REPORT FOR
GEOTECHNICAL ENGINEERING SERVICES
OLD U.S. 80 BRIDGE
OVER THE HASSAYAMPA RIVER
MCDOT SCOUR PROJECT & PS&E
MARICOPA COUNTY, ARIZONA

Registered Professional Engineer (Civil)
CERTIFICATE NO. 25182
DAVID A. THOMAS
Date Signed 10/17/97
ARIZONA U.S.A.

MAXIM
TECHNOLOGIES INC

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REPORT FOR
GEOTECHNICAL ENGINEERING SERVICES
OLD U.S. 80 BRIDGE
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MARICOPA COUNTY, ARIZONA

Submitted To:

INCA ENGINEERS, INC.
Attention: Mr. Dennis Trefren, P.E., S.E.
1702 East Highland Avenue, Suite 207
Phoenix, Arizona 85016

Project No. 97-0130
Final

October 17, 1997

7031 WEST OAKLAND ST. • CHANDLER, AZ 85226 • (602) 961-1169 • FAX (602) 940-0952

MAXIM
TECHNOLOGIES INC

INCA ENGINEERS, INC.
Attention: Mr. Dennis Trefren, P.E., S.E.
1702 East Highland Avenue, Suite 207
Phoenix, Arizona 85016

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Subject: *Report for Geotechnical Engineering Services*
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MCDOT Scour Project & PS&E
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Dear Mr. Trefren:

This final, revised report presents the results of the geotechnical engineering services authorized on the site of the existing Old U.S. 80 Bridge over the Hassayampa River located in west-central Maricopa County, Arizona. This final report includes recommendations specific to the planned method(s) of scour control for the above-referenced structure, described in detail in the report.

The purpose of these services is to determine the shallow soil conditions at the locations indicated which thereby provide a basis for the discussions and geotechnical recommendations presented herein. This firm should be notified for evaluation if conditions other than described herein are encountered.

The services performed provide an evaluation at selected locations of the soils within the upper elevations of the river channel. Our field services have not included exploration for underlying geologic conditions or evaluation of potential geologic hazards such as seismic activity, ground subsidence/earth fissures or faulting, or the presence of contamination.

The recommendations presented in this report are based upon the project information received and described in the "Scope" portion of Part I. This firm should be contacted for review if the design conditions are changed substantially.

Respectfully submitted,
MAXIM TECHNOLOGIES, INC.

Registered Professional Engineer (Civil) Certificate No. 28182 DAVID A. THOMAS Date Signed 10/17/97 ARIZONA, U.S.A.

Prepared By:____________
David A. Thomas, P.E.

Registered Professional Engineer (Civil) Certificate No. 25285 TIM W. ANDERSON Date Signed 10/17/97 ARIZONA, U.S.A.

Reviewed By:____________
Tim W. Anderson, P.E.

Copies to: Addressee (4)

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Registered Professional Engineer (Civil)
CERTIFICATE NO. 28182
DAVID A. THOMAS
Date Signed 10/17/97
ARIZONA U.S.A.

PART I

REPORT

MAXIM
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SCOPE

The existing Old U.S. 80 Bridge over the Hassayampa River has been designated a potentially scour-critical structure by the Maricopa County Department of Transportation (MCDOT). The purpose of our investigation was to evaluate the near-surface soil conditions underlying the existing bridge structure, and to provide geotechnical recommendations which may be used in the design of scour/erosion protection measures for the existing bridge structure. The discussions and recommendations presented herein are based on a review of available construction plans, a comprehensive site reconnaissance of the existing bridge structure, a review of the presently planned scour control measures proposed by INCA Engineers, Inc. (INCA), and a field and laboratory testing program conducted by Maxim Technologies, Inc. (Maxim).

SITE/STRUCTURE DESCRIPTION

The existing Old U.S. 80 Bridge over the Hassayampa River is a four (4) span structure located on Old U.S. Highway 80 (Old U.S. 80), approximately 0.25 miles east of Salome Road, just east of the town of Hassayampa, Arizona. The bridge consists of precast (possibly prestressed) concrete beams supported at both ends by concrete abutments, by two piers located in the main river channel, and by a third pier that is located between the main channel and an apparent overflow channel (which apparently drains into surrounding agricultural land during periods of very high flow in the river channel). The concrete beams appear to support cast-in-place, reinforced concrete decking. Based on our site observations and a review of existing construction plans for the bridge structure (including the "Plans for the Construction of Old U.S. 80 Bridge at Hassayampa River", dated December 14, 1986) provided to Maxim, the abutments and piers each appear to be supported upon four (4) 5.5-foot diameter, drilled, cast-in-place concrete shafts. The typical tip elevations shown on the plans for the drilled shaft foundations are 795 feet and 770 feet at the abutments and piers, respectively. With a bottom of channel elevation specified on the plans at 825 feet, it appears that the drilled shafts extend to depths below the bottom of the channel elevation of roughly 30 feet at the abutments and 55 feet at the piers, assuming that the typical shaft tip elevations noted on the plans represent the actual, as-constructed tip elevations of the shafts. No evidence of a previously removed bridge structure apparently located to the north of the existing bridge (as shown on the construction plans for the existing bridge), was observed at the time of this investigation.

The Hassayampa River crossing under the Old U.S. 80 Bridge is a well defined drainage feature which originates just south Prescott, Arizona, approximately 75 miles north of the bridge site. The direction of flow in the Hassayampa River is generally to the south in the bridge vicinity. The existing river channel under the Old U.S. 80 Bridge appears to have been channelized/narrowed to some degree. At the time of this investigation, a minor flow of what was possibly irrigation tail water from nearby crops was observed in the Hassayampa River. Below the bridge, this flow divided into two relatively small streams of water. Vegetation in the general area of the site consists of native shrubs and small trees (palo verde, etc.), some of which have taken root in the wash channel adjacent to the existing bridge structure.

