

# Groundwater and Wellhead Protection in the HUA

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The Idaho Snake-Payette Rivers Hydrologic Unit Area (HUA) Water Quality Project was one of 74 projects funded nationally by the United States Department of Agriculture (USDA) designed to protect and improve water quality. The purpose of these 8-year, federally funded projects was to accelerate the transfer of technology necessary to protect ground and surface water quality while maintaining farm profitability. This project had three phases consisting of: (1) the determination of surface and groundwater quality problems in the study area; (2) the development of best management practices (BMPs) to solve identified problems; and (3) the implementation of state-of-the-art BMPs on farms in the study area to improve surface and groundwater quality. **BMPs are management strategies that protect water quality without adversely impacting the profitability of farms.** Three USDA agencies provided leadership for this project—the Natural Resource Conservation Service (NRCS; formerly the Soil Conservation Service), the University of Idaho Cooperative Extension System (CES), and Farm Services Agency (FSA, formerly the Agriculture Stabilization and Conservation Service).

The Idaho Snake-Payette Rivers HUA Water Quality Project includes more than 840,000 acres in Canyon, Gem, Payette, and Washington counties in southwestern Idaho (Figure 1). Within this geographic area are more than 3,400 farms covering more than 500,000 acres. Virtually all

of the highly productive farmland is irrigated and the type of agriculture practiced is diverse, as more than 40 different crops are grown. The largest acreage crops include: alfalfa (76,000 acres), wheat (52,400 acres), sugarbeets (39,100 acres), barley (25,100 acres), corn (20,800 acres), beans (12,100 acres), orchards (12,090 acres), peppermint (11,000 acres), oats (9,800 acres), seed crops (8,800 acres), onions (7,700 acres), potatoes (5,000 acres), hops (2,600 acres), and spearmint (2,000 acres).

A competitive USDA grant awarded to the NRCS, FSA, and University of Idaho Cooperative

Extension System allowed the HUA project to hire staff in a centrally located office in Payette, Idaho. NRCS personnel provided technical assistance necessary for BMP implementation. The FSA provided cost-share assistance for BMP implementation while the University of Idaho Cooperative Extension System provided educational and technical BMP information to individual growers.

This geographic area was chosen for federal funding because there was a concern that agrichemicals (nutrients and pesticides) are a threat to groundwater quality, and that sediments, nutrients and pesticides are

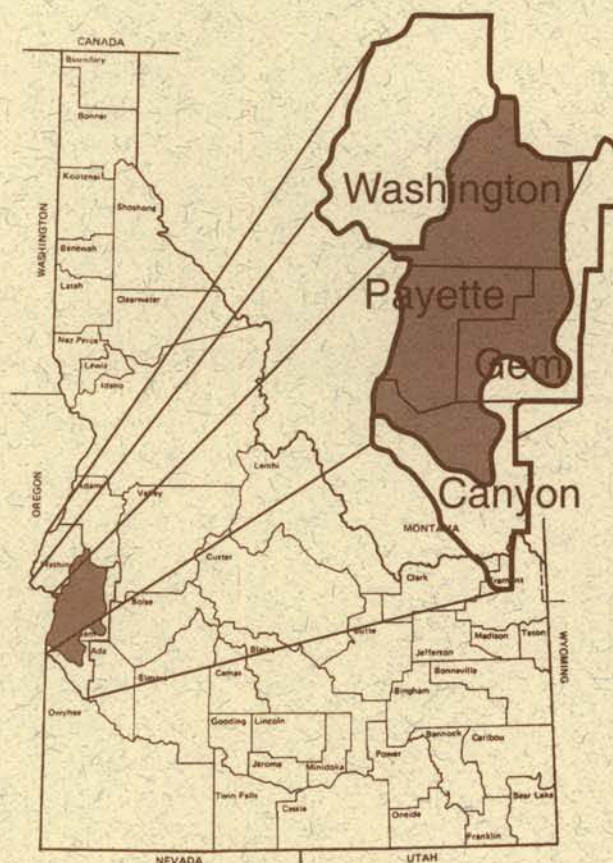


Figure 1. Map of the Snake-Payette Rivers HUA Water Quality Project encompassing Canyon, Gem, Payette and Washington counties in southwestern Idaho.



