FEMA CLOMR SUBMITTAL FOR A PORTION OF QUEEN CREEK POWER ROAD TO RECKER ROAD TOWN OF GILBERT MARICOPA COUNTY, ARIZONA

May 27, 1998

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CVL Project No. 61-0004-02-02

FEMA CLOMR SUBMITTAL FOR A PORTION OF QUEEN CREEK POWER ROAD TO RECKER ROAD TOWN OF GILBERT MARICOPA COUNTY, ARIZONA

May 27, 1998

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FEMA CLOMR Submittal
for
A Portion of Queen Creek
Power Road to Recker Road
Town of Gilbert
Maricopa County, Arizona

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1.0 INTRODUCTION

1.1 Scope and Location

The purpose of this report and its enclosures is to provide hydraulic analyses in support of a Conditional Letter of Map Revision (CLOMR) submittal to the Federal Emergency Management Agency (FEMA). The CLOMR involves a portion of Queen Creek between Power Road and the Recker Road in the Town of Gilbert in central Arizona (Figures 1 through 3). The purpose of this CLOMR request is to modify the flood zones so that a new residential development can be constructed adjacent to Queen Creek. The development will include a new, wide fully-incised channel to replace the existing narrow "perched" channel confined by unengineered earthen dikes.

Because the published Flood Insurance Rate Map (FIRM) shows flood zones for this area based on approximate methods (References 1 and 2), it was necessary to develop a pre-project fixed-bed model and a post-project model for this CLOMR request. Please note that the pre-project model is not a "corrected effective model". The effective model includes a floodplain based on hypothetical breaching of the in-place Queen Creek dikes. CVL did not evaluate breaches as part of this CLOMR effort because the dikes will be removed during the proposed construction. The pre-project model is included to demonstrate how flow velocities and depths will be impacted by the project.

1.2 Description of CLOMR Area

For the purpose of this CLOMR request, a "CLOMR Area" has been defined. This CLOMR Area comprises a strip of land straddling the section line between Sections 12 and 13 of Township 2 South, Range 6 East of the Gila and Salt River Meridian (Figure 2). It is bounded on the east by Power Road, on the west by Recker Road and extends far enough north and south to include the current effective 100-year floodplain for Queen Creek. Channel improvements will be extended a short distance east of Power Road and west of Recker Road, respectively, to transition from and back to existing conditions. However, it is not envisioned that the floodplain will be modified east of Power Road or west of Recker Road as part of this CLOMR effort.

The proposed development, Meadowbrook Village, includes the CLOMR Area and is bounded on the north by Queen Creek Road, on the east by Power Road, on the south by Ocotillo Road and on the west by Recker Road.

The local watershed area draining into Queen Creek is characterized by mostly agricultural land and undeveloped desert (Figures 4 & 5). The land slopes to the west with Queen Creek aligned generally east-west across the area. Queen Creek now consists of a generally trapezoidal channel that has been graded and confined by dikes of unengineered soil along both channel banks (Photographs 1 through 4). In an earlier HEC-2 model (Reference 3) it was recognized that overtopping and/or breaching of the dikes could occur with the floodwaters then ponding against the upslope (south) side of the left (south) dike or flowing downslope to the northwest (Figure 3). Queen Creek is an ephemeral wash with flows occurring only after major storms. It is normally a dry, sandy channel due to the lack of rainfall in this desert area.

1.3 Objective

The objective of this CLOMR and subsequent Letter of Map Revision (LOMR) is to reduce the aerial extent of the Zone A on the published FIRM for Queen Creek (Reference 1) in the CLOMR Area in order to allow for the development of residential and supporting land uses.

It is important to note how the existing floodplain delineation was completed. CVL understands that the perched channel system was first modeled as a fixed-bed (non-erodible) facility. From this model, the height of the laterally constrained water surface above the adjacent ground outside of the dikes was then used to estimate how far away from a dike breach water would flow before its depth would be less than 12 inches. With the post-project conditions, the water surface profile will be lowered between Power Road and Recker Road and this lowering of the water surface will extend upstream of Power Road for some distance. In fact, the HEC-2 results indicate that, in the perched channel reach just upstream of Power Road, the 100-year water surface elevation will be only about 1 foot above the existing adjacent ground outside of the in-place dikes. In practical effect, the 100-year floodplain will be reduced in width as it approaches the Power Road bridge from the east until it reaches the width of the perched channel. The ability of the water to breach the in-place dikes will be reduced to the impacts potentially caused by a 1-foot water surface differential across the earthen dikes. However, this CLOMR is not requesting that the floodplain east of Power

Road be modified. The raised roadway approaches to the Power Road bridge will represent the transition from the wider currently effective floodplain east of Power Road to the new floodplain west of Power Road.

Similarly, the transition at the downstream side of Recker Road will be based on the new raised roadway approaches to the Recker Road box culvert. Upstream of the new Recker Road box culvert, the 100-year flow will be confined to the new fully-incised channel. Downstream from the new Recker Road box culvert, the flow will generally be constrained by the existing dikes and the potential for dike breaches will remain similar to existing conditions. The proposed Recker Road box culvert does include new earthen dikes extending downstream from the box culvert about 290 feet. These dikes will be riprapped for erosion protection. The purpose of the transition dikes is only to protect the new Recker Road box culvert. Even though the floodplain will be physically constrained for a short distance downstream from the Recker Road box culvert, CVL is not requesting that the floodplain downstream from this box culvert be modified as a result of the construction of these dikes.

1.4 Methodology

The methodology used for this CLOMR request involved development of a pre-project fixed-bed model to understand existing hydraulic conditions, and a post-project model to assess hydraulic conditions with the development in place. Exhibit 1 presents a comparison of the current flood Zone A as shown on the FIRM and the pre-project fixed-bed model floodplain as estimated by a HEC-2 analysis. The following items are relevant to this process.

Background:

- This CLOMR addresses the Queen Creek floodplain in the CLOMR Area extending from Power Road to Recker Road.
- The in-force FIRM for the Study Area is based on approximate methods.

Baseline Fixed-Bed Model:

- Current detailed topography and existing cross sections have been developed for the project site.
- The existing bridge at Power Road is included within the model.
- A HEC-2 model has been developed based on the current topography, including the in-place bridge at Power Road (Enclosure 1).

Post-Project Model:

- A new channel has been designed so that the 100-year peak flow rate in Queen Creek will be contained in a fully-incised, generally trapezoidal channel. A low flow trapezoidal channel will meander within the larger trapezoidal channel section. This new, wide channel will lower the water surface profile and reduce the flow velocities while increasing the flow width. The areas adjacent to the new channel and now in the floodplain will be physically isolated from the Queen Creek 100-year flow.
- A post-project HEC-2 model has been developed based on the proposed new channelization from Power Road to Recker Road (Enclosure 1).
- Exhibit 1 presents a comparison of the current flood zone A as shown on the FIRM and the post-project fixed-bed model floodplain as estimated by a HEC-2 analysis.
- With the significantly lower channel velocities, the potential for channel erosion will also be significantly reduced across the CLOMR Area.
- A HEC-6 sediment transport model (Enclosure 2) developed for this CLOMR request indicates that sediment movement will not be a significant problem.
- A program of inspection and maintenance (Appendix A) is in force under the Town of Gilbert Floodplain Management Ordinance (Reference 4).