INVESTIGATION

Prior to initiation of the field activities at the bridge site, Mr. David A. Thomas, P.E., Project Geotechnical Engineer for Maxim, reviewed existing construction plans available for the existing Old U.S. 80 Bridge over the Hassayampa River. A previous geotechnical investigation had apparently been conducted at the bridge site (by others) as indicated by 11 boring logs included on the plan sheets. Five (5) of these borings were advanced in the river channel, while 6 borings were drilled along the alignment of the new roadway approaches to the new bridge. These initial test borings were advanced with a CME-55 drill rig using 7-inch diameter, hollow stem auger, to depths ranging from roughly 15 to 115 feet below existing site grades at the time of test drilling. No other evidence of this previous geotechnical investigation was apparent (i.e., no plan reference to an existing bridge foundation report, etc.). Mr.

Thomas also attended a project meeting conducted at the bridge site on June 20, 1997, which was attended by representatives of INCA and MCDOT, as well as representatives of other members of the design team. A comprehensive reconnaissance of the bridge structure and general vicinity was conducted during this meeting.

On August 20, 1997, a representative of Maxim supervised the excavation of three (3) exploratory test pits in the existing river channel (within the existing MCDOT Right-of-Way), directly adjacent to the existing bridge structure, for examination of the shallow subsurface profile. The test pits were excavated to depths ranging from 4 to 14 feet below existing grades with a CASE 580K backhoe using a 12-inch wide bucket. The excavations were terminated at depths ranging from 4 to 14 feet due to a shallow groundwater table, which resulted in seepage and excessive sloughing in the excavations. Test Pit HA-A was excavated on the north side of the bridge structure, between the first and second piers east of the west abutment. Test Pit HA-B was excavated on the north side of the bridge, between the second and third piers east of the west abutment and between the two separate flows in the river channel. Test Pit HA-C was advanced on the north side of the bridge, between the east pier and the east abutment. No test pits were excavated in the apparent overflow channel between the west abutment and the west pier.

During the recent subsurface exploration activities, the soils encountered were visually classified, and representative soil samples were obtained at selected depths from the test pit cuttings. The complete results of the excavation efforts are presented in Appendix A of this report, entitled "Field Results".

Representative soil samples obtained during the excavation efforts were subjected to the following laboratory analyses:

Test	Sample(s)	Purpose
Sieve Analysis & Plasticity Index	Representative soils (3)	Material classification & gradation

The complete results of the laboratory testing efforts conducted during this investigation are presented in Appendix B of this report, entitled "Laboratory Results".

SOIL CONDITIONS

Based on the results of the test excavation and laboratory testing efforts conducted by Maxim as part of this investigation, soil profiles at the test pit locations were found to be somewhat variable, and detailed descriptions are presented on the individual test pit logs included in Appendix A. At the location of Test Pit HA-A, the surface and subsurface soils consisted of variably graded, gravelly sand (SP) deposits containing generally trace amounts of silt and intermixed with occasional cobbles. This granular river deposit was found to extend to a depth of at least 14 feet (the maximum depth of our exploration) below the bottom on the river channel. This relatively clean, sandy material was found to be nonplastic and generally in a loose to medium dense state to a depth of about 8 feet. Below this depth, an increase in cobbles was apparent, and these deeper soils were generally in a medium dense to dense state. Groundwater was encountered in Test Pit HA-A at a depth of roughly 14 feet.

In the main river channel (Test Pit HA-B), a surface layer of variably graded, gravelly sand (SP) soil containing generally trace amounts of silt and also intermixed with occasional cobbles was encountered extending to a depth of roughly 4 feet. This relatively clean, sandy material was found to be nonplastic and was generally in a loose to medium dense state throughout the depths explored. Test Pit HA-B was terminated at a depth of 4 feet due to a continuous flow of groundwater into the excavation, which caused excessive sloughing in the test pit excavation.

At the location of Test Pit HA-C, a roughly 1-foot thick surficial deposit of sandy clay (CL) soil was encountered. This finer grained soil was found to contain little or no gravel, was of medium plasticity, and was generally of stiff to very stiff consistency. Underlying this surficial clay deposit were variably graded gravelly sand (SP) soils, containing trace amounts of silt and occasional cobbles. These relatively clean, sandy materials were found to be nonplastic and generally in a loose to medium dense state to a depth of roughly 6 feet. Below this depth, the soils were found to contain an increased amount of cobbles and were found to be generally in a medium dense to dense state. These granular river deposits were found to extend to a depth of at least 9.5 feet below the bottom of the river channel at the location of Test Pit HA-C. Test Pit HA-C was terminated at a depth of roughly 9.5 feet due to the presence of groundwater.

Soil moisture conditions were described as slightly damp (at the ground surface) to nearly saturated (near or below groundwater levels), generally increasing with depth. Groundwater was encountered in each of the test pits during excavation, at depths in which the excavation activities were terminated (ranging from 4 to 14 feet).

The soils identified on the boring logs from the previous investigation including a surface layer of fill consisting of soil mixed with trash and debris encountered in three (3) of the original bridge-area test borings. The native site surface soils consisted primarily of variably stratified silty sands (SM), silty sands and gravels (SM/GM), and sandy gravels (SW/GW) to depths of roughly 10 to 20 feet. Underlying these nonplastic, stratified surficial soils, and extending to the maximum depths of exploration (up to 115 feet below the then-existing grades), a rather uniform deposit of silty sand to relatively clean sand (SM-SW) was identified. Groundwater was encountered in all 5 of the bridge-area test borings at depths ranging from roughly 19 to 30 feet below existing site grades at the time of the test drilling.

