



Public Works Department

433 N. Virginia Street  
Prescott, AZ 86301  
(928) 777-1130

**ADDENDUM NUMBER ONE**  
**to the**  
**PROJECT SPECIFICATIONS and CONTRACT DOCUMENTS**  
**for the**  
**Hummingbird Way and Sunrise Boulevard Culvert Replacement**  
**Project**

**DATE OF ADDENDUM:** April 15, 2016

**TO ALL BIDDERS BIDDING ON THE ABOVE PROJECT:**

The following addendum shall be made part of the Contract Documents. All other provisions of the Contract Documents remain unchanged. The Bidder shall acknowledge receipt of this Addendum on page 15 of the Proposal and by signing below and returning this form with the bid package. The contents of this Addendum shall be given full consideration in the preparation of the Bid.

**Add Detail 1 for Drawings on Plan Sheets D.04 and D.06**

As stated in these drawing sheets, the details are provided by an arch supplier as reference only. Detailed, engineer sealed drawings will be provided by a supplier after they are under contract.

**Special Provisions Revise and Add**

**SP01 Scope of Work**

**Revise Item C. Time of Completion and Add Items C2 and C3:**

1. The Contractor shall commence the work under this contract on or before the fifth (5<sup>th</sup>) calendar day after receiving written Notice to Proceed from the City. The Contractor shall fully complete all work within ninety (90) calendar days in accordance with the date set forth in the Notice to Proceed. The Contractor shall at all times during the continuance of the Contract prosecute the work with such work force and equipment as is sufficient to complete the project within the time specified.
2. The contractor shall complete construction of Sunrise Boulevard first.
3. Road closures are to be limited to 30 calendar days total per location.

**SP02 Manufacture and Installation of CONTECH Engineered Solutions Conspan Bridge Systems and Express Foundations (Or Approved Equal)**

**Add Under Title:**

Alternative Manufactured Products are acceptable as long as they meet the engineering design requirements for hydraulic capacity, precast foundation and structural requirements, and the minimum 30

day road closure criteria. The City and Engineer reserve the right to review/approve the final/sealed structural drawings prior to the contractor ordering the arched bridge materials.

**Add Copy of Project Geotechnical Reports:**

1. Engineering & Testing Consultants Inc., Subsurface Soil Exploration for Yavapai Hills Culvert Replacements, Prescott, AZ, dated November 15, 2015;
2. Engineering & Testing Consultants Inc., Addendum to Subsurface Soil Exploration for Yavapai Hills Culvert Replacements, Prescott, AZ, dated January 8, 2016.

**CLARIFICATION QUESTIONS**

1. Does the floor inside the arch way need a line item or is it included with the archway bid item?

*It is specifically mentioned and included in the measurement and payment for Special Provision Item SP02.*

2. Which are the non-friable ACP bid items and which are the friable ACP bid items?

*Per COP Technical Specifications, 350.6.1 is non-friable and 350.6.1a is friable. The "(a)" represents the 6" main in Hummingbird Way; the "(b)" represents the 8" main in Sunrise Boulevard.*

3. What is the thickness of the spillway base slab?

*The thickness of the base slab is 6-inches.*

4. Is the arched span considered pipe? And will we have to backfill over arch with slurry or can we use the native soil?

*The arched span is not a pipe. The backfill is specified in Special Provision Section SP02.*

