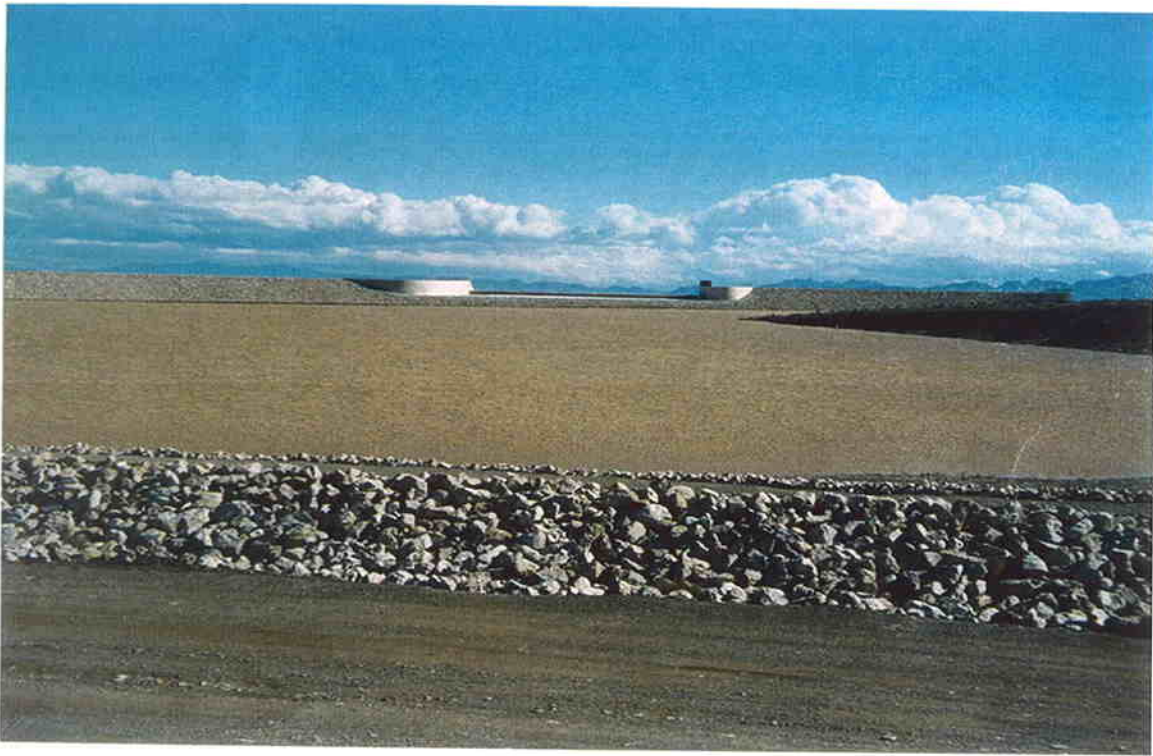


FIELD TRIP 6

ENGINEERING GEOLOGY OF THE LAS VEGAS VALLEY, NEVADA

2005 Association of Engineering Geologists Annual Meeting
Las Vegas, Nevada
September 24, 2005



West Charleston Detention Basin during a 100 year flood event that occurred in January, 2005.



FIELD TRIP LEADERS

John H. Peck, Consultant; Jason Mace, Southern Nevada Water Authority; Marvin (Nick) Saines, Consultant; and James Werle, Converse Consultants

ENGINEERING GEOLOGY OF THE LAS VEGAS VALLEY GEOLOGIC AND HYDROLOGIC CHALLENGES

**2005 Association of Engineering Geologists Annual Meeting
Las Vegas, Nevada
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Leaders: John H. Peck, Consulting Geologist, Marvin "Nick" Saines, Consulting Geologist, James Werle, Converse Consultants, Jason Mace, Southern Nevada Water Authority, with contributions by David Donovan of the Southern Nevada Water Authority

