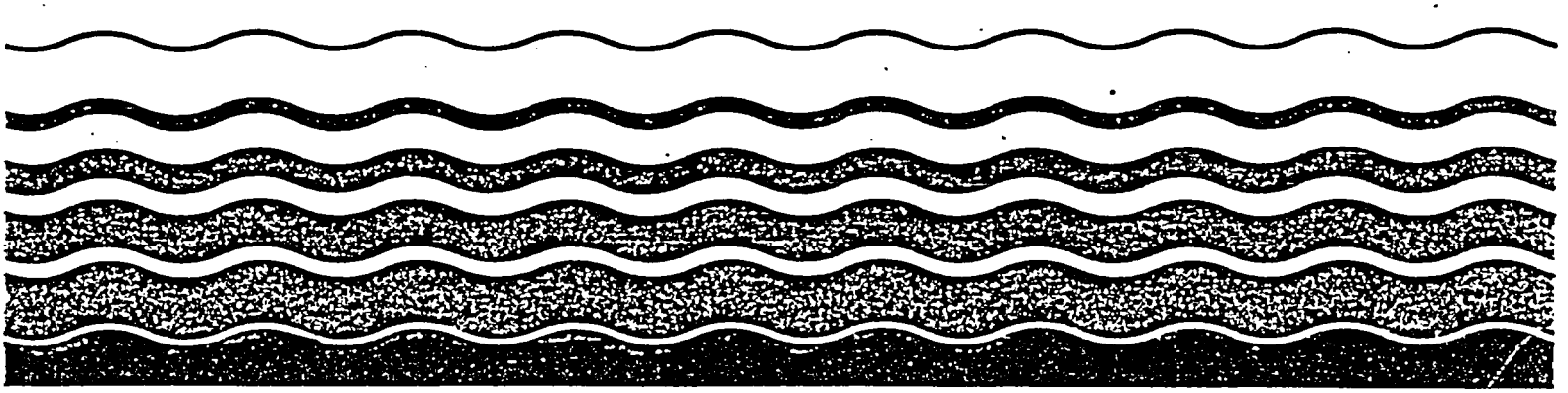
Office of
Ground-Water Protection
Washington, DC 20460

August 1984

Water

EPA

Ground-Water Protection Strategy



CHAPTER I: EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

In the last decade the public has grown increasingly aware of the potential problem of ground-water contamination. Reports of chemicals threatening drinking water supplies have mobilized State, local and Federal governments to respond. But these responses suffer from a lack of coordination among responsible agencies, limited information about the health effects of exposure to some contaminants, and a limited scientific foundation on which to base policy decisions.

Officials at all levels of government have begun to look for a definable strategy to protect ground water. The strategy presented here will provide a common reference for responsible institutions as they work toward the shared goal of preserving, for current and future generations, clean ground water for drinking and other uses, while protecting the public health of citizens who may be exposed to the effects of past contamination.

EPA Administrator William D. Ruckelshaus recognized the need to protect ground-water quality as a national concern. In response, Deputy Administrator Alvin L. Alm formed a Ground-Water Task Force to: (1) identify areas of serious inconsistencies among programs and institutions at the State, local and Federal levels; (2) assess the need for greater program coordination within EPA; and (3) help strengthen States' capabilities to protect ground-water resources as they themselves define the need. In line with EPA's mission to preserve and enhance environmental quality, this strategy document focuses on issues of ground-water quality.

(Issues of water quantity and allocation are also important, but they are outside the province of EPA. Many ground-water quality issues (for example, salt-water intrusion) are closely related to issues of ground-water quantity and allocation. States will have to approach such issues through integrated policies; topics relating primarily to quantity and allocation are not addressed in this document. With respect to EPA activities the scope and intent of this document includes only EPA's statutory and regulatory authority.)

The Task Force was composed of staff from each affected EPA Program Office and two EPA regions. The Office of Water chaired the group. Beginning work in June 1983, the Task Force delivered a draft report to the Deputy Administrator on September 1, 1983. He sought the views of senior Agency policy-makers by meeting with the involved Assistant Administrators and their key staff on many occasions to discuss the report and its implications.

As options began to narrow, this senior policy group requested additional analyses from the Task Force, consulting with Regional Administrators as it proceeded. At length, after concerted debate and broad-scale Agency involvement, the main policy elements for an EPA Ground-Water Protection Strategy emerged. Draft conclusions were discussed with Congressional staff, State organizations, and environmental and industry organizations.

A draft strategy resulting from that decision process was then distributed to State officials and to select State, business and industry, and environmental organizations for comment. Approximately 150 organizations submitted comments. After receiving comments from these interested parties, EPA revised the draft strategy for final consideration by the Deputy Administrator and Assistant Administrators. This final Ground-Water Protection Strategy is the product of that deliberation process.

A Perspective on Ground Water

In the 1970's, national environmental concern focused mainly on natural resources and pollutants we could see or smell. Surface water and air quality, specific types of contaminants such as pesticides, or obvious sources of contamination such as uncontrolled hazardous waste sites, were of primary concern. People concerned themselves only rarely with ground water since, hidden from view as it is, few knew or really understood how seriously the resource was being compromised.

Today, ground-water contamination looms as a major environmental issue of the 1980's. The attention of agencies at all levels of government, as well as that of industry and environmentalists, is now focused on this vital resource. As contamination has appeared in well water and wells have been closed, the public has expressed growing concern about the health implications of inappropriate use and disposal of chemicals. As concern has increased, so have demands for expanded protection of the resource.

Our understanding of the sources and dimension of the threat is limited, but increasing. Scientists can now measure specific

organic chemicals at the parts-per-billion or -trillion levels. As new health studies are completed and as we learn more about various sources of ground-water contamination, our capacity to deal with this problem increases. Scientists and engineers have also learned more about how contaminants move in the subsurface -- which ones bind to soils and which ones pass through to the water table beneath. They are now identifying technologies to prevent, control, and clean up ground-water contamination.

Major Authorities and Responsibilities

The Task Force reviewed EPA's statutory authority as it relates to ground water and examined the current scope and extent of State programs as well. While the nature and variability of ground water makes its management the primary responsibility of States, the Task Force found that a number of Federal authorities exist to support States in the effort.

Since these Federal statutes were enacted at various times for separate purposes, inconsistency developed in EPA's regulations and in the decisions made under them. While these differences are often necessary and reasonable, there are a number that appear to hinder a cohesive approach to ground-water protection. Improving harmony among EPA's program rules affecting ground-water protection is an important need, since inconsistency in such matters leads to confusion and less effective protection than if roles, requirements, and responsibilities are clear and consistent.

In addition to its own authorities, EPA found a variety of powerful State and local statutes available for use. A number of States have begun their own programs for ground-water protection, some built on permits supported by a system of aquifer classification. Continuing the development of State programs in this area is vital, as they have the basic responsibility for the protection of the ground-water resource.

Strategic Concerns

Given public concerns, EPA, as well as State and local governmental agencies, must decide how best to protect public health and critical environmental systems. It seems clear to many that we must direct our energies to minimize future contamination, even as we detect and manage contamination associated with past activities.

Protecting ground water will be difficult. Starting with limited knowledge of the resource and limited means to address existing or potential problems, we must expend our efforts where

groundwater contamination would cause the greatest harm. Consequently, we assign highest priority to those ground waters that are currently used as sources of drinking water or that feed and replenish unique ecosystems.

Ground-water protection is a very complex and difficult issue. It will require sustained effort at all levels of government over a long period of time before this resource will be adequately protected. Within this context, EPA developed its Ground-Water Protection Strategy.

EPA's Ground-Water Protection Strategy

The EPA Strategy includes four major components that address critical needs. They are:

- Short-term build-up of institutions at the State level;
- Assessing the problems that may exist from unaddressed sources of contamination--in particular, leaking storage tanks, surface impoundments, and landfills;
- Issuing guidelines for EPA decisions affecting ground-water protection and cleanup; and
- Strengthening EPA's organization for ground-water management at the Headquarters and Regional levels, and strengthening EPA's cooperation with Federal and State agencies.

These components, described in detail in Chapter IV, are summarized below.

EPA will provide support to States for program development and institution building. EPA will encourage States to make use of certain existing grant programs to develop ground-water protection programs and strategies. These funds will support necessary program development and planning, the creation of needed data systems, assessment of legal and institutional impediments to comprehensive State management, and the development of State regulatory programs such as permitting and classification. Regional Administrators will work with Governors so that funds are directed to the State agency or programs with the most complete authority and capability to undertake or continue statewide program or strategy development. EPA will also provide State agencies with technical assistance in solving ground-water problems and will continue to support a strong research program in ground water.

EPA will address contamination from underground storage tanks. Because the evidence suggests that leaking storage tanks--particulary from gasoline--may represent a major, unaddressed source of ground-water contamination, the Deputy Administrator has directed the Office of Toxic Substances to design a study to identify the nature, extent, and severity of the problem. EPA is investigating the application of the Toxic Substances Control Act (TSCA), as well as other authorities, as a potential legal basis for applying appropriate requirements on design and operation of these tanks. In the meantime, the Agency will issue chemical advisories to alert owners and operators about the problem and work with States and industry to develop voluntary steps to reduce contamination. EPA is also planning direct regulation of underground storage of hazardous waste under the Resource Conservation and Recovery Act (RCRA).

EPA will study the need for further regulation of land disposal facilities, including surface impoundments and landfills. EPA, in cooperation with the States, will conduct studies of impoundments and landfills as to the degree of danger they present, set priorities for control, review the regulatory options available, and determine if additional Federal controls are needed.

EPA will adopt guidelines for consistency in its ground-water protection programs. The guidelines will be based on the policy that ground-water protection should consider the highest beneficial use to which ground water having significant water resources value can presently or potentially be put. Under this policy, the guidelines define protection policies for three classes of ground water, based on their respective value and their vulnerability to contamination. These guidelines are intended to provide a framework for the decisions that EPA and States will have to make in implementing EPA programs. The guidelines will be used by EPA and the States to make decisions on levels of protection and cleanup under existing regulations, to guide future regulations, and to establish enforcement priorities for the future. (These regulations will then provide the legal basis for the implementation of the guidelines. It is not intended that any substantive or procedural rights are provided by this Strategy.)

The classes of ground water are as follows:

Class I: Special Ground Waters are those that are highly vulnerable to contamination because of the hydrological characteristics of the areas under which they occur and that are also characterized by either of the following two factors:

a) Irreplaceable, in that no reasonable alternative source of drinking water is available to substantial populations; or

b) Ecologically vital, in that the aquifer provides the base flow for a particularly sensitive ecological system that, if polluted, would destroy a unique habitat.

Class II: Current and Potential Sources of Drinking Water and Waters Having Other Beneficial Uses are all other ground waters that are currently used or are potentially available for drinking water or other beneficial use.

Class III: Ground Waters Not Considered Potential Sources of Drinking Water and of Limited Beneficial Use are ground waters that are heavily saline, with Total Dissolved Solids (TDS) levels over 10,000 mg/L), or are otherwise contaminated beyond levels that allow cleanup using methods reasonably employed in public water system treatment. These ground waters also must not migrate to Class I or II ground waters or have a discharge to surface water that could cause degradation.

EPA will accord different levels of protection to each class as described in the examples below. Chapter IV describes in more detail the regulatory approaches EPA will take to protect these ground-water classes under each statute.

To prevent contamination of Class I ground waters EPA will initially discourage by guidance, and eventually ban by regulation, the siting of new hazardous waste land disposal facilities over Special Ground Waters. Some restrictions may also be applied to existing land disposal facilities. Further, Agency policy will be directed toward restricting or banning the use in these areas of those pesticides which are known to leach through soils and are a particular problem in ground water. EPA's general policy for cleanup of contamination will be the most stringent in these areas, involving cleanup to background or drinking water levels.

Ground waters that are current and potential sources of drinking water (Class II) will receive levels of protection consistent with those now provided for ground water under EPA's existing regulations. In addition, where ground waters are vulnerable to contamination and used as a current source of drinking water, EPA may ban the siting of new hazardous waste land disposal facilities, initially through guidance, and later through regulation. While EPA's cleanup policy will assure drinking water quality or levels that protect human health, exemptions will be available to allow a less stringent level under certain circumstances when protection of human health and the environment can be demonstrated. EPA may establish some

differences in cleanup depending on whether the ground water is used as a current or potential source of drinking water or for other beneficial purposes.

Ground waters that are not considered potential sources of drinking water and have limited beneficial use (Class III) will receive less protection than Class I or II. Technology standards for hazardous waste facilities generally would be the same as for Class I and Class II. With respect to cleanup, should the hazardous waste facility leak, waivers establishing less stringent concentration limits would be considered on a case-by-case basis. Waivers would not be available, however, when a facility caused the contamination that precluded future use. EPA's Superfund program will not focus its activities on protecting or improving ground water that has no potential impact on human health and the environment.

To improve the consistency and effectiveness of EPA's current ground-water programs, the guidelines will be incorporated into each of the Agency's relevant program areas. Many of these programs are delegated to the States, and for most programs, States must demonstrate that their programs are "no less stringent" than the Federal program in order to qualify for authorization to implement the programs. However, in implementing these guidelines EPA will provide as much flexibility to the States as is possible under state delegation agreements.

Consequently, EPA will to the extent possible keep regulatory requirements based on EPA's ground-water protection guidelines general and performance-oriented. EPA will, in addition, develop guidance to accompany such regulations for use by EPA when EPA directly administers a program in a State (e.g., implementation in a non-delegated State or implementation of a program which cannot be delegated). Such accompanying guidance would not be binding on the States, but it could also be used by the States to assist them in developing their own regulatory requirements or guidelines. This guidance will, for example, define more precisely the meaning of the terms used in the Strategy, such as "vulnerable and unique habitat".

The task of actually determining whether the ground water in a particular location fits the criteria for Class I, II, or III will be a site-specific determination. In programs involving permits, such as RCRA and Underground Injection Control (UIC), for example, this determination will be made during the permitting process based on data supplied by the permit applicant. In cleanup actions under Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the ground-water class will

be determined in conjunction with the assessment of the extent of contamination. Where States have already mapped or designated ground water for that location, the State classification of the ground water will provide useful guidance.

EPA will improve its own institutional capability to protect ground water. EPA has assigned ground-water coordination and development responsibilities to the Assistant Administrator for Water and he has established an Office of Ground-Water Protection to oversee the implementation of this Strategy. The Director of that Office has already started to work with other EPA offices and Regions to institutionalize EPA and State ground-water roles, plan for correction of uncontrolled sources of contamination, identify and resolve inconsistencies among EPA programs, and learn more about the nature and extent of ground-water contamination.

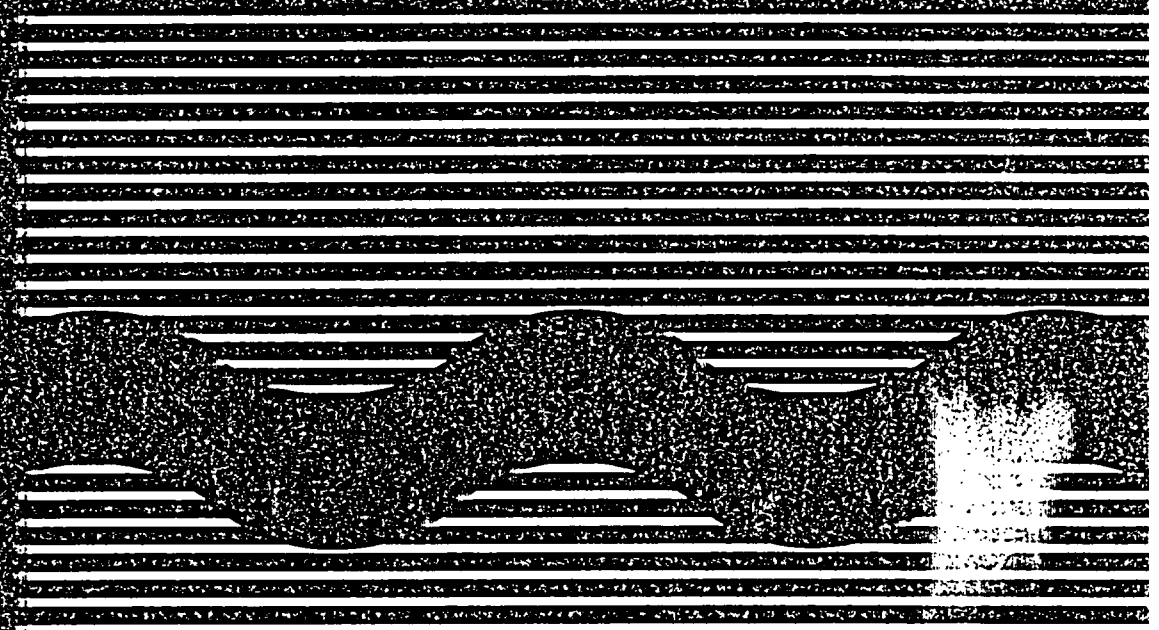
EPA Regional offices are also in the process of establishing Regional ground-water units. They will coordinate Regional ground-water policy and program development and assist the States through grants and technical assistance designed to increase their institutional capabilities to manage ground water.

EPA will carry out this Strategy in partnership with other Federal agencies, especially the Department of Interior (DOI), to insure that the Strategy is implemented as effectively as possible.

The body of this report contains three chapters and an Appendix. Chapter II describes the nature and extent of ground-water contamination. Chapter III describes State and Federal programs for ground-water protection. Chapter IV describes EPA's strategy to protect ground water. The appendices include a matrix describing State, local, and Federal roles and a summary of the options considered by EPA in developing this Strategy.

