APPENDIX K
(Historical / Cultural)

K.1 – Errata

K.2 – Human Systems Research, Inc. (HSR) Report

K.3 – Parsons Engineering Science (Parsons) Report

K.1 - ERRATA

ERRATA

The purpose of this errata page is to correct the text and captions related to bridges that were misidentified in the historical and archaeological investigation conducted by Human Systems Research, Inc. (HSR) in 1999.

The photographs listed below were incorrectly labeled and the correct captions are as follows:

- Plate 30: Photograph depicts 12 March 1938 view of Hart's Mill Road Bridge; and

- Plate 66: Photograph depicts 1999 view of the remnants of the Hart's Mill Road Bridge.

The descriptions of the Globe Street and Hart's Mill Road Bridges on pages 62, 66, and 67 of the HSR report contain incorrect information. The description and dimensions provided correctly describe only the Hart's Mill Road Bridge. A revised description of the two bridges can be summarized as follows:

> An examination of USIBWC construction drawings, maps, and photographs reveals that while the Globe Street Bridge was constructed as a footbridge across the canal, the structure at Hart's Mill Road was a timber vehicular bridge. Although remnants of the Globe Street Bridge no longer exist, the original Hart's Mill Road Bridge has been replaced with a sewer line and only the abutments remain. Photograph #ADC-385 in the USIBWC archives depicts the construction of the Globe Street footbridge in an April 1938 view. Furthermore, a construction drawing dated May 28, 1938, and entitled "Earthwork & Gravel Surfacing at American Dam and Canal – General Plan" (#2693-49) corroborates the location and method of construction of both the Globe Street and Hart's Mill Road Bridges. No construction drawings have been found for the Globe Street pedestrian bridge, perhaps indicating the structure's simplicity of design.

Furthermore, the HSR study claimed that a third bridge, which led to the American Smelting and Refining Company (ASARCO) plant, was likewise of wood-frame construction, has been replaced by a new structure, and that no original remnants exist. However, the Smelter Road Bridge still stands and is addressed in detail in the August 2000 *Supplemental Report, Controlling Water on the Border: The American Canal System, United States Section, International Boundary and Water Commission, El Paso, Texas*. The correct station for the Smelter Road Bridge is 63.00.

K.2 - HUMAN SYSTEMS RESEARCH, INC. (HSR) REPORT

CONTROLLING WATER ON THE BORDER:

THE AMERICAN CANAL SYSTEM,
INTERNATIONAL BOUNDARY AND WATER COMMISSION,
EL PASO, TEXAS

By

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Prepared for
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International Boundary and Water Commission
United States and Mexico
El Paso, Texas
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ABSTRACT

This study focuses on the historical and archaeological background of the American Canal in El Paso, TX. Construction of the canal began in 1937 and was completed in 1938. The American Canal is operated and maintained by the United States Section of the International Boundary and Water Commission (USIBWC) which has proposed to reconstruct the American Canal using one of four (4) alternate courses of action as follows:

> Alternative 1 (Box Canal Alternative). This alternative calls for all but 400 ft of open channel portions of the American Canal between the American Dam and the International Dam to be replaced with boxed conduits
>
> Alternative 2 (Partial Box Canal Alternative A). This alternative calls for replacing 2941 ft of open channels with closed conduits, leaving the remainder of the canal in its original configuration
>
> Alternative 3 (Partial Box Canal Alternative B). This alternative calls for replacing 5521 ft of open channels with boxed conduits, leaving the remainder of the canal in its original configuration.
>
> Alternative 4 (No-action Alternative). This alternative would leave the American Canal in its original configuration.

This report presents detailed archival research, combined with repeat photography and on-site inspections of the existing canal system. This research shows that the American Canal system has retained a high degree of integrity relative to its original 1938 configuration. More precisely, the American Canal exhibits a number of historically-significant engineering and construction characteristics typical of Depression-era Federal irrigation projects.

Second, the American Canal represents the earliest attempt by the United States to enforce the terms and conditions of the 1906 Treaty with Mexico regarding water allocations between the two countries. As such, it symbolizes efforts to resolve water allocations from the Rio Grande between the United States and Mexico *in the Rio Grande basin* in a way that ultimately allowed the expansion of irrigated agriculture in the El Paso Valley.

Based on the findings presented here, the American Canal is potentially eligible for inclusion on the National Register of Historic Places. Specifically, its construction style is typical of Depression-era construction methods *and* the canal is pivotal in international relations between the United States and Mexico. Accordingly, the American Canal is significant under Criterion “A” and Criterion “C” of Section 106 of the National Historic Preservation Act (1966). It is recommended that Alternative 3 be implemented by the USIBWC.

INTRODUCTION

Irrigation in the El Paso Valley of west Texas may have antedated the 1540 arrival of Coronado and been an independent invention of Native Americans (Hutson 1898:18, 66; Taylor 1902:15). Irrigation almost certainly appeared shortly thereafter, since Espejo commented in 1582 that "Some of the [Piro] fields are under irrigation, possessing very good diverting ditches, while others are dependent on the weather [rainfall]" (Bolton 1930:178).

Later authors, notably White (1950:4–7), believed that irrigation was a Spanish innovation first introduced to the region sometime between 1659 and 1661. Similarly, Hackett found that "Farther Garcia was there [Juarez] attending to the establishment of a farm, and obliging even the heathen to construct a ditch for it, with great labor, from the Rio del Norte" (1932:193–213).

Regardless of the precise timing, the arrival of irrigation technology began to radically transform the El Paso Valley, particularly after the Pueblo Revolt of 1680 (Ackerly 1994, White 1950). The sudden influx of refugees from the north, both Spanish and Indian, demanded a substantial increase in the scale of agricultural production to support this new population. By 1726, even after the Reconquest in 1692, the El Paso Valley contained several irrigation canals (White 1950:18). Irrigation systems continued to expand throughout the 1700s and 1800s so that, by 1908, upwards of 9,000 acres were actively cultivated.

Further expansion of irrigation systems in the region continued throughout the twentieth century, largely under the aegis of the Bureau of Reclamation (BOR). The goals of the BOR were to (1) stabilize water supplies, (2) institute flood control measures, and (3) increase agricultural production in the valley. However, the project considered here, the American Canal, was built not so much to address any of these three goals, but rather to resolve potential treaty disputes between the United States and Mexico. The general purpose of the American Dam-American Canal project is best summarized in a BOR Project History (1938:66–67; see also Timm 1941:189):

> The American Canal built by the International Boundary Commission serving the Franklin Canal was completed and placed in operation on June 2, 1938. This canal was built for the purpose of insuring a division of water in accordance with the Treaty of 1906, which gave Juarez Valley, Mexico, 60,000 acre-feet per year in recognition of prior use and rights to Rio Grande water. The canal is concrete lined, 9,800 feet long and required a new diversion dam, which is a multiple radial gate type placed in concrete pier structure. This afforded a means of closer regulation of irrigation water, insured the delivery of required water to the American side and water was delivered to Mexico in accordance with the treaty provisions. As a result there was a considerable reduction in the amount of water received by the Juarez Valley, and requests were made to readjust the flow.

As this quote makes abundantly clear, the purpose of the American Dam and Canal project was to resolve disputes over water allocations between the United States and Mexico. Only then could sufficient water supplies be assured for American farmers to expand the scale and scope of agriculture in the valley.

This study was prompted by a proposal from the United States Section, International Boundary and Water Commission (USIBWC) to reconstruct the American Canal. For purposes of this report, the title International Boundary and Water Commission (IBWC) is used in a manner to mean either the IBWC or the United States Section of the International Boundary and Water Commission (USIBWC). The United States and Mexico when referencing the international organization use the acronym IBWC. When referring to one section or the other of this international commission, the Acronyms USIBWC for the United States and MxIBWC for Mexico, are used (Source: IBWC).

Specifically, the IBWC has proposed replacing one or more of the concrete-lined, open-channel segments of the American Canal with concrete box conduits extending from the beginning of the American Canal at the American Dam downstream approximately 1.98 mi to the intake of the Franklin Canal at the International Dam. Mr. Steve Fox, Environmental Protection Specialist with the IBWC, is the liaison between Human Systems Research and ENCON International, the IBWC contractor preparing the Environmental Assessment. Mr. John Knopp is the ENCON project manager.

This report provides (1) an overview of the project area, (2) a review of United States-Mexico treaty controversies that prompted construction of the American Dam-American Canal complex, (3) a narrative chronology augmented with vintage photographs that summarizes major milestones in the construction of the American Canal, and (4) inventories of the American Dam, American Canal, and associated water-control and measurement structures associated with the American Canal system.

This report relies on a variety of records including BOR project histories, internal IBWC reports and as-built engineering drawings, and on-site inspection of existing irrigation facilities. In addition, a concerted effort was made to obtain repeat photographs comparing the configuration of the irrigation system in 1938 with its current (1999) configuration. Using this approach, it is possible to better evaluate the extent (or lack thereof) of changes in the system since its completion in 1938. Considered together, the information presented in this report provides (1) a detailed historic context for the American Canal and (2) an evaluation of potential effects arising from the four IBWC reconstruction alternatives.

The proposed alternate IBWC undertakings discussed later in this report would be limited to the existing right-of-way; no new right-of-way will be required for any alternative. This right-of-way traverses an area that was extensively disturbed during the original 1937–1938 construction of the American Canal. On this basis, there would be minimal integrity of any remnant prehistoric or historic remains that might once have existed in this right-of-way. For this reason, this report focuses on the American Canal as the primary cultural resource of importance.

A DESCRIPTION OF THE PROJECT AREA

The project area is situated on the United States side of the International Boundary between the United States and Mexico. It extends from the upstream American Dam approximately two mi downstream to the International Dam and encompasses all of the American Canal (Plate 1).

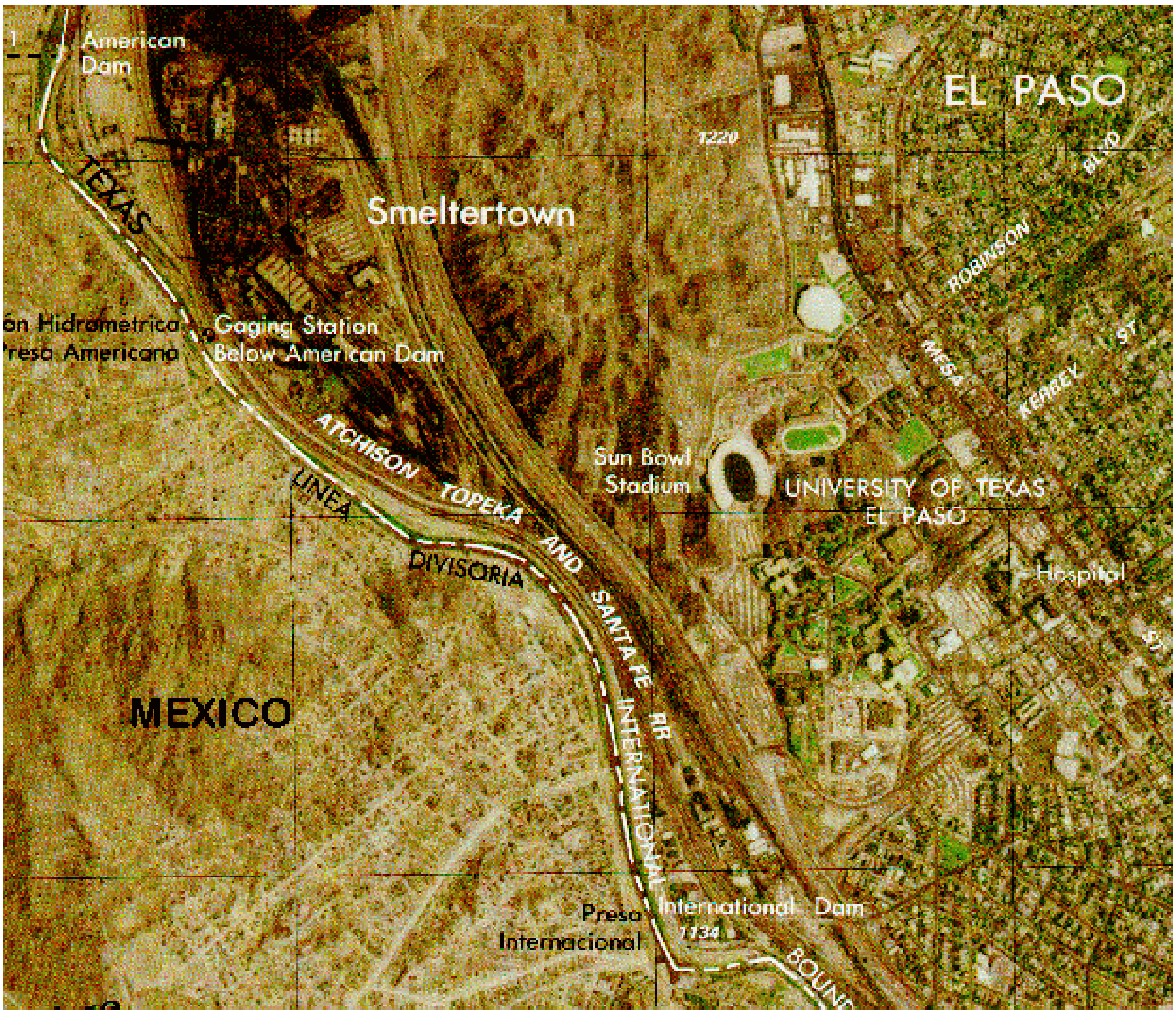


Plate 1. Aerial Photograph of the Project Area
(From Department of the Treasury, United States
Customs Service, Smeltertown, 1:25,000, 1982).

The project area consists of a northwest-southeast trending polygon situated in UTMG Zone 13 with corner points at approximately:

NW Corner— E 355350, N 3517400
NE Corner—E 355600, N 3517400
SW Corner—E 356920, N 3514800
SE Corner—E 357200, N 3514800

This polygon measures 225 m in width and is approximately 3,200 m in length (720,000 m^2). Although portions of this polygon extend into Mexico, all work was restricted to the United States side of the border.

Some 1961 strip maps depicting location of the American Dam, the American Canal, and the International Dam are shown in Figure 1. The American Canal is situated entirely within USIBWC right-of-way. The canal extends southeastward from the American Dam (Station 00), south of the American Smelting and Refining Company (ASARCO) plant, along the left bank of the Rio Grande. At the canal's downstream gauging station, approximately 2,700 ft from the dam (Station 2,700), it enters a culvert running underneath U.S. 80 and continues below the surface for about 870 ft (Station 3570). The canal resumes an above-ground, open-channel for another 3,000 ft, then enters a second conduit at about Station 6,570. This second conduit extends below the surface for 1,600 ft (Station 8,720). It then remerges as an open channel that continues another 2,700 ft to the beginning of the Franklin Canal (Station 10,970). Within the project area, the right-of-way for the American Canal proper encompasses an area of 3,200 m in length by approximately 31 m in width (99,200 m^2).

In addition to the canal itself, the American Canal contains a number of other features. The features listed below are ordered from upstream to downstream:

1. Station 00—a weir-sluiceway complex at the intake of the American Canal
2. Station 30—a concrete bridge with canal headgates over the canal into the American Dam complex
3. Station 9,300—a 16-ft-wide concrete bridge over the canal into ASARCO

Additional details regarding these structures are presented in the archaeological inventory below.

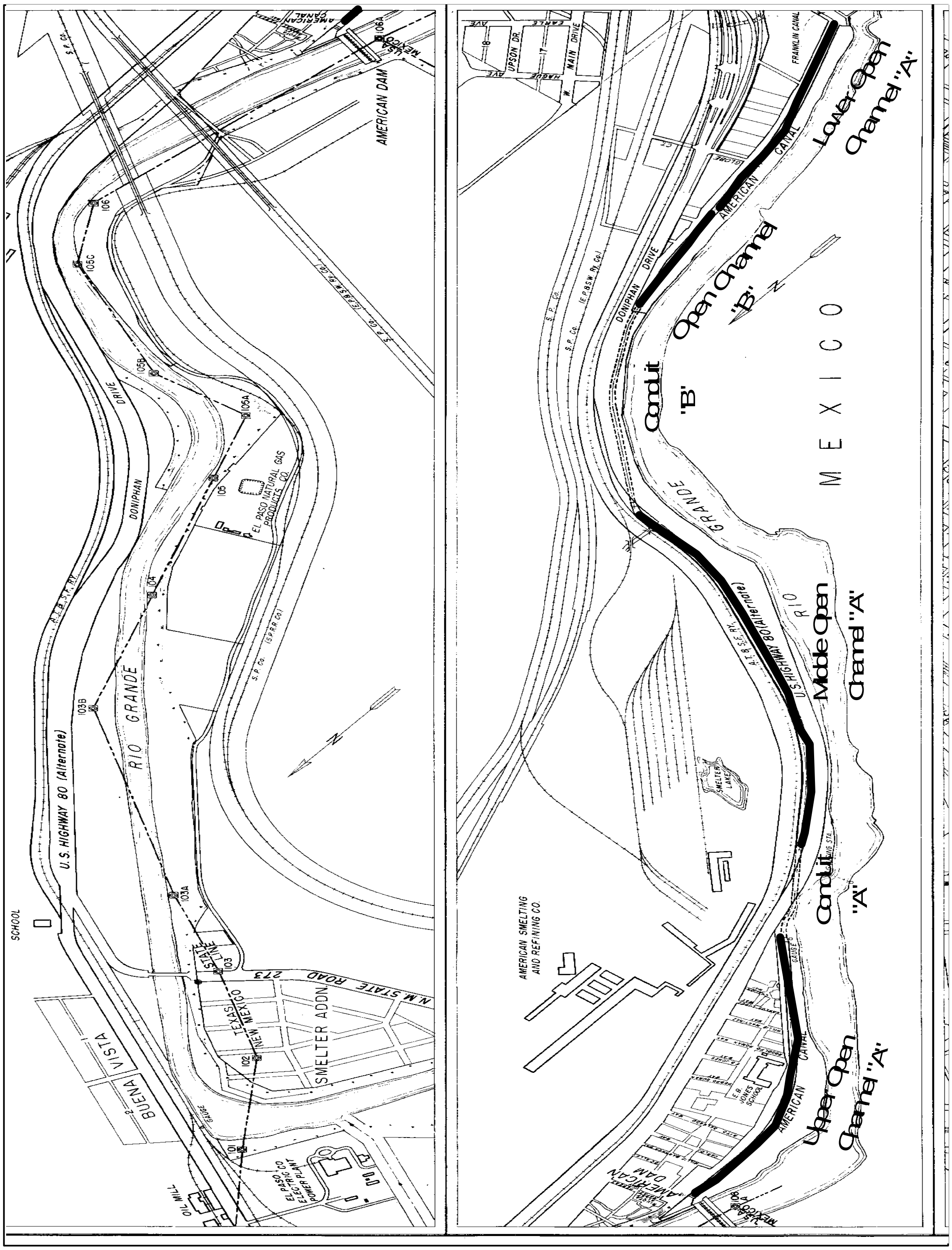


Figure 1. Strip Map of American Canal Showing Open Channels and Conduits (From U.S. Bureau of Reclamation, Irrigable Area and Property Maps, Sheet 1, 1961).

UNITED STATES-MEXICO TREATY CONTROVERSIES: A PROLOGUE TO CONSTRUCTION OF THE AMERICAN CANAL

Given that water for irrigation purposes was critical to both the United States and Mexico, early treaties and conventions, astonishingly, did not explicitly consider the allocation of water between the two countries. In the United States, the progressive expansion of irrigation systems upstream of Paso del Norte, especially those in the San Luis Valley of southern Colorado, led to water shortages in many downstream portions of the Rio Grande Basin, including the Paso del Norte region (Mills 1896 in Follett 1898:12). Documentary sources suggest persistent seasonal water shortages as early as 1879 and lack of water continued to play a crucial role in inhibiting agricultural production throughout the Rio Grande Basin.

Under the terms of Article V of the 1848 Treaty of Guadalupe-Hidalgo and Article Vll of the 1852 treaty between the United States and Mexico, the boundary between the two countries was established as the middle of the deepest channel of the Rio Grande. This agreement implied, but did not specify, that Mexico was free to divert irrigation water into canals in Ciudad Juarez opposite El Paso, Texas, from its half of the river. However, faced with ever-changing river channel locations, the United States and Mexico agreed, in 1884, that the dividing line would conform to the original 1852 channel of the Rio Grande and reaffirmed that no works affecting the river flow would be constructed. Yet, even at this later time, no agreement existed concerning how much water could be diverted by either country.

Between 1855 and 1885, progressive channel migration, estimated at more than 0.6 mi, resulted in the southward migration of the main stem of the Rio Grande into Mexican territory. This channel shift resulted in loss of lands and destruction of ditches, as well as threats to the Mexican diversion dam and remaining Acequia Madre. By 1885, it was found that:

> ...not only had Mexico lost a very considerable part of cultivated and irrigable lands and some dwelling houses, but also one of the irrigating canals, known as the Chamizal Ditch, loss of which constituted a greater damage because it ruined and converted into arid lands a considerable amount of ground formerly used for viticulture and the cultivation of choice fruits; that these damages were caused in the beginning by the natural effect of the water, which in this part of the channel attacks the right bank as it makes a big curve, to the detriment of the concave part, which is on the right-hand [Mexican] side, and partly caused by small wing-dams constructed for defense on the left [American] side, which helped powerfully to increase the destruction that already without them had been considerable (Ernst 1889:57–58).

In an effort to stabilize the channel, Mexican authorities constructed, in 1886, a series of wing-dams downstream of their dam to halt further movement of the river into Mexican territory. The reaction of United States authorities was almost immediate: the actions of the Mexican government were construed as a violation of Article Vll of the 1852 treaty and Article lIl of the 1884 convention because the structures altered the channel of the Rio Grande and potentially impeded the navigability of the river (Ernst 1889:50). Although the Mexican government suspended further construction of wing structures, this incident clarified the linkage between channel stability—a factor very explicitly considered in all prior treaties and conventions—and the operation of acequia systems in the El Paso Valley. Despite this incident, the United States and Mexico did not undertake any agreements regarding water diversions into canals.

A second event underscored the problem of water allocations between the United States and Mexico. In 1890, local El Paso developers argued that canal systems and community ditch associations were not efficiently delivering water to farms in the valley. Their proposed remedy involved the construction of a single canal that was large enough to provide water to all farmers throughout the valley.

This proposal culminated in the formation of the El Paso Irrigation Company and its ill-fated offspring, the Franklin Canal. In its original prospectus for the Franklin Canal, the company proposed to construct a large canal through the middle of the floodplain for some 30 mi downstream of the American Dam. The company would then contract for water deliveries to individual farmers or community ditch associations. Within two years, the El Paso Irrigation Company fell on difficulties and was reorganized as the Franklin Irrigation Company. Between 1892 and 1912, the Franklin Canal was leased to the El Paso Valley Water Users Association.

Designed to divert approximately 300 cubic feet per second (cfs), the Franklin Canal was intended to convey water for some 30 mi down the El Paso Valley. A 1909 report indicates that infilling by sediments had reduced the capacity to only about 175 cfs (BOR, RG 115, National Archives and Records Administration (NARA), General Correspondence File, 1902–1942,115-54-A-81, Box 1111, Folder 249, np). At the time the BOR acquired the canal in 1912, the Franklin Canal extended for only 5 mi through the valley and its capacity was only about 85 cfs (BOR, RG 115, NARA, Project Reports, Box 722, pp 1–4).

The reason the Franklin Canal was of little concern to Mexican water users can be traced to the location of the dam that supplied water to the canal. The Mexican Dam appears to have been rebuilt in 1848 and then again between 1886 and 1889 using stronger materials (Plate 2). At the same time, the American Dam was constructed 1800 ft *below* the Mexican Dam. Although efforts were made to place the American Dam upstream of the Mexican Dam, opposition from American landowners prevented its construction at that location. Consequently, farmers on the Acequia Madre in Juarez were able to divert water before it reached the American Dam and the Franklin Canal did not pose any substantial threat to Mexican farmers (BOR, NARA, RG 115, Project Reports, Fiock letter, 22 July 1935). Sometime between 1904 and 1909, the intake or throat of the Franklin Canal was relocated to a point some 150 to 200 ft above the Mexican Dam (BOR, NARA, RG 115, Project Reports, pg. 14; Fiock, BOR, FRC, 22 July 1935). The apparent lack of response of the Mexican government to this relocation suggests this intake was constructed after the 1906 agreement in which the United States agreed to supply Mexico with water (see Appendix AA for a copy of this treaty).

Plate 2. Mexican Dam and Head of Juarez's Acequia Madre
(August 1934 - NARA, BOR, RG 115-87-0028, Resch report).

The explicit consideration of water allocations between the United States and Mexico was an inadvertent outgrowth of the first effort to construct a dam on the Rio Grande. A local New Mexican businessman, Nathan Boyd, formed the Rio Grande Dam and Irrigation Company in 1895 with the express intent of appropriating all of the water of the Rio Grande and building a water storage facility near Engle, N.M. Shortly thereafter, Boyd arranged for a group of English financial backers to take over control of the company while preserving much of its original intent. According to the original prospectus, the Rio Grande Irrigation and Land Company, Ltd. was

> . . . formed to acquire, by lease and assignment, the franchise rights, water rights, right of appropriating the waters of the Rio Grande (United States of America), contracts, properties, and undertaking of the Rio Grande Dam and Irrigation Company, and for the purposes of irrigating, colonizing, and improving the lands in the famous Rio Grande Valley, between Engle, N. Mex. and Fort Quitman, Tex[as] (Mills in Follett 1898:12).

Dam sites were proposed at Elephant Butte, Rincon, and Fort Selden, New Mexico (Mills 1896 in Follett 1898:12).

The Mexican government responded that this project violated the 1852 and 1884 agreements, since a dam would adversely affect the navigability of the Rio Grande. Although this scheme foreshadowed the eventual construction of the Elephant Butte Dam, subsequent litigation (*United States of America vs. Rio Grande Irrigation and Land Company, Ltd.*) prevented the company from continuing its plans. Nevertheless, the proposed dam crystallized the problems associated with water allocations between the United States and Mexico.

In 1896, W. W. Follett was assigned the task of determining water usage throughout the Rio Grande Basin. His report (Follett 1898) showed the surface water of the Rio Grande to be oversubscribed and that remedial measures would have to be taken to avoid the collapse of irrigation agriculture throughout the downstream portions of the basin. Follett (1898:41) further recommended that the United States:

> ...restrain any such reservoirs hereafter constructed from the use of any waters to which the citizens of the El Paso Valley, either in Mexico or in the United States, have right by prior appropriation, and provide some legal and practicable remedy and redress, in case such waters should be used, to the citizens of both countries. And that thereafter the two Governments provide by joint representatives or mixed commission who are to reside at their respective ends of the dam, for a permanent distribution of the flow, as follows: one half or so much as one-half as may be required to the Mexican side of the river for such use as the Mexican Government may see proper to apply it.

This report is the first reference to the dilemma of allocating water between the two countries. More important, Follett recommended that Mexico receive 50 percent of the Rio Grande's flow.

Given the decision to construct the Elephant Butte Dam, the United States and Mexican governments negotiated an agreement in 1906 to allocate water between the two countries (see Appendix AA). According to Article I, the United States agreed to provide 60,000 acre-feet of water annually at the headgate of the Acequia Madre in Juarez (Lawson 1926:2). What is surprising is that the amount allocated to Mexico represented slightly less than 10 percent of the long-term average annual discharge of the Rio Grande at El Paso, Texas. Even more surprising are other terms of this agreement. Under the terms of Article IV, the United States stipulated these water deliveries would not to be ". . . construed as a recognition by the United States of any claim on the part of Mexico to the said waters." In other words, the United States did not recognize that Mexico had any legal claim to any water from the Rio Grande. Even today, water deliveries to Mexico continue on the basis of this 1906 agreement.

Despite the agreement between the United States and Mexico regarding water allocation between the countries, illegal diversions of water by Mexican farmers began as early as 1919 and continued at various points below the American-Mexican Diversion Dam for a number of years (BOR, RG 115, NARA, General Correspondence files, 1902–1942, Box 1109, 115-54-A-81, Folder 249, pg. 3–4; Lawson 1926:3). In 1923, for example, Debler estimated illegal diversions to amount to almost 30,000 a.f. *above* the 60,000 a.f. agreed upon in 1906 (BOR RG 115, NARA, Project Reports, 1910–1955, Box 717, Folder: Water Supply Requirements, pg. 6; Lawson 1926:5). Three years later, Lawson (1926:3) found no less than seven illegal dams diverting water downstream of the International Dam. In a 1935 report, Fiock noted:

> ...in 1932 a large increase in the diversions by the Mexican canals was made and has continued; also since the Mexican canal diversion records have not been made accessible (although it is certain that such records are kept) there is nothing else to believe other than the Mexican records show a much greater volume being diverted than is allowed in the treaty of 1906, and for that reason the Mexican officials do not wish to release them.

The apparent locations of these illegal diversion dams began with the San Augustine Acequia (Plate 3) some 17 mi below the International Dam (BOR, RG 115, NARA, General Correspondence files, 1902–194, Fiock 1935:np; BOR, RG 115, NARA, General Correspondence files, 1902–1942, Box 1109, 115-54-A-81, Folder 249, pg. 4). Still other illegal diversion dams were found further downstream (Lawson 1926:4). These included, ordered by downstream distance, the Guadalupe Acequia (32 mi), San Ignacio Acequia (32 mi—Plate 4), Porvenir Acequias (44 and 45 mi—Plate 5 below), Miramar Acequia (48 mi), Cuervo Acequia (Plate 6), and San Lorenzo Acequia (Plate 7).

Plate 3. Brush-and-Rock Diversion Dam of the San Augustine Acequia (August 1934 - NARA, BOR, RG 115-87-0028, Resch Report).

Plate 4. San Ignacio Earthen Dam Looking Upstream - Note Reduced Flow of the Rio Grande(August 1934- NARA, BOR, RG 115-87-0028, Resch Report

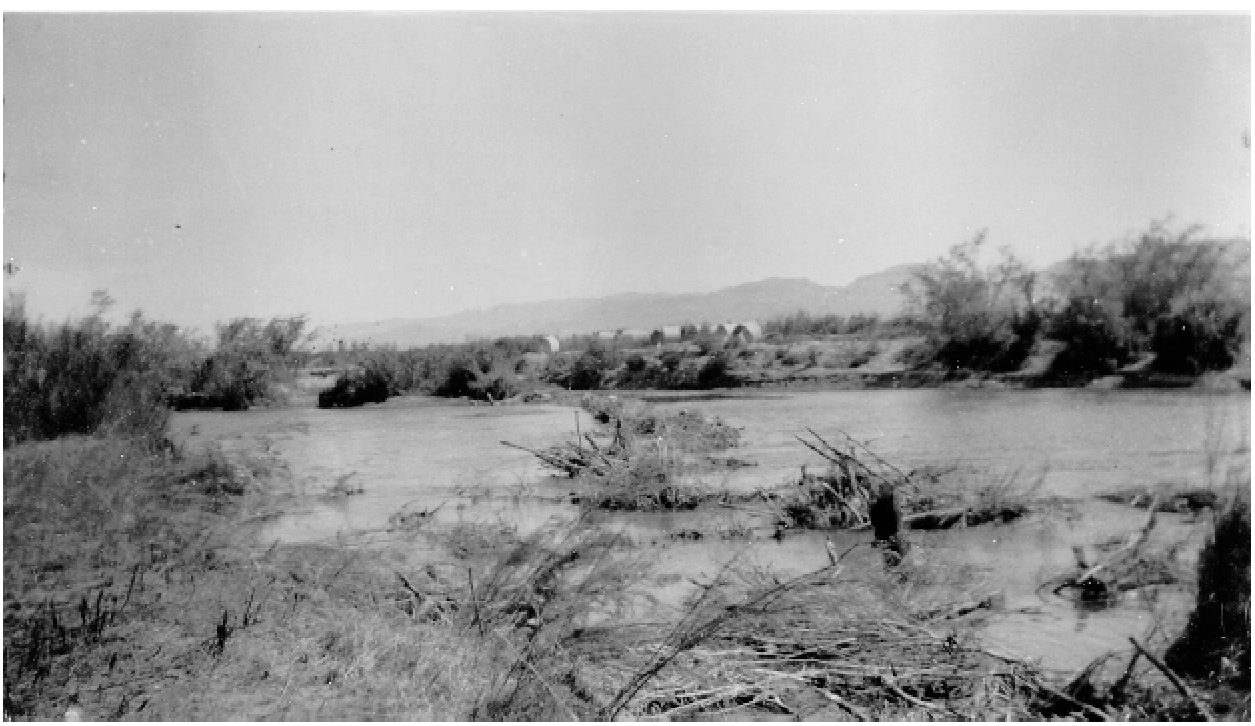


Plate 5. El Porvenoir Brush Dam Looking Downstream (July 1934 - NARA, COR, RG 115-87-0028, Resch Report).

Plate 6. Brush-and Rock Dam of the Cuervo Acequia
(July 1934 - NARA, BOR, RG 115-87-0028, Resch Report).

Plate 7. Dam (left) and Intake (right) of the San Lorenzo Acequia
(July 1934 - NARA, BOR, RG 115-87-0028, Resch Report).

The presence of so many illegal diversions caused Resch (1934:7–9, 26–27) to comment at length about the nature of difficulties between the United States and Mexico:

> The conservation and economic distribution of water in the El Paso Valley has become increasingly difficult, in fact impossible, during the past two years due to the lack of information regarding the volume of water that was being diverted by the [Mexican] Acequia Madre, and to the absence of some means of measuring out the 60,000 acre-feet as provided in the distribution schedule contained in Article II of the [1906] treaty . . . An attempt was made to secure from the Mexican Irrigation Service an estimate of their diversion prior to the time it was to be made, but the effort was far from being successful and it was abandoned after several telephone calls failed to secure the necessary information . . . However it was soon evident [fall of 1933] that the Acequia Madre was not being operated according to treaty; in fact, due to the excess diversion by the Acequia Madre above treaty stipulations more water was being diverted into the head of the Mexican Canal than could be diverted by the Franklin Canal. While all of the water being taken into the head was not used, due to the system under which the canal is operated, at the same time it was not available for diversion by the Franklin Canal in which it was badly needed. The Mexican system of operation has been uncontrolled intake at the head of the canal, no gates of any type being used and net control being secured by one waste return to the river about 400 feet below the International Dam and a second waste return to river about one mile below the International Dam. With 250 second feet and less available in the river during the fall months it can readily be seen how the Acequia Madre uncontrolled intake seriously interfered with the operation of the Franklin Canal by "running" most of the water around the International Dam through the Acequia Madre head, then to the river through one of the wasteways . . . [This] indicates conclusively that the Acequia Madre at Juarez and a number of additional canals diverting from the river between Juarez and Fort Quitman were diverting and using during the period covered by the records of 1910–1928 more than 60,000 acre-feet a year.

Resch presented a number of recommendations in his report. His two most relevant conclusions were (Resch 1934:26–27; see also Lawson 1926:7, 10):

> Conclusion #3. Economic and efficient control and conservation of water below El Paso is impossible due to the uncontrolled diversions of the Acequia Madre at Juarez, Mexico, opposite El Paso, Texas, and the several other unauthorized diversions to the Mexican side of the river below that point.

> Conclusion #5. The only permanent solution is the construction of a diversion dam above the point where the Rio Grande becomes the International Boundary and an All American Canal built from the diversion dam along the American side of the river to the present Franklin Canal which would ultimately be enlarged to carry the entire irrigation requirement for the El Paso Valley.

Both recommendations were adopted by the International Boundary and Water Commission (IBWC) as a justification for constructing the American Dam and the American Canal. What is ironic, of course, is that despite completion of these two structures, illegal diversions of water into Mexican acequias continued well into the 1940s (Timm 1941:189–190). Indeed, one commentator observed that illegal diversions in 1945 probably equaled or exceeded the 60,000 acre-feet to which Mexico was legally entitled under the 1906 treaty (IBWC 1945:15). Consequently, full implementation of the American Dam and Canal did not, in and of itself, solve the problem of illegal water diversions.

American and Riverside Dams

Two measures immediately were proposed to reduce illegal Mexican diversions. First, the IBWC proposed, in 1926, to build a dam *above* the Mexican diversion dam at a point along the Rio Grande before the river became the International Boundary between Mexico and the United States (BOR, RG 115, NARA, General Correspondence files, 1902–1942, Box 1109,115-54-A-81, Folder 249, pg. 7). This dam would capture the entire flow of the Rio Grande into the Franklin Canal and then divert the Mexican allotment of 60,000 a.f. into the Acequia Madre on the Juarez side of the river (Fiock 1935:np).

What was more important, as BOR officials noted (1935:19), was that this dam would allow the United States to completely control water distributions in the El Paso region:

> It is proposed to construct a diversion dam across the river [Rio Grande] near El Paso, above the point where the International Boundary Line between the United States and Mexico leaves the Rio Grande and runs west to California. The location is to be such that it will lie entirely in United States territory. The proposed dam will consist essentially of thirteen steel gates located between concrete piers and so arranged that the ordinary controlled flow of the river can be diverted into a new canal (to connect with the present Franklin Canal) while high flows can be passed through the structure with a minimum of interference and consequent backing-up of the water. The new canal is designed to carry a flow of water sufficient for all of the Rio Grande Federal Irrigation Project lands below El Paso (estimated at 1200 second feet), so that eventually all of such lands can be supplied from the new diversion dam through the new canal and an enlarged Franklin Canal.

The BOR also commented at length on the general design and constraints faced in constructing the American Dam (BOR 1935:25–27):

> [The dam] is a structure of the floating type, resting on the fine sands and silts of

> the river bed, which extend to considerable depths . . . The proposed structure consists of twelve steel radial gates, each 30 feet wide by 7'6" high, set between reinforced concrete piers 24" thick and 18" above the floor. In addition, a special gate is provided through which diversions to Mexico can be measured. The floor or apron is a reinforced concrete slab extending upstream for a distance of forty feet above the gates, and downstream for a distance of 30 feet below them. This floor varies in thickness as shown on the plans, being 9 inches above the piers, 24 inches under the piers, and 18 inches below the piers. A line of 20-foot sheet steel piling extends across the river under both the upper and lower ends of the concrete apron, and a line of weep holes for structure drainage is located immediately above the downstream row of sheet pile . . . A small "sill" at the lower end of the downstream apron will tend to prevent erosion below by deflecting water currents upward and creating a "backroll" with upstream velocities immediately below the sill. Below the structure proper it is planned to pave the river bottom with a bed of bonded riprap three feet in depth and twenty-five feet in length, across the entire width of the dam. Should erosion occur, this riprap will prevent any excessive scouring below the dam structure.

As later accounts by Hill (1964:9–10) indicate, the American Dam was, indeed, built largely to the original 1935 specifications (Figures 2 and 3):

> AMERICAN DIVERSION DAM on the Rio Grande 2 miles northwest of El Paso and immediately above the point where the river becomes the International Boundary line, is for the diversion of irrigation water to the El Paso Valley for use on the American side. This dam consists of a 286-foot long concrete weir with 13 radial gates with a structural height of 18 feet and a hydraulic height of 5 feet. It was constructed in 1938 and is operated by the American Section of the International Boundary and Water Commission to regulate delivery of water to Mexico in accordance with Treaty [of 1906] provisions.

The construction of the American Dam was completed in July of 1938 (BOR, RG 115, NARA, Project Histories, Box 1087, 115-66A693, pg. 20–23).

The second component of this plan, while not directly relevant to this specific inquiry, was construction of the Riverside Dam and Canal complex to capture water not diverted into the Franklin Canal and the Acequia Madre (BOR, RG 115, NARA, General Correspondence files, 1902–1942, Box 1109, 115-54-A81, Folder 249, pg. 8). This

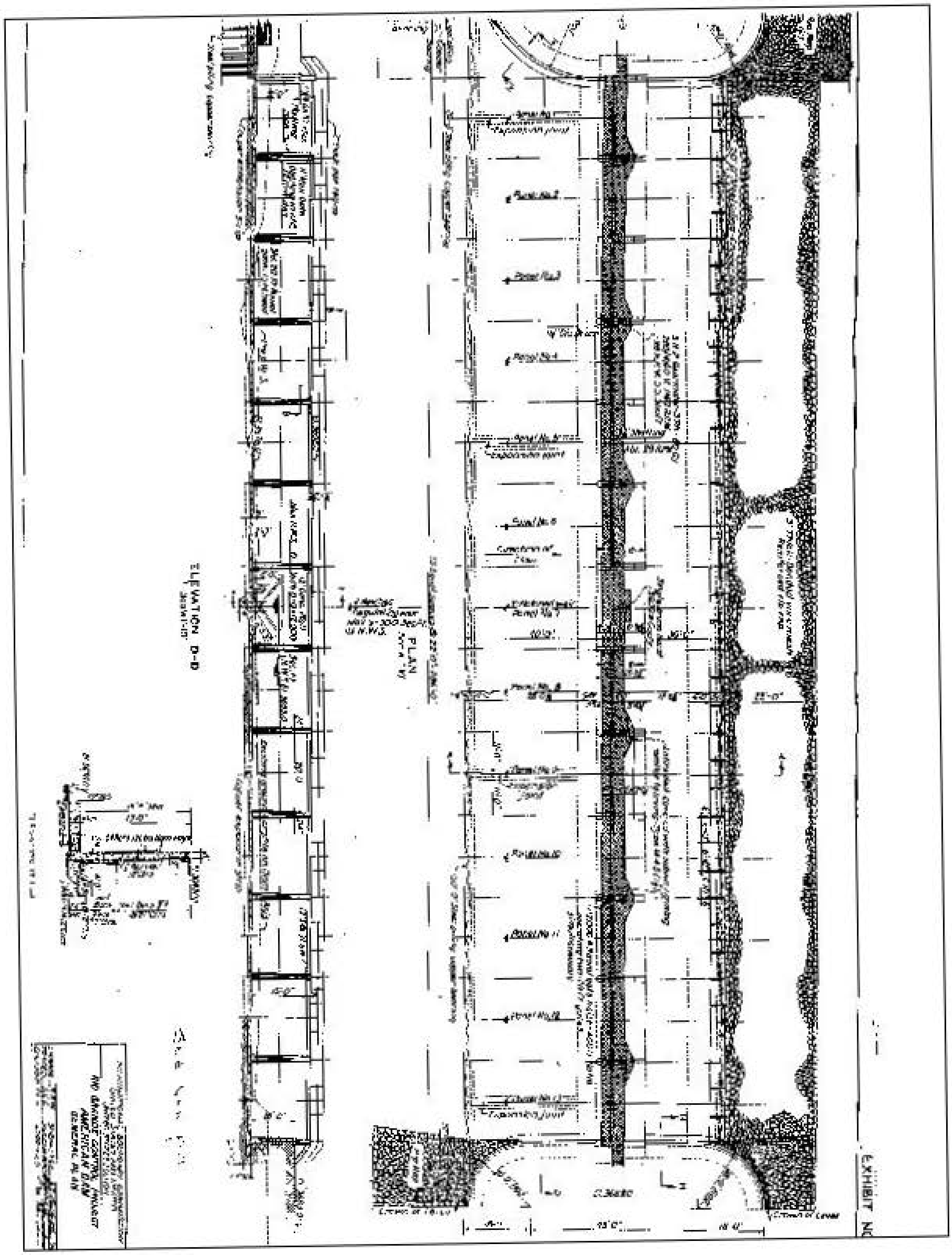


Figure 2. Plan and Profile Engineering Drawing of the American Dam (1935).

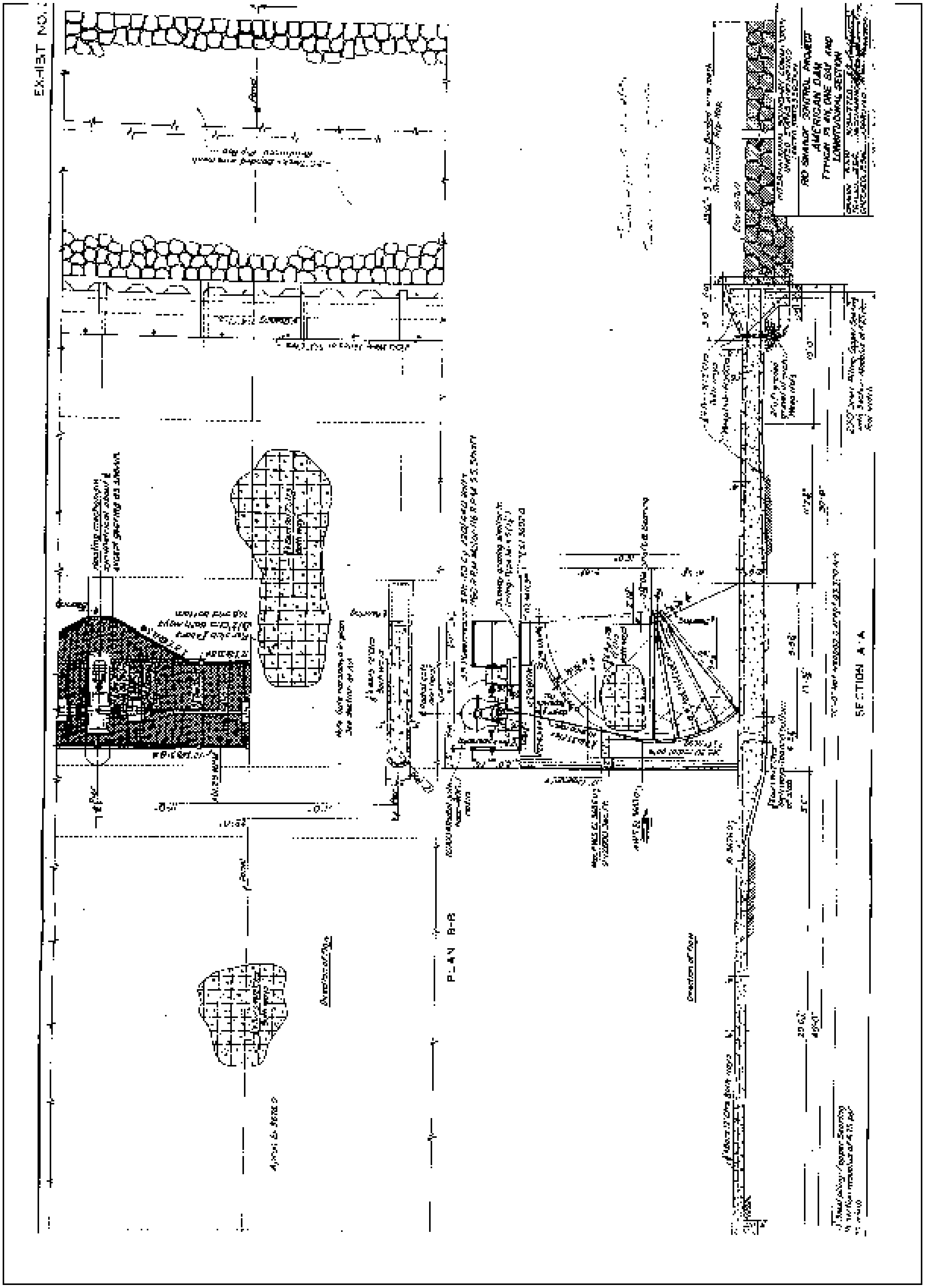


Figure 3. Engineering Drawing of Radial Gates at the American Dam (1935).

facility would not only capture excess water, but would provide a more stable diversion point for irrigable lands in the San Elizario, Tornillo, and Island Districts (BOR, RG 115, NARA, General Correspondence files, 1902–1942, Box 1109,115-54-A-81, Folder 249, pg. 9). Construction of this complex was begun in 1927 and completed by 1940. The Riverside Dam is 20 mi downstream from the former location of the headgates of the Franklin Canal.

AMERICAN DAM AND CANAL: AS-BUILT CHARACTERISTICS

The American Dam provided water through the newly-constructed American Canal in the following fashion (BOR 1938:27–28):

> The manner of operation of the American Dam and Canal is that the water allocated to Mexico is passed through the dam into the old river channel, while the remaining total flow of the river is carried through the American Canal to the Franklin Canal settling basin. The net diversion for the Franklin is made several miles below the settling basin after sluicing operations have returned to the river all of the water not desired for the Franklin Canal net diversion. This water returned to the river, of course, is for later diversion by the Riverside Canal located a few miles below Ysleta, Texas. Incidentally, the old International Diversion Dam, which formerly served both the Franklin Canal and the Acequia Madre [of Juarez] is now used only by the Acequia Madre, since under the new setup the diversion for the Franklin Canal is now made at the American Dam.

As noted above, the American Dam was useless without completing the American Canal. Yet, compared to the dam, construction of the canal was far more problematic due, in large part, to difficulties in acquiring easements and the high sediment content of Rio Grande waters (Resch 1934:27–28; Figure 4 and Plate 8):

> The American Canal, while only two miles long, will involve a number of difficult and costly features. These are due largely to the limitations of the location, and to the railroads, paved highway, and other works already constructed in the narrow canyon which the canal also must traverse . . . Right of way will be a costly item. The physical limitations of the location are such that the upper end of the canal must be located through a thickly settled district of "shacks" and small houses in what is locally known as "Smelter Town," and a number of such properties must be purchased and torn down. Its lower end is within the El Paso city limits and through a well developed section known as "Old Fort Bliss Place" and the "Wuerthman Subdivision" . . . The headworks of the American Canal consist of a long skimming weir over which river waters are diverted into a settling basin 1200 feet long. At the lower end of the settling basin water is diverted into the canal proper over a second skimming weir.

Figure 4. Structures Along the Left Bank of the Rio Grande Near the Future Site of the American Dam (1888—From Ernst 1889:63).

Plate 8. Dwellings Near the Future American Canal Right-of-Way (ca. 1918).

> The purpose of the skimming weirs is to prevent, insofar as possible, the entrance of heavier sands and silts into the canal by diverting in each case, only the "top layer" of water . . . Adjacent to the second skimming weir are radial sluice gates. When these gates are closed they act as a check, or dam, in the settling basin, and low velocities with consequent deposition of silt and sand in the settling basin result. When open, however, the grade is such that the flow of water in the settling basin is greatly accelerated, and the resulting high velocities will be sufficient to scour out the sand and silt deposits with the settling basin and carry them on into the river.

American Dam

The American Dam is a diversion dam of the floating type. It is located 3.5 mi from the business center of El Paso and between 140-200 ft above the boundary between the United States and Mexico (IBWC 1955:44, IBWC 1981:1). It is 284 ft wide between abutments and 70 ft long from the edge of the upstream apron to the downstream side of the dentated-type sill (IBWC 1955:44, IBWC 1981:1). The dam is controlled by thirteen 7.56 x 20 ft radial gates with the gate sill on the floor of the structure, which was placed approximately two ft below the existing river bed. The dam and canal were designed with a 1200 cfs capacity and the dam's gates open automatically when Rio Grande flows exceed this amount (IBWC 1981:1).

American Canal

A general summary statement regarding the American Canal appeared in a BOR Project History (1938:29–30):

> Below the intake structure leading from the settling basin to the canal, the canal section consists of a concrete-lined trapezoidal channel to Station 15+18.5, a distance of 1164.0 feet. At Station 15+18.5 a fifty foot transition leads to a closed monolithic concrete section located under the paved highway (U.S. 80) and which continues to Station 38+50. Through this stretch of 2281.50 feet, there is barely sufficient room between the river and the Atchison, Topeka and Santa Fe Railway for the paved highway and the railway is located at the foot of a high slag dump . . . From Station 38+50 to Station 60+31.25, a distance of 2181.25 feet, the canyon widens out sufficiently to permit of the location [sic] of an open concrete-lined conduit between the highway and the railway. At Station 60+31.25, the canal again enters a closed monolithic section which continues to Station 70+50 or for 1518.75 feet. Near Station 62, the railroad and the highway are so close together that is was necessary to locate the canal between the pavement and the river. As the distance between these features in the particular locality is less than 100 feet, the closed section became necessary. From Station 75+50 to Station 98+50, or for the last 2300 feet of the canal location, the river and the highway diverge sufficiently to make it possible to adopt a concrete-lined trapezoidal [open] canal section.

More detailed descriptions of the canal derive from other sources. At the head of the American Canal, upstream of the headgates, is a skimming weir. The weir is oriented at a 90-degree angle to the long axis of the American Dam. It extends upstream from the left abutment of the dam along an axis parallel to the general course of the river (IBWC 1955:44). The weir is situated at a 70-degree angle to the American Canal headgate structure and measures 250 ft long by 2 ft high. A 210 x 2.5 ft timber platform is placed on top of it for access by foot for cleaning/maintenance.

The American Canal's headgate structure is constructed of concrete and steel. Its overall dimensions are 9 x 44 ft. The structure contains two radial sluice gates, each 20 ft wide x 11 ft high. The radial gates are raised and lowered by two 3-h.p., Type D-254 Gearmotors (3 Ph 60 Cy. 220/440 V. 1160 rpm motors) and two 12,000-lb. radial gate hoists geared at a 400:1 ratio. The floor of the equipment platform is covered with subway grating.

There are a number of attributes common to all of the American Canal's open sections. Concrete lining in open sections contain vertical construction joints across the bottom and side slopes on 10-ft centers. The lining also includes 2-in.-diameter weep holes draining into 1 x 1 ft gravel drains located along 5-foot centers. There are five weep holes per cross-section, two on each side and one on the bottom (Plate 9).

Plate 9. Open Section "A" Showing Configuration of Construction Joints and Gravel Drains Common in All Open Sections, 31 December 1937.

As-built engineering drawings (IBWC files, El Paso) provide nine representative cross-sections showing the configuration of the American Canal. Open section "A" refers to portions of the canal that traverse alluvial sediments, while open section "B" refers to portions of the canal passing through bedrock. Open section "A" consists of three discontinuous segments as follows: upper open "A," middle open "A," and lower open "A." Upper open "A" extends 2,239 ft below the intake structure before entering Conduit "A." Middle open "A" begins 3,224 ft below the intake structure before entering Conduit "B." Lower open "A" begins 8,374 ft below the intake structure and continues to the junction of the Franklin Canal. Cross-sections from Stations 14+00, 45+00, and 102+45 exhibit a general trapezoidal shape (Figure 5 and 7). In each of these segments, the canal measures 55.75 ft wide at the top, 12 ft wide at the bottom, and 10 ft in depth. Side slopes are 1.5:1. The concrete lining is 0.25 ft thick and reinforced with 3/8-in. deformed steel bars on 1 ft centers. The three lengths of open section "A" comprise about 70 percent of the canal's total length.