DISCUSSION AND RECOMMENDATIONS

General: The scour control method which has been proposed (by INCA) for the existing, Old U.S. 80 Bridge over the Hassayampa River consists of a minimum 3.0 feet thick soil-cement liner (blanket) to be constructed below the existing bridge. The top of the soil-cement liner is proposed to be constructed roughly 5 feet below the existing elevation of the river channel below the bridge. At a presently specified distance of 15 feet upstream from the bridge, the soil-cement liner will dip downward and away from the bridge with a slope of 1H:1V. This slope will extend to a depth of 6 feet below the top of the soil cement liner. At a distance of 15 feet downstream from the bridge, the soil-cement liner will dip downward and away from the bridge with a slope of 2H:1V, and will extend to a depth of 10 feet below the top of the soil cement liner. The deeper, embedded portions of the soil-cement liner (i.e., the cutoff structures) both upstream and downstream from the bridge will be 8 feet thick.

The planned soil-cement liner will extend from the top of the east abutment downward with a slope of 1H:1V, and then westward across the bottom of the river channel below the bridge. Two alternatives for the full extent of the scour control were originally proposed by INCA. Alternative 1 consisted of the soil-cement liner extending below the entire bridge structure (including the existing, apparent overflow channel located between the west abutment and west pier), and up the west abutment with a slope of 1H:1V. Alternative 2 consisted of the soil-cement liner extending from the east abutment to the east side of the west pier, where the soil cement would extend upward at a slope of 1H:1V. For both options, the sloping portions of the soil-cement liner would be covered with a significant amount of soil. It is our understanding that Alternative 2 will most likely be the method of scour control implemented at the bridge site.

General geotechnical engineering recommendations for support and preparation of the planned scour/erosion control elements described above are presented in the following sections. These recommendations are based upon the results of our review of available project documents, our initial site visit on June 20, 1997, and our recent test excavation and laboratory testing activities, the results of which are presented in Appendices A and B of this report. Alternative recommendations may also be possible, and will be considered upon request.

Soil-cement Liner & Cutoff Structures: According to Mr. Dennis Trefren, P.E., S.E., Project Manager for INCA, specifications for the soil-cement liner and cutoff structures are currently being finalized. It is anticipated that the project-specific soil-cement design and construction requirements will be comparable to specifications prepared by/for the Arizona Department of Transportation (ADOT), MCDOT, or the Flood Control District of Maricopa County (FCD), for projects of similar size and scope. Maxim will be available to review the project-specific specifications for the soil-cement liner, when completed.

It appears that the upper sandy soils encountered during our recent test excavation efforts, and described on the test boring logs from the previous investigation(s), contain a sufficient amount of nonplastic to slightly plastic fines (percent passing No. 4 sieve) for unrestricted use in the proposed soil-cement liner and cutoff structures. Typical soil-cement design requirements specify a minimum 7-day laboratory compressive strength of 750 psi when tested in accordance with Arizona Test Method 241a (or comparable test method). A project-specific mix design will be required to determine the cement content of the soil-cement mixture using soil sampled from the desired material source (the anticipated source for the project is the sandy, near-surface river bed deposits from below and directly adjacent to the existing bridge structure). The cementitious material in the soil-cement blend should consist of Type II, Low Alkali Portland cement, unless otherwise specified by the design engineer. The preparation, mixing, placement, compaction and curing of soil-cement mixtures should be in strict compliance with the project specifications. The contractor should be required to submit a detailed plan outlining the intended method of construction, including a discussion of the intended equipment to be used in the preparation, placement, compaction and finishing of the soil-cement liner.

Site Preparation for Soil-cement Structures: The variably sandy fluvial deposits encountered in the upper 5 feet + of the wash channel are anticipated to be in a relatively loose state, and would undoubtedly be susceptible to saturation and erosion due to even minor, infrequent flows in the river channel. The deeper, more granular soils should be in a somewhat denser state (generally below depths of 6 to 8 feet). To provide a firm, level, uniform base for placing and compacting the soil-cement mixture, the upper 12 inches below the proposed structures should be removed, the exposed soils proof-rolled, and the removed soils then moistened and replaced as recommended later in this report.

Excavation Conditions: We present the following general comments regarding excavatability for the designers' information with the understanding that they are approximations based on our recent test excavation activities, and on our review of previous test drilling conducted at the site (by others). Additional information regarding excavatability should be evaluated by contractors or other interested parties from test excavations using the intended equipment.

The surface and near surface soils (to depths of at least 14 feet) underlying the bridge site are non-cemented and can probably be removed with conventional earth excavating equipment. Instability in the form of raveling or caving should be expected in all excavations at the site, due to the presence of the granular surface soil layers, especially where excavations are cut with slopes steeper than 1.5H:1V (as will be necessary for construction of the upstream cutoff structure). Where shallow groundwater conditions are not allowed to drain prior to initiation of excavation activities, dewatering of excavations will be necessary. All excavations should be braced, sloped or benched as required to provide personnel safety and satisfy local safety code regulations. In addition, benching cut slopes against which the soil-cement material is to be placed will allow for a more uniform, level base for placement and compaction, and will reduce the potential for slippage between the soil-cement and the underlying soils.

Site Soil Workability: Below the soil-cement liner and cutoff structures, the moisture content of the existing/exposed site soils should be maintained at optimum moisture content ±2 percent (ASTM D698) during and subsequent to site grading. Under the higher moisture conditions, some pumping may be experienced under dynamic loading if the compaction is done by very heavy equipment (i.e., loaded scrapers, water-pulls, etc.). Lighter compaction equipment and/or drying of wet soils may be used to reduce pumping if this condition becomes severe.

