

A Good Term

Commissioner of Reclamation  
upon some of the achievements  
of the past four years.

record for monies—the allocations,  
carryover, and reversion for use on Reclamation projects  
States.

more important than the number of projects  
which they have been and will be  
needed to serve people throughout the West  
water supplies have been improved  
Atmospheric Water Recovery  
is the water potential and the  
great promise for man's future  
Large Programs are another

Power and the Irrigation  
projects were particularly useful  
largest dams and hydroelectric  
the 5-year, \$33 billion program  
areas, improve water quality  
industrial water supplies.

We've got a good look at our  
country, our friendly people,  
understanding and cooperation

industrial water deliveries  
have now increased to over

over 55 million tons of food  
irrigated farms. In 1970 the  
output of the small farm has

problems in 1972 from the millions  
of acres reached a record high

objective procedures will ensure  
projects will better meet people's

guidelines have been established  
in future Bureau planning  
of the Bureau should be  
I am confident that with  
people, the Bureau of Reclamation  
all Americans as it keeps  
national needs and programs

*Ellis L. Armstrong*

ELLIS L. ARMSTRONG  
Commissioner of Reclamation

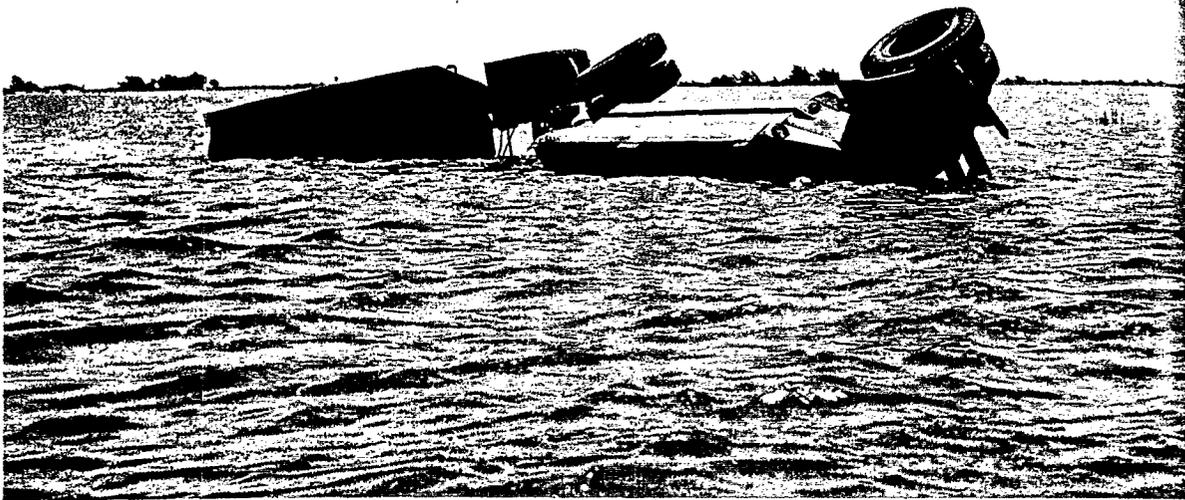


Vast quantities of water gushed in from the Pacific Ocean causing great damage to the levee along the San Joaquin River, Calif.

*Reclamation Era 59, 4, 1973*

# Disaster Strikes Isleton

by JIM COOK, Chief, Delta and Bay Area Branch,  
Division of Planning, Mid-Pacific Region; and  
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Mid-Pacific Region, Sacramento, Calif.



This is only a small example of the destruction created by the levee

**T**HE NIGHT OF JUNE 20, 1972, began much as any other night on Andrus and Brannan Islands in the Sacramento-San Joaquin River Delta of California. The day had been hot and the stiff 30 mile-per-hour wind blowing in from the Pacific Ocean through San Francisco Bay and the Carquinez Strait provided a welcome respite.

The crops on the islands were approaching maturity, promising a bountiful fall harvest. Work on the south levee was progressing well and would soon be completed. A high tide was building in the ocean and would shortly be moving inland to spend its energy flowing through the Delta, but this too was a common phenomenon.

As darkness descended, the people of the islands retired for the day—secure in their knowledge that the coming morning would bring another day of serenity, characteristic of the Delta during this time of year.

### Fire!

The quiet of the little town of Isleton on the northern levee of Andrus Island was mildly disturbed at about 12:30 a.m. on June 21 by a report of a fire near the Spindrift Marina on the island's southern levee bordering the San Joaquin River. Little did those aware of the alarm know this was

the beginning of a disaster that would force evacuation of the Andrus and Brannan Islands' residents. The fire had been caused by an unknown present danger in the Delta—a levee break.