Open section "B" begins approximately 7,894 ft from the headgate and extends 480 ft. Two representative cross-sections are located at Stations 84+15 and 87+00 (Figures 6 and 7). Open section "B" is 58 ft wide at the top and 21 ft wide at the bottom. The overall depth is 10 ft with a side slope of .25:1. The concrete lining ranges from 0.83 ft thick across the bottom to as little as 0.5 ft in thickness along the sides.

Situated at two intervals in the American Canal are closed conduits through which irrigation water is conveyed. The first, Conduit "A," begins 2,239 ft downstream from the headgate and extends 985 ft northeastward beneath U.S. 80. The second, Conduit "B," begins 6,165 ft downstream from the headgate and extends 1,729 ft southeastward beneath U.S. 80. As-built engineering drawings provide detailed data regarding the dimensions and construction materials of both conduits. Both are rigid-frame concrete structures measuring 1.83 ft thick on the sides and top. The conduits are 28.5 ft wide. Conduit "A" is 11 ft high, while Conduit "B" is 13 ft high. The footings for both conduits measure 6.5 ft x 1.75 ft. Similar to the open sections, 2-in. weep holes on 5-ft centers are located on the bottom and sides of both conduits. As well, both conduits have been heavily reinforced to support an earth cover, overlying highway pavement and associated traffic. Conduit "A" has only a 2-ft earth cover, while conduit "B" is more heavily reinforced, having upwards of a 4-ft earth cover.

Associated with the original canal were a number of ancillary structures, notably bridges. Two bridges, one located at Globe Street and the other at Hart's Mill Road, were built in 1938. Both bridges measured 41.5 ft long by 18 ft wide and were situated 15.4167 ft above the base of the canal. These bridges were constructed of 0.33 x 1.33 x 22 ft stringers with 0.25 x 0.67 x 18 ft plank flooring. Bridge supports included two abutments measuring 7.3 x 19 ft and a 12 x 12 x 15.5 ft concrete and steel pile.

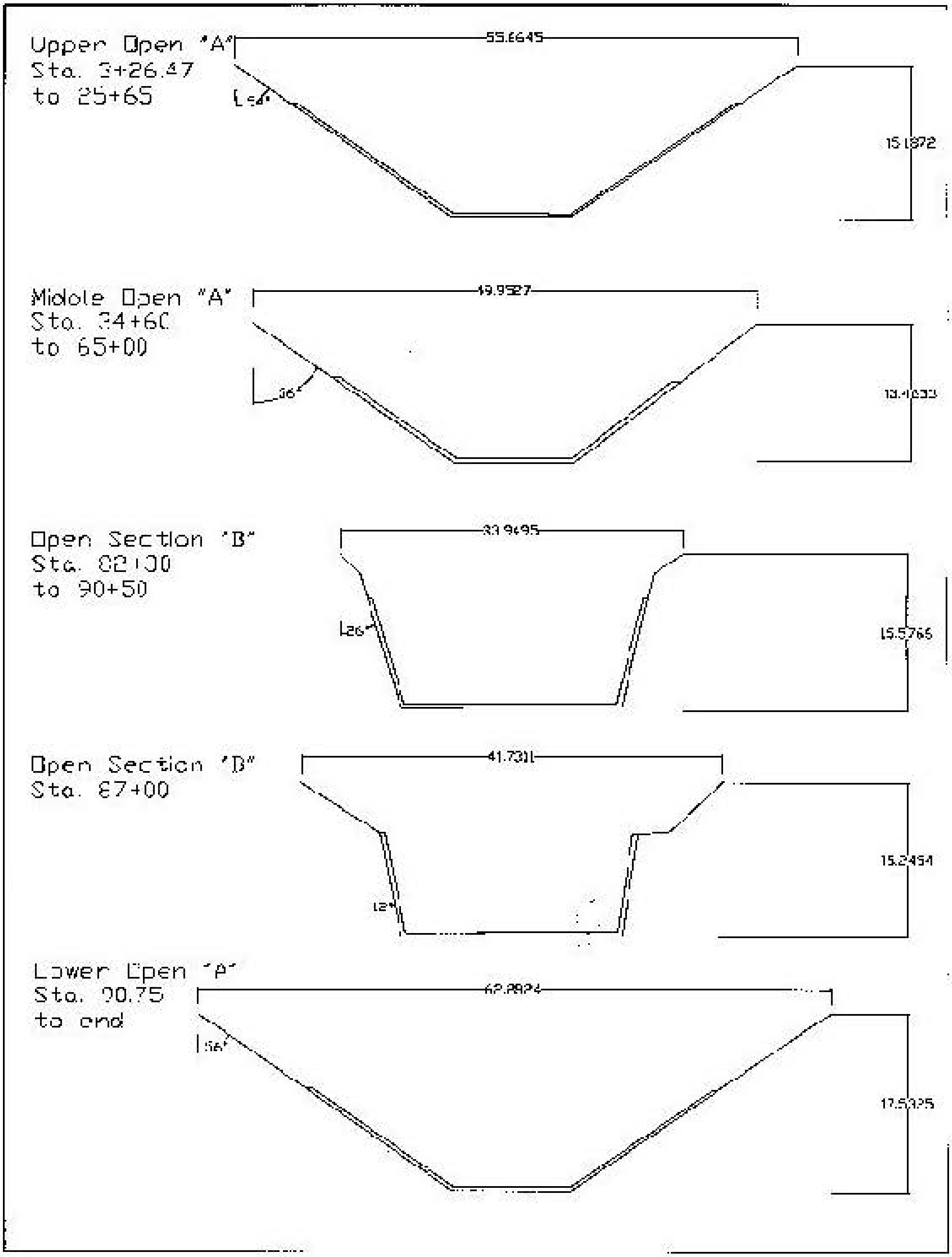


Figure 5. Representative Cross-sections of Open Channel Portions of the American Canal (Redrawn from original engineering drawings on file at IBWC).

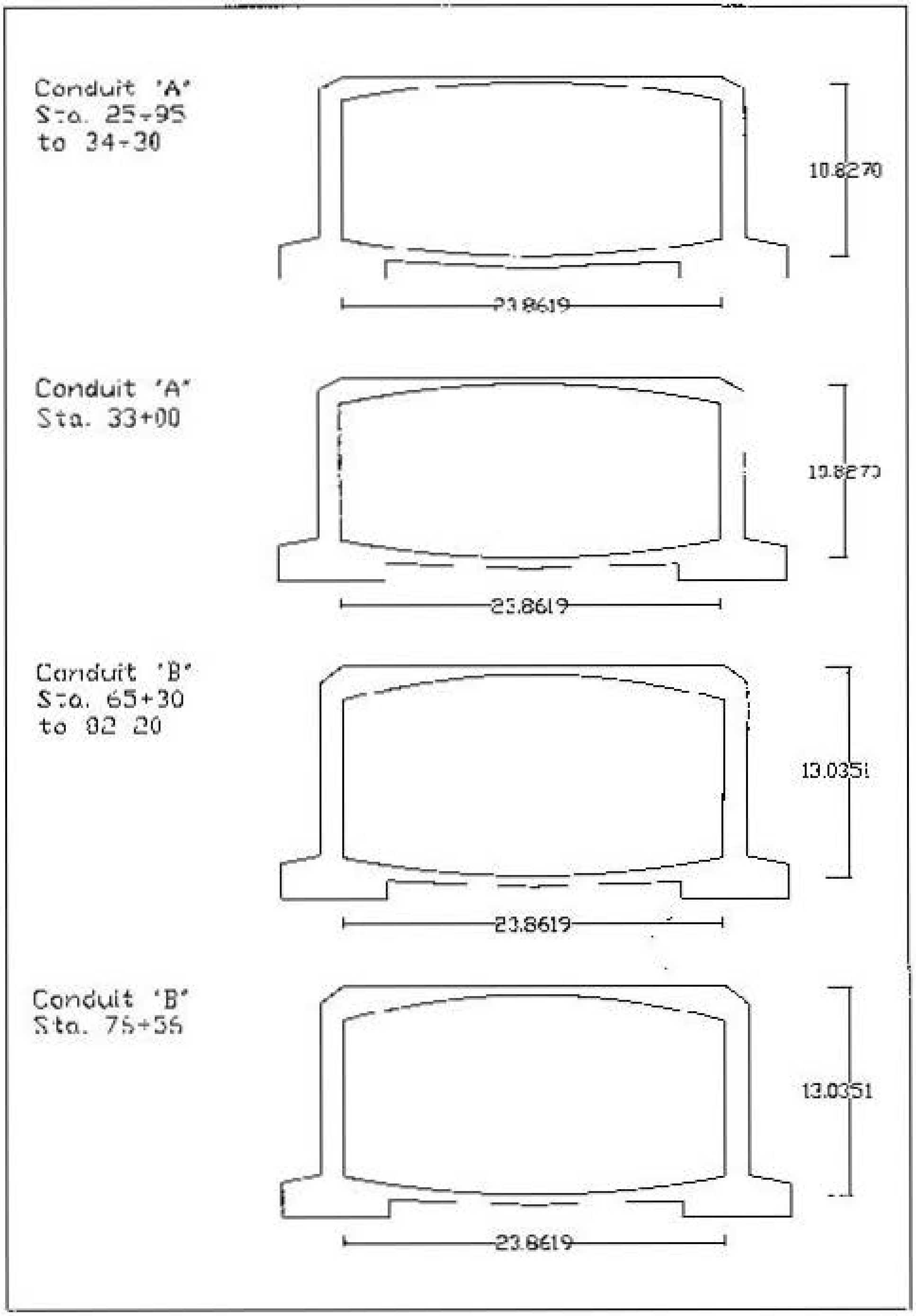


Figure 6. Representative Cross-sections of Closed Conduit Portions of the American Canal (Redrawn from original engineering drawings on file at IBWC).

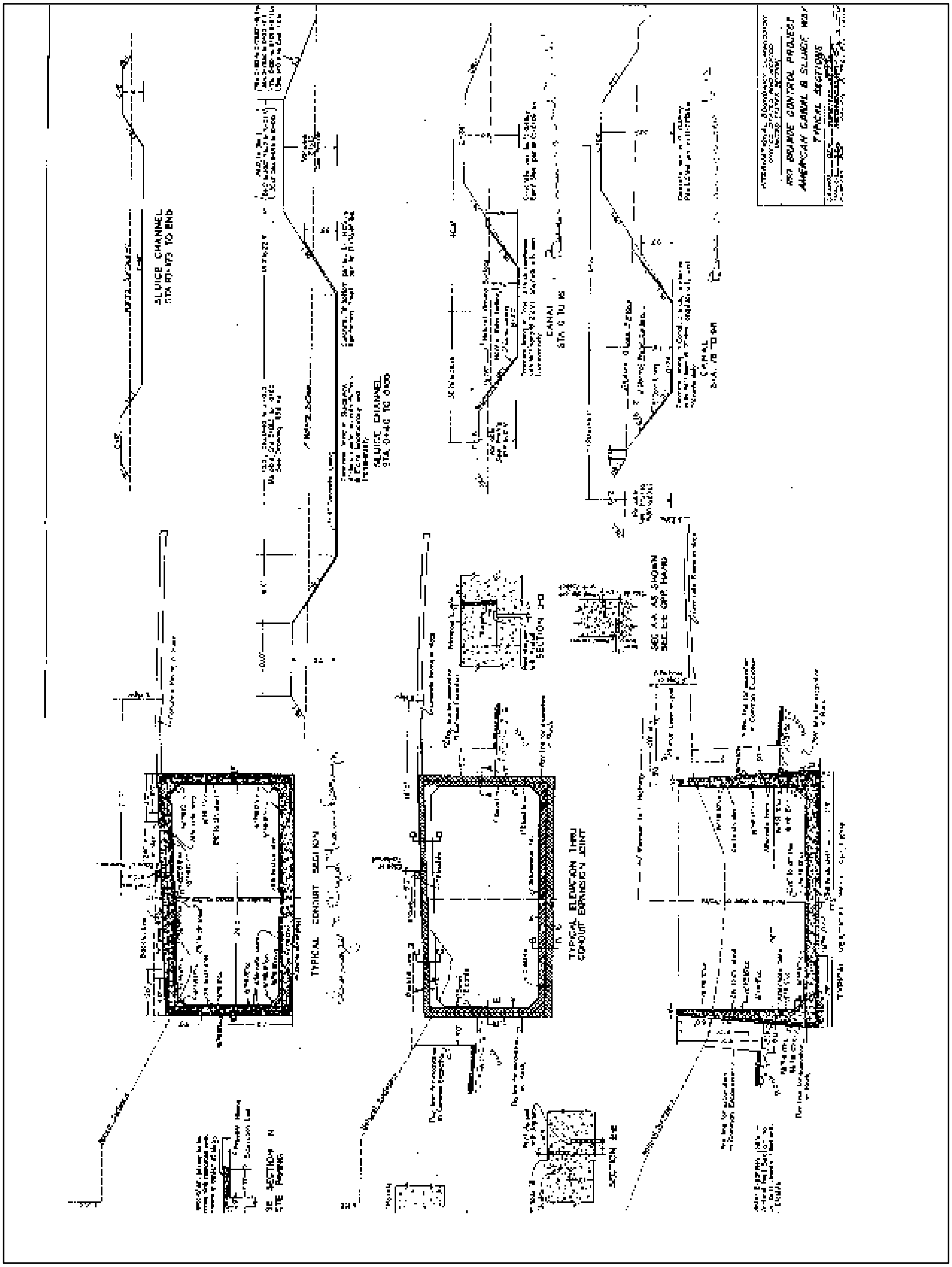


Figure 7. Cross-sectional Drawings of Sluiceway, Culverts, and Canal Channels (1935).

Overall operating characteristics of the American Canal from its inception in 1938 are summarized using data from the IBWC. Between 1938 and 1996, total annual diversions into the American Canal averaged 285,336 acre–feet (SD = 120,327). At the same time, there were considerable annual fluctuations in total diversions consistent with alternating macro-regional wet-and-dry climatic cycles (Figure 8). For example, the deleterious impact of the 1950s drought interval on water diversions into the American Canal is readily apparent in Figure 8.

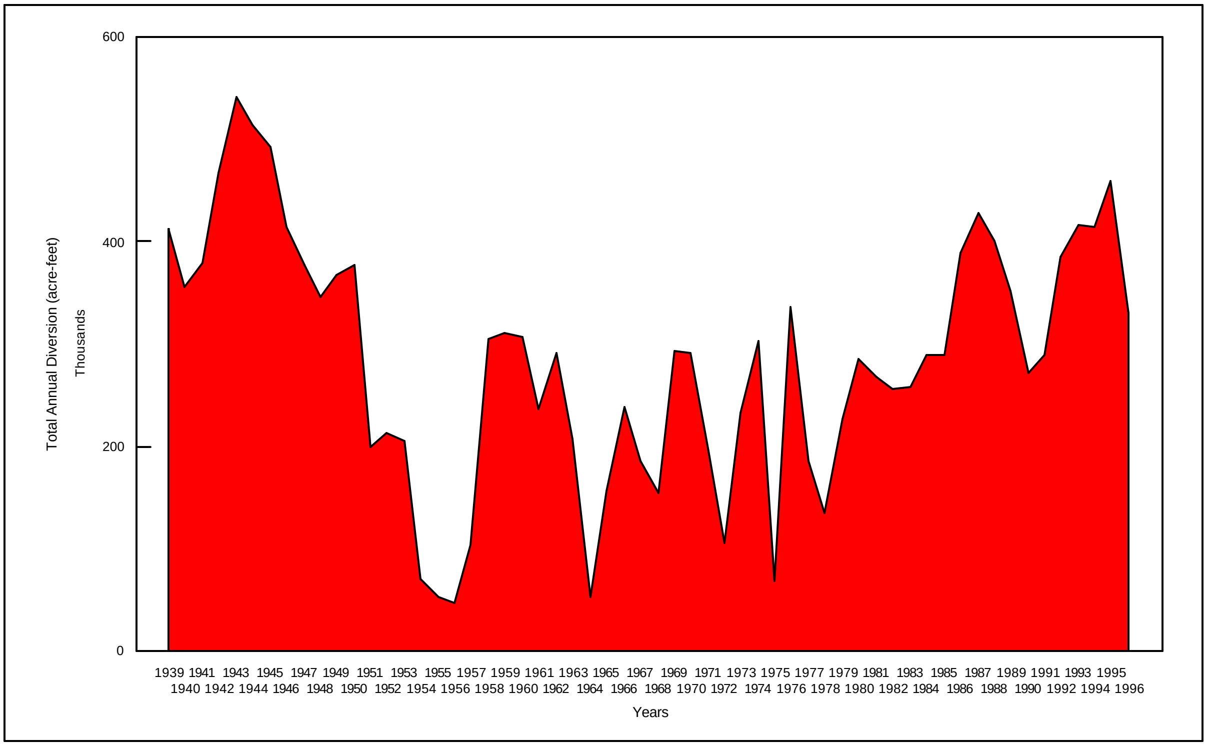


Figure 8. Annual Acre-foot Diversions in the American Canal: 1938-1996 (IBWC Records)

Similarly, there are pronounced seasonal differences in water diversions corresponding to local agricultural practices and demand for irrigation water (Figure 9). Water is generally diverted, beginning in February, to soak fields prior to planting. The irrigation season begins in earnest in April, with peak periods of water diversions continuing through May, June, and July. Beginning in August, as crops begin to be harvested, water diversions gradually decline. By October, there is almost no water being diverted. During the period October to January, the canal minimal water—mostly from seepage through the headgates—and activities focus primarily on routine canal maintenance.

Not surprisingly, the flow of water through the American Canal mirrors total seasonal acre-foot diversions (Figure 10). Flows increase in March, decline through April and May, and peak in July when crops are most in need of irrigation water. Interestingly, water diversions have never exceeded the original design capacity of 1,200 cfs.

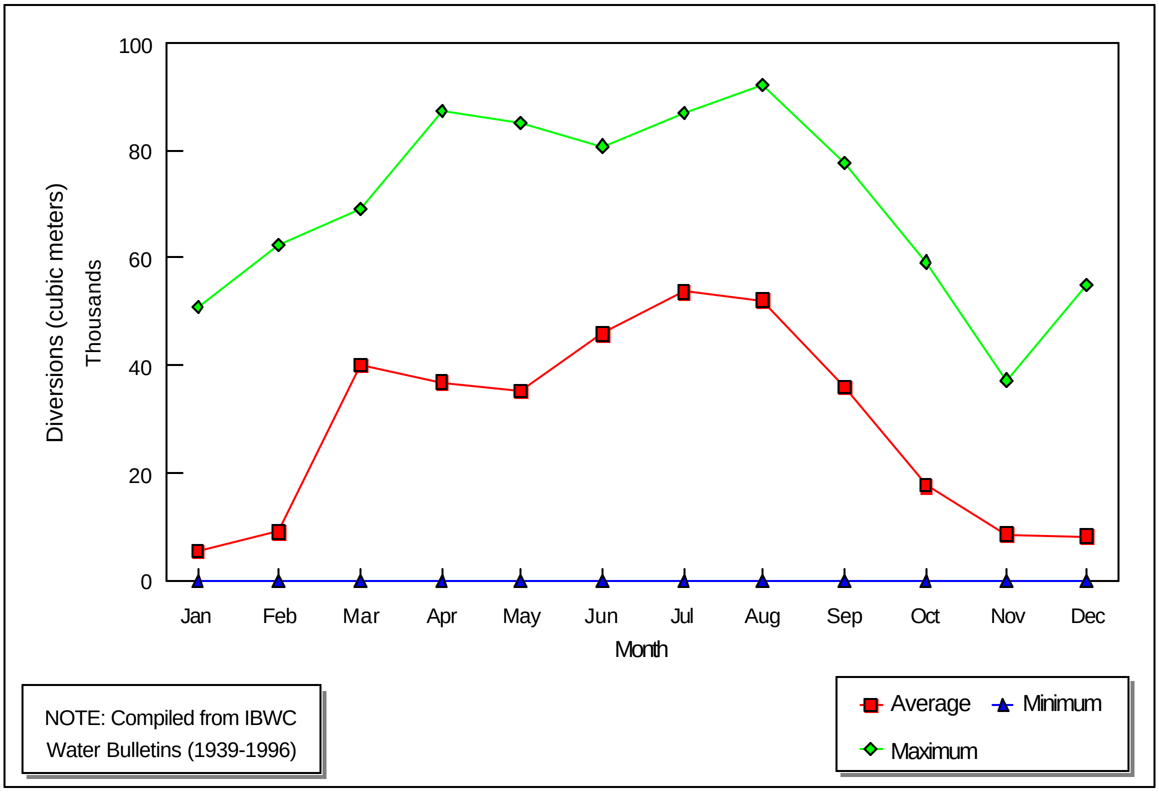


Figure 9. Seasonal Volume of Water Diversions of American Canal: 1956-1996.

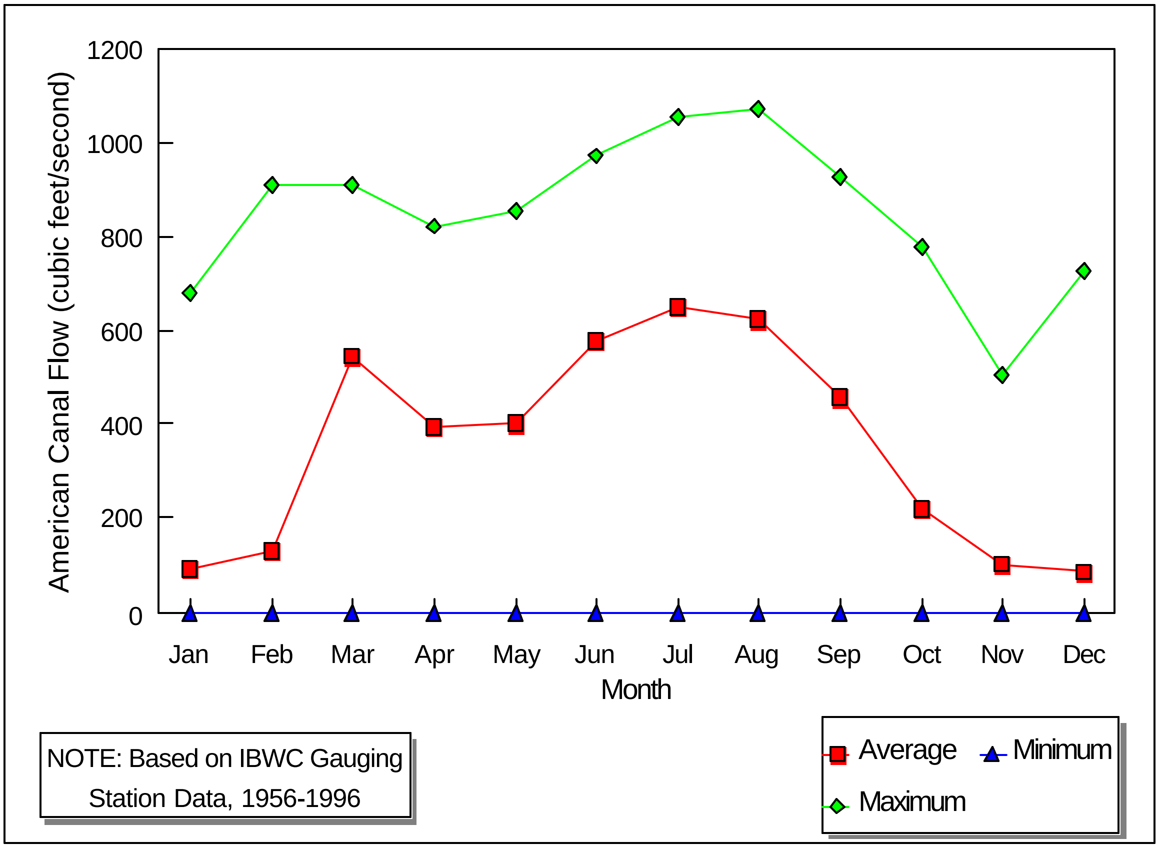


Figure 10. Seasonal Flow Rate of the American Canal: 1956-1996.

There is independent confirmation that the design attributes described above were largely implemented during final construction. Specifically, a summary by the Water and Power Resources Service (1981:1057) indicates that, as described above, the American Canal is 2.1 mi long, concrete lined, with side slopes at a 1.5:1 ratio, a bottom width of 12 ft, a water depth of 8.75 ft, and a capacity of 1,200 cfs. These measurements conform almost exactly to those recommended in the 1935 engineering feasibility and design study.

A CONSTRUCTION CHRONOLOGY AND PHOTODOCUMENTARY SUMMARY OF THE AMERICAN DAM AND CANAL SYSTEM

Records from a retrospective summary of the American Dam and Canal construction history provide a detailed chronology of events surrounding this project (IBWC 1938:Exhibit E). A selected narrative summary, extracted verbatim from this chronology, has been combined with a parallel sequence of vintage photographs, also from IBWC files, to provide a comprehensive overview of the American Canal project. Major milestones and related photographs for some of these milestones are presented below.

April 3, 1935	Letter of Department authorized American Commissioner to begin investigation and study of canalization.
April, 1935	Surveys begun.
August 3, 1935	Preliminary Report submitted to Department.
August 29, 1935	Authorization $1,000,000, Public Act #392, 74th Congress, approved.
Nov 25, 1935	Engineering Board Report.
Dec 5, 1935	Budget estimate $1,000,000 transmitted to Department.
Dec 14, 1935	Final Report.
Dec 16, 1935	Final Report submitted to Department.
June 4, 1936	Authorization of canalization project and of appropriation $1,000,000, Public Act #648, 74th Congress, approved.
July 28, 1936	Right-of-way acquisition initiated.
August 25, 1936	Field party began final location of canal and right-of-way.

August 27, 1936	Chief Engineer of Western Lines, A.T. & S.F. R.R. Co., visited El Paso for conference on relocation of Santa Fe tracks.
August 30, 1936	Chief Designing Engineer Savage, Bureau of Reclamation, visited project for conference on project design.
October 14, 1936	Invitation for bids issued for the principal construction contract.
October 26, 1936	Construction of Garage and Field Office begun by Government force.
Nov 14, 1936	Bids opened for the principal construction contract.
Dec 16, 1936	Contract # IBM-975 awarded to Austin Bridge Co. and Austin Road Co., estimated amount $348,908.60, for the construction of the American Dam and Canal. Contractor given notice to begin the work.
January 4, 1937	Field Office completed and occupied.
January 6, 1937	Contractors started clearing rights-of-way.
January 16, 1937	Contract IBM-994 awarded to Austin Bridge Co. and Austin Road Co., estimated amount $4,085, for Smelter Arroyo Improvements.
January 25, 1937	River diversion began.

Plate 10. Beginning River Diversions, 27 January 1937.

February 12, 1937	Canal Excavation started.
February 15, 1937	Cofferdam for Units 2 and 3 completed; excavation for dam started; dewatering cofferdam started.
February 27, 1937	Started driving steel sheet piling.

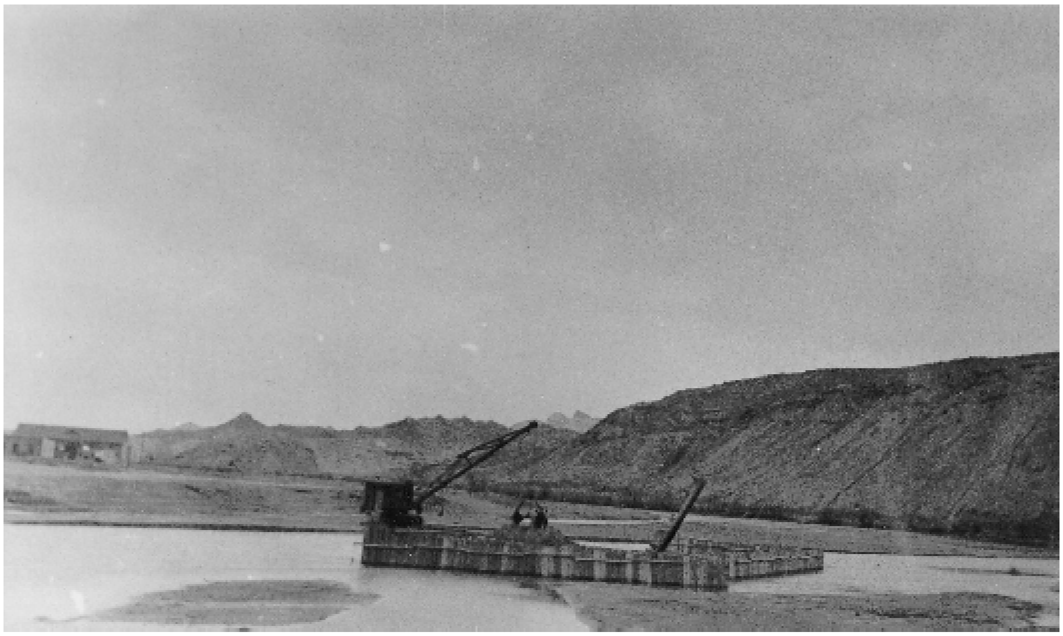


Plate 11. Cofferdam for the American Dam, 8 February 1937.

Plate 12. Northwest Corner of East Cofferdam, 13 March 1937.

March 18, 1937 First concrete poured—Jones School retaining Wall.

March 22, 1937 First concrete poured in American Dam.

Plate 13. Initial Excavation of American Canal, 20 March 1937.

Plate 14. Early Phase of American Canal Construction;
View from Hart's Road, 31 March 1937.

March 29, 1937 Contractors began work on Smelter Arroyo Improvement.

Plate 15. Piers 7-9 of the American Dam
Prior to Pouring Concrete, 12 April 1937.

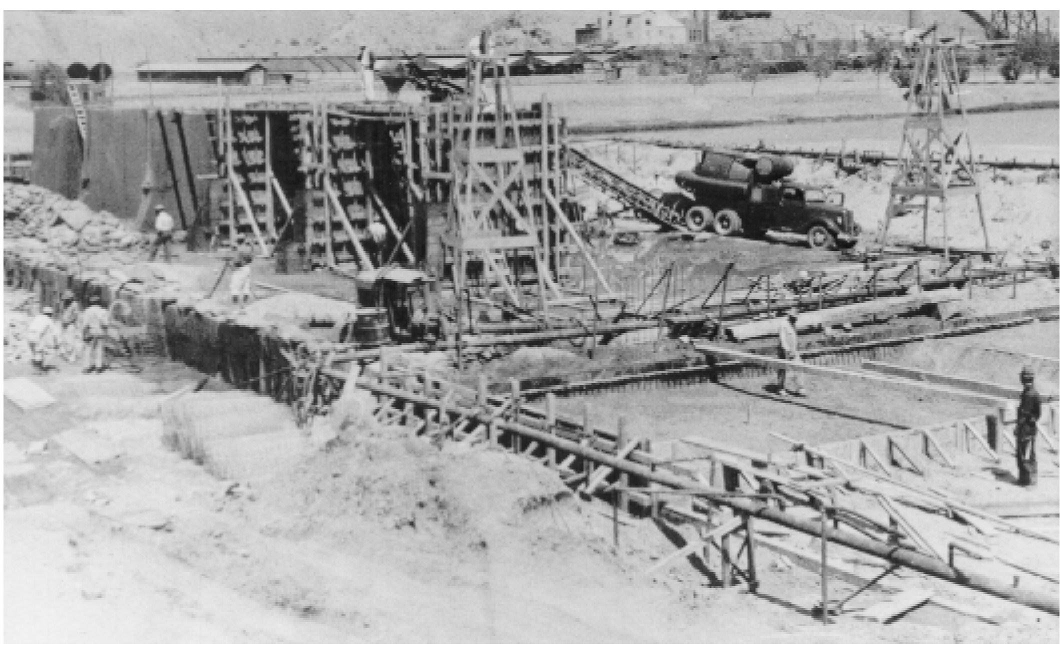


Plate 16. Pouring Concrete in Pier 5, American Dam, 19 April 1937.

Plate 17. Erecting Platform Steel on
Piers 6-9, American Dam, 28 April 1937.

Plate 18. Hand-grading in the American Canal, May 1937.

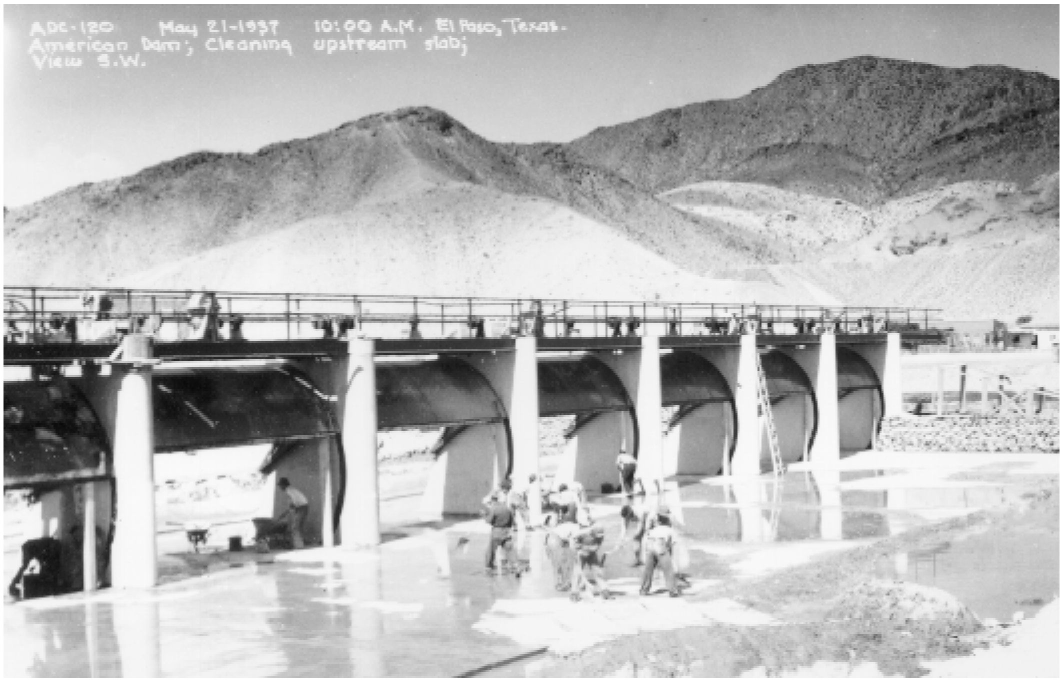


Plate 19. Cleaning Upstream Slab of the American Dam, 21 May 1937.

May 21, 1937 Units 1, 2, and 3 of American Dam completed, including gates # 1–8

May 22, 1937 River turned through completed section of dam.

May 29, 1937 4,000 cubic feet per second flowed through the dam.

Plate 20. Water Flowing Through American Dam, 31 May 1937.

Plate 21. Cleaning Closed Conduit "B," 31 May 1937.

June 11, 1937 First concrete poured for canal, at station 81+25, closed conduit "A."

June 22, 1937 West side cofferdam unwatered, excavation begun.

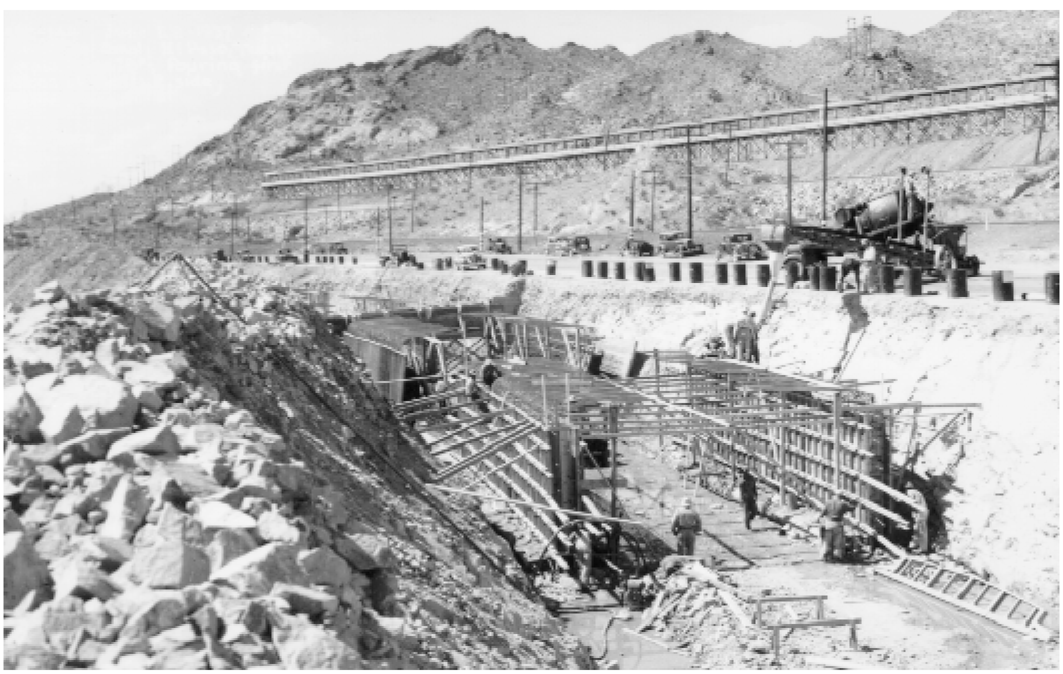


Plate 22. Pouring First Concrete, Closed Conduit "B," 22 June 1937.

June 26, 1937	Contract # IBM-1096 awarded to Austin Bridge Co. and Austin Road Co., estimated amount $26,185.00, for the construction of Protective Work above American Dam.
June 28, 1937	4,700 c.f.s. flood passed American Dam. No damage to cofferdam.
June 30, 1937	Construction costs to date total $394,681.15. Average of 63 men employed during year. Approximately 26% of dam and canal completed.
July 1, 1937	Relocation of A.T. & S.F. Track and Western Union lines begun.
July 9, 1937	Smelter Arroyo Improvements, Contract IBM-994, completed.

Plate 23. Closed Conduit "B" Concrete Walls Completed, 29 July 1937.

Plate 24. Forms for Roof of Closed Conduit "B" in Place, 29 July 1937.

August 31, 1937	Erection of radial gates in dam proper completed.
Sept. 20, 1937	Work on Closed Conduit "A" begun.
October 18, 1937	Relocation of track, A.T. & S.F. R.R. completed.

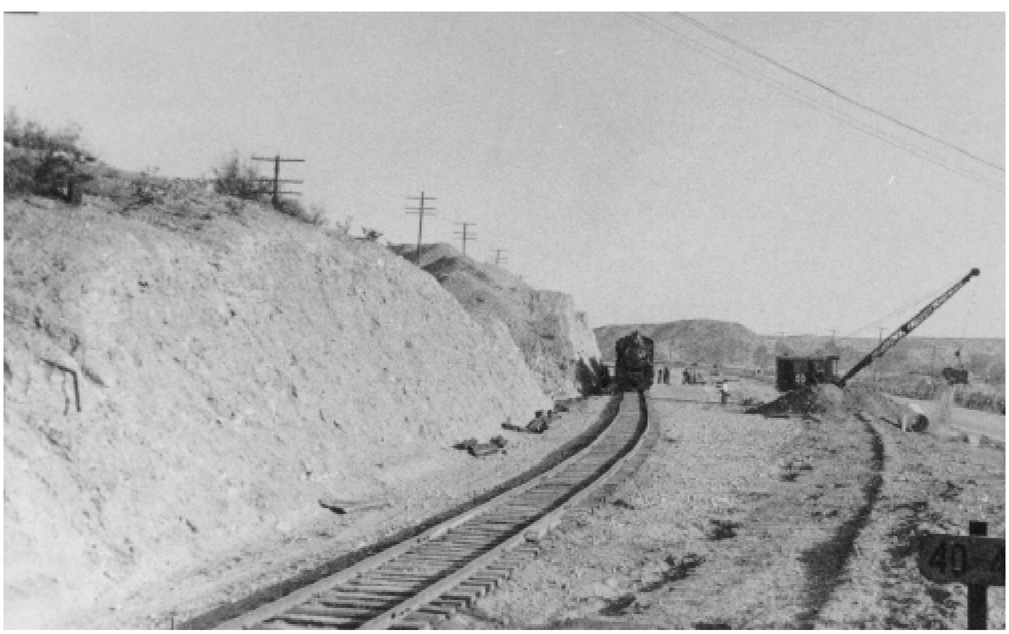


Plate 25. Relocation of AT&SF Railway Tracks, 19 October 1937.

October 23, 1937 Protective Work above American Dam started.

Plate 26. Pouring Concrete for the American
Canal Headworks, 10 November 1937.

Plate 27. Erecting American Canal Headgates, 27 November 1937.

Plate 28. Pouring First Concrete in Open Section “A,” 17 December 1937.

Dec 19, 1937 Third cofferdam at American Dam removed completing river diversion.

Plate 29. Open Section “A” Under Construction, 24 December 1937.

Dec 28, 1937 Closed Conduit “B” completed.

Dec 31, 1937 Approximately 73% of dam and canal completed.

January 15, 1938 Connection of new American Canal to Franklin Canal Heading completed.

February 20, 1938 Lower section of canal lining completed.

Plate 30. Lower Open Section "A" with Globe Street Bridge in Foreground, 12 March 1938.

Plate 31. Final Cleaning of Upper Open Section "A," 31 March 1938.

April 12, 1938 Closed Conduit “A” completed.

April 19, 1938 Canal intake transition and upper section of canal lining completed.

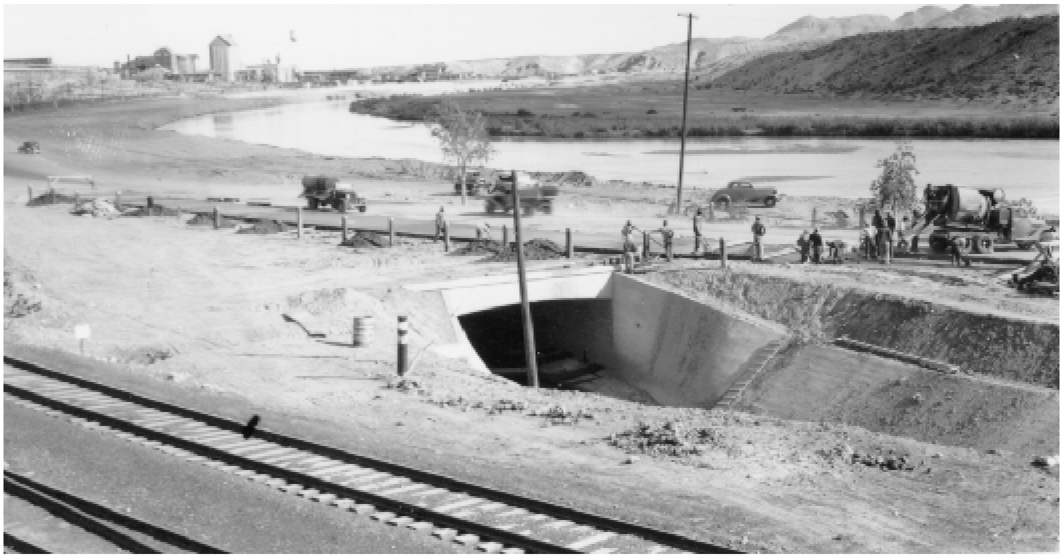


Plate 32. Intake of Closed Conduit “B,” 16 April 1938.

Plate 33. Open Section "B" Looking Downstream, 1 May 1938.

May 24, 1938 Canal lining completed.

Plate 34. Downstream View of American Canal Headworks, 1 May 1938.

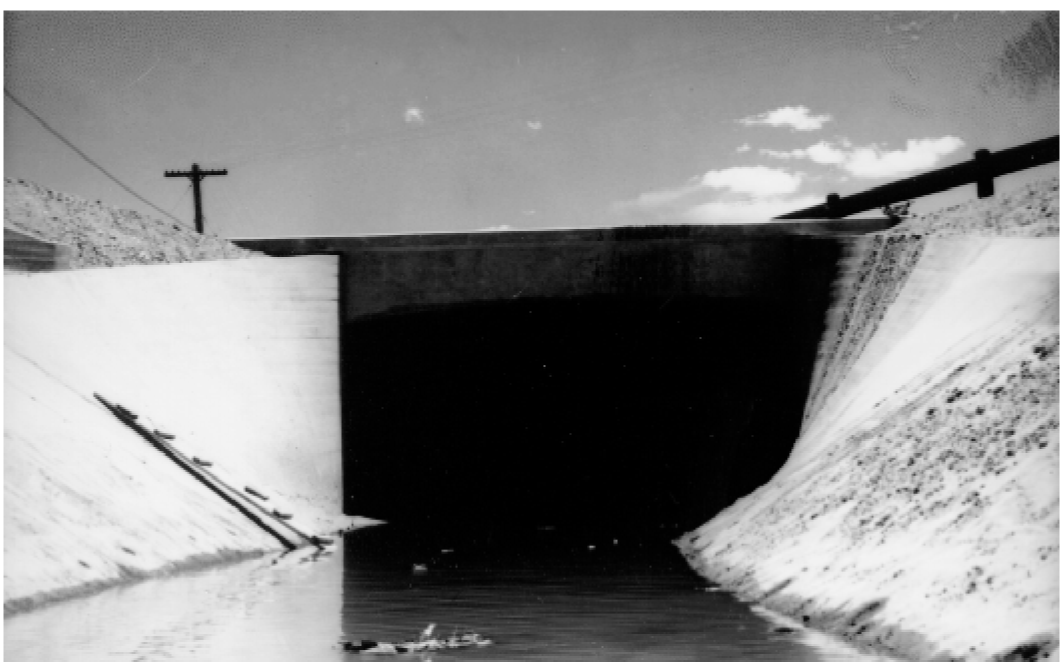


Plate 35. Intake of Closed Conduit “B,” 25 May 1938.

May 27, 1938 Contract # IBM-975 for construction of American Dam and Canal completed.

June 2, 1938 American Dam and Canal put into service.

Plate 36. Upper Open Section "A" From Headgate, 3 June 1938.

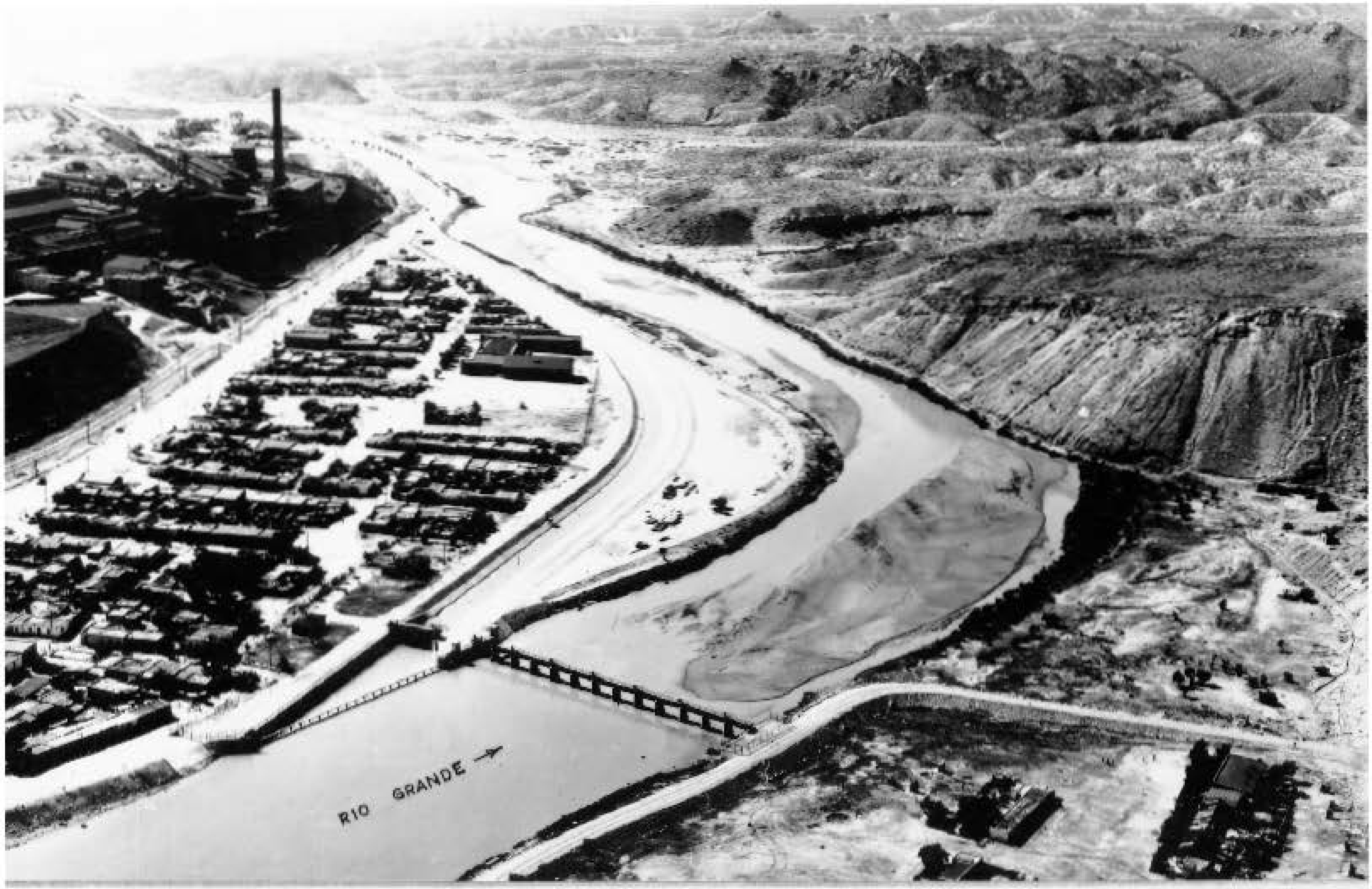
June 18, 1938 Contract # IBM-1318 awarded to Austin Bridge Co. and Austin Road Co., estimated amount $10,252.50 for earthwork and levee surfacing.

June 22, 1938 Protective work above American Dam, Contract # IBM-1096, completed.

June 30, 1938 Construction costs to date $850,937.52. Average of 150 men employed during the six-month period. Dam, canal, and protective work above dam completed.

August 10, 1938 Austin Bridge Co. and Austin Road Co. completed fourth and last contract (# IBM-1318) for construction of dam and canal.

August 31, 1938 Total cost to date $864,614.20; total man-hours 439,263. Average of 101 employees during entire construction. Total earthwork 333,219 cubic yards; total concrete placed 18,365 cubic yards.



American Dam and Canal in operation. View southeast showing dam and part of canal. Irrigation water for El Paso Valley flowing through canal; water for delivery to Mexico being discharged into river channel through gate at left end of dam. El Paso Smelter in upper left. Aerial photograph, August 18, 1939.

Plate 37. American Dam and Intake of the American Canal After Completion, 18 August 1939.

View north showing upper open section of American Canal. American Dam across Rio Grande in upper center. Railroad bridges in upper right. U.S. Highway 80-A and El Paso smelter at right. October 18, 1938.

Plate 38. Upper Open Section “A” Looking Upstream; Note Entry into Closed Conduit “A”, 18 October 1938.

INVENTORY OF THE AMERICAN DAM

The American Dam is *not* part of the proposed USIBWC undertaking. However, the American Canal, the focus of this proposed undertaking, cannot fully be evaluated without considering the dam that supplies water to it.

As noted above, the dam has not been modified since its completion in 1938. It is 284 ft wide between abutments and 70 ft long from the edge of the upstream apron to the downstream side of the dentated-type sill. Water diversions are controlled by thirteen 7.56 x 20-ft radial gates, whose base is approximately 2 ft below the grade of the river bed.

In the remainder of this section, all photographs dated 1938 were obtained from IBWC files in El Paso. These vintage photographs are used to compare and contrast changes in the configuration of the American Dam between 1938 and 1999. Plate 39 shows the American Dam and intake of the American Canal viewed upstream of the dam. Plate 40 is a vintage 1938 photograph of the dam-canal complex viewed from even further upstream, while Plate 41 is a repeat photograph taken during this project. A comparison of these two photographs confirms that the American Dam has not changed from its 1938 configuration.

Plate 39. American Dam (right) and American Canal Weir and Intake (left), 1999.

Plate 40. American Dam (center) and Canal (left), 1 July 1938.

Plate 41. Repeat photograph of American Dam and Canal (1999).

INVENTORY OF THE AMERICAN CANAL

A comparison of photographs taken in 1938 and 1999 show that the intake and weir of the American Canal retains virtually all of its original, as-built characteristics (Plates 42 and 43). Indeed, there appears to have been no change to its configuration since 1938.

Plate 42. American Canal and Intake with Weir, 26 January 1938.

Plate 43. Photograph of American Canal and Intake Weir (1999).

Skimming Weir

The original skimming weir, measuring 250 ft in length and 2 ft in height, is situated above the headgates of the canal (see Figure BB-3 in Appendix BB). Remeasurement during this inventory, as well as comparative repeat photography, confirmed that the contemporary weir conforms to the original design specifications (Plates 44 to 47). The hoist motors for each headgate are both 3 h.p. Gearmotor 1160-rpm designs (see Figure BB-4 in Appendix BB). These, too, also conform to original, as-built specifications (Plates 48 and 49). The dual 12 X 20 ft radial gates are of original construction (Plate 50, see Figure BB-2 in Appendix BB).

