Dam Safety Program
Field Operations
TCEQ Dam Inspection Report

GENERAL INFORMATION

INVENTORY NO.: TX 03288 WATER RIGHT AUTHORIZATION: Adjudication 4560A

DAM: Franklin County Dam

OWNER: Franklin County Water District

STREAM: Big Cypress Creek

BASIN: Cypress COUNTY: Franklin

GENERAL LOCATION: 8-miles southeast of Mount Vernon, Texas

DAM HEIGHT: 73.0 ft DOWNSTREAM HAZARD RATING: Significant

NORMAL CAPACITY: 72,800 acre-ft MAXIMUM CAPACITY: 164,000 acre-ft

INSPECTION DATE: September 13, 2005 PREVIOUS INSPECTION DATE: May 7, 2002

NORMAL WATER LEVEL: 378.00 ft MSL (principal spillway elevation)
CURRENT WATER LEVEL: ≈376.00 ft MSL

INSPECTION BY: TCEQ Personnel
Johnny Cosgrove, PE
Warren Samuelson, PE

PERSONNEL CONTACTED: John Edwards, Franklin County Water District
David Weidman, General Manager, Franklin County Water District

SUMMARY

Franklin County Dam is an earth embankment dam classified as large due to its impounded storage capacity; additionally, it is classified as a significant-hazard dam due to the downstream development. The dam's structure is in poor condition. Although a routine maintenance and monitoring plan is apparent, the deterioration of the downstream slope needs to be addressed. It is recommended that Franklin County Water District begin planning improvements to stabilize the downstream embankment, as well as potential improvements to the spillway, if an investigative assessment indicates the need.

BACKGROUND

Franklin County Dam was originally built in 1971 for both water supply and recreational purposes. The impoundment is known as Lake Cypress Springs and its authorized capacity is 72,800 acre-feet at normal water level. The earthfill structure has a height of 73 feet, a length of 5250 feet, and a crest width of 44 feet. Designed by Wisenbaker, Fix, and Associates, the Franklin County Dam underwent construction beginning in June of 1968. The Texas Water Development Board (TWDB), a predecessor agency of the TCEQ, inspected the dam 30 times during construction, or roughly once per month. Deliberate impoundment began in July of 1970, and the project was completed in February of 1971.

During an inspection in July of 1973, the TWDB observed for the first time the engaged service spillway's morning glory inlet passing water. The inspection revealed bad erosion on the downstream slope. Some erosion was severe enough that it was cutting into the crest of the dam. Additionally, a seepage area nearly 15 feet in diameter was detected roughly 35 to 40 feet to the south of the service spillway outlet at the toe of the Franklin County Dam. Also, spalling was observed at the lower left corner of the spillway outlet's concrete headwall. The spalling condition was severe enough that reinforcement was being exposed. In 1976, the dam was inspected four times; a 6-foot by 9-foot sink hole had developed at the seep area previously noted, many erosion areas were witnessed on the downstream embankment near the outlet works, and many small gullies created by surface erosion were located at the downstream toe of the dam. It should be noted that suspended soil was never witnessed in the seepage waters during any of these inspections.

An inspection by the TWDB in April of 1977 revealed a crucial problem with the operation of the service spillway. Due to a vacuum break occurring in the spillway pipe, a booming geyser effect was witnessed at the spillway outlet, spraying water 15 to 20 feet in the air. Additionally, a slide 55 feet long and 3 to 4 feet deep had occurred near the crest on the south end of the downstream slope. Also, a major erosion gully had formed in the left upstream groin measuring 5 feet in depth and 4 feet in width. The previously noted seepage area had several small boils, and very fine soil was being moved in the seepage waters.

In November of 1977, the TWDB advised Franklin County Water District to perform an inspection on the service spillway conduit in an effort to determine the affects of the persistent vacuum breaking on the structure. The next month, an inspection on the inside of the conduit revealed that the spillway pipe was in overall good condition, with only minimal leakage and minor spalling noted. However, there were two conduit section joints that had approximately ½ inch drops across the joints. It was assumed that this separation was occurring due to the cavitation of the spillway's operation. Furthermore, the discharge end of the service spillway conduit was found to be 3 inches higher than the entrance; this was indicative of the cavitation/vacuum breaking phenomenon. During this inspection, an unsuccessful, yet extensive attempt was made to locate the dam's toe drain outlet. It was considered that this unlocated and possibly blocked outlet could have led to the documented seepage and boil problem, which had not worsened at the time.

The national dam safety program's Phase I inspection of Franklin County Dam took place in July of 1978. A hydraulic/hydrologic study at the time showed the dam capable of handling a 100%

Probable Maximum Flood (PMF) event with roughly 1.2 feet of freeboard.

Completion of the Fort Sherman Dam in 1978 brought about the filling of Lake Bob Sandlin immediately downstream of Franklin County Dam. It was determined that at its normal water level, Lake Bob Sandlin would inundate the downstream toe of Franklin County Dam. Additionally, the previously unlocated toe drain outlet would not be effective as a drain pipe due to the backwaters of Lake Bob Sandlin. The Texas Water Rights Commission (TWRC), a predecessor agency of the TCEQ, recommended a study be undertaken to determine the affect on the stability of Franklin County Dam from the submergence of the toe. These uncertainties combined with the seepage problems noted near the spillway outlet of Franklin County Dam, led to the conclusion that more investigative efforts were needed before allowing Lake Bob Sandlin to fill all the way to its normal operating water level, effectively submerging the outlet and toe of Franklin County Dam.

In April of 1980, more small slides were documented on the steep 2 horizontal to 1 vertical (2H:1V) downstream slope during an inspection. Additionally, a new boil with suspended fines was located about 60 feet downstream of the spillway outlet, and a hole was found above the buried spillway pipe. This hole/cavity discharged into an underground channel that exited at the spillway outlet bankline. Two months later 7 piezometers were installed at the dam in an attempt to better understand the nature of the seepage and boil problems. A slope stability investigation and report were generated in June of 1981. By monitoring the piezometer readings, it was determined that the dam's drainage blanket was working because the pore pressures along the downstream slope were measured to be zero. After reviewing the report, the Texas Department of Water Resources (TDWR), another predecessor agency of the TCEQ, stated that the dam was stable, and the backwaters of Lake Bob Sandlin would not have an affect on the stability of Franklin County Dam. Still, it was determined upon report reviews by both the TDWR and National Soil Service, Inc., that the steep downstream slope would require periodic maintenance to deal with the slides, and with the normal operating water level of Lake Bob Sandlin, there would be no access possible. It was considered at that time to flatten the entire downstream slope to at least a 3H:1V, in addition to adding a maintenance berm for access. In December of 1981, Franklin County Water District began implementing a design to construct a 3H:1V maintenance berm with a toe drain, a filter, and protective rip-rap to deal with wave erosion from Lake Bob Sandlin. A plan to flatten the entire downstream slope was not undertaken. Nevertheless, remedial work was planned at the seepage area around the spillway outlet to install a filter over the boil zone, with rip-rap and bedding, to protect the bluff line encircling the concrete headwall at the spillway outlet. This work was completed in November of 1982.

The next inspection of Franklin County Dam by TWDB was in November of 1985. Deeply incised erosion gullies, erosion tunnels, small sink holes, a small superficial slide, and extensive animal burrowing were all noted on the downstream slope. The boil activity near the spillway outlet had appeared to subside considerably. Measurements taken from the piezometers that could be located indicated that no changes were evident since the previous 1982 inspection. In 1990 and 1994, inspections by the TWDB revealed sunken/benched areas in the rip-rap on the upstream slope, downstream burrows and erosion gullies, and numerous reoccurring small slides on the downstream slope, as well as one significant slide over 250 feet long with depths ranging from 1 to 8 feet. Piezometer readings taken closely agreed with previous readings, indicating no change. In the 1994 inspection report, it was recommended that a cost analysis be prepared for

repeated slope repair versus permanent slope repair as an aid to the dam owner.