adversely impacting surface water quality. The Idaho Division of Environmental Quality (IDEQ) identified the Payette and Boise river aquifers (both found in the HUA project area) in southwestern Idaho as particularly vulnerable aquifers because of associated human activities. Both federal and state agencies have accumulated data that indicate nutrients and pesticides have had a negative impact on the groundwater quality in the HUA during the last 50 years.

A significant portion of the land within the HUA project area is considered vulnerable to groundwater contamination. This vulnerability is due in part to the close proximity of the water table to the land surface and the often excessive amount of irrigation water applied to crops, which often results in a large amount of leaching. Excess water use causes percolation of agrichemicals (nutrients and pesticides) through the soil beyond the crop root zone and into the groundwater. More than 95 percent of rural residents in the HUA depend on groundwater to meet their domestic needs. This reliance on the aquifer for drinking water in combination with excess irrigation by intensive agriculture may put groundwater in jeopardy. Groundwater monitoring studies conducted in the 1980's by the Idaho Department of Water Resources (IDWR) and IDEQ indicated that both nitrates and pesticides (such as Dacthal) are reaching aquifers under the HUA.

Groundwater and wellhead protection were a priority of the HUA project. Monitoring and educational components of groundwater cleanup in the HUA consisted of four parts: (1) the Idaho Farm Bureau (IFB) Idaho Wellhead Sampling Program, (2) the Home\*A\*Syst Wellhead protection program, (3) specific water quality educational programs, and (4) a survey of the general public in the HUA project

area about water quality. The results of this four-point program are outlined in this report.

### Idaho Wellhead Sampling Program

The HUA project was a partner in the Idaho Wellhead Sampling Program initiated and coordinated by the Idaho Farm Bureau (IFB). More than 700 private wellhead samples were collected from farmers and rural residents in Canyon, Gem, Payette and Washington counties during this program. In addition to the IFB and HUA project staff (UI and NRCS), the Idaho Department of Agriculture (IDA), IDEQ, United States Geological Survey (USGS) and local soil and water conservation districts (SWCD) participated in this sampling program.

This well sampling program was conducted in the HUA project area for the following reasons:

More than 90 percent of the residents in southwestern Idaho obtain their drinking water from groundwater.

Initial groundwater monitoring data from the Treasure Valley (southwestern Idaho) indicated some nitrate contamination.

Both shallow and deep aquifers exist in the project area. The shallow aquifers are used by local residents for drinking water.

Intensive and extensive nitrogen fertilizer practices are used in the area. Nitrogen use averages 130 pounds per acre. Excessive use of irrigation water may flush nitrates into groundwater.

Observations indicate some wellheads are not constructed properly, causing a danger of contaminants being directly transferred into groundwater.

No local baseline wellhead data exists to determine water quality trends or to evaluate the need for BMPs.

Intensive animal operations exist over shallow aquifers in the area.

In addition to collecting 703 well-water samples from the public, more than 200 blind, spiked water samples and blanks were included to ensure quality control and quality assurance. In some cases duplicate farm well samples also were included. Nitrate ( $\text{NO}_3\text{-N}$ ) concentrations in water samples were determined by the University of Idaho's College of Agriculture Analytical Laboratory in Moscow, Idaho.

A total of 450 private wellhead samples were collected from farmers and rural residents in Canyon County in February 1991. Eight percent of these sampled wells contained nitrate ( $\text{NO}_3\text{-N}$ ) levels greater than 10 ppm and another 19 percent had levels ranging 5.0 – 9.9 ppm (Figure 2). Gem and Payette counties had a combined well sampling program in 1991 where 150 private wellhead samples were collected. Approximately 5 percent of the well samples collected in Gem and Payette counties exceeded 10 ppm nitrate-N and an additional 7 percent of these wells had nitrate-N values ranging from 5.0 to 9.9 ppm (Figure 2). Of 89 private well samples collected in Washington County in April 1995, 30 percent contained nitrate ( $\text{NO}_3\text{-N}$ ) levels greater than 10 ppm and an additional 27 percent had levels ranging 5.0 – 9.9 ppm (Figure 2). Based on the wellhead survey data collected across the state, Washington County had the highest levels of  $\text{NO}_3\text{-N}$  in well water.