Plate 44. American Canal Weir Looking North, 14 May 1938

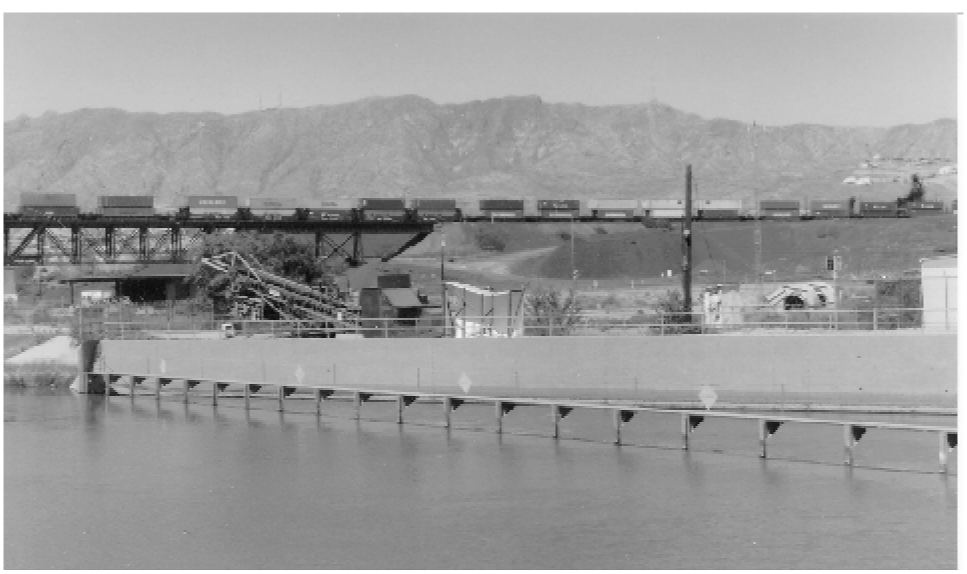


Plate 45. Repeat Photograph of American Canal Weir (1999).

Plate 46. American Canal Weir Looking Upstream, 7 February 1938.

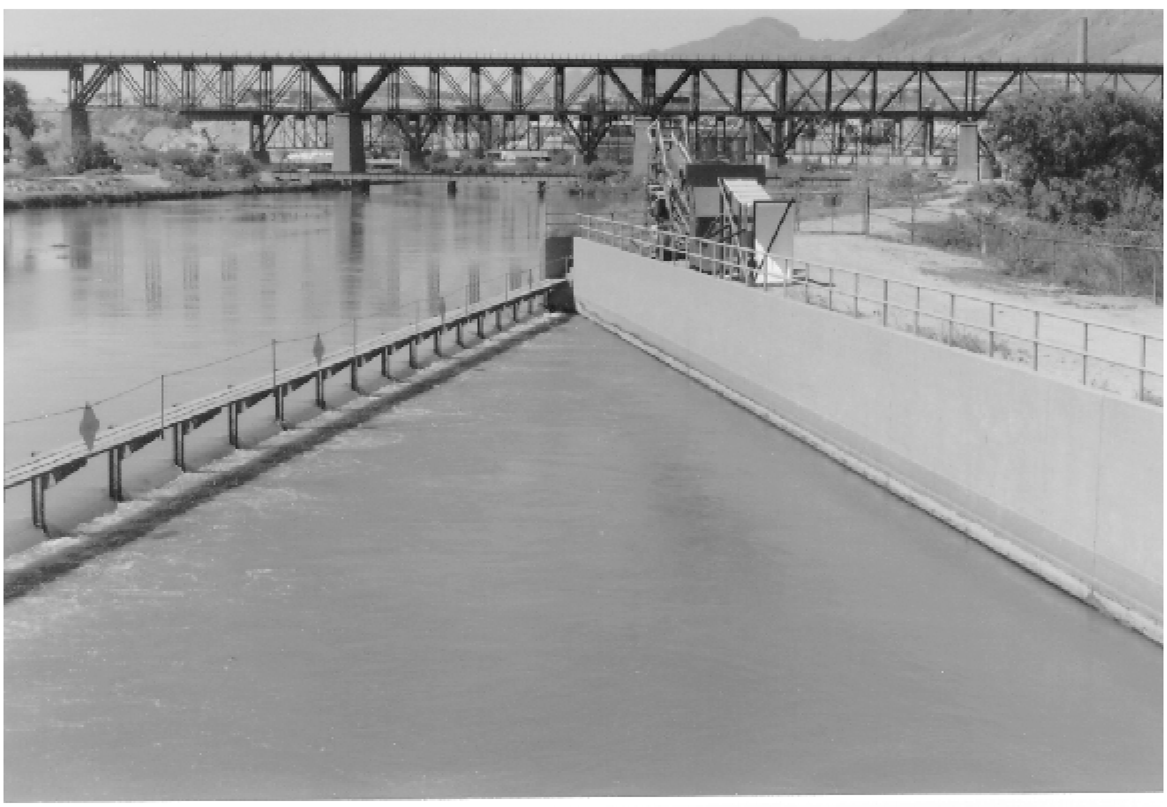


Plate 47. Repeat photograph of American Canal Weir Looking Upstream (1999).

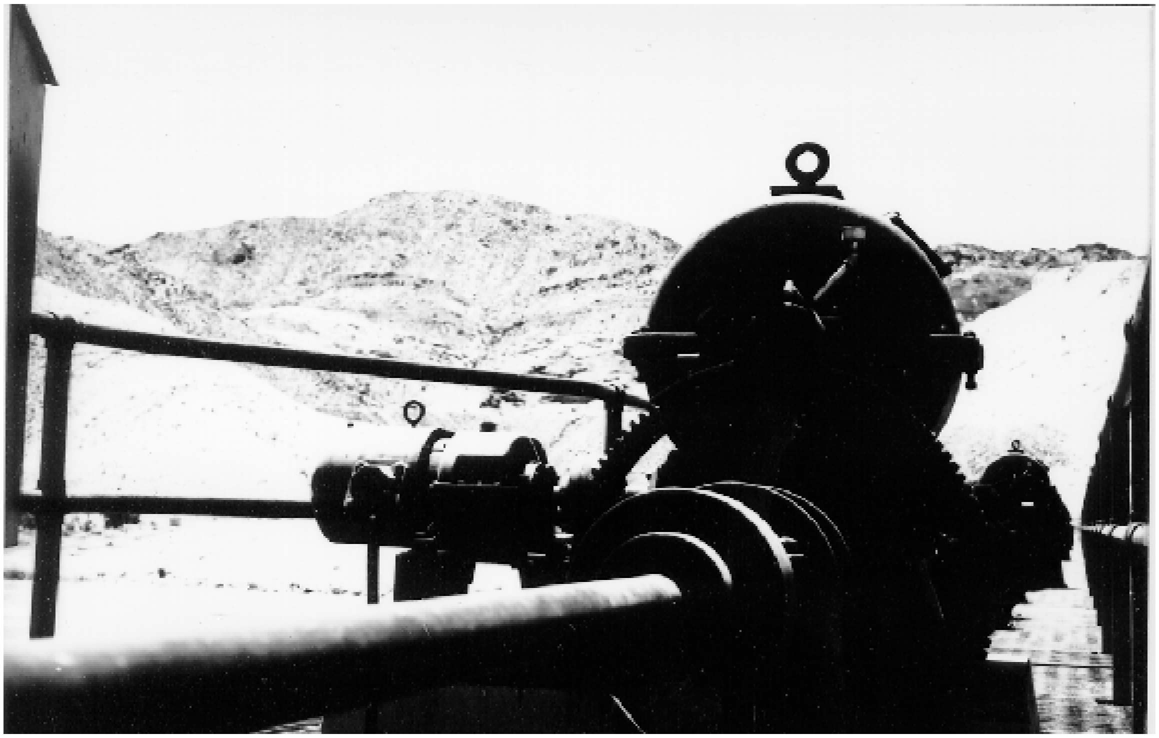


Plate 48. Hoist Machinery at the American Dam, 25 May 1938

Plate 49. Repeat photograph of Hoist Machinery at the American Dam (1999).

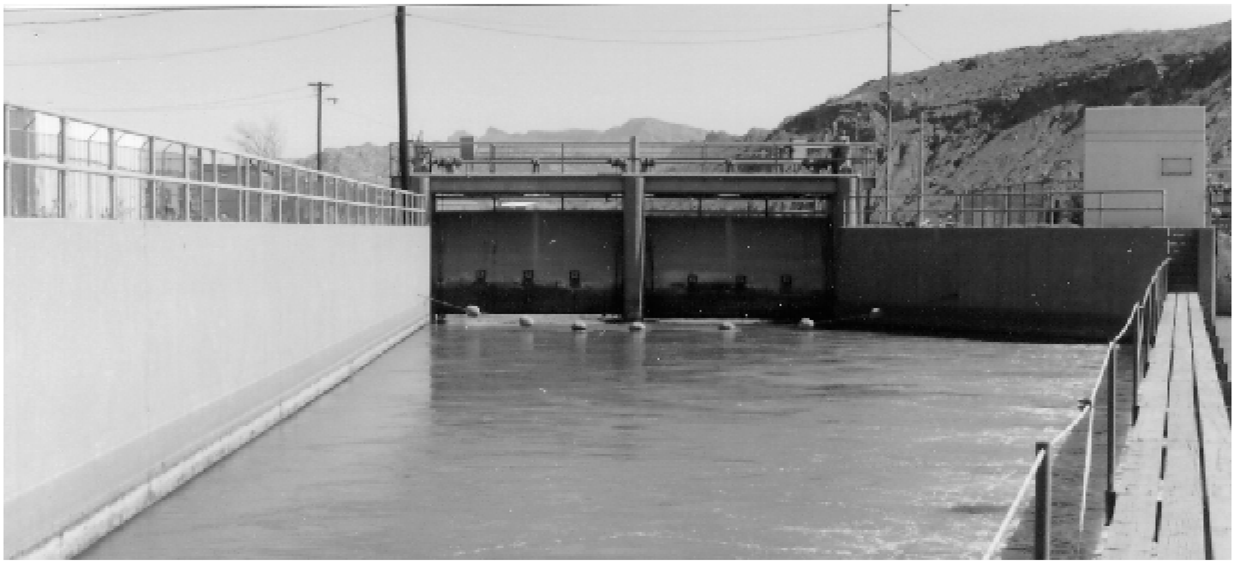


Plate 50. Upstream Intake of the American Canal Showing Radial Gates (1999).

American Canal

Examination of the contemporary American Canal also revealed a high degree of integrity with respect to original canal configurations. There is independent confirmation that the design attributes described above were largely implemented during final construction. Indeed, the contemporary canal corresponds almost precisely to an earlier summary by the Water and Power Resources Service (1981:1057) indicating that the canal is 2.1 mi long, concrete-lined, with side slopes at a 1.5:1 ratio, a bottom width of 12 ft, a water depth of 8.75 ft, and a capacity of 1,200 cfs. Further, the original headgate structure remains unchanged from that built in 1938 (Plates 51 and 52).

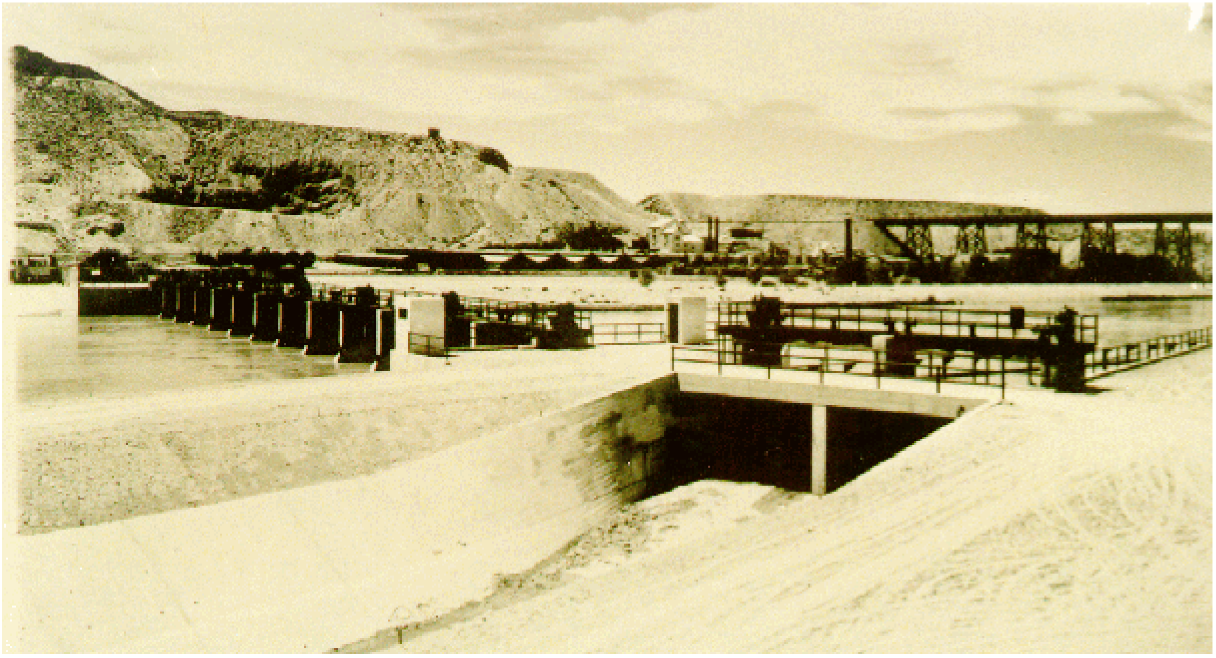


Plate 51. American Dam and Canal Intake, 28 May 1938.

Plate 52. Repeat Photograph of the
American Dam and Canal Intake (1999).

Open Channels

The dimensions of the American Canal have remained largely unchanged since 1938. For example, Plates 53 and 54 present an original, as-built view of the American Canal downstream of the headgate and a repeat photograph taken in 1999.

Plate 53. American Canal Downstream of Headgate, 30 April 1938.

Plate 54. Repeat Photograph of American Canal Downstream of Headgate (1999).

Original, as-built dimensions of the American Canal are available from a series of cross-sections extending down the length of the canal (Table 1). Measurements during this inventory confirm that cross-sectional characteristics have remained unchanged since 1938, although several concrete "panels" have been replaced over time as required to maintain the canal in operational readiness. Original, as-built cross-sections of the American Canal are available from a number of sources. Open channel "A" cross-sections proved remarkably stable, as did the cross-sections of Open channel "B" portions of the canal (see Figure BB-5 and BB-6 in Appendix BB). For this study, canal widths were measured from the top of the concrete lining rather than the plane of the adjoining berms since successive remodeling probably has altered this plane. All 1938 measurements have been modified accordingly to match this measurement approach.

Table 1
Comparative Measurements of Selected Portions
of the American Canal: 1938 and 1999

		1938		1999	
Station (ft)	Segment	Top Cross-Sectional Width (ft)	Depth (ft)	Top Cross-Sectional Width (ft)	Depth (ft)
0.00	Headgate	42.0	No data	42.0	11.2
344	Upper Open "A"	43.6	10.9	40.7	No data
1742	Upper Open "A"	43.6	10.9	40.7	11.3
2239	Conduit "A"	26.9	12.09	No data	No data
3224	Middle "A"	32.9	8.2	No data	No data
6165	Conduit "B"	26.9	13.4	25.9	12.1
7894	Open "B"	26.8	10.4	24.1	11.5
8374	Lower Open "A"	40.7	9.8	No possible comparison*	No possible comparison*
10474	American-Franklin Confluence	No data	No data	No possible comparison*	No possible comparison*

* Rebuilt in 1997

In contrast, the confluence of the American Canal with the Franklin Canal has undergone significant modifications as a result of reconstruction in 1997 (Plates 55 and 56). Plate 55 shows a view looking upstream at the skimming weir and the settling basin. Plate 56 shows a view looking downstream from the downstream end of the reconstructed settling basin. As a consequence, there is little correspondence between the original configuration of the American-Franklin confluence in 1938 and that observed today.

Plate 55. Confluence of the American and
Franklin Canals, 17 May 1939.

Plate 56. Headgates of the Franklin (left) and
Wastegates (right) of the American Canals (1999).

Conduits

The two subterranean conduits, “A” and “B,” also show no discernable changes compared with their 1938, as-built characteristics (see Figure BB-7 in Appendix BB). Dimensions measured during this inventory, as well as comparative repeat photography, conform precisely to the 1938 nominal specifications (Plates 57 and 58).

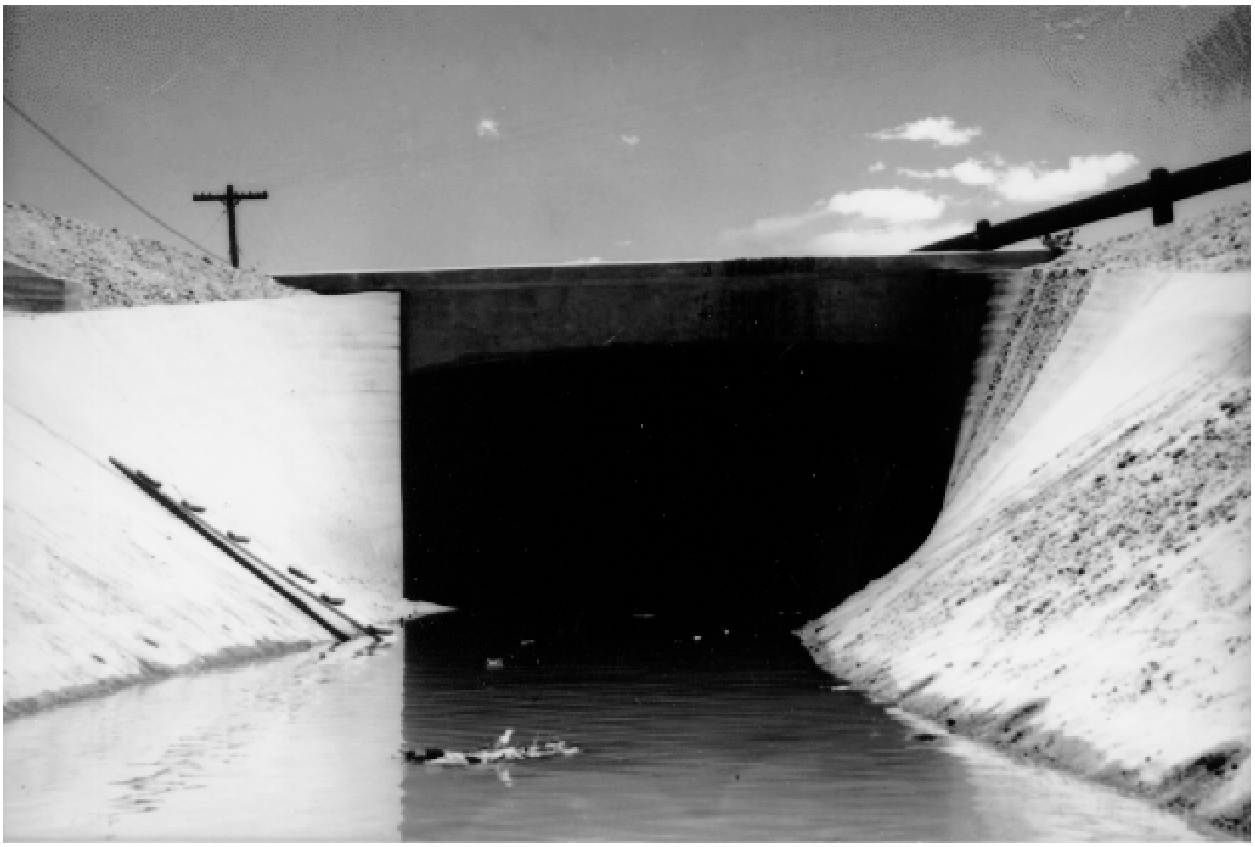


Plate 57. Upstream Intake of Closed Conduit “B,” 25 May 1938.

The interior of conduits “A” and “B” could not be evaluated during this inventory. Safety considerations prevented entering the conduits, since water was flowing through the conduits at an estimated rate of 1050 cfs. The general configuration of conduit interiors can, however, be gleaned from vintage photographs (Plates 23 and 24) showing the conduits to be of a rounded rectangular cross-section. There is no low-flow channel (see also Figure BB-7 in Appendix BB) and water simply retreats toward the low point (i.e., center) of the conduit during periods of reduced flow. Plate 59 shows the interior of Conduit “B” immediately following completion in 1938. There is no evidence to indicate that either conduit “A” or conduit “B” has been modified in any way since 1938.

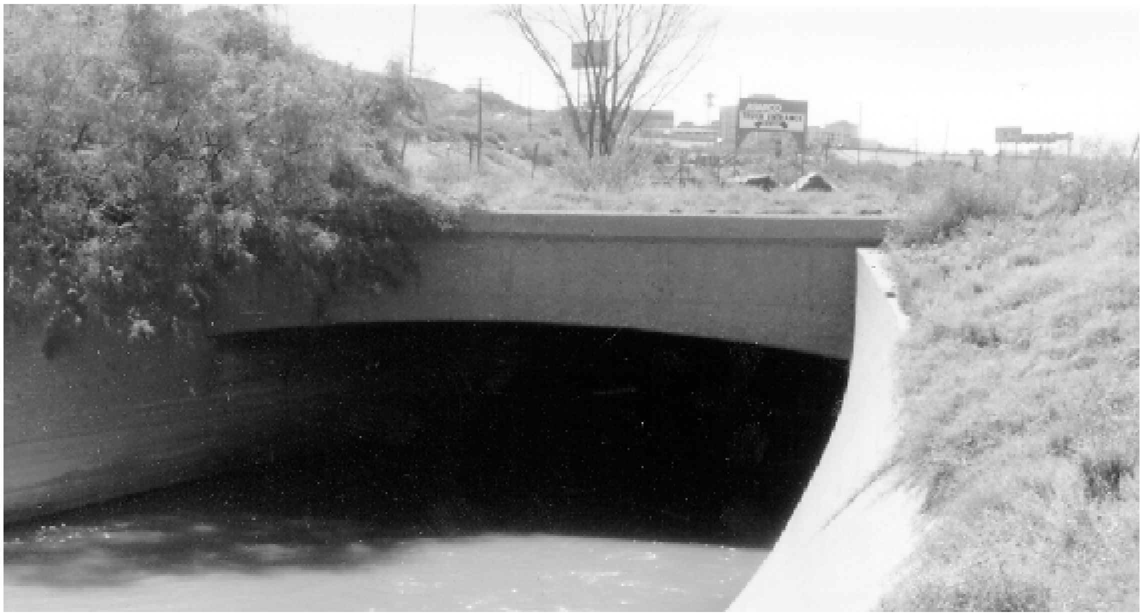


Plate 58. Repeat Photograph of Intake of Closed Conduit “B” (1999).

Plate 59. Interior of As-built Closed Conduit “B,” 29 April 1938.

STRUCTURES IN THE AMERICAN CANAL

Structures refer to a variety of water-control (e.g., checks, siphons), water measurement (e.g., gauges) and bridging devices often associated with canals. At the time the American Canal was constructed in 1938, there were a number of gauges, bridges, and other structures in the canal.

Most of the original structures appear to have long since been removed entirely or replaced with newer structures. Most appear to have been removed prior to 1972. Indeed, according to a 1972 structure inventory (Table 2), the American Canal contained the following devices, ordered from head to tail (IBWC 1972:Exhibit F(1)).

Table 2
American Canal Structures (1972)

Station	Structure	Owner	File No.
4+30	2" Water line (abandoned)	El Paso Brick Co.	LSF/G2
4+30	8" Water line	ASARCO	LSF/G-245
4+30	Sewer line	IBWC	No file
2+93	36" X 46' Iron Pipe	IBWC	L2.I27
10+81	36" Concrete Pipe	Public Service Board	LSF/G-891
12+51.62	42" Concrete Storm Drain	City of El Paso	LSF/G-888

Accordingly, all that remains of most of the original 1938 structures are vintage drawings and photographs.

Gauges

There is one gauge in the American Canal, one located about 100 m downstream from the headgate. (Plates 60 and 61). Original specifications for these devices could not be located. Regardless, the 1938 gauges have been replaced by three newer gauging devices. One is located about 110 m downstream from the headgate, another at the intake of Conduit "A," and the last approximately 150 m above the headgate of the Franklin Canal (Plates 62 to 64).

Plate 60. Gauging Station 100 m Downstream
of American Canal Headgates, 3 June 1938.

Plate 61. Detail of Gauging Station 100 m Downstream
of American Canal Headgates, 1 May 1938.

Plate 62. Bridge and Gauging Station in Open
Channel “A” at 1742 ft from Headgates (1999).

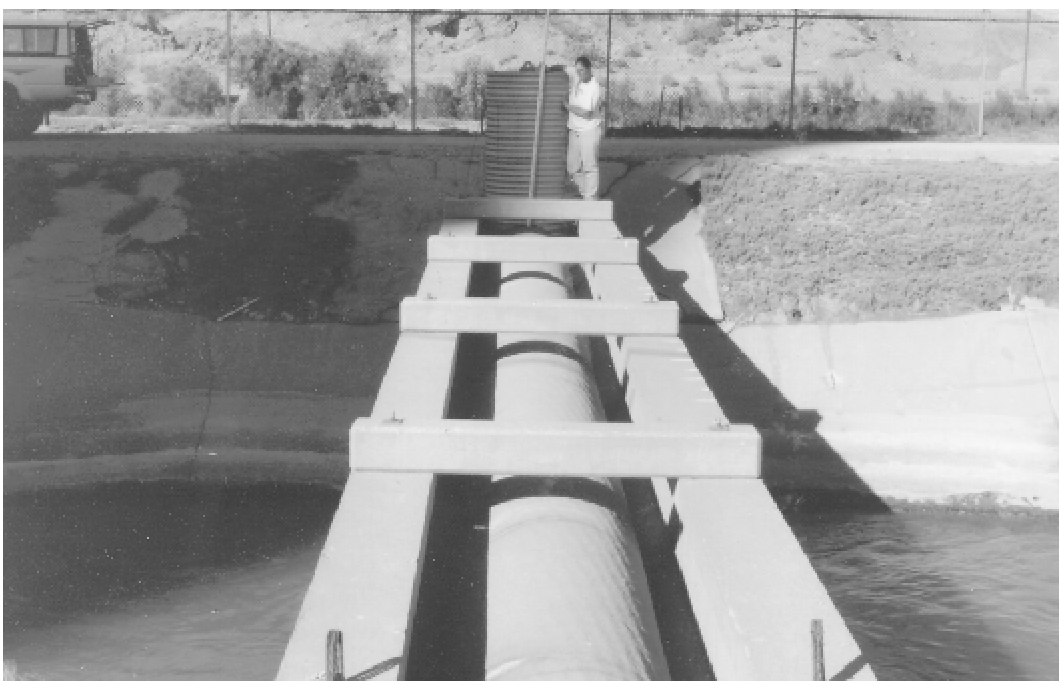


Plate 63. Gauging Station and Utility Crossing
Above Closed Conduit "A" Looking North (1999).

Plate 64. Stilling Well Near the Confluence
of the American and Franklin Canals (1999).

Bridges

Three bridges crossed the American Canal when it was completed in 1938. One was located at the U.S. 80 entrance into the ASARCO plant; the remaining two crossed the American Canal at the foot of Globe Street and at Hart's Mill (Plates 65 and 67).

Nominal specifications for all bridges indicate they were 41.5 ft long X 18 ft wide (see Figure BB-8 and BB-9 in Appendix BB). All were constructed of 0.33 x 1.33 x 21 ft stringers with a decking built of 0.25 x 0.67 X 18 ft wooden planks. A 15.5 ft tall wooden piling with cross-bracing located in the center of the structure provided additional support. Concrete abutments at both ends anchored the bridges firmly into the canal berms.

The bridge over the canal into the ASARCO plant has been replaced by a new structure and all evidence of the original bridge has been removed. Further downstream, below the outlet of Conduit "B," the right (south) bank of the Rio Grande is not fenced. To prevent illegal immigrants from crossing into the United States, the Globe Street and Hart's Mill bridges were removed sometime between 1938 and 1971. The only part of the original Globe Street Bridge that remains today are the abutments (Plates 65 and 66).

Plate 65. Globe Street Bridge, 15 May 1938.

Plate 66. Repeat Photograph of the Remnant
of the Globe Street Bridge (1999).

Plate 67. Hart's Road Bridge, 15 May 1938.

SUMMARY AND RECOMMENDATIONS

Detailed archival research, combined with repeat photography and an on-site inventory, indicates that the American Canal system has retained a high degree of integrity relative to its original 1938 configuration. Of all the features examined here, only water control devices and bridges exhibit any changes; most have been removed entirely or replaced with newer structures. Accordingly, the American Canal exhibits a number of historically-significant engineering and construction characteristics typical of Depression-era Federal irrigation projects.

More importantly, the American Canal represents the earliest attempt by the United States to enforce the terms and conditions of the 1906 Treaty with Mexico. Specifically, it was constructed with a design capacity of 1,200 cfs to insure that only the 60,000 acre-feet of water owed to Mexico annually was, in fact, delivered to Mexico under the 1906 Treaty. As such, it symbolizes efforts to resolve water allocations between the United States and Mexico *in the Rio Grande basin* in a way that ultimately allowed the expansion of irrigated agriculture in the El Paso Valley.

The only other example of irrigation works built to allocate water between the United States and Mexico is the Boulder Canyon Project—authorized by an Act of Congress on 21 December 1928 (45 Stat. 1057)—on the Colorado River. According to the 3 February 1944 treaty between the United States and Mexico, 1,500,000 acre-feet of water initially stored in Hoover Dam is delivered to Morelos Dam in Mexico through a series of subsidiary dams, including the Davis, Parker, Imperial, and Laguna Dams, along the Colorado River (WPRS 1981:83, 299, 307, 341). Of these, the Imperial Dam and All-American Canal are directly responsible for diverting water to Mexico according to 1944 treaty commitments (WPRS 1981:69, 338). Completed in 1940, the Imperial Dam and All-American Canal are quantitatively and qualitatively quite different from the American Dam-American Canal complex, having capacities in excess of 15,000 cfs (e.g., WPRS 1981:71–72, 299).

Accordingly, the American Dam and American Canal complex is but one of two examples of irrigation works that divide water between the United States and Mexico according to specific treaty obligations. Based on the findings presented here, the American Canal is potentially eligible for inclusion on the National Register of Historic Places (NPS 1991). Specifically, its construction style is typical of Depression-era construction methods *and* the canal is pivotal in international relations between the United States and Mexico. Accordingly, the American Canal is significant under Criterion "A" and Criterion "C," respectively, of Section 106 of the National Historic Preservation Act (1966).

The IBWC has proposed to reconstruct the American Canal in an effort to improve its structural stability and increase its conveyance capacity to 1,500 cfs discharge. Measures proposed to improve structural stability include (1) replacing existing open-channel concrete lining with thicker concrete lining, (2) improving concrete panel joints to increase longitudinal expansion and contraction consistent with varying thermal regimes present in the canal, and (3) replacing existing open-channel portions of the canal with precast concrete box culverts. These measures, when fully implemented, would increase the canal's capacity to 1,500 cfs and would insure the permanence of the canal. In addition, the IBWC proposes to install high fences, posted signs, safety escape ladders, and safety cables at various intervals along the American Canal in an effort to reduce unauthorized access to the canal and minimize the potential for injuries.

Four alternatives have been proposed to improve the stability and capacity of the American Canal. These including the following:

1. Alternative 1 (Box Canal Alternative). This alternative calls for all open-channel portions of the American Canal between the American Dam and the International Dam to be replaced with boxed conduits, *with the exception of a 400 ft open channel immediately downstream of the American Canal headgates.* This 400 ft open channel section would be replaced by a newer, thicker concrete lining and would allow for the proper operation and maintenance of the flow measurement gauge.

2. Alternative 2 (Partial Box Canal Alternative A). This alternative calls for the open channel portion of the American Canal between Conduit "A" and Conduit "B," identified elsewhere in this report as the Middle Open Channel "A," to be replaced with a box conduit. Upper Open Channel "A," Open Channel "B," and Lower Open Channel "A" would *not* be replaced with box conduits, but *would be* reconstructed and slightly enlarged. Although the remaining open-channels would be replaced by thicker concrete lining, these segments would remain as open channels, thereby conforming to the original configuration of the American Canal.

3. Alternative 3 (Partial Box Canal Alternative B). This alternative calls for open channel portions of the American Canal previously identified as Middle Open Channel "A," Open Channel "B," and Lower Open Channel "A" to be replaced with a box conduit. Upper Open Channel "A" would *not* be replaced with a box conduit, but would remain as an open channel. The concrete lining of this segment would, however, be replaced by a new, thicker concrete lining.

4. Alternative 4 (No-action Alternative). This alternative would leave the American Canal in its current configuration. The concrete lining of open- channel portions would remain as they are and existing box conduits would not be affected.

About 74 percent of the length of the American Canal now consists of open channels, while the remaining 26 percent consists of closed conduits (2.9 open:1 closed). Though largely hidden from public view, there are remnants of two original bridges still present in the lower segment (i.e., Lower Open "A") of the canal. As well, there are two complete original conduits (i.e., Conduit "A" and Conduit "B") that will not be affected by any of the proposed alternatives.

Based on the existing characteristics of the American Canal, Table 3 summarizes the effect of each of the four alternatives on its existing character. The lower the ratio of open to closed canal channel, the less visible the American Canal becomes and the greater the cumulative effect of any one alternative on the overall integrity of this system.

Table 3
Effects of Proposed Alternatives on the American Canal

Effects	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Original 1938 Bridges Removed (no.)	2	2	2	0
Original 1938 Bridges Remaining (no.)	0	0	0	2
Original 1938 Box Culverts Remaining (no.)	2	2	2	2
Original 1938 Open-channel Segments Replace by Box Conduits (ft)	7,360	2,941	5,521	0
Original 1938 Open-channel Lining Replaced with New Concrete Lining (ft)	400	4,819	2,239	0
Original 1938 Open-channel Lining Remaining (ft)	0	0	0	7,760

Based on these data, the potential effects of each alternative can be summarized as follows:

1. Alternative 1 would replace all but 400 ft of the open channel portions of the American Canal with closed conduits. The relative proportions of open to closed portions of the canal would shift dramatically to 1 ft of open channel for every 26 ft of closed channel. This alternative would reduce the need for physical safety barriers (e.g., fences, ladders, and cables) would probably lead to the greatest reduction in human injuries along the canal alignment.
At the same time, this alternative *would erase almost all visible evidence* of the as-built characteristics of the American Canal. This alternative also would remove all evidence of the two remnant bridges spanning the canal. Considered jointly, this alternative would virtually erase any visible evidence of this feature in a way that is incompatible with its demonstrated historic significance.

2. Alternative 2 would replace only the middle, open-channel section—2,941 ft—of the American Canal with a new box conduit. The relative proportions of open to closed portions of the canal would be reduced to 1.1 ft of open channel for every 1.0 ft of closed channel. Both bridge remnants would be removed. However, existing original conduits would not be affected in any way. Remaining open-channel portions of the American Canal would be slightly enlarged and replaced with new, thicker concrete lining. This alternative would require the greatest investment in physical safety barriers (e.g., fences, ladders, and cables) and the potential for human injuries would be only slightly reduced. This alternative would preserve large portions of the visible (i.e., open-channel) segments of the original canal, but may not be as cost-effective as Alternative 1 in meeting the goal of increasing the capacity of the canal and reducing human injuries.

3. Alternative 3 would replace an aggregate of 5,521 ft of original open-channel canal with closed conduits, thereby reducing open channels:closed channels to a ratio of 0.27:1. This alternative would remove all evidence of the two remnant bridges spanning the canal. This alternative would require a moderate investment in physical safety barriers and probably achieve a moderate reduction in human injuries along the canal alignment. At the same time, this alternative would leave largely intact the upper 2,239 ft open-channel segment of the American Canal immediately below the headgate. For reasons discussed below, this alternative most closely achieves a balance between the need for preserving portions of this canal and the need of the IBWC to increase the canal's capacity and reduce the potential for human injuries along the canal alignment.

4. Alternative 4 would not result in any changes to the existing configuration of the American Canal and the relative proportions of open to closed channels (2.9:1) would remain unchanged. As well, existing original conduits and remnant bridges would not be affected by this alternative. Installation of physical safety barriers would not occur and the potential for human injuries along the American Canal alignment would remain unchanged from current conditions. While this alternative would preserve the American Canal in its current 1938 as-built configuration, it would fail to (1) improve structural stability, (2) increase the canal's capacity, and (3) reduce the potential for human injuries.

A summary matrix ranking the four reconstruction alternatives in terms of specific factors is presented in Table 4. Each factor is ranked from 1 (worst) to 4 (best). An overall rank for each alternative is presented by multiplying alternative-specific ranks for visibility, stability, capacity, and injuries. It may be seen that Alternative 1 has the highest overall rank, but would result in a reconstructed system that is the least visible of any alternative and the least similar to the original 1938 system.

Table 4
Matrix for Evaluating Reconstruction
Alternatives for the American Canal.
(Ranked where 4=best, 1=worst)

Factor	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Visibility	1	3	2	4
Structural Stability	4	2	3	1
Increased Capacity	4	2	3	1
Human Injuries	4	2	3	1
Overall Alternative Rank—(Multiply rank score in each alternative)	64	24	54	4

To reiterate, the American Canal is one of only two water diversion devices in the nation that regulates the distribution of water between the United States and Mexico. Further, the American Canal is typical of Depression-era construction methods and design specifications employed in irrigation construction. In an effort to achieve a balance between the historic significance of this resource and the needs of the IBWC, *it is recommended that the IBWC pursue Alternative 3* for the following reasons:

1. This alternative preserves the original headgate and upper 2,239 ft open channel of the American Canal in a segment where the canal parallels U.S. 85 and is visible to passing motorists and pedestrians. When accompanied by appropriate IBWC signage, this would enhance public appreciation for the pivotal role played by this irrigation feature in the development of the El Paso Valley, as well as in relations between the United States and Mexico.

2. At the same time, this alternative results in a 71 percent reduction in the amount of open channel present in the American Canal, thereby largely meeting the IBWC's goal of increasing the structural stability and discharge capacity of the American Canal. At the same time, this reduction in the amount of open-channel segments greatly reduces the potential for human injuries. Assuming a uniform distribution of injuries per length of open channel canal, this alternative should result in a 71 percent decline in injuries along the American Canal.

3. Existing remnants of bridges over the American Canal are situated along a segment of the canal largely hidden from public view. Further, the superstructures of these bridges have already been removed, thereby reducing the overall integrity of these structures to a significant degree. The removal of these structures would not affect the overall integrity of the American Canal.

4. The overall rank-order score of Alternative 3 is relatively comparable to that of Alternative 1—the highest ranked alternative—without sacrificing the visibility that so directly affects the integrity of the American Canal.

In sum, it is recommended to the Texas Historical Commission (THC) and the United States Section of the International Boundary and Water Commission (USIBWC) that the American Canal is eligible for inclusion on the National Register of Historic Places under Criteria "A" and "C" of Section 106 of the National Historic Preservation Act (1966). Further, it is recommended to THC and IBWC that reconstruction Alternative 3 (Partial Box Canal Alternative B) be implemented to preserve the most important segment of the American Canal while simultaneously meeting the needs of the USIBWC.

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APPENDIX AA

**ENGLISH VERSION OF A TREATY BETWEEN
THE UNITED STATES OF AMERICA
AND UNITED STATES OF MEXICO
(1906)**

**FROM
"REPORT OF THE AMERICAN SECTION OF THE INTERNATIONAL WATER
COMMISSION, UNITED STATES AND MEXICO
71ST CONGRESS, 2ND SESSION, HOUSE DOCUMENT No. 359
(1930)**

1906 United States-Mexico Treaty Apportioning Water Between the Two Countries

Whereas a Convention between the United States of America and the United States of Mexico, providing for the equitable distribution of the waters of the Rio Grande for irrigation purposes, and to remove all causes of controversy between them with respect thereto, was concluded and signed by their respective Plenipotentiaries at Washington on the twenty-first day of May, one thousand nine hundred and six, the original of which Convention, being in the English and Spanish languages, is word for word as follows:

The United States of American and the United States of Mexico being desirous to provide for the equitable distribution of the waters of the Rio Grande for irrigation purposes, and to remove all causes of controversy between them with respect thereto, and being moved by considerations of international comity, have resolved to conclude a Convention for these purposes and have named as their Plenipotentiaries:

The President of the United States of American, Elihu Root, Secretary of State of the United States; and

The president of the United States of Mexico, His Excellency Señor Don Joaquín D. Casasús, Ambassador Extraordinary and Plenipotentiary of the United States of Mexico at Washington, who, after having exhibited their respective full powers, which were found to be in good and due form, have agreed upon the following articles:

Article I

After the completion of the proposed storage dam near Engle, New Mexico, and the distributing system auxiliary thereto, and as soon as water shall be available in said system for the purpose, the United States shall deliver to Mexico a total of 60,000 acre-feet of water annually, in the bed of the Rio Grande at the point where the headworks of the Acequia Madre, known as the Old Mexican Canal, now exist above the city of Juarez, Mexico.

Article II

The delivery of the said amount of water shall be assured by the United States and shall be distributed through the year in the same proportions as the water supply proposed to be furnished from the said irrigation system to lands in the United States in the vicinity of El Paso, Texas, according to the following schedule, as nearly as may be possible:

	Acre feet per Month	Corresponding cubic feet of water
January	0	0
February	1090	47480400
March	5460	237837600
April	12000	522720000
May	12000	522720000
June	12000	522720000
July	8180	356320800
August	4370	190357200
September	3270	142441200
October	1090	47480400
November	540	23522400
December	0	0
Total for the Year	60,000	2613600000

In case, however, of extraordinary drought or serious accident to the irrigation system in the United States, the amount delivered to the Mexican Canal shall be diminished in the same proportion as the water delivered to lands under said irrigation system in the United States.

Article III

The said delivery shall be made without cost to Mexico, and the United States agrees to pay the whole cost of storing the said quantity of water to be delivered to Mexico, of conveying the same to the international line, of measuring the said water, and of delivering it to the head of the Mexican Canal. It is understood that the United States assumes no obligation beyond the delivering of the water in the bed of the river above the head of the Mexican Canal.

Article IV

The delivery of water as herein provided is not to be construed as a recognition by the United States of any claim on the part of Mexico to the said waters; and it is agreed that in consideration of such delivery of water, Mexico waives any and all claims to the waters of the Rio Grande for any purpose whatever between the head of the present Mexican Canal and Fort Quitman, Texas, and also declares fully settled and disposed of, and hereby waives, all claims heretofore asserted, against the United States on account of any damages alleged to have been sustained by the owners of land in Mexico, by reason of the diversion by citizens of the United States of waters of the Rio Grande.

Article V

The United States, in entering into this treaty, does not thereby concede, expressly or by implication, any legal basis for any claims heretofore asserted or which may be hereafter asserted by reason of any losses incurred by the owners of land in Mexico due or alleged to be due to the diversion of the waters of the Rio Grande within the United States; nor does the United States in any way concede the establishment of any general principle or precedent by the concluding of this treaty. The understanding of both parties is that this treaty extends only to the portion of the Rio Grande which forms the international boundary, from the head of the Mexican Canal down to Fort Quitman, Texas, and in no other case.

Article VI

The present Convention shall be ratified by both contracting parties in accordance with their constitutional procedure, and the ratifications shall be exchanged at Washington as soon as possible.

In witness whereof, the respective Plenipotentiaries have signed the Convention in both the English and Spanish languages and have thereunto affixed their seals. Done in duplicate at the City of Washington, this 21st day of May, one thousand nine hundred and six.

Elihu Root [seal]
Joaquín D. Casasús [seal]

APPENDIX BB

SELECTED ENGINEERING DRAWINGS OF THE AMERICAN DAM, AMERICAN CANAL, AND ASSOCIATED STRUCTURES.

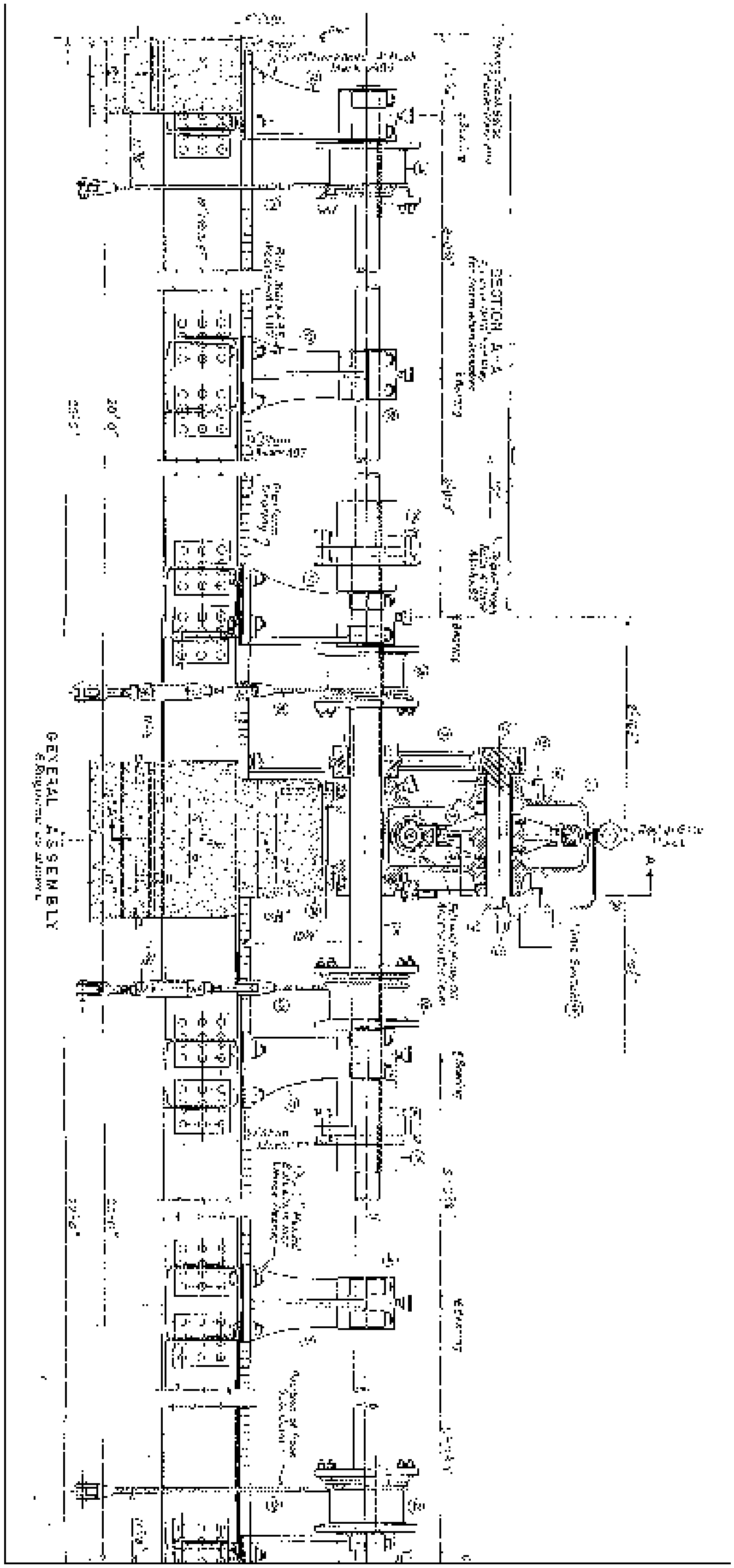

Figure BB–1. Schematic of Hoist Devices on the American Dam.

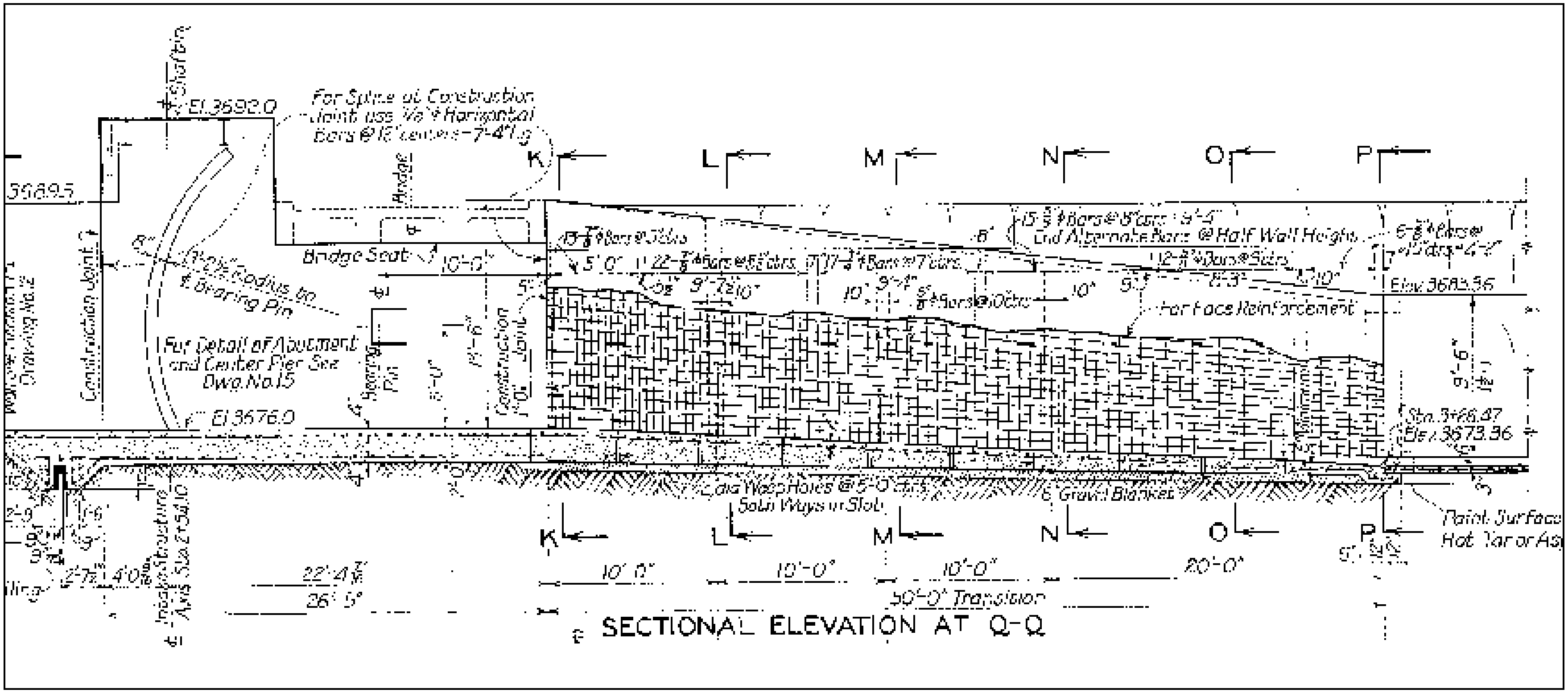

Figure BB-2. Longitudinal Cross-section of the Intake for the American Canal.

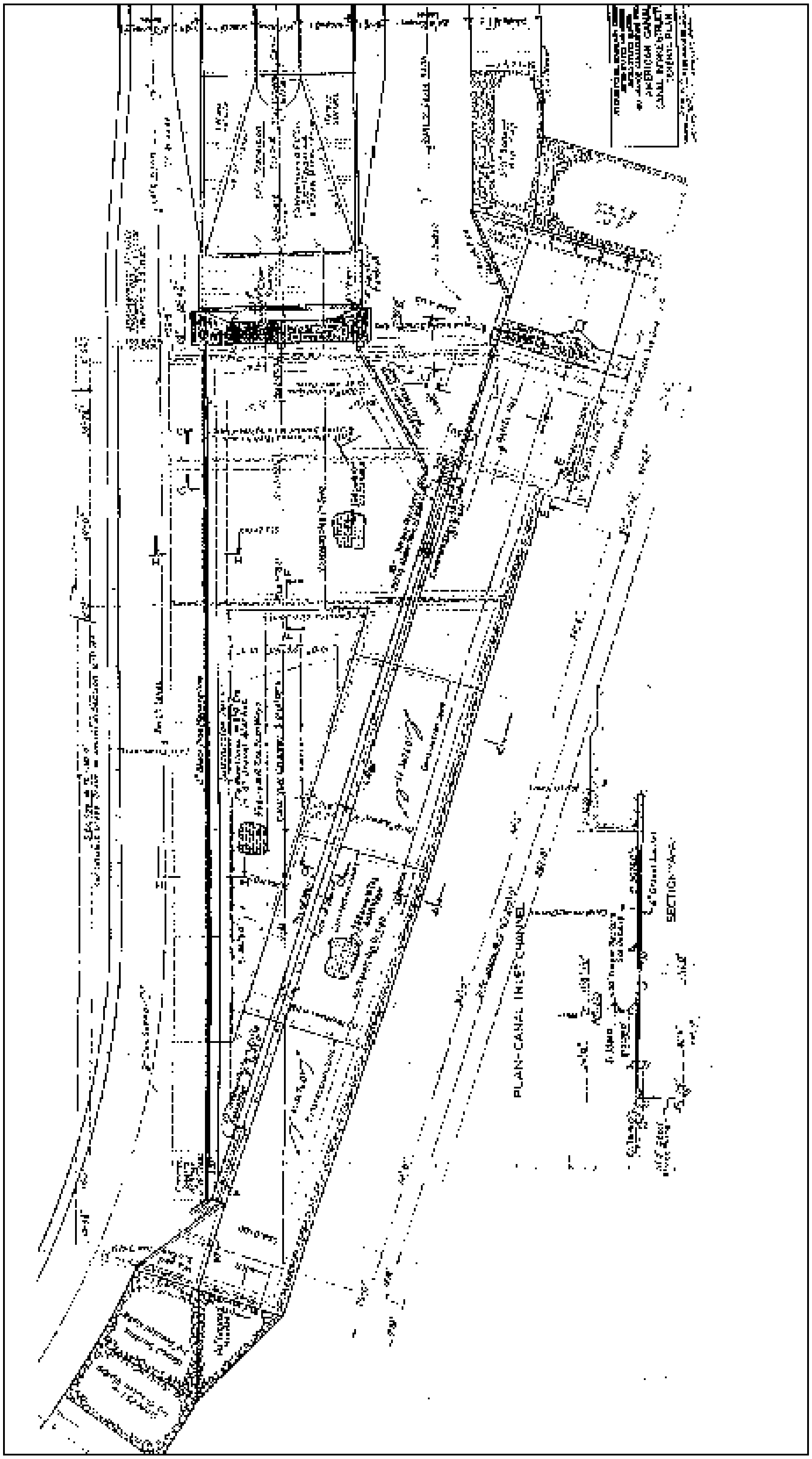

Figure BB-3. Plan View Schematic of American Canal Weir-Intake-Headgate Structure.