**- END -**

City of Prescott, Public Works Department

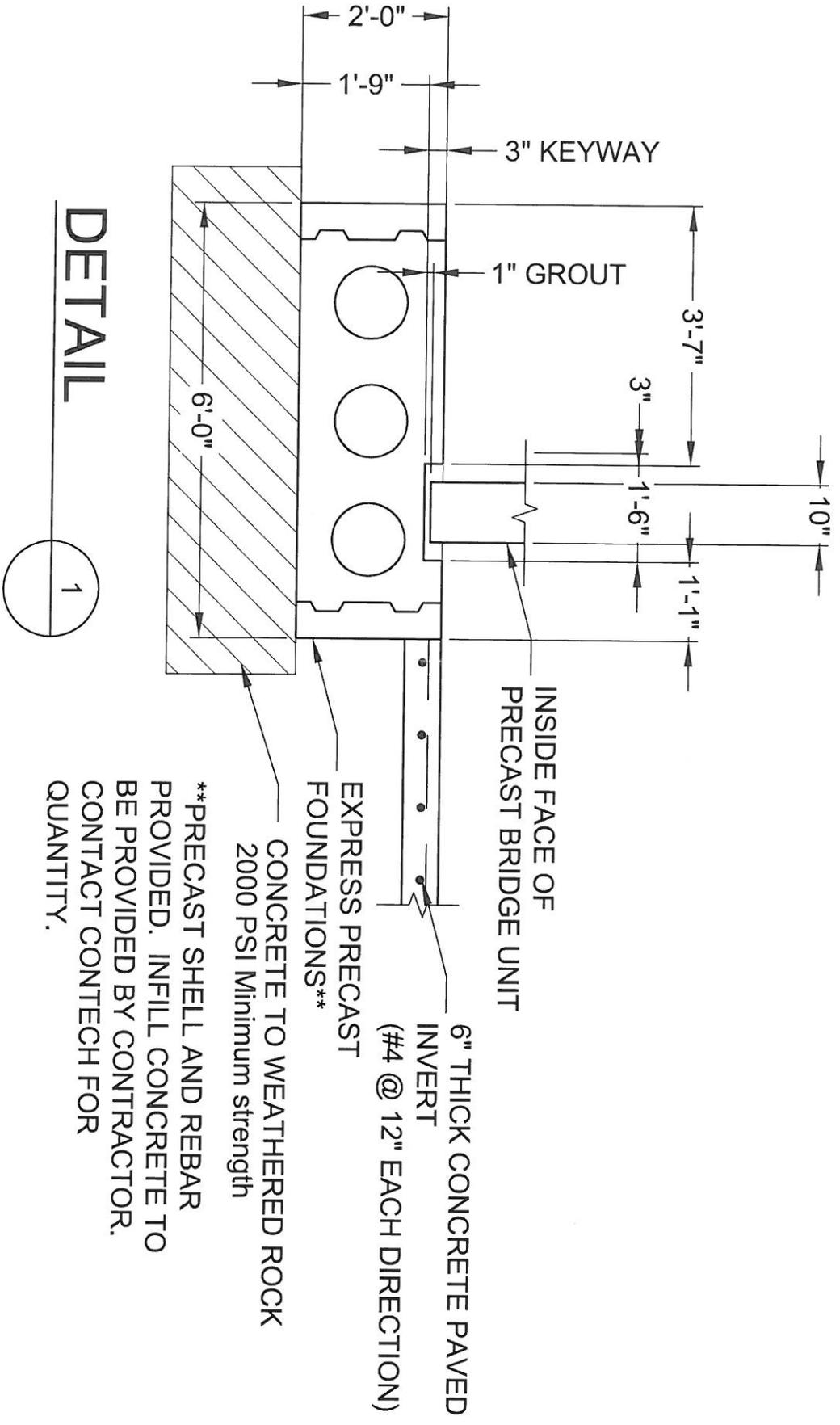
*Henry Hash* 4-15-16  
 Henry Hash, Public Works Director

**Acknowledgement:** (must be signed and turned in with the bid documents)

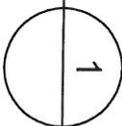
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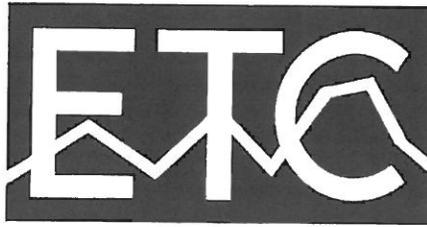
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Signature of Company Official

\_\_\_\_\_  
Date



**DETAIL**





## **ENGINEERING & TESTING CONSULTANTS INC.**

November 16, 2015

Mr. Brian Bucholtz, P.E., CFM  
Lyon Engineering  
1650 Willow Creek Road  
Prescott, Arizona 86301

**SUBJECT: SUBSURFACE SOIL EXPLORATION FOR YAVAPAI HILLS  
CULVERT REPLACEMENTS, PRESCOTT, AZ**

Dear Mr. Bucholtz:

Engineering & Testing Consultants, Inc., (ETC) has completed our geotechnical soil exploration for the subject project referenced above.

The purpose of the geotechnical exploration was to evaluate the general subsurface soil conditions in the area of the two proposed culvert replacements, and to provide geotechnical engineering recommendations with regard to foundation support, site grading, and pavement structural section for construction of the new culverts.

### **PROJECT AND SITE CONDITIONS**

We understand that the project will include replacement of two culvert crossings in Yavapai Hills. The culverts will be replaced with a ConArch culvert system from Contech.

One culvert replacement will be across Sunrise Boulevard, between Hornet Drive and Dragonfly Drive. At this location, the road consists of one lane in each direction, with an irrigated grass median. Several trees are also located within the median.

The second culvert replacement is located across Hummingbird Way, approximately 360 feet south-southwest of Hornet Drive. At this location, the road consists of one lane in each direction. A small, center median divides the road. However, the median ends near the northeast side of the proposed new culvert. The median is landscaped with gravel.

**GEOTECHNICAL ENGINEERING • SOILS & MATERIALS TESTING • SPECIAL INSPECTION**

**417 NORTH ARIZONA AVENUE • PRESCOTT, ARIZONA 86301  
928-778-9001 • FAX 928-778-4866**



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
November 16, 2015  
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## **SUBSURFACE CONDITIONS**

ETC drilled two exploratory test borings in accessible locations at the Sunrise Boulevard crossing. We drilled three borings in accessible locations at the Hummingbird Way crossing. The test holes were performed in order to determine general subsurface soil conditions and to collect soil samples for laboratory analysis. If during subsequent design and construction, project information or soil conditions are different than is indicated herein, this firm should be notified for evaluation.

### **Sunrise Boulevard Crossing**

One boring was drilled near the southeast side of the proposed culvert location (boring B-1). This boring encountered medium dense clayey sand with gravel (SC). Auger refusal on rock or boulder was encountered at a depth of approximately 16 feet.