General:

- All new finish floors in the proposed development (Figure 6) adjacent to the CLOMR Area will be at least 12 inches (Reference 5) above the 100-year water surface elevation (WSEL).

1.5 Regulatory Jurisdiction

The development of this project is in accordance with the Town of Gilbert's drainage design requirements (Reference 5) and Arizona Revised Statutes (ARS) 48-3609A.

1.6 Previous Submittals to FEMA

The only known previous submittal to FEMA regarding this area was the work completed for the in-force Flood Insurance Study (FIS), (Reference 2) and associated FIRM (Reference 1).

1.7 FEMA Revision Requestor and Community Official Form

The attached Revision Requestor and Community Official Form (MT-2 Form 1) is provided per FEMA requirements, and is provided in Appendix B.

1.8 FEMA Certification by Registered Professional Engineer and/or Land Surveyor Form

The attached Certification by Registered Professional Engineer and/or Land Surveyor Forms (MT-2 Form 2) are provided per FEMA requirements, and are provided in Appendix C.

In reference to items 5 and 6 on the certification forms, the engineers and surveyor that reviewed this submittal have reviewed the current on-site conditions and the proposed development plans. As construction progresses, as-built information will be prepared and reviewed by Arizona registered professionals, as appropriate, before submitting final as-built information to FEMA. Due to the fact that this is a CLOMR submittal, neither the engineer nor the surveyor can certify as-built information at this time. Certification of final as-built information will be made upon application for LOMR.

2.0 HYDROLOGIC SETTING

The CLOMR Area (Figure 2) is currently agricultural property sloping down to the northwest at approximately 0.3 percent. The surrounding properties consist primarily of undeveloped desert to the east and agricultural lands to the west, south and north. The project site and off-site watershed area historically was an alluvial outwash plain with well drained loams and sandy clay loams.

Queen Creek crosses the project site in a westerly direction just south of Queen Creek Road. It has a natural, sandy bottom and man-made bermed banks which, in some locations, contain vegetation such as palo verde, mesquite trees and creosote bushes. The Queen Creek alignment continues west to Higley Road then turns south. It eventually outfalls to the East Maricopa Floodway (EMF) near the Chandler Heights Road alignment. The EMF is a regional drainage outfall for the east City of Mesa, Town of Gilbert, and Town of Queen Creek areas. The EMF was constructed by the U.S. Soil Conservation Service and is now maintained and operated by the Flood Control District of Maricopa County (FCDMC). The EMF outlets to the Gila River across the Gila River Indian Community (GRIC) lands.

3.0 HYDROLOGY AND HYDRAULICS BY OTHERS

The in-force Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Maricopa County (Reference 2) indicates that the Queen Creek was studied by approximate methods. Peak discharges are not listed.

The Queen Creek Area Drainage Master Study (ADMS) prepared by Wood & Associates for FCDMC in 1991 (Reference 3) used a HEC-1 model to develop the hydrology and HEC-2 model to generate water surface profiles for Queen Creek.

The HEC-1 model indicates that Queen Creek conveys a 100-year peak flow rate of 3,000 cfs at Power Road. The hydrologic analysis used drainage areas delineated over U.S.G.S. 7.5-minute quadrangle maps. This limitation is explained in the ADMS. Floodplain delineation was based on water surface profiles generated by a HEC-2 model. The cross-sections were spaced at approximately 500-foot intervals. The ADMS indicates that at certain locations Queen Creek has inadequate dikes that are not properly constructed or maintained. This has been recently confirmed by field work completed for this project (Appendix L). It was stated that overtopping of dikes could occur with floodwaters headed in a northwesterly direction.

4.0 PROPOSED QUEEN CREEK CHANNEL IMPROVEMENTS

A fully-incised widened and deepened channel is proposed. Within the CLOMR Area, the 100-year flow will be confined within the incised channel (Exhibit 1). Channel improvements are described below:

Location	Description
Power Road	Clean up channel under existing bridge.
Power Road to Recker Road (approx. 1.0 mile)	Widen channel bottom to approximately 200± feet. Use 4:1 or flatter side slopes. Provide a meandering 1-foot-deep, 100-foot-wide low flow channel within the larger trapezoidal channel section (Figure 6). Channel velocities generally between 5-6 fps, except at bridge locations. Lower channel invert by up to 2 feet. Use 4:1 side slopes. All local flow outfalls that will discharge to the new channel will be constructed with non-erosive downchutes and splash pads to minimize the potential for channel side slope/toe erosion. The remainder of the Queen Creek channel side slopes will be stabilized, as necessary, with grass to minimize the erosion potential. Provide multiple culverts for one new roadway crossing.
Recker Road	Provide a multiple box culvert at Recker Road.
West of Recker Road	Transition channel from Recker Road culvert to existing natural channel. Provide erosion protection at outfall. Extend low flow channel west until daylight (see Figure 7).

The above improvements will produce the following benefits:

- Lowered 100-year water surface profile from upstream of the Power Road bridge to Recker Road.
- The 100-year floodplain across the CLOMR Area is physically confined to the new channel width.
- Reduced flow velocities in the widened channel reaches.
- Removal of earthen levees between the Power Road and Recker Road and elimination of the risk of levee breach/failure.

Please refer to the supporting Enclosure 1 for a detailed description of the hydraulic analysis and design for this channel.

5.0 SEDIMENT TRANSPORT ANALYSIS

The sediment transport analysis for the study area is presented in a separately bound report included with this CLOMR request as Enclosure 2.

6.0 INSPECTION AND MAINTENANCE PROGRAM

The channel in the Meadowbrook Village development will be maintained by the developer, UDC Homes, until such time as it is turned over to the following organizations: the Town of Gilbert (Gilbert) will be responsible for the Recker Road box culvert area; the golf course operator will be responsible for the golf course and the Section 404 mitigation areas; and the Meadowbrook Village Home Owners Association (HOA) will be responsible for the entrance road (Meadowbrook Village Parkway) and the areas not assigned to another entity. In all areas the landscaping will be maintained on a regular basis. Other possible problem areas, such as bank erosion, will be addressed on an as-needed basis.

Mr. Lonnie Frost is the floodplain administrator for Gilbert. One of the responsibilities of the floodplain administrator for Gilbert is to ascertain whether in fact, maintenance activities for storm water management structures associated with delineated floodplains are being accomplished. Gilbert's floodplain ordinance (Town of Gilbert Ordinance No. 525) required that conveyance capacity for flowing water and volumetric capacity for basins must be maintained for hydraulic structures in delineated floodplains (Appendix A). In the event that the entity responsible for an area does not fulfill its obligation, Gilbert will maintain those areas within the delineated floodplain.

Gilbert participates in FEMA's Community Rating System (CRS) and has been awarded points for the construction, operation, and maintenance of regional detention facilities. This demonstrates that Gilbert has the intent and financial resources to perform the maintenance for the Meadowbrook Village development, if need be.

7.0 SUMMARY AND CONCLUSIONS

1. The peak 100-year flow rate of 3,000 cfs in Queen Creek will be safely conveyed across the CLOMR Area in a new, wide fully-incised channel. This will lower the water surface profile and reduce the 100-year floodplain width to the channel width. This channel will provide for low velocities even during the 100-year flow. Erosion protection will be provided, as necessary, for the channel side slopes across the CLOMR Area.

