ALMA SCHOOL ROAD SOUTH BRIDGE AT SALT RIVER

DESIGN CONCEPT REPORT

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
CONTRACT # CY 1997-09
W.O. # 68931

DRAFT

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DESIGN CONCEPT REPORT

ALMA SCHOOL ROAD SOUTH BRIDGE OVER SALT RIVER

Overview and Project Background

Purpose

The purpose of this Design Concept Report (DCR) is to establish approved criteria for the final design and construction plans for widening the existing Alma School Road South Bridge over the Salt River and associated approach roadway and drainage improvements.

Background

Alma School Road from McLellan Road to McKellips Road is an existing arterial road which crosses the Salt River in two locations. The north crossing is a precast, prestressed concrete box beam bridge over the main river channel whereas the south crossing is a similar structure over a smaller secondary channel. Both bridges were constructed by Maricopa County in 1980-81 under Work Order Nos. 60400 and 60401. The south channel also serves as a haul road from sand and gravel pits located on the west side of Alma School Road to Sunward Materials plant operations located on the east side of Alma School Road with primary access currently located between the two bridges. The existing roadway and bridges have a clear roadway width of 20.7m (68') from McLellan to just north of the north bridge and are striped for 2 traffic lanes in each direction separated by a continuous left turn lane.

Extension of the Red Mountain (Loop 202) Freeway from Price Road to McKellips Road is currently under construction. As part of the freeway project, a full diamond interchange is being constructed at Alma School Road between McLellan Road and the Salt River. Alma School Road will be improved through the interchange limits as part of the freeway project.

Plans for the Red Mountain interchange indicate that as part of the freeway project, Alma School Road will be improved by ADOT from a point just north of the McLellan Road intersection to a point immediately south of the south bridged crossing of the Salt River secondary channel. The roadway traffic section through the interchange area will include 3 southbound through lanes with 1 southbound left turn lane to accommodate eastbound freeway access and 2 northbound through lanes with 2 north bound left turn lanes to accommodate westbound freeway access. Once through the interchange, ADOT plans to taper the traffic lanes to match the existing 5 traffic lane section approximately 183m (600') north of the freeway westbound on and off ramps which is within 15.2m (50') of the south abutment of the south bridge.

A Candidate Assessment Report (CAR) C96-0044-09 for this project was prepared for MCDOT by Inca Engineers, Inc., dated December 15, 1995. The results of the preliminary studies and the CAR indicate that improvement of the roadway section north of the interchange to a point just south of the north bridge structure should be reasonable from a cost standpoint and will help minimize the adverse effects of the potential traffic problem in this area.

The improved roadway section should accommodate three southbound traffic lanes, three northbound traffic lanes and a center left turn median area. Provisions should be made to utilize the median lane and the exterior north bound lane at the ingress and egress access points for Sunward Materials properties for acceleration and deceleration lanes.

Widening the existing roadway section between the interchange and the south end of the north bridge structure will require widening the south bridge structure approximately 6 meters plus additional width to accommodate the current County minimum standard sidewalk section.

All design procedures will be in accordance with MCDOT Roadway Design Manual and MCDOT Traffic Engineering Manuals and Procedures. Standard project specifications and details will be in accordance with the Maricopa Association of Governments (MAG) Standard Plans and Specifications, 1996 Metric Edition. All bridge design will be in accordance with AASHTO Standard Specifications for Road and Bridge Construction, 1996, Sixteenth Edition. All project construction plans will be developed and prepared in the SI (metric system) of units. All project special provisions to the project standard specifications will be prepared in the SI (metric system) of units.

Major Project Issues

There are several constraints and major issues of concern associated with this proposed project including, but not limited to, the close proximity of the freeway interchange with the south bridge, alignment of the roadway and subsequent ultimate traffic lanes through the bridge corridor, roadway and bridge drainage, site drainage, access to local properties (especially Sunward Materials plant site), roadway design section, river hydraulics and scour potential, bridge superstructure and substructure widening concepts and methods, overhead high voltage power lines, right-of-way considerations, construction traffic movement and control, and constructibility including possible staging. These issues and concerns were investigated, analyzed and the results documented in a series of Technical Memorandums and project specific reports.

The following memoranda were prepared in support of this project and are intended to address the relevant major project issues. These memoranda are included in their entirety as integral parts of this Design Concept Report:

1. CHARACTERISTICS OF THE CORRIDOR (TM)
2. ALIGNMENT ANALYSIS-McLELLAN RD TO McKELLIPS RD (TM)
3. TRAFFIC VOLUME DATA (TM)

4. EVALUATION OF AUXLIARY LANES AND INTERSECTION ILLUMINATION (TM)

The following supplemental reports were prepared in support of this project and are included in their entirety as integral parts of this Design Concept Report:

1. DRAINAGE AND SCOUR ANALYSIS AND REPORT
2. GEOTECHNICAL INVESTIGATION REPORT
3. BRIDGE SELECTION REPORT

Right-of-Way

All existing right-of-way throughout the project limits is within Maricopa County or the Salt River Pima-Maricopa Indian Community. (See right-of-way requirements as delineated on the preliminary right-of-way strip map included in the Alignment Analysis Technical Memorandum portion of this document)

Preliminary calculations indicate approximately four thousand fifty (4,050) square meters or approximately 1 acre of new right-of-way will need to be acquired from the SRPMIC for this project.

Environmental

Due to the nature of the construction on this project, certain sections of the Federal Clean Water Act will need to be addressed and complied with, specifically Sections 401, 402 and 404.

Since a portion of this project is currently on SRPMIC lands, a Section 401 certification will need to be applied for and obtained from the Arizona Department of Environmental Quality (ADEQ).

In addition, since the proposed area of disturbance for the project exceeds 5 acres, a Section 402 NPDES permit will also probably be required.

Since construction of the bridge foundations and channel bank stabilization will involve excavation and/or fill in the Salt River, it is anticipated that a Section 404 permit will be required by the US Corps of Engineers, however, since the disturbed area will be relatively small, it is anticipated that the appropriate Nationwide Permit will be sufficient.

Alternative Alignment Considerations

Results of the CAR prepared for this project indicate the south bridge and approach roadway should be widened on each side, however, certain significant benefits will be derived by considering widening the bridge structure on one side only.

A detailed geometric, traffic and structural analysis of each alternative alignment was made and presented in the Alignment Analysis Technical Memorandum, the Evaluation of

Auxiliary Lanes and Intersection Illumination Technical Memorandum and Bridge Selection Report which are included as part of this report.

Based on results of the Alignment Study and Traffic Analysis reports together with consideration of comments obtained from the Project Public Meeting held at MCDOT offices on Wednesday, August 27, 1997, it is recommended that the typical roadway section from the north end of the Loop 202 interchange to the south end of the north bridge over the Salt River for north bound traffic include 2 continuous through lanes plus an additional auxiliary deceleration lane entering and an acceleration lane leaving Sunward Materials main plant site on the east side of Alma School Road.

The south bound traffic lanes will include 3 through lanes plus a median left turn lane. In the vicinity of the east side entrance to the Sunward Materials plant, the median lane will double as a left turn lane for southbound traffic entering the plant and an acceleration lane for southbound traffic exiting the plant site.

In addition, north bound access to the south channel bank entrance to Sunward Materials mining operations currently using the haul road under the bridge will be maintained. This will also provide northbound access to the properties located at the northeast quadrant of the Loop 202 and Alma School Road interchange.

Due to the need for minimizing disruption to both the general Alma School Road traffic and Sunward Materials plant operations, the project plans and/or specifications will need to insure complete and continuous coordination of all construction operations. Special attention will be required during construction operations that may conflict with normal materials plant haul road activities in the vicinity of the bridge widening.

Preferred Alternative (See Figure 1)

Results of the Alignment Analysis indicates there is no significant advantage or disadvantage to widening the existing roadway on both sides or to one side only. If the roadway is widened only on the east side, some cost savings will be realized by avoiding conflict with major overhead electric lines.

Results of the Traffic Analysis indicate that widening to the east side only will accommodate all the traffic requirements for acceleration and deceleration lanes, left turn storage capacities as well as through traffic requirements. Slight additional project costs may be required to install illumination devices at the east access to Sunward Materials plant site.

The Bridge Selection Report indicates a significant cost benefit to widening the existing bridge structure only to the east. This will avoid major conflicts with overhead powerlines and the channel grade control structure currently located on the west side of the existing bridge structure. In addition, only the existing wingwalls and bank protection on the east side of the bridge will need to be replaced. (See the attached Bridge Selection Report for further bridge widening details and discussions)

Both general public and construction equipment traffic movements during construction of the bridge and approach roadway sections will be optimized by widening only to one side. Construction phasing and traffic lane adjustments will be minimized thus reducing the overall construction cost.

Based on the results of all the combined project specific technical memoranda and reports, widening the existing bridge structure and approach roadway to the east only is the preferred alternative alignment and is recommended for final design and plans preparation.

Based on information derived from the C.A.R. and on the results of the project geotechnical investigation and subsequent geotechnical report, it is recommended that the existing AC pavement and subgrade between the north end of the south bridge and the south end of the north bridge be removed and replaced with new subgrade, AC pavement and Rubberized Asphalt (RA) overlay surface. ADOT's Red Mountain Freeway project, currently under construction, will provide a new AC pavement connection between the north end of their PCCP section and the south end of the existing south bridge approach slab. To accommodate new traffic lanes for MCDOT's Alma School Road project (See the Evaluation of Auxiliary Lanes Technical Memorandum) it is recommended that new subgrade and AC pavement sections be added to each side of the existing ADOT AC section. The existing ADOT AC section will be milled to accommodate a new RA surface overlay of the complete MCDOT and ADOT AC sections south of the bridge. It is further recommended that the existing AC surface on the bridge be milled, a new AC surface be provided to the widened portion of the bridge and a new RA overlay be applied over the complete deck surface.

It is further recommended that new curb, gutter and sidewalk be provided on the new section south of the bridge while only new curb and gutter is currently recommended on each side for the section of roadway between the north end of the south bridge and the south end of the north bridge. As an option, sidewalks can be added to this section at an additional cost (See Summary of Estimated Construction Costs for Preferred Alternative).

All storm water surface drainage from the bridge structure and the approach roadways will be collected in a new catch basin and/or spillway system located in the approach roadways at each end of the bridge (See project Drainage Report for drainage concepts and details). All N.P.D.E.S. requirements will be considered and provided for in the drainage of both the bridge and approach roadways.

Although results of the Bridge Scour Analysis indicate special remedial measures should be considered and are recommended to optimize channel efficiency and provide improved scour protection for the existing bridge structure (See Drainage and Hydraulic Analysis T.M.), the current scope of this particular project assumes no major channel bottom or grade control stucture modifications will be considered at this time. This will necessitate design consideration of full general, contraction, and local scour to determine appropriate foundation depths and column sections for the new piers. It is also proposed as part of this project that the new abutment extensions be designed considering utilization of new riprap armored bank protection similar to the existing abutment protection.

Since it is not currently within the scope of this project to address the suggested channel and grade control structure remedial measures in detail, the following estimated construction costs for this project include only the costs necessary for bank protection at the abutments with the piers being designed to take full design scour.

Summary of Estimated Construction Costs for Preferred Alternative

Following is an estimate of construction costs based on preliminary design information for the bridge widening, approach roadway improvements, roadway drainage and channel modifications:

Bridge Widening

	Proposed	Optional
Superstructure	$ 260,000	
Substructure	$ 230,000	
AC Milling & RA Overlay	$ 12,200	
Miscellaneous Removal & Other Items	$ 50,000	
Subtotal Bridge Costs	$ 552,200	$ 552,200
Approach Roadway		
N.P.D.E.S.	$ 5,000	
Mobilization	$ 50,000	
AC Pavement Removal & Replacement	$ 205,000	
AC Milling & RA Overlay	$ 18,600	
Concrete Curb & Gutter	$ 19,600	
Sidewalk (South of Bridge)	$ 8,200	
Sidewalk (North of Bridge Optional)		$ 18,000
Subtotal Roadway Costs	$ 306,400	$ 324,400
Drainage and Channel Modifications		
Roadway Drainage	$ 70,200	
Abutment Protection	$ 75,000	
Subtotal Drainage and Channel	$ 145,200	$ 145,200
Summary		
Estimated Construction Cost	$1,003,800	$ 1,021,800
Construction Engineering & Administration	$ 150,000	$ 155,000
Contingency @ 10% of Construction Cost	$ 100,000	$ 102,200
Total Estimated Cost	**$ 1,253,800**	**$ 1,279,000**

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931	1	1	

Sta 1+105.182
Begin Project
Match Existing

Lt Sta 1+145
New 12 m Turnout
Sunward Materials

Existing R/W

Edge of Pavement
New

Existing Grade
Control Structure

Existing South Bridge 14.747 m

Red Mountain T.I.
Existing Ramp A
Construction ℄

End PCCP
Existing

R= 4.5 m
Typ

Edge of Pavement
Existing

1+100

1+200

1+300

1+400

13.676 m

15.120 m

15.164 m

14.513 m

Match Line Sta 1+400

N 5°08'51" W

13.211 m

PT 1+373.109

Existing Alma School ℄

Proposed South Bridge
Widening See Bridge
Selection Report for Details

Red Mountain T.I.
Existing Ramp C
Construction ℄

MCDOT STA 1+000.00=
ADOT STA 20+00.00

PC 1+182.039

Proposed Median

Curve Data

PI Sta 1+277.655
Δ= 4°33'36" L
T= 95.556 m
L= 191.010 m
R= 2400 m

Existing R/W

Proposed Alma School ℄

Existing Alma School ℄

Edge of Pavement
Existing

1+500

Edge of Pavement
New

Existing R/W

1+600

Existing
Overhead Powerpoles

Existing North Bridge

1+700

1+400

Match Line Sta 1+400

N 9°42'27" W

Edge of Pavement
Existing

Edge of Pavement
New

R= 22.5 Typ

Rt Sta 1+420
New 14 m Turnout
Sunward Materials

PC 1+810.025

Curve Data

PI Sta 1+686.078
Δ= 9°57'20" R
T= 76.053 m
L= 151.724 m
R= 873.188 m

Existing R/W

Sta 1+761.749
End Project
Match Existing

PT 1+761.749

Proposed Alma School ℄

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE AT THE SALT RIVER PROJECT NO. 68931

	BY	DATE
DESIGNED	P. DICKMAN	5/97
DRAWN	C. KMETTY	5/97
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

FIGURE 1
PREFERRED ALTERNATE

SHEET 1 OF 1

TRACS NO.

mb.dgn 12/02/94

$DATE$ $TIME$ 641133.tbl

TECHNICAL MEMORANDUM

ALMA SCHOOL ROAD
WORK ORDER NO. 68931

CORRIDOR CHARACTERISTICS
McLellan Road to McKellips Road

Introduction

The Alma School Road project resides primarily on an unincorporated "island" of land belonging to Maricopa County and to a lesser extent on the Salt River Pima Maricopa Indian reservation. The unincorporated island is surrounded by land owned by the City of Mesa to the south, east and west and land owned by the Salt River Pima Maricopa Indian Community (SRPMIC) on the north (See Location Map, Figure 1, and Vicinity Map, Figure 2). Alma School Road is a four lane arterial roadway with a paved median that runs in a north-south direction through the project area. The roadway includes two bridge crossings over the Salt River.

Several engineering and environmental studies have been conducted in the vicinity of the project. Some of these studies were specifically prepared for Alma School Road whereas others were conducted as part of the Red Mountain Freeway project from Price Road to SR87 (McKellips Road) which bisects the southern reaches of the Alma School Road project area. Project specific engineering studies include a Candidate Assessment Report that was completed in December 1995 by Inca Engineers, Inc. and an Operational Study that was completed in July 1996 by Kirkham-Michael Consulting Engineers. Studies conducted by/for the Arizona Department of Transportation (ADOT) as part of the Red Mountain Freeway project include an Environmental Impact Statement (EIS), a Drainage Study, and a Traffic Study. The information contained in these reports is, for all practical purposes, directly applicable to the present Alma School Road project. This is particularly true for the EIS, because the study area defined for the Red Mountain Freeway project completely encompasses that identified for the Alma School Road project.

The Maricopa County Department of Transportation (MCDOT) has budgeted $1,140,000 in fiscal year 2000-01 for improvements to Alma School Road. This project has also been selected as a candidate for possible early construction. Proposed improvements to Alma School Road would widen the roadway within the project limits to an Urban Principal Arterial Road. Detailed information concerning the nature of these improvements is contained in the Alignment Technical Memorandum as well as in the Bridge Selection Report. A Drainage Technical Memorandum and a Traffic Technical Memorandum have also been completed for this project in order to fully assess the factors influencing the design of the roadway improvements.

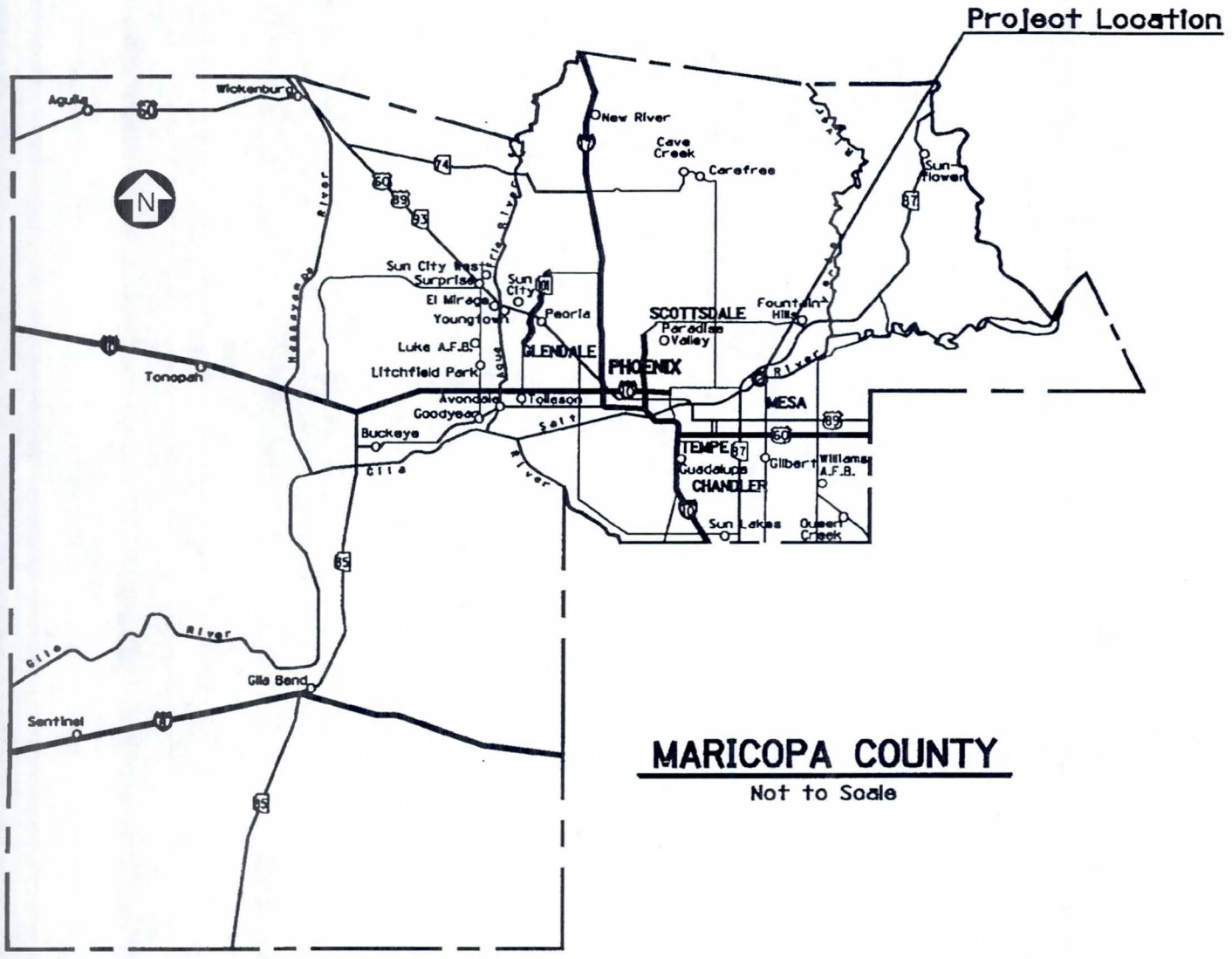


Figure 1
Location Map

Figure 2
Vicinity Map

The north bridge over the main Salt River channel and the south bridge over the secondary channel were both constructed by Maricopa County in 1980-81 (W.O. Nos. 60400 and 60401). The bridges are both 25.6 m (84 ft) wide with clear roadway width of 20.7 m (68 ft), 1.2 m (3 ft 10 in) sidewalk on the west side and 2.1 m (6 ft 10 in) sidewalk on the east side, separated from the roadway by concrete traffic barriers.

The south bridge is a seven-span, prestressed box beam bridge that is 124.8 m (409.6 ft) long. The north bridge is a 14-span, prestressed box beam bridge that is 285.3 m (936.2 ft) long. Both bridges have grade control structures and gabion scour protection that were constructed in 1995 with FEMA funding to repair scour damage that occurred in 1993.

Between the south bridge and the north bridge is approximately 384 m (1262 ft) of asphaltic concrete roadway pavement. The pavement north of the north bridge was replaced by MCDOT in 1994 and is in good condition. The asphalt wearing surface on the north bridge was milled and overlaid with approximately 37.5 mm (1.5 in) of rubberized asphalt at this time. North of McKellips Road, Alma School Road continues through the Salt River Pima-Maricopa Indian Community as a four lane roadway with paved median.

Utilities

Several utilities exist along Alma School Road within the project limits. These include a waterline, overhead phone lines, and overhead 12kv powerlines. The 12kv powerline on the west side is constructed similar to a 69kv powerline and may pose relocation problems.

The Salt River - A Key Topographical Feature

The Salt River runs primarily in an east-west direction through the greater Phoenix metropolitan area and is normally a dry channel. As previously mentioned, within the project area, the main Salt River channel is crossed by the northern 14-span bridge and a secondary channel is crossed by the southern seven-span bridge. Surface water flow in the Salt River is limited to periodic releases from upstream reservoirs, wastewater treatment plants, agricultural return flows, and runoff from storms on the watershed below the reservoirs. Flow characteristics in the Salt River vary greatly from year to year. Flows are determined by the magnitude of the releases from the upstream reservoirs. Historic data indicate there were no releases from 1940 to 1965. Between 1965 and 1996, several flows have occurred, ranging from a rare major flood in the early 1980's to relatively small releases. In the event of major storms, flows in the Salt River cause the closure of the McKellips Road low water crossing of the Salt River, upstream of the Alma School Road crossing. A large portion of the traffic that normally travels on McKellips Road utilizes Alma School Road to cross the river during these occurrences.

Available Flood Insurance Study (FIS) mapping indicates that the 100-year floodplain associated with the Salt River actually extends south of the southern bridge and essentially encompasses the entire project study area. However, the Salt River topography used as a basis for the FIS mapping is substantially different from the present topography. These topographic changes have primarily been the result of mining activities. In stream mining operations have generally resulted in three major impacts on the Salt River channel. Mining has generally lowered the Salt River channel, flattened the slope, and left an extensive number of abandoned open pits. The combined effect of the mining is channel incisement leading to unstable main channel banks throughout the project reach. In addition, mining has likely reduced the extent of the regulatory Salt River floodplain and floodway. Mining activities are furthered discussed in the Land Use section below. The Drainage Technical Memorandum contains more detailed information pertaining to floodplain and drainage issues.

Land Use/Zoning

Industrial uses are clustered along Alma School Road south of the Salt River and north of McLellan Road. Sand and gravel operations predominate, with mining operations occurring primarily west of Alma School Road and along the riverbed. The ready-mixed concrete production plant associated with the sand and gravel mining operation is located east of the road and north of the Red Mountain Freeway interchange that is presently under construction. Land that is not associated with the sand and gravel mining activities is either vacant, has been committed to highway use, or is occupied by commercial business. A tire shop located along the south bank of the Salt River is the lone commercial use in the study area. Until recently, several commercial and industrial businesses were also located along Alma School Road just north of McLellan Road. These businesses had to be acquired by ADOT as part of the right-of-way requirements associated with the construction of the Red Mountain Freeway and interchange in this area. Presently, there are no residential or recreational land uses along the corridor, however, the City of Mesa's future land use plan and zoning ordinance designate the project area as Park/Open Space once the sand and gravel activities cease and the land is reclaimed.

Immediately north of the project area, the Salt River Pima Maricopa Indian Community has plans to construct a Casino/Gaming Center on their reservation. Improvements to Alma School Road will enhance access to this planned facility.

Emergency services including fire protection are provided to the project area by Rural Metro, a private company located in Mesa. These services are required because the area is a small unincorporated island of Maricopa County.

Property Ownership

Most of the land in the study area is owned by private companies involved in the sand and gravel business. These companies and the land they own are described below.

- **CALMAT -** This company owns 28.3 ha (70 ac) associated with a gravel pit located south of the Salt River that is currently inactive. Although these areas are inactive, they could be brought to active use at any time. Presently, the property is used for equipment storage. When in production, seventy-five employees are assigned to this site. Materials extracted from this pit are transported across the dry Salt River bed and processed at the plant operated by the Salt River Pima Maricopa Indian Community on the north bank of the river. CALMAT has sold its mining patent to the Indian Community. Access to the site is provided from Alma School Road across the Johnson Stewart Johnson Company property.

- **Johnson Stewart Johnson Company -** This company owns 25.5 ha (63 ac) on both sides of Alma School Road south of the Salt River. The subsurface mining and use of surface rights are leased to Sunward Materials, the American operating company of CeMex, a Mexican Company. Sunward employs 120 persons at this site. The aggregate materials are mined from the westerly parcel and trucked to the materials production plant east of Alma School Road. An access road runs beneath the south bridge of Alma School Road along the riverbed and provides a direct link between the eastern and western parcels. The employee access to Sunward Materials is located along Alma School Road on the east side of the Road, between the north and south bridges. There is also an access road on the east side, south of the south bridge, that is currently not in use.

  A portion of the property located west of Alma School Road has been acquired as right-of-way associated with ADOT's Red Mountain Freeway project. However, the southern-most parcel west of Alma School Road and the majority of the processing plant to the east remain intact. ADOT has provided an underpass as part of the Red Mountain Freeway's design in this area in order to maintain Sunward's access to the southwestern materials source.

Biological/Ecological Resources

Biological/Ecological resources within the project area have been heavily disturbed by sand and gravel mining and urban development. Virtually no undisturbed open space areas remain. Thus, the habitat within the project area is designated as Ruderal/Disturbed. This designation is characterized by annual weeds and occasional desert broom (*Baccharis sarothroides*) and blue palo verde (*Cercidium floridium*).

According to the Red Mountain Freeway Environmental Impact Statement, there are no Federal or State-listed threatened or endangered plant or animal species in the area. This includes the entire study area associated with the present Alma School Road project. This determination was based on consultations with the U.S. Fish and Wildlife Service, the Arizona Game and Fish Department and the Arizona Department of Agriculture during development of the Red Mountain EIS.

Cultural Resources

There are no historic sites within the limits of the project. Additionally, studies of the area conducted for the preparation of the Red Mountain Freeway Environmental Impact Statement indicate that the sand and gravel mining operations together with the historic meandering movements of the Salt River have rendered the area generally void of any archeological materials. Ground disturbance during construction of the existing Alma School Road, its bridges and associated scour protection has also contributed to the removal of archaeological materials that may have once existed in the area. This is also true for the ongoing construction associated with the Red Mountain Freeway through the area.

Agricultural Resources

Other than a small inactive agricultural parcel located immediately west of Alma School Road that is surrounded by sand and gravel activities, there are no agricultural resources in the study area.

Hazardous Materials/Wastes

A Phase 1 Environmental Assessment was conducted for the Red Mountain Freeway project and included the area associated with this project. The assessment involved a visual inspection of the area as well as a review of all relevant environmental databases. The assessment identified a solid waste landfill (Alma School Landfill) located at the northwest corner of Alma School and McLellan Roads. This site is outside the area of this project. The assessment also identified registered underground storage tanks along Alma School Road. These are located east of the road and south of the Red Mountain Freeway interchange (See Figure 3).

Figure 3
UST Map

TECHNICAL MEMORANDUM

ALMA SCHOOL ROAD

WORK ORDER NO. 68931

ALIGNMENT ANALYSIS
McLellan Road to McKellips Road

Technical Memorandum Purpose:
The purpose of this Technical Memorandum is to review the alignment information presented in the Candidate Assessment Report, Operational Study and other documents relating to the Alma School Road corridor, further analyze new or updated information, and determine the preferred alignment to be included in the final Design Concept Report.

Introduction:
Alma School Road is currently a four-lane rural arterial road with a paved median and two bridge crossings of the Salt River. Both the north bridge over the main Salt River channel and the south bridge over the secondary channel were constructed by Maricopa County in 1980-81 (W.O. Nos. 60400 and 60401). The bridges are both 25.6 m (84') wide with clear roadway width of 20.7 m (68'), 1.2m (3'-10") sidewalk on the west side and 2.1m (6'-10") sidewalk on the east side, separated from the roadway by concrete traffic barriers.

North of McKellips Road Alma School Road continues in the Salt River Pima-Maricopa Indian Community as a four-lane roadway with paved median. South of McLellan Road, in the City of Mesa, Alma School Road has been improved to an urban arterial road with 26.8m (88') clear width consisting of six 3.35 m (11') wide lanes, a 3.35 m (11') wide paved median and two 1.6 m (5.5') paved shoulders.

MCDOT has proposed widening the south bridge to a seven lane section. The north bridge is not being modified under this project. In addition to the bridge widening, a channelized "T" intersection is being proposed for the main access to Sunward Materials.

Existing Alignment:
The existing Alma School Road project alignment begins on a left-hand curve (looking north - up station) established by ADOT for the Red Mountain Interchange on the south. The PT of this curve is located 0.944 m onto the south end of the bridge to be widened under this project. The

combination of ADOT's 0°45'00" curve and 64 km/h (40 mph) design speed does not require superelevation. ADOT's improvements are currently under construction.

Beyond the PT of the existing curve, the roadway continues on a tangent for 378.437 m. This stretch of roadway includes the bridge to be widened and the "channelized T" intersection proposed for Sunward Materials access.

Following the tangent, the alignment curves back to the right with a 2°0'00" curve ending on the approach slab 3.620 m south of the existing north bridge over the Salt River. This bridge will not be modified during this project and the proposed improvements will match the existing bridge section. As-builts show that this curve is superelevated at 2% and that the super transitions back to a normal crown by the PT. Current MCDOT standards require a superelevation of 2.5% for a 64 km/h (40 mph) design speed.

Existing right-of-way varies significantly throughout the project. A tight spot exists north of the main Sunward driveway, between the driveway and the north bridge over the Salt River where the right-of-way is 16.839 m from the existing centerline. Additional right-of-way may be required in this area.

Sunward Materials operation currently has access from four points located essentially at each quadrant of the south bridge. The northeast access is the main entrance to the Sunward plant, all other access points are used by their trucks either going to or from their operation. The southeast access is currently not in use but needs to be provided for in this project.

The existing posted speed is 40 mph which is equivalent to 64 km/h. The existing roadway has a normal crown of 2%.

Alternative Alignments:
Two alignments were considered during development of this Technical Memorandum. The first is to widen about the existing center line and the second is to widen all to the east side.

The first alternative, to widen on each side of the existing centerline, is based on the contract documents and has been the concept throughout the various past study phases of this project. Widening along this alignment would require relocation of the existing 12kV overhead power lines currently located on the west side of Alma School Road. The existing south bridge would also require widening on each side resulting in additional foundation costs. See the Bridge Selection Report Technical Memorandum for a full discussion of the bridge advantages/disadvantages for each alignment. From a geometric standpoint, widening on each side poses no clear advantage. Conversely, in addition to the utility relocation discussed above, maintenance of traffic during construction would require shifting from side to side during the bridge construction operations.

The second alignment alternative (see Figure 1) was proposed to take advantage of the cost savings which will be realized if the bridge is widened to the east side only. See the Bridge

Selection Report Technical Memorandum for a discussion of the savings. After meeting with MCDOT, it was agreed widening to the east side would be presented as the preferred alignment.

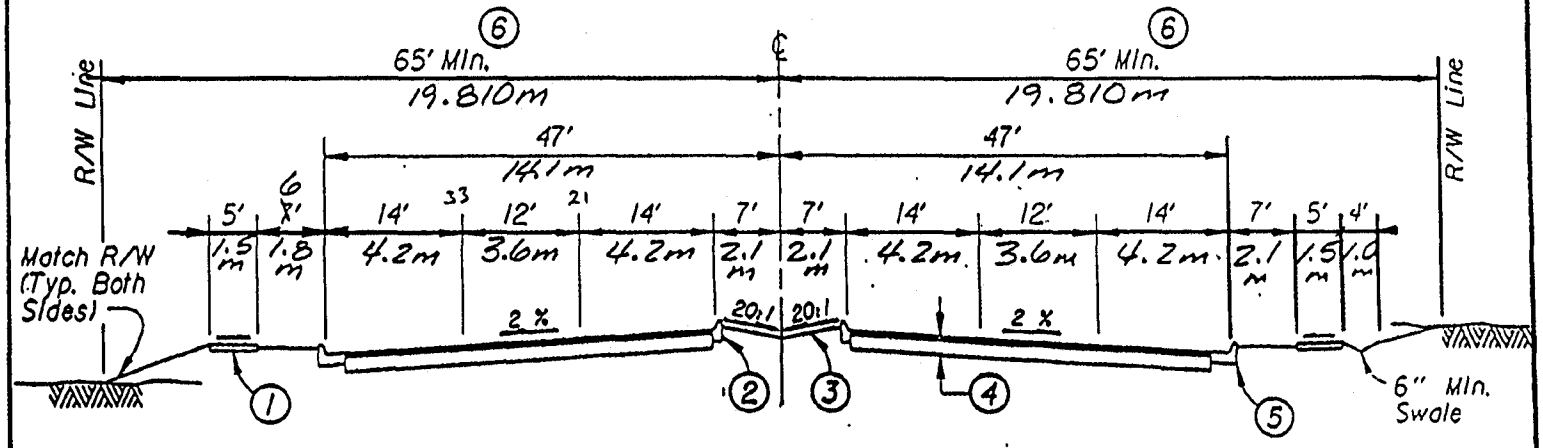
In order to widen to the east it is proposed to end ADOT's curve at the north end of their concrete paving. From ADOT's concrete paving, a short tangent is proposed before adding a 2400 m left-hand curve ending north of the existing south bridge. This will require reconstruction/realignment of a portion of ADOT's proposed raised median. A request has been forwarded to ADOT to replace their raised median with a striped median in the interim between ADOT's and MCDOT's construction. At this time of this technical memorandum, ADOT had not yet responded.

Since the existing south bridge is on a tangent and the proposed centerline is on a curve, the half-width from the centerline is not constant. Because of the lane and sidewalk width desired and the precast girder dimensions, the clear roadway width of the proposed widened south bridge is 28.905 m. The preferred typical section (Figure 5.6 of the MCDOT Roadway Design Manual, see page 5) has a half-width of 14.1 m. The geometric arrangement shown on Figure 1 has a half-width which varies from a maximum of 15.211 m to a minimum of 13.676 m on the southwest end of the bridge. Several options will be proposed during final design to mitigate the narrower half-width including adjusting the geometrics and/or narrowing the median. Narrowing the lanes will only be considered as a last option. It should be noted that the City of Mesa section south of the Red Mountain Interchange is also using a seven-lane section except with a 13.411 m (44') half-width. ADOT's design carried Mesa's lane widths north through their portion of the Alma School Road/Red Mountain Interchange design before transitioning to the existing MCDOT striping south of the south bridge. Carrying Mesa's half-width across the bridge may also be a possible mitigation method.

The current posted speed limit is 40 mph which is equivalent to 64 km/h. This suggests a desired design speed of approximately 80 km/h which is preferred by MCDOT. While the horizontal sight distance is adequate for a 80 km/h design speed, existing conditions may warrant a lower design speed. ADOT used a design speed of 64 km/h (40 mph) at the south end of this project. A higher design speed would have required superelevation for their ending curve. At the north end of this project the existing curve ends at the south end of the north bridge. This curve is a two degree curve which by current MCDOT standards would require super elevation to 2.5% at 64 km/h (40 mph). Currently the curve is super elevated at 2% and transitions to normal crown at the PT of the curve to keep the super elevation off of the north bridge. This existing transition method will have to be maintained for the proposed improvements. The use of a 80 km/h design speed will be contingent upon the existing super elevation conditions.

The table on the following page summarizes and compares the issues of the existing centerline alternative with the preferred alternative of widening to the east.

Criteria	Widen on Each Side of Existing Centerline Alternative	Widen To East Side Only Alternative
Cross Slope	NC 2%	NC 2%
Curvature	R1= 2328.500 m (Existing - ADOT) R2=873.188 m (Existing - N Bridge)	R1= 2328.500 m (Existing - ADOT) R2=2400.000 m (New) R3=873.188 m (Existing - N Bridge)
Design Speed	80 km/h	80 km/h
Lane Widths	Full width	Median narrowed along south bridge
Right-of-Way	Additional right-of-way required	More right-of-way required than widening about centerline (centerlines are approx.1.8 m apart) (See R/W Strip Map attached)
Sight Distance	Min 122 m, desired 145 m @ 80 km/h Actual = 145 m+	Min 122 m, desired 145 m @ 80 km/h Actual 145 m
Typical Section	*Figure 5.6 (See page 5)	*Figure 5.6 (See page 5)
Major Utility Impacts	Relocation of 69kV lines on west side of Alma School Rd. required	
Superelevation	Match existing north curve	Match existing north curve
Maintenance of Traffic	Widening to both sides will require shifting traffic during construction	Widening to east can be accomplished with minor disruption to existing traffic
Earthwork	No advantage	No advantage
Vertical Clearance	Widening may require minor regrading of the dirt road under the bridge to maintain existing vertical clearance	Widening may require minor regrading of the dirt road under the bridge to maintain existing vertical clearance
Sunward Access	Widening to both sides will impact proposed SW access road and SE access road	Widening to east will impact proposed SE access road



N.T.S.

(1) Designer Shall Offset S/W Except at Street Intersections (Typ. Both Sides).

(2) MCDOT Std. Detail 2030, Single Curb (Typ. Both Sides).

(3) Under Certain Conditions, the Construction of Median Curb may be Waived by the Department.

(4) 100mm Min. A.C. Over 250mm Min. A.B. or Approved Equivalent.

(5) MAG Std. Detail 220, Type A or MCDOT Std. Detail 2030, Curb & Gutter (Typ. Both Sides).

(6) Road of Regional Significance Alignment - 21.3m Typical Half-Width Min.

NOTE: Cross Section may be Flared at Intersections to Provide Dual Left Turn Lanes and/or Right Turn Lanes.

Maricopa Co. Dept. of Transportation Standard Typical Section	URBAN PRINCIPAL ARTERIAL ROAD	FIG. 5.6

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931	1	1	

Sta 1+105.182
Begin Project
Match Existing

Red Mountain T.I.
Existing Ramp A
Construction ℄

Lt Sta 1+145
New 12 m Turnout
Sunward Materials

End PCCP
Existing

R= 4.5 m
Typ

Edge of Pavement
Existing

Edge of Pavement
New

Existing R/W

Existing
Overhead Powerpoles

Existing Grade
Control Structure

Existing South Bridge

14.747 m

13.676 m

15.211 m

15.129 m

15.241 m

14.955 m

1+100

1+200

1+300

1+400

Match Line Sta 1+400

N 5°08'51" W

PC 1+182.099

PT 1+373.109

Existing Alma School ℄

Proposed South Bridge
Widening See Bridge
Selection Report for Details

Red Mountain T.I.
Existing Ramp C
Construction ℄

MCDOT STA 1+000.00=
ADOT STA 20+00.00

Proposed Median

Proposed Alma School ℄

Curve Data

PI Sta 1+277.655
Δ= 4°33'36" L
T= 95.556 m
L= 191.010 m
R= 2400 m

Existing R/W

Edge of Pavement
New

Existing
Overhead Powerpoles

Existing North Bridge

Existing Alma School ℄

Edge of Pavement
Existing

1+400

1+500

1+600

1+700

Existing R/W

Match Line Sta 1+400

N 9°42'27" W

PT 1+761.749

Sta 1+761.749
End Project
Match Existing

Edge of Pavement
Existing

Edge of Pavement
New

Proposed Alma School ℄

PC 1+610.025

Curve Data

PI Sta 1+686.078
Δ= 9°57'20" R
T= 76.053 m
L= 151.724 m
R= 873.188 m

R= 22.5 Typ

Rt Sta 1+420
New 14 m Turnout
Sunward Materials

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE AT THE SALT RIVER PROJECT NO. 68931

	BY	DATE
DESIGNED	P DICKMAN	5/97
DRAWN	C KMETTY	5/97
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

FIGURE 1
PREFERRED ALIGNMENT

SHEET 1 OF 1

TRACS NO.

mb.dgn 12/02/94
$DATE$ $TIME$ 641133.tbl

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	69003			

6C Z

Report No. _____
INDIAN RES
Rec. No. _____
Date _____ D# _____
R/W Req. _____ sq. m
T.C.E. Req. _____ sq. m
D.E. Req. _____ sq. m
S.E. Req. _____ sq. m

6C Z

Report No. _____
INDIAN RES
Rec. No. _____
Date _____ D# _____
R/W Req. _____ sq. m
T.C.E. Req. _____ sq. m
D.E. Req. _____ sq. m
S.E. Req. _____ sq. m

50 0 50 100
Scale in Meters

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

Center Sec. 8

N1/4 Cor. Sec. 8

N89°45'37"W 873.728m (2866.56')

N89°56'47"E 806.089m (2644.65')

Δ=4°41'19"
R=2328.501m (7639.44')
L=190.546m (625.15')

S81°20'38"W
7.364m (24.16')

Δ=3°23'08"
R=901.188m (2956.65')
L=53.249m (174.70')

Δ=2°10'24"
R=889.952m (2919.79')
L=33.756m (110.75')

S88°02'34"E
11.456m (37.58')

Med. ℄ S.R. 202
(Red Mountain Fwy)

Exist. R/W

New R/W

N09°42'26"W 209.996m (688.96')

6C

ALMA SCHOOL ROAD

Exist. ℄

51.816m (170')

N08°39'23"W
508.321m (1667.72')

28.000m (91.86')

S08°39'23"E 227.341m (745.87')

N09°42'26"W
236.917m (777.29')

16.764m (55')

N08°39'23"W
88.434m (290.14')

N17°52'16"W
34.413m (112.90')

23.000m (75.46')

S09°42'26"E
134.760m (442.12')

New R/W

6C

N05°08'50"W
76.916m (252.35')

3.658m (12')

N00°27'31"W
69.433m (227.80')

N00°27'31"W
345.643m (1134.00')

12.192m (40')

N17°52'16"W
13.550m (44.45')

Δ=3°18'53"
R=860.996m (2824.79')
L=49.811m (163.42')

S89°47'20"W
91.448m (300.02')

N00°27'31"W
148.867m (488.41')

N00°27'31"W
815.156m (2674.39')

Old R/W ℄

Exist. R/W

Constr. ℄

Δ=18°07'09"
R=873.188m (2864.79')
L=276.135m (905.96')

Δ=08°11'52"
R=873.188m (2864.79')
L=124.934m (409.89')

Δ=17°24'45"
R=873.188m (2864.79')
L=265.367m (870.62')

Δ=4°33'36"
R=2400.000m (7874.02')
L=191.010m (626.67')

S.W. Cor. Sec. 9
Fd. BC In HH

N.W. Cor. Sec. 9
Fd. 1/2" Iron Pin

N89°47'33"E
777.124m (2549.62')

S89°09'34"W
765.625m (2511.89')

Center Sec. 9
Fd. BC In HH

N1/4 Cor. Sec. 9

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
RIGHT OF WAY DIVISION

ALMA SCHOOL ROAD
SOUTH BRIDGE AT SALT RIVER
PROJECT NO. 68931

		BY	DATE
PRELIMINARY	DESIGNED	MGJ	8/97
	DRAWN	JEV	8/97
Review	CHECKED	KMD	8/97
NOT FOR CONSTRUCTION	DIBBLE & ASSOCIATES CONSULTING ENGINEERS		

RIGHT-OF-WAY STRIP MAP

SHEET 1 OF 2

TRACS NO.

mb.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	69003			

50 0 50 100
Scale in Meters

N

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

N1/4Cor. Sec. 8

N89°56'47"E
806.089m (2644.65')

Exist. R/W

ALMA SCHOOL ROAD

G.L.O. Meander Corner
Not Found

Fd. BC In HH

Constr. ℄

S89°45'07"E
6.207m (20.36')

51.816m (170')

Exist. ℄

N00°14'53"E
507.275m (1664.29')

N00°21'10"E
431.280m (1414.96')

N00°14'53"E
411.901m (1351.38')

N00°15'43"E
297.889m (977.33')

16.764m (55')

21.336m (70')

23.000m (75.46')

6C

Fd. BC Flush

E1/4Cor. Sec. 4
Fd. BC In HH

N13°37'31"W
384.365m (1261.04')

Exist. R/W

S89°47'20"W
91.448m (300.02')

New R/W

Δ=9°57'19"
R=873.188m (2864.79')
L=151.719m (497.76')

Δ=6°31'37"
R=856.424m (2809.79')
L=97.561m (320.08')

Δ=7°37'07"
R=850.188m (2789.33')
L=113.048m (370.89')

N89°47'33"E
777.124m (2549.62')

N.W. Cor. Sec. 9
Fd. 1/2" Iron Pin

N1/4Cor. Sec. 9

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
RIGHT OF WAY DIVISION

ALMA SCHOOL ROAD
SOUTH BRIDGE AT SALT RIVER
PROJECT NO. 68931

		BY	DATE
PRELIMINARY	DESIGNED	MGJ	8/97
	DRAWN	JEV	8/97
Review	CHECKED	KMD	8/97
NOT FOR CONSTRUCTION	DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1960		

RIGHT-OF-WAY STRIP MAP

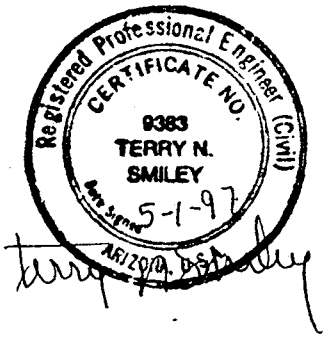
SHEET 2 OF 2

TRACS NO.

mb.dgn 12/02/94

TECHNICAL MEMORANDUM NUMBER 1
TRAFFIC VOLUME DATA
ALMA SCHOOL ROAD
AT THE
SALT RIVER BRIDGE

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION
WORK ORDER 68931



Bolduc, Smiley & Associates, Inc.

TRANSPORTATION ENGINEERING CONSULTANTS

5080 North 40th Street - Suite 250
Phoenix, Arizona 85018 (602) 952-1577

APRIL 29, 1997

921COV.AI

TECHNICAL MEMORANDUM NUMBER 1

TRAFFIC VOLUME DATA

ALMA SCHOOL ROAD AT THE

SALT RIVER BRIDGE

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TRAFFIC VOLUME DATA

ALMA SCHOOL ROAD AT THE

SALT RIVER BRIDGE

LIST OF EXHIBITS (Continued)

TECHNICAL MEMORANDUM NUMBER 1

TRAFFIC VOLUME DATA

ALMA SCHOOL ROAD AT THE

SALT RIVER BRIDGE

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION
WORK ORDER 68931

April 29, 1997

TECHNICAL MEMORANDUM PURPOSE

The purposes of this technical memorandum are to document the existing traffic volumes using Alma School Road at the Salt River Bridge, to show the distribution of the existing traffic volumes by vehicle classification and to present forecasts of future traffic that will be using Alma School Road in the study area. This technical memorandum is being prepared at the request of the Maricopa County Department of Transportation (MCDOT) to assist in the design of the Alma School Road-South Salt River Bridge widening project. Bolduc, Smiley & Associates, Inc. is the traffic engineering member of the DeLeuw Cather & Company (DCCO) design team. The vehicle classification data is important for both pavement design and to understand the heavy truck traffic entering and exiting Alma School Road from the Sunward Materials Company.

PREVIOUSLY COLLECTED TRAFFIC VOLUME DATA

A report titled Alma School Road Operational Study was completed by Kirkham Michael Consulting Engineers in July, 1996 for the Maricopa County Department of Transportation. A ten-hour turning movement count was performed for this study by the Maricopa County Department of Transportation on March 19, 1996 which counted vehicles entering and exiting the two access points for the Sunward Materials plant. The results of the ten-hour turning movement count are reproduced on Exhibit 1.

CITY OF MESA TRAFFIC VOLUMES

The City of Mesa conducts annual traffic counts throughout the city. There is a traffic volume count location on Alma School Road south of McLellan Road and the City of Mesa collected data in 1994 and again in 1996. The two-way traffic volume on Alma

Alma School turning movment of the Truck Crossing

Weather : Sunny
Counted by: AS,KEL,RA,VG
Board # :
Other :

	North Entr.				South Entr.							
	Out		In		Out		In					
	North	South	North	South	South	North	South	North	Total Out	Total In	Total	Hour Count Total
3/19/96 6:15	2		0	0	7		2	1	9	3	12	
3/19/96 6:30	4		1	0	6		4	0	10	5	15	
3/19/96 6:45	5		3	1	0		2	0	5	6	11	
3/19/96 7:00	9		0	0	2		3	0	11	3	14	52
3/19/96 7:15	3	1	1	1	2		2	0	6	4	10	
3/19/96 7:30	9		0	0	0		6	1	9	7	16	
3/19/96 7:45	9		3	0	4		0	0	13	3	16	
3/19/96 8:00	7		1	1	4		2	0	11	4	15	57
3/19/96 8:15	10		1	2	2		4	2	12	9	21	
3/19/96 8:30	4		0	0	7		7	0	11	7	18	
3/19/96 8:45	5	1	4	1	0		3	0	6	8	14	
3/19/96 9:00	6		0	0	0		7	0	6	7	13	66
3/19/96 9:15	3		2	5	0		2	0	3	9	12	
3/19/96 9:30	6		1	0	4		18	0	10	19	29	
3/19/96 9:45	10		1	0	1		9	0	11	10	21	
3/19/96 10:00	5		3	0	1		4	1	6	8	14	76
3/19/96 10:15	8	2	4	0	7		7	0	17	11	28	
3/19/96 10:30	6		2	0	0		7	0	6	9	15	
3/19/96 10:45	2		1	0	7		5	0	9	6	15	
3/19/96 11:00	8		0	1	0		7	0	8	8	16	74
3/19/96 11:15	4		4	0	2		4	0	6	8	14	
3/19/96 11:30	4		1	1	2		2	1	6	5	11	
3/19/96 11:45	3		1	0	4		6	1	7	8	15	
3/19/96 12:00	8	1	1	0	3		1	0	12	2	14	54
3/19/96 12:15	2		3	0	2		7	0	4	10	14	
3/19/96 12:30	7		1	3	3		5	0	10	9	19	
3/19/96 12:45	5	1	1	1	4		12	0	10	14	24	
3/19/96 13:00	7	1	1	3	5		4	1	13	9	22	79
3/19/96 13:15	4		3	0	5		5	1	9	9	18	
3/19/96 13:30	4		3	1	5		2	0	9	6	15	
3/19/96 13:45	6		4	1	3		6	0	9	11	20	
3/19/96 14:00	5		2	4	3		4	0	8	10	18	71
3/19/96 14:15	5		4	2	5		4	0	10	10	20	
3/19/96 14:30	1		2	0	0		1	0	1	3	4	
3/19/96 14:45	1	2	2	1	1		2	0	4	5	9	
3/19/96 15:00	1	1	0	0	4		4	0	6	4	10	43
Total									303	269		

SOURCE: Alma School Road Operational Study By Kirkham Michael Consulting Engineers (July, 1996)

Bolduc, Smiley & Associates, Inc.

TEN-HOUR TRUCK TURNING MOVEMENT COUNT

EXHIBIT 1

922102.AI 4/29/97

School Road south of McLellan Road in 1994 was 25,100 vehicles per day (vpd) and the two-way volume in 1996 was 21,000 vpd. The study section for this technical memorandum for Alma School Road is north of the limits for the City of Mesa, and therefore, north of this count location.

APRIL, 1997 TRAFFIC COUNTS

Twenty-four hour volume counts which recorded the classification of each vehicle were performed at two locations on Alma School Road by Traffic Research & Analysis, Inc. for Bolduc, Smiley & Associates, Inc. on March 17, 18 and 19, 1997. The counts started at 3:00 PM on Monday, March 17, 1997 and concluded at 3:00 PM on Wednesday, March 19, 1997. Twenty-four hour counts were performed for northbound and southbound traffic on Alma School Road south of McLellan Road and on Alma School Road south of McKellips Road. The classification of each vehicle are determined by categorizing each vehicle into the vehicle-types defined by the Federal Highways Administration (F.H.W.A.). This system has thirteen vehicle classification types. The thirteen vehicle classifications are described on Exhibit 2 and are shown graphically on Exhibit 3.

The twenty-four hour data from Tuesday, March 18, 1997 has been summarized by vehicle classification on Exhibits 4 through 13, respectively. Exhibits 4 through 7 show the twenty-four hour volumes for northbound and southbound traffic at the two count locations for each of the thirteen vehicle classifications. Exhibits 8 through 11 show the number and percentage of vehicles by vehicle group and by direction of travel, the volumes of each vehicle group as a percentage of the hourly and daily totals, and the AM and PM peak hour volumes. Exhibits 12 and 13 show the vehicle classification count data for Alma School Road south of McLellan Road and for Alma School Road south of McKellips Road.

The twenty-four hour volume for southbound Alma School Road south of McLellan Road was 1,549 vehicles and the twenty-four hour volume of heavy trucks in Group 3 (F7 thru F13) was 45, which was 3% of the total twenty-four hour volume. The AM peak hour for southbound Alma School Road south of McLellan Road occurred between 7:00 AM and 8:00 AM on Tuesday, March 18, 1997. The AM peak hour total volume accounts for 8% of the twenty-four hour total volume for this direction at this location. The volume of heavy trucks in Group 3 (F7 thru F13) during the AM peak hour accounts for 13% of the twenty-four hour total volume and 5% of the AM peak hour total volume. The PM peak hour for southbound Alma School Road south of McLellan Road occurred between 4:00 PM and 5:00 PM on Tuesday, March 18, 1997. The PM peak hour volume accounts for 10% of the twenty-four hour volume at this location. There were no Group 3 (F7 thru F13) heavy trucks recorded during the PM peak hour.

FHWA VEHICLE CLASSIFICATION WITH DEFINITIONS

1. Motorcycles

All two or three wheeled motorized vehicles. Typical vehicles in this category have saddle type seats and are steered by handle bars rather than a wheel. This category includes motorcycles, motor scooters, mopeds, motor powered bicycles, and three wheeled motorcycles.

2. Pasenger Cars

All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.

3. Other Two Axle, Four Tire Single Unit Vehicles

All two axle, four tire vehicles, other than passenger cars. Included in this classification are pickups, panels, vans and other vehicles such as campers, motor homes, ambulances, hearses, and carryalls. Other two axle, four tire single unit vehicles pulling recreational or other light trailers are included in this classification.

4. Buses

All vehicles manufactured as traditional passenger carrying buses with two axles and six tires or three or more axles. This category includes only traditional buses (including school buses) functioning as passenger carrying vehicles.

NOTE: In reporting information on trucks, the following criteria is used:

a. Truck tractor units traveling without a trailer will be considered single unit trucks.

b. A truck tractor unit pulling other such units in a "saddle mount" configuration will be considered as one single unit truck and will be defined only by the axles on the pulling unit.

c. Vehicles shall be defined by the number of axles in contact with the roadway. Therefore, "floating" axles are counted only when in the down position.

d. The term "trailer" includes both semi and full trailers.

5. Two Axle, Six Tire, Single Unit Trucks

All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., having two axles and dual rear wheels.

6. Three Axle Single Unit Trucks

All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., having three axles.

7. Four or More Axle Single Unit Trucks

All trucks on a single frame with four or more axles.

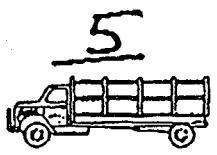
Bolduc, Smiley & Associates, Inc.

F.H.W.A. VEHICLE CLASSIFICATION TYPE AND DESCRIPTION

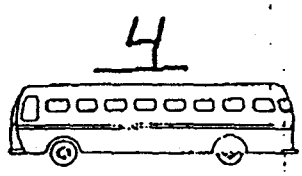
EXHIBIT 2

ILLUSTRATION OF COMMERCIAL VEHICLE TYPES

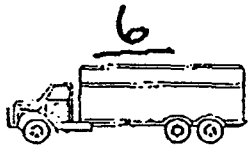
SINGLE TRUCK 2-AXLE SINGLE TIRE



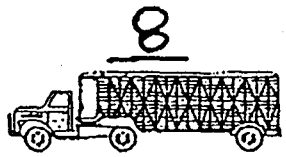
SINGLE TRUCK 2-AXLE DUAL TIRE



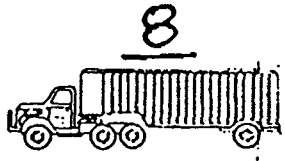
BUS



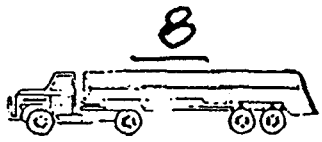
SINGLE TRUCK 3-AXLE



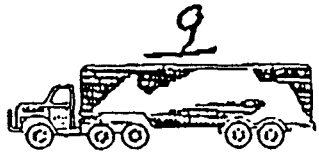
TRACTOR - TRUCK SEMI 3-AXLE



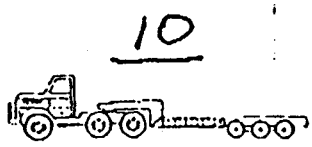
TRACTOR - TRUCK SEMI 4-AXLE



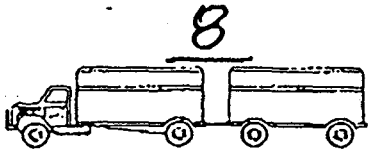
TRACTOR - TRUCK SEMI 4-AXLE



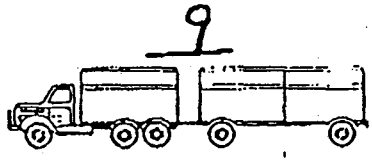
TRACTOR - TRUCK SEMI 5 AXLE



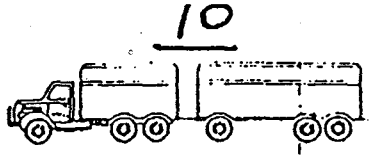
TRACTOR - TRUCK SEMI 6 AXLE



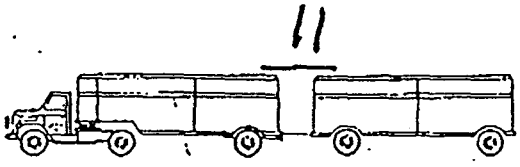
TRUCK AND TRAILER 4-AXLE



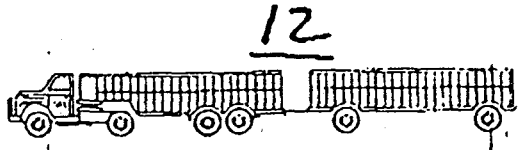
TRUCK AND TRAILER 5 AXLE



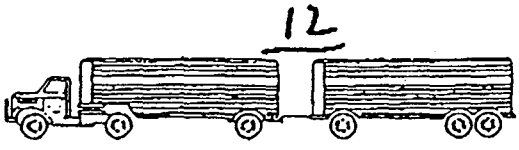
TRUCK AND TRAILER 6-AXLE



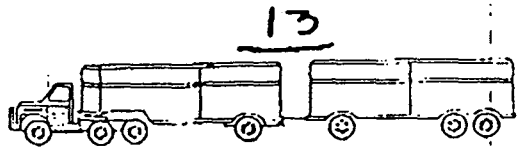
TRAIN 5-AXLE



TRAIN 6-AXLE



TRAIN 6-AXLE



TRAIN 7-AXLE

Bolduc, Smiley & Associates, Inc.

F.H.W.A. VEHICLE CLASSIFICATION TYPES

EXHIBIT 3

921103.AI 4/29/97

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Southbound on Alma School Road South of McLellan**

Date Counted: **March 18, 1997**

Number of Vehicles by Classification

Begin Time Period	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	Total
Midnight	1	13	2	0	1	0	0	0	0	0	0	0	0	17
01:00 AM	0	4	0	0	0	0	0	0	0	0	0	0	0	4
02:00 AM	0	8	6	0	0	0	0	0	0	0	0	0	0	14
03:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	2
04:00 AM	0	11	0	1	0	0	0	0	0	0	0	0	0	12
05:00 AM	1	42	9	0	0	0	0	0	0	0	0	0	0	52
06:00 AM	0	92	25	0	0	0	1	1	3	0	2	0	0	124
07:00 AM	0	98	20	0	2	2	0	0	3	2	1	0	0	128
08:00 AM	1	79	14	0	0	3	0	0	2	1	4	0	0	104
09:00 AM	0	50	18	0	1	4	0	0	2	0	1	0	0	76
10:00 AM	1	45	9	0	0	2	0	1	2	3	1	0	0	64
11:00 AM	0	50	14	0	2	1	0	0	1	2	0	0	0	70
Noon	0	51	16	0	2	3	0	0	1	1	0	0	0	74
01:00 PM	0	46	9	0	3	3	0	0	2	2	1	0	0	66
02:00 PM	0	65	16	0	0	0	1	0	1	1	1	0	0	85
03:00 PM	0	104	18	0	2	2	0	0	1	0	0	0	0	127
04:00 PM	1	111	33	1	3	0	0	0	0	0	0	0	0	149
05:00 PM	0	106	20	0	0	0	0	0	0	0	0	0	0	126
06:00 PM	0	55	12	0	0	0	0	0	0	0	0	0	0	67
07:00 PM	0	58	9	0	1	0	0	0	0	0	0	0	0	68
08:00 PM	0	32	8	0	0	0	0	0	0	0	0	0	0	40
09:00 PM	0	34	5	0	0	0	0	0	0	0	0	0	0	39
10:00 PM	0	21	4	0	0	0	0	0	0	0	0	0	0	25
11:00 PM	0	12	4	0	0	0	0	0	0	0	0	0	0	16
TOTAL	5	1189	271	2	17	20	2	2	18	12	11	0	0	1549

Bolduc, Smiley & Associates, Inc.

SOUTHBOUND ALMA SCHOOL ROAD
SOUTH OF McLELLAN ROAD
VEHICLES BY CLASSIFICATION

EXHIBIT 4

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Northbound on Alma School Road South of McLellan**

Date Counted: **March 18, 1997**

Number of Vehicles by Classification

Begin Time Period	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	Total
Midnight	0	40	4	0	0	0	0	0	0	0	0	0	0	44
01:00 AM	0	24	1	0	0	0	0	0	0	0	0	0	0	25
02:00 AM	0	13	2	0	0	0	0	0	0	0	0	0	0	15
03:00 AM	0	18	2	0	0	0	0	0	0	0	0	0	0	20
04:00 AM	0	17	6	0	0	0	0	0	0	0	0	0	0	23
05:00 AM	0	68	15	0	0	0	0	0	1	0	0	0	0	84
06:00 AM	2	133	20	0	1	2	0	3	0	0	0	0	0	161
07:00 AM	3	180	31	0	3	5	0	0	0	0	0	2	0	224
08:00 AM	2	140	32	0	2	9	0	1	0	0	0	0	0	186
09:00 AM	0	129	25	0	8	8	0	1	1	0	0	0	0	172
10:00 AM	4	134	26	0	2	7	0	1	1	0	0	0	1	176
11:00 AM	3	190	22	0	5	9	0	0	1	0	1	0	0	231
Noon	0	194	20	0	3	6	0	0	1	0	0	0	0	224
01:00 PM	0	187	27	0	1	6	1	2	2	0	0	0	0	226
02:00 PM	0	210	29	1	2	4	0	1	2	1	0	0	0	250
03:00 PM	0	280	43	1	0	4	0	1	1	0	0	0	1	331
04:00 PM	2	287	42	0	0	1	0	0	1	0	0	0	0	333
05:00 PM	2	284	34	0	1	0	0	1	0	0	0	1	0	323
06:00 PM	0	198	28	1	0	0	0	1	0	0	0	1	0	229
07:00 PM	0	168	13	0	1	0	0	0	0	0	0	0	0	182
08:00 PM	1	108	8	1	1	0	0	0	0	0	0	0	0	119
09:00 PM	0	117	10	0	0	0	0	0	0	0	0	0	0	127
10:00 PM	1	77	11	0	0	0	0	0	1	0	0	0	0	90
11:00 PM	0	63	3	0	0	0	0	0	0	0	0	0	0	66
TOTAL	20	3259	454	4	30	61	1	12	12	1	1	4	2	3861

Bolduc, Smiley & Associates, Inc.

NORTHBOUND ALMA SCHOOL ROAD
SOUTH OF McLELLAN ROAD
VEHICLES BY CLASSIFICATION

EXHIBIT 5

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Southbound on Alma School Road South of McKellips**

Date Counted: **March 18, 1997**

Number of Vehicles by Classification

Begin Time Period	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	Total
Midnight	0	7	0	0	0	0	0	0	0	0	0	0	0	7
01:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	2
02:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	2
03:00 AM	0	2	2	0	0	0	0	0	0	0	0	0	0	4
04:00 AM	0	5	2	0	1	0	0	0	1	0	0	0	0	9
05:00 AM	0	6	4	0	1	5	1	0	1	0	1	0	0	19
06:00 AM	0	19	4	0	1	5	1	0	9	1	2	0	0	42
07:00 AM	0	33	9	0	1	9	0	0	16	3	2	0	2	75
08:00 AM	0	61	18	0	0	8	3	0	18	4	4	0	3	119
09:00 AM	0	50	19	0	1	9	1	1	10	0	2	0	0	93
10:00 AM	0	48	17	0	5	8	0	0	9	1	2	0	0	90
11:00 AM	0	55	20	0	1	4	0	1	14	3	1	0	0	99
Noon	0	82	5	1	0	4	0	1	15	2	2	0	1	113
01:00 PM	0	61	11	0	1	7	1	1	8	1	2	0	0	93
02:00 PM	0	80	22	1	2	7	0	0	12	2	0	0	2	128
03:00 PM	0	100	18	0	3	3	1	2	3	0	4	0	0	134
04:00 PM	0	154	33	0	3	2	0	2	1	0	0	0	1	196
05:00 PM	3	158	28	0	1	1	0	2	1	0	0	0	0	194
06:00 PM	0	76	11	0	1	0	0	0	0	0	0	0	0	88
07:00 PM	0	44	6	0	0	0	0	0	0	0	0	0	0	50
08:00 PM	0	26	1	0	0	0	0	0	1	0	0	0	0	28
09:00 PM	0	18	4	0	0	0	0	0	0	0	0	0	0	22
10:00 PM	0	12	2	0	0	0	0	0	0	0	0	0	0	14
11:00 PM	0	12	0	0	0	0	0	0	0	0	0	0	0	12
TOTAL	3	1113	236	2	22	72	8	10	119	17	22	0	9	1633

Bolduc, Smiley & Associates, Inc.

SOUTHBOUND ALMA SCHOOL ROAD
SOUTH OF McKELLIPS ROAD
VEHICLES BY CLASSIFICATION

EXHIBIT 6

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Northbound on Alma School Road South of McKellips**

Date Counted: **March 18, 1997**

Number of Vehicles by Classification

Begin Time Period	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	Total
Midnight	0	19	0	0	0	0	0	0	0	0	0	0	0	19
01:00 AM	0	11	1	0	0	0	0	0	0	0	0	0	0	12
02:00 AM	0	6	0	0	0	0	0	0	0	0	0	0	0	6
03:00 AM	0	3	0	0	0	0	0	0	0	0	0	0	0	3
04:00 AM	0	6	6	0	0	2	1	0	3	0	0	0	0	18
05:00 AM	0	34	15	0	1	6	2	0	8	0	0	0	0	66
06:00 AM	0	67	31	0	2	8	2	9	36	3	5	1	1	165
07:00 AM	1	92	24	0	3	8	5	6	56	6	5	3	1	210
08:00 AM	0	65	21	0	1	5	5	1	46	6	5	1	3	159
09:00 AM	0	44	22	0	4	7	1	3	51	6	4	0	3	145
10:00 AM	1	61	25	0	2	4	2	6	48	5	8	0	2	164
11:00 AM	0	68	19	0	5	5	4	2	52	9	2	2	1	169
Noon	1	73	24	0	3	10	2	8	49	2	5	3	2	182
01:00 PM	1	76	17	0	4	3	0	6	54	6	5	1	1	174
02:00 PM	0	66	22	0	2	3	0	5	39	5	3	1	0	146
03:00 PM	3	101	26	1	1	1	0	1	12	0	0	0	0	146
04:00 PM	0	105	26	0	0	1	0	0	1	0	1	0	0	134
05:00 PM	0	107	19	0	1	0	0	2	0	0	0	0	0	129
06:00 PM	0	92	11	0	0	0	0	0	0	0	0	0	0	103
07:00 PM	0	63	6	0	1	0	0	0	0	0	0	0	0	70
08:00 PM	0	60	6	0	0	0	0	0	0	0	0	0	0	66
09:00 PM	1	63	11	0	1	0	0	0	2	0	0	0	0	78
10:00 PM	0	32	5	0	1	0	0	0	0	0	0	0	0	38
11:00 PM	0	27	2	0	0	0	0	0	0	0	0	0	0	29
TOTAL	8	1341	339	1	32	63	24	49	457	48	43	12	14	2431

Bolduc, Smiley & Associates, Inc.