Boring B-2 was drilled near the northwest side of the culvert location. This boring also encountered clayey sand with gravel. Relatively loose material was encountered from approximately 4 to 9 feet. Weathered rock was encountered at a depth of approximately 13 feet.

The existing pavement structure encountered was 2.5 and 4 inches of asphaltic concrete on 6 to 6.5 inches of base course material.

### **Hummingbird Way Crossing**

Three borings were drilled in the area of the Hummingbird Way culvert crossing. The existing pavement structure encountered in B-3 and B-4 consisted of 5¼ to 5½ inches of asphaltic concrete. The aggregate base material was difficult to distinguish.

Boring B-3 was drilled near the middle of the road on the southwest side of the culvert. This boring encountered medium dense soils, becoming loose to medium dense at a depth of 6.5 feet. Weathered rock was encountered at 12 feet.

Boring B-4 was also drilled near the middle of the road, north-northeast of the culvert. This boring encountered medium dense soils. Weathered rock was encountered at approximately 9 feet.

The third boring, B-5, was drilled near the northeast side of the culvert, on the shoulder of the road. This boring encountered loose to medium dense, rocky soil. At 10 feet, the soils became medium dense with an occasional boulder. Weathered rock was encountered at approximately 18.5 feet.



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
 Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
 November 16, 2015  
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Soils with higher clayey fines content were encountered directly above the lower rock stratum, where encountered.

Subsurface water was not encountered within the test holes during the field operation. However, water was observed to be flowing within the drainage channel along the alignments of the culverts. Therefore, water is expected during construction. A more detailed description of the subsurface conditions encountered by each of the test borings is presented on the boring logs included in Appendix A. Boring Location Maps are attached as Figures 1 & 2.

### **LABORATORY**

Atterberg limits, moisture content, and gradation laboratory testing was performed for representative soil samples collected during the field exploration. Laboratory testing was performed in accordance with applicable ASTM standards.

As shown in Table 1, the soils encountered at the site are generally low in plasticity, consisting of moderate to high percentage of clayey fines. A summary of the laboratory test results is presented below in Table 1.

**TABLE 1  
 SUMMARY OF LABORATORY TEST RESULTS**

Culvert Crossing	Boring	Depth (feet)	Liquid Limit (%)	Plasticity Index	Moisture Content (%)	Fines <sup>1</sup> Content (%)	Gravel Content (%)	USCS
Sunrise Blvd	B-1	1-4	30	10	7.2	27	27	SC
	B-2	4-9	33	14	8.5	32	27	SC
		9.5-13	25	5	6.0	23	26	SM-SC
Hummingbird Ln.	B-3	1-4	27	5	6.4	26	36	SM-SC
	B-4	8-9	35	12	16.0	38	15	SC

<sup>1</sup>Note: Total silt and clay fraction of soil (percent passing #200 sieve).



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
November 16, 2015  
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## FOUNDATIONS

ETC recommends that shallow foundations for the new culverts be seated in firm, native soils and/or weathered rock. Foundation excavations shall be a minimum of 18 inches below adjacent, compacted finished grade, or anticipated scour depth, whichever depth is greater. Foundations may need to be deepened, or otherwise protected against scour which would compromise foundation bearing soils, which is outside of our scope of work.

Loose soils, if encountered, will require over-excavation and replacement in controlled, compacted lifts. Removal of loose soils shall extend at least 4 feet beyond the foundation edges. Alternatively, bottom of footings may be extended to the recommended bearing stratum with concrete or lean 2-sack concrete slurry, up to a maximum depth of 4 feet below bottom of footing.

Bottom of footing excavations shall be scarified, moisture conditioned, and thoroughly compacted in accordance with the compaction criteria herein, except on rock. Sub footing preparation and other recommendations by the Manufacturer Contech shall also be followed.

Due to the varying anticipated foundation bearing conditions, ETC recommends a maximum allowable foundation pressure of **2,000 psf** be used for design of shallow foundations.

## EARTHWORK

ETC recommends that backfill within 3 feet of vertical culvert walls/wing walls be completed with granular, non-expansive, engineered fill, as specified herein.

The areas where fill is required must be stripped of all vegetation, debris, loose or other unstable soils and such material should be removed. Depressions and sloped ground should be widened or benched as necessary to accommodate compaction equipment and provide a level base for placing fill.

Prior to fill placement, the exposed ground surface shall be scarified, moisture conditioned, and thoroughly compacted to a minimum depth of 8 inches. ETC shall be contacted to observe the ground surface prior to fill placement to verify that the ground surface has been adequately prepared.

It is ETC's intention that the on-site soils be used for site general site grading. All fill soils shall be placed in accordance with the compaction criteria provided herein.



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
November 16, 2015  
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Granular, non-expansive engineered fill, where required, shall be clean, granular soil free of vegetation, debris, organic soil, and shall conform to the following requirements, or as approved by the engineer:

- 100 percent passing 6" sieve;
- 0 to 36 percent passing No. 200 sieve;
- 30 to 90 percent passing No. 4 sieve;
- Plasticity Index (PI) of 3 to 15; and
- Maximum expansion index of 15.

