

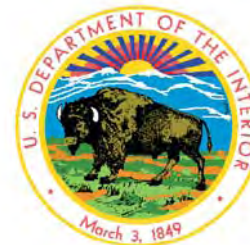


August 2001

**For More Information:**

National Irrigation Water Quality Program  
P.O. Box 25007, D-6200  
Denver, CO 80225

[doi\\_niwqp@do.usbr.gov](mailto:doi_niwqp@do.usbr.gov) (e-mail)  
[www.usbr.gov/niwqp](http://www.usbr.gov/niwqp) (www)



**Bureau of Indian Affairs  
Bureau of Reclamation  
U.S. Fish and Wildlife Service  
U.S. Geological Survey**

# Background

In 1982, dying waterfowl and waterfowl with birth defects and reproductive failures were discovered by the U.S. Fish and Wildlife Service at the Kesterson Reservoir, National Wildlife Refuge, California. Investigations were initiated in 1982 and continued through 1985. The cause of the problem was determined to be high levels of selenium in the irrigation drainwater discharged into the reservoir.

There was widespread media attention and congressional interest in 1985 concerning the potential for similar toxic impacts from irrigation drainwater at other locations across the West. This prompted the Secretary of the Interior to open an investigation of the effects of irrigation drainwater in the Western United States. A congressional hearing, several television programs, more than 100 newspaper and magazine articles, and numerous other inquiries focused on the contaminant issues related to irrigation drainwater.

In late 1985, the Department of the Interior (DOI) developed a program to investigate the extent and magnitude of the problem. That program is described in a document entitled "Management Strategy for Department of the Interior Irrigation Drainage Quality Issues" and was submitted to the Congress in 1985. This management strategy committed DOI to initiate a program that would identify and address irrigation-induced water quality and contamination problems related to DOI water projects in the West. No specific congressional action was taken and the Secretary of the Interior approved the initiation of the National Irrigation Water Quality Program (NIWQP). DOI was selected to manage the NIWQP with an advisory group of Bureau Coordinators representing the Bureau of Reclamation, Bureau of Indian Affairs, U.S. Geological Survey, and U.S. Fish and Wildlife Service.

Management of the NIWQP was transferred from DOI to the Bureau of Reclamation in fiscal year 1999. As part of the transfer agreement, the NIWQP retained the Bureau Coordinators as an advisory group to the NIWQP Manager.

# Related Activities- Contaminant Guidelines

## Constituents Affecting NIWQP Remediation Decisions

|         |            |
|---------|------------|
| Arsenic | Molybdenum |
| Boron   | Salinity   |
| Copper  | Selenium   |
| DDT     | Zinc       |
| Mercury |            |

The NIWQP considers the impacts from all chemicals that can be transported by irrigation drainwater to areas being used by fish and wildlife. These chemicals, the levels to which they are regulated by other state and Federal programs, and their impacts on fish and wildlife can affect NIWQP decisions to remediate for naturally occurring trace elements.

A copy of the contaminant guidelines may be viewed or downloaded at the NIWQP Web site: [www.usbr.gov/niwqp](http://www.usbr.gov/niwqp).



Sprinkler irrigation at Kendrick Project, Wyoming



Migratory birds at a National Wildlife Refuge.

# Related Activities- Contaminant Guidelines

## Guidelines for Interpretation of the Biological Effects of Selected Constituents in Biota, Water, and Sediment

The guidelines, criteria, and other information in this volume were originally compiled for use by personnel conducting studies for the Department's NIWQP program. The purpose of these studies is to identify and address irrigation-induced water quality and contamination problems associated with any of the Department's water projects in the Western United States.

When NIWQP scientists submit samples of water, soil, sediment, eggs, or animal tissue for chemical analysis, they face a challenge in determining the significance of the analytical results. How much of a given chemical constituent is normal in the tested medium? How much is unusually high? What adverse effects may result from the reported concentration? Studies that address these questions are myriad: they are widely scattered in the literature, they use many different approaches and testing protocols, and they yield greatly varying and sometimes contradictory results. The chapters in this volume are intended to:

1. Identify the most important, most relevant studies for several constituents of concern that are commonly encountered in environments affected by irrigation drainage.
2. Present a sampling of notable results from these studies in tables organized according to tested medium.
3. Explain further, in the accompanying text, the significance of these results.
4. Give full and accurate references to the original studies for those who desire more detailed information.

# Program Scope

The NIWQP program focuses on irrigation delivery water that originates from DOI developed irrigation and drainage projects. Impacts from irrigation return flows were focused on the following groups of fish and wildlife resources for which the Department has responsibilities.

- National Wildlife Refuges receiving drainwater from DOI irrigation and drainage facilities.
- Areas important to migratory birds and endangered species receiving drainwater from DOI irrigation and drainage facilities.
- Public water supplies that may be affected by drainwater from DOI irrigation and drainage facilities.

