STATE OF CALIFORNIA -- THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

BOARD OF SUPERVISORS
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CORRESPONDENCE 2
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August 22, 2007

The Honorable William O'Brien
Chairman
Stanislaus County
1010 Tenth Street, Suite 6500
Modesto, CA 95354

SUBJECT: Upcoming Helicopter Survey Flights to Evaluate Flood Control Levees

Dear Chairman O'Brien:

Starting in early September, the Department of Water Resources (DWR) will be conducting electromagnetic levee surveys using low-altitude helicopter flights. The helicopter will be carrying a torpedo-shaped survey "bird" suspended about 100 feet above the ground in order to gather important data on levees ranging from Oroville in the north to Lathrop in the south.

Because homes, businesses, and other sensitive land uses are in close proximity to parts of the levee system, a vigorous media and outreach campaign is being conducted in order to generate public awareness and education. DWR is requesting your valuable assistance in disseminating information about the survey flights to your local constituents, community and civic groups, law enforcement, 911 centers and schools, as appropriate.

The survey flights, which are expected to last four to six weeks, will take place along portions of the Feather River, Bear River, American River, Sutter Bypass, Yolo Bypass, Sacramento River, Stanislaus River, San Joaquin River, and their tributaries.

Enclosed, please find a map of the levees expected to be surveyed in your area, fact sheets that provide more details on the levee evaluation program, and a photo of the helicopter and survey "bird" for easy recognition (this photo is also available in electronic format upon request).

Because flight plans are still under development at this time, ***DWR will be posting updated flight schedules online at www.levees.water.ca.gov as they become available.***

If you need further information or have any questions or concerns, please contact Elizabeth Scott, DWR Public Affairs, at (916) 653-0979.

Sincerely,

Steve Mahnke
Chief, Levee Evaluations and Repairs

ATTACHMENTS AVAILABLE FROM YOUR CLERK

RESOLVE

DEPARTMENT OF WATER RESOURCES

LEVEE EVALUATION PROGRAM
Levee Analysis Methods

Summer 2007

Reflecting Governor Arnold Schwarzenegger's long-term commitment to improving flood safety to prevent possible catastrophic flooding and loss of life, the State of California's Department of Water Resources (DWR) is undertaking unprecedented efforts to evaluate and upgrade aging and deteriorating levees in the Sacramento and San Joaquin River Valleys and Delta.

Of highest priority, DWR is fully evaluating more than 300 miles of urban project levees in these areas, with plans to later survey the entire 1,600 miles of project levees in the Central Valley. Funding for the levee evaluation efforts is provided through two large flood control bonds approved by California voters in November 2006, Propositions 84 and 1E.

As an essential first step in providing improved flood protection for communities in the Central Valley, DWR is conducting geotechnical exploration, testing, and analysis of state and federal levees that protect the highly populated urban areas of greater Sacramento, Stockton/Lathrop, and Marysville/Yuba City. (This program is being implemented simultaneously with various urgent levee repairs.)

To expedite flood control efforts aimed at protecting these communities, levee evaluations are being conducted in a fast-track manner over a two- to three-year period. During this time, technical specialists are reviewing existing levee historical data; conducting field explorations (including drilling and geophysical methods, along with associated laboratory testing); performing engineering, stability and seepage analyses; and preparing preliminary design and construction estimates for repairing and upgrading the levees, where needed.

The goal is to provide information needed for the eventual upgrade of levees to a 200-year level of flood protection in urban areas and the design level of protection in rural areas.