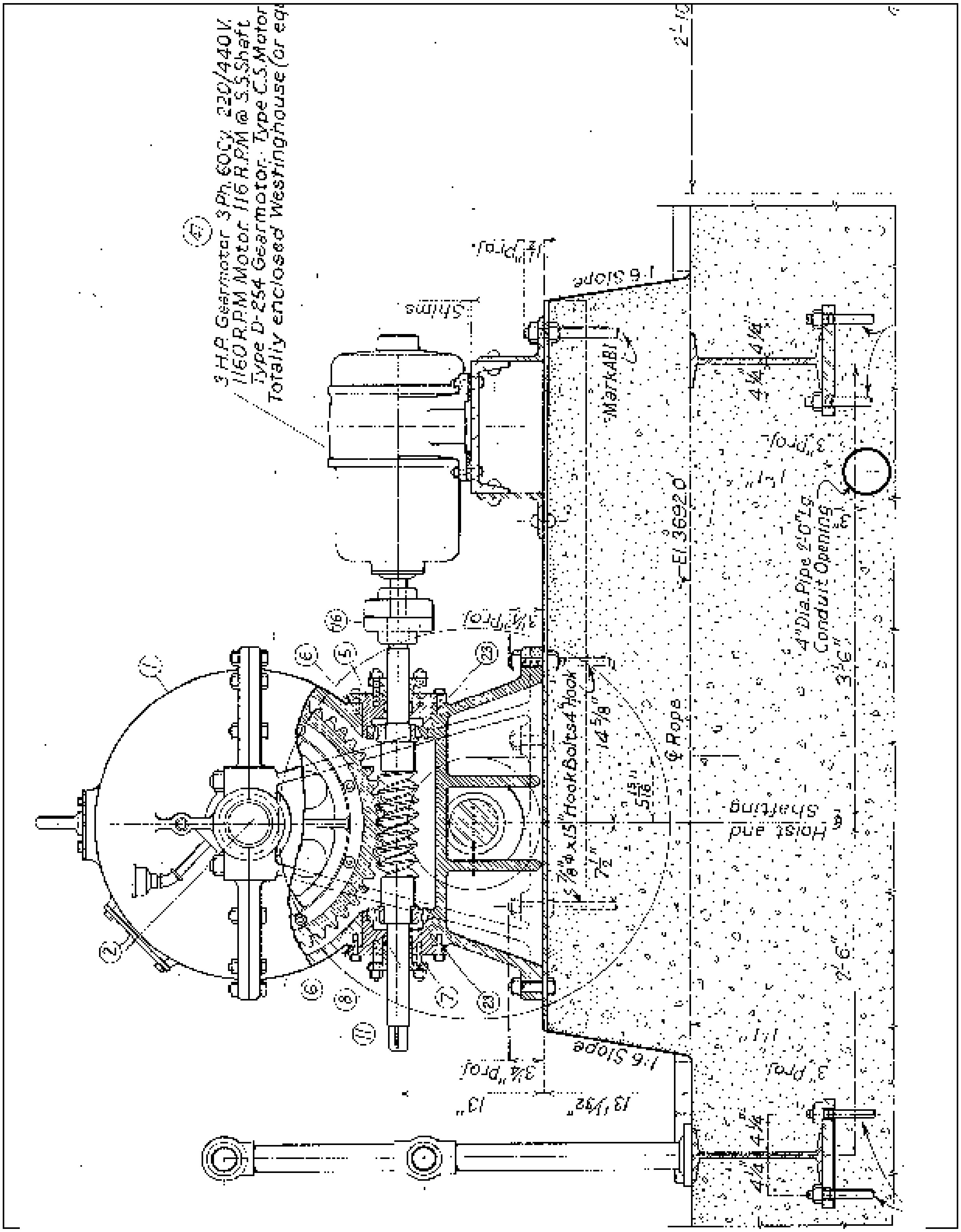

Figure BB–4. Schematic of Hoist Motors Used on the American Dam and American Canal Intake.

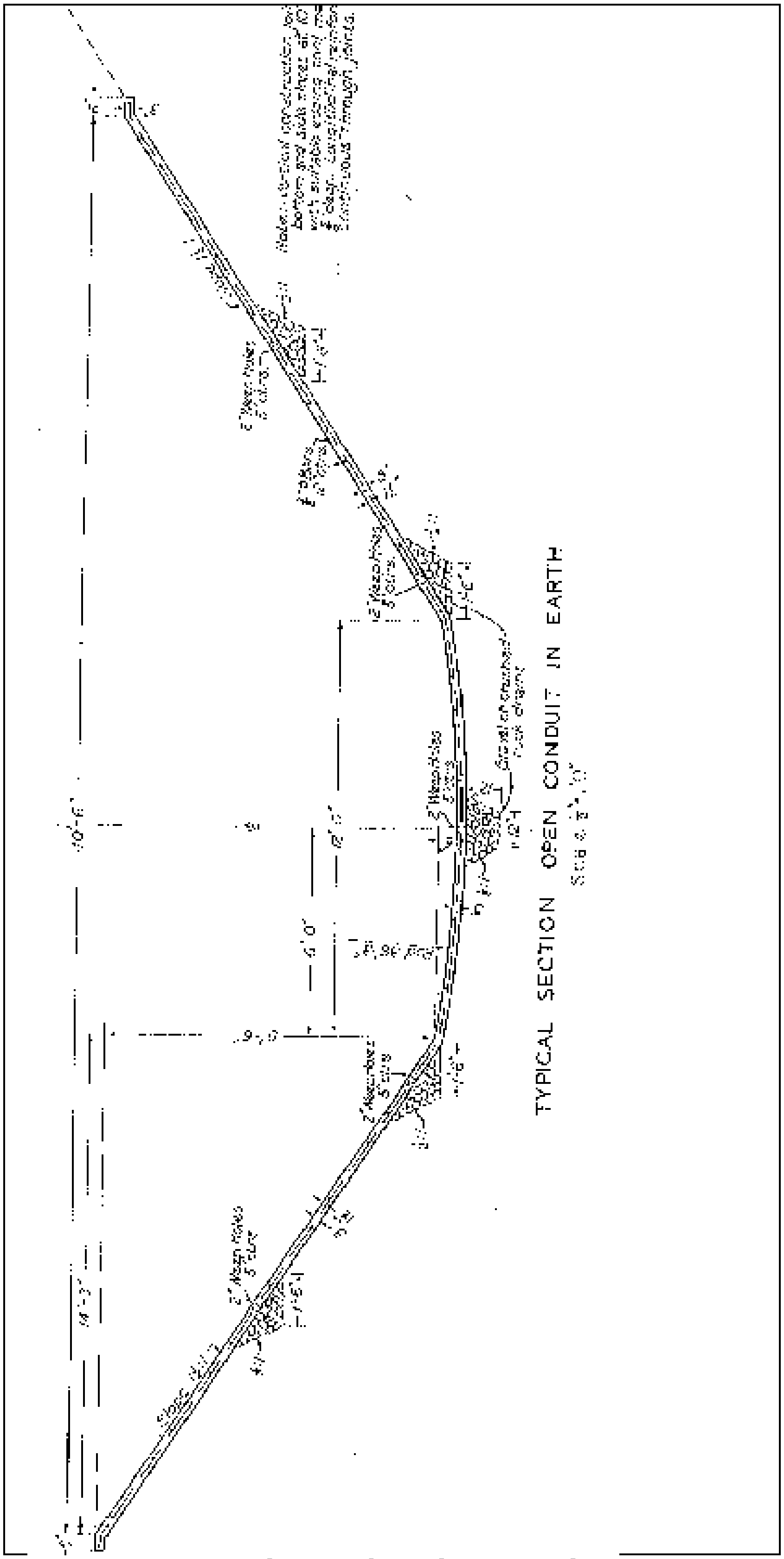

Figure BB–5. Typical Open-channel “A” Canal Cross-section.

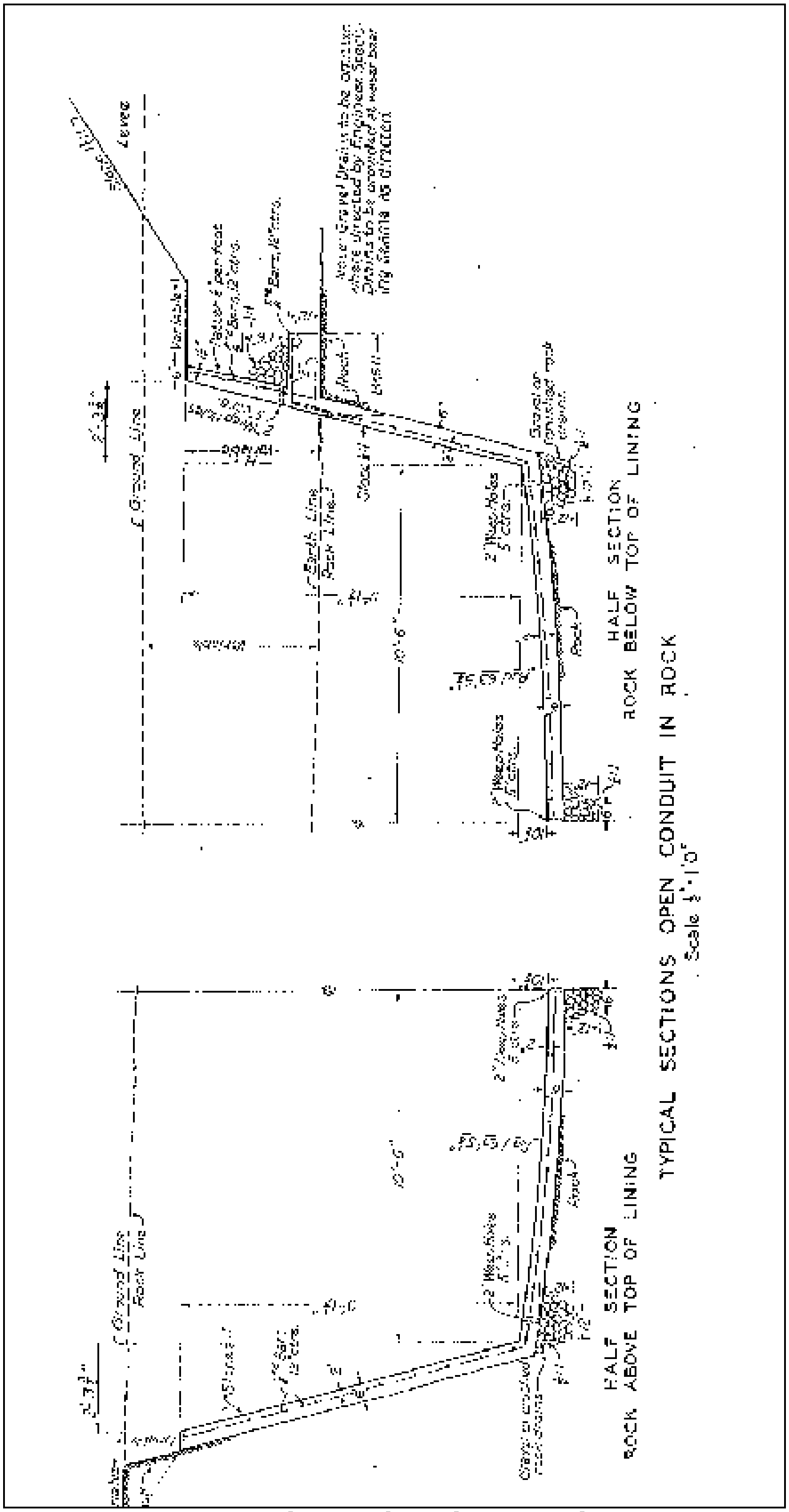

Figure BB–6. Typical Open-channel “B” Canal Cross-section.

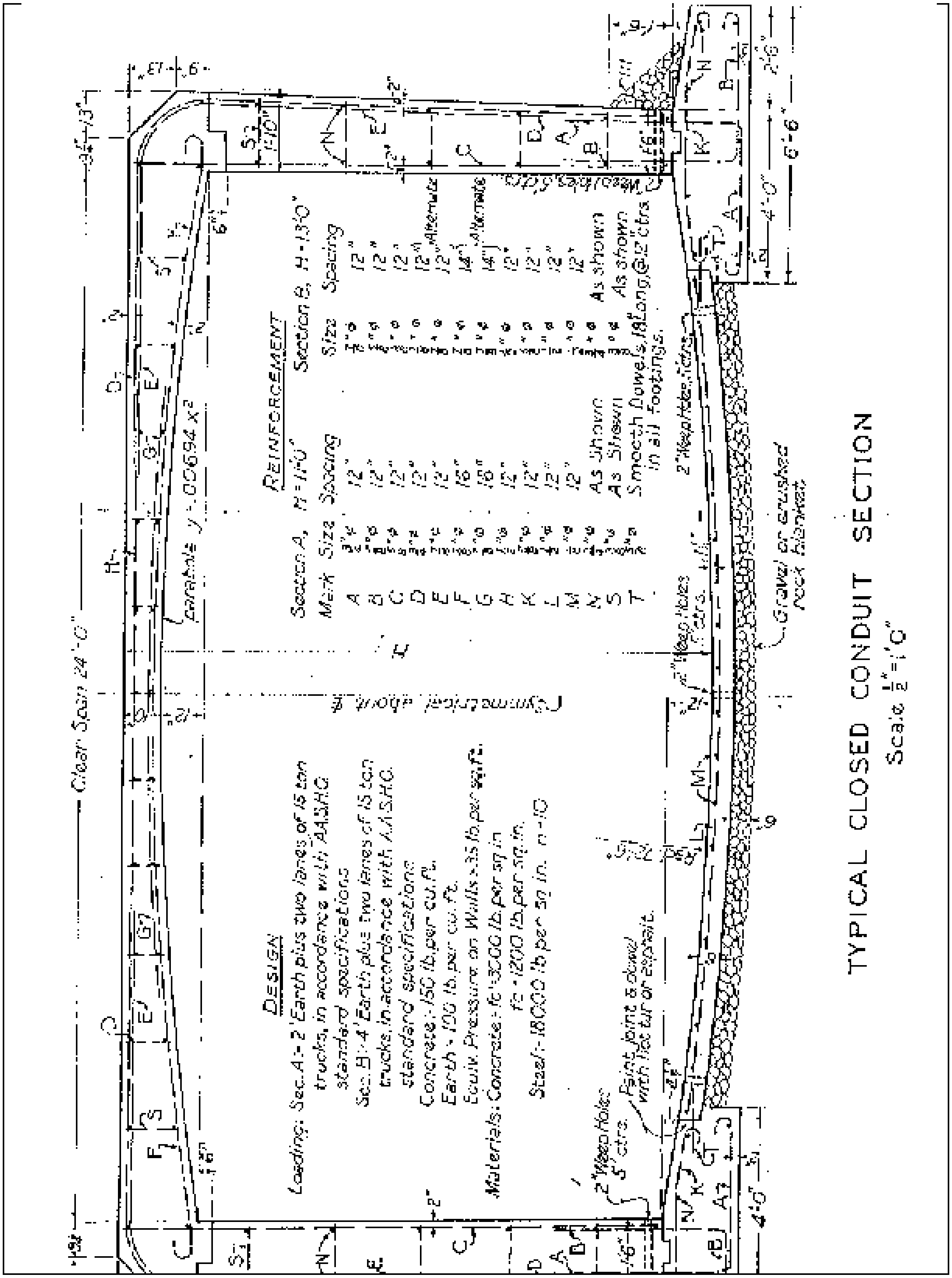

Figure BB-7. Conduit Cross-sections for Conduit "A" and Conduit "B".

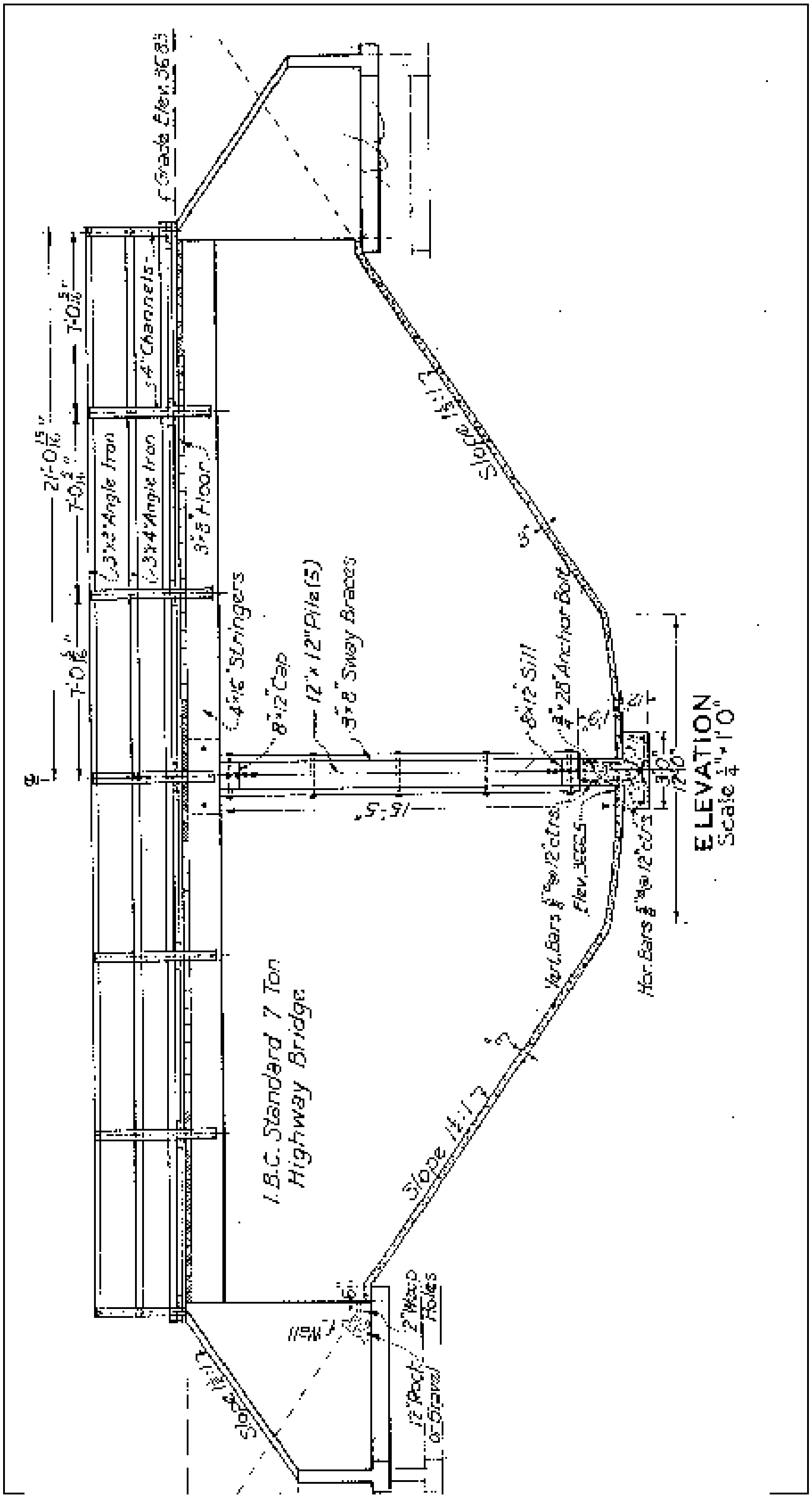

Figure BB-8. Cross-section of Standard 7-ton IBWC Bridge.

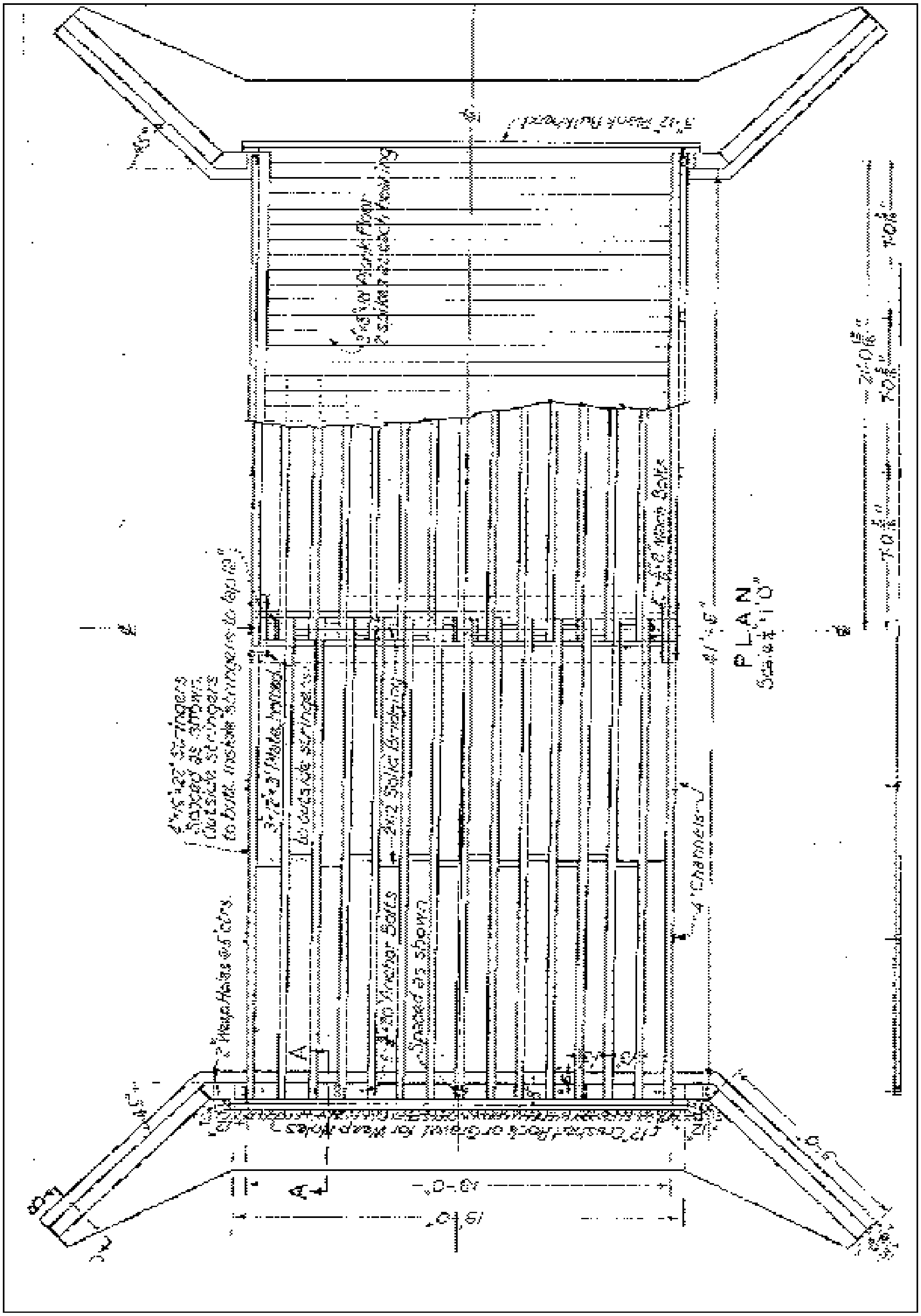

Figure BB-9. Plan View of Standard 7-ton IBWC Bridge.

K.3 - PARSONS ENGINEERING SCIENCE (PARSONS) REPORT

SUPPLEMENTAL REPORT

CONTROLLING WATER ON THE BORDER:
THE AMERICAN CANAL SYSTEM,
UNITED STATES SECTION,
INTERNATIONAL BOUNDARY AND WATER COMMISSION,
EL PASO, TEXAS

Prepared for
United States Section
International Boundary and Water Commission
United States and Mexico
El Paso, Texas
Contract # IBM 99-30

Prepared by
Parsons Engineering Science, Inc.
Austin, Texas

August 2000

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ERRATA

The purpose of this errata page is to correct the text and captions related to bridges that were misidentified in the historical and archaeological investigation conducted by Human Systems Research, Inc. (HSR) in 1999.

The photographs listed below were incorrectly labeled and the correct captions are as follows:

- Plate 30: Photograph depicts 12 March 1938 view of Hart's Mill Road Bridge; and

- Plate 66: Photograph depicts 1999 view of the remnants of the Hart's Mill Road Bridge.

The descriptions of the Globe Street and Hart's Mill Road Bridges on pages 62, 66, and 67 of the HSR report contain incorrect information. The description and dimensions provided correctly describe only the Hart's Mill Road Bridge. A revised description of the two bridges can be summarized as follows:

> An examination of USIBWC construction drawings, maps, and photographs reveals that while the Globe Street Bridge was constructed as a footbridge across the canal, the structure at Hart's Mill Road was a timber vehicular bridge. Although remnants of the Globe Street Bridge no longer exist, the original Hart's Mill Road Bridge has been replaced with a sewer line and only the abutments remain. Photograph #ADC-385 in the USIBWC archives depicts the construction of the Globe Street footbridge in an April 1938 view. Furthermore, a construction drawing dated May 28, 1938, and entitled "Earthwork & Gravel Surfacing at American Dam and Canal – General Plan" (#2693-49) corroborates the location and method of construction of both the Globe Street and Hart's Mill Road Bridges. No construction drawings have been found for the Globe Street pedestrian bridge, perhaps indicating the structure's simplicity of design.

Furthermore, the HSR study claimed that a third bridge, which led to the American Smelting and Refining Company (ASARCO) plant, was likewise of wood-frame construction, has been replaced by a new structure, and that no original remnants exist. However, the Smelter Road Bridge still stands and is addressed in detail in the August 2000 *Supplemental Report, Controlling Water on the Border: The American Canal System, United States Section, International Boundary and Water Commission, El Paso, Texas*. The correct station for the Smelter Road Bridge is 63.00.

INTRODUCTION

The United States Section of the International Boundary and Water Commission (USIBWC), the agency which operates and maintains the American Canal in El Paso, Texas, has proposed to reconstruct the canal in order to improve its structural stability and increase its overall capacity from 1,200 to 1,535 cubic feet per second. This supplemental report serves as an addendum to the historical investigation and archaeological inventory of the American Canal conducted in 1999 by Human Systems Research, Inc. (HSR). The previous analysis assessed the potential impacts of four alternatives for the proposed reconstruction of the canal, including a No Action Alternative in which the canal would be maintained in its current configuration. The three action alternatives proposed the replacement of varying amounts of the open channel segments (ranging from a total of 2,941 feet to 7,360 feet) with closed conduits. Additionally, HSR conducted extensive archival research on the construction of the American Canal, as well as repeat photography and on-site inspections of the existing canal system. Figure 1 depicts the location and layout of the American Canal, which is situated on the American side of the international boundary between the United States and Mexico. Figures 2 and 3 provide detailed views of portions of the canal.

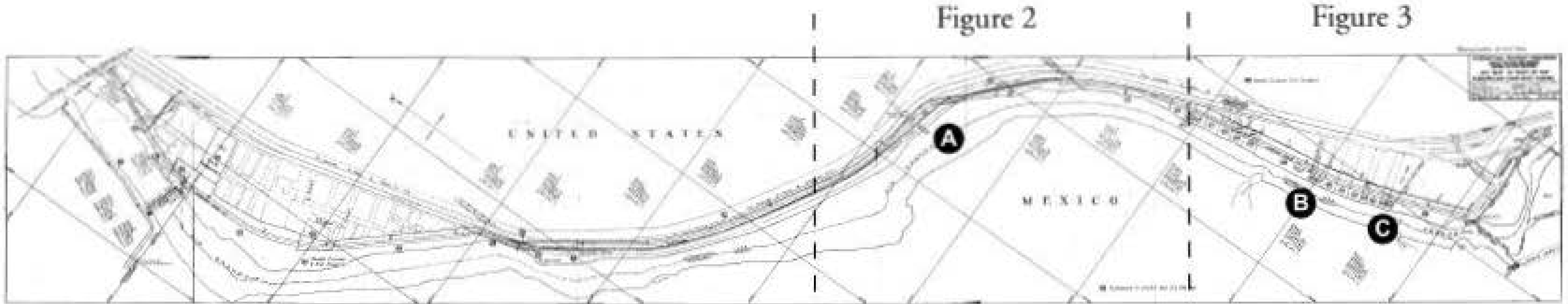
Thus, the purpose of this subsequent study is two-fold: (1) to address a new alternative that was proposed following the submission of the previous analysis; and (2) to refine the statement of historical significance for the American Canal. Evaluation of the additional alternative, as well as fieldwork and photographic research of the only bridge associated with the canal that remains intact, was conducted in March 2000.

In general terms, the American Canal possesses significance for its political and agricultural contributions to the El Paso Valley. Completed on June 2, 1938, construction of the American Canal represents the earliest attempt by the United States to ensure the distribution of waters to the United States and Mexico under the terms of the 1906 Treaty with Mexico. Although the HSR report stated that the American Canal exhibits historically significant engineering and construction characteristics typical of Depression-era Federal irrigation projects, this claim was not established. Upon consideration of both the previous investigation and this more recent evaluation, this supplemental report emphasizes the retention of the design and configuration of the canal as opposed to the supposed significance of its method of construction and use of materials. It should be noted that by the time of the construction of the American Canal, the use of reinforced concrete was common and hardly more representative of Depression-era construction than of any other period during the 20th century.

DESCRIPTION OF OPEN CHANNEL ALTERNATIVE

Implementation of the newly proposed alternative would retain the headgate structure and two closed conduit sections, yet require the removal and reconstruction of all concrete lining in the open channel portions, which constitute approximately 74% of the total

Figure 1: Location of the American Canal



Source: International Boundary Commission, January 1941

A Smelter Bridge
B Globe Street Bridge
C Approximate Location of Hart's Mill Road Bridge

Figure 2: Location of Smelter Bridge

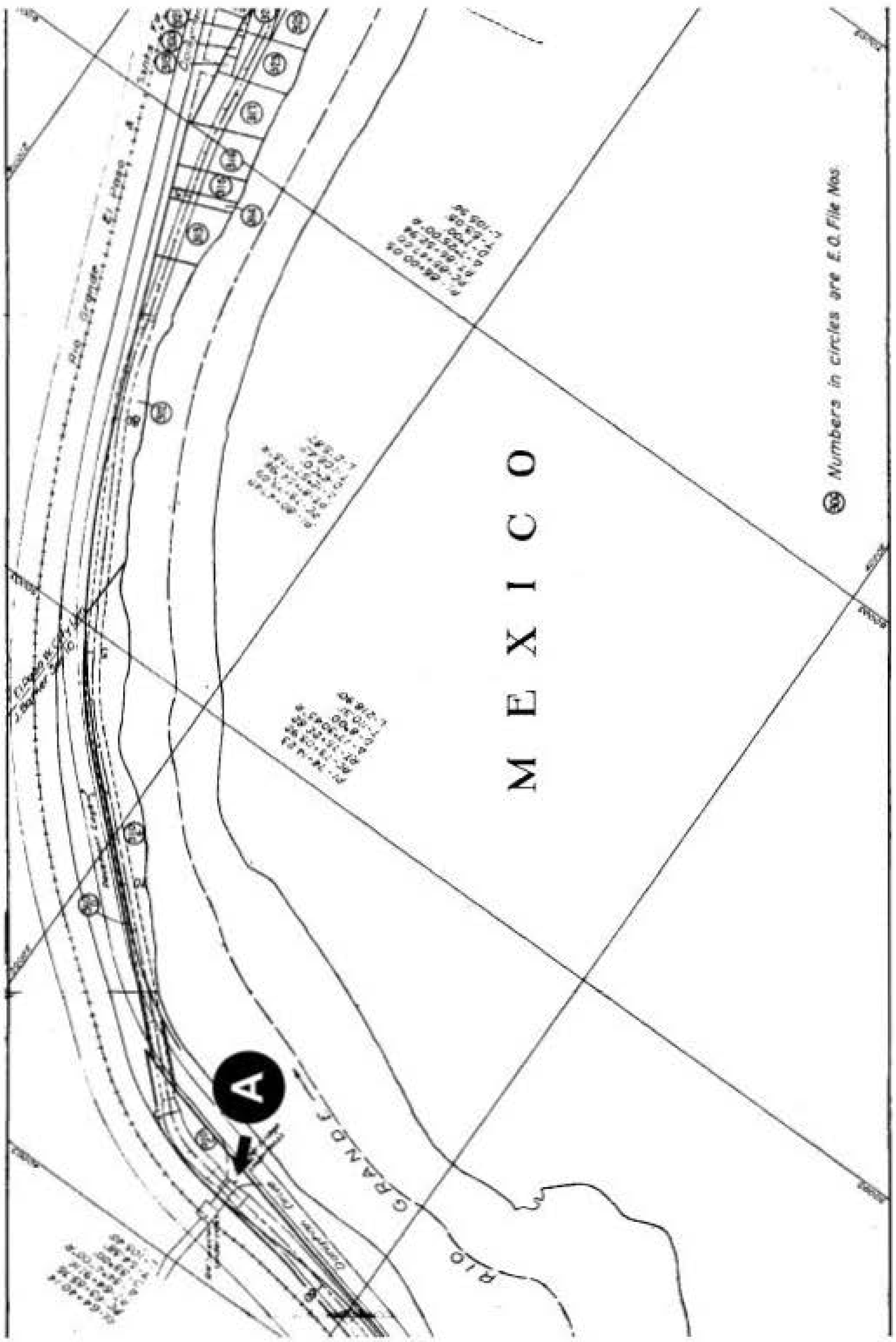
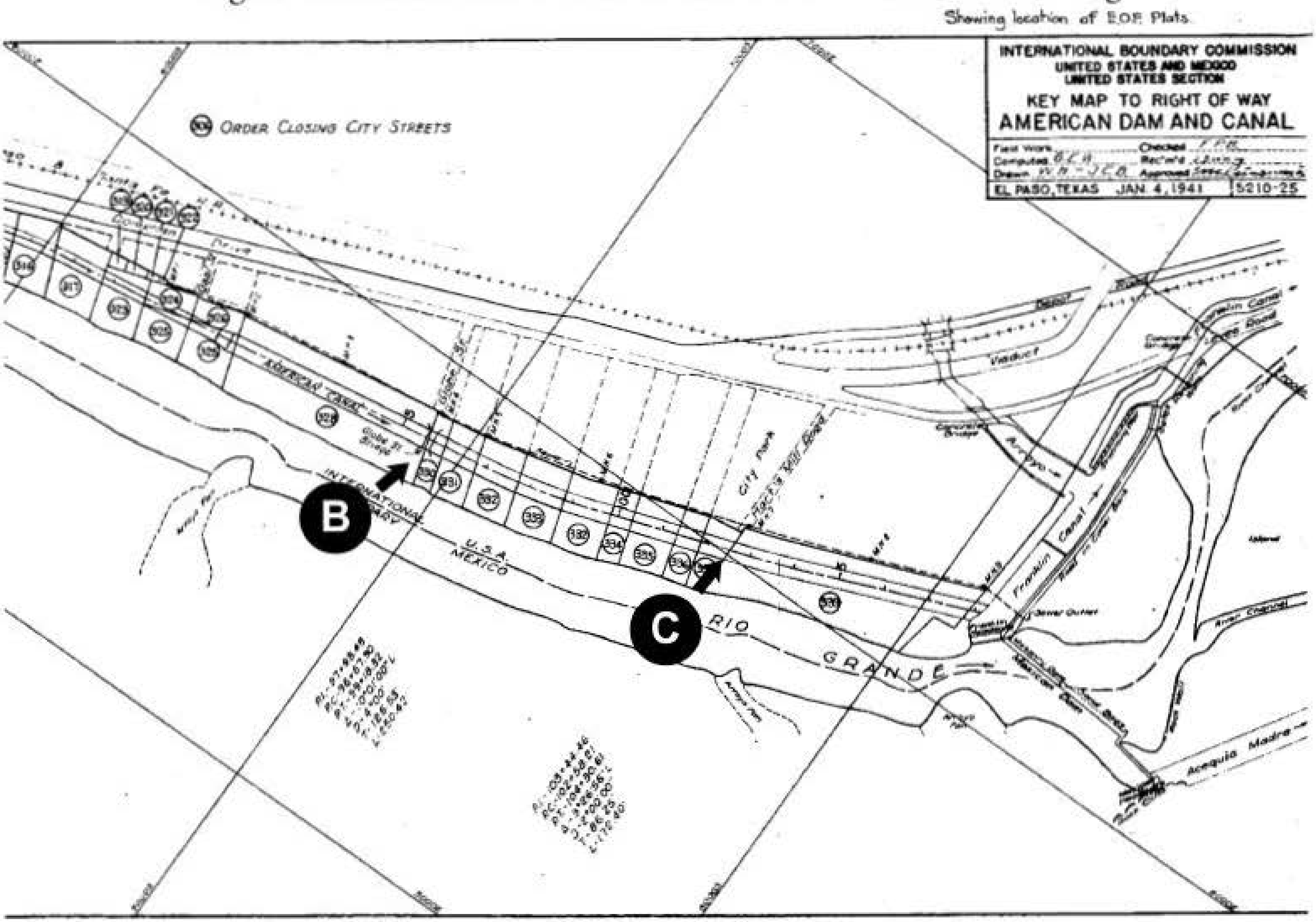


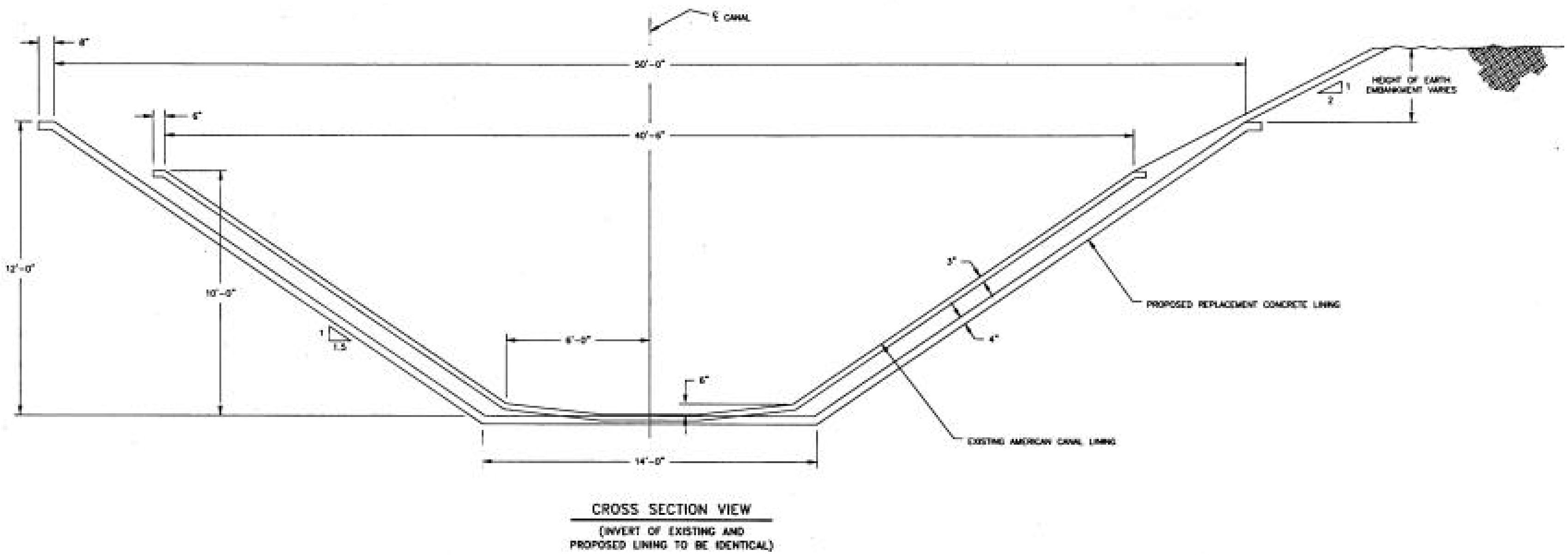
Figure 3: Location of Globe Street and Hart's Mill Road Bridges



length of the canal. Prior to installation of the new concrete lining, the open channel dimensions would be slightly enlarged to convey higher design flow. Anticipated characteristics of the new open channel portions are illustrated in Figure 4, which shows the cross section of the new lining superimposed over top of a sketch of the old (existing) lining. Improved panel joints in the new lining are also proposed. The fourth alternative would retain the original aesthetic character of the canal's design by preserving its open channel segments and eliminating the construction of new closed conduits as recommended in the other three action alternatives.

Implementation of any of the four action alternatives would involve retaining the two original closed conduits since they appear to be in excellent structural condition and have sufficient capacity to handle the new design flow. However, any of the four action alternatives would require the removal of the original concrete panels that line the open channel segments in order to accommodate the increased flow. Most of these panels are currently in an extremely deteriorated state, as evidenced by cracking, spalling, and shifting. Depending on the alternative selected, this lining would be replaced with either a new lining of concrete that measures two feet wider and two feet higher than the existing panels (as depicted in Figure 4), or new precast concrete closed conduits with a double barrel opening. Additionally, in order to accommodate the proposed widening of the canal, the original transition areas flanking the closed conduits also would be removed so as to allow the extant closed conduits to properly tie into the new canal (Seiger 2000). The variations between the five different alternatives are illustrated in Table 1 in the Determinations of Effect and Recommendations section of this report.

Figure 4 Open Channel Alternative – Typical Cross Section



REFINEMENT OF HISTORICAL SIGNIFICANCE

Construction of the American Dam and Canal was intended to ensure the distributions of waters to the United States and Mexico under the terms of the 1906 Treaty with Mexico. This treaty provides a guaranteed amount of delivery to Mexico. The Juarez Acequia Madre complex provides delivery of approximately 60,000 acre-feet of water. The El Paso Valley receives about 376,862 acre-feet of water. The American Canal complex is significant in that it prevented disruptions in United States – Mexican relations by separating United States from Mexican waters. As such, and in accordance with the findings of HSR, the American Canal is significant under National Register Criterion A for several reasons: its importance in international relations between the United States and Mexico; its role in water distribution to ensure compliance with the Treaty of 1906; and its contributions to the development of irrigated agriculture in the El Paso Valley. Furthermore, the American Canal possesses significance under Criterion C for its overall design, specifically its open character and configuration, and continues to exhibit such aspects of its historic integrity as location, setting, materials, workmanship, and feeling.

Although the HSR investigation addressed three bridges originally associated with the American Canal, the report included historic documentation of only two of these structures – the Globe Street and Hart's Mill Road Bridges. An examination of USIBWC construction drawings, maps, and photographs reveals that while the Globe Street bridge was constructed as a footbridge across the canal, the structure at Hart's Mill Road was a timber vehicular bridge. Although remnants of the Globe Street Bridge no longer exist, the original Hart's Mill Road Bridge has been replaced by a sewer line and only the abutments remain. Furthermore, the HSR study claimed that a third bridge, which led to the American Smelting and Refining Company (ASARCO) plant, has been replaced by a new structure and no original remnants exist. The report also mistakenly stated that all three bridges were of wood construction with concrete abutments.

However, this supplemental report specifically addresses the existence of this third bridge, known as the Smelter Bridge. With a total width of 34 feet, the bridge is of poured concrete construction, leads east from Paisano Drive, extends over the canal, and provides access to the ASARCO plant. The bridge features a poured concrete approach road, deck, and abutments. Each side of the bridge is composed of low guardrails consisting of four poured concrete piers connected by two rails square in plan. The guard rails, curbs, and span have a rough-faced aggregate surface. Barbed wire fencing flanks each side of the bridge. A modern poured concrete barrier abuts the eastern span at its northern corner.

The USIBWC Headquarters in El Paso possesses extensive archives pertaining to the construction of the American Canal. This collection includes historic photographs, maps, and construction drawings for the canal and its associated features and bridges. A review of historic photographs within the archives reveals that construction of the Smelter Bridge was completed by December 1937. By March 1938, the portion of the canal on each side of the bridge, as well as neighboring Conduit A, also was completed.

Plates 1 through 5 illustrate the construction of the Smelter Bridge, and include a portion of the original construction drawing (Plate 1), a view of the land prior to construction (Plate 2), the pouring of the concrete deck (Plate 3), and its appearance upon completion (Plates 4 and 5). Additionally, two contemporary views of the bridge are included in order to illustrate that the Smelter Bridge remains largely intact and relatively unchanged (Plates 6 and 7). However, it should be noted that the images offered in this supplemental report represent only a sampling of the documentation that exists for both the Smelter Bridge and the American Canal and were selected as representative views.

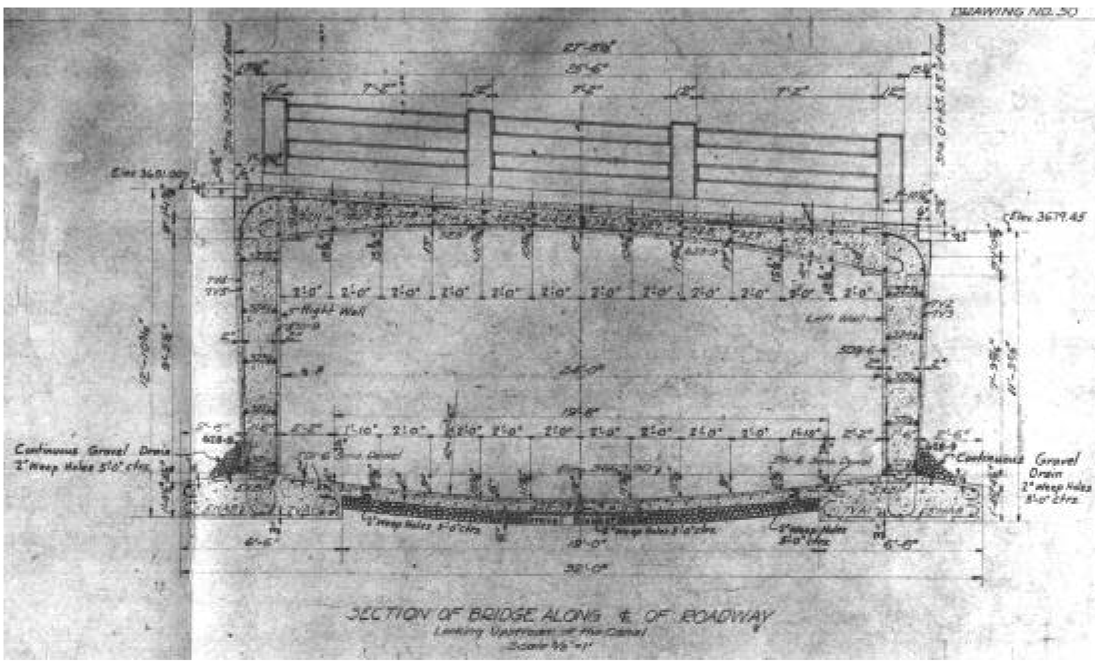


Plate 1: Section of Smelter Bridge, February 10, 1937.
Source: Construction drawing for Smelter Bridge and Transitions. Courtesy of USIBWC.

Plate 2: View prior to construction of the Smelter Bridge or American Canal, looking west, March 31, 1937.
Source: USIBWC Archives, Photograph No. ADC-703.

Plate 3: Pouring the concrete deck for Smelter Bridge, looking southeast, October 29, 1937.
Source: USIBWC Archives, Photograph No. ADC-240.

Plate 4: View of the completed Smelter Bridge and the construction of the American Canal, looking south, December 31, 1937.
Source: USIBWC Archives, Photograph No. 302.

Plate 5: View of the Smelter Bridge and American Canal, looking south, June 11, 1938.
Source: USIBWC Archives, Photograph No. 1586.

Plate 6: View of Smelter Bridge from the eastern side of Paisano Drive, looking northeast, March 20, 2000.

Plate 7: View of Smelter Bridge toward Paisano Drive, looking west, March 21, 2000.

DETERMINATIONS OF EFFECT AND RECOMMENDATIONS

Implementation of any of the four action alternatives, including the newly proposed Open Channel Alternative, would have an adverse effect on the American Canal for purposes of Section 106 of the National Historic Preservation Act due to the removal of original materials (e.g., concrete lining) and demolition of associated structures (e.g., extant Smelter Bridge and abutments of Hart's Mill Road Bridge). With the exception of the two original closed conduits, most of the remaining material composing the canal is in a deteriorated state and of insufficient size to handle the proposed increased capacity. Thus, the replacement of these materials would be necessary in order to eliminate the need for continual repairs and monitoring of the condition of materials. Additionally, although original to the construction of the American Canal, the Smelter Bridge is too narrow to accommodate large trucks that traverse the bridge to enter and exit the ASARCO plant. In fact, vehicular damage is evident on the pier at the northwestern corner of the northern side of the bridge.

Despite the loss of these original materials and structural components, implementation of the Open Channel Alternative would retain the visual character of the canal's original design by maintaining its open channel configuration. In contrast, the other three action alternatives propose disrupting the character of the original design of the canal with the construction of some segments of closed conduits. Although enclosing the uncovered portions of the canal presents a safety advantage, the construction of closed conduits is typically more costly than simply relining the canal with slightly enlarged replacement concrete panels. As such, Alternative 4 would be the most cost effective option and have the least impact on the original character and design of the American Canal, with the exception of the No Action Alternative.

SUMMARY OF EFFECTS

Table 1 on the following page highlights the characteristics of each of the alternatives, and their respective effects. The American Canal System is significant primarily for its association with American history, and much less so for its engineering and construction characteristics. With the exception of the removal of the Smelter Bridge, the proposed open channel alternative will largely preserve the overall visual characteristics and original design and feeling of the canal. For this reason, the length of open channel remaining in each alternative was chosen as the indicator issue.

Table 1

Comparison of Proposed Alternatives

Effects	Alternative 1 (Closed Conduit)	Alternative 2 (Partial Closed Conduit Alternative A)	Alternative 3 (Partial Closed Conduit Alternative B)	Alternative 4 (Open Channel)	Alternative 5 (No Action)
Number of original 1938 bridges removed	1	1	1	1	0
Number of original 1938 bridges remaining	0	0	0	0	1
Number of original 1938 bridge abutments removed	2	2	2	2	0
Number of original 1938 bridge abutments remaining	0	0	0	0	2
Number of original 1938 closed conduits remaining	2	2	2	2	2
Length of closed conduit (in feet)	9,774	5,490	8,210	2,470	2,470
Length of open channel (in feet)	675	4,959	2,239	7,979	7,804
Length of original 1938 open channel lining remaining (in feet)	0	0	0	0	7,804
Sources: Ackerly, 1999. Seiger, 2000.					

PROPOSED MITIGATION MEASURES

For purposes of Section 106 of the National Historic Preservation Act, the American Canal System is significant primarily for its history, and much less so for its engineering and construction characteristics. The proposed open channel alternative will have the least effect of the possible alternatives other than the no-action alternative, since it will largely preserve the overall visual characteristics and original design and feeling of the canal, with the exception of the removal of the Smelter Bridge. Nevertheless, removing the Smelter Bridge will have an adverse effect on the canal.

In order to mitigate the adverse effect of the loss of this bridge, the USIBWC will prepare documentation of the resource according to Level III Historic American Engineering Record (HAER) standards. Preparation of the HAER documentation will draw on the extensive existing documentation and archival records pertaining to the construction of the American Canal. The Headquarters of the USIBWC in El Paso maintains a substantial collection of historic documentary materials, including photographs, maps, and construction drawings. In addition, an uncataloged collection of materials is located in the vaults at the USIBWC American Dam field office. Furthermore, Record Group 76 housed at the National Archives Southwest Region branch in Fort Worth contains assorted monthly reports related to construction, technical, and budgetary progress for various Rio Grande canalization projects, including the American Canal (Hacker 2000). Some of these reports include photographs, maps, and blueprints relevant to these canalization projects.

The HAER documentation of the Smelter Bridge would consist of the following three components:

- Drawings: Creating a sketch plan of the Smelter Bridge, as well as compiling a set of existing drawings of the resource, including the original construction drawings on file at the USIBWC, in order to illustrate the dimensions and historic value of the bridge;

- Photographs: Producing photographs with large-format negatives of exterior and interior views of the Smelter Bridge in either a 4 x 5”, 5 x 7”, or 8 x 10” format. All photographs will be perspective-corrected, contain full captions, and convey both the appearance and significance of the resource; and

- Written data: Completing a one-page HAER Data Form, which includes such information as location, builder, present owner, present use, and other descriptive information about the resource. Additionally, the cultural resources documentation of the American Canal System provided in the initial study prepared by Human Systems Research, as well as in this Supplemental Report, will contribute to the textual record of the Smelter Bridge.

REFERENCES CONSULTED

Ackerly, Neal W.
1999 *Controlling Water on the Border: The American Canal System, International Boundary and Water Commission, El Paso, Texas*. Prepared by Human Systems Research, Inc., for the United States Section, International Boundary and Water Commission.

Hacker, Meg
2000 Director of Archival Operations for National Archives Southwest Region, Fort Worth, Texas. Personal communication with Cynthia Liccese of Parsons Engineering Science, Inc., 19 April 2000.

Seiger, Andrew
2000 Project Engineer, USIBWC. Personal communication via electronic mail with Cynthia Liccese of Parsons Engineering Science, Inc., 28 March 2000.

United States Section, International Boundary and Water Commission (USIBWC)
1936 *American Dam and Canal Construction Progress Photographs*. Albums commence with Volume 1 (October 2, 1936 to May 3, 1937) and conclude with Volume 9 (June 2, 1938 to October 1939). On file at the USIBWC Headquarters, El Paso, TX.

1937 Construction drawings for the “Smelter Bridge and Transitions” (Sheets 2240-49, 2241-49, 2242-49, 2244-49, and 2245-49) dated February 10, 1937. Original drawings on file at the USIBWC Headquarters, El Paso, TX.

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APPENDIX L
(Water and Soil)

- **L.1 – Water and Soil Text**
- **L.2 – Rio Grande Water Quality**
- **L.3 – Canal Flow and Influent Water Quality**
- **L.4 – Canal Effluent Water Quality**
- **L.5 – Groundwater Elevation Maps**
- **L.6 – USIBWC American Dam UST Facility Documents**
- **L.7 – Upper & Middle Open Channel Heavy Metal Concentrations in Groundwater**
- **L.8 – Upper Open Channel Diesel Plume Maps**
- **L.9 – Middle Open Channel Diesel Plume Maps**
- **L.10 – Bell Thunderbird UST Facility Documents**
- **L.11 – Paisano Auto Salvage UST Maps**
- **L.12 – USIBWC International Dam UST Documents**
- **L.13 – Hydrogeologic Cross-section Map**
- **L.14 – Lower Open Channel Soil Data**
- **L.15 – Letter from US Dept. of the Army, Albuquerque District, Corps of Engineers**
- **L.16 – Records of Conversation**

L.1 - WATER AND SOIL TEXT

WATER AND SOIL

1.0 WATER

For over 100 years, people in the El Paso-Juarez area have been mining groundwater from the Hueco Bolson. As many wells in the aquifer have already gone dry, people realize that the renewable Rio Grande will have to become an increasingly important water source for the area. In El Paso, the American Canal serves as the "faucet" to that source of water. A discussion of this source of water follows.