2. In addition to the proposed improvements within the CLOMR Area, improvements will be effected both downstream and upstream from the CLOMR Area. These include the following:

   - Proposed channel improvements downstream from the CLOMR Area include a new half-street multiple box culvert at Recker Road and short channel transition from this culvert to the existing channel configuration to the west.

   - Proposed channel improvements upstream from the CLOMR Area include removal of vegetation with associated minimal channel recontouring.

3. All finish floor elevations of insurable structures in the CLOMR Area will be designed to be at least 12 inches above the expected 100-year high water elevation in Queen Creek.

8.0 COMPLETED FEMA FORMS

All FEMA forms required to support this CLOMR request have been completed and are included in Appendices B through H. Additional supporting documentation is also included in Appendices I through K. A set of As-Built construction drawings for the in-place Power Road bridge is included in Appendix I. This set of drawings represents the highest quality available.

9.0 REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Rate Map Numbers 04013C2690F and 040132695F, December 3, 1993.

2. Federal Emergency Management Agency, Flood Insurance Study, *Maricopa County, Arizona Incorporated Areas,* Revised September 30, 1995.

3. Wood & Associates, *Final Report Queen Creek Area Drainage Master Study*, 1991.

4. Town of Gilbert, Floodplain Management Ordinance.

5. Town of Gilbert Unified Land Development code.

DOCUMENT QUALITY ASSURANCE

As part of CVL's policy to provide quality products to its clients, all reports are subject to review for technical accuracy, validity of conclusions and appropriateness of recommendations.

This document was prepared by: _____

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Date: *May 27, 1998*

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Printed/Typed Name: *Greg Rodzenko, P.E.*