NORTHBOUND ALMA SCHOOL ROAD
SOUTH OF McKELLIPS ROAD
VEHICLES BY CLASSIFICATION

EXHIBIT 7

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Southbound on Alma School Rd South of McLellan**

Date Counted: **March 18, 1997**

Number and Percentage of Vehicles

Begin Time Period	F2-Passenger Car & F1-Motorcycles			F3, F5 & F6-Single Truck & F4-Bus			F7 to F13-Trucks & Tractors with Trailers & Trains			TOTAL	
	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Day
Midnight	14	82%	1%	3	18%	1%	0	0%	0%	17	1%
01:00 AM	4	100%	0%	0	0%	0%	0	0%	0%	4	0%
02:00 AM	8	57%	1%	6	43%	2%	0	0%	0%	14	1%
03:00 AM	2	100%	0%	0	0%	0%	0	0%	0%	2	0%
04:00 AM	11	92%	1%	1	8%	0%	0	0%	0%	12	1%
05:00 AM	43	83%	4%	9	17%	3%	0	0%	0%	52	3%
06:00 AM	92	74%	8%	25	20%	8%	7	6%	16%	124	8%
07:00 AM	98	77%	8%	24	19%	8%	6	5%	13%	128	8%
08:00 AM	80	77%	7%	17	16%	5%	7	7%	16%	104	7%
09:00 AM	50	66%	4%	23	30%	7%	3	4%	7%	76	5%
10:00 AM	46	72%	4%	11	17%	4%	7	11%	16%	64	4%
11:00 AM	50	71%	4%	17	24%	5%	3	4%	7%	70	5%
Noon	51	69%	4%	21	28%	7%	2	3%	4%	74	5%
01:00 PM	46	70%	4%	15	23%	5%	5	8%	11%	66	4%
02:00 PM	65	76%	5%	16	19%	5%	4	5%	9%	85	5%
03:00 PM	104	82%	9%	22	17%	7%	1	1%	2%	127	8%
04:00 PM	112	75%	9%	37	25%	12%	0	0%	0%	149	10%
05:00 PM	106	84%	9%	20	16%	6%	0	0%	0%	126	8%
06:00 PM	55	82%	5%	12	18%	4%	0	0%	0%	67	4%
07:00 PM	58	85%	5%	10	15%	3%	0	0%	0%	68	4%
08:00 PM	32	80%	3%	8	20%	3%	0	0%	0%	40	3%
09:00 PM	34	87%	3%	5	13%	2%	0	0%	0%	39	3%
10:00 PM	21	84%	2%	4	16%	1%	0	0%	0%	25	2%
11:00 PM	12	75%	1%	4	25%	1%	0	0%	0%	16	1%
Totals	1194	77%	* 100%	310	20%	* 100%	45	3%	* 100%	1549	100%
AM Peak Hour	7:00 AM to 8:00 AM										
	98	77%	8%	24	19%	8%	6	5%	13%	128	8%
PM Peak Hour	4:00 PM to 5:00 PM										
	112	75%	9%	37	25%	12%	0	0%	0%	149	10%

*Percent totals may be in error due to rounding

Bolduc, Smiley & Associates, Inc.

SOUTHBOUND ALMA SCHOOL ROAD
SOUTH OF McLELLAN ROAD
NUMBER AND PERCENTAGE OF VEHICLES

EXHIBIT 8

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Northbound on Alma School Rd South of McLellan**

Date Counted: **March 18, 1997**

Number and Percentage of Vehicles

Begin Time Period	F2-Passenger Car & F1-Motorcycles			F3, F5 & F6-Single Truck & F4-Bus			F7 to F13-Trucks & Tractors with Trailers & Trains			TOTAL	
	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Day
Midnight	40	91%	1%	4	9%	1%	0	0%	0%	44	1%
01:00 AM	24	96%	1%	1	4%	0%	0	0%	0%	25	1%
02:00 AM	13	87%	0%	2	13%	0%	0	0%	0%	15	0%
03:00 AM	18	90%	1%	2	10%	0%	0	0%	0%	20	1%
04:00 AM	17	74%	1%	6	26%	1%	0	0%	0%	23	1%
05:00 AM	68	81%	2%	15	18%	3%	1	1%	3%	84	2%
06:00 AM	135	84%	4%	23	14%	4%	3	2%	9%	161	4%
07:00 AM	183	82%	6%	39	17%	7%	2	1%	6%	224	6%
08:00 AM	142	76%	4%	43	23%	8%	1	1%	3%	186	5%
09:00 AM	129	75%	4%	41	24%	7%	2	1%	6%	172	4%
10:00 AM	138	78%	4%	35	20%	6%	3	2%	9%	176	5%
11:00 AM	193	84%	6%	36	16%	7%	2	1%	6%	231	6%
Noon	194	87%	6%	29	13%	5%	1	0%	3%	224	6%
01:00 PM	187	83%	6%	34	15%	6%	5	2%	15%	226	6%
02:00 PM	210	84%	6%	36	14%	7%	4	2%	12%	250	6%
03:00 PM	280	85%	9%	48	15%	9%	3	1%	9%	331	9%
04:00 PM	289	87%	9%	43	13%	8%	1	0%	3%	333	9%
05:00 PM	286	89%	9%	35	11%	6%	2	1%	6%	323	8%
06:00 PM	198	86%	6%	29	13%	5%	2	1%	6%	229	6%
07:00 PM	168	92%	5%	14	8%	3%	0	0%	0%	182	5%
08:00 PM	109	92%	3%	10	8%	2%	0	0%	0%	119	3%
09:00 PM	117	92%	4%	10	8%	2%	0	0%	0%	127	3%
10:00 PM	78	87%	2%	11	12%	2%	1	1%	3%	90	2%
11:00 PM	63	95%	2%	3	5%	1%	0	0%	0%	66	2%
Totals	3279	85%	* 100%	549	14%	100%	33	1%	* 100%	3861	* 100%
AM Peak Hour	11:00 AM to Noon										
	193	84%	6%	36	16%	7%	2	1%	6%	231	6%
PM Peak Hour	4:00 PM to 5:00 PM										
	289	87%	9%	43	13%	8%	1	0%	3%	333	9%

*Percent totals may be in error due to rounding

Bolduc, Smiley & Associates, Inc.

NORTHBOUND ALMA SCHOOL ROAD
SOUTH OF McLELLAN ROAD
NUMBER AND PERCENTAGE OF VEHICLES

EXHIBIT 9

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Southbound on Alma School Rd South of McKellips**

Date Counted: **March 18, 1997**

Number and Percentage of Vehicles

Begin Time Period	F2-Passenger Car & F1-Motorcycles			F3, F5 & F6-Single Truck & F4-Bus			F7 to F13-Trucks & Tractors with Trailers & Trains			TOTAL	
	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Day
Midnight	7	100%	1%	0	0%	0%	0	0%	0%	7	0%
01:00 AM	2	100%	0%	0	0%	0%	0	0%	0%	2	0%
02:00 AM	2	100%	0%	0	0%	0%	0	0%	0%	2	0%
03:00 AM	2	50%	0%	2	50%	1%	0	0%	0%	4	0%
04:00 AM	5	56%	0%	3	33%	1%	1	11%	1%	9	1%
05:00 AM	6	32%	1%	10	53%	3%	3	16%	2%	19	1%
06:00 AM	19	45%	2%	10	24%	3%	13	31%	7%	42	3%
07:00 AM	33	44%	3%	19	25%	6%	23	31%	12%	75	5%
08:00 AM	61	51%	5%	26	22%	8%	32	27%	17%	119	7%
09:00 AM	50	54%	4%	29	31%	9%	14	15%	8%	93	6%
10:00 AM	48	53%	4%	30	33%	9%	12	13%	6%	90	6%
11:00 AM	55	56%	5%	25	25%	8%	19	19%	10%	99	6%
Noon	82	73%	7%	10	9%	3%	21	19%	11%	113	7%
01:00 PM	61	66%	5%	19	20%	6%	13	14%	7%	93	6%
02:00 PM	80	63%	7%	32	25%	10%	16	13%	9%	128	8%
03:00 PM	100	75%	9%	24	18%	7%	10	7%	5%	134	8%
04:00 PM	154	79%	14%	38	19%	11%	4	2%	2%	196	12%
05:00 PM	161	83%	14%	30	15%	9%	3	2%	2%	194	12%
06:00 PM	76	86%	7%	12	14%	4%	0	0%	0%	88	5%
07:00 PM	44	88%	4%	6	12%	2%	0	0%	0%	50	3%
08:00 PM	26	93%	2%	1	4%	0%	1	4%	1%	28	2%
09:00 PM	18	82%	2%	4	18%	1%	0	0%	0%	22	1%
10:00 PM	12	86%	1%	2	14%	1%	0	0%	0%	14	1%
11:00 PM	12	100%	1%	0	0%	0%	0	0%	0%	12	1%
Totals	1116	68%	* 100%	332	20%	* 100%	185	11%	100%	1633	* 100%
AM Peak Hour	8:00 AM to 9:00 AM										
	61	51%	5%	26	22%	8%	32	27%	17%	119	7%
PM Peak Hour	4:00 PM to 5:00 PM										
	154	79%	14%	38	19%	11%	4	2%	2%	196	12%

*Percent totals may be in error due to rounding

Bolduc, Smiley & Associates, Inc.

SOUTHBOUND ALMA SCHOOL ROAD
SOUTH OF McKELLIPS ROAD
NUMBER AND PERCENTAGE OF VEHICLES

EXHIBIT 10

Counts by: **Traffic Research & Analysis, Inc.**
Data Input: **E. Supanich**
Checked By: **G. Jasenovec**
Project #: **97921**

Location: **Northbound on Alma School Rd South of McKellips**

Date Counted: **March 18, 1997**

Number and Percentage of Vehicles

Begin Time Period	F2-Passenger Car & F1-Motorcycles			F3, F5 & F6-Single Truck & F4-Bus			F7 to F13-Trucks & Tractors with Trailers & Trains			TOTAL	
	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Hour	% of Day	#	% of Day
Midnight	19	100%	1%	0	0%	0%	0	0%	0%	19	1%
01:00 AM	11	92%	1%	1	8%	0%	0	0%	0%	12	0%
02:00 AM	6	100%	0%	0	0%	0%	0	0%	0%	6	0%
03:00 AM	3	100%	0%	0	0%	0%	0	0%	0%	3	0%
04:00 AM	6	33%	0%	8	44%	2%	4	22%	1%	18	1%
05:00 AM	34	52%	3%	22	33%	5%	10	15%	2%	66	3%
06:00 AM	67	41%	5%	41	25%	9%	57	35%	9%	165	7%
07:00 AM	93	44%	7%	35	17%	8%	82	39%	13%	210	9%
08:00 AM	65	41%	5%	27	17%	6%	67	42%	10%	159	7%
09:00 AM	44	30%	3%	33	23%	8%	68	47%	11%	145	6%
10:00 AM	62	38%	5%	31	19%	7%	71	43%	11%	164	7%
11:00 AM	68	40%	5%	29	17%	7%	72	43%	11%	169	7%
Noon	74	41%	5%	37	20%	9%	71	39%	11%	182	7%
01:00 PM	77	44%	6%	24	14%	6%	73	42%	11%	174	7%
02:00 PM	66	45%	5%	27	18%	6%	53	36%	8%	146	6%
03:00 PM	104	71%	8%	29	20%	7%	13	9%	2%	146	6%
04:00 PM	105	78%	8%	27	20%	6%	2	1%	0%	134	6%
05:00 PM	107	83%	8%	20	16%	5%	2	2%	0%	129	5%
06:00 PM	92	89%	7%	11	11%	3%	0	0%	0%	103	4%
07:00 PM	63	90%	5%	7	10%	2%	0	0%	0%	70	3%
08:00 PM	60	91%	4%	6	9%	1%	0	0%	0%	66	3%
09:00 PM	64	82%	5%	12	15%	3%	2	3%	0%	78	3%
10:00 PM	32	84%	2%	6	16%	1%	0	0%	0%	38	2%
11:00 PM	27	93%	2%	2	7%	0%	0	0%	0%	29	1%
Totals	1349	55%	100%	435	18%	* 100%	647	27%	100%	2431	* 100%
AM Peak	7:00 AM to 8:00 AM										
Hour	93	44%	7%	35	17%	8%	82	39%	13%	210	9%
PM Peak	Noon to 1:00 PM										
Hour	74	41%	5%	37	20%	9%	71	39%	11%	182	7%

*Percent totals may be in error due to rounding

Bolduc, Smiley & Associates, Inc.

NORTHBOUND ALMA SCHOOL ROAD
SOUTH OF McKELLIPS ROAD
NUMBER AND PERCENTAGE OF VEHICLES

EXHIBIT 11

VEHICLE CLASSIFICATION COUNT DATA
ALMA SCHOOL ROAD, SOUTH OF McLELLAN

Group	FHWA Category	24 Hour Traffic Volume		Percent of Volume By Category	
		SB	NB	SB	NB
1	F1	5	20	0%	1%
	F2	1189	3259	77%	84%
2	F3	271	454	17%	12%
	F4	2	4	0%	0%
	F5	17	30	1%	1%
	F6	20	61	1%	2%
3	F7	2	1	0%	0%
	F8	2	12	0%	0%
	F9	18	12	1%	0%
	F10	12	1	1%	0%
	F11	11	1	1%	0%
	F12	0	4	0%	0%
	F13	0	2	0%	0%
TOTAL		1549	3861	100%	100%

Data Collected:
March 18, 1997

Bolduc, Smiley & Associates, Inc.

VEHICLE CLASSIFICATION COUNT DATA
ALMA SCHOOL ROAD
SOUTH OF McLELLAN ROAD

EXHIBIT 12

VEHICLE CLASSIFICATION COUNT DATA
ALMA SCHOOL ROAD, SOUTH OF McKELLIPS

Group	FHWA Category	24 Hour Traffic Volume		Percent of Volume By Category	
		SB	NB	SB	NB
1	F1	3	8	0%	0%
	F2	1113	1341	68%	55%
2	F3	236	339	14%	14%
	F4	2	1	0%	0%
	F5	22	32	1%	1%
	F6	72	63	4%	3%
3	F7	8	24	0%	1%
	F8	10	49	1%	2%
	F9	119	457	7%	19%
	F10	17	48	1%	2%
	F11	22	43	1%	2%
	F12	0	12	0%	0%
	F13	9	14	1%	1%
TOTAL		1633	2431	98%	100%

Data Collected:
March 18, 1997

Bolduc, Smiley & Associates, Inc.

VEHICLE CLASSIFICATION COUNT DATA
ALMA SCHOOL ROAD
SOUTH OF McKELLIPS ROAD

EXHIBIT 13

The twenty-four hour volume for northbound Alma School Road south of McLellan Road was 3,861 vehicles and the twenty-four hour volume of heavy trucks in Group 3 (F7 thru F13) was 33, which was 1% of the total twenty-four hour volume. The AM peak hour for northbound Alma School Road south of McLellan Road occurred between 11:00 AM and noon on Tuesday, March 18, 1997. The AM peak hour total volume accounts for 6% of the twenty-four hour total volume for this direction at this location. The volume of heavy trucks in Group 3 (F7 thru F13) during the AM peak hour accounts for 6% of the twenty-four hour total volume and 1% of the AM peak hour total volume. The PM peak hour for northbound Alma School Road south of McLellan Road occurred between 4:00 PM and 5:00 PM on Tuesday, March 18, 1997. The PM peak hour volume accounts for 9% of the twenty-four hour volume at this location. There was one Group 3 (F7 thru F13) heavy truck recorded at this location during the PM peak hour and this single vehicle accounts for 0% of the twenty-four hour total volume and 3% of the PM peak hour total volume.

The twenty-four hour volume for southbound Alma School Road south of McKellips Road was 1,633 vehicles and the twenty-four hour volume of heavy trucks in Group 3 (F7 thru F13) was 185, which was 11% of the total twenty-four hour volume. The AM peak hour for southbound Alma School Road south of McKellips Road occurred between 8:00 AM and 9:00 AM on Tuesday, March 18, 1997. The AM peak hour total volume accounts for 7% of the twenty-four hour total volume for this direction at this location. The volume of heavy trucks in Group 3 (F7 thru F13) during the AM peak hour accounts for 17% of the twenty-four hour total volume and 27% of the AM peak hour total volume. The PM peak hour for southbound Alma School Road south of McKellips Road occurred between 4:00 PM and 5:00 PM on Tuesday, March 18, 1997. The PM peak hour volume accounts for 12% of the twenty-four hour volume at this location. The volume of heavy trucks in Group 3 (F7 thru F13) at this location accounts for 2% of the twenty-four hour total volume and 2% of the PM peak hour total volume.

The twenty-four hour volume for northbound Alma School Road south of McKellips Road was 2,431 vehicles and the twenty-four hour volume of heavy trucks in Group 3 (F7 thru F13) was 647, which was 27% of the total twenty-four hour volume. The AM peak hour for northbound Alma School Road occurred between 7:00 AM and 8:00 AM on Tuesday, March 18, 1997. The AM peak hour total volume accounts for 9% of the twenty-four hour total volume for this direction at this location. The volume of heavy trucks in Group 3 (F7 thru F13) during the AM peak hour accounts for 13% of the twenty-four hour volume and 39% of the AM peak hour total volume. The PM peak hour for northbound Alma School Road south of McKellips Road occurred between noon and 1:00 PM on Tuesday, March 18, 1997. The PM peak hour volume accounts for 7% of the twenty-four hour total volume at this location. The volume of heavy trucks in Group 3 (F7 thru F13) at this location accounts for 11% of the twenty-four hour total volume and 39% of the PM peak hour total volume.

Exhibit 14 summarizes the AM peak hour, the PM peak hour and the twenty-four hour traffic volumes at the two count locations by direction and for the two-way total. The percentage of heavy trucks in Group 3 (F7 thru F13) for the AM peak hour, the PM peak hour and the twenty-four hour period are also summarized at each location by direction and for the two-way total.

FUTURE TRAFFIC VOLUMES

Forecasts of future traffic volumes that are anticipated to use this section of Alma School Road were gathered from several sources and are shown on Exhibit 15. Kirkham Michael generated Year 2005 AM and PM peak hour volumes for northbound and southbound Alma School Road. The Year 2005 volumes generated by Kirkham Michael are originally from a November, 1994 document prepared by Stanley Consultants, Inc. titled Red Mountain Freeway at McKellips Road-Draft Traffic Analysis Summary-Bridge/Frontage Road Alternatives. The northbound AM peak hour traffic volume on Alma School Road for Year 2005 is projected to be 950 vehicles and the southbound AM peak hour volume is projected to be 510 vehicles. The northbound PM peak hour traffic volume on Alma School Road for Year 2005 is projected to be 680 vehicles and the southbound PM peak hour volume is projected to be 710 vehicles.

Twenty-four hour traffic volume forecasts for Year 2005 and for Year 2015 were obtained from an October, 1989 Red Mountain Freeway-Dobson Road to Lindsay Road-Design Concept Report prepared by Parsons Brinckerhoff Quade & Douglas, Inc. The Year 2005 and Year 2015 traffic volume forecasts were based on the Maricopa Association of Governments Transportation Planning Office (MAGTPO) regional transportation model. The Year 2005 twenty-four hour two-way volume projection on Alma School Road north of the Red Mountain Freeway (Loop 202) is 25,000 vpd. The Year 2015 twenty-four hour two-way projection on Alma School Road north of the Red Mountain Freeway (Loop 202) is 28,000 vpd.

Year 2020 traffic volume projections were obtained by Bolduc, Smiley & Associates, Inc. from MAGTPO for the Traffic Analysis For Red Mountain Freeway (Loop 202) SR 87 To US 60 Environmental Impact Statement completed in January, 1997. The twenty-four two-way traffic volume projection for Alma School Road north of the Red Mountain Freeway (Loop 202) was shown to be 26,000 vpd. The AM peak hour volume projection on Alma School Road was 1,297 vehicles northbound and 1,069 vehicles southbound. The PM peak hour volume projection on Alma School Road north of the Red Mountain Freeway (Loop 202) was 916 vehicles northbound and 1,047 vehicles southbound.

TWO-WAY TOTAL

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	329	35%
PM	378	20%
24-HOUR	4,064	20%

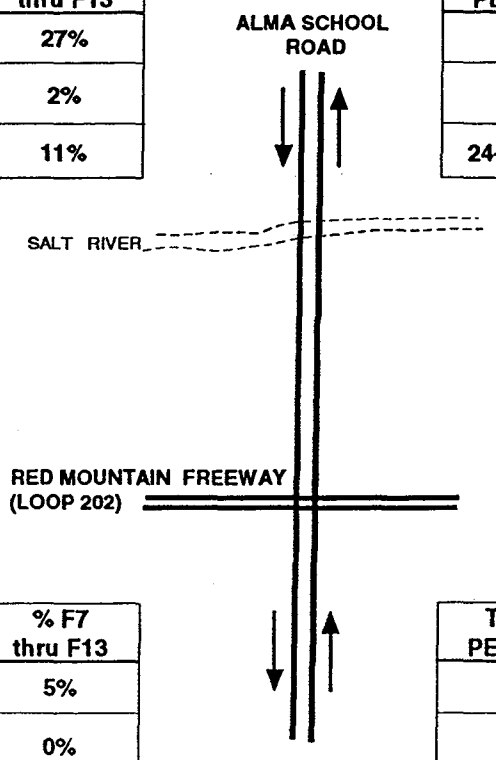
N

SB

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	119	27%
PM	196	2%
24-HOUR	1,633	11%

NB

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	210	39%
PM	182	39%
24-HOUR	2,431	27%



SB

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	128	5%
PM	149	0%
24-HOUR	1,549	3%

NB

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	231	1%
PM	333	0%
24-HOUR	3,861	1%

TWO-WAY TOTAL

TIME PERIOD	TOTAL VOLUME	% F7 thru F13
AM	359	2%
PM	482	0%
24-HOUR	5,410	1%

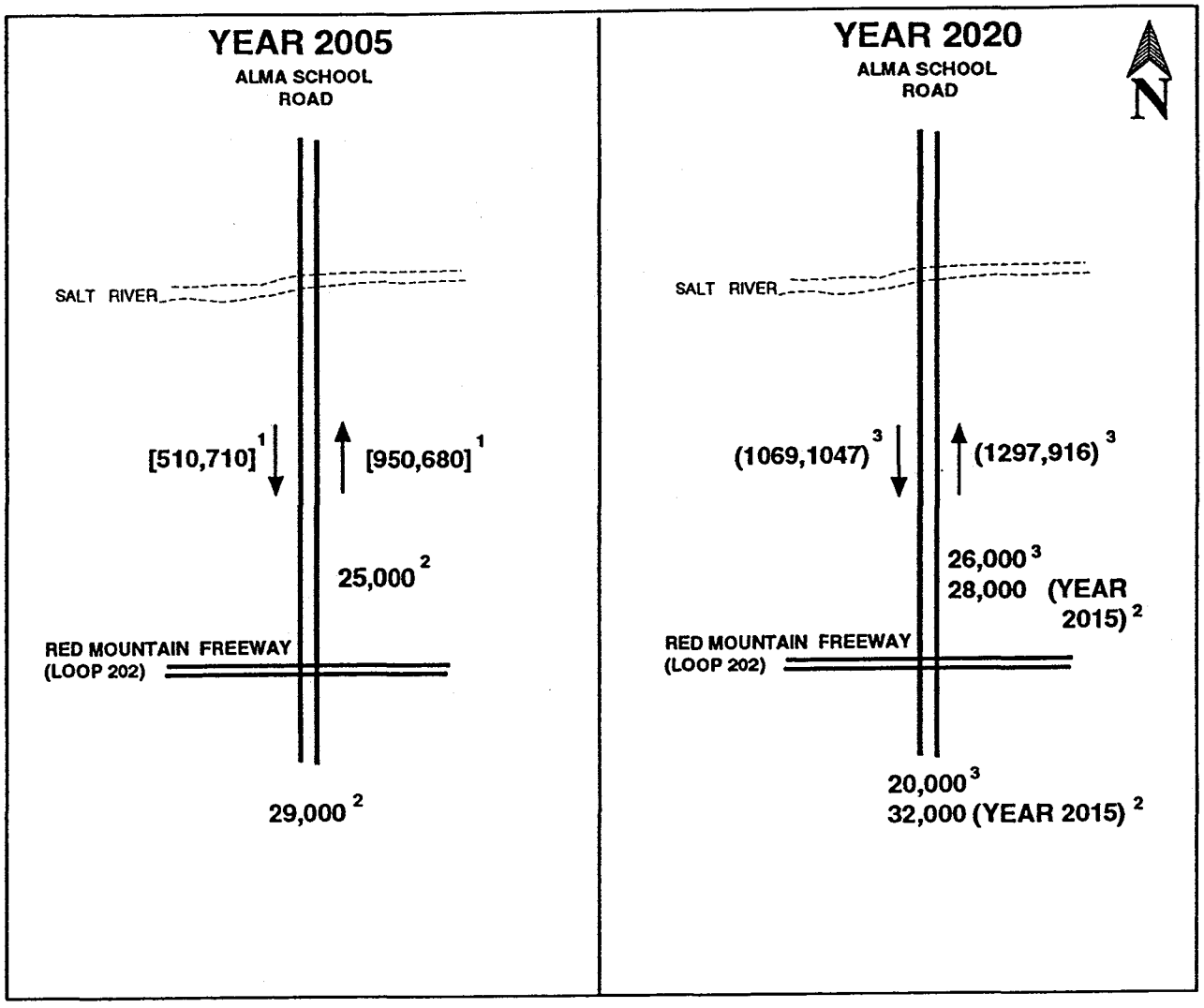
DATA COLLECTED:
MARCH 18, 1997

Bolduc, Smiley & Associates, Inc.

EXISTING TRAFFIC VOLUMES

EXHIBIT 14

921101.AI 4/29/97



LEGEND	
XXX	= 24-HOUR VOLUME
[XXX,XXX]	= YEAR 2005 AM,PM
(XXX,XXX)	= YEAR 2020 AM,PM

SOURCES:

1. *Alma School Road Operational Study (July, 1996)*
2. *Red Mountain Freeway-Dobson Road to Lindsay Road-Design Concept Report (October, 1989)*
3. *Traffic Analysis For Red Mountain Freeway (Loop 202) S.R. 87 To U.S. 60 Environmental Impact Statement (January, 1997)*

Bolduc, Smiley & Associates, Inc.

FUTURE TRAFFIC VOLUMES

EXHIBIT 15

921100.AI 4/29/97

SUMMARY

Bolduc, Smiley & Associates, Inc. has gathered, compiled and reviewed traffic volume data from several sources. The following summarizes the findings:

- The 1994 traffic volume count conducted by the City of Mesa on Alma School Road south of McLellan Road was 25,100 vpd and the 1996 traffic volume count conducted by the City of Mesa at this location was 21,000 vpd.

- Twenty-four hour traffic volume counts which recorded vehicle classification were performed at two locations on Alma School Road by Traffic Research & Analysis, Inc. for Bolduc, Smiley & Associates, Inc. The counts started at 3:00 PM on Monday, March 17, 1997 and concluded at 3:00 PM on Wednesday, March 19, 1997. This count shows a total two-way traffic volume significantly lower than either the 1994 or the 1996 counts conducted by the City of Mesa. The twenty-four hour two-way volume on Alma School Road south of McLellan Road was 5,410 vpd and the twenty-four hour two-way volume at the other count location on Alma School Road south of McKellips Road was 4,064 vpd. The Arizona Department of Transportation is constructing the Red Mountain Freeway interchange with Alma School Road. Traffic control is restricting traffic to a single lane in each direction and these construction activities are resulting in the significantly lower traffic volumes.

- The AM peak hour volumes range from 6% of the total daily volume to 9% of the total daily volume, and the PM peak hour volumes range from 7% of the total daily volume to 12% of the total daily volume.

- The volume of heavy trucks in Group 3 (F7 thru F13) during the AM peak hour ranges from 1% of the total AM peak hour volume to 39% of the total AM peak hour volume. The volume of heavy trucks in Group 3 (F7 thru F13) during the PM peak hour ranges from less than 1% of the total PM peak hour volume to 39% of the total PM peak hour volume.

- The highest heavy truck volumes (F7 thru F13) occurred at the count location on Alma School Road south of McKellips Road for both northbound and southbound traffic. Northbound traffic on Tuesday, March 18, 1997 at this count location consisted of 27% heavy trucks (F7 thru F13) for the twenty-four hour period, and 39% heavy trucks (F7 thru F13) for both the AM and PM peak hours. Southbound traffic at this count location consisted of 11% heavy trucks (F7 thru F13) for the twenty-four hour period, 27% heavy trucks (F7 thru F13) for the AM peak hour and 2% heavy trucks (F7 thru F13) for the PM peak hour.

- Future traffic volume projections for a twenty-four hour period on Alma School Road were gathered from several sources. Year 2005 traffic volume projections from the October, 1989 Red Mountain Freeway-Dobson Road to Lindsay Road-Design Concept Report show a two-way volume on Alma School Road north of the Red Mountain Freeway (Loop 202) of 25,000 vpd. The Year 2015 twenty-four hour two-way volume projection on Alma School Road north of the Red Mountain Freeway (Loop 202) is 28,000 vpd.

- The Year 2020 traffic volume projections obtained by Bolduc, Smiley & Associates, Inc. from MAGTPO for the Traffic Analysis For Red Mountain Freeway (Loop 202) SR 87 To US 60 Environmental Impact Statement show a twenty-four hour two-way volume of 26,000 vpd.

TECHNICAL MEMORANDUM
NUMBER 2

EVALUATION OF AUXILIARY LANES
AND INTERSECTION ILLUMINATION

ALMA SCHOOL ROAD AT THE
SOUTH SALT RIVER BRIDGE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
WORK ORDER 68931

Bolduc, Smiley & Associates, Inc.

TRANSPORTATION ENGINEERING CONSULTANTS

5080 North 40th Street - Suite 250
Phoenix, Arizona 85018 (602) 952-1577

JULY 25, 1997

921COV2.AI

TECHNICAL MEMORANDUM NUMBER 2

EVALUATION OF AUXILIARY LANES

AND INTERSECTION ILLUMINATION

ALMA SCHOOL ROAD AT THE

SOUTH SALT RIVER BRIDGE

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

WORK ORDER 68931

BY:

Bolduc, Smiley & Associates, Inc.
5080 North 40th Street, Suite 250
Phoenix, Arizona 85018

July 25, 1997

TECHNICAL MEMORANDUM NUMBER 2

EVALUATION OF AUXILIARY LANES

AND INTERSECTION ILLUMINATION

ALMA SCHOOL ROAD AT THE

SOUTH SALT RIVER BRIDGE

TABLE OF CONTENTS

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EVALUATION OF AUXILIARY LANES

AND INTERSECTION ILLUMINATION

ALMA SCHOOL ROAD AT THE

SOUTH SALT RIVER BRIDGE

LIST OF EXHIBITS

TECHNICAL MEMORANDUM NUMBER 2

EVALUATION OF AUXILIARY LANES

AND INTERSECTION ILLUMINATION

ALMA SCHOOL ROAD AT THE

SOUTH SALT RIVER BRIDGE

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION
WORK ORDER 68931

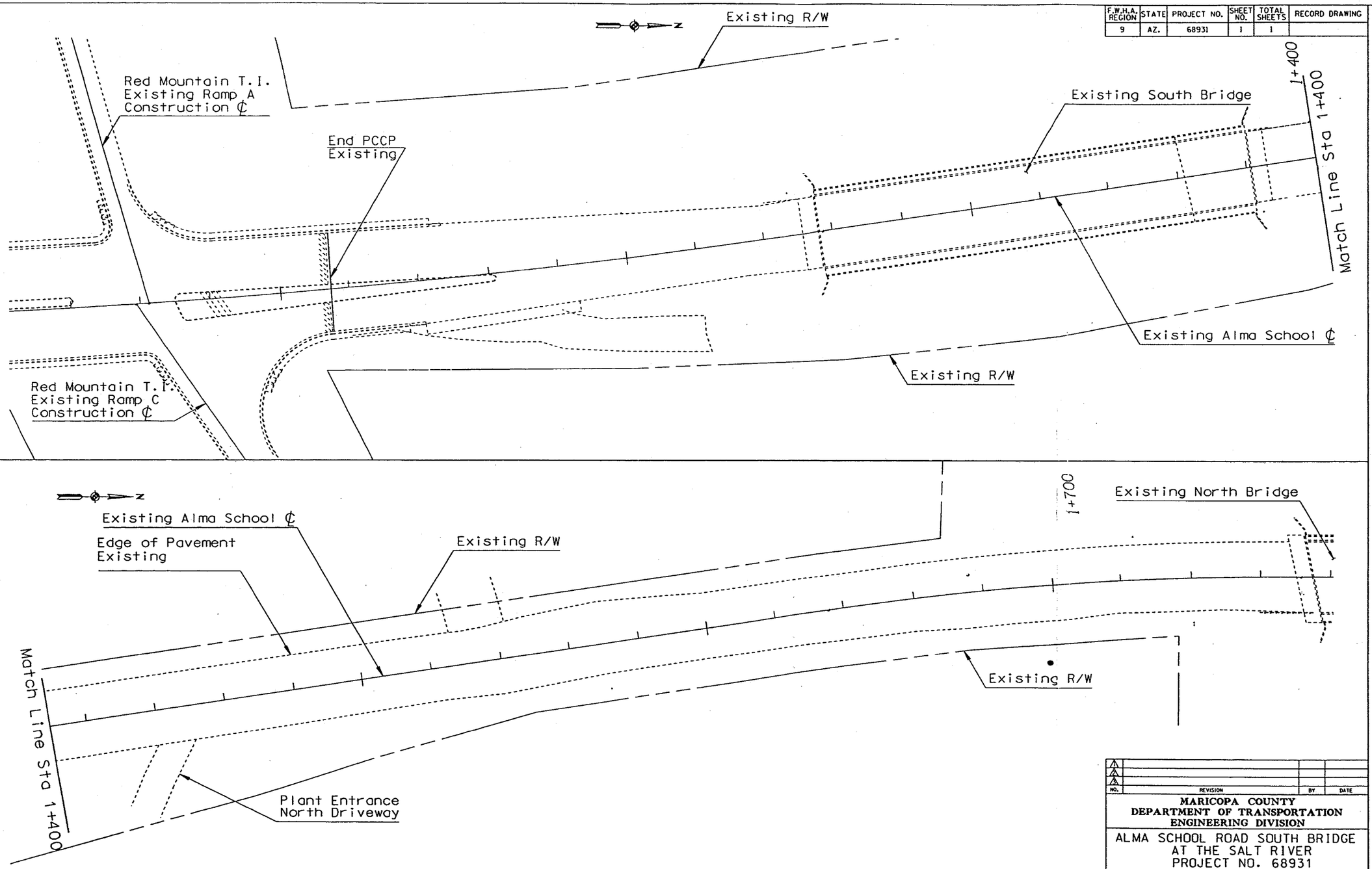
July 24, 1997

TECHNICAL MEMORANDUM PURPOSE

The purposes of this technical memorandum are to review recent transportation planning documents prepared for streets and roadways in the area adjacent to and including the section of Alma School Road which extends from its intersection with McKellips Road to the future Alma School Road interchange with the Red Mountain Freeway; to evaluate acceleration and deceleration lane requirements on Alma School Road at its intersection with the driveway serving the Sunward Materials plant; and to evaluate intersection lighting warrants at the Sunward Materials main driveway. The Alma School Road Operational Study and the Red Mountain Freeway (SR202L) SR101L - Country Club Drive Final Traffic Analysis were determined to be the most recent transportation planning documents that had traffic data and analysis that are directly applicable to the analysis that is being performed on this section of Alma School Road. These documents were reviewed and the results and recommendations were summarized. The Maricopa Association of Governments Transportation Planning Office (MAGTPO) Year 2020 AM and PM peak hour traffic volume projections will be presented and discussed, and acceleration and deceleration lane requirements on Alma School Road at the Sunward Materials plant entrance will be evaluated. Intersection lighting warrants at the Sunward Materials main driveway will also be evaluated based on Maricopa County Department of Transportation (MCDOT) and Arizona Department of Transportation (ADOT) lighting design criteria.

This technical memorandum is being prepared at the request of MCDOT to assist in the design of the Alma School Road-South Salt River Bridge widening project. Bolduc, Smiley & Associates, Inc. is the traffic engineering member of the DeLeuw Cather & Company (DCCO) design team. The existing geometrics for Alma School Road in the study area are shown on Exhibit 1.

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931	1	1	



NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE
AT THE SALT RIVER
PROJECT NO. 68931

	BY	DATE
DESIGNED	DCCO	7/97
DRAWN	SAW	7/97
CHECKED	GAJ	7/97

Bolduc, Smiley & Assoc. Inc.
TRANSPORTATION ENGINEERS
5080 NORTH 40th STREET, SUITE 250, PHOENIX, AZ 85018 (602) 952-1577

EXHIBIT 1
EXISTING GEOMETRICS

SHEET 1 OF 1

TRACS NO.

mb.dgn 12/02/94

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REVIEW OF PREVIOUS REPORTS

A report titled Alma School Road Operational Study was completed by Kirkham Michael Consulting Engineers in July, 1996 for the Maricopa County Department of Transportation. The conclusions reached in this study are listed below:

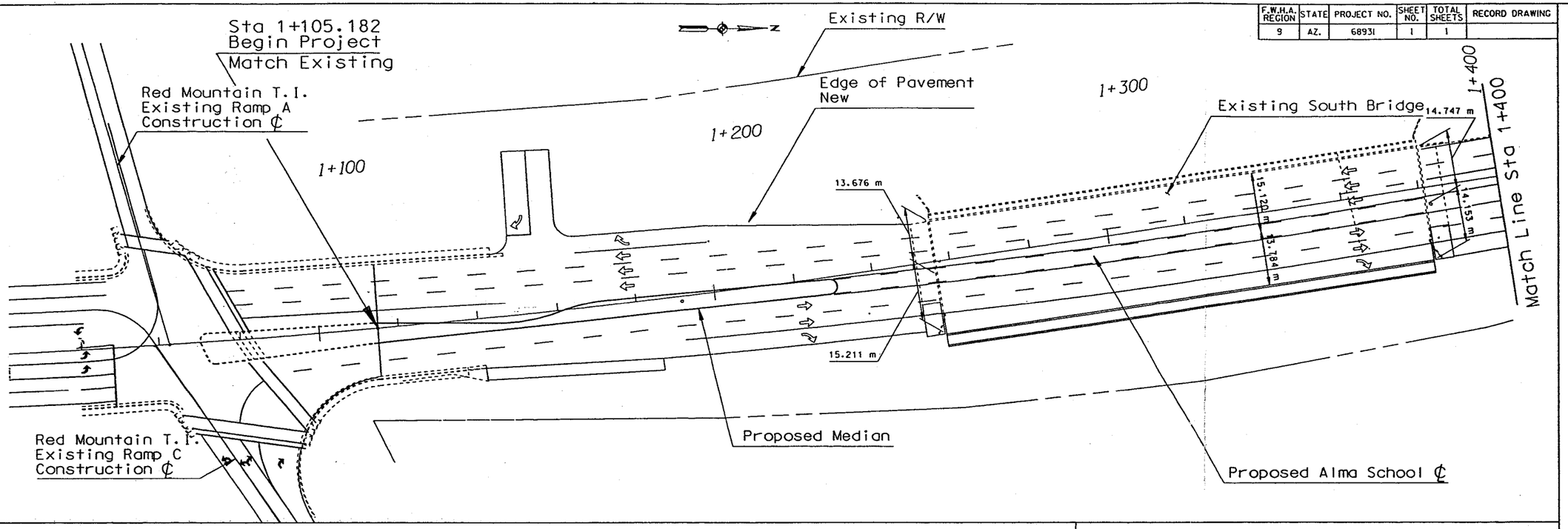
- Alternative 5a, referred to in the study as a channelized-tee type intersection, is the recommended alternative because this alternative provides separate lanes for acceleration and deceleration for northbound Alma School Road traffic as it leaves or arrives at the main driveway serving the Sunward Materials facility. This alternative also provides a separate acceleration lane for westbound to southbound left turns and provides left turn storage for southbound trucks entering the Sunward Materials driveway. Alternative 5a originally provided a single access point for Sunward Materials. The revised Alternative 5a has two access points and the proposed geometrics are shown on Exhibit 2.

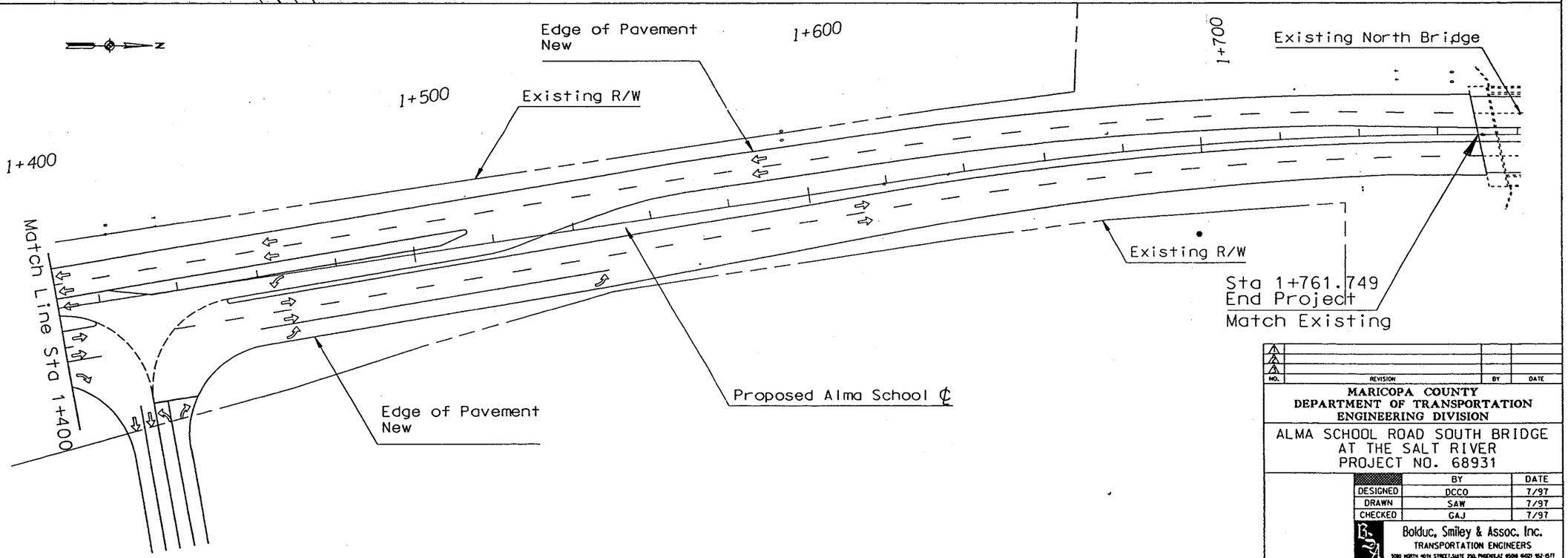
- This study indicates that the northbound acceleration lane on Alma School Road is proposed to be approximately 535 feet (163m) in length while the northbound deceleration lane is proposed to be approximately 500 feet (152m) in length. The southbound left turn lane storage is proposed to be approximately 285 feet (87m) long with approximately 225 feet (66m) of reverse curve transition to create the left turn lane.

- Alternative 5a proposes that the median area be striped to provide an acceleration lane for trucks leaving the Sunward Materials facility and turning south on Alma School Road. Trucks, because of their slower acceleration characteristics, require larger gaps in the traffic stream in order to cross or merge into traffic. Alternative 5a reduces the distance trucks must cross, thereby reducing the critical gap size to approximately eight seconds because only gaps in northbound traffic are of concern to the westbound to southbound left turners. If trucks must cross both directions of travel, the required minimum gap size would be twenty-nine seconds. The twenty-nine seconds was calculated based on Table 2.7 of the Institute of Transportation Engineers (ITE) Traffic Engineering Handbook. This table gives operational characteristics of vehicles and maximum acceleration rates which are expressed as a function of weight(lb)/power(hp) ratio. Kirkham Michael Consulting Engineers used 200 lb/hp in calculations and a 30 mile per hour desired speed for heavy trucks.

- The report indicates that the traffic signal at the Red Mountain Freeway (SR202L) traffic interchange will create gaps in northbound traffic that can be used to allow left turns into and out of the Sunward Materials site.

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931	1	1	





NO.	REVISION	BY	DATE

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE
AT THE SALT RIVER
PROJECT NO. 68931

	BY	DATE
DESIGNED	DCCO	7/97
DRAWN	SAW	7/97
CHECKED	GAJ	7/97

Bolduc, Smiley & Assoc. Inc.
TRANSPORTATION ENGINEERS
5080 NORTH 40TH STREET, SUITE 250, PHOENIX, AZ 85018 (602) 952-1577

EXHIBIT 2
PREFERRED ALTERNATIVE

SHEET 1 OF 1

TRACS NO.

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- The Sunward Materials driveway is projected to operate at Level of Service "C" during the design peak hour with the geometrics proposed in Alternative 5a.

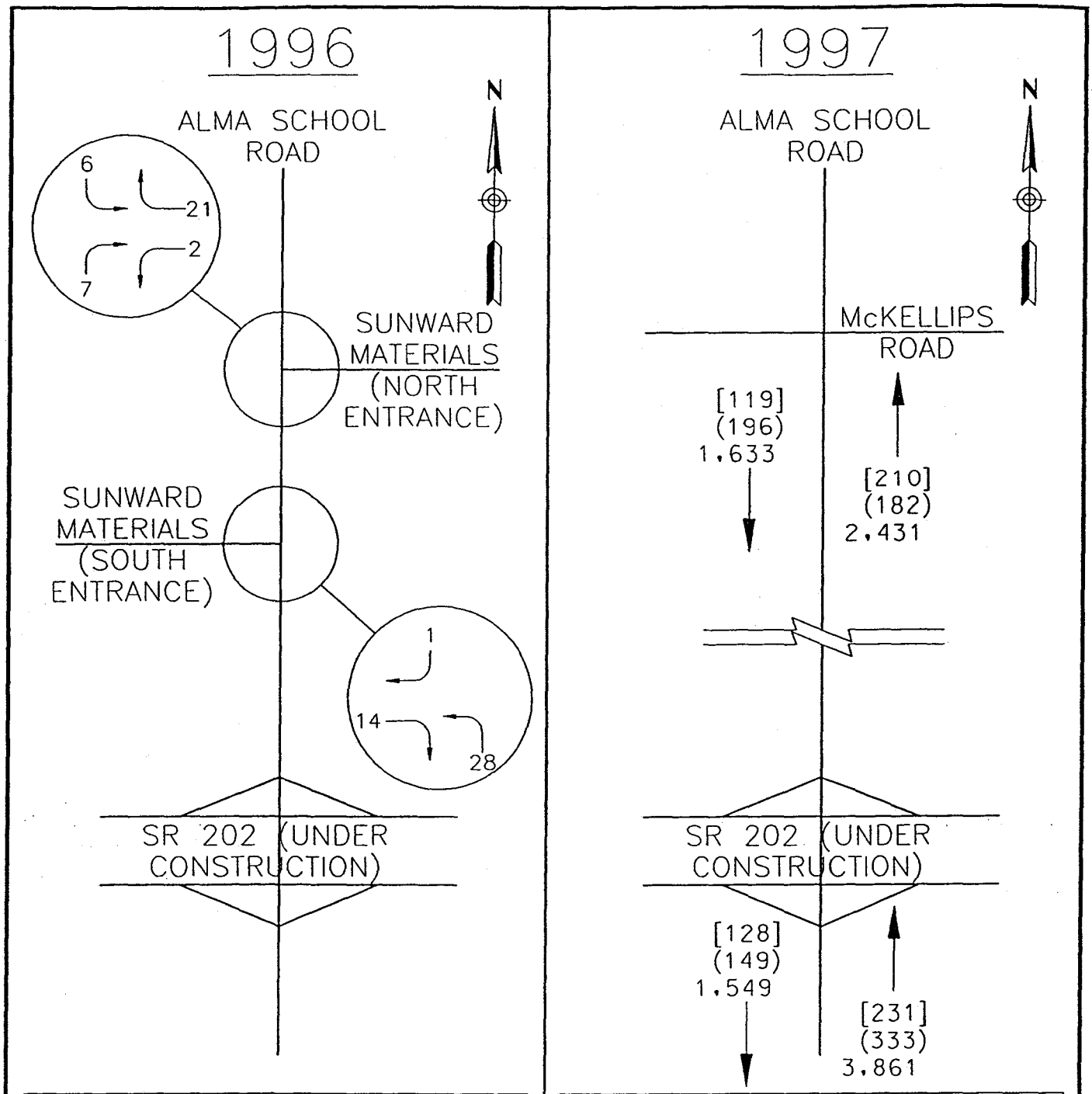
- This study further concludes that a traffic signal is not warranted at the Sunward Materials driveway when the combined peak hour truck volumes counted at the driveways during the study were applied to the traffic signal warrant criteria identified in the Manual on Uniform Traffic Control Devices (MUTCD). Traffic volumes exiting the site are lower than the minimum required volume of 52 vehicles per hour.

- The study then concludes that provisions for implementing a future traffic signal at the Sunward Materials driveway should be incorporated into the widening of Alma School Road to a 6-lane cross section because this widening will need to occur into the median area, thus eliminating the southbound acceleration lane.

The Red Mountain Freeway (SR202L) SR101L - Country Club Drive Final Traffic Analysis Report was prepared for ADOT by Stanley Consultants, Inc. in May, 1996. The purpose of the report was to prepare a traffic capacity and operational analysis for the Red Mountain Freeway (SR202L) mainline segments, ramps, weaving sections and traffic interchanges. The traffic interchange at Alma School Road was evaluated using Year 2020 turning movement volumes provided by MAGTPO. The PASSERIII-90 computer software was utilized for the capacity analyses of the diamond interchange configuration. The results of the analyses for the Alma School Road traffic interchange show that two through lanes are required northbound and three through lanes are required southbound on Alma School Road north of the traffic interchange in order to achieve Level of Service "D" operation in Year 2020.

TRAFFIC VOLUMES

Twenty-four hour volume counts were performed at two locations on Alma School Road by Traffic Research & Analysis, Inc. for Bolduc, Smiley & Associates, Inc. on March 17, 18 and 19, 1997. The twenty-four hour volume for southbound Alma School Road south of McKellips Road was 1,633 vehicles and the twenty-four hour volume for northbound Alma School Road south of McKellips Road was 2,431 vehicles. The AM peak hour volume on Alma School Road at the same location was 119 vehicles per hour southbound and 210 vehicles per hour northbound. The PM peak hour volume on Alma School Road at the same location was 196 vehicles per hour southbound and 182 vehicles per hour northbound. These volumes are shown on Exhibit 3. The Arizona Department of Transportation is currently constructing the Red Mountain Freeway (Loop 202) traffic interchange with Alma School Road and these construction activities are resulting in significantly lower traffic volumes than are typically experienced on this section of Alma School Road.



LEGEND
XX = SUNWARD MATERIALS PEAK HOUR VOLUME

LEGEND
[XXX] = AM PEAK HOUR VOLUME
(XXX) = PM PEAK HOUR VOLUME
XXX = 24-HOUR VOLUME

Bolduc Smiley & Associates, Inc.

ALMA SCHOOL ROAD
SOUTH SALT RIVER BRIDGE
EXISTING VOLUMES

EXHIBIT 3

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Ten-hour turning movement counts were conducted between 6:00 AM and 3:00 PM by Kirkham Michael Consulting Engineers for the two access points at the Sunward Materials facility on March 19, 1996. The peak hour for the two access points occurred between 12:00 and 1:00 PM, with 79 trucks entering and leaving the Sunward Materials site. The peak hour turning movement volumes from the south and north access points for Sunward Materials are shown on Exhibit 3.

Future traffic volume data was obtained by Bolduc, Smiley & Associates, Inc. for many of the major streets in this portion of Maricopa County from MAGTPO for the Traffic Analysis For Red Mountain Freeway (Loop 202) SR 87 To US 60 Environmental Impact Statement completed in January, 1997. The Year 2020 twenty-four hour two-way volume that is forecast for Alma School Road north of the Red Mountain Freeway (Loop 202) was shown to be 26,000 vehicles per day (vpd). The AM peak hour volume projection on Alma School Road is 1,297 vehicles per hour northbound and 1,069 vehicles per hour southbound. The PM peak hour volume projection on Alma School Road north of the Red Mountain Freeway (Loop 202) is 906 vehicles per hour northbound and 1,047 vehicles per hour southbound. Year 2020 traffic volume projections on Alma School Road north of the Red Mountain Freeway (Loop 202) are shown on Exhibit 4.

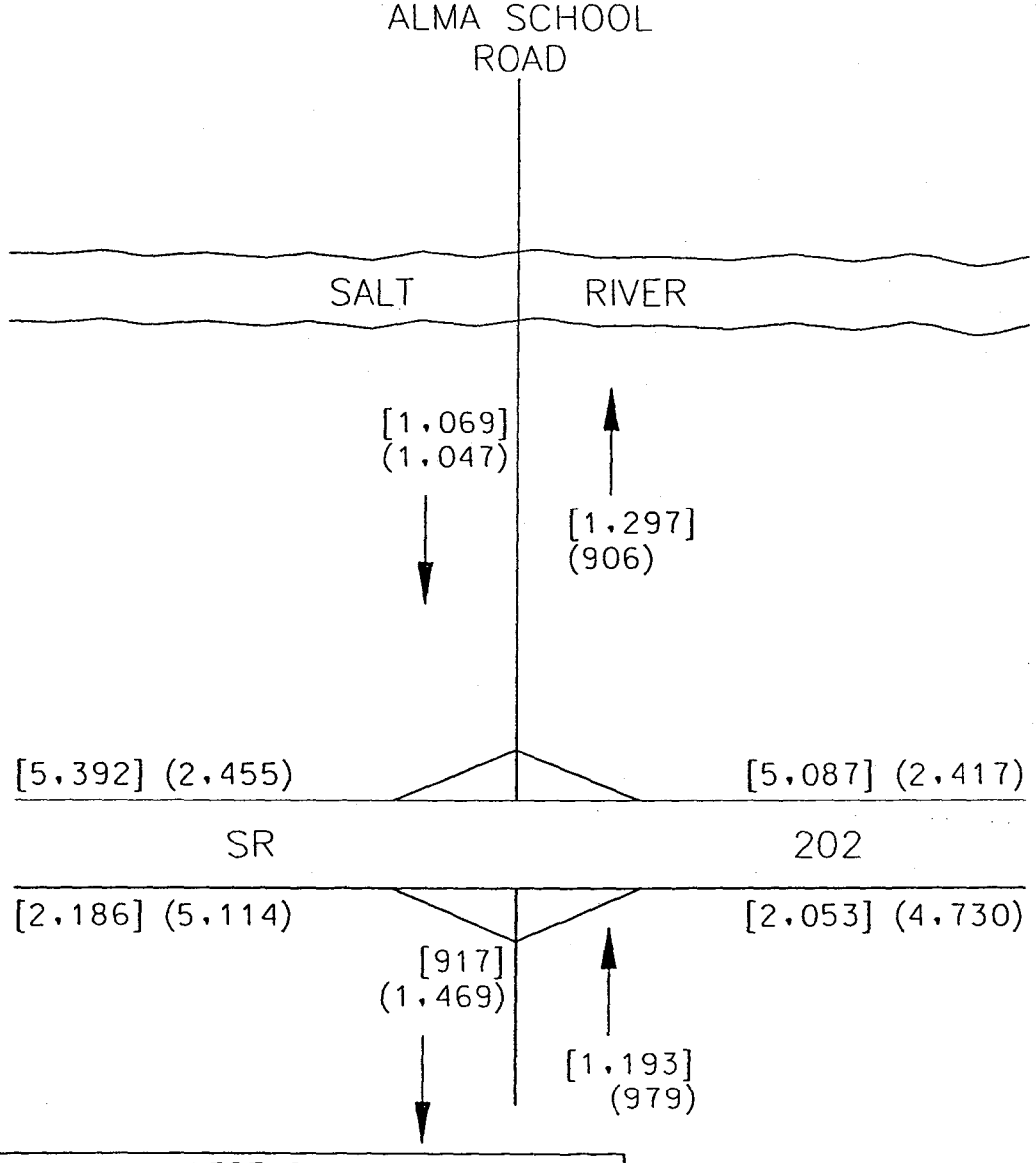
AUXILIARY LANES ON ALMA SCHOOL ROAD

Acceleration Lane Requirements:

The recognized design guide for determining acceleration and deceleration lane requirements is AASHTO's A Policy On Geometric Design Of Highways And Streets (1994). The posted speed limit on this section of Alma School Road is 40 miles per hour (60kmph) and, for purposes of this study, the truck operating speed was assumed to be 34 miles per hour (57kmph). Based on this operating speed, for a 300 lb/hp (180kg/kW) truck (this design vehicle was assumed to be representative of medium-sized tractor-semitrailer combinations commonly in use) accelerating from 0 miles per hour to 34 miles per hour, the minimum northbound acceleration lane length from Figure IX-34 is approximately 1050 feet (320 meters). Trucks exiting the Sunward Materials driveway northbound will be leaving the site from a free-flowing right turn and will not be coming from a stop condition. Therefore, the 1050 foot length acceleration length requirement could be reduced for the northbound acceleration lane.

Alternative 5a shows a northbound acceleration lane and a southbound acceleration lane for trucks exiting the Sunward Materials site. The northbound acceleration lane will terminate prior to crossing the north Salt River Bridge. The taper length for the termination of the acceleration lane can be calculated two different ways. AASHTO quotes the Manual On Uniform Traffic Control Devices (MUTCD) for recommended taper lengths for design speeds of 40 miles per hour or less. Based on the MUTCD method, the minimum recommended taper length on Alma School Road should be 320 feet (98m). The MCDOT Roadway Design Manual recommends a minimum taper length of 480 feet (146m) based on a speed limit of 40 miles per hour.

YEAR 2020



LEGEND
[XXX] =YEAR 2020 AM PEAK HOUR VOLUME
(XXX) =YEAR 2020 PM PEAK HOUR VOLUME

SOURCE: TRAFFIC ANALYSIS FOR RED MOUNTAIN FREEWAY (LOOP 202) SR 87 TO US 60 ENVIRONMENTAL IMPACT STATEMENT (JANUARY, 1997)

Bolduc, Smiley & Associates, Inc.

ALMA SCHOOL ROAD
SOUTH SALT RIVER BRIDGE
YEAR 2020 TRAFFIC VOLUMES
EXHIBIT 4

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Deceleration Lane Requirements:

The AASHTO Green Book states that "the total deceleration lane length required is that which is needed for a safe and comfortable stop from the design speed of the highway." AASHTO also states that "minimum deceleration lengths for auxiliary lanes on grades of 2 percent or less, with an accompanying stop condition, for design speeds of 50, 60 and 80km/h are 70, 100, and 130m, respectively." The posted speed limit is 40 miles per hour (57km/h), and therefore, the minimum recommended deceleration lane length is 80 meters, or approximately 260 feet. This is the deceleration length that will be required in the northbound deceleration lane (located between the Red Mountain Freeway traffic interchange and the entrance to the Sunward Materials facility) and the southbound left turn deceleration lane at the Sunward Materials driveway intersection.

Left Turn Lane Storage Requirements:

The recommended storage length for the southbound deceleration lane is based on truck arrival rates for trucks entering the Sunward Materials site. The peak hour volume for trucks entering the site from the north is 7 trucks, with six trucks entering at the north driveway and one truck entering at the south driveway. Assuming the same split between driveways will continue with the proposed geometrics, one truck will be arriving and making a left turn into the plant approximately every ten minutes. Truck lengths are approximately sixty feet, and assuming two trucks arrive at the same time, a minimum storage length of 150 feet (45m) is recommended on Alma School Road.

INTERSECTION LIGHTING

A literature and agency search for criteria or warrants for intersection lighting revealed very little criteria or information for determining whether lighting is warranted at the Alma School Road intersection with the Sunward Materials driveway. MCDOT does not have any established criteria. The Arizona Department of Transportation does have established guidelines and warrants, but it is tailored to freeway and freeway interchange applications. According to the ADOT Traffic Engineering Policies, Guides And Procedures PGP-10A-1-2 (October, 1985) "...illumination may also be considered under the following conditions:

(7) For any other special conditions that may be confusing if not adequately illuminated."

The Alternative 5a geometrics for the intersection of Alma School Road and the Sunward Materials main driveway is not a standard intersection configuration and will probably be unusual for most drivers. Because the unusual geometrics have the potential to confuse drivers and because intersection lighting will advise drivers that they are approaching an intersection, intersection illumination is recommended at this location. Reflectorized raised pavement markers are recommended where the southbound acceleration lane meets the two southbound through lanes on Alma School Road.

SUMMARY

Bolduc, Smiley & Associates, Inc. has reviewed and evaluated acceleration and deceleration lane requirements and intersection lighting warrants at the Sunward Materials main driveway. The following summarizes the findings:

- A report titled Alma School Road Operational Study was completed by Kirkham Michael Consulting Engineers in July, 1996 for the Maricopa County Department of Transportation. The study identified Alternative 5a, the channelized-tee, as the recommended alternative. Alternative 5a provides two access points to serve the Sunward Materials facility and the proposed geometrics are shown on Exhibit 2.

- Kirkham Michael recommended a northbound acceleration lane on Alma School Road with a length of approximately 535 feet (163m) and a northbound deceleration lane approaching the Sunward Materials driveway of approximately 500 feet (152m). The length of the southbound left turn storage is proposed to be approximately 285 feet (87m) with a 225 feet (66m) reverse curve.

- Kirkham Michael performed capacity analysis which indicated that the intersection of Alma School Road and the Sunward Materials driveway will operate at Level of Service "C" during the peak hour with the single access point geometrics of the original Alternative 5a.

- The Alma School Road Operational Study concludes that a traffic signal is not warranted at the Sunward Materials driveway. Traffic volumes exiting the site are lower than the minimum required hourly volume of 52 vehicles. The study further concludes that provisions for implementing a future traffic signal at the Sunward Materials driveway should be incorporated into any future widening of Alma School Road that will remove or eliminate the southbound acceleration lane in the median.

- The Red Mountain Freeway (SR202L) SR101L - Country Club Drive Final Traffic Analysis was prepared for ADOT by Stanley Consultants, and defined the required laneage at the Alma School Road traffic interchange utilizing Year 2020 traffic volume forecasts. The results of the analyses show that two through lanes are required northbound and three through lanes are required southbound on Alma School Road north of the Red Mountain Freeway traffic interchange to achieve Level of Service "D" operation through the interchange in Year 2020.

- Existing traffic volumes were collected by Bolduc, Smiley & Associates, Inc. on Alma School Road in March, 1997 and ten-hour turning movement counts were collected by Kirkham Michael in March, 1996. These traffic volumes are shown on Exhibit 3.

- Year 2020 traffic volume forecasts were obtained by Bolduc, Smiley & Associates, Inc. from MAGTPO for the Traffic Analysis For Red Mountain Freeway (Loop 202) SR 87 To US 60 - Environmental Impact Statement. The Year 2020 traffic volume projections on Alma School Road north of the Red Mountain Freeway (Loop 202) are shown on Exhibit 4.

- The recognized guide for determining acceleration and deceleration lane requirements was determined to be AASHTO's A Policy On Geometric Design Of Highways And Streets (1994). Figure IX-34, Acceleration Curves, shows that the minimum acceleration lane length for a northbound truck exiting the Sunward Materials facility is approximately 1050 feet, or 320 meters. Trucks exiting the Sunward Materials driveway northbound will be leaving the site from a free-flowing right turn and will not be starting its acceleration from a stop condition. Using the length of acceleration lane shown in Alternative 5a, a fully loaded, accelerating truck leaving the Sunward Materials site and going north on Alma School Road will be able to obtain a speed of approximately 27 mph when it reaches the end of the acceleration lane and begins to merge with northbound traffic.

- The recommended taper length of the transition from the acceleration lane should be a minimum of 320 feet (98m) and a desirable length of 480 feet (146m) depending upon which method of calculation is used. The first method is from the Manual On Uniform Traffic Control Devices and the other method of calculation is based on the MCDOT Roadway Design Manual. The transition distance shown in Alternative 5a exceeds the desirable value.

- AASHTO states that "minimum deceleration lengths for auxiliary lanes on grades of 2 percent or less, with an accompanying stop condition, for design speeds of 50, 60 and 80km/h are 70, 100, and 130m, respectively." The posted speed limit on Alma School Road is 40 miles per hour (57km/h), and therefore, the minimum recommended deceleration lane length is 80 meters, or approximately 260 feet. The proposed geometrics provides a deceleration length in excess of this minimum value.

- The minimum recommended storage length for the southbound left turns on Alma School Road is 150 feet (45m). The geometrics provided in Alternative 5a provides left turn storage in excess of this value.

- Because of the large volume of truck traffic, extensive channelization and unusual geometrics proposed on Alma School Road at the Sunward Materials driveway, intersection illumination is recommended at this location. Reflectorized raised pavement markers are recommended where the southbound acceleration lane meets the two southbound through lanes on Alma School Road.

BRIDGE SELECTION REPORT

FOR WIDENING

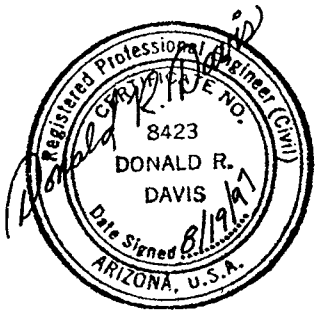
ALMA SCHOOL ROAD SOUTH BRIDGE

AT SALT RIVER

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

WORK ORDER NO. 68931

CONTRACT NO. CY 1997-09



August 1997

Hoffman-Miller/DeLeuw Cather
3875 N. 44th Street * Suite 250 * Phoenix, Arizona 85018

TABLE OF CONTENTS

I. GENERAL

Purpose

The purpose of this report is to discuss the structural options for widening the existing Alma School Road South Bridge over the Salt River and make a recommendation for the structural type, location and details most appropriate for this project. The approved results of this report will be used to develop the final bridge widening design and construction plans.

Background

Alma School Road from McLellan Road to McKellips Road is an existing urban principal arterial road which crosses the Salt River in two locations. The north crossing is a precast, prestressed concrete box beam bridge over the main river channel whereas the south crossing is a similar structure over a smaller secondary channel. The south channel also serves as a haul road from sand and gravel pits located on the west side of Alma School Road to Sunward Materials plant operations located on the east side of Alma School Road with primary access currently located between the two bridges. The existing roadway and bridges have a clear roadway width of 20.7m (68′) from McLellan to just north of the north bridge and are striped for 2 traffic lanes in each direction separated by a continuous left turn lane.

Extension of the Red Mountain (Loop 202) Freeway from Price Road to McKellips Road is currently under construction. As part of the freeway project, a full diamond interchange is being constructed at Alma School Road between McLellan Road and the Salt River. Alma School Road will be improved through the interchange limits as part of the freeway project.

Plans for the Red Mountain interchange indicate that as part of the freeway project, Alma School Road will be improved by ADOT from a point just north of the McLellan Road intersection to a point immediately south of the south bridged crossing of the Salt River secondary channel. The roadway traffic section through the interchange area will include 3 southbound through lanes with 1 southbound left turn lane to accommodate eastbound freeway access and 2 northbound through lanes with 2 north bound left turn lanes to accommodate westbound freeway access. Once through the interchange, ADOT plans to taper the traffic lanes to match the existing 5 traffic lane section approximately 183m (600′) north of the freeway westbound on and off ramps which is within 15.2m (50′) of the south abutment of the south bridge.

To help eliminate a possible bottleneck situation and increase the level of service on Alma School Road during peak hour traffic, Maricopa County Department of Transportation (MCDOT) intends to improve the portion of Alma School Road, including widening the south bridge over the Salt River, from the northern ADOT right-of-way limits for the Red Mountain Freeway interchange to the southern limits of the existing north bridge over the Salt River. All of the proposed project limits fall within MCDOT or SRPMIC rights-of-way.

A Candidate Assessment Report (CAR) C96-0044-09 for this project was prepared for MCDOT by Inca Engineers, Inc., dated December 15, 1995. The results of the preliminary studies and the CAR indicate that improvement of the roadway section north of the interchange to a point just south of the north bridge structure should be reasonable from a cost standpoint and will help minimize the adverse effects of the potential traffic problem in this area. Widening the existing roadway section between the interchange and the south end of the north bridge structure would require widening the south bridge structure approximately 6 meters plus additional width to accommodate current County standard sidewalk sections.