Since no one witnessed the beginning of the levee failure near the Spindrift Marina, it can be supposed that a combination of levee instability, tides, winds, and wave action caused failure of a privately-owned and maintained levee. The breach was probably small at first, little more than a wet spot on the inner face of the levee.

The inner surfaces of the islands lie 10 feet below sea level, however, and the small breach probably exploded into a furiously roaring torrent which tossed aside like matchsticks trailer homes, boats, mooring docks, and sheds at the Spindrift Marina. As the levee heaved inward, falling trees and poles caused a short circuit of powerlines and the fires that alarmed the slumbering Delta community to what rapidly became a disaster.

### "Water Carried Our Home Away!"

Mr. Fred Wilson and his wife, residents of the Spindrift Marina mobile home park, described the levee break in an article appearing in the Antioch Ledger.

Wilson said, "I thought it was a back door there was swirling around. Wilson continuing his story that was 3 feet deep. We didn't leave. We carried our home. The Wilsons made a road and were at center hastily Vista High School."

**Ab Anything The**  
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r. Wilson said, "There was this terrible roar. I thought it was a storm. But when I opened the back door there was no rain or wind. Suddenly the water was swirling around my feet."

Mrs. Wilson continued, "Fred grabbed David (my visiting grandson) and I followed him into the water that was 3 feet deep around our trailer. We didn't leave a moment too soon. The trailer carried our home away in a matter of seconds."

The Wilsons made it to a solid section of the levee road and were evacuated to an emergency shelter center hastily established in the nearby Vista High School.

### Grab Anything That Floats

Although there is usually a master plan for what to do in the event of a disaster, it seldom is of great practical value at the height of such a crisis as was created by a Delta levee break. If caught in a break, as were the people in the vicinity of Spindrift Marina, you don't plan. You react. You grab for anything that floats or anything that is firmly anchored. Your most compelling thought is to get yourself and your loved ones to higher ground and safety.

The people of the islands and the surrounding

area hurriedly answered the emergency call. Privately-owned boats and State and Federal agencies' boats and helicopters were quickly marshalled to pluck stranded residents from the raging waters that had rapidly covered the southern edge of the islands. What followed in the next few hours was a miracle—all the people along the southern edge of the islands were rescued with only 20 injuries and no fatalities.