1.1 Background of the American Canal

After the construction of Elephant Butte Dam and reservoir, the 60,000 acre-feet of water allotted to Mexico was delivered at the head gates of the International Dam near downtown Ciudad Juarez. However, individual farmers in Mexico occasionally continued to build small diversion dams across the Rio Grande downstream from El Paso, and illegally diverted part of the American water allotment into Mexican fields. To prevent the diversion of American water, the US Government, through the US Bureau of Reclamation, built the American Canal to divert all of El Paso County's water allotment from the Rio Grande at a point before it passed to Mexican soil. The Canal was originally constructed (1937-1938) for farms located in the southern part of El Paso County, below downtown El Paso on the American side of the international boundary. No other uses for river water were planned at that time when the entire El Paso – Ciudad Juarez Valley was still very rural, with a population not much over 100,000.

Now, more than 60 years later, the population of the valley has risen to estimates approaching three million people. As the cities have expanded, much of the farmland has been converted to urban neighborhoods, with the water rights commonly being leased by the cities. Now, the water of the American Canal is used not only for irrigation of crops but also for providing drinking water for El Paso. In 1999, two water treatment plants operated by the El Paso Water Utilities – Public Service Board (EPWU - PSB) produced approximately 80 MGD (million gallons per day) of potable water from the American Canal. Two planned expansions of the Jonathon Rogers Water Treatment Facility will increase the drinking water use of American Canal water to approximately 160 MGD. Though a third facility is planned in Northwest El Paso's Upper Valley, no expansion of the aging downtown Umbenhauer-Robertson (or "Canal Street") Plant is planned at this time.

At present, the City of Juarez uses rapidly diminishing supplies of groundwater for 100% of its drinking water. However, through the Border Environmental Cooperation Commission, Cd. Juarez is reportedly requesting a grant from the North American Free Trade Bank to build a water treatment facility to purify river water into potable water. Though no official request has been made by Cd. Juarez to take this water from the American Canal, it is likely to happen if the treatment facility is actually built. Similarly, the Mexican Government is reported to be considering requesting its entire 60,000 acre-foot annual water allotment to be delivered from the end of the American Canal near the Riverside Dam, rather than at the International Dam; though Mexico has not made that decision at this time. Withdrawing the water downstream would prevent a huge annual water loss through the crumbling Acequia Madre, and would prevent the drowning of many persons in the Acequia Madre as it flows through Juarez.

1.2 Control of the American Canal

Though the USIBWC presently owns and maintains the American Canal, the Bureau of Reclamation regulates both the flow in the American Canal and the storage of Elephant Butte Reservoir and other Rio Grande dams. Its area customers are the Elephant Butte Irrigation District (EBID), the El Paso County Water Improvement District #1 (EPCWID #1), and the Mexican government. El Paso County farmers and EPWU – PSB request water from EPCWID #1 which then requests a Bureau of Reclamation water release from Elephant Butte. From Elephant Butte, the water reportedly takes approximately three days to reach the American Canal.

1.3 Capacity of the American Canal

Because of the probable future Mexican request to take its annual water allotment at the rate of 335 cfs (cubic feet per second) from the American Canal, the design capacity of the recently-completed, approximately 15.4-mile Rio Grande American Canal Extension (RGACE) was increased from 1200 cfs to 1535 cfs. The original segments of the Canal were designed to carry only 1200 cfs, but can probably no longer carry that volume of water. A recent USIBWC engineering inspection and test found only the two closed conduit segments under West Paisano Drive to be in good enough condition to carry the expected peak flow of 1535 cfs.

Even in this arid area of about seven inches of annual precipitation, flash floods can occur. For example, according to EPCWID #1 personnel, some years ago, the generally dry College Arroyo which drains the area near UTEP was measured at nearly 1500 cfs. That arroyo flows under Interstate-10, and empties into the RGACE immediately south of the study area, and below the International Dam, where the stormwater becomes part of the irrigation allotment downstream.

So in addition to its current use as a source of both agricultural and potable water, the Canal also serves as a flood control structure. In June of 1999, a four-inch rainfall in Northern Do✶a Ana County, New Mexico, produced a Rio Grande flow of over 7000 cfs which threatened to destroy the aging and weakened International Dam. To reduce the force on the dam, the El Paso County Water Improvement District #1 and the Bureau of Reclamation decided to divert approximately 1450 cfs through the American Canal and return it to the river below the International Dam through the wasteway. Luckily, neither the Dam nor the Canal sustained any serious damage in that operation.

Because of canal deterioration and damage, the original 1200 cfs design capacity of the American Canal is thought to be somewhat diminished. Personnel from the USIBWC and the EPCWID #1 have expressed concern that in its present deteriorated condition, some segments of the American Canal (especially the Lower Open Channel) can safely carry much less water in a sustained flow.

The capacity is also somewhat diminished by losses due to evaporation and to water seeping through the cracks in the canal lining. The evaporation rate in the El Paso area can exceed six feet per year, though the swift canal current probably reduces the evaporation rate from the Canal. The evaporation losses from the canal are estimated to be 25 to 40 acre feet per year. No estimate was available for losses through the cracks in the canal lining.

DEMANDS AND CAPACITY OF FIVE AMERICAN CANAL *REPLACEMENT* ALTERNATIVES

Alternatives® / Effects¯	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Maximum water delivery capacity (cfs)	1535	1535	1535	1535	1200**
Current expected average daily water demand (cfs)	750*	750*	750*	750*	750*
Current maximum expected daily water demand (cfs)	1200*	1200*	1200*	1200*	1200*
Storm water capture capacity for peak irrigation day [max capacity - max demand] in cfs	335*	335*	335*	335*	0*
Storm water capture capacity for avg. irrigation day [max cap – avg. demand] in cfs	785*	785*	785*	785*	450*, **
Possible future Mexican water demand from American Canal (cfs)	335	335	335	335	335
Water demand for average irrigation day including Mexican demand (cfs)	1085	1085	1085	1085	1085
Storm water capture capacity on average irrigation day (with Mexican demand) in cfs	450	450	450	450	115

*Does not include possible future 335 cfs delivery to Mexico near Riverside Dam

**It is unknown if this maximum water delivery can be sustained without risking damage to the Canal or "locking up" of the Canal. The sustained water delivery capacity actually may be much lower.

At peak flows of 1200 – 1535 cfs, the great force of the swiftly-flowing water could more easily damage the already deteriorated three-inch-thick concrete. Additionally, stormwater flow from summer monsoon rains is most likely to occur during the peak irrigation and domestic water use months of July and August. A heavy stormwater flow added to a peak irrigation flow would put the damaged segments of the Canal at greater risk. Personnel from the EPCWID #1 suggest that such a flow in the next five years could cause tremendous damage to the existing concrete canal lining. They fear that the time needed to empty the canal, dewater the surrounding area, obtain all necessary permits, and repair or replace a section of the Canal could easily take up to 30 days. The effects of an unplanned 30-day canal repair project during peak irrigation in July could cause up to a $20 million loss in crops in El Paso County, a $300 million loss to El Paso agribusinesses, 500 local farmers going bankrupt, a $1 million loss to EPCWID #1, over $5 million in losses to EPWU-PSB, extreme water restrictions, business disruptions to El Paso water users, and potential legal liability to many agencies.

1.4 Sources of Water in the American Canal

Generally all of the water in the American Canal flows from the Rio Grande through the head gates which open at the American Dam. Except for occasional stormwater runoff from West Paisano Drive and a few other areas, all the water in the Canal comes from the river. During the irrigation season, most of the water in the El Paso region of the Rio Grande has been released from Elephant Butte Reservoir. During the non-irrigation season, very little water is released from Elephant Butte, and much of the flow is "secondary water" such as stormwater, return water from agricultural fields through drainage ditches, or discharge into the river from the Las Cruces Wastewater Treatment Facility. According to EPCWID #1 personnel, 41% of its available annual water is secondary water.

1.5 Hydrogeology

The American Canal, located on the banks of the Rio Grande, forms a small passage between the Franklin Mountains and the Juarez Mountains. The ground water in this area is fed by the recharged alluvial fans located at the Franklin Mountains. The principal aquifers in El Paso County are the Mesilla Bolson which underlies the Rio Grande Valley in Northwestern El Paso County, and the Hueco Bolson which is located generally east of the Franklin Mountains in South and East El Paso. In places, the principal aquifers can be up to 1000 feet thick. The aquifer below the river in the area of the Canal is quite shallow, but plays an important role in connecting the river, the Mesilla Bolson, and the Hueco Bolson. The shallow aquifer is recharged by infiltration from the Rio Grande and from irrigated fields during the irrigation season. Reportedly, up to half the water used locally for agricultural flood irrigation percolates down into the groundwater. The shallow aquifer under the Canal is not used as a source of potable water.

1.6 Depth to Local Groundwater

The local groundwater table fluctuates seasonally from a high near the end of the irrigation season in September to a low after the beginning of the irrigation season in March. In the study area, more groundwater information is available for the Upper Open Channel Area than for the Middle or Lower Open Channel Areas (see Figures 1-3 in Appendix C). A summary of measurements of 1997–1999 groundwater elevations in the Upper Open Channel Area from ASARCO-owned monitor wells is found below. (A more complete set of data is contained in the supporting documents of this Appendix.) The measurements indicate a fluctuation of the local shallow water table of up to 2.8 feet.

1997–1999 GROUNDWATER ELEVATIONS MEASUREMENTS AT ASARCO MONITOR WELLS IN THE UPPER OPEN CHANNEL AREA

Monitor Well ID #	Groundwater Elevation Minimum (Ft.)	Groundwater Elevation Maximum (Ft.)	Fluctuation in Groundwater Elevation (Ft.)
EP-61	3711.14	3713.51	2.37
EP-62	3711.00	3713.34	2.34
EP-63	3710.10	3712.94	2.84
EP-64	3711.73	3713.82	2.09
EP-65	3710.66	3713.07	2.41
EP-66	3711.03	3712.89	1.86

Each season, the lowest ASARCO monitor well groundwater levels were measured during winter. However, the groundwater elevations in February 1999 were approximately two feet higher than in February 1997 and February 1998. Therefore, before any dewatering activities are begun for reconstruction of the Canal, updated groundwater elevations should be determined for more current data. Personnel from ASARCO and Hydrometrics have stated that the bottom of the Upper Open Channel lining is always above the groundwater level.

The Middle and Lower Open Channel portions of the study area do not have extensive sets of groundwater table data. The available data indicates similar seasonal fluctuations of the water table. Because USIBWC personnel report seeing water draining through cracks into the American Canal every autumn after irrigation season ends, it can be assumed that the bottom of the concrete canal lining lies below the water table in open channel segments. That implies the need for dewatering during canal reconstruction.

Available local groundwater elevation data also suggests a groundwater flow generally following the local topography above (typically below arroyos). Overall, groundwater flows from alluvial fans under ASARCO across Paisano towards the Rio Grande. On the Rio Grande flood plain, water generally flows parallel to the river.

1.7 Water Quality

An important chemical parameter commonly analyzed in laboratories to determine water quality is Total Dissolved Solids (TDS). But because the lab testing takes at least 24 hours to obtain results, a field monitoring equivalent, specific conductivity (EC), provides “real time” data. Therefore, EC measurements are very commonly taken and used to monitor water quality. Other common measurements to monitor surface water quality include sodium, chlorides, sulfates, some metals, Biochemical Oxygen Demand (BOD), and coliform bacteria.

1.7.1 Groundwater Quality

As previously mentioned, the local drinking water has historically been pumped from the deep aquifers which typically have better water quality than the Rio Grande. The deeper local aquifers typically have lower concentrations of TDS, sodium, sulfates, chlorides, and other parameters than the surface river source. The shallow local aquifers beneath the American Canal typically have such high concentrations of salts and minerals that they are not used as sources of either drinking water or irrigation water.

1.7.2 Surface Water Quality

Data of chemical analyses for Rio Grande water samples from Elephant Butte Dam to the Tornillo Drain (in southern El Paso County, downstream from the American Canal) were available from both the EPCWID #1 and the EPWU–PSB from as early as 1936. However, the two sets of data were typically collected on different dates. Water is not commonly sampled by USIBWC from head gates of the American Canal. However, river water from under the Courchesne Bridge closely approximates the water quality flowing into the Canal.

1998-1999 RIO GRANDE WATER QUALITY PARAMETERS MEASURED NEAR AMERICAN DAM AT COURSHESNE BRIDGE

Month Sampled	Temperature °C	Field measured EC (μmho/cm^2)	Lab-measured TDS (ppm)
April-99	17.5	1094	676
March-99	15.2	932	615
February-99	7.2	1015	542
January-99	9.7	2100	1291
December-98	15.0	1975	1254
November-98	NA	2070	1123
October-98	18.1	1307	735
September-98	28.7	711	735

Winter EC measurements always showed higher values than summer measurements. The difference in EC measurements is mainly due to the presence of higher Cl, SO_4 and Na concentrations during the winter when a higher percentage of the river flow is from secondary sources (i.e., return flow from fields and effluent from waste water treatment plants at Las Cruces, Anthony, Hatch, etc.) rather than from the water stored at Caballo and Elephant Butte Reservoirs.

A comparison of chemical analyses of American Canal water influent and effluent samples is found in the following chart, which shows the values to be very similar for the various parameters. The slight differences might be attributed to the delay of one day or to other factors. The comparison shows that influent and effluent quality of canal water are nearly identical during irrigation season.

CHEMICAL ANALYSES OF INFLUENT AND EFFLUENT OF AMERICAN CANAL, SAMPLED AUGUST 18 AND 19, 1997

Sampling Location	EC (mmho/cm^2)	TDS (mg/l)	Ca (mg/l)	Na (mg/l)	Cl (mg/l)	HCO_3 (mg/l)	SO_4 (mg/l)
Courchesne Bridge (near Canal head gates)	957	585	58	97	76	191	170
Canal Street Water Plant (near end of Canal)	938	583	69	116	90	183	188

1.8 Environmental Concerns in the Canal Area

Many possible sources of contamination have historically existed along the route of the American Canal. At present, the only large industries operating in the area are brick manufacturing plants across the river, often noted by plumes of dust and smoke. Even the large ASARCO smelter that operated in that location for over 100 years has been temporarily shut down for approximately two years. For decades, a nearby plant produced Portland Cement. Smaller facilities have included a gardening center, a metal plating operation, a bus depot and other facilities. Since the 1880s, railroads have transported chemicals and other hazardous materials on tracks adjacent to the Canal. Until recent years, no records were kept for spills or leaks from trains. For many years after the U.S. ban on the sale of leaded gasoline, some drivers on Paisano Drive (U.S. 85) filled their cars and trucks in Mexico with leaded gasoline, which emitted leaded exhaust. USIBWC's diesel generators were fueled from onsite diesel storage tanks. Further, with prevailing winds generally from the west, other potential contaminants could easily have blown into the area from other sources. In summary, the many sources of potential hydrocarbon and/or heavy metals contamination warrant concern in the Canal area.

The two water-related concerns are the possible infiltration of contaminated groundwater through the existing cracks and joints in the concrete canal lining, and the discharge of potentially poor quality water during reconstruction dewatering activities, per Clean Water Act Section 401. During the non-irrigation season, when groundwater typically leaks into the nearly empty American Canal, USIBWC and TNRCC personnel have sometimes smelled or seen what appeared to be diesel or gasoline leaking into the Canal through the cracks in the canal lining. Some leaks led TNRCC to investigate unknown sources and to identify leaking underground petroleum storage tanks (LUSTs). Indeed, several LUSTs have been identified in the study area. Data from boring logs and monitor wells from UST-related projects are included in Appendix L.

TNRCC-DOCUMENTED HYDROCARBON RELEASES (LEAKING USTs) IN THE STUDY AREA

Location	TNRCC LUST No.	TNRCC Facility No.	Current TNRCC status
ASARCO UST Facilities (2 diesel locations)	• 94594 • 95897	• 0021993 • 0021993	• 1999, Open; Closure Requested • 1999, Open
Paisano Auto Salvage	• 97518	• 0028230	• 1997, Open
USIBWC American Dam UST Facility	• 108049	• 9971	• 1998, Closed
Bell Thunderbird	• 96823	• 47661	• 1999, Open
USIBWC- International Dam UST Facility	• 107801	• Not assigned	• 1997, Closed

1.8.1 Upper Open Channel Groundwater Chemistry

The Upper Open Channel is the northern part of the study area along the island-like Rio Grande flood plain between Paisano Drive and the Rio Grande, from the American Dam to Conduit A. This area includes ASARCO monitoring wells EP-61 to EP-66, and a surface water sample station (SEP-1) at the southern rim of the area. In the southwestern area of this flood plain, an approximately 15 foot high vertical interceptor curtain was installed three to five feet below the groundwater surface. The curtain consists of a 60-mil thick impermeable fabric and a bentonite clay liner.

A dual-phase vacuum extraction system has been installed in the flood plain by ASARCO, and has been operating in this area to remove the liquid and gas phases of a diesel plume. The vacuum extraction remediation system consists of 70 interconnected extraction wells in ten rows, spaced about 50 feet apart. Water samples were obtained from ASARCO monitor wells EP-57 to EP-66 in the area.

Groundwater samples from ASARCO wells EP-61, 62, 63, 64, and 66 showed elevated specific conductivity (EC) measurements as high as an 8420 μmho/cm^2 at EP-64. That suggests a TDS concentration over 5000 mg/l, which would be too high for normal discharge into the river during the irrigation season.

Heavy Metals

In the Upper Open Channel area, several water samples collected from ASARCO monitoring wells contained elevated heavy metal concentrations. As dissolved metals do not migrate in plumes as do hydrocarbons, valid "plume maps" of concentrations of metals cannot be drawn. Area maps that were prepared by ASARCO for each dissolved metal show the average of that metal over four sampling events from August 1997 to May 1998.

As: Arsenic was detected in all the ASARCO water samples along the American Canal. The highest value (11 mg/l) found in EP-66 exceeds the present EPA limit for drinking water of 0.05 mg/l by over 200 times and exceeds the recently-announced future 0.005 mg/l limit by 2000 times. As previously stated, this groundwater is not used as a source of potable water, and is therefore, not subject to the EPA drinking water maximum allowable concentration (MAC). During construction and dewatering activities, migration of some contaminated water towards dewatering pumps is possible due to the lowering of the local water table and a probable increase of the flow gradient towards the monitor wells close to the Canal.

Se: Selenium was also detected in all water samples analyzed from the monitor wells in this study area. Most of the water samples exceeded the EPA drinking water MAC of 0.01 mg/l. The highest Selenium value of 0.62 mg/l was found in the water sample from monitor well EP-64.

Cd: Cadmium levels in most of the ASARCO water samples were below the laboratory detection limit. The highest value was observed at ASARCO SEP-1 with 0.01 mg/l (MAC = 0.005 mg/l). Similar to the arsenic distribution, high Cd concentrations were found in ASARCO EP-49 (43.0 mg/l). Furthermore, a migration of contaminated water from this well towards the Canal would be possible during dewatering operations. However, as detailed in Section 1.8.2, cadmium does not appear to be migrating and does not appear to present a serious threat.

Pb: Lead concentrations in all the monitor wells were either below or near the detection limit (SEP-1). Even the wells which had high detectable heavy metal concentrations, contained low detectable lead concentrations. This reflects the tendency of Pb to be easily absorbed to soil surfaces. Further, lead is not very soluble. The present drinking water MAC for lead is 0.05 mg/l.

Hydrocarbons

The available data from the 1997 diesel spill in this area shows a diesel plume extending from the higher elevations at the ASARCO plant down to the Rio Grande flood plain. Initial data from ASARCO monitor well EP-65 (approximately 200 feet from the Canal) showed a diesel free product thickness of 2.5 feet. The available data for February 2000 shows the diesel plume decreased in ASARCO EP-65 to a thickness of only 0.02 feet. Hydrometrics Inc. (ASARCO environmental consultant) personnel expect the plume to be greatly diminished by the start of the projected canal reconstruction in October 2001.

It should be mentioned that, as a result of the remediation system, the cleanup of those portions of the local ground water aquifer with the highest permeability was successful. However, the less permeable areas may not have been as well remediated by this system.

At the former UST location near the American Dam, seven monitor wells were maintained over a period of three years from 1994 to 1997. In 1994, the highest hydrocarbon concentrations in groundwater samples were detected at MW-6 (approximately 17 ppm BTEX and 7 ppm TPH) and at MW-1 (6.7 ppm BTEX and 43 ppm TPH). High TPH concentrations were also detected at MW-3 (900 ppm). The concentrations of BTEX and TPH found in wells MW-1, MW-3, and MW-6 decreased as a result of the remediation system in operation at the subject facility. The final closure report for this site was submitted in July 1998 (see table titled "Hydrocarbon Releases at TNRCC-Registered Facilities in the Study Area", page 8), and the facility was given TNRCC "closure". This closure status suggests that no further environmental assessment or corrective actions are warranted.

1.8.2 Middle Open Channel Groundwater Chemistry

In contrast to the Upper Open Channel area, the Middle Open Channel area is comprised of only a narrow strip of land between Paisano Drive and the Burlington Northern Santa Fe Railroad tracks. Directly adjacent to the railroad tracks, the land slopes downward from the railroad right-of-way towards the Canal. Monitor Wells EP18-20 and EP 29-40 are located in this portion of BNSF right-of-way.

Groundwater sampled from the monitor well EP-20 showed a very high specific conductivity of 10,090 μmho/cm^2 suggesting a TDS concentration over 6000 mg/l. This saline water would require authorization prior to discharge during dewatering activities. Soil and groundwater pH values are typically near 8 in this area.

Heavy Metals

As: As in the Upper Open Channel area, elevated concentrations of arsenic were detected in the water samples from all monitor wells located in the Middle Open Channel area ("Diesel Plume #1"). The highest concentration in this portion of the Canal was detected at ASARCO Monitor Well EP-20. Similar concentrations of arsenic were also detected at monitor wells EP-43, EP-12, and EP-70 located approximately 250 feet up-gradient from the Canal. Despite their distance from the Canal, the up-gradient locations of these wells suggests a potential migration of the arsenic contamination towards the Canal area during construction dewatering when local groundwater could be drawn towards the canal area.

Se: Selenium was also detected in all monitor wells close to the Canal. The highest selenium concentration near the Canal was 3.7 mg/l which was observed at monitor well EP-35. Monitor well EP-12, located approximately 250 feet upstream from the monitor well EP-35, also showed a selenium concentration of 3.7 mg/l. It should be noted that selenium is commonly found in other distant areas near the Rio Grande.

Cd: The 0.042 mg/l cadmium concentration present in monitor well EP-20 was the only value above the detection limit. A surface water analysis of ASARCO Pond 1 (located approximately 300 feet uphill from the Canal) showed 12.67 mg/l, an extremely high concentration of cadmium. The distance is probably enough that cadmium does not appear to present a serious threat in this area.

Pb: At the elevated local soil pH values of approximately 8, lead typically does not readily dissolve in water, and does not migrate past the top few inches of soil. Not suprisingly, in this area, groundwater concentrations of lead (Pb) were found to be below the laboratory detection limit, and should not present any serious contamination potential for the water pumped during the construction dewatering.

Hydrocarbons

A pump-and-treat system to remediate a diesel plume from a former release at ASARCO consists of pumps, an oil/water separator, and an aerator. For this remediation site, data available from different years indicated a successful cleanup of this diesel plume. The August 1999 data did not indicate any remaining detectable concentrations of BTEX or TPH in any of the subject remediation monitor wells; therefore, TNRCC Site Closure Status has been requested. Pump-and-treat operations are typically most effective in remediating hydrocarbon contamination in areas of high permeability.

1.8.3 Lower Open Channel Groundwater Chemistry

The Lower Open Channel portion is the southernmost segment located between Paisano Drive and the Rio Grande near the International Dam. The land slopes gently from Paisano Drive towards the Rio Grande (see Appendix C). A few commercial buildings and some apartments are located adjacent to the Lower Open Channel area.

Heavy Metals

Project limitations precluded obtaining groundwater samples for metals analyses at this study area. Except for rust and metal debris located on the Paisano Auto Salvage property, heavy metal contamination from current local businesses is not expected to be a concern. However, past on-site practices regarding stored metals are not known.

Hydrocarbons

In the Lower Open Channel portion of the study site, several past hydrocarbon releases have occurred. Analyses were available from releases at Bell Thunderbird, Paisano Auto Salvage, and at the International Dam.

The releases at the adjoining Paisano Auto Salvage and Bell Thunderbird were reported in 1992 and 1991, respectively. TNRCC closure status has apparently not been granted at either location, though monitors wells have not been sampled in several years, reportedly due to bankruptcies of the business owners. Groundwater samples from Paisano Auto Salvage monitor wells (MW1 to MW4) were analyzed in 1992 for BTEX and TPH. The highest BTEX concentration of 1148 ppm and TPH concentration of 104 ppm were detected at MW-2 and MW-3, respectively. For this study, it was not possible to sample the groundwater from the existing monitor wells in 1999 as several feet of scrap metal covered the subject facility.

Available 1997 field measurements for Bell Thunderbird Monitor Wells indicated a gasoline plume thickness of 0.82 feet at MW-1. While laboratory analyses data were not available from 1997, it can be assumed that with a plume nearly one foot thick, the BTEX concentration would be near the saturation concentration of over 1700 ppm. In the July 16, 1999 ENCON sampling event, laboratory analyses of groundwater from Bell Thunderbird Monitor Wells (MW-1, MW-5) indicated a significant decrease to 1.082 ppm. (see Summary below.) It should be noted that for liquids, a measurement of 1 mg/l is approximately equivalent to 1 ppm. It can be assumed that due to natural biodegradation, the hydrocarbon concentrations previously detected at this site have diminished significantly since the earlier sampling events.

1.8.4 Summaries of Hydrocarbon and Metal Concentrations in Groundwater in Three Open Channel Areas

SUMMARY OF RECENT HEAVY METAL MAXIMUM CONCENTRATIONS IN GROUNDWATER FROM MONITOR WELLS IN THREE OPEN CHANNEL AREAS

Contaminants	Upper Open Channel	Middle Open Channel	Lower Open Channel
As	11.0 mg/l	1.05 mg/l	Not available
Se	0.38 mg/l	3.7 mg/l	Not available
Pb	Below detection limit	Below detection limit	Not available
Cd	Below detection limit	0.042 mg/l	Not available

SUMMARY OF RECENT MAXIMUM HYDROCARBON MEASUREMENTS IN MONITOR WELLS IN THREE OPEN CHANNEL AREAS

Contaminants	Upper Open Channel	Middle Open Channel	Lower Open Channel
TPH	Below detection limit	Below detection limit	14 mg/l (Thunderbird)
BTEX	Below detection limit	Below detection limit	1.082 mg/l (Bell Thunderbird)
Diesel plume vertical thickness (in feet)	0.18 feet	Sheen Only	(Not applicable)
Gasoline plume vertical thickness (in feet)	(Not applicable)	(Not applicable)	None observed

2.0 SOILS AND SOIL CHEMISTRY

During the preparation of this document, a 1992 US Geological Survey report prepared for the USIBWC titled "Results of Simulations by a Preliminary Numerical Model of Land Subsidence in the El Paso, Texas Area" was reviewed. However, the purpose of the USGS report was modeling land subsidence that might occur upon replacing the existing earthen canal with a concrete canal in a different area of El Paso County. Differences in soil characteristics and final objectives, i.e., replacing existing concrete canal segments with new segments, restricted the usefulness of the numerical model.

2.1 Soil Types

The soil types in the study area were summarized from ASARCO cross-sections as four general groups. Permeabilities stated are typical for soils of this type and were not obtained for these specific area soils, which can vary widely from published norms.

Gravelly material: (gravelly silt, and silty, to sandy gravel)
This soil predominantly consists of coarse-grained material with lesser proportions of fine-grained material. This soil type, which is common around the arroyo fillings, has a very high permeability (typically 10^{1} to 10^{-1} ft/min or 10^{-2} to 10^{-3} m/s).

Sandy material: (fine-grained to coarse-grained sand, silty sand, and clayey sand)
This soil is dominated by sand and has only minor portions of other materials. The permeability of this material is generally high (typically $10^{-1}$to 10^{-4} ft/min or 10^{-3} to 10^{-6} m/s).

Silty material: (sandy silt, clayey silt, and organic silt)
This soil is relatively dense due to the presence of fine-grained material. Therefore, the permeability of this soil material is generally low (typically 10^{-4} to 10^{-6} ft/min or 10^{-5} to 10^{-8} m/s).

Clayey material: (gravelly clay, sandy clay, and silty clay)
This soil is very dense due to the presence of a high amount of clay minerals, which also contributes to its very low permeability (typically 10^{-6} ft/min or less than 10^{-8}m/s). This type of clayey material generally forms a barrier to water percolation in an aquifer depending on the clay thickness and continuity.

2.2 Soil Chemistry

2.2.1 Upper Open Channel Soil Chemistry

It should be mentioned that this flood plain contains the site of the former Smeltertown which had to be relocated due to lead contamination in the soil. This contamination was caused by long-term air emissions from the ASARCO plant. The 1994 soil sample results from the USIBWC American Dam UST Facility site, which is located directly north of the former Smeltertown, showed very high lead concentrations (3200 mg/l) at the bottom of an excavation site. The source of the lead detected at the American Dam UST Facility is therefore likely related to the air emission concentrations. Other soil samples from 1994 analyzed for hydrocarbons showed BTEX concentrations in the soil of approximately 190 mg/kg. Soil samples taken in 1994 from MW-1A showed a fairly high soil contamination of hydrocarbons around the surface of the water table (6.2 mg/kg benzene, 136.8 mg/kg BTEX and 12,000 ppm TPH). Soil samples taken in 1998 indicated maximum benzene concentrations of up to 130 mg/kg (MW-2) at a distance of approximately 220 feet from the American Canal. Despite the TNRCC closure status of this USIBWC UST site, (probably granted as a result of the steadily decreasing hydrocarbon concentration in the water samples from the monitoring wells [see section 1.6.1]), the soil still might present elevated hydrocarbon concentrations in some locations. Fortunately, the locations with (1998) elevated hydrocarbon concentrations in the soil are some distance from the Canal and therefore, may not be of concern during reconstruction activities. It is possible that water-borne hydrocarbons which migrated towards the American Canal are now trapped in the soils adjacent to the concrete walls of the Canal.

Heavy Metals

Soil data were not available for the area of the ASARCO-owned portion of the Rio Grande flood plain near the facility. Only water samples were analyzed for heavy metals. The water samples from this area contained significant concentrations of arsenic and selenium. This may suggest that the vicinity soil also has elevated concentrations of arsenic and selenium. It may be that the groundwater carrying elevated concentrations of heavy metals is being stopped in its flow path towards the river by the concrete walls of the American Canal. Arsenic and selenium concentrations from the groundwater are likely to continue to become trapped in the fine sand and clay particles within the subsurface soil. The true extent of heavy metal contamination in the soil is not fully known.

Hydrocarbons

At the site of the ASARCO Diesel Plume #2, no soil samples were collected and analyzed for hydrocarbons, but it is likely that diesel may remain adhered to the soils within the area of the plume. It appears that the diesel plume at this site has not reached the soil immediately adjacent to the American Canal. But without additional soil samples from borings near the levee of the Canal, hydrocarbon migration to groundwater and soil near the Canal cannot be ruled out.

Soil to be excavated along the Upper Open Channel of American Canal might or might not contain elevated concentrations of both heavy metals and hydrocarbons.

2.2.2 Middle Open Channel Soil Chemistry

The discussion related to heavy metals and hydrocarbons in the Upper Open Channel is also valid for the Middle Open Channel area. However, TNRCC Closure status has been requested for ASARCO's Diesel Plume #1 because hydrocarbon concentrations have been reduced to non-detection levels.

2.2.3 Lower Open Channel Soil Chemistry

Soil analyses were available from Bell Thunderbird, but not from Paisano Auto Salvage or the International Dam UST. Using a geoprobe, ENCON International obtained soil samples on July 16, 1999, from the narrow eastern levee of the American Canal (see results in Appendix L.14). The soil samples were analyzed for both hydrocarbons and heavy metals. The heavy metals laboratory results indicated that only lead showed slightly elevated values, which should not present a contamination hazard due to its relatively immobile chemical behavior in soil.

3.0 CONTAMINATION POTENTIAL AND CONCLUSIONS

The contamination potentials for the three Open Channel areas concerning groundwater and soils are assessed separately. The evaluation of the available data for groundwater and soil is summarized in the tables that follow.

Upper Open Channel: This segment of the construction site is located close to several potential contaminants in groundwater and soil. The highest arsenic concentrations and other hydrocarbon contaminants in the segment were detected close to the Canal reconstruction site.

Middle Open Channel: This segment of the site has a high selenium contamination potential in ground water and soil. The highest selenium concentrations for the whole project area were found close to the Middle Open Channel portion of this Canal. Additionally, it is possible that hydrocarbons are still of local concern for both soil and groundwater, despite the documented satisfactory cleanup results.

Lower Open Channel: In this segment of the study area, the concern includes possible hydrocarbon contaminants in both groundwater and soil. There is no conclusive proof that the hydrocarbon contaminants have completely degraded or migrated offsite. Heavy metals are not likely in either soil or water in this area.

GROUNDWATER CONTAMINATION POTENTIAL IN OPEN CHANNEL AREAS

Contaminant	Risk		
	Upper Open Channel	Middle Open Channel	Lower Open Channel
Heavy metals			
As	Medium	Low	Unknown
Se	Low	High	Unknown
Cd	Low	Medium	Unknown
Pb	Low	Unlikely	Low
Hydrocarbons			
Diesel	High	Low	Low
Gasoline	Unlikely	Unlikely	Medium

SOIL CONTAMINAT ION POTENTIAL IN OPEN CHANNEL AREAS

Contaminant	Risk		
	Upper Open Channel	Middle Open Channel	Lower Open Channel
Heavy metals			
As	Low	Low	Low
Se	Unlikely	Low	Low
Cd	Unlikely	Low	Low
Pb	Unlikely	Low	Low
Hydrocarbons			
Diesel	Medium	Medium	Medium
Gasoline	Unlikely	Unlikely	Low

In Summary, there is a possibility of localized hydrocarbon or heavy metal contamination of groundwater or soil in all three Open Channel areas. These contaminants could be encountered during construction activities and could also contaminate water in the existing Canal through infiltration through cracks.

4.0 WATER AND SOIL EFFECTS OF FIVE ALTERNATIVES

The planned reconstruction activities would be completed within the October through February season when water is not used for water treatment or for irrigation. None of the construction alternatives is likely to have any serious long-term effects on the water quality of the Rio Grande. During planned reconstruction activities, water pumped and soil excavated can be sampled and tested regularly. The previously described 15-20 gpm pump-and-treat operation at ASARCO is available to treat any hydrocarbon-contaminated water encountered in the areas of the two ASARCO diesel plumes. ASARCO's lined pond will be available to store and evaporate any water with high concentrations of heavy metals in areas of previous ASARCO-related metal concentrations. Discharge of high-TDS water can be authorized during nonirrigation season only. Water with high TDS is not usable for either irrigation or potable water.

EFFECTS TO CANAL WATER QUALITY
FROM FIVE AMERICAN CANAL REPLACEMENT ALTERNATIVES

Alternatives® Effects¯	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Is there a long-term risk of heavy metal contamination of canal water via adjacent groundwater or soil?	No	No	No	No	Yes
Is there a long-term risk of hydrocarbon contamination of canal water via adjacent groundwater or soil?	No	No	No	No	Yes
During planned reconstruction during non-irrigation season or emergency rebuilding (likely during irrigation season), will high-TDS groundwater need treatment before discharge into the river?	No	No	No	No	Yes
During planned reconstruction or emergency rebuilding, will ASARCO facilities be available for treating or storing contaminated groundwater from Upper and Middle Open Channel segments?	Yes	Yes	Yes	Yes	No

During peak irrigation and water production seasons, an emergency canal shutdown and repair caused by possible contaminated groundwater entering the undersized and deteriorating canal would drastically disrupt the lives of all El Pasoans. Therefore, the lost daily EPWU–PSB Drinking Water Production was chosen as the indicator to this resource.

During planned dewatering activities, EPCWID #1 can request BOR to release stored water to minimize the possibility of exceeding CWA Section 401 requirements for discharging high TDS waters into live streams. During unplanned emergency dewatering activities, water from Caballo Dam, which takes three days to flow to the American Canal head gates, might not arrive in time to assist with CWA Section 401 compliance.

During planned dewatering activities, the TDS concentration can be estimated in the field during construction by measuring specific conductivity (EC). Extremely high TDS - water can be pumped to ASARCO's massive lined oxidation pond eliminating the need for CWA compliance certification.

EFFECTS TO WATER AND SOIL RESOURCES OF FIVE AMERICAN CANAL RECONSTRUCTION ALTERNATIVES

Alternatives® Effects¯	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Maximum water delivery capacity (cfs)	1535	1535	1535	1535	1200*
Storm water capture capacity for peak irrigation day without Mexican allotment (cfs)	335	335	335	335	0
Expected # of major canal failures during peak irrigation season (requiring 1 month closure for emergency repairs) within the next 5 years	0	0	0	0	1
Direct financial loss to EPCWID#1 farmers during 1-month disruption of service & canal repair	$0	$0	$0	$0	$20 Million
"Ripple effect" loss to El Paso economy during 1-month disruption of service & canal repair	$0	$0	$0	$0	$300 Million
Estimated number of bankruptcies among farmers due to farm losses from 1-month disruption of service & canal repair	0	0	0	0	500
Loss of daily drinking water production by 2 EPWU-PSB Board plants during 1-month disruption of service & canal repair	0	0	0	0	80 -120 MGD
Lost Revenue to EPWU-PSB during 1-month disruption of service & canal repair	0	0	0	0	$3.6 - $5.4 Million
Additional EPCWID#1 costs during disruption of service & canal repair, not including possible lawsuits	$0	$0	$0	$0	$1 Million
Additional tax levied on EPCWID#1 customers to pay for canal failure & repair (per acre)	0	0	0	0	$15
Is there a long-term risk of heavy metal or hydrocarbon contamination of canal water via adjacent groundwater or soil?	No	No	No	No	Yes
During planned reconstruction or emergency rebuilding, will high-TDS groundwater need treatment before discharge into the river?	No	No	No	No	Possibly
During planned reconstruction or emergency rebuilding, will ASARCO facilities be available for treating or storing contaminated groundwater for Upper and Middle Open Channel segments?	Yes	Yes	Yes	Yes	No

** It is unknown if this maximum water delivery can be sustained without risking damage to the Canal or "locking up" of the Canal. The sustained water delivery capacity actually may be much lower.

5.0 MITIGATIONS

- Beginning canal reconstruction at the upper portion of each channel segment would minimize the inflow of any contaminated groundwater in that section.
- During soil excavation activities, soil and air should be monitored regularly for volatile hydrocarbons and heavy metals.
- During dewatering activities, groundwater should be field-tested regularly for specific conductivity to check for relative TDS values in water to be discharged.
- During dewatering activities, if groundwater samples have a hydrocarbon odor or sheen, they should be diverted to an oil-water separator and pretreated prior to discharge into the river or possibly into the ASARCO stormwater pond.
- To further protect the Canal from infiltration, an impermeable liner and/or clay fill should be placed prior to the construction of new canal segments.
- The Stormwater Pollution Prevention Plan will include "Best Management Practices" such as hay bales, silt fences, or other similar erosion prevention techniques, as requested by the Texas Parks and Wildlife Department.

6.0 RECOMMENDATIONS

Even in the arid El Paso climate, any reconstruction alternatives could include working during times of rainfall. Therefore, a construction Stormwater Pollution Prevention Plan (SWP3) must be prepared and submitted to the City of El Paso. A Texas Pollutant Discharge Elimination Permit (TPDES) must be requested from EPA prior to submitting the SWP3. As the area has no wetlands, a dredging permit from the US Army Corps of Engineers (per CWA 404) is not expected to be required. See letter from Corps of Engineers at Appendix G.

7.0 SOURCES OF INFORMATION FOUND IN THIS SECTION

Data and maps used for this study were made available by TNRCC and by the following companies and institutions:

ASARCO, 2699 West Paisano Drive, (east of Paisano)

- Chemical analyses of groundwater samples for the years 1997 to 1999, for hydrocarbons (groundwater) and for heavy metals,
- Groundwater elevations between February 1997 and February 1999,
- One geological cross-section, and boring logs of several monitor wells in Upper Open Channel and Middle Open Channel.

Bell Thunderbird, 2000 West Paisano Drive, (west of Paisano)

- Chemical analyses of groundwater samples for hydrocarbons (1997-1999) and for heavy metals (calculated average for the quarterly samples taken between August 1997 and May 1998),
- Groundwater elevations for August 1992 and January 1997,
- Boring log for monitor well MW-1.

Paisano Auto Salvage, 1908 West Paisano Drive (west of Paisano)

- Chemical analyses of 1992 groundwater sample for hydrocarbons,
- Ground water elevations for 1992.

USIBWC, American Dam UST Facility, 2616 Paisano Drive (west of Paisano)

- Chemical analyses for 1994 to 1998,(groundwater, and soil samples for hydrocarbons) and soil samples for hydrocarbons for heavy metals,
- Boring log for monitor well MW-1A.

USIBWC, International Dam UST Facility (West of Paisano)

Groundwater elevations (year unknown).

El Paso County Water Improvement District #1 (EPCWID #1)

Chemical analyses of Rio Grande water samples from Elephant Butte Reservoir to Tornillo Drain for September 1998 to April 1999.

El Paso Water Utilities-Public Service Board (EPWU-PSB)

Chemical analyses of Rio Grande water samples at the Courchesne Bridge (1936-1997) and at the Canal Street Water Plant (1986-1999).

ENCON International, Inc.

- Chemical analyses of groundwater samples from Bell Thunderbird.
- Chemical Analyses of soil samples from geoprobe samples for heavy metals.
- Geoprobe soil logs GP-1 to GP-6.
- Bell Thunderbird monitor wells MW-1, MW-6 (1999).

L.2 – RIO GRANDE WATER QUALITY

Summary Water Quality Data from Caballo Dam to American Dam

(Source: EPCWID #1)

SUMMARY OF WATER QUALITY DATA
FROM CABALLO DAM TO AMERICAN DAM
(Source: El Paso County Water Improvement District #1)

Sample Location	Date	Field Tests		Laboratory Analytical Results									
		Temp	EC	TDS	pH	Na	Ca	Mg	SAR	Cl	SO_4	NO_3	PO_4
		°C	μohm/cm^2	mg/L		mg/L	mg/L	mg/L	ratio	mg/L	mg/L	mg/L	mg/L
Caballo Cable (Downstream from Caballo Dam where water is stored)	Oct-98	18.0	623	410	8.30	65.6	46.4	10.1	2.20	47.5	111	1.24	<MDL
	Nov-98	unavailable	unavailable	460	8.08	70.3	49.9	11.8	2.32	58.8	111	2.10	<MDL
	Dec-98	14.4	889	504	7.95	104	51.6	10.5	3.44	61.2	108	2.46	<MDL
	Jan-99	4.9	1220	709	7.92	166	53.6	16.8	5.05	61.2	108	2.46	<MDL
	Feb-99	7.4	850	482	8.24	80.4	17.3	<MDL	unavailable	107	121	3.29	<MDL
	Mar-99	11.6	815	506	8.29	89.5	28.6	12.9	3.48	90.9	120	1.56	<MDL
American Dam (Head gates of American Canal)	Oct-98	27.9	2070	767	8.23	139	75.1	16.9	3.75	124	227	1.45	<MDL
	Nov-98	unavailable	unavailable	1173	8.17	216	98.9	21.4	5.12	175	331	12.1	<MDL
	Dec-98	16.9	1970	1244	8.29	293	108	23.7	6.63	194	342	11.7	1.30
	Jan-99	12.5	2090	1263	8.11	293	95.6	23.4	6.94	250	399	14.4	1.13
	Feb-99	9.4	1170	641	7.97	131	26.4	<MDL	unavailable	145	216	7.84	1.49
	Mar-99	15.6	1093	749	814	134	35.4	15.2	4.73	138	195	4.70	0.985

<MDL = Below Lab Detection Limit

L.3 – CANAL FLOW AND INFLUENT WATER QUALITY

- **Selected Rio Grande Water Quality Data Collected from Courchesne Bridge (1936-1997)**

  (Source: EPWU - PSB)

- **Diversion from the Rio Grande into American Canal at El Paso, Texas**

  (Source: USIBWC)

SELECTED RIO GRANDE WATER QUALITY DATA COLLECTED FROM COURCHESNE BRIDGE (1936 - 1996)
(Source: EPWU- PSB)

Date	SiO_2 mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	HCO_3 mg/l	CO_3 mg/l	SO_4 mg/l	Cl mg/l	F mg/l	NO_3 mg/l	PO_4 mg/l	Rept TDS mg/l	Hard mg/l	Sp. Cond.	pH	Calc TDS mg/l
Jan-36	***	130	31	303	***	301	Tr	418	307	***	Tr	***	1412	453	2140	8.3	1490
Feb-36	***	132	26	243	***	270	Tr	382	243	***	4.3	***	1236	437	1840	8.1	1300
Mar-36	***	100	20	163	***	218	0	297	145	***	3.1	***	978	333	1360	7.7	946
Apr-36	***	99	21	154	***	206	0	312	125	***	3.1	***	853	333	1300	7.6	920
May-36	***	97	20	142	***	203	Tr	289	126	***	4.3	***	853	323	1270	8.0	881
Jun-36	***	94	21	139	***	202	0	281	108	***	4.3	***	758	322	1230	7.9	849
Jul-36	***	93	18	139	***	208	0	270	115	***	3.1	***	816	307	1200	7.6	846
Aug-36	***	89	19	132	***	199	0	260	112	***	4.3	***	677	300	1100	7.9	815
Sep-36	***	96	20	154	***	223	Tr	246	152	***	1.2	***	816	322	1280	8.1	892
Oct-36	***	125	24	246	***	274	0	368	242	***	1.9	***	1118	412	1830	7.6	1281
Nov-36	***	126	29	268	***	289	Tr	400	275	***	1.2	***	1317	435	2000	7.9	1388
Dec-36	***	127	32	254	***	287	0	396	256	***	3.1	***	1265	447	1870	7.8	1355
Jan-56	***	154	38	788	***	329	0	958	706	***	<0.6	***	2891	539	4250	8.1	2973
Feb-56	***	166	47	877	***	323	0	1067	806	***	0.6	***	3178	607	4700	8.2	3287
Mar-56	***	130	27	191	***	195	0	446	169	***	1.2	***	1133	437	1630	8.0	1159
Apr-56	***	114	26	168	***	199	0	403	126	***	<0.6	***	993	390	1430	8.1	1036
May-56	***	124	28	307	***	214	0	528	263	***	0.6	***	1405	426	2090	8.0	1465
Jun-56	***	106	24	173	***	192	0	375	143	***	0.6	***	964	364	1430	8.0	1014
Jul-56	***	92	23	168	***	187	0	339	137	***	0.6	***	927	325	1350	8.1	947
Aug-56	***	99	21	204	***	201	0	357	172	***	0.6	***	1008	334	1530	7.9	1055
Sep-56	***	94	23	205	***	195	0	368	176	***	<0.6	***	1015	331	1530	7.8	1061
Oct-56	***	165	37	861	***	262	0	1104	770	***	0.6	***	3199	563	4580	8.0	3200
Nov-56	***	168	38	858	***	274	0	1102	769	***	<0.6	***	3163	574	4610	8.2	3209
Dec-56	***	168	40	787	***	302	Tr	999	726	***	<0.6	***	2986	585	4400	8.5	3022

***Not Tested

SELECTED RIO GRANDE WATER QUALITY DATA COLLECTED FROM COURCHESNE BRIDGE (1936 - 1996)
(Source: EPWU- PSB)

Date	SiO_2 mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	HCO_3 mg/l	CO_3 mg/l	SO_4 mg/l	Cl mg/l	F mg/l	NO_3 mg/l	PO_4 mg/l	Rept TDS mg/l	Hard mg/l	Sp. Cond.	pH	Calc TDS mg/l
Jan-76	***	100	22	200	***	252	0	340	180	***	1.9	***	1037	340	1650	8.0	1096
Feb-76	***	100	21	180	***	262	0	320	150	***	0.6	***	986	336	1450	7.9	1034
Mar-76	***	82	16	120	***	212	0	210	100	***	1.2	***	684	271	1040	7.5	741
Apr-76	***	80	15	110	***	200	0	220	84	***	***	***	662	261	1010	7.7	709
May-76	***	76	15	100	***	204	0	200	74	***	0.6	***	588	251	961	7.7	670
Jun-76	***	81	16	120	***	218	0	230	85	***	0.6	***	662	268	1040	7.8	751
Jul-76	***	86	17	130	***	224	0	240	96	***	0.6	***	728	285	1110	8.0	794
Aug-76	***	83	16	120	***	224	0	220	89	***	1.2	***	691	273	1060	8.0	753
Sep-76	***	96	20	170	***	250	0	300	130	***	1.9	***	919	322	1370	8.1	968
Oct-76	***	120	31	290	***	290	0	490	240	***	1.2	***	1353	427	2060	8.2	1462
Nov-76	***	120	32	300	***	270	0	500	270	***	1.2	***	1471	431	2160	8.1	1493
Dec-76	***	130	32	340	***	300	0	530	270	***	1.2	***	1530	456	2260	8.0	1603
Jan-96	15	73	18	160	8.3	228	0	260	150	0.6	3.9	0.52	828	260	1310	8.3	902
Feb-96	12	66	17	130	7.1	197	9.0	200	120	0.7	2.1	0.46	698	230	1110	8.2	749
Mar-96	11	56	13	95	5.8	196	0	160	79	0.7	1.4	0.09	557	190	878	8.3	607
Apr-96	11	65	15	110	5.2	220	0	190	95	0.7	1.0	0.06	624	220	1020	8.2	702
May-96	12	62	14	120	6.8	198	7.0	200	95	0.6	***	***	***	210	1060	8.4	703
Jun-96	12	49	11	86	6.3	155	0	150	66	0.6	1.6	0.09	498	170	801	7.9	526
Jul-96	17	60	14	110	7.1	195	4.0	190	89	0.7	0.8	0.64	627	210	1000	8.3	671
Aug-96	16	57	13	100	7.4	181	0	180	85	0.6	2.0	1.53	588	200	963	8.0	626
Sep-96	18	72	17	150	7.5	217	4.0	240	120	0.7	1.4	0.58	766	250	1220	8.4	830
Oct-96	24	110	27	270	9.4	189	***	440	260	0.7	3.7	0.18	1330	390	2000	8.6	1310
Nov-96	24	140	32	400	12	321	0	540	400	0.8	4.9	0.43	1740	480	2660	8.3	1851
Dec-96	22	140	31	410	11	299	8.0	570	430	0.7	3.9	0.43	1870	480	2810	8.5	1904

***Not Tested

Diversions from the Rio Grande into American Canal at El Paso, Texas
(Source: USIBWC)

Mean Daily Discharge in Cubic Feet per Second 1995

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	118.7	249.4	261.0	706.4	854.7	649.9	1084.3	946.6	928.9	755.8	385.0	3.2
2	114.8	252.9	222.2	653.4	914.8	1063.1	1140.8	953.6	907.7	794.7	337.3	3.2
3	103.1	246.2	406.2	586.3	897.1	1155.0	1109.0	1102.0	950.1	755.8	306.6	3.2
4	121.9	229.2	445.0	547.5	851.2	1151.4	1155.0	1218.5	1133.8	724.1	290.0	2.8
5	133.9	225.0	476.8	579.2	812.4	1094.9	1119.6	1027.8	1140.8	657.0	285.4	2.8
6	151.9	215.8	522.7	540.4	798.2	1006.6	1006.6	1130.2	1109.0	628.7	301.3	2.8
7	155.1	198.9	533.3	466.2	865.3	883.0	1070.2	1162.0	996.0	614.6	286.1	2.5
8	142.0	217.6	543.9	501.5	808.8	907.7	1087.9	1109.0	900.7	653.4	275.8	2.5
9	161.4	272.0	632.2	533.3	734.7	1006.6	1098.5	1041.9	890.1	657.0	255.0	2.5
10	156.5	367.3	586.3	434.4	706.4	1031.3	1091.4	943.0	826.5	642.8	241.9	2.5
11	143.8	250.4	561.6	406.2	727.6	1045.5	1013.7	914.8	1102.0	596.9	237.4	2.5
12	139.2	226.0	702.9	392.1	755.8	1059.6	1027.8	886.5	1147.9	621.6	227.8	2.5
13	132.1	226.8	826.5	416.8	706.4	964.2	978.4	1158.5	1112.6	646.4	220.0	2.5
14	129.3	192.8	844.1	547.5	653.4	879.5	999.6	1218.5	1063.1	649.9	219.0	2.5
15	128.6	232.4	784.1	547.5	688.7	865.3	1073.7	1169.1	1063.1	681.7	206.6	2.5
16	131.4	395.6	883.0	600.4	762.9	918.3	1080.8	1176.2	1126.7	720.5	197.4	2.5
17	120.4	356.7	897.1	671.1	727.6	974.8	1094.9	1155.0	1109.0	702.9	195.7	2.5
18	116.9	254.0	904.2	667.5	911.3	999.6	1073.7	1183.2	978.4	731.1	193.6	2.5
19	113.4	225.0	875.9	625.2	1063.1	1013.7	1017.2	1190.3	974.8	734.7	192.1	2.5
20	118.0	251.5	883.0	586.3	1094.9	1013.7	1010.2	1147.9	911.3	766.4	195.0	2.5
21	285.0	328.5	943.0	717.0	1119.6	950.1	1066.7	1119.6	851.2	893.6	186.1	2.5
22	317.2	278.0	996.0	695.8	1080.8	830.0	1070.2	1070.2	791.2	921.9	185.8	2.5
23	329.5	251.1	1006.6	717.0	1024.3	914.8	1063.1	978.4	805.3	879.5	186.5	2.5
24	334.5	226.0	981.9	695.8	904.2	1017.2	1073.7	967.8	812.4	794.7	140.9	2.5
25	340.8	241.6	967.8	681.7	858.3	1020.7	1087.9	932.4	791.2	773.5	120.1	2.5
26	363.8	219.7	900.7	642.8	883.0	1010.2	1041.9	946.6	713.5	770.0	182.3	2.5
27	406.2	262.4	865.3	589.8	893.6	928.9	1003.1	1024.3	664.0	766.4	182.3	2.5
28	367.3	254.7	858.3	515.7	883.0	865.3	1003.1	1155.0	625.2	755.8	173.1	2.5
29	356.7	N/A	890.1	614.6	939.5	943.0	981.9	1105.5	646.4	561.6	57.9	2.5
30	300.6	N/A	770.0	664.0	851.2	953.6	989.0	1066.7	801.8	487.4	3.2	2.5
31	266.7	N/A	695.8	N/A	720.5	N/A	996.0	978.4	N/A	413.2	N/A	2.5