A fish screen was added to the morning glory service spillway drop inlet in August of 1997, and 6 new piezometers were installed in April of 1998. It should be noted that TCEQ files do not contain any data for initial measurements taken from the new piezometers. During the last inspection of Franklin County dam in May 2002, the Texas Natural Resource Conservation Commission (TNRCC), another predecessor agency of the TCEQ, did not take any readings from the piezometers; however, Franklin County Water District informed TNRCC that a consulting engineering firm was going to take measurements from the piezometers and send a copy of the data to TNRCC. TCEQ's present files do include this information. The other items noted in the TNRCC inspection report included burrows and continuing slides on the steep downstream slope. Additionally, a wet area was documented roughly 75 feet from the toe of the dam on the south side of the flooded outlet works.

CURRENT EVALUATION

Franklin County Dam was scheduled for an inspection at the request of Mr. David Weidman, based upon concerns regarding the condition of the downstream slope and detected seepage near the toe of the dam. Figures 1 to 4 show street, topographic, aerial and plan views of Franklin County Dam . Photos 1 to 16 illustrate particular features of the dam. These photos are referenced in the report and on Figure 4.

Crest of Embankment:

1. The crest of the dam was in good condition. Also serving as a major road (Highway 3007), the 25-foot wide paved crest had a straight alignment, and no significant ruts or depressions were noted along its roughly 5250-foot length. Additionally, the guardrails adjacent to the road along each edge of the crest showed no indication of alignment problems.

2. It should be noted that one of the utility poles that runs along the eastern edge of the crest was severely leaning towards the downstream embankment [Photo 1]. Located near the mid section of the dam's northern half, the slanted utility pole was located just above an area of the downstream slope where a slide had occurred.

Upstream Embankment:

1. The overall condition of the upstream embankment was fair. The slope varied from 3 horizontal to 1 vertical (3H:1V) to 2H:1V across most of the upstream embankment [Photo 2]. It reached almost a 1H:1V slope in some areas near the crest.

2. Large rip-rap protected the entire shoreline, as well as the majority of the upstream slope. Some of the shale rip-rap stones were severely weathered and cracked and would break apart when struck with a survey rod [Photo 3].

3. There was a pocket in the rip-rap at one spot along the shoreline of Lake Cypress Springs;

however, it did not appear to be moving out and away from the crest [Photo 4].

4. Many small trees and brush were growing through the voids in the rip-rap [Photo 5].

5. Numerous small sloughs, holes, and undulations were characteristic of the entire upstream embankment [Photo 6].

6. Additionally, quite a few small rodent burrows were noted [Photo 7].

Downstream Embankment:

1. The downstream embankment was in poor condition. With a slope ranging from (1 to 1.5)H:1V over most of the incline, the slope was very steep and had been subjected to substantial erosion in a few areas. In some locations near the crest, the slope reached nearly 0.75H:1V. Persistent erosion was taking place due to storm water runoff.

2. Although vegetation seemed to be prevailing over much of the downstream slope [Photo 8], it was bare in some areas. Small trees and brush were observed across most of the downstream embankment; however, a herbicide had obviously been applied in conjunction with an ongoing maintenance plan. The vast majority of this undesired vegetation was either dead or dying off, yet the clearing phase had not been initiated at the time of the inspection.

3. Many small sloughs, holes, undulations, and gullies were characteristic of the entire downstream embankment [Photos 9 & 10]. It should be noted that a geo-fabric had been placed on old slide areas on the downstream slope, in an effort to promote vegetative growth and combat the continual erosion.

4. Near the mid section of the dam's northern half, a slide approximately 10 foot wide by 6 foot deep was noted about midpoint on the slope, just below the previously noted leaning utility pole [Photo 1]. Small slides (some reoccurring slides) were seen across the downstream embankment with a higher concentration near the middle of the dam [Photo 11].

5. There was not any seepage detected on the face of the downstream slope. Nonetheless, due to the overgrowth of vegetation, seepage could have existed and not been observed.

6. The piezometers have not been read for some time. The piezometers on the crest are the only piezometers that have been located.

Downstream Area:

1. In both the left and right downstream groins, near the toe of the dam, minor seepage was noted.

2. At the north end of the downstream area, a standing marsh was witnessed [Photo 12]. It could not be determined if the water was due to seepage, a covered toe drain, or possibly a spring.

3. A seep was noted at the south end of the downstream area just to the right of the service spillway outlet [Photo 13]. The seepage appeared to be in roughly the same location as indicated in numerous past inspection reports, and no evidence of suspended soil was observed in the trickling seep waters.

Service Spillway:

1. The morning glory spillway inlet was in good condition [Photo 14], and only minor spalling of the concrete was detected. Still, Lake Cypress Springs was roughly two feet below the spillway drop inlet elevation, and the operation of the spillway was not witnessed.

2. The service spillway drop inlet, the instrumentation and control room, and the low flow intake valves [Photos 15 & 16] were all well maintained and secure with the necessary fencing, locks, etc.

3. The fish screen was intact and in good condition [Photo 16]. The fish screen and walkway to the morning glory had been painted the day before.

4. The condition of the service spillway outlet could not be assessed, as it was beneath the water level of Lake Bob Sandlin located immediately downstream.

Emergency Spillway:

The emergency spillway appeared to be clear, well-vegetated, and in good condition. This observation was made during a drive-by inspection (FM 3122 crosses emergency spillway).

Emergency Action Plan:

No Emergency Action Plan is on record for this dam.

RECOMMENDATIONS

1. The District's maintenance and monitoring plan should be continued and should include monitoring of the seepage areas.

2. An official Emergency Action Plan (EAP) is not presently on file with the TCEQ for this dam; however, it is rated significant-hazard. It is strongly recommended that an EAP be prepared and kept current. An EAP should provide a systematic means to: identify emergency conditions threatening a dam; expedite effective response actions to prevent dam failure; and prevent or reduce the loss of life and property damage should dam failure occur. This plan can be a positive step by the dam owner to accomplish safety objectives, protect the investment, and reduce potential liability. The following website gives guidelines for developing an EAP: www.fema.gov/fima/damsafe/eap_toc.shtm. Note that these guidelines were developed for larger dams, nevertheless, they provide a general overview of the EAP's purpose. A proposed EAP should be submitted to the TCEQ Dam Safety Program for

review, and updated yearly.

3. The continual deterioration of the downstream embankment should be addressed. With the steep slope that presently exists, the historic problem with slides will persist indefinitely. Many past slides have been fixed, yet many have reoccurred in the same location(s). The application of fly ash/lime mix with geo-fabric has been attempted in the past to combat the slides; however, these efforts have not proven effective. The specific clay material that composes the downstream slope is highly susceptible to cracking from dry conditions, and this allows rain water to penetrate into the dam. This wet, saturated soil then loses its cohesion due to the steep downstream slope and slides. A minimum slope of at least 3H:1V is recommended for the downstream embankment as a long term solution to the slide problems. This work should be undertaken under the supervision of a Registered Texas Professional Engineer (RTPE) with experience in the repair of dams. It is also recommended that a cost analysis be prepared for repeated slope repair versus permanent slope repair as an aid to the dam owner. All plans should be submitted to TCEQ for review and approval before any work starts.