* * * * * * *

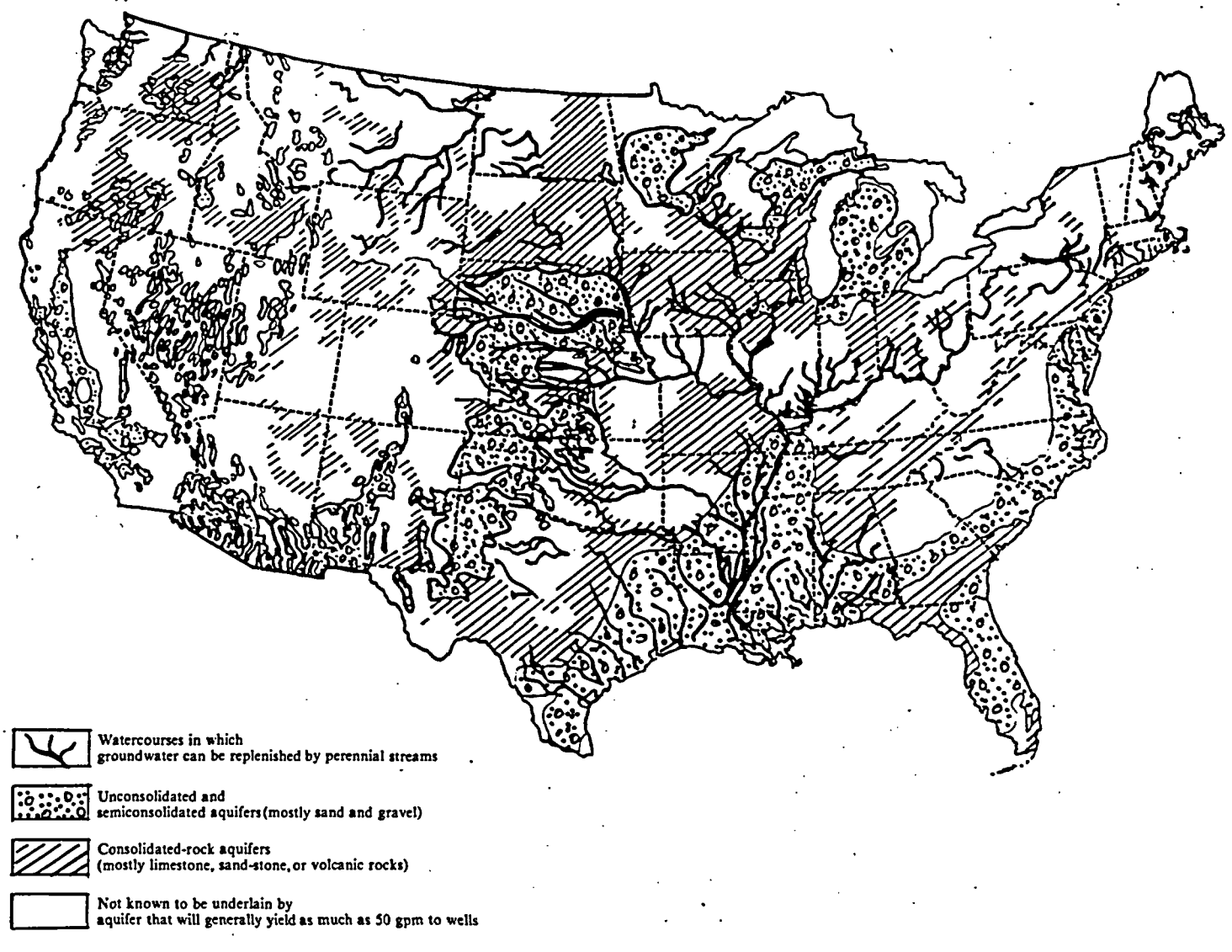
Groundwater



a community action guide

a Concern, Inc. publication

Major aquifers in the continental United States



Groundwater

a community action guide

CONCERN, INC.

This publication is made possible by grants from the Ruth Mott Fund, the Hillsdale Fund, and through the annual contributions of individual supporters.

June 1984

About This Booklet

In the United States almost half of us rely on groundwater for our domestic water needs. But, despite its importance to our lives and well-being, we are neglecting to manage this resource properly. In some areas serious depletion is taking place; in others, contamination from toxic chemicals, biological wastes, and other pollutants threatens groundwater supplies.

This booklet defines groundwater, the issues surrounding its use and misuse, and the urgent need for comprehensive management. It is the second booklet in Concern's series of community action guides. The first, *Hazardous Waste,* examines the extent of current improper management of hazardous materials. These booklets are intended to be used by individuals and groups everywhere as guides to gathering information and developing a local plan of action.

About Concern

Concern is a nonprofit, tax-exempt organization, founded in 1970, that provides environmental information to individuals and groups and encourages them to act in their communities. Concern publishes concise reports which define key environmental issues and contain suggestions for individual and group action. In many instances these reports have been the foundation for subsequent workshops, conferences, exhibits, and other educational activities. Concern's programs are supported by private grants and individual contributions.

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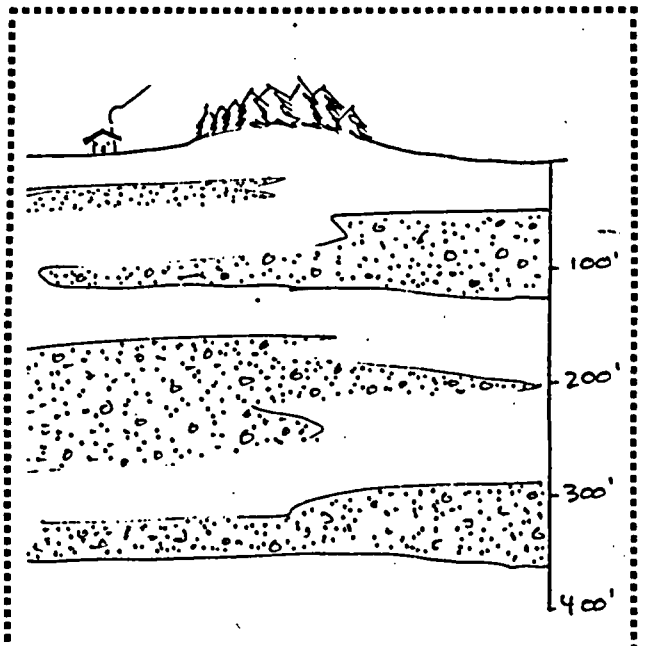
Contents

What is Groundwater?

Beneath the earth's surface lies our nation's greatest supply of fresh water. Representing 96% of our total water resources, groundwater constitutes the major source of drinking water for half our population. Once thought to be inexhaustible and safe from pollution, these reserves now face depletion and contamination. As instances of these problems are reported with increasing frequency around the country, public demand is mounting for improved management of this irreplaceable resource.

Many people envision groundwater as a series of lakes and rivers flowing beneath the surface of the earth and are surprised to learn that groundwater exists in permeable saturated zones of rock, sand or gravel called *aquifers.* These aquifers may cover only a few miles in overall area or they may extend over thousands of square miles—as does the Ogallala aquifer which reaches from South Dakota down to the plains of central Texas.



Cross-Section of Aquifers

Most groundwater originates as precipitation, percolates into the soil much as water fills a sponge, and moves from place to place along fractures in rock, through sand and gravel, or through channels in formations such as cavernous limestone. Constantly encountering resistance from the surrounding material, groundwater moves in a manner considerably different from that of surface water. Varying with the type of formation, its flow ranges from a fraction of an inch to a few feet per day. These movement characteristics are important to an understanding of groundwater contamination, since concentrations of pollutants called plumes will also move very slowly, with little dilution or dispersion.

"Unconfined" aquifers are the most susceptible to contamination. These aquifers are not protected by an overlying layer of impermeable material and may occur fairly close to the land surface. The volume of water available in unconfined aquifers will fluctuate with usage and with seasonal replenishment or "recharging" of the source by precipitation.

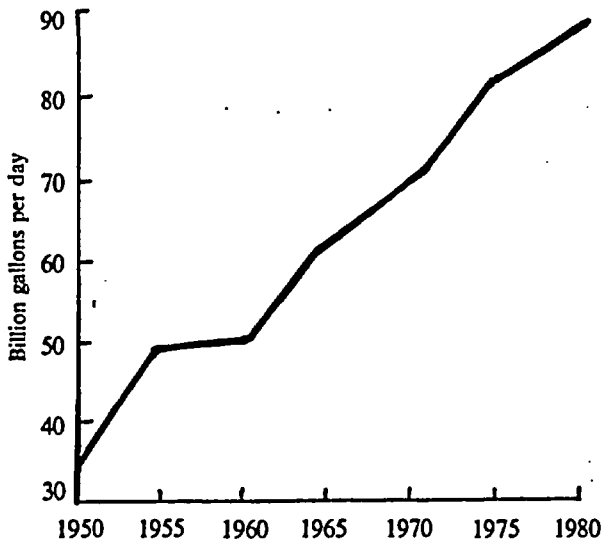
In contrast to this type of aquifer is the "confined" aquifer which is bounded on top and below by layers of relatively impermeable material. Confined aquifers generally occur at greater depths and their impermeable layers may offer a certain measure of protection from contamination. Some confined aquifers have no recharge zone at all and must be recognized as a finite resource which cannot be replenished.

Many types of human activities disrupt the natural equilibrium of an aquifer, affecting both the quality and the quantity of groundwater. Increased extraction of water in one area of an aquifer can affect availability in another; diversion of streams and draining of wetlands can change the location and amount of water absorption; paving for buildings, roads, and parking lots can prevent water from entering the soil and eventually recharging the aquifer;

changes in the type or amount of vegetation grown on the surface can alter water circulation, as can flooding or prolonged drought.

Population pressure, increased per capita use, and contamination of surface supplies have forced many communities to turn to groundwater. Estimates are that almost half the people living in the United States today rely solely on it for their domestic needs. Of course, people have been digging wells and pumping water out of the ground for centuries. It is the current scale of dependence on groundwater that is new.

More than two-thirds of all groundwater extracted is used for agricultural purposes, especially in Western states where farmers depend particularly heavily on it to irrigate their crops. Since 1960, groundwater withdrawals have doubled, creating severe problems of supply in many areas; contamination from industrial, agricultural, and commercial activities has rendered many existing supplies unusable.



Groundwater withdrawals in the U.S.

Source: U.S. Geological Survey

Percentage of population relying on groundwater

State	Total Users	Public Supply Users	Rural Users
Alabama	59	38	100
Alaska	63	49	74
Arizona	71	66	100
Arkansas	67	49	100
California	46	43	93
Colorado	23	16	87
Connecticut	37	24	98
Delaware	65	53	100
Florida	91	89	100
Georgia	70	38	98
Hawaii	87	95	14
Idaho	88	87	90
Illinois	38	36	82
Indiana	58	43	87
Iowa	82	75	100
Kansas	62	50	93
Kentucky	39	14	88
Louisiana	62	48	100
Maine	37	20	91
Maryland	30	12	100
Massachusetts	31	27	100
Michigan	38	20	100
Minnesota	67	55	100
Mississippi	90	85	100
Missouri	31	24	74
Montana	47	30	93
Nebraska	86	81	100
Nevada	64	60	97
New Hampshire	61	48	98
New Jersey	53	47	100
New Mexico	92	91	96
New York	32	25	100
North Carolina	60	25	99
North Dakota	66	48	99
Ohio	40	29	80
Oklahoma	40	28	85
Oregon	56	30	92
Pennsylvania	30	14	100
Rhode Island	33	25	100
South Carolina	61	18	100
South Dakota	79	69	94
Tennessee	51	38	100
Texas	58	50	100
Utah	58	53	99
Vermont	56	35	96
Virginia	34	14	98
Washington	44	38	78
West Virginia	53	32	97
Wisconsin	64	49	100
Wyoming	61	52	89
District of Columbia	0	0	0
Puerto Rico	26	17	80

Source: US EPA

Availability and Depletion

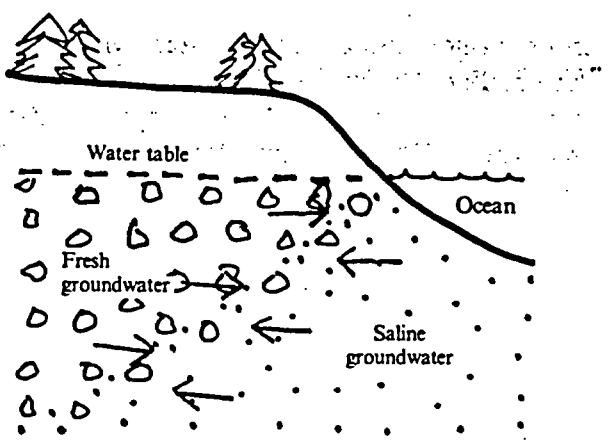
All states depend in varying degrees on groundwater resources. Arizona, Texas, Oklahoma, Kansas, Nebraska, Mississippi, Delaware, Hawaii, and Florida use more groundwater than surface water. Water consumption is expected to continue to keep pace with population growth in coming decades. If populations in the whole Southwest and the "sunbelt" states of Texas, California, and Florida expand, as census predictions suggest, the already stressed groundwater reserves in these areas could be depleted. With no change in management policies, severe shortages can be expected.

Availability is largely determined by geological characteristics and economic considerations. Climate also plays a role. In dry areas where annual precipitation is less than 10 inches, surface evaporation may exceed rainfall. In these areas and others where pressure from population and economic growth exists, groundwater depletion is a potentially critical problem.

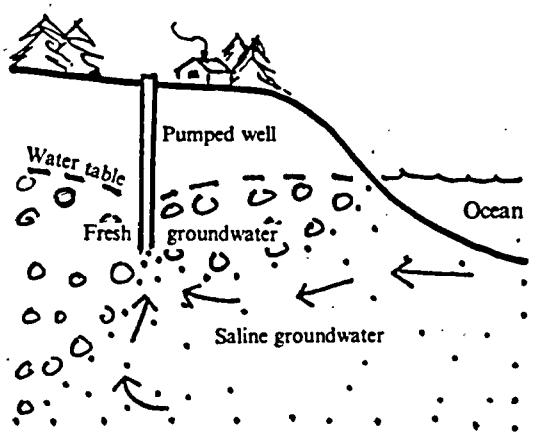
Groundwater depletion, longstanding in some areas and only now emerging in many others, is due to the overdrafting of aquifers, which means that the rate of water withdrawal exceeds the rate of recharge. This net extraction of water, particularly prevalent in the western and southwestern states, is often called "water mining," a practice that can eventually lead to depletion of an aquifer, or at least a lowering of the water table below the point at which extraction is economically feasible. When this occurs, groundwater ceases to be a renewable resource in that area. In those western states where a steady water supply is a matter of life or death for communities, the way in which groundwater resources are managed may spell the future economic fate of the entire region.

Exploiting a life-sustaining resource so as to bring about its eventual depletion is a serious problem in itself, but a number of other environmental problems also result. The lowering of the water table in an aquifer can make the aquifer more vulnerable to encroachment from outside bodies of water. This can be disastrous if the entering waters are saline, as in the case of sea water, or polluted, as is the case with many rivers and streams. Concentrations of salts, minerals, and other materials may increase to a level at which the aquifer is unsuitable for certain uses, such as drinking and irrigation.

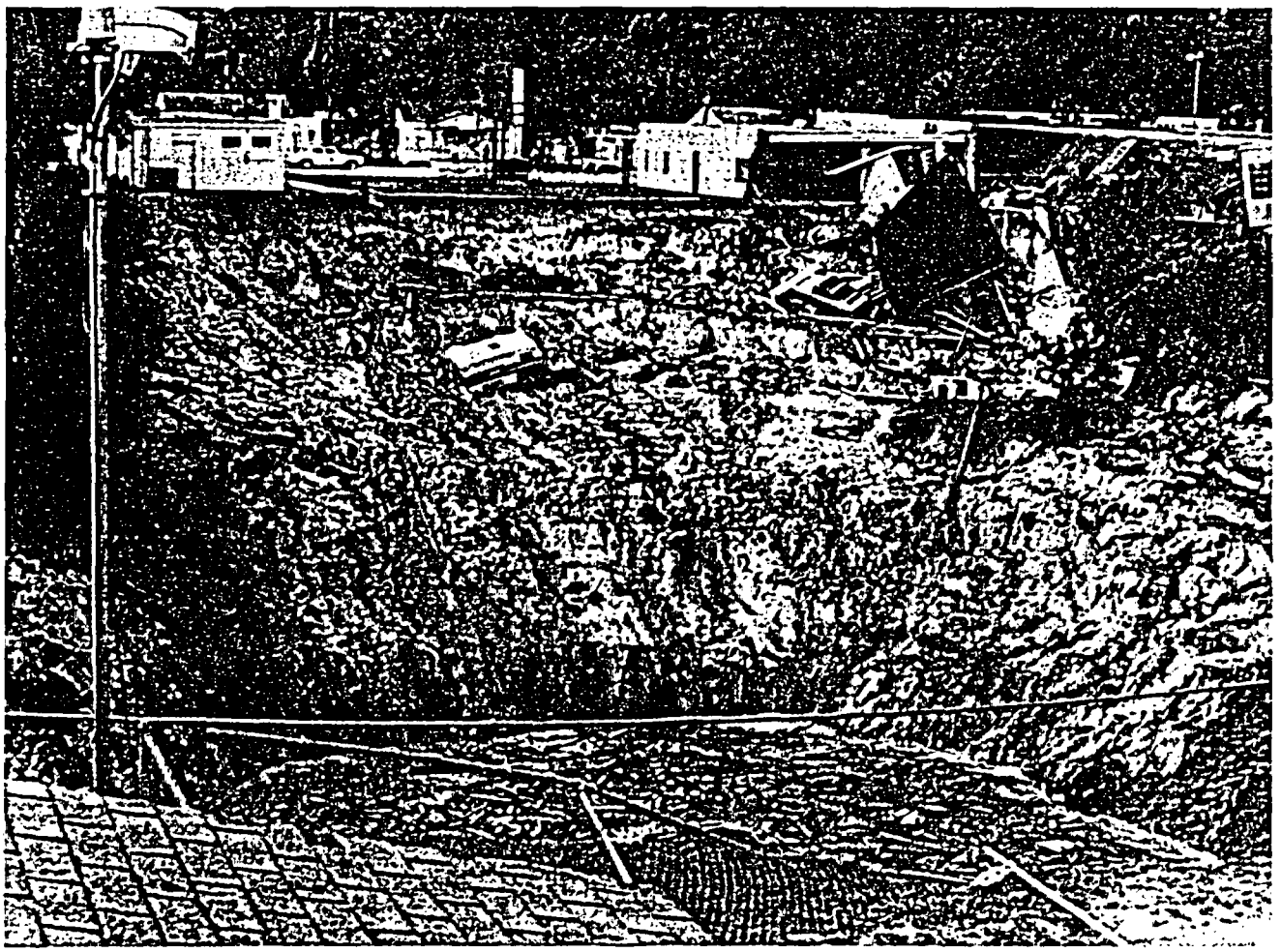
Another serious side-effect of groundwater overdraft is land subsidence, which may occur when large volumes of water are extracted from an aquifer without sufficient recharge. Subsidence occurs because water pressure in the pores of the aquifer supports, to some extent, the weight of the overlying earth. When significant amounts of water are withdrawn, the decline in



NATURAL CONDITIONS
Stable relationship of fresh groundwater to saline groundwater in a coastal area



SALT INTRUSION
Salt water intrusion caused by reduction of fresh water aquifer



A sinkhole disaster in Florida

Photo: US Geological Survey

pressure allows the particles of rock to settle together slightly. Eventually this effect is transmitted over a large area to the ground surface and subsidence occurs. In Dallas and Galveston, Texas, such shifts have caused damage to buildings, roads, and bridges; in areas of California's highly productive San Joaquin Valley, subsidence of up to 30 feet has made the land more exposed to flooding and drainage problems; in urban areas like Phoenix, Arizona, damage to underground well casings, cables, and sewer pipes has decreased sewage flow capacity and increased maintenance cost. Subsidence also reduces the overall volume of the underlying aquifer so that even if recharge should take place former levels of supply could never be maintained.