All subbase fill required to bring the structured areas up to subgrade elevation should be placed in horizontal lifts not exceeding 8 inches compacted thickness. All fill soils within the roadway prism, culvert backfill, or other structural areas, and backfill in utility trenches and behind retaining walls shall be compacted to a minimum relative density of 95% of maximum dry density at +/-2% of optimum moisture content (ASTM D698).

ETC recommends the observation of the site grading operation with sufficient tests to verify proper compaction.

*Prior to placement of new fill material against any existing embankment slope, the slope face shall be keyed back in a stepped pattern. ETC shall be contacted to approve preparation of the embankment slope prior to fill placement.*

Positive drainage is critical to the successful performance of any foundation or slab system. Efficient surface and subsurface drainage should be established prior to and maintained during and after construction to help prevent water from ponding within or adjacent to structural foundations.

### **Slopes**

ETC recommends maximum embankment slope angles of 2:1 (horizontal:vertical). Surface drainage should be intercepted and prevented from flowing down the face of constructed slopes without installation of adequate revetment protection.

### **LATERAL DESIGN PARAMETERS**

Engineered fill is required for backfill at least within 3 feet of retaining walls. For unsaturated soil conditions, the lateral backfill pressure may be determined using an equivalent fluid backfill pressure of 54pcf for restrained walls, and 34pcf for unrestrained walls.



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
 Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
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For roadway surcharge loads of 250psf, ETC recommends an additional horizontal pressure of 105psf be applied against the entire restrained wall height. This additional horizontal roadway surcharge pressure may be reduced to 68psf for unrestrained walls.

ETC recommends a coefficient of base friction of 0.40 be used to determine sliding resistance between concrete and firm soils.

When calculating wall stability against sliding, independent of passive resistance, ETC recommends a minimum factor of safety of 1.5.

The equivalent fluid pressures provided are for vertical wall surfaces with relatively level backfill. The pressures provided do not include temporary forces imposed during backfill compaction, adjacent surcharge loads, or swelling pressures that can develop from expansive clay backfill. Walls should be suitably braced during backfilling to prevent damage and/or deflection.

For foundations subject to eccentric or lateral loading, the recommended foundation bearing pressures provided herein may be increased by one-third for increased toe pressure.

**PAVEMENT DESIGN**

Site grading for pavement areas should be as outlined herein, to provide subgrade support of flexible pavements. ETC recommends the pavement structural sections presented below in Table 2 for the proposed improvements. The 3.75 inch asphaltic concrete thickness will allow for installation of the AC in one lift, in accordance with MAG lift thickness specifications.

**TABLE 2  
 PAVEMENT STRUCTURAL SECTIONS**

Road	Alternative	Asphalt Concrete Thickness (inches)	Aggregate Base Course Thickness (inches)	Prepared Existing Subgrade (inches)
Sunrise Blvd.	1	5	8	8
	2	4	11	8
Hummingbird Way	1	3	8	8



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
 Geotechnical Engineering Services – Yavapai Hills Culvert Replacements, Prescott, AZ  
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The recommended pavement sections are expected to function with periodic maintenance or overlays when the subgrade, base, and pavement are constructed in accordance with accepted construction standards. Efficient surface water drainage must be provided and maintained in an attempt to prevent moisture infiltration into the subgrade.

**LIMITATIONS**

The figures and recommendations in this report were prepared in accordance with accepted professional engineering principles and soil mechanics practices. We make no other warranty, either implied or expressed. If during subsequent planning and construction, conditions are different than as indicated, this firm should be notified for evaluation.

This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

For your use. If you have any questions, please contact us at (928) 778-9001.