When the results from the four counties were combined, 10 percent of the wells sampled in the HUA project area contained nitrate-N levels greater than 10 ppm which is the U.S. Public Health Service drinking



water standard. Additionally, 17 percent of the wells in the four county area contained nitrate-N levels between 5.0 and 9.9 ppm. Conversely, more than 41 percent of the sampled wells contained less than 2.0 ppm nitrate-N. The collected information was not encouraging when compared with data from the EPA's national survey for nitrates in groundwater conducted in 1988. At that time only 2.4 percent of rural domestic wells exceeded federal health standards (10 ppm  $\text{NO}_3\text{-N}$ ) (Figure 3).

Based on the HUA project study, the following can be concluded:

- 90 percent of sampled wells do not contain excessive levels of nitrate-N based on U.S. Public Health Service drinking water standards.

- 41 percent of sampled wells contain less than 2 ppm  $\text{NO}_3\text{-N}$ .
- 49 percent of sampled wells contain between 2 and 10 ppm  $\text{NO}_3\text{-N}$ .

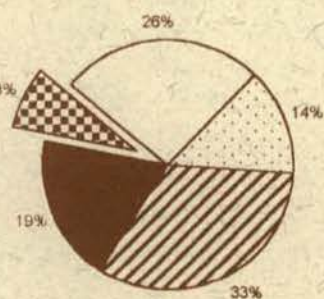
The fact that 59 percent of the wells sampled exceed 2.0 ppm  $\text{NO}_3\text{-N}$  suggests that groundwater contamination by nitrates in the HUA project area is a problem. The wells that contain less than 2.0 ppm  $\text{NO}_3\text{-N}$  (41 percent) have good water quality. There is no reason to believe that human-induced practices are adding nitrates to groundwater in these areas because low levels of nitrate (0.1-2 ppm) may be natural background levels in some aquifers. The best possible solution to the high nitrate problem is implementation of BMPs

to prevent further deterioration of water quality in southwestern Idaho.

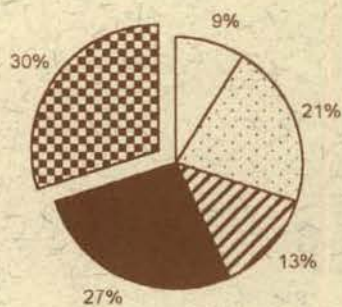
The wells that contain between 2 and 10 ppm  $\text{NO}_3\text{-N}$  (49 percent) should be regularly sampled at 2 to 3 year intervals. Although these wells meet federal nitrate-N drinking water standards, it is probable that human activity has introduced nitrate into the groundwater in the vicinity of these wells since detected  $\text{NO}_3\text{-N}$  levels are greater than normal, natural nitrate levels in aquifers.

According to this survey, 90 percent of the wells in the HUA project area are safe for domestic uses with respect to  $\text{NO}_3\text{-N}$ ; however, compared to national data collected by the EPA in 1988, groundwater nitrate concentrations in the HUA project area are high (Figure 3). Because 10 percent of the drinking