The development of sinkholes, a natural phenomenon in areas containing soluble rock, seems to be aggravated by increased extraction of groundwater. More and more incidents of this have been reported: in Alabama, Georgia, Tennessee, and Florida in the Southeast; Pennsylvania in the East; and Missouri in the Midwest. Because these collapses happen suddenly, injuries as well as property damage are likely to occur. Introduction of pollutants from the surface may also contaminate the groundwater. Since the geological characteristics of most regions are known, and the amount of extraction quantified, sinkholes could be prevented.

Quality and Contamination

Groundwater naturally contains organic substances, minerals, sediment, bacteria, and viruses. Its properties (hardness, salinity, pH, turbidity, color, taste, and odor) can be measured by units of concentration. Depending on its intended use—domestic, agricultural, or industrial—recommended concentrations vary. When these concentrations are exceeded, the water is said to be contaminated. The degree to which aquifers are affected depends in part on geology, permeability of soils, climate, depth of groundwater, the type and intensity of human activities on the surface, and the interaction of contaminants as they percolate through the soil.

Natural contaminants include chlorides, radioactivity from uranium in the ground, arsenic such as that found in the thermal springs in the Northwest, and concentrated salts from heavy irrigation in arid areas and where the water table may be near the surface as in parts of the West and Southwest.

It is, however, man-made contamination from most of our "accepted" waste disposal practices that is responsible for the incidents of groundwater contamination throughout the United States. Primary pollution sources include:

- industrial impoundments
- land disposal sites
- septic tanks
- oil drilling
- mining
- municipal wastewater

Discarded chemical products, as well as wastes from their manufacture, end up in many of the 18,500 landfills spread across the nation. Wastes from smaller commercial enterprises (printers, dry cleaners, gas stations) are also disposed of in this manner, as is sewage sludge, a product of the sewage treatment process, which may contain heavy metals or organic chemicals. Across the country, toxic wastes which have leached from these municipal and industrial landfills are being discovered in underlying aquifers.

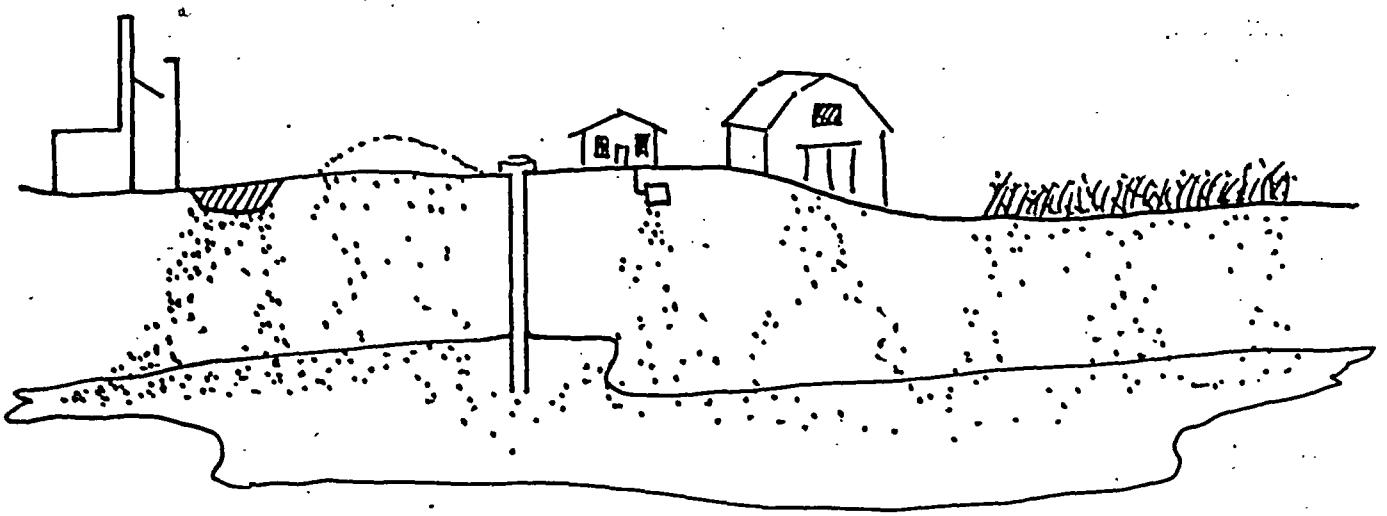
In addition to landfills, 180,000 wastewater impoundments (ponds, pits, lagoons) have been built to store wastes. About 23% of them contain hazardous substances such as heavy metals, oil, organic compounds, and pathogenic organisms. Often overlying aquifers, many of these sites are unlined and unmonitored.

Polluted water draining from a cattle feed lot

Human wastes from septic fields and livestock wastes from feedlots are also seeping into these underground areas. In agricultural areas, pesticides, herbicides, and fertilizers, thought until recently to break down in soil, are polluting both surface and groundwater.

Drilling and mining operations are also responsible for introducing contaminants into groundwater. In oil and gas production, for every barrel of oil extracted, 10 to 100 times as much brine is produced. Formerly this liquid was emptied into unlined pits. Now it is often injected deep into the ground. Once thought to be a fail-safe method of disposal, this technology is now being questioned as to its safety.

Spills from pipeline breaks and accidents in transportation contribute to the contamination problem. Acid mine drainage from coal and metal mining and radioactive waste from uranium mining, hospitals, utilities, and defense operations have contaminated groundwater in many states.



Aquifer contamination from industry, home and farm

Leakage from underground storage tanks (at gas stations and industrial plants) is also believed to be a major source of contamination. Huge quantities of salts used for de-icing roads in northern states are entering aquifers as well as surface water. The result of these two practices has been extensive contamination of thousands of wells affecting millions of people.

The potential gravity of this situation derives from the geological characteristics of aquifers. Unlike surface waters, aquifers are not visible. One cannot see or smell changes in them. No biological indications give a clue to alterations of quality. There is no early warning system.

Aquifers are not exposed to air or sunlight, nor do they have the free-flowing, self-oxygenating cleansing properties of surface water. Most water within the aquifers moves at an extremely slow rate so that if there is contamination, usually in the form of a plume, it spreads slowly and unpredictably. Pollutants tend to be more concentrated and, since there is little motion, may sink to the bottom and remain undetected by shallow monitoring.

A polluted aquifer is virtually impossible to clean. Preventing contamination is the only effective long-range solution.

Public Health Considerations

Microbial or chemical contamination of groundwater can result in disease and poisoning. Since the passage of the Clean Water Act of 1972, there has been a widespread decline in the presence of bacteria in both surface and ground waters, largely due to regulation of the effluent from specific point sources, such as sewage treatment plants.

In contrast, there has been a dramatic rise in the number and concentrations of toxics, in general, and of synthetic organic chemicals, in particular, in groundwater. These are generally colorless, tasteless, and odorless; expensive to test; unregulated and unmonitored. Even though the US Geological Survey in its 1984 study concluded that insufficient data exist to determine their full impact on groundwater quality and human health, it is known that many of these compounds are toxic, mutagenic, or carcinogenic and that water treatment does not necessarily remove them.

Although they are found in drinking water sources across the country, these synthetic

organic chemicals receive only minimal attention in the Safe Drinking Water Act—the *only* legislation that regulates water quality to protect human health. In fact, only 21 chemicals, of the thousands that exist, are included in the drinking water standards. With hundreds of new compounds being introduced into the environment each year, and more cases of contamination turning up, the regulation of these chemicals should be greatly accelerated.

Detection and Monitoring

A comprehensive monitoring system is part of sound groundwater management and central to the protection of human health. The United States does not have one.

Monitoring the water in aquifers on a regular basis can provide the data needed for trend analysis. Monitoring at waste disposal sites can track the presence of contaminants. Federal agencies such as the US Geological Survey and the Environmental Protection Agency—in addition to state water, geologic and health departments and public water suppliers—monitor groundwater in those situations prescribed by federal and state laws, but methods are limited and not coordinated. Furthermore, since so few maximum contaminant levels (MCLs) have been set by EPA, as prescribed by federal law, pollutants that have not been classified remain entirely unregulated.

Monitoring of the type, source, extent, and concentration of pollutants is made more difficult by the fact that, while moving down to the aquifer, substances can change chemically as they react with other substances in the soil. Testing, which must be done on an extensive and regular basis to be effective, is very expensive. Priorities are set within the restrictions of funding and personnel. At the same time, reporting of groundwater contamination and federal enforcement of standards has been limited. As a result, so little incentive exists for private industry and governments that voluntary compliance is now virtually nonexistent. In short, our failure to deal with groundwater deterioration only postpones and increases its eventual cost; only the will of the public can bring about government response.

Federal Legislation*

No one federal law or agency deals exclusively or even comprehensively with groundwater protection and management. Instead, numerous unrelated statutes address sources and types of contamination in very specific ways and with very few standards. Legally and administratively, these lack coordination. They generally deal with contamination after-the-fact, rather than with protection and prevention, and do not adequately identify the sources of contamination, leaving groundwater subject to diverse types of degradation.

Lack of commitment at the national level by Congress and the Executive agencies is reflected by inadequate funding, insufficient monitoring, poor regulatory follow-up, and lack of an overall legal framework with which to guide state and local policymakers and administrators. During the past years, the EPA has been devising and revising drafts of a national groundwater strategy. Its 1984 version primarily emphasizes guidelines (mostly organizational) for states to adopt, rather than the development of federal regulatory and enforcement capability. As a result, there are few incentives for states to protect aquifers, and little financial and technical assistance to carry out programs. Although internal administrative changes at the EPA are mentioned, integration of planning and implementation for water resources by all responsible agencies is not addressed.

*For a description of federal laws relating to groundwater, see Appendix.

Comprehensive management to protect our water resources is essential and should include:

- integrated management of surface and groundwater resources
- stringent regulation of the disposal of wastes
- comprehensive permit systems
- strong water conservation incentives
- land-use planning
- standards for the construction and operation of underground storage facilities and wells.

State and Local Legislation*

Traditionally, state and local governments have had the primary responsibility for groundwater use and protection; yet not one state has a truly comprehensive management system. In the absence of a federal model, each state has approached groundwater management with its own standards, regulatory mechanisms, and organizational structure, generally dividing the responsibility among two or more state agencies. Crisis-management, the usual response to groundwater problems, has proven totally inadequate and costly—a situation which may be the very stimulus needed to force states to consider the adoption of more foresighted

*For a description of state laws relating to groundwater, see Appendix.

"EPA has no coordination between setting standards under one program and correcting for those toxic requirements in other programs it regulates. Thus, the Toxic Substances Control Act (TSCA) enacted in 1976 regulates 53 substances which were tested and determined to be hazardous to human health. EPA under the Safe Drinking Water Act only regulates maximum contaminant levels of 21 substances. EPA has no apparent mechanism for forwarding the results of research from TSCA to incorporate in the Safe Drinking Water Act standards. This is just one example. There is little coordination between TSCA and the effluent guidelines established for industries under the Clean Water Act. The Resource Conservation and Recovery Act (RCRA) regulates 13 more substances than are controlled under the the Clean Water Act. There is no coordination between substances controlled in the water and airborne emissions under the Clean Air Act, such as benzene. The so-called manifest tracking systems were established under RCRA, but no system was established for the disposal of hazardous substances like PCBs regulated by TSCA. Finally, EPA has no way of identifying if an industry handling a hazardous substance is controlled by or has a permit under more than one regulatory program, such as RCRA, the Clean Water Act, Superfund, or the Clean Air Act. Often the facility is identified by its headquarters address, not the location of the actual discharge. This makes it hard to identify if a hazardous substance effectively controlled under one regulatory program is now being disposed of in another media; for example RCRA waste being disposed of into a sewer.

"Under such obvious lack of rudimentary coordination, it is clear that groundwater protection cannot be achieved and public health cannot be protected."

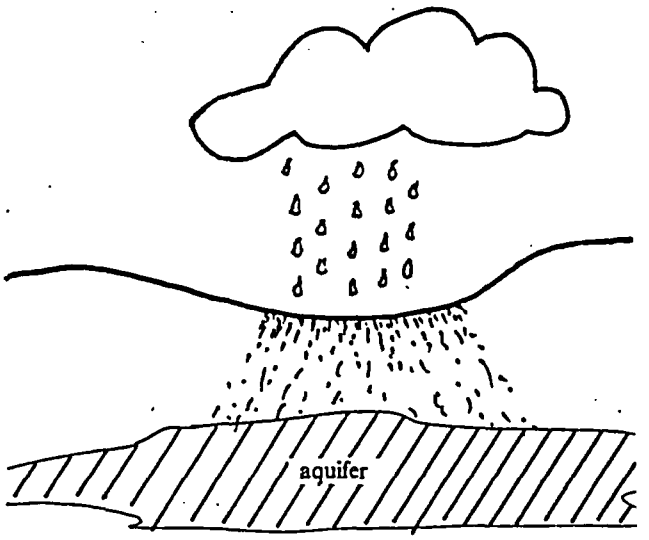
Brent Blackwelder
Environmental Policy Institute
excerpt from testimony to House Government Operations Committee, April 12, 1984

systems. States need an integrated plan within which to structure prevention, monitoring, and enforcement programs.

Today, state effectiveness is generally hindered by conflicting institutional and legal approaches and by the lack of adequate funding. In most states, agencies that control water allocation are not the same as those that oversee water quality, and neither of these groups may have regulatory or judicial powers. The many agencies that administer laws and regulations concerning groundwater protection range from health departments, natural resource commissions, and departments of environmental protection to water resource commissions, water management districts, and zoning boards. As a result, groundwater allocation policies have been established without regard for the maintenance of quality and vice-versa, or without consideration for the legal ramifications. The following situations can arise:

- A state draws up an aquifer classification system which permits an aquifer to degrade and allows a waste disposal facility to be constructed above it. Owners of neighboring wells then claim compensation from the state or facility for infringing on their water rights.
- In contrast, a community wishes to protect its aquifer by imposing strict zoning limitations in a designated area. Landowners within that area claim loss of property values.
- Or, a municipality allows a housing development above a critical recharge zone, thus impeding the return flow of water to the aquifer and potentially adding more sewage waste to it. This decision not only results in short-term expenditures for additional water treatment, but also in a need to find other water resources in the long term.

As groundwater becomes increasingly important to meet future water resource needs, state agencies need to integrate surface water, groundwater, and land-use policies.



Aquifer Recharge Area

Three State Programs

New Jersey residents recently passed one of the most stringent bills in the country to protect their groundwater supplies from increasing contamination. The Water Quality Bill of 1984 places responsibility on water suppliers to conduct more thorough testing and reporting of contaminants and requires the designation of maximum contaminant levels (MCLs) for a much broader spectrum of organic compounds. New Jersey also recognized the importance of an area with particularly high-quality and vulnerable groundwater, the Central Pine Barrens, by imposing a non-degradation policy for its underlying aquifers, effectively blocking industrial development and intensive land use in that area.

Similarly, **Florida** has acted to protect its critical recharge zones by employing zoning powers to limit activities in these areas. Here, shallow aquifers which supply over 90% of the population with its drinking water are in danger of pollution from leachates at hazardous waste sites and from pesticides in agricultural areas. Florida is also adopting a stricter groundwater

classification system and has increased the number of pollutants for which standards will be established. It has undertaken primary enforcement responsibility for underground injection of wastes and an aggressive program to control mining operations. Florida has also attempted to unify the administration of groundwater withdrawal near coastal areas to prevent ocean water intrusion into freshwater aquifers.

Irrigation on an Arizona farm

Typical of those states with a rapidly growing population and scarce rainfall, **Arizona** has had to decide between competing interests—from population growth, with its demands ranging from sewer systems to swimming pools, to industry and agriculture, which annually consume 89% of the state's water. In 1980, Arizona passed one of the nation's most extensive pieces of legislation for groundwater conservation, the Groundwater Management Act. With the goal of reducing per capita consumption 50% by 2025, this Act controls groundwater use through conservation plans for all water users, but most stringently for farming and industry in defined areas. In fact, the plan includes staged acquisition by the state of about half its agricultural acreage, the costs of which will be largely financed through pumping fees.