Sincerely,

**ENGINEERING & TESTING CONSULTANTS, INC.**



Expires 09/30/17

Michael P. Wilson, P.E.  
 Project Engineer



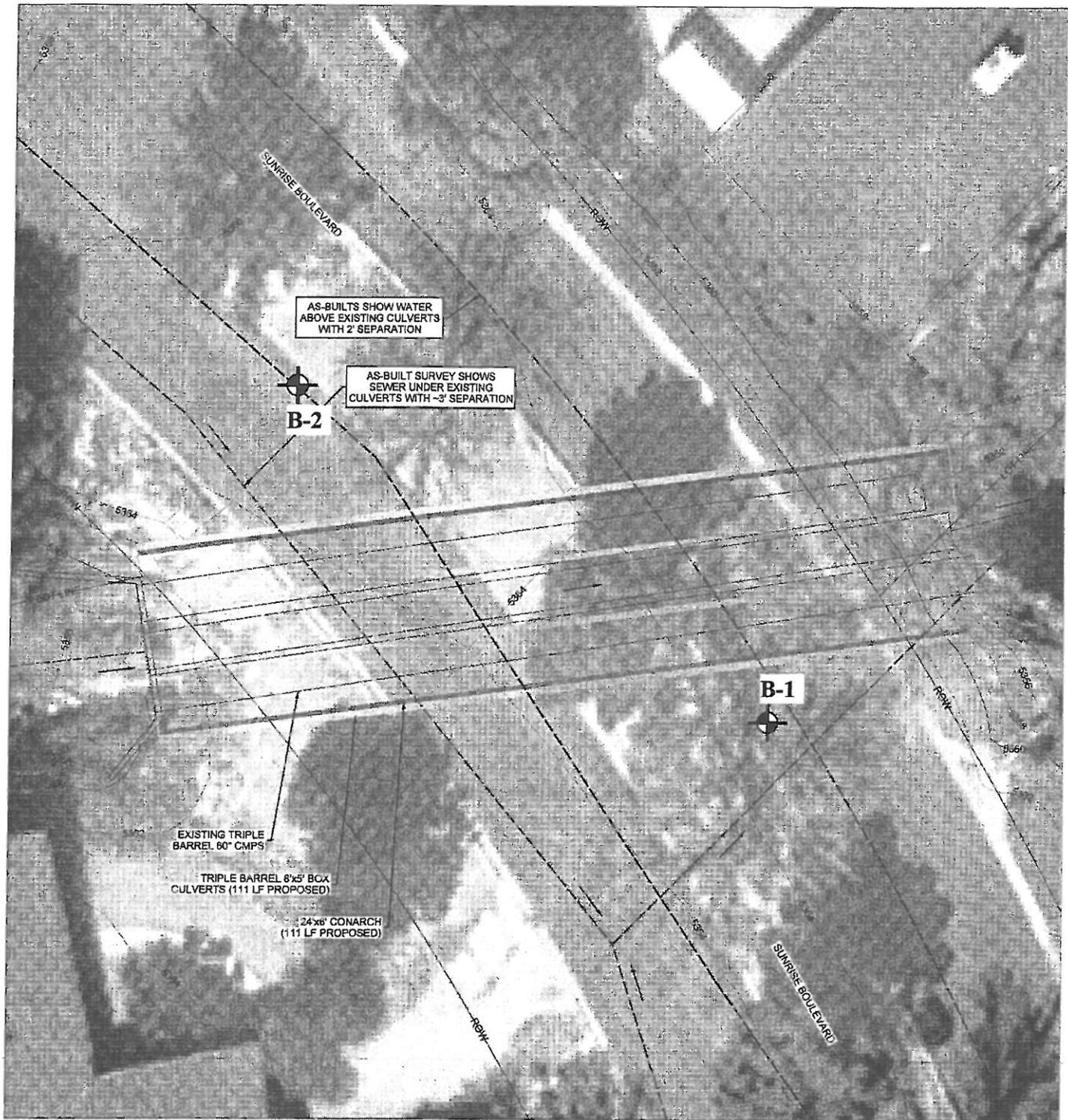
Expires 03/31/17

Reviewed by: Richard G. Kelley, P.E.  
 Project Manager

Attachments: Figure 1 and Appendix A

cc: ETC File No. 9003

# SUNRISE BOULEVARD CROSSING



## Legend



Approximate Boring Location



Engineering & Testing Consultants, Inc.  
 •Subsurface Drilling •Geotechnical •Environmental Support

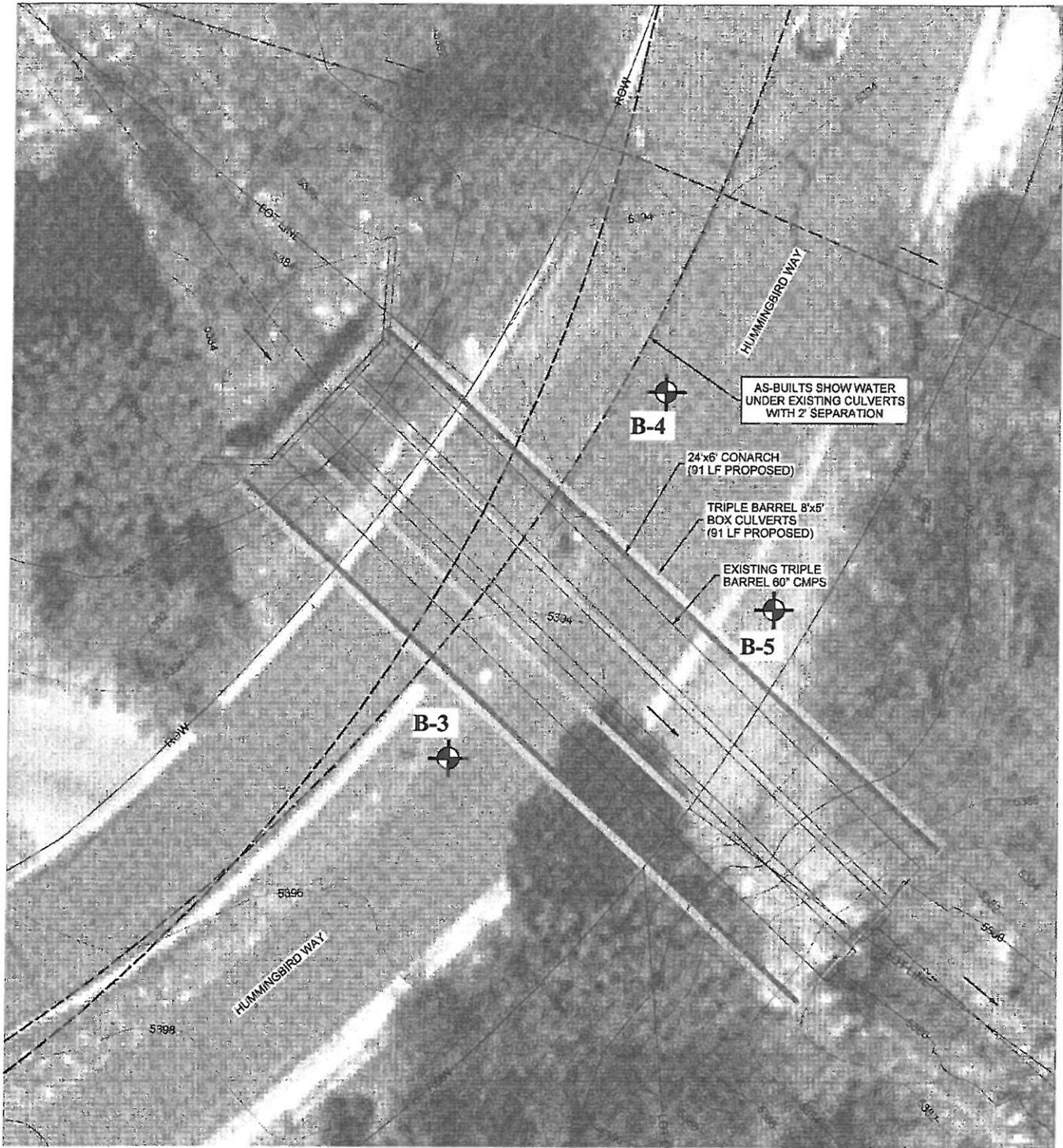
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 Project No: ETC 9003 Page No:

## FIGURE 1 BORING LOCATION MAP

Sunrise Boulevard Culvert Replacement  
 Prescott, AZ



# HUMMINGBIRD WAY CROSSING



**Legend**



Approximate Boring Location



Engineering & Testing Consultants, Inc.  
 •Subsurface Drilling •Geotechnical •Environmental Support

**FIGURE 2**  
**BORING LOCATION MAP**



Drawn by: others      Date: 11/2/15  
 Project No: ETC 9003      Page No:

Hummingbird Way Culvert Replacement  
 Prescott, AZ



**APPENDIX A**  
**FIELD EXPLORATION**

## GENERAL NOTES

### DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: Clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

### CONSISTENCY OF FINE-GRAINED SOILS:

N-Blows/ft.	Consistency
0-2	Very Soft
3-4	Soft
5-8	Medium
9-16	Stiff
17-32	Very Stiff
33+	Hard

### RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50+	Very Dense

### RELATIVE PROPORTIONS OF SAND AND GRAVEL:

Description Term(s) (of Components Also Present in Sampling)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

### GRAIN SIZE TERMINOLOGY:

Major Component of Sampling	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

### RELATIVE PROPORTIONS OF FINES:

Description Term(s) (of Components Also Present in Sampling)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12



# UNIFIED SOIL CLASSIFICATION SYSTEM\*

				Soil Classification	
				Group Symbol	Group Name <sup>#</sup>
COARSE-GRAINED SOILS More than 50 % retained on No. 200 sieve	Gravels More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5 % fines <sup>c</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel <sup>F</sup>
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel <sup>F</sup>
		Gravels with Fines More than 12 % fines <sup>c</sup>	Fines classify as ML or MH Fines classify as CL or CH	GM	Silty gravel <sup>F,G,H</sup>
	Sands 50 % or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines <sup>d</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand <sup>I</sup>
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand <sup>I</sup>
		Sands with Fines More than 12 % fines <sup>d</sup>	Fines classify as ML or MH Fines classify as CL or CH	SM	Silty sand <sup>G,H,I</sup>
FINE-GRAINED SOILS 50 % or more passes the No. 200 sieve	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line <sup>J</sup> $PI < 4$ or plots below "A" line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>
		organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OL	Organic clay <sup>K,L,M,N</sup> Organic silt <sup>K,L,M,O</sup>
	Silt and Clays Liquid limit 50 or more	inorganic	$PI$ plots on or above "A" line $PI$ plots below "A" line	CH	Fat clay <sup>K,L,M</sup>
		organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OH	Organic clay <sup>K,L,M,P</sup> Organic silt <sup>K,L,M,O</sup>
		inorganic	$PI$ plots on or above "A" line $PI$ plots below "A" line	MH	Elastic silt <sup>K,L,M</sup>
		organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OH	Organic clay <sup>K,L,M,P</sup> Organic silt <sup>K,L,M,O</sup>
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat	

<sup>A</sup> Based on the material passing the 3-in. (75-mm) sieve.

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> Gravels with 5 to 12 % fines require dual symbols:

- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

<sup>D</sup> Sands with 5 to 12 % fines require dual symbols:

- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

$$^E Cu = \frac{D_{60}}{D_{10}} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup> If soil contains  $\geq 15$  % sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15$  % gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30$  % plus No. 200, predominantly sand, add "sandy" to group name.