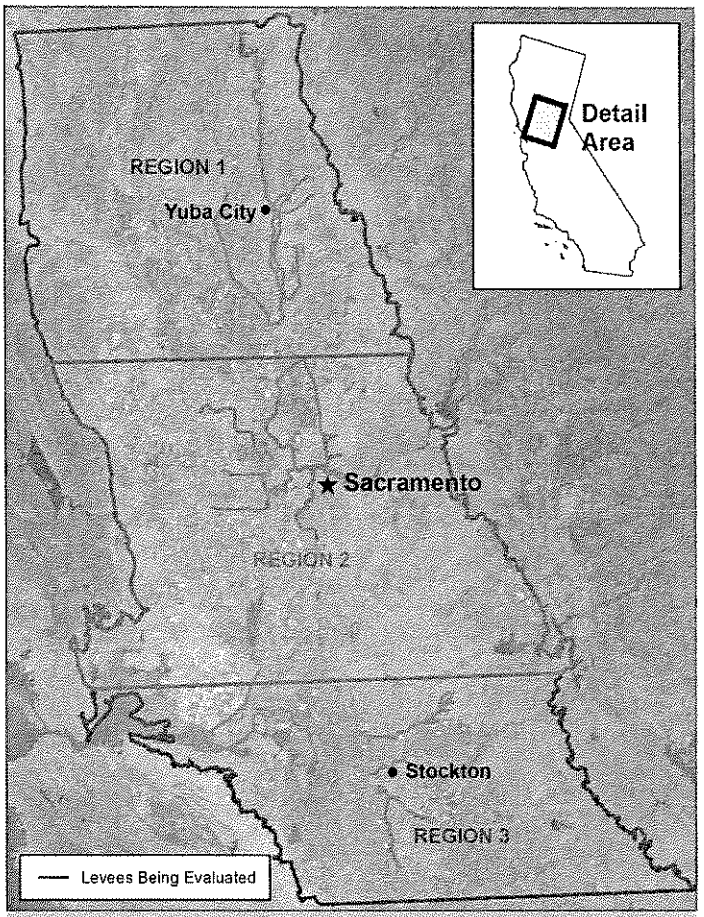
As part of its mission, DWR is also responding to requests to assist various local agencies by surveying other non-project-related levees during the evaluation process. DWR is committed to assisting local agencies in determining the best way to implement and fund needed repairs to their levees.

Levee Analyses

Levee analyses look at both the past and future (projected) performance of flood control levees as it relates to seepage, stability, erosion, settlement, and seismic factors. To get a detailed picture of the flood control system's current condition, experts study a wide range of critical levee properties, including:

- Geomorphology (the processes that shape and alter surface features of the land)
- Levee topography (the configuration of levee surfaces, including elevation and position of natural and man-made features)
- Subsurface geologic and groundwater conditions
- Water levels of rivers and channels
- Historical events
- Man-made conditions
- Erosion conditions

The results of the levee analyses will be reviewed by DWR, the Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers (USACE), and local agencies.



Throughout the Central Valley, levees provide essential protection for communities and farmland, preventing possible catastrophic flooding and loss of life. DWR is currently evaluating more than 300 miles of project levees protecting the urban areas of Marysville/Yuba City, Sacramento, and Stockton/Lathrop.

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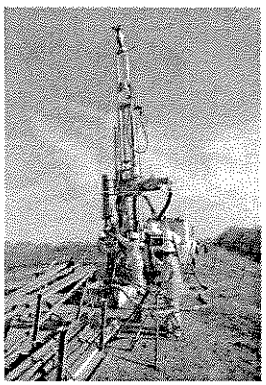
Evaluation Methods

In addition to the basic geotechnical evaluation program of drilling and boring to collect levee soil samples, other proven methods and innovative technologies are being used to develop a comprehensive understanding of the levees' existing subsurface conditions. These methods include regional geomorphologic assessments, detailed mapping of geomorphic features and surficial geologic deposits, Light Detection and Ranging (LiDAR) topographic surveys, geophysical electromagnetic (EM) surveys, and underwater bathymetric surveys. Data collected from these and other methods is used to cumulatively assess the levees' structural integrity and identify which areas are most in need of critical improvements or repairs.

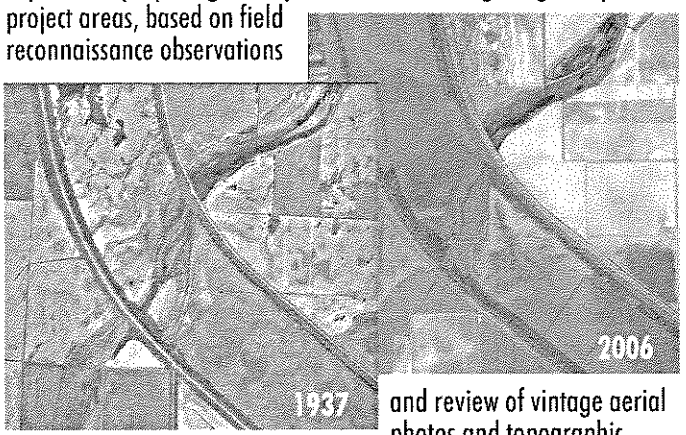


Geotechnical Evaluations (Drilling)

Much of the evaluation of the levees and their foundations is done by relatively straightforward methods (e.g., drilling and boring) to collect soil samples, which are then analyzed to assess subsurface conditions. These ongoing subsurface explorations are typically conducted at 1,000-foot intervals along the levees, with additional explorations done on the landside of the levees. Looking closely at subsurface soil conditions—such as moisture, density, and soil grain size distribution—helps identify potential problems or weaknesses in the flood control structures.