Community Organizing

Cape Cod

A successful approach to local comprehensive groundwater protection is demonstrated by the work of the Cape Cod Planning and Economic Development Commission. Because the Cape's sandy soil and high water table make its aquifers particularly vulnerable to contamination, in this case from commercial and household waste, the Commission developed a broad-based strategy to protect its drinking water. It began with establishing a regional comprehensive monitoring system. This included the purchase of equipment to test for the presence of chemicals in private wells, landfills, and public water supplies, with the intention of using the collected data as a basis for enforcement as well as for land use planning.

The next step involved a strategy to reduce the amount of hazardous material that could enter the ground. Businesses were required to register the type, amount, use, and storage of all their hazardous materials with the local Boards of Health. This information provided a better understanding of the location and quantity of chemicals being used. Follow-up inspections revealed improper methods of storage and transportation. Testing and standards for underground storage tanks were prescribed in order to detect and prevent leaks. Many Cape communities placed a ban on household use of certain pesticides and passed strict regulations for the installation of septic tanks.

To protect its sensitive recharge zones, a land acquisition plan was drawn up, partially funded by the state and by revenues from each property sale. Certain areas were also designated as sole-source aquifer regions under the federal program.

Throughout this process, public support was essential to its success and public education played a vital role in the passage of laws now used as models by other communities.

Long Island

Long Island is geographically similar to Cape Cod in that its soils are sandy, and deep aquifers serve as the primary source of drinking water for nearly all its residents. However, on Long Island, large-scale suburban development eastward from Brooklyn and Queens has taken place at a relentless pace over the last thirty years. Because there has been little or no planning for this growth, western Long Island has become a seemingly endless expanse of high-density subdivisions, shopping malls, highways, and parking lots.

The catastrophic consequences of this development pattern for the island's groundwater resources have only recently become apparent. Large-scale paving over of the land has greatly inhibited the capacity for rainfall to percolate through the soil and recharge the aquifers. The water that does enter the aquifers tends to be polluted with the inescapable by-products of urbanization—gasoline, lead, lawn chemicals, household cleaners, nitrates, and leachate from landfills.

The most significant residential development has taken place in the coastal areas, leaving commercial and industrial development to the central portion of the island where the major critical recharge areas for Long Island's water supply are also located. Due to this mistake in land-use planning, day by day, year by year, Long Island's water supply is becoming more severely contaminated. In fact, significant portions of the groundwater supply under western and central Long Island are already contaminated and/or overdrawn.

Until recently, it seemed that similar, unchecked development in eastern Long Island would quickly lead to the contamination of its aquifer, the area's last remaining supply of pure drinking water. Fortunately, in certain areas, citizen action succeeded in breaking this destructive pattern of laissez-faire growth. In the mid-1970s, residents of the South Fork, a region in eastern Long Island, became concerned about the implications of a building boom on their long-term drinking water supplies. Some instances of contamination had already occurred, most notably from leaking storage tanks in gas stations, improperly located landfills, septic systems, and agricultural use of pesticides.

Photo: The South Fork Land Foundation

The Group for the South Fork, a local environmental organization, investigated the issue. They concluded that population growth up to the levels permitted by the existing town plans would create a demand for water which would greatly outstrip the aquifer's safe yield and ultimately lead to serious depletion problems, and that water quality would continue to deteriorate if residential and industrial development were not carefully controlled. Fortunately, the critical recharge zones for the South Fork's aquifer lie in an area still almost completely free of development. Hydrological studies revealed that, in order to protect the groundwater from degradation, *no* development should take place in the recharge zones, and residential housing should be clustered in less sensitive areas. The group also found that population should be held down to 90,000. If there had been any doubt as to the validity of these findings, a federal report which came out shortly afterwards confirmed these conclusions.

In 1982, the Group for the South Fork set out to educate their communities and their local officials. They found that few people, in or out of government, had given much thought to the impact of population growth and poor land use planning on drinking water quality and quantity. The group began printing ads in local newspapers to publicize the problem. They published a booklet explaining the technical

issues and their policy recommendations. Gradually an informed public began to support groundwater protection.

Finally, the group began to press for action from local governments. With much of the community united in agreement, they achieved results remarkably quickly. In March, 1983, the town of Southampton rezoned 26,000 acres, about one-third of the town's unincorporated land, from two-acre-minimum lot size to five acres. Shortly afterward, the citizens of East Hampton voted out their aggressively pro-development town council, while voting in a new government which promised to protect the town's environment and drinking water.

The rezoning of residential acreage and the use of strict land-use controls hold great promise as tools to assure an adequate supply of clean groundwater for the future. Other protective measures include "watershed overlay districts" which limit the amount of chemical-dependent lawn turf which may be planted over the groundwater. New rules require gas stations to install improved underground tanks to minimize gasoline leaks. A new state law requires all landfills to be capped and closed by 1987.

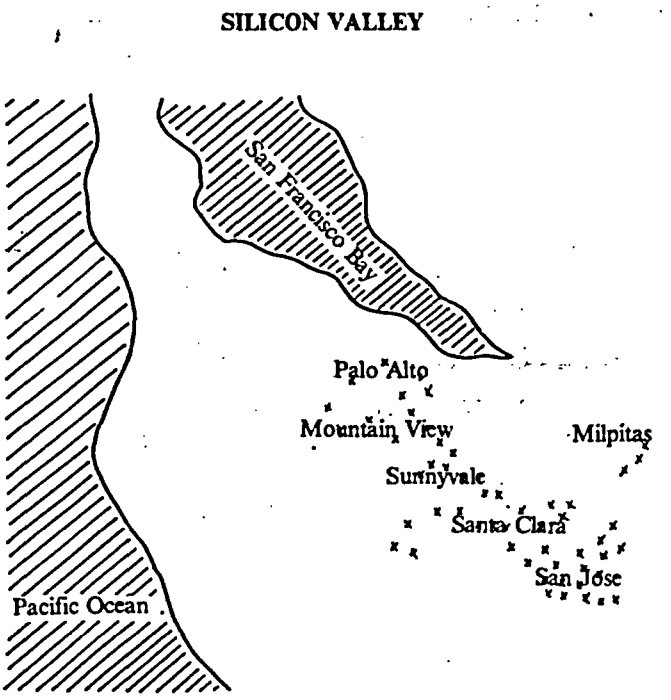
It is to be hoped that these landmark changes will be adopted elsewhere in the region so that Long Island's last unpolluted groundwater reserves may be safeguarded for future generations.

Silicon Valley

In 1982, upon discovering a concentration of health problems in their community, residents in "Silicon Valley," an area of concentrated high technology plants south of San Francisco, began to question the quality of their drinking water and its health effects. Chemical leakage from underground storage tanks was thought to be responsible, even though at that time high technology was considered an environmentally "clean" industry. Those residents employed by the "high tech" companies formed worker safety committees and pressed for public disclosure concerning identification and storage of the chemicals. When investigations revealed that over 90% of the tanks leaked, labor and citizen groups joined forces to press for legislation. A model ordinance was drawn up which required:

- Secondary containment for all storage facilities
- Strict monitoring and leak detection provisions
- Reporting of all leaks and spills
- Comprehensive listing of chemicals needing to be regulated
- "Right-to-know" provisions
- Permit fees

Over 30 local governments adopted ordinances and, in the fall of 1983, despite heavy opposition from the electronics industry and oil companies, a state Groundwater Protection Bill was passed.



Location of underground chemical leaks and spills in Santa Clara County, as of March, 1983.

Citizen Action

Do you know the origin of your drinking water? The source may be as close as your home or hundreds of miles away.

If you are relying on public water supplies, you may be using groundwater or surface water, or both. If you have your own well you know that you are using groundwater. What do you know about the aquifer supplying that well?

To find out the exact source and quality of your public drinking water, contact your local Department of Environmental Services or your private water supplier. If you have a well, have your water tested.* A map of your aquifer or aquifer systems may be available from the US Geological Survey's District or Regional offices, located within the Department of the Interior. Determine who may be using, polluting, or drinking your water supply.

Many citizen organizatons are working on groundwater resource problems. The more informed you are, the better able you will be to ensure that you and your community are drinking clean water.

Get to know your aquifer or aquifer systems

- How extensive an area does it cover?
  - What jurisdictions does it cross?
  - How many citizens does it serve?
  - What percentage is used residentially, commercially, or industrially?
- Where are its critical recharge zones?
  - How is the land used above them?
  - How permeable is the soil?
- How much water is pumped out each year relative to its recharge?
  - What is the "safe yield" for this aquifer or aquifer system?
  - Has the water table dropped during recent years?
- Has your aquifer been mapped for its location, overdraft, and vulnerability to contamination?

Determine whether there are potential or existing threats to your groundwater

From agriculture:

- Has the level of nitrates in your water been tested?
- Are pesticides used widely in your area?
- Is there pesticide spraying on rights-of-way, Federal lands, municipal parks?

From industry:

- Are there any known toxic dumps overlying your aquifer or aquifer system?
- Are there, or were there, any factories which produced or used toxic substances in your region?
- Do you have any high technology firms in residential areas which are storing chemicals in underground storage tanks? Are they located over an aquifer?
- If there is oil and gas drilling, are these activities carefully regulated to prevent groundwater contamination?
- What provision is made for brine disposal?

* See Appendices

From households:

- What proportion of residents use septic tanks? What are the specifications for their use, installment, and monitoring?
- What provisions are made for the safe disposal of household pesticides, oils, paints and solvents?

From urban activities:

- Are your local gas stations monitoring for possible leaks from their storage tanks?
- Do you know how gas stations dispose of their used motor oil?
- How do the local dry cleaners, printers and other small establishments store, transport, or otherwise dispose of their toxic substances?
- If de-icing salts are used in winter in your area, are they stored carefully and applied sparingly?

From government planning:

- Is projected population, industrial, or agricultural growth threatening to strain your water supplies?
- Is there adequate planning in your region to balance water supplies fairly among competing sectors?
- Are there conservation programs to eliminate wasteful use of water in all sectors?

Find out how your groundwater is managed

- What agencies are responsible for your state and local water resource planning? How many personnel are involved? What is the funding level of the operations? What is their capability for monitoring and enforcement of water regulations?
- What substances are tested in your water? By whom? How is the information made known to the public? Is the record-keeping sufficient? Is the equipment adequate?
- How are the activities of these various agencies coordinated? Is there one central agency?
- How much technical assistance is there from the regional EPA?

Learn what your state and local governments are doing to protect your groundwater

- Is there an aquifer classification system?
- Have any aquifers been designated as "sole source?"
- How is the disposal of hazardous wastes controlled?
  - How is underground waste injection regulated?
  - Have siting standards for the land disposal of hazardous wastes been developed?
  - Is the production, handling, and disposal of chemicals closely monitored? Do companies have to register their use of chemicals with the Department of Health?
- Are there standards for underground storage tanks/well casings/well construction?
- Have land use controls been adopted?
- Are the safe drinking water standards stricter than the national standards? Are there standards for additional contaminants?
- How is depletion controlled?
  - Are there appropriation codes for groundwater allocation?
  - Is groundwater mining prohibited?
  - Is there a program of artificial groundwater recharge?
- How effective is the enforcement of regulations?
- Does the state have a compensation structure in effect for those adversely affected by contaminated and/or unavailable water?

- To what extent is public participation institutionalized in groundwater management decision-making?
- Have local governments adopted model municipal ordinances for groundwater protection?
- Are there established emergency plans for use in instances of spills and other types of contamination?

Make the issues known

Having established a sound data base on the sources and vulnerability of your groundwater, hold meetings, educate the media, write letters to the editor of your local newspaper, and inform your elected representatives of your concerns. Build a constituency to promote:

- appropriate land use controls
- registration of chemicals used by local industry/commerce/agriculture
- "right to know" legislation
- publication of violations of drinking water standards
- reduction of the production of toxic wastes
- containment standards for underground storage tanks
- regulation of chemicals
- model ordinances for groundwater protection
- comprehensive monitoring of aquifers
- conservation of water resources
- planning for growth
- funding of public intervenors who can represent citizen cases

How to Have Your Water Tested

If your water comes from a private well, you can ask your local health authorities to test it. However, as these tests can be extremely expensive and public funds for such purposes are generally quite limited, the chance of your request being acted upon is considerably enhanced if you can show that there is reason to believe that your water is contaminated. Has there been a high rate of illness among your neighbors? Are there landfills, chemical factories, or farms that use large amounts of fertilizers or pesticides nearby? Do you live in a heavily industrialized area? Have there already been instances of serious groundwater pollution in your state? If any of these situations is true, your case for getting your water tested is stronger.

> It has been proposed that a National Hot Line to provide information about tests which have already been conducted in various areas, as well as names of certified laboratories, be set up at a national level.

Send away to the EPA Office of Drinking Water for the most recent federal pollutant standards, and to your state agency for state pollutant standards (see State Resource List).

The water quality test results will probably include pre-and post-treatment figures. It will be divided into:

- organic chemicals, subdivided into trihalomethanes and pesticides;
- inorganic chemicals, including metals;
- arsenic, and other such elements;
- radioactive particles;
- microbiological contaminants.

It will also probably contain information on dissolved oxygen levels, turbidity, pH factor, temperature, chlorine, and fluoride. Most contamination levels will be given in mg/1, which represents a "parts per million" or ug/1, "parts per billion." Compare the concentrations given in your test print-out with official standards.

If you ascertain that your water contains contaminants, the next step is to analyze their source. You can use the Community Action Guide to develop a plan.

Federal Laws

SAFE DRINKING WATER ACT of 1974 contains the following sections that deal directly with groundwater:

Underground Injection Control Program (UIC)—intended to protect drinking water sources from underground injection of toxic waste by requiring state permits for such facilities and by strict monitoring of them.

The law does not:

- eliminate injection near or into drinking water quality aquifers;
- adequately provide for careful monitoring to insure the safety of the current technology and the possibility of contamination through leaks;
- apply to the disposal of oil, natural gas, and brine from oil and gas extraction;
- contain bonding and liability provisions as do other waste disposal practices under RCRA.

Sole Source Aquifer Program—addresses those aquifers that serve as the principal drinking water source for the majority of a community. It prevents a federally funded project from initiating any activity which might contaminate these water reserves.

The law does not:

- include federal programs such as water development projects undertaken by the Corps of Engineers, the Department of the Interior, and other government agencies;
- provide federal and state assistance for the designation of sensitive recharge zones and strict control for their protection.

Drinking Water Standards—set to assure the quality of drinking water supplies by determining certain maximum contaminant levels (MCLs) for specified pollutants in most, but not all, public water supplies. These standards are the minimum requirements that must be met in order for a state to assume primary enforcement responsibility, but states may adopt stricter ones.

The law does not:

- cover all water supplies;
- control all pollutants or require EPA to accelerate standard-setting for additional pollutants. (EPA has detected more than 700 synthetic organic chemicals in public drinking water supplies and yet current standards cover only *seven*);
- provide adequate monitoring and reporting;
- require comprehensive testing by public water suppliers or prompt notification to customers as to their findings (a study in 1983 revealed that 29% of municipal water wells in the U.S. contained toxic chemicals).

RESOURCE CONSERVATION AND RECOVERY ACT of 1976 (RCRA)—designed to protect groundwater, as well as other resources, from contamination by the improper treatment, storage and disposal of solid wastes. Through its 'cradle to grave' monitoring system, RCRA aims to end irresponsible dumping practices. Subtitle C expressly aims to prevent toxic leachate contamination from landfills and other surface impoundments, land treatment facilities, tanks, injection wells and others. Subtitle D prohibits a solid waste disposal facility from polluting a subsurface source of drinking water beyond its boundary.

The law does not:

- adequately regulate small generators of hazardous waste;
- regulate underground chemical storage tanks;
- include all hazardous waste, e.g. many carcinogenic wastes;
- adequately control land disposal facilities through strong siting codes, monitoring, construction, and eligibility of types of wastes for disposal.

CLEAN WATER ACT of 1972—provides limited authority for groundwater protection. Section 208, the main section affecting groundwater quality, covers the management of waste treatment. Other sections regulate the setting of state water quality standards and point source discharge. (Ironically, this Act, by controlling point source discharge into surface waters, has diverted wastes to land disposal, and thereby has subjected groundwater to additional contamination.)

The law does not:

- provide adequate regulatory powers;
- require the identification and clean-up of heavily contaminated waters;
- provide effectively for the control of non-point source pollution.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT of 1980 (CERCLA or "Superfund")—seeks to clean up and prevent the release of toxic materials from hazardous waste disposal sites. It addresses the prevention of groundwater contamination through the funding and implementation of remedial action.

The law does not:

- give a clear definition of what "effective" remedial action is;
- require sufficient taxation of industries that produce hazardous waste;
- provide technical assistance to citizens groups;
- include health studies and exposure assessments at sites;
- provide for emergency relief to those suffering from exposure to contaminants;
- update the hazard ranking system to accurately reflect possible effects on natural resources.

Other federal legislation which directly or indirectly affects groundwater: TOXIC SUBSTANCES CONTROL ACT (TSCA) of 1976; SURFACE MINING CONTROL AND RECLAMATION ACT of 1977; FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT(FIFRA) of 1972 (amended).

State Laws

Groundwater quality is addressed by the following types of state laws:

- Laws which regulate **discharging sources.** These laws address the problem of point source pollution, including solid and hazardous waste facilities and underground injection wells as well as septic systems, fuel and chemical storage tanks, salt storage, and water detention basins.
- Zoning laws which control **land use.** These address non-point source pollution by restricting the location of potentially contaminating activities to a defined area; limiting development which might reduce the natural recharge of aquifers; and controlling the location and number of septic tanks in a given area so as not to exceed the natural assimilative capacity of the soil. Some provide for the actual purchase of land to preserve critical recharge areas.
- Laws which require **standards for contaminants** not covered by the national Safe Drinking Water Act.
- Laws which implement **aquifer classification.** These set water quality standards according to the projected use of the aquifer; e.g., drinking, irrigation, etc. They are being increasingly used by states to assure long-term availability of water reserves. Consideration is given to difference in existing water quality and geological characteristics that contribute to the vulnerability of the aquifer. Three main classifications have been considered by states:
  1) maintenance of aquifer quality at drinking water levels;
  2) prevention of further degradation for those aquifers with some contamination;
  3) in some cases, allowance for further degradation up to an established level.