The NIWQP identifies all chemicals that might be transported by irrigation drainwater from a Federal irrigation project and that might be impacting sensitive/protected species or public water supplies. However, actual NIWQP remediation is conducted for only those chemicals that are naturally occurring.

Contaminants, such as DDE and DDT or other human introduced trace elements, are generally governed by Federal and state regulations relating to their uses. The NIWQP considers the impacts of these human activities in all its remediation decisions because (1) other contaminants in an area may make a NIWQP remediation ineffective or (2) there may be some opportunity to develop remediation plans that effectively correct both NIWQP related and non-NIWQP related contaminant problems at little or no additional public expense.



Redhead Duck embryos from Middle Green River Basin Study Area in Utah. The right embryo is normal. The other embryos show deformities typical of those caused by selenium.

# Program Phases

The NIWQP was designed to be conducted in five distinct phases.

Phase 1, 2, and 3 investigations were conducted by interbureau study teams composed of scientists from the U.S. Geological Survey as team leaders with participation by scientists from U.S. Fish and Wildlife Service, Bureau of Reclamation, and Bureau of Indian Affairs, as appropriate. The investigations were directed toward determining whether irrigation drainage (1) had caused or had the potential to cause significant harm to fish, wildlife, or human health or (2) could adversely affect the suitability of water for other beneficial uses. Phase 4 and 5 remediation efforts are being lead by the agency that constructed the project.

## Phase 1: Site Identification

Examination of existing information to determine sites likely to have irrigation-induced contamination problems.

## Phase 2: Reconnaissance Investigations

Field sampling studies to determine levels of potentially toxic chemical constituents in water, sediment, plants, fish, and migratory waterbirds.

## Phase 3: Detailed Studies

Field studies to gather information to identify the extent of any biological impacts. Detailed studies include identification of sources, transport mechanisms and fate of potentially toxic chemicals, and quantification of adverse impacts.

## Phase 4: Remediation Planning

Development of remediation alternatives to alleviate any existing biological impacts found during Phase 3. Planning is coordinated with appropriate Federal, state, and local agencies.

## Phase 5: Remediation Implementation

Implementation of corrective actions identified in Phase 4.

# Related Activities- Data Synthesis

In 1992, the DOI began a data synthesis study. The overall objective of this effort was to create a database of information collected by the investigations at the 26 study areas shown under Phase 2, Reconnaissance Investigations, and to use the database to identify commonalities and dominant factors that result in irrigation-induced contamination of water and biota. Previous publications from the data synthesis have concentrated on selenium because it was the contaminant in the 26 study areas that most frequently exceeded criterion for the protection of wildlife. A listing of these previous publications can be found in the bibliography on the NIWQP Web site at [www.usbr.gov/niwqp](http://www.usbr.gov/niwqp). Chemical data collected from these study sites can be viewed and downloaded from the NIWQP Web site.



A final Data Synthesis report is being prepared which will summarize the previously published selenium results. This report will describe the contents and construction of the database and will present information on the concentrations of arsenic, boron, molybdenum, uranium, and organic pesticides in water, biota, and sediments. The final report will also include a quantitative toxicological risk assessment on the effects of selenium on bird populations.

## Phase 5: Remediation Implementation



Two projects, or wetland sites within project areas, are currently in Phase 5 remediation. Remediation activities in the Middle Green River Project in Utah includes extending drains away from Stewart Lake wetlands to the Green River. The Gunnison/Grand Valley Project in Colorado contains over 20 wetland sites that may require remediation. Orchard Mesa is the first site in this area to go to Phase 5.



Middle Green Project Remediation Activities



## Phase 1: Site Identification

A comprehensive survey of about 600 irrigation project areas and Federal and state wildlife refuges was completed in 1989. Based upon screening criteria, 31 sites in 15 states were identified as having high or medium potential for irrigation-induced contamination problems. After further review, several sites were combined to bring the total to 26 sites. Nine additional sites were later identified for field screening studies.

It is possible that more sites will be identified for field screening as a result of independent investigations by individual bureaus or based on new information from other sources.



Irrigation drainage entering Stewart Lake, Middle Green Project, near Vernal, Utah.

## Phase 2: Reconnaissance Investigations

Reconnaissance investigations have been completed for 26 sites identified in 1989. Reconnaissance investigations were funded for up to 2 years to investigate and determine levels of potential toxic chemicals in water, sediment, plants, fish, and aquatic birds, and if those contaminants were at a level that could potentially cause injury to fish or wildlife resources.