3. The long term effects of the service spillway's surging action should be investigated. The interior of the spillway conduit was first inspected in 1977 for deterioration, and it should be examined again. When it was first inspected, the dam had only been in operation for about six years, and the continual vacuum breaking had already caused a couple of joints in the conduit to begin offsetting roughly an inch. The dam is now 35 years old, and the damaging effects of the routine vacuum breaking/cavitation on the structural integrity of the spillway conduit should be assessed. It is recommended that the interior of the conduit be inspected. A diver and/or video camera could be utilized for this purpose. If it is determined that appreciable damage has been done, a piping condition may exist from water leaking through the conduit joints, and a plan should be initiated to remedy the situation.

4. The upstream slope rip-rap is intact, yet very weathered in places. Some of the rock is deteriorating and becoming brittle with age, and its effectiveness in a major flood event is questionable. The condition of the rip-rap should be regularly checked as part of the routine maintenance and monitoring plan, and action to replace the deteriorated rip-rap should be considered.

5. It is recommended that the downstream slope not be mowed any longer, as this action is likely doing more damage than good. Still, tree and shrub growth should be controlled.

6. Reshape and repair the areas that have been damaged by animal burrows with well compacted non-dispersive clay material.

7. All of the bare, eroded areas on the downstream embankment should have a vegetative cover reestablished.

8. It should also be noted that it is the owner's responsibility to maintain the dam in a safe condition in order to prevent loss of life, reduce liability and to limit the potential property loss in the event the dam were to fail.