PART II

MATERIALS

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FILL MATERIALS

All fill materials should be inorganic soils free of vegetation, debris, organic contaminants, and fragments larger than *6 inches in size. The on-site sandy river materials were nonplastic and will exhibit negligible expansive potentials when compacted. The surface soils outside of the main river channel on the east portion were found to consist of medium plasticity sandy clays will exhibit somewhat higher expansive potentials when compacted. Soils excavated from all areas of the site may be used for required fills in all areas of the site. However, it is recommended that excavated clayey site soils be blended with more granular, sandy soils prior to use for required fills below proposed scour control structures.

PART III

EXECUTION

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SITE GRADING

The following recommendations are presented for site grading within and extending 5 feet beyond the planned soil-cement structure areas. These recommended site grading procedures are intended to provide support for scour-protection elements constructed at or near-grade. Therefore, all phases of earthwork should be performed under observation and testing directed by the geotechnical engineer.

1. Remove all surface and subsurface remnants of former facilities, all vegetation and organic contaminants, any debris and trash, any backfills, and any unstable soils (loose, disturbed, wet, etc.) from all proposed structure areas. Observe the cleared surface before and during subsequent scarification for evidences of debris-laden soils, disturbance, or loose zones requiring additional removal.

2. Widen any resulting depressions as necessary to accommodate compaction equipment and provide a level base for placing fill.

3. Below areas to be surfaced with soil-cement, remove the upper 12 inches (minimum) of the existing sandy material below the bottom of the proposed structures, moisten (if necessary) and proof-roll the exposed soils, and backfill the zone of removal as recommended in the following paragraphs.

4. Horizontal benches with minimum vertical steps of 2 feet (not exceeding 4 feet) should be provided for all sloping services steeper than 5H:1V.

5. Place backfill or fill materials required to elevate site areas to specified subbase grade. Fill materials should be placed and compacted in horizontal lifts of thicknesses compatible with the compaction equipment used.

6. Compaction of cleaned exposed soil, and each lift of backfill, subbase fill, and base course materials should be accomplished to the following density criteria:

Material	Percent Compaction (ASTM D698)
Cleaned Exposed Soil, Backfill, and Subbase Fill:	
Below soil-cement structures:	
Less than 5 feet deep	95 min.
More than 5 feet deep	100 min.
Soil-Cement Mixtures	*95 min.

*Unless otherwise specified by the design engineer.

Within all structure areas, compaction of exposed natural underlying site surface soils and low expansive, imported soils should be performed with soils uniformly mixed at a moisture content between optimum ±2 percent. Soil-cement mixtures should be thoroughly blended at a moisture content between optimum ± 2 percent, unless otherwise directed in the field by the design engineer. In cool weather, it is typical to limit the compaction moisture for soil-cement mixtures to between optimum and optimum -2 percent.

Natural undisturbed soils or compacted soils subsequently disturbed or removed by construction operations should be replaced with materials compacted as specified above or as recommended in the field by the geotechnical engineer.