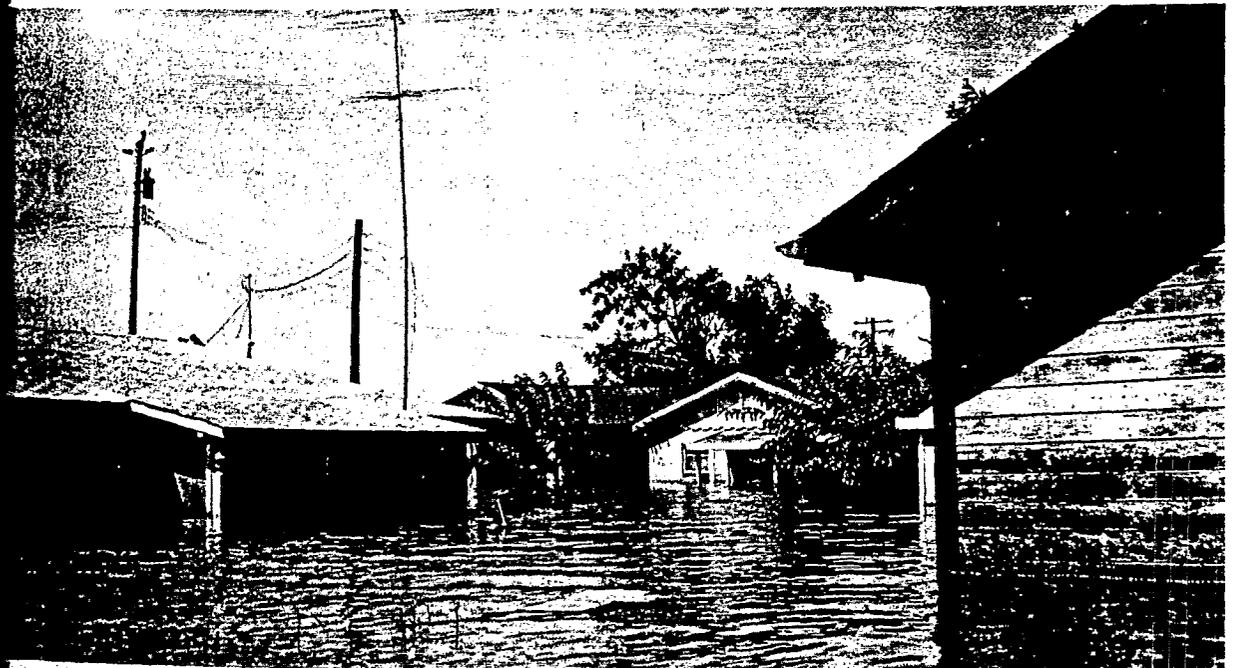
### Dike Is Built

While rescue operations were still in progress, the Corps of Engineers and local volunteers committed the small amount of heavy equipment available to the task of building a dike around the town of Isleton.

Throughout the next two days and a long night, weary crews fought a losing battle to save the town from the windswept waters pouring onto the islands. The town of Isleton was officially evacuated at 9:30 p.m. on June 22.

Along with evacuation of the 1,600 residents of Isleton, the 3,000 residents of Andrus and Brannan Islands were safely removed from the disaster area. Some came away with almost all their belongings, some with none, but all came away with their most precious possessions—their lives.

Flooded streets in Isleton, Calif. were part of the 13,000 acres of land inundated in Andrus and Brannan Islands.



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### Home Away!

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The Delta has been called the heart of California's water supply system because all water flowing southward through the State is presently pumped from the Delta. On June 20, the Delta went out of "balance" that is, the amount of water coming into the Delta was sufficient to meet local and export demands, and to prevent salinity intrusion into San Francisco Bay.

### Water Balance Upset

When the Andrus Island levee failed along a 10-foot front, the water balance of the Delta was upset. Nearly 150,000 acre-feet of water rushed into Andrus and Brannan Islands submerging about 13,000 acres to depths of 8 to 14 feet.

The vacuum created by the flow of fresh water from the San Joaquin River and tributary waterways into the island began to draw salty water from San Francisco Bay into the western Delta. With each rising tide 200,000 to 300,000 c.f.s. (cubic feet per second) of salt water was forced inland toward the Delta.

### Salt Water Threatens

This salt water intrusion posed an immediate threat to Delta water users and to over a quarter of a million people, a million acres of rich agricultural lands, and billions of dollars worth of industrial

production capacity dependent upon Federal and State exports from the Delta for a water supply.

During the hours immediately after the levee break and for almost 6 weeks thereafter, the Bureau of Reclamation and the California Department of Water Resources battled to regain the balanced water condition in the Delta necessary for protection of these water users.

These efforts required carefully coordinated operation and adjustment of California's water supply system stretching over 1,000 miles between the Oregon and Mexican borders.

State and Federal export pumping from the southern Delta was reduced from 6,600 to 900 c.f.s. soon after the levee break, and water demands south of the Delta were met from San Luis Reservoir. Between June 21 and 28, releases from Keswick and Nimbus Reservoirs of the Central Valley project were increased from 12,000 to 14,000 c.f.s. and from 2,000 to 5,000 c.f.s., respectively.

During this period, releases from Oroville Reservoir of the State water project were increased from 3,000 to 4,000 c.f.s. These added releases were successful in significantly reducing salinity intrusion into the Delta.

### Salt Water Removal

Once contained, the salt water had to be moved out of the Delta so water demands on the Contra

This farmhouse was almost completely destroyed by wave action before water could be pumped out. An estimated 3,000 persons were left homeless when the break occurred.





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Costa and Delta-Mendota Canals and the State's South Bay Aqueduct, which were at peak annual levels, could continue to be met.

Based on the Bureau's 30 years of experience in Delta water operations, three possible alternatives for removing salt water from the Delta were evident:

1. Wait for flushing flows from winter rains;
2. Gradually increase pumping over a period of many months; or
3. Pump at a maximum rate with Federal pumps in the Delta-Mendota Canal to pull the salt water out of the southern Delta and to put fresh water into the salt contaminated channels of the western Delta (State water quality contracts for the South Bay Aqueduct would not permit use of State pumps in this effort).

Immediate demands for quality water in the service areas beyond the Delta rendered alternatives 1 and 2 unacceptable. Between June 30 and July 4, pumping to the Delta-Mendota Canal was increased from 900 to 4,300 c.f.s.