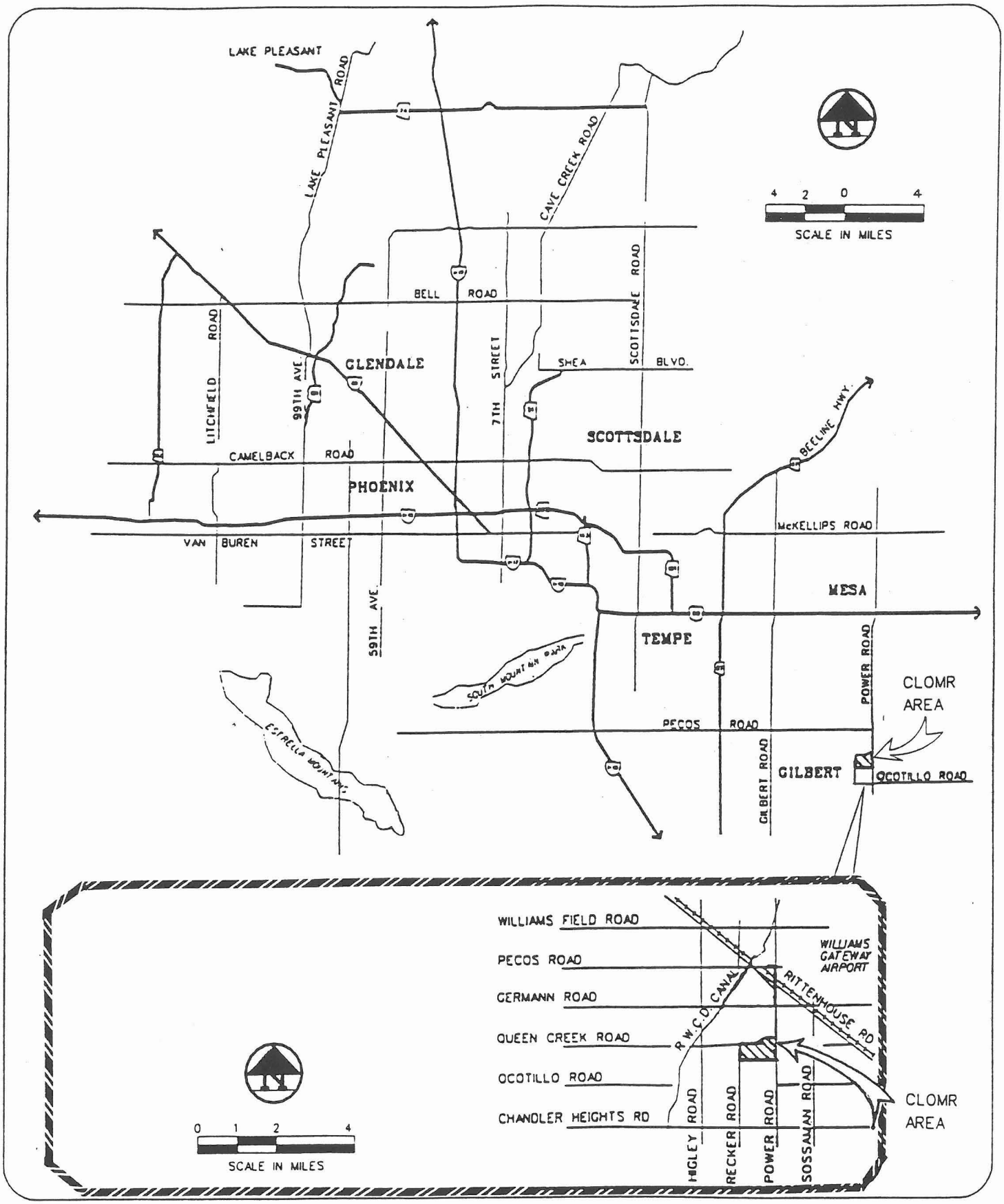
Date: *May 27, 1998*

This document was prepared under the direction of: _____

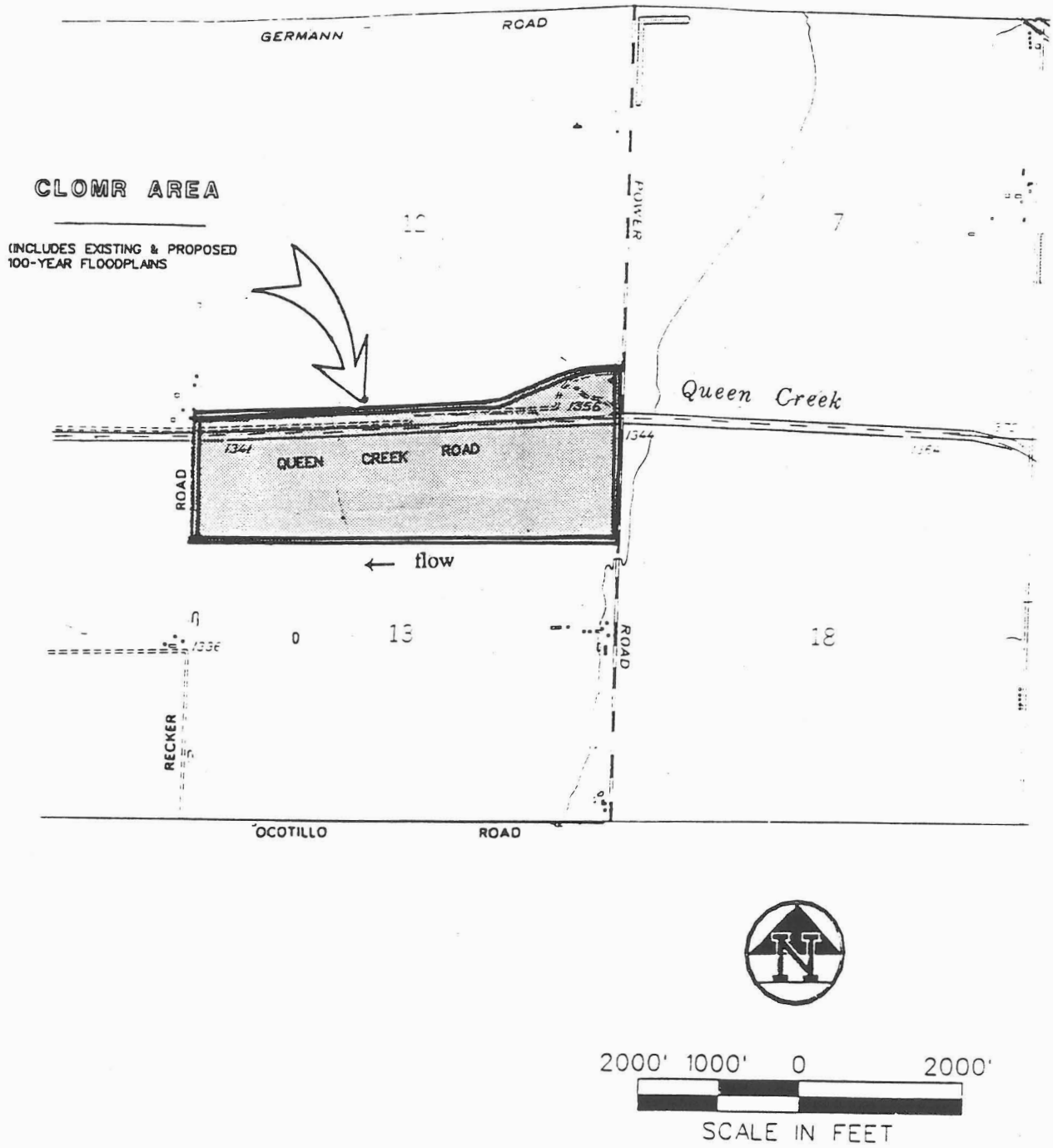
Printed/Typed Name: *George J. Geiser, P.E.*

Date: *May 27, 1998*

FIGURES



VICINITY MAP & LOCATION MAP	QUEEN CREEK CLOMR POWER RD. TO RECKER RD.	JOB NO 610004-02
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	**COE & VAN LOO** PLANNING•ENGINEERING•LANDSCAPE ARCHITECTURE	FIGURE 1



CLOMR AREA MAP	QUEEN CREEK CLOMR POWER RD. TO RECKER RD.	JOB NO 610004-02
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264 6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 2

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2695 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
GILBERT, TOWN OF	040044	2695	F
MARICOPA COUNTY UNINCORPORATED AREAS	040037	2695	F
MESA, CITY OF	040040	2695	F
QUEEN CREEK, TOWN OF	040132	2695	F

MAP NUMBER
04013C2695 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2690 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
GILBERT, TOWN OF	040044	2690	F
MARICOPA COUNTY UNINCORPORATED AREAS	040037	2690	F
MESA, CITY OF	040040	2690	F

MAP NUMBER
04013C2690 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency

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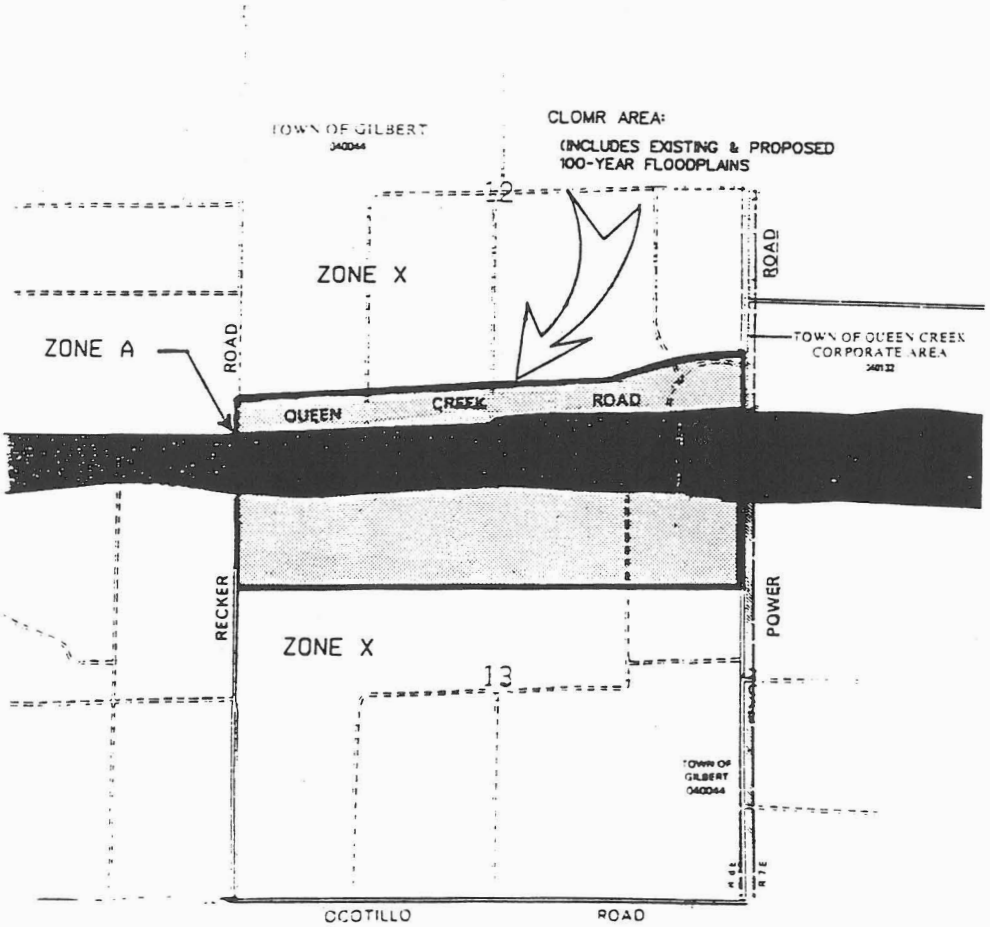
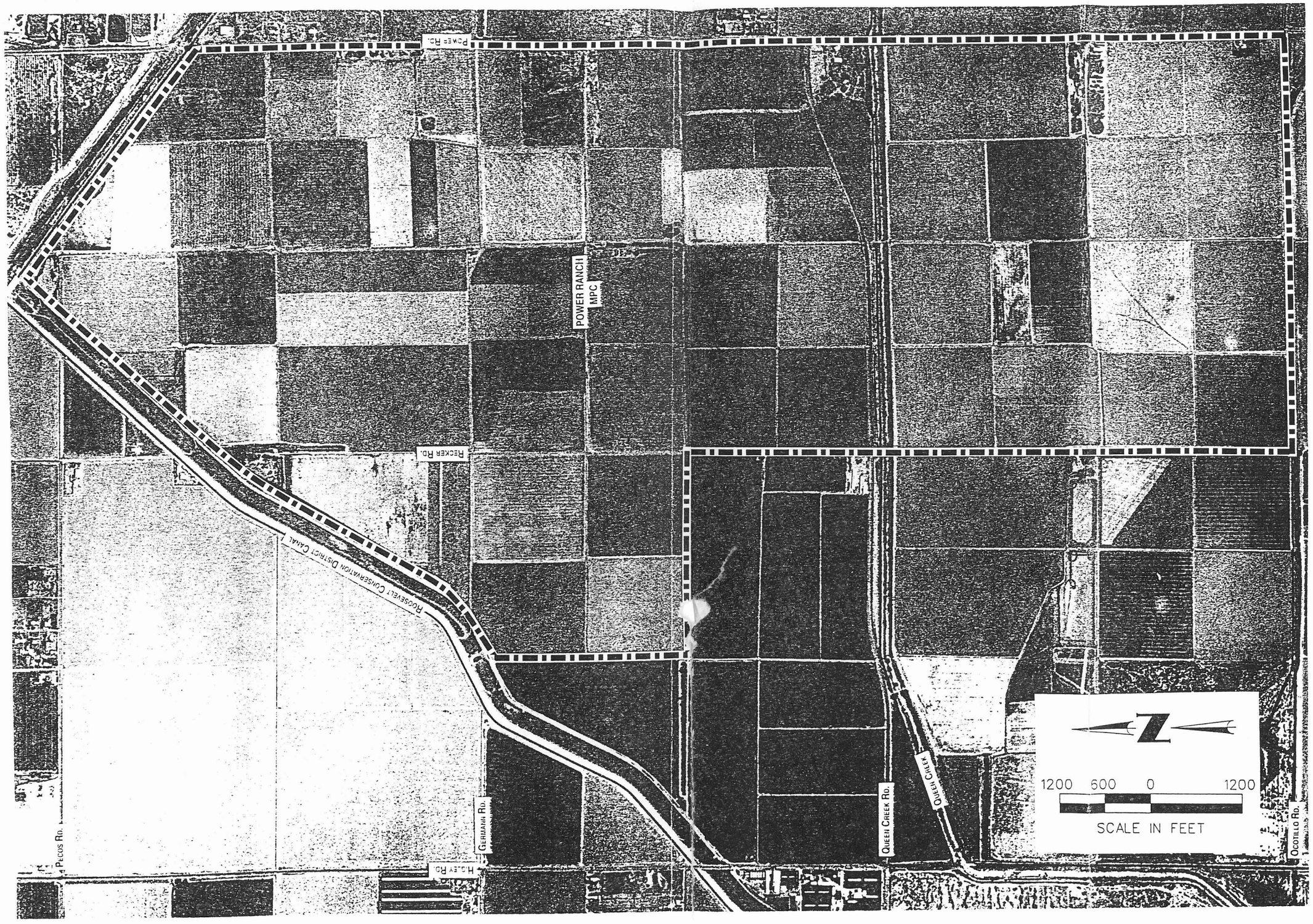