The following areas were selected for reconnaissance investigations:

- American Falls Reservoir, ID
- Angostura Reclamation Unit, SD
- Belle Fourche Reclamation Unit, SD
- Columbia Basin Project, WA
- Dolores Project, CO
- Gunnison/Uncompahgre Rivers, CO
- Humboldt Wildlife Management Area, NV
- Kendrick Reclamation Project Area, WY
- Klamath Basin National Wildlife Refuge Complex, CA/OR
- Lower Colorado/Gila River Valley, AZ/CA
- Lower Rio Grande/Laguna Atascosa National Wildlife Refuge, TX
- Malheur National Wildlife Refuge, OR
- Middle Arkansas River, CO/KS
- Middle Green River, UT
- Middle Rio Grande/Bosque del Apache National Wildlife Refuge, NM
- Milk River, MT
- Owyhee-Vale Projects, ID/OR
- Pine River, CO
- Riverton Reclamation Project, WY
- Sacramento National Wildlife Refuge Complex, CA
- Salton Sea, CA
- San Juan River, NM
- Stillwater National Wildlife Refuge, NV
- Sun River, MT
- Tulare Lake Bed, CA
- Vermejo Project, NM

## Phase 4: Remediation Planning Map

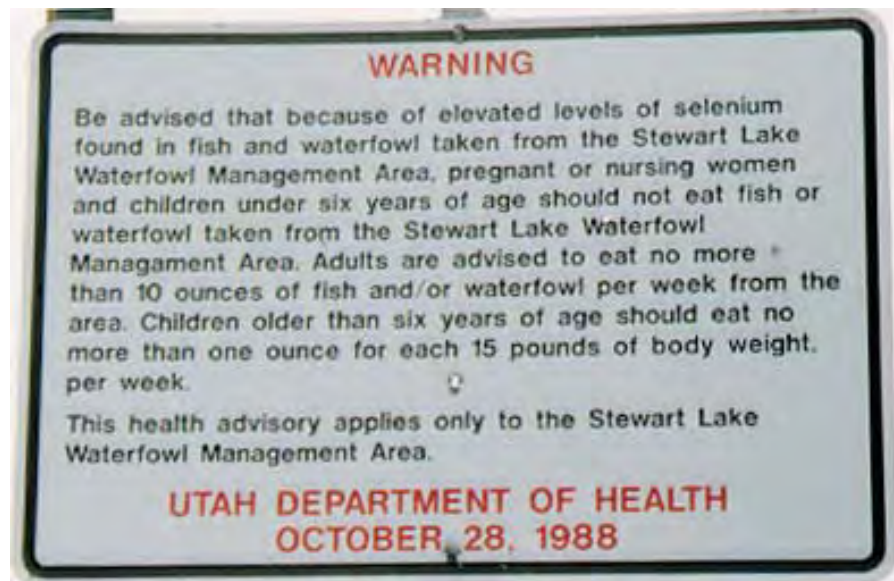


## Phase 4: Remediation Planning

Phase 4 is designed to evaluate remediation alternatives; this process takes approximately 3 years. The planning process is led by the bureau (Bureau of Reclamation or Bureau of Indian Affairs) responsible for the irrigation project. The planning process is governed by a core team made up of representatives from Reclamation or Indian Affairs (as appropriate), the U.S. Geological Survey, and the U.S. Fish and Wildlife Service. A technical team works under the direction of the core team to evaluate various technical issues related to the proposed remediation alternatives.

Based upon the results of the Phase 3 detailed studies, it was determined that the following five areas had adverse impacts to fish and wildlife resources from Federal irrigation projects.

Gunnison/Grand Valley, CO  
Kendrick Reclamation Project Area, WY  
Middle Green River, UT  
Salton Sea, CA  
Stillwater National Wildlife Refuge, NV



## Phase 2: Reconnaissance Investigations

Since 1989, field screening investigations have been initiated for nine additional sites. Field screening studies are similar to reconnaissance investigations but are limited to 1 year of data collection.

The following areas were selected for field screening studies:

Dolores/Mancos, CO  
Emery/Scofield, UT  
Helena Valley, MT  
Indian Lakes, NV  
North Platte River, NE  
Uintah/Ouray, UT  
Walker River, NV  
Wind River, WY  
Yuma Valley, AZ

None of these field screening study areas have warranted further study.



Aerial view of irrigation drainage flowing into the Salton Sea in Southern California.

## Phase 3: Detailed Studies

Based upon the results of the reconnaissance investigations, it was determined that eight sites warranted a more in-depth investigation. The purpose of the detailed studies is to gather information to identify and evaluate sources and transport of contaminants and to quantify the adverse impacts to fish and wildlife.

The following sites were evaluated during Phase 3.

Gunnison River/Grand Valley, CO  
Kendrick Reclamation Project Area, WY  
Klamath Basin, CA/OR  
Middle Green River, UT  
Salton Sea, CA  
San Juan River, NM  
Stillwater National Wildlife Refuge, NV  
Sun River, MT



Measuring flows at  
Burn's Bench Canal,  
Middle Green Project,  
Utah.



Core sediment sampling  
at Kendrick Project,  
Wyoming.

## Phase 3: Detailed Studies Map