N/A = Not Available

Note: Original USIBWC Metric Data converted at 1 cms = 35.32 cfs

L.4 – APPROXIMATION OF CANAL EFFLUENT WATER QUALITY

Robertson & Umbenhauer "Canal Street Water Treatment Plant

Selected Influent Water Quality Data (Oct-Mar, 1991-1999)

(Source: EPWU - PSB)

APPROXIMATION OF CANAL EFFLUENT WATER QUALITY
Robertson & Umbeuhauer ("Canal Street") Water Treatment Plant Influent Data
(Selected Dates October - May, 1991 - 1999)
(Source: EPWU- PSB)

Date	SiO_2 mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	HCO_3 mg/l	CO_3 mg/l	SO_4 mg/l	Cl mg/l	F mg/l	NO_3 mg/l	PO_4 mg/l	Rept TDS mg/l	Hard mg/l	Sp. Cond.	pH
Mar-91	***	79	10	156	***	223	4.9	231	102	***	***	***	***	238	***	8.42
Nov-91	28	124	28	273	11	281	19	420	228	0.9	4.2	0.1	1247	428	1950	8.38
Mar-92	11	68	13	132	7.0	178	12	218	95	0.8	1.5	<0.09	635	224	1093	8.43
Oct-92	15	104	21	191	8.2	255	16	298	150	1.3	3.0	0.1	917	344	1440	8.71
Feb-93	15	90	17	180	7.9	229	2.4	246	180	0.7	2.9	0.1	840	296	1290	8.40
Mar-93	13	65	13	119	6.1	181	4.8	179	100	0.6	1.3	0.1	578	216	930	8.44
Oct-93	17	89	19	181	8.3	239	7.2	288	140	0.7	3.4	0.1	854	300	1340	8.50
Nov-93	28	118	24	254	11	276	6.0	404	215	0.7	3.7	0.1	1171	392	1720	8.50
Dec-93	25	121	27	269	10	290	7.2	411	230	1.1	4.2	0.1	1224	414	1770	8.50
Feb-94	10	71	14	130	7.3	181	3.6	197	115	0.7	1.9	<0.09	629	236	1020	8.43
Mar-94	6.0	63	12	118	6.0	176	1.2	166	100	0.6	1.5	0.2	554	204	875	8.30
Oct-94	15	71	12	123	8.1	173	2.4	197	110	0.6	3.1	<0.09	613	230	1110	8.37
Nov-94	20	122	22	232	9.9	290	2.4	374	200	0.7	4.0	0.1	1109	394	1720	8.42
Dec-94	27	126	25	286	11	295	3.6	444	238	0.8	4.7	0.1	1284	418	1915	8.37
Jan-95	18	127	24	315	10	290	4.8	504	250	0.9	5.7	0.1	1384	416	2080	8.33
Mar-95	8.0	65	11	100	5.5	176	2.4	145	85	0.6	1.0	<0.09	501	206	852	8.41
Sep-95	15	81	16	157	6.6	210	7.2	238	125	0.6	1.9	<0.09	736	268	1150	8.43
Nov-95	21	120	25	268	6.7	300	2.4	397	230	0.7	5.2	0.1	1203	404	1860	8.42
Jan-96	14	80	18	162	5.6	210	4.8	238	145	0.7	4.4	0.1	762	276	1170	8.36
Feb-96	12	72	16	138	5.9	200	3.6	196	120	0.7	4.1	0.1	655	246	1040	8.39
Mar-96	12	65	12	109	6.0	188	3.6	155	93	0.6	1.6	<0.09	539	214	860	8.32
Feb-97	17	79	17	162	8.2	202	7.2	206	165	0.8	3.4	0.1	748	268	1270	8.43
Mar-97	15	65	12	107	6.3	183	2.4	141	103	0.7	1.6	0.1	529	212	914	8.33
Mar-98	12	71	11	126	7.0	200	3.6	177	99	0.68	7.2	0.08	601	222	980	8.48
Oct-98	12	71	16	140	7.1	212	3.6	230	110	0.66	4.5	0.09	690	240	1100	8.44
Mar-99	11	63	13	109	7.2	190	2.4	170	87	0.7	43	0.18	550	210	910	8.40

***Not Tested

L.5 – GROUNDWATER ELEVATION MAPS

American Canal Area 1997-1999

(Source: ASARCO)

NORTH

SCALE

(In Feet)

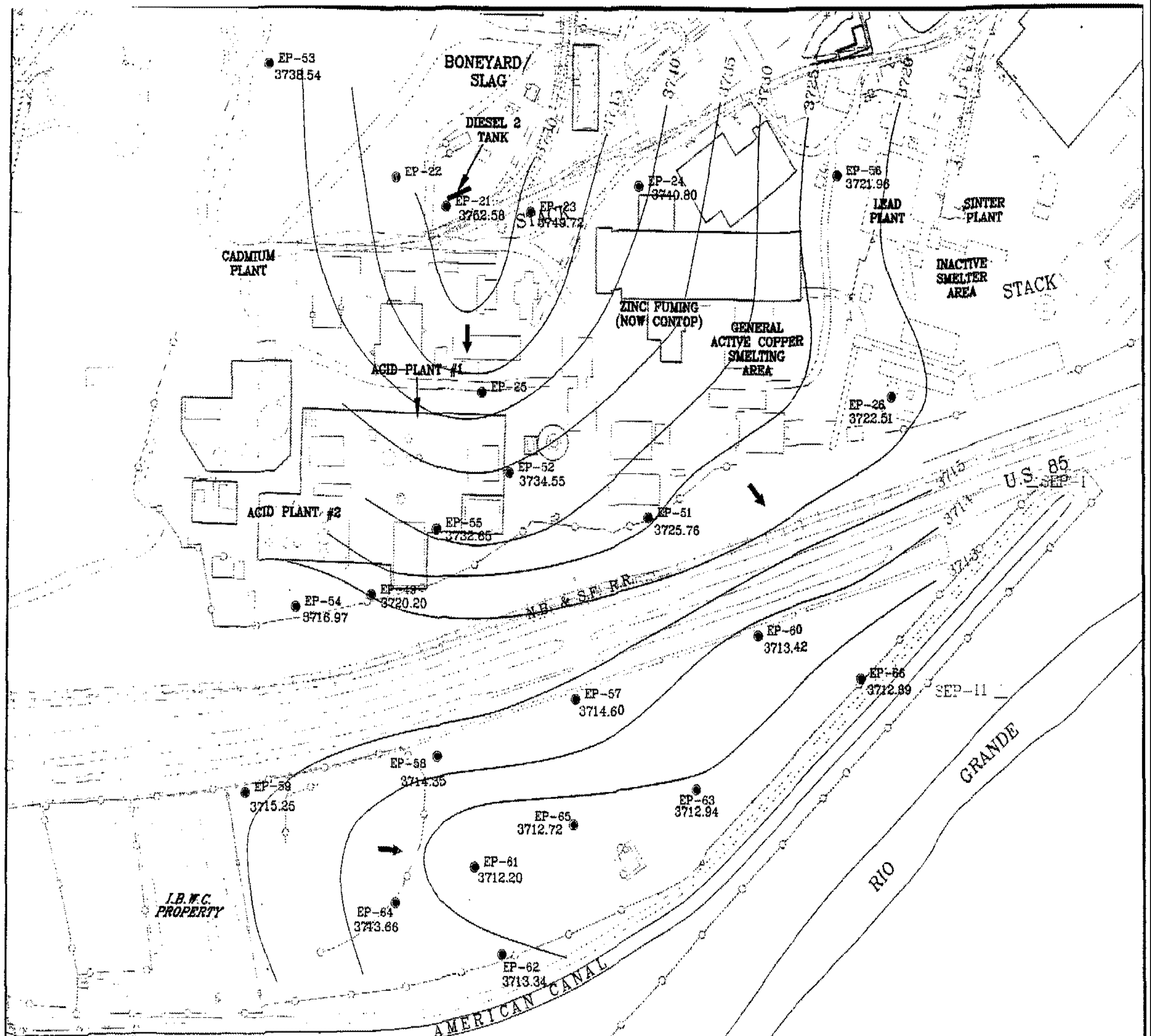
200 0 200

GROUNDWATER FLOW DIRECTION

3730-3715 — GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715-3713 — GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3752.58
EP-22	ABANDONED
EP-23	3749.72
EP-24	3740.80
EP-25	BLOCKED
EP-26	3722.51
EP-49	3720.20
EP-51	3725.76
EP-52	3734.55
EP-53	3738.54
EP-54	3716.97
EP-55	3732.65
EP-56	3721.96
EP-57	3714.60
EP-58	3714.35
EP-59	3715.25
EP-60	3713.42
EP-61	3712.20
EP-62	3713.34
EP-63	3712.94
EP-64	3713.66
EP-65	3712.72
EP-66	3712.89



ASARCO INCORPORATED
DIESEL NO.2 REMEDIATION SITE
1999 ANNUAL REPORT
EL PASO, TEXAS

GROUNDWATER ELEVATION MAP
FEBRUARY 1999

FIGURE A4-1

UPDATE TIME: 9:30
128\0927\065\0180\TUC\042999\I:\DRFT\ 92799U18.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

SCALE

(In Feet)

200 0 200

(Approximate Only)

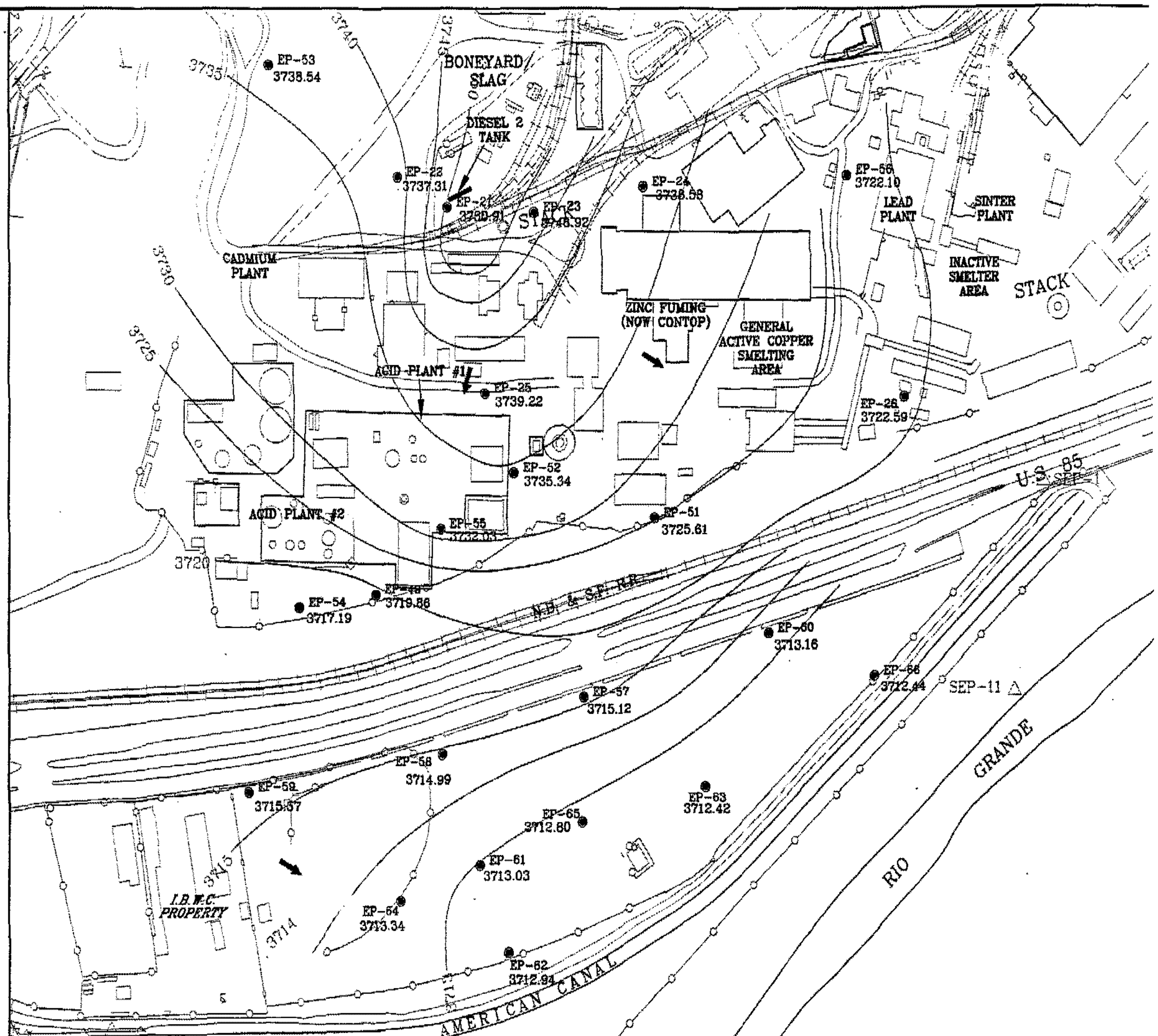
CONTOUR INTERVALS

GROUNDWATER FLOW DIRECTION

3750-3715 GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715-3713 GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3750.91
EP-22	3737.31
EP-23	3748.92
EP-24	3738.58
EP-25	3739.22
EP-26	3722.59
EP-49	3719.86
EP-51	3725.61
EP-52	3735.34
EP-53	3738.54
EP-54	3717.19
EP-55	3732.03
EP-56	3722.10
EP-57	3715.12
EP-58	3714.99
EP-59	3715.57
EP-60	3713.16
EP-61	3713.03
EP-62	3712.94
EP-63	3712.42
EP-64	3713.34
EP-65	3712.80
EP-66	3712.44



ASARCO INCORPORATED
EL PASO PLANT DIESEL NO.2
REMEDIATION SITE
EL PASO, TEXAS

GROUNDWATER ELEVATION MAP
DIESEL NO.2
NOVEMBER 1998

FIGURE

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

UPDATE TIME: 9:30
128\0927\065\0180\TUC\010599\I:\DRFT\ 92799U02.DWG

SCALE

(In Feet)

200 0 200

(Approximate Only)

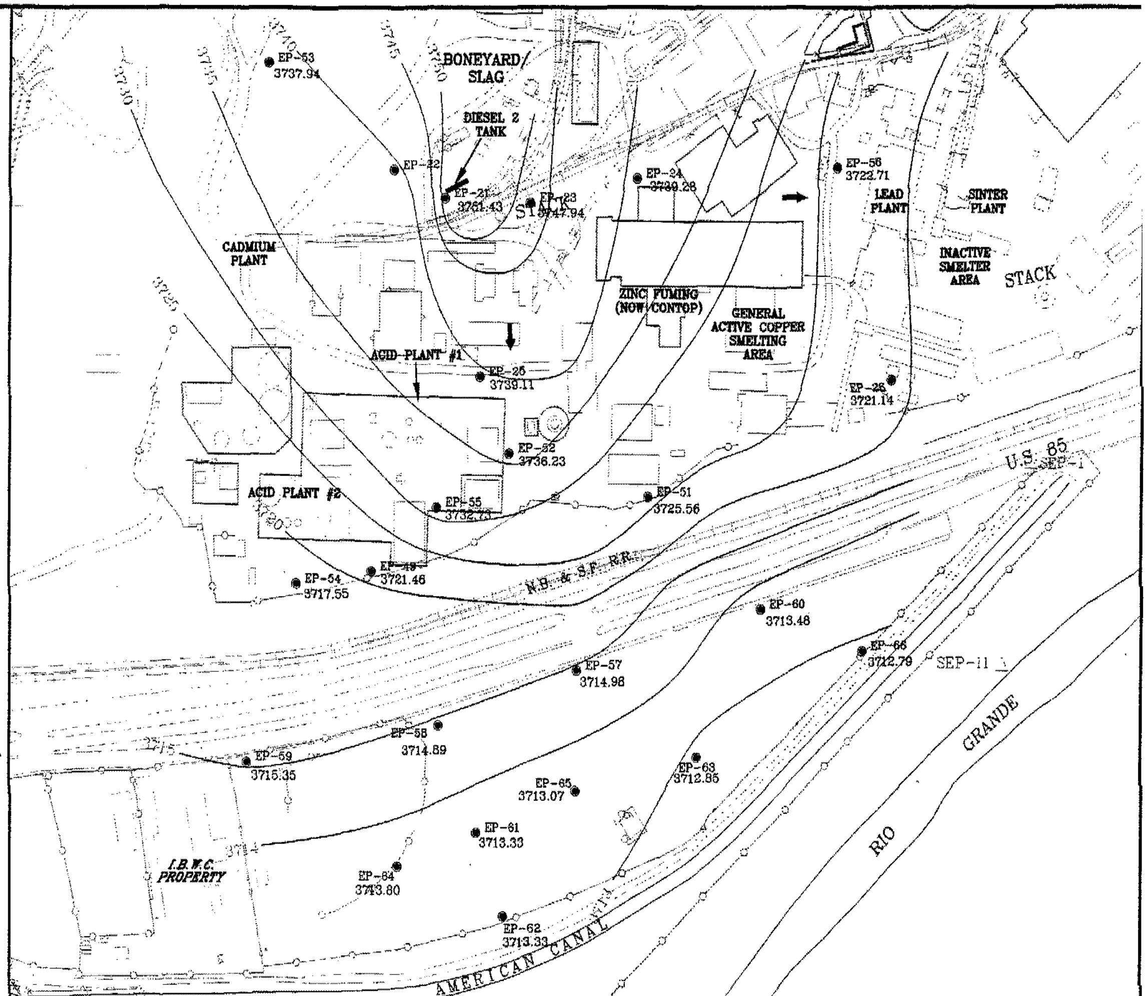
CONTOUR INTERVALS

GROUNDWATER FLOW DIRECTION

3750–3715 GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715–3713 GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3751.43
EP-22	
EP-23	3747.94
EP-24	3739.28
EP-25	3739.11
EP-26	3721.14
EP-49	3721.46
EP-51	3725.56
EP-52	3736.23
EP-53	3737.94
EP-54	3717.55
EP-55	3732.73
EP-56	3722.71
EP-57	3714.98
EP-58	3714.89
EP-59	3715.35
EP-60	3713.48
EP-61	3713.33
EP-62	3713.33
EP-63	3712.85
EP-64	3713.80
EP-65	3713.07
EP-66	3712.79



ASARCO INCORPORATED
EL PASO PLANT DIESEL NO.2
REMEDIATION SITE
EL PASO, TEXAS

GROUNDWATER ELEVATION MAP DIESEL NO.2 AUGUST 1998

FIGURE

UPDATE TIME: 9:30
128\0715\065\0180\TUC\121129SB\DRFT\ 71598U40.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

SCALE
(In Feet)
200 0 200
(Approximate Only)

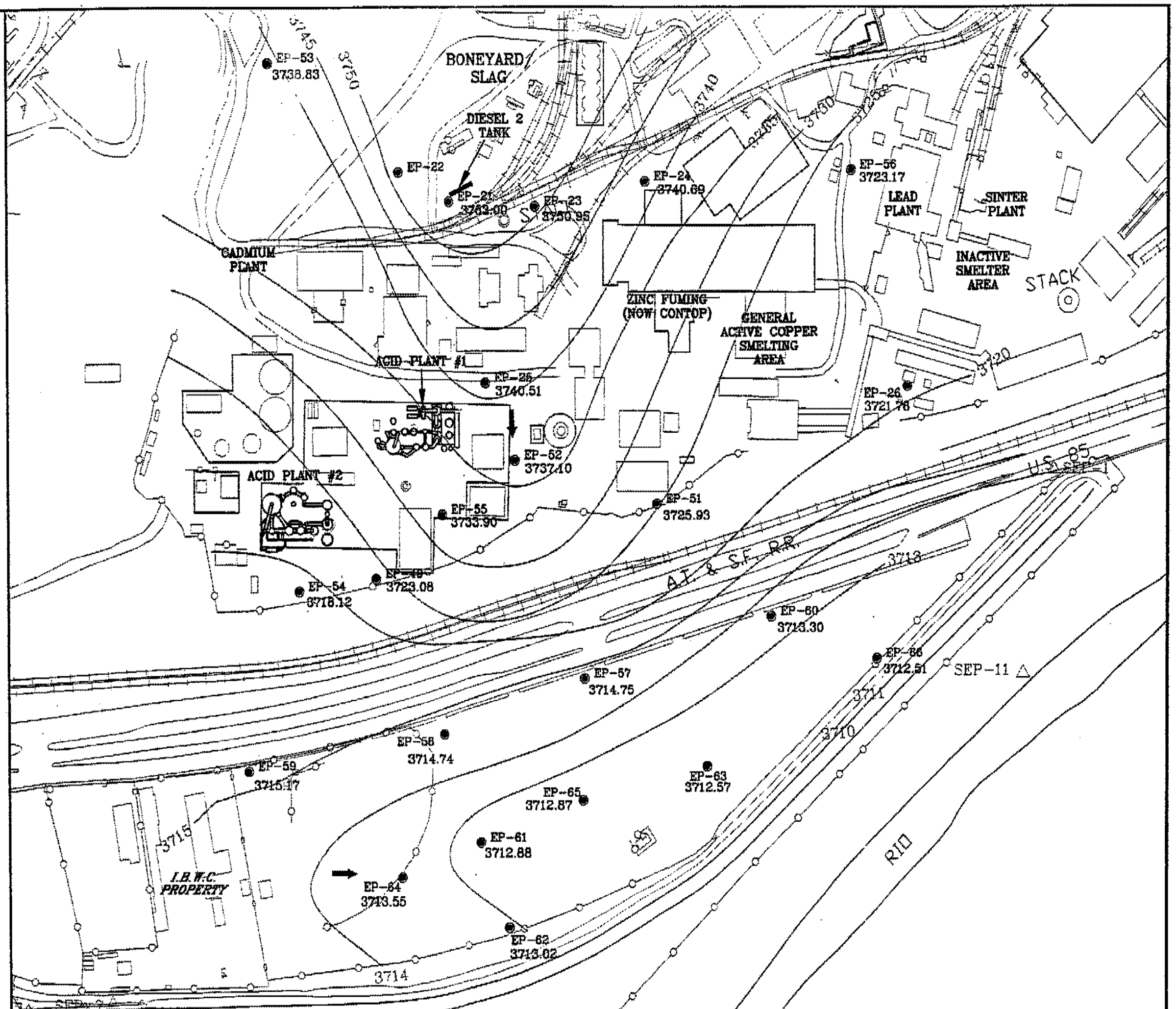
CONTOUR INTERVALS

➡ GROUNDWATER FLOW DIRECTION

3750-3715 — GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715-3713 — GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3735.00
EP-22	
EP-23	3750.95
EP-24	3740.69
EP-25	3740.51
EP-26	3721.78
EP-49	3723.08
EP-51	3725.93
EP-52	3737.10
EP-53	3738.83
EP-54	3718.12
EP-55	3733.90
EP-56	3723.17
EP-57	3714.75
EP-58	3714.74
EP-59	3715.17
EP-60	3713.30
EP-61	3712.88
EP-62	3713.02
EP-63	3712.57
EP-64	3713.55
EP-65	3712.87
EP-66	3712.51



ASARCO INCORPORATED
EL PASO PLANT DIESEL NO.2
REMEDIATION SITE
EL PASO, TEXAS

GROUNDWATER ELEVATION MAP
DIESEL NO.2
MAY 1998

FIGURE

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

PDATE TIME: 9:30
28\0715\065\0180\TUC\061098\:\DRFT\ 71598U12.DWG

NORTH

SCALE
(In Feet)
200 0 200
(Approximate Only)

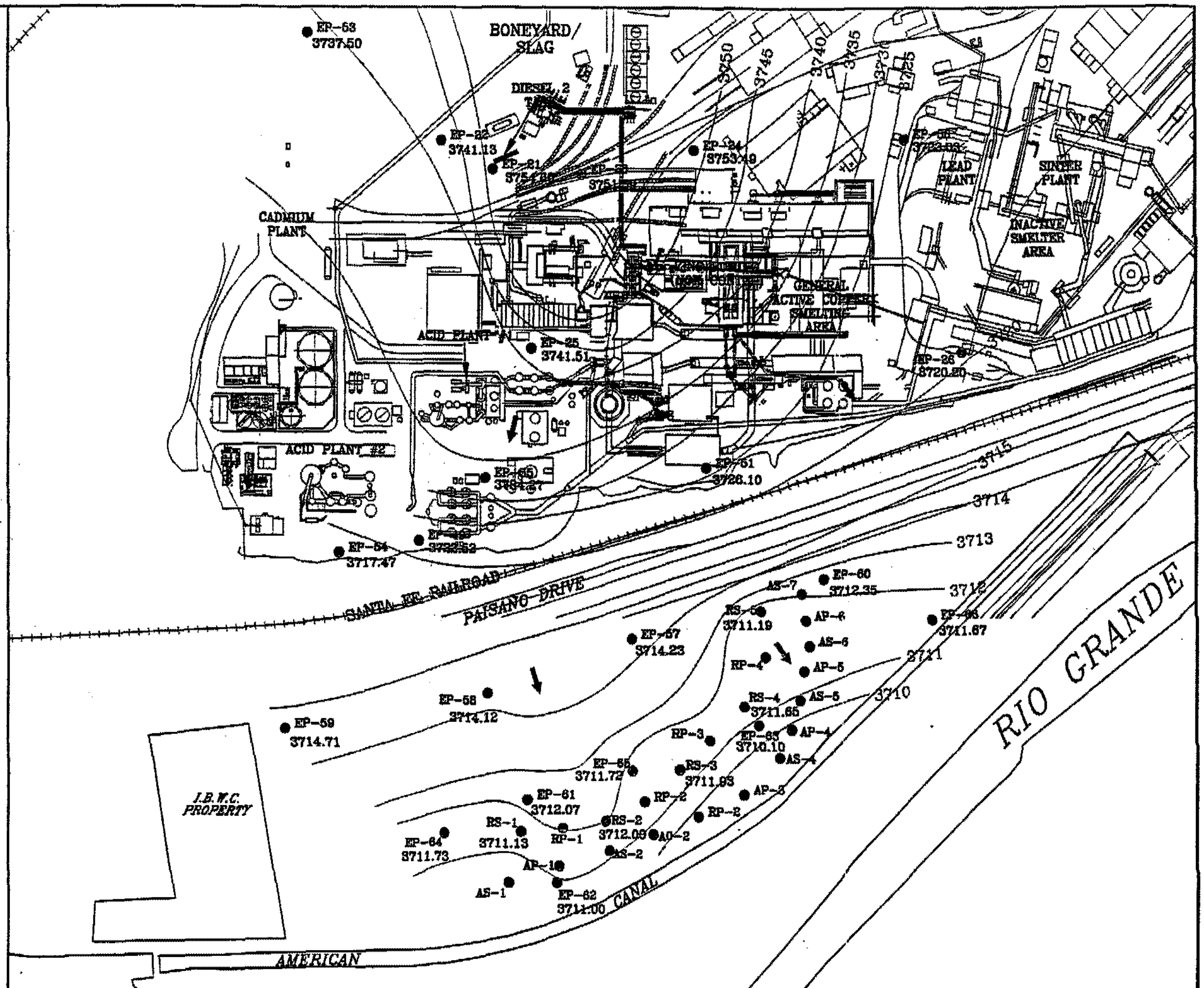
CONTOUR INTERVALS

→ GROUNDWATER FLOW DIRECTION

3750–3715 — GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715–3710 — GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3754.60
EP-22	3741.13
EP-23	3751.59
EP-24	3753.49
EP-25	3741.51
EP-26	3720.20
EP-49	3722.52
EP-51	3726.10
EP-52	
EP-53	3739.50
EP-54	3717.47
EP-55	3734.27
EP-56	3723.03
EP-57	3714.23
EP-58	3714.12
EP-59	3714.71
EP-60	3712.35
EP-61	3712.07
EP-62	3711.00
EP-63	3710.10
EP-64	3711.73
EP-65	3711.72
EP-66	3711.67
RS-1	3711.13
RS-2	3712.00
RS-3	3711.93
RS-4	3711.65
RS-5	3711.19



ASARCO INCORPORATED
EL PASO PLANT DIESEL NO.2
REMEDIATION SITE
EL PASO, TEXAS

GROUNDWATER ELEVATION MAP
DIESEL NO.2
FEBRUARY 1998

FIGURE

UPDATE TIME: 9:30
128\0715\085\0180\TUC\040898\\:\DRFT\ . 71598U07.DWG

NORTH

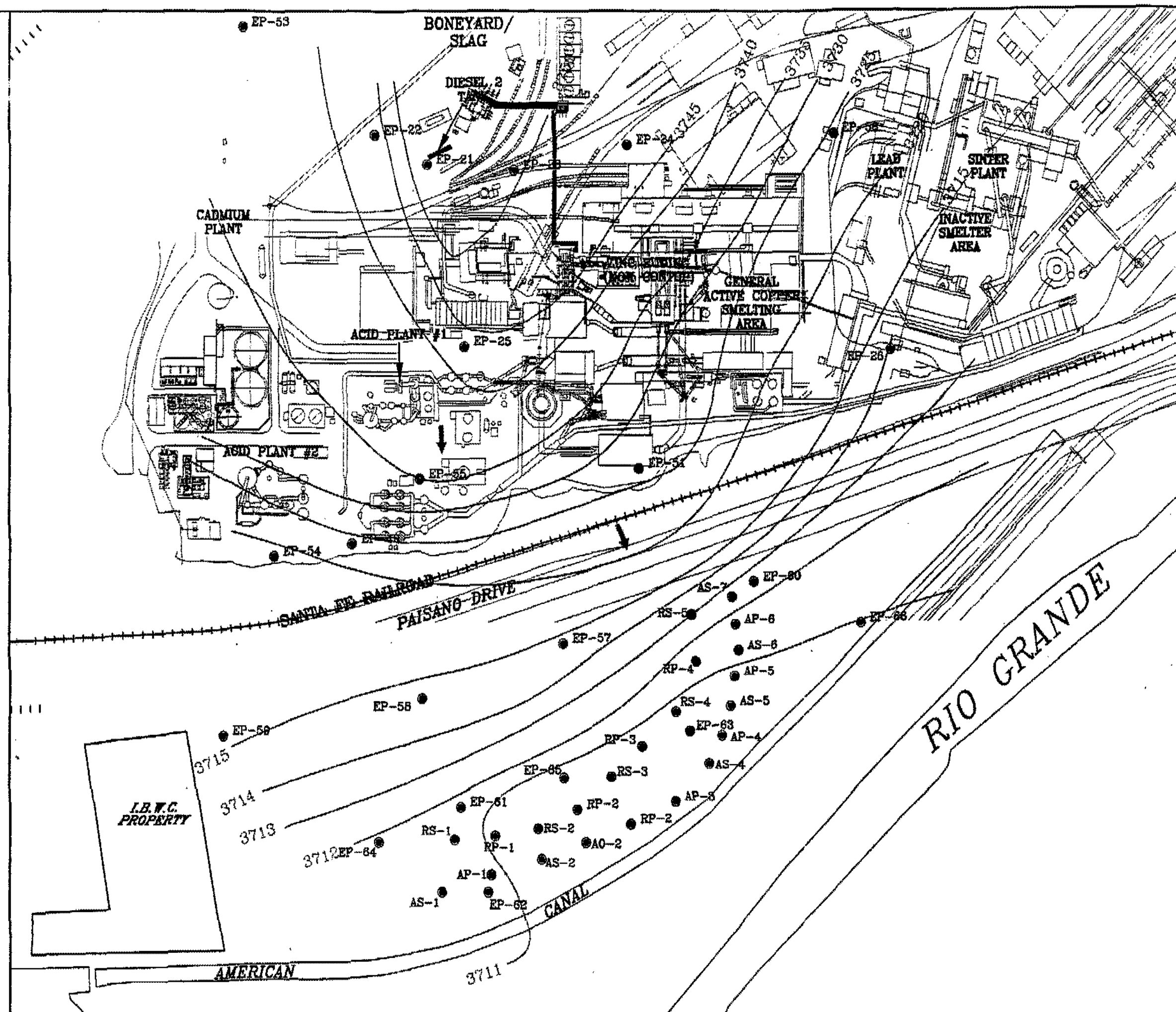
SCALE
(In Feet)
200 0 200
(Approximate Only)

GROUNDWATER FLOW DIRECTION

3750-3715 — GROUNDWATER ELEVATION CONTOUR AT 5 FOOT

3715-3711 — GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

WELL	GROUNDWATER ELEVATION
EP-21	3735.35
EP-22	3740.47
EP-23	3750.22
EP-24	3748.40
EP-25	3741.48
EP-26	3713.94
EP-49	3723.16
EP-51	3725.86
EP-52	
EP-53	3739.16
EP-54	3718.32
EP-55	3734.04
EP-56	3723.58
EP-57	3714.51
EP-58	3714.53
EP-59	3715.17
EP-60	3712.50
EP-61	3711.14
EP-62	3711.09
EP-63	3710.22
EP-64	3711.95
EP-65	3710.66
EP-66	3711.03



ASARCO INCORPORATED
EL PASO PLANT
DIESEL NO.2 1997 ANNUAL REPORT
EL PASO, TEXAS

GROUND WATER ELEVATION MAP
DIESEL NO. 2
NOVEMBER 1997

FIGURE
A4-4

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

UPDATE TIME: 2:30
128\0715\065\0180\TUC\042098\I:\DRFT\ 71598U37.DWG

NORTH

SCALE
(In Feet)
200 0 200
(Approximate Only)

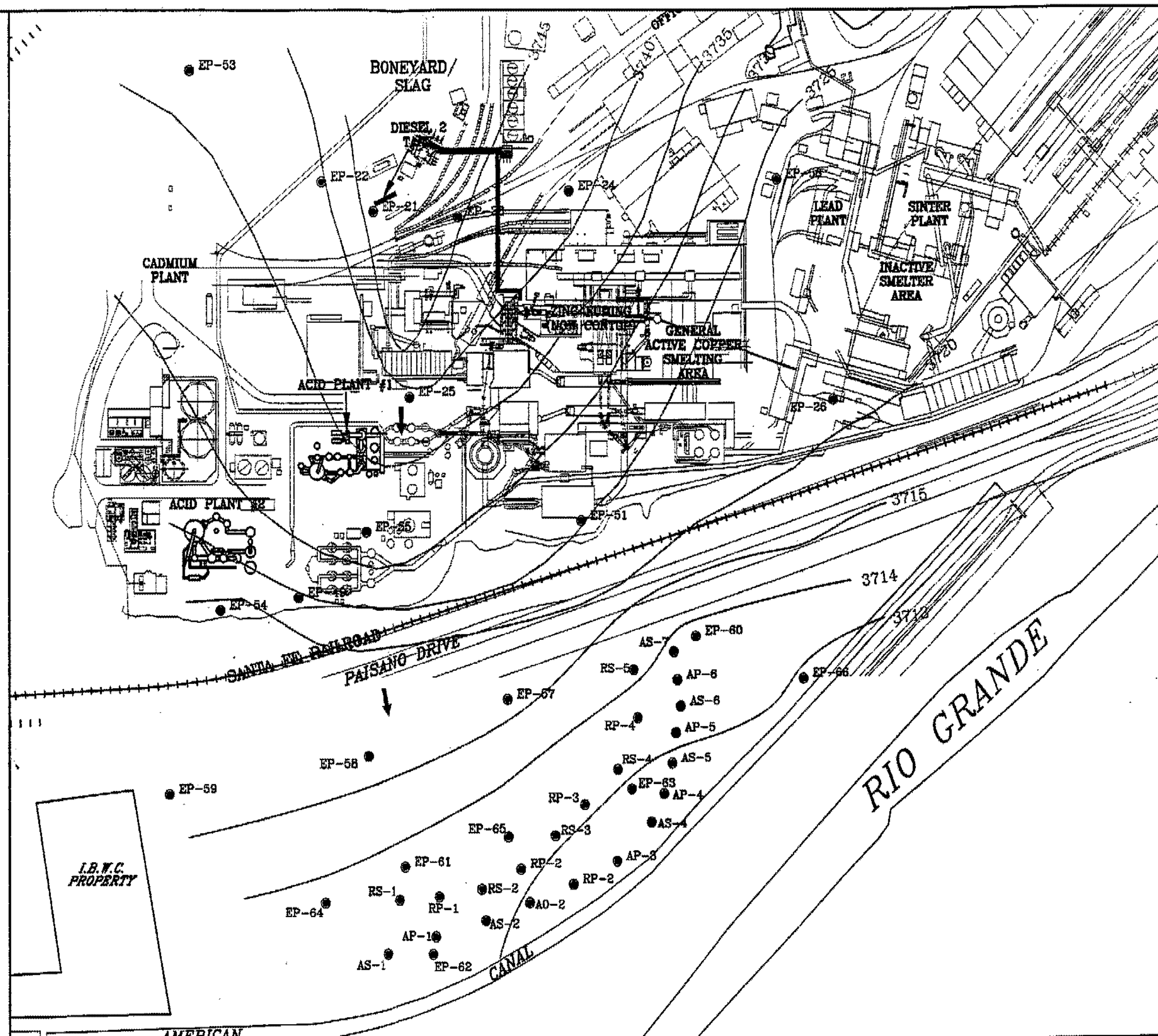
CONTOUR INTERVALS
3711-3715=1'
3715-3745=5'

→ GROUNDWATER FLOW DIRECTION

3713-3715 — GROUNDWATER ELEVATION CONTOUR AT 1 FOOT

3715-3745 — GROUNDWATER ELEVATION CONTOUR AT 5 FEET

WELL	GROUNDWATER ELEVATION
EP-21	3747.88
EP-22	3738.96
EP-23	3745.65
EP-24	3742.78
EP-25	3739.56
EP-26	3721.84
EP-49	3723.93
EP-51	3725.84
EP-52	BLOCKED
EP-53	3738.04
EP-54	3718.79
EP-55	3733.88
EP-56	3722.86
EP-57	3715.15
EP-58	3715.18
EP-59	3715.47
EP-60	3713.52
EP-61	3713.51
EP-62	3713.32
EP-63	3712.90
EP-64	3713.82
EP-65	3713.24
EP-66	3712.86



ASARCO INCORPORATED
EL PASO PLANT
DIESEL NO.2 1997 ANNUAL REPORT
EL PASO, TEXAS

GROUND WATER ELEVATION MAP
DIESEL NO. 2
AUGUST 1997

FIGURE
A4-3

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

JPDATE TIME: 2:30
128\0715\065\0160\TUC\042098\:\DRFT\ 71598U36.DWG

NORTH

SCALE

(In Feet)

200 0 200

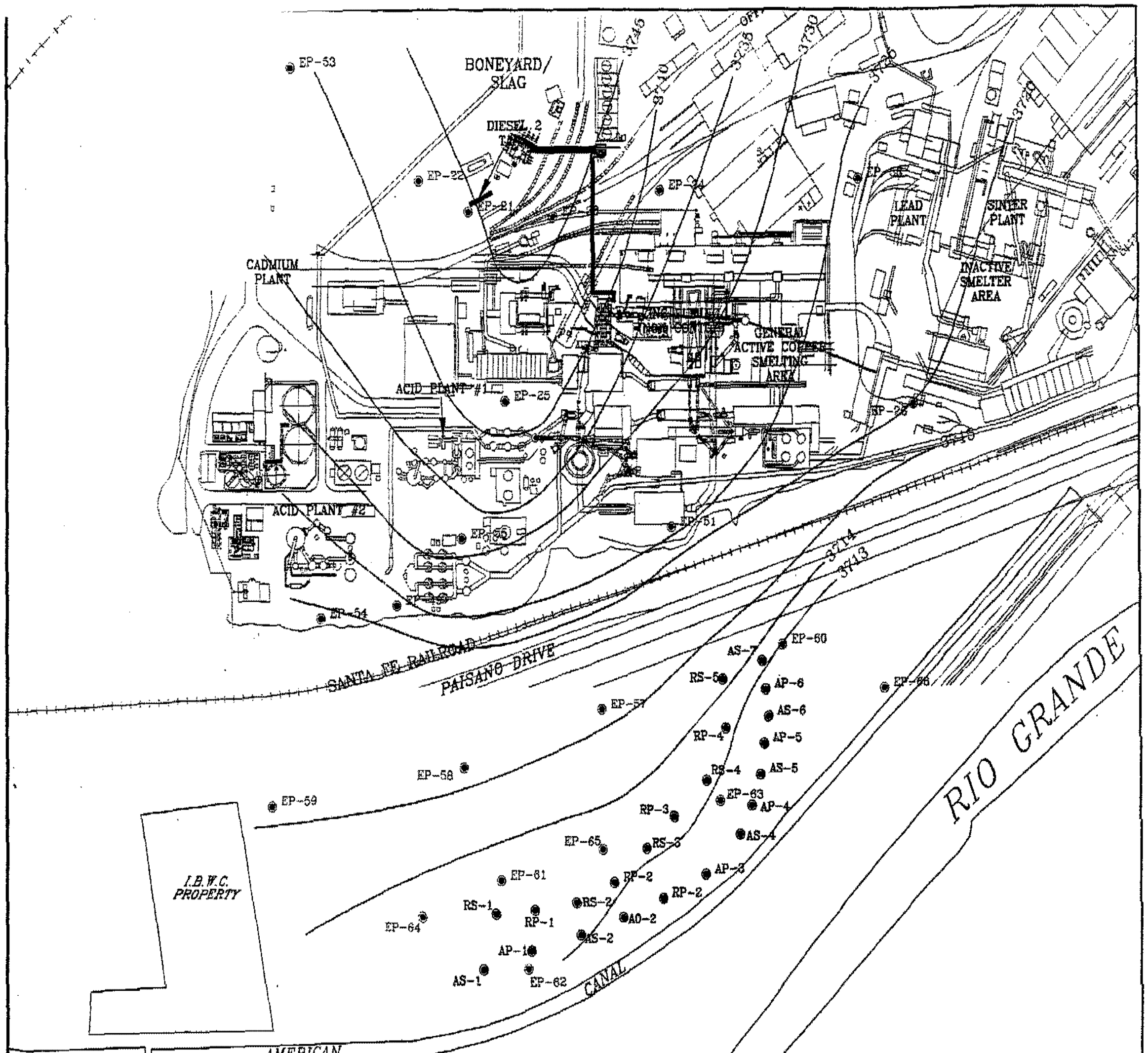
(Approximate Only)

CONTOUR INTERVAL = 1'

➡ GROUND WATER FLOW DIRECTION

3714 —— GROUND WATER ELEVATION CONTOUR

WELL	GROUNDWATER ELEVATION
EP-53	3738.34
EP-22	3743.65
EP-21	3743.53
EP-23	3745.42
EP-24	3739.27
EP-56	3722.71
EP-26	3720.06
EP-51	3726.11
EP-55	3734.32
EP-49	3723.51
EP-54	3718.77
EP-59	3715.27
EP-58	3715.14
EP-57	3715.10
EP-60	3713.02
EP-66	3712.60
EP-64	3713.74
EP-61	3713.43
EP-65	3713.15
EP-63	3712.64
EP-62	3713.29



ASARCO INCORPORATED
EL PASO PLANT
DIESEL NO.2 1997 ANNUAL REPORT
EL PASO, TEXAS

GROUND WATER ELEVATION MAP
DIESEL NO. 2
MAY 1997

FIGURE **A4-2**

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

UPDATE TIME: 2:30
128\ 0715\065\0180\TUC\042098\I:\DRFT\ 71598U35.DWG

L.6 – USIBWC AMERICAN DAM UST FACILITY DOCUMENTS

(Source: TNRCC)

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▸ 6

To MR. JOHN KNOPP	From USIBWC MIKE MIN
Dept./Agency ENCON	Phone # 832-4739
Fax # 581-2044	Fax # 832-4167
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Jeffrey A. Saitas, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

July 29, 1998

Mr. Yusuf E. Farran, P.E.
Division Engineer, EMD
International Boundary and Water Commission
4171 N. Mesa St. Bldg C-Suite 310
El Paso, TX 79902

Re: Leaking Petroleum Storage Tank (LPST) Case Closure of Subsurface Release of Petroleum Hydrocarbons at the American Dam, 2616 Paisano, El Paso (El Paso County), Texas. (LPST ID No.108049, Facility ID No.9971) - Priority 2.6

Dear Mr. Farran:

This letter confirms the completion of corrective action requirements for the release incident at the above-referenced facility. Although contaminant concentrations were reported above Plan A Target screening levels, the following criteria were used as justification for site closure:

- A water well search indicated no water wells ½ a mile from the site.
- The contaminant plume appears to be confined on site and decreasing in contaminant concentrations.
- The extent of groundwater contamination appears to be delineated to MCL's in the downgradient direction.
- The shallow groundwater does not appear to have a local beneficial use. Domestic water for this area is provided by a municipal water supply.
- According to information provided, vapor calculations do not indicate a potential problem.
- The former UST system and presumably the source of contamination was removed from the site in 1994.

Based upon the submitted information and with the provision that the documentation provided to this agency was accurate and representative of site conditions, we accept your conclusions and recommendation that the site has met closure requirements. No further corrective action will be necessary.

Case closure is based on identified exposure pathways and any remaining contaminant levels. These potential exposure pathways should be evaluated when conducting future soil excavation or construction activities at this site. Additionally, all wastes generated from these activities must be handled in compliance with all applicable regulations.

For any subsequent release from an underground or aboveground storage tank at this site, the deductible will be increased in accordance with Section 26.3512 of the Texas Water Code. Please note that financial assurance must be maintained for all operational storage tanks at this site.

Please be advised that all monitor wells which are not now in use and/or will not be used in the next 180 days must be properly plugged and abandoned pursuant to Chapter 32.017 of the Texas Water Code and in accordance with Title 30, Texas Administrative Code (TAC), Section 338.48-338.50. A State of Texas Plugging Report (Form No. TNRCC-0055) is required to be submitted to the Water Well Drillers Section of the Texas Department of Licensing and Regulation, P.O. Box 12157, Capitol Station, Austin, Texas 78711, within thirty (30) days of plugging completion. If you have any questions regarding the future use of an existing monitor well, please contact the Texas Department of Licensing and Regulation at 512/463-7880 or 800/803-9202.

If there are to be any monitor well plugging or other necessary site restoration activities to complete site closure, complete a *Final Site Closure Report* and submit the report to both the local TNRCC Regional Field Office and to the Central Office in Austin to document actual site closure. For sites which are eligible for reimbursement through the Petroleum Storage Tank Remediation Fund, written preapproval should be obtained prior to initiation of site closure activities. Reimbursement claims for activities that are not preapproved will not be paid until all claims for preapproved work are processed and paid.

Please note that the *Final Site Closure Report*, if necessary, will be the last submittal associated with this case. This letter signifies the completion of corrective action associated with the release. No subsequent TNRCC correspondence will be issued in response to the *Final Site Closure Report*.

All correspondence must include the LPST ID Number and submitted to both the local TNRCC Regional Field Office and the Central Office in Austin. Should you have any questions, please contact me at 512/239-2200. **Please reference the LPST ID Number when making inquiries.** Your cooperation in this matter has been appreciated.

Sincerely,

Kenneth Klanika

Kenneth Klanika
Team I Leader
Petroleum Storage Tank Responsible Party Remediation Section
Remediation Division

AB/mel
108049.rba

cc: Mr. Terry McMillan, TNRCC Region 6 Field Office, 915/778-9634
7500 Viscount Blvd, Suite 147, El Paso, Texas 79925-5633

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

OFFICE OF THE COMMISSIONER
UNITED STATES SECTION

MAR 8 1999

RECEIVED
MAR 09 1999
TNRCC-REGION 6

Mr. Arturo Burgos
Petroleum Storage Tank Responsible Party Investigations
Remediation Division
Texas Natural Resource Conservation Commission
P.O. Box 13087
Austin, Texas 78711-3087

Re: Subsurface Release of Gasoline at American Dam, 2616 Paisano, El Paso (El Paso County), Texas (LPST ID No. 108049, Facility ID No. 9971)

Dear Mr. Burgos:

Pursuant to your letter of July 29, 1998, the U.S. Section of the International Boundary and Water Commission has plugged and abandoned the seven monitoring wells constructed for the monitoring activities associated with the petroleum storage tanks at American Dam. The State of Texas Plugging Reports were submitted to the Water Well Drillers Section of the Texas Department of Licensing and Regulation within the specified time. Enclosed please find the Final Site Closure Report. A copy of this letter and attachments will also be provided to the TNRCC, Region 6 office.

If you have any questions, please contact me at (915) 832-4148 or Ms. Sylvia A. Waggoner at (915) 832-4149 extension 2140.

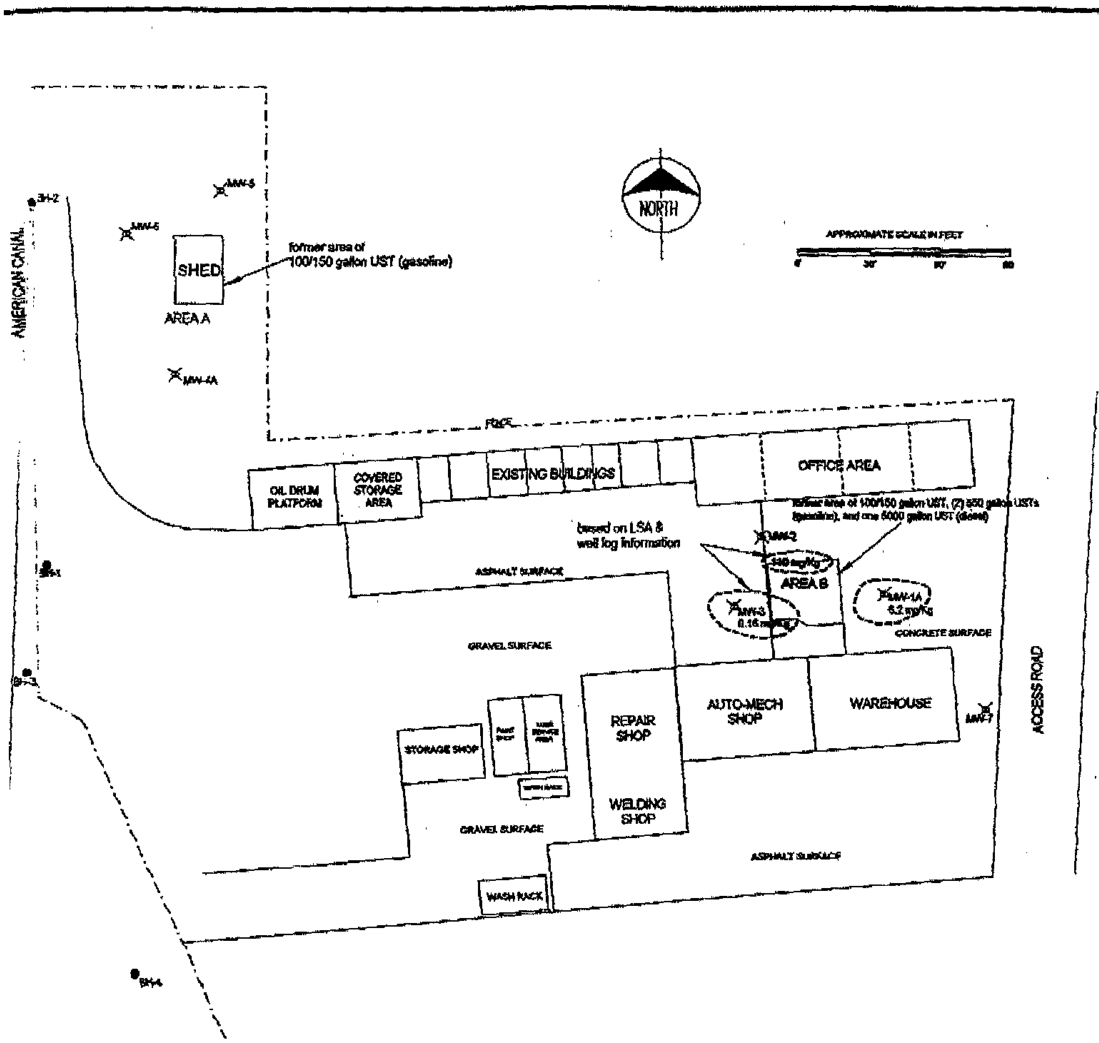
Sincerely,

Yusuf E. Farran

Yusuf E. Farran, P.E.
Division Engineer, EMD

Enclosure: As Stated

cc: w/encl:
Mr. Frank Espino
TNRCC, Region 6 Field Office
7500 Viscount Blvd, Suite 147
El Paso, Texas 79925



Site plan referenced from Limited Site Assessment
Report dated January 2, 1995

International Boundary & Water Commission
American Dam Facility 2616 W. Paisano
El Paso, Texas

Soil Contaminant Concentration Map
LPST ID NO. 108049

SCALE: 1" = 60'

DRAWING NO.: 980018

DRAWN BY:
FRONTERA ENVIRONMENTAL, L.L.C.
2310 MONTANA AVE.
EL PASO, TEXAS 79903

04/28/98

LEGEND

monitor well (4-inch dia.)
max. benzene conc.

soil boring

LOG OF TEST BORING NO. MW-1 MONITOR WELL NO. MW-1A

PROJECT NAME: American Dam
LPST ID: 10849
Facility ID: 0009971

PROJECT LOCATION: 2616 West Paisano
EL Paso, Texas
El Paso County

BORING EQUIPMENT & METHOD:
Truck-mounted B-61 Mobile Drill Rig & 6 5\8" I.D. 10" O.D. Hollowstem Auger

SURFACE ELEVATION: TOC= 99.80

BENCHMARK: Arbitrary Datum 100'

DESCRIPTION	Depth in Feet	Sample	Graphical Log	USCS	HEADSPACE (PPM)	TPH (418.1) ppm	Benzene (8020) ug/kg	Total BTEX (8020) ug/kg	WELL CONSTRUCTION
1.5" of HMAC									sloped pad; 4" sch.40 PVC
Sand, silty, loose, light brown.	5	X		SM	3	10.0	<10.0	55.0	
	10	X		SM	3000	12000.0	6200.0	136800.	
Sand, silty, very loose, light brown with gray staining, very strong hydrocarbon odor.						Water Table 11.26 11-17-97			
	15	X		SM	200	<10.0	130.0	2640.0	12-20 Silica Sand
	20	X		SC	22				
Sand, clayey, with silt, loose, light brown with gray staining, hydrocarbon odor .									
Sand, clayey, with silt, loose, light brown.	25	X		SC					
	30								
	35								
	40								

REMARKS:
Boring Termination Depth 25'
Sampler Termination Depth 26.5'

DRILLED BY: John Miller
Well Replaced By G Goodwin Lic.3252M
see State of Texas Well Report

DATE STARTED: 8/25/94

LOGGED BY: Amy Castner
Susana Facio

DATE COMPLETED: 8/25/94

GROUNDWATER DEPTH: 11.58' **HOUR:** n/a **DATE:** 2-28-97

CHECKED BY: Gerald Goodwin
3/29/97

SHEET 1 OF 1

SUNBELT LABORATORIES, INC.