Canyon County 1991



Washington County 1995



Gem and Payette Counties 1991

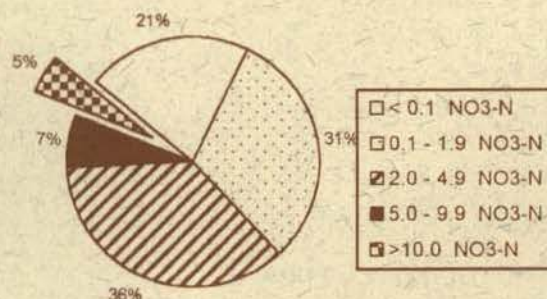
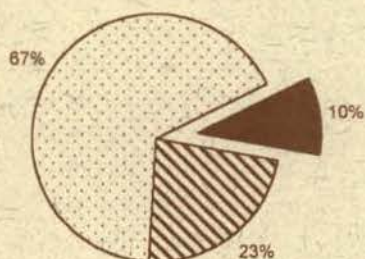


Figure 2. Results of wellhead survey for nitrate-N coordinated by the Idaho Farm Bureau Federation conducted in Canyon, Gem, Payette, and Washington counties between 1991 and 1995.

Canyon, Gem, Payette and Washington Counties Nitrate-N levels



EPA National Nitrate Survey Nitrate-N levels

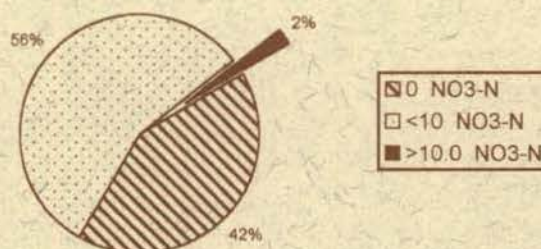


Figure 3. Comparison of IFB survey results for  $\text{NO}_3\text{-N}$  in 703 sampled wells in Canyon, Gem, Payette, and Washington counties (the HUA project area) with results from the 1988 national EPA survey for  $\text{NO}_3\text{-N}$ .



water wells do not meet federal standards, materials were made available to inform the public of the potential drinking water problems.

The wellhead sampling program conducted in the HUA project area included a significant educational component. Specific educational accomplishments included:

Trained the general public to use correct procedures for obtaining water samples from wells for chemical analysis.

Raised awareness of the drinking water quality in HUA wells.

Informed the participating public on the conditions of drinking water from their wells. This information either assured homeowners that their drinking water was safe or raised concerns and provided the needed momentum to take corrective action.

Provided wellhead protection BMP information to homeowners that had high nitrate-N values in submitted well water samples.

### **Home\*A\*Syst Wellhead Protection Program**

Home\*A\*Syst in Idaho is a self-assessment program to evaluate homes and property for groundwater pollution and health risks associated with drinking water. Using the University of Minnesota and University of Wisconsin Farm\*A\*Syst programs as a model, an interagency team developed a similar program for Idaho. This program, known as the Idaho Homestead Assessment System (Home\*A\*Syst) was launched in Idaho in 1995. The Idaho Home\*A\*Syst program is an interagency undertaking involving Idaho Association of Soil Conservation Districts (IASCD), IDA,

DEQ, IDWR, Idaho Food Producers Association, Environmental Protection Agency (EPA), University of Idaho Cooperative Extension System (CES), and NRCS. This program can be used as a self-assessment tool or can be done by a professional on site.

The Home\*A\*Syst wellhead protection program consists of three steps. Step 1. is the use of a series of fact/worksheets to assess the ground-water pollution potential of homestead structures and activities. The fact/worksheets contain information about BMPs to protect water quality and a general risk assessment of current practices and/or conditions. The topics addressed by 13 separate fact/worksheets include: (1) drinking water well condition; (2) pesticide storage and handling; (3) fertilizer storage and handling; (4) petroleum product storage; (5) farm and home waste management; (6) household wastewater treatment; (7) animal manure storage; (8) animal lot management; (9) silage storage; (10) milking center wash water treatment; (11) lawn and garden management; (12) pasture and riparian management; and (13) storm-water management.

Step 2. of the Home\*A\*Syst program is a site evaluation assessment of soil and geologic features that affect the groundwater pollution potential of the property. The worksheets completed in step 1 are combined with the site assessment in step 2 to produce a list of high-risk activities (step 3). Step 3 guides landowners to allocate money and/or efforts most effectively to protect their well water quality.