There are several constraints and major issues of concern associated with this proposed project including, but not limited to, the close proximity of the freeway interchange with the south bridge, alignment of the roadway and subsequent ultimate traffic lanes through the bridge corridor, roadway and bridge drainage, site drainage, access to local properties (especially Sunward Materials plant site), river hydraulics and scour potential, bridge superstructure and substructure widening concepts and methods, overhead high voltage power lines, right-of-way considerations, construction traffic movement and control, and constructibility including possible staging.

All design procedures will be in accordance with MCDOT Roadway Design Manual and MCDOT Traffic Engineering Manuals and Procedures. Standard project specifications and details will be in accordance with the Maricopa Association of Governments (MAG) Standard Plans and Specifications, 1996 Metric Edition. All bridge design will be in accordance with AASHTO Standard Specifications for Road and Bridge Construction, 1996, Sixteenth Edition. All bridge plans will be developed and prepared in the SI (metric system) of units. All bridge special provisions to the project standard specifications will be prepared in the SI (metric system) of units.

Existing Bridge Description

The existing bridge is a 7-span right angled structure approximately 124.8m (409.5′) long. The structure was designed for AASHTO HS-20-44 loading and in accordance with AASHTO Standard Specifications for Highway Bridges, 1977 edition including 1978 Interim Specifications and revisions through 1980.

The superstructure in each span is comprised of 21 - 1219mm (4′) wide precast, prestressed concrete box beams with asphalt concrete overlay for a wearing surface. The beams were designed as simple spans for all loads. The overall out-to-out deck width is 25.6m (84′) with 20.7m (68′) clear roadway between concrete traffic barriers. There is a 1168mm (3′-10″) wide pedestrian walkway with a concrete parapet and chain link fence on the west side and a 2083mm (6′-10″) pedestrian walkway/bicycle path with a concrete parapet and chain link fence on the east side.

To minimize differential vertical deflection between adjacent concrete beams, grout keys were provided on both sides of all interior girders and on the interior sides of the two exterior beams. In addition, to help minimize differential deflections and provide for lateral continuity, 1¼" diameter tensioning rods were placed transversely through the box beams and secured with a steel plate and nut assembly at the outside face of each exterior beam.

The substructure consists of 2 abutments and 6 piers. The abutments are high wall type with skewed wingwalls on each side. Both abutments are protected by a rip rap covered sloped bank. Both abutments and wingwalls are supported on steel H-pile foundations. The piers are 4 column bents supported on steel H-pile foundations.

Widened Bridge Criteria

The new widened bridge cross section will be designed to accommodate seven traffic lanes (three northbound lanes, three southbound lanes and one median lane) with sidewalk sections on each side of the bridge separated from the traffic lanes by concrete traffic barriers. The new widened roadway section will accommodate the standard Maricopa County roadway width of 28.6m (94′) minimum between barriers.

II. MAJOR BRIDGE WIDENING ISSUES

The following major issues effecting selection of the appropriate bridge widening location, methods and details have been identified:

- Geometric Interface with Approach Roadway Alignment

The existing roadway alignment from McClellan to McKellips is composed of several horizontal curves and tangents. ADOT's Red Mountain Interchange plans revised the existing centerline alignment and designed their north connection to the existing County roadway section utilizing a 64km/h (40mph) design speed with no superelevation. This configuration assumed the County roadway and bridge project would widen on each side of Alma School Road.

Preliminary investigations indicated that some major benefits might be realized by widening the bridge to one side only. A roadway alignment study was then prepared to determine the feasibility of this approach. It was determined that widening only to the east side of the bridge could effectively accommodate the new traffic lane requirements with minor adjustments. See the Alignment Analysis Technical Memorandum prepared for this project for more details.

- Bridge Deck Drainage

The existing bridge deck drainage system consists of scupper blockouts through the concrete traffic barriers and prefabricated drain tubes through the pedestrian fencing curbs at approximately 32ft centers. The drains were designed to disperse accumulated rainfall on the deck surface directly into the riverbed below. In accordance with NPDES requirements of the Federal Clean Water Act, this is no longer an acceptable method for dispensing with bridge deck rainfall accumulations.

Preliminary results of the Drainage Report being prepared for this project indicate that design rainfall accumulations can be carried in the gutter lanes and drained longitudinally off the bridge into the new roadway storm drain system in compliance with current County roadway drainage design standards, therefore, there will be no deck drains required in the widened portion of the bridge. See the Drainage Report Technical Memorandum prepared for this project for more drainage details.

- Utilities

There are currently no known utilities carried in the existing bridge. There is an existing 12Kv powerline located east of the bridge and a 69Kv powerline to the west. A minimum of 2-69Kv powerline towers may be impacted by the new construction depending on whether or not the bridge is widened to the west.

At this time it is anticipated that several utility conduits will need to be accommodated on the new widened portion of the bridge. Conduit for cable television as well as future street light and possible signalization at the Sunward Materials main access have been identified. Conduit will be provided in the new traffic barrier, pedestrian curb or through the new precast girders as appropriate.

- Hydraulic and Scour Analysis

In 1993 a river grade control structure was designed and constructed across the Salt River immediately downstream from both bridge structures in an attempt to control stream bed degradation and head cutting which was negatively impacting the existing bridge substructures. The grade control structures were designed by MCDOT as part of the FEMA program.

A preliminary scour analysis prepared by Dibble & Associates for this project indicates that while the degradation and head cutting problems may have been solved, there still remains potential local scour problems that could possibly adversely affect the existing bridge foundations. The design of any additional scour protection that may be required, if any, for the existing bridge substructure is beyond the scope of this project. See the Drainage Report Technical Memorandum prepared for this project for further hydraulic detail.

The new widened bridge foundation final designs for the pier and abutment extensions will consider the calculated local scour depth, as reflected in the approved Project Drainage Report, in the selection of the appropriate foundation type and size.

- Substructure Design and Connections

In order to maintain structural consistency and aesthetic compatibility, the substructure configuration of reinforced concrete column bents with reinforced concrete cap beams at the piers and high wall abutments will be maintained throughout the widened section of the structure.

Foundations for the existing pier and abutment substructures as well as the abutment wingwalls consist of reinforced concrete footings supported by driven steel H-piles. Driving steel piles in the Salt River for the existing bridge and grade control structure proved somewhat difficult at this location, therefore, it is anticipated the new bridge widening will be supported on drilled, cast-in-place concrete shafts designed for full support beneath the river scour depth. This method has proven to be more cost effective on similar structures in the recent past.

The existing abutment wingwalls and footings are separated from the existing abutment walls and footings by an expansion type joint. Both the walls and footings are joined with shear dowels in expansion sleeves cast in the wing sections. The existing wingwalls and wingwall footings will be removed with the existing steel H-piles cut off at a sufficient depth to avoid conflict with the widened sections. The new abutment wall and footing extensions and new wingwalls will be designed similar to the existing sections, however, the new extensions will be supported on foundation types recommended in the approved Geotechnical Report. Drilled cast-in-place concrete shaft type foundations are anticipated.

The existing concrete pier caps are flush with the outside edge of the deck and cantilevered 1600mm (5′-3″) from the center of the exterior pier columns. The new pier extensions will be self supporting and will only be tied to the existing piers through nominal drilled and grouted dowel bars in the ends of the cap beams in an effort to minimize potential lateral separation.

- Superstructure Design and Connections

The existing superstructure consists of seven spans of side-by-side 762mm (30″) deep precast prestressed concrete box beams connected laterally by 31.8mm (1¼″) diameter tensioning rods. Differential vertical movement between the beams is controlled by grouted shear keys running longitudinally along the top of all interior beams. The deck is covered with an asphalt concrete wearing surface.

The existing beams were designed as simple span units for all loads including HS20-44 live load in accordance with AASHTO Standard Specifications for Highway Bridges, 1977 edition, revised through 1980.

There are three different bearing conditions associated with the existing structure. Pier 4 has a sliding or expansion bearing to the south with a fixed bearing condition to the north. All other piers have fixed bearing conditions. The beams simply rest on elastomeric bearing pads at each abutment. The fixed bearing assemblies at the piers consist of vertical dowels extending from the pier caps into vertical pockets blocked out in the ends of the beams. In addition, horizontal hairpin bars cast in the beams, extend into the pockets and around the vertical dowels. These pockets are grouted solid. The expansion bearings at pier 4 consist of Flourogold slide bearing assemblies and vertical notched steel bar shear connectors.

Based on the As-Built drawings for the existing structure, the bearing assemblies at all piers make it extremely difficult to remove any of the existing beams. In addition, to remove an existing beam would require release and at least partial removal of the lateral tensioning rods. Since Alma School Road is to remain open to traffic during construction, removal of the lateral rods could loosen the grout in the longitudinal shear keys making it difficult to re-tension. Due to these and other considerations, it is recommended that the existing beams remain intact.

The new beams will require development of special bearing and shear details. This will be accomplished during final design. The new bearing and shear details will be compatible with the design intent of the existing structure.

To provide lateral continuity and minimize differential vertical deflection, several methods were investigated. Removal of the existing asphalt concrete wearing surface and replacement with reinforced concrete topping extending over the new beams was considered, however, the necessary construction techniques and excessive cost made this option unacceptable. Extending the existing lateral tie rods through the new beams requires difficult coupling procedures and could create problems if traffic remains on structure during construction as previously discussed. Steel angles cast in the top edges of the new beams with field welded tie plates was considered and appears to be the most cost effective and constructible option considered. A special tie plate detail will be developed to laterally connect the new beams to the existing beams. See proposed details on Drawing 2 of 2 in Appendix B of this report.

- Remove and Replace Barriers and Fence Curbs

Obtaining the desired roadway width will require removal and relocation of the existing concrete traffic barriers and fence curbs. Since removal of the beams with these elements attached is impractical, it will be necessary to carefully remove these elements without damaging their respective beams. Sawcutting may be required.

- Constructibility

Since the dry river bed beneath the bridge is used as a haul road from Sunward Material's mining operation to the west of the bridge to their plant operations located east of the bridge, special consideration will be given to erection methods and timing. Coordination of the beam erection schedule with Sunward's plant operations will be required.

Traffic will be maintained on Alma School Road during the bridge widening operations. Construction sequencing and beam erection schedules will be developed to minimize disruption of traffic and at the same time optimize the construction methods.

Construction of the pier and abutment foundations will be complicated by the existence of the concrete and rock mattress grade control structure. Drilling through this structure will be difficult and expensive. Clearance of the drill rig boom with the high tension powerlines will require de-energizing the lines during drilling operations. This may limit the drilling operation to low energy usage times of the year.

- Right-of-Way and Easements

Additional rights-of-way and/or easements for the bridge widening are not anticipated at this time.

- Construction Costs

Comparative construction costs for the bridge widening alternatives will be evaluated and considered in the selection of the preferred alternative. A comparative cost analysis of the major common items for both alternates has been prepared and included in Section IV of this report.

III. BRIDGE WIDENING ALTERNATES

ALTERNATE 1 - WIDEN EXISTING BRIDGE on BOTH SIDES:

The Candidate Assessment Report prepared for this project suggests widening the existing bridge on each side to provide for the City of Mesa standard roadway width of 26.8m (88′) and MCDOT standard pedestrian walkways as the preferred alternative alignment. Subsequent discussions with key MCDOT staff indicate a County standard 28.6m (94′) roadway section with pedestrian walkways on each side would be preferred. This alternative reflects the latter concept.

- Geometric Interface

Widening the existing bridge on each side will accommodate the proposed approach roadway geometrics and permit widening both sidewalk sections to current MCDOT standards.

Maintaining the existing roadway centerline and providing a 432mm (1′-5″) wide traffic barrier, a 1830mm (6′) sidewalk section and a 305mm (12″) wide fence curb section on each side of the bridge will require adding 3 - 1219mm (4′) wide beam lines to the east and 4 - 1219mm (4′) wide beam lines to the west for a total of 49 new beams.

- Deck Drainage Considerations

Existing tubular steel deck drains will need to be removed from each side of the bridge. According to the drainage report for this project, the deck drainage can be accomplished by the longitudinal vertical curve in the deck which will allow water to travel in the curb lane and enter the roadway drainage system at each end of the bridge.

- Utilities Considerations

Conduit can be provided for any new utilities through the barriers, curbs or new deck units as required. Expansion sleeves will be required at all joints. Major utility conflicts with the existing high tension powerline located on the west side of Alma School Road will result if the bridge is widened to the west. A minimum of 2 poles will be affected.

- Hydraulics and Scour Considerations

Preliminary scour analysis, indicates local scour will be produced at each of the upstream pier columns. Local scour will be minimized at the downstream columns due to protection from the grade control structure. New pier foundations will be designed for stability beneath the anticipated scour depth. See the Drainage Report for this project.

- Substructure Considerations

Extending the piers on each side will require a minimum of 2 columns on each side for stability. This will result in the addition of 24 new columns and pier foundations. It is anticipated the pier foundations will be drilled shaft types as an extension of the columns. This will require penetrating the existing grade control structure with a minimum of 12 shafts. As discussed previously, this is a difficult operation and will cost an estimated 2 times the cost per foot of drilling the shafts on the east side of the existing bridge.

It is anticipated that extending the abutments on all 4 corners will require approximately 4 drilled shafts per abutment extension and an additional 4 per wingwall for a total of 32 drilled shafts. As discussed for the piers, the new west side abutment and wingwall foundations will be extremely difficult to construct due to interference with the existing grade control structure and the overhead high tension powerlines.

- Superstructure Considerations

Connections for securing the new widened beams to the existing beams will be accomplished with steel angles and weld plates. Since this alternate requires widening on each side, angles will need to be secured to the external side of each existing exterior unit, 14 beams total, by drilling and installing inserts at appropriate spacing.

- Remove and Replace Barriers and Fence Curbs

Widening for this alternative will require removal and replacement of the existing concrete barriers, curbs and fencing on each side of the bridge. This will allow for installation of County standard sidewalk sections on each side. The current sidewalk section on the west side is substandard at only 1,168mm wide.

- Constructibility Considerations

Widening on both sides will require considerable moving of major construction equipment such as beam erection cranes and foundation drilling rigs from one side to the other. This will negatively impact haul road traffic due to extending the overall construction schedule. Alma School Road traffic will also be negatively impacted by construction time increases and the need to switch traffic from one side of the bridge to the other depending on construction sequence.

- Right-of-Way Considerations

No additional right-of-way will be required for widening the existing structure on both sides.

ALTERNATE 2 - WIDEN EXISTING BRIDGE on EAST SIDE ONLY:

In the early stages of reviewing existing data, it became apparent that significant cost savings could probably by achieved by widening the existing bridge to one side only. This alternate was then investigated to determine if all final design criteria could be met utilizing this approach.

- Geometric Interface

The preliminary alignment study prepared for this project confirms that with minor modifications to the roadway striping alignment across the new bridge, widening to the east side only will accommodate the proposed approach roadway geometrics. This option, however, does not allow for modification of the existing substandard west side sidewalk area.

To accommodate the new 28.6m (94′) roadway section, 7 - 1219mm (4′) wide beam lines for a total of 49 new beams will need to be added.

- Deck Drainage Considerations

Existing tubular steel deck drains will need to be removed only from the east side of the bridge. The existing west side drains can be plugged to be in compliance with the federal Clean Water Act NPDES requirements. According to the drainage report for this project, the deck drainage can be accomplished by the longitudinal vertical curve in the deck which will allow water to travel in the curb lane and enter the roadway drainage system at each end of the bridge.

- Utility Considerations

Conduit can be provided for any new utilities through the barriers, curbs or new deck units as required. Expansion sleeves will be required at all joints. Major utility conflicts with the existing high tension powerline located on the west side of Alma School Road will be avoided in this option. This will result in considerable savings. See Section IV of this report.

- Hydraulics and Scour Considerations

Preliminary scour analysis, indicates local scour will be produced at each of the upstream pier columns, therefore, the new pier foundations will be designed for stability beneath the anticipated scour depth. See the Drainage Report for this project.

- Substructure Considerations

Extending the piers to the east side only will require a minimum of 2 columns per pier for stability. Geotechnical and scour considerations may require a third column at each new pier extension. This will result in the addition of 12 to 18 new columns and pier foundations. It is anticipated the pier foundations will be drilled shaft types as an extension of the columns. Widening only to the east will eliminate conflicts with the existing grade control structure. This will greatly reduce the foundation costs for this project.

It is anticipated that extending the abutments to the east will require approximately 4 drilled shafts per abutment extension and an additional 4 per wingwall for a total of 16 new drilled shafts. Widening only to the east will require the removal and replacement of only 2 wingwalls. Again, no interference with the existing grade control structure will be a major cost benefit.

- Superstructure Considerations

Connections for securing the new widened beams to the existing beams will be accomplished with steel angles and weld plates. Since this alternative requires widening on only one side, angles will need to be secured to the external side of each existing exterior unit, 7 beams total, by drilling and installing inserts at appropriate spacing.

- Remove and Replace Barriers and Fence Curbs

Since the west side of the existing structure will remain unchanged, it will only be necessary to remove and replace the east side existing concrete traffic barrier and fence curb section.

The current substandard sidewalk section on the west side will remain. The impact of this situation is diminished when considering the existing bridge immediately to the north of this bridge has the same substandard section and is not scheduled for improvement in the foreseeable future.

- Constructibility Considerations

From a constructibility standpoint, widening to one side only will quite beneficial. It will require only one mobilization and move-in of major construction equipment such as beam erection cranes and foundation drilling rig. Current Alma School Road traffic patterns can be maintained throughout most of the bridge construction operation. The existing east side traffic barrier can remain in place until the new widened section is constructed and ready for paving. Milling the existing A.C. deck surface and replacing with new A.C. or Rubberized Asphalt wearing surface will require special traffic control measures. Reduction in overall construction time will also benefit the Sunward Material's haul road traffic.

- Right-of-Way Considerations

No additional right-of-way will be required for widening the existing structure all to the east.

IV. COST COMPARISONS

The following section presents a relative cost comparison of major bridge construction items for Alternate 1 - Widen Existing Bridge on Both Sides and Alternate 2 - Widen Existing Bridge on East Side Only. This comparison is not a complete estimate of bridge construction costs for each alternate and only represents comparable costs for selected major items in an effort to distinguish differential costs in support of the recommended alternate. See Appendix "A" for cost analysis comparisons of each alternate.

Cost Comparison Summary:

Alternate 1

Drilled Shaft Foundations		
Piers (24)	$199,680	
Abutments & Wings (32)	$199,680	
Piers		
Columns (24)	$ 25,920	
Abutments		
4 Wingwalls	$ 34,320	
Remove & Replace Barriers, Curbs & Fences		
Traffic Barriers	$ 36,250	
Concrete Curbs and Fences	$ 20,000	
Powerline Relocations	$150,000	
TOTAL ALTERNATE 1 SELECTED COSTS		$665,850

Alternate 2

Drilled Shaft Foundations		
Piers (18 conservative)	$115,200	
Abutments & Wings (16)	$ 76,800	
Piers		
Columns (18)	$ 19,440	
Abutments		
2 Wingwalls	$ 17,160	
Remove & Replace Barriers, Curbs & Fences		
Traffic Barriers	$ 18,125	
Concrete Curbs and Fences	$ 10,000	
TOTAL ALTERNATE 2 SELECTED COSTS		$256,725

APPROXIMATE COST DIFFERENTIAL $409,125

V. SUMMARY

In order to obtain acceptable aesthetic appearance and structural compatibility, it is recommended the existing south bridge over the Salt River be widened in kind, i.e., precast, prestressed concrete box beam superstructure with concrete column and cap beam type piers, high wall concrete abutments and skewed concrete wingwalls.

Two alternative widening options were considered. Alternate 1 would widen the existing bridge appropriately on each side. This alternative would accommodate the full 28.6m (94') roadway width and MCDOT standard sidewalks on each side, however, major conflicts with foundation construction, powerline relocations, construction scheduling and construction traffic maintenance exist. This alternate is also the most expensive to construct.

Alternate 2 would widen the existing bridge all to the east or upstream side. This option also accommodates approach roadway requirements, however, the west side sidewalk section would remain substandard and will continue to match the corresponding sidewalk section on the existing bridge immediately to the north of this project. Substructure construction time and costs would be reduced due to fewer pier and abutment foundation shafts, fewer pier columns, removal and replacement of only 2 wingwalls and the reduction in move-in and mobilization time for foundation drilling. Superstructure construction time and costs would be reduced due to minimum beam erection time for one side erection, removal and replacement of only one set of traffic barrier and fence curb, and the installation of only one set of connection assemblies from existing to new beams. Construction traffic disruption would be minimized.

As noted in previous sections of this report, the ultimate traffic operation and roadway configuration will not be compromised by widening the bridge all to the east side. In addition, the hydraulic report for this project indicates that if the bridge were widened all to the east side, sufficient bridge opening will still be available to adequately handle the design flow.

Based on the previous discussions of each alternative and the significant cost differential between the two, it is recommended that Alternate 2 - Widen Bridge on East Side Only be the preferred alternate and that the final design reflect this option.

APPENDIX "A"

RELATIVE COST COMPARISONS

ALTERNATE 1 - WIDEN BOTH SIDES

1. Drilled Shaft Foundations

Abutments (32 total shafts required)

East Side:	16 shafts	x	12 m/shaft	x	$400 /m	=	$76,800
West Side:	16 shafts	x	12 m/shaft	x	$640 /m	=	$122,880

Piers (24 total shafts required)

East Side:	12 shafts	x	16 m/shaft	x	$400 /m	=	$76,800
West Side:	12 shafts	x	16 m/shaft	x	$640 /m	=	$122,880

SUBTOTAL DRILLED SHAFT FOUNDATIONS = $399,360

2. Columns (24 required) - Includes Concrete & Reinforcing Steel

Piers:	3 cu m/col	x	24 cols.	x	$360 /cu m	=	$25,920

SUBTOTAL COLUMNS = $25,920

3. Wingwalls (4 required) - Includes Concrete & Reinforcing Steel

East Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160
West Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160

SUBTOTAL WINGWALLS = $34,320

4. Remove and Replace Barriers and Curbs (2 each required)

Barrier:	2 barriers	x	125 m/barrier	x	$145 /m	=	$36,250
Curb:	2 curbs	x	125 m/curb	x	$80 /m	=	$20,000

SUBTOTAL BARRIERS AND CURBS = $56,250

5. Remove and Replace Powerline Towers (2 minimum required)

Towers:	2 towers	x	$75,000 ea.	=	$150,000

SUBTOTAL POWERLINE TOWERS = $150,000

TOTAL COMPARATIVE COSTS - ALTERNATE 1 $665,850

RELATIVE COST COMPARISONS

ALTERNATE 2 - WIDEN EAST SIDE ONLY

1. Drilled Shaft Foundations

Abutments (16 total shafts required)

East Side:	16 shafts	x	12 m/shaft	x	$400 /m	=	$76,800
West Side:	0 shafts	x	12 m/shaft	x	$640 /m	=	$0

Piers (18 total shafts required)

East Side:	18 shafts	x	16 m/shaft	x	$400 /m	=	$115,200
West Side:	0 shafts	x	16 m/shaft	x	$640 /m	=	$0

SUBTOTAL DRILLED SHAFT FOUNDATIONS = $192,000

2. Columns (18 required) - Includes Concrete & Reinforcing Steel

Piers:	3 cu m/col	x	18 cols.	x	$360 /cu m	= $19,440

SUBTOTAL COLUMNS = $19,440

3. Wingwalls (2 required) - Includes Concrete & Reinforcing Steel

East Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160
West Side:	0 wings	x	22 cu m/wing	x	$390 /cu m	=	$0

SUBTOTAL WINGWALLS = $17,160

4. Remove and Replace Barriers and Curbs (1 each required)

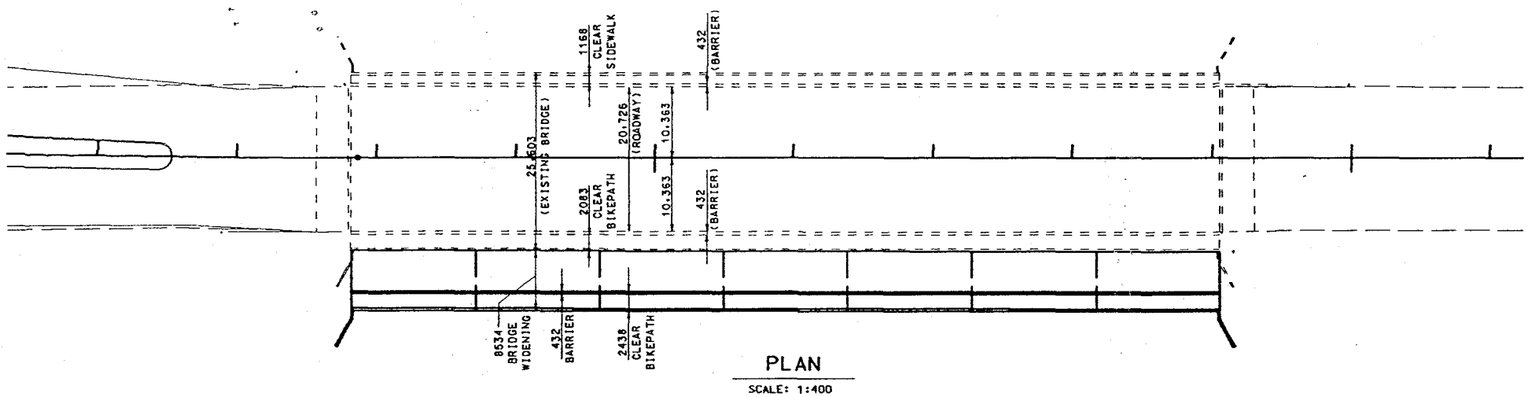
Barrier:	1 barriers	x	125 m/barrier	x	$145 /m	=	$18,125
Curb:	1 curbs	x	125 m/curb	x	$80 /m	=	$10,000

SUBTOTAL BARRIERS AND CURBS = $28,125

TOTAL COMPARATIVE COSTS - ALTERNATE 2 $256,725

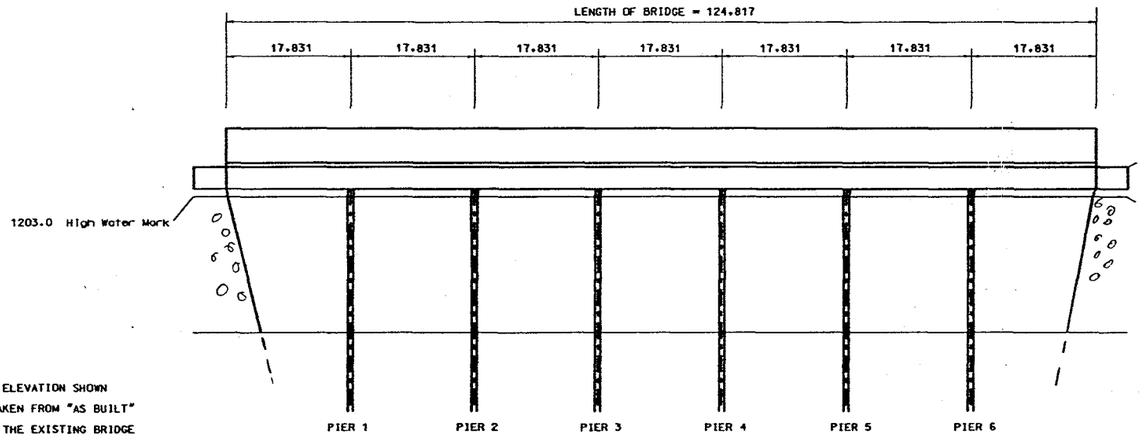
APPENDIX "B"

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931			



PLAN

SCALE: 1:400



ELEVATION

SCALE: HOR. 1:400
VERT. 1:100

NOTE A:
HIGH WATER ELEVATION SHOWN HAS BEEN TAKEN FROM "AS BUILT" PLANS FROM THE EXISTING BRIDGE DATED 11-10-80.

NOTE B:
ELEVATIONS SHOWN ARE MEASURED THE TOP OF ROADWAY (TOP OF WEARING SURFACE) AT THE ℄ OF THE EXISTING ROADWAY. (TYP.)

GENERAL NOTES:

CONSTRUCTION:
Maricopa Association of Governments Uniform Standard Specification for Public Works Construction, 1996 Edition including all supplements and amendments by MCDOT and the Project Special Provisions

DESIGN:
AASHTO Standard Specifications for Highway Bridges, 1996 Edition, revised to date, metric units.

LOADING CLASS: AASHTO MS18-44

STRESSES:

CONCRETE:

Abutments	f'c = 30 MPa - Class AA
Piers	f'c = 30 MPA - Class AA
Box Beams	f'c = 35 MPa - Class Special
Barrier, Curb & Approach Slabs	f'c = 20 MPa - Class B

REINFORCING STEEL: ASTM A615M
Grade 400 f's = 165 MPa

PRESTRESSING STEEL:
12.70 mm dia. 7-wire low-relaxation strand f's = 1860 MPA
Prestressing Steel shall conform to ASTM A416.

STRUCTURAL STEEL: ASTM A709 Grade 36

All placement dimensions for reinforcing steel shall be to the center of the bar unless otherwise noted.

All bend dimensions for reinforcing steel shall be measured out to cut unless otherwise noted.

All reinforcing steel shall have a minimum 50 mm clear cover unless otherwise noted.

All welding shall conform to the requirements of the American Welding Society Structural Welding Code D1.1-92, revised to date.

Dimensions shall not be scaled for drawings.

All dimensions are in millimeters (mm) and all elevations are in meters (m) unless otherwise noted.

For additional information relating to the existing bridge not shown, see the "As Built" plans dated 11-10-80.

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE
AT THE SALT RIVER
PROJECT NO. 68931

	BY	DATE
DESIGNED		
DRAWN		
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

GENERAL PLAN

SHEET __OF_

TRACS NO.

mb.dgn 12/02/94
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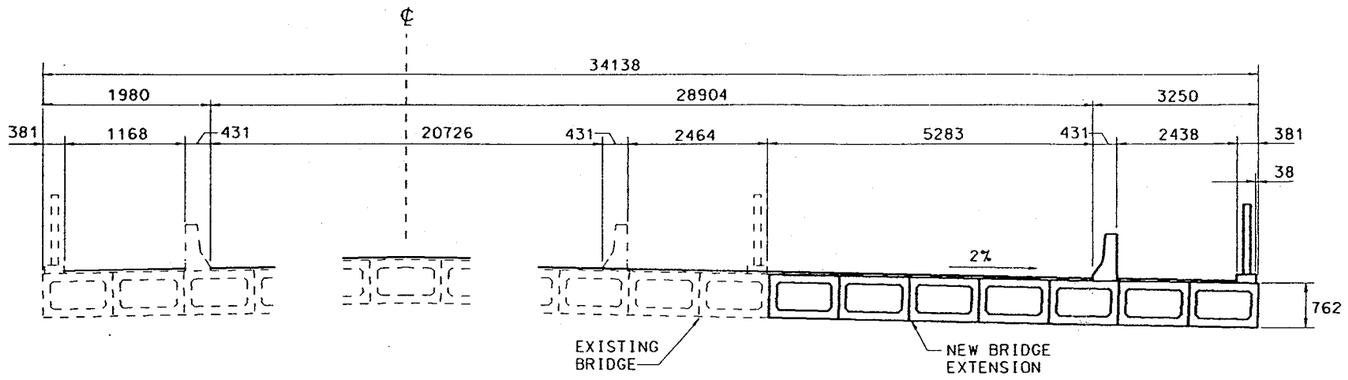
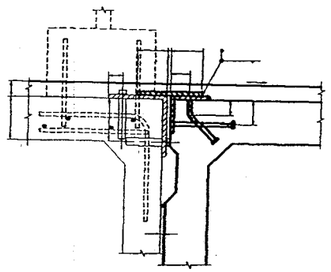
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931			



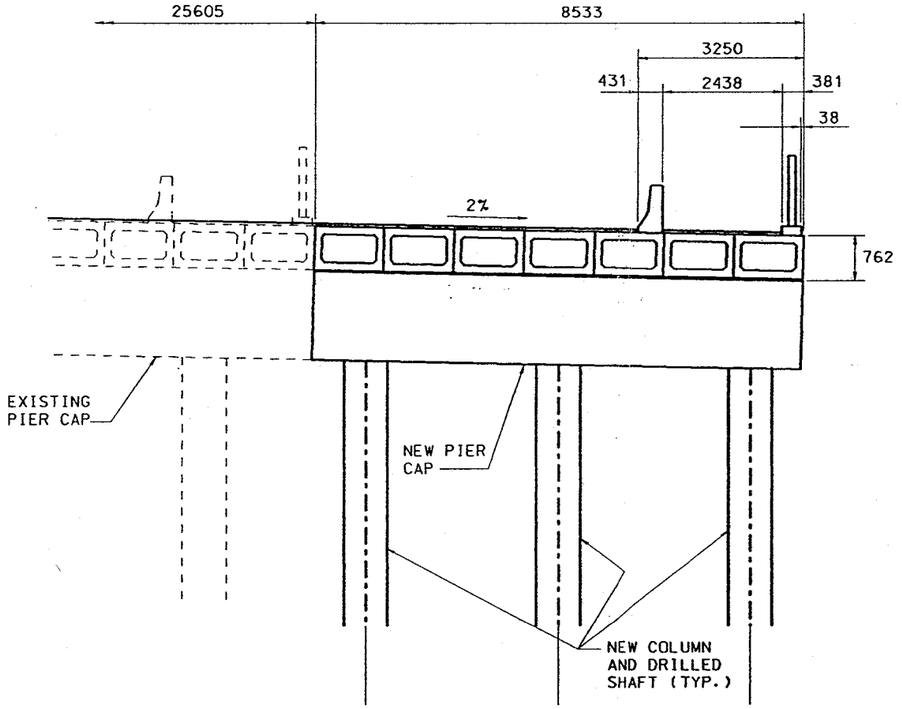
TYPICAL DECK SECTION

(LOOKING NORTH)
Scale 1:50



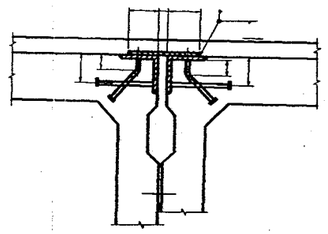
BOX BEAM CONNECTION DETAIL

(BETWEEN EXISTING & PROPOSED BOX BEAMS)
Scale 1:50



TYPICAL SECTION AT PIER

(LOOKING NORTH)
Scale 1:50



BOX BEAM CONNECTION DETAIL

(BETWEEN PROPOSED BOX BEAMS)
Scale 1:50

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE AT THE SALT RIVER PROJECT NO. 68931

	BY	DATE
DESIGNED	W ZAPFEL	5/97
DRAWN	M FEE	5/97
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

BRIDGE DETAILS

SHEET __ OF __

TRACS NO.

ALMA SCHOOL ROAD-SOUTH BRIDGE
OVER THE SALT RIVER

DESIGN CONCEPT REPORT
DRAINAGE REPORT

PREPARED FOR:

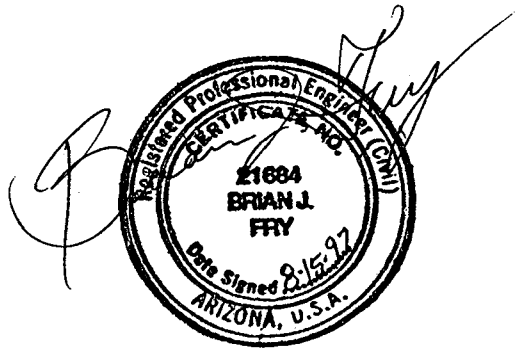
MARICOPA COUNTY

DEPARTMENT OF TRANSPORTATION

Prepared By:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

TABLE OF CONTENTS



ALMA SCHOOL ROAD-SOUTH BRIDGE

DESIGN CONCEPT REPORT
DRAINAGE REPORT

1-INTRODUCTION

The Alma School Road South Bridge Project, included in this Preliminary Drainage Report consists of widening and overlaying Alma School Road from the south side of the South Bridge, where the ADOT Red Mountain Interchange project ends, to the south end of the North Bridge. The present four-lane paved median road will be widened to an ultimate six lanes, including widening of the South Bridge to accommodate the new section which includes a bike path on the west side and sidewalk on the east side.

This Preliminary Drainage Report has been prepared in accordance with guidelines and criteria established by the Arizona Department of Transportation, Maricopa County Department of Transportation, and the Maricopa County Flood Control District.

Included in this report are the roadway drainage system, stream analysis, bridge hydraulics, scour calculations, scour remedial measures, and bank evaluation and stabilization method. The FHWA Technical Circulars HEC-18 and HEC-20 establish the criteria used in the stream stability scour analysis and scour remedial measures.

The river and bridge hydraulics have been performed using the U.S. Army Corps of Engineers HEC-RAS Model.

Engineering calculations, tables, drawings, and other supporting graphics (whenever feasible) are presented in SI units.

2-DRAINAGE SYSTEM- ROADWAY

A-SYSTEM DESCRIPTION

The roadway drainage includes two systems. System A extends north, from the center of the South Bridge, at Sta. 92 + 50.40 to the center of the North Bridge at Sta. 98 + 32.40. System B extends from the center of the South Bridge at Sta. 92 + 50.40 to Sta. 91+18.40 where the project begins.

Both systems discharge into the Salt River at points of outfall on the north and south banks respectively.

Drainage of the bridge deck is achieved by intercepting the runoff from the deck through slots set at the flow line elevation in the barrier wall, and conveying the runoff via the bike path and sidewalk to inlets at each of the four corners of the bridge. Runoff from the south half of the North Bridge and north section of the road is intercepted by inlets on each side of the road at a low point approximately 190 m (623 ft.) north of the south bridge.

Preliminary runoff calculations, storm drain design, inlet capacity and spread magnitude are presented in tables I and III and Fig. 2.

B-SITE INSPECTION

There are no existing drainage facilities in the section of Alma School Road included in this project.

There are several driveways on the east and west side of the road near the South Bridge. Driveways on the west side of the road are used by Sunward Materials, a rock mining company operating in the river. These driveways will require cross-gutters to avoid discharge of pavement runoff outside the right of way at points other than the system outfall.

C-HYDROLOGY

The methodology presented in the Maricopa County Drainage Design Manual Volumes I and II has been implemented in the design of the drainage system. The Rational Method is used to determine the peak discharge during the design event. Ten minutes inlet time is the initial time of concentration used in the calculations. The 10 year storm is the selected design event for the storm sewer system. See Section 4.

D-HYDRAULICS

Manning's equation and the Manning's n values from Volume II of MC Drainage Design Manual are used in the storm sewer calculations. Inlet hydraulics and losses through manholes and inlets are in accordance with MC Drainage Manual II.

The 10 year event is the criteria for spread calculations of the roadway section and bridge deck. See Table II.

3-BRIDGE HYDRAULICS AND SCOUR CALCULATIONS

A-GENERAL.

The scour evaluation and remedial measures presented herein are based on guidelines and requirements set forth by FHWA publications HEC-18 and HEC-20. This reach of the Salt River was recently studied as part of the preparation of the *Letter of Map Revision (LOMR) for the Salt River Floodplain Delineation* by Wood-Patel and Associates Inc., dated September 13, 1995. The LOMR Report provides information on stream characteristics, 100 year storm flow and stages. Information from the LOMR Report and a recent field survey and aerial mapping have been used to obtain a detailed bridge hydraulics analysis using the HEC-RAS model. See Section 5-B.

The existing ground elevations and cross-sections within the south branch of the Salt River covered in this report have changed since preparation of the LOMR Report. Material stockpiles and ponds have been placed within the conveyance area of the river. The new mapping more accurately reflects existing conditions, however, following a storm event the river channel may be restored to its previous, more natural, condition.

B-SITE CHARACTERISTICS

The South River Bridge is located approximately 880 m (2900 ft) west of a diversion side weir where a portion of the flow from the main river channel is diverted to the south branch during extreme events. The elevation of the side weir is set to allow diversion to commence when flow in the main channel is approximately 2,750 m^3/s (97,000 cfs). The side weir is constructed as an earth dam and is designed to allow its obliteration when flows exceed the overtopping rate.

The estimated 100-year peak discharge in the South River from the LOMR analysis is 2,053 m^3/s (72,500 cfs). The 10-year and 500-year discharges are estimated to be 1,359 m^3/s (48,000 cfs) and 3,490 m^3/s (123,250 cfs) respectively.

Sunward Materials operates a plant adjacent to the south branch of the Salt River immediately upstream from the Alma School Road South Bridge. A significant amount of material has been placed within the channel area. This material is the source of the changes in cross-section referenced above. The material occupies flow conveyance area that was present when the LOMR Report was prepared and causes a backwater effect which raises the upstream water surface during flow events.

A grade control structure has been constructed immediately downstream from the bridge. The stated purpose of the structure is to prevent upstream migration of a headcut through the bridge. The structure projects above the channel bed elevation beneath the bridge by about 0.60 m (2 ft). There is a depressed section at the south end of the structure that is even with the bed elevation to allow passage of trucks for access to Sunward Materials. There is a permanent barbed wire fence

across the channel attached to the grade control structure. This fence is susceptible to debris blockage when flows occur and is not likely to remain.

C-STREAM STABILITY

An inspection of the site revealed an armored bed in areas of the river away from the bridge. Under and in the vicinity of the bridge, the armored bed is covered by sand to an elevation, in some areas, of a few meters above the stream bed elevation. There is a compacted vehicular dirt road swinging across and along the river bed. There are also several sandy material stockpiles within the floodway. The existing bridge has a cobble mat extending approximately 10 m (30 ft) from the toe of the sloped cobble abutment protection. See pictures in Section 4-B.

The south branch of the Salt River is an ephemeral stream at this location. The occurrence of flows depends on extreme events exceeding the rate where overtopping of the side weir begins. Local scour may occur at the upstream side of the grade control structure when flows occur.

D-HEC-RAS MODEL

The River Analysis System HEC-RAS Model was used to perform the bridge and stream hydraulics analysis. Input from the LOMR Report provides the stage and flow data used in the analyses presented in this report. The topography reflected in the LOMR cross sections has been changed in areas of the waterway as a result of the existing stockpiling and vehicular trails. Therefore, a new analysis, using actual elevations, is included and is presented in Section 4.

The 10 year, 100 year, and 500 year flow events are modeled. Determination of the pressure flow producing event and resulting stage are included in the analysis. See HEC-RAS input/output printout in section 5.

E-SCOUR ANALYSIS

Analyses of the scour in the structural elements produced by the 10 year, 100 year, and 500 year flows are presented in this report.

The methodology of FHWA HEC- 18 and HEC-20 is employed to determine the magnitude of the scour preventive and remedial measures required. For Scour calculations see Section 5-C. Scour prevention and remedial measures are presented in section 3-F.

Version 2.0 of the HEC-RAS model, released in April 1997 performs scour calculations according to the HEC-18 methodology. The HEC-RAS model has been used for the scour calculations for this study. An attempt was made to perform the calculations in metric units, however, the HEC-RAS software produced unrealistic results for the abutment scour component.

To obtain realistic results, the metric data set was converted to english units and the scour calculations re-run. The resulting calculations were more realistic. It is likely that the coefficient in the Froehlich abutment scour equation was not converted to metric in the program. As a result, the scour results are presented in English units and manually converted to metric.

The contraction scour calculations have been performed assuming live bed conditions. The information obtained from sediment transport models by ADOT supports the Live Bed approach. Although there is wire-tied rip-rap slope protection on each abutment, the magnitude of the local scour at the toe of the slope has been determined. The existing rip-rap mat must be upgraded to meet the requirements of the scour preventive measures presented in this report.

The results of the scour analysis are summarized on **Table 1**. The bridge is in pressure flow during the 100 year event and in pressure flow with weir flow over the bridge during the 500 year event. The flow velocity through the bridge is 4.0 m/s (13 ft/s) for the 100 year flow. The grade control structure will prevent general channel scour. The abutment scour will be avoided by preventive and remedial measures. Contraction scour and pier scour will be accounted for in the new bridge design. In addition to the contraction scour and pier scour, the grade control structure is expected to cause scour from flow impinging on the upstream face of the structure. A portion of the flow will be directed downward along the upstream face of the structure causing a scour hole to be formed through a mechanism similar to that of pier scour with the exception that it will act all along the entire grade control structure. Methodologies have not been developed to predict the scour from the grade control structure. However, it is anticipated that the scour hole will extend upstream far enough to impact the scour on some of the piers.

The low point on the grade control structure is at elevation 361.5 m (1185.7 ft). The top of the pile caps are at elevation 359.5 m (1179.0 ft) for a depth of cover of 2 m (6.7 ft). The sum of computed contraction scour and pier scour of 3.1 m (10.1 ft) for the 100 year flow will be 1.1 m (3.6 ft) below the top of the pile caps. The impact of the un-quantified grade control structure scour may result in greater depths of scour. For the existing structure, it is recommended that scour not be allowed below the top of pile cap unless a stability analysis is done to determine the resulting factor of safety.

F-SCOUR PREVENTION AND REMEDIAL MEASURES.

The scour prevention and remedial measures presented in this Drainage Report are subject to modifications upon final design of the structure.

Evaluation of the HEC-RAS model indicates that the flow allowed into the South River, during an event of equal or higher intensity than the 100 year recurrence results in pressure flow conditions and scour producing velocities and depths.

Several options of scour prevention and remedial measures are presented in this section. New scour calculations may be necessary depending on the selected option.

SCOUR PREVENTION
Existing Structure:

Option 1: Re-design the earth dam to divert a smaller flow to the South River during an extreme event. New scour calculations and remedial measures may be required depending on flow limitation.

Option 2: Seal invert.

A: Provide a riprap mat across and to the full length of the existing structure. (In accordance with HEC 18 and 20 guidelines).

B: Provide a concrete slab extending beyond the scour susceptible area. This option may always be required within the vehicular pathway since a riprap or gabion mat alone will not support the heavy truck traffic.

C: Provide a gabion mat across and to the full length of the existing structure. This option will require consideration to the drag and rolling effect on cobbles produced by high velocities and flow depth.

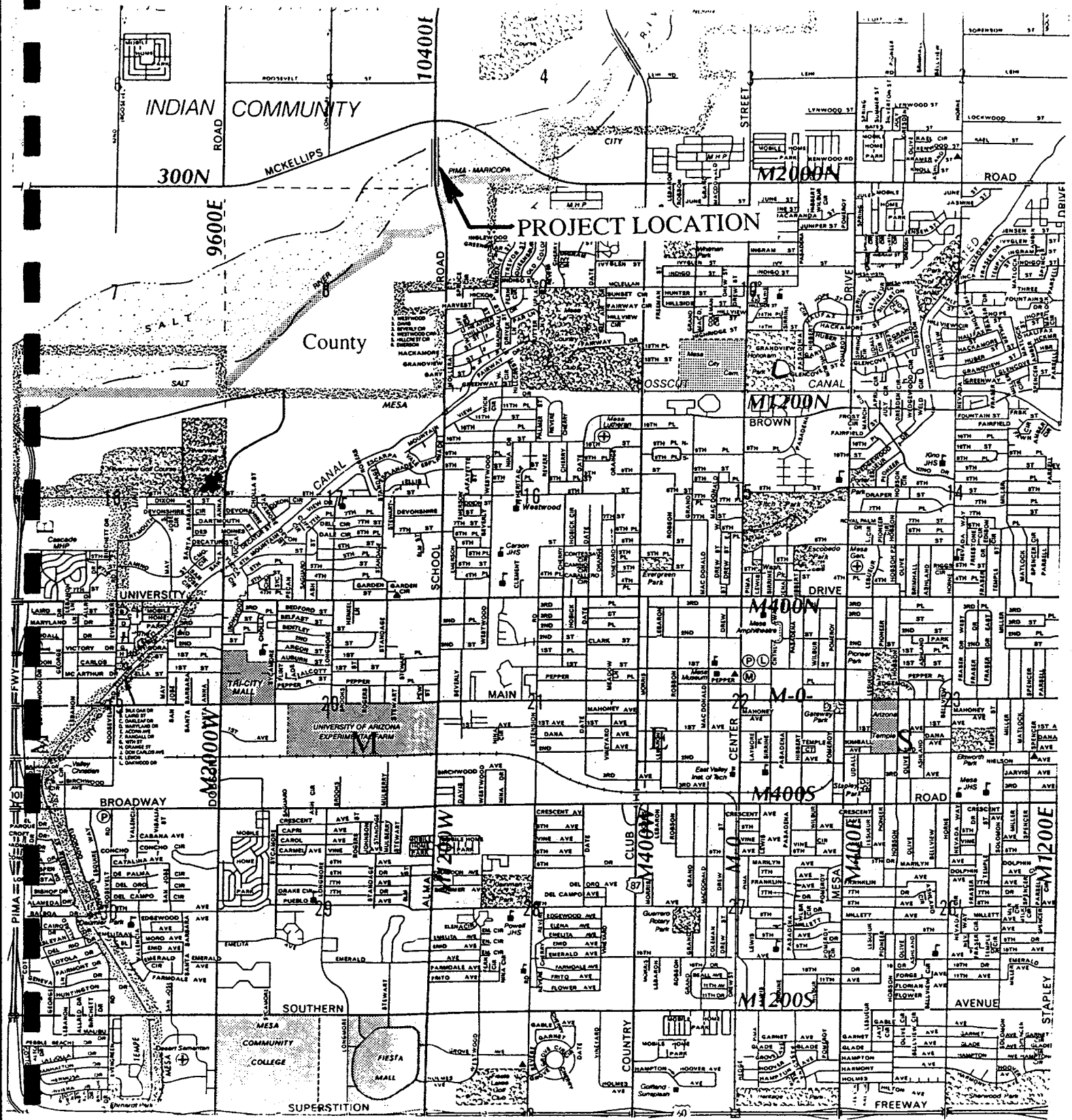
New Structure:

Pier columns, pier caps and piles shall be designed considering the scour reflected in the calculations included in this report unless a new weir and flow diversion rate are selected. In this case piers shall be designed according to the scour resulting from the selected diversion flow. Riprap protection to the abutments is required in the new structure unless a considerable lower flow rate, from a new weir, allows protection of the structural element to be included in the design.

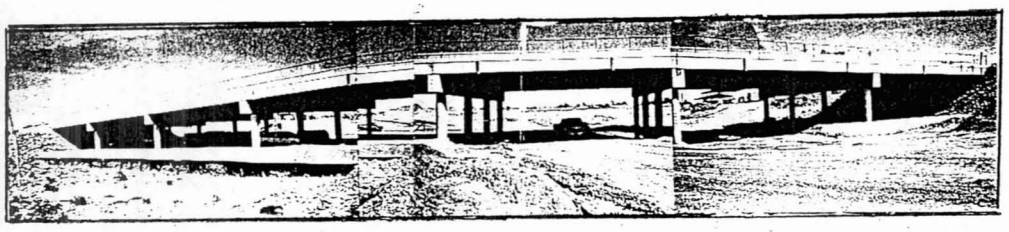
Indentations on the south bank downstream from the bridge are produced by the combined of high velocities and the sharp bend in that location. Rip rap protection should be provided in that area if restoration of the banks in the vicinity of the bridge is made a part of the scope of work in this project.

At the present time there are no empirical or theoretical formulas to determine the scour that the concrete cap on the grade control structure may produce. It is recommended that the concrete cap be lowered to the same elevation as the truck path and that the existing gabion be covered across its full width a new concrete cap.

4-GRAPHICS



LOCATION MAP



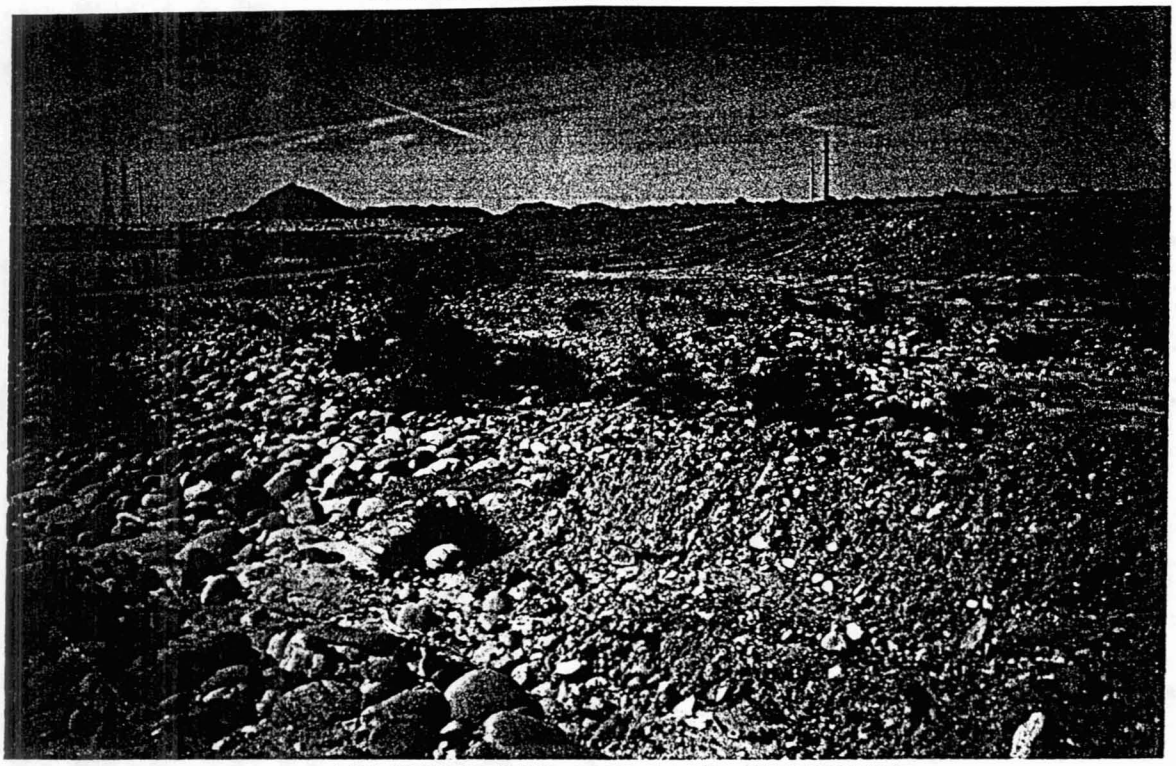
ALMA SCHOOL RD. BRIDGE

OVER THE SALT RIVER

DOWNSTREAM SIDE

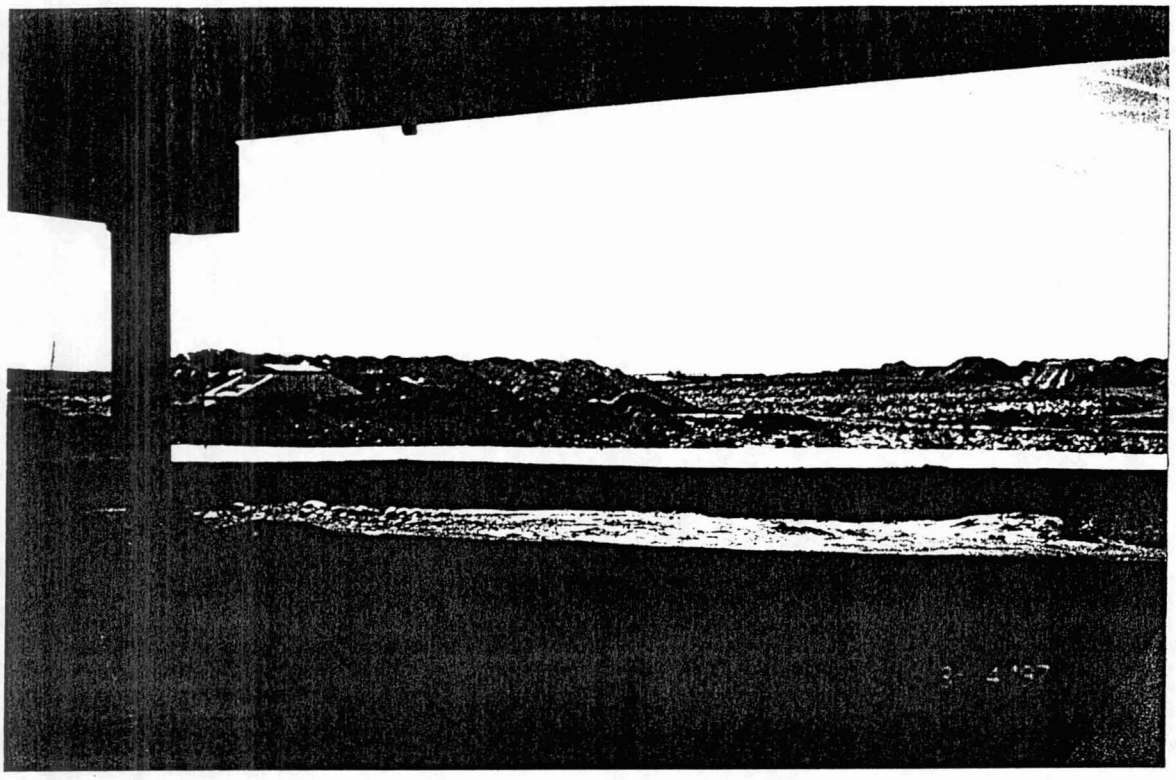
RIVER BED AND GRADE CONTROL STRUCTURE

DOWNSTREAM SIDE



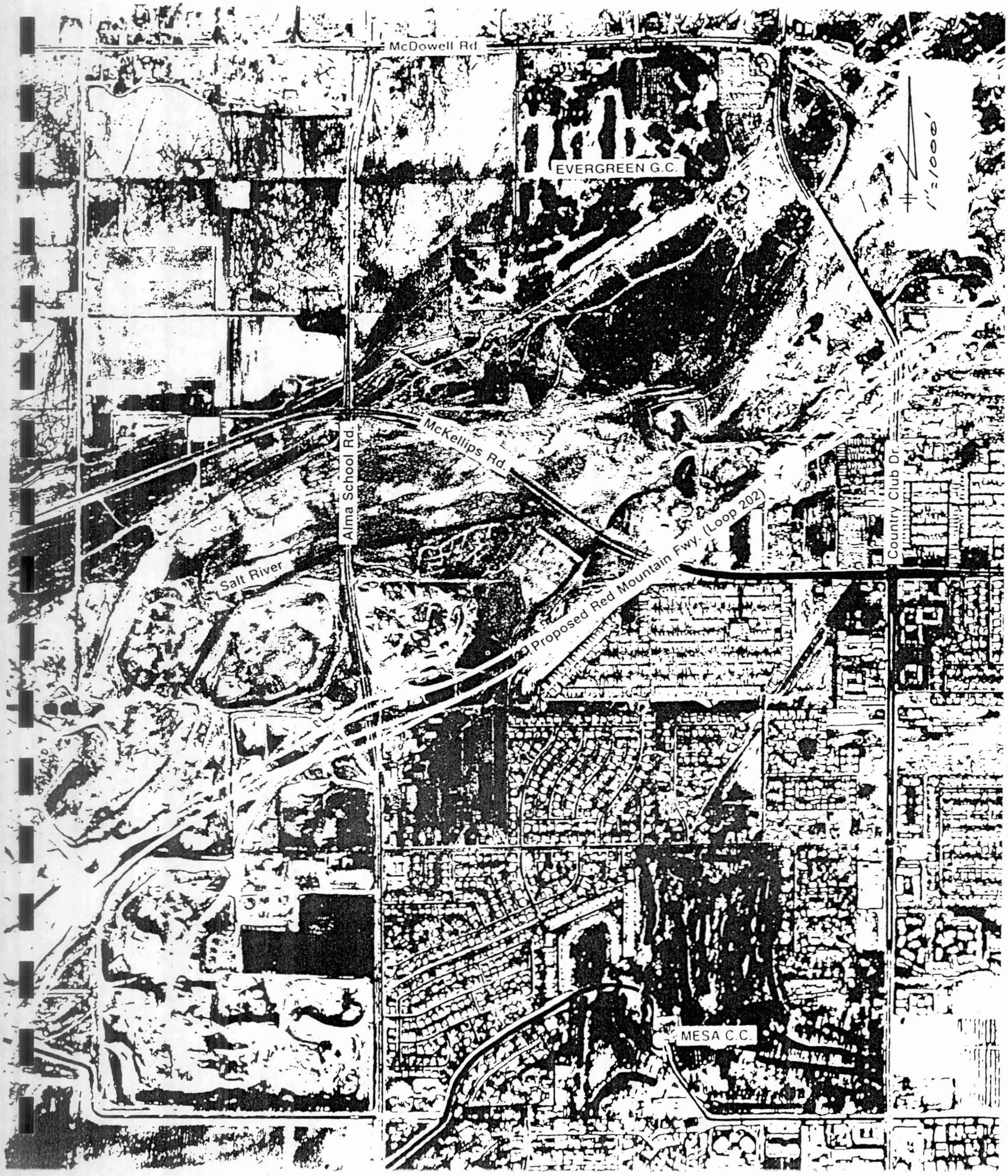
ARMORED BED AND SAND STOCKPILE

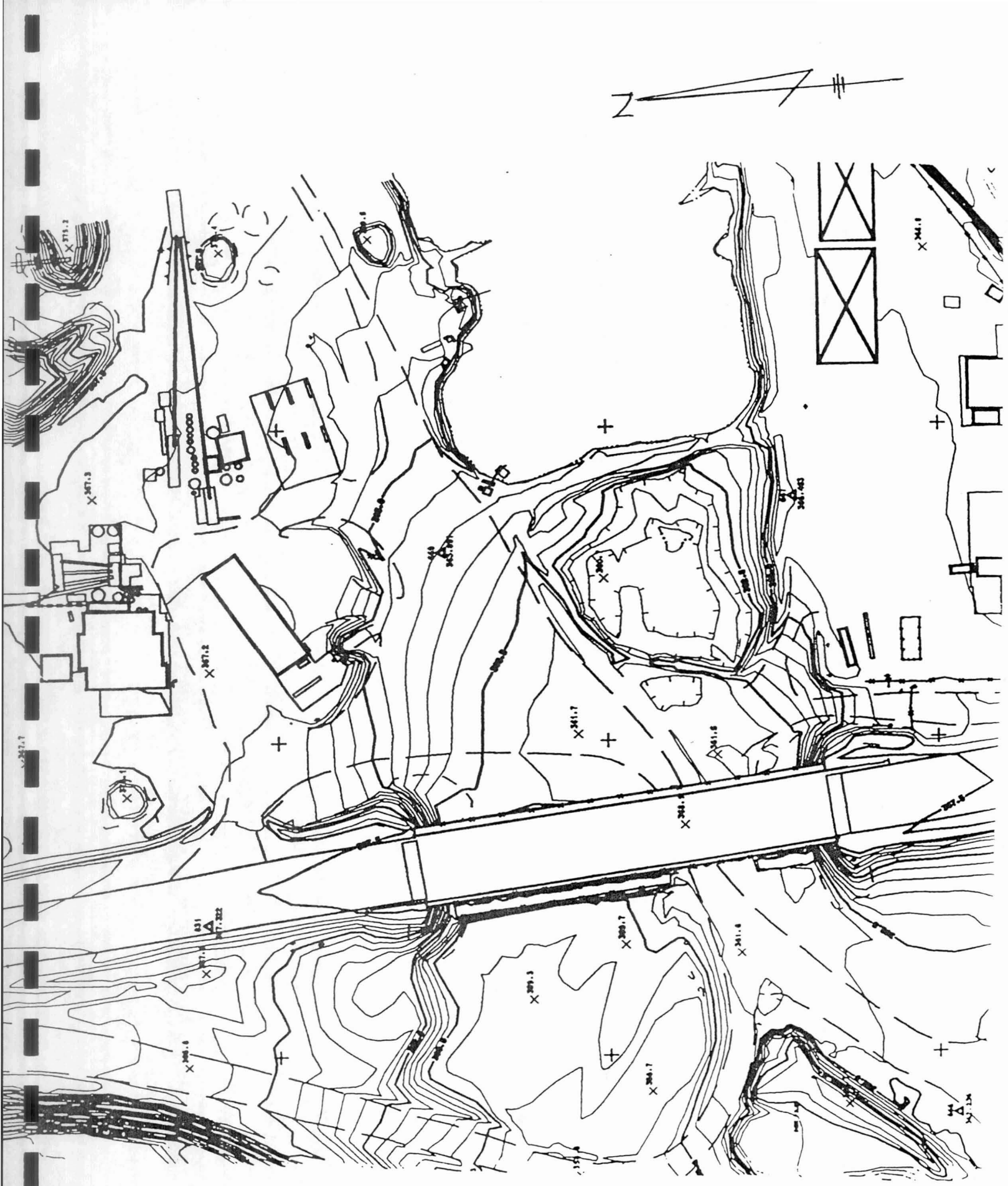
DOWNSTREAM SIDE



SAND STOCKPILES DOWNSTREAM SIDE

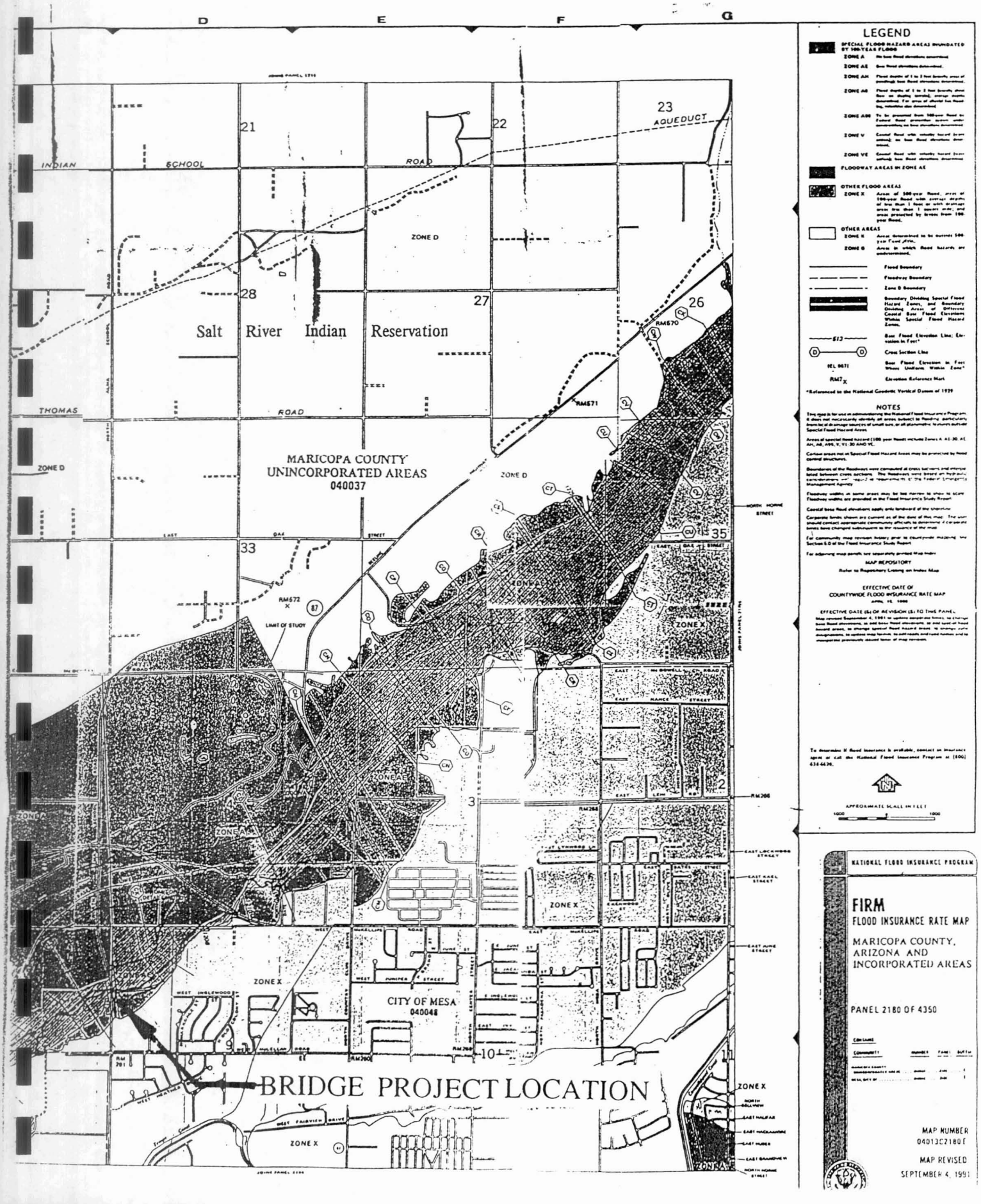
SAND STOCKPILES UPSTREAM SIDE


McDowell Rd.
EVERGREEN G.C.
McKellips Rd.
Alma School Rd.
Salt River
Proposed Red Mountain Fwy. (Loop 202)
Country Club Dr.
MESA C.C.
1"=1000'



TOPOGRAPHIC MAP

BRIDGE SITE



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A — No base flood elevations determined.
- ZONE AE — Base flood elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- ZONE V — Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE X — Areas determined to be outside 500-year flood plain.
- ZONE D — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

EL 9671 — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross-section and interpolated between cross-sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are presented in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see Section 5.0 of the Flood Insurance Study Report.