Johnny Cosgrove, P.E.
Dam Safety Engineer
Field Operations Division

Warren Samuelson, P.E.
Dam Safety Program Coordinator
Field Operations Division

Franklin County Dam

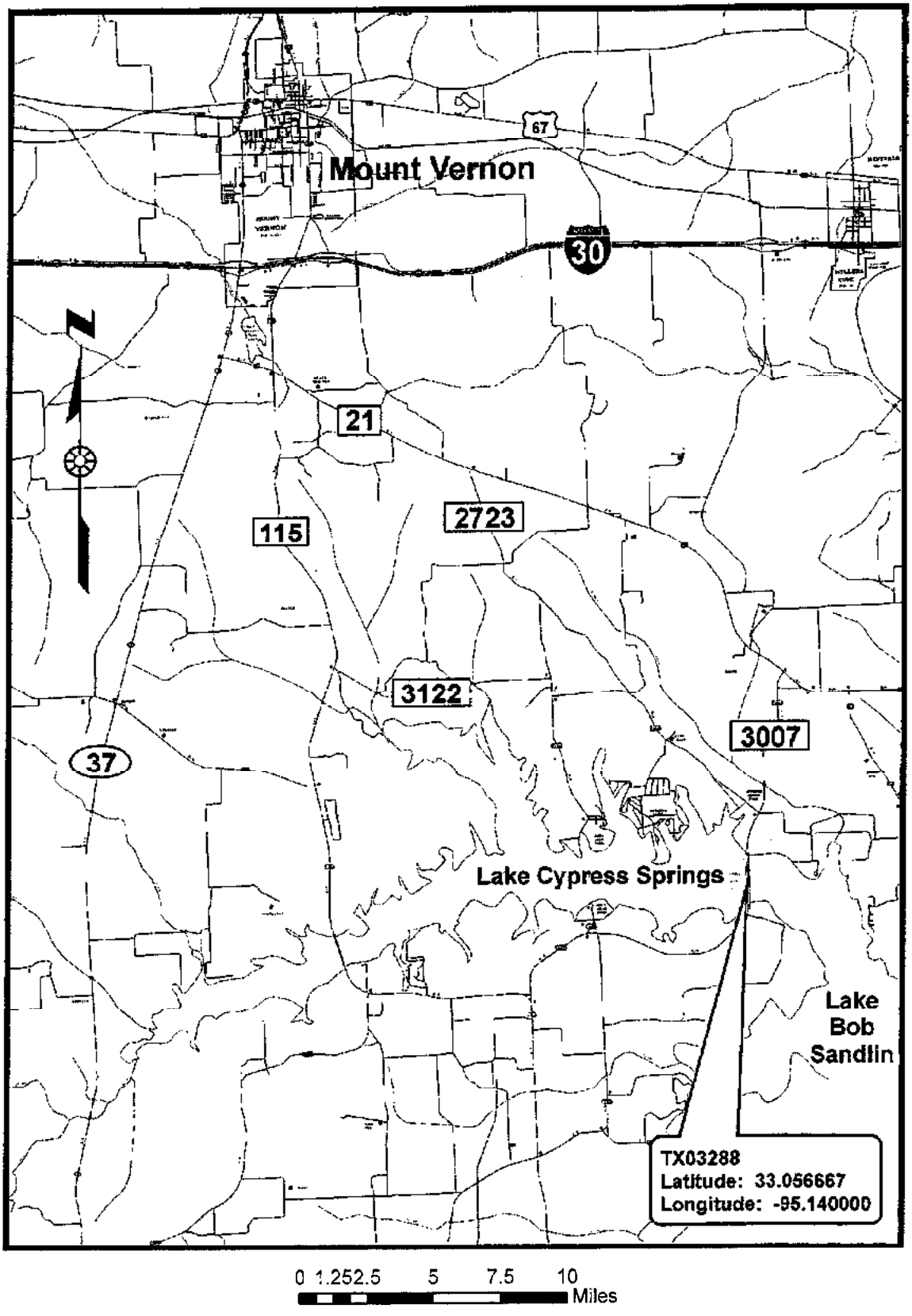

Figure 1

Franklin County Dam

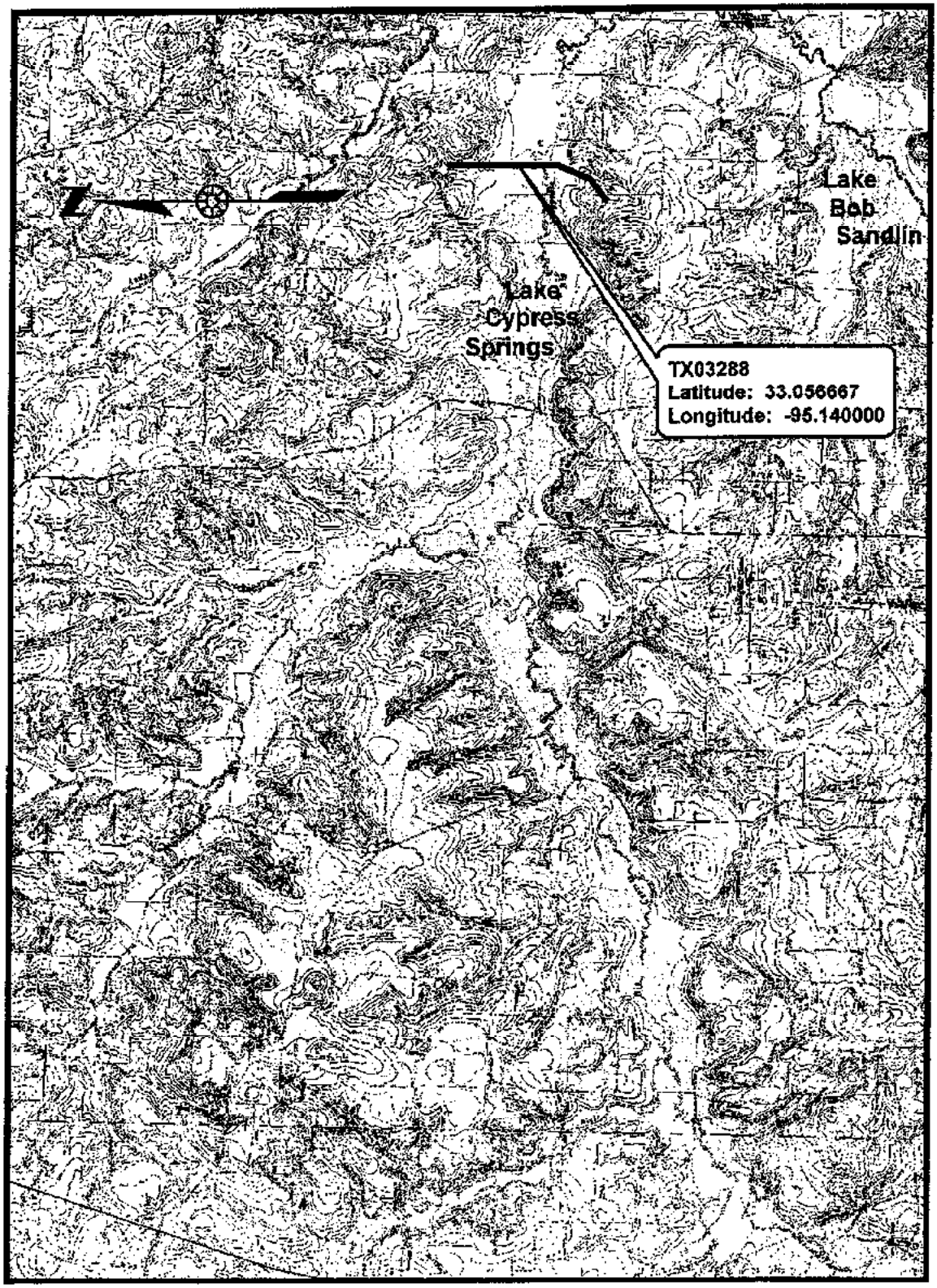

Figure 2

Franklin County Dam

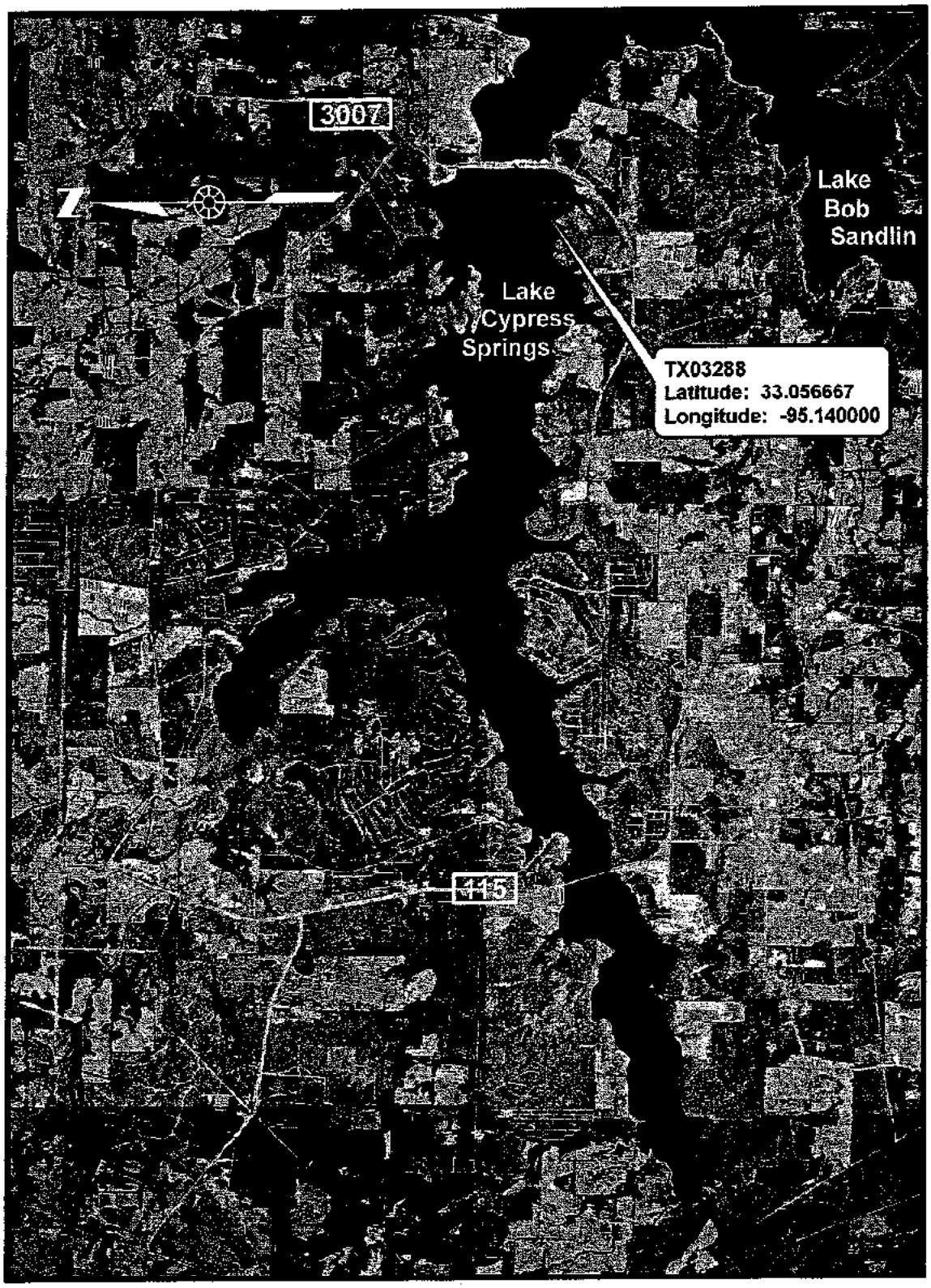

Figure 3

Franklin County Dam

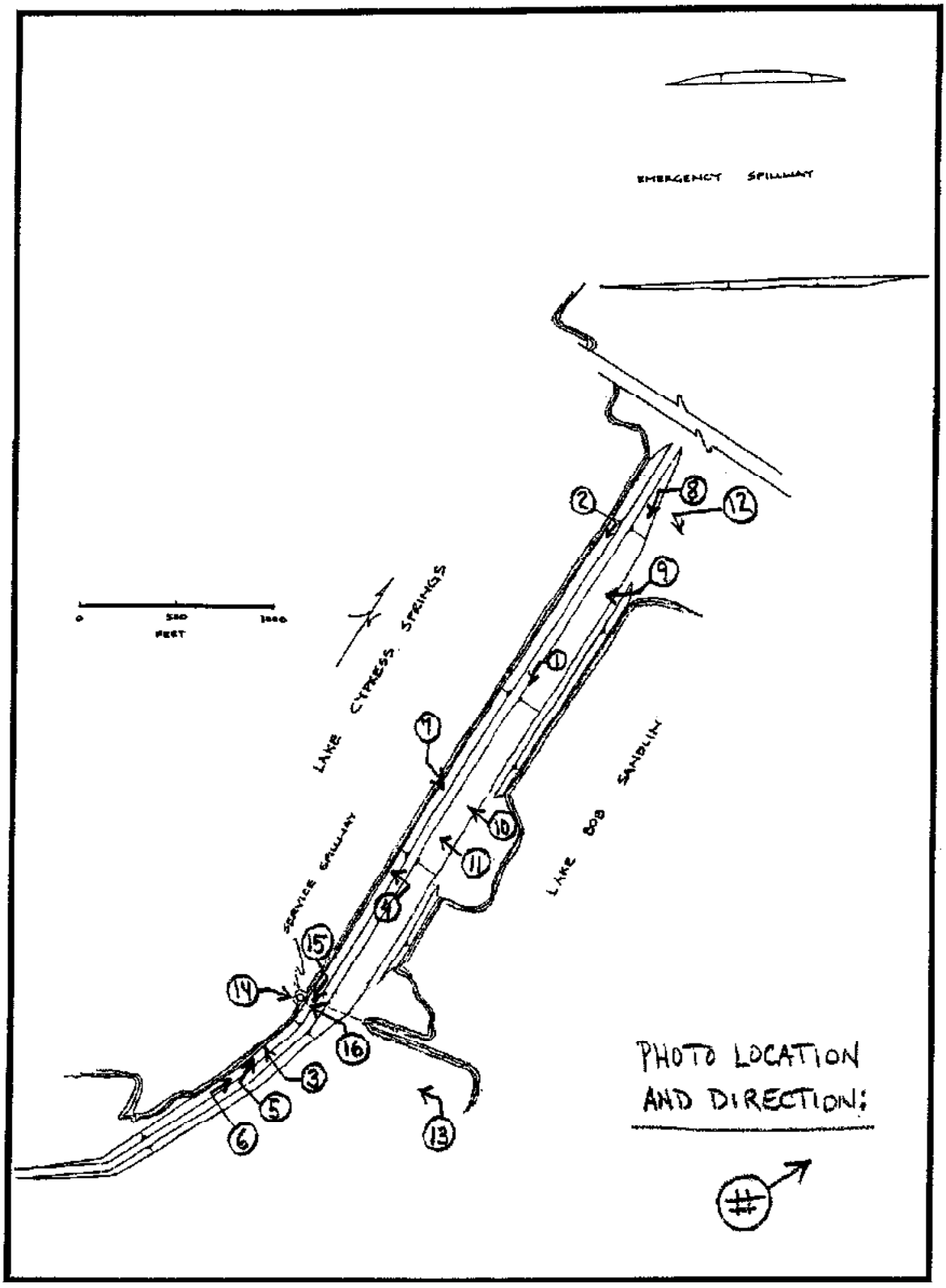

Figure 4