The Idaho Home\*A\*Syst project secured funds to hire four USDA/Americorps employees in southwestern Idaho. These employees were stationed in the Ada, Canyon, Washington, Gem, and Payette Soil Conservation District field offices. Three of the four employees were stationed within the HUA project area. Since 1995 the Idaho Home\*A\*Syst

program in southwestern Idaho has accomplished the following:

- Notified 16,276 homes in the HUA geographic area of the Home\*A\*Syst program.
- Signed up 231 homeowners for individual homestead assessments.
- Completed more than 125 Idaho Home\*A\*Syst worksheets.
- Received requests from more than 120 homeowners for assistance in designing solutions based on risk assessment.
- More than 40 homeowners have made corrective action plans based on the overall risk assessment.

In addition to providing on-site help, the Home\*A\*Syst team was also active in conducting several workshops for more than 200 HUA homeowners between 1996 and 1998. Workshop topics included: (1) introduction to Home\*A\*Syst; (2) pesticide storage and handling; (3) Integrated Pest Management (IPM); (4) ground and surface water quality: nutrients and pesticides; (5) weed control management; (6) irrigation management; (7) nutrient and manure management; (8) pesticide safety; (9) lawn and landscape pesticide management; and (10) pasture, rangeland and riparian management.

These workshops were often conducted in conjunction with pesticide recertification programs that are required by the IDA. Program participants received two private applicator credits for attendance. A follow-up survey of workshop participants found that many people were planning changes in their management strategies based on their educational experience at these workshops. Some of these changes



included: (1) pesticide storage facilities upgraded with locks; (2) the removal of underground storage tanks; (3) stream fencing; (4) improved handling of pesticides and fertilizer; and (5) flood control to reduce contaminated run-off.

Newspapers, newsletters, television (public service announcements), poster displays at fairs, presentations at meetings, direct mailings, and one-on-one visits were all used to inform people of Idaho Home\*A\*Syst Program. The most effective publicity using Idaho Home\*A\*Syst displays occurred at the Western Idaho State Fair, the Canyon County Fair, and at the Gem County Fair.

### Specific Water Quality Educational Programs

Strong emphasis was placed on educational programs to increase the adoption of water quality BMPs within the HUA project area to help protect and/or improve groundwater quality. Public meetings, farm tours, publications, and exhibits at fairs and trade shows were used to accomplish this educational objective. During the eight-year duration of the HUA project, the HUA project staff conducted more than 200 meetings. These meetings ranged from organiza-

tional steering committee meetings to initially organize the HUA's goals and logistics, to field tours and local workshops for growers and the general public.

Water quality booths were used as educational tools at the Canyon County fair, the Washington County fair, and at the Western Treasure Valley Business Fair. Radio and newspaper advertising were used to encourage residents to bring well water samples to the fairs for nitrate testing. As a result of the advance publicity more than 325 water samples were analyzed at the fairs for nitrate-N. More than 2,000 extension brochures about wellhead protection and water quality were distributed to the public at these events. Extension water quality materials were made available to the Gem and Payette Soil and Water Conservation districts for use in their fair booths as well.

Publications were also an important method for distributing wellhead protection information not only to the 52 HUA project cooperators but to all the HUA growers. The HUA project office issued a quarterly newsletter called *The Farm Planner* to educate readers about water quality BMPs. Circulation of this newsletter exceeded 2,500 per issue. In addition,

approximately 50 articles about the HUA and its progress appeared in local and regional newspapers and magazines such as *Argus Observer*, *Capital Press*, *Independent Enterprise*, *Idaho Farmer-Stockman*, and *Signal American*.

Several wellhead protection educational programs were targeted at rural residents living in the HUA project area. The five major BMP emphasis areas were: (1) well location, (2) well construction, (3) well management and maintenance, (4) new wells and (5) proper closure of unused wells. Examples of the types of principles taught at these sessions are shown in Figures 4, 5, and 6. These educational materials also were available in printed form.