For adjoining map panels not separately printed, see Index.

MAP REPOSITORY

Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

(Map revised September 4, 1991 to update corporate limits, to change zone flood elevations, to add base flood elevations, to add some of flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision)

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

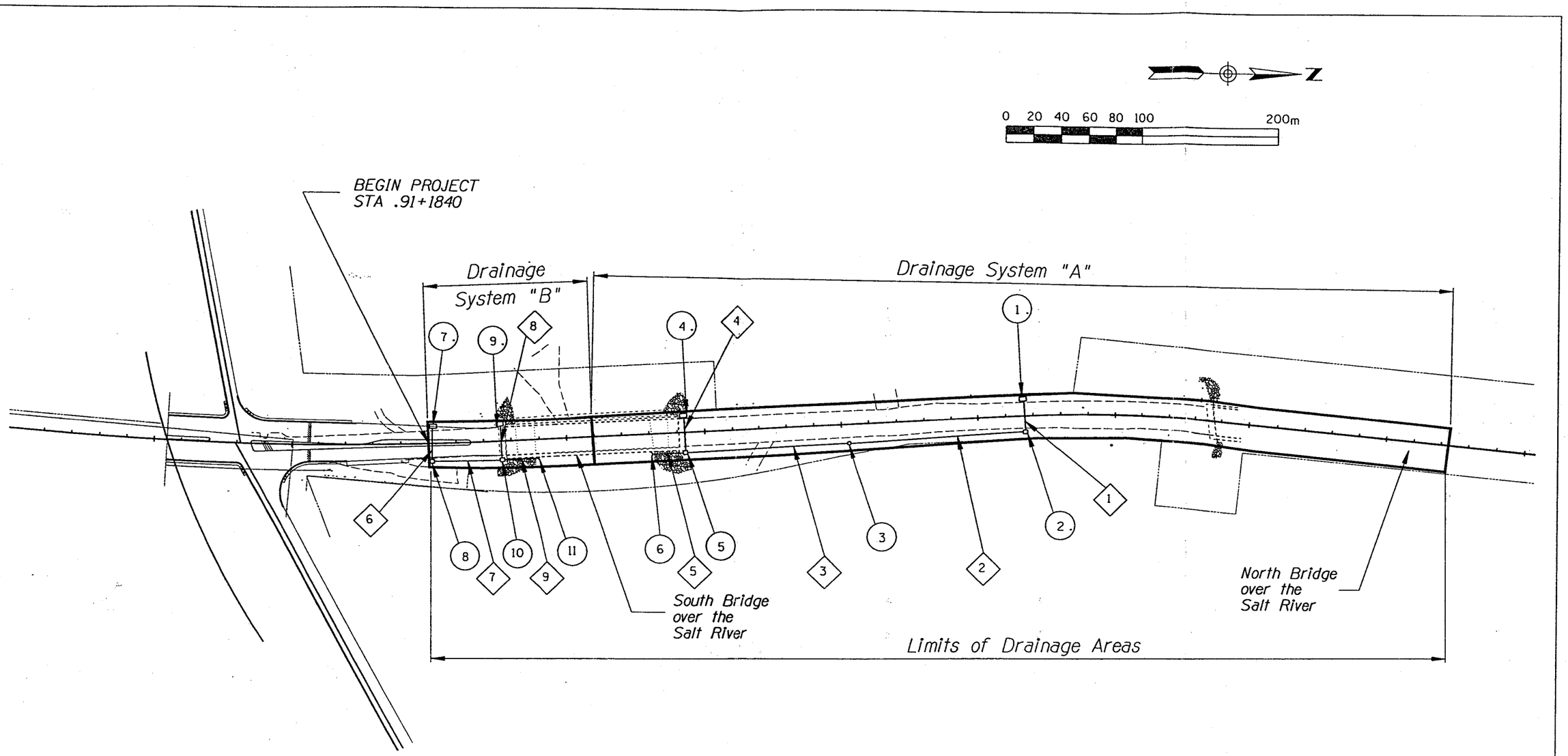
PANEL 2180 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY UNINCORPORATED AREAS	040037	2180	E
CITY OF MESA	040048	2180	E

MAP NUMBER
04013C2180E

MAP REVISED
SEPTEMBER 4, 1991



LEGEND

(1) Depicts Reach No.

◇1 Depicts Structure No.

—— Depicts Limits of Drainage Area

DRAINAGE MAP

FIGURE 1

TABLE I

SYSTEM A

STRUCT. NO.	REACH NO	LENGTH M.	INC. AREA Ha.	TOTAL AREA Ha.	CA	I Cm.	Q CMS	PIPE MM.
1								
	1	28	6.42	6.42	5.01	10.31	0.258	450
2								
	2	95	6.42	12.84	10.02	10.12	0.494	610
3								
	3	95	-	12.84	10.02	-	0.494	610
4								
	4	27	0.54	0.54	0.513	10.35	0.028	450
5								
	5	13	0.54	13.92	11.05	10.12	0.55	610
6								

SYSTEM B

STRUCT. NO	REACH NO.	LENGTH M.	INCR. AREA Ha.	TOTAL AREA Ha.	CA	I Mm.	Q CMS	PIPE Mm.
7								
	6	28	0.618	0.618	0.482	10.31	0.025	450
8								
	7	70	0.618	1.236	O.964	10.13	0.049	450
9								
	8	28	0.544	0.544	0.52	10.31	0.028	610
10								
	9	13	0.544	2.324	2.028	10.10	0.112	610
10								

TABLE II

SUMMARY OF SCOUR

Frequency	Contraction Scour	Pier Scour	Total at Pier	Abutment Scour		Total at Abutment	
				Left	Right	Left	Right
10-yr	0.23 m (0.74 ft)	2.30 m (7.54 ft)	2.52 m (8.28 ft)	5.88 m (19.30 ft)	3.76 m (12.33 ft)	6.11 m (20.04 ft)	3.98 m (13.07 ft)
100-yr	0.75 m (2.45 ft)	2.34 m (7.69 ft)	3.09 m (10.13 ft)	4.43 m (14.53 ft)	6.05 m (19.83 ft)	5.17 m (16.97 ft)	6.79 m (22.28 ft)
500-yr	0.0 m (0.0 ft)	2.37 m (7.76 ft)	2.37 m (7.76 ft)	12.64 m (41.46 ft)	17.06 m (55.96 ft)	12.64 m (41.46 ft)	17.06 m (55.96 ft)

NOTE: Scour depths can be converted to elevations by subtracting the depths from elevation 361.5 m (1185.7 ft), which is the low point on the grade control structure.

TABLE III

INLET SPREAD TABULATION

INLET NO.	FLOW (CMS)	SPREAD M.	CURB OPENING (CMS)	GRATE (CMS)	SIDE (CMS)	BY-PASS (CMS)
1	0.258	3.658	----SUMP COND. * 100% INTERCEP.* -----			
2	0.258	3.658	-----SUMP COND. *100% INTERCEP.*------			
4	0.0300	1.27	0.0249	0.0051	----	----
5	0.0300	1.27	0.0249	0.0051	----	-----
7	0.0295	1.27	0.0249	0.00456	----	-----
8	0.0295	1.27	0.0249	0.00456	----	-----
9	0.0269	1.112	0.0220	0.0049	----	-----
10	0.0269	1.112	0.0220	0.0049	----	-----

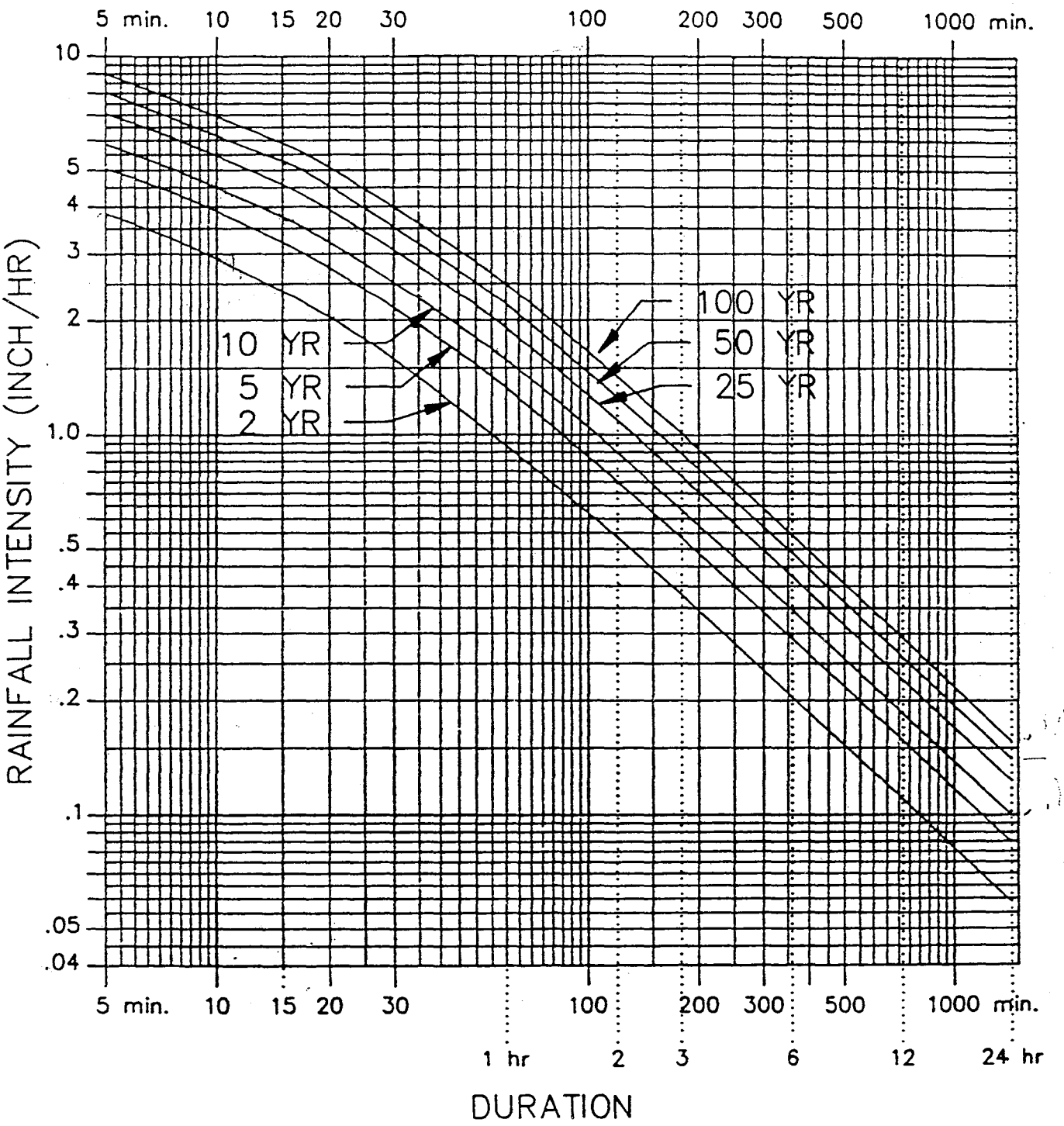


Figure 3.2
Rainfall Intensity-Duration-Frequency Relation
(Phoenix Metro Area)

ADOT - HIGHWAY DRAINAGE DESIGN MANUAL - HYDROLOGY
RAINFALL DEPTH-DURATION-FREQUENCY (D-D-F) WORKSHEET

Project No.: 9632 TRACS NN/A
Project Name: Alma School Road South Bridge Date: 15-Aug-97
Location/Sta: MARICOPA COUNTY, AZ
Designer: Brian Fry Checker:

PART A

Rainfall Depths from Isopluvials:

2-year, 6-hour =	1.16 in.
2-year, 24-hour =	1.60 in.
100-year, 6-hour =	3.10 in.
100-year, 24-hour=	3.90 in.

PART B

2-year, 1-hour =	0.78 in.
100-year, 1-hour =	2.35 in.
2-year, 2-hour =	0.91 in.
2-year, 3-hour =	1.00 in.
2-year, 12-hour =	1.38 in.
100-year, 2-hour =	2.61 in.
100-year, 3-hour =	2.78 in.
100-year, 12-hour=	3.50 in.

PART C

Zone = 8 (6 or 8)

2-year, 5-min =	0.27 in.
2-year, 10-min =	0.40 in.
2-year, 15-min =	0.48 in.
2-year, 30-min =	0.64 in.
100-year, 5-min =	0.71 in.
100-year, 10-min =	1.08 in.
100-year, 15-min =	1.39 in.
100-year, 30-min =	1.88 in.

Duration (Min)	Ratio 2-yr	Ratio 100-yr
5	0.34	0.30
10	0.51	0.46
15	0.62	0.59
30	0.82	0.80

PART D & E

Duration	Rainfall Depth, (in) Frequency (yrs) 2-yr	5-yr	10-yr	25-yr	50-yr	500-yr
5-min =	0.27	0.38	0.45	0.55	0.63	0.89
10-min =	0.40	0.57	0.68	0.84	0.96	1.36
15-min =	0.48	0.71	0.86	1.07	1.23	1.76
30-min =	0.64	0.96	1.16	1.45	1.67	2.39
1-hour =	0.78	1.18	1.44	1.80	2.08	2.99
2-hour =	0.91	1.34	1.62	2.01	2.31	3.30
3-hour =	1.00	1.44	1.74	2.15	2.47	3.50
6-hour =	1.16	1.64	1.97	2.41	2.76	3.89
12-hour =	1.38	1.90	2.26	2.75	3.12	4.37
24-hour =	1.60	2.16	2.54	3.08	3.49	4.85

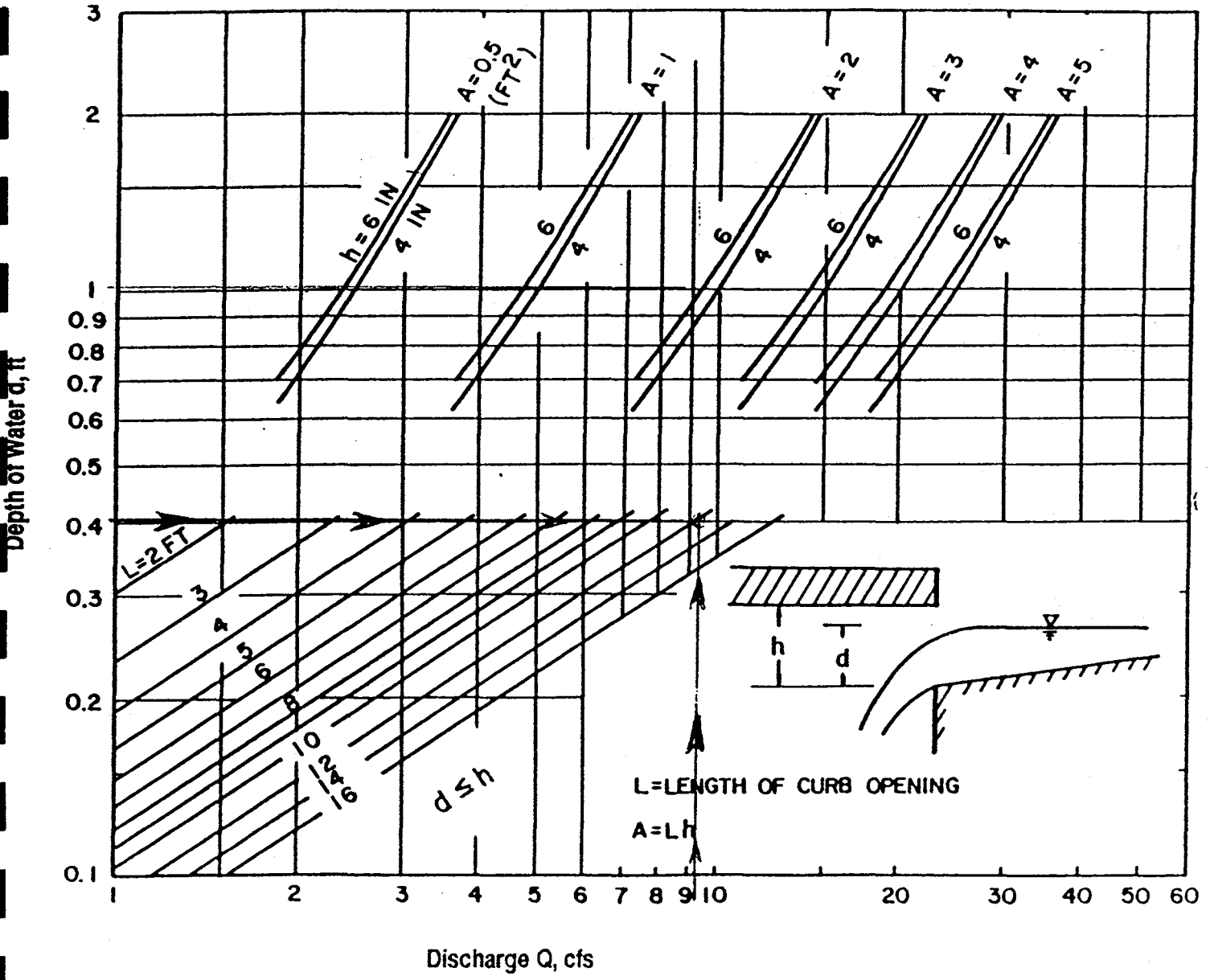


FIGURE 2

Curb Opening Inlet Capacity in Sump Locations

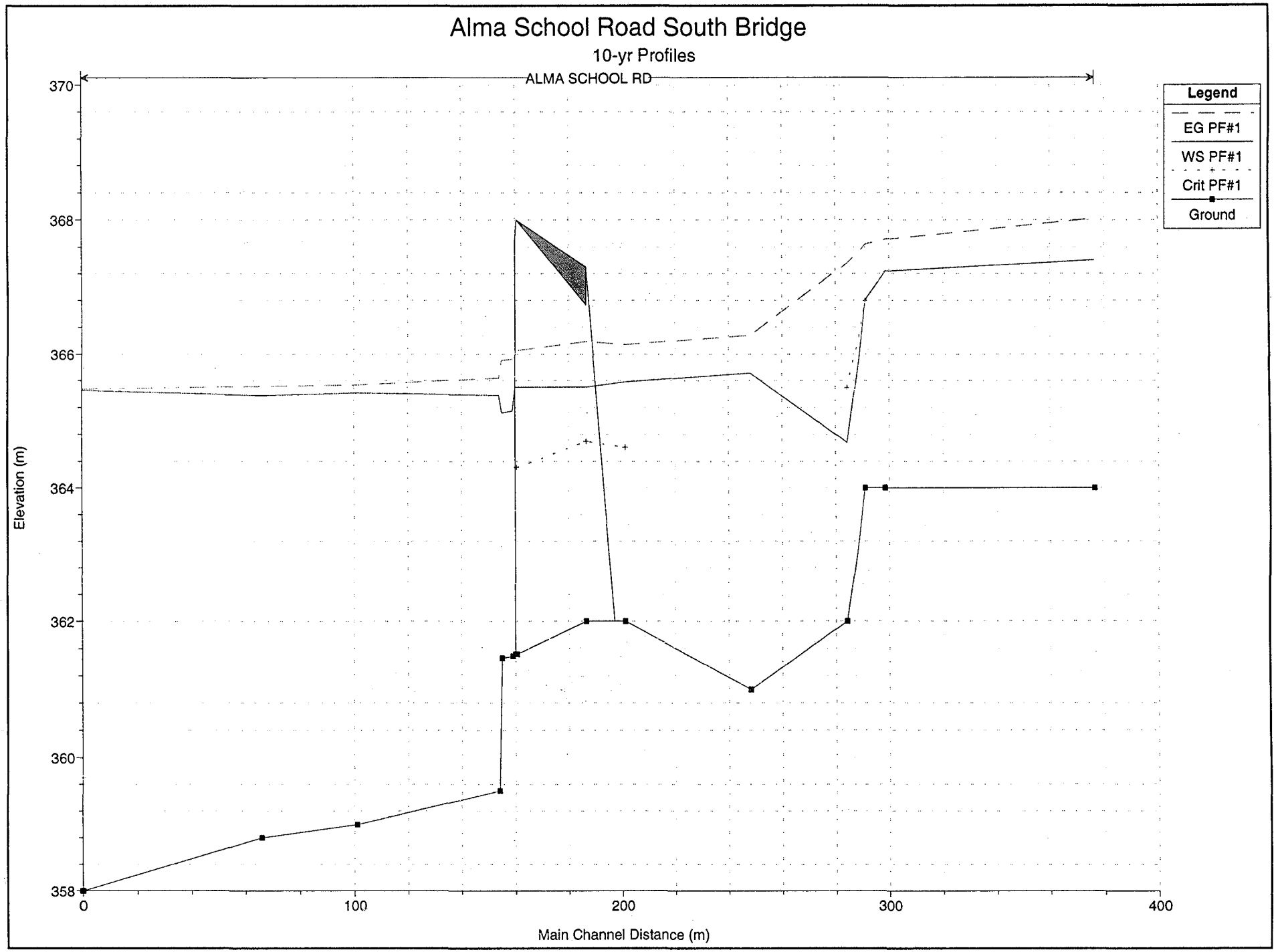
(source: FHWA, 1984, HEC-12)

5-SUPPORTING DOCUMENTATION

HEC-RAS PRINTOUT

EXISTING TOPOGRAPHY

NOTE: A HYDRAULIC ANALYSIS OF AN EVENT OF INTENSITY APPROXIMATELY EQUAL TO 10 YEAR RECURRENCE IS INCLUDED FOR ILLUSTRATIVE PURPOSES ONLY.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10-yr Profiles
ALMA SCHOOL RD
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Elevation (m)
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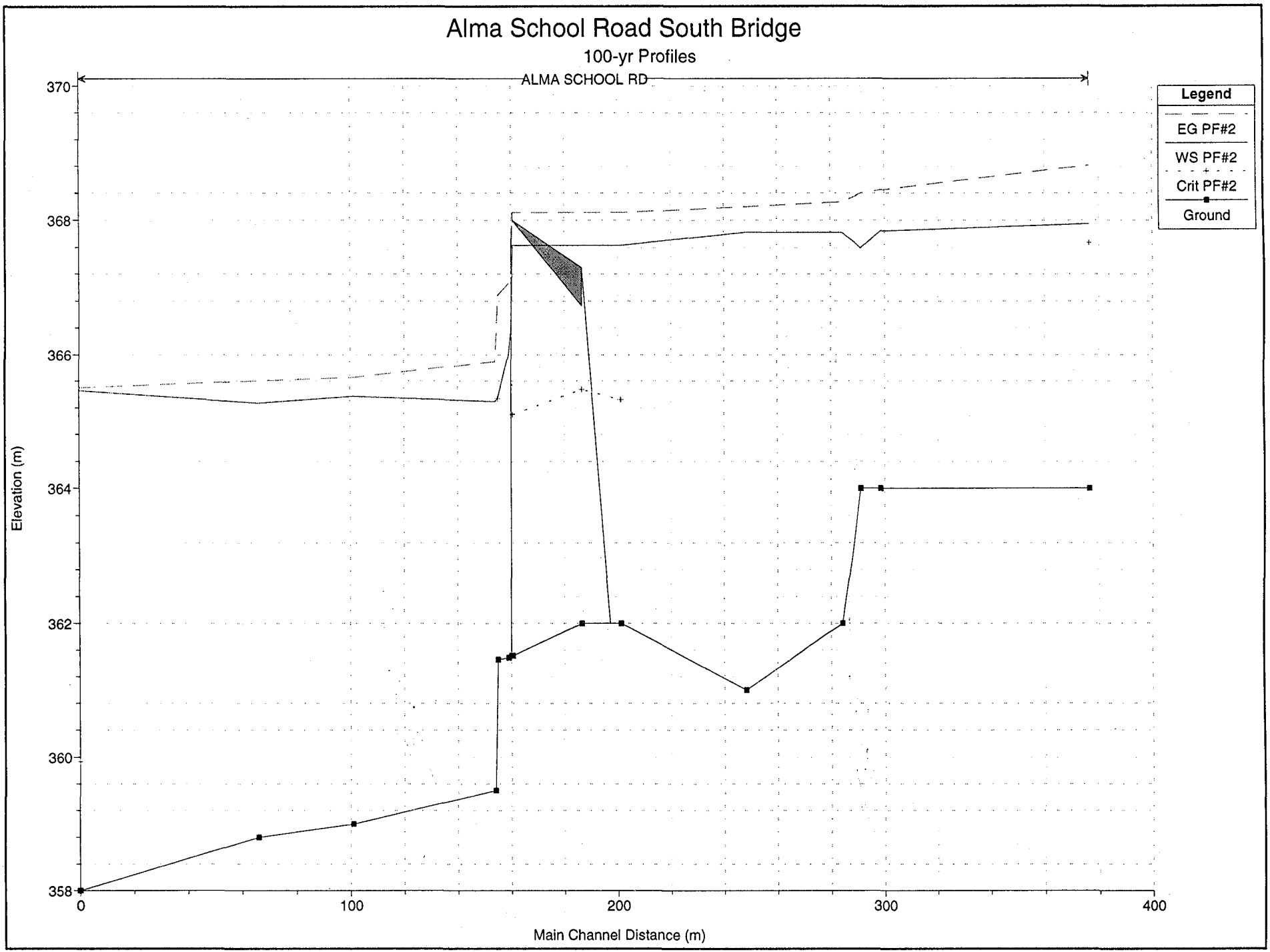
368
366
364
362
360
358
0
100
200
300
400
Main Channel Distance (m)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Crit PF#2
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358
0
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200
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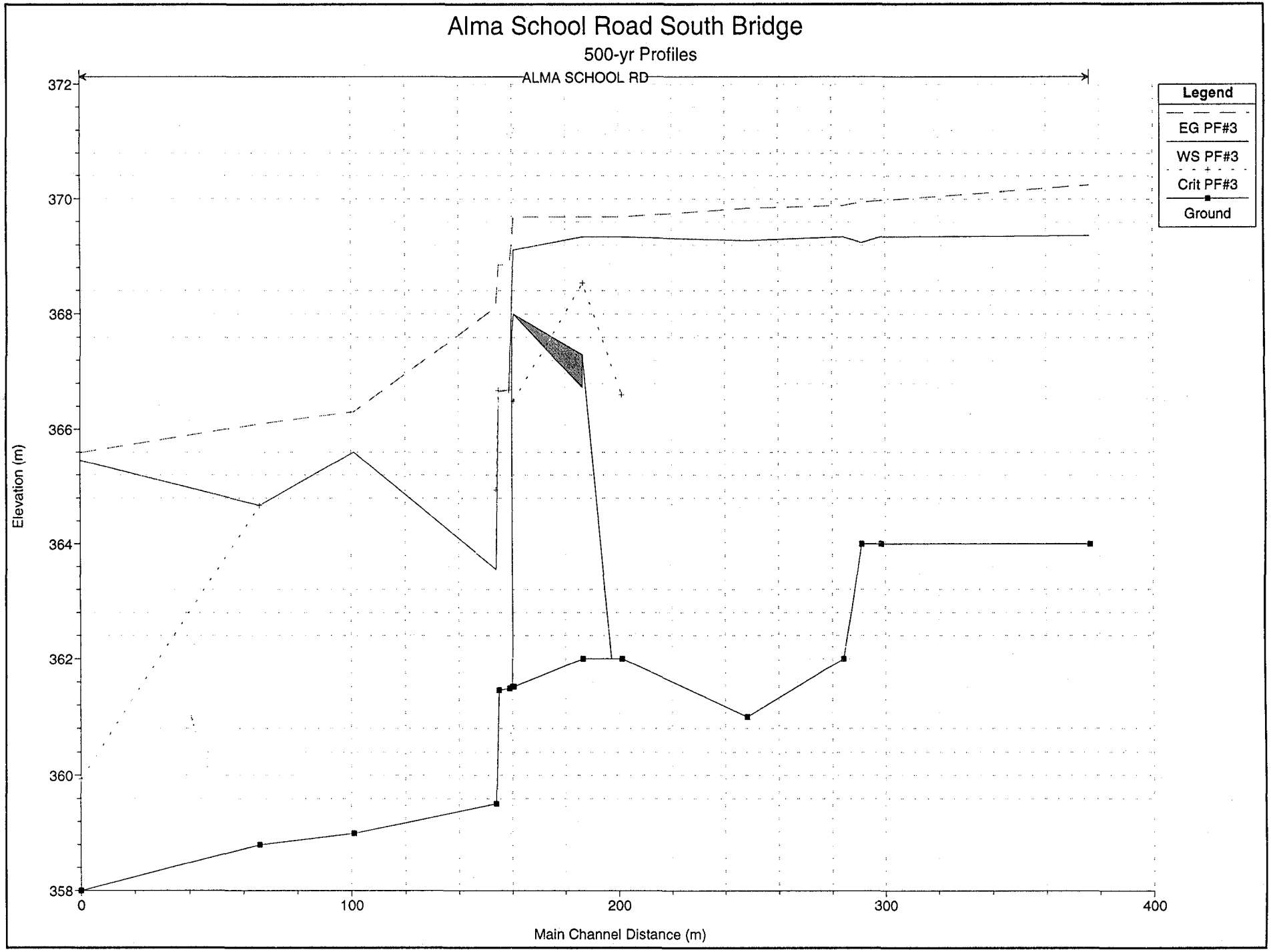
400
Main Channel Distance (m)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Crit PF#3
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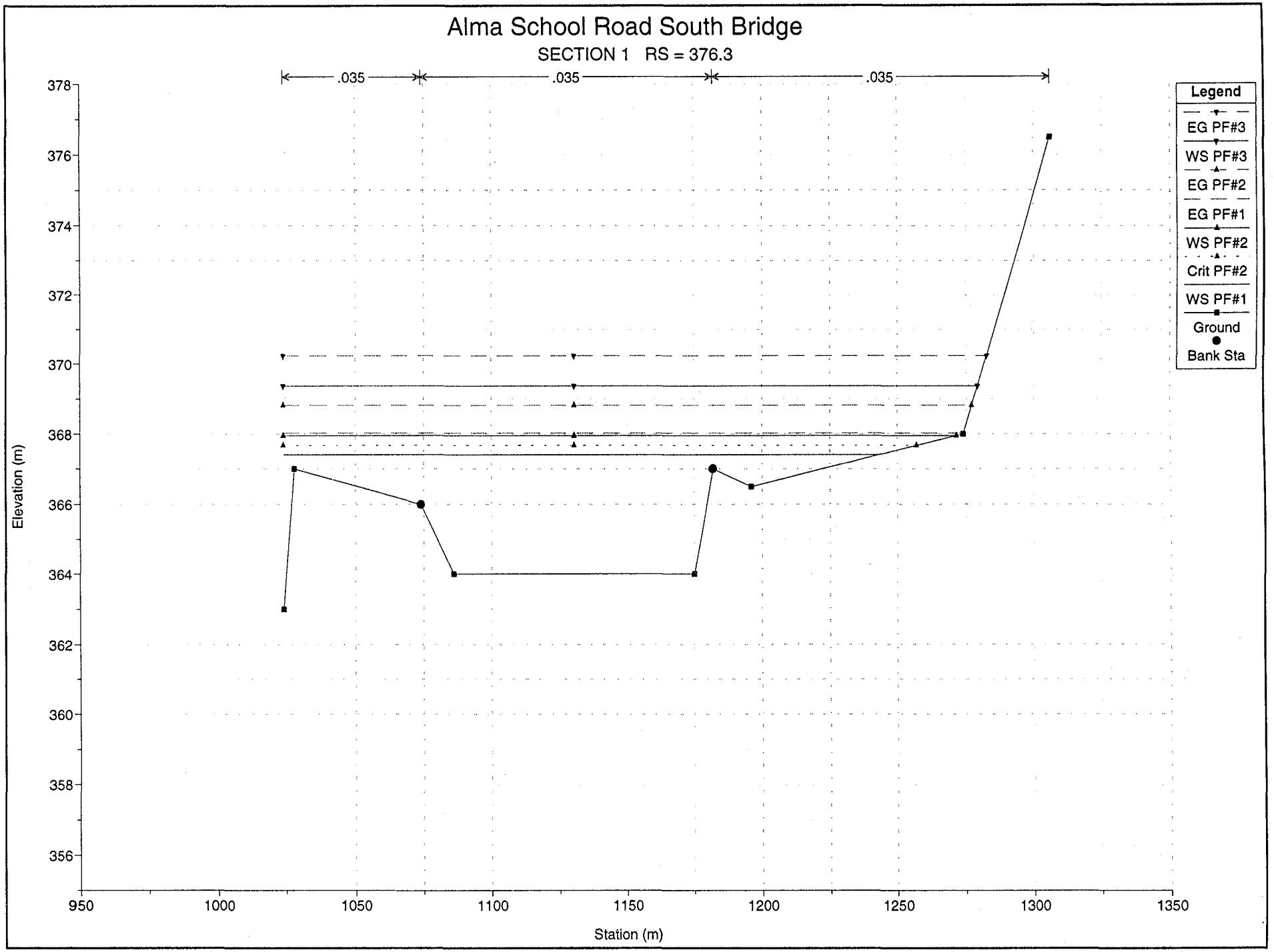
Main Channel Distance (m)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WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
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362
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358
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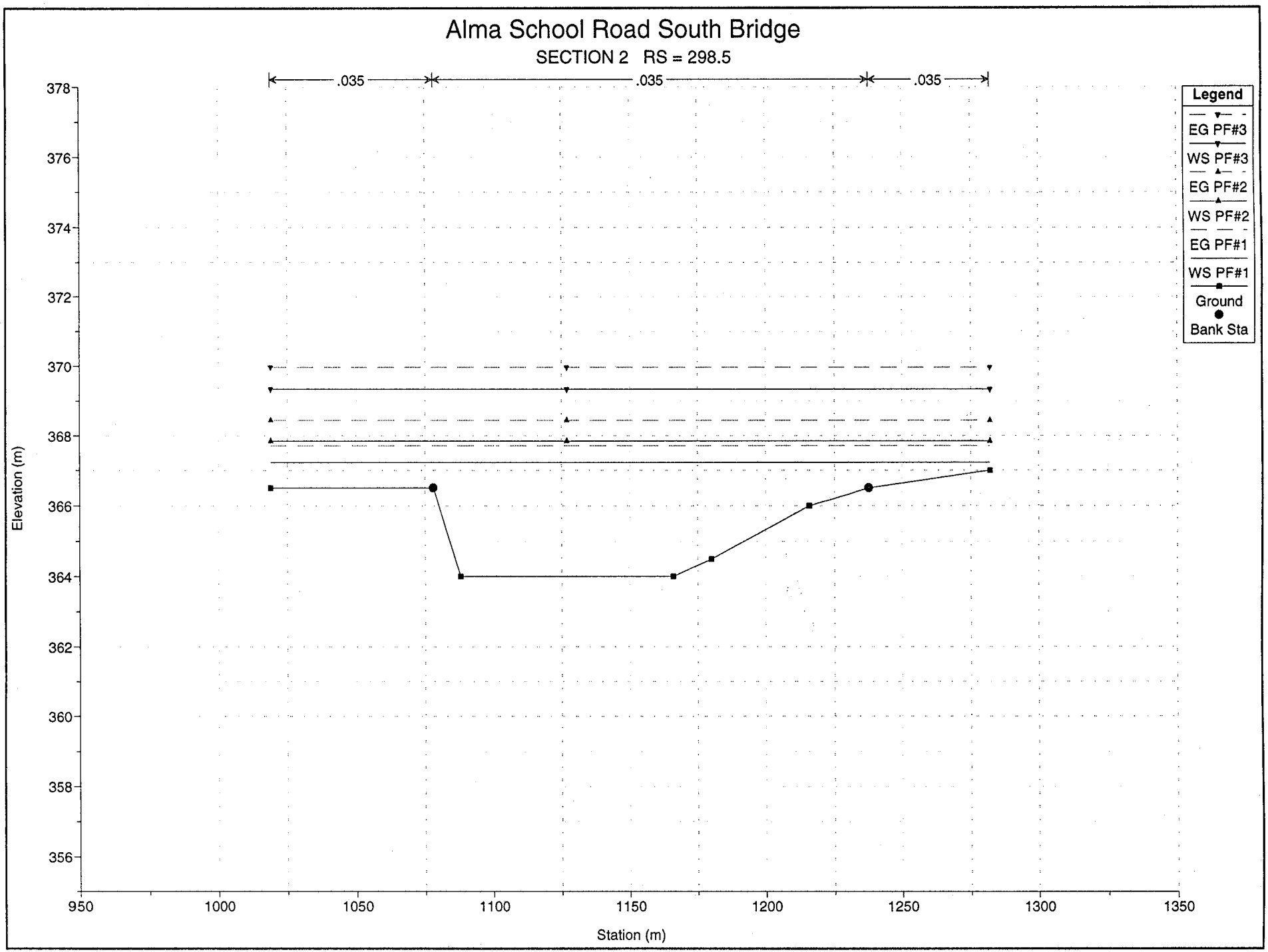
950
1000
1050
1100
1150
1200
1250
1300
1350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WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
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376
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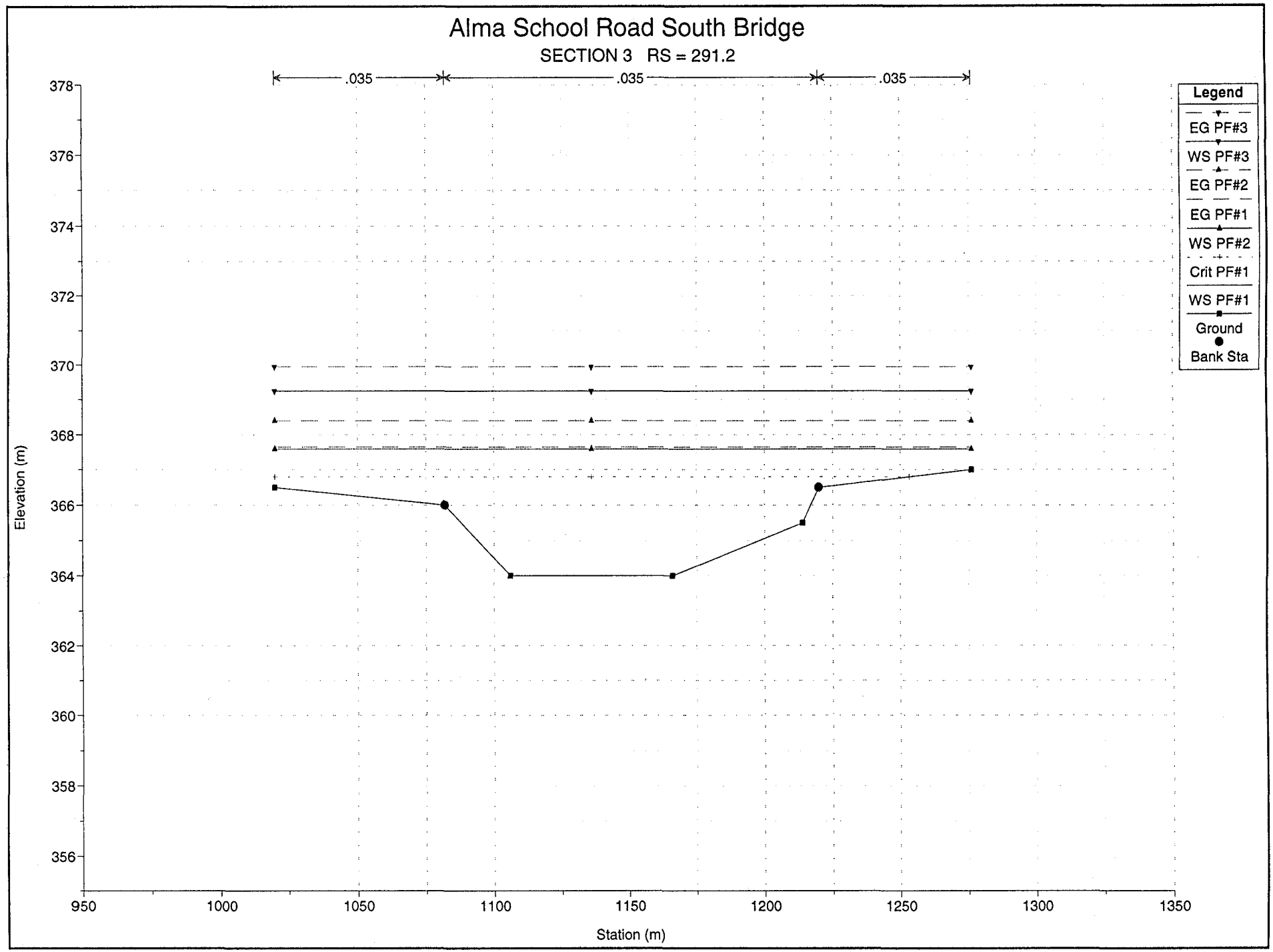
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Bank Sta
Elevation (m)
Station (m)
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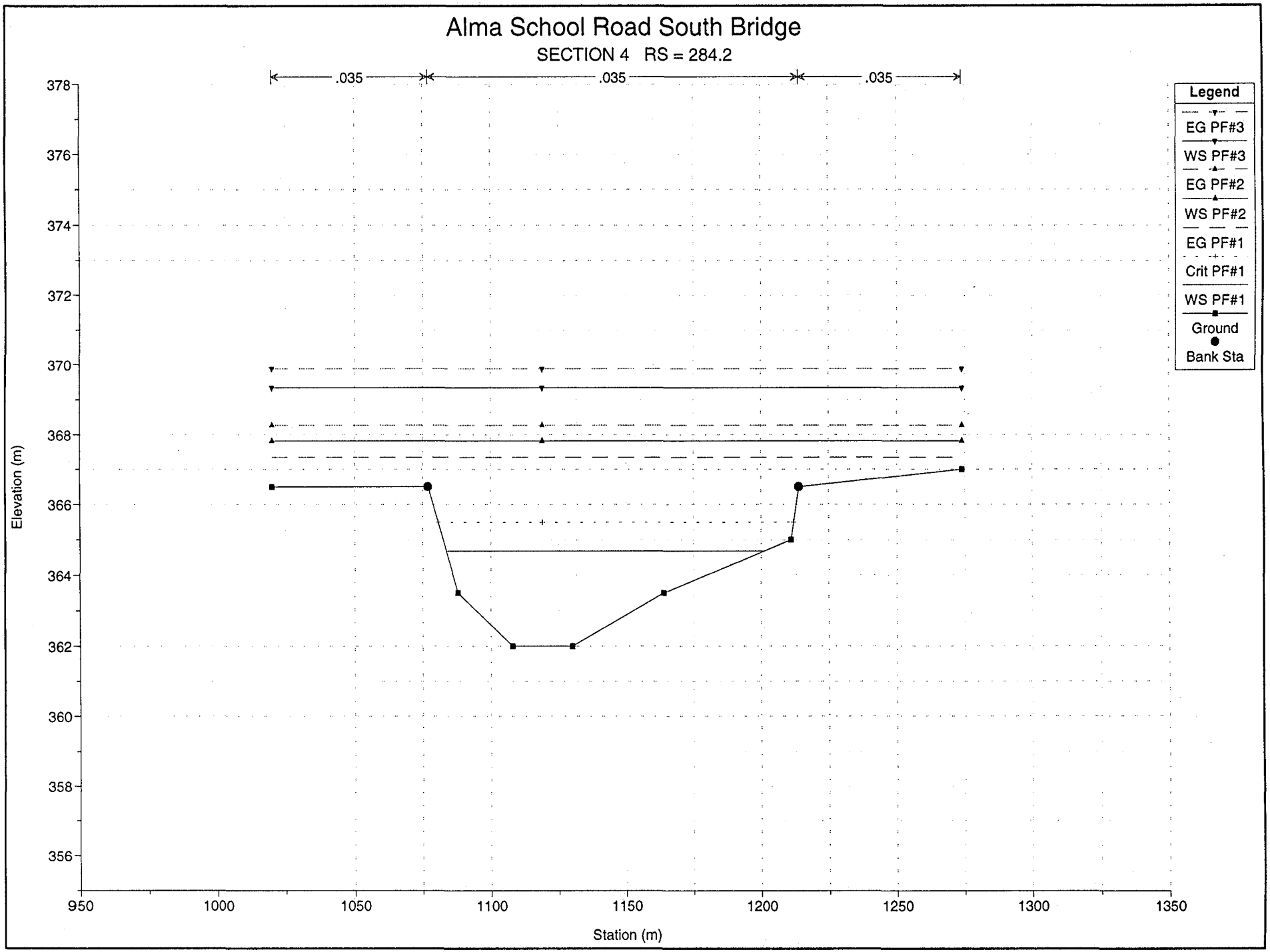
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Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
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376
374
372
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1050
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1200
1250
1300
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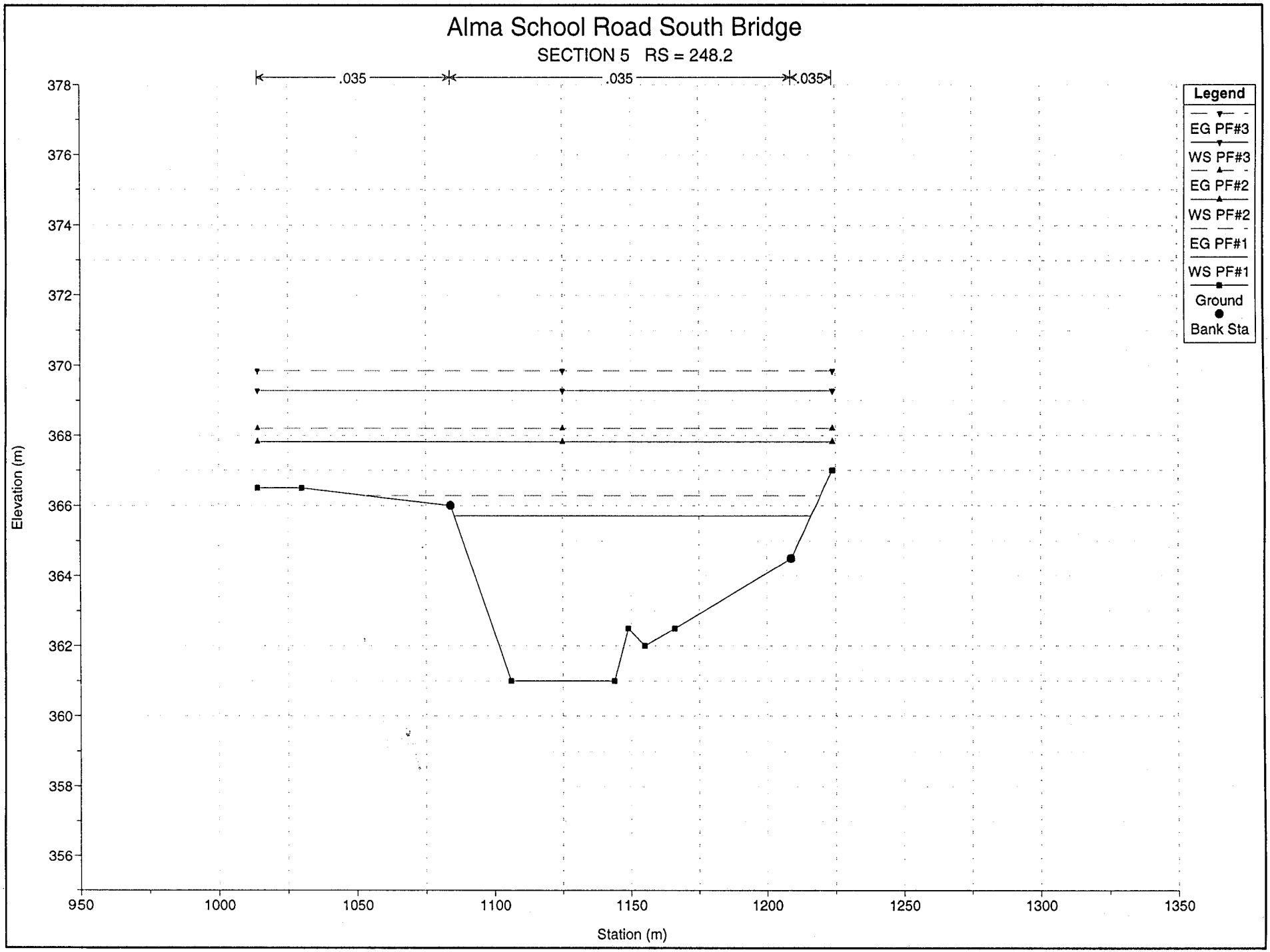
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EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
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376
374
372
370
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1300
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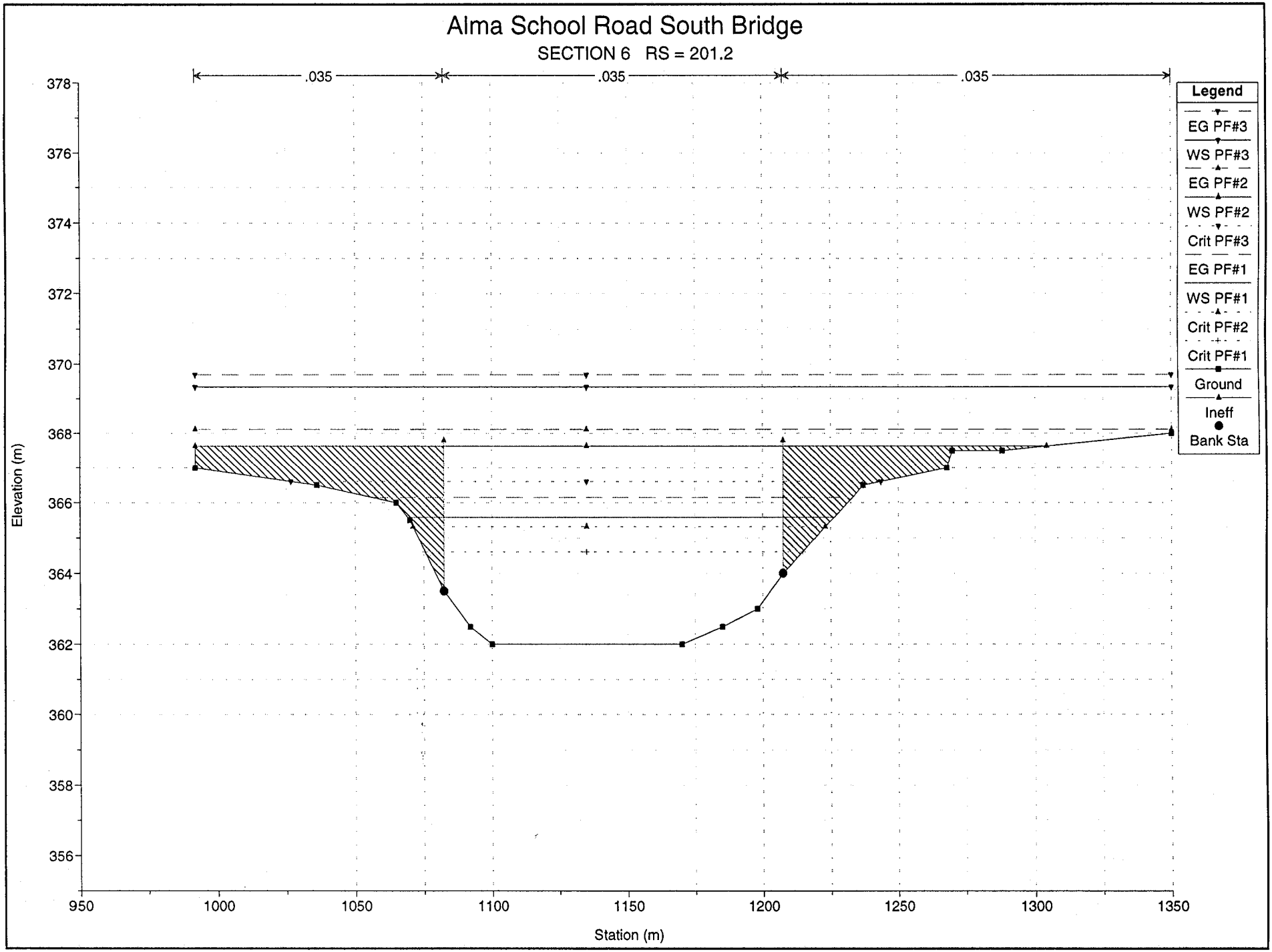
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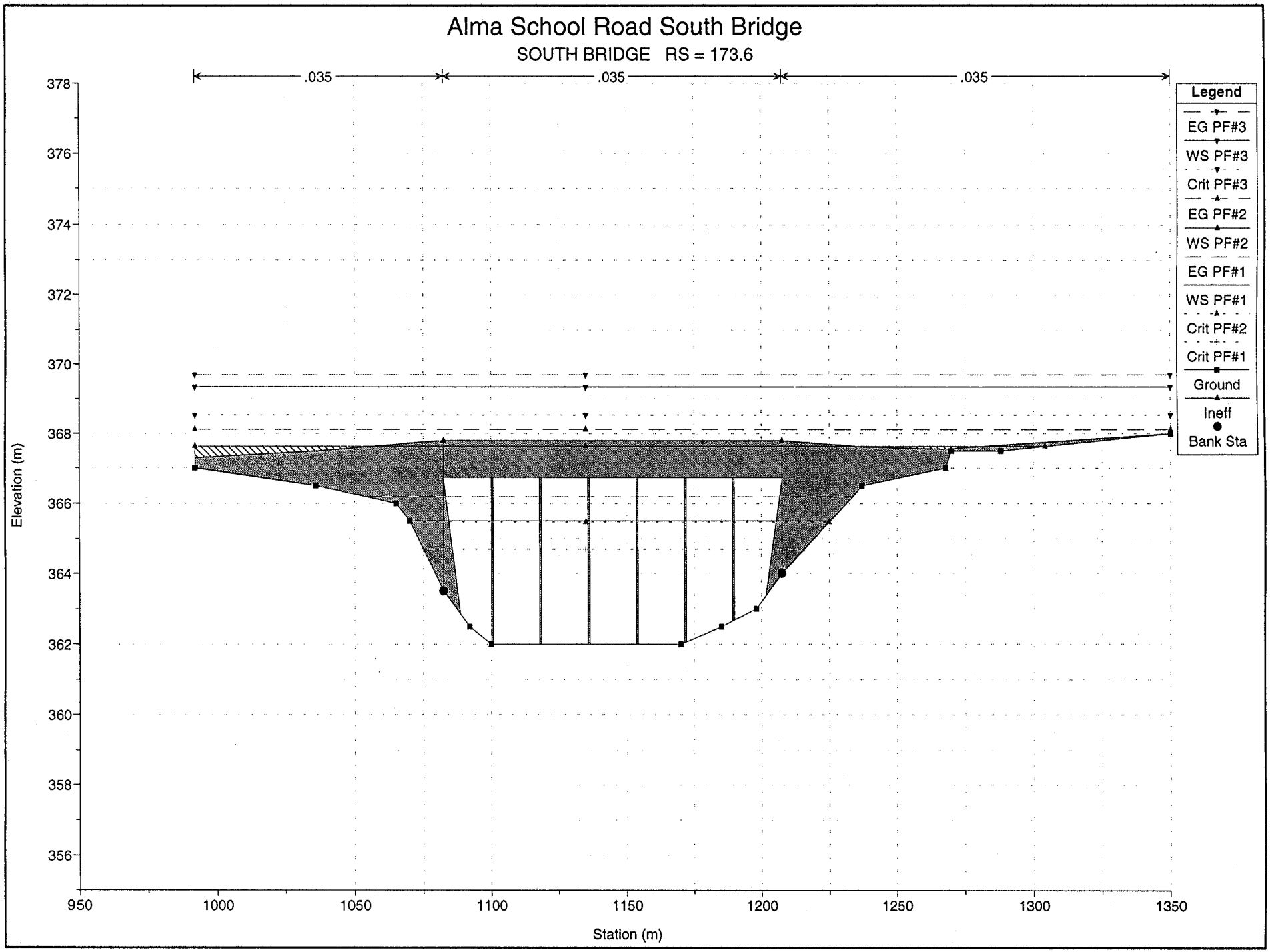
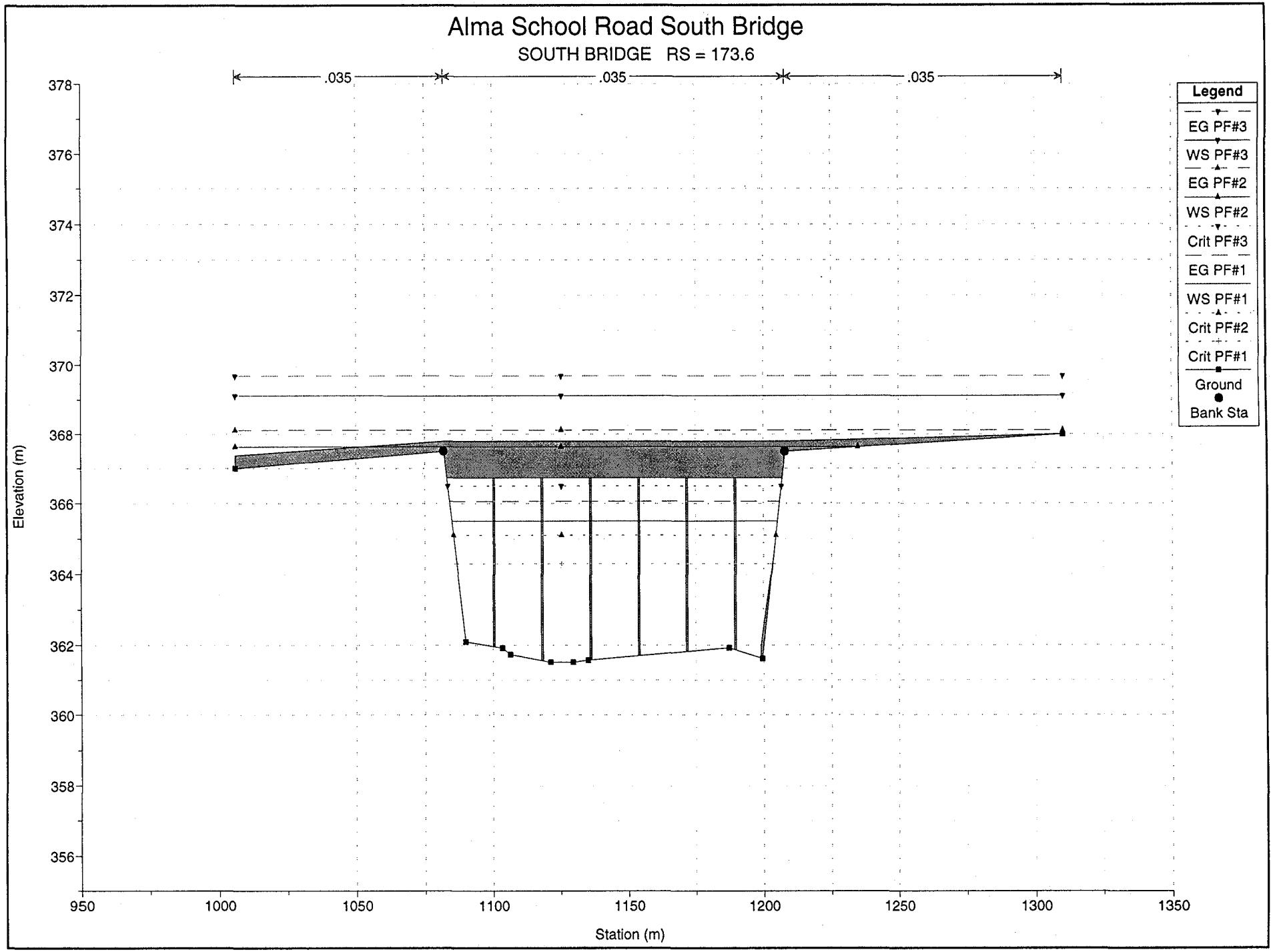
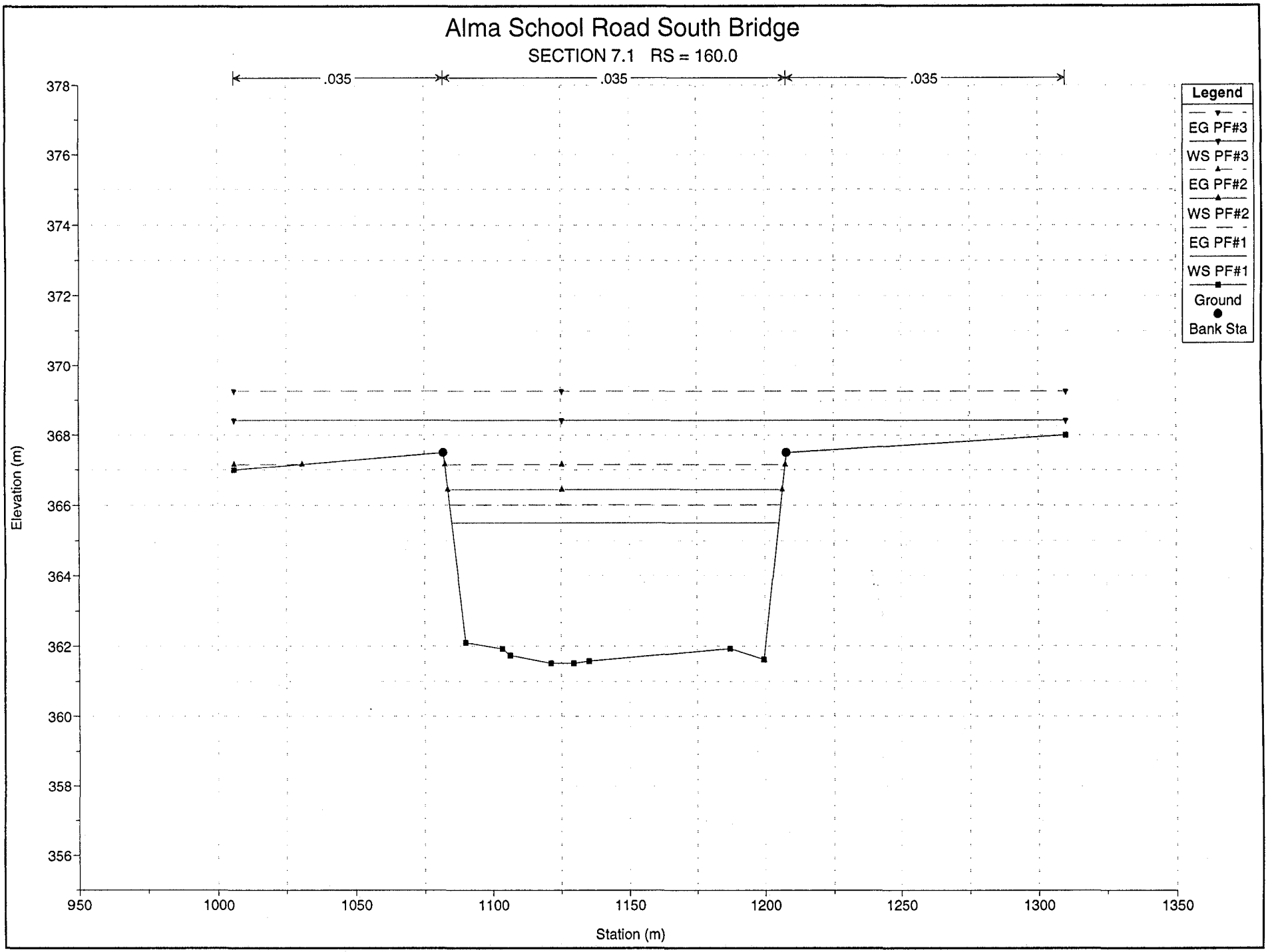
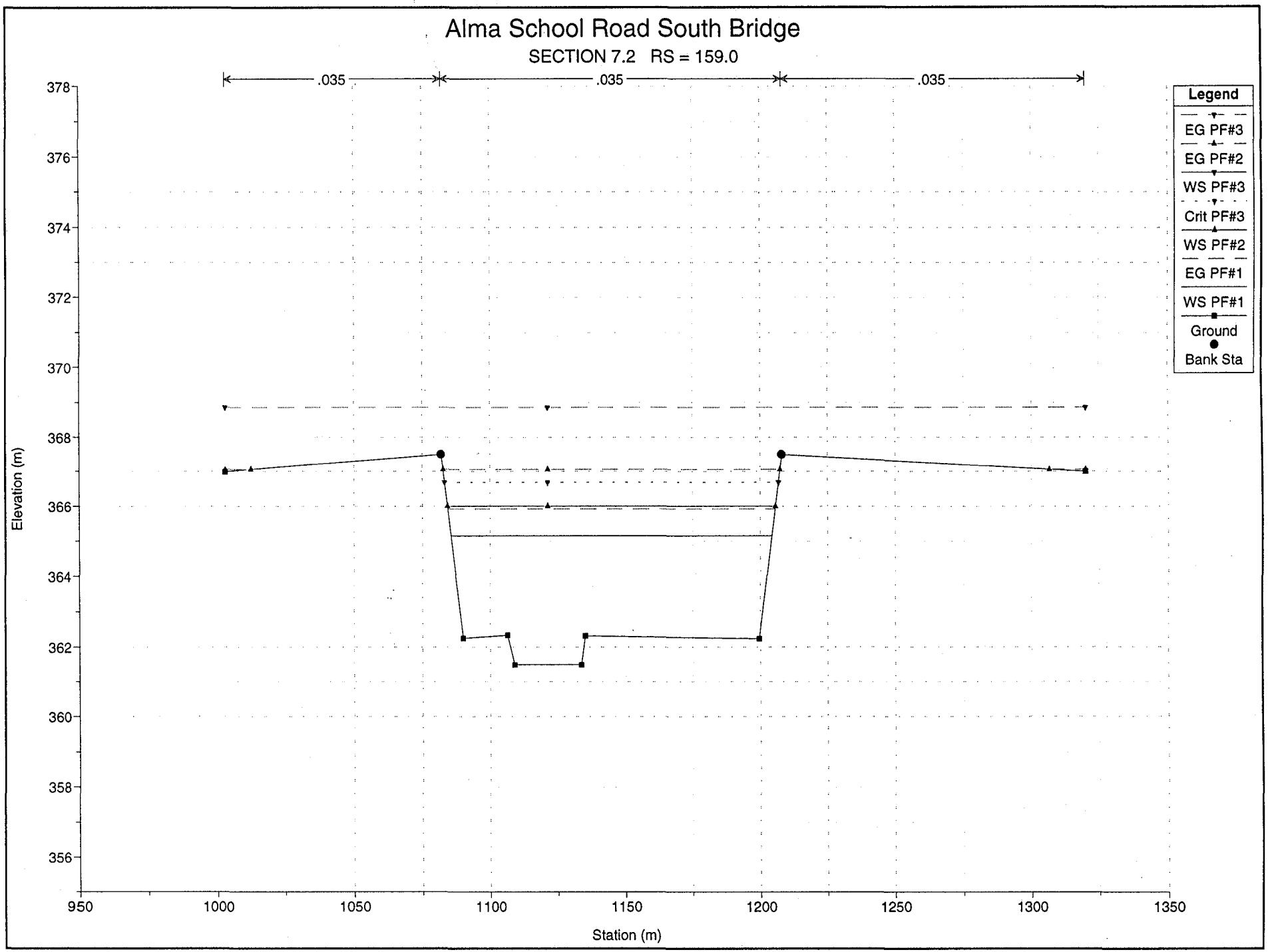
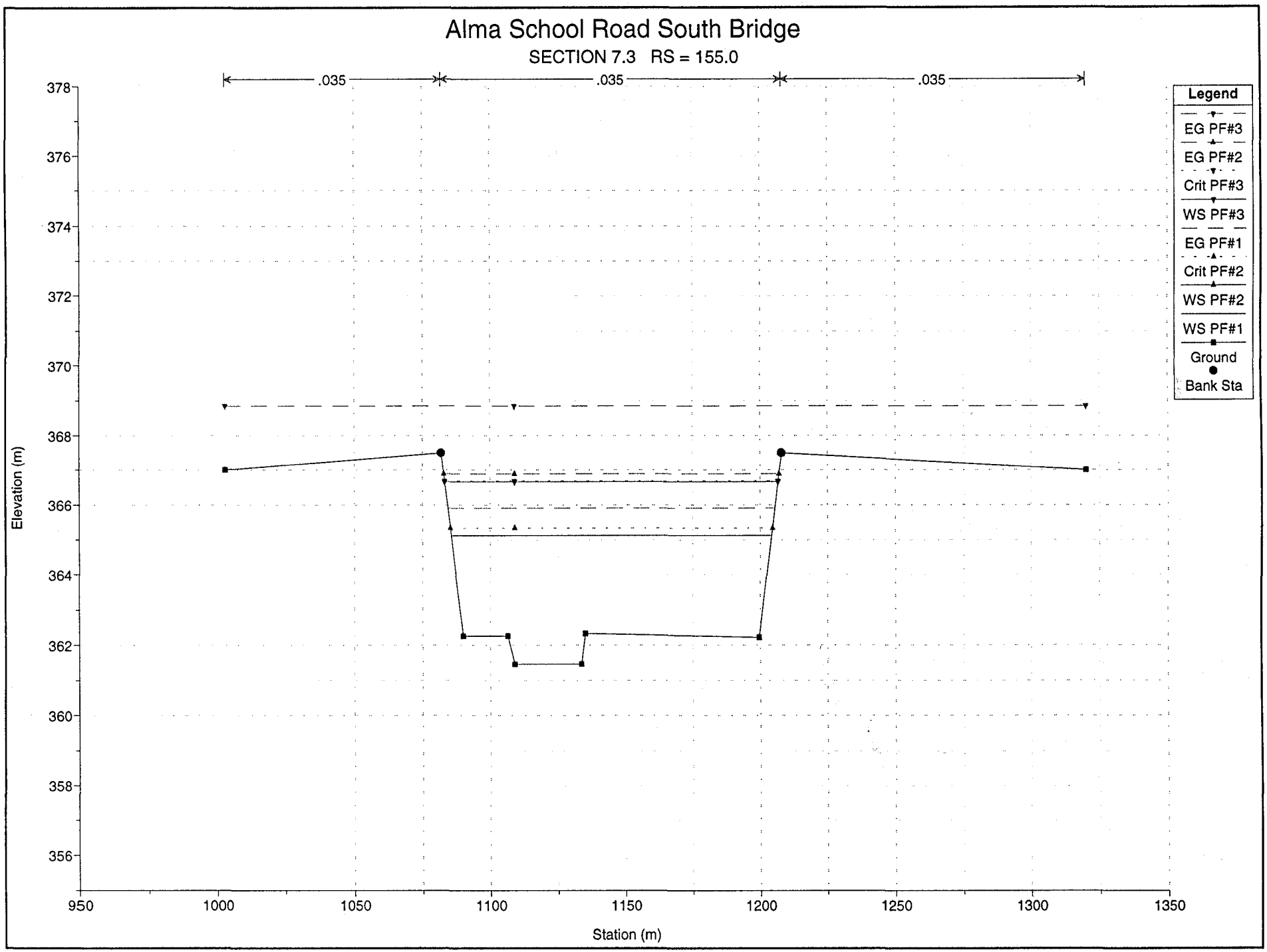
WS PF#2
Crit PF#3
EG PF#1
WS PF#1
Crit PF#2
Crit PF#1
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350