APPENDIX A

FIELD RESULTS

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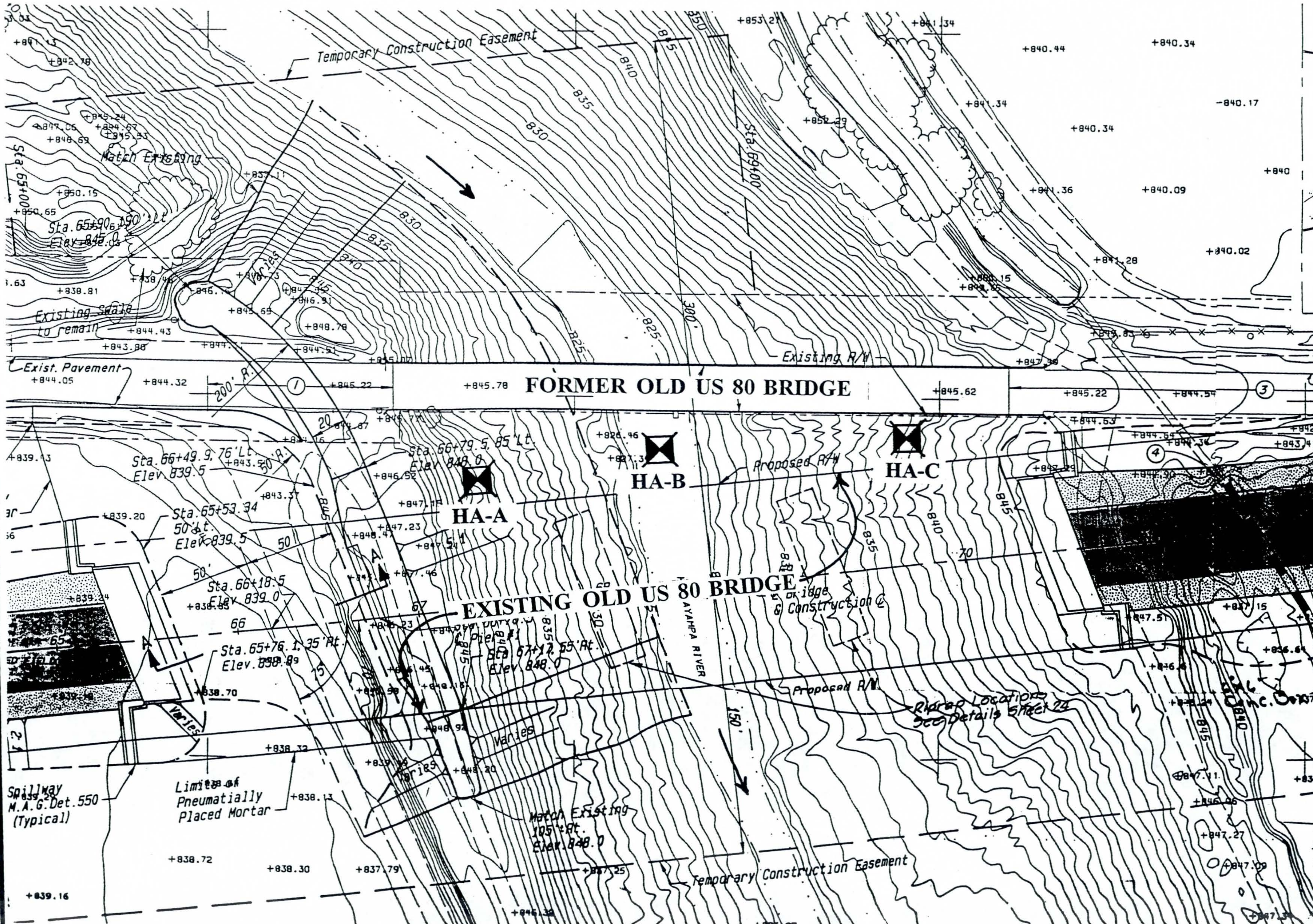
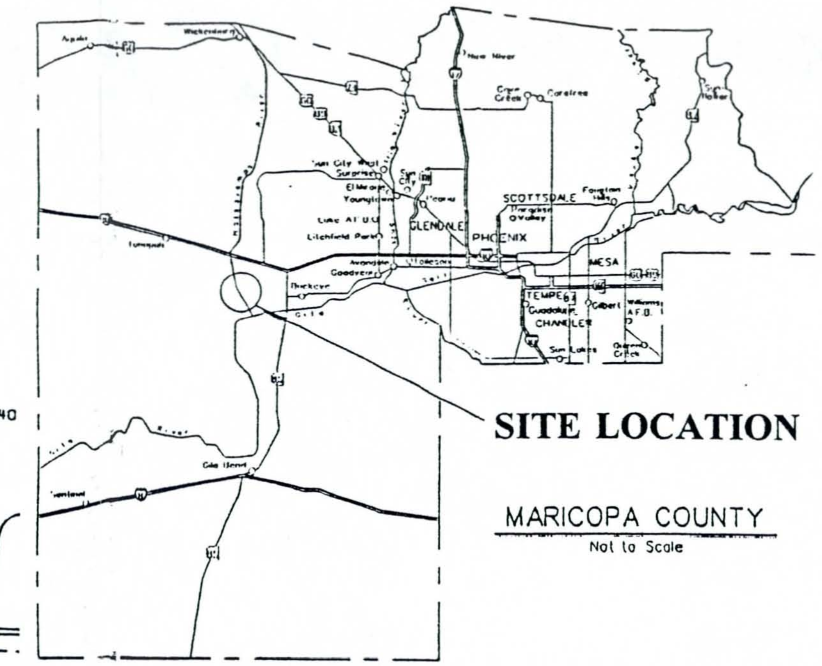


SITE MAP
(not to scale)

LOCATION OF TEST PITS



COUNTY/VICINITY MAP

FIGURE 1 SITE PLAN
OLD U.S. 80 HIGHWAY BRIDGE
OVER HASSAYAMPA RIVER

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LEGEND

Soil Classification

COARSE-GRAINED SOIL

More than 50% larger than 200 sieve size

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS
	GW	Well-graded gravels or gravel sand mixtures. Less than 5% -#200 fines	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
	GP	Poorly-graded gravels or gravel sand mixtures. Less than 5% -#200 fines	
	GM	Silty gravels or gravel-sand-silt mixtures. More than 12% -#200 fines	
	GC	Clayey gravels or gravel-sand-clay mixtures. More than 12% -#200 fines	
	SW	Well-graded sands or gravelly sands. Less than 5% -#200 fines	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
	SP	Poorly-graded sands or gravelly sands. Less than 5% -#200 fines	
	SM	Silty sands or sand-silt mixtures. More than 12% -#200 fines	
	SC	Clayey sands or sand-clay mixtures. More than 12% -#200 fines	

FINE-GRAINED SOIL

More than 50% smaller than 200 sieve size

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS
	ML	Inorganic silts, rock flour, and fine sandy or clayey silts of low to medium plasticity	SILTS AND CLAYS Liquid limit less than 50
	CL	Inorganic clays, gravelly clays, sandy clays, and lean clays of low to medium plasticity	
	MH	Inorganic silts, micaceous or diatomaceous, and fine sandy or clayey silts of high plasticity	SILTS AND CLAYS Liquid limit greater than 50
	CH	Inorganic clays, fat clays, and silty or sandy clays of high plasticity	

GRAIN SIZES

U.S. Standard Series Sieves — Clear Square Sieve Openings

	200	40	10	4	3/4"	3"	12"
Silts and clays distinguished on basis of plasticity	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

MOISTURE CONDITION

Dry	Slightly Damp	Damp	Moist	Very Moist	Wet (Saturated)
		(Plastic Limit)		(Liquid Limit)	

CONSISTENCY CORRELATION		RELATIVE DENSITY CORRELATION	
Clays & Silts	**Blows/Foot***	**Sands & Gravels**	**Blows/Foot***
Very Soft	0-2	Very Loose	0-4
Soft	2-4	Loose	4-10
Firm	4-8	Medium Dense	10-30
Stiff	8-16	Dense	30-50
Very Stiff	16-32	Very Dense	Over 50
Hard	Over 32		

*Number of blows of 140 lb. hammer falling 30" to drive a 2" O.D. (1-3/8" I.D.) split-spoon sampler (ASTM D1586)

Sampler blow counts and 2.0" O.D. bullnose penetration resistance shown on logs are blows per foot using 140 lb. hammer with 30" free-fall unless otherwise noted.