### Survey of Public Attitudes about Water Quality

Public attitudes about qualitative and quantitative water issues in the Idaho Snake-Payette Rivers Hydrologic Unit Water Quality (HUA) Project watershed, and more specifically, the perception of agriculture's impact on water quality were assessed with a survey in 1996. The objectives of this survey were to assess: (1) public awareness of water issues; (2) public

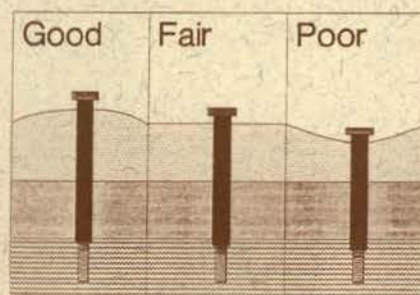


Figure 4. An example of the BMP principles stressed for well location—well location in relation to surface drainage.

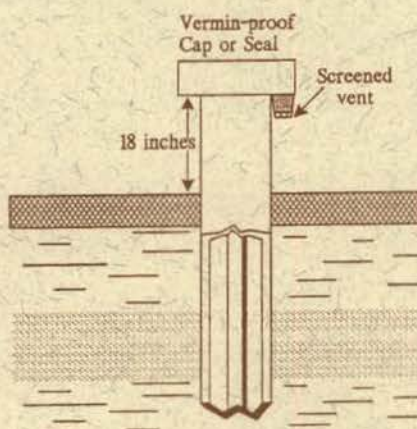


Figure 5. An example of the BMP principles stressed for well construction—casing and well depth.

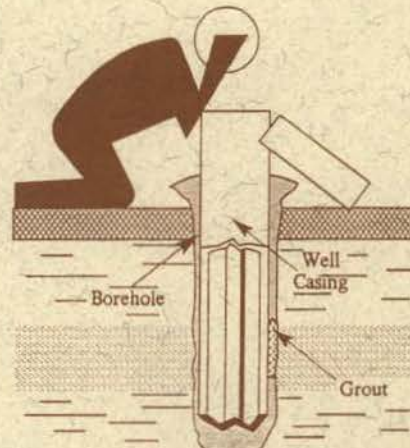


Figure 6. An example of the BMP principles stressed for well construction—casing depth and height.



literacy of drinking water contaminants; (3) public views of agriculture; (4) public importance placed on water issues; and (5) public awareness of agricultural best management practices (BMPs) and the HUA project. A 53-question assessment survey was developed and sent to 800 randomly chosen residents in the HUA watershed to answer the study's objectives. Almost 56 percent of the surveys were returned completed.

Seventy-one percent of the survey respondents in western Canyon, Gem, Payette, and Washington counties believed groundwater quality in the four-county area of southwestern Idaho is good or excellent, compared to 57 percent indicating that surface water is good or excellent (Figure 7). Different segments of the population had differing opinions on the quality of ground and surface water. A higher percentage of males (75 percent) than females (63 percent) rated groundwater quality good or excellent. Idaho natives (people born in Idaho) also were more optimistic about ground-

water quality than non-natives (78 percent vs. 66 percent). As the education level of the population increased from less than 12 years (less than high school diploma) to more than 16 years (college graduate), the opinion on the quality of groundwater became less optimistic.

The surveyed public had definite views about the quality of water in the three major rivers (Snake, Payette, and Weiser) in the HUA watershed. More than two-thirds of the respondents identified the Snake River as being dirtier (more polluted) than the Payette and Weiser rivers (Figure 8). Males were much more likely than females (78 percent vs. 44 percent) to rate the Snake River as the dirtiest. Conversely, the largest percentage of respondents ranked the Payette River (42 percent) as the cleanest, followed by the Weiser River (24 percent). Males were more likely than females to label the Payette River as the cleanest (48 percent vs. 26 percent). A substantial portion of female respondents had no opinion about

which were the cleanest (48 percent) and dirtiest (45 percent) rivers in the geographic watershed.