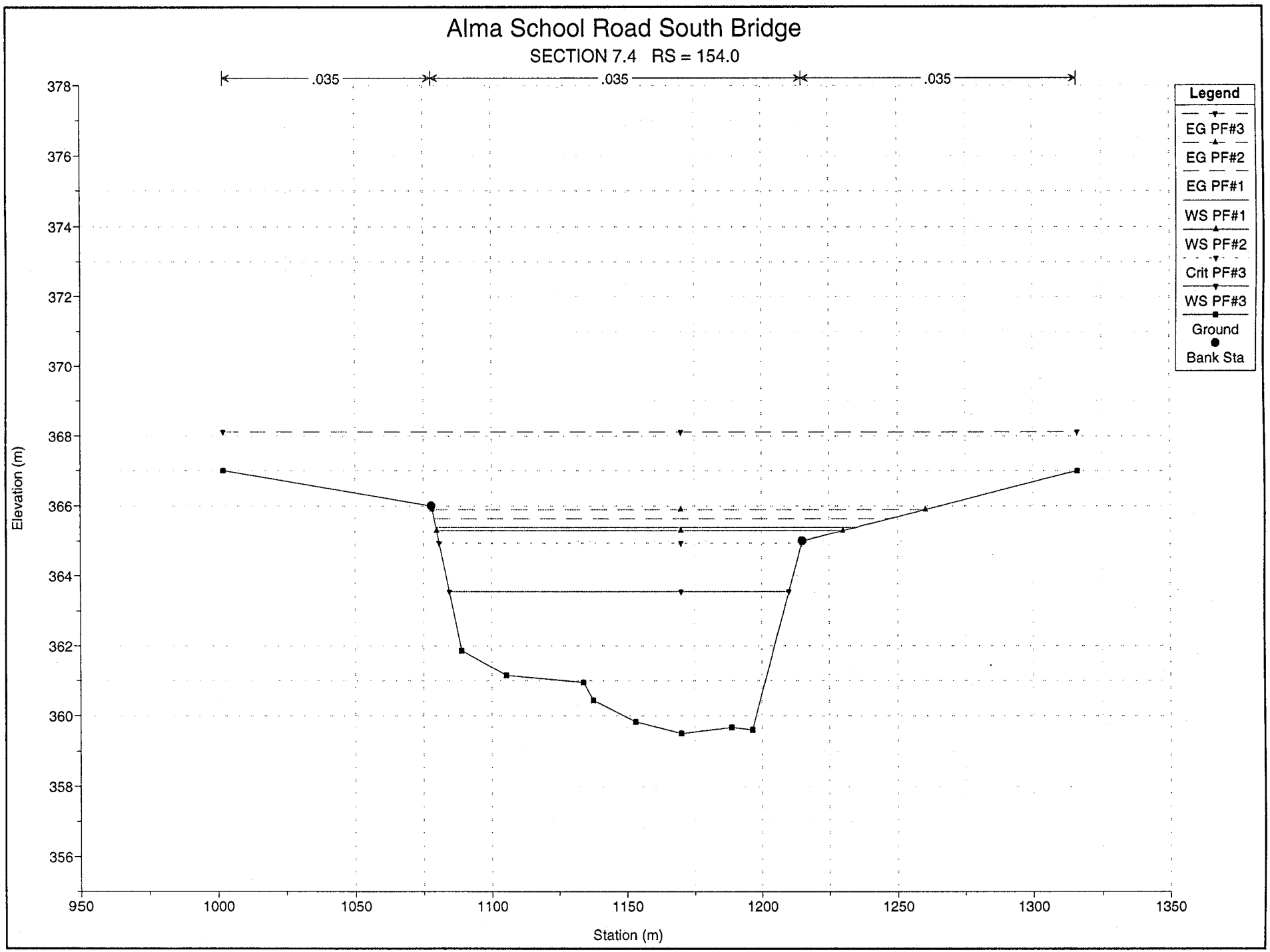

Alma School Road South Bridge
SOUTH BRIDGE RS = 173.6
.035
.035
.035
Legend
EG PF#3
WS PF#3
Crit PF#3
EG PF#2
WS PF#2
EG PF#1
WS PF#1
Crit PF#2
Crit PF#1
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350

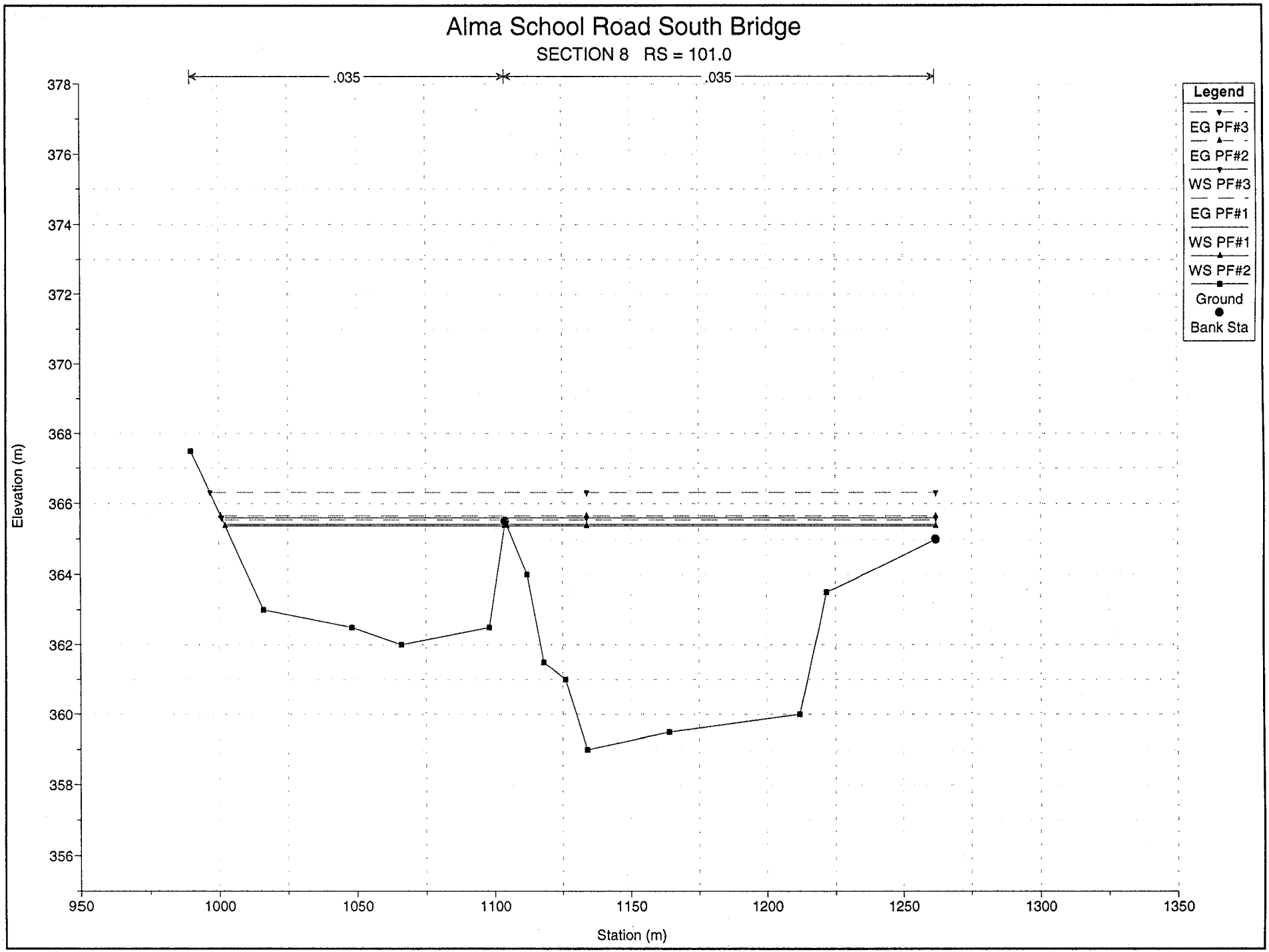

Alma School Road South Bridge
SOUTH BRIDGE RS = 173.6
.035
.035
.035
Legend
EG PF#3
WS PF#3
EG PF#2
WS PF#2
Crit PF#3
EG PF#1
WS PF#1
Crit PF#2
Crit PF#1
Ground
Bank Sta
Elevation (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350
Station (m)

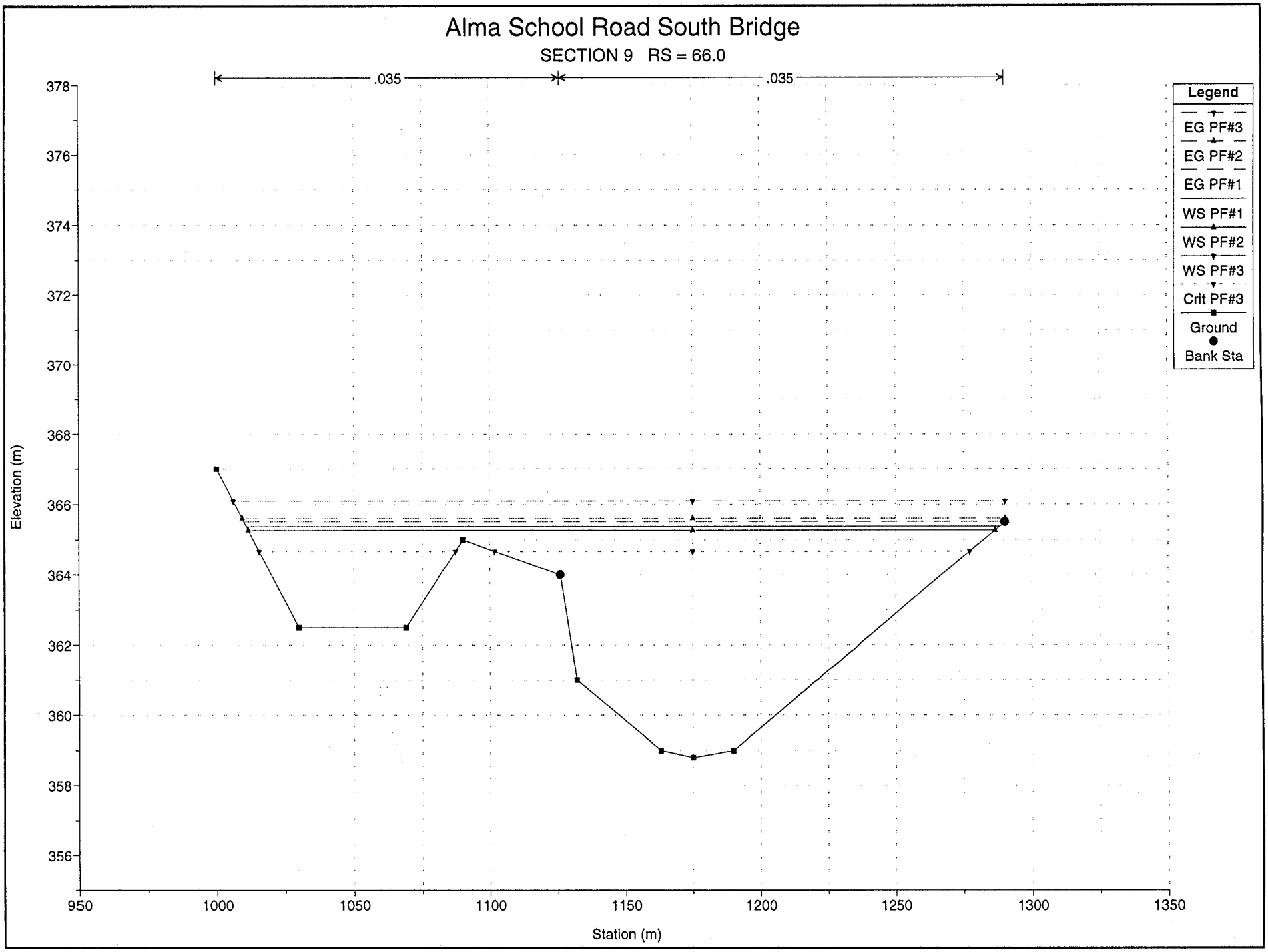

Alma School Road South Bridge
SECTION 7.1 RS = 160.0
.035
.035
.035
Legend
EG PF#3
WS PF#3
EG PF#2
WS PF#2
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350
Station (m)

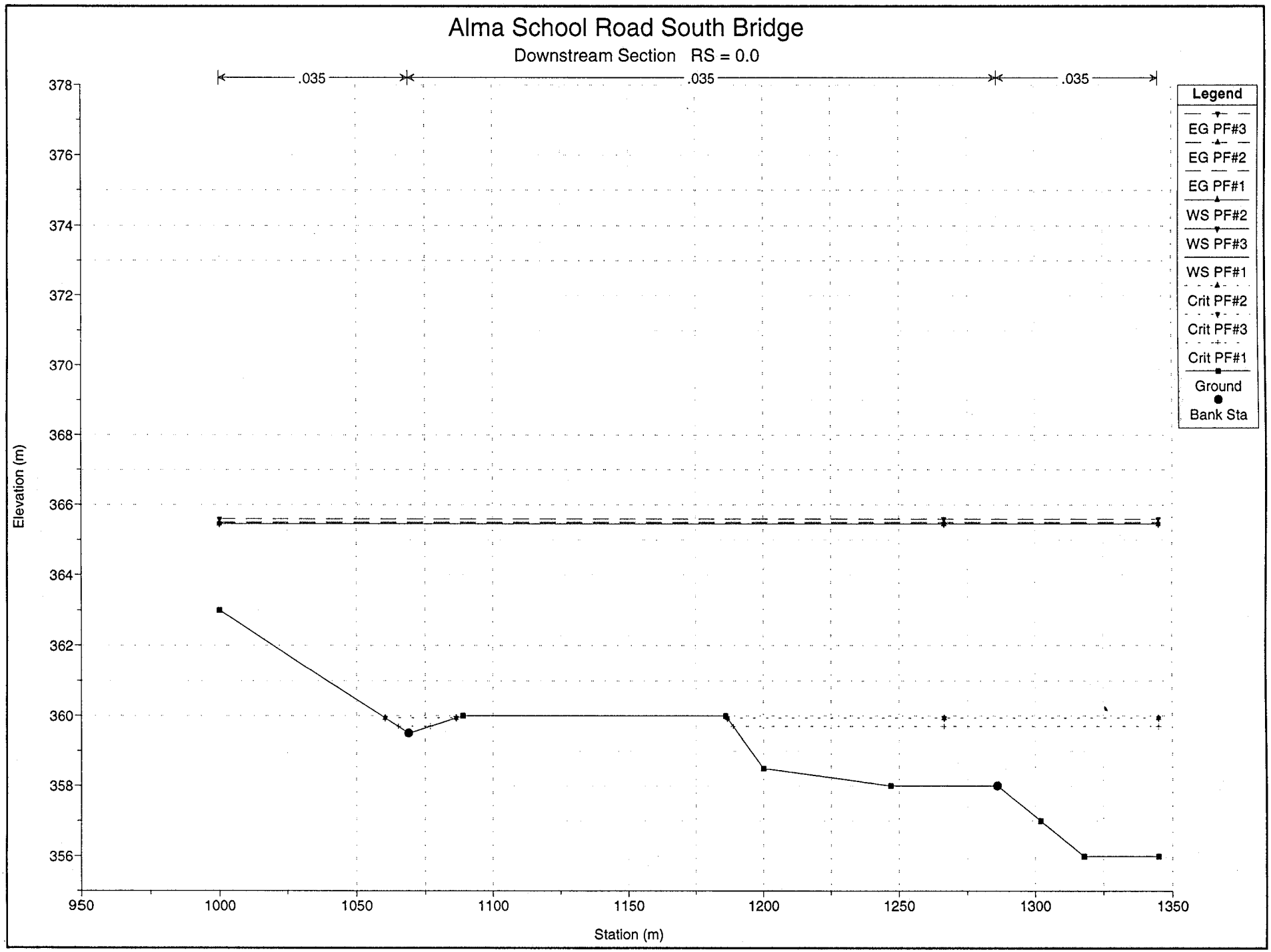

Alma School Road South Bridge
SECTION 7.2 RS = 159.0
.035
.035
.035
Legend
EG PF#3
EG PF#2
WS PF#3
Crit PF#3
WS PF#2
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350


Alma School Road South Bridge
SECTION 7.3 RS = 155.0
.035
.035
.035
Legend
EG PF#3
EG PF#2
Crit PF#3
WS PF#3
EG PF#1
Crit PF#2
WS PF#2
WS PF#1
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350


Alma School Road South Bridge
SECTION 7.4 RS = 154.0
.035
.035
.035
Legend
EG PF#3
EG PF#2
EG PF#1
WS PF#1
WS PF#2
Crit PF#3
WS PF#3
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350


Alma School Road South Bridge
SECTION 8 RS = 101.0
.035
.035
Legend
EG PF#3
EG PF#2
WS PF#3
EG PF#1
WS PF#1
WS PF#2
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350


Alma School Road South Bridge
SECTION 9 RS = 66.0
.035
.035
Legend
EG PF#3
EG PF#2
EG PF#1
WS PF#1
WS PF#2
WS PF#3
Crit PF#3
Ground
Bank Sta
Elevation (m)
Station (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350


Alma School Road South Bridge
Downstream Section RS = 0.0
.035
.035
.035
Legend
EG PF#3
EG PF#2
EG PF#1
WS PF#2
WS PF#3
WS PF#1
Crit PF#2
Crit PF#3
Crit PF#1
Ground
Bank Sta
Elevation (m)
378
376
374
372
370
368
366
364
362
360
358
356
950
1000
1050
1100
1150
1200
1250
1300
1350
Station (m)

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Alma School Road South Bridge
Project File : almasout.prj
Run Date and Time: 8/14/97 10:40:44 AM

Project in SI units

Project Description:
ALMA SCHOOL ROAD SOUTH BRIDGE SCOUR ANALYSIS PROJECT
Dibble & Associates
Consulting Engineers Job: 9632
MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

PLAN DATA

Plan Title: SCOUR ANALYSIS RUN
Plan File : j:\9632\hec\ras\almasout.p02

Geometry Title: NEW MAPPING GEOMETRY (METRIC)
Geometry File : j:\9632\hec\ras\almasout.g02

Flow Title : METRIC: 10-, 100-, 500-Year Flows
Flow File : j:\9632\hec\ras\almasout.f02

Plan Summary Information:
Number of: Cross Sections = 13 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 1

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculaton tolerance = 0.003
Maximum number of interations = 20
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: METRIC: 10-, 100-, 500-Year Flows
Flow File : j:\9632\hec\ras\almasout.f02

Flow Data (m3/s)

River	Reach	RS	PF#1	PF#2	PF#3
SALT RIVER	ALMA SCHOOL RD	376.3	1359	2053	3490

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
SALT RIVER	ALMA SCHOOL RD	PF#1	Normal S = 0.001	Known WS = 365.455
SALT RIVER	ALMA SCHOOL RD	PF#2	Normal S = 0.001	Known WS = 365.455
SALT RIVER	ALMA SCHOOL RD	PF#3	Normal S = 0.001	Known WS = 365.455

GEOMETRY DATA

Geometry Title: NEW MAPPING GEOMETRY (METRIC)
Geometry File : j:\9632\hec\ras\almasout.g02

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 376.3

INPUT
Description: SECTION 1
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1024	363	1028	367	1074	366	1086	364	1175	364
1182	367	1196	366.5	1274	368	1306	376.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1024	.035	1074	.035	1182	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1074	1182	77.8	77.8	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 298.5

INPUT
Description: SECTION 2
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1019	366.5	1078	366.5	1088	364	1166	364	1180	364.5
1216	366	1238	366.5	1282	367				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1019	.035	1078	.035	1238	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1078	1238	7.3	7.3	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 291.2

INPUT
Description: SECTION 3
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1020	366.5	1082	366	1106	364	1166	364	1214	365.5
1220	366.5	1276	367						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1020	.035	1082	.035	1220	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1082	1220	7	7	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 284.2

INPUT
Description: SECTION 4
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1020	366.5	1077	366.5	1088	363.5	1108	362	1130	362
1164	363.5	1211	365	1214	366.5	1274	367		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1020	.035	1077	.035	1214	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1077	1214	41.2	36	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 248.2

INPUT
Description: SECTION 5
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1014	366.5	1030	366.5	1084	366	1106	361	1144	361
1149	362.5	1155	362	1166	362.5	1209	364.5	1224	367

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1014	.035	1084	.035	1209	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1084	1209	47	47	.3	.5

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 201.2

INPUT
Description: SECTION 6
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
992	367	1036	366.5	1065	366	1070	365.5	1082.5	363.5
1092	362.5	1100	362	1170	362	1185	362.5	1198	363
1207.5	364	1237	366.5	1268	367	1270	367.5	1288	367.5
1350	368								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
992	.035	1082.5	.035	1207.5	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1082.5	1207.5	41.2	41.2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
992	1082.5	367.8	1207.5	1350	367.8

BRIDGE RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 173.6

INPUT
Description: SOUTH BRIDGE
Distance from Upstream XS = 14.6
Deck/Roadway Width = 26
Weir Coefficient = 1.44
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 13

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
992	367.3	367	1036	367.5	366.5	1065	367.69	366
1070	367.73	365.5	1082.5	367.8	363.5	1082.5	367.8	366.73
1207.5	367.8	366.73	1207.5	367.8	364	1237	367.62	366.5
1268	367.55	367	1270	367.57	367.5	1288	367.67	367.5
1350	368	368						

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
992	367	1036	366.5	1065	366	1070	365.5	1082.5	363.5
1092	362.5	1100	362	1170	362	1185	362.5	1198	363
1207.5	364	1237	366.5	1268	367	1270	367.5	1288	367.5
1350	368								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
992	.035	1082.5	.035	1207.5	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
1082.5	1207.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
992	1082.5	367.8	1207.5	1350	367.8

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1006	367.38	367	1082.5	367.8	367.5	1082.5	367.8	366.73
1207.5	367.8	366.73	1207.5	367.8	367.5	1310	368	368

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1006	367	1082	367.5	1090	362.1	1103.5	361.92	1106.4	361.74
1121.3	361.52	1129.5	361.52	1135.1	361.58	1187.2	361.93	1199.5	361.62
1208	367.5	1310	368						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1006	.035	1082	.035	1208	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
1082	1208	.3	.5

```
Upstream Embankment side slope                =       2 horiz. to 1.0 vertical
Downstream Embankment side slope              =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =      .95
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Abutments =  2

Abutment Data
Upstream      num=        2
     Sta     Elev      Sta     Elev
  1082.5    366.7     1090      362
Downstream      num=        2
     Sta     Elev      Sta     Elev
  1082.5    366.7     1090      362

Abutment Data
Upstream      num=        2
     Sta     Elev      Sta     Elev
    1199      362   1207.5    366.7
Downstream      num=        2
     Sta     Elev      Sta     Elev
    1199      362   1207.5    366.7

Number of Piers =  6

Pier Data
Pier Station     Upstream= 1100.43    Downstream= 1100.43
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732

Pier Data
Pier Station     Upstream= 1118.26    Downstream= 1118.26
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732

Pier Data
Pier Station     Upstream= 1136.09    Downstream= 1136.09
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.188      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.188      .762 366.732

Pier Data
Pier Station     Upstream= 1153.92    Downstream= 1153.92
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.188      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.188      .762 366.732

Pier Data
Pier Station     Upstream= 1171.75    Downstream= 1171.75
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732

Pier Data
Pier Station     Upstream= 1189.58    Downstream= 1189.58
Upstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732
Downstream      num=        2
    Width    Elev     Width    Elev
    .762 361.798      .762 366.732

Number of Bridge Coefficient Sets =  1
```

Low Flow Methods and Data
Energy
Yarnell KVal = 1.05
Selected Low Flow Methods = Yarnell

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the downstream end
Criteria to check for pressure flow = Upstream water surface

BRIDGE OUTPUT Profile #PF#1
Opening : Bridge #1

			Inside BR US	Inside BR DS
E.G. US. (m)	366.15	Element		
W.S. US. (m)	365.58	E.G. Elev (m)	366.19	366.06
Q Total (m3/s)	1359.00	W.S. Elev (m)	365.50	365.50
Q Bridge (m3/s)	1359.00	Crit W.S. (m)	364.70	364.31
Q Weir (m3/s)		Max Chl Dpth (m)	3.50	3.98
Weir Sta Lft (m)		Vel Total (m/s)	3.67	3.30
Weir Sta Rgt (m)		Flow Area (m2)	370.07	411.94
Weir Submerg		Froude # Chl	0.67	0.56
Weir Max Depth (m)		Specif Force (m3)	1115.73	1217.69
Min Top Rd (m)	367.80	Hydr Depth (m)	3.12	3.56
Min El Prs (m)	366.73	W.P. Total (m)	161.80	162.94
Delta EG (m)	0.14	Conv. Total (m3/s)	18354.8	21842.5
Delta WS (m)	0.08	Top Width (m)	118.52	115.58
BR Open Area (m2)	513.03	Frctn Loss (m)		
BR Open Vel (m/s)	3.67	C & E Loss (m)		
Coef of Q		Shear Total (N/m2)	122.96	95.97
Br Sel Mthd	Yarnell	Power Total (N/m s)	451.55	316.62

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

BRIDGE OUTPUT Profile #PF#2
Opening : Bridge #1

			Inside BR US	Inside BR DS
E.G. US. (m)	368.12	Element		
W.S. US. (m)	367.63	E.G. Elev (m)	368.12	368.12
Q Total (m3/s)	2053.00	W.S. Elev (m)	367.63	367.63
Q Bridge (m3/s)	1908.14	Crit W.S. (m)	365.47	365.10
Q Weir (m3/s)	144.86	Max Chl Dpth (m)	5.63	6.11
Weir Sta Lft (m)	992.00	Vel Total (m/s)	4.00	3.65
Weir Sta Rgt (m)	1350.00	Flow Area (m2)	513.03	561.84
Weir Submerg	0.00	Froude # Chl	0.56	0.50
Weir Max Depth (m)	0.82	Specif Force (m3)	2444.54	2625.20
Min Top Rd (m)	367.80	Hydr Depth (m)		12.27
Min El Prs (m)	366.73	W.P. Total (m)	300.95	350.11
Delta EG (m)	0.95	Conv. Total (m3/s)	20917.6	23801.4
Delta WS (m)	1.19	Top Width (m)		45.79
BR Open Area (m2)	513.03	Frctn Loss (m)		
BR Open Vel (m/s)	3.72	C & E Loss (m)		
Coef of Q		Shear Total (N/m2)	161.04	117.09
Br Sel Mthd	Press/Weir	Power Total (N/m s)	644.42	427.84

Note - The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
Note - For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The selected bridge modeling method does not compute answers inside the bridge.

BRIDGE OUTPUT Profile #PF#3
Opening : Bridge #1

			Inside BR US	Inside BR DS
E.G. US. (m)	369.69	Element		
W.S. US. (m)	369.34	E.G. Elev (m)	369.69	369.69

Q Total (m3/s)	3490.00	W.S. Elev (m)	369.34	369.11
Q Bridge (m3/s)	2045.38	Crit W.S. (m)	368.53	366.49
Q Weir (m3/s)	1444.62	Max Chl Dpth (m)	7.34	7.59
Weir Sta Lft (m)	992.00	Vel Total (m/s)	3.17	3.63
Weir Sta Rgt (m)	1350.00	Flow Area (m2)	1099.67	961.50
Weir Submerg	0.36	Froude # Chl	0.39	0.44
Weir Max Depth (m)	2.39	Specif Force (m3)	4098.20	4250.16
Min Top Rd (m)	367.80	Hydr Depth (m)	3.07	3.16
Min El Prs (m)	366.73	W.P. Total (m)	662.33	610.91
Delta EG (m)	0.42	Conv. Total (m3/s)	44076.1	37442.2
Delta WS (m)	0.92	Top Width (m)	358.00	304.00
BR Open Area (m2)	513.03	Frctn Loss (m)		
BR Open Vel (m/s)	3.99	C & E Loss (m)		
Coef of Q		Shear Total (N/m2)	102.08	134.09
Br Sel Mthd	Press/Weir	Power Total (N/m s)	323.97	486.73

Note - Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The
Yarnell answer has been disregarded.
Note - Momentum answer is not valid if the water surface is above the low chord or if there is weir flow.
The momentum answer has been disregarded.
Note - The downstream water surface is above the minimum elevation for pressure flow. The orifice
equations were used for pressure flow.
Warning - The parabolic search method failed to converge on critical depth. The program will try the
cross section slice/secant method to find critical depth.
Note - For the cross section inside the bridge at the upstream end, the water surface and energy have
been projected from the upstream cross section. The selected bridge modeling method does
not compute answers inside the bridge.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.
Note - For the cross section inside the bridge at the downstream end, the water surface is based on
critical depth over the weir. The energy has been projected.

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 160.0

INPUT
Description: SECTION 7.1
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1006	367	1082	367.5	1090	362.1	1103.5	361.92	1106.4	361.74
1121.3	361.52	1129.5	361.52	1135.1	361.58	1187.2	361.93	1199.5	361.62
1208	367.5	1310	368						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1006	.035	1082	.035	1208	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1082	1208	1	1	.3	.5

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 159.0

INPUT
Description: SECTION 7.2
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1003	367	1082	367.5	1090	362.25	1106.4	362.34	1109	361.49
1133.6	361.49	1135.1	362.32	1199.5	362.24	1208	367.5	1320	367

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1003	.035	1082	.035	1208	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1082	1208	4	4	.3	.5

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 155.0

INPUT
Description: SECTION 7.3
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1003	367	1082	367.5	1090	362.26	1106.4	362.26	1109	361.46
1133.6	361.47	1135.1	362.33	1199.5	362.22	1208	367.5	1320	367

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1003	.035	1082	.035	1208	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.

1082	1208	1	1	1	.3	.5

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 154.0

INPUT
Description: SECTION 7.4
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1002	367	1078	366	1089	361.87	1105.4	361.15	1134	360.95
1137.7	360.44	1153.2	359.83	1170	359.5	1188.6	359.67	1196.4	359.6
1215	365	1316	367						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1002	.035	1078	.035	1215	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1078	1215	57	53	35	.3	.5

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 101.0

INPUT
Description: SECTION 8
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
990	367.5	1016	363	1048	362.5	1066	362	1098	362.5
1104	365.5	1112	364	1118	361.5	1126	361	1134	359
1164	359.5	1212	360	1222	363.5	1262	365		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
990	.035	1104	.035	1262	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1104	1262	30	35	32	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 66.0

INPUT
Description: SECTION 9
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	367	1030	362.5	1069	362.5	1090	365	1126	364
1132	361	1163	359	1175	358.8	1190	359	1290	365.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.035	1126	.035	1290	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1126	1290	60	66	63	.1	.3

CROSS SECTION RIVER: SALT RIVER
REACH: ALMA SCHOOL RD RS: 0.0

INPUT
Description: Downstream Section
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	363	1069	359.5	1089	360	1186	360	1200	358.5
1247	358	1286	358	1302	357	1318	356	1345	356

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.035	1069	.035	1286	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
1069	1286	.1	.3

SUMMARY OF MANNING'S N VALUES

River:SALT RIVER

Reach	River Sta.	n1	n2	n3
ALMA SCHOOL RD	376.3	.035	.035	.035
ALMA SCHOOL RD	298.5	.035	.035	.035
ALMA SCHOOL RD	291.2	.035	.035	.035
ALMA SCHOOL RD	284.2	.035	.035	.035

ALMA SCHOOL RD	248.2	.035	.035	.035
ALMA SCHOOL RD	201.2	.035	.035	.035
ALMA SCHOOL RD	173.6	Bridge		
ALMA SCHOOL RD	160.0	.035	.035	.035
ALMA SCHOOL RD	159.0	.035	.035	.035
ALMA SCHOOL RD	155.0	.035	.035	.035
ALMA SCHOOL RD	154.0	.035	.035	.035
ALMA SCHOOL RD	101.0	.035	.035	.035
ALMA SCHOOL RD	66.0	.035	.035	.035
ALMA SCHOOL RD	0.0	.035	.035	.035

SUMMARY OF REACH LENGTHS

River: SALT RIVER

Reach	River Sta.	Left	Channel	Right
ALMA SCHOOL RD	376.3	77.8	77.8	77.8
ALMA SCHOOL RD	298.5	7.3	7.3	7.3
ALMA SCHOOL RD	291.2	7	7	7
ALMA SCHOOL RD	284.2	41.2	36	30
ALMA SCHOOL RD	248.2	47	47	47
ALMA SCHOOL RD	201.2	41.2	41.2	41.2
ALMA SCHOOL RD	173.6	Bridge		
ALMA SCHOOL RD	160.0	1	1	1
ALMA SCHOOL RD	159.0	4	4	4
ALMA SCHOOL RD	155.0	1	1	1
ALMA SCHOOL RD	154.0	57	53	35
ALMA SCHOOL RD	101.0	30	35	32
ALMA SCHOOL RD	66.0	60	66	63
ALMA SCHOOL RD	0.0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: SALT RIVER

Reach	River Sta.	Contr.	Expan.
ALMA SCHOOL RD	376.3	.1	.3
ALMA SCHOOL RD	298.5	.1	.3
ALMA SCHOOL RD	291.2	.1	.3
ALMA SCHOOL RD	284.2	.1	.3
ALMA SCHOOL RD	248.2	.3	.5
ALMA SCHOOL RD	201.2	.3	.5
ALMA SCHOOL RD	173.6	Bridge	
ALMA SCHOOL RD	160.0	.3	.5
ALMA SCHOOL RD	159.0	.3	.5
ALMA SCHOOL RD	155.0	.3	.5
ALMA SCHOOL RD	154.0	.3	.5
ALMA SCHOOL RD	101.0	.1	.3
ALMA SCHOOL RD	66.0	.1	.3
ALMA SCHOOL RD	0.0	.1	.3

HEC-RAS Plan: NEW GEOM. River: SALT RIVER Reach: ALMA SCHOOL RD

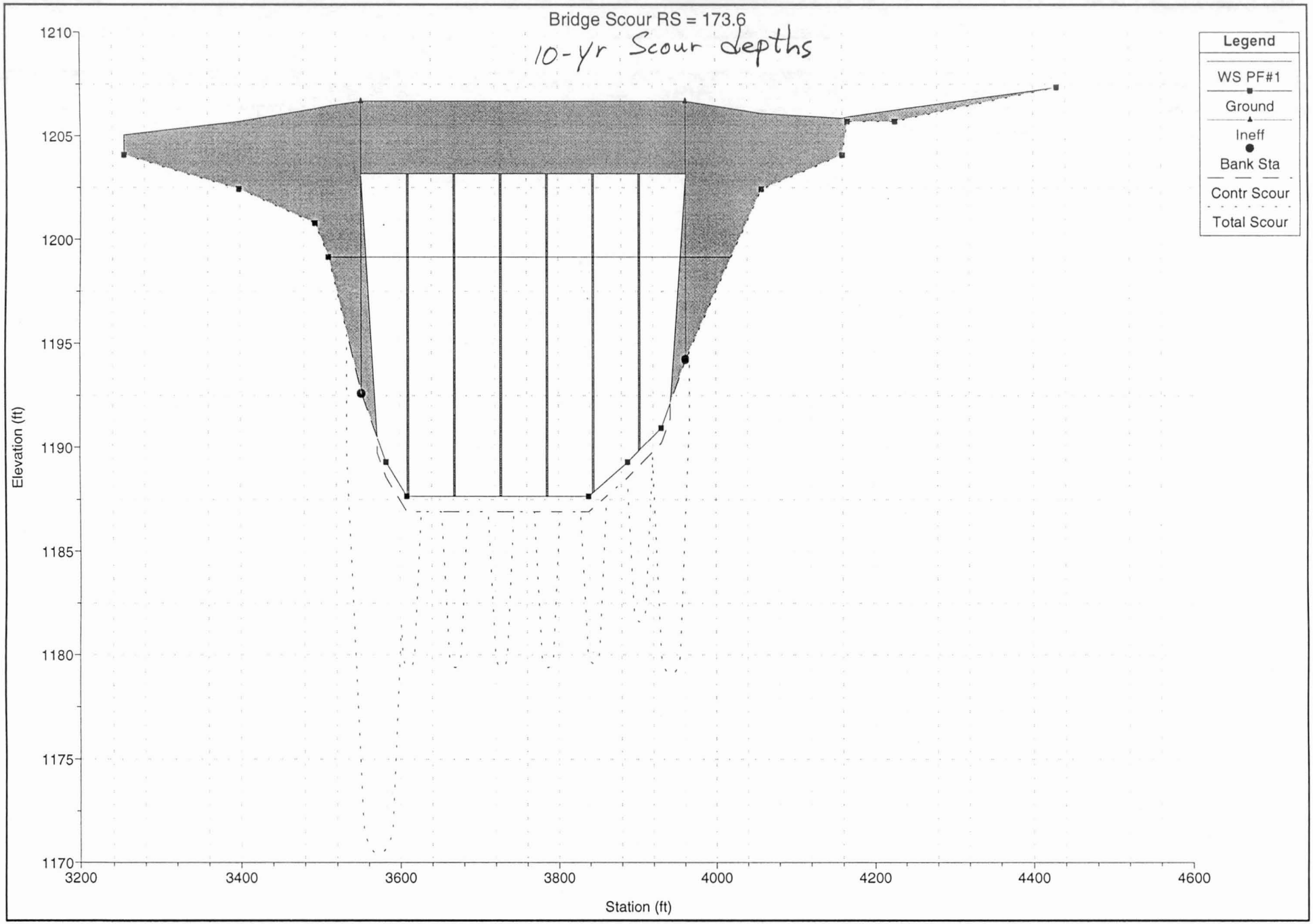
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
ALMA SCHOOL RD	376.3	1359.00	364.00	367.41		368.02	0.003424	3.61	426.91	219.07	0.64
ALMA SCHOOL RD	376.3	2053.00	364.00	367.95	367.67	368.81	0.004056	4.36	554.06	247.43	0.72
ALMA SCHOOL RD	376.3	3490.00	364.00	369.37		370.24	0.002886	4.56	911.90	255.15	0.64
ALMA SCHOOL RD	298.5	1359.00	364.00	367.24		367.71	0.003485	3.14	471.81	263.00	0.63
ALMA SCHOOL RD	298.5	2053.00	364.00	367.85		368.45	0.003414	3.59	632.28	263.00	0.64
ALMA SCHOOL RD	298.5	3490.00	364.00	369.34		369.97	0.002201	3.73	1025.65	263.00	0.55
ALMA SCHOOL RD	291.2	1359.00	364.00	366.80	366.80	367.64	0.007045	4.14	352.87	233.32	0.88
ALMA SCHOOL RD	291.2	2053.00	364.00	367.59		368.40	0.004824	4.19	553.54	256.00	0.76
ALMA SCHOOL RD	291.2	3490.00	364.00	369.24		369.95	0.002471	3.99	976.89	256.00	0.59
ALMA SCHOOL RD	284.2	1359.00	362.00	364.68	365.49	367.35	0.034480	7.24	187.58	117.28	1.83
ALMA SCHOOL RD	284.2	2053.00	362.00	367.82		368.27	0.001619	3.09	746.30	254.00	0.47
ALMA SCHOOL RD	284.2	3490.00	362.00	369.34		369.89	0.001399	3.49	1132.63	254.00	0.46
ALMA SCHOOL RD	248.2	1359.00	361.00	365.71		366.29	0.002928	3.37	405.83	130.97	0.60
ALMA SCHOOL RD	248.2	2053.00	361.00	367.82		368.20	0.001060	2.82	802.85	210.00	0.39
ALMA SCHOOL RD	248.2	3490.00	361.00	369.28		369.84	0.001185	3.51	1107.67	210.00	0.43
ALMA SCHOOL RD	201.2	1359.00	362.00	365.58	364.61	366.15	0.002796	3.33	408.67	156.97	0.59
ALMA SCHOOL RD	201.2	2053.00	362.00	367.63	365.32	368.12	0.001261	3.09	664.66	312.11	0.43
ALMA SCHOOL RD	201.2	3490.00	362.00	369.34	366.61	369.69	0.000769	2.91	1496.97	358.00	0.35
ALMA SCHOOL RD	173.6	Bridge									
ALMA SCHOOL RD	160.0	1359.00	361.52	365.50		366.01	0.002276	3.15	430.88	120.15	0.53
ALMA SCHOOL RD	160.0	2053.00	361.52	366.44		367.16	0.002465	3.77	544.67	122.89	0.57
ALMA SCHOOL RD	160.0	3490.00	361.52	368.42		369.26	0.001899	4.17	950.20	304.00	0.53
ALMA SCHOOL RD	159.0	1359.00	361.49	365.15		365.93	0.004534	3.90	348.40	118.62	0.73
ALMA SCHOOL RD	159.0	2053.00	361.49	366.00		367.06	0.004549	4.56	450.45	121.29	0.75
ALMA SCHOOL RD	159.0	3490.00	361.49	366.69	366.69	368.86	0.007635	6.53	534.55	123.45	1.00
ALMA SCHOOL RD	155.0	1359.00	361.46	365.12		365.91	0.004621	3.92	346.29	118.53	0.73
ALMA SCHOOL RD	155.0	2053.00	361.46	365.34	365.34	366.89	0.008367	5.52	372.18	119.22	1.00
ALMA SCHOOL RD	155.0	3490.00	361.46	366.66	366.68	368.85	0.007717	6.55	532.66	123.37	1.01
ALMA SCHOOL RD	154.0	1359.00	359.50	365.38		365.64	0.000833	2.23	612.51	154.72	0.34
ALMA SCHOOL RD	154.0	2053.00	359.50	365.29		365.90	0.002030	3.44	598.71	149.90	0.52
ALMA SCHOOL RD	154.0	3490.00	359.50	363.55	364.94	368.12	0.026355	9.47	368.63	125.48	1.76

HEC-RAS Plan: NEW GEOM. River: SALT RIVER Reach: ALMA SCHOOL RD (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
ALMA SCHOOL RD	101.0	1359.00	359.00	365.42		365.54	0.000503	1.61	907.73	259.36	0.26
ALMA SCHOOL RD	101.0	2053.00	359.00	365.37		365.65	0.001191	2.47	896.50	258.79	0.39
ALMA SCHOOL RD	101.0	3490.00	359.00	365.60		366.31	0.002830	3.94	955.35	261.03	0.61
ALMA SCHOOL RD	66.0	1359.00	358.80	365.38		365.52	0.000548	1.72	878.40	277.37	0.27
ALMA SCHOOL RD	66.0	2053.00	358.80	365.27		365.60	0.001376	2.69	847.60	274.91	0.43
ALMA SCHOOL RD	66.0	3490.00	358.80	364.67	364.67	366.10	0.006517	5.51	689.76	247.17	0.91
ALMA SCHOOL RD	0.0	1359.00	358.00	365.46	359.70	365.48	0.000041	0.62	2175.72	345.00	0.08
ALMA SCHOOL RD	0.0	2053.00	358.00	365.46	359.94	365.50	0.000094	0.94	2175.72	345.00	0.12
ALMA SCHOOL RD	0.0	3490.00	358.00	365.46	359.94	365.59	0.000272	1.60	2175.72	345.00	0.20

HEC-RAS Plan: NEW GEOM. River: SALT RIVER Reach: ALMA SCHOOL RD

Reach	River Sta	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
		(m)	(m)	(m)	(m)	(m)	(m)	(m3/s)	(m3/s)	(m3/s)	(m/s)
ALMA SCHOOL RD	248.2	366.29	365.71		0.13	0.01	130.97		1354.20	4.80	3.37
ALMA SCHOOL RD	248.2	368.20	367.82		0.05	0.03	210.00	128.69	1879.31	45.00	2.82
ALMA SCHOOL RD	248.2	369.84	369.28		0.04	0.11	210.00	411.23	2970.01	108.76	3.51
ALMA SCHOOL RD	201.2	366.15	365.58	364.61			156.97		1359.00		3.33
ALMA SCHOOL RD	201.2	368.12	367.63	365.32			312.11		2053.00		3.09
ALMA SCHOOL RD	201.2	369.69	369.34	366.61			358.00	467.93	2551.98	470.10	2.91
ALMA SCHOOL RD	173.6 BR U	366.19	365.50	364.70			118.52		1359.00		3.67
ALMA SCHOOL RD	173.6 BR U	368.12	367.63	365.47					2053.00		4.00
ALMA SCHOOL RD	173.6 BR U	369.69	369.34	368.53			358.00	542.25	2234.87	712.88	3.17
ALMA SCHOOL RD	173.6 BR D	366.06	365.50	364.31			115.58		1359.00		3.30
ALMA SCHOOL RD	173.6 BR D	368.12	367.63	365.10			45.79	3.55	2049.45		3.69
ALMA SCHOOL RD	173.6 BR D	369.69	369.11	366.49			304.00	403.40	2714.26	372.34	3.76
ALMA SCHOOL RD	160.0	366.01	365.50		0.00	0.08	120.15		1359.00		3.15
ALMA SCHOOL RD	160.0	367.16	366.44		0.00	0.10	122.89		2053.00		3.77
ALMA SCHOOL RD	160.0	369.26	368.42		0.00	0.40	304.00	121.57	3303.31	65.13	4.17
ALMA SCHOOL RD	159.0	365.93	365.15		0.02	0.00	118.62		1359.00		3.90
ALMA SCHOOL RD	159.0	367.06	366.00		0.02	0.15	121.29		2053.00		4.56
ALMA SCHOOL RD	159.0	368.86	366.69	366.69	0.03	0.01	123.45		3490.00		6.53


Bridge Scour RS = 173.6
10-yr Scour Depths
Legend
WS PF#1
Ground
Ineff
Bank Sta
Contr Scour
Total Scour
Elevation (ft)
1210
1205
1200
1195
1190
1185
1180
1175
1170
3200
3400
3600
3800
4000
4200
4400
4600
Station (ft)

HEC-RAS 10-Yr Scour depths

Contraction Scour

	Left	Channel	Right
Ys (ft):		0.74	
Vc (ft/s):		4.00	
Equation:	Default	Live	Default

Pier Scour

All Piers:	Ys (ft):	7.54
	Froude #:	0.59
	Equation:	CSU equation

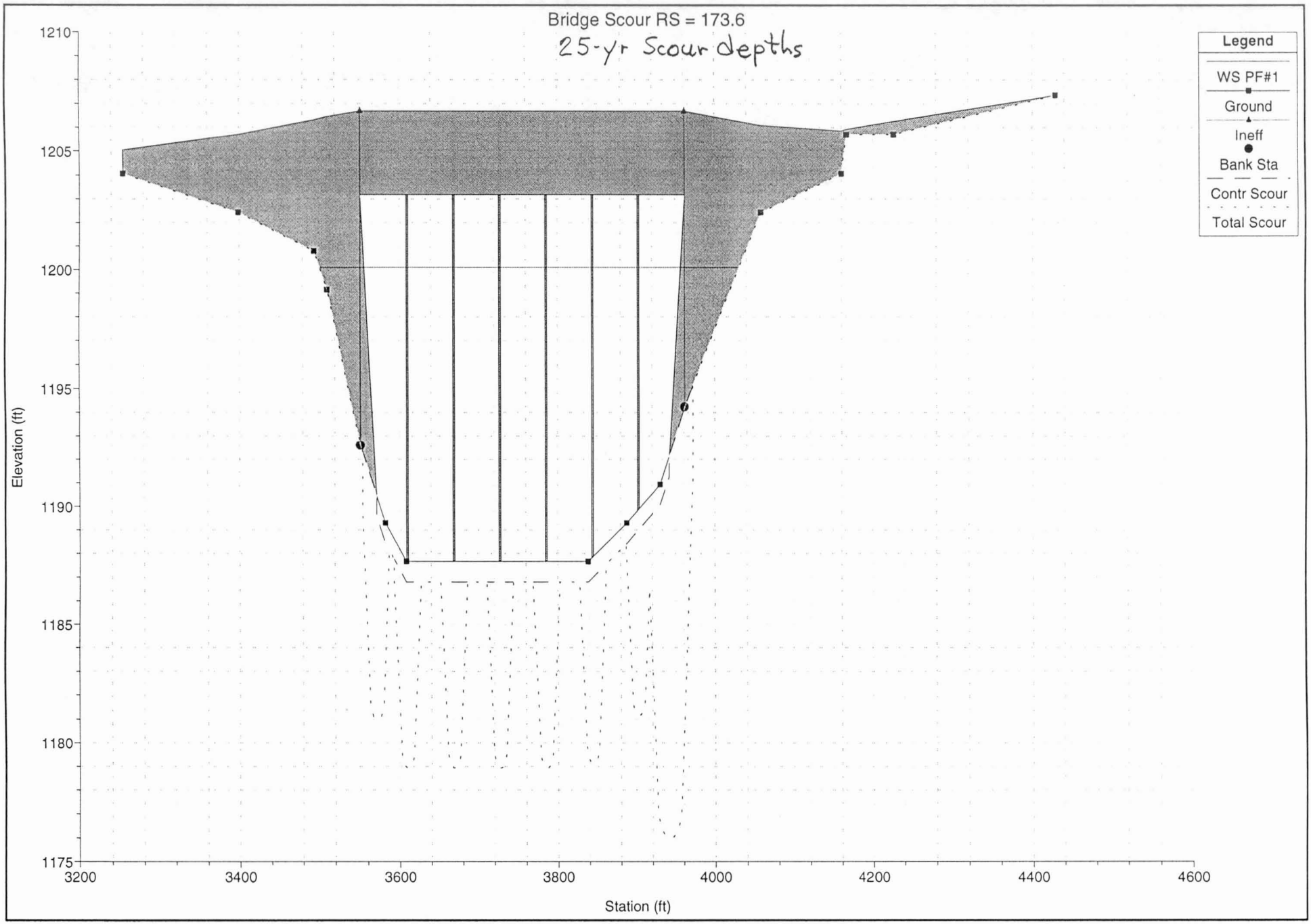
Abutment Scour

	Left	Right
Abutment Ys (ft):	19.30	12.33
Ve=	7.08	5.61
Froude #:	0.52	0.67
Equation:	Froehlich	Froehlich

Combined Scour Depths

Pier Scour + Contraction Scour (ft):

Channel:	8.28
Left abut + contr (ft):	20.04
Right abut + contr (ft):	13.07


Bridge Scour RS = 173.6
25-yr Scour depths
Legend
WS PF#1
Ground
Ineff
Bank Sta
Contr Scour
Total Scour
Elevation (ft)
1210
1205
1200
1195
1190
1185
1180
1175
3200
3400
3600
3800
4000
4200
4400
4600
Station (ft)

HEC-RAS 25-Yr Scour depths

Contraction Scour

	Left	Channel	Right
Ys (ft):		0.87	
Vc (ft/s):		4.05	
Equation:	Default	Live	Default

Pier Scour

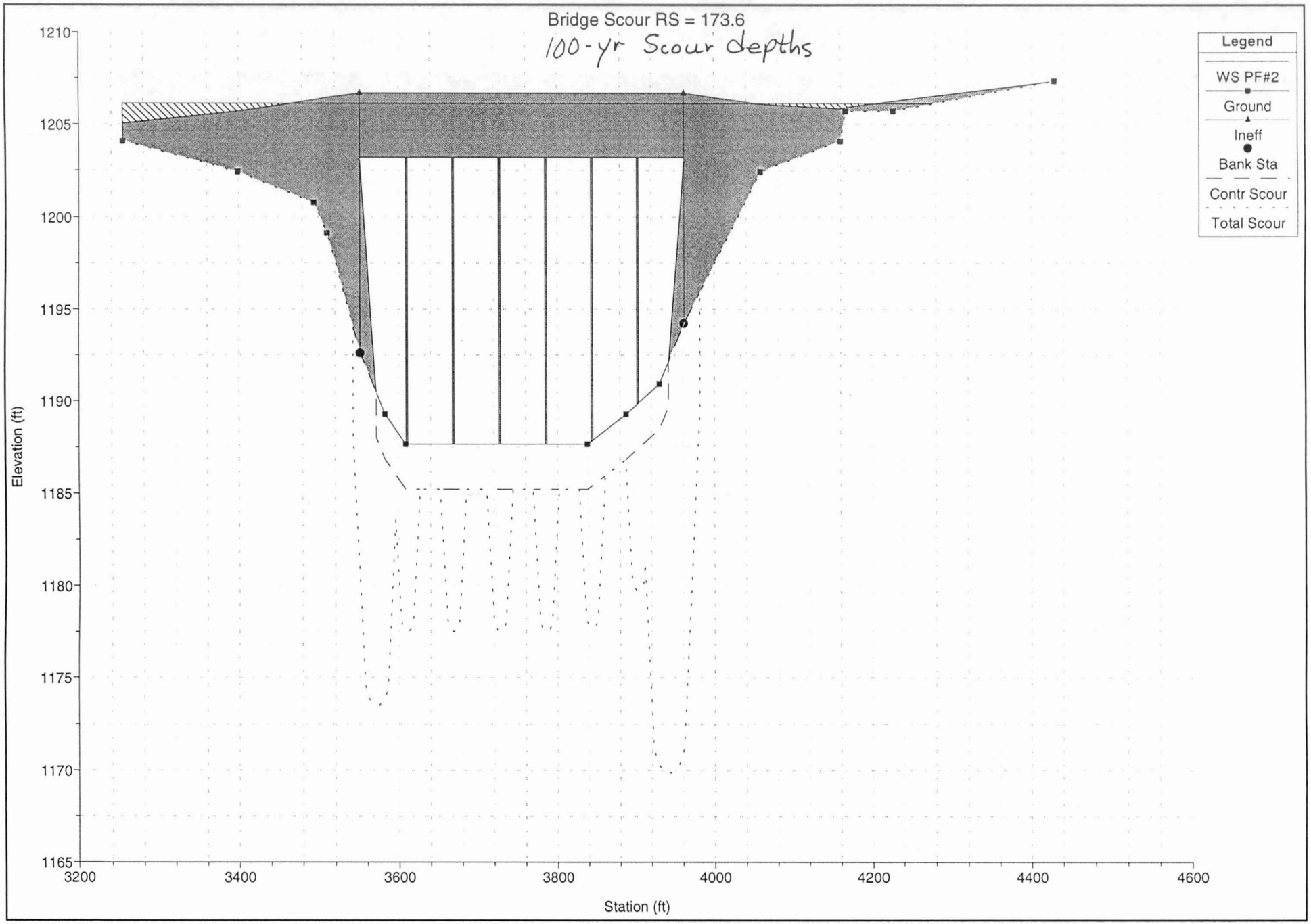
All Piers:	Ys (ft):	7.86
	Froude #:	0.61
	Equation:	CSU equation

Abutment Scour

	Left	Right
Abutment Ys (ft):	8.63	15.28
Ve=	7.64	6.28
Froude #:	1.83	0.65
Equation:	Froehlich	Froehlich

Combined Scour Depths

Pier Scour + Contraction Scour (ft):		
	Channel:	8.73
Left abut + contr (ft):	9.50	
Right abut + contr (ft):	16.15	


Bridge Scour RS = 173.6
100-yr Scour depths
Legend
WS PF#2
Ground
Ineff
Bank Sta
Contr Scour
Total Scour
Elevation (ft)
1210
1205
1200
1195
1190
1185
1180
1175
1170
1165
3200
3400
3600
3800
4000
4200
4400
4600
Station (ft)

HEC-RAS 100-Yr Scour depths

Contraction Scour

	Left	Channel	Right
Ys (ft):		2.45	
Vc (ft/s):		4.34	
Equation:	Default	Live	Default

Pier Scour

All Piers:	Ys (ft):	7.69
	Froude #:	0.43
	Equation:	CSU equation

Abutment Scour

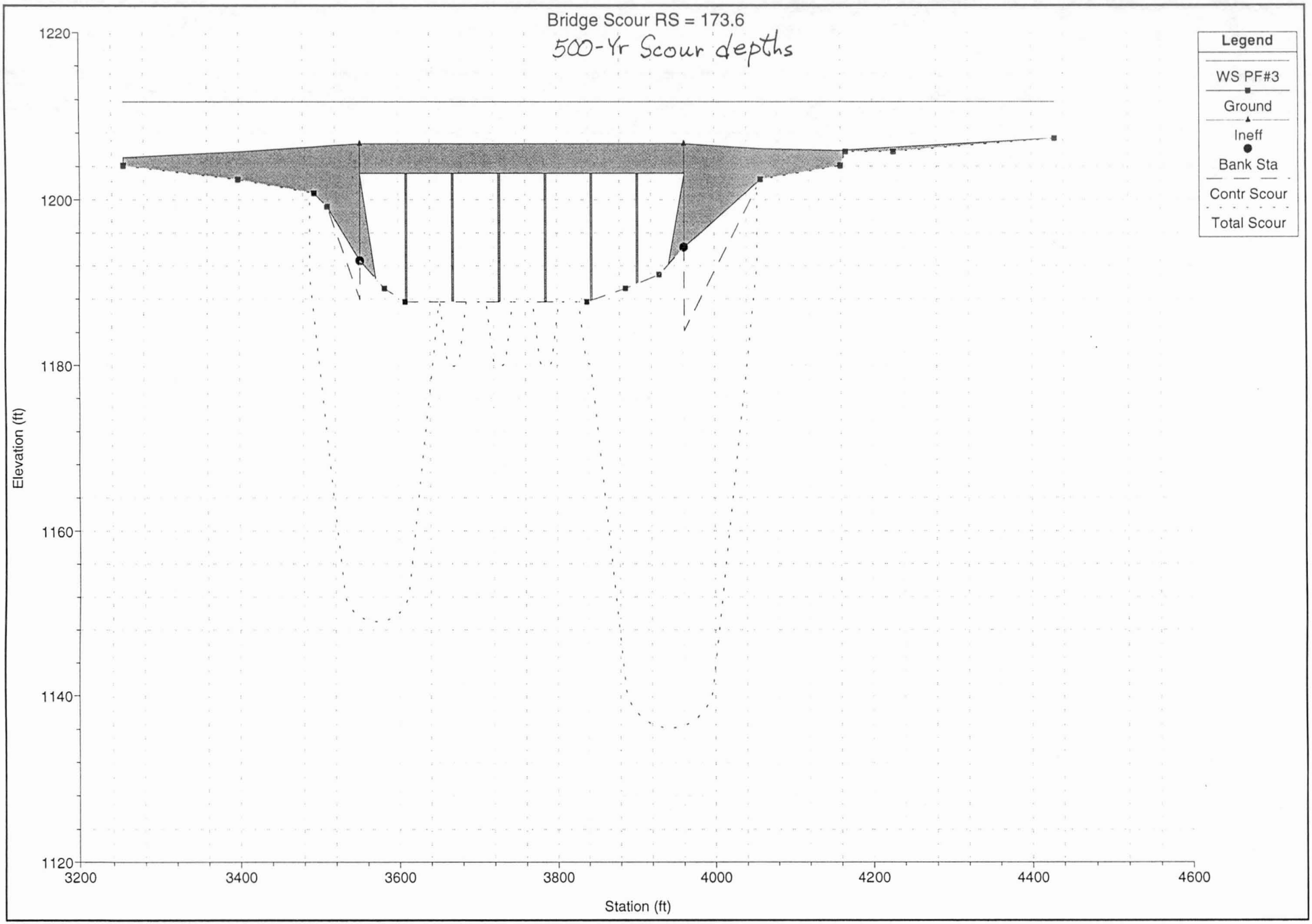
	Left	Right
Abutment Ys (ft):	14.53	19.83
Ve=	4.56	5.75
Froude #:	0.34	0.35
Equation:	Froehlich	Froehlich

Combined Scour Depths

Pier Scour + Contraction Scour (ft):

Channel:	10.13

Left abut + contr (ft):	16.97
Right abut + contr (ft):	22.28


Bridge Scour RS = 173.6
500-Yr Scour depths
Legend
WS PF#3
Ground
Ineff
Bank Sta
Contr Scour
Total Scour
Elevation (ft)
1220
1200
1180
1160
1140
1120
3200
3400
3600
3800
4000
4200
4400
4600
Station (ft)

HEC-RAS 500-Yr Scour depths

Contraction Scour

	Left	Channel	Right
Ys (ft):	4.67	0.00	10.04
Vc (ft/s):	3.94	4.52	4.05
Equation:	Live	Live	Live

Pier Scour

All Piers:	Ys (ft):	7.76
	Froude #:	0.35
	Equation:	CSU equation

Abutment Scour

	Left	Right
Abutment Ys (ft):	41.46	55.96
Ve=	6.90	7.77
Froude #:	0.38	0.38
Equation:	Froehlich	Froehlich

Combined Scour Depths

Pier Scour + Contraction Scour (ft):

Channel:	7.76

Left abut + contr (ft):	41.46
Right abut + contr (ft):	55.96

ATL, INC.
CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

FAX

To Brian Fay
Dibble & Assoc

Date 4/15/97

Project Alma School Road Bridge

ATL Job No. 19604S

FAX NUMBER 957-2838

From David P. Hayes, P.E.