LIMITATIONS

The data presented on the test boring logs represent subsurface conditions only at the specific locations and at the times designated. These data may not represent conditions at other locations and/or times. Contacts between soil strata may be gradual rather than abrupt. These data were compiled primarly for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the test boring logs.

TEST PIT LOG

Job Number:	97-0130	Test Pit No.:	HA-A
Project:	Old U.S. 80 @ Hassayampa River	Rig Type:	Case 580K Backhoe
Date Started:	8/20/97	Ground Elev.:	
Date Completed:	8/20/97	Elev. Datum:	None

Legend of Symbols: 2.5" Ring Sample; Standard Split Spoon Sample; Thin Wall Tube; ▽ Water Table Encountered; ▼ Stabilized Water Table

Elevation (ft)	Depth (ft)	Graphic Log	Sampler Blow Count	Sample Type	Dry Density (pcf)	Water Content (%)	SOIL DESCRIPTION
	0–1						**POORLY GRADED SAND (SP)**; some gravel; trace of cobbles; light greyish brown; loose to medium dense; subangular to subrounded; nonplastic; slightly damp.
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						Note: some increase in cobbles below 8 feet.
	9						
	10						
	11						Note: becoming damp to moist, light greyish brown and reddish brown below 11 feet.
	12						
	13						
	14						▽ Stopped excavating at 14.0 feet. Groundwater encountered at 14.0 feet.

TEST PIT LOG

Job Number:	97-0130	Test Pit No.:	HA-B
Project:	Old U.S. 80 @ Hassayampa River	Rig Type:	Case 580K Backhoe
Date Started:	8/20/97	Ground Elev.:	
Date Completed:	8/20/97	Elev. Datum:	None

Legend of Symbols: 2.5" Ring Sample; Standard Split Spoon Sample; Thin Wall Tube; ▽ Water Table Encountered; ▼ Stabilized Water Table

Elevation (ft)	Depth (ft)	Graphic Log	Sampler Blow Count	Sample Type	Dry Density (pcf)	Water Content (%)	SOIL DESCRIPTION
	0–4						**POORLY GRADED SAND (SP)**; some gravel; trace of cobbles; light greyish brown; loose to medium dense; subangular to subrounded; nonplastic; slightly damp to damp.
	4						▽ Stopped excavating at 4.0 feet. Groundwater encountered at 4.0 feet.

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TEST PIT LOG

Sheet 1 of 1

Job Number:	97-0130	Test Pit No.:	HA-C
Project:	Old U.S. 80 @ Hassayampa River	Rig Type:	Case 580K Backhoe
Date Started:	8/20/97	Ground Elev.:	
Date Completed:	8/20/97	Elev. Datum:	None

Legend of Symbols: 2.5" Ring Sample; Standard Split Spoon Sample; Thin Wall Tube; Water Table Encountered; Stabilized Water Table

Elevation (ft)	Depth (ft)	Graphic Log	Sampler Blow Count	Sample Type	Dry Density (pcf)	Water Content (%)	SOIL DESCRIPTION
	0–1						**SANDY CLAY (CL)**; brown; slightly damp; predominantly fine grained sand; medium plasticity; stiff to very stiff consistency.
	1–9.5						**POORLY GRADED SAND (SP)**; some gravel; trace of cobbles; light greyish brown; loose to medium dense; subangular to subrounded; nonplastic; slightly damp to damp.
	6						Note: increase in cobbles below 6 feet.
	9.5						Stopped excavating at 9.5 feet. Groundwater encountered at 9.5 feet.

APPENDIX B

LABORATORY RESULTS

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REPORT ON SIEVE ANALYSIS AND PLASTICITY INDEX

Old U.S. 80 Bridge Over The Hassayampa River
MCDOT Scour Project & PS&E
Maricopa County, Arizona

SAMPLE: **DATE:** September 2, 1997

Source: As Noted Below
Type: Bulk Grab Samples From Test Pits
Material: On-Site Surface and Subsurface Soils
Sampled By: Maxim / R. Orlando