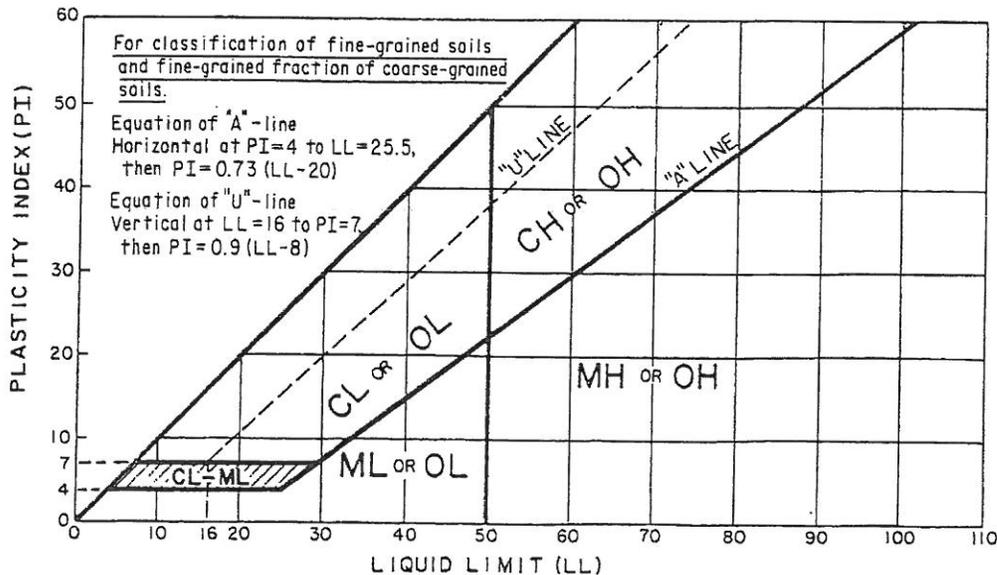
<sup>M</sup> If soil contains  $\geq 30$  % plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup>  $PI$  plots on or above "A" line.

<sup>Q</sup>  $PI$  plots below "A" line.



# LOG OF BORING NO. B-1



ENGINEERING & TESTING CONSULTANTS, INC.

PROJECT: <u>Yavapai Hills Culvert Replacements</u>	PROJECT NO.: <u>9003</u>
CLIENT: <u>Lyon Engineering</u>	DATE: <u>11/02/2015</u>
LOCATION: <u>See Boring Location Map</u>	ELEVATION: <u>---</u>
DRILLER: <u>ETC</u>	LOGGED BY: <u>MPW</u>
DRILLING METHOD: <u>Continuous Flight Auger</u>	

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	TEST RESULTS					Remarks	
				SAMPLERS	Plastic Limit	Water Content - ●	Liquid Limit	Penetration - ▨		
					10	20	30	40	50	
	2.5" ASPHALTIC CONCRETE	AC	□							
	6.5" BASE COURSE MATERIAL	AB	□							
	CLAYEY SAND WITH GRAVEL, light brown, moist, occasional cobble, Medium Dense	SC	▨							
3	Damp to moist									
	Brown to light brown									
6										
9										
	Rocky layer cobble/gravel									Likely native
	CLAYEY SAND WITH GRAVEL, brown, moist, Medium Dense	SC	▨							
12										
15										
	Auger refusal on rock or boulder at 16 feet depth.									
18										
21										

Figure A-4

# LOG OF BORING NO. B-2



ENGINEERING & TESTING CONSULTANTS, INC.

PROJECT: <u>Yavapai Hills Culvert Replacements</u>	PROJECT NO.: <u>9003</u>
CLIENT: <u>Lyon Engineering</u>	DATE: <u>11/02/2015</u>
LOCATION: <u>See Boring Location Map</u>	ELEVATION: <u>---</u>
DRILLER: <u>ETC</u>	LOGGED BY: <u>MPW</u>
DRILLING METHOD: <u>Continuous Flight Auger</u>	

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	TEST RESULTS		Remarks
				Plastic Limit	Liquid Limit	
	4" ASPHALTIC CONCRETE	AC	■			
	6" BASE COURSE MATERIAL, moist to very moist	AB	□			
	CLAYEY SAND WITH GRAVEL, light brown to brown, moist to very moist, Medium Dense	SC	▨			
3	Damp to moist light brown, some cobble					
	Loose					Loose
6						
9	Medium Dense Brown to dark brown	SC-SM	▩			Likely Native
12						
	WEATHERED ROCK	ROCK	▧			
15	Boring terminated at 14 feet depth.					
18						
21						

Figure A-5



# LOG OF BORING NO. B-4



ENGINEERING & TESTING CONSULTANTS, INC.

**PROJECT:** Yavapai Hills Culvert Replacements      **PROJECT NO.:** 9003  
**CLIENT:** Lyon Engineering      **DATE:** 11/02/2015  
**LOCATION:** See Boring Location Map      **ELEVATION:** ---  
**DRILLER:** ETC      **LOGGED BY:** MPW  
**DRILLING METHOD:** Continuous Flight Auger

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	TEST RESULTS		Remarks
				Plastic Limit	Liquid Limit	
	5.25" ASPHALTIC CONCRETE	AC				No AB layer, or contaminated AB layer
	CLAYEY SAND WITH GRAVEL, light brown, moist, low plasticity, Medium Dense	SC				
3						Likely native
	Dark greyish-brown, moist					
6						
	Some cobble					Likely native
	Very moist, dark reddish-brown, high clayey fines, Stiff			●	-----	
9						
	WEATHERED ROCK	ROCK				Likely native
	Auger refusal on rock at 9.5 feet depth.					
12						
15						
18						Likely native
21						

Figure A-7

# LOG OF BORING NO. B-5



ENGINEERING & TESTING CONSULTANTS, INC.