  This system helps focus limited state resources on both planning and enforcement activities. Since aquifers cross state boundaries in many cases, consultation with neighboring jurisdictions is a prerequisite to success in standard-setting. The disadvantages of aquifer classification involve not only the political difficulty of choosing certain areas for waste discharge, but also the undervaluing of portions of groundwater resources, thereby allowing or even sanctioning degradation of the water.
- Laws which give the public the *right to sue* for property and/or personal injury. These can be applied to injury caused by groundwater contamination, as in the case of pollution of wells, but this is a costly, after-the-fact response to a problem and has limited effect as a deterrent.

Regulation of groundwater withdrawal and resolution of conflicts between competing demands generally come under the following rules, all modified from the original English rule of absolute ownership, which gave the landowner the right to withdraw water beneath his/her property, regardless of possible effects on neighboring property:

- **Reasonable Use Doctrine,** under which a landowner is permitted to withdraw water for reasonable and beneficial purposes.
- **Correlative Rights Doctrine,** which requires a landowner to coordinate withdrawal with neighboring withdrawal needs. Any surplus may be exported to other areas.
- **Prior Appropriation,** the method employed in some western states in which surface and groundwater is allocated according to "first in time, first in right" principles. Permits define both the amount of groundwater to be withdrawn and its intended use. Because individuals do not want to risk losing their allotment by not using their full quota each year, this rule tends to encourage wasteful practices.
- **New Well Permit Requirements,** used by some states to regulate the withdrawal of water. Consideration is given to the capacity of the underlying aquifer, and competing uses for it. In a few states, drilling is prohibiting in certain critical areas where depletion problems exist or are anticipated.

Interstate and Regional Commissions

Because aquifers and river systems cross state boundaries, several interstate groundwater management alliances have been formed. The Delaware River Basin Commission and the Susquehanna River Basin Commission, established by both state and federal law, focus their activities mostly on assessment, development, and allocation of the groundwater and surface water resources in their respective multi-state regions. These commissions have power to regulate and license; authority to finance, construct, and maintain water resource projects; and license to appropriate water among participating states. They also provide technical services to states for a variety of activities, such as water resource management, water quality, and project evaluation.

The High Plains Study Council, concerned with the Ogallala multi-state aquifer, is one of several special study groups which offers fundamental technical information and management. Though authorized solely to study and recommend, the Council has effectively served to promote action and coordinate the activities of affected states.

Recommended Reading

An Annotated Groundwater Bibliography. Massachusetts Audubon Society, Lincoln, MA 01773. $5.00.

Blackwelder, B. and Pl. Carlson. *Survey of Water Conservation Programs in the Fifty States: Model Water Conservation Program for the Nation.* Washington, D.C.: The Environmental Policy Institute, Aug. 1982. (Available from EPI, 218 D St., SE, Washington, D.C. 20003. $5)

Directory of Groundwater Programs and Activities of the Federal Government. Washington, D.C.: U.S. Department of the Interior, Office of Water Policy, Feb., 1983. (Available from the National Technical Information Service, Springfield, VA 22161)

Groundwater Management: Discussion of Issues. Report of the Interstate Groundwater Management Task Force. Washington, D.C.: U.S. Water Resources Council, Sept., 1981. (Available from NTIS, Springfield, VA 22161)

Groundwater Protection: A Citizen's Handbook, Natural Resources Defense Council, 1984.

Groundwater Protection Strategy, Environmental Protection Agency, 1984.

Groundwater Protection: A Guide for Communities, (Available from the Metropolitan Area Planning Council, 110 Tremont St., Boston, MA 02108)

The Nation's Water Resources. 1975-2000. Volume 1: Summary. Washington, DC: U.S. Water Resources Council, Dec. 1978. (Available from NTIS, Springfield, VA 22161)

National Water Summary, 1983 - Hydrologic Events and Issues, US Geological Survey. Water Supply Paper 2250. (Available from the US Government Printing Office.)

Patrick, Ruth, Veronica I. Pye, John Quarles, *Groundwater Contamination in the U.S.,* University of Pennsylvania Press, Philadelphia, 1983.

Powledge, Fred, *Water, The Nature, Uses, and Future of Our Most Precious and Abused Resource,* Farrar, Straus, Giroux, New York, 1982.

Rogers, Peter, "The Future of Water," *The Atlantic Monthly,* July, 1983.

Selig, E.I., *An Overview of Laws Dealing With Groundwater,* A speech prepared for the 6th National Groundwater Quality Symposium of the National Water Well Association in Atlanta, GA, Sept. 22, 1982.

Tripp, James and Adam Jaffe, "Preventing Groundwater Pollution: Towards a Coordinated Strategy to Protect Critical Recharge Zones," *Harvard Law Review,* Cambridge, MA.

"War over Water: Crisis of the 80's", *US News and World Report,* Oct. 31, 1983.

Citizen Organizations

The following organizations have regional offices and may be active on groundwater issues in your area:

Clean Water Action Project
733 15th St., N.W. #1110
Washington, DC 20005
(202) 638-1196

Environmental Defense Fund
444 Park Avenue South
New York, NY 10016
(212) 686-4191

Friends of the Earth
1045 Sansome St.
San Francisco, CA 94111
(415) 433-7373

Izaak Walton League
1701 N. Fort Drive #1100
Arlington, VA 22209
(703) 528-1818

League of Women Voters
1730 M St., N.W.
Washington, DC 20036
(202) 429-1965

National Audubon Society
950 Third Avenue
New York, NY 10022
(212) 832-3200

Natural Resources Defense Council
122 E. 42nd St.
New York, NY 10168
(212) 949-0049

Sierra Club
530 Bush St.
San Francisco, CA 94108
(415) 981-8634

The following national organizations are working on groundwater issues:

Environmental Action Foundation
724 DuPont Circle Building
Washington, DC 20036
(202) 659-9682

Environmental Law Institute
1346 Connecticut Ave., N.W. #600
Washington, DC 20036
(202) 452-9600

Environmental Policy Institute
218 D St., S.E.
Washington, DC 20003
(202) 544-2600

National Wildlife Federation
1412 16th St., N.W.
Washington, DC 20036
(202) 797-6800

For information and activities concerning water issues in your state or region contact your state Citizen Action Group or Coalition, Environmental Council or Public Interest Research Group, often located in the state capital, or your soil and water conservation district, or the following citizen and environmental organizations:

Arizona
Southwest Environmental Service
P.O. Box 2231
Tucson, AZ 85702
(602) 624-2353

Arkansas
National Water Center
Box 548
Eureka Springs, AR 72632
(501) 253-9431

California
Silicon Valley Toxics Coalition
361 Willow Street
San Jose, CA 95110
(408) 998-4050

Colorado
Western Organization Resource Council
P.O. Box 1742
Montrose, CO 81402

Florida
Environmental Service Center
916 E. Park Ave.
Tallahassee, FL 32301
(904) 222-0433

Georgia
The Georgia Conservancy
4405 Paulsen Street
Savannah, GA 31405
(914) 234-1628

Hawaii
Hazel Cunningham
3011 Oahu Avenue
Honolulu, HI 96822

Illinois
Citizens for a Better Environment
59 East VanBuren Street
Suite 1600
Chicago, IL 60605
(312) 939-1530

Indiana
Citizens Action Coalition
311 West Washington #303
Indianapolis, IN 46204

Kansas
Kansas Natural Resource Council
P.O. Box 2128
Topeka, KS 66603

Louisiana
Ecology Center
Box 19146
New Orleans, LA 70179

Maine
Maine Natural Resource Council
51 Chapel Street
Augusta, ME 04330

Michigan
West Michigan Environmental Action Council
1324 Lake Drive, SE
Grand Rapids, MI 49506
(616) 451-3051

Missouri
Coalition for the Environment
6267 Delmar
St. Louis, MO 63123
(314) 727-0600

Montana
Mountain Environmental Information Center
P.O. Box 1184
Helena, MT 59624

Nebraska
Center for Rural Affairs
P.O. Box 736
Hartington, NE 68739

New Jersey
Passaic River Coalition
246 Madisonville Road
Basking Ridge, NJ 07920

New Mexico
Southwest Research and Information Center
P.O. Box 4524
Albuquerque, NM 87194
(505) 262-1862

New York
Group for the South Fork
Box 569
Bridgehampton, NY 11932
(516) 537-1400

North Carolina
Conservation Council of N. Carolina
307 Granville Road
Chapel Hill, NC 27514
(919) 942-7935

North Dakota
Dakota Resource Council
Box 254
Dickinson, ND 58601

Oregon
Oregon Environmental Council
2637 W. Water Avenue
Portland, OR 97201

Vermont
Vermont Natural Resource Council
26 State Street
Montpelier, VT 05602

Washington
Four Creeks Community Association
Box 508
Chimacum, WA 98325

Wisconsin
Wisconsin's Environmental Decade
114 N. Carroll St.
Madison, WI 53703
(608) 251-7020

Wyoming
Powder River Basin Resource Council
48 North Main Street
Sheridan, WY 82891
(307) 672-5809

Other interested individuals and citizen groups can be located by contacting CONCERN, Inc. 1794 Columbia Rd. N.W., Washington, DC, 20009, (202) 328-8160.

State Groundwater Contacts

Alabama
Joe Alan Power
Water Supply Program
Department of Environmental Management
State Capitol
Montgomery, AL 36130
(205) 261-5667

Alaska
Dick Farnell
Dept. of Environmental Conservation
Pouch O
Juneau, AK 99881
(907) 465-2653

Arizona
Bob Munari
Bureau of Water Quality Control
Dept. of Health Services
1740 West Adams Street
Phoenix, AZ 85007
(602) 255-1254

Arkansas
Benjamin Saltzman
Arkansas Department of Health
4815 West Markham
Little Rock, AR 72201
(501) 661-2111

California
Peter Rogers
Dept. of Health Services
714 P Street
Sacramento, CA 95814
(916) 324-2207

Colorado
Rick Karlin
Water Quality Division
Dept. of Health
4210 East 11th Avenue
Denver, CO 80220
(303) 320-8333

Connecticut
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Water Supplies Section
Conn. Dept. of Health
79 Elm Street
Hartford, CT 06145
(203) 566-1253

Delaware
Richard B. Howell
Division of Public Health
Jesse Cooper Memorial Bldg.
Dover, DE 19901
(302) 736-4731

Florida
Al Bishop
Bureau of Water Management
Dept. of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32301
(904) 488-9560

Georgia
Gene B. Welsh
Dept. of Natural Resources
Water Protection Branch
270 Washington Street SW
Atlanta, GA 30334
(404) 656-6593

Hawaii
M.K. Koizumi
Environmental Health
Hawaii Dept. of Health
P.O. Box 3378
Honolulu, HI 96801
(808) 548-4139

Idaho
Larry Koenig
Division of Environment
Dept. of Health & Welfare
State House
Boise, ID 83720
(208) 334-4255

Illinois
Ira Markwood
Illinois Environmental Protection Agency
Public Water Supply Division
2200 Churchill Road
Springfield, IL 62706
(217) 782-9470

Indiana
C. Neil Ott
Div. Public Water Supply
Indiana State Board of Health
1330 W. Michigan Street
Indianapolis, IN 46206
(317) 633-0174

Iowa
Keith Bridson
Water, Air, & Waste Management
Wallace State Office Building
Des Moines, IA 50319
(515) 281-8935

Kansas
Gyula Kovach
Bureau of Water Protection
Div. of Environment
Kansas Dept. of Health & environment
Forbes Field, Bldg. #740
Topeka, KS 66620
(913) 862-9360

Kentucky
Division of Water Quality
Dept. of Natural Resources & Environmental Protection
18 Reilly Road, Ft. Boone Plaza
Frankfort, KY 40601
(502) 564-3410

Louisiana
Sarah Braud
LA Dept. of Health and Human Resources
P.O. Box 60630
New Orleans, LA 70160

Maine
Clough Topan
Drinking Water Program
Div. of Health Engineering
Dept. of Human Services
157 Capital Street
Augusta, ME 04333
(207) 289-3826

Maryland
William Parrish
Division of Water Supply
Dept. of Health & Mental Hygiene
201 W. Preston Street
Baltimore, MD 21201
(301) 383-4249

Massachusetts
M. Ilyas Bhatti
Div. of Water Supply
Dept. of Environmental Quality Engineering
One Winter Street
Boston, MA 02108
(617) 292-5500

Michigan
William Kelley
Water Supply Division
Department of Public Health
3400 N. Logan
PO Box 30335
Lansing, MI 48909
(517) 373-1376

Minnesota
Gary Englund
Health Department
717 Delaware Street, NW
Minneapolis, MN 55440
(612) 296-5330

Mississippi
James McDonald
Bureau of Environmental Health
Water Supply Division
Jackson, MS 39209
(601) 354-6616

Missouri
William C. Ford
Dept. of Natural Resources
Division of Environmental Quality
Public Drinking Water Program
PO Box 1368
Jefferson City, MO 65102
(314) 751-3241

Montana
Dan Fraser
Water Quality Bureau
Dept. of Health & Environmental Sciences
Cogswell Building
Helena, MT 59620
(406) 449-2406

Nebraska
Clifford Summers
Div. of Environmental Engineering
Nebraska Dept. of Health
PO Box 95007
Lincoln, NE 68509
(402) 471-2674

Nevada
James Maston
Public Health Engineering
Nevada State Health Division
505 E. King Street
Carson City, NV 89710
(702) 885-4750

New Hampshire
Bernard D. Lucey
NH Water Supply & Pollution Control Commission
P.O. Box 95, Hazer Drive
Concord, NH 03301
(603) 271-3139

New Jersey
Raymond Barg, Chief
Bureau of Potable Water
Dept. of Environmental Protection
Division of Water Resources
PO Box CN-029
Trenton, NJ 08625
(604) 292-5550

New Mexico
Denise Fort
Environmental Improvement Division
PO Box 968
Santa Fe, MN 87503

New York
John Orndorff
Bureau of Public Water Supply Protection
New York State Dept. of Health
Empire State Plaza
Tower Building
Albany, NY 12237
(518) 474-5577

North Carolina
Charles Rungren
Water Supply Branch
Dept. of Human Resources
P.O. Box 2091, Bath Building
Raleigh, NC 27602
(919) 733-2321

North Dakota
Jack Long
Division of Water Supply & Pollution Control
Dept. of Health
1200 Missouri Avenue
Bismarck, ND 58505
(701) 224-2354

Ohio
Robert McEwen
Office of Public Water Supply
Ohio Environmental Protection Agency
361 E. Broad Street
Columbus, OH 43216
(614) 466-8307

Oklahoma
Mark Coleman
Environmental Health Services
Oklahoma Dept. of Health
P.O. Box 53551
Oklahoma City, OK 73152

Oregon
Harold Sawyer, Administrator
Dept. of Environmental Quality
Water Quality Division
PO Box 1760
Portland, OR 97207
(503) 378-2982

Pennsylvania
Fred Marrocco
Div. of Water Supply
Bureau of Community
Environmental Control
P.O. Box 2357
Harrisburg, PA 17120
(717) 783-3797

Puerto Rico
Jorge Martinez
Drinking Water Supply
Puerto Rico Dept. of Health
P.O. Box 10427
San Juan, PR 00922
(809) 763-4307

Rhode Island
John Haqopian
Div. of Water Supply
RI Dept. of Health
75 Davis Street, Health Building
Providence, RI 02908

South Carolina
Max Batavia
Division of Water Supply
Dept. of Health & Environmental Control
2600 Bull Street
Columbus, SC 29201
(803) 758-0345

South Dakota
Mark Steichen
Office of Drinking Water
SD Dept. of Water & Natural Resources
Joe Foss Building
Pierce, SD 57501
(605) 773-3754

Tennessee
W. David Draughon
Drinking Water Section
Div. of Water Management
T.E.R.R.A. Building
150 9th Avenue North
Nashville, TN 37203
(615) 741-6636

Texas
Robert Bernstein
Texas Dept. of Health
1100 West 49th Street
Austin, TX 78756
(512) 458-7111

Utah
Gayle Smith
Bureau of Public Water Supplies
Department of Health
PO Box 2500
Salt Lake City, UT 84110
(801) 533-4207

Vermont
Kenneth M. Stone
Vermont Department of Health
Division of Environmental Health
60 Main Street
Burlington, VT 05401
(802) 863-7223

Virgin Islands
Francine Lang
Natural Resources Management
Government of Virgin Islands
P.O. Box 4340
Charlotte Amalic
St. Thomas, V.I.
(809) 774-6420

Virginia

Richard N. Barton
Virginia State Water Control Board
PO Box 11143
Richmond, VA 23230
(804) 257-6383

Washington
James Pluntze
Water Supply and Waste Section
Washington Dept. of Social and Health Services
Mail Stop LD-11
Olympia, WA 98504
(206) 753-5954

West Virginia
Donald Kuntz
Drinking Water Division
WV State Dept. of Health
Environmental Health Services
1800 Washington Street, East
Charleston, WV 25305
(304) 348-2981

Wisconsin
Robert Baumiester
Public Water Supply Section
Dept. of Natural Resources
Box 7921
Madison, WI 53707
(608) 266-2299

Wyoming
William Garland
Dept. of Environmental Quality
Water Quality Division
401 West 19th Street
Cheyenne, WY 82002
(307) 777-7781

American Samoa & Guam
Pati Faiai
Environmental Quality Commission
Office of the Governor
Pago Pago, American Samoa 96799

James B. Branch
Guam Environmental Protection Agency
Government of Guam
P.O. Box 2999
Agana, Guam 96950

CONCERN, INC.
1794 Columbia Road, N.W.
Washington, D.C. 20009

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ATT. D

To: Holders of RHO-BWI-MA-4

Release No. CR-016

Date 6-14-85

Subject: MANUAL REVISION INSTRUCTIONS

TITLE AND REASON FOR CHANGE	REMOVE		INSERT	
	NO.	DATE	NO.	DATE
Table of Contents, Volumes 2 & 3	TOC	5-13-85	TOC	6-17-85
"Storage and Inventory Control of Drilling and Testing Materials and Equipment" - Procedure no longer needed; desk instruction being used.	C-2.7	5-84		
Change Notice - "Change to BOP C-2.12, Appendix B" - Change added to reflect actual practice.			CN-045 C-2.12 App. B	5-22-85
Change Notice - "Change to BOPs C-4.23, C-4.56, C-4.57, and C-4.58" - Eliminate use of laboratory notebooks for data recording.			CN-039 C-4.23	5-21-85
			CN-040 C-4.56	5-21-85
			CN-041 C-4.57	5-21-85
			CN-042 C-4.58	5-21-85
Change Notice - "Changes to BOP C-4.59" - Remove inconsistency from the cement testing procedures			CN-044 C-4.59	5-21-85
Change Notice - "Changes to BOP C-4.63" - Bring QA section up to requirements.			CN-043 C-4.63	5-21-85

R COOK
FEDERAL BLDG.
DOE COPY NO.-69

When manual has been updated, please sign (1) your name, (2) name manual is assigned to, (3) manual copy number, and (4) date. Fold and return to address on reverse.