TESTED: Sieve Analysis and Plasticity Index

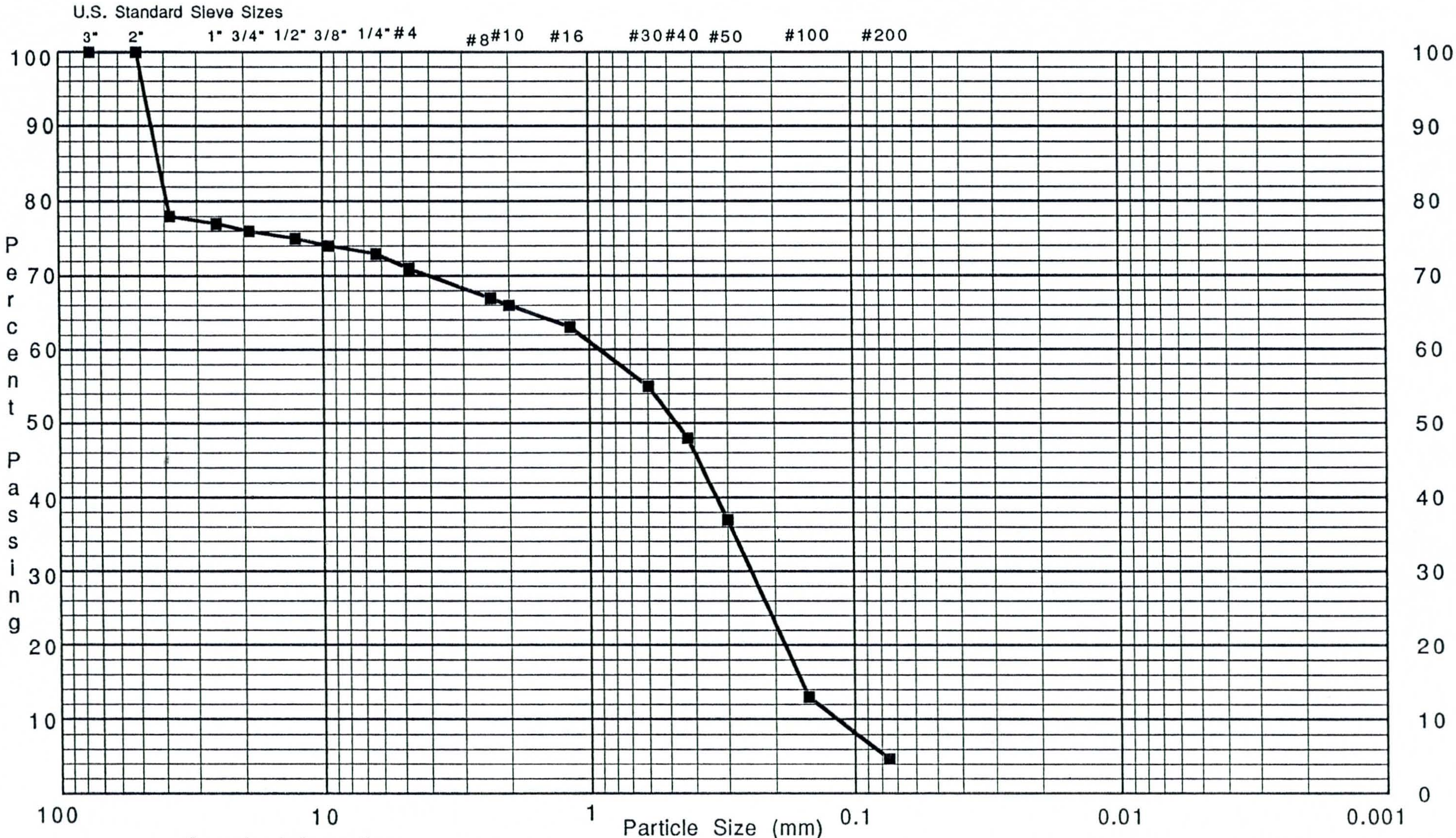
Test Results

Sample	Atterberg Limits		Sieve Size - Accumulative % Passing											*
	LL	PI	#200	#100	#50	#30	#16	#8	#4	1/2"	3/4"	1"	2"	CLASS
HA-A (0.0-8.0')	--	NP	4.7	13	37	55	63	67	71	75	76	78	100	SP
HA-B (0.0-4.0')	--	NP	2.6	7	19	43	61	68	72	77	83	85	100	SP
HA-C (0.0-1.0')	35	15	77	82	88	93	96	98	99	100				CL

* - Unified Soil Classification System (USCS)