Fax Number (602) 277-1306

We are transmitting 13 page(s) including this cover page.
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HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0197
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-1 Depth: 0- 1.5 m

WEIGHT OF SAMPLE = 103.43 (GMS) SOIL PASSING #10 SIEVE = 80.08 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.616

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 10:39 AM	21.7	0.01396	1.00375	1.00775	1.00400	14.2	0.037	5.0
2	10:41 AM	21.7	0.01396	1.00375	1.00675	1.00300	14.5	0.038	3.8
5	10:44 AM	21.7	0.01396	1.00375	1.00675	1.00300	14.5	0.024	3.8
15	10:54 AM	21.7	0.01396	1.00375	1.00575	1.00200	14.8	0.014	2.5
30	11:09 AM	22.2	0.01396	1.00375	1.00550	1.00175	14.8	0.010	2.2
60	11:41 AM	22.2	0.01396	1.00375	1.00525	1.00150	14.9	0.007	1.9
250	02:49 PM	23.3	0.01396	1.00375	1.00525	1.00150	14.9	0.003	1.9
04/10/97 1440	10:39 AM	23.3	0.01396	1.00375	1.00500	1.00125	15.0	0.001	1.6

Reviewed By:
Input By: AO

Respectfully Submitted:

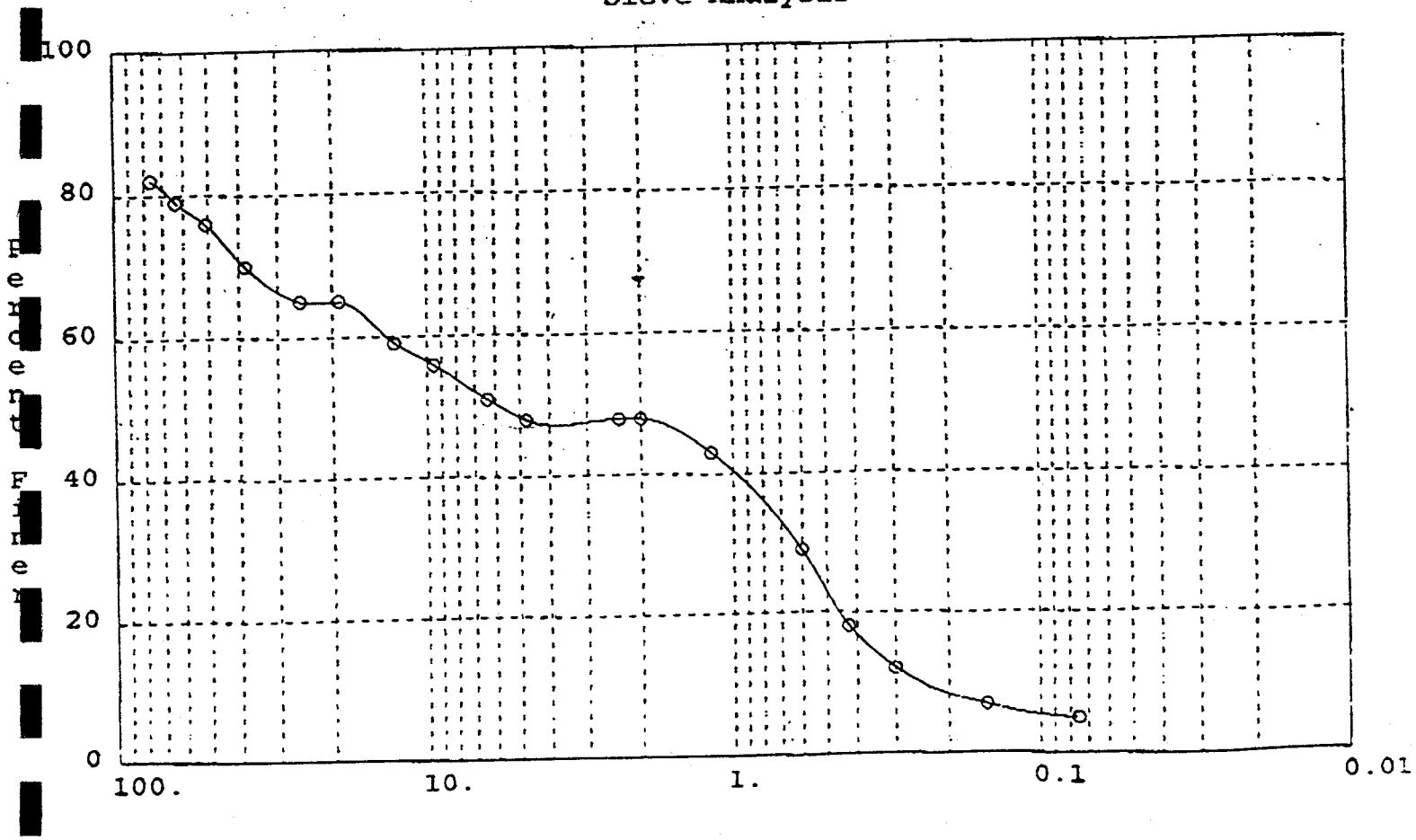
J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0197Geo

[redacted] = Alma School Road South Bridge
[redacted]e = 4/8/97
[redacted]sted By = V. Nichols Jr.
[redacted]oring Number = TP-4
[redacted]epth = 0-0.30m
[redacted]ample Number = 97-0201
Description = Well-graded GRAVEL(GW) w/ sand
[redacted]y Sample Weight (g) = 1000

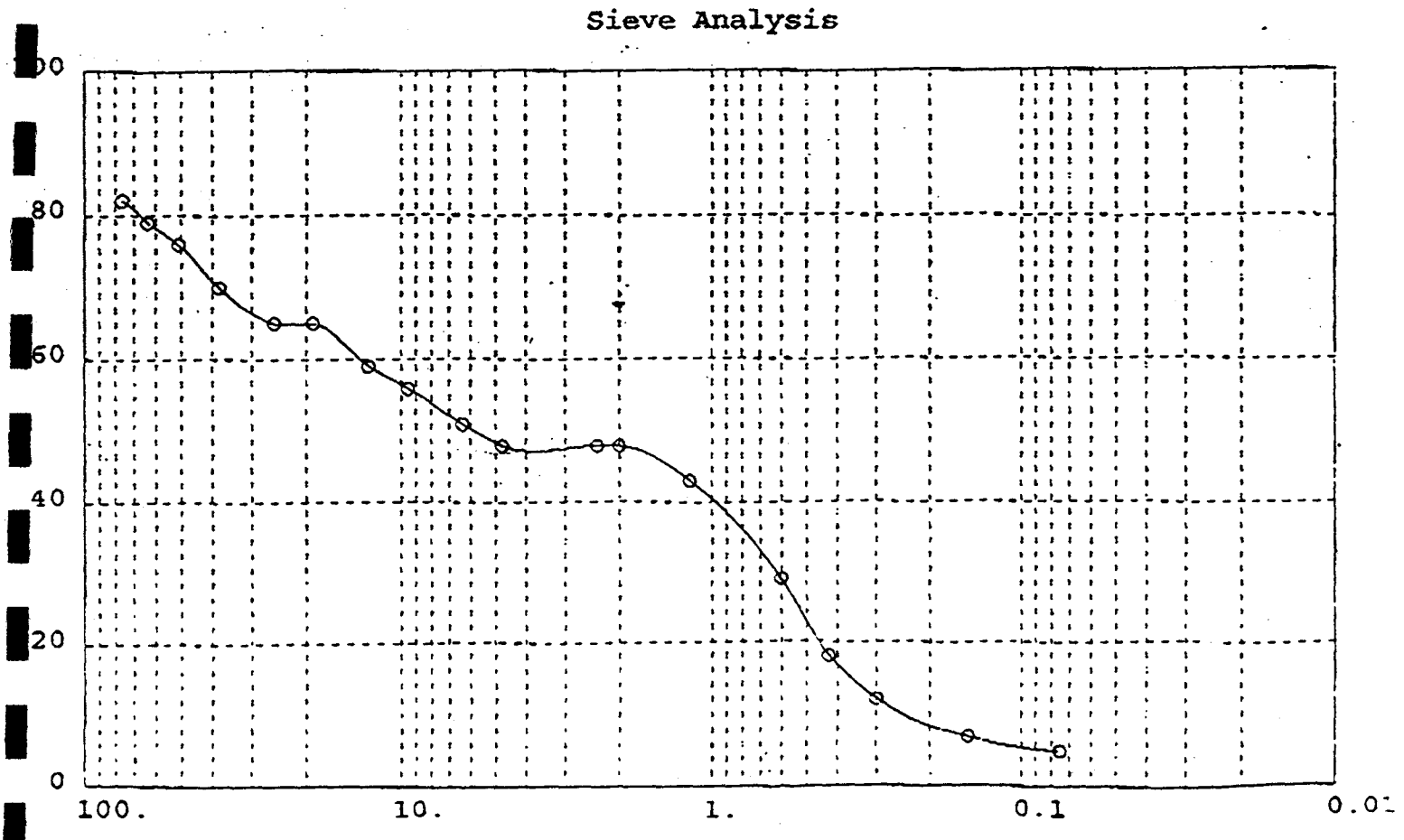
SIEVE [redacted]MBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3[redacted]	76.200	40.00	4.00	18.00	82.00
2[redacted]1/2"	63.500	30.00	3.00	21.00	79.00
2"	50.800	30.00	3.00	24.00	76.00
1 1/2"	38.100	60.00	6.00	30.00	70.00
1[redacted]	25.400	50.00	5.00	35.00	65.00
3/4"	19.050	0.00	0.00	35.00	65.00
1/2"	12.700	60.00	6.00	41.00	59.00
3[redacted]8"	9.500	30.00	3.00	44.00	56.00
1[redacted]4"	6.350	50.00	5.00	49.00	51.00
#4	4.750	30.00	3.00	52.00	48.00
#[redacted]	2.360	0.00	0.00	52.00	48.00
#[redacted]0	2.000	0.00	0.00	52.00	48.00
#16	1.180	50.00	5.00	57.00	43.00
#[redacted]0	0.600	140.00	14.00	71.00	29.00
#[redacted]0	0.425	110.00	11.00	82.00	18.00
#50	0.300	60.00	6.00	88.00	12.00
#100	0.150	50.00	5.00	93.00	7.00
#[redacted]00	0.075	20.00	2.00	95.00	5.00
p[redacted]n	0.000	0.00	0.00	95.00	5.00

Sieve Analysis



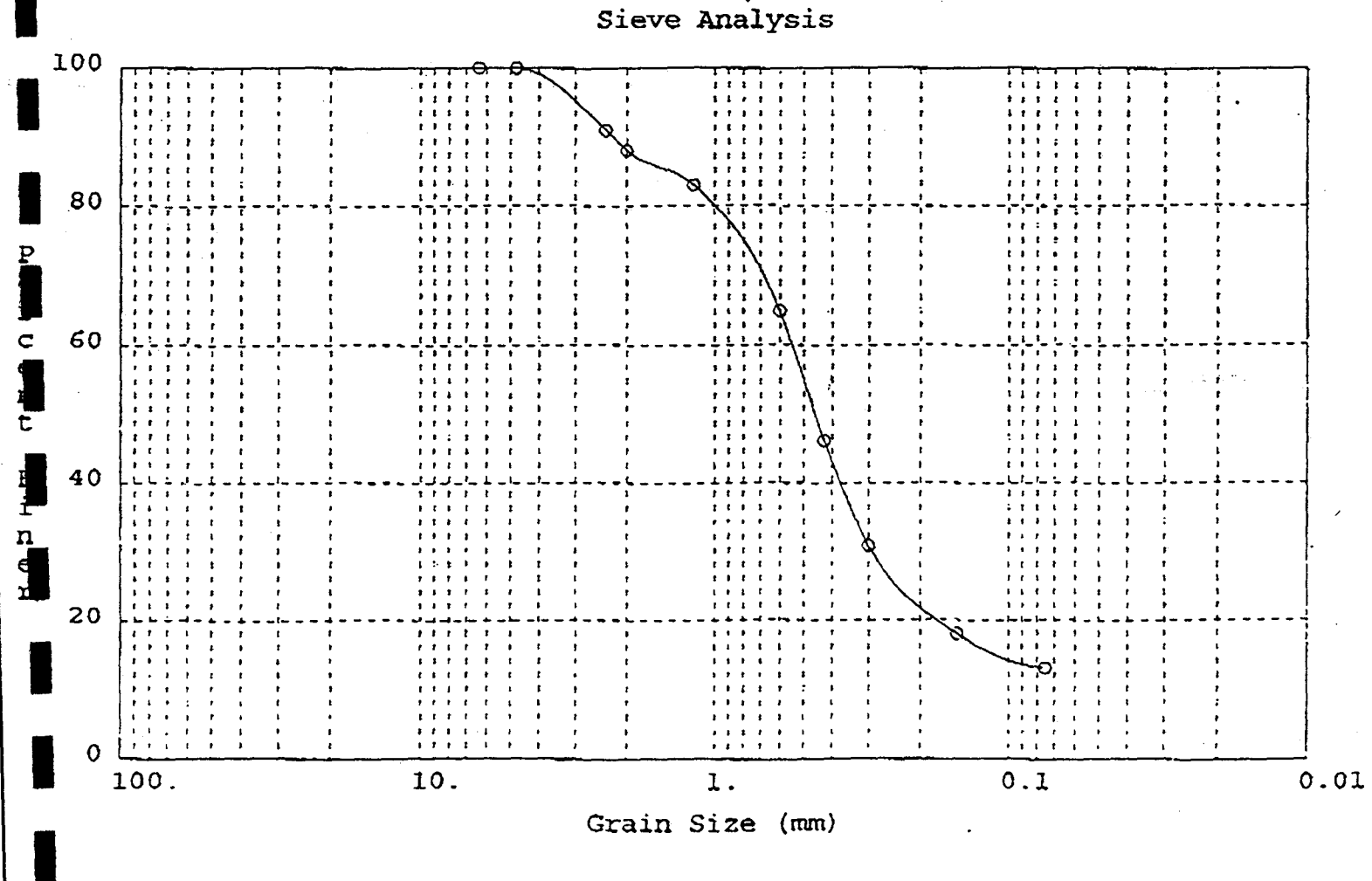
[redacted] = 4/8/97
[redacted]ed By = V. Nichols Jr.
oring Number = TP-4
e[redacted]h = 0-0.30m
a[redacted]le Number = 97-0201
escription = Well-graded GRAVEL(GW) w/ sand
r[redacted] Sample Weight (g) = 1000

IEVE UM[redacted]ER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
"	76.200	40.00	4.00	18.00	82.00
[redacted]2"	63.500	30.00	3.00	21.00	79.00
"	50.800	30.00	3.00	24.00	76.00
1/2"	38.100	60.00	6.00	30.00	70.00
"	25.400	50.00	5.00	35.00	65.00
/4"	19.050	0.00	0.00	35.00	65.00
/2"	12.700	60.00	6.00	41.00	59.00
/8	9.500	30.00	3.00	44.00	56.00
/4	6.350	50.00	5.00	49.00	51.00
4	4.750	30.00	3.00	52.00	48.00
8	2.360	0.00	0.00	52.00	48.00
10	2.000	0.00	0.00	52.00	48.00
16	1.180	50.00	5.00	57.00	43.00
30	0.600	140.00	14.00	71.00	29.00
40	0.425	110.00	11.00	82.00	18.00
50	0.300	60.00	6.00	88.00	12.00
100	0.150	50.00	5.00	93.00	7.00
200	0.075	20.00	2.00	95.00	5.00
Pan	0.000	0.00	0.00	95.00	5.00



Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-2
Depth = 0 - 1.5m
Sample Number = 97-0198
Description = Well graded GRAVEL(GW) with sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	0.00	0.00	0.00	100.00
#8	2.360	90.00	9.00	9.00	91.00
#10	2.000	30.00	3.00	12.00	88.00
#16	1.180	50.00	5.00	17.00	83.00
#30	0.600	180.00	18.00	35.00	65.00
#40	0.425	190.00	19.00	54.00	46.00
#50	0.300	150.00	15.00	69.00	31.00
#100	0.150	130.00	13.00	82.00	18.00
#200	0.075	50.00	5.00	87.00	13.00
Pan	0.000	0.00	0.00	87.00	13.00



HYDROMETER ANALYSIS
([redacted] D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0199
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Silty SAND(SM) with gravel
SOURCE OF MATERIAL: Boring TP-3 Depth: 0- 0.75m

WEIGHT OF SAMPLE = 49.53 (GMS) SOIL PASSING #10 SIEVE = 80.60 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.604

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 11:20 AM	22.2	0.01396	1.00375	1.01175	1.00800	13.2	0.036	21.1
2	11:22 AM	22.2	0.01396	1.00375	1.01175	1.00800	13.2	0.036	21.1
5	11:25 AM	22.2	0.01396	1.00375	1.01075	1.00700	13.5	0.023	18.5
15	11:35 AM	22.2	0.01396	1.00375	1.01025	1.00650	13.6	0.013	17.2
30	11:50 AM	22.2	0.01396	1.00375	1.00975	1.00600	13.7	0.009	15.9
60	12:20 AM	22.2	0.01396	1.00375	1.00975	1.00600	13.7	0.007	15.9
250	03:30 PM	23.3	0.01396	1.00375	1.00775	1.00400	14.2	0.003	10.6
1440	11:20 AM	23.3	0.01396	1.00375	1.00700	1.00325	14.4	0.001	8.6

Reviewed By:
Input By: AO

Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

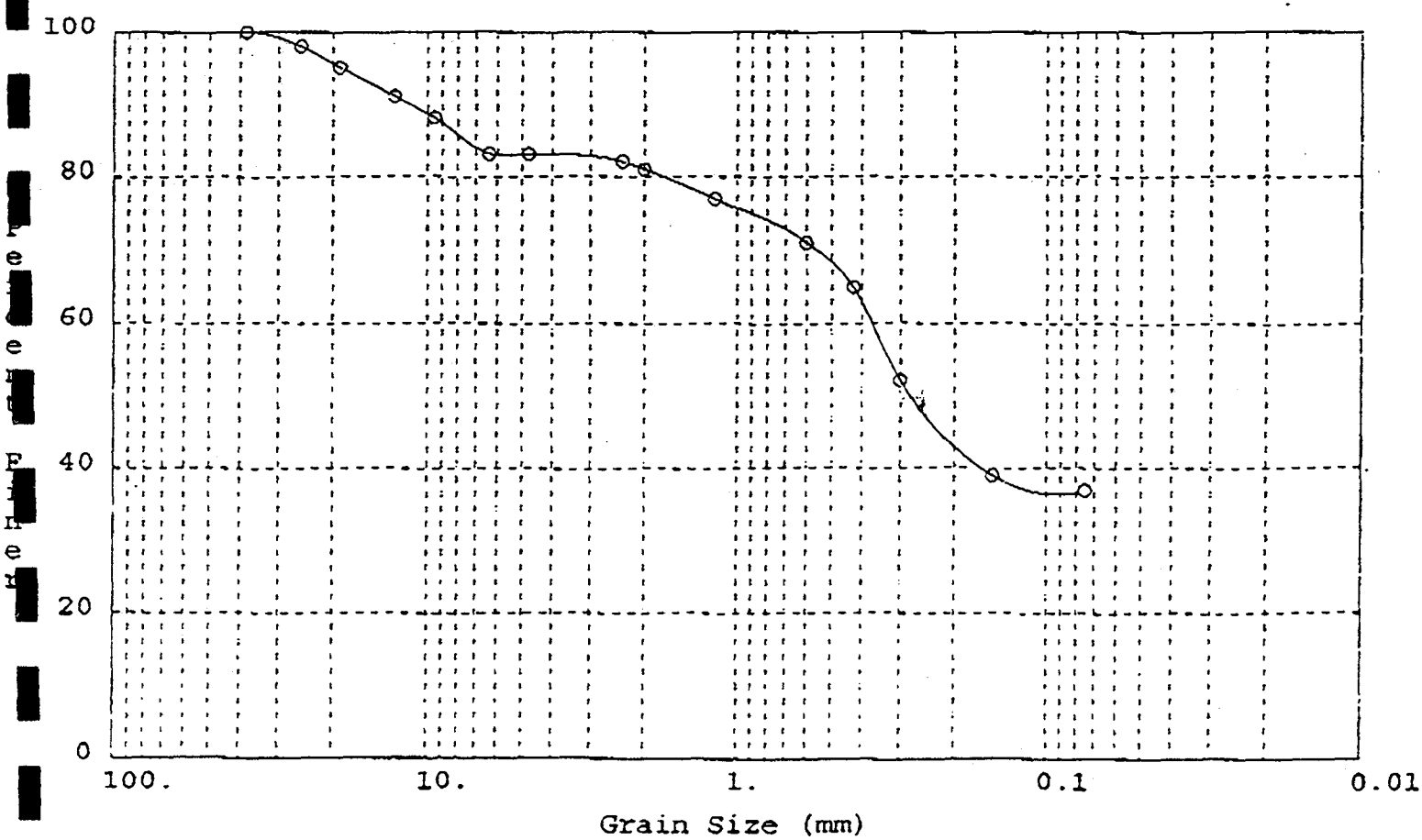
DeLeuw/Hydro/97-0199Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-3
Depth = 0 - 0.75m
Sample Number = 97-0199
Description = silty SAND(SM) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1 1/2"	38.100	0.00	0.00	0.00	100.00
1"	25.400	20.00	2.00	2.00	98.00
3/4"	19.050	30.00	3.00	5.00	95.00
1/2"	12.700	40.00	4.00	9.00	91.00
3/8"	9.500	30.00	3.00	12.00	88.00
1/4"	6.350	50.00	5.00	17.00	83.00
#4	4.750	0.00	0.00	17.00	83.00
#8	2.360	10.00	1.00	18.00	82.00
#10	2.000	10.00	1.00	19.00	81.00
#16	1.180	40.00	4.00	23.00	77.00
#30	0.600	60.00	6.00	29.00	71.00
#40	0.425	60.00	6.00	35.00	65.00
#50	0.300	130.00	13.00	48.00	52.00
#100	0.150	130.00	13.00	61.00	39.00
#200	0.075	20.00	2.00	63.00	37.00
Pan	0.000	0.00	0.00	63.00	37.00

1" = 29 mm

Sieve Analysis



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0200
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Silty SAND (SM) with gravel
SOURCE OF MATERIAL: Boring TP-3 Depth: 0.75 m - 1.5 m

WEIGHT OF SAMPLE = 50.00 (GMS) SOIL PASSING #10 SIEVE = 83.80 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.624

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 01:30 PM	23.3	0.01396	1.00375	1.011	1.00725	13.4	0.036	19.6
2	01:32 PM	23.3	0.01396	1.00375	1.01025	1.00650	13.6	0.036	17.6
5	01:35 PM	23.3	0.01396	1.00375	1.00975	1.00600	13.7	0.023	16.2
15	01:45 PM	23.3	0.01396	1.00375	1.00925	1.00550	13.8	0.013	14.9
30	02:00 PM	23.3	0.01396	1.00375	1.00875	1.00500	14.0	0.010	13.5
60	02:30 PM	23.3	0.01396	1.00375	1.00700	1.00325	14.4	0.007	8.8
250	05:30 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.003	7.4
04/10/97 1440	01:30 PM	23.3	0.01396	1.00375	1.00550	1.00175	14.8	0.001	4.7

Reviewed By:
Input By: AO

Respectfully Submitted:

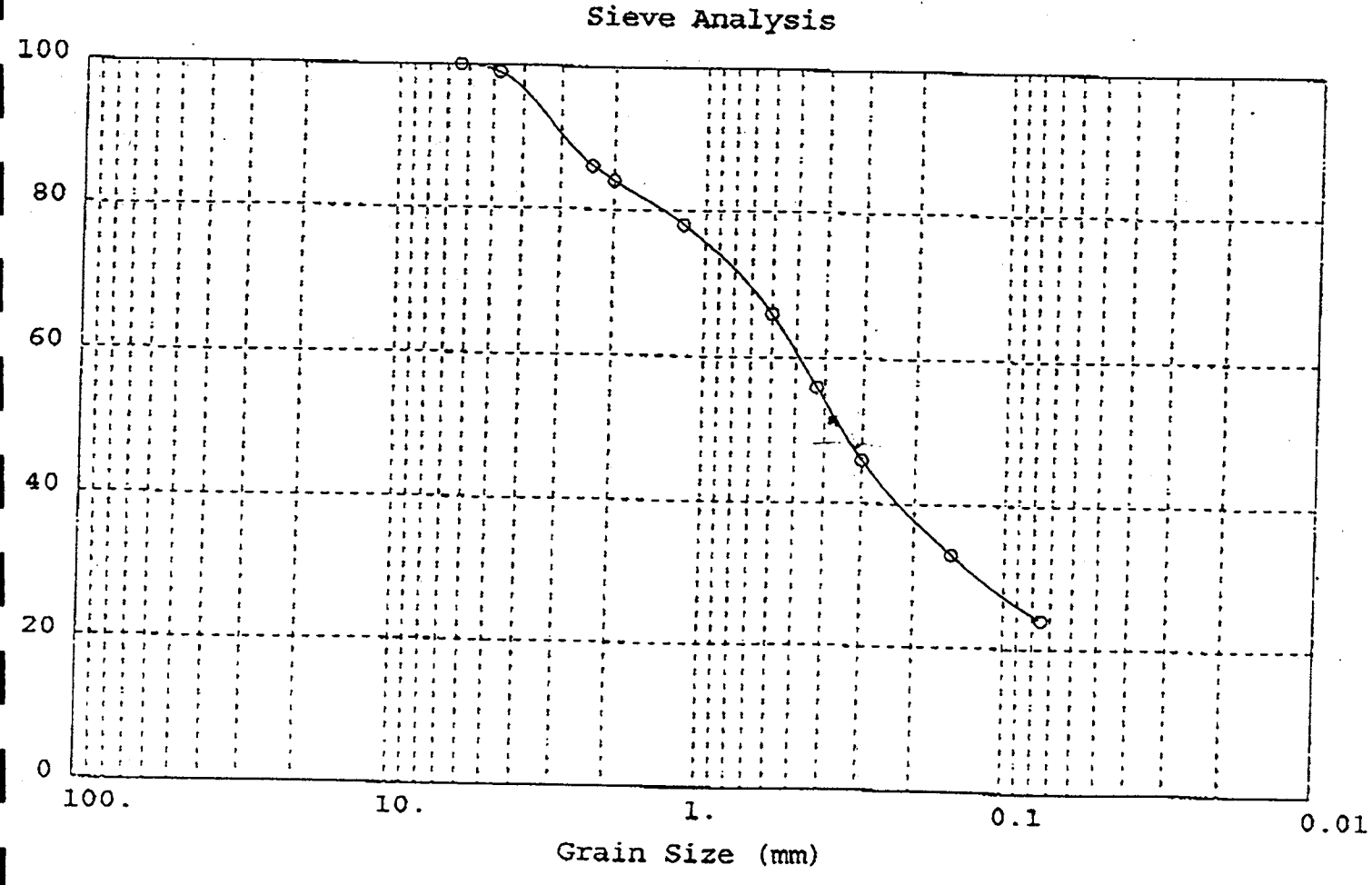
J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-200Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-3
Depth = 0.75m - 1.5m
Sample Number = 97-0200
Description = silty SAND(SM) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3/4"	6.350	0.00	0.00	0.00	100.00
4	4.750	10.00	1.00	1.00	99.00
#8	2.360	130.00	13.00	14.00	86.00
#10	2.000	20.00	2.00	16.00	84.00
16	1.180	60.00	6.00	22.00	78.00
#30	0.600	120.00	12.00	34.00	66.00
#40	0.425	100.00	10.00	44.00	56.00
50	0.300	100.00	10.00	54.00	46.00
100	0.150	130.00	13.00	67.00	33.00
#200	0.075	90.00	9.00	76.00	24.00
Pan	0.000	0.00	0.00	76.00	24.00

0.3



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0201
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-4 · Depth: 0- 0.30 m

WEIGHT OF SAMPLE = 100.62 (GMS) SOIL PASSING #10 SIEVE = 47.50 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.658

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 01:50 PM	23.3	0.01396	1.00375	1.01025	1.00650	13.6	0.036	4.9
2	01:52 PM	23.3	0.01396	1.00375	1.00875	1.00500	14.0	0.037	3.8
5	01:55 PM	23.3	0.01396	1.00375	1.00775	1.00400	14.2	0.024	3.0
15	02:05 PM	23.3	0.01396	1.00375	1.00725	1.00350	14.4	0.014	2.6
30	02:20 PM	23.3	0.01396	1.00375	1.00750	1.00375	14.3	0.010	2.8
60	02:50 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.007	2.3
250	06:00 PM	23.3	0.01396	1.00375	1.00500	1.00125	15.0	0.003	0.9
04/10/97 1440	01:50 PM	23.3	0.01396	1.00375	1.00550	1.00175	14.8	0.001	1.3

Reviewed By:
Input By: AO

Respectfully Submitted:

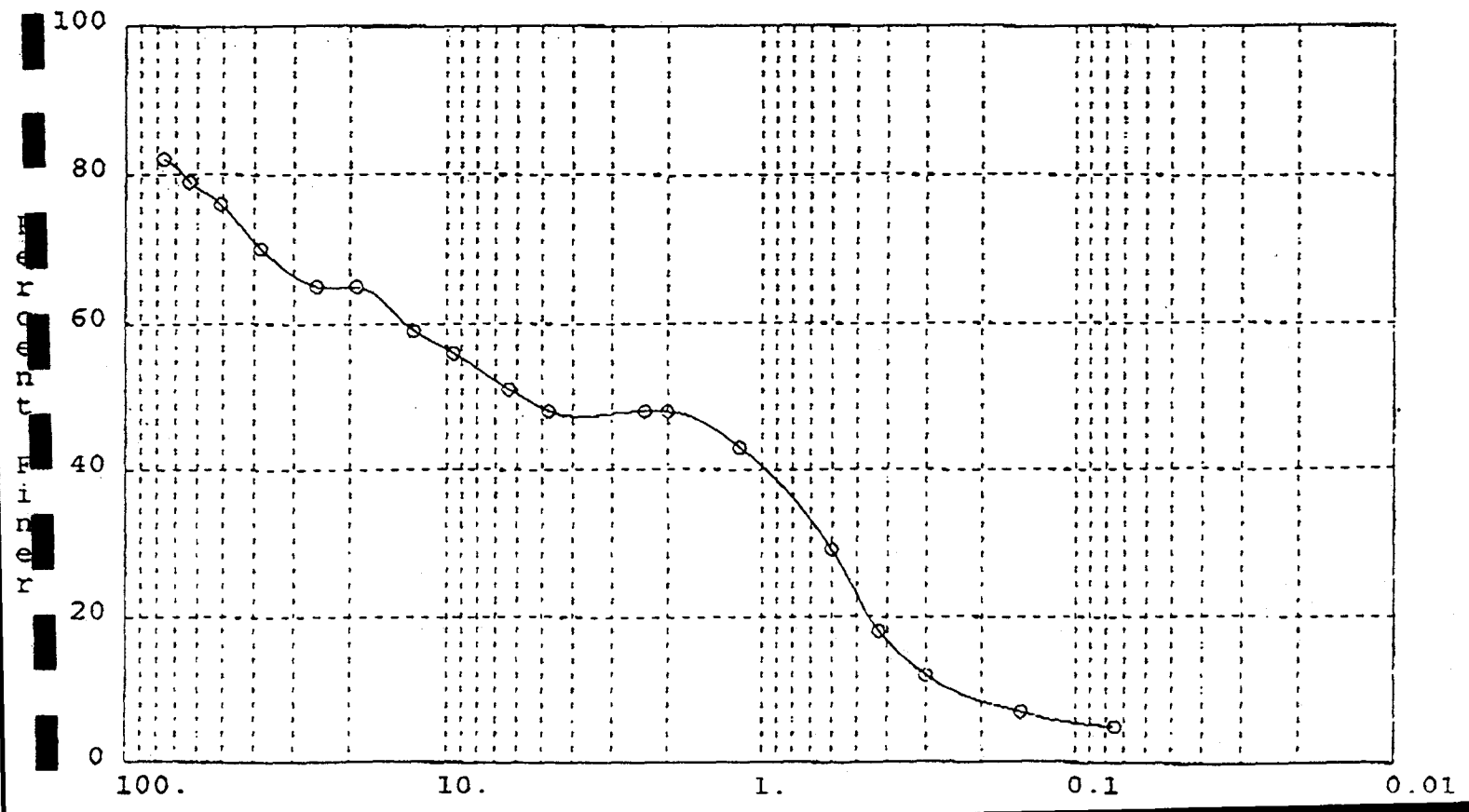
J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-201Geo

Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-4
Depth = 0-0.30m
Sample Number = 97-0201
Description = Well-graded GRAVEL(GW) w/ sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3"	76.200	40.00	4.00	18.00	82.00
2 1/2"	63.500	30.00	3.00	21.00	79.00
2"	50.800	30.00	3.00	24.00	76.00
1 1/2"	38.100	60.00	6.00	30.00	70.00
1"	25.400	50.00	5.00	35.00	65.00
3/4"	19.050	0.00	0.00	35.00	65.00
1/2"	12.700	60.00	6.00	41.00	59.00
3/8"	9.500	30.00	3.00	44.00	56.00
1/4"	6.350	50.00	5.00	49.00	51.00
4	4.750	30.00	3.00	52.00	48.00
#8	2.360	0.00	0.00	52.00	48.00
#10	2.000	0.00	0.00	52.00	48.00
#16	1.180	50.00	5.00	57.00	43.00
#30	0.600	140.00	14.00	71.00	29.00
#40	0.425	110.00	11.00	82.00	18.00
#50	0.300	60.00	6.00	88.00	12.00
#100	0.150	50.00	5.00	93.00	7.00
#200	0.075	20.00	2.00	95.00	5.00
Pan	0.000	0.00	0.00	95.00	5.00

Sieve Analysis



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0202
JOB NO. : 196045
DATE RCVD: 03/25/97.
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-4 Depth: 0.30m - 1.5 m

WEIGHT OF SAMPLE = 100.73 (GMS) SOIL PASSING #10 SIEVE = 80.40 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.628

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 02:05 PM	23.3	0.01396	1.00375	1.0075	1.00375	14.3	0.037	4.8
2	02:07 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.038	3.9
5	02:10 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.024	3.9
15	02:20 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.014	3.5
30	02:35 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.010	3.5
60	03:05 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.007	3.5
250	06:15 PM	23.3	0.01396	1.00375	1.00625	1.00250	14.6	0.003	3.2
04/10/97 1440	03:05 PM	23.3	0.01396	1.00375	1.00575	1.00200	14.8	0.001	2.6

Reviewed By:
Input By: AO

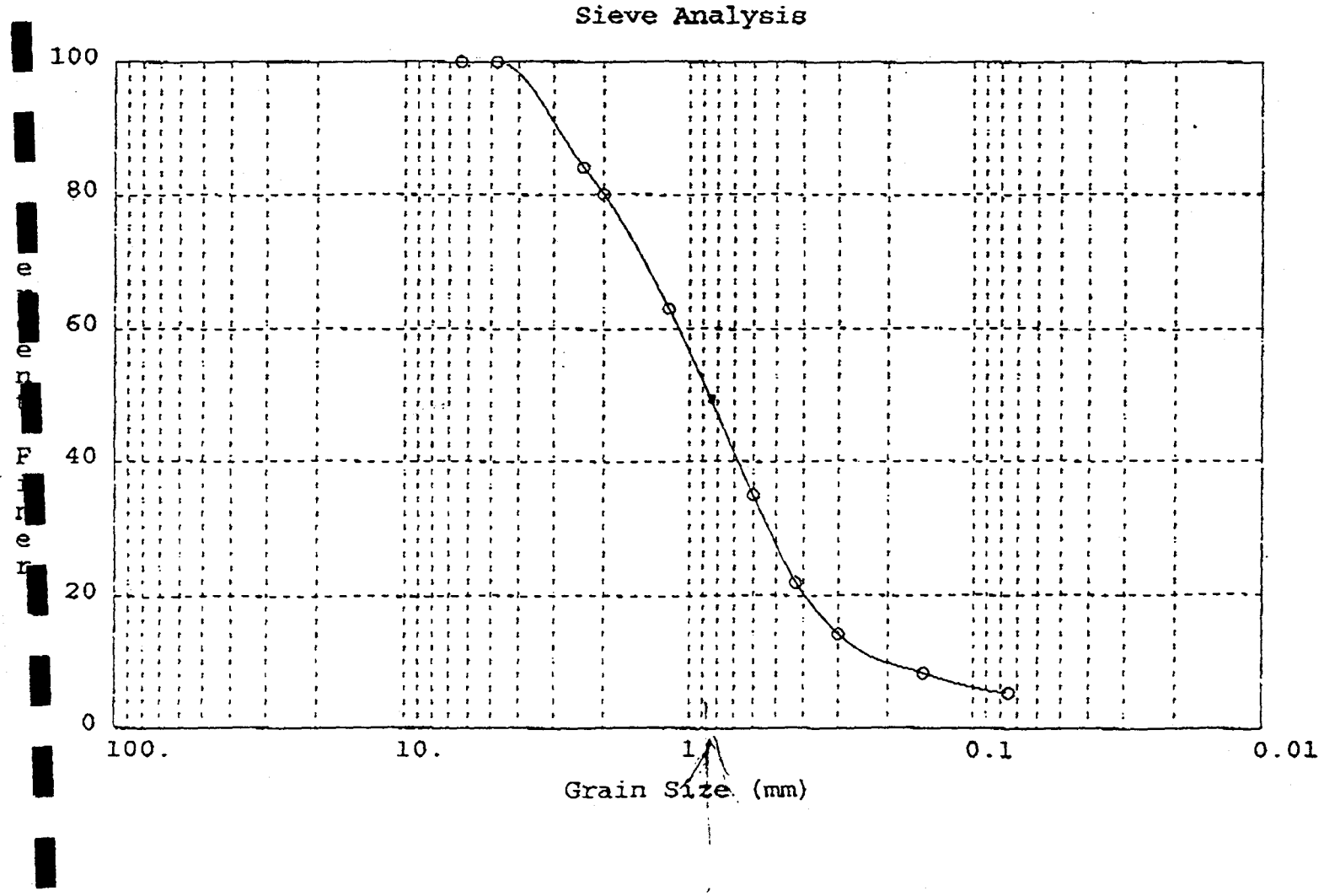
Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0202Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-4
Depth = 0.30m - 1.5m
Sample Number = 97-0202
Description = Well-graded GRAVEL(GW) w/ sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	0.00	0.00	0.00	100.00
#8	2.360	160.00	16.00	16.00	84.00
#10	2.000	40.00	4.00	20.00	80.00
#16	1.180	170.00	17.00	37.00	63.00
#30	0.600	280.00	28.00	65.00	35.00
#40	0.425	130.00	13.00	78.00	22.00
#50	0.300	80.00	8.00	86.00	14.00
#100	0.150	60.00	6.00	92.00	8.00
#200	0.075	30.00	3.00	95.00	5.00
Pan	0.000	0.00	0.00	95.00	5.00



6-REGULATORY AGENCIES

U.S. ARMY CORPS OF ENGINEERS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ARIZONA DEPARTMENT OF TRANSPORTATION

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

SALT RIVER PROJECT

ATL, INC.
CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

July 15, 1997

Mr. Donald R. Davis, P.E.
DeLeuw, Cather & Company
3875 N. 44th Street, Ste. 250
Phoenix, Arizona 85018

Re: Geotechnical Investigation
Alma School Road South Bridge at Salt River
Maricopa County, Arizona
MCDOT Work Order No. 68931
ATL Job No. 196045

Dear Mr. Davis:

This report presents the results of a geotechnical investigation for the proposed widening and overlay of Alma School Road South Bridge at Salt River in Maricopa County, Arizona. Field exploration, laboratory tests and engineering analysis are included along with boring logs and laboratory results. ATL's work was performed in accordance with ATL Proposal No. P96194, dated November 27, 1996.

The roadway subsurface investigation provided input for the design of new approach road pavement sections on either side of the bridge, which was coordinated with a recommended bridge overlay. The structural borings provided input for the presentation of a proposed foundation configuration for the abutments and piers. This information also assisted in the development of recommended construction techniques for the construction of the extended wingwalls to the east.

Test pits excavated in the overflow channel yield grain size distribution data that was presented to Dibble & Associates for their use in creating flow models for the channel and estimating scour. Discussions with MCDOT relative to scour depth were on-going at the time this report was published. Therefore, the scour depth was estimated to be twenty (20) feet below existing channel grade.

ATL has appreciated the opportunity to be of service to you on this project and looks forward to a continued association on future projects. Should any questions arise, please do not hesitate to contact us at your earliest convenience.

Very truly yours,

David P. Hayes, P.E.
Executive Vice President

DPH/brc

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ATL Job No. 196045

Julu 15, 1997

GEOTECHNICAL INVESTIGATION

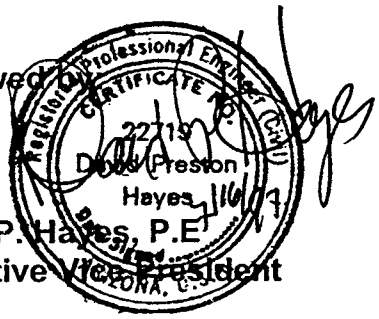
REPORT FOR

DE LEUW, CATHER & COMPANY

PROJECT

ALMA SCHOOL ROAD SOUTH BRIDGE AT SALT RIVER
MARICOPA COUNTY, ARIZONA
MCDOT WORK ORDER NO. 68931
ATL JOB NO. 196045

Reviewed by:



David P. Hayes, P.E.
Executive Vice President

Prepared by:

Ammi Osorio
Project Engineer

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GEOTECHNICAL INVESTIGATION

REPORT FOR

DELEUW, CATHER AND COMPANY

PROJECT

ALMA SCHOOL ROAD SOUTH BRIDGE AT SALT RIVER
MARICOPA COUNTY, ARIZONA
MCDOT WORK ORDER NO. 68931
ATL JOB NO. 196045

1.0 PROJECT INFORMATION

The Maricopa County Department of Transportation is developing plans for the widening and overlay of Alma School Road South Bridge at Salt River. This project includes both a Design Concept Report (DCR) and a final design. The existing South Bridge is 25.6 m wide and 124.8 m long with seven (7) spans of 17.83 m each.

During the 1995-1996 construction season, Alma School Road was reconstructed by the City of Mesa to a six (6) lane urban arterial road, 26.8 m wide. Immediately north of McLellan Road, ADOT is constructing the Price-Pima Freeway Interchange.

In July, 1996, MCDOT completed the "Alma School Road Operational Study". The "Channelized T" alternative was chosen, and later a northbound right turn lane north of the ADOT improvements was added, resulting in consideration of a 28.6 m wide roadway.

This section of Alma School Road crosses the Salt River. The Salt River at this location is divided into two (2) channels. The north bridge crosses the main river channel and the south bridge crosses a minor river channel. These two bridges were constructed in 1980 and are both constructed with prestressed concrete box beams. The existing roadway between these bridges and the approaches to these bridges were constructed at the same time as the bridges, and consist of a 50-mm asphaltic concrete layer over 75-mm of an aggregate base course over 150-mm of a select material subbase.

The Red Mountain Freeway project is currently under construction and includes the construction of a full diamond interchange at Alma School Road. The Red Mountain Freeway improvements to Alma School Road begin just south of McLellan Road where the City of Mesa improvements terminate. North of the northern-most on-and-off ramp, Alma School Road tapers to match the existing roadway width at the south end of the southern bridge. The new pavement at this match point will consist of 112-mm of asphaltic concrete over 100-mm of aggregate base.

MCDOT has budgeted $1,140,000.00 for the construction of the widening and overlay.

2.0 LOCATION AND GEOLOGIC DESCRIPTION

The proposed project site is located parallel to 101 Freeway, approximately 0.4 km south of McKellips Road and approximately 3.2 km north of University Drive, Maricopa County, Arizona. On the east side of Alma School Road, Sunward Materials maintains a crushing and concrete producing plant. South of the bridge, the Arizona Department of Transportation is constructing a Traffic Interchange for the Red Mountain Freeway. The

westbound on-ramp will transition from the south bound lane(s) of Alma School Road, while the westbound off-ramp will transition into the northbound Alma School Road.

A geologic review revealed that the site is part of the Basin and Range Province created in the Cenozoic Era. The Basin is relatively flat, underlain by deep sediments in lake beds and valley fills. Thick salt deposits were formed in several ancient saline lakes in the area, resulting in random areas of cemented soils. The Salt River main channel flows north of this bridge. It appears that the main channel overflow passes through this site, thus requiring the bridge for Alma School Road.

3.0 SCOPE OF WORK

ATL's responsibility was to perform a geotechnical investigation during the Design Concept Report (DCR) phase that addressed the following issues:

1. **Foundation design recommendation for new bridge piers.**
2. **Pavement design for north and south approach roads.**
3. **Recommendations for the type of bank protection to tie-in to ADOT's south bank.**

ATL was responsible for obtaining right-of-entry permits from those entities that either owned the land that we would be investigating or maintained access strips. ATL was also responsible for coordinating with team members and disseminating preliminary laboratory test data. ATL was required to present its findings using the metric system of units, in a bound report format.

4.0 DRILLING AND SAMPLING PROCEDURES

After the boring locations were cleared of utility interference, a business license (No. 97-01262) and permit (97-028) had been obtained from the Salt River Pima-Maricopa Indian Community, and verbal access permission received from Sunward Materials, the following drilling and sampling program was initiated.

Three (3) boreholes, 1.5 m deep each were drilled in the approach roads for the development of a new pavement design. Two (2) boreholes were located at the north

bridge approach, and one (1) was located at the south approach. Bulk samples were obtained using an 203 mm diameter auger in order to perform Index and R-value testing. Upon completion of drilling and sampling, each hole was backfilled with cuttings from the borehole except for the top 300 mm, which was filled with compacted cold mix.

The investigation of the streambed was accomplished by excavating four (4) test pits with a backhoe and sampling specific soil layers within the top 1.5 m. The test pit locations were determined with the assistance of representatives of Dibble and Associates. Sieve/Hydrometer analysis were performed on material from each layer and grain-size distribution curves constructed for use in the determination of various scour components by the hydrologists. Each test pit was backfilled with the excavated material upon completion of sampling.

At the time of ATL's field investigation, the configuration of the bridge widening had not been finalized. Therefore, four (4) boreholes were drilled to a depth of 15 m each at locations on the east and west sides of the bridge for the design of the bridge widening supports. In order to penetrate the sand, gravel, and cobble layer, an ODEX 90 system was utilized, using the hollow-stem auger drilling technique. The holes were logged based on the sand, gravel, and cobbles (SGC) cuttings collected by the "cyclone". Due to the nature of the material, we were unable to collect brass ring samples. Because water zones were encountered at different levels, each hole was left open 24 hours to observe changes in water levels. After the 24-hour period, each hole was backfilled with available rock and the top 6 m was grouted as required by ADEQ.

5.0 LABORATORY TESTING

Representative bulk samples of the subgrade were collected at each boring location, as well as at each test pit locations for soil classification purposes and physical property analysis.

Visual classifications were supplemented by index tests such as Sieve Analysis and Atterberg Limits on representative samples. Moisture Content tests were performed to determine the amount of water present in the soil at the time of sampling. A Standard Proctor analysis was completed on the subgrade material to determine the relationship

between the maximum dry density and optimum moisture content. R-values were obtained to determine support capability of the soil. Hydrometer analysis were conducted to determine quantitative distribution of particle sizes within a soil sample from the water-way channel.

The following table lists the types and quantities of tests performed to provide the project design information:

TEST DESCRIPTION	QUANTITY OF TESTS
Sieve Analysis	9
Hydrometer Analysis	6
Plasticity Index	9
Moisture Content	3
Standard Proctor	1
R-value	2

6.0 SUMMARY OF EXISTING CONDITIONS

The soil types encountered at the proposed site can be summarized as follows:

(A) The subgrade of Boring SG-1, located on the south approach of the Alma School Road South Bridge, consisted of a **light brown, well-graded GRAVEL (GW)** with sand, in a damp condition. throughout the depth of boring. For Borings SG-2 and SG-3, a **light brown, well-graded SAND (SW-SM)** with silt and gravel in a damp condition was observed throughout the depth of each boring. A Standard Proctor analysis conducted for Boring SG-2 resulted a maximum dry density of 138.3 lbs/ft^3 at an optimum moisture content of 7.3%. The R-values for Boring Nos. SG-1 and were 73 and 40 respectively.

The subgrade borings were drilled through the existing pavement section. The variance in asphaltic concrete and aggregate base course thickness for each location is as follows:

Description	Boring SG-1	Boring SG-2	Boring SG-3
Asphaltic Concrete	51 mm	76 mm	51 mm
Aggregate Base	89 mm	102 mm	152 mm

(B) For Boring Nos. S-1 and S-2 located near the proposed new bridge piers, **a light brown silty SAND (SM),** with gravel and cobbles in a moist condition was observed from the surface to approximately 4 meters below existing grade followed by a **gray-tan, well graded SAND (SW-SM)** with silt and gravel and cobbles, in a moist condition down to approximately 10 meters below existing grade. A **light brown, silty SAND (SM)** with gravel and cobbles was observed from a depth of 10 m to the bottom of boring. Water zones were encountered at depths of 6 m and 13 m below existing grade. For Boring Nos. S-3 and S-4, a **gray-tan silty SAND (SM)** with gravel was observed throughout the boring profile to a depth of 15.3 m. Water zones were encountered at depths of 5 m and 14 m below existing grade.

(C) For Test Pits TP-1, TP-2, TP-3, and TP-4 excavated east and west of the Alma School Road South Bridge Over-Flow Channel, a **gray-tan, well graded GRAVEL (GW)** with sand, in a damp condition was observed throughout the boring depth of 1.5 m below existing grade. For Test Pits TP-1, TP-2, and TP-4 cobbles and boulders were about 380 mm in size, increasing as the pit got deeper. For Test Pit TP-3, located 30 m east of Alma School Road Bridge near the center of the Overflow Channel, a **brown, silty SAND (SM)** with gravel, cobbles and boulders up to 380 mm in diameter was observed to the bottom of the pit.

The results of a Hydrometer Analysis conducted for Test Pits TP-1 thru TP-4 ranged from 80% to 87% minus No. 10 material; except for Test Pit TP-4 which exhibited 47.5% minus #10 material. This information was

transmitted to Dibble & Associates on April 15 so that they could continue their hydrologic reviews and calculations

A review of all borings and test pits indicated minus #200 contents less than 15% and in-situ moisture contents of less than 10%. All samples were non-plastic.

7.0 DISCUSSIONS AND RECOMMENDATIONS

7.1 Slope Protection

The existing slope protection consists of large cobbles and boulders held in place by a wire mesh and appears to be in good repair. It extends on both ends rom the face of the abutments to the first span of bridge supports or concrete columns. The protection extends across the full width of the roadway under the bridge girders.

The ADOT bank protection to the south and west of this site appears to be a Cement Stabilized Alluvium (CSA). Due to the small quantity, it is recommended that current rip rap slope protection be extended using the guidelines in MAG Section 220. Trimming and compaction of the ground surface will be required prior to placing the rip rap. The area between the edge of the boulders adjacent to the CSA should be grouted.

7.2 Pavement Sections

As part of this contract, Bolduc, Smiley & Associates (BSA) produced "**Technical Memorandum Number 1, Traffic Volume Data, Alma School Road at the Salt River Bridge**", dated April 29, 1997. This memorandum documented existing traffic volumes and vehicle types currently using this portion of Alma School Road. The memorandum included previously collected traffic volume data by Kirkham, Michael Consulting Engineers in July, 1996.

The BSA report summarized existing traffic by total ADT and vehicle type category, (Groups 1, 2, and 3) and predicted future traffic for the years 2015 and 2020 by total ADT only. Standard pavement design procedures specified in the AASHTO **"Guide for the Design of Pavement Structures"**, 1993 require the determination of 18-kip ESAL's over the design period. Current ADT and the current percentage of vehicle types are projected over the design period using a growth factor and assuming that the mix of vehicle types

will not vary substantially over the design period. That **may not be true** for this project, since vehicle counts recorded in 1997 include the construction traffic for Red Mountain Freeway. Once the highway is complete, heavy vehicle percentages should reduce. The location of the Sunward Concrete and Asphalt plants on the east side of Alma School Road at the bridge will result in the maintenance of a level of heavily loaded vehicles. As a conservative approach, ATL has maintained the current vehicle type percentages over the design period in developing the design for the approach road pavement sections.

The Arizona Department of Transportation Materials Section "Preliminary Engineering and Design" Manual (PE & D) summarizes the AASHTO Design Guide and provides coefficients and factors for Arizona.

7.2.1 Traffic Projection - 18 KIP ESAL

The BSA Report was used to obtain estimates of the traffic volumes and type over the 20 year design life. The current traffic mix of 19% medium trucks (Group II), 13% Group 3 (heavy trucks) and 68% Group I (cars) was in calculating the 18-kip ESAL's over the design period.

For an initial ADT of 4064 for 2-way traffic and a 2020 ADT of 26,000, a Growth Factor of 27 was computed for a 20-year design period. The 18-kip ESAL's over 20 years was **6,308,380.**

The AASHTO 1993 Design Guide and the ADOT PE & D Manual provide a formula to determine the structural number for a pavement section. The formula uses several coefficients that indicate climate, level of reliability, and serviceability. The other major input items are total equivalent 18-kip wheel loads over the design period and the subgrade support capability.

Given the relative consistency of the subgrade material and it's high in-situ density throughout the project length, one structural number was used to develop the pavement alternates. The following variables were used for this project in conjunction with the predicted number of 18-kip equivalent single axle load applications determine in Section 7.1:

7.2.2 Design Coefficients

- **Level of Reliability and Standard Normal Deviate(Z_R)**

For non-divided, non-interstate highways with ADT's >10,000, the required Level of Reliability is **95%**. The corresponding Z_R value is **-1.645**

- **Serviceability Index**

  For the same type of highway, the initial level is 4.2 (P_o). The terminal level is 2.8 (P_t). The change in PSI is **1.4.**

- **Seasonal Variation Factor**

  For this area, a factor of **1.0** is suggested to convert R-value to Modulus of Resiliency (M_R).

- **Mean R-value**

  The mean R-value combines actual R-values with correlated R-values and is used in determining the Modulus of Resiliency for use in the determination of the design Structural Number. The calculated R_{mean} **>70.**

- **Resilient Modulus (M_R)**

  Using the above "Mean R-value" and the "Seasonal Variation Factor", the M_R>30,000. For design purposes, a maximum allowable value of **26,000** was used.

- **Structural Number**

  The calculated Structural Number **(SN) is 3.21.**

7.2.3 Pavement Sections - Approach Roads

The current road sections on both the north and south approaches averages less than 205 mm in total thickness, consisting typically of 51 mm of asphaltic concrete and 102 mm of aggregate base course. The widening and re-alignment requirements of the new section suggests that the existing material be removed, the subgrade re-graded to accommodate a new section.

The minimum section required by MCDOT for an Urban Minor Arterial Road results in a structural number of 3.16, which is less than the 3.21 required by the above analysis. Therefore, suggested pavement section alternates are:

ALTERNATE	PAVEMENT SECTION	BASE COURSE
1	25 mm Asphalt Rubber 100 mm MAG C 3/4, PG 70-10 Compacted 2 lifts Tack Coat between Lifts	201 mm - MAG ABC
2	25 mm Asphalt Rubber 75 mm MAG C¾, PG 70-10 Compacted 2 lifts Tack Coat between Lifts	277 mm - MAG ABC
3	25 mm Asphalt Rubber 75 mm MAG C 3/4, PG 70-10 Compacted 2 lifts Tack Coat between Lifts	150 mm - BTB

The following structural coefficients were used in estimating the above pavement sections:

New Asphaltic Concrete	=	0.44
Bituminous Treated Base	=	0.21
Aggregate Base Course	=	0.14
Aggregate Subbase	=	0.11

It should be noted that the pavement section constructed for the north bridge approaches in 1994 consisted of 139 mm of asphaltic concrete and 328 mm of aggregate base course, equating to a structural number of 4.26, 30% higher than that calculated for this project. This could be due, in part to the inclusion of construction vehicles for the Red Mountain Freeway.

The ADOT pavement section thickness from the the PCCP section under the Red Mountain Freeway to the approach road section of our bridge, was proposed at 113 mm of asphaltic concrete and 100 mm of aggregate base course, thinner than what we propose.

7.2.4 Pavement Section - Bridge Overlay

It is recommended that the existing asphaltic concrete on the bridge deck be milled a depth of 25 mm and replaced with a 25 mm thickness of

asphaltic rubber. The estimated bitumen content is 8.5%, and should conform to the material recommendations of Section 8.0 of this report. The widened bridge section will be paved with a conventional MAG C 3/4 mix, allowing for the 25 mm thick rubberized asphalt overlay.

7.3 Bridge Widening Foundation

The current support system for the bridge consists of two abutments and seven (7) spans of 17.83 m each. The total bridge length is 124.8 m. Downstream, a grade control structure was constructed in 1995 and consisted of vertical steel H-piles driven 10 to 13 m below grade and capped with portland cement concrete. Large boulders were placed behind these vertical pile and contained by steel wire.

While two (2) "water zones" were encountered during drilling between 6 and 9 m below grade on the east side, they were thin zonaes that quickly dissipated during drilling. The intermediate piers were supported on H-piles that were driven to design depth, and extended into a concrete pile cap. Columns were constructed on the cap and extended up to the superstructure.

The widening of the bridge is proposed for one direction - the east side - for a distance of 8.53 m. The structural boring logs indicate that the subsurface material is Sand with some silt, gravel and cobbles. Either concrete drilled shafts or driven H-piles may be used to support the abutments and intermediate piers. The loading, as supplied by DeLeuw Cather, is 1030 K on the abutments and 615 K on the piers. These represent a combination of dead and live load but do not include the weight of the drilled shafts.

Deep foundations are utilized when shallow foundations are not practical; to transmit loads to a competent zone or to increase lateral load capacity. When the support level is such that the width to depth ratio is greater than 5, we have a "deep" foundation. In calculating the proposed pile diameter, one parameter that must be considered is the scour depth. The scour depth had not been agreed upon when this report was prepared. Based on experience downstream, at the Hohokam bridge of the Salt River, a scour depth of 6 m will be used. This means that the pile will be considered un-supported from top of grade to a depth of 6 m. Because the pile cap restrains the pile at the top, bending will be evaluated.

Procedures presented in the Naval Facilities Engineering Command, "Foundations and Earth Structures, Design Manual 7.02" were used to compute the proposed pile diameter for the assumed conditions of:

1. The top of the pile is fixed from rotation by the pile cap.
2. A Safety Factor of 3 is used for Bearing Capacity determination.
3. The depth of embedment is 9 meters.
4. The unit weight of the surrounding soil is 1765 kg/m^3.
5. The soil is hard.
6. The coefficient of lateral subgrade reaction of the embedment soil is constant with depth.
7. Friction angle is 40°
8. Friction angle between pile and soil is 30°.

The calculated pile diameter is 908 mm, with four(4) piles required per abutment and three (3) piles per pier. The pile should be spaced at least three (3) pile diameters apart.

8.0 CONSTRUCTION RECOMMENDATIONS

8.1 Excavation

Section 205 of MAG should be followed. It is anticipated that most of the excavated material may be re-used as backfill for the extended abutment wingwalls. Material greater than 3 inches in diameter should be stockpiled for other uses. Existing asphaltic concrete should be disposed of properly off-site.

8.2 Compaction

MAG Section's 211 and 215 should be followed, as appropriate, using either AASHTO T-99 or ASTM D698 for the determination of the maximum dry density and optimum moisture content. In-place densities of the backfill should be no less than 95% of the maximum laboratory dry density and within ±2% of the optimum moisture content.

8.3 Borrow

Imported borrow may be required to fill behind the extended abutment wingwall at both the north and south abutments. The following criteria should be followed for acceptance:

Sieve Size	Percent Passing
3"	100
3/4"	55 - 80
No. 4	35 - 60
No. 40	5 - 20
No. 200	0 - 12

Plasticity Index ≤ 10.

In addition, the borrow shall contain no "chunks" of clay, organic matter, tree limbs, excess moisture and stones larger than 3 inches.

8.4 Aggregate Base Course

The aggregate base course (ABC) material used under pavement sections should conform to Table 702 of MAG as follows:

Sieve Size	Percent Passing
1 1/8"	100
No. 4	38 - 65
No. 8	25 - 60
No. 30	10 - 40
No. 200	3 - 12

8.5 Prime Coat

This material will be applied to the aggregate base course prior to placing the first course of asphaltic concrete pavement. ATL recommends using either an MC 250 applied at a rate of 0.35 gal/yd^2 or a CSS 1 or 1h emulsion, diluted 50-50 with water and applied at a diluted rate of 0.65 gal/yd^2.

8.6 Tack Coat

Between asphaltic concrete lifts, a tack coat shall be applied in accordance with MAG Section 329. A CSS 1 applied at a rate of 0.07 gal/yd^2 and diluted with 50 percent water is recommended.

8.7 Structural Concrete

There are several types of concrete that could be specified for this project. MAG Section 725 provides general guidelines.

MAG Class B concrete should be specified for the curb, gutter and sidewalks with a 2,500 psi 28-day compressive strength.

The wingwall extensions and foundation should be constructed of a MAG Class A concrete with a 3000 psi 28-day compressive strength.

If drilled concrete piles/drilled shafts are used, a 7-sack mix is recommended, with compressive strengths at 28-days no less than 4,500 psi.

8.8 Asphaltic Concrete

MAG Section 320 should be followed in the placement of the material, with MAG Section 717 followed for the production of the asphalt rubber overlay for the bridge deck. ATL suggests that the asphalt rubber content be no less than 9% by weight due to the low volume usage of the runway. An AC 20 or PG 70-10 may be used as the paving grade asphalt. Compaction requirements should be based on either a 75-blow Marshall and the mix design developed accordingly or gyratory compaction values as required by " SuperPave" procedures.

The approach road sections may be constructed using a MAG C 3/4 mix as specified in Section 710, except for the final 25 mm, which will be an asphalt rubber.

9.0 ADDITIONAL SERVICES

ATL is prepared to provide materials testing services during construction. Our Phoenix office employs a staff of experienced technicians that are NICET certified and possess many years of testing experience. Full quality control services, including inspection and construction administrative services are also available.

ATL has appreciated the opportunity to be of service to you on this project. A library of past reports is maintained to answer future questions so do not hesitate to contact us when needed.

PLATES

GUIDELINES IN THE USE AND INTERPRETATION

OF THIS GEOTECHNICAL REPORT

ATL Job No. 196045

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The geotechnical report was prepared for the use of the Owner in the design of the subject facility and should be made available to potential contractors and/or the Contractor for information on factual data only. This report should not be used for contractual purposes as a warranty of interpreted subsurface conditions such as those indicated by the interpretive boring and test pit logs, cross sections, or discussion of subsurface conditions contained herein.

The analyses, conclusions and recommendations contained in the report are based on site conditions as they presently exist and assume that the exploratory borings, test pits, and/or probes are representative of the subsurface conditions of the site. If, during construction, subsurface conditions are found which are significantly different from those observed in the exploratory borings and test pits, or assumed to exist in the excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

The Summary Boring Logs are our opinion of the subsurface conditions revealed by periodic sampling of the ground as the borings progressed. The soil descriptions and interfaces between strata are interpretive and actual changes may be gradual.

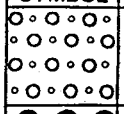
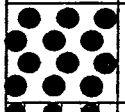
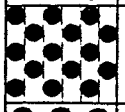
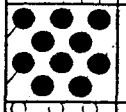
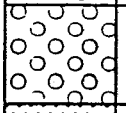
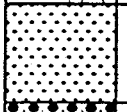
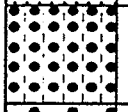
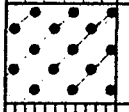
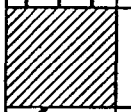
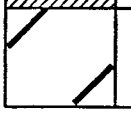
The boring logs and related information depict subsurface conditions only at these specific locations and at the particular time designated on the logs. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the soil conditions at these boring locations.

Groundwater levels often vary seasonally. Groundwater levels reported on the boring logs or in the body of the report are factual data only for the dates shown.

Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples, borings or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. It is recommended that the Owner consider providing a contingency fund to accommodate such potential extra costs.

This firm cannot be responsible for any deviation from the intent of this report including, but not restricted to, any changes to the scheduled time of construction, the nature of the project or the specific construction methods or means indicated in this report; nor can our firm be responsible for any construction activity on sites other than the specific site referred to in this report.

SOIL CLASSIFICATION & TERMINOLOGY

GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
	GW	Well graded gravels, gravel - sand mixtures, or sand - gravel - cobble mixtures.
	GP	Poorly graded gravels, gravel - sand mixtures, or sand - gravel - cobble mixtures.
	GM	Silty gravels, gravel - sand - silt mixtures.
	GC	Clayey gravels, gravel - sand - clay mixtures.
	SW	Well graded sands, gravelly sands.
	SP	Poorly graded sands, gravelly sands.
	SM	Silty sands, sand - silt mixtures
	SC	Clayey sands, sand - clay mixtures
	ML	Inorganic silts, clayey silts with slight plasticity
	MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand - gravel mixtures,

N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
50	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency	Remarks
0 - 4	Very soft	Easily penetrated several inches with fist.
3 - 4	Soft	Easily penetrated several inches with thumb.
5 - 8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9 - 15	Stiff	Readily indented with thumb but penetrated only with great effort.
16 - 30	Very stiff	Readily indented with thumbnail.
30 +	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and / or cemented soils which commonly occur the Southwest including clays, cemented granular materials silts and silty and clayey granular soils.

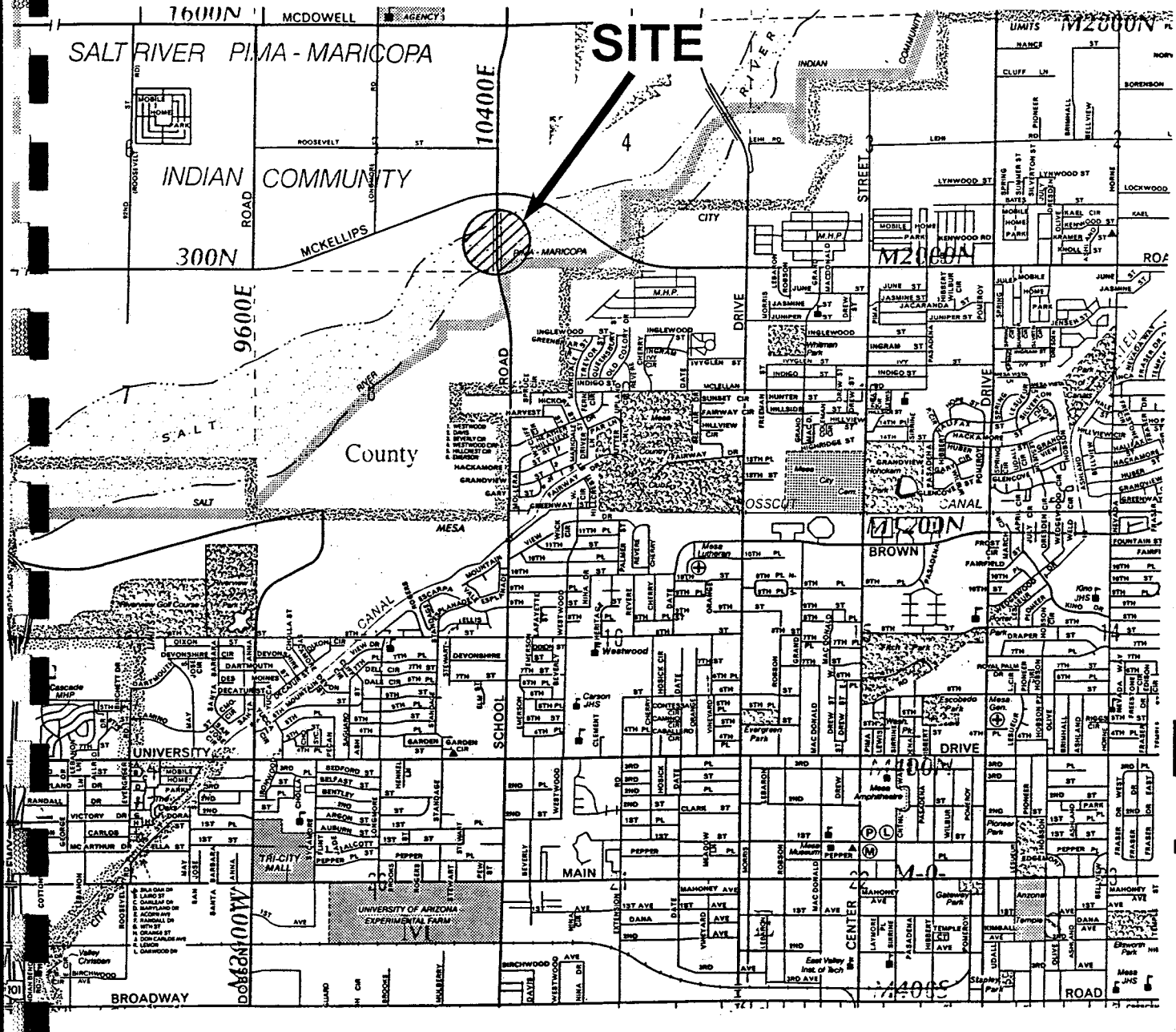
N	Relative Firmness
0 - 4	Very soft
5 - 8	Soft
9 - 15	Moderately firm
16 - 30	Firm
31 - 50	Very firm
50 +	Hard

4. Standard Penetration Tests (SPT) = [redacted]

DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 inches
Gravel	3 inches to No. 4 sieve
Coarse gravel	3 inches to 3/4 inch
Fine gravel	3/4 inch to No. 4 sieve
Sand	No. 4 sieve to No. 200
Coarse	No. 4 sieve to No. 10
Medium	No. 10 sieve to No. 40
Fine	No. 40 sieve to No. 200
Fines (silt or clay)	Below No. 200 sieve

PLATE 2

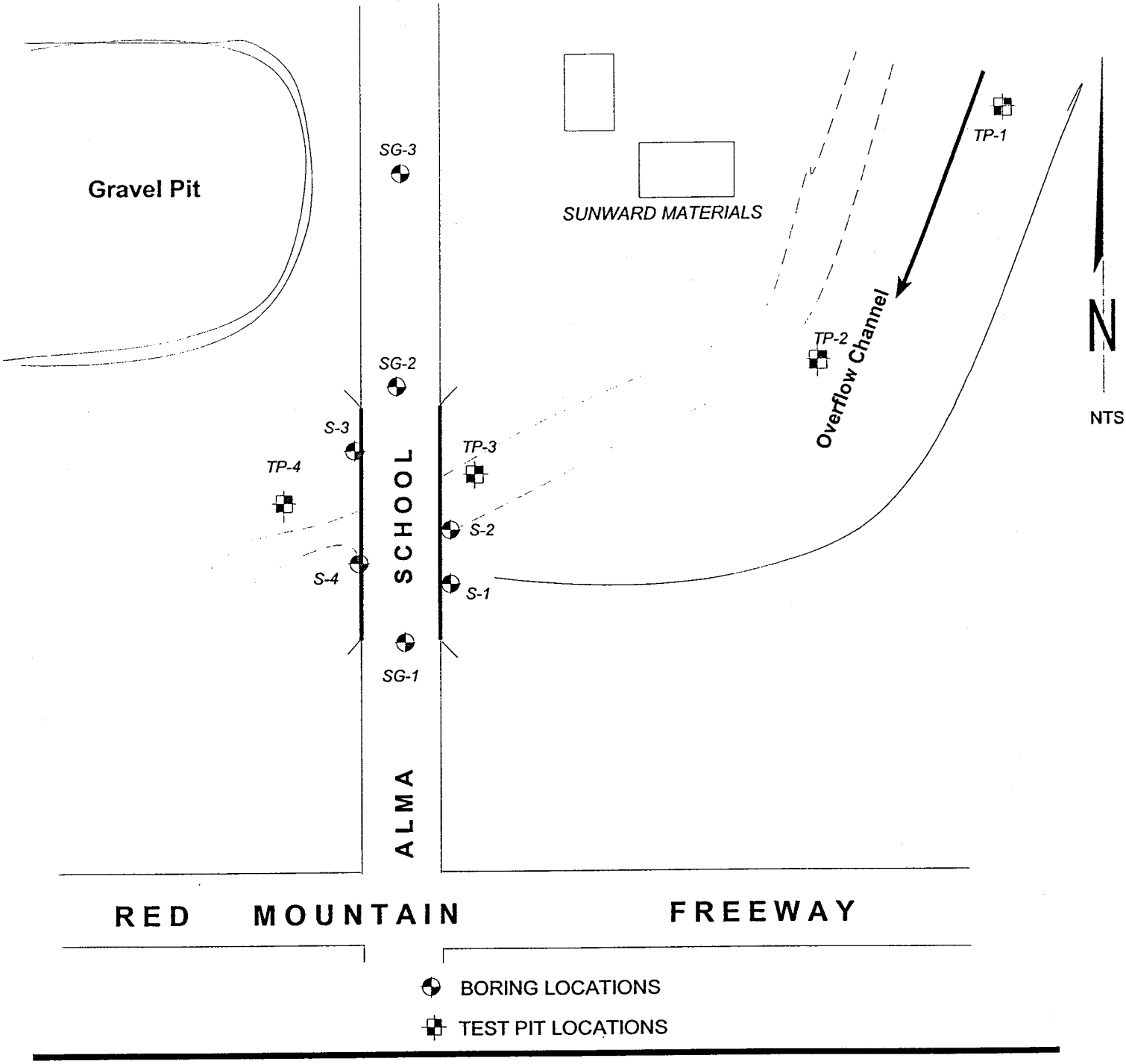


VICINITY MAP

ALMA SCHOOL ROAD
South Salt River Bridge
Maricopa County, Arizona

ATL JOB NO. 196045

PLATE 3



BORING AND TEST PIT LOCATIONS

ALMA SCHOOL ROAD
South Salt River Bridge
Maricopa County, Arizona

ATL JOB NO. 196045

PLATE NO. 4

APPENDIX A
BORING LOGS AND TEST PIT LOGS

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*

Boring No.:*SG-1*

Boring Location: *72 meters South of South end of Alma School Road South Bridge*

Equipment used: *Mobil B-50 , 203 mm diameter auger*

Date of Work: *3/18/97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		51 mm AC, 89 mm AB				
		Light brown, well-graded GRAVEL (GW) with sand, Damp				
	1	*(Bottom of boring at 1 meter)*				
	2					
	3					
	4					
	5					

Boring Stopped at 1.0 Meter Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A1

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*
Boring No.: *SG-2*

Boring Location: *43meters North of North end of Alma School Road South Bridge , 24 feet West centerline*

Equipment used: *Mobil B-50 - 203 mm diameter auger*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		76 mm AC, 102 mm AB				
	1	*Light brown, well-graded SAND(SW-SM) with silt and gravel, Damp*				
		(Bottom of boring at 1.5 meter)				
	2					
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A2

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. 196045
Boring No.: SG-3

Boring Location: *198 meters North of North end of Alma School Road South Bridge*

Equipment used: *Mobil B-50 - 203 mm diameter auger*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		51 mm AC, 152 mm AB				
		Light brown, well-graded SAND(SW-SM) with silt and gravel, Damp				
	1					
		(Bottom of boring at 1.5 meters)				
	2					
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A3

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*

Test Pit No.: *TP-1*

Boring Location: *580 feet +/- East of Alma School Road*
In center of overflow channel

Equipment used: *Case 580 Backhoe*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Gray-tan, well-graded GRAVEL(GW) with sand, Damp				
		Estimated 5 - 10% cobbles				
	1	*Increase in % cobbles & boulders to 20%*				
		(Bottom of boring at 1.5 meters)				
	2	*Note: Surface is covered with cobbles & boulders to 380mm size*				
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A4

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*

Test Pit No.: *TP-2*

Boring Location: *245 meter East of Alma School Road At Northedge of sediment ponds in overflow channel*

Equipment used: *Case 580 Backhoe*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
	1	*Gray-tan, well-graded GRAVEL(GW) with sand, Moist some boulders 300mm size*				
		(Bottom of boring at 1.5 meter)				
	2					
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A5

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*
Test Pit No.: *TP-3*

Boring Location: *30 meters East of Alma School Road*
Near center of overflow channel

Equipment used: *Case 580 Backhoe*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Brown, silty SAND(SM) with trace of gravel, Moist (Fill)				
	1	*Brown, silty SAND(SM) with gravel, Moist cobbles aand boulders to 380 mm*				
		(Bottom of boring at 1.5 meter)				
	2					
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A6

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*
Test Pit No.: *TP-4*

Boring Location: *122 meters West of Alma School Road*
New center of overflow channel

Equipment used: *Case 580 Backhoe*

Date of Work: *3-18-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Gray-tan, well - graded GRAVEL(GW) with sand , Damp				
	1	*with cobbles & boulders to 380mm.*				
		(Bottom of boring at 1.5 meters)				
	2	*Notes:* *Total surface covered with cobbles & boulders to 380 mm size*				
	3					
	4					
	5					

Boring Stopped at 1.5 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. *196045*

Boring No.: *S-1*

Boring Location: *3.6 meters East of East column*
2nd column row from South end of bridge

Equipment used: *Mobil B-50 , 115 mm ODEX*

Date of Work: *3-19-97* **Elevation of Boring :** *Existing Grade*

Driller: *J. Cowell* **Logger:** *J. Cowell* **Reviewed By:** *D. Hayes*

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Brown, silty SAND(SM), gravel & cobbles, Moist				
		Gray-tan, Sand, gravel, cobbles & boulders, Moist	*50 @ 10mm bouncing on rock*			
	5		*36 @150mm rec.*			
		Water Zone	*75 @ 150mm rec*			
			50 @ 10mm rec			
		Water Zone				
	10	*Lt. brown, silty SAND(SM) with gravel and cobbles, Moist*	*50 @ 125mm-50mm rec*			
			100 @ 50mm			
		with trace of cementation				
			50 @ 100mm - 50mm rec			
		trace ofcementation	*50 @ 175mm - bouncing on the rock*			
	15					
			50 @ 125mm			
		(Bottom of boring at 15.27 meters)				
	20					
	25					

Boring Stopped at 15.27 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A8

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. 196045

Boring No.: S-2

Boring Location: 3.6 meters East of East column
4th Column row from south end of bridge

Equipment used: Mobil B-50 , 115 mm ODEX

Date of Work: 3-21-97 **Elevation of Boring :** Existing Grade

Driller: J. Cowell **Logger:** J. Cowell **Reviewed By:** D. Hayes

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Lt. brown, silty SAND(SM), gravel & cobbles, Moist				
			29 @ 300mm rec.			
	5	Gray-tan, well-graded SAND (SW-SM) with silt and gravel, and cobbles, Moist	50 @ 50mm bouncing on rock 50 @ 75mm rec.			
		With trace of cementation	50 @ 100mm			
		Lt. brown, silty SAND(SM), Moist with cobbles	50 @ 125mm			
	10	▽ Water Zone	71			
			50 @ 150mm 50 @ 100mm			
		▽ Water Zone Note: Considerable water to bottom of boring est. 4 to 5 gallons per minute expelled with drill cuttings				
	15		50 @ 125mm			
		(Bottom of boring at 15.3 meters)				
	20					
	25					

Boring Stopped at 15.3 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A9

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. 196045
Boring No.: S-3

Boring Location: 8 meters West of West column
6th row of columns north of south end of bridge

Equipment used: Mobil B-50 , 115 mm ODEX

Date of Work: 3-24-97 **Elevation of Boring :** Existing Grade

Driller: J. Cowell **Logger:** J. Cowell **Reviewed By:** D. Hayes

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		SAND, gravel , cobbles and boulders, Portland Cement Cobbles and boulders				
		Gray-tan, silty SAND(SM) and gravel, Moist				
		Water Zone	100mm no rec.			
	5		100mm no rec.			
			50/150mm			
			50/150mm			
		Water zone				
			125mm 25mm rec.		Rocks only	
	10		50/125mm			
			125mm			
		with cobbles	50/50mm			
	15		50/75mm not saved			
		(Bottom of boring at 15.3 meters)				
	20					
	25					

Boring Stopped at 15.3 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

ALMA SCHOOL ROAD
South Salt River Bridge

ATL Job No. 196045
Boring No.: S-4

Boring Location: 8 meters West of West column
3rd row of columns north of south end of bridge

Equipment used: Mobil B-50 , 115 mm ODEX

Date of Work: 3-26-97 **Elevation of Boring :** Existing Grade

Driller: J. Cowell **Logger:** J. Cowell **Reviewed By:** D. Hayes

Graphical Log	Depth (Meter)	SOIL DESCRIPTION	SPT Blows/ft	Ring Blows/ft	Water Content %	Dry Density (pcf)
		Lt. brown, silty SAND(SM) with gravel and cobbles, Moist				
		Portland Cement concrete cobbles and boulders				
		Lt. brown, silty SAND(SM) with gravel, Moist (Loose)	25			
	5		82 @ 75mm			
			92			
		With gravel and cobbles	50/100mm			
		Wet				
			50/125mm			
	10	Increase in % cobbles	25/0mm bouncing on rock			
			125mm			
		Water Zone	50/100mm			
	15		50/100mm Bouncing on rock			
		(Bottom of boring at 15.3 meters)				
	20					
	25					

Boring Stopped at 15.3 Meters Below Existing Grade

Groundwater	Initial Depth	Hour	24 Hour Depth
	None		

NOTE: THE ABOVE DATA FOR DESIGN PURPOSES ONLY.