FLOOD INSURANCE RATE MAP	QUEEN CREEK CLOMR POWER RD. TO RECKER RD.	JOB NO 610004-02
[illegible]	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE 3



QUEEN CREEK CLOMR
POWER ROAD TO RECKER ROAD

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

AERIAL PHOTO

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PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO
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FIGURE 4

FILENAME 610004 LANDPLEX-404.DGN DATE:4-98

JOB NO 610004-02	OBLIQUE AERIAL PHOTO	QUEEN CREEK CLOMR POWER ROAD TO RECKER ROAD
FIGURE 5	4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

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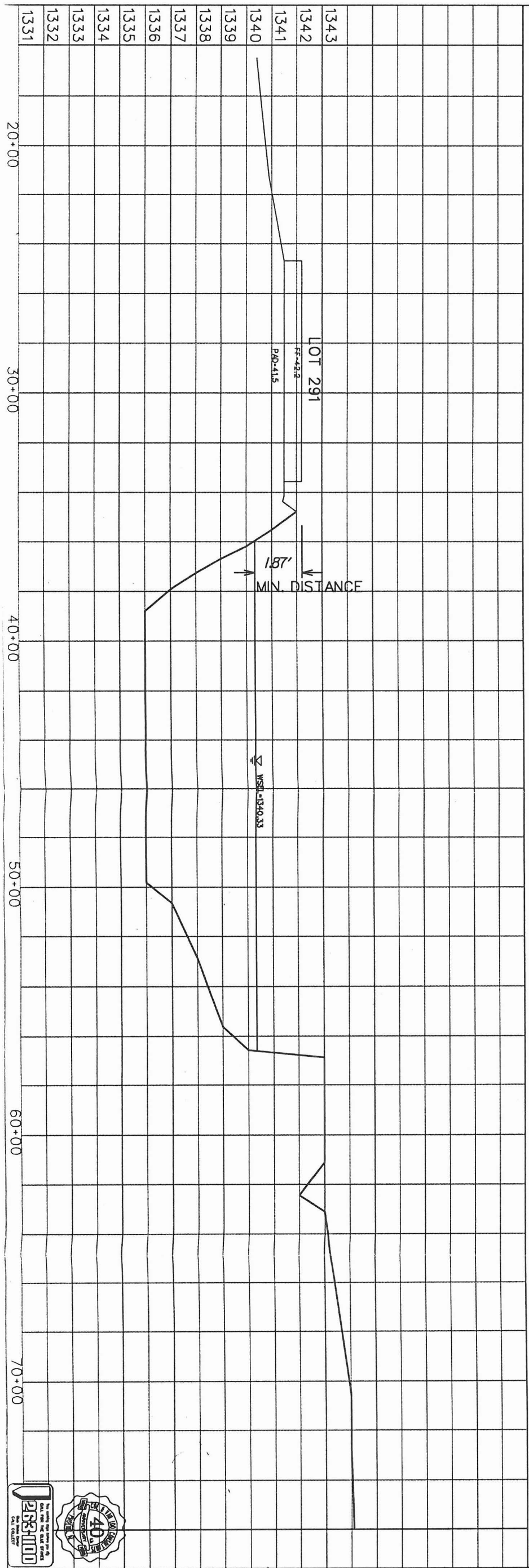