NP - NonPlastic

GRADATION CURVE



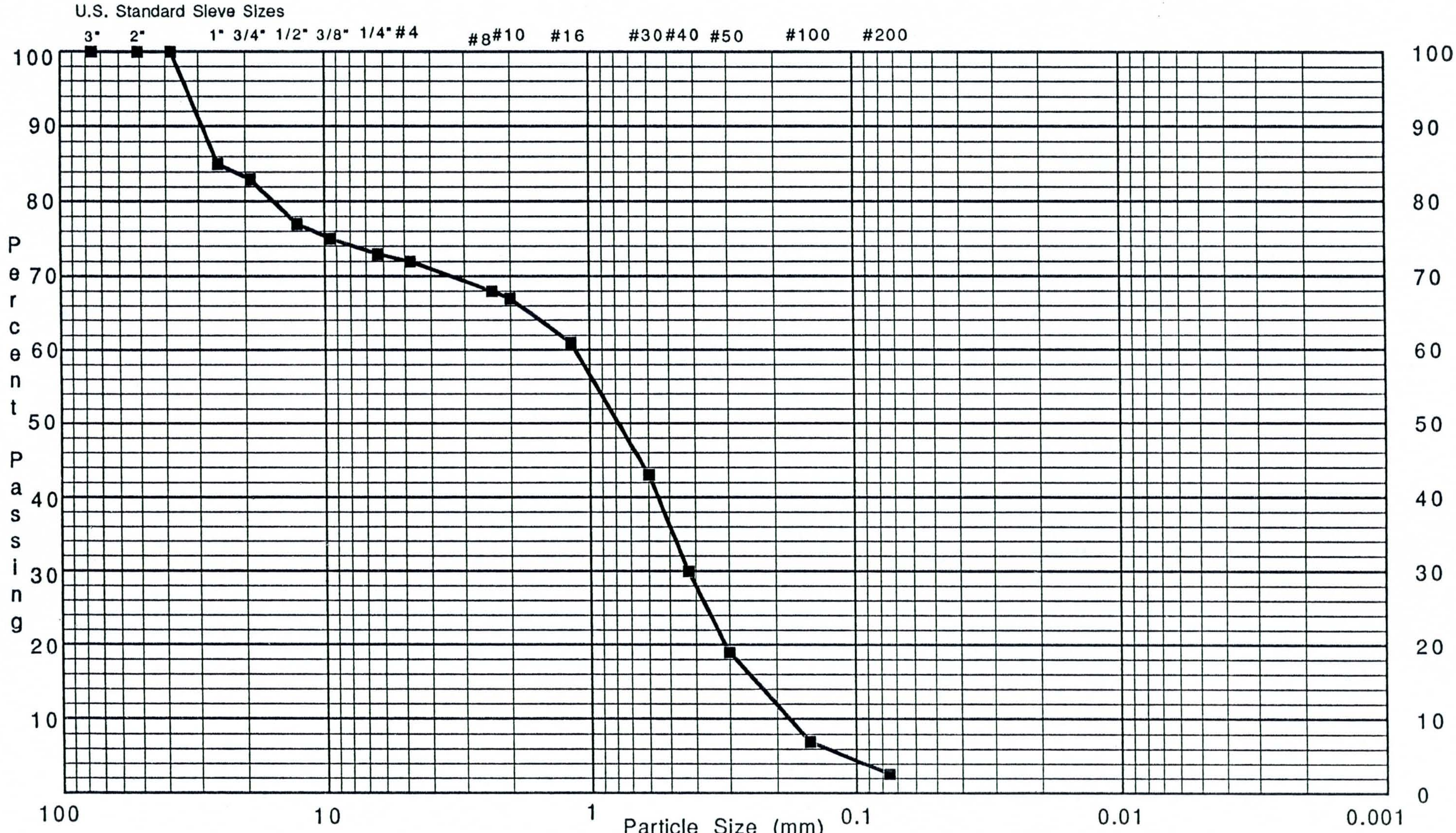
<u>Sample Information</u>

Test Boring HA-A, 0-8' Depth
Old U.S. 80 Highway Bridge over
the Hassayampa River

Liquid Limit = --; Plasticity Index = NP
USCS Classification = Gravelly Sand (SP)

Maxim Technologies, Inc. Project No. 97-0130

GRADATION CURVE



<u>Sample Information</u>

Test Boring HA-B, 0-4' Depth
Old U.S. 80 Highway Bridge over
the Hassayampa River

Liquid Limit = --; Plasticity Index = NP
USCS Classification = Gravelly Sand (SP)

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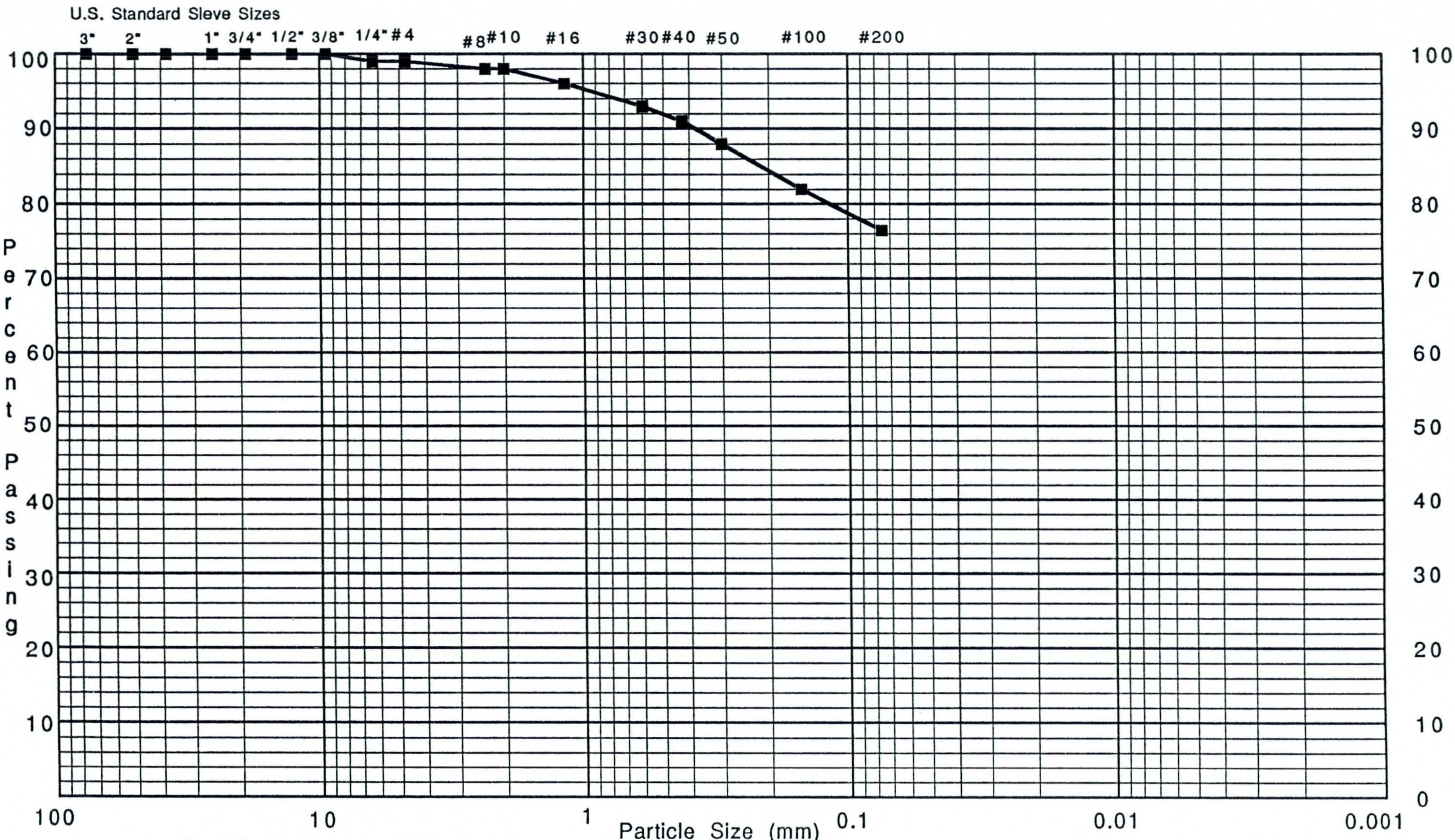
GRADATION CURVE



Sample Information

Test Boring HA-C, 0-1' Depth
Old U.S. 80 Highway Bridge over
the Hassayampa River

Liquid Limit = 35; Plasticity Index = 15
USCS Classification = Sandy Clay (CL)

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