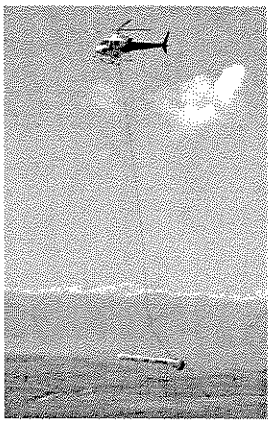
Geomorphologic Assessments

By studying the evolution of landforms and the processes that alter them, scientists can better assess levee stability and understand the materials beneath the levees. For the levee evaluation program, experts are preparing a comprehensive surficial geologic map of project areas, based on field reconnaissance observations and review of vintage aerial photos and topographic maps, geologic maps, and satellite imagery. Results of this effort will lead to a better understanding of the geologic materials directly beneath existing levees and of the geomorphic processes (e.g., erosion, deposition) responsible for those materials.



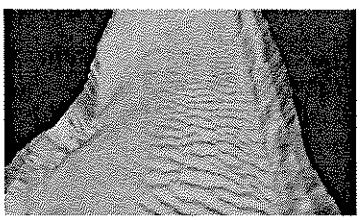
Light Detection and Ranging (LiDAR) Topographic Surveys

Light Detection and Ranging (LiDAR) technology deployed in low-flying helicopters was used to electronically gather data about the topography and configuration of the flood control levees. In spring 2007, helicopter flights equipped with LiDAR performed aerial topographic surveys over approximately 500 miles of levees stretching from Oroville to Lathrop. Airborne LiDAR produces accurate elevation models for terrain, which helps in evaluating the geotechnical and erosion characteristics of the surveyed levees.



Electromagnetic (EM) Surveys

Another way to evaluate levee subsurface conditions is by conducting geophysical electromagnetic (EM) surveys. Like LiDAR, this technology is deployed during helicopter flights over the levees. An EM survey "bird," which resembles an airborne torpedo, is suspended from the helicopter about 100 feet above the levees. The EM technology senses variations in the ground's electrical conductivity to depths of more than 100 feet underground. The goal is to map important changes in soil types and ground conditions, identifying zones where permeable soils are present or excessive water penetration is taking place. These surveys are being conducted in late summer 2007 along more than 200 miles of levees on the Feather River, Bear River, American River, Sutter Bypass, Yolo Bypass, Sacramento River, Stanislaus River, San Joaquin River, and tributaries.



Bathymetric Surveys

Underwater bathymetric surveys are explorations conducted by boats equipped with special multibeam sonar. These surveys produce detailed topographic data of the riverbed and riverbanks that essentially form the base of the levee systems. The collected data provide an image of the levees' underwater structure that cannot be obtained by conventional land topographic methods. The data are especially important in revealing underwater erosion of the riverbanks. Bathymetric surveys are scheduled for summer 2007 along parts of the Sacramento, American, San Joaquin, and Calaveras Rivers. The survey's ultimate purpose is to supplement the above-water topographic data collected during the LiDAR surveys. Together, this information will be used to assist in the geotechnical evaluation of the levees. ■

For further information, please contact:

Elizabeth Scott
DWR Public Affairs
(916) 835-5344
leveerepair@water.ca.gov
DEPARTMENT OF WATER RESOURCES
PO Box 942836, Sacramento, CA 94236

DEPARTMENT OF WATER RESOURCES

LEVEE EVALUATION PROGRAM

Electromagnetic (EM) Survey

Summer 2007

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Of highest priority, DWR is fully evaluating more than 300 miles of urban project levees in these areas, with plans to later survey the entire 1,600 miles of project levees in the Central Valley. Funding for the levee evaluation efforts is provided through two large flood control bonds approved by California voters in November 2006, Propositions 84 and 1E.