In general, survey respondents were found to exhibit a moderate to a high level of literacy about drinking water contaminants. Many respondents could correctly link a water contaminant with its probable source. For instance, more than 67 percent attributed geological factors as the prime cause of minerals in water, while 65 percent and 79 percent said agriculture was the most likely source of nitrate-N and pesticide contamination of water, respectively. Public literacy about the major sources of bacteria, heavy metals, and industrial contaminants in drinking water was also judged to be good.

A majority of the survey respondents chose agriculture as the main source of pollution in area rivers, with 42 percent attributing crop production as the major contaminator of Idaho's water (Table 1). When the survey responses that selected crop production or cattle operations were added together, more than 59 percent of the respondents cited agriculture as the major cause of river pollution in southwestern Idaho. Urban wastes were also considered a main cause of river pollution (29 percent) but these wastes were not cited nearly as often as agriculture. Agriculture is probably most often cited because the public links the brown color of river water with sediment runoff from agricultural fields.

More than 88 percent of surveyed respondents considered clean drinking water, clean groundwater, ample water supply, and clean rivers as very or extremely important water issues to them. The loss of wetlands, water for recreation, and salmon extinction were considered less important water issues in southwestern Idaho.

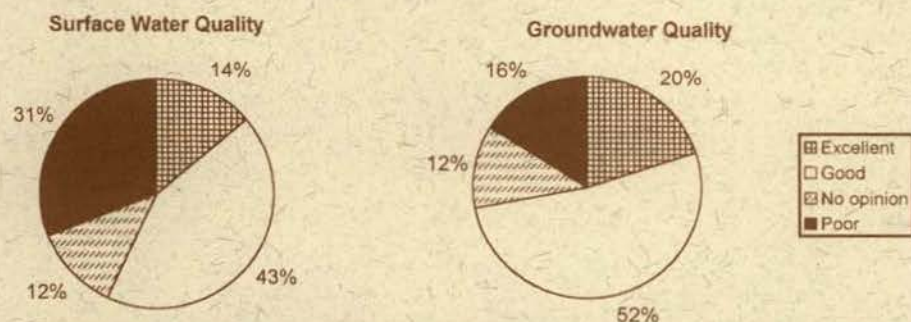


Figure 7. Public views on the current status of groundwater and surface water quality in Canyon, Gem, Payette, and Washington counties based on a survey conducted in 1996.

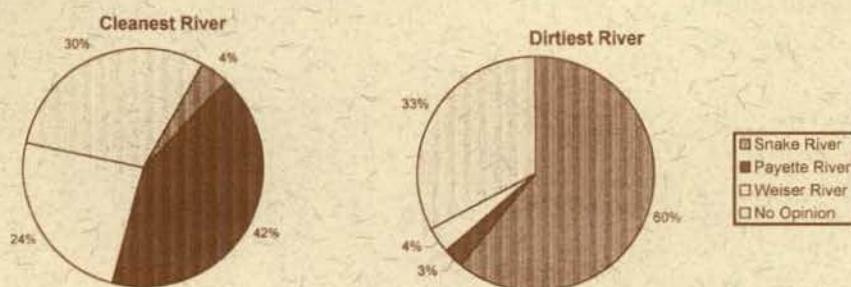


Figure 8. Public rating of cleanest and dirtiest rivers in southwestern Idaho based on the water issues survey conducted in 1996.



## SUMMARY

The Idaho Snake-Payette Rivers HUA Water Quality Project successfully accelerated the transfer of water management technology and wellhead protection BMP's to local growers to protect both ground and surface water quality. Highlights of the project's accomplishments include:

- More than 700 private wellhead samples were collected from farmers and rural residents in Canyon, Gem, Payette and Washington counties during the IFB wellhead nitrate sampling program.
- Of the 700 wells sampled in the HUA project area (Canyon, Gem, Payette and Washington counties), 10 percent contained nitrate  $\text{NO}_3\text{-N}$  levels greater than 10 ppm which is the National Public Health Service drinking water standard. Ninety percent of the wells appeared safe for drinking at this time.
- The incidence of high nitrates in the HUA was four times greater than levels observed in the EPA's national survey for

nitrates in groundwater conducted in 1988, which found that 2.4 percent of rural domestic wells exceed federal health standards.