Entity: Franklin County Dam County: Franklin	TCEQ ID: TX03288	Inspection Date: 9/13/05 Inspected By: Johnny Cosgrove

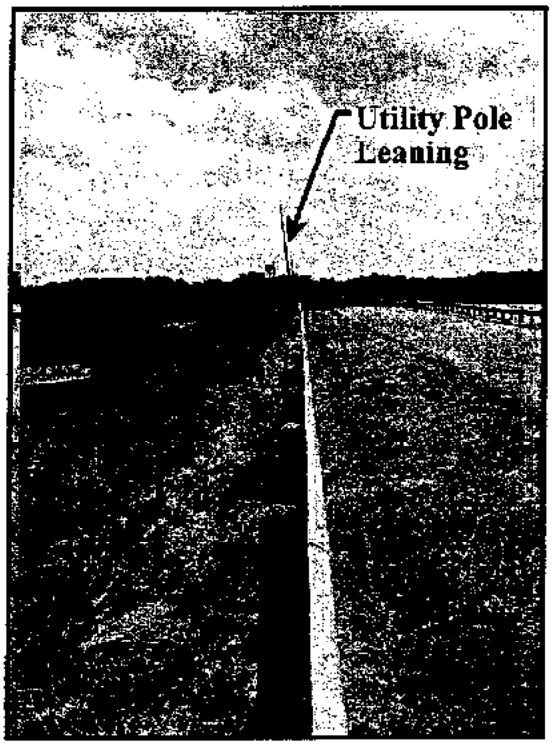

Photo 1: Utility pole leaning (≈ 11 degrees from vertical) towards downstream slope just above a noted slide

Photo 2: Upstream embankment and rip-rap

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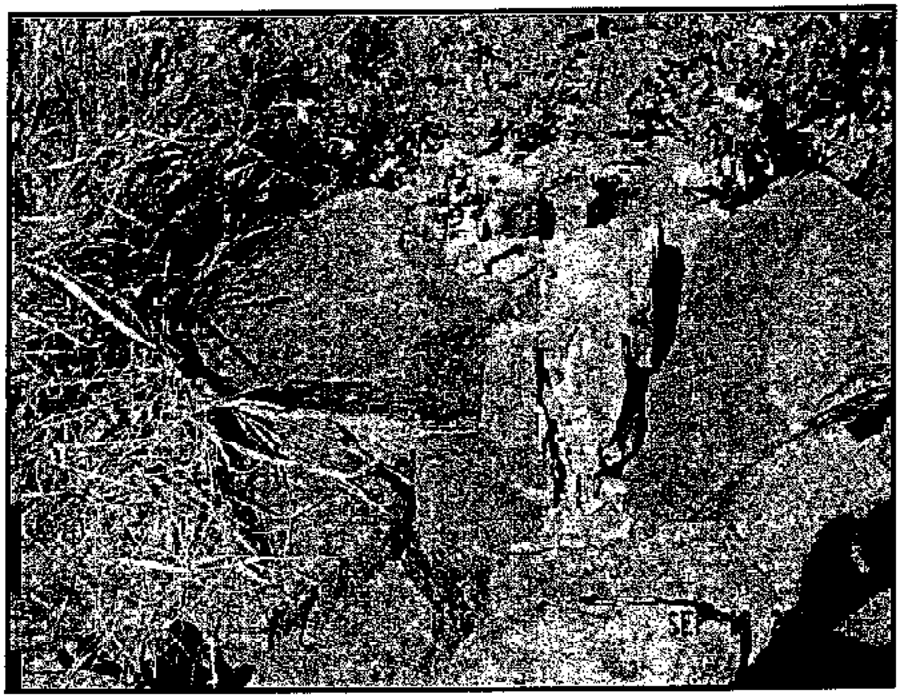

Photo 3: Weathered rip-rap on upstream slope was easily fractured when struck with a survey rod