Summary

This field trip presents various aspects of engineering geology, and geologic and hydrologic hazards of the Las Vegas valley. Stops will include discussion of flood control structures, caliche soils, well fields that tap ground water along faults, faulted and fissured ground having subsidence due to groundwater withdrawal, and problem soils. On the east side of Las Vegas, stops will highlight tectonically transported blocks of the Colorado Plateau, Quaternary fault scarps, residential development in active washes on alluvial fans, and a grand overview of the Las Vegas alluvial basin. Wetland restoration along Las Vegas Wash highlights erosion problems related to delivering treated effluent to Lake Mead via the wash. The trip will emphasize engineering challenges of a rapidly expanding city in a desert environment and in a valley filled with alluvial material deposited in a closed basin until Pleistocene time. Las Vegas was founded in 1905. The population of the Las Vegas valley is now 1.7 million and growing. Expansion is testing the limits of water supply, flood control, infrastructure design and construction, and mitigation of hazardous geologic conditions.

Introduction

The engineering geology of the Las Vegas metropolitan area is summarized by Wyman and others (1993), and Longwell and others (1965) describe the overall geology of Clark County. Bell (1981, 1991 and 1992) describes the geology of fault scarps and fissured areas in the valley, as well as ground subsidence due to ground water withdrawal. Geologic and hydrologic hazards of the Las Vegas valley are described in the proceedings of three workshops held by the Southwestern Section of the Association of Engineering Geologists in 1991, 1997, and 2000. DePolo (1998) published a summary of the proceedings of a conference on seismic hazards of the Las Vegas region that was held at the University of Nevada, Las Vegas, in November, 1996. The proceedings contain an extensive list of the literature concerning the geology and hydrogeology of this region of southern Nevada and of adjacent areas of Arizona and Utah.

The Las Vegas valley is a tectonic depression developed on downfaulted Paleozoic and Mesozoic bedrock, and filled with alluvium and sediments derived from the surrounding mountains. From mid-Tertiary until Pleistocene time, the valley was a closed basin with interior drainage. During early Pleistocene time, the valley was breached on the southeast side by headward erosion from the Colorado River and now drains via Las Vegas Wash into Lake Mead. Alluvial fans from the Spring Mountain Range on the west are by far the largest contributors of erosional debris to the valley. Other ranges bordering the valley have less extensive alluvial fans. Subsurface deposits include lacustrine carbonates and evaporites, marsh and spring mound deposits, clay, silt and organic materials, and coarser sand and gravel deposits. Caliche layers are commonly developed on older alluvial surfaces that have been exposed for long periods of time to the arid climate. The finer-grained materials and lakebed sediments are prevalent in the topographically lower parts of the valley, particularly in the northern and southern quadrants. Range-bounding faults, typical of Basin and Range structures, are present along the mountain fronts, and down-to-basin faults cut Quaternary alluvial deposits within the basin. Groundwater springs once were common along the faults in the topographically lower parts of the valley, supporting abundant vegetation from which the name Las Vegas (the meadows) was derived. Groundwater pumping has lowered the water table significantly causing land subsidence and ground fissuring, particularly in the vicinity of Quaternary faults in the basin.