A11

APPENDIX B

LABORATORY TEST RESULTS

SUMMARY OF LABORATORY ANALYSIS

CLIENT: DE LEUW CATHER AND COMPANY DATE: 04/18/97

PROJECT: ALMA SCHOOL ROAD SOUTH BRIDGE AT SALT RIVER

LOCATION: MARICOPA COUNTY, ARIZONA

MATERIAL: See Below SAMPLING DATE: 03/18/97

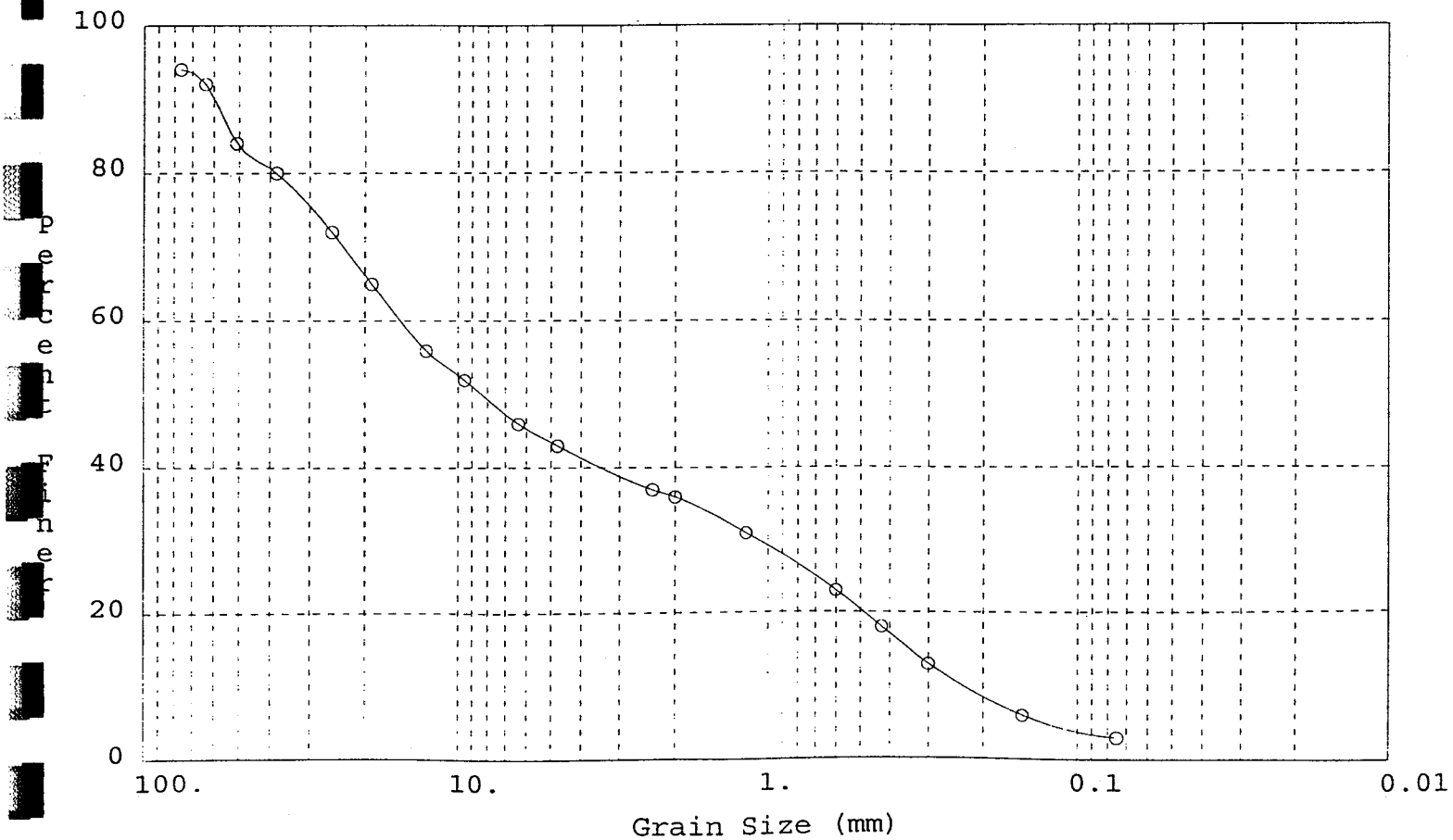
REQUESTED BY: David Hayes ATL JOB NO: 196045

LOG No.	DEPTH (FT)	MOIST (%)	USCS	LL	PI	SIEVE ANALYSIS - PERCENT PASSING											
						200	100	50	40	30	16	10	4	3/8	2"	4"	6"
SG-1	0.14 - 1.0	0.89	GW	NP	NP	3.4	6	13	18	23	31	36	43	51	84	100	-
SG-2	0.18 - 1.0	0.7	SW - SM	NP	NP	7.7	12	21	28	35	45	50	55	61	89	100	-
SG-3	0.20 - 1.5	3.5	SW - SM	NP	NP	10.9	16	24	29	33	40	45	51	62	100	-	-
TP-1	0 - 1.5	0.6	GW	NP	NP	1.0	2	4	6	8	12	15	19	30	71	90	100
TP-2	0 - 1.5	1.1	GW	NP	NP	4.5	6	10	14	18	25	27	31	39	84	100	-
TP-3	0.75 - 1.5	1.0	SM	NP	NP	14.3	20	27	31	36	42	46	52	60	90	100	-
TP-4	0.30 - 1.5	0.5	GW	NP	NP	1.4	2	3	5	8	15	20	27	34	70	92	100
S-2	6.7 - 7.6	9.6	SW - SM	NP	NP	10.2	13	20	27	33	43	57	82	99	100	-	-
S-2	9.8 - 10.6	6.7	SM	NP	NP	14.5	18	24	29	36	48	60	86	95	100	-	-

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 3/18/97
Tested By = V. Nichols Jr.
Boring Number = SG-1
Depth = 0.14m - 1.0 m
Sample Number = 97-0192
Description = Lt. brown, well-graded GRAVEL(GW) with sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3"	76.200	60.00	6.00	6.00	94.00
2 1/2"	63.500	20.00	2.00	8.00	92.00
2"	50.800	80.00	8.00	16.00	84.00
1 1/2"	38.100	40.00	4.00	20.00	80.00
1"	25.400	80.00	8.00	28.00	72.00
3/4"	19.050	70.00	7.00	35.00	65.00
1/2"	12.700	90.00	9.00	44.00	56.00
3/8"	9.500	40.00	4.00	48.00	52.00
1/4"	6.350	60.00	6.00	54.00	46.00
#4	4.750	30.00	3.00	57.00	43.00
#8	2.360	60.00	6.00	63.00	37.00
#10	2.000	10.00	1.00	64.00	36.00
#16	1.180	50.00	5.00	69.00	31.00
#30	0.600	80.00	8.00	77.00	23.00
#40	0.425	50.00	5.00	82.00	18.00
#50	0.300	50.00	5.00	87.00	13.00
#100	0.150	70.00	7.00	94.00	6.00
#200	0.075	30.00	3.00	97.00	3.00
Pan	0.000	0.00	0.00	97.00	3.00

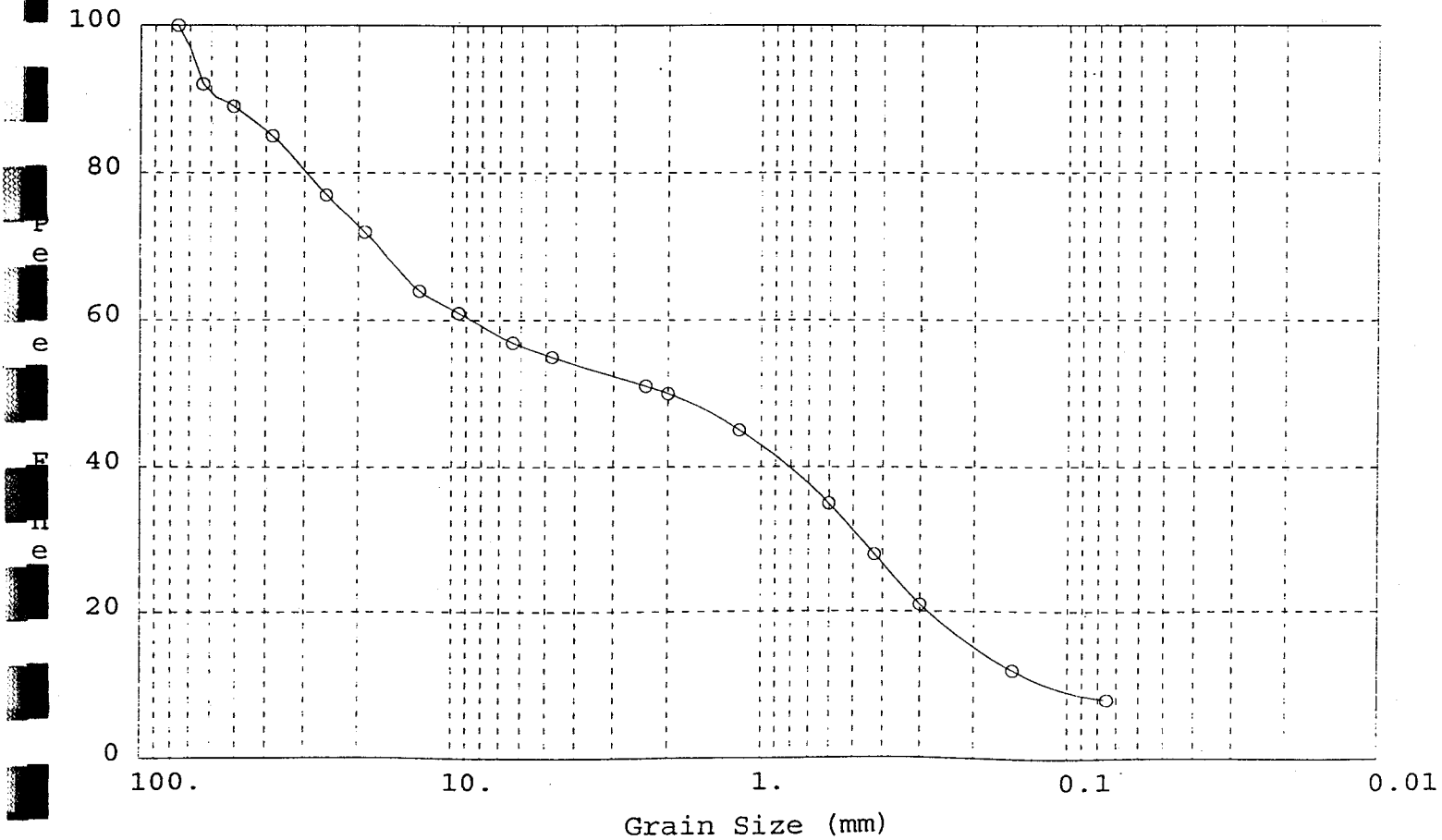
Sieve Analysis



Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 3/18/97
Tested By = V. Nichols Jr.
Boring Number = SG-2
Depth = 0.18m - 1.08m
Sample Number = 97-0194
Description = Lt. brn, well graded SAND(SW-SM) with silt and gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
3"	76.200	0.00	0.00	0.00	100.00
2 1/2"	63.500	80.00	8.00	8.00	92.00
2"	50.800	30.00	3.00	11.00	89.00
1 1/2"	38.100	40.00	4.00	15.00	85.00
1"	25.400	80.00	8.00	23.00	77.00
3/4"	19.050	50.00	5.00	28.00	72.00
1/2"	12.700	80.00	8.00	36.00	64.00
3/8"	9.500	30.00	3.00	39.00	61.00
1/4"	6.350	40.00	4.00	43.00	57.00
#4	4.750	20.00	2.00	45.00	55.00
#8	2.360	40.00	4.00	49.00	51.00
#10	2.000	10.00	1.00	50.00	50.00
#16	1.180	50.00	5.00	55.00	45.00
#30	0.600	100.00	10.00	65.00	35.00
#40	0.425	70.00	7.00	72.00	28.00
#50	0.300	70.00	7.00	79.00	21.00
#100	0.150	90.00	9.00	88.00	12.00
#200	0.075	40.00	4.00	92.00	8.00
Pan	0.000	0.00	0.00	92.00	8.00

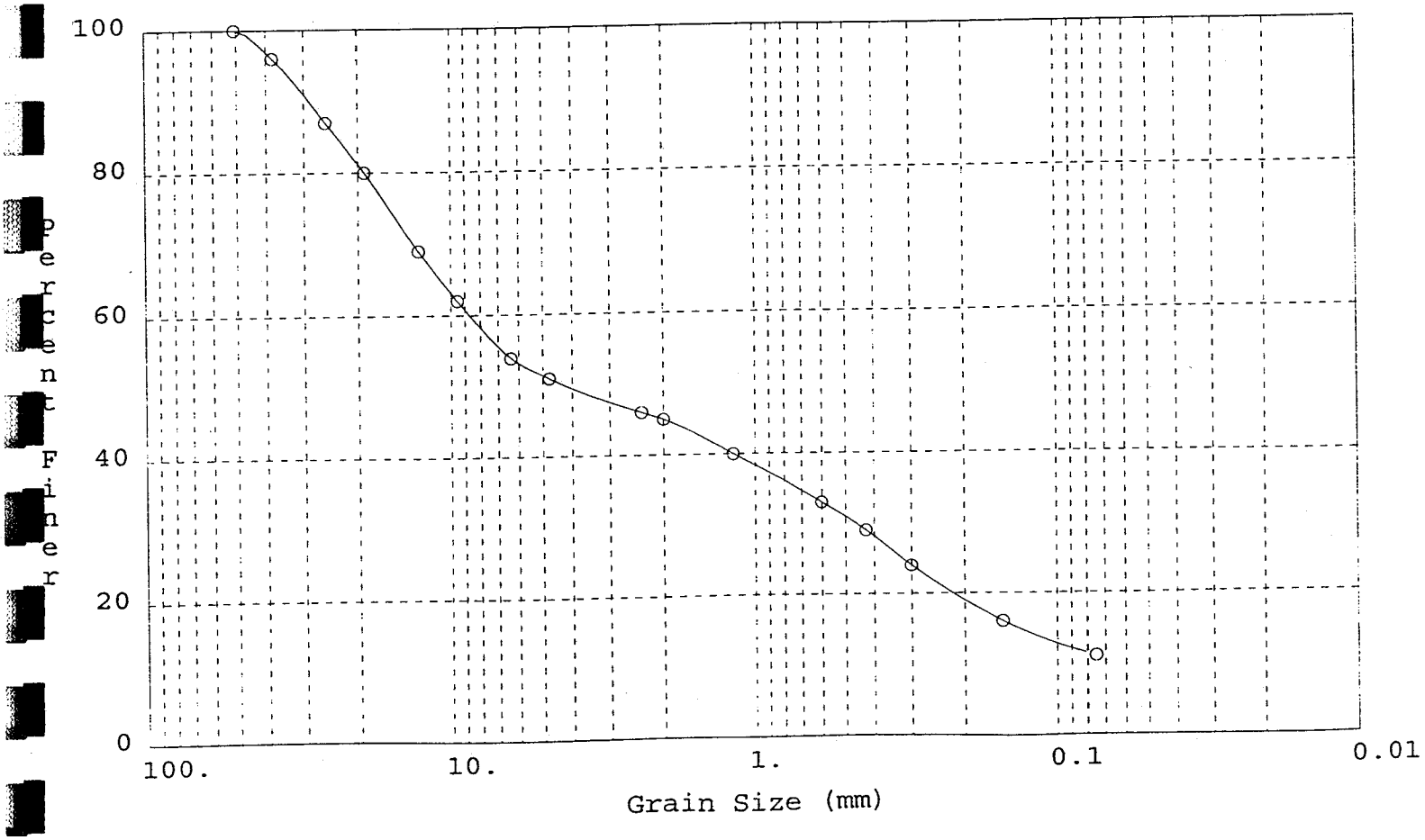
Sieve Analysis



Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 3/18/97
Tested By = V. Nichols Jr.
Boring Number = SG-3
Depth = 0.20m - 1.5 m
Sample Number = 97-0196
Description = Lt. brn, well-graded SAND(SW-SM) with silt and gravel
Dry Sample Weight (g) = 1000

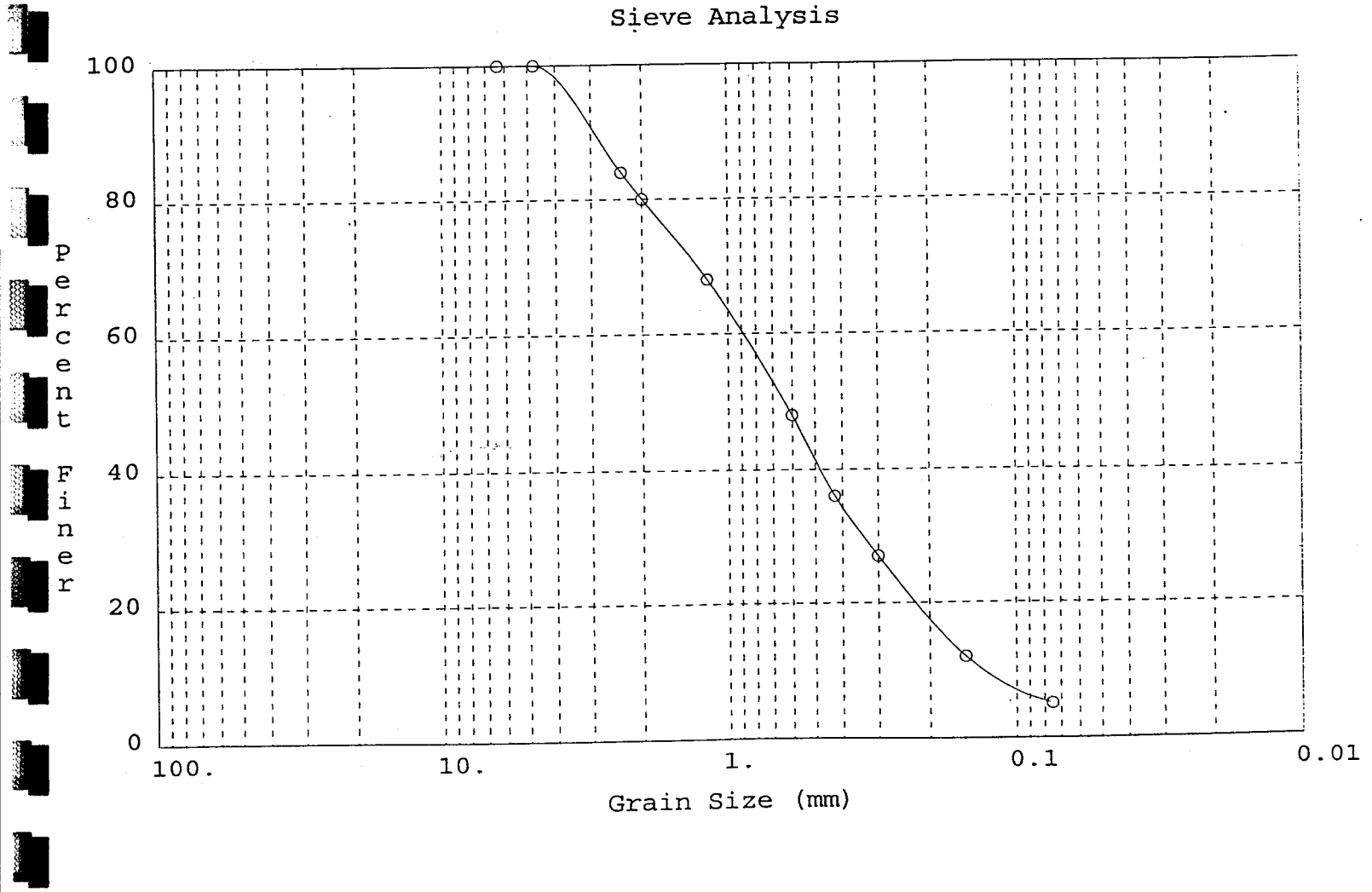
SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
2"	50.800	0.00	0.00	0.00	100.00
1 1/2"	38.100	40.00	4.00	4.00	96.00
1"	25.400	90.00	9.00	13.00	87.00
3/4"	19.050	70.00	7.00	20.00	80.00
1/2"	12.700	110.00	11.00	31.00	69.00
3/8"	9.500	70.00	7.00	38.00	62.00
1/4"	6.350	80.00	8.00	46.00	54.00
#4	4.750	30.00	3.00	49.00	51.00
#8	2.360	50.00	5.00	54.00	46.00
#10	2.000	10.00	1.00	55.00	45.00
#16	1.180	50.00	5.00	60.00	40.00
#30	0.600	70.00	7.00	67.00	33.00
#40	0.425	40.00	4.00	71.00	29.00
#50	0.300	50.00	5.00	76.00	24.00
#100	0.150	80.00	8.00	84.00	16.00
#200	0.075	50.00	5.00	89.00	11.00
Pan	0.000	0.00	0.00	89.00	11.00

Sieve Analysis



Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-1
Depth = 0 - 1.5m
Sample Number = 97-0197
Description = Well graded GRAVEL(GW) with sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	0.00	0.00	0.00	100.00
#8	2.360	160.00	16.00	16.00	84.00
#10	2.000	40.00	4.00	20.00	80.00
#16	1.180	120.00	12.00	32.00	68.00
#30	0.600	200.00	20.00	52.00	48.00
#40	0.425	120.00	12.00	64.00	36.00
#50	0.300	90.00	9.00	73.00	27.00
#100	0.150	150.00	15.00	88.00	12.00
#200	0.075	70.00	7.00	95.00	5.00
Pan	0.000	0.00	0.00	95.00	5.00



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0197
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-1 Depth: 0- 1.5 m

WEIGHT OF SAMPLE = 103.43 (GMS) SOIL PASSING #10 SIEVE = 80.08 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.616

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 10:39 AM	21.7	0.01396	1.00375	1.00775	1.00400	14.2	0.037	5.0
2	10:41 AM	21.7	0.01396	1.00375	1.00675	1.00300	14.5	0.038	3.8
5	10:44 AM	21.7	0.01396	1.00375	1.00675	1.00300	14.5	0.024	3.8
15	10:54 AM	21.7	0.01396	1.00375	1.00575	1.00200	14.8	0.014	2.5
30	11:09 AM	22.2	0.01396	1.00375	1.00550	1.00175	14.8	0.010	2.2
60	11:41 AM	22.2	0.01396	1.00375	1.00525	1.00150	14.9	0.007	1.9
250	02:49 PM	23.3	0.01396	1.00375	1.00525	1.00150	14.9	0.003	1.9
04/10/97 1440	10:39 AM	23.3	0.01396	1.00375	1.00500	1.00125	15.0	0.001	1.6

Reviewed By:
Input By: AO

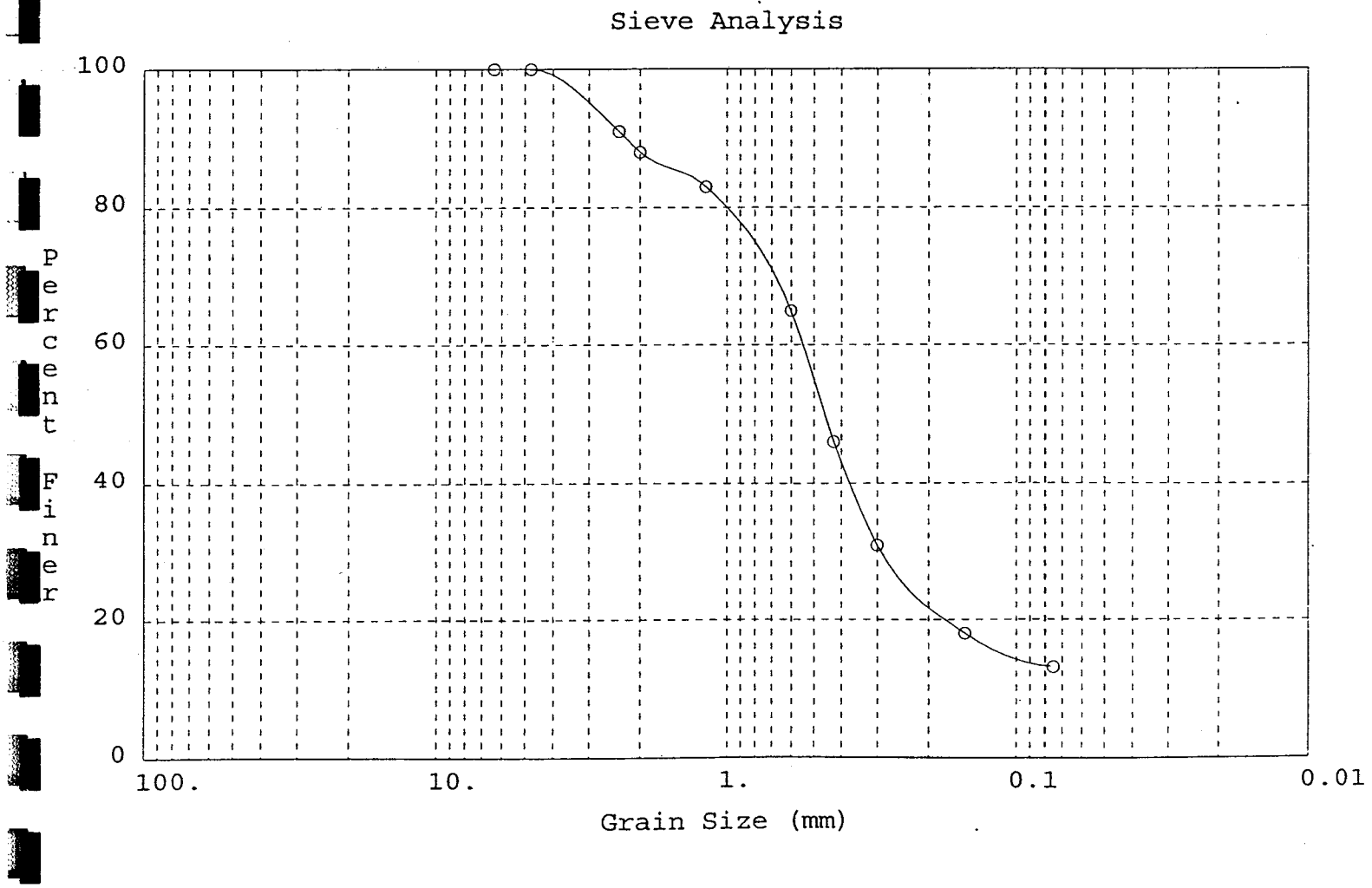
Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0197Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-2
Depth = 0 - 1.5m
Sample Number = 97-0198
Description = Well graded GRAVEL(GW) with sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	0.00	0.00	0.00	100.00
#8	2.360	90.00	9.00	9.00	91.00
#10	2.000	30.00	3.00	12.00	88.00
#16	1.180	50.00	5.00	17.00	83.00
#30	0.600	180.00	18.00	35.00	65.00
#40	0.425	190.00	19.00	54.00	46.00
#50	0.300	150.00	15.00	69.00	31.00
#100	0.150	130.00	13.00	82.00	18.00
#200	0.075	50.00	5.00	87.00	13.00
Pan	0.000	0.00	0.00	87.00	13.00



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0198
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Road. South Bridge
MATERIAL : Well-graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring No. TP-2 Depth: 0 - 1.5m

WEIGHT OF SAMPLE = 52.13 (GMS) SOIL PASSING #10 SIEVE = 87.90 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.464

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 11:00 AM	22.2	0.01396	1.00375	1.00775	1.00400	14.2	0.037	11.4
2	11:02 AM	22.2	0.01396	1.00375	1.00675	1.00300	14.5	0.038	8.5
5	11:05 AM	22.2	0.01396	1.00375	1.00675	1.00300	14.5	0.024	8.5
15	11:15 AM	22.2	0.01396	1.00375	1.00650	1.00275	14.6	0.014	7.8
30	11:30 AM	22.0	0.01396	1.00375	1.00500	1.00125	15.0	0.010	3.5
60	12:00 AM	22.0	0.01396	1.00375	1.00500	1.00125	15.0	0.007	3.5
250	03:10 PM	23.3	0.01396	1.00375	1.00400	1.00025	15.2	0.003	0.7
1440	10:45 AM	22.0	0.01396	1.00375	1.01125	1.00750	13.3	0.001	21.3

Reviewed By:
Input By: AO

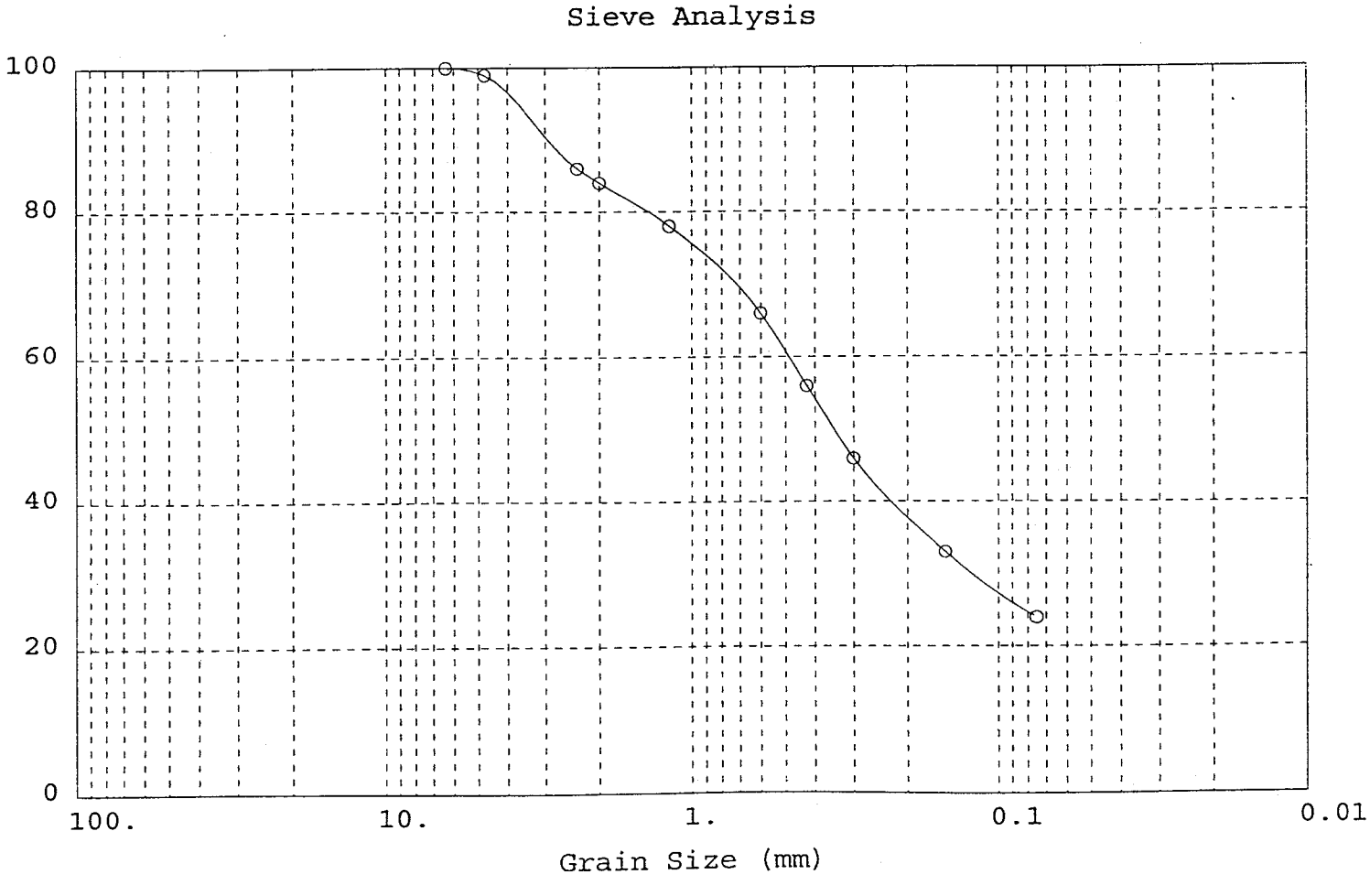
Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0198Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-3
Depth = 0.75m - 1.5m
Sample Number = 97-0200
Description = silty SAND(SM) with gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	10.00	1.00	1.00	99.00
#8	2.360	130.00	13.00	14.00	86.00
#10	2.000	20.00	2.00	16.00	84.00
#16	1.180	60.00	6.00	22.00	78.00
#30	0.600	120.00	12.00	34.00	66.00
#40	0.425	100.00	10.00	44.00	56.00
#50	0.300	100.00	10.00	54.00	46.00
#100	0.150	130.00	13.00	67.00	33.00
#200	0.075	90.00	9.00	76.00	24.00
Pan	0.000	0.00	0.00	76.00	24.00



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0199
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Silty SAND(SM) with gravel
SOURCE OF MATERIAL: Boring TP-3 Depth: 0- 0.75m

WEIGHT OF SAMPLE = 49.53 (GMS) SOIL PASSING #10 SIEVE = 80.60 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.604

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 11:20 AM	22.2	0.01396	1.00375	1.01175	1.00800	13.2	0.036	21.1
2	11:22 AM	22.2	0.01396	1.00375	1.01175	1.00800	13.2	0.036	21.1
5	11:25 AM	22.2	0.01396	1.00375	1.01075	1.00700	13.5	0.023	18.5
15	11:35 AM	22.2	0.01396	1.00375	1.01025	1.00650	13.6	0.013	17.2
30	11:50 AM	22.2	0.01396	1.00375	1.00975	1.00600	13.7	0.009	15.9
60	12:20 AM	22.2	0.01396	1.00375	1.00975	1.00600	13.7	0.007	15.9
250	03:30 PM	23.3	0.01396	1.00375	1.00775	1.00400	14.2	0.003	10.6
1440	11:20 AM	23.3	0.01396	1.00375	1.00700	1.00325	14.4	0.001	8.6

Reviewed By:
Input By: AO

Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0199Geo

HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0200
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Silty SAND (SM) with gravel
SOURCE OF MATERIAL: Boring TP-3 Depth: 0.75 m - 1.5 m

WEIGHT OF SAMPLE = 50.00 (GMS) SOIL PASSING #10 SIEVE = 83.80 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.624

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 01:30 PM	23.3	0.01396	1.00375	1.011	1.00725	13.4	0.036	19.6
2	01:32 PM	23.3	0.01396	1.00375	1.01025	1.00650	13.6	0.036	17.6
5	01:35 PM	23.3	0.01396	1.00375	1.00975	1.00600	13.7	0.023	16.2
15	01:45 PM	23.3	0.01396	1.00375	1.00925	1.00550	13.8	0.013	14.9
30	02:00 PM	23.3	0.01396	1.00375	1.00875	1.00500	14.0	0.010	13.5
60	02:30 PM	23.3	0.01396	1.00375	1.00700	1.00325	14.4	0.007	8.8
250	05:30 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.003	7.4
04/10/97 1440	01:30 PM	23.3	0.01396	1.00375	1.00550	1.00175	14.8	0.001	4.7

Reviewed By:
Input By: AO

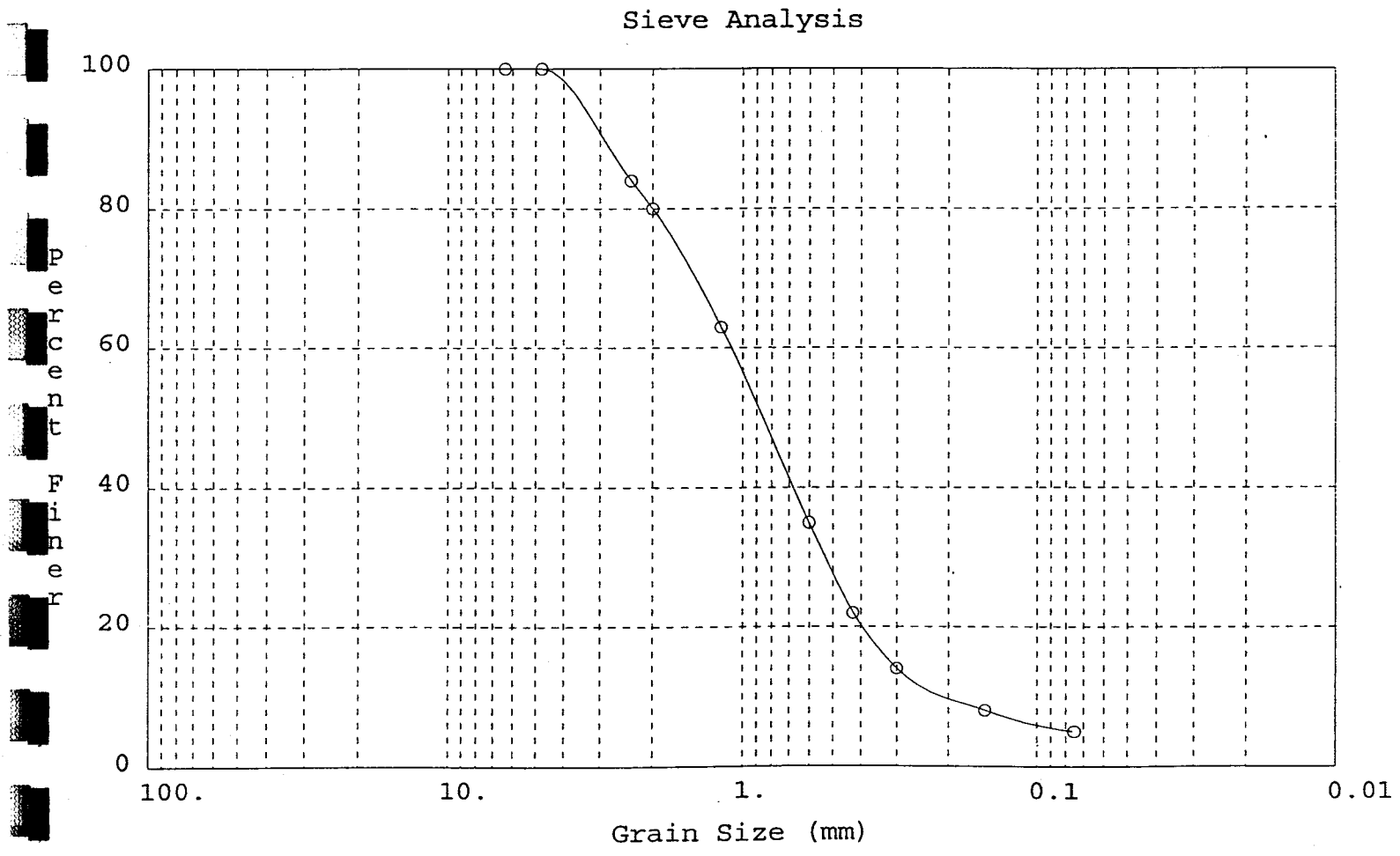
Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-200Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/8/97
Tested By = V. Nichols Jr.
Boring Number = TP-4
Depth = 0.30m - 1.5m
Sample Number = 97-0202
Description = Well-graded GRAVEL(GW) w/ sand
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/4"	6.350	0.00	0.00	0.00	100.00
#4	4.750	0.00	0.00	0.00	100.00
#8	2.360	160.00	16.00	16.00	84.00
#10	2.000	40.00	4.00	20.00	80.00
#16	1.180	170.00	17.00	37.00	63.00
#30	0.600	280.00	28.00	65.00	35.00
#40	0.425	130.00	13.00	78.00	22.00
#50	0.300	80.00	8.00	86.00	14.00
#100	0.150	60.00	6.00	92.00	8.00
#200	0.075	30.00	3.00	95.00	5.00
Pan	0.000	0.00	0.00	95.00	5.00



HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0201
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-4 Depth: 0- 0.30 m

WEIGHT OF SAMPLE = 100.62 (GMS) SOIL PASSING #10 SIEVE = 47.50 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.658

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 01:50 PM	23.3	0.01396	1.00375	1.01025	1.00650	13.6	0.036	4.9
2	01:52 PM	23.3	0.01396	1.00375	1.00875	1.00500	14.0	0.037	3.8
5	01:55 PM	23.3	0.01396	1.00375	1.00775	1.00400	14.2	0.024	3.0
15	02:05 PM	23.3	0.01396	1.00375	1.00725	1.00350	14.4	0.014	2.6
30	02:20 PM	23.3	0.01396	1.00375	1.00750	1.00375	14.3	0.010	2.8
60	02:50 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.007	2.3
250	06:00 PM	23.3	0.01396	1.00375	1.00500	1.00125	15.0	0.003	0.9
04/10/97 1440	01:50 PM	23.3	0.01396	1.00375	1.00550	1.00175	14.8	0.001	1.3

Reviewed By:
Input By: AO

Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-201Geo

HYDROMETER ANALYSIS
(ASTM D422)

CLIENT : De Leuw Cather

DATE : 04/14/97

LAB. NO.: 97-0202
JOB NO. : 196045
DATE RCVD: 03/25/97
SAMPLED BY: J. Cowell

PROJECT : Alma School Rd. S. Bridge
MATERIAL : Well graded GRAVEL(GW) with sand
SOURCE OF MATERIAL: Boring TP-4 Depth: 0.30m - 1.5 m

WEIGHT OF SAMPLE = 100.73 (GMS) SOIL PASSING #10 SIEVE = 80.40 %

SPECIFIC GRAVITY OF SOIL SAMPLE = 2.628

ELAPSED TIME (MIN)	TIME	TEMP. (oC)	CORR.(K) USING (TAB. 3)	HYDROMETER READING (WATER)	HYDROMETER READING (W/SOIL)	CORR. READING	EFFECTIVE DEPTH (CMS)	PARTICLE SIZE (M.M)	PERCENT FINER IN SUSPENSION
0	START 02:05 PM	23.3	0.01396	1.00375	1.0075	1.00375	14.3	0.037	4.8
2	02:07 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.038	3.9
5	02:10 PM	23.3	0.01396	1.00375	1.00675	1.00300	14.5	0.024	3.9
15	02:20 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.014	3.5
30	02:35 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.010	3.5
60	03:05 PM	23.3	0.01396	1.00375	1.00650	1.00275	14.6	0.007	3.5
250	06:15 PM	23.3	0.01396	1.00375	1.00625	1.00250	14.6	0.003	3.2
04/10/97 1440	03:05 PM	23.3	0.01396	1.00375	1.00575	1.00200	14.8	0.001	2.6

Reviewed By
Input By: AO

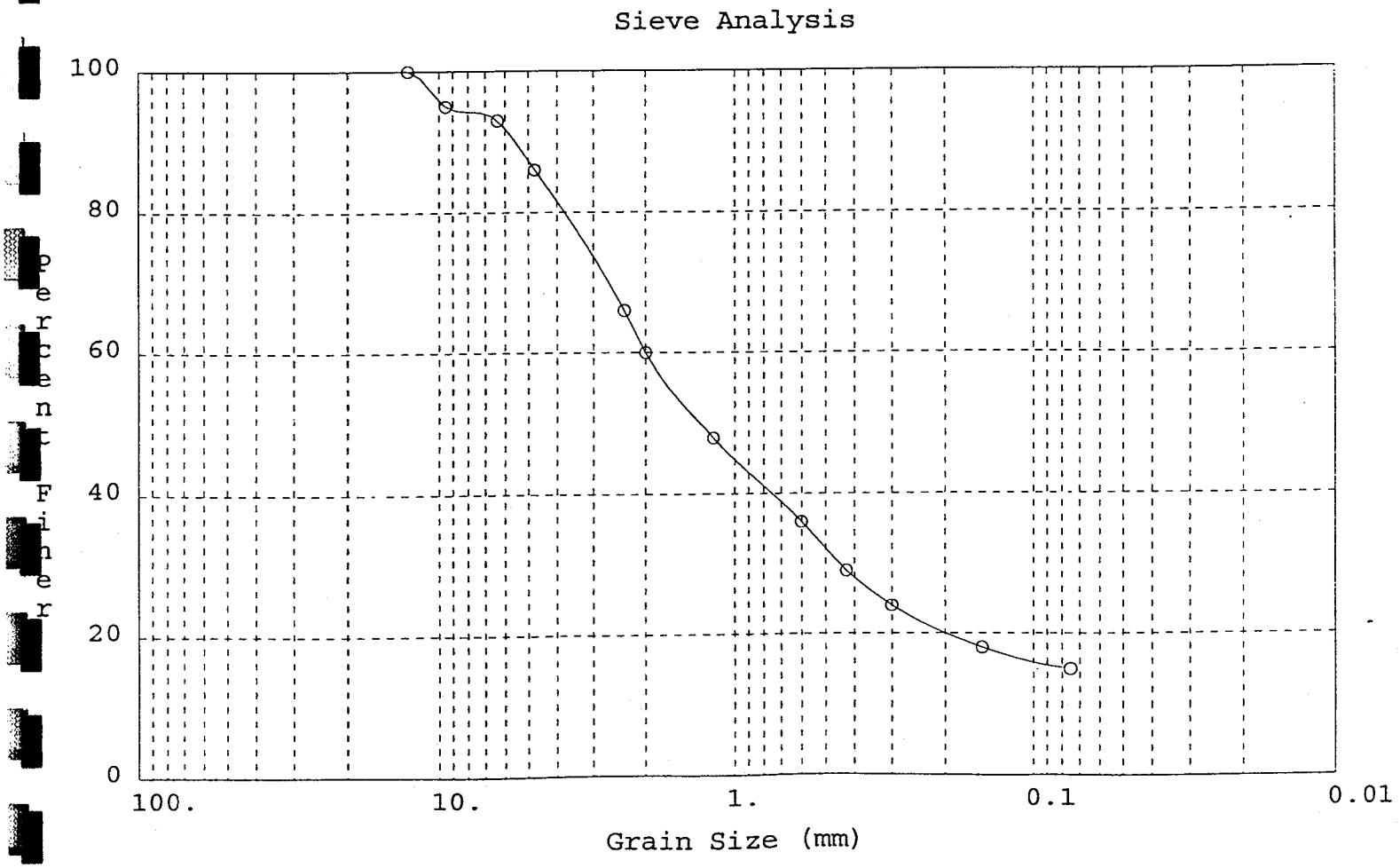
Respectfully Submitted:

J. Michael Addington
Laboratory Supervisor

DeLeuw/Hydro/97-0202Geo

Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/4/97
Tested By = D. Johnson
Boring Number = S-2
Depth = 9.8m-10.6m
Sample Number = 97-0212
Description = Brown, silty SAND(SM)
Dry Sample Weight (g) = 1000

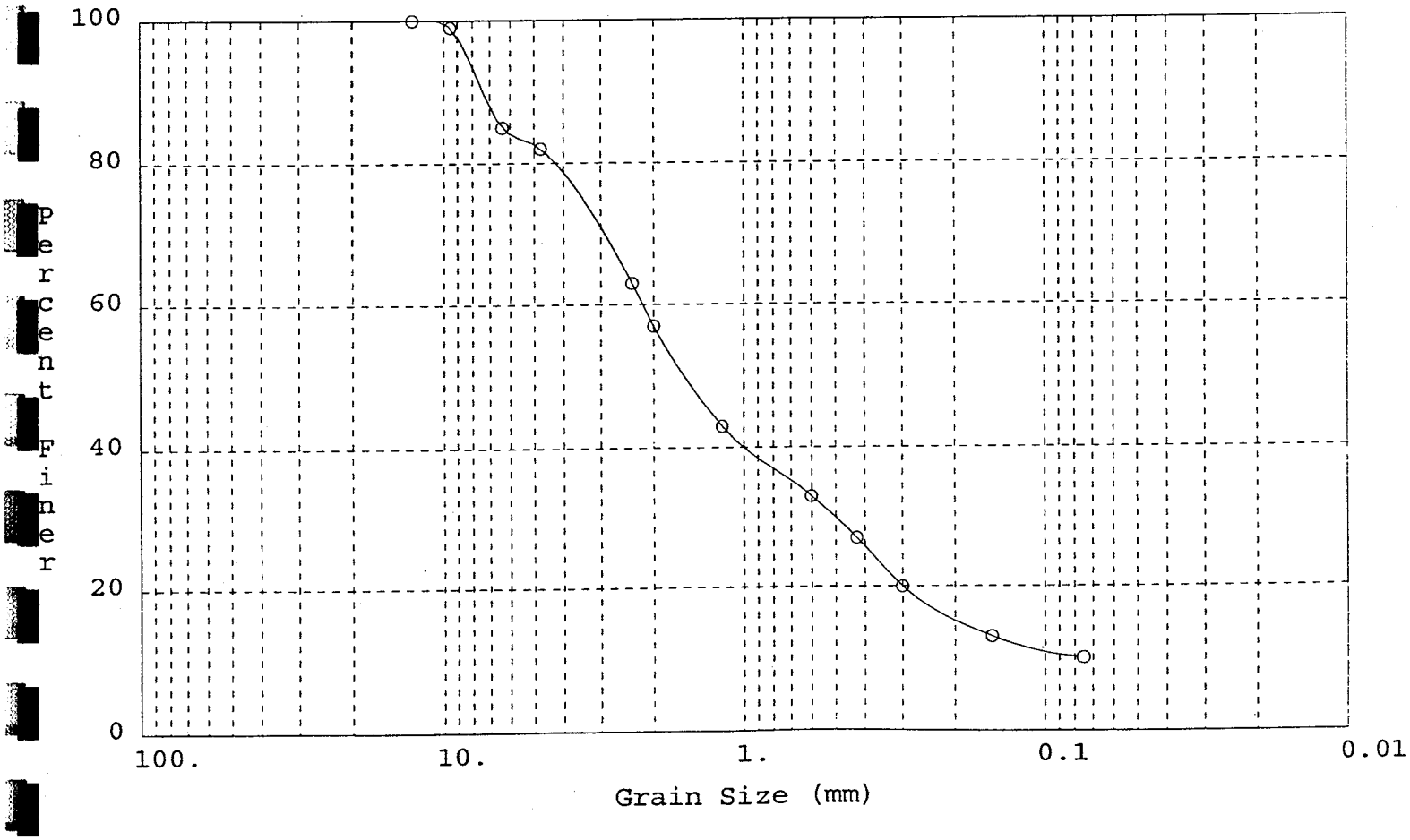
SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/2"	12.700	0.00	0.00	0.00	100.00
3/8"	9.500	50.00	5.00	5.00	95.00
1/4"	6.350	20.00	2.00	7.00	93.00
#4	4.750	70.00	7.00	14.00	86.00
#8	2.360	200.00	20.00	34.00	66.00
#10	2.000	60.00	6.00	40.00	60.00
#16	1.180	120.00	12.00	52.00	48.00
#30	0.600	120.00	12.00	64.00	36.00
#40	0.425	70.00	7.00	71.00	29.00
#50	0.300	50.00	5.00	76.00	24.00
#100	0.150	60.00	6.00	82.00	18.00
#200	0.075	30.00	3.00	85.00	15.00
Pan	0.000	0.00	0.00	85.00	15.00



Project Number = 196045 Client: De Leuw Cather
Location = Alma School Road South Bridge
Date = 4/4/97
Tested By = D. Johnson
Boring Number = S-2
Depth = 6.7m - 7.6m
Sample Number = 97-0211
Description = Brown, well-graded SAND(SW-SM) with silt & gravel
Dry Sample Weight (g) = 1000

SIEVE NUMBER	SIEVE OPENING (mm)	RETAINED WEIGHT (g)	PERCENT OF WEIGHT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT FINER (%)
1/2"	12.700	0.00	0.00	0.00	100.00
3/8"	9.500	10.00	1.00	1.00	99.00
1/4"	6.350	140.00	14.00	15.00	85.00
#4	4.750	30.00	3.00	18.00	82.00
#8	2.360	190.00	19.00	37.00	63.00
#10	2.000	60.00	6.00	43.00	57.00
#16	1.180	140.00	14.00	57.00	43.00
#30	0.600	100.00	10.00	67.00	33.00
#40	0.425	60.00	6.00	73.00	27.00
#50	0.300	70.00	7.00	80.00	20.00
#100	0.150	70.00	7.00	87.00	13.00
#200	0.075	30.00	3.00	90.00	10.00
Pan	0.000	0.00	0.00	90.00	10.00

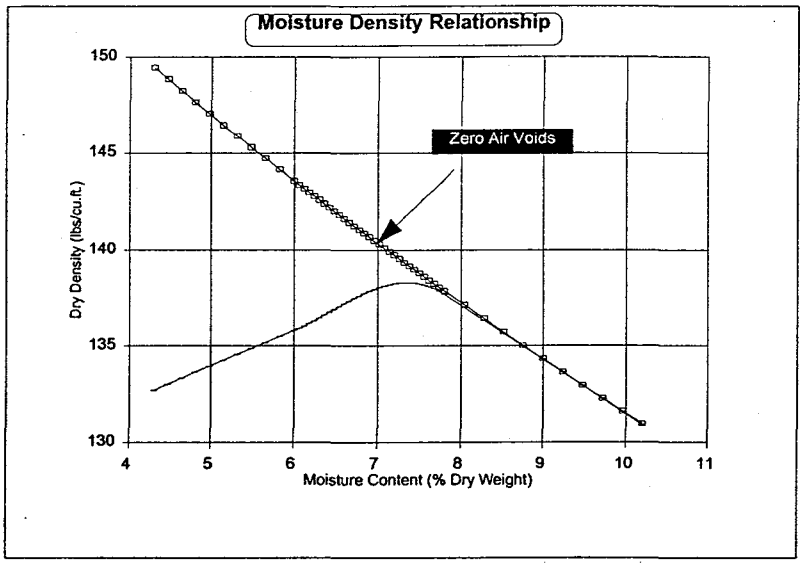
Sieve Analysis



ATL, INC.
CONSTRUCTION QUALITY CONTROL
GEOTECHNICAL CONSULTANTS

Summary of Moisture Density Relationship Tests

Client:	De Leuw Cather and Company 3875 N. 44th street, Ste 250 Phoenix, Az 85018	**Job No.**	196045
		Lab No.	97-0194
		Type of Rammer:	Manual
		Test Date:	04/08/97
Project:	Alma School Road Bridge	**Material Description:**	Lt. brn, Well-graded SAND
Test Designation:	ASTM D-698		(SW-SM) with silt & gravel
Test Method:	A	Boring No: SG-2	Depth: 0.18m - 1.0m



Specific Gravity Used For Zero Air Voids Curve: 2.67

Test No.	1	2	3	4
Dry Density (lbs/cu.ft.)	132.7	135.8	137.7	130.9
Moisture Content (%)	4.3	6.0	7.8	10.2

Maximum Dry Density (lbs/cu.ft.): **138.3**
Optimum Moisture Content (% of Dry Weight): **7.3**

Remarks:

Respectfully Submitted:

Reviewed By:
Input By: AO

J. Michael Addington
Laboratory Manager

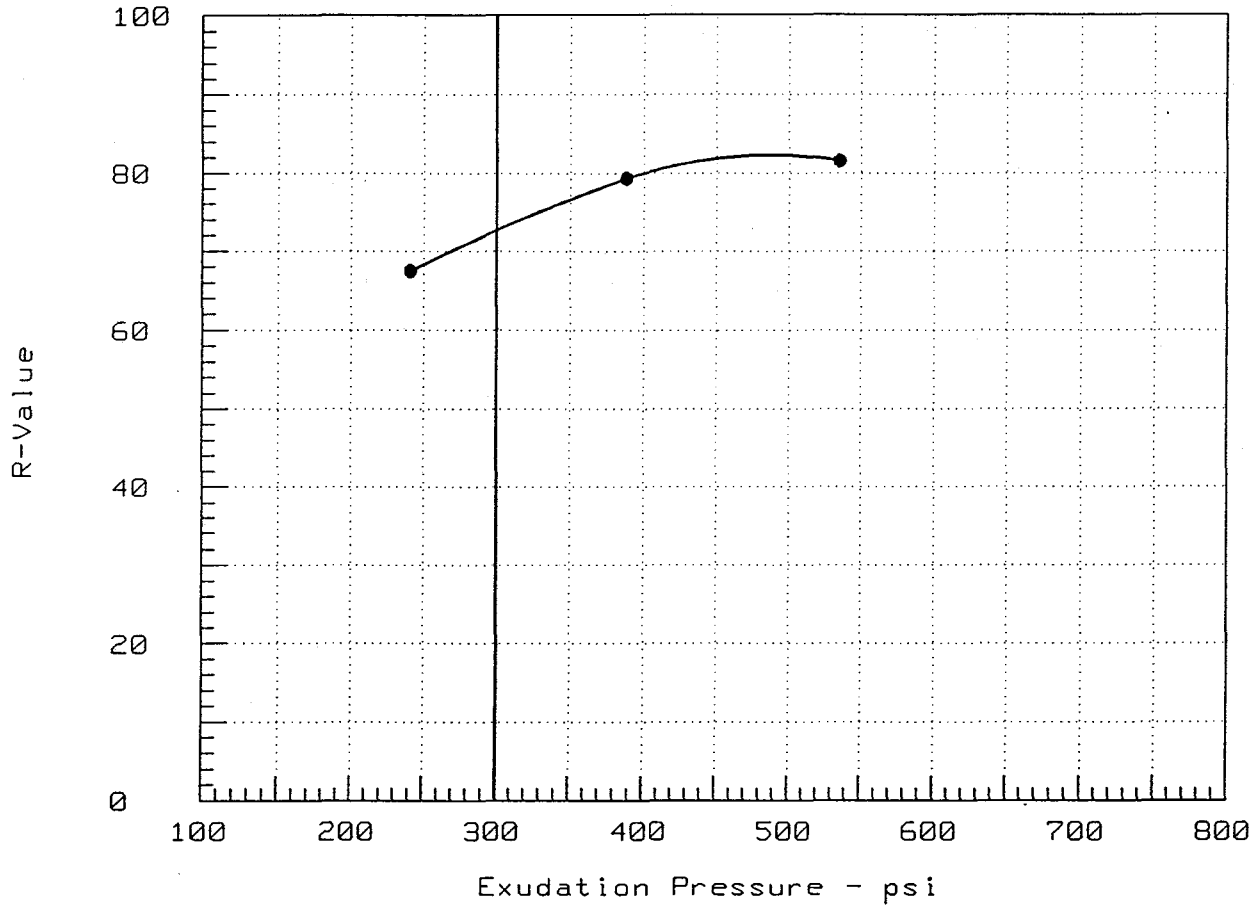
2512 W. CLARENDON
PHOENIX, AZ 85017
TELEPHONE (602) 241-1097
FAX (602) 277-1306

820 E. 47TH STREET, SUITE B-1
TUCSON, AZ 85713
TELEPHONE (520) 623-4547
FAX (520) 623-4603

1400½ N. BROAD
GLOBE, AZ 85502
TELEPHONE (520) 425-8999
FAX (520) 425-9597

1855 W. KAIBAB LANE SUITE 6
FLAGSTAFF, AZ 86001
TELEPHONE (520) 773-9614
FAX (520) 773-9522

R-VALUE TEST REPORT

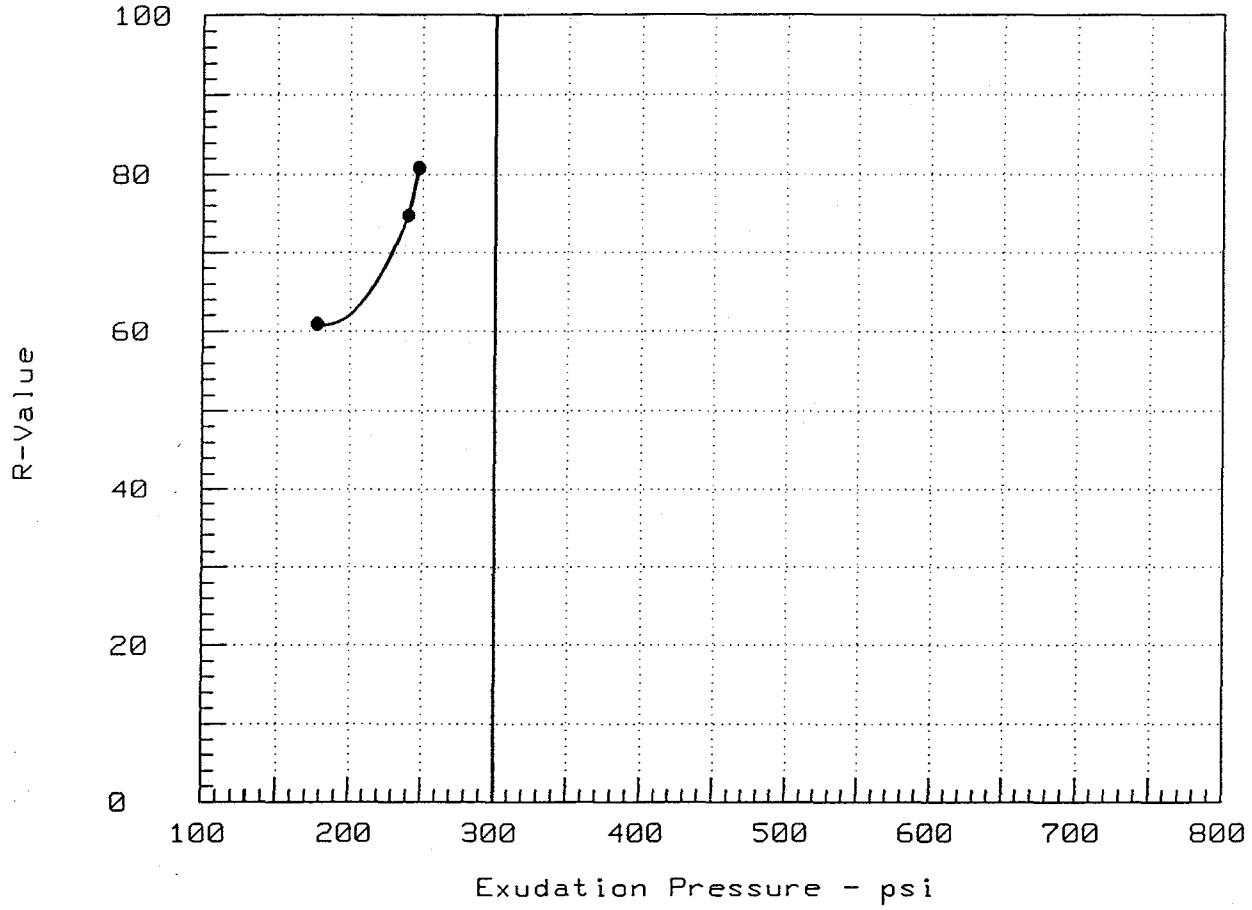


Resistance R-Value and Expansion Pressure - ASTM - D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	200	134.1	0.7	0.00	18	2.30	388	81.2	79.3
2	200	134.1	0.7	0.00	17	2.30	536	83.2	81.6
3	200	135.6	0.7	0.00	30	2.30	241	70.9	67.5

TEST RESULTS	MATERIAL DESCRIPTION
R-Value @ 300 psi exudation pressure = 72.7	Sample Source: SG-1 Depth: 0.14m - 1.0m
Project No.: 196045 Project: Alma School Rd. Bridge Location: South Salt River Bridge Maricopa County, Arizona Date: 3-28-97	Tested by: D. Johnson Checked by: Addington Remarks: Lab No. 97-0192
R-VALUE TEST REPORT **ATL, INC.**	Fig. No. 2

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM - D 2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	127.0	1.3	0.00	37	2.30	177	65.0	60.9
2	350	126.8	1.3	0.00	26	2.30	240	77.3	74.8
3	350	138.2	1.3	0.00	17	2.30	248	82.5	80.8

TEST RESULTS	MATERIAL DESCRIPTION
R-Value @ 300 psi exudation pressure = 39.6	Sample location: SG-2 Depth: 0.18m - 1.0m
Project No.: 196045 Project: Alma School Rd. Bridge Location: S. Salt River Bridge Maricopa County, Az Date: 3-26-97	Tested by: D. Johnson Checked by: Addington Remarks: Lab. No.:97-0194
R-VALUE TEST REPORT **ATL, INC.**	Fig. No. 1

931-A.2

DE LEUW, CATHER A PARSONS TRANSPORTATION GROUP COMPANY

De Leuw, Cather & Company • 3875 N. 44th Street, Suite 250 • Phoenix, Arizona 85018 • (602) 852-9195 • Fax: (602) 952-9303

Alma School Road -South Bridge at Salt River

Report of Meeting

Date: February 24, 1997

Time: 9:00 AM

Location: Maricopa County Department of Transportation (MCDOT)

Subject: Project Kickoff Meeting

Attendees:

Bruce Ward (MCDOT)	Yogesh Mantri (MCDOT)
Ed Mihiloff (MCDOT)	Wayne Butch (MCDOT)
George Rodek (MCDOT)	Bud Black (MCDOT)
Don Davis (DCCO)	Lee Dickson (DCCO)
Paul Stanton (DCCO)	Paul Dickman (DCCO)
Walter Zapfel (DCCO)	Rich Perry (Dibble)
Brian Fry (Dibble)	Myron Jasmann (Dibble)
David Hayes (ATL)	Terry Smiley (BSA)

Transactions and Determinations:

1. Completion of the project schedule is the top priority. The DCR is the first task. It will take 150 days excluding reviews (approximately 195 days including reviews). The DCR will not be as detailed as is described in MCDOT's Scope of Services primarily because project alternatives have already been determined. According to Bruce Ward, the DCR will simply be a technical memorandum that pulls together all of the technical project studies. The Design will take 240 days excluding review (approximately 366 days including review).