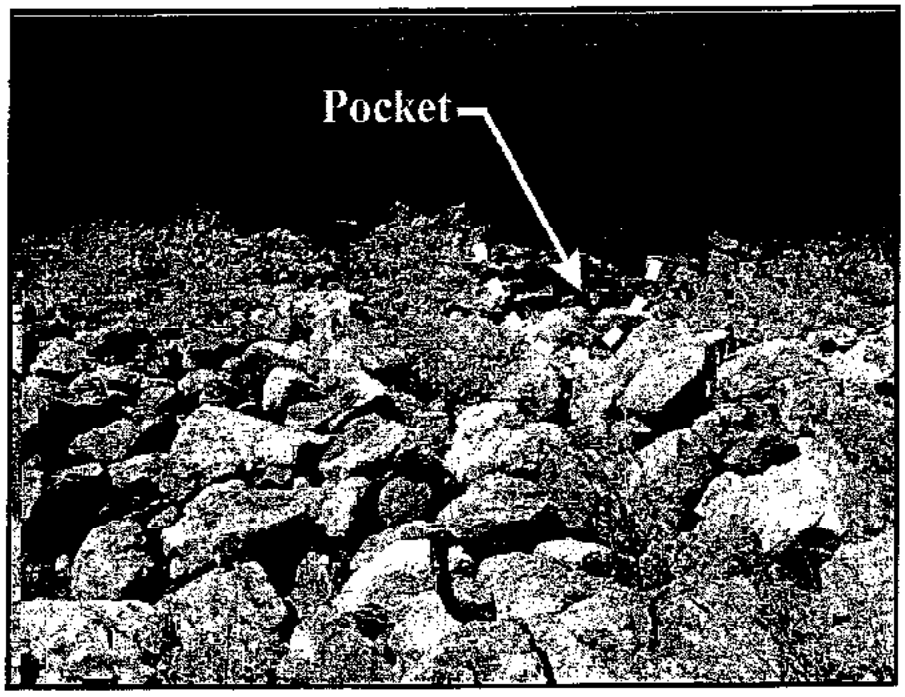

Photo 4: Pocket in rip-rap on upstream slope; it did not appear to be moving

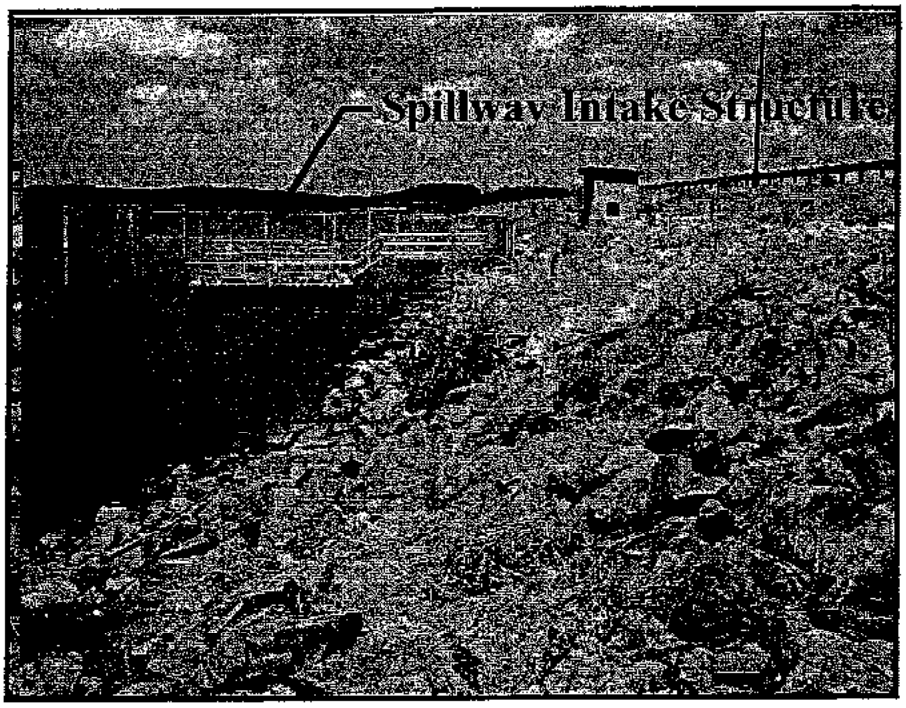

Photo 5: Small trees and brush growing through voids in rip-rap

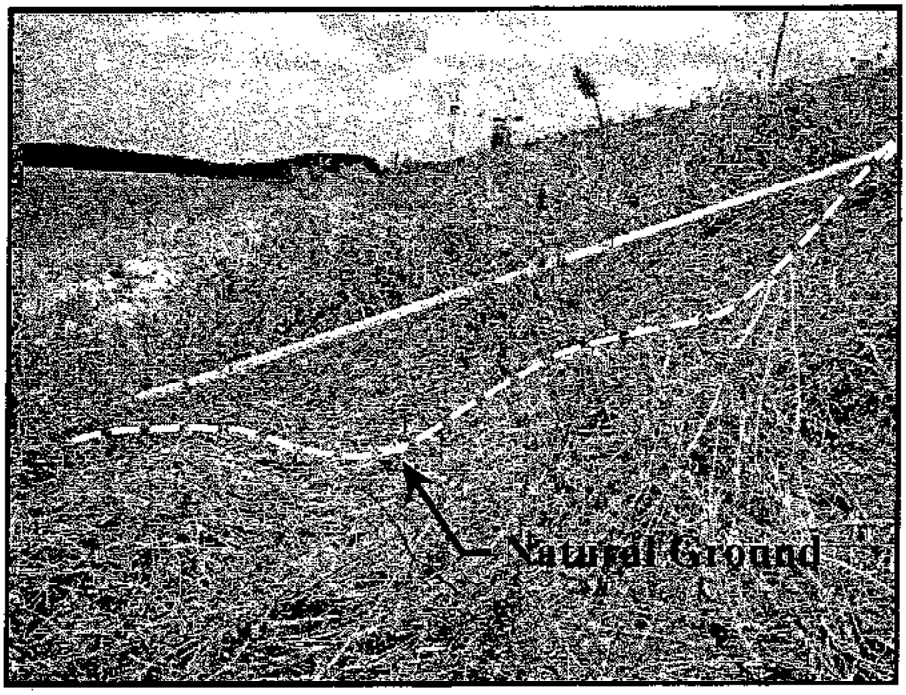

Photo 6: Survey rod laying on the upstream slope; note the separation between natural ground