Received _____ Manual Holder (please print) _____

Manual Copy Number _____ Date _____

LINDA JAMESON
CDC-2
ROCKWELL

BASALT OPERATING PROCEDURE

TABLE OF CONTENTS - VOLUME 2

BASALT OPERATING PROCEDURE

TABLE OF CONTENTS - VOLUME 2

BASALT OPERATING PROCEDURE

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*Expired interim approval

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BASALT OPERATING PROCEDURE

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Rockwell International
Rockwell Hanford Operations

Change Notice No. CN-045
Procedure No. C-2.12, ADD. B
Date 5-22-85
Page 1 of 1
Supersedes: N/A

CHANGE NOTICE

Approved By:
R. E. May, Manager
BWIP EMS

Subject	Change to BOP C-2.12, Appendix B

Please make the following change to the subject procedure. File this Change Notice in front of the procedure until the next revision.

Section 2.2, last paragraph: Delete the last two sentences, "In addition, pressure readout . . . in a controlled notebook."

Section 6.0: Change the title of Appendix B to "Pressure Measurement Procedure." Also change the title in the title block on Page 1 of Appendix B.

Add Section 2.3 to Appendix B:

2.3 ATMOSPHERIC PRESSURE MEASUREMENT

The atmospheric pressure measurement equipment consists of a digi-quartz transducer that converts atmospheric pressure to an electrical frequency signal. The signal is transmitted to a frequency counter. The frequency is then sent to recording equipment where a record of the data is created. Attached to the pressure transducer is a temperature transducer which senses the pressure transducer temperature. The frequency signal for temperature is also transmitted to the recording equipment.

Atmospheric pressure transducers will be calibrated at two year intervals.

Rockwell International

Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-039
Procedure No. C-4.23
Date 5-21-85
Page 1 of 1
Supersedes: N/A

Approved By:
R. E. May, Manager
BWIP EMS

CHANGE NOTICE

Subject: Change to BOP C-4.23

Please make the following change to the subject procedure. File this Change Notice in front of the procedure until the next revision.

Section 7.2: Delete the paragraph and replace with the following:

Data collected from testing of materials described herein are to be recorded on laboratory data sheets. Data recorded by the cognizant engineer/scientist are governed by Rockwell policy and are to be reviewed per QAPP 3-301. Completed data sheets are to be transmitted to the BWIP Records Management Center for archival and microfilming per QAPP 17-101.

Rockwell International

Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-040
Procedure No. C-4.56
Date 5-21-85
Page 1 of 1
Supersedes: N/A

Approved By:

R. E. May, Manager
BWIP EMS

CHANGE NOTICE

Subject: Changes to BOP C-4.56

Please make the following changes to the subject procedure. File this Change Notice in front of the procedure until the next revision.

1. Section 6.4: Delete the second sentence of the first paragraph.

2. Section 7.2: Delete the paragraph and replace with the following:

   Data collected from testing of materials described herein are to be recorded on laboratory data sheets. Data recorded by the cognizant engineer/scientist are governed by Rockwell policy and are to be reviewed per Quality Assurance Program Procedure (QAPP) 3-301. Completed data sheets are to be transmitted to the BWIP Records Management Center for archival and microfilming per QAPP 17-101.

3. Section 8.0: Delete reference to BOPs A-22, E-6, and E-9.

4. Section 8.0: Add the following:

   RHO-BW-MA-14, Quality Assurance Program Procedures (QAPP) Manual

   QAPP 3-301, "Technical Document Review"
   QAPP 17-101, "BWIP Records Management System"

Rockwell International

Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-041
Procedure No. C-4.57
Date 5-21-85
Page 1 of 1
Supersedes: N/A

Approved By:

R. E. May, Manager
BWIP EMS

CHANGE NOTICE

Subject: Changes to BOP C-4.57

Please make the following changes to the subject procedure. File this Change Notice in front of the procedure until the next revision.

1. Section 6.3(1): Delete the last sentence.

2. Section 7.2: Delete the paragraph and replace with the following:

   Data collected from testing of materials described herein are to be recorded on laboratory data sheets. Data recorded by the cognizant engineer/scientist are governed by Rockwell policy and are to be reviewed per Quality Assurance Program Procedure (QAPP) 3-301. Completed data sheets are to be transmitted to the BWIP Records Management Center for archival and microfilming per QAPP 17-101.

3. Section 8.0: Delete reference to BOPs A-22, E-6, and E-9. Insert the following:

   Quality Assurance Program Procedures (QAPP) Manual
   QAPP 3-301, "Technical Document Review"
   QAPP 17-101, "BWIP Records Management Center"

Rockwell International
Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-042
Procedure No. C-4.58
Date 5-21-85
Page 1 of 1
Supersedes: N/A

Approved By:
R. E. May, Manager
BWIP EMS

CHANGE NOTICE

Subject: Changes to BOP C-4.58

Please make the following changes to the subject procedure. File this Change Notice in front of the procedure until the next revision.

1. Section 6.3: Delete the last line of the first paragraph.

2. Section 7.2: Delete the paragraph and replace with the following:

   Data collected from testing of materials described herein are to be recorded on laboratory data sheets. Data recorded by the cognizant engineer/scientist are governed by Rockwell policy and are to be reviewed per Quality Assurance Program Procedure (QAPP) 3-301. Completed data sheets are to be transmitted to the BWIP Records Management Center for archival and microfilming per QAPP 17-101.

3. Section 8.0: Delete reference to BOPs A-22, E-6, and E-9. Insert the following:

   Quality Assurance Program Procedures (QAPP) Manual
   QAPP 3-301, "Technical Document Review"
   QAPP 17-101, "BWIP Records Management System"

Rockwell International
Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-044
Procedure No. C-4.59
Date 5-21-85
Page 1 of 1
Supersedes: N/A

CHANGE NOTICE

Approved By:
R. E. Ma[illegible] Manager
BWIP EMS

Subject: Changes to BOP C-4.59

Please make the following changes to the subject procedure. File this Change Notice in front of the procedure until the next revision.

1. Change Section 6.1 to read:

   6.1 SAMPLE PREPARATION

   The sample will be mixed per BOP C-4.66. Time of set and flow measurements are determined by the material being tested and per their applicable procedures.

2. Replace Section 7.2 with the following:

   Data collected from testing of materials described herein are to be recorded on the Micrometer Bridge Data Sheet. Recorded data are to be handled per BOP C-4.3.7.

   After a data sheet has been completed by the test operator, it is checked by a qualified reviewer. (The test operator and the reviewer cannot be the same person.) This person is responsible for checking that the data sheet is technically correct and complete. Anyone trained in this procedure is qualified to review data sheets. The data sheet is approved and forwarded to the MTG file system. The MTG file system is maintained per BOP C-4.37.

3. Section 8.0: Delete reference to BOP E-6 and add the following:

   BOP C-4.3.7, "Data and Sample Control System for the Concretes and Grouts Laboratory"
   BOP C-4.37, "Materials Testing Group Control of Quality Documents"
   BOP C-4.66, "Preparation of Mixing of Concrete and Grout"
   BOP C-4.80, "Materials Testing Laboratory Responsibilities"

Rockwell International
Rockwell Hanford Operations
Energy Systems Group

Change Notice No. CN-043
Procedure No. C-4.63
Date 5-21-85
Page 1 of 2

CHANGE NOTICE

Supersedes: N/A

Approved By:
R. E. May, Manager
BWIP EMS

Subject	Changes to BOP C-4.63

Please make the following changes to the subject procedure. File this Change Notice in front of the procedure until the next revision.

1. Delete Sections 4.1 through 4.5 and replace with the following statement: "See BOP C-4.80."

2. Change Section 5.2 to read:

5.2 SAFETY HAZARDS, EQUIPMENT, AND PRECAUTIONS

- o The principal safety hazards are eye and skin irritations.
- o Test operators must wear safety glasses and safety shoes in the laboratory.
- o Gloves will be provided for test operators.

3. Change Section 7.1 to read:

7.1 EQUIPMENT CALIBRATION

The test equipment is labeled with a unique identification number. The calibration record of test equipment is maintained through the Maintenance and Instrument Calibration System (MICS) per BOP C-1.3. Calibration records are maintained in a calibration file as part of the permanent record on that piece of test equipment. Each month a copy of the MICS printout can be obtained and calibration of test equipment verified.

BASALT OPERATING PROCEDURE

4. Change Section 7.2 to read:

7.2 DOCUMENT CONTROL

Data collected from testing of materials described herein are to be recorded on the Time of Set Data Sheet. Recorded data are to be handled per BOP C-4.3.7.

After a data sheet has been completed by the test operator, it is checked by a qualified reviewer. (The test operator and the reviewer cannot be the same person.) This person is responsible for checking that the data sheet is technically correct and complete. Anyone that is trained in the procedure may check data. The data sheet is then approved and forwarded to the MTG file system. The MTG file system is maintained per BOP C-4.37.

5. Section 8.0: Delete reference to BOPs A-22 and E-9. Add the following:

BOP C-4.37, "Materials Testing Group Control of Quality Documents"
BOP C-4.80, "Materials Testing Laboratory Responsibilities"

* N.W. GROUND WATER

* The INVISIBLE RESOURCE

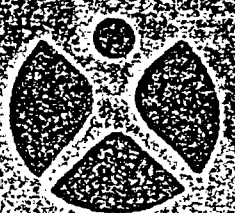
* A HIDDEN CRISIS ?

FIELD TRIP - JUNE 13, 1985

CONFERENCE - JUNE 14 & 15, 1985

BICENTENNIAL PAVILION - SHERATON TACOMA HOTEL

TACOMA, WASHINGTON



INSTITUTE FOR ENVIRONMENTAL STUDIES
UNIVERSITY OF WASHINGTON
SEATTLE WA 98195

NORTHWEST GROUND WATER:
THE INVISIBLE RESOURCE! A HIDDEN CRISIS?

Thursday, June 13

1:15 pm FIELD TRIP, City of Tacoma and Pierce County Area

Friday, June 14

7:30 am REGISTRATION: Tacoma Bicentennial Pavilion Rotunda

PROGRAM

7:55 Film in Bicentennial Pavilion
Groundwater: Part of the Hydrologic Cycle
by the National Water Well Association

8:30 OPENING REMARKS/WELCOMES

Polly Dyer, Continuing Environmental Director
Institute for Environmental Studies
University of Washington

Honorable Doug Sutherland, Mayor of Tacoma

Norma Jean Germond, Vice Chair
Columbia River Task Force
League of Women Voters of Idaho, Oregon and Washington

Andrea Beatty Riniker, Director
Washington Department of Ecology

9:00 WHAT IS GROUND WATER? WHY WE ARE HERE!

Keynoter: John Bredehoeft, Western Regional Hydrologist (past)
U.S. Geological Survey

9:30 GROUND WATER PROBLEMS EXPERIENCED

John Beare, MD/MPH, Head, Health Services
Washington Dept. of Social & Health Services
Overview/Moderator

9:45 CITIZENS GIVE EXPERIENCES/PROFESSIONALS SAY WHY:

Biological Contamination:

Pete Corwin, Commissioner of Public Works
Centralia

James Goode, Assistant Director
Environmental Health Section
Lewis County Health District

Chemical (EDB) Contamination:

David Bricklin, Attorney-at-Law

Larry West, Geologist, Sweet Edwards & Associates

Petroleum Contamination:

Paul Fetrow, Vice President, Resource Management
St. Alphonsus Regional Medical Center
Boise, Idaho

Michael Warfel, Hydrogeologist
Hart Crowser & Associates

Depletion:

Stafford Hansell, Chair, Land & Conservation
Development Commission, State of Oregon

Marc Norton, Hydrogeologist
Oregon Department of Water Resources

10:50 LOCAL GROUND WATER INTERESTS

Congressman Norm Dicks, Sixth District, Washington

11:05 BREAK

11:15 GROUND WATER RIGHTS AND OWNERSHIP: "IT'S MY WATER!"

Linda Tanz, League of Women Voters
of Tacoma-Pierce County
Moderator

How Water Rights Are Handled in the PNW:

Charles Roe, Chair, Ground Water Protection Comm.
Western States Water Council, and
Sr. Attorney General, State of Washington

For the Private Interest:

Mary Burke, Chair, Sub-committee on Water Rights
and Resources, National Cattlemen's Association

Tribal Rights:

Roger Jim, Jr., Chair, Yakima Tribal Council
Confederated Tribes of the Yakima Indian Nation

Public Interest:

Cindy Mackay, Executive Director,
Northwest Environmental Defense Center

12:20 pm AUDIENCE QUESTIONS/ANSWERS

12:35 LUNCH (Catered or on your own)

1:30 pm WHO DOES WHAT IN GOVERNMENT

Robert Burd, Director, Water Division
U.S. Environmental Protection Agency, Region 10
Remarks/Moderator

1:50 NATIONAL PERSPECTIVE ON GROUND WATER

Philip Metzger, Associate, The Conservation
Foundation and National Ground Water Policy Forum
Washington, DC

2:20 WHAT'S GOING ON IN STATE LEGISLATURES

Representative Brian Ebersole,
Washington State Legislature

2:35 AGENDA OF STATE AGENCIES & INTER-AGENCY COORDINATION

Ground Water Quantity:

Glen Fiedler, Acting Deputy Director
Washington Department of Ecology

Ground Water Quality:

Kent Ashbaker, Chief, Industrial Waste Section
Oregon Department of Environmental Quality

AN ENVIRONMENTAL RESPONSE

David Ortman, Conservation Representative
Northwest Friends of the Earth

3:20 BREAK

3:35 LOCAL AND TRIBAL GOVERNMENTS GROUND WATER ISSUES

Municipal/Liberty Lake, Spokane:

Stan Miller, Manager, Spokane "208" Program

On Behalf of Counties:

Helen Dygert, Clark County Citizen Activist
Member, Washington State Board of Health

Within Tribal Government:

Mel Tonasket, Vice Chair, Business Council
Confederated Tribes of the Colville Indian Nation

4:35 AUDIENCE QUESTIONS/ANSWERS

5:00 ADJOURN

Dinner on your own and return for special session on GROUND WATER/GEOLOGY/RADIOACTIVITY beginning with Social Hour at 7:00 pm -- Browse among the exhibits.

FILMS will be available for viewing in the Board Room off the Rotunda balcony, during the Friday and Saturday lunch hours and the Friday evening Social Hour:

The Water Crisis: A NOVA film showing that "water scarcity could become the next national issue."

Ground Water: Its Occurrence, Movement, and Potential for Pollution. (Slides/cassette tape) National Water Well Association, narrated by Dr. Jay Lehr.

SPECIAL EVENING PROGRAM Bicentennial Pavilion Rotunda

7:00 pm SOCIAL HOUR (No Host) - Bicentennial Rotunda

8:00 GROUND WATER / GEOLOGY / RADIOACTIVITY

USA as a Whole - Geologic Sites & Radioactive Waste

William Meyer, Asst. District Chief, PNW District
U.S. Geological Survey

Idaho Falls/Recent Studies:

Larry Mann, Project Chief, Idaho Nat'l Engineering
Laboratory, U.S. Geological Survey

Hanford: A Proposed Nuclear Waste Storage Site

Steven Baker, Manager, Site Analysis
Basalt Waste Isolation Project
Rockwell Hanford Operations

William Brewer, Technical Director
Washington Nuclear Waste Board

Fred Lissner, Member
Oregon Hanford Repository Review Committee

Two Citizen Perspectives:

Ruth Weiner, Sierra Club

Economic Perspective (To Be Announced)

AUDIENCE QUESTIONS/ANSWERS

10:00 pm ADJOURN to Saturday at 8:15 am

Saturday, June 15, 1985

8:15 am Slides/Narrative:
How Spokane's 11,000 BC Flood Influenced the Pacific Northwest Aquifer
by Paul Weis, Geologist

8:45 GROUND WATER MANAGEMENT - SOME PNW CASE HISTORIES

Kenneth Dunn, Director, Idaho Dept. of Water Resources
Overview/Moderator

Ground Water Supplies: How Dependable in the Columbia River Basin of Washington, Idaho, and Oregon?

Dale Ralston, Professor of Hydrogeology
University of Idaho

The Coastal San Juan Islands: Ground Water Limits on Land Use, Growth, Salt Water Intrusion?