- More than 16,000 homes in the HUA project area were introduced to the Idaho Home\*A\*Syst Wellhead Assessment Program.
- A substantial number of HUA residents have participated in the Home\*A\*Syst Wellhead Assessment Program. Several have made corrective action plans based on their own assessments completed with materials produced by this program.
- Public meetings, tours of farms, publications, exhibits at fairs and trade shows were educational tools used to increase the awareness and adoption of BMPs to protect surface and groundwater.
- The HUA project office issued a quarterly newsletter called the *Farm Planner* that educated readers about water quality BMPs. Circulation of this newsletter exceeded 2,500 per issue.
- Seventy-one percent of the residents in western Canyon, Gem, Payette, and Washington counties feel that groundwater quality in the four-county area of southwestern Idaho is good or excellent.
- A majority of the HUA area residents believe that agriculture is the main source of pollution in area rivers; 42 percent attributing crop production as the major contaminator of Idaho's water while another 17 percent link river pollution to cattle.
- The water issues considered most important to the general public in the HUA area are clean drinking water, clean groundwater, ample water supply, and clean rivers.
- More than 62 percent of the HUA residents feel that the HUA project would have either some impact or a great deal of impact on water quality in the watershed.

Even though a primary goal of the HUA project was to educate all citizens within the geographic watershed, almost 70 percent of the surveyed public had never heard of the HUA project. Less than 3 percent had received information directly from the project office, while another 25 percent of the survey respondents indicated that they had read about the project.

The county of residence of the respondent seemed to have an impact on project knowledge. More than 69

**Table 1 Public perception of the major source of river pollution in southwestern Idaho based on the 1996 water issues survey.**

Source of contamination	Major cause of pollution, % citing
Agriculture/crop production	42
Agriculture/ cattle operations	17
Road Erosion	2
Urban Wastes	29
Wastes from food processing	10
<b>Total</b>	<b>100</b>



percent of those surveyed had never heard of the HUA project as compared to 62 percent of the survey participants in Payette County. Payette County residents were most likely more informed because the HUA project was headquartered at the USDA office in the town of Payette. Based on these findings, the education of the general public was not as successful as anticipated. However, due to the fact that most residents receive information from television and newspapers based out of Boise and Nampa, Idaho, may have made the dissemination of HUA

project information into homes of the four county area (Gem, Payette, Washington, and Canyon) more difficult.

Despite the fact that most residents had not heard of the HUA project before, more than 62 percent of the survey respondents felt that the HUA project would have either some impact or a great deal of impact on water quality in the watershed. Only 7 percent of the respondents felt that the HUA project would have no impact on water quality.

### **About the authors**

L.R. Huter is a graduate student in soil science at the University of Idaho. R.L. Mahler is a professor of soil science in UI's Department of Plant, Soils, and Entomological Sciences, and the Extension Water Quality Coordinator for UI's College of Agriculture. L.E. Brooks is the Assistant Conservationist for the USDA Natural Resources Conservation Service in Boise. B.A. Lolley is a former graduate student in soil science. L. Holloway is Coordinator of the Idaho Home\*A\*Syst Program.

*This material is based upon work supported by the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture, under special project number 95-EHUA-1-0143.*

*The authors would like to acknowledge Tim Stieber, Tim Stack, and Mike Raymond for their dedication to this USDA water quality project. Tim Stack was the HUA project leader for the Natural Resource Conservation Service, while Tim Stieber was the HUA project leader for the Cooperative Extension System. Both Stack and Stieber staffed the project office in Payette for the majority of the projects' duration. They were responsible for the successful implementation of all the BMP strategies discussed in this publication. Mike Raymond, an USDA-Natural Resources Conservation Service Employee, is the current HUA project leader. He is responsible for the continued successful implementation of BMPs introduced through this project.*