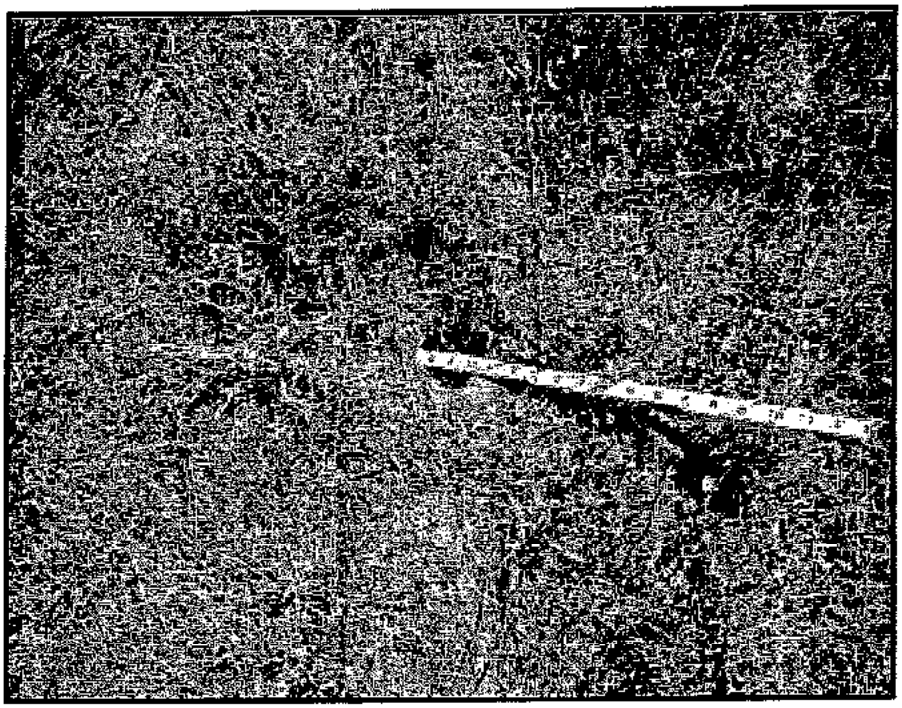

Photo 7: Animal burrow on upstream embankment

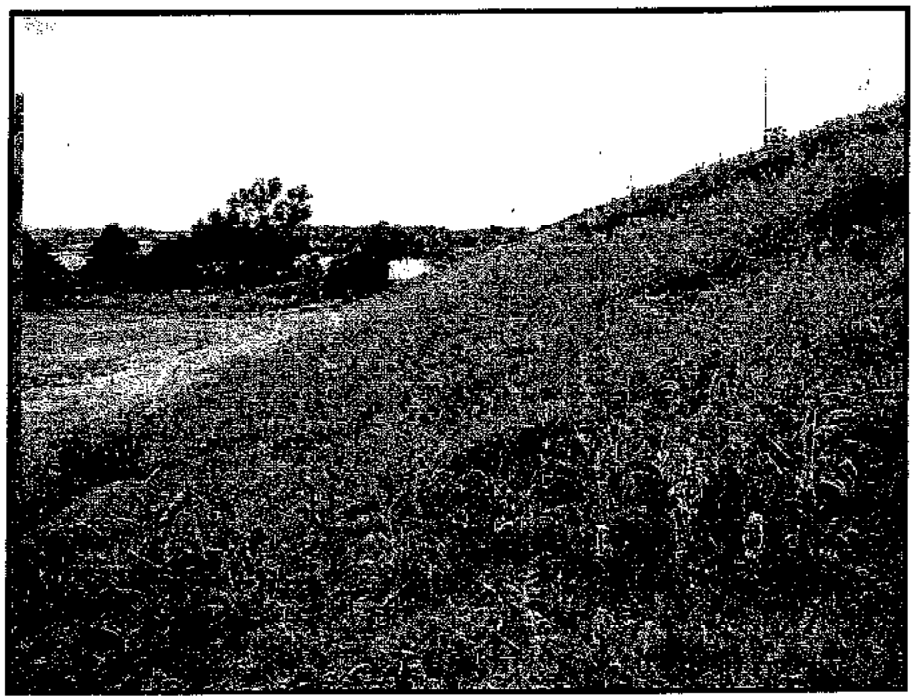

Photo 8: Prevailing vegetation on downstream slope

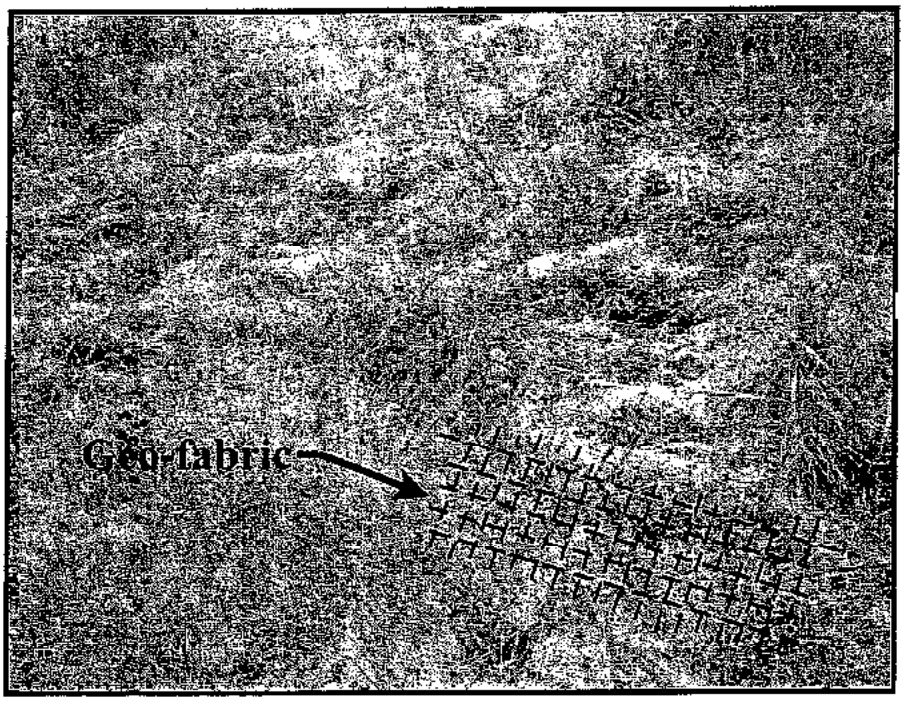

Photo 9: Holes and undulations across downstream embankment

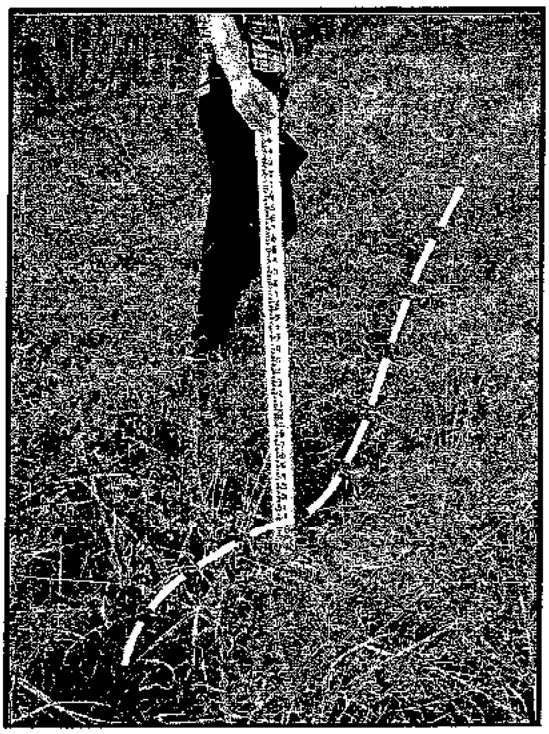

Photo 10: Erosion gully (≈ 1 foot deep) on downstream embankment

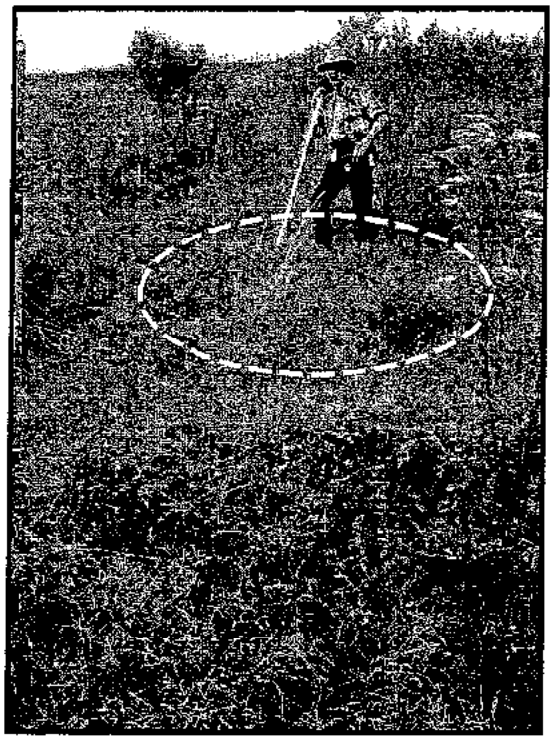

Photo11: Inspector standing on top of slide