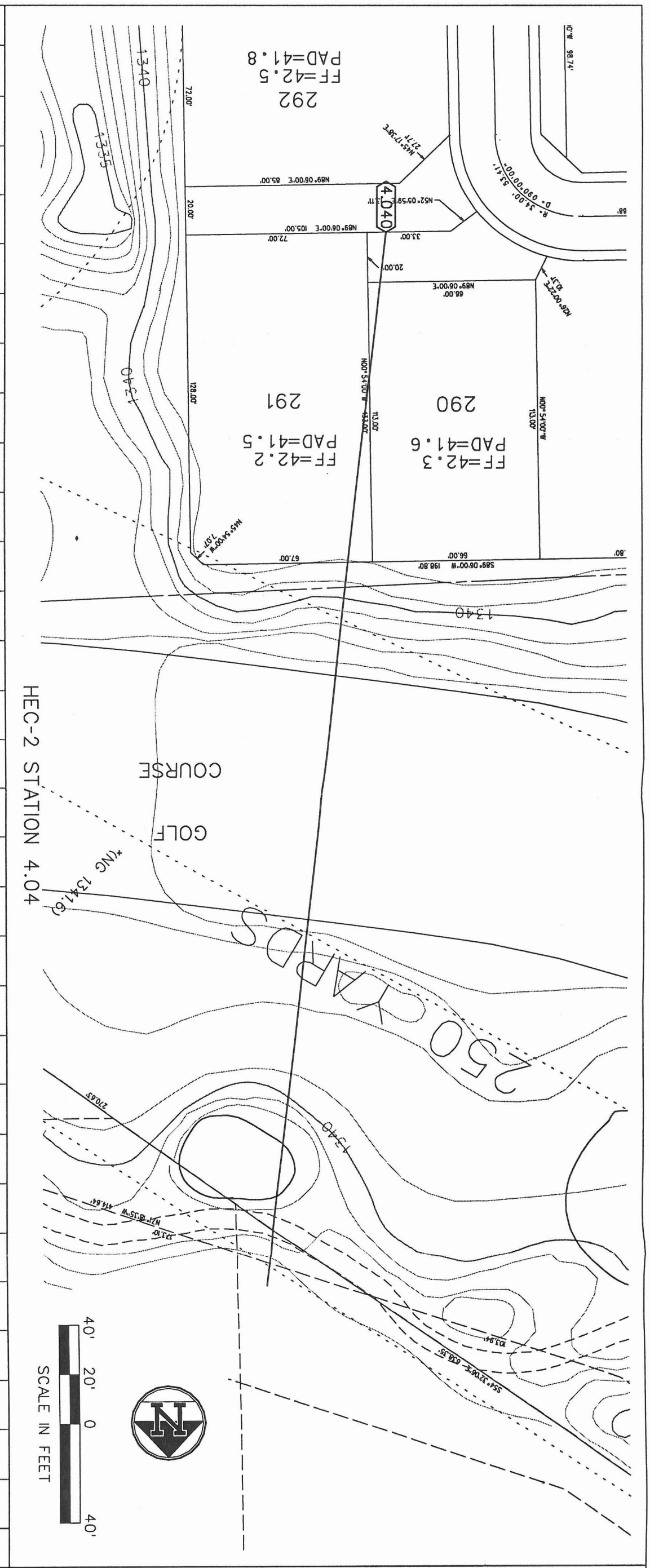

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DRAWN	NAME			
CHECKED	NAME			
DATE	DATE			

HEC-2 TYPICAL SECTION

QUEEN CREEK CHANNELIZATION

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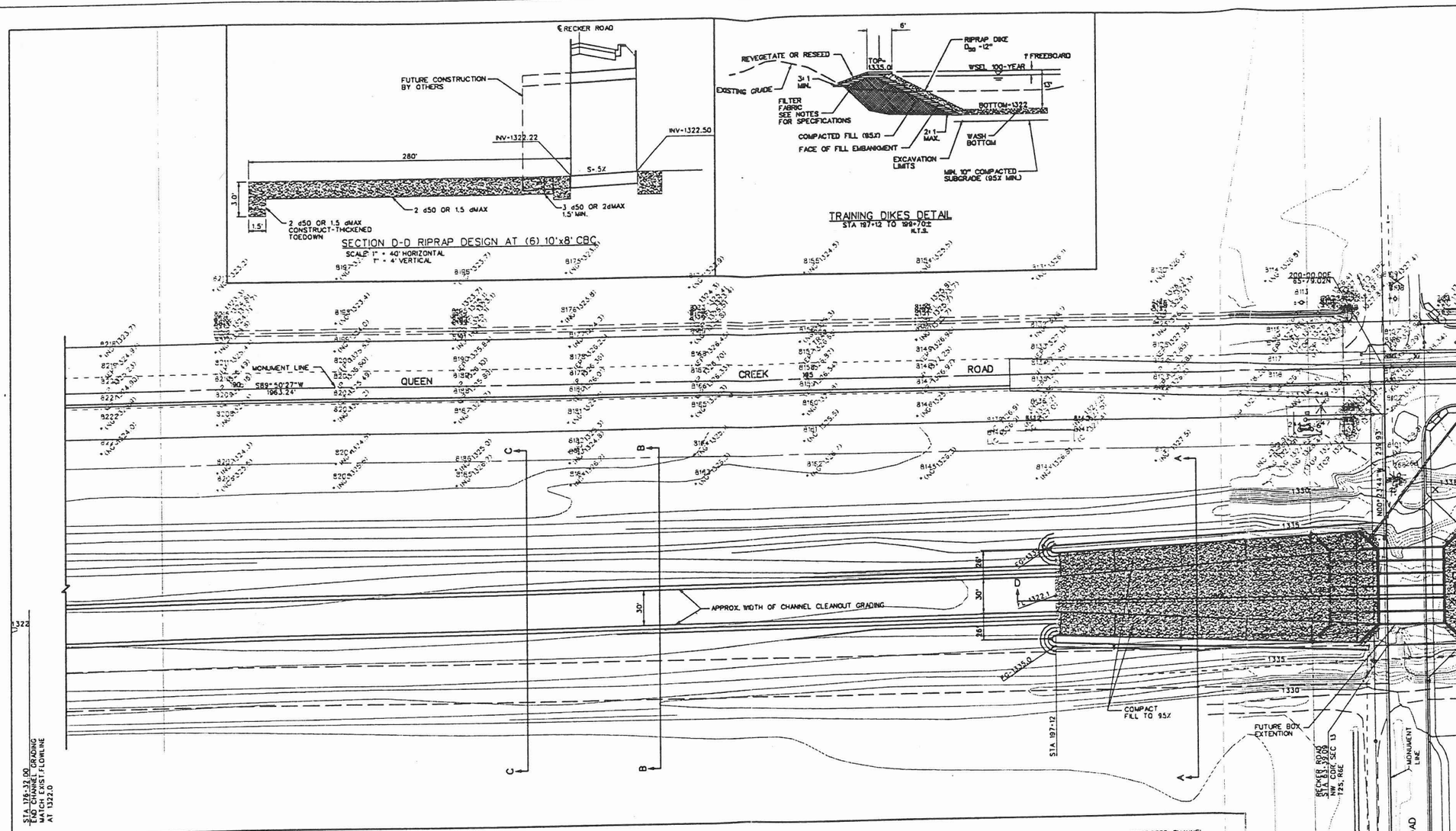
SHEET
FIGURE 6
610004
PLAN K



MEADOWBROOK VILLAGE AT
POWER RANCH INFRASTRUCTURE

COE & VAN LOO
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PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

REVISIONS	DATE	BY

DESIGNED NAME
DRAWN NAME
CHECKED NAME
DATE

DOWNSTREAM OF CLOMR AREA
PROPOSED CHANNEL IMPROVEMENTS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 14733 GEORGE J. GEISER ARIZONA U.S.A.