Within 4 weeks, all of the western Delta was cleansed of the salt water intrusion. Peak salinities in water deliveries to CVP water customers during this operation were 440 p.p.m. (parts per million) chlorides in the Contra Costa Canal intake on July 4 and 165 p.p.m. chlorides at the intake of the Delta-Mendota Canal on July 7 as compared with normal values of 100 p.p.m. chlorides and 70 p.p.m. chlorides respectively for this time of year.

As the peak salinity reached the Contra Costa Canal, an intertie was completed by the Contra Costa County Water District to provide daily delivery of 40 million gallons of fresh water from the East Bay Municipal Utility District's nearby Mokelumne Aqueduct into the canal. This water was blended with the highly saline waters from the Delta to deliver water of 120 p.p.m. chlorides to 180,000 people downstream of the intertie.

Upstream of the intertie 70,000 people had to rely temporarily on the higher-salt-content waters. Salt content of the water and directions for watering lawns and for other uses of the water were published in daily papers of Contra Costa County throughout the crisis period.

### **Salty Cardboard**

The most significant effect of the highly saline water delivered to the Contra Costa Canal was

the impact on paper products plants in the Antioch-Pittsburg area. These plants had to continue production of cardboard boxes and package metal cans because the cans would rust from the high salt content of the board.

The slightly higher salt content of the Delta-Mendota Canal waters caused no apparent damage as peak salinity was within tolerance limits for crops being irrigated in the San Joaquin Valley.

The ability of the Bureau and California Department of Water Resources to react successfully to this crisis is a tribute to the years of planning, designing and constructing water storage and conveyance works that provide dependable service and a high degree of operational flexibility.

Since levee breaks in the past occurred during winter months, with high rainfall and fresh water flowed through the Delta, this year's levee failure provided an excellent opportunity to assess the capability of projects to operate under conditions of peak water demands and low-normal fresh water availability.

### **Upstream Reservoir Releases**

It soon became apparent that a majority of upstream reservoir releases were not reaching the area affected by the salinity intrusion. Only about 25 percent of the water released was passing through the existing Delta cross channel into the interior Delta. It was also readily apparent that the proposed peripheral canal, recommended for construction by 1980, would have significantly enhanced the ability of the projects to react to an emergency of this nature.

With the Peripheral Canal in operation, a release of 6,000 c.f.s. could have been made to the interior Delta in addition to flows introduced with existing cross-Delta transfer methods. These additional releases would have moved westward and southward through the Delta, thus sweeping out the salt water. This would have allowed for an immediate reaction to the emergency, and a shorter time and smaller reservoir release to restore the Delta water balance.

In view of the increasing risk of Delta failure, buildup in water demands and the impact of dry year conditions on reservoir storage, the increased operational flexibility that would be provided by the Peripheral Canal became highly significant.



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Surveying his pear orchard, which is a total loss, this farmer joins numerous others who lost more than 20 square miles of delta farmland.

Debris washed up by the flood covered the entire landscape.



Repairing the levee break was an arduous task, requiring 33 days, 600,000 cubic yards of sand and 60,000 tons of rock.