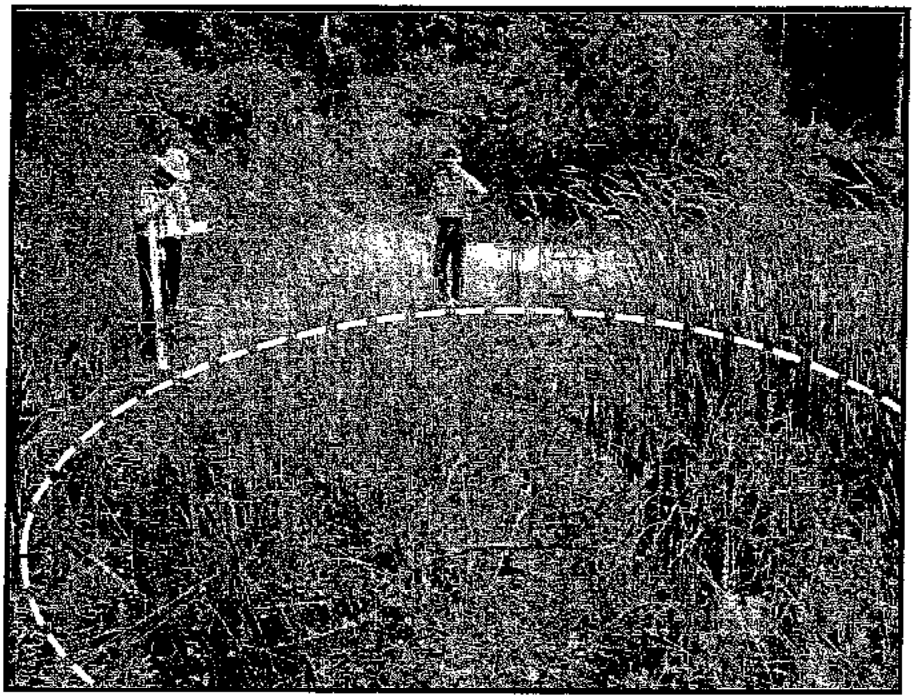

Photo 12: Standing marsh at north end of downstream area

Photo13: Seepage south of service spillway outlet

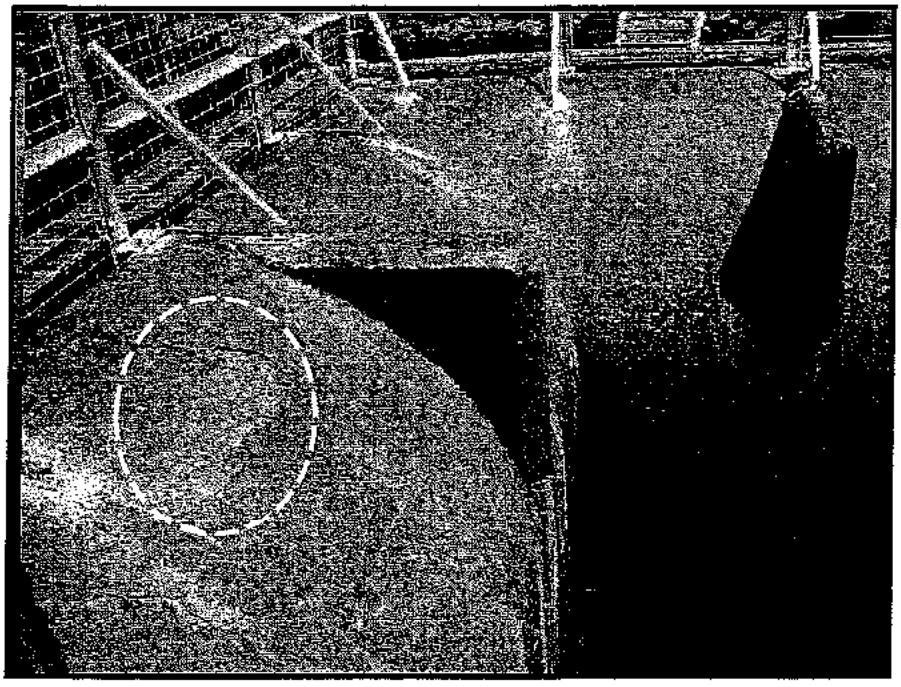

Photo 14: Morning glory service spillway drop inlet; note the minor concrete spalling

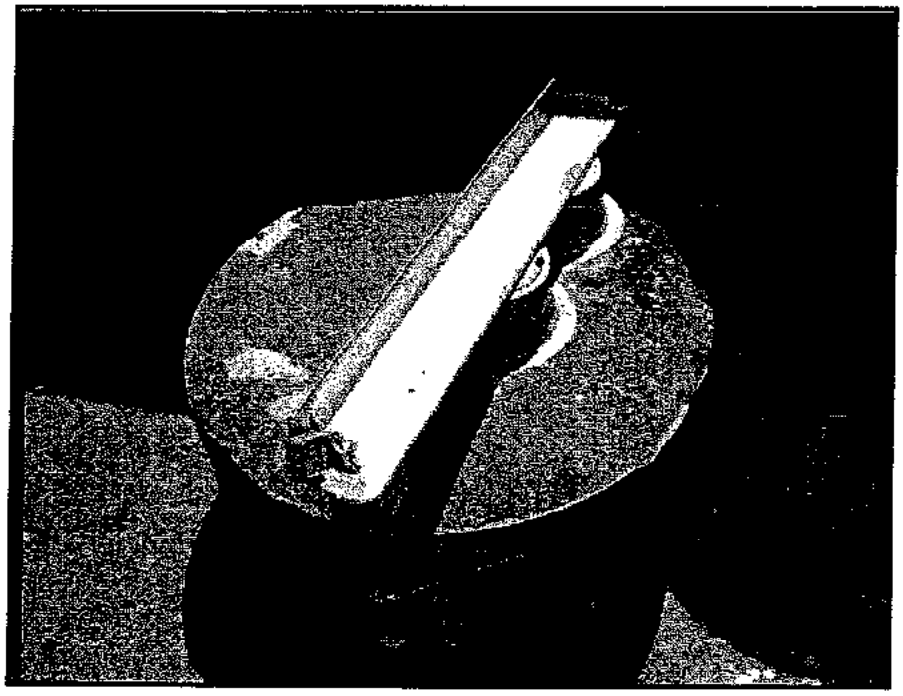

Photo15: Low flow intake valves and pad lock

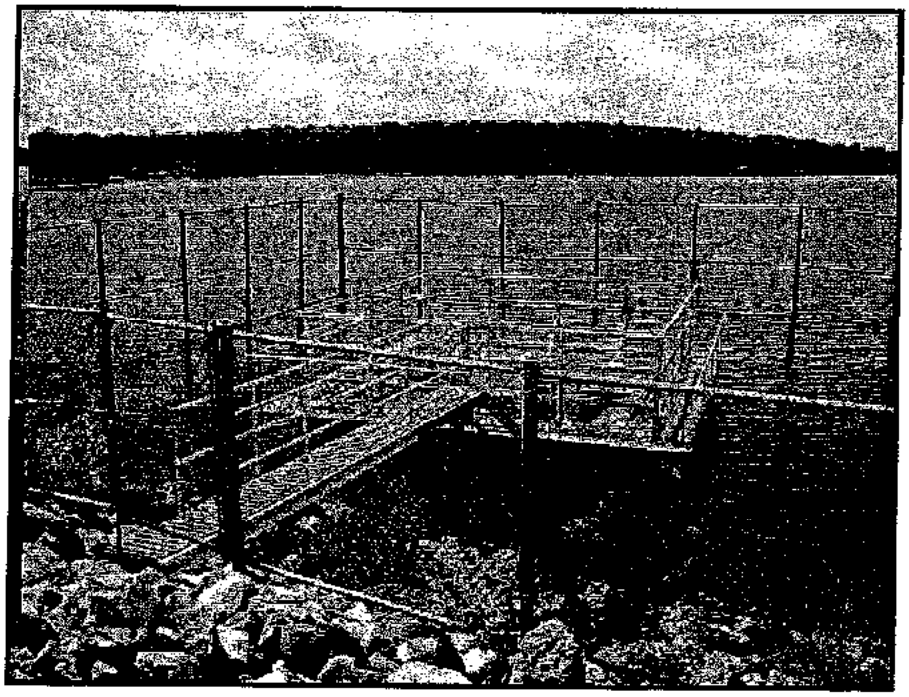

Photo 16: Service spillway morning glory intake structure, access platform(s), and fish screen; note locked gate