CVL

SHEET
FIGURE 7

610004-02-02

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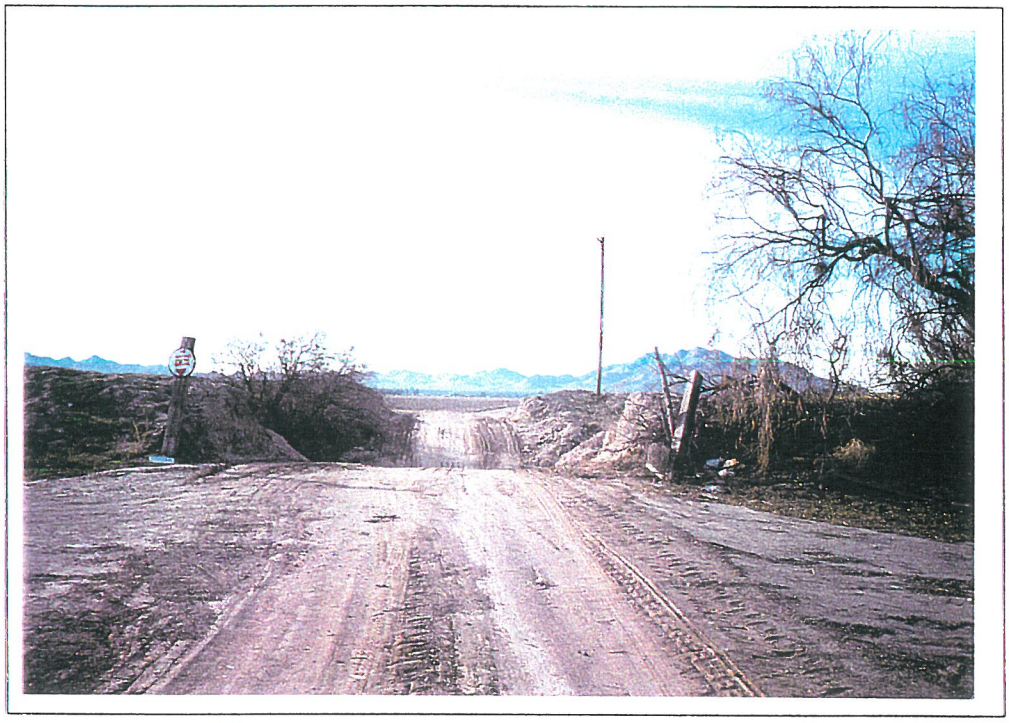
SITE PHOTOGRAPHS

PHOTOGRAPH 1 QUEEN CREEK LOOKING UPSTREAM (EAST) TOWARD POWER ROAD BRIDGE

PHOTOGRAPH 2 QUEEN CREEK LOOKING UPSTREAM (EAST) FROM EAST OF RECKER ROAD



PHOTOGRAPH 3 LOOKING NORTH ACROSS QUEEN CREEK ALONG RECKER ROAD ALIGNMENT

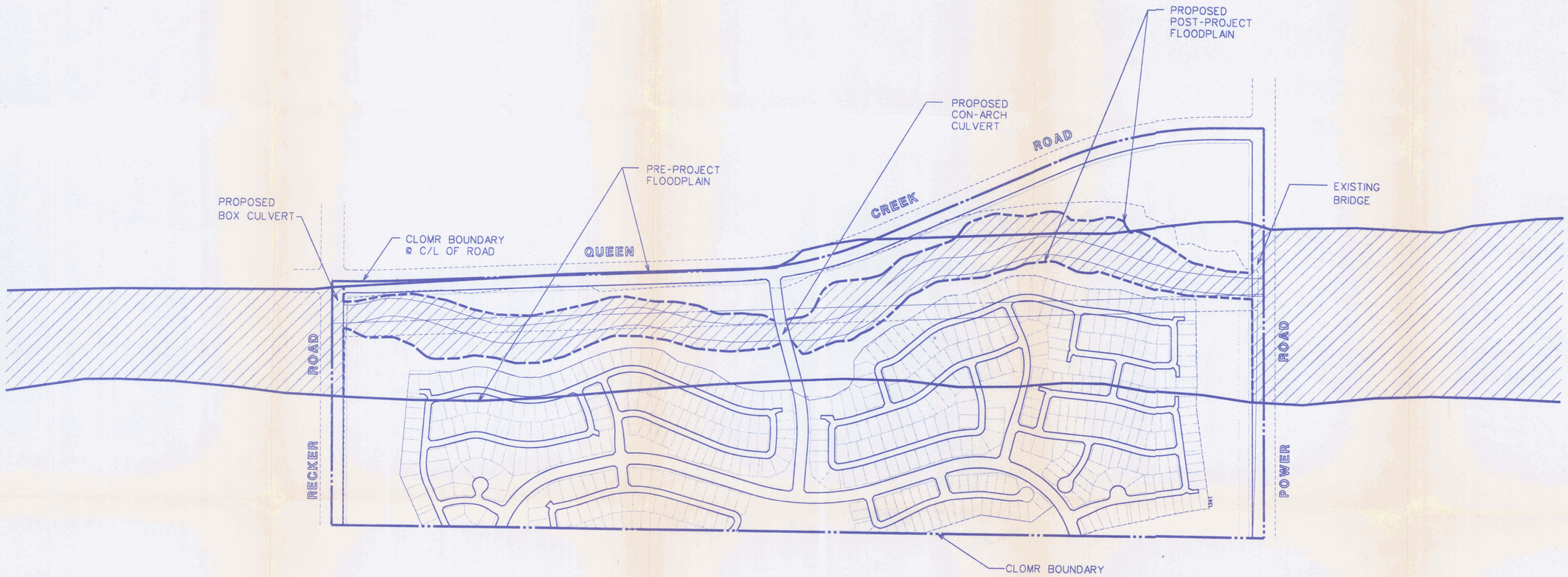
PHOTOGRAPH 4 LOOKING NORTH ACROSS QUEEN CREEK IN VICINITY OF RECKER ROAD

Exibit 1

PRE-PROJECT CONDITION MODEL AND PROPOSED POST-PROJECT MODEL 100-YEAR FLOODPLAINS

KEY TO SYMBOLS

- CLOMR AREA BOUNDARY
- PRE-PROJECT FLOODPLAIN
- PROPOSED POST-PROJECT FLOODPLAIN



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SCALE IN FEET

QUEEN CREEK CLOMR
POWER RD. TO RECKER RD.

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PRE-PROJECT & PROPOSED POST-PROJECT MODEL 100-YR. FLOODPLAINS

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JOB NO
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EXHIBIT 1

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APPENDICES

Appendix A

EXCERPT FROM TOWN OF GILBERT'S FLOODPLAIN ORDINANCE NO. 525

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FLOOD DAMAGE PREVENTION ORDINANCE

ARTICLE 8-1 STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND METHODS

Section 8-1-1 Statutory Authorization.

The Legislature of the State of Arizona has in A.R.S. § 48-3609 enabled Gilbert to adopt regulations in conformance with A.R.S. § 48-3604 designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the Town Council of Gilbert, Arizona, does ordain as follows:

Section 8-1-2 Findings of Fact.

A. The flood hazard areas of Gilbert are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

B. These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazards which increase flood heights and velocities, and when inadequately anchored, damage uses in other areas. Uses that are inadequately floodproofed, elevated or otherwise protected from flood damage also contribute to the flood loss.

Section 8-1-3 Statement of Purpose.

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

A. To protect human life and health;

B. To minimize expenditure of public money for costly flood control projects;

C. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

D. To minimize prolonged business interruptions;

E. To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;

F. To help maintain a stable tax base by providing for the second use and development of areas of special flood hazard so as to minimize future flood blight areas;

G. To insure that potential buyers are notified that property is in an area of special flood hazard;

H. To insure that those who occupy the areas of special flood hazard assume responsibility for their actions and

I. To maintain eligibility for State disaster relief.

Section 8-1-4 Methods of Reducing Flood Losses.

In order to accomplish its purposes, this ordinance includes methods and provisions for:

A. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

B. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

C. Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;

D. Controlling filling, grading, dredging, and other development which may increase flood damage; and,

E. Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

ARTICLE 8-2 DEFINITIONS

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application.

"Appeal" means a request for a review of the Floodplain Administrator's interpretation of any provision of this ordinance or a request for a variance.