Colonel Sorenson, Planner, San Juan County, WA

Pure or Contaminated Ground Water? Non-point sources from Land Use Practices - Inland Empire, Plus a Glimpse at Puget Sound's Environs:

Kenneth Lustig, Director, Panhandle Health District
Idaho

Tacoma-Pierce County's Hazardous Materials/Waste Management in Commercial/Industrial Areas:

Derek Sandison, Environmemtal Health
Supervisor, Tacoma-Pierce Health Department

Kevin Foley, Urban Planner, City of Tacoma

Bob Myrick, Water Quality Manager
Tacoma Dept. of Public Utilities

10:35 UNDERGROUND STORAGE TANKS AND SOLID WASTE LANDFILLS:

City of Renton Management Plan:

Russell Stepp, Manager, Water Dept., CH_2M Hill

10:55 BREAK

11:10 Joining the Panel for Audience Question/Answers:

Summary of ALARA with criteria for reduction

Chris Platt, Environmental Lobbyist P05/06 §8102

M. G. McLanahan, Assistant Public Works Director, City of Moses Lake

David Wolf, Board of Trustees, The Confederated Tribes of Umatilla Indian Reservation in Oregon

Chris Smith, Special Assistant to President, McFarland-Cascade

12:00 pm LUNCH (Catered or on your own)

1:05 THE FUTURE IS NOW - A LOOK AHEAD

Richard Thompson, Director, State of Washington Department of Community Development

1:20 GROUND WATER MANAGEMENT

David Morell, Director, Santa Clara Integrated Environmental Management Project (EPA, Region 9, San Francisco)

2:15 INDUSTRIAL/BUSINESS CONSIDERATIONS TO PREVENT CONTAMINATING & DEPLETING GROUND WATER

Stewardship:

Allen Slickpoo, Nez Perce Tribal Executive Committee

Food Processors:

John Edwards, Vice President
Sweet, Edwards & Associates

Water Well Drillers:

Al Butler, Board of Directors
Washington State Water Well Drillers Assn.

Agriculture:

Don Ahrenholtz, Executive Vice President
Washington State Farm Bureau

3:30 AUDIENCE QUESTIONS/ANSWERS

3:45 CLOSING ADDRESS

GROUND WATER IN THE CONGRESSIONAL AGENDA

Honorable Slade Gorton, United States Senator
Senate Chair, Environmental & Energy Study Conference

4:45 ADJOURN

BIOGRAPHICAL SKETCHES

DON AHRENHOLTZ, Executive Vice President, Washington State Farm Bureau since 1974; he previously served in a variety of positions with the Colorado Farm Bureau, coming to Washington State from the American Farm Bureau Federation. He is Secretary-Treasurer, Washington State Pest Management Alliance, serves on the Irrigated Technical Advisory Committee of the Wash. Dept. of Ecology, and is on the Board of the Wash. Highway Users Federation. He holds a Bachelors degree in Business Administration, U. of Iowa, and an LLB, LaSalle Extension University.

KENT ASHBAKER, Manager, Source Control, Water Quality Division, Oregon Dept. of Environmental Quality, since 1972, being with this agency when it was the Oregon State Sanitary Authority before becoming a part of the DEQ. He serves on the Board of Directors, Underground Inspection Practices Council; is a Registered Professional Engineer in Oregon. Previously he was with the U.S. Public Health Service (1961-63), State of Kansas (1964-66), coming to Oregon in 1966. BS/Civil Engineering, Utah State Univ., MS/Civil Engineering, U. of Oklahoma.

STEVEN BAKER, Manager, Site Analysis, Basalt Waste Isolation Project (BWIP), Rockwell-Hanford Operations, since January 1982. Previous positions include working on the Fast Flux Test Facility for the U.S. Dept. of Energy, teaching mathematics and nuclear engineering at the Univ. of Alaska and Humboldt State College, and serving in the U.S. Navy Nuclear Submarine Program for seven years. BS/Mathematics, MS/Nuclear Engineering, PhD/Mathematics, Oregon State University.

JOHN A. BEARE, M.D., Director, Division of Health, Wash. Dept. of Social & Health Services, since 1974. Secretary, Wash. State Board of Health, and serves on the Wash. Traffic Safety Commission. He is a member of the American Public Health Assn.; Wash.State Public Health Assn.; Assn. of State and Territorial Health Officials, serving as President, 1978, and on the Executive Committee, 1983. BS/Seattle Pacific College; M.D./Univ. of Oregon Medical School; MPH/Univ. of California School of Public Health, Berkeley.

JOHN D. BREDEHOEFT, Past Regional Hydrologist, Western Region, US Geological Survey, 1980-84; he is now Research Geologist, USGS, Menlo Park, CA, and a Visiting Scholar in the Applied Earth Sciences Department of Stanford University. With the USGS since 1968, he

has held positions in USGS as Research Geologist, Deputy Asst. Chief Hydrologist (Virginia), and participated in a USGS cooperative study with Resources for the Future. Served, and serving, on many scientific committees, he is currently a Member of the Panel on the Waste Isolation Pilot Plant (WIPP) of the National Research Council. In 1977-80 he chaired UNESCO's International Hydrological Program Work Group for Ground Water Models for Management, and 1967-79, was Chair, Ad Hoc Internat'l. Committee on Utilization of Numerical Ground Water Models for Water Resources Management for the Scientific Committee on Problems of the Environment (SCOPE) of the Internat'l. Council of Scientific Unions. Mr. Bredehoeft has received many awards, including Fellow of the American Geophysical Union; Distinguished Service Award, US Dept. of Interior; and the O.E.Meinzer Award (shared with G.F.Pinder) from the Geological Society of America. He has written, and co-authored, more than sixty publications; the most recent, Water Management in the United States--a democratic process (who are the managers?), Univ.of Arizona Third Chester Keisel Lecture (1984); Physical Limitations of Water Resources in the Arid West, Univ.of California (1984), both in press. BSE/Geological Engineering, Princeton Univ. (Honors); MS & PhD/Geology, Univ. of Illinois.

WILLIAM A. BREWER, Technical Director, Washington Nuclear Waste Board, a state agency charged with managing high-level nuclear waste in Washington. He supervises an extensive engineering and geotechnical program dealing with the proposed nuclear waste repository on the Hanford Reservation. During 1972-75 he was Exec.Dir., Wash. Energy Policy Council, and Energy Advisor to Governor Dan Evans; and also Chair, the Pacific Oil & Ports Group. Previously he was Senior Geologist, Anaconda Co., Chile; Chief of Engineering, Nat'l. Photointerpretation Center; and with the Central Intelligence Agency. Brewer, listed in Who's Who in the World," has some 75 publications and two patents. He also taught in Argentina, Brazil, Venezuela, Berkeley, and retired from the faculty of the Institute for Environmental Studies, UW, in 1979. MS/Geology, PhD/Engineering, U.of California, Berkeley.

DAVID BRICKLIN, Attorney-at Law, is a partner of Bricklin & Gendler of Seattle, with special emphases on environmental and land use law. He is on the Board of Directors of the Washington Environmental Council. He holds a Bachelors degree for Michigan State U., and graduated from Harvard Law School in 1977.

A. KENNETH DUNN, Director, Idaho Dept. of Water Resources, was appointed in 1981, serving as Deputy Director 1976-81. Active in several state and national water resource organizations, he is immediate Past Chair, Interstate Conference on Water Problems, and is currently Chair, Water Resource Committee of the Western States Water Council, and a member of the WSWC Executive Committee. His responsibilities include management of Idaho's ground water through the appropriation of water, and waste disposal and injection well laws. A licensed professional engineer, he holds a degree from Sacramento State University.

HELEN N. DYGERT, Member, Wash. State Board of Health, served as its Chair 1981-82, and was a member of its Task Force on Future of Health Planning in Wash. State, 1982, and the Task Force on Cost Containment, 1983-84. In October 1984 she received the Wash. State Public Health Assn's. President's Award for Contribution to Public Health. A civic activist, volunteer, and homemaker, Dygert served on the Clark College Foundation Board, and as its President, 1980-82; was a member of the Advisory Board of The Evergreen State College's Vancouver campus (1978-84); and currently is on the Consumer Advisory Panel for PNW Bell, on the Mayor's (Vancouver, WA) Select Committee on the Arts, and the Advisory Board for People in Need (a non-profit corporation of "The Columbian," Vancouver's newspaper.) Active throughout Clark County, she has received many awards, including being given the First Citizen Distinguished Service Award from the Vancouver Jaycees in 1981. BA/Political Science, Alfred Univ., New York.

BRIAN EBERSOLE, Representative, State of Washington Legislature, from the 29th Legislative District (Pierce County and Tacoma), is in his second term. Representative Ebersole chairs the House Education Committee and also serves on the Committees for Local Government, for Commerce, and for Labor. He has sponsored several ground water protection bills in the Washington State Legislature. An educator, he holds a BA from the U. of Tennessee and a Masters Degree from Univ. of Connecticut.

JOHN E. EDWARDS, Vice President, Sweet, Edwards & Associates, Inc., and Associate Geologist, joined the parent firm, Environmental Geology and Ground Water, in 1978. Among the companies utilizing his services are food processors, including regional siting studies for land application of waste sludges and effluents; he also has and is conducting studies for pulp mills and municipal sewage plants, and is Project Geologist conducting ground water

ROBERT S. BURD, Director, Water Division, US Environmental Protection Agency, Region 10. In his seventeen years with EPA, he also served as Dir., Nat'l. Water Quality Standards Program, and as Deputy Asst. Commissioner for Operations, FQWA. Earlier he worked with Dow Chemical Co., the California Water Pollution Control Board, and served in the US Marine Corps. Publications include Sludge Handling and Disposal. Burd also led a joint Canadian/US environmental team to Sweden, and participated on an environmental technology team to Japan. Currently he is responsible for administering Federal water pollution control & drinking water programs in AK, ID, OR, & WA. BS/Civil Engineering, MS/Engineering, U.of Michigan.

MARY BURKE, Chair, Subcommittee on Water Rights and Resources, Committee on Private Lands and Environmental Management, National Cattlemen's Assn. She represents the Washington Cattlemen's Assn. as a member of the Water Quality Policy Advisory Committee for the Washington Dept. of Ecology; and is a former member of the Washington Forest Practices Advisory Committee to the Forest Practices Board, representing herself. She recently participated in a conference on non-point sources of water pollution held in Kansas City. Ms. Burke and her husband operate a cattle ranch north of Ellensburg, WA, where they have homestead water rights and water rights under the US Bureau of Reclamation project. Her family homesteaded in the area, in 1880, where she was raised on a cattle ranch.

AL BUTLER, Director on the Washington State Well Drillers Assn's. Board, is also a Water Well Technology Contractor and an Instructor/Coordinator of the Water Well Technology Program at Edmonds Community College. He is a member of the Washington State Senate Ground Water Advisory Board's Agricultural Committee, and serves on the Wash. Dept. of Ecology's Ground Water Management Strategy Task Force. Born into the well drilling industry in Wisconsin, Butler has worked in various stages of the water well drilling business since 1967 in the State of Washington.

PETE CORWIN, is Commissioner of Public Works for the City of Centralia, WA, an elected position. He has served on the Planning Commission, was a teacher for six years, a salesman and sales manager before that, and has been an insurance agent since 1978. BS Education/U. of Idaho.

quality studies in handling hazardous wastes, such as metal plating, petroleum refining, and wood treatment. A member of the Nat'l. Ground Water Committee of the Assn. of Engineering Geologists, he has a number of papers to his credit, including "Mt. St. Helens Eruptive Impacts to the Toutle Community Ground Water Supply," Bulletin of the Assn. of Engineering Geologists, Vol.XX, No. 2, 1983. He is also a member of the Nat'l. Water Well Assn., a Registered Professional Geologist, and a Certified Engineering Geologist. BS/Geology, MA/Geology & Hydrogeology, U.of Texas,Austin.

PAUL B. FETROW, Vice President, Resource Management, St. Alphonsus Regional Medical Center, Boise, Idaho, has been actively involved in development, construction, operation, and maintenance of institutional physical facilities for 24 years, including several years with Omaha, Nebraska's, water utility as well as other hospitals. In 1982, his facility, Saint Alphonsus, found itself operating an acute care hospital twenty feet above a ground water table which appeared to be laden with six million gallons of spilled petroleum products. BS/Mechanical Engineering, U. of Nebraska; MBA/Boise State Univ.

GLEN H. FIEDLER, Acting Deputy Director, Washington State Dept. of Ecology, was previously Asst. Director, Dept. of Water Resources, responsible for all water right and water management activities in Washington, starting in 1968, and continuing when the DWR was consolidated with other state agencies into the Dept. of Ecology. His work since 1951 has been in most facets of water management, water rights, administration, and enforcement, including being a referee in water right adjudications. Born and raised in the Puget Sound area, he is a registered Professional Engineer. BS/Civil Engineering, U.of Washington.

KEVIN FOLEY is a Planner with the City of Tacoma's Planning Dept, serving there since 1975. Mr. Foley is a member of the Steering Committee planning this conference and the field trip on Northwest Ground Water: The Invisible Resource! A Hidden Crisis?

NORMA JEAN GERMOND, Vice Chair, Columbia River Basin Task Force of the League of Women Voters of Idaho, Oregon, and Washington, with a particular concern for water resources and development, is also Past President of the Oregon LWV. She is a member of the Advisory Committee to the Oregon Hanford Respsitory Review Committee. An activist and volunteer, Germond was coordinator for the primary campaign of Oregon's newly-elected Secretary of State, Barbara Roberts; was the first President of the Northwest Conservation Act Coalition; formerly Legislative Liaison for the Oregon

DEQ; and a member of the Oregon Energy Advisory Committee, appointed by the late Governor McCall, to produce an energy study and policy. She serves on the Clackamas County Dome Foundation, the City of Portland's Solar Access Ordinance Steering Committee, the Boards of Directors for Portland Community College, the John Inskeep Environmental Learning Center of Clackamas Community College, and the LWV of Western Clackamas County. Formerly a teacher, she holds a BA/Education, Montclair State Teachers College, New Jersey.

JAMES T. GOODE, Assistant Director, Environmental Health Section, Lewis County Health District, Washington, is responsible for department-wide programs in sewage, food, solid waste, epidemiology, water supply and laboratory, nuiscance complaints, vector control, and other environmental health programs. With the Director, he is responsible for all program development and coordination of new programs. BS/Bacteriology & Public Health, Washington State Univ.

SLADE GORTON, United States Senator, State of Washington, was named the Senate Chair of the Environmental and Energy Study Conference, a membership organization for Senators and Congressmen. Elected to the U. S. Senate in 1980, Senator Gorton serves on five major committees and eight sub-committees, including: Banking, Housing, and Urban Affairs, Chair of its Sub-committee on Financial Institutions and Consumer Affairs; Budget, and has been named as one of the Senate conferees to the House-Senate Conference Committee on the Budget; Commerce, Science, and Transportation, Chair of its Sub-committee on Science, Technology, and Space; Small Business, Chair of its Sub-committee on Productivity and Competition; and Indian Affairs. In 1958 he was first elected to the Washington State House of Representatives, serving five consecutive terms, where he was House Majority Leader in his last term. In 1969 he was elected Attorney General for Washington, where he served three consecutive terms; he also was President of the National Association of Attorney Generals. Senator Gorton was an officer in the US Army and US Air Force, attaining the rank of Colonel in the Air Force Reserve. BA/International Relations, Dartmouth Univ.; received his law degree, with Honors, from the Columbia University School of Law.

STAFFORD HANSELL, Chair, Oregon Land and Conservation Development Commission, appointed by the Governor in 1983. Hansell operates one of the largest hog ranches in the country following his purchase of Hermiston Ordnance Depot in 1960. A member of the Oregon House of Representatives, 1957-75, he served continuously on the Rules Committe and Emergency Board, and as Co-chair of the Ways and Means Committee. Following retirement from the Oregon Legislature, he continued his public service in a variety of areas: 1977-83, National Governing Board, Common Cause; Advisory Committee to the President's Commission for a National Agenda for the Eighties; Board of Directors, Oregon Historical Society; Oregon Education Coordinating Commission; Acting Administrator, Liquor Control Commission; Governor's First Commission on Foreign Languages and International Study; Board of Directors, Oregon Community Foundation; Chair, Governor's Task Force on Land Use Planning to study impact of planning on Oregon's economic development. In 1977 with his brother, he was named Conservation Men of the Year. He is a lifetime resident of Oregon. Attended the U.of Montana; BA/ Economics, Whitman College.

ROGER JIM, Jr., Chair, Yakima Tribal Council, since January 1985, Confederated Tribes of the Yakima Indian Nation. He has served on the Tribal Council for sixteen years. Tribal Council committees include or have included Health, Education, & Welfare; Overall Economic Development; Legislative; Irrigation and Land; and Enrollment. He is Past Chair, Ceilo Wy-am (of the Yakima Indian Nation); Past Chair, Eastern Washington Indian Consortium; served two terms as Vice President, National Congress of American Indians; and served three terms as President, Affliated Tribes of Northwest Indians.

FREDERICK G. LISSNER, Administrator, Ground Water Division, Oregon Water Resources Dept., is responsible for managing ground water quality, quantity and thermal capacity as perpetual resources. He is a member of the recently appointed Oregon Hanford Repository Review Committee. Lissner joined the Water Resources Dept. in 1973, after a tour of duty with the US Army in Panama, and working in the mid-west for two years in petroleum exploration. Born and raised in Michigan. BS/Geology, U.of Michigan; MS/Geology, U.of Oregon.

KEN LUSTIG, Director, Panhandle Health District, Idaho, since 1983; previously he was Supervisor, appointed in 1976, and has been with the District since 1972. He has several publications in the solid waste area, and in septic tank/ground water pollution effects in the Rathdrum aquifer. Mr. Lustig has also worked on problems of methane gas migration from decomposing waste land fills, as well as on non-point source contributions by septic tanks in lakes of northern Idaho under the "208" program during 1975-77 -- or, "cultural eutrophication." BS/Zoology and MS/Terrestrial and Aquatic Ecology; U. of Idaho.