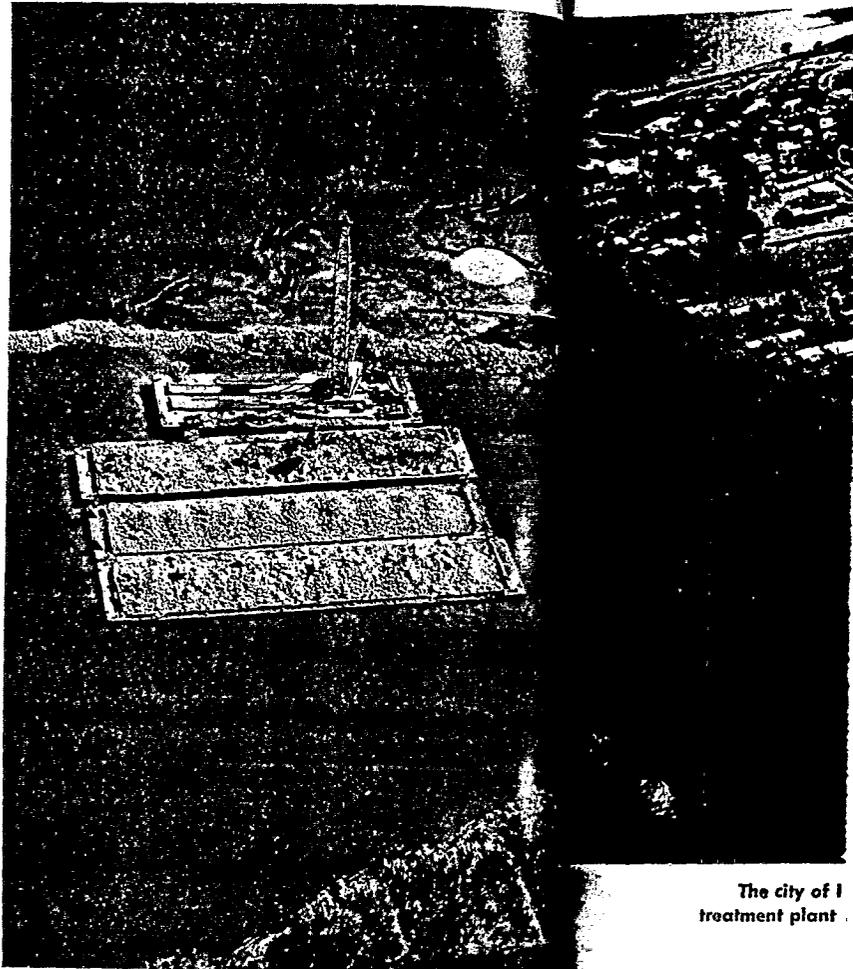
### Close the Levee Break

With the failure of the emergency dike and the evacuation of the town of Isleton, the Corps of Engineers immediately turned its attention to closing the levee break. Work on the closure could not begin until the island filled with water because of the high velocity of flow into the break. Closure of the 500-foot long, 75-foot deep break began June 28. In an around-the-clock effort, the Corps placed 60,000 tons of rock and 500,000 cubic yards of sand in the levee break, completing the closure at 3:15 a.m. on July 24.

As closure neared completion, power facilities and 16 pumps were installed to begin removing approximately 150,000 acre-feet of water from Andrus and Brannan Islands. The pumps have a total capacity of 600,000 gallons per minute and will require 2 to 4 months to "dry out" the island. At present pumping rates, the water level in the islands is dropping about 1½ inches per day.

### Expensive Disaster

The Andrus Island levee failure was an expensive disaster with an estimated \$21 million in prop-



The 500-foot wide, 75-foot deep break also required two hydraulic dredges to plug the break and a clamshell with rock barges to dress the levee.



The city of Isleton treatment plant.

erty loss and damage, about \$10 million for air and unwatering, a \$5 million emergency water supply, and release of so much sewage from Federal project from State water project far more expensive diverted through the companies of State and Federal funds of millions of dollars manufacturing output of domestic and industrial water have been contaminated with salts for upwards of 6 million gallons.

### Lessons Learned

Several important lessons were learned from the crisis created by the failure. One lesson is that the fragile levee system is liable to failure at any time during periods of high flood flow.



The city of Isleton on Andrus Island as it looked on July 21, 1972, one month after the levee break. Note the sewage treatment plant in the lower right ringed by a temporary levee. The Sacramento River is in the upper right-hand portion.

...y loss and damage, about \$1.5 million for levee repair and unwatering, an as-yet-unreported cost of emergency water supplies to the Contra Costa Canal, and release of some 200,000 acre-feet of storage from Federal projects and 100,000 acre-feet from State water projects.

A far more expensive disaster was narrowly averted through the combined emergency operations of State and Federal water projects. Hundreds of millions of dollars in field crops and manufacturing output could have been lost since domestic and industrial water supplies would have been contaminated beyond salt tolerance limits for upwards of 6 months.

### Lessons Learned

Several important lessons were learned during the crisis created by the levee failure. One major lesson is that the fragile Delta levee system is subject to failure at any time, not just during winter floods of high flood flows. Another is that effects

of Delta levee failures are no longer only local disasters since, due to the importance of the Delta in present water transfer systems, they can have a tremendous impact on the operation of water supply systems throughout the State.

It was also learned that water projects of the Department of Water Resources and Bureau of Reclamation have been well designed, with high resilience and flexibility for providing a dependable supply of useable water under emergency conditions. And, finally, it was learned that the Peripheral Canal is vitally needed for protection of the State's water supply systems and for protection of water supplies in the Delta itself.

The Andrus Island levee failure will soon become history to most of us. The damage will be repaired, reports will be written, hearings will be held, and plans to avert future emergencies will be made. However, for the residents of Andrus and Brannan Islands, the memory of June 21, 1972, a fire alarm and a countdown to disaster will remain forever. # # #