2. Bruce Ward indicated that Yogesh Mantri will be Project Manager. He also mentioned that Bud Black of MCDOT is in-charge of getting the project built once the design plans are done. He identified John Rose as MCDOT's survey head.

3. A preliminary structures analysis meeting will be scheduled with Phil Epstein to discuss the content of the Structure Selection Report.

4. As far as environmental permitting is concerned, the project is subject to Section 404 of the Clean Water Act. In January, the Section 404 Nationwide Permit Program was revised by the U.S. Army Corps of Engineers. Application of Section 404 to the project will need to consider these revisions. National Pollutant Discharge Elimination System (NPDES) requirements will be assessed by Dibble & Associates during project design.

5. Coordination with ADOT (Steve Jimenez) is key to the success of the project. This will ensure that our design plans match ADOT's current construction of the Red Mountain Freeway interchange with Alma School Road.

6. The project will be done in metric. Metric standards will need to be acquired for all project elements, including survey. Our metric survey will need to tie directly into ADOT's survey, which is in English units. The contour interval for survey/mapping will be ½ meter. Yogesh Mantri stated that MCDOT's CAD Standards manual will be furnished to the consulting team, however, the manual has not yet been converted to metric.

7. Bruce Ward indicated that Volume 2 of the Flood Control Manuals are needed for this project. Brian Fry indicated that he already has them in his possession.

8. Vehicle classifications used in the traffic studies are the same as those used by the Federal Highway Administration.

9. Wayne Butch and George Rodek will handle utilities coordination for MCDOT. The consultant team will furnish design plans to MCDOT, and MCDOT will distribute them to utility companies.

10. A meeting with Sunward Materials Co. will be arranged. Preliminary indication is that Sunward is satisfied with the traffic/access information contained in the Kirkham-Michael report.

11. Coordination with the Salt River Pima-Maricopa Indian Community (SRPMIC) will be an important aspect of this project. The river bottom of the Salt River is SRPMIC land. Before commencing with drilling, ATL Inc. should coordinate with the SRPMIC as well as with Sunward Materials Co.

12. MCDOT uses an On-Call Public Relations consultant whose responsible for advertising and organizing public information meetings and hearings. With respect to the Public Participation Plan, the project team is responsible for notifying MCDOT as to when the meetings will be required as well as preparing/supplying any necessary meeting graphics.

13. Bruce Ward indicated that widening the bridge may result in a potential clearance problem at the northwestern corner of the bridge, where a power/light pole exists. This dual utility pole may need to be relocated. Wayne Butch indicated this would probably be accomplished with the relocation of the 12kv line.

14. MCDOT's checklist format will be distributed to the consultant team.

15. MCDOT's invoice format remains unchanged.

16. Lee Dickson put in a request for bridge inspection reports. Bruce Ward said Phil Epstein would supply the reports.

17. Paul Dickman inquired as to whether plans still exist for a bike path along the east side of the project. Bruce indicated that the bike path is still planned.

If any clarification of items noted are required, please contact Paul Stanton or Don Davis at De Leuw, Cather. Phone (602) 852-9192, Fax (602) 952-9303.

cc: Yogesh Mantri (MCDOT)
Bud Black (MCDOT)
Ed Mihiloff (MCDOT)
Wayne Butch (MCDOT)
Philip Epstein (MCDOT)
Donald Davis (DCCO)
Paul Dickman (DCCO)
Lee Dickson (DCCO)
Paul Stanton (DCCO)
Walter Zapfel (DCCO)
Brian Fry (Dibble)
Terry Smiley (Bolduc-Smiley)
David Hayes (ATL, Inc.)
File 68931-A.2

ALMA SCHOOL ROAD SOUTH BRIDGE AT SALT RIVER

MCDOT CONTRACT NO.
MCDOT WORK ORDER NO. 68931

Project Team Contacts

I. De Leuw, Cather & Company

Address:	3875 N. 44th Street, Suite 250, Phoenix, Az. 85018		
Phone:	852-9195	Fax:	952-9303
Responsibility:	Prime Consultant / Proj. Mngmt. / Rdwy. & Bridge Design & Plans		
Key Contacts:	**Don Davis**	(Project Management/Administration)	
	Paul Stanton	(DCR Report /Environmental /Public & Agency Coordination)	
	Paul Dickman	(Rdwy. Alignment / Rdwy. Design / Rdwy. Plans)	
	Wally Zapfel	(Bridge Report / Bridge Design / Bridge Plans)	
	Lee Dickson	(Data Search /Utitlity Coordination /Construction Staging)	

II. Dibble & Associates

Address:	2633 East Indian School Road, Suite 401, Phoenix, Az. 85016-6763		
Phone:	957-1155	Fax:	957-2838
Responsibility:	Survey / R.O.W. Delin. / Drainage / Hydraulics & Scour		
Key Contacts:	**Myron Jasmann**	(Surveying)	
	Drew Spear	(R/W Engineering)	
	Brian Fry	(Project Drainage & Hydraulics)	

III. Bolduc, Smiley & Associates, Inc.

Address:	5080 North 40th Street, Suite 250, Phoenix, Az. 85018		
Phone:	952-1577	Fax:	952-1134
Responsibility:	Traffic Engineering - Traffic Analysis T.M. / Striping & Signing Design & Plans		
Key Contact:	**Terry Smiley**	(Traffic Manager)	

IV. ATL, Inc.

Address:	2912 W. Clarendon, Phoenix, Az. 85017		
Phone:	241-1097	Fax:	277-1306
Responsibility:	Geotechnical Investigation & Report / Foundation Recommendations / Materials Gradation		
Key Contact:	**David Hayes**	(Geotechnical Manager)	

MCDOT CONTACTS:

Contact:	**Bruce Ward**	Contact:	**Philip Epstein**
Responsibility:	Project Management	Responsibility:	Bridge Management
Phone:	506-8681	Phone:	506-8625

Contact:	**Renate Lewis**
Responsibility:	Contract Administration
Phone:	506-8647

731-A.2

Alma School Road -South Bridge at Salt River
MCDOT W.O. 68931
Report of Meeting

Date: March 20, 1997

Time: 9:00 AM

Location: MCDOT

Subject: Coordination Meeting

Attendees: Don Davis (DCCO), Paul Dickman (DCCO), Bruce Ward (MCDOT), Yogesh Mantri (MCDOT)

Transactions and Determinations:

1. In preparation for a coordination meeting with ADOT, Don Davis and Paul Dickman discussed various options for bridge widening and ultimate traffic lane configurations. (See attached agenda for complete list of items and advantages and disadvantages discussed.)

2. Alignment options discussed included widening bridge on each side, widening bridge on west side only and widening bridge on east side only. Widening each side is desirable from approach roadway geometric standpoint, however, widening to one side only is preferred from a structural retrofit standpoint. All agreed widening only to the East would probably be most beneficial. By avoiding conflicts with the existing grade control structure, SRP overhead power lines and existing traffic barrier, parapet and pedestrian fence on West side cost savings could be realized. Don also stated additional cost savings for this option could probably be realized in foundation excavations, superstructure erection and traffic maintenance. All attendees agreed this option was worth pursuing. Additional study is required to resolve roadway geometrics and traffic striping issues.

   Bruce Ward stated MCDOT has no plans to widen the north bridge through the year 2000. It is unlikely that a third northbound lane and deceleration lane for Sunward will be required at that time. Therefore no third northbound through lane should be considered for this project and ADOT's traffic signals and ramp curb returns will not require modification.

   Bruce Ward also showed an approved concept to maintain Sunward's south access by providing a turnout before the south bridge. This will need to be studied in the DCR phase. This access will be integrated into the bank protection plan.

3. Structural options discussed included widening superstructure in kind and providing AC or Rubberized Asphalt overlay for riding surface. New superstructure would be

connected laterally to exiting girders by extending existing tensioning rods. Another option discussed was to remove existing AC overlay and provide a reinforced concrete structural topping to the new and existing precast units. The concrete overlay option could eliminate the need for lateral tensioning rods connecting the new units to the existing units by providing positive connection of the slab to the top of the girders. The structural topping could also provide possible longitudinal continuity between the spans. Phil also indicated he felt the existing bridge was capable of carrying the additional dead load of the concrete topping with no adverse effects. This option seemed to be the preferred option by all attendees. Other possible options will be discussed further in the Bridge Selection Report.

4. Don Davis produced some alternate bridge cross section details for consideration. One option included providing a space between existing and new girders for possible NPDES required piping and/or utility conduit.

5. The use of concrete between the end of ADOT's concrete paving and the south bridge was also discussed. This is a viable alternative which should be discussed in the DCR.

6 In conclusion, in order to maintain the most flexibility for widening and maintenance of traffic during construction it was decided to request that ADOT not install the curbed median during their construction. The median will be installed later at MCDOT's expense. Impacts to ADOT's design including geometrics, drainage and traffic will also be discussed on a conceptual level.

7. The meeting with ADOT was subsequently scheduled for Thursday, March 27 at 11:00 AM in room 295 at ADOT.

cc: Wally Zapfel (DCCO)
Paul Stanton (DCCO)
Paul Dickman (DCCO)
Lee Dickson (DCCO)
Bruce Ward (MCDOT)
File

Alma School Road South Bridge at Salt River
MCDOT W.O. 68931
Meeting Agenda 3-20-97

Preparation for ADOT Coordination Meeting

Replace Curbed Median with Striping

Advantages

Allows flexibility in Maintenance of traffic.

Allows flexibility in widening bridge to one side or the other.

Disadvantages

Overhead in median sign must be protected or alternate installation required.

MCDOT will have to pay for reconstruction in future.

Lose the shadowing effect for the left turn lanes.

Relocate ADOT Signal Pole @ NE Quadrant

Advantages

Allows third northbound lane to be added without future relocation.

Disadvantages

Redesign required by ADOT.

Third lane not necessary until third lane provided under interchange and on north bridge.

Revise Curb Return NE Quadrant to Provide for Ultimate Third NB through Lane.

Advantages

Allows third northbound lane to be added without future reconstruction

Could be used now for the decel lane for Sunward and a "free" right turn.

Disadvantages

Redesign required by ADOT.

Third lane not necessary until third lane provided under interchange and on north bridge.

Addition of third lane w/o third lane under interchange will cause competition for right turns vs. Sunward.

Clarification

Scope states that "Since the completion of the report an additional northbound right turn lane north of the proposed ADOT improvements has been tentatively approved by MCDOT for access to east side properties and Sunward".

Widen Bridge Entirely to East (Preferred) or West.

Advantages

Cost saving because fewer foundations required.

Potential cost savings to east because scour protection structure is avoided.

May avoid relocation of overhead power lines on west side.

Minimize impact to ADOT's drainage structures.

Disadvantages

Widening all to one side will either introduce a "kink" in alignment and/or place bridge on a curve. A certain amount of kink can be tolerated and striping can be used to smooth appearance however lanes may be narrower on one end of bridge.

Requires realignment/redesign of median.

May require additional R/W.

931-A.2

Alma School Road - South Bridge at Salt River
MCDOT W.O. 68931
Report of Meeting

Date: March 18, 1997

Time: 1:00 PM

Location: MCDOT

Subject: Initial Bridge Coordination Meeting

Attendees: Don Davis (DCCO)
Wally Zapfel (DCCO)
Phil Epstein (MCDOT)

Transactions and Determinations:

1. Don Davis indicated purpose of meeting was to brainstorm about various options for widening the existing bridge structure.

2. Alignment options were discussed including widening bridge on each side, widening bridge on west side only and widening bridge on east side only. Widening each side is most preferred from approach roadway geometric standpoint, however, widening to one side only is preferred from a structural retrofit standpoint. All agreed widening only to the East would probably be most beneficial. Don stated by avoiding conflicts with the existing grade control structure, SRP overhead powerlines and existing traffic barrier, parapet and pedestrian fence on West side cost savings could be realized. Don also stated additional cost savings for this option could probably be realized in foundation excavations, superstructure erection and construction traffic maintenance. All attendees agreed this option was worth pursuing. Phil indicated he had no objection to widening to one side if roadway geometrics and traffic movement considerations could be resolved. Further studies are required.

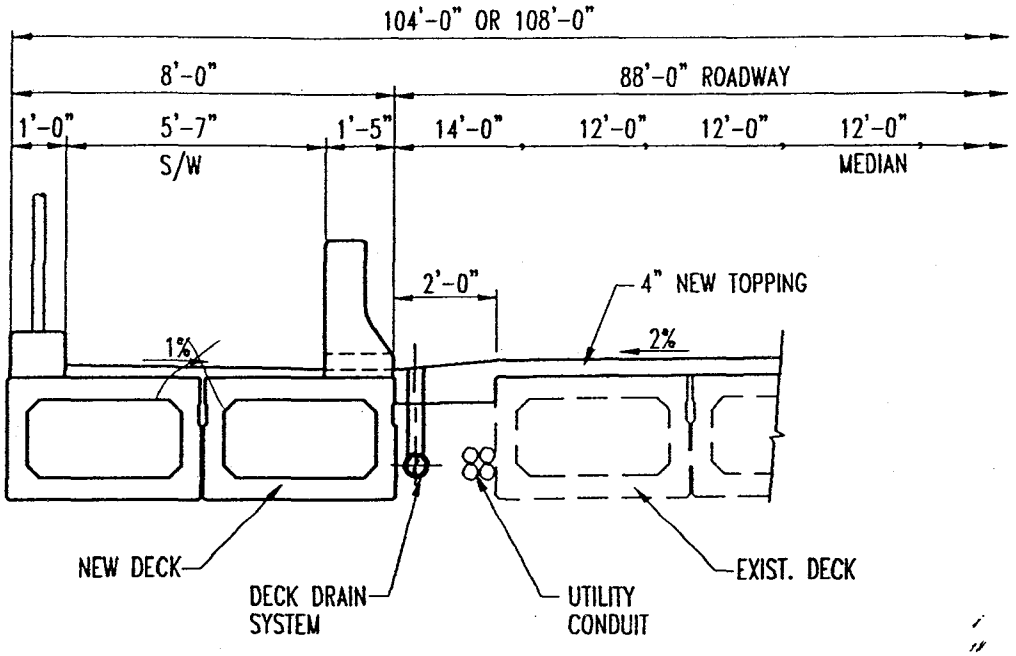
3. Structural options discussed included widening superstructure in kind and providing AC or Rubberized Asphalt overlay for riding surface. New superstructure would be connected laterally to exiting girders by extending existing tensioning rods. Another option discussed was to remove existing AC overlay and provide a reinforced concrete structural topping to the new and existing precast units. Phil Epstein indicated that the concrete overlay option could eliminate the need for lateral tensioning rods connecting the new units to the existing units by providing positive connection of the slab to the top of the girders. The structural topping could also provide possible longitudinal continuity between the spans. Phil also indicated he felt the existing bridge was capable of carrying the additional dead load of the concrete topping with no adverse effects. This option seemed to be the preferred option by all attendees. Other possible options will be discussed further in the Bridge Selection Report.

4. Don Davis produced some alternate bridge cross section details for consideration. One option included providing a space between existing and new girders for possible NPDES required piping and/or utility conduit.

5. Wally Zapfel inquired about the County's position on the bridge deck drainage. Phil indicated that it was his opinion the bridge should be designed with sufficient longitudinal vertical grade to eliminate the need for a transverse deck drainage system. It was agreed that this is the approach we should take concerning bridge drainage. It was also agreed that leaving a longitudinal spacing between the existing and new girders for possible utility supports is probably worth additional consideration.

6. Don indicated that the DCCO staff will be discussing the alignment alternatives issue with Bruce Ward at a progress meeting scheduled for Thursday, March 20 and subsequently with ADOT as soon as more precise existing alignment and right-of-way information can be obtained.

cc: Wally Zapfel (DCCO)
Paul Stanton (DCCO)
Paul Dickman (DCCO)
Lee Dickson (DCCO)
Phil Epstein (MCDOT)
Bruce Ward (MCDOT)
File



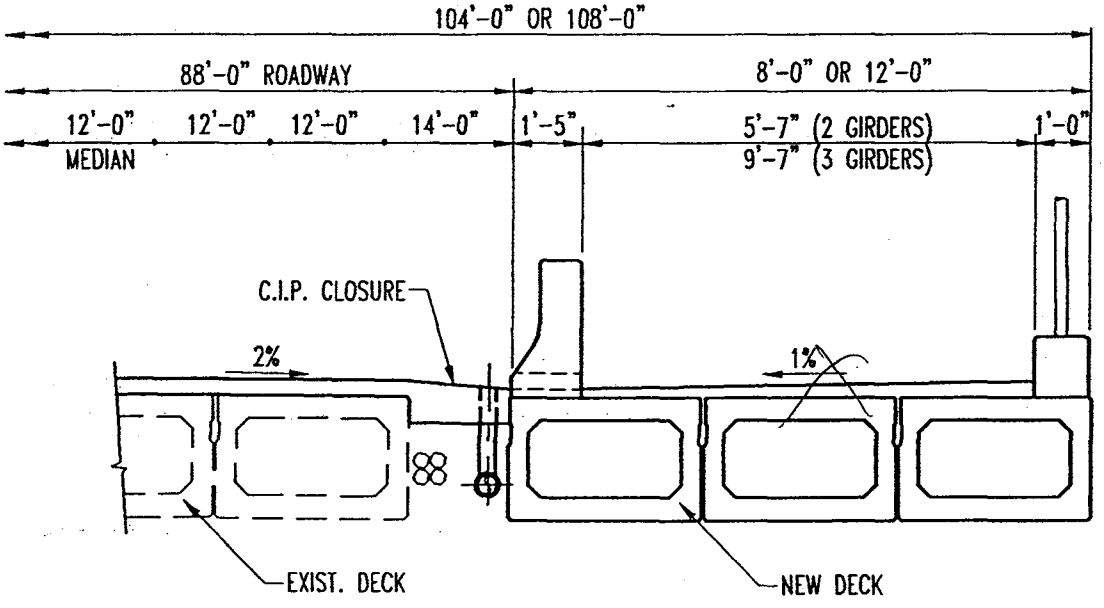


FIGURE 1 OF 45

ALMA SCHOOL ROAD SOUTH BRIDGE

ALTERNATIVE 1

HOFFMAN-MILLER ENGINEERS, INC.

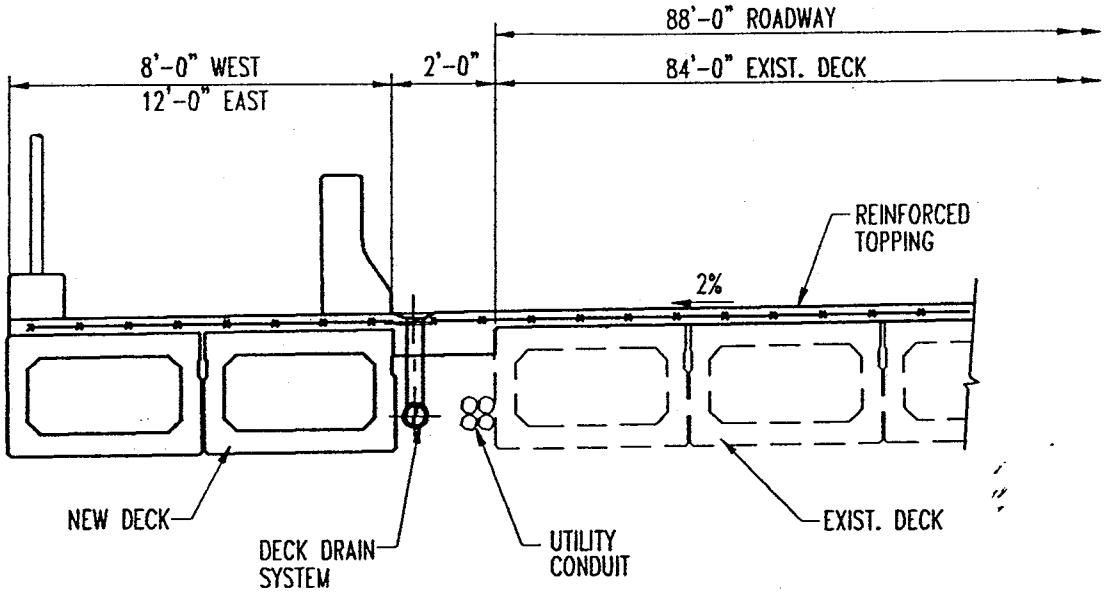


FIGURE 2 OF #5

ALMA SCHOOL ROAD SOUTH BRIDGE

ALTERNATIVE 2

HOFFMAN–MILLER ENGINEERS, INC.

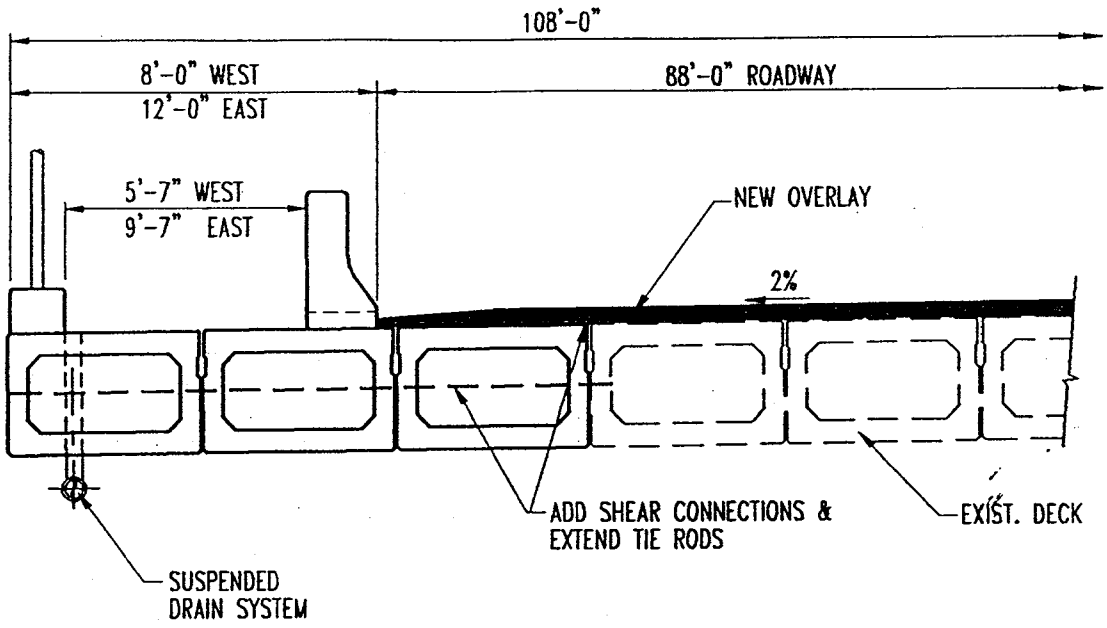
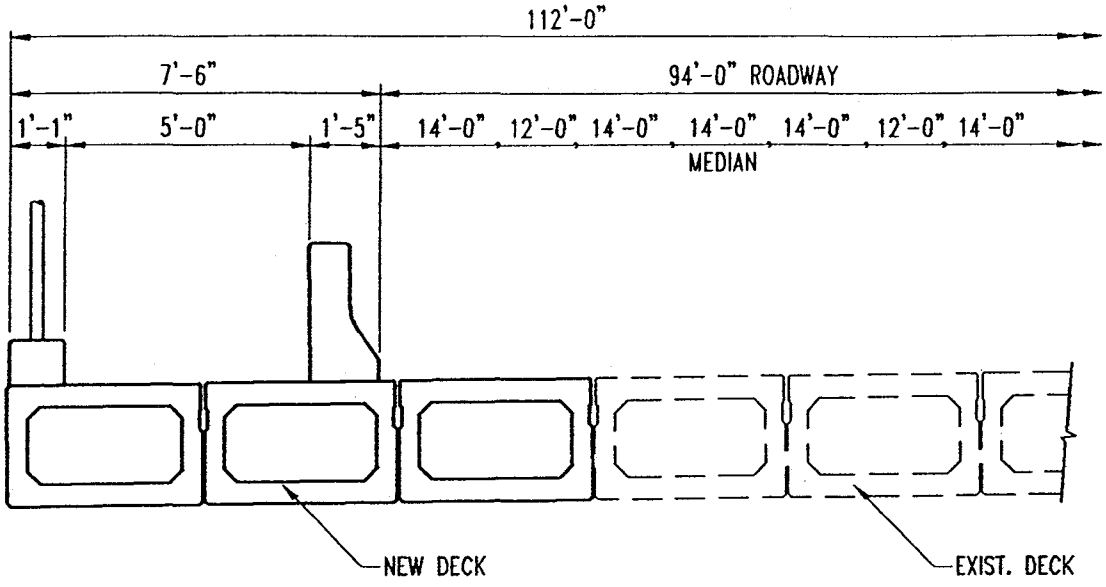


FIGURE 3 OF 45

ALMA SCHOOL ROAD SOUTH BRIDGE

ALTERNATIVE 3

HOFFMAN–MILLER ENGINEERS, INC.



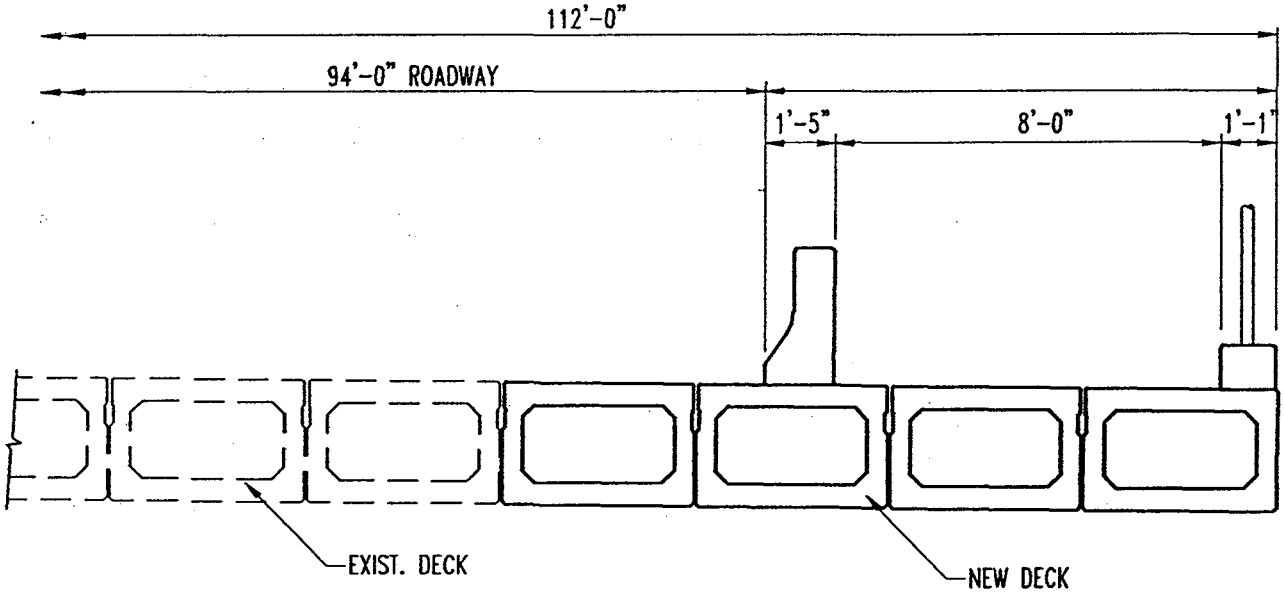


FIGURE 4 OF 4S

ALMA SCHOOL ROAD SOUTH BRIDGE

ALTERNATIVE 4

HOFFMAN-MILLER ENGINEERS, INC.

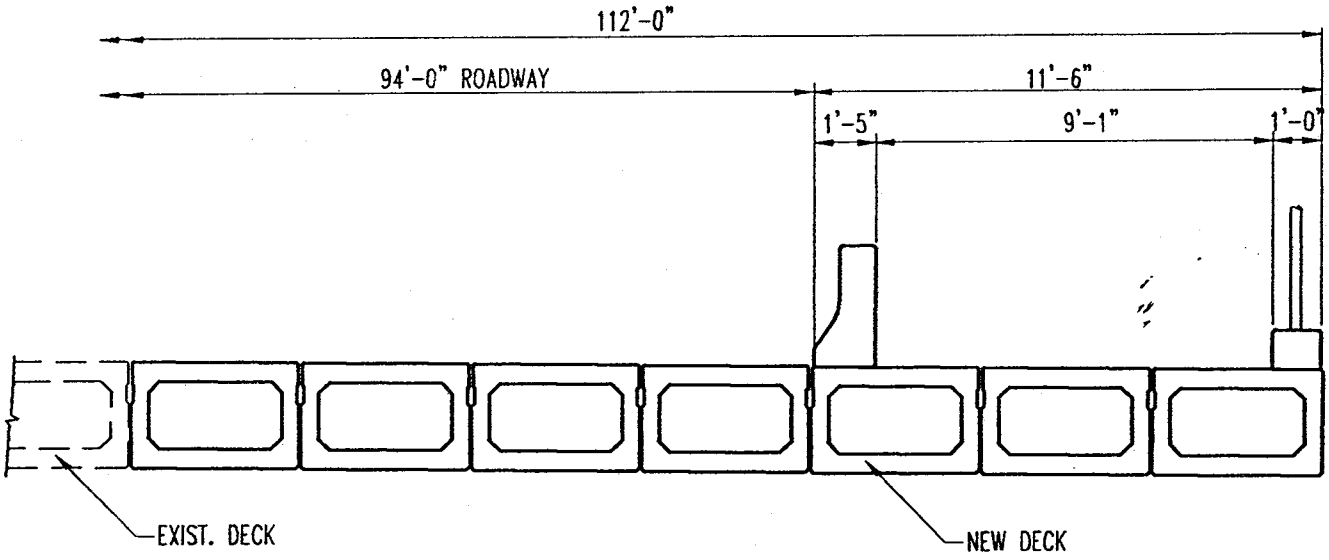


FIGURE 5A OF 5

ALMA SCHOOL ROAD SOUTH BRIDGE

ALTERNATIVE 5

HOFFMAN-MILLER ENGINEERS, INC.

931-A.2

Alma School Road -South Bridge at Salt River
MCDOT W.O. 68931
Report of Meeting

Date: March 27, 1997

Time: 11:00 AM

Location: ADOT

Subject: Coordination Meeting

Attendees:

Bruce Ward (MCDOT)	Steve Jimenez (ADOT)
Yogesh Mantri (MCDOT)	Thomas Parlante (ADOT)
Don Davis (DCCO)	Steve Wilcox (Stanley)
Paul Dickman (DCCO)	

Transactions and Determinations:

1. Introductions were made and a meeting agenda was distributed by Don Davis (attached). The purpose of this early meeting was to discuss concepts for the county work and how they will coordinate with ADOT's ongoing construction project.

2. Prior to discussing the agenda items several items were discussed by ADOT and MCDOT. Steve Jimenez stated he would begin writing the IGA covering the traffic signal responsibilities for Dobson Road, Alma School Road, Mckellips Road and Country Club. Bruce Ward directed Steve to contact Al (MCDOT) for specific wording. ADOT has placed interconnect conduits to accommodate a future signal at Sunward Materials.

2. Bridge widening concepts were discussed including widening the bridge about the centerline, widening the bridge on west side only and widening the bridge on the east side only. Widening about the centerline is desirable from approach roadway geometric standpoint, however, widening to one side only is preferred from a structural retrofit standpoint. Widening to the East would be most beneficial. By avoiding conflicts with the existing grade control structure, SRP overhead power lines and existing traffic barrier, parapet and pedestrian fence on West side cost savings could be realized. Don also stated additional cost savings for this option could probably be realized in foundation excavations, superstructure erection and traffic maintenance. All attendees agreed this concept was worth pursuing. Additional study is required to resolve roadway geometrics and traffic striping issues. A subsequent meeting with ADOT will be held after the mapping has been obtained and the concept further defined.

3 ADOT agreed to look at striping a portion of the curbed median. Pulice is schedule to construct the median in July, 1997. One of their concerns was the length of time the median would remain striped. Bruce Ward stated MCDOT would begin construction in early 1999. ADOT also expressed concern about vehicles turning left onto Alma School Road across the painted median. This situation will be studied to see if this problem can be eliminated without putting in the curbed median.

3. Paul Dickman discussed the possibility of a tie to ADOT's drainage system. This was considered feasible and Paul requested ADOT's drainage report and drainage calculations.

4. The use of concrete between the end of ADOT's concrete paving and the south bridge was also discussed. ADOT had no objections.

5 The meeting was concluded and it was agreed a second coordination meeting would be held in approximately 3-4 weeks. By then mapping will be available and the concepts can be further refined.

cc: Attendees
Wally Zapfel (DCCO)
Paul Stanton (DCCO)
Lee Dickson (DCCO)
File

Alma School Road South Bridge at Salt River
MCDOT W.O. 68931
Meeting Agenda 3-27-97

Options for interface with ADOT construction

Widen Bridge Entirely to East (Preferred) or West.

Advantages

- Cost saving because fewer foundations required.
- Cost savings to widen to east because scour protection structure is avoided.
- Avoid relocation of overhead power lines on west side.

Disadvantages

- Widening all to one side will either introduce a "kink" in alignment and/or place bridge on a curve. A certain amount of kink can be tolerated and striping can be used to smooth appearance however lanes may be narrower on one end of bridge.
- Design speed may need to be lowered to eliminate need for superelevation if curve is on bridge.
- Requires realignment/redesign of curbed median.
- May require additional R/W.

Replace Curbed Median with Striping

Advantages

- Allows flexibility in maintenance of traffic.
- Allows flexibility in widening bridge to one side or the other.

Disadvantages

- Overhead in median sign must be protected or alternate installation required.
- MCDOT will have to pay for reconstruction in future.
- Lose the shadowing effect for the left turn lanes.

Tie-in to ADOT Drainage System

Advantages

- No separate system required.

Disadvantages

- Will require modification to ADOT catch basins.

Required to evaluate concept

- ADOT drainage report.
- ADOT drainage calculations.

931 - Cr. 1

DE LEUW, CATHER A PARSONS TRANSPORTATION GROUP COMPANY

De Leuw, Cather & Company • 3875 N. 44th Street, Suite 250 • Phoenix, Arizona 85018 • (602) 852-9195 • Fax: (602) 952-9303

April 24, 1997

Steven A. Jimenez, P.E., R.L.S.
Project Management Supervisor
Highways Division
Arizona Department of Transportation
Statewide Project Management
205 S. 17th Ave., RM 216E, MD 614E
Phoenix, Arizona 85007-3212

Ref: Red Mountain Freeway Interchange at Alma School Road

Dear Mr. Jimenez:

As you will recall, at the coordination meeting requested by MCDOT and held in your office on March 27, we discussed the possibility of eliminating a portion of the planned raised curb median at the north terminus of your Red Mountain interchange with Alma School Road. We also discussed possibly revising and/or relocating the overhead sign structure currently scheduled to be constructed over the Alma School Road southbound lanes at Sta. 24+50±.

The discussion was initiated due to a concern by MCDOT that construction of the raised median and overhead sign at this time would seriously impede traffic movements during the construction of their Alma School Road widening project which will abut your current project to the immediate north. As a result of that meeting, it was our understanding that both of these items warranted further consideration.

Our intention at that time was to develop new base maps at this location and then prepare a detail reflecting our recommended approach to this problem. Unfortunately, there has been a delay in our receipt of the base map information and since the project area of concern is currently under construction, we do not feel we have adequate time to develop a new drawing reflecting these changes.

We therefore are recommending the following 2 options for your consideration and approval. The preferred option, Option 1, would be to temporarily end the raised median at the planned north end of the PCCP at Sta. 23+45.09 and utilize an at-grade painted median for the remainder. In addition, for safety reasons, we recommend replacing the overhead sign structure with a temporary smaller directional sign located on the west side of Alma School Road. The full raised median and overhead sign structure would then be installed with MCDOT's construction project.

Option 2 would involve the same median treatment as Option 1, however, if it is impractical to revise and/or relocate the sign structure at this time, we recommend placement of temporary crash barriers in front of the interior pole which would then be removed when the raised median is completed with MCDOT's project.

Either option would be very beneficial in facilitating construction traffic movements, especially during the widening of the Salt River bridge, however, we feel Option 1 provides the most safety to the traveling public.

We are including a copy of ADOT's Crossroad Plan , Alma School Road, Sta. 23+00 to Sta. 29+00 and the Alma School Road Pavement Marking and Signing sheet from your RED MTN - SR 101L - McKELLIPS ROAD project plans with the areas of concern highlighted for your reference.

Please review and respond with your comments as soon as possible. If you have any questions or need additional information concerning this request, please contact me at 852-9195.

Very truly yours,
De Leuw, Cather

Donald R. Davis

Donald R. Davis, P.E.
Project Manager

Enclosures

cc: Y. Mantri, B. Ward (MCDOT)
L. Dickson, P. Dickman (DCCO)

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS PLT
9	ARIZ.	600-8-(006)P	140	497	

202L MA 013

Lt Alma School Rd Cst ℄
Sta 23+00.00 to Sta 24+41.27
700 Sq Ft Conc Swlk.
Std C-05.20

Lt Alma School Rd Cst ℄
Sta 23+50.09 to Sta 24+41.27
92 Lin Ft C&G. Dtl K

Lt Alma School Rd Cst ℄
Sta 23+00.00 to Sta 23+45.09
43 Lin Ft C&G.
Std C-05.10. Type D. h=7"

Exst R/W

New R/W

FHWY

Lt Alma School Rd Cst ℄
Sta 23+45.09 to Sta 23+50.09
5 Lin Ft C&G Trns.
Std C-05.12. Type 6

END SGL CURB
STA. 23+45.09

52.20' Lt Alma School Rd Cst ℄
Sta 24+50.00
Angle Pt. Edge of Pvmt

ALMA SCHOOL ROAD
CST ℄ STA 27+80.00
END CONSTRUCTION

32.00' Lt Alma School Rd Cst ℄
Sta 27+52.94
Angle Pt. Edge of Pvmt

Lt Alma School Rd Cst ℄
Sta 24+41.27 to Sta 24+56.27
15 Lin Ft C&G Trns
Std C-05.12. Type 3

T.1N.
R.5E.

Alma School Rd Cst ℄
Sta 27+80.00
End AC Pvmt

Sta 23+45.09
End Conc Pvmt
Begin AC Pvmt

ROAD

End Alma School Rd Cst ℄
PT Sta 28+12.95

MATCH LINE STA 23+00

ALMA SCHOOL

Alma School Rd Cst ℄

25'

16.5'

10'

Sta 23+00.00 to Sta 27+80.00
Exst Asphaltic Concrete Pavement
Remove 4026 Sq Yd AC Pvmt

Sct Line

Rt Alma School Rd Cst ℄
Sta 24+18.01 to Sta 24+33.01
15 Lin Ft C&G Trns
Std C-05.12. Type 3

End 40:1 Taper
32.00' Rt Alma School Rd Cst ℄
Sta 27+38.00

New R/W

Rt Alma School Rd Cst ℄
Sta 23+00.00 to Sta 24+18.01
600 Sq Ft 5' Conc Swlk. Std C-05.20

Rt Alma School Rd Cst ℄
Sta 23+50.09 to Sta 24+18.01
68 Lin Ft C&G Dtl K

Alma School Rd Cst ℄
Sta 23+00.00 to Sta 27+36.00
877 Lin Ft Sgl Curb.
Std C-05.10. Type A. h=7"

Rt Alma School Rd Cst ℄
Sta 23+00.00 to Sta 23+45.09
47 Lin Ft C&G
Std C-05.10. Type D. h=7"

Rt Alma School Rd Cst ℄
Sta 23+45.09 to Sta 23+50.09
5 Lin Ft C&G Trns. Std C-05.12. Type 6

Rt Alma School Rd Cst ℄
Sta 24+33.01 to Sta 25+79
163 Sq Yd AC Pvmt. Dtl O

	NAME	DATE
DESIGN	MRC	3/96
DRAWN	CGS	3/96
CHECKED	SDW	3/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 952-6580

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CROSSROAD PLAN
ALMA SCHOOL ROAD
STA 23+00 TO STA 29+00

ROUTE 202L | LOCATION RED MTN - SR 101L - McKELLIPS ROAD

DWG NO. C-3.13

TRACS NO. H087502C | 600-8-(006)P | ___ OF ___

REDUCED SIZE
DO NOT SCALE

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /12168/RM2C3-12.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(006)P	261	497	
		202L MA 013			

MATCH LINE
RAMP A
STA. 10+00

C11-26
MOUNT ON BRIDGE FACE

C11-25
R4-7, R3-8L(S)
BACK TO BACK
STA. 20+96±

C11-22
STA. 21+28±

C11-21
W4-2R
STA. 13+23±

C11-20
R5-10a
M9-10(1)
STA. 13+85±

C11-23
RED MTN FRWY
MOUNT ON SIGNAL MAST ARM

C11-24
R6-2(R)
MOUNT ON SIGNAL MAST ARM

C11-33
Alma School Rd
MOUNT ON SIGNAL MAST ARM

R3-2
BACK TO BACK MOUNTED ON SIGNAL POLE

C11-15

SIGN NO. C11-19
STA. 24+50±

C11-18
R4-7
STA. 27+15±

C11-17
STA. 35+20±

4BW
G

4BW
(TYP.)

4SW

8SW

18SW
(TYP.)

STA. 13+13±

STA. 21+17±

25

4DW

4DY

EXISTING STRIPING TO REMAIN

PAINT BULLNOSE PER
STD. DWG. 4-M-1.02
(TYP.)

STA. 27+37±
MATCH EXISTING STRIPING

MATCH LINE
STA. 20+00

R=55

R=45

R=45

R=100

STA. 1+60±

TURN LANE MARKING
STANDARD DRAWING
4-M-1.16 (TYP)

C11-12 (L&R)
BACK TO BACK
MOUNT ON SIGNAL POLE

STA. 21+27±

12SW
(TYP.)

100' TYPE I @ 20' C.C. SPACING

C11-35
R3-5L
R5-1
BACK TO BACK
STA. 1+20±

C11-34
R3-5R
R5-1
BACK TO BACK
STA. 1+50±

C11-14
R6-1(L)
MOUNT ON SIGNAL POLE

R1-5R
R3-5R

4SW

8SW
G

R1-5R
R3-5L

4SY

MATCH LINE
RAMP C
STA. 4+00

1 LANE
AHEAD

ONLY

ONLY

C11-13
STA. 3+35±

M9-10(1)(J)
R3-2
R3-5L
R3-5R
R3-8L(S)
R4-7
R5-1
R5-10a
R6-1L
R6-1R
R6-2L
R6-1R
W4-2R

	NAME	DATE
DESIGN	EL, CJ	3-96
DRAWN	BLJ, SC	3-96
CHECKED	TNS	3-96

Bolduc, Smiley & Assoc. Inc.
TRANSPORTATION ENGINEERS

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ALMA SCHOOL ROAD
PAVEMENT MARKING
AND SIGNING

ROUTE 202L | LOCATION RED MTN - SR 101L - McKELLIPS ROAD

DWG NO. T-3.04

REDUCED SIZE
DO NOT SCALE

TRACS NO. H0875 02C | 600-8-(006)P | OF

SURVEY NO.	REVISIONS	DATE
	FINISHED PLANS	
	LOCATION	

733C602B 03-13-96 733TBLK, 733X10L, 733SC102, 733FC101

INTEROFFICE CORRESPONDENCE

		DATE:	May 13, 1997
TO:	Don Davis	FROM:	Stan Polasik
LOCATION:	Phoenix	LOCATION:	Phoenix
PHONE:	(602) 852-9195	PHONE:	(602) 852-9195

SUBJECT: **Meeting Minutes**
Alma School Bridge
Site Meeting - Bridge Scour

FILE Number
641133 -00100 Min50897.doc

Purpose: The draft bridge hydraulic report reviewed the "As-Builts" for the bridge and grade control structure as well as performing HEC-RAS and bridge scour calculations. The scour calculations and the grade control structure's plans and calculations indicated a significant scour problem. This meeting was called to review the conditions at the site.

Attendance:

Name	Organization	Phone
Yogesh Mantri	Maricopa County	506-8689
John Lastra	Dibble	957-1155
Paul Dickman	DCCO	852-9195
Chris Kmetty	DCCO	852-9195
Stan Polasik	DCCO	852-9195

Time and Location: 3:30 PM May, 8, 1997 at the Alma School South Channel Bridge.

Discussion: Dibble prepared a draft bridge hydraulic report and determined that there was a significant problem with scour at the existing bridge. A meeting was held on May 8, 1997 in the morning where it was determined that a site meeting was required. From "As-Built" records of the existing bridge and grade control structure, it appeared that the bridge footing piles were exposed. Also according to FEMA flood plain calculations a channel significantly narrower than the bridge formed.

The grade control structure immediately downstream of the bridge has a notch to allow equipment to pass under the bridge. This notch would affect the channel hydraulics. Just upstream of the grade control structure, cars were parked on bare earth. South of the equipment access road, the channel surface and bridge abutment slopes were lined with gabion mattresses.

The hydraulic calculations developed by FEMA did not reflect the grade control structure. The calculations also reflected a locally incised channel through the bridge structure that exposed the bridge footings. This was not evident. HEC-RAS calculation showed a 22 fps velocity through the bridge which resulted in a 10 feet of local scour. Assuming that the bridge piers have 6 foot of cover, there is a scour problem. Counter measures were discussed and it was decided to suggest a gabion mattress in the DCR covering the channel bottom for the whole length of the bridge.

The channel approach was reviewed and it was determined that the upstream channel was slightly narrower than the bridge or the same width. Therefore, there would be no contraction scour. The upstream channel had been lined in some sections. Also present was two ponds formed by small dikes. Water from these ponds was being used by gravel mining operations for a water source. These pond present a potential problem in that flow will build up in the ponds until it overtops the dike and begins to wash it away. Water stored in the pond will surge through the bridge resulting in high velocity and a large amount of sediment going through the bridge site during the initial flow through the channel. The ponds should be completely washed away when the peak flow occurs.

Dibble is to revise the report to reflect the grade control structure and the existing grading. The HEC-RAS model was based upon the FEMA floodplain calculation. They are to review the scour calculations with respect to contraction and abutment scour. The hydraulic report may be ready my the middle of the week ending on May 16, 1997.

cc:
Yogesh Mantri, MCDOT
Philip Epstein, MCDOT
Paul Dickman, DCCO
Chris Kmetty, DCCO
Brian Fry, Dibble
File 931-A.2

731 - A.2

INTEROFFICE CORRESPONDENCE

		DATE:	May 15, 1997
TO:	Don Davis	FROM:	Paul Dickman
LOCATION:	Phoenix	LOCATION:	Phoenix
PHONE:	(602) 852-9195	PHONE:	(602) 852-9195

SUBJECT: **Meeting Minutes**

FILE Number
641133 133m0508.doc

Purpose: Two items were discussed. The first item was a scour concern posed by Dibble & Associates. The second item was a proposed alignment showing all widening to the east.

Attendance:

Name	Organization	Phone
Bruce Ward	Maricopa County	506-8681
Yogesh Mantri	Maricopa County	506-8689
Philip Epstein	Maricopa County	506-8625
Don Davis	DCCO	852-9195
Paul Dickman	DCCO	852-9195
Brian Fry	Dibble & Assoc.	957-1155
John Lastra	Dibble & Assoc.	957-1155

Time and Location: 10:00 AM May, 8, 1997 at MCDOT.

Discussion:

According to Dibble's calculations, which are substantiated by the calculations in the grade control structure report furnished by MCDOT, there is a problem with scour for the 100 year event. The grade control structure was put in to control head cutting and downstream degradation, not scour. Nothing was proposed to counter act the scour caused by the piers and the scour contribution by the grade control structure itself. Dibble does not believe the grade control structure will control the scour and they feel the bridge may be unstable in the 100 year event.

Phil Epstein stated that the grade control structure design was checked by the Corp of Engineers in San Francisco and MCDOT did not believe there was a scour problem. After discussion, it was agreed that Dibble would present their concerns in a scour report per the scope of work. MCDOT would pass the report on to the grade control structure designer for review. After the review, a meeting would be arranged to resolve the scour issue

The second issue discussed was a proposed alignment showing widening all to the east side of the existing south bridge. Don Davis proposed that widening the south bridge entirely to the east could save MCDOT a considerable amount of construction cost. Paul Dickman presented a 1:500 scale plot which showed the proposed alignment and discussed the merits of the design.

In order to widen to the east it is proposed to end ADOT's curve at the north end of their concrete paving. From ADOT's concrete paving, a short tangent is proposed before adding a 2400 m left-hand curve ending north of the existing south bridge. This will require reconstruction/realignment of a portion of ADOT's proposed raised median. A request has been forwarded to ADOT to replace their raised median with a

striped median in the interim between ADOT's and MCDOT's construction. At the time of the meeting ADOT had not yet responded.

Since the existing south bridge is on a tangent and the proposed centerline will be on a curve, the half-width from the centerline is not constant. Because of the lane and sidewalk width desired and the precast girder dimensions, the clear roadway width of the proposed widened bridge is 28.905 m. The preferred typical section (Figure 5.6 of the MCDOT Roadway Design Manual) has a half-width of 14.1 m. The geometric arrangement presented had a half-width which varied from a maximum of 15.211 m to a minimum of 13.676 m on the southwest end of the bridge. DCCO discussed several options to be proposed during final design to mitigate the narrower half-width including adjusting the geometrics and/or narrowing the median. Narrowing the lanes will only be considered as a last option. It was noted during discussion that the City of Mesa section south of the Red Mountain Interchange is using a similar lane arrangement except with a 13.411 m (44') half-width. ADOT design carried Mesa's lane widths north through their portion of the Alma School Road/Red Mountain Interchange design before tying into the existing MCDOT striping south of the south bridge. Carrying Mesa's half-width across the bridge may also be a possible mitigation method.

Phil Epstein asked what design speed was proposed. Mr. Dickman stated that horizontal sight distance appears to be adequate for a 50 mph design speed. However, ADOT had used a design speed of 40 mph. The curve radius used by ADOT would have required superelevation at a higher design speed. Also, the existing curve approaching the south end of the north bridge is a two degree curve which by current MCDOT standards would require super elevation to 2.5% at 40 mph. Currently the curve is super elevated at 2% and transitions to normal crown at the PT of the curve to keep the super elevation off of the north bridge. This situation will have to be remain for the proposed improvements. The current posted speed limit is 40 mph. Using a design speed higher than 40 mph would have to recognize the substandard super elevation conditions. Mr. Epstein stated that based on the past operating speeds for this section, MCDOT prefers a design speed of at least 50 mph.

A the conclusion of the discussion, it was agreed that the Alignment Technical Memorandum should contain a very short discussion of the original alignment option of widening on both sides of the existing centerline. The alignment alternative showing widening entirely to the east side should be presented as the preferred alignment. The level of detail should include the items presented in the meeting.

cc:
Bruce Ward, MCDOT
Yogesh Mantri, MCDOT
Philip Epstein, MCDOT
Don Davis, DCCO
Paul Dickman, DCCO
Brian Fry, Dibble & Assoc.
John Lastra, Dibble & Assoc.
File 931-A.2

731 - A.Z

INTEROFFICE CORRESPONDENCE

		DATE:	July 14, 1997
TO:	Distribution	FROM:	Don Davis
LOCATION:		LOCATION:	Phoenix
PHONE:		PHONE:	(602) 852-9195

SUBJECT: **Meeting Minutes**

FILE Number
641133 133m0710.doc

Purpose: Review meeting for initial submittal of DCR documents

Attendance:

Name	Organization	Phone
Bruce Ward	Maricopa County	506-8681
Yogesh Mantri	Maricopa County	506-8689
Don Davis	DCCO	852-9195
Brian Fry	Dibble & Assoc.	957-1155
John Lastra	Dibble & Assoc.	957-1155

Time and Location: 11:00 AM July 10, 1997 at MCDOT.

Discussion:

Yogesh Mantri provided attendees with copies of the Review Comment Sheets which summarized comments from all responding agency review staff. All items were discussed in order of appearance on the Review Comment Sheet. The following comments and conclusions were made:

Corridor Characteristics Report:

1. It was agreed that all references to the new Alma School Road County classification would consistently be Urban Principal Arterial in all the project reports.
2. It was agreed the existing roadway width at the south bridge would be corrected from 19.5 m (64 ft) to 20.7 m (68 ft).
3. Reference to the 12kv powerline in the utilities section shown on page 5 will be changed from the east side to the west side.
4. The relevant underground storage tank located near the Sunward Materials plant will be located in a drawing and included in the final report.
5. North arrows will be included in figure drawings.

Alignment Analysis Report

6. Typical Roadway Section drawing will be included in final report.
7. Right-of-way strip map will be include in final report.
8. All known utilities will be shown on drawings in final report.
9. It was agreed that a ball park construction cost estimate for the preferred alternative be prepared and included in the final report. Yogesh agreed to furnish DCCO with a master Excel spreadsheet file containing unit costs for most items anticipated on this project. DCCO will review the unit costs and revise where appropriate. Approximate quantities will be used in calculating this initial cost estimate. The final DCR cost estimate presentation does not necessarily have to be in a spreadsheet format.
10. Since the proposed vertical alignment is very close to the existing, there is no need for concern at this time.

Bridge Selection Report

Approved for final submittal.

Traffic Analysis Report

11. It was agreed the traffic analysis TM would be included in the final report.
12. Section 6.0 Page 4 of the DCR Scope of Work will be complied with.

General

13. It was agreed DCCO would look into the necessity for any environmental permits for this project and include general statement of the results in the final DCR. If any permits (401,404, etc.) are required, the County will be fully responsible for preparing the permit applications.
14. It was agreed the final DCR will provide a cost estimate for the recommended alternative only.
15. It was agreed the minutes of the project meeting with ADOT will be included in the final DCR.

Preliminary Drainage Report

Comments from the Flood Control District (Kofi Awumah, dated 7/8/97) which were attached to the MCDOT Review Comments Sheet were discussed. Brian Fry indicated that items 1 and 2 would be addressed and revised as appropriate. Item 3 will be discussed by Brian Fry and John Lastra of Dibble & Associates with Kofi Awumah at FCD. The results of their discussion will be addressed in the final drainage report. Both MCDOT and DCCO will be kept informed of the results of the discussions with FCD by Brian.

It was agreed Item 4 would be addressed and revised in the final drainage report.

Don Davis indicated the turnaround time on the final DCR submittal would be based on the results of the drainage discussions between Dibble and FCD. If environmental documents will need to be prepared for the project, it was pointed out that they should be identified and prepared as soon as possible since their approval may have a definite impact on the construction schedule.

Bruce Ward stated that the decision had been made to eliminate any formal public meetings from this project. He said the County decided to have an informal sit down meeting with the interested parties and inform them of the current project direction.

There being no further business to discuss, the meeting was adjourned.

cc:
Bruce Ward, Yogesh Mantri (MCDOT)
Lee Dickson, Paul Dickman , Stan Polasik (DCCO)
Brian Fry, John Lastra (Dibble & Assoc.)
File 931-A.2

MCDOT ENGINEERING DIVISION
PROJECT DEVELOPMENT BRANCH
REVIEW COMMENT SHEET

PROJECT NAME: Alma School Road South Bridge **LOCATION:** Mesa	**DATE:** July 10, 1997
CONSULTANT: De Leuw, Cather **PROJECT #:** 16083	**REVIEWER:** Y. Mantri (506-8689)
CONTACT PERSON: Don Davis **PHONE #:** (602) 852-9195	**CODE: A = WILL COMPLY B = DELETED** **C = CONSULTANT TO EVALUATE**

ITEM NUMBER	DWG/SHT PAGE	COMMENT	FINAL DISPOSITION
		Corridor Characteristics Report:	
1.	1.	Identify Alma School road as an Urban Principal Arterial. (in all the reports)	
2.	4.	Last paragraph:- Existing roadway width at the south bridge is 20.7m (68') instead of 64'	
3.	5.	Utilities :- power line is on west side	
4.	8.	Hazardous Materials:- Include a map showing location of the underground hazardous storage tank.	
5.		General:-Indicate North on figures	
		Alignment Analysis Report:-	
6.		Show the typical roadway section (MCDOT Standard Typical section 5.6)	
7.		Conceptual right-of way strip map is missing.	
8.		Show all the utilities in the vicinity of the project.	
9.		Show Spread sheets showing construction costs.	
10.		Do we have to be concerned about the vertical Alignment at this stage.	
		Bridge Selection report	
		Good Report.	
		Traffic Analysis Report:	
11.		Only the Traffic Volume data has been provided. Need Traffic Analysis report.	
12.		Comply with the scope of work section 6.0 Page 4.	
		General:-	
13.		Indicate the necessity of environmental permits (404, 401) for the project.	
14.		Provide the total construction cost estimate for each of the alternatives.	
15.		Include the minutes of the meeting which we had with ADOT.	
		Preliminary drainage report:-	
		See the attached Flood Control District's comments sheet.	

Flood Control District
of Maricopa County

2801 West Durango
Phoenix, AZ 85009

Interoffice Memorandum

DATE: 7/8/97

SUBJECT: Alma School Road South Bridge - Preliminary Drainage Report

TO: Yogesh Mantri
Via: Pedro Calza
From: Kofi Awumah — 506-2942 FILE: AlmaSth1

The following are my comments on the above submittal.

1. The report stated (page 4) that the Wood-Patel topographic data has changed and therefore this report has altered the original HEC-RAS model. It is not clear in the report if this change occurred at the location of the split flow. If so then was the split flow re-analyzed to correct the discharge flowing through the South Bridge.

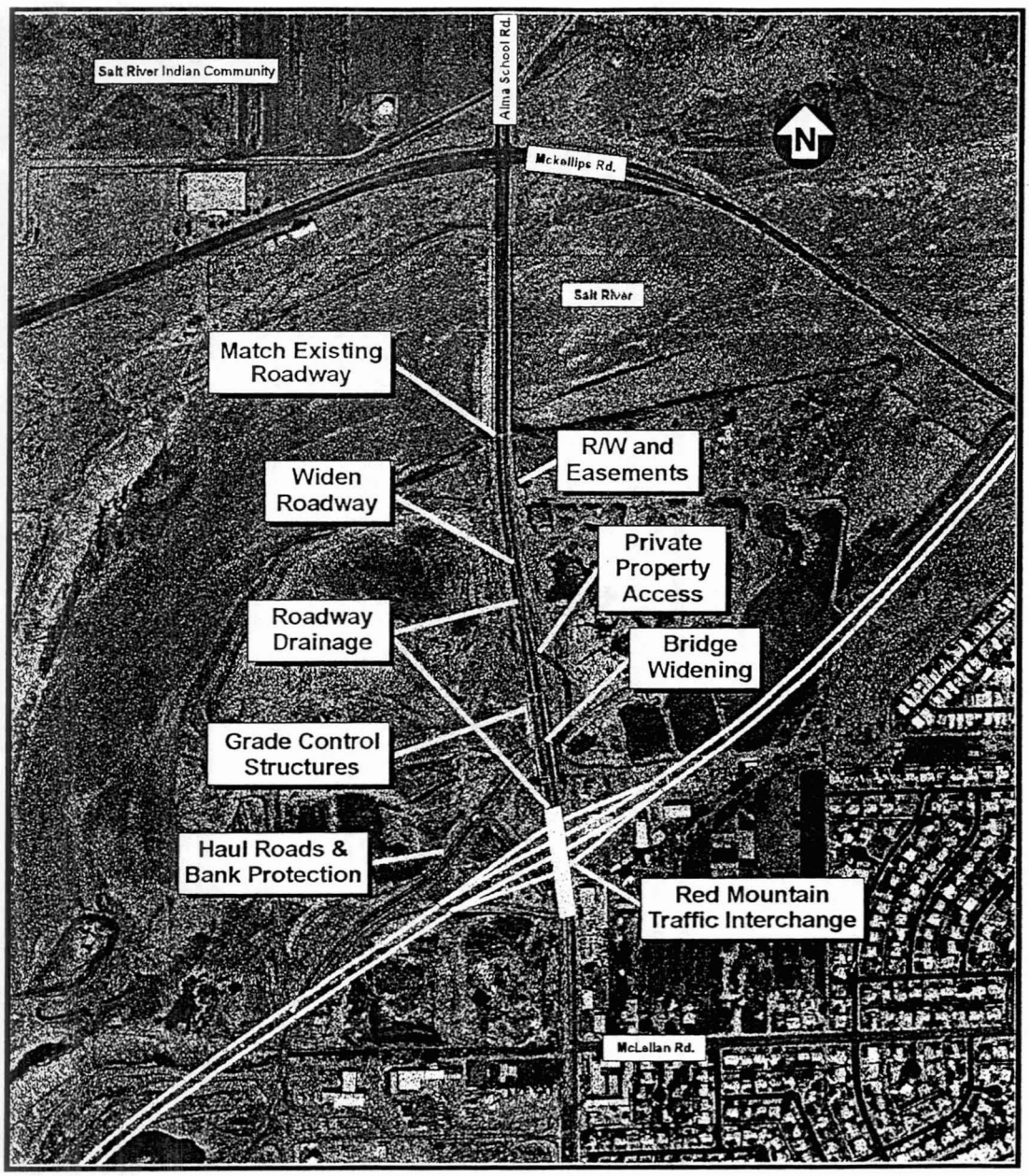
2. The HEC-RAS model should be revised to include enough GR points to contain the flow for all discharges being modeled. Warning comments in the model '... cross section end points had to be extended vertically...' indicate this condition. It is possible flows could leave the channel completely, especially for the extreme events. This can only be determined if the GR points extend well beyond the channel width.

3. The computed contraction scour depths appear excessive, since they are two to three times those of the local pier and abutment scour. Typically, contraction scour is a general cross section scour that is lesser than local scour. This analysis should be revisited by the consultant for the following reasons:
   a) The consultant assumed clear water condition type of equation. The criterion set up in the HEC-18, Section 4.3.4 equation 16 does not support this type of equation.
   b) The consultant assumed the clear water equation because of amoring in this reach. It is therefore obvious that the South Bridge area will have amoring potential as well (as documented on page 3 of the report, Section C). Amoring will limit the contraction scour to the depth to amor. The consultant should therefore check for amoring potential and compare the depth to the computed contraction scour depth.

4. In the report (page 2) Table I that contains system total area, pavement and pervious area etc was not include as indicated.

ALMA SCHOOL ROAD SOUTH BRIDGE PROJECT

FROM RED MOUNTAIN TRAFFIC INTERCHANGE
TO
NORTH BRIDGE
MCDOT WORK ORDER NO. 68931



MEETING WITH STAKEHOLDERS

AUGUST 27, 1997 2:00 TO 4:00 PM

MCDOT PROJECT MANAGER: - BRUCE WARD, P.E. 506-8681
MCDOT PROJECT ENGINEER: - YOGESH MANTRI, E.I.T. 506-8689

ALMA SCHOOL ROAD SOUTH BRIDGE PROJECT
PROPOSED IMPROVEMENTS

- Add two lanes one in each direction from Loop 202 freeway interchange to North Bridge to eliminate a possible traffic bottleneck situation and increase the level of service on Alma School Road during peak hours.

- Widen the bridge only on the East Side to avoid relocation of overhead power lines and conflict with the existing Grade Control Structure.

- Channelized "T" Intersection at main access to Sunward Materials to facilitate the movement of turning vehicles (especially trucks).

- Provide dedicated acceleration and deceleration lanes for trucks leaving and entering Sunward Materials.

- Some R/W will be required

- Budgeted for construction in Fiscal Year 1999

- Construction Funds Budgeted $1.7 Million

Maricopa County Department of Transportation

ALMA SCHOOL ROAD & SOUTH BRIDGE PROJECT

~~(144th Street - Palisades Boulevard)~~

~~ALMA~~ S

SIGN-IN SHEET

August 27, 1997

PLEASE PRINT	PLEASE PRINT	PLEASE PRINT
NAME	***ADDRESS***	***PHONE***
1. DONALD R. DAVIS	DELEUW, CATHER - 3875 N. 44TH ST., STE. 250	840-2256
2 Chris Perkins	10005 Osborn Scottsdale AZ	874-8161
3. Darrel Hale Sunward Materials	2625 South 19th Ave Phx Az	416-2600
4. ANTHONY ARAZA	CITY OF MESA - 320 E. 6TH ST. MESA, AZ	644-3537
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Maricopa County Department of Transportation

ALMA SCHOOL ROAD & SOUTH BRIDGE PROJECT

~~(144th Street - Palisades Boulevard)~~

SIGN-IN SHEET

August 27, 1997

PLEASE PRINT	PLEASE PRINT	PLEASE PRINT
NAME	***ADDRESS***	***PHONE***
1. L. J. DeWitt	1132 W. Michelan Mesa 85201	834 1042
2. Terry Bourland	205 S. 17th Ave. Phx. 85009	255-7645
3. Brian Fry	2633 E. Indian School Rd, ste 401 Phx 85029	957-1155
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Maricopa County Department of Transportation

ALMA SCHOOL ROAD & SOUTH BRIDGE PROJECT

~~(144th Street - Palisades Boulevard)~~

SIGN-IN SHEET

August 27, 1997

PLEASE PRINT	PLEASE PRINT	PLEASE PRINT
NAME	***ADDRESS***	***PHONE***
1. LEE W. DICKSON	DELEUW, CATHER 3875 N. 44th St #250 PHX 85018	840-2256
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August 27, 1997

Citizen Comments

Maricopa County Department of Transportation

Alma School Road & South Bridge Project

Project number: 68931 - Project Manager: Bruce Ward, 506-8681

Please complete and submit this card to a staff member before leaving or mail to **Maricopa County Department of Transportation, Attn: Bruce Ward, 2901 W. Durango St., Phoenix, AZ 85009.** Include your name and mailing address so we can respond to your questions. **Please Print.**

Name: SUNWARD MATERIALS **Phone number:** 416-2600

Address: Attn: Darrel Hale 2625 South 19th Ave

Phoenix, ARIZONA

Meeting Survey

How would you rate the knowledge and helpfulness of staff members who assisted you?

- ☒ Very knowledgeable
- ☐ Somewhat knowledgeable
- ☐ Not very knowledgeable

- ☒ Very helpful
- ☐ Somewhat helpful
- ☐ Not very helpful

Was all the project information presented in an understandable manner? Yes X No ____

Did staff answer your questions? Yes X No ____. If not, what didn't they answer?

Do you want more information about MCDOT projects? Yes X No ____. If yes, please make sure your name and address are filled in so we can add you to our mailing list.

How did you hear about the meeting?

Newspaper ____ Radio ____ Flyers ____ Trail Signs ____

Friends/Neighbors ____ Other (please comment) Property Owner

Additional Comments or Questions:

1) Access to the SunWard Materials Plant from underneath the bridge during construction (Both East & West traffic)

2) Contractor with County to widen Bridge will Consult with SunWard on truck access

(Continued on back)

during construction

3) Acceleration and deacceleration Lanes critical to good traffic flow

4) North Bound access at South Bank Entrance (adjacent to Treviso) Be maintained.

Thank you for your input!