CINDY MACKAY, Executive Director, Northwest Environmental Defense Center, based at the Lewis and Clark Law School, Portland, Oregon.

LARRY MANN, Project Chief, Idaho National Engineering Laboratory, US Geological Survey, Idaho Falls, ID, appointed in August 1984. 1980 - 1984 he was Ground Water Discipline Specialist with the USGS in Arizona; he joined the USGS in 1965. BS/Mathematics, with an emphasis on geology, Northern Arizona Univ.

M. G. McLANAHAN, Assistant Director, Dept. of Public Works, City of Moses Lake, WA, since 1976, and joined the department in March 1958. Prior to this he was the resident engineer with Gray & Osborne, Consulting Engineers, covering central Washington. He also worked with the Guy F. Atkinson Construction Co., the US Army Corps of Engineers, and the US Dept. of Interior. Mac is a member of the Steering Committee for the this conference on Northwest Ground Water: The Invisible Resource! A Hidden Crisis? He attended Clemson Univ., So.Carolina, and graduated from the Norwich University, VT, with an Air Force Certificate of College Completion (the pre-ROTC degree).

PHILIP C. METZGER, Associate, The Conservation Foundation, also serves as an advisor to the newly-formed (January 1985) National Ground Water Policy Forum. Based in Washington, D.C.. Metzger is responsible for research and administration, particularly in the areas of national water policy, instream values, water rights and their transfer, and ground water management. Prior to joining CF, he was Policy Analyst for the Office of Policy Analysis, US Dept. of the Interior, serving as a member of USDI Task Groups on threats to National Parks, water supply for development of western synfuels, policy recommendations on offshore oil and gas

leasing, and the Bureau of Land Management wilderness study programs. Previously he was in private law practice; was Research Assistant, School of Natural Resources, U.of Michigan; RA for US Representative Clarence Long; Public Lands Assistant, Friends of the Earth; and several other positions. He is principal author of the chapter on water resource issues in the CF study, The State of the Environment: An Assessment at Mid-Decade; he is author of To Master A Thirsty Future: An Analysis of Water Management Efforts in Tucson, Arizona (a CF research report, May 1984); and with Edwin H. Clark II, of America's Waters: Current Conditions and Emerging Issues (CF, Washington,DC, Jan.1985). He attended the London School of Economics and Political Science and the U.of Chicago Law School; AB/History & Political Science (w/High Honors), MS/Natural Resources Policy & Management, JD magna cum laude, Univ. of Michigan.

WILLIAM MEYER, Assistant District Chief, Pacific Northwest District, US Geological Survey, serving in this position since 1979. He joined USGS in 1961. His research and investigative studies have been in remote sensing and ground water, both nationwide and internationally in Europe, Mexico, and the Philippines. Mr. Meyer is the USGS senior representative on an interagency working group for the proposed Hanford nuclear waste site. BS/Geology, MS/Hydrology, Arizona State Univ.

STAN MILLER, Project Manager, Spokane "208" Project, since 1981, he joined the project in 1977, with responsibilities for water quality monitoring. Prior to his present position, he taught science and mathematics in high school. Miller has published numerous articles about water quality. BA/Chemistry & BA/Education, Central Washington University; MS/Environmental Science, Washington State University.

DAVID MORELL, Senior Policy Analyst and Special Assistant to the Adminstrator, US Environmental Protection Agency, Region IX, San Francisco, since 1983. Morell is Director, Santa Clara Integrated Environmental Management Project. 1980-83 he was the Project Manager, Santa Clara Hazardous Waste Management Project for EPA. 1980-83, he was Director of Policy, State of California Hazardous Waste Program. 1974-82 he was on the faculty of Princeton University, where he taught Environmental Politics. He first joined EPA in 1971, serving until 1974 in the Director's Office of Transportation and Land Use Policy at headquarters in Washington, D.C. Morell currently is also a Consulting Associate Professor in Environmental Engineering, Stanford University. Publications include: Siting Hazardous Waste Facilities (Harper & Rowe, 1982); "Siting and Politics of Equity" in the Hazardous Waste Journal, Jan. 1985; and numerous other books and articles. He holds the degree of Ph.D.

C. R. (BOB) MYRICK, Water Quality Manager, Dept. of Public Utilities, City of Tacoma, since 1969. Prior to that he served in the US Army, and was with the Los Angeles Dept. of Water and Power. Bob Myrick is a member of the Steering Committee for the conference and field trip on Northwest Ground Water: The Invisible Resource! A Hidden Crisis? BS/Civil Engineering, Missouri School of Mines & Metallurgy; MS/Sanitary Engineering, U. of Missouri.

MARC A. NORTON, Hydrogeologist, Oregon Water Resources Dept. since 1983, with responsibilities for detailed geologic and hydrologic studies of the Butter Creek area, northeastern Oregon. He was the State's primary witness in a public hearing on the determination of a Critical Ground Water Area. Norton has held several positions in the private sector, as project hydrogeologist for chemical and hazardous waste projects in Louisiana; analyzing well data, including geothermal systems, in Idaho; monitoring as the Geohydrologist seepage at a coal fired generating station in Arizona; and was Senior Water Resources Analyst with the Idaho Dept. of Water Resources. He is a member of the Idaho Assn. of Professional Geologists and a Registered Geologist in ID & OR. Assoc.BS/ Forestry, North Idaho College; BS/Geology, Boise State Univ.; MS/Hydrology, U.of Idaho.

DAVID E. ORTMAN, Conservation Representative, Northwest Friends of the Earth, based in Seattle, WA. The NW office covers Idaho, Oregon, and Washington, with approximately 2500 members located in this region. He has been with FOE since 1975, both in Washington, D. C. and Seattle. Ortman has participated in the US Environmental Protection Agency-sponsored workshops held in Virginia to prepare a national ground water strategy. He is a member of the Steering Committee for this conference on Northwest Ground Water: The Invisible Resource! A Hidden Crisis? BA/Environmental Studies, Bethel College, N.Newton, Kansas.

CHRIS PLATT, Legislative Coordinator/Lobbyist, Cascade Chapter, Sierra Club, focusing in particular on Washington State legislation dealing with a state-wide ground water management process. For the past seven years, she has participated in citizen organizing and education for water quality and nuclear waste issues. Platt recently participated in the ground water conference sponsored by the Environmental Policy Institute in Washington, D. C.

DALE RALSTON, Professor, Hydrogeology, in the College of Mines and Earth Resources, University of Idaho. His duties include responsibilities for the graduate level hydrology program, graduate and undergraduate teaching, and the direction of Master's and Ph.D. candidates. Ralston's research includes studies on the hydrology of acid mine drainage problems, land use on abandoned mine tailings, water resource problems related to open pit phosphate mining, and ground water management. BS/Civil Engineering, Oregon State Univ.; MS/Hydrology, Arizona State Univ.; PhD/Civil Engineering (water resources), Univ.of Idaho.

CHARLES ROE, Senior Attorney General, State of Washington; Chair, Ground Water Protection Committee, Western States Water Council.

ANDREA BEATTY RINIKER, Director, Washington Dept. of Ecology; formerly City Manager, City of Bellevue (See insert for fuller bio.)

COLONEL L. SORENSON (his name, not his title), Planning Director, San Juan County, WA, a fast-growing but rural area comprised entirely of islands. He has more than twenty years experience in local government planning and has specialized in environmentally special, rural areas that have experienced rapid growth and change. Prior to coming to San Juans in 1980, he was Deputy Planning Director of San Luis Obispo County, California, for ten years. While there he also taught regional and environmental planning part-time at Cal-Poly State University.

DEREK SANDISON, R.S., Supervisor, Water Resources, Tacoma-Pierce County Health Dept. Currently he is Chair, Pierce County Water Utilities Coordinating Committee, Project Administrator for the Clover-Chambers Creek Drainage Basin Geohydrologic Study, and Project Administrator of the Pierce County Ground Water Data Base Management System Project. Derek Sandison is a member of the Steering Committee for the conference and field trip on Northwest Ground Water: The Invisible Resource! A Hidden Crisis? BS/ Biology, Central Washington Univ.

ALLEN SLICKPOO, Sr., Nez Perce Tribal Executive Committee, has served in tribal government on the governing board for 25 years. He has also served on a number of sub-committees relating to human and natural resources, including water rights; he is the water rights contact person for the Nez Perce Tribal Council. Slickpoo also is liaison to the Federal and State governments on matters relating to economics.

CHRIS SMITH, Special Assistant to the President, McFarland Cascade, a family-owned firm operating continuously in Tacoma for seventy-five years. Prior to joining the staff of Governor John Spellman, she was Director of Inter-governmental Affairs for the Washington Dept. of Ecology, responsible for hazardous waste legislation. Smith was Chair of the Washington State Pollution Control Hearings Board, and was also Chair of the Council on Environmental Policy, responsible for the initial rules and regulations for the Washington State Environmental Policy Act (SEPA). In 1971 she was elected to the Bellevue, WA, City Council, serving until 1974. BA/English, Bowling Green State Univ., Ohio.

RUSSELL J. STEPP, Water Department Manager, CH_2M Hill, has had over 13 years experience in all aspects of potable water supply and treatment, principally concentrating in the public sector. He received his degree in Civil Engineering from Marquette University.

LINDA TANZ, League of Women Voters of Tacoma-Pierce County is a member of the Planning Committee and the field trip on Northwest Ground Water: The Invisible Resource! A Hidden Crisis?

RICHARD J. THOMPSON, Director, Washington State Dept. of Community Development, January 1985 to the present. Formerly he was City Manager, Puyallup, WA, 1981-85; Chief Administrative Assistant, Everett, WA, 1977-80; and Acting City Manager, Snohomish, WA, 1971-72. He has also served as municipal attorney in these three communities. An attorney, he was in the private practice of law, limited primarily to municipal, environmental, and land use issues. 1983-84 he was a lecturer at The Evergreen State College for short courses on basis and advanced local government. BA/Political Science, Western Washington Univ.; JD/U.of Washington School of Law.

MEL TONASKET, Vice Chair, Business Council, and former Chair, Tribal Council, Confederated Tribes of the Colville Indian Nation. He is a member of the Advisory Committee to the Institute for Environmental Studies, UW.

MICHAEL WARFEL, Project Hydrogeologist with Hart-Crowser & Associates, Seattle. During the past eight years he has conducted ground water contamination investigations and water supply studies in the Midwest, East, and Pacific Northwest. Warfel also has experience in applications of ground water source heat pumps to heating and cooling systems. Prior to joining Hart-Crowser, he was employed by the nationally-known ground water firm of Geraghty & Miller, Inc. BS/Geology, U.of Illinois; MS/Geological Engineering, U.of Missouri-Rolla.

RUTH WEINER, Professor, Environmental Studies, Western Washington University. She is Past Chair, Cascade Chapter; Sierra Club, and is the current Chair of its Conservation Committee, and is a member of the Sierra Club's national energy and air quality study group. Wiener was a Congressional Science Fellow for the American Association for the Advancement of Science in 1984. Ph.D./Chemistry, Johns Hopkins Univ.

PAUL WEIS, Consulting Geologist, retired from the US Geological Survey after 32 years service, 20 years being in the Pacific Northwest states. He was Deputy Assistant Chief Geologist of the Office of Mineral Resources, USGS. Most of Weis's work was related to the origin and distribution of mineral resources, and he spent eight years surveying the mineral resources potential in proposed Wilderness Areas of the Northwest, as required by the Wilderness Act of 1964, in the North Cascades, the Salmon River Breaks of Idaho, the Pasayten Wilderness in WA, and the Eagle Cap Wilderness in OR. Ph.D/Geology, U. of Wisconsin,Madison.

LAWRENCE M. WEST, Associate Geologist for Sweet, Edwards and Associates, Inc., joining the firm in 1983, manages the Redmond, WA office. His twelve years experience encompasses numerous regional and site specific investigations throughout the West, focussing on ground water protection, control, and development. Currently he is Project Manager/Geologist for the Pierce County Clover/Chambers Creek Basin Geohydrologic Study and the concurrent Solid Waste Comprehensive Plan. Prior to joining Sweet-Edwards, he was with Brown & Caldwell Consulting Engineers for five years; with Stang Hydronics, Inc. for three years; staff geologist for the Ground Water Division of the Oregon Dept. of Water Resources; with Rittenhouse-Zeman & Associates, and Woodward Clyde Consultants where he conducted nuclear reactor siting studies, among other responsibilities. Author of many papers on ground water and seismic hazards. He is a member of the Geological Society of America, Nat'l. Water Well Assn., and the Assn. of Engineering Geologists. BS/Geology, California State Univ., Northridge; MBus.Admin./City Univ., Seattle.

DAVID WOLF, serves on the Board of Trustees, the governing council, for the Confederated Tribes of the Umatilla Indian Nation in Oregon. He is Chair of the Umatilla Tribes' Natural Resources Commission. Wolf represents the Umatilla on the Governor's Task Force on Ground Water.

N. W. GROUND WATER: The Invisible Resource! A Hidden Crisis?

June 14 & 15, 1985 - Tacoma, WA - BIOGRAPHICAL SKETCHES

NORMAN D.DICKS, United States Congressman, 6th District, Washington, was first elected in 1976, after serving as Administrative Assistant to U. S. Senator Warren G. Magnuson. He is on the House of Representatives Appropriations Committee, and three of its sub-committees: Defense, Interior and Military Construction. Also he is on the Federal Government Service Task Force, Congressional Arts Caucus, Democratic Study Group, and Environmental & Energy Study Conference. Earlier he served on the Sub-committee on Public Works & the Environment, and the Interior Appropriations Committee. Dicks is a member of the Board of Visitors, Air Force Academy, and before that on the Naval Academy Advisory Board and Board of Visitors for the Naval Postgraduate School at Monterey, CA. Among many honors is recognition for historical preservation, Nat'l.Leadership Award by Preservation Action, 1978 & 1982. BA and JD/Univ. of Washington.

ANDREA BEATTY RINIKER, Director, Washington Dept. of Ecology, since Feb.1985, appointed by Governor Booth Gardner. Previously, she was City Manager, Bellevue, WA, 1980-85; with the City of Austin, TX, 1970-80, as Personnel Director, Director of Community Development, and Assistant City Manager. She is a member of the Executive Board & Vice President, International City Management Assn., serves on the Boards of Washington City Management Assn. and United Way of Kind County. BA/Histor, magna cum laude, U.of Delaware; MA/Urban Studies, U. of Michigan.

DOUG SUTHERLAND, Mayor of Tacoma, since Jan. 1982, first serving on the Tacoma City Council, 1980-82. Currently, Mayor Sutherland is on the Board of Directors, Assn.of Washington Cities; and Chairs the Puget Sound Air Pollution Control Agency, Tacoma/Pierce County Board of Health, Tacoma/Pierce County Employment & Training Consortium, Law Envorcement Support Agency; and for the U.S.Conference of Mayors he chairs the Energy & Environment Committee and is on the State/Local EPA Liaison Group. He was recently appointed by Governor Gardner to the Maritime Committee for the Washington State Centennial; and is a member of the Community and Economic Development Steering Committee for the National League of Cities. BA/Central Washington University. Formerly he was employed by The Boeing Company; Sutherland is President of the Tacoma Tent & Awning Company.

CONFERENCE PLANNING COMMITTEE

The program and field trip for this conference was developed during frequent meetings of representatives from citizen organizations, public agencies, and business. The Institute for Environmental Studies is most appreciative to the following for their participation during the past year. Although there is not space to list all of those whose contributions were made by telephone or by mail, with critiques and suggestions for program topics and speakers, the Steering Committee was most appreciative of their "long distance" contributions, a number of which were incorporated in the program. (# identifies the Steering Committee.)

Tony Barrett, Washington Dept. of Ecology
Don Bliss, U.S. Environmental Protection Agency, Region 10
Doris Cellarius, Sierra Club, Ground Water Committee
Wensen Chu, Professor, Dept. of Civil Engineering, UW
Kevin Foley, Dept. of Urban Planning, City of Tacoma
Boyd Holding, Chevron USA
Muriel Lightfoot, Leagues of Women Voters of Seattle and Washington
M. G. McLanahan, Asst. Director, Dept. of Public Works, City of Moses Lake, Washington
William Meyer, Asst. Director, PNW Region U.S. Geological Survey
William Mullen, Director, Office of Ground Water U.S. Environmental Protection Agency, Region 10
Joe Murphy, Shapiro Associates
Bob Myrick, Water Quality Manager, Dept. of Public Utilities City of Tacoma
David Ortman, Conservation Director NW Friends of the Earth
Frank Packard, U.S. Geological Survey
Nancy Pearson, League of Women Voters of Tacoma-Pierce County
David Peeler, Washington Dept. of Ecology
Eugene Peterson, King County Building & Land Development Div.
Gary Plews, Washington Dept. of Social & Health Services
John Rieber, American Planning Assn., Washington Chapter

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National Audubon Society
Washington Environmental Council
Walla Walla Treaty Council
Confederated Tribes of the Colville Indian Nation
Puget Sound Alliance

GRATEFUL ACKNOWLEDGEMENTS

Financial assistance is greatly appreciated from:

U.S. Environmental Protection Agency, Region 10
Washington Department of Ecology
City of Tacoma's Department of Public Utilities

CREDITS

14 CLE (Continuing Legal Education)

15.7 CEU (Continuing Education Units)

Molly Ribby, Columbia River Task Force; Leagues of Women Voters of Idaho, Oregon, and Washington

Derek Sandison, Tacoma-Pierce County Dept. of Health

Mike Smith, Dept. of Urban Planning, City of Tacoma

Linda Tanz, League of Women Voters of Tacoma-Pierce County

Don Tahkeal, Natural Resource Analyst, Confederated Tribes of the Yakima Indian Nation

Michael Warfel, Hydrogeologist, Hart Crowser & Associates

Allen Zillgitt, Soil Conservation Service, U.S. Dept. of Agriculture

Conference Chair

Polly Dyer, Continuing Environmental Education Director
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