To get a detailed picture of the Central Valley flood control system's current condition, experts study a wide range of critical levee properties, including geomorphology (the forces that alter land features), levee topography (the configuration of levee surfaces), subsurface geologic and groundwater conditions, the water levels of rivers and channels, historical events, man-made conditions, and erosion conditions. A number of proven methods and innovative technologies are being used to assess the levees' structural integrity and identify which areas are most in need of improvements or repairs.

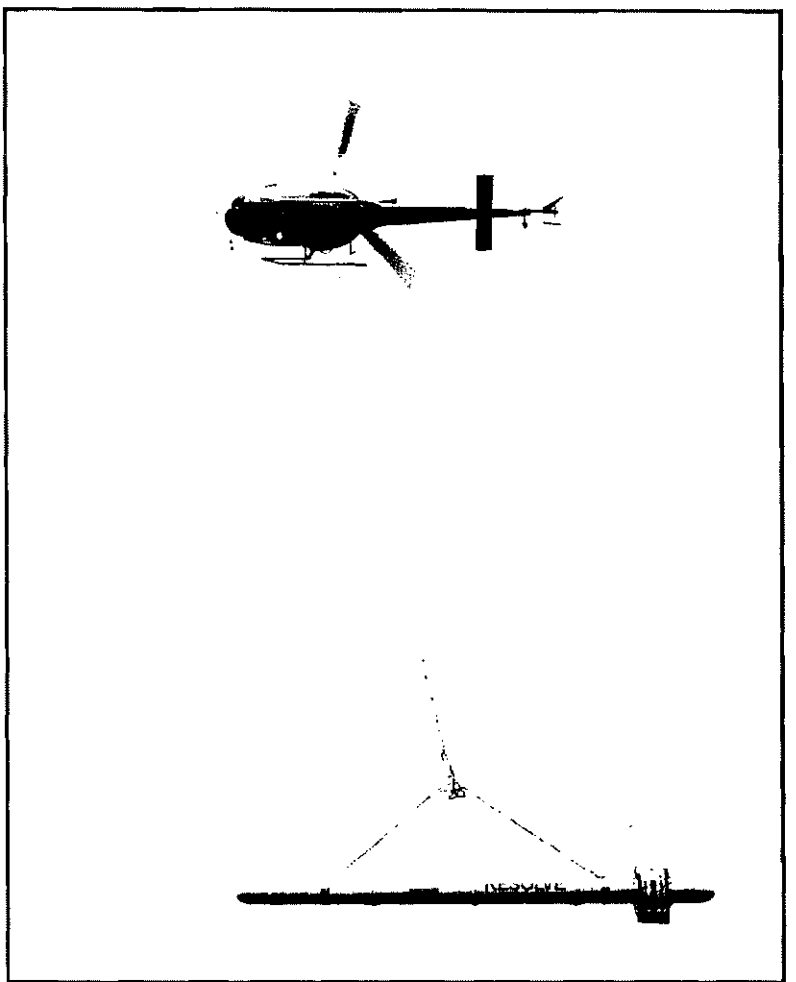
Airborne Electromagnetic Surveys

Geophysical electromagnetic (EM) surveys are one of the unique tools experts are using to examine levee subsurface conditions. Airborne EM surveys are conducted during low-level helicopter passes over selected levees. A survey "bird," which resembles an airborne torpedo (*see photo*), is suspended from the helicopter about 100 feet above the levees. As the helicopter flies parallel to the levees, the EM technology senses variations in the ground's electrical conductivity to depths of more than 100 feet underground. The goal is to map important changes in soil types and ground conditions, identifying zones where permeable soils are present or excessive water penetration is taking place.

Detailed flight maps and schedules will be updated daily at:

www.levees.water.ca.gov

These surveys are being conducted in late summer 2007 over more than 200 miles of levees. From Oroville in the north to Lathrop in the south, the flights are taking place along the Feather River, Bear River, American River, Sutter Bypass, Yolo Bypass, Sacramento River, Stanislaus River, San Joaquin River, and their tributaries.



EM helicopter survey flights will be conducted along levee systems that provide critical flood protection for the urban areas of Marysville/Yuba City, Sacramento, and Stockton/Lathrop. The flights will be conducted in late-summer 2007 and will take approximately four to six weeks to complete.

Because homes, businesses, and other sensitive land uses are close to parts of the levee system, DWR is coordinating with elected officials, community leaders, residents, law enforcement, and the media to ensure that local communities are aware of the purpose and timing of the flyovers.