**PROJECT:** Yavapai Hills Culvert Replacements      **PROJECT NO.:** 9003  
**CLIENT:** Lyon Engineering      **DATE:** 11/02/2015  
**LOCATION:** See Boring Location Map      **ELEVATION:** ---  
**DRILLER:** ETC      **LOGGED BY:** MPW  
**DRILLING METHOD:** Continuous Flight Auger

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (feet)	Description	GROUP SYMBOL	SOIL TYPE	TEST RESULTS		Remarks	
				Plastic Limit	Liquid Limit		
	CLAYEY SAND WITH GRAVEL, light brown, damp-moist, some cobbles, Medium Dense	SC		Water Content - ●			
3	Loose to medium dense, rocky			Penetration -	10    20    30    40    50		
6							
9							
12	Ocasional boulder, Medium Dense						
15							
18	Very moist, dark brown, high clayey fines, some gravel, Stiff						
	WEATHERED ROCK	ROCK					
21	Boring terminated at 19.5 feet depth.						

Figure A-8

# KEY TO SYMBOLS

Symbol Description

## Strata symbols



Asphaltic Concrete



Aggregate base material



Clayey sand



Poorly graded clayey  
silty sand



Weathered rock

## Soil Samplers



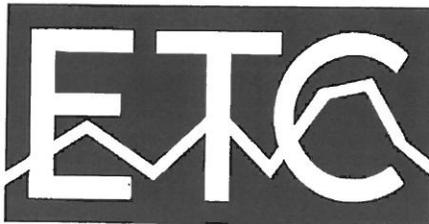
Bulk sample taken  
from 4 in. auger



Standard penetration test

## Notes:

1. Exploratory borings were drilled on 11/02/2015 using a 4-inch diameter continuous flight power auger.
2. No free water was observed at the time of drilling.
3. Boring locations were estimated from existing site features using a preliminary site plan.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.



## **ENGINEERING & TESTING CONSULTANTS INC.**

January 8, 2016

Mr. Brian Bucholtz, P.E., CFM  
Lyon Engineering  
1650 Willow Creek Road  
Prescott, Arizona 86301

**SUBJECT:     ADDENDUM TO SUBSURFACE SOIL EXPLORATION FOR YAVAPAI  
                  HILLS CULVERT REPLACEMENTS, PRESCOTT, AZ**

Dear Mr. Bucholtz:

Engineering & Testing Consultants, Inc., (ETC) has prepared this letter as an addendum to our report for the above referenced project, dated November 16, 2015. The purpose of this addendum is to provide revised foundation bearing recommendations after review of the preliminary construction documents.

### **Sunrise Boulevard Crossing**

As discussed in the original report, the two boring performed in the area of the Sunrise Boulevard Crossing encountered rock at depths of approximately 13 and 16 feet.

We understand that footing depth for the Contech products will be approximately 13 feet.

### **Hummingbird Way Crossing**

Three borings were drilled in this project area. At the locations drilled, the borings encountered rock at depths ranging from approximately 9 to 18.5 feet.

At this location, bottom of footing for the Contech products will be approximately 15 feet.

### **Foundations**

After review of the preliminary documents, seating all foundations on the lower rock stratum would likely be a viable alternative.

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928-778-9001 • FAX 928-778-4866**



Mr. Brian Bucholtz, P.E., CFM – Lyon Engineering  
Addendum to Geotechnical Report – Yavapai Hills Culvert Replacements, Prescott, AZ  
January 8, 2016  
Page 2 of 2

For this alternative, ETC recommends that shallow foundations for the new culverts be seated in the weathered rock stratum.

In areas where over-excavation is required to reach the lower rock stratum, structural concrete shall be used to extend bottom of footings to the rock stratum.

*Steel reinforcement is not our expertise. Therefore, reinforcement specifications within the deepened foundations, if required, will have to be provided by others.*

For conventional shallow foundations seated in the lower rock stratum, ETC recommends a maximum allowable foundation pressure of **4,500 psf** be used for design.

ETC recommends a coefficient of base friction of 0.55 be used to determine sliding resistance between concrete and rock.

For your use. This addendum is part of a complete geotechnical report and does not stand-alone. Other comments and recommendations not specifically addressed in this addendum shall remain applicable to the project.

Sincerely,

**ENGINEERING & TESTING CONSULTANTS, INC.**



Expires 09/30/17

Michael P. Wilson, P.E.  
Project Engineer



Expires 03/31/17

Reviewed by: Richard G. Kelley, P.E.  
Project Manager

cc: Mr. Kenneth Meyer, PE – Contech (KMeyer@conteches.com)  
ETC File No. 9003