[illegible] ANALYSES OF GROUNDWATER SAMPLES FROM MONITORING WELLS*

Well Name	Sample Date	TPH[1] (ppm)	Benzene[2] (ppb)	Toluene[2] (ppb)	Ethyl-benzene[2] (ppb)	o-, m- & p- Xylenes[2] (ppb)	MTBE[1] (Methyl tert-Butyl Ether) (ppb)	TDS (Total Dissolved Solids) (ppm)
MW-1	09/14/94	**43**	**2200**	**2400**	<1.0	3,000	6	3100
	05/14/97	1.1	**31**	<1.0	3.4	8	<2.0	
	08/11/97	<1.0	**77**	<1.0	7.7	7	<2.0	
	11/17/97	<1.0	**60**	<1.0	4.3	3.7	<2.0	
MW-2	09/14/94	3	3	4	2	17.0	<2.0	3100
	05/14/97	<1.0	<1.0	<1.0	2.6	<1.0	<2.0	
	08/12/97	<1.0	<1.0	<1.0	2.1	<1.0	<2.0	
	11/17/97	<1.0	<1.0	<1.0	3.1	<1.0	<2.0	
MW-3	09/14/94	**900**	**10**	3	1	210	7	3000
	05/14/97	7.1	**5**	1.9	16	25	21	
	08/11/97	2.9	**8.4**	2.4	20	26	37	
	11/17/97	11	4.6	<1.0	7.9	14	33	
MW-4	09/14/94	<1.0	<1.0	<1.0	<1.0	<0.03	<2.0	1700
	05/14/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	08/08/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	11/14/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
MW-5	09/14/94	<1.0	<1.0	<1.0	<1.0	<0.03	<2.0	
	05/14/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	08/08/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	11/14/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
MW-6	09/14/94	**7**	**4600**	**5100**	**1,500**	5,700	290	
	05/14/97	<1.0	**32**	11	27	51	3.2	
	08/08/97	<1.0	**24**	9.1	24	36	2.8	
	11/14/97	<1.0	**12**	1.6	6.7	3.9	2.1	
MW-7	09/14/94	3.3	<1.0	<1.0	<2.0	9	<2.0	3100
	05/14/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	08/11/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	
	11/17/97	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	

* concentrations in boldface type indicates at or exceed TNRCC Action Levels

[1] EPA Method 418.1 Total Petroleum Fuel Hydrocarbons

[2] EPA Method 8020A

— not submitted for this analyte

tech
boratories
nc.
The Quality People
Since 1955
10[illegible] Gateway West, No. 100
El Paso, Texas 79935
(915) 592-3591 • fax 592-3594

D & H Pump Service, Inc.
1201 Tower Trail
El Paso, TX 79907

SAMPLE NO. : 6400618
INVOICE NO.: 62140129
REPORT DATE: 02-22-94
REVIEWED BY:
PAGE : 1 OF 1

SAMPLE ID : #5
TYPE .....: Soil
D BY ......: S. Svoboda
TED BY ....: S. Svoboda
SOURCE ...: N+W Wall
T ....: C. Warner

AUTHORIZED BY : Steve Svoboda
CLIENT P.O. : --
SAMPLE DATE ...: 02-16-94
SUBMITTAL DATE : 02-16-94
EXTRACTION DATE: 02-19-94
ANALYSIS DATE .: 02-21-94

Method: Modified 418.1 (TPH) + 8020 (BTEX)

DATA TABLE

Parameter	Result	Unit	Detection Limit
l Petroleum Hydrocarbons .....:	4700	mg/Kg	10.
ene ....:	570	ug/Kg	10.
lbenzene ....:	44000	ug/Kg	10.
ene ....:	41000	ug/Kg	10.
l Xylenes ....:	96000	ug/Kg	3.0

(1) Copy to Client

Managing Director

boratories
nc.
he Quality People
Since 1955
El Paso, Texas 79935
(915) 592-3591 • fax 592-3594

D & H Pump Service, Inc.
1201 Tower Trail
El Paso, TX 79907

SAMPLE NO. : 6400620
INVOICE NO.: 62140129
REPORT DATE: 02-22-94
REVIEWED BY: [signature]

: SAMPLE ID : #7
: TYPE .....: Soil
ED BY ......: S. Svoboda
TED BY ....: S. Svoboda
: SOURCE ...: Botton of Excavation

AUTHORIZED BY : Steve Svoboda
CLIENT P.O. : --
SAMPLE DATE ...: 02-16-94
SUBMITTAL DATE : 02-16-94
EXTRACTION DATE: --

RKS -

orrected Certificate.

Inorganic Chemistry-Total Metals

DATA TABLE

Parameter	Result	Unit	Detection Limit	Analysis Date
tal Arsenic ....:	40	mg/Kg	0.50	02-24-94
tal Barium ....:	180	mg/Kg	10	02-21-94
tal Cadmium ....:	26	mg/Kg	2.5	02-21-94
tal Chromium ....:	<5.0	mg/Kg	5.0	02-21-94
tal Lead ....:	3200	mg/Kg	5.0	02-21-94
tal Mercury ....:	0.95	mg/Kg	0.50	02-23-94
tal Selenium ....:	0.81	mg/Kg	0.50	02-22-94
tal Silver ....:	<2.5	mg/Kg	2.5	02-21-94

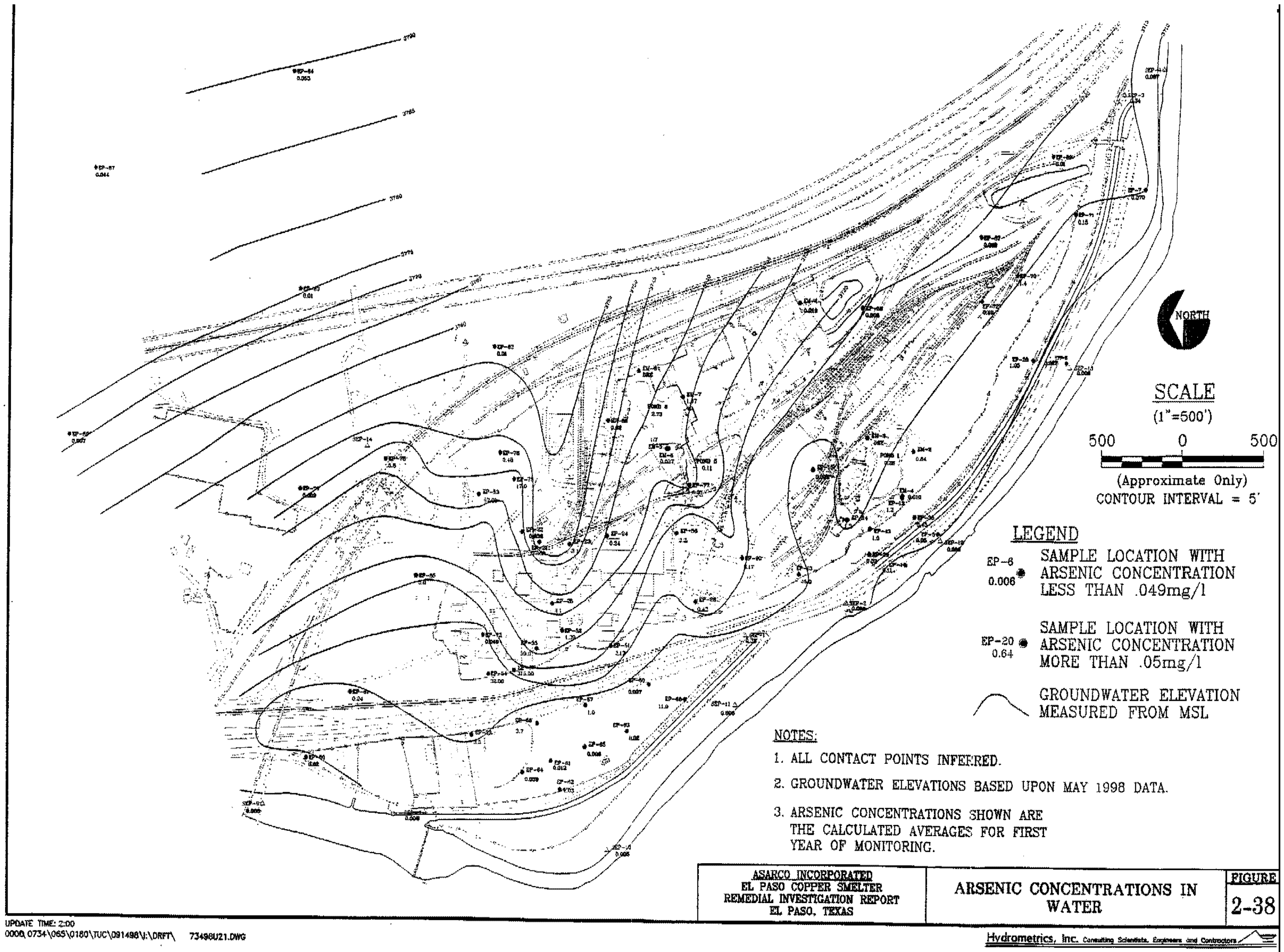
(1) Copy to Client

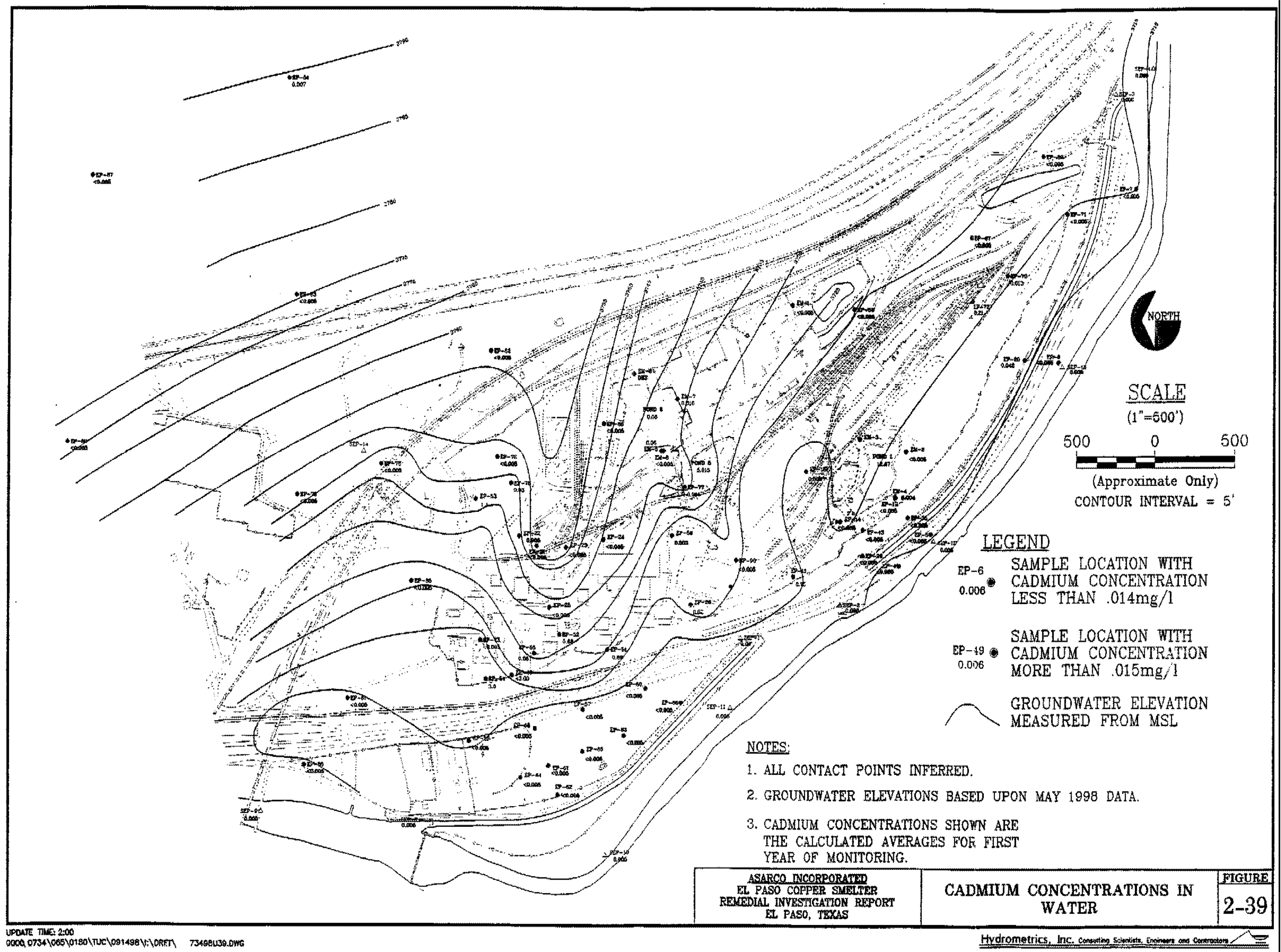
[signature]
Managing Director

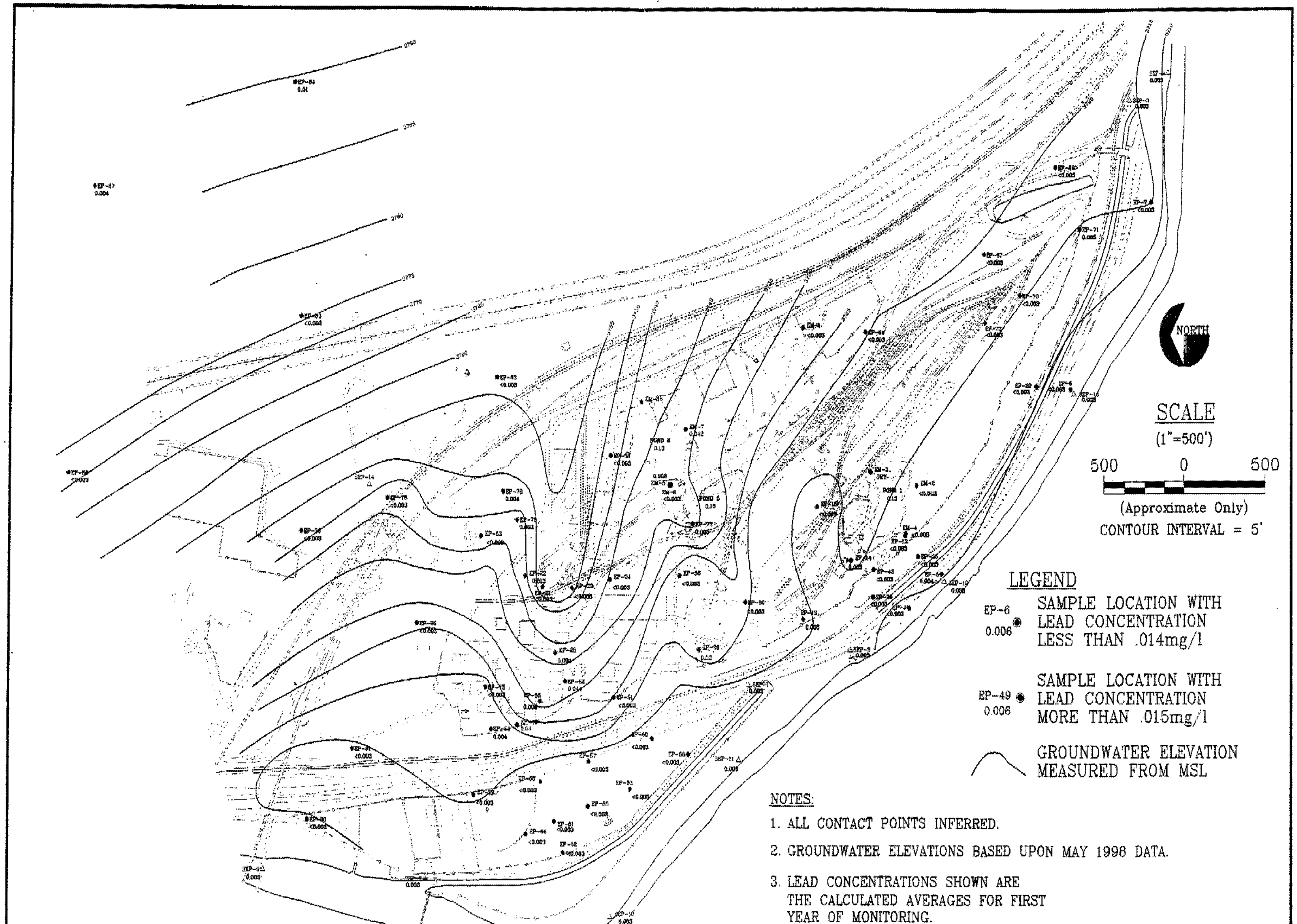
L.7 – UPPER & MIDDLE OPEN CHANNEL HEAVY METAL CONCENTRATIONS IN GROUNDWATER

ASARCO 1998 Monitoring Well Maps

(Source: ASARCO)


NORTH
SCALE
(1"=500')
500
0
500
(Approximate Only)
CONTOUR INTERVAL = 5'
LEGEND
EP-6
0.006
SAMPLE LOCATION WITH ARSENIC CONCENTRATION LESS THAN .049mg/l
EP-20
0.64
SAMPLE LOCATION WITH ARSENIC CONCENTRATION MORE THAN .05mg/l
GROUNDWATER ELEVATION MEASURED FROM MSL
NOTES:
1. ALL CONTACT POINTS INFERRED.
2. GROUNDWATER ELEVATIONS BASED UPON MAY 1998 DATA.
3. ARSENIC CONCENTRATIONS SHOWN ARE THE CALCULATED AVERAGES FOR FIRST YEAR OF MONITORING.
ASARCO INCORPORATED
EL PASO COPPER SMELTER
REMEDIAL INVESTIGATION REPORT
EL PASO, TEXAS
ARSENIC CONCENTRATIONS IN WATER
FIGURE
2-38
UPDATE TIME: 2:00
0000,0734\065\0180\TUC\091498\I:\DRFT\ 73498U21.DWG
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors


NORTH
SCALE
(1"=600')
500 0 500
(Approximate Only)
CONTOUR INTERVAL = 5'
LEGEND
EP-6 0.006 SAMPLE LOCATION WITH CADMIUM CONCENTRATION LESS THAN .014mg/l
EP-49 0.006 SAMPLE LOCATION WITH CADMIUM CONCENTRATION MORE THAN .015mg/l
GROUNDWATER ELEVATION MEASURED FROM MSL
NOTES:
1. ALL CONTACT POINTS INFERRED.
2. GROUNDWATER ELEVATIONS BASED UPON MAY 1998 DATA.
3. CADMIUM CONCENTRATIONS SHOWN ARE THE CALCULATED AVERAGES FOR FIRST YEAR OF MONITORING.
ASARCO INCORPORATED
EL PASO COPPER SMELTER
REMEDIAL INVESTIGATION REPORT
EL PASO, TEXAS
CADMIUM CONCENTRATIONS IN WATER
FIGURE
2-39
UPDATE TIME: 2:00
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



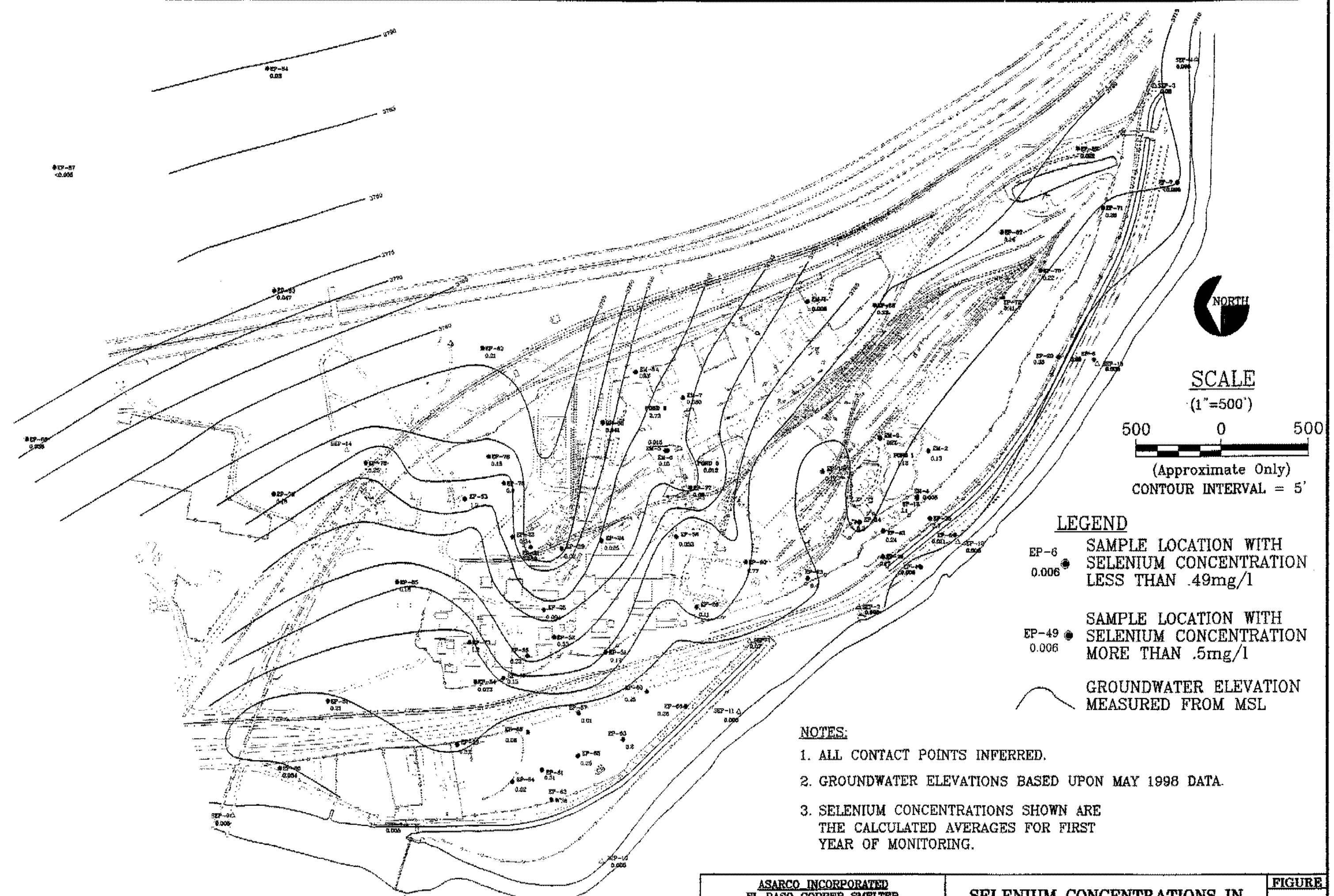
NOTES:

1. ALL CONTACT POINTS INFERRED.
2. GROUNDWATER ELEVATIONS BASED UPON MAY 1998 DATA.
3. LEAD CONCENTRATIONS SHOWN ARE THE CALCULATED AVERAGES FOR FIRST YEAR OF MONITORING.

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	LEAD CONCENTRATIONS IN WATER	FIGURE 2-40

UPDATE TIME: 2:00
0000,0734\065\0180\TUC\091498\I:\DRFT\ 73498U41.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



NOTES:

1. ALL CONTACT POINTS INFERRED.
2. GROUNDWATER ELEVATIONS BASED UPON MAY 1998 DATA.
3. SELENIUM CONCENTRATIONS SHOWN ARE THE CALCULATED AVERAGES FOR FIRST YEAR OF MONITORING.

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	SELENIUM CONCENTRATIONS IN WATER	FIGURE 2-41

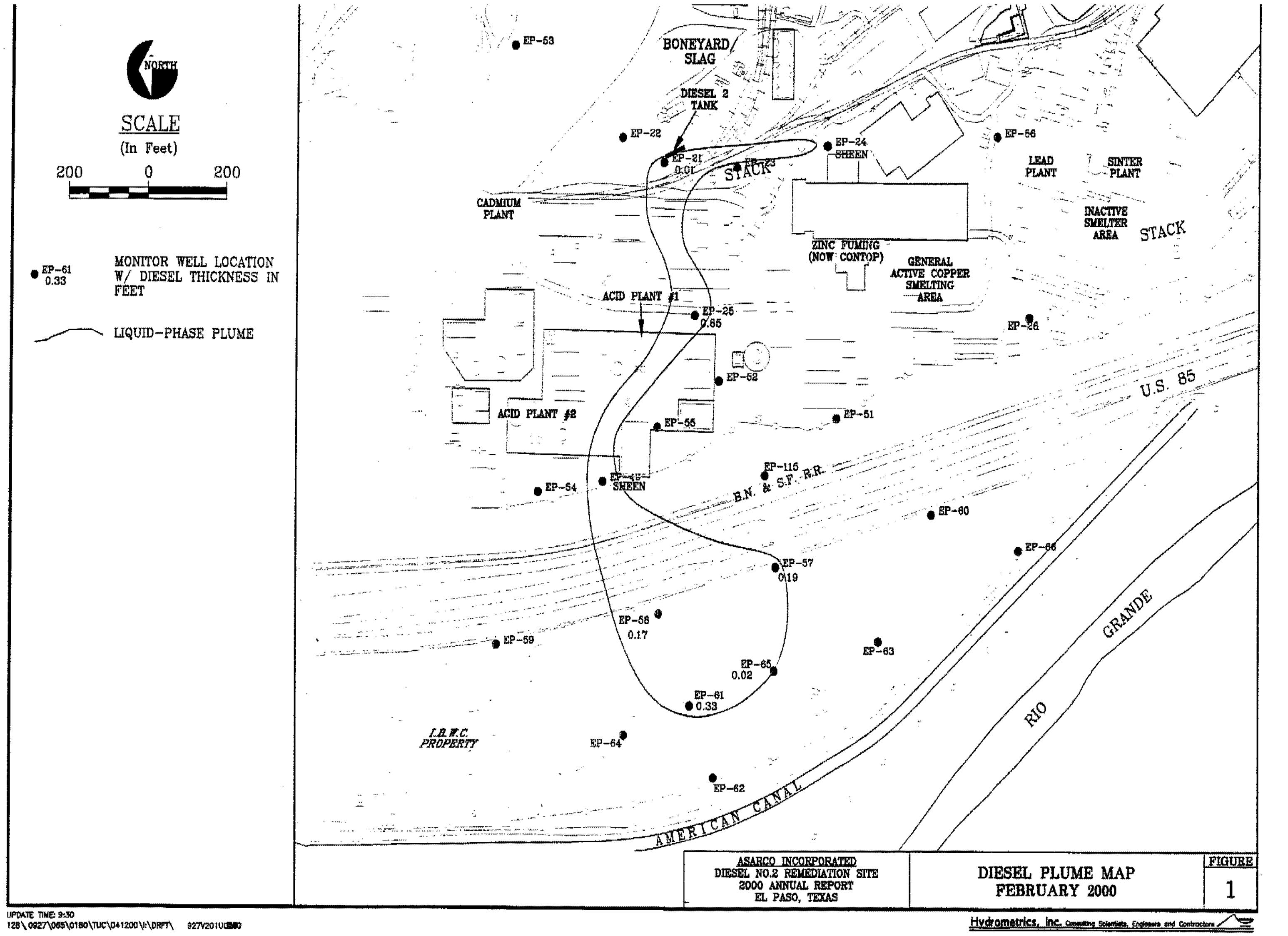
UPDATE TIME: 2:00
0000\0734\065\0180\TUC\091498\I:\DRFT\ 73498U40.DWG

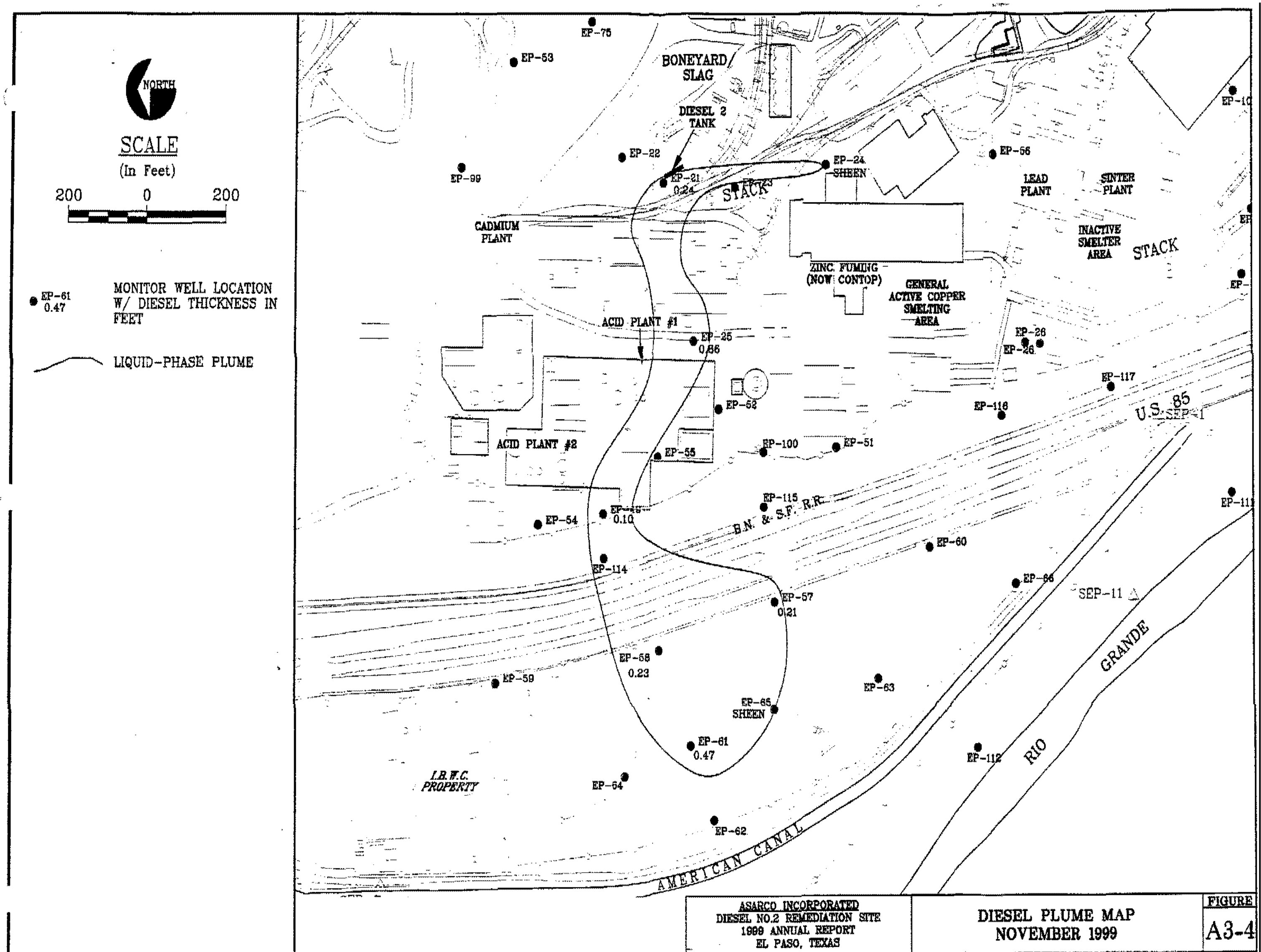
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

L.8 – UPPER OPEN CHANNEL DIESEL PLUME MAPS

ASARCO Diesel No. 2 Plume Maps 1997-2000

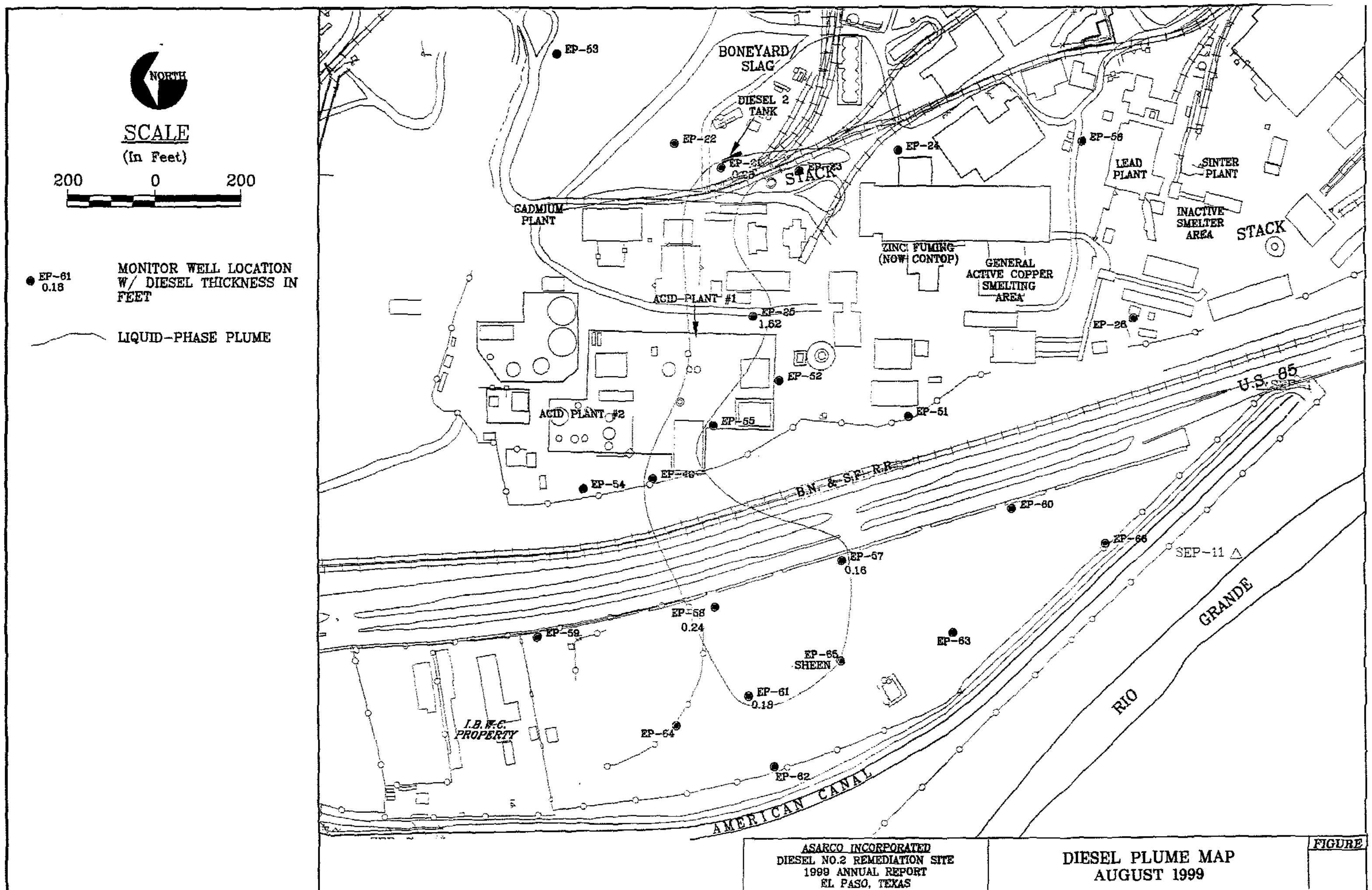
(Source: ASARCO)


NORTH
SCALE
(In Feet)
200 0 200
EP-61
0.33
MONITOR WELL LOCATION W/ DIESEL THICKNESS IN FEET
LIQUID-PHASE PLUME
EP-53
BONEYARD/ SLAG
DIESEL 2 TANK
EP-22
EP-21
0.01
STACK
EP-24
SHEEN
EP-56
LEAD PLANT
SINTER PLANT
CADMIUM PLANT
INACTIVE SMELTER AREA
STACK
ZINC FUMING (NOW CONTOP)
GENERAL ACTIVE COPPER SMELTING AREA
ACID PLANT #1
EP-25
0.85
EP-26
EP-52
U.S. 85
ACID PLANT #2
EP-55
EP-51
EP-115
B.N. & S.F. R.R.
SHEEN
EP-54
EP-60
EP-66
EP-57
0.19
EP-58
0.17
EP-59
EP-63
EP-65
0.02
EP-61
0.33
RIO GRANDE
I.B.W.C. PROPERTY
EP-64
EP-62
AMERICAN CANAL
ASARCO INCORPORATED
DIESEL NO.2 REMEDIATION SITE
2000 ANNUAL REPORT
EL PASO, TEXAS
DIESEL PLUME MAP
FEBRUARY 2000
FIGURE
1
UPDATE TIME: 9:30
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



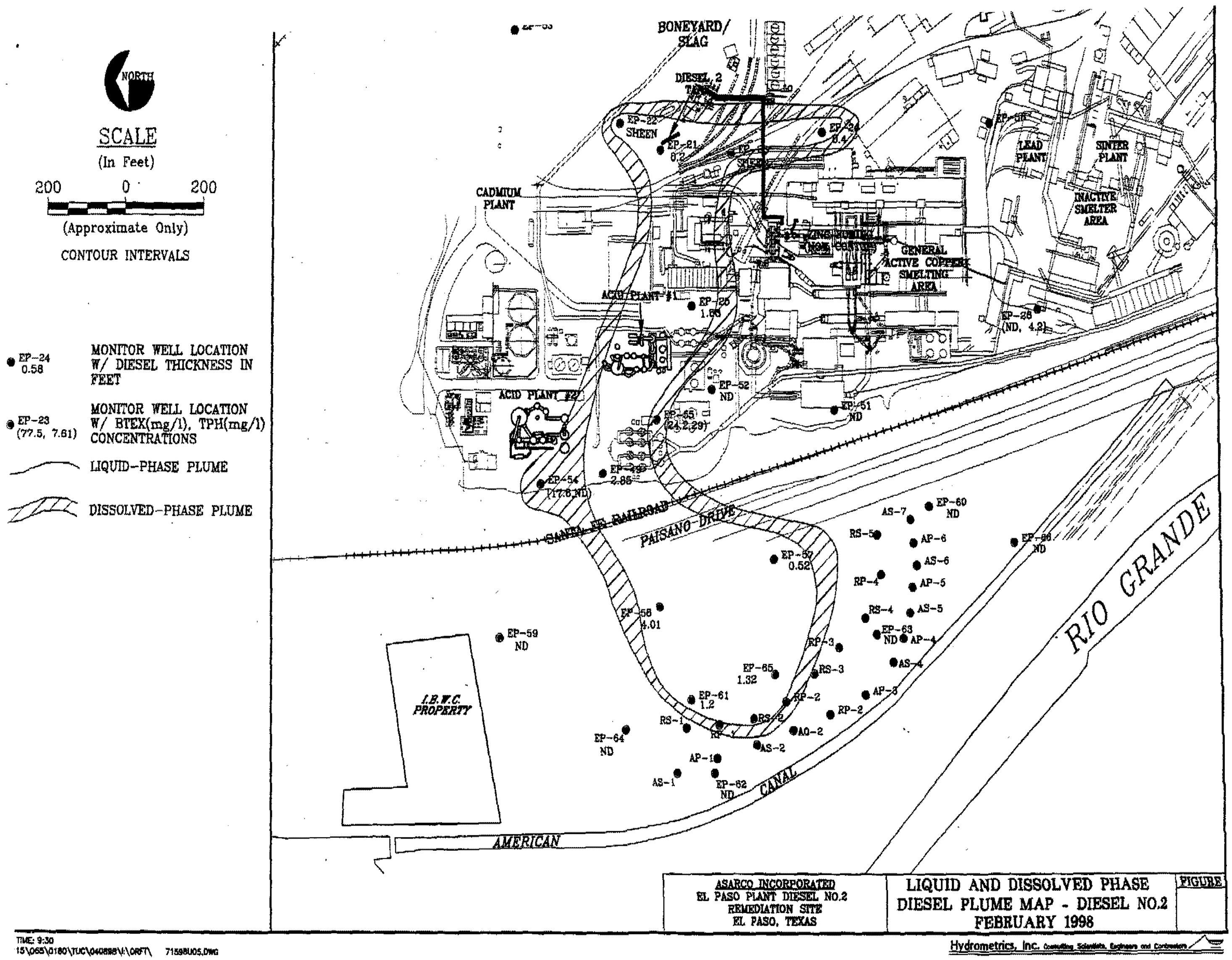
UPDATE TIME: 9:30
128\0927\065\0180\TUC\012600\E\DRFT\ 92700U04.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



UPDATE TIME: 9:30
128\0931\065\0180\TUC\102099\I:\DRFT\ 93199u16.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



NORTH
SCALE
(In Feet)
200 0 200
(Approximate Only)
CONTOUR INTERVALS
EP-24 0.58 MONITOR WELL LOCATION W/ DIESEL THICKNESS IN FEET
EP-23 (77.5, 7.61) MONITOR WELL LOCATION W/ BTEX(mg/l), TPH(mg/l) CONCENTRATIONS
LIQUID-PHASE PLUME
DISSOLVED-PHASE PLUME
BONEYARD/ SLAG
DIESEL 2
CADMIUM PLANT
LEAD PLANT
SINTER PLANT
INACTIVE SMELTER AREA
GENERAL ACTIVE COPPER SMELTING AREA
ACID PLANT #1
ACID PLANT #2
EP-22 SHEEN
EP-21 0.2
EP-25 1.65
EP-26 (ND, 4.2)
EP-52 ND
EP-51 ND
EP-54 (17.6,ND)
EP-49 2.85
SANTA FE RAILROAD
PAISANO DRIVE
EP-60 ND
EP-57 0.52
EP-56 4.01
EP-59 ND
EP-63 ND
EP-65 1.32
EP-61 1.2
EP-64 ND
EP-62 ND
AS-7
RS-5
AP-6
AS-6
RP-4
AP-5
RS-4
AS-5
AP-4
RP-3
AS-4
RS-3
AP-3
RP-2
RS-2
AO-2
AS-2
RS-1
RP-1
AP-1
AS-1
I.B.W.C. PROPERTY
RIO GRANDE
AMERICAN CANAL
ASARCO INCORPORATED
EL PASO PLANT DIESEL NO.2
REMEDIATION SITE
EL PASO, TEXAS
LIQUID AND DISSOLVED PHASE
DIESEL PLUME MAP - DIESEL NO.2
FEBRUARY 1998
FIGURE
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors
TIME: 9:30
15\065\0180\TUC\040898\\:\DRFT\ 71598U05.DWG

NORTH

SCALE
(In Feet)
200 0 200
(Approximate Only)

DIESEL PLUME

WELL	DIESEL THICKNESS IN BORE HOLE (FT)
EP-21	0.57
EP-22	0.08
EP-25	9.57
EP-49	2.19
EP-57	1.13
EP-65	2.50

ASARCO INCORPORATED
EL PASO PLANT
ANNUAL STATUS REPORT

LIQUID-PHASE AND DISSOLVED-PHASE DIESEL PLUME MAP DIESEL NO. 2 FEBRUARY 1997

FIGURE

UPDATE TIME: 10:35AM
128\ 0714\065\0151\HEL\030497\I:\STORAGE\71497A30.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

L.9 – MIDDLE OPEN CHANNEL DIESEL PLUME MAPS

ASARCO Diesel No. 1 Plume Maps 1998-2000

(Source: ASARCO)

NORTH

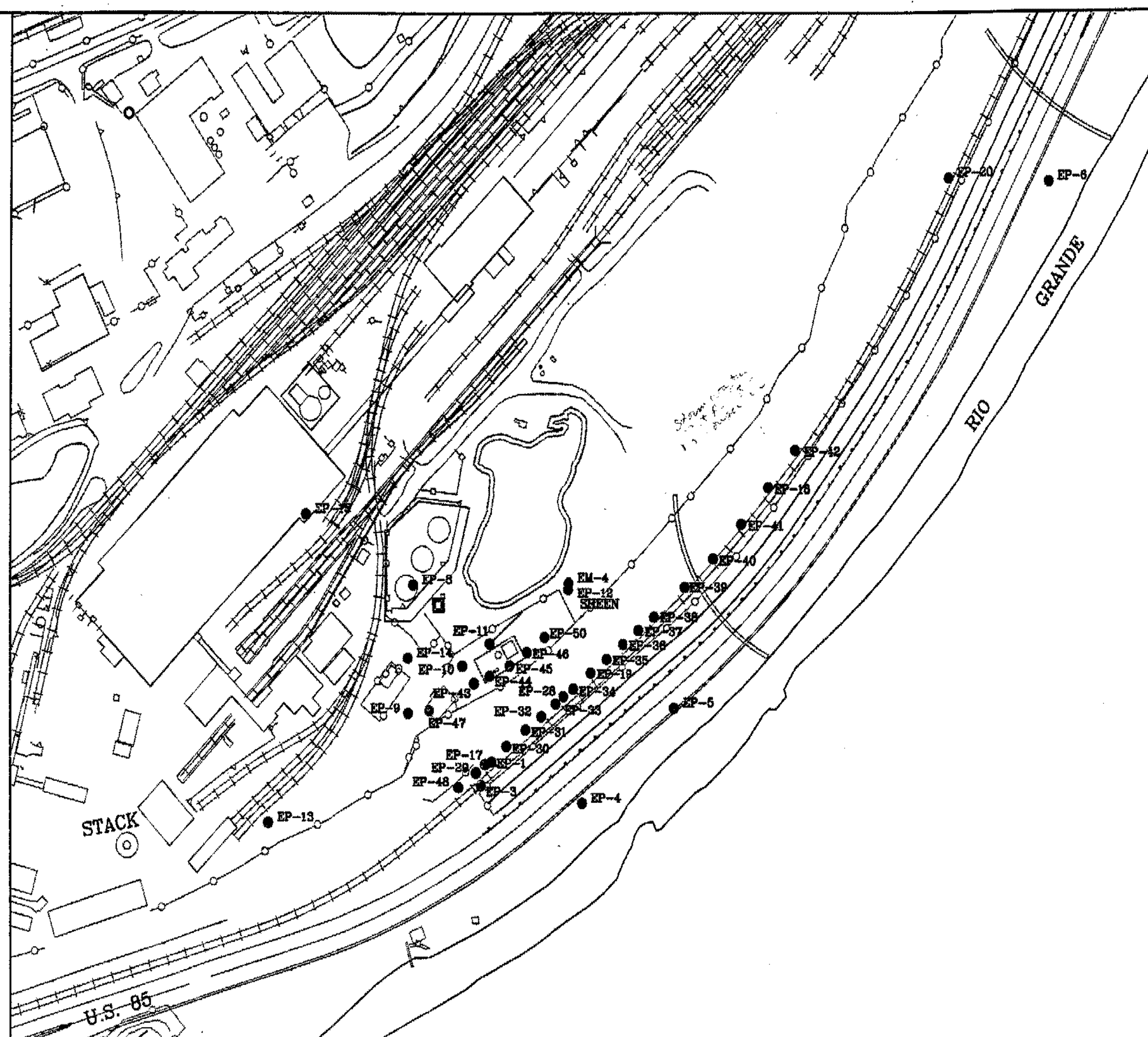
SCALE

(In Feet)

200 0 200

(Approximate Only)

● EP-12 SHEEN — MONITOR WELL LOCATION W/ DIESEL THICKNESS IN FEET



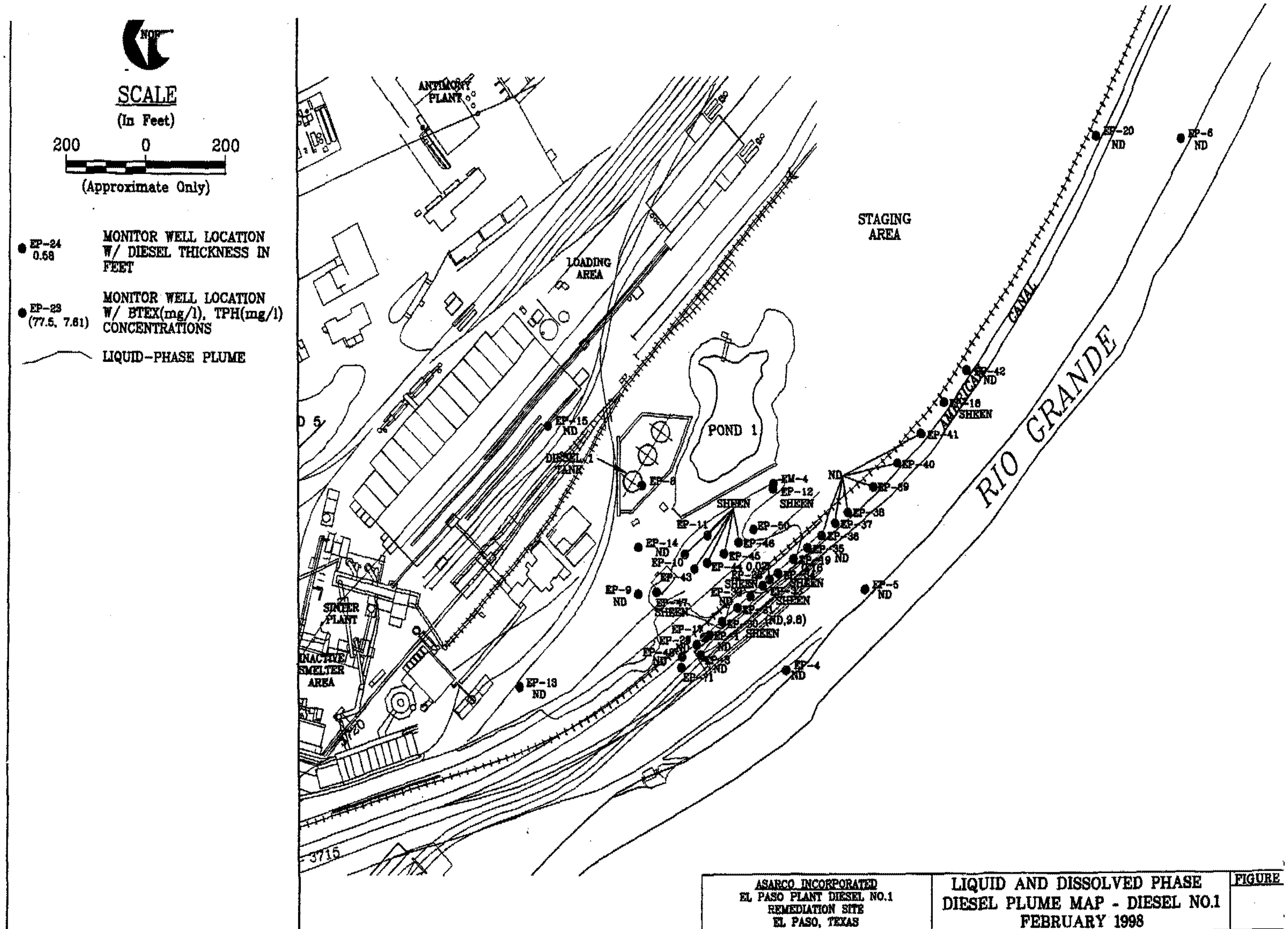
ASARCO INCORPORATED
1999 ANNUAL REPORT
DIESEL NO.1 REMEDIATION SITE
EL PASO, TEXAS

DIESEL SHEEN/ODOR BOUNDARY
AUGUST 1999

FIGURE

UPDATE TIME: 9:30
128\0931\065\0160\TUC\101899\I:\DRFT\ 93199U13.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

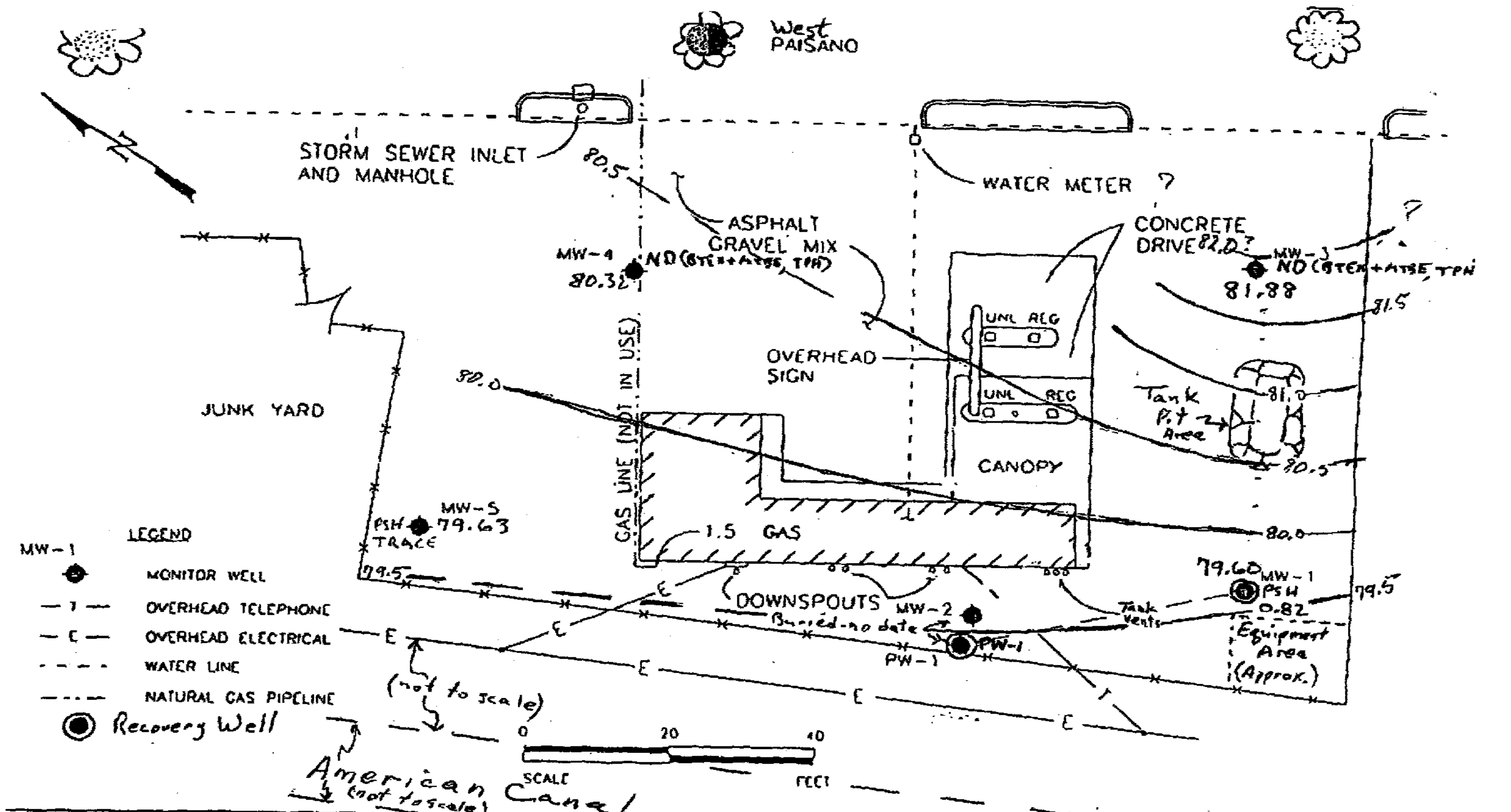


UPDATE TIME: 9:30
128\0715\065\0180\TUC\040198\E\DRFT\ 71598U06.DWG

L.10 – BELL THUNDERBIRD UST FACILITY DOCUMENTS

- **UST Facility Diagram**
  (Source: TNRCC)

- **Monitor Well Water Data**
  (Source: ENCON, 1999)



Potentiometric Contours 1/15/97

RIO GRANDE THUNDERBIRD, 2000 W. Paisano, El Paso, TX
LPST # 096823

Date:	Contour Interval:	Prepared By:	
1/15/97		JD 1/22/97	**SK ENGINEERING** 1122 S. Bryant Blvd., San Angelo, Texas 76903

TRACEANALYSIS, INC.