Airborne Electromagnetics – Frequently Asked Questions

What is "airborne electromagnetics"?

Airborne electromagnetics (AEM) is an airborne geophysical technology developed for use in the mining industry to locate and map bodies of ore. It works by measuring variations in the electrical conductivity of the ground. In so doing, AEM is able to detect and map geological changes and variations beneath the earth's surface.

How does it work?

Electrical conductivity is measured using a helicopter carrying a torpedo-shaped "bird" that houses an electromagnetic transmitter and receiver system. The system transmits an electromagnetic field (radio waves) into the ground and then measures the response that returns from the ground. The strength of the response changes as the geology of the earth changes. The data collected are processed into mapped images that give geophysicists a composition model of the earth's subsurface.

What is the survey procedure?

The electronic sensors are carried in a 30-foot long tube (or "bird") that weighs about 600 pounds. The bird is suspended about 100 feet below the helicopter, which flies about 200 feet above the ground. The helicopter travels 30-60 miles per hour in parallel lines across the area to be mapped. Based at nearby airfields, the helicopter typically departs in the morning and surveys during much of the day, weather and flying conditions permitting. It may land during the day to refuel, but it does not fly at night.

Is airborne electromagnetics a safe technology?

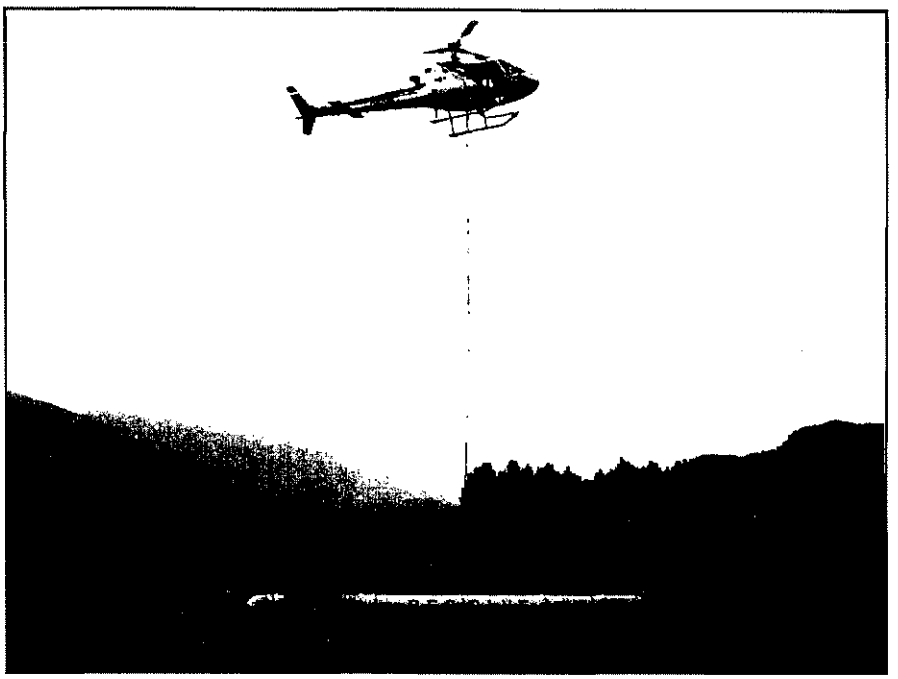
AEM is safely used throughout the world in mineral exploration and the evaluation of land features and natural resources. The electromagnetic field generated by this system is considerably weaker than the fields generated by natural and man-made sources surrounding us every day. All operations must pass strict government aviation regulations, and the aircraft are flown by specialists who have many decades of experience collecting data in a wide variety of flying environments. The helicopter stays high enough that there is no rotor wash (wind) felt on the ground. It also keeps well above power lines and other obstacles. The survey bird is securely fastened with a stainless-steel wire rope and a backup Kevlar safety rope.

Does it affect livestock?

The technology causes no ill effects to livestock and horses, but because low-flying helicopters are involved, there is the potential for livestock to be alarmed.

Does it affect electronic or communications equipment?

Because the electromagnetic field generated by the equipment is weak, electronic or communications equipment is not adversely affected. ■



Survey helicopter lifting off.

As the helicopter flies over the levees with the survey "bird" suspended below, electromagnetic equipment records data about subsurface soil conditions.

For further information, please contact:

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