

Terminus Dam Edition — July 2004

FUSEGATE NEWS



CALIFORNIA—USA

Terminus Dam Inauguration



Photo: David Thompson



UPSTREAM VIEW OF THE SPILLWAY BEFORE REHABILITATION

The construction of the Terminus Dam, boasting the largest Fusegates in the world, is now completed. Its application of the Hydroplus System is attracting national and international attention since its inception.

The Terminus Dam has been built according to a very innovative approach, that is relatively new to the United States. The construction consists of free-standing blocks installed on top of an existing or new spillway. This type of construction provides additional storage, and upgrades undersized spillways according to modern standards.

New Storage Capacity

230 x 10⁶ m³

Storage Capacity Increase

50 x 10⁶ m³

Fusegate Height/Width

6.5 m high / 11.7 m wide

Fusegate Unit Mass

450 tons

Spillway Discharge Capacity

8500 m³/s

Total Project Cost

US \$55.8 million

including \$35 million for land

What is a Fusegate?

Pictured here is a Fusegate. It is typically composed of a water-retaining structure and a water inlet stack which daylight in a chamber located beneath the unit. Fusegates can be built using either steel or concrete, depending on project requirements and economical considerations. The system comprises independent and free-standing units installed side by side on top of a free overflow spillway sill.

At the Terminus Dam, six concrete Fusegates, measuring 6.5 m high by 11.7 m wide, were built on the existing spillway. These massive structures, weighing 450 tons each, increase the capacity of Lake Kaweah by 30%.



How does it Operate?

The majority of the dams are equipped with a spillway designed to evacuate flooding and thus prevent too much pressure from being exerted on the dam. Usually, the spillway corresponds to a breach built into the dam embankment.

Fusegates fit onto the spillway and operate much like a labyrinth weir. When the water is below their crest, the Fusegates work as a watertight barrier. In time of small to moderate floods, water spills over the Fusegates.



*SLIGHT OVERSPILLING ABOVE THE FUSEGATES CREST
AT MCCLURE DAM, NEW MEXICO*

The Triggering Process

The major innovation provided by the Hydroplus System is the Fusegate operation process : during rare floods that threaten the dam, the Fusegates overturn one by one like fuses in an electrical circuit, thus allowing the water to flow through the breach.

When the water in the reservoir reaches a certain, pre-determined level, it will flow into the inlet well and then

into the base chamber. Uplift pressure will rapidly increase, causing the Fusegates to pivot on the concrete toe abutments and rotate downstream. Each Fusegate overturns in a series, depending on the magnitude of the flood. As more of the Fusegates overturn, more water is discharged over the spillway.



🔧 Triggering Process - Cont.

In the case of the Terminus Dam, the Fusegates were designed while keeping in mind the snowmelt from the mountains and the possibility of giant sequoias being swept into the Fusegates. To withstand the snowmelt and giant trees, intake wells are located in a protective enclosure that is open to the reservoir. A network of pipes is embedded in the concrete sill to connect the intake wells to the base chambers of the Fusegates. Apart from the use of the protective enclosure, the principle underlying the operation of the Terminus Fusegates is quite similar to that of other Fusegates.

The normal water level in the reservoir is maintained below the crest of the Fusegates. Overflow will not occur until the flood frequency exceeds an event occurring 1 time in 69 years. The first Fusegate at the Terminus Dam

has been designed to overturn for an event occurring only 1 time in 1,000 years, which is twice the magnitude of the catastrophic flood of 1955.



THIS IS A LIFE-SIZE MODEL SHOWING FUSEGATE TIPPING DURING ARTIFICIAL FLOOD TEST CONDUCTED AT ST. HERBOT DAM IN BRITTANY.

A Wide Range of Applications

SAFETY

The Fusegate System application can greatly increase the safety level of the dams. This is achieved by lowering the existing spillway sill, and recovering the storage capacity by installing Fusegates on top of the new spillway platform.

This procedure was followed for the Black Rock Dam in New Mexico. Its service spillway has been equipped with labyrinth crested steel Fusegates, 3.5 m long and 2.4 m high. The discharge capacity has increased by 1060%. No major work was required on the embankment as there was no increase in the maximum flood level.



BLACK ROCK DAM, NEW MEXICO

THE 2002 NATIONAL REHABILITATION PROJECT OF THE YEAR AWARD FROM ASDSO

STORAGE CAPACITY

The Fusegate System can also increase the storage capacity of the reservoir by up to 30%, by raising the permanent pool elevation.

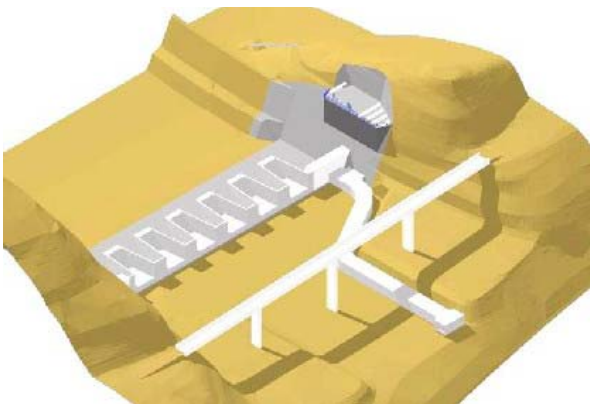
The McClure Dam in New Mexico is a good example. (See picture on p. 2) Eight steel Fusegates, 2.15 m high by 2.13 m wide, each weighing 4.5 tons, were installed on the Ogee crested sill. Installing the Fusegates increased the live reservoir storage capacity by 17% in record time and at minimal cost, with no change in the maximum reservoir level.

JUNE 2003—JANUARY 2004

The Terminus Dam Rehabilitation Project

The Terminus Dam is owned and operated by the US Army Corps of Engineers. It consists of a 80 m high embankment that was completed in 1962. It provides flood control and irrigation storage for Tulare County, and is also a pleasant area for recreational activities.

In 1996, local sponsors approached the Sacramento District of the Corps of Engineers to investigate the possibility of increasing the storage capacity of the reservoir. The District examined a range of alternatives and model tested a Fusegate System, which was found to be the most cost-effective and reliable option.



SPILLWAY RAISE PERTINENT FEATURES
COURTESY OF USCOE—SACRAMENTO DISTRICT

The construction of the Fusegates and their appurtenances began in June 2003, and was completed by late January 2004. All parties were satisfied with the construction and the timeline. The Dam owner, municipalities and sponsors involved in the Terminus Dam project became leaders in the field of dam rehabilitation, as they implemented an innovative, cost-effective, reliable and environmentally friendly solution for increasing the water supply storage level.

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STEPS OF THE CONSTRUCTION