ANALYTICAL REPORT

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
6015 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

CLIENT ENCON
7307 REMCON CIRCLE
EL PASO, TX 79912

SAMPLE NO.: 993331
INVOICE NO.: 22104422
REPORT DATE: 08-07-99
REVIEWED BY:
PAGE : 1 OF 2

CLIENT SAMPLE ID : MW #1
SAMPLE TYPE .....: water
SAMPLED BY ......: R.K.
SUBMITTED BY ....: R.K.
SAMPLE SOURCE ...: 122-9
ANALYST ....: A. Donohue

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-23-99
SUBMITTAL DATE : 07-23-99
EXTRACTION DATE: --
ANALYSIS DATE .: 07-26-99

Petroleum Contaminants by 8021B

DATA TABLE

Parameter	Result	Unit	Detection Limit
Benzene	900	ug/L	1.0
Toluene	25.	ug/L	1.0
Ethylbenzene	100	ug/L	1.0
Total Xylenes	39.	ug/L	1.0
Methyl Tert-Butyl Ether	18.	ug/L	5.0

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

MANAGING DIRECTOR

TRACEANALYSIS, INC.
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6015 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL REPORT

CLIENT ENCON
7307 REMCON CIRCLE
EL PASO, TX 79912

SAMPLE NO. : 993331
INVOICE NO.: 22104422
REPORT DATE: 08-07-99
REVIEWED BY:
PAGE : 1 OF 1

CLIENT SAMPLE ID : MW #1
SAMPLE TYPE .....: water
SAMPLED BY ......: R.K.
SUBMITTED BY ....: R.K.
SAMPLE SOURCE ...: 122-9
ANALYST ....: D.Guzman

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-23-99
SUBMITTAL DATE : 07-23-99
EXTRACTION DATE: 07-29-99
ANALYSIS DATE .: 07-29-99

TPH TX1005

DATA TABLE

Parameter	Result	Unit	Detection Limit
C6-C10	<5.0	mg/L	5.0
>C10-C28	8.8	mg/L	5.0
C6-C28	8.8	mg/L	5.0

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

MANAGING DIRECTOR

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[illegible] Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL REPORT

CLIENT ENCON
7307 REMCON CIRCLE
EL PASO, TX 79912

SAMPLE NO.: 993332
INVOICE NO.: 22104422
REPORT DATE: 08-07-99
REVIEWED BY:
PAGE : 1 OF 2

CLIENT SAMPLE ID : MW #5
SAMPLE TYPE .....: water
SAMPLED BY ......: R.K.
SUBMITTED BY ....: R.K.
SAMPLE SOURCE ...: 122-9
ANALYST ....: A. Donohue

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-23-99
SUBMITTAL DATE : 07-23-99
EXTRACTION DATE: --
ANALYSIS DATE .: 07-26-99

REMARKS -

MTBE detection limit raised due to dilution.

Petroleum Contaminants by 8021B

DATA TABLE

Parameter	Result	Unit	Detection Limit
Benzene	15.	ug/L	1.0
Toluene	<1.0	ug/L	1.0
Ethylbenzene	3.5	ug/L	1.0
Total Xylenes	1.7	ug/L	1.0
Methyl Tert-Butyl Ether	<5.0	ug/L	5.0

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

MANAGING DIRECTOR

TRACEANALYSIS, INC.

ANALYTICAL REPORT

6701 Aberdeen Avenue, Suite 9 · Lubbock, Texas 79424 · 800•378•1296 · 806•794•1296 · FAX 806•794•1298
6725 Ripley Avenue, Suite A · El Paso, Texas 79922 · 888•588•3443 · 915•585•3443 · FAX 915•585•4944
E-Mail: lab@traceanalysis.com

CLIENT ENCON
7307 REMCON CIRCLE
EL PASO, TX 79912

SAMPLE NO.: 993332
INVOICE NO.: 22104422
REPORT DATE: 08-07-99
REVIEWED BY:
PAGE : 1 OF 1

CLIENT SAMPLE ID : MW #5
SAMPLE TYPE .....: water
SAMPLED BY ......: R.K.
SUBMITTED BY ....: R.K.
SAMPLE SOURCE ...: 122-9
ANALYST ....: D.Guzman

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-23-99
SUBMITTAL DATE : 07-23-99
EXTRACTION DATE: 07-29-99
ANALYSIS DATE .: 07-29-99

TPH TX1005

DATA TABLE

Parameter	Result	Unit	Detection Limit
C6-C10	<5.0	mg/L	5.0
>C10-C28	14.	mg/L	5.0
C6-C28	14.	mg/L	5.0

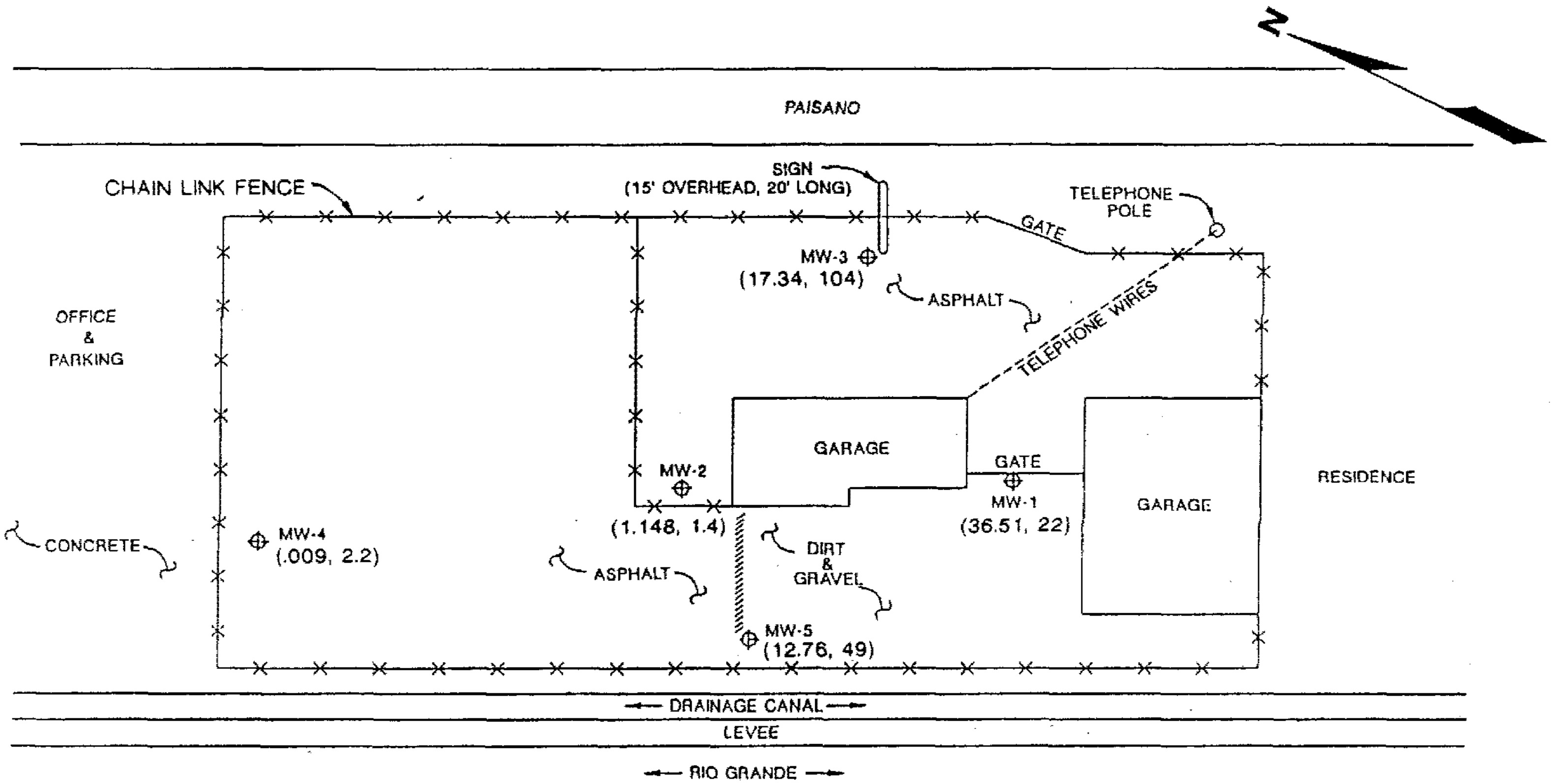
(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

MANAGING DIRECTOR

L.11 – PAISANO AUTO SALVAGE UST MAPS

(Source: TNRCC, 1992)



LEGEND

⊕ MONITOR WELL

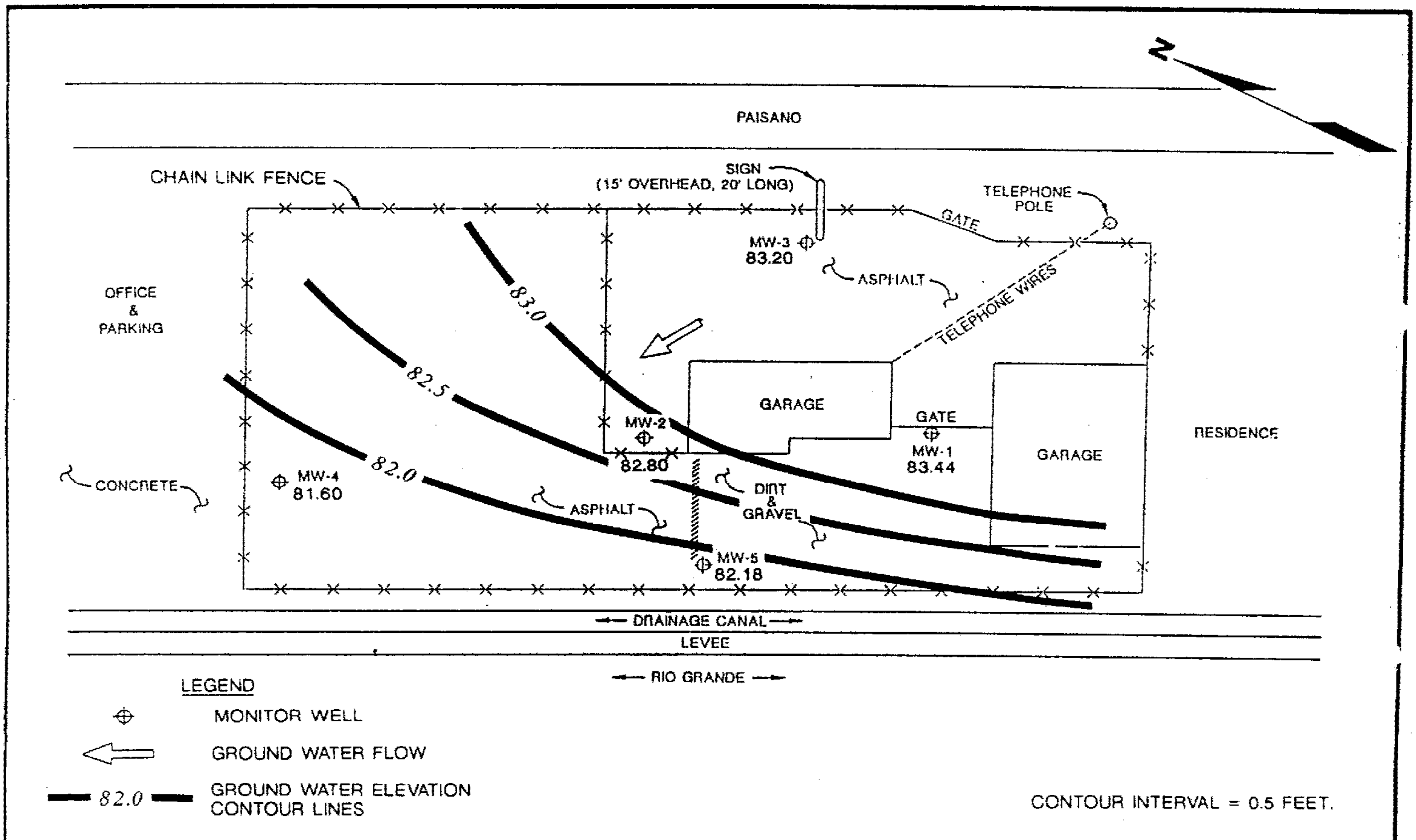
(.1,.2) *DISSOLVED-PHASE (BTEX, TPH) ppm*

ERM-Southwest, inc.

NEW ORLEANS, LOUISIANA HOUSTON, TEXAS

DATE 02/07/92 W.O.NO. 0426A013

FIGURE 3-1
DISSOLVED-PHASE HYDROCARBON CONCENTRATIONS
JANUARY 3, 1992
Palsano Auto Salvage
1900 W. Paisano
El Paso, Texas



ERM-Southwest, inc.
NEW ORLEANS, LOUISIANA HOUSTON, TEXAS

DATE 02/07/92 W.O.NO. 0426A012

FIGURE 2-1
WATER TABLE ELEVATION
JANUARY 3, 1992
Paisano Auto Salvage
1900 W. Paisano
El Paso, Texas

L.12 – USIBWC INTERNATIONAL DAM UST DOCUMENTS

(Source: USIBWC, 1997)

EMD file

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Dan Pearson, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

February 3, 1997

Mr. Yusuf E. Farran
Division Engineer, EMD
International Boundary and Water Commission
4171 N. Mesa Street
El Paso, Texas 79902

Re: Leaking Product Storage Tank (LPST) Case Closure of Subsurface Contamination at the International Dam, Rio Grande Floodway, El Paso (El Paso County), Texas (LPST ID No. 107801 - Facility ID No. N/A)

Dear Mr. Farran:

This letter confirms the completion of corrective action requirements for the release incident at the above-referenced facility. Based upon the submitted information and with the provision that the documentation provided to this agency was accurate and representative of site conditions, we concur with your recommendation that the site has met the closure requirements. No further corrective action is necessary.

For any subsequent release after case closure from an underground or aboveground storage tank at sites eligible for reimbursement, the deductible will be increased in accordance with Section 26.3512 of the Texas Water Code. Please note that financial assurance must be maintained for all operational storage tanks at this site.

Please be advised that all monitor wells which are not now in use and/or will not be used in the next 180 days must be properly plugged and abandoned pursuant to Chapter 32.017 of the Texas Water Code and in accordance with Title 30, Texas Administrative Code (TAC), Section 338.48-338.50. Plugging and abandonment reports (Form No. WWD-009) are required to be submitted to the Water Well Drillers Program of the Texas Natural Resource Conservation Commission (TNRCC) within thirty (30) days of plugging completion. If you have any questions regarding the future use of an existing monitor well, please contact the TNRCC Water Well Drillers Unit of the Occupational Certification Section of the Environmental Training Division at 512/239-0530.

If any monitor well plugging or other necessary site restoration activities will be performed to complete site closure, please prepare a *Final Site Closure Report* to document the conclusion of actual site closure. For sites which are eligible for reimbursement through the Petroleum Storage

P.O. Box 13087 • Austin, Texas 78711-3087 • 512/239-1000
printed on recycled paper using soy-based ink

Draft Dam

Tank Remediation Fund, written preapproval should be obtained prior to initiation of any remaining site closure activities. Reimbursement claims for activities that were not preapproved will not be paid until all claims for preapproved work are processed and paid.

Please note that the *Final Site Closure Report*, if necessary, will be the last submittal associated with this case. This final concurrence letter signifies the completion of corrective action associated with the release. No subsequent TNRCC correspondence will be issued in response to the *Final Site Closure Report*.

Please ensure that all correspondence with this Office includes the LPST ID Number and is submitted to both the local TNRCC Regional Field Office and to the Central Office in Austin.

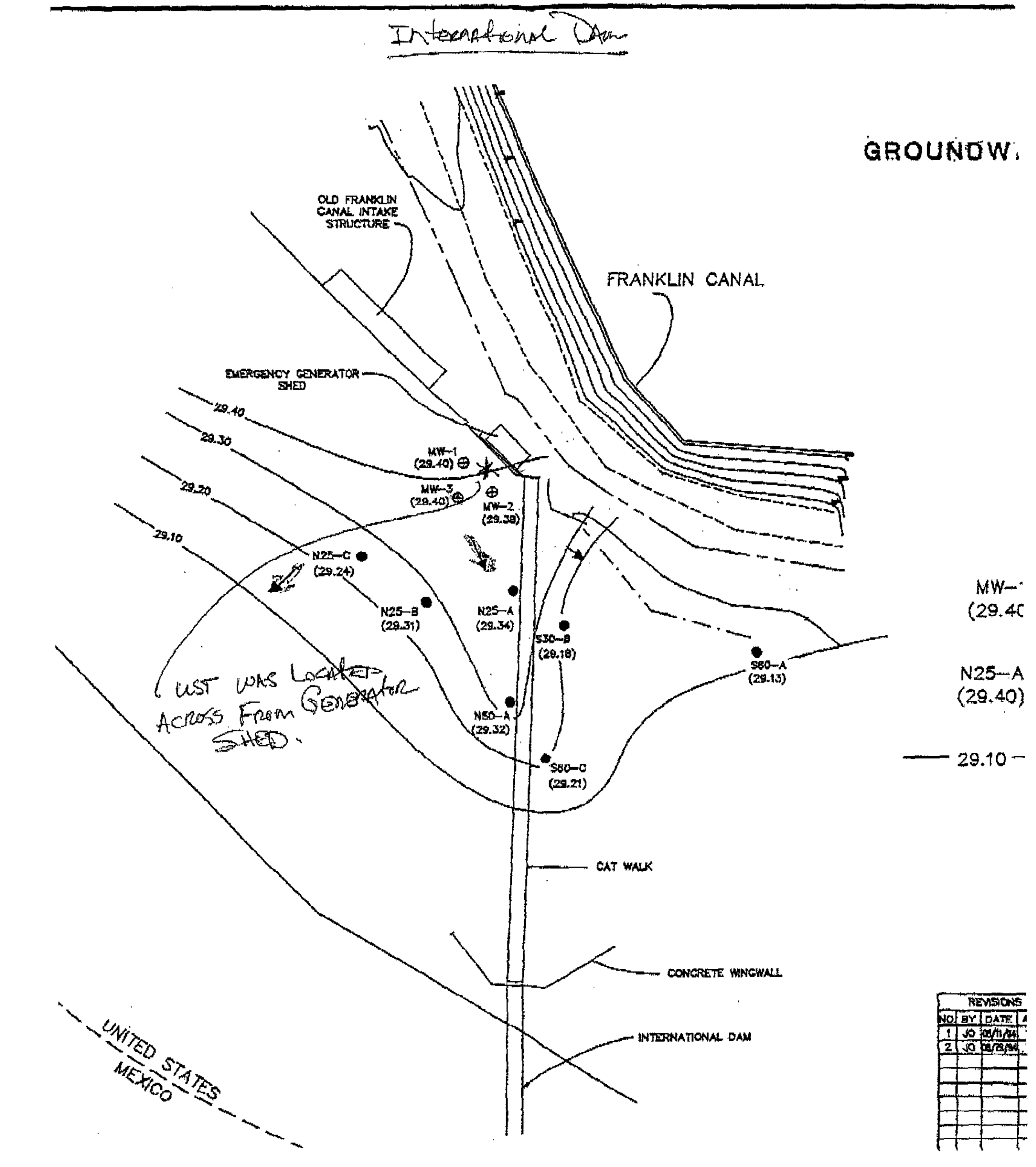
Should you have any questions, please contact Richard Scharlach of my staff at 512/239-5806. **Please reference the LPST ID Number when making inquiries.** Your cooperation in this matter has been appreciated.

Sincerely,

Liz Scaggs, Team Leader
Responsible Party Remediation Section, Team II
Petroleum Storage Tank Division

LAS/RAS/keh
107801.fnn

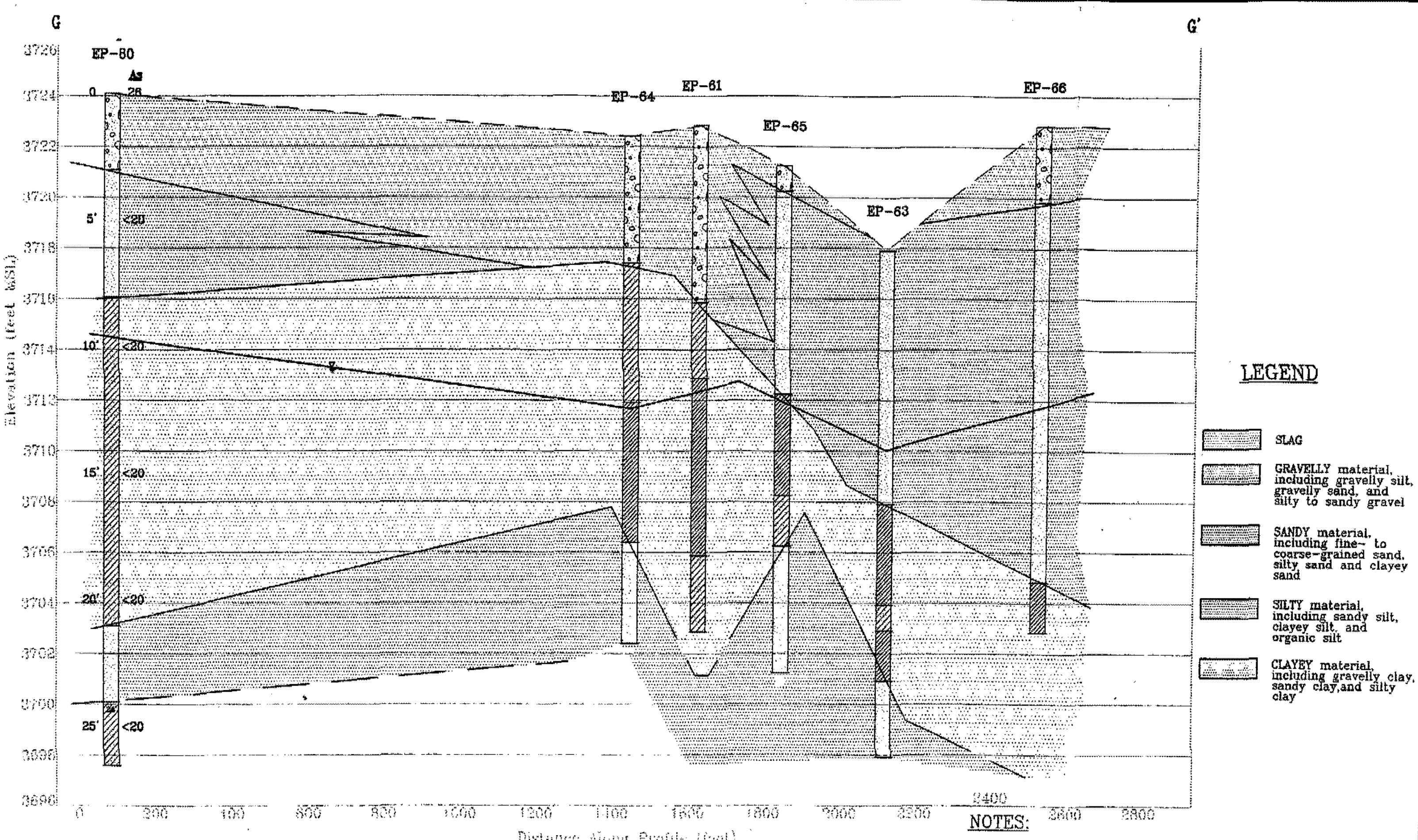
cc: Terry McMillian, TNRCC Region 6 Field Office, 915/778-9634
(7500 Viscount Blvd., El Paso, Texas 79925)
Warren Samuelson, TNRCC Occupational Certification Section


International Dam
GROUNDW
OLD FRANKLIN CANAL INTAKE STRUCTURE
FRANKLIN CANAL
EMERGENCY GENERATOR SHED
29.40
29.30
29.20
29.10
MW-1 (29.40)
MW-3 (29.40)
MW-2 (29.39)
N25-C (29.24)
N25-B (29.31)
N25-A (29.34)
S30-B (29.18)
S60-A (29.13)
N50-A (29.32)
S60-C (29.21)
UST WAS LOCATED ACROSS FROM GENERATOR SHED.
CAT WALK
CONCRETE WINGWALL
INTERNATIONAL DAM
UNITED STATES
MEXICO
MW-
(29.40
N25-A
(29.40)
29.10
REVISIONS
NO BY DATE
1 JO
2 JO

L.13 – HYDROGEOLOGIC CROSS-SECTION MAP

Hydrogeologic Cross-section Map for ASARCO Monitor Wells in Upper Open Channel Area

(Source: ASARCO, 1998)



GEOLOGIC CROSS-SECTION G - G'

(LOOKING WEST)
HORIZONTAL: 1"=240'
VERTICAL: 1"=4'

NOTES:

1. ALL CONTACT POINTS INFERRED.
2. WATER TABLE CALCULATED FROM FEB. 1998 DATA.
3. As = ARSENIC CONCENTRATION IN SOIL SAMPLE COLLECTED AT DEPTH INDICATED.

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	HYDROGEOLOGIC CROSS-SECTION G - G'	FIGURE 2-33

UPDATE TIME: 11:00
0000, 0:`34\065\0180\TUC\081898\I:\STORAGE\73498U28.DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

L.14 – LOWER OPEN CHANNEL SOIL DATA

Lower Open Channel Levee Soil Laboratory Results

(Source: ENCON, 1999)

TRACEANALYSIS, INC.

ANALYTICAL REPORT

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915
E-Mail: lab@traceanalysis.com

CLIENT ENCON INTERNATIONAL
7307 REMCON #101
EL PASO, TX 79912

SAMPLE NO. : 993213
INVOICE NO.: 22104393
REPORT DATE: 07-28-99
REVIEWED BY:

CLIENT SAMPLE ID : GP #1
SAMPLE TYPE .....: soil
SAMPLED BY ......: R.K
SUBMITTED BY ....: R.K
SAMPLE SOURCE ...: 122-9

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-16-99
SUBMITTAL DATE : 07-16-99
EXTRACTION DATE: --

REMARKS -

Matrix spike and matrix spike duplicate were out of acceptance criteria range possibly due to matrix interference for the following parameters: Silver, Cadmium, Lead & Chromium.
Reporting limit for Selenium was raised as sample was analyzed diluted to avoid matrix interference.

METALS - SOLID

D A T A   T A B L E

Parameter	Result	Unit	Detection Limit	Analysis Date	Test Method	Analyst
Total Silver ....:	<1.3	mg/Kg	1.30	07-26-99	3111B	N. Munir
Total Arsenic ....:	11.	mg/Kg	5.00	07-26-99	6010B	N. Munir
Total Barium ....:	190	mg/Kg	5.00	07-26-99	6010B	N. Munir
Total Cadmium ....:	<5.0	mg/Kg	5.00	07-26-99	6010B	N. Munir
Total Chromium ....:	5.8	mg/Kg	2.50	07-26-99	3050B/3111B	N. Munir
Total Lead ....:	56.	mg/Kg	5.00	07-26-99	6010B	N. Munir
Total Selenium ....:	<10.	mg/Kg	10.0	07-26-99	6010B	N. Munir

ANALYTICAL RESULTS REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

(1) Copy to Client

Karen Costa

TRACEANALYSIS, INC.
6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
6725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL REPORT

CLIENT ENCON INTERNATIONAL
7307 REMCON #101
EL PASO, TX 79912

SAMPLE NO. : 993213
INVOICE NO.: 22104393
REPORT DATE: 07-28-99
REVIEWED BY:

D A T A T A B L E (Continue)

Parameter	Result	Unit	Detection Limit	Analysis Date	Test Method	Analyst
Total Mercury ....:	<0.50	mg/Kg	0.50	07-21-99	SW-7470	N. Munir
Total Nickel ....:	3.9	mg/Kg	5.00	07-26-99	6010B	N. Munir

(1) Copy to Client

TRACEANALYSIS, INC.
6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL REPORT

CLIENT ENCON INTERNATIONAL
7307 REMCON #101
EL PASO, TX 79912

SAMPLE NO. : 993214
INVOICE NO.: 22104393
REPORT DATE: 07-28-99
REVIEWED BY:
PAGE : 1 OF 1

CLIENT SAMPLE ID : GP #4
SAMPLE TYPE .....: soil
SAMPLED BY ......: R.K
SUBMITTED BY ....: R.K
SAMPLE SOURCE ...: 122-9

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-16-99
SUBMITTAL DATE : 07-16-99
EXTRACTION DATE: --

METALS - SOLID

D A T A T A B L E

Parameter	Result	Unit	Detection Limit	Analysis Date	Test Method	Analyst
Total Lead ....:	21.	mg/Kg	5.00	07-26-99	6010B	N. Munir

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

Karen Costa

TRACEANALYSIS, INC. ANALYTICAL REPORT
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

CLIENT ENCON INTERNATIONAL
7307 REMCON #101
EL PASO, TX 79912

SAMPLE NO. : 993215
INVOICE NO.: 22104393
REPORT DATE: 07-28-99
REVIEWED BY:
PAGE : 1 OF 1

CLIENT SAMPLE ID : GP #5
SAMPLE TYPE .....: soil
SAMPLED BY ......: R.K
SUBMITED BY ....: R.K
SAMPLE SOURCE ...: 122-9

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-16-99
SUBMITTAL DATE : 07-16-99
EXTRACTION DATE: --

METALS - SOLID

DATA TABLE

Parameter	Result	Unit	Detection Limit	Analysis Date	Test Method	Analyst
Total Lead ....:	6.8	mg/Kg	5.00	07-26-99	6010B	N. Munir

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

Karen Costa

TRACEANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL REPORT

CLIENT ENCON INTERNATIONAL
7307 REMCON #101
EL PASO, TX 79912

SAMPLE NO. : 993216
INVOICE NO.: 22104393
REPORT DATE: 07-28-99
REVIEWED BY:
PAGE : 1 OF 1

CLIENT SAMPLE ID : GP #6
SAMPLE TYPE .....: soil
SAMPLED BY ......: R.K
SUBMITTED BY ....: R.K
SAMPLE SOURCE ...: 122-9

AUTHORIZED BY : R. Kommajosyula
CLIENT P.O. : --
SAMPLE DATE ...: 07-16-99
SUBMITTAL DATE : 07-16-99
EXTRACTION DATE: --

METALS - SOLID

DATA TABLE

Parameter	Result	Unit	Detection Limit	Analysis Date	Test Method	Analyst
Total Lead ....:	15.	mg/Kg	5.00	07-26-99	6010B	N. Munir

(1) Copy to Client

ANALYTICAL RESULT(S) REPORTED HEREIN APPLY ONLY TO THE SAMPLE(S) TESTED. FURTHERMORE, THIS REPORT CAN ONLY BE COPIED IN ITS ENTIRETY.

MANAGING DIRECTOR

L.15 – LETTER FROM US DEPT. OF THE ARMY, ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
El Paso Regulatory Office
P.O. Box 6096
FORT BLISS, TEXAS 79906-6096
FAX (915) 568-1348

September 24, 1999

REPLY TO
ATTENTION OF:

Operations Division
Regulatory Branch

Mr. John Knopp
ENCON International, Inc.
7307 Remcon Circle, Suite 101
El Paso, Texas 79912

Dear Mr. Knopp:

Reference is made to your telefax dated September 23, 1999 regarding International Boundary and Water Commission' proposed replacement of an approximately 2-mile segment of the American Canal in El Paso, El Paso County, Texas. (Action No. 1999-50132)

We have studied the project description, other records, and documents available to us. The project is not regulated under the provisions of Section 404 of the Clean Water Act and a Department of the Army permit will not be required. This determination was made because no dredged or fill material will be placed into waters of the United States, including wetlands.

Should you have any questions, please feel free to write or call me at (915) 568-1359.

Sincerely,

Daniel Malanchuk

Daniel Malanchuk
Chief, El Paso
Regulatory Office

Copies furnished w/cy incoming:

El Paso Reg Ofc

L.16 – RECORDS OF CONVERSATION

RECORD OF CONVERSATION - ENCON File # 122-9
Water

Name: Robert Riley
Date/Time: 11/1/99
Agency: El Paso Water Utilities
Phone No.: 915-594-5402

Canal Street Plant has been converted to treat only river water.

Treats 42 MGD

Plant can convert to groundwater treatment in 1 to 2 days, but only 5 MGD.

Recommended Action or Response

Name and Date: John Knopp 11/1/99

RECORD OF CONVERSATION - ENCON File # 122-9
Water

Name: **Dr. Doug Rittman** **Date/Time:** **Nov. 7, 1999**

Agency: **EPWU - PSB, Water System Div.** **Phone No.:** **915-594-5773**

At present, there is a maximum production of 80 MGD from River Water and 150 MGD from wells for a maximum production of 2230 MGD. They are planning to expand Jonathan Rogers plant from 40 to 60 then 80 MGD in the next 5 years or so.
Later, they hope to build an 80 MGD plant in the Upper Valley near Anthony to increase river water treatment to 160 MGD. At present, a peak day demand is 150 MGD (70% from lawn watering) and a minimum day is about 60 MGD. But for peak demand, you need to include a 17% safety factor or 194 MGD.

They sell water for $1.50 per 1000 gal or $1500 per MG. If they lost both American Canal-fed plants due to a canal repair, they would lose approximately $150,000 per day or $4.5 million per 30 days. Also there would be extreme water rationing, especially to stop all yard watering.

Recommended Action or Response

Name and Date: John Knopp 11/7/99

RECORD OF CONVERSATION - ENCON File # 122-9
Water

Name: Wayne Treers **Date/Time:** 10/29/99 10:00 am

Agency: Bureau of Reclamation, Water Operations **Phone No:** 915-534-6299 fax 915-534-6321

BOR releases stored water from Caballo Dam at the request of

- EPCWID#1: Water diverted into Franklin Canal and transported through City to Lower Valley Farms
- EPWU-PSB: Diverts water for treatment at Jonathon Rogers and Canal Street Water Plants (City of El Paso). CEP uses approximately 52,000 acre feet of water per year.
- USIBWC (for Mexico): Mexico is considering taking its water allotment from the RGACE near the Zaragosa Bridge. At present Mexico still takes its allotment from International Bridge.

EPCWID#1, CEP, Mexico order water from BOR each day, but delivery takes about 3 days:

- Day 1: Caballo Dam to Leasburg Dam
- Day 2: Leasburg Dam to Mesilla Dam
- Day 3: Mesilla Dam to Courshesne Bridge near headgates of American Canal

USIBWC operates International Dam, but Mexico operates headgates of Acequia Madre. BOR owns the other diversion dams (Leasburg, Mesilla, American, Riverside). In 1996 BOR turned over title of canal systems to either Elephant Butte Irrigation District or El Paso County Water Improvement District #1.

American Canal includes water from 1) river, 2) rainfall spikes, and 3) runoff from Paisano Drive.

BOR does not have estimates of losses from Canal. However, "PAN Evaporation losses" are estimated as approximately 120 inches per year at Elephant Butte Dam and 112 inches per year at Caballo Dam. From RGACE experience, Mr. Treers believes that evaporation loss from the swift-flowing water in the Canal would be much less than from either dam, perhaps half. But he does not consider evaporation losses from the canal to be significant compared to other needs such as safety or maintenance.

National Weather Service for El Paso provides annual and monthly Climatological Data for the area on the Net. Mr. Treers suggests using Ysleta Station Data. Ken Rakestraw in Water Accounting at USIBWC might know evaporation losses.

Any rebuilding of the Canal needs to leave at least 100 feet of open channel downstream from the gauging shelter for BOR to be able to accurately measure the Canal flow. BOR does not have a preference for closed or open canal segments if the minimum 100-foot canal length is left as open channel.

Addendum June 1, 2000

For ease of gauging, BOR would prefer the Open Canal Alternative #4. However, any of the alternatives except the No Action Alternative would be acceptable as long as the gauging station remains in the same location and 100 feet or more open channel is left downstream from the gauging station for accurate flow measurements.

Name and Date: John Knopp, Oct. 29, 1999

RECORD OF CONVERSATION - ENCON File # 122-9

Water (Page 1 0f 2)

Name: Edd Fifer & Frank Marquez , Chairman, Supervisor

Date/Time: 10/29/99 10:00 am

Agency: El Paso County Water Improvement District #1

Phone No: 859-4186

Capacity issues of the American Canal:

- Average daily Canal flow ranges from approximately 900 – 1000 cfs in March, then drops to 750 cfs or less, then increases to between 1000 – 1200 cfs in the July peak summer irrigation season.
- If Mexico chooses to divert its 60,000 acre foot allotment of water from the RGACE near Riverside Dam, the canal will have to carry an extra 335 cfs.
- By July, the regular water allotment (Allotment #1) is generally exhausted. Then the principal source of "Allotment #2 water becomes "return flow" or rainfall runoff from Caballo Dam through El Paso. Return flow comprises approximately 41% of the flow in the Canal, and is essential for meeting irrigation needs.
- Stormwater flowing into the Canal from the College Arroyo near the International Dam can reach 250 – 400 cfs during a typical heavy July rainfall, but reached a maximum of 1500 cfs during one rainfall in the early 1970s. In a peak rainfall, runoff can be discharged from the Canal into the River through Wasteway #1 near the International Dam.
- Wasteway #1 is now automated, and can release up to 1500 cfs of water from the Canal into the river below the International Dam. However, if a heavy rain occurs between Caballo Dam and El Paso, the gates could go under water and cease to function, the dam could be destroyed, and flooding could occur all along the RGACE, the Franklin Canal, and especially the Acequia Madre in Juarez.

Telemetry Sites or "black boxes" upriver automatically gauge the river flow and transmit the data to BOR and IBWC, and EPCWID#1.

Name and Date: John Knopp June 1, 2000

RECORD OF CONVERSATION - ENCON File # 122-9
Water (Page 2 of 2)

Name: Edd Fifer (& Frank Marquez) **Date/Time:** 10/29/99 10:00 am

Agency: El Paso County Water Improvement District #1 **Phone No:** 859-859-4186

EPCWID#1 Fears concerning the American Canal (RGACE):

- The American Dam has eight sections, but the smaller International Dam has only four. It is more vulnerable to hydrological pressure in a flood. (This was a real fear with the heavy rains near Leasburg Dam in 1999. BOR diverted 1600 cfs into the RGACE to protect the aging International Dam from the 7000 cfs storm flow, then returned 1450 cfs back into the new RGACE extension below the Dam. Serious damage to the Dam and serious flooding was averted.

- Fast-moving surges of water in storm flows can destroy old concrete canal linings.
- Storm flows have popped the seals out from between new concrete sections of canal.
- A June 9, 1987 failure of the small downstream Riverside Dam put 32,000 acres of farmland at risk of having no irrigation water. EPCWID#1 employees worked 72 hours continuously to finish a temporary coffer dam to divert water from the Rio Grande to the Lower Valley. The EPCWID#1 was not reimbursed by any agency for paying the huge amount of money in overtime wages in the emergency.
- A failure in the aging RGACE (where there is no location to construct a temporary canal) would be much worse than the 1987 Riverside Dam failure. A failure in the high flow period in July could easily result in the canal being unusable for 30 days of emergency repairs. Thousands of farmers would lose their entire crop, and up to 500 farmers would lose their farms in bankruptcies. Farmers would suffer up to $20 Million in crop losses, and EPCWID#1 would lose approximately $0.5 Million in lost revenues. The local agribusiness ripple effect of the farm losses could reach up to $300 Million. Further, the City of El Paso would have insufficient water treat to meet its customer and fire demands.

Mr. Fifer's chief concern is that the aging canal be replaced to avert a possible catastrophe in Juarez or El Paso. Any of the construction alternatives are acceptable except the No Action Alternative which Mr. Fifer believes would guarantee future canal failure and economic disaster.

Addendum May 16, 2000

The snow runoff was down 83% this year, yielding only 17% of normal runoff being added to storage. Water is more critical than ever. The EPCWID#1 prefers Alternative 4, the Open Channel Alternative, but finds any of the others also acceptable except the No Action Alternative.

Name and Date: John Knopp June 1, 2000

APPENDIX M
(Hazardous Waste Disposal Section)

- **Hazardous Waste Disposal Text**

HAZARDOUS WASTE DISPOSAL

1.0 DEFINITION OF HAZARDOUS WASTE

In 1976, the US Congress defined "hazardous waste" in Section 1004 of the Resource Conservation and Recovery Act (RCRA) as:

> "….. a solid waste or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may …
>
> A) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or
>
> B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed…."

It should be noted that the "solid waste" category used in the RCRA definition includes liquids, sludges, and containerized gases.

Hazardous wastes do not include wastes which are discharged directly into the air or water as those wastes are regulated under prior air and water laws which predated RCRA.

Under EPA regulations, there are three ways in which a solid waste is considered to be a "hazardous waste", viz.,

1) The known waste is specifically listed in EPA regulations, generally with an assigned hazardous waste number,
2) The waste meets one of the four EPA characteristics for hazardous wastes: ignitable, corrosive, reactive, or toxic, or
3) Based on knowledge of the waste, it is declared hazardous by the waste generator, the entity which produced the waste.

2.0 CLASSIFICATION OF HAZARDOUS WASTE

Ignitable wastes are either solids capable of causing a fire under standard temperature and pressure, or liquids with flashpoints below 60°Centigrade.

Corrosive wastes are aqueous (dissolved in water) wastes with a pH above 12.5 or below 2.0, or which corrode steel at a rate greater than 0.25 inches per year.

Reactive wastes are normally unstable, form potentially explosive mixtures with water, or react violently with air or water. This group includes materials capable of detonation and wastes that emit toxic fumes when mixed with water.

Toxic wastes are those toxic substances, which through the EPA laboratory Toxic Characteristic Leaching Procedure (TCLP), are shown to be likely to leach into groundwater if placed in a municipal landfill.

3.0 FEDERAL, STATE, AND LOCAL REGULATORY AUTHORITY

The Resource Conservation and Recovery Act of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984 authorized EPA and state environmental agencies to regulate and supervise the handling, storage, transportation, and disposal of hazardous wastes. In Texas, that task is supervised by the Texas Natural Resources Conservation Commission. Locally, the City and County of El Paso apply TNRCC regulations for hazardous wastes.

4.0 POTENTIAL HAZARDOUS WASTES LOCATED IN THE CANAL RECONSTRUCTION AREA

It is expected that during reconstruction activities, there may be no hazardous wastes as containerized gases, but there may be hazardous waste liquids or sludges (i.e., soil or groundwater contaminated with hydrocarbons, etc.)

As discussed in the Water Quality Section, hydrocarbon contamination in soil and groundwater has been found in the vicinity of all three Open Channel segments of the American Canal. Heavy metals have been detected in groundwater samples from the Upper and Middle Open Channel segments.

4.1 Heavy Metals In Groundwater and Soils

The heavy metals concerns in the Upper Open Channel area are lead in the soil (probably from airborne deposits), as well as arsenic and cadmium in the groundwater. In the Middle Open Channel area, elevated levels of arsenic, selenium, and cadmium have been found in monitor wells. The concentration of metals in the water varies greatly, even between monitor wells less than 50 feet apart. The principal source of these three metals is thought to be the old ponds at the nearby ASARCO smelter facility, but may also have been nearby brick plants, other area industries, and natural sources.

No data concerning heavy metals in soil or water were available for the Lower Open Channel area. Across West Paisano Drive from the Lower Open Channel is an historic manufacturing area where there may have been past releases of heavy metals. The El Paso City Directories list a former metal plating facility which was known as PMH Electroplating at 101 Ruhlin Court (located on the east side of Paisano Drive, approximately 200 yards east of the Lower Open Channel) from 1980 through 1982. Mr. Terry McMillan of TNRCC Region 6 remembered hearing of a possible release of plating chemicals from the facility, but no TNRCC records could be found. In an area of the Lower Open Channel east levee, that appeared to be "downstream" from any stormwater runoff from the former plating facility, ENCON personnel obtained surface soil samples and geoprobe subsurface soil samples. However, the results of the laboratory analyses (included in supporting documentation of Appendix L) did not indicate elevated levels of any heavy metals in these soil samples.

4.2 Hydrocarbons in Groundwater and Soils

Six known diesel or gasoline releases have been documented in the area of the American Canal: two which affected the Upper Open Channel area, one which affected the Middle Open Channel area, and three which affected the Lower Open Channel. Two former Underground Storage Tank (UST) facilities have received TNRCC closure. (A discussion of these UST facilities is included in the Water and Soil Section of this Report, Appendix L.)

5.0 POSSIBLE HAZARDOUS WASTE EXPOSURES OCCURRING DURING RECONSTRUCTION

Characteristics of the hazardous wastes likely to be encountered in soil and groundwater during reconstruction activities are summarized in the table below. Lead was not included in this table as a potentially significant contaminant since elevated lead levels have only been detected in shallow soils.

CHARACTERISTICS OF HAZARDOUS WASTE CONTAMINANTS

Substance ® Parameter ¯	Hazardous Waste Contaminant			
	Arsenic	**Selenium**	**Cadmium**	**Hydrocarbons**
Unusual Characteristics	Can react with hydrogen gas to form highly toxic arsine	None	None	Flammable liquids
Carcinogenic?	Yes	No	Yes	Yes
IDLH Respiratory Concentration	5 mg/m^3	1 mg/m^3	9 mg/m^3	Not determined
8-hr OSHA Respiratory Exposure Limit (TWA)	0.010 mg/m^3	0.2 mg/m^3	0.005 mg/m^3	Not determined, but NIOSH recommends SCBA protection if free product is encountered
Flashpoint	• None in solid form • Slight explosion hazard as dust when exposed to flame	None	• None in solid form • Will burn in powder form	Gasoline = -45°F Diesel = 125°F
Is PPE recommended during worker exposure exceeding OSHA TWA?	Yes	Yes	Yes	Yes* (If free product encountered)
Is PPE needed for canal area residents or workers during construction?	No	No	No	No

Note: Gasoline and diesel have been grouped together as "hydrocarbons" due to their similar characteristics, even though flashpoints vary greatly.

6.0 SUMMARY OF HAZARDOUS WASTE EFFECTS FROM RECONSTRUCTION ALTERNATIVES

It is likely that hazardous wastes will be encountered in the soil (and possibly in the water) during reconstruction activities. However, without knowing the concentrations of the wastes in soil or groundwater, the quantity of any hazardous wastes needing disposal cannot be estimated at this time. Careful advance preparation and implementation of the suggested mitigations should help to prevent worker exposure or unplanned construction delays.

As hydrocarbons have been detected in soil and water samples from all three open channel areas of the study area, the indicator issue chosen is the need for Disposal of Hydrocarbon-Contaminated Soil or Water.

SUMMARY OF HAZARDOUS WASTE EFFECTS FROM FIVE ALTERNATIVES

Alternative ® Effect ¯	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Will canal reconstruction activities potentially produce airborne heavy metals concentrations putting the nearby residents at risk?	No	No	No	No	No
Will canal reconstruction activities potentially produce airborne hydrocarbons concentrations putting the nearby residents at risk?	No	No	No	No	No
Will canal reconstruction activities potentially produce airborne heavy metals concentrations putting construction workers at risk?	Yes	Yes	Yes	Yes	Yes*
Will canal reconstruction activities potentially produce airborne hydrocarbons concentrations putting construction workers at risk?	Yes	Yes	Yes	Yes	Yes*
Is it likely that during reconstruction activities, groundwater or soil contaminated with heavy metals will require disposal as a hazardous waste?	Yes	Yes	Yes	Yes	Yes*
Is it likely that during reconstruction activities, groundwater or soil contaminated with hydrocarbons will require disposal as a hazardous waste?	Yes	Yes	Yes	Yes	Yes*

*Since future reconstruction/repair will eventually be needed, hazardous waste disposal may similarly be required.

It should be noted that if Alternative 5 (the No Action Alternative) is chosen; original sections of the Canal are likely to need emergency repair or reconstruction within the next five years, and the heavier hydrocarbons in the soil (i.e., diesel) would probably require emergency handling, management and disposal at that time.

Depending on the location and quantity of hydrocarbon-contaminated groundwater pumped during dewatering operations from related reconstruction activities, the ASARCO "pump and treat" system may be available for water treatment. The ASARCO remediation system consists of an oil/water separator, aerator, and evaporation pond.

The likelihood of significant worker exposure to OSHA exposure limits from soil heavy metals or hydrocarbons should not be exaggerated. After dewatering, the hydrocarbons may volatilize more easily than before, and some of the heavy metals in the soil matrix may become airborne. As such, the concentrations previously detected in soil and/or water warrant routine, limited air monitoring. It is expected that construction activities can likely be performed in Level D (least stringent) Personal Protective Equipment if airborne metals or hydrocarbon concentrations exceed TWAs.

7.0 SUGGESTED MITIGATIONS

- During subsurface work for reconstruction activities, the soil should be monitored at intervals throughout the day with a photo-ionization detector for volatile hydrocarbons. This action will determine if soil must be treated as a hazardous waste, and will also safely prevent excessive hydrocarbon exposures to construction workers.

- Prior to reconstruction activities, an area should be set aside for temporary stockpiling of any soil which might require hazardous waste disposal, pending laboratory analyses. The stockpiled area should be properly designed to prevent runoff during rainfall and have an impermeable liner underneath. This stockpiled area would need to be included in the Construction Stormwater Pollution Prevention Plan.

- An environmental consulting firm, independent from the prime reconstruction contractor should perform routine air monitoring for hydrocarbons and heavy metals. Monitoring would safely prevent worker exposures and determine the need to handle any contaminated soil or groundwater as a hazardous waste. The firm should also be under contract to perform expedited groundwater or soil sampling, laboratory analysis, and consulting to minimize the possibility of very costly reconstruction delays.

APPENDIX N

- **References**

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APPENDIX O

- **Glossary of Abbreviations**

µmho/cm^2	Measurement of Specific Conductivity
As	Arsenic
ASARCO	American Smelting and Refining Corporation
BNSF	Burlington Northern Santa Fe Railroad
BTEX	Benzene, Toluene, Ethylbenzene, & Total Xylenes
CAA	Clean Air Act
Cd	Cadmium
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CO	Carbon Monoxide
CWA	Clean Water Act
EBID	Elephant Butte Irrigation District
EC	Specific Conductivity
EPA	Environmental Protection Agency
EPCCHED	El Paso City-County Health & Environment District
EPCWID #1	El Paso County Water Improvement District #1
EPWU-PSB	El Paso Water Utilities-Public Service Board
gpm	Gallons per Minute
HSR	Human Systems Research, Inc.
HSWA	Hazardous and Solid Waste Amendments
I-10	Interstate 10
IBC	International Boundary Commission
IDLH	Immediately Dangerous to life or Health
MAC	Maximum Allowable Concentration
mg/M^3	Milligrams per cubic Meter
Mg/l	Milligrams per Liter
MGD	Million Gallons per Day
MXIBWC	Mexican Section International Boundary and Water Commission
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health

NMED	New Mexico Environment Department
NO_x	Nitrous Oxides
O_3	Ozone
OSHA	Occupational Safety and Health Administration
Pb	Lead
pH	A measure of acidity/alkalinity
PID	Photo Ionization Detector
PM-10	Airborne particulates measured to be greater than 10 microns in size
ppb	Parts per Billion
PPE	Personal protection equipment
ppm	Parts per Million (equivalent to mg/l in water)
RCRA	Resource Conservation and Recovery Act
RGACE	Rio Grande American Canal Extension
ROW	Right-of-Way
SAR	Sodium Adsorption Ratio
SCBA	Self-Contained Breathing Apparatus
Se	Selenium
SO	Sulfur Oxide
SO_2	Sulfur Dioxide
TCLP	Toxic Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resource Conservation Commission
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average (a method of determining exposures)
TxDot	Texas Department of Transportation
UP	Union Pacific Railroad
USIBWC	United States Section International Boundary and Water Commission
UST	Underground Storage Tanks
UTEP	University of Texas El Paso
VOC	Volatile Organic Carbons (Hydrocarbon vapors)