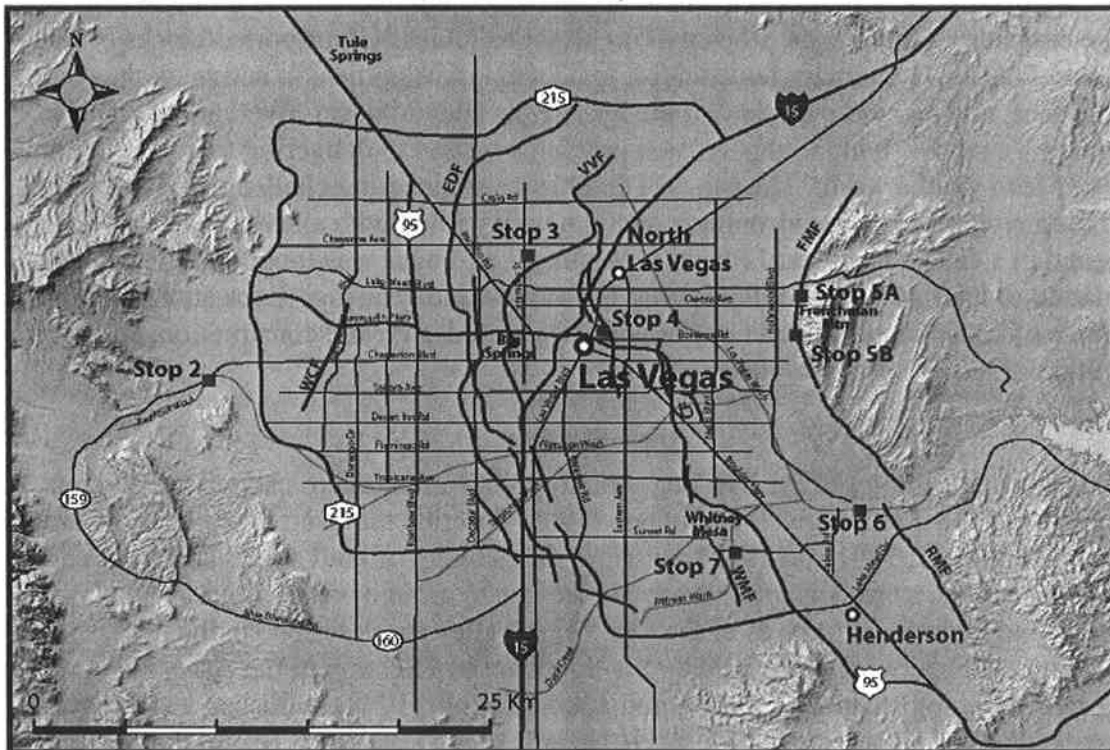


Figure 1 Field Trip Stops In The Las Vegas Valley

FIELD TRIP ITINERARY

Meet at the Flamingo Hotel, north entrance, at 7:45 AM. We will leave by bus promptly at 8:00 AM.

STOP 1 Foundation Conditions at a Strip Construction Site

Stop 1 will be an excavation on or near the Strip at the location of a high-rise building under construction. The soils, caliche occurrence, and shallow groundwater in the polluted shallow aquifer will be discussed. Design of foundations and dewatering systems along the Strip will be discussed in regard to problems encountered in the past and what the future may hold for new construction in the vicinity.

From the Strip (Las Vegas Blvd.), go west on Flamingo Road to Decatur Boulevard and turn south. Note the Decatur fault scarp, which Decatur Blvd. crosses just south of the intersection. Proceed south to the Flamingo Wash bridge (about 2/3 mile). Upstream of the bridge are silty deposits typical of the lower reaches of the Las Vegas valley, here on the footwall of the Decatur fault. Proceed to Tropicana Avenue and turn west. Drive west on Tropicana to Rainbow Boulevard. The badlands northwest of the Tropicana-Decatur intersection are formed on eroded fine silts and sands on the upthrown block of the Decatur fault and are truncated by the fault scarp that is about 40 feet high. Flamingo Wash has deeply eroded these soft materials that were originally laid down in quiet water environments. As we approach Rainbow Blvd., we will cross over Flamingo Wash, which has been confined within riprap, gabions, and concrete walls.

Turn south on Rainbow and proceed to Hacienda Avenue. Flamingo Wash flows out of the Spanish Trails development in a concrete channel that has a right-angle bend, just east of Rainbow Blvd. Water does not like right angles. A more curved channel would have been a better idea.

Turn west on Hacienda and proceed one mile to the crossing of Flamingo Wash. Flamingo Wash is notorious for having caused severe damage during floods in the past. Upstream of this point is a large detention basin to capture floodwaters and release them slowly. The channel here is armored to prevent erosion. It emptied into the Spanish Trails Golf Course, which was designed to serve as a floodway until just recently. Now a concrete diversion channel carries the discharge from the detention basin east and southeast to Tropicana Wash and another detention basin near Decatur Blvd.. Tropicana Wash flows into Flamingo Wash east of the Strip and Paradise Road; which have been severely flooded by Flamingo Wash in the past. This design effectively beheads Flamingo Wash before it reaches the Strip and bypasses the flood water to points east of the area of major commercial development.

Proceed west to Durango Road. Turn left on Durango. Proceed about 0.3 miles to the crossing of Flamingo Wash. Here the wash is contained within a concrete channel and flows into a large detention basin. (east side of the road) The excavation of the basin is not yet complete. This basin was half full in January, 2005. Continue west about 0.3 miles to Russell Road; turn right and proceed to County Bypass 215. Go north on 215 to