"Area of shallow flooding" means a designated AO Zone on the Flood Insurance Rate Map (FIRM). The base flood depths range from one to three feet; a clearly defined channel does not exist; the path of flooding is unpredictable and indeterminate; and, velocity flow may be evident.

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"Base flood" means the flood having a one percent chance of being equalled or exceeded in any given year.

"Breakaway Wall" means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building supporting foundation system.

"Critical Feature" means an integral and readily identifiable part of a flood protection system without which the flood protection provided by the entire system would be compromised.

"Development" means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations located within the area of special flood hazard.

"Financial assistance" means any form of loan, grant, guaranty, insurance, payment, rebate, subsidy, disaster assistance loan or grant, or any other form of direct or indirect Federal assistance, other than general or special revenue sharing or formula grants made to States.

"Flood or flooding" means a general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of flood waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, and/or (3) the collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in this definition.

"Flood Boundary Floodway Map" means the official map on which the Federal Insurance Administration has delineated both the areas of flood hazard and the floodway.

"Flood Insurance Rate Map (FIRM)" means the official map on which the Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

"Flood Insurance Study" means the official report provided by the Federal Insurance Administration that includes flood profiles, the FIRM, the Flood Boundary Floodway Map, and the water surface elevation of the base flood.

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"Floodplain or flood-prone area" means any land area susceptible to being inundated by water from any source (see definition of "flooding").

"Floodplain Administrator" means the person designated in the Town who is hereby authorized by the Floodplain Board to administer the provisions of this ordinance.

"Floodplain Board" means the Town Council of Gilbert at such times as they are engaged in the enforcement of this ordinance.

"Floodplain management" means the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

"Floodplain management regulations" means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

"Flood protection system" means those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to a "special flood hazard" and the extent of the depths of associated flooding. Such a system typically includes dam, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

"Flood proofing" means any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

"Flood-related erosion" means the collapse or subsidence of land along the shore of a lake or other body of water as a result of undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as a flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding.

"Floodway" means the channel of a river or other watercourse and the adjacent land areas necessary in order to discharge the one hundred-year flood without cumulatively increasing the water surface elevation.

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"Functionally dependent use" means a use which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

"Highest adjacent grade" means the highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

"Levee" means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

"Levee System" means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

"Lowest floor" means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance.

"Manufactured home" means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For floodplain management purposes the term "manufactured home" also includes park trailers, travel trailers and other similar vehicles placed on a site for greater than 180 consecutive days.

"Manufactured home park or subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for sale or rent.

"Mean sea level" means, for purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's Flood Insurance Rate Map are referenced.

"New construction" means, for floodplain management purposes, structures for which the "start of construction": commenced on or after the effective date of a floodplain management regulation adopted by a community.

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"Person" means an individual or his agent, firm, partnership, association or corporation, or agent of the aforementioned groups, or this state or its agencies or political subdivisions.

"Program" means the National Flood Insurance Program authorized by 42 U.S.C. 4001-4128.

"Program deficiency" means a defect in a community's floodplain management regulations or administrative procedures that impairs effective implementation of those floodplain management regulations or of the NFIP standards.

"Regulatory flood elevation" means an elevation one foot above the base flood elevation.

"Remedy a violation" means to bring the structure or other development into compliance with State or local floodplain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of the ordinance or otherwise deterring future similar violations, or reducing Federal financial exposure with regard to the structure or other development.

"Riverine" means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

"Special flood hazard area" means an area having special flood or floodrelated erosion hazards, and shown on an FHBM or FIRM as Zone A, AO, A1-30, AE, A99 or AH.

"Start of Construction" includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

"Structure" means a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

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"Substantial improvement" means any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either (a) before the improvement or repair is started, or (b) if the structure has been damaged, and is being restored, before the damage occurred. For the purposes of this definition "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not, however, include either (1) any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions or (2) any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

"Variance" means a grant of relief from the requirements of this ordinance which permits construction in a manner that would otherwise be prohibited by this ordinance.

"Violation" means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in this ordinance is presumed to be in violation until such time as that documentation is provided.

ARTICLE 8-3 GENERAL PROVISIONS

Section 8-3-1 Lands to Which This Ordinance Applies.

This ordinance shall apply to all areas of special flood hazards within the corporate limits of Gilbert.

Section 8-3-2 Basis for Establishing the Areas of Special Flood Hazard.

The area of special flood hazard identified by the Federal Insurance Administration (FIA) in a scientific and engineering report entitled "The Flood Insurance Study for Town of Gilbert" with an accompanying Flood Insurance Rate Map is hereby adopted by reference and declared to be a part of this ordinance. The Flood Insurance Study is on file with the Town of Gilbert, 119 North Gilbert Road, Gilbert, Arizona 85234. The Flood Insurance Study is the minimum area of applicability of this ordinance and may be supplemented by studies for other areas which allow implementation of this ordinance and which are recommended to the Floodplain Board by the Floodplain Administrator.

Section 8-3-3 Compliance.

No structure shall hereafter be constructed, located, extended, converted, or altered and no building permit shall be

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issued without full compliance with the terms of this ordinance and other applicable regulations. No land shall hereafter be altered and no Floodplain Use Permit shall be issued without full compliance with the terms of this Ordinance and other applicable regulations.

Section 8-3-4 Abrogation and Greater Restriction.

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

Section 8-3-5 Interpretation.

In the interpretation and application of this ordinance, all provisions shall be:

A. Considered as minimum requirements;

B. Liberally construed in favor of the governing body; and,

C. Deemed neither to limit nor repeal any other powers granted under state statutes.

Section 8-3-6 Warning and Disclaimer of Liability.

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of the Town, any officer or employee thereof, or the Federal Insurance Administration, for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

Section 8-3-7 Statutory Exemptions.

A. In accordance with A.R.S. § 48-3609, nothing in this ordinance shall:

1. Affect existing uses of property or the right to continuation of the use under conditions which existed on the effective date of this ordinance.

2. Affect repair or alteration of property for the purposes for which such property was used on the effective date of this ordinance; providing such repair or alteration does not exceed 50

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percent of the value of the property prior to the repair or alteration; and provided the repair or alteration does not decrease the carrying capacity of the watercourse.

3. Affect or apply to facilities constructed or installed pursuant to a certificate of environmental compatibility issued under the authority of Title 40, Chapter 2, Article 6.2.

B. In accordance with A.R.S. § 48-3613, written authorization shall not be required, nor shall the Floodplain Board prohibit:

1. The construction of bridges, culverts, dikes and other structures necessary to the construction of public highways, roads and streets intersecting a watercourse.

2. The construction of storage dams for watering livestock or wildlife, structures on banks of a creek, stream, river, wash, arroyo, or other watercourse to prevent erosion of or damage to adjoining land, or dams for the conservation of flood waters as permitted by Title 48, Chapter 21.

3. Construction of tailing dams and waste disposal areas for use in connection with mining and metallurgical operations. This paragraph does not exempt those sand and gravel operations which will divert, retard or obstruct the flow of waters in any watercourse.

4. Any flood control district, or other political subdivision, from exercising powers granted to it under A.R.S. Title 45, Chapter 10.

C. Before any construction authorized by Subsection 2 of this Section may begin, the responsible person must submit plans for the construction to the Board for review and comment.

D. These exemptions do not preclude any person from liability if that person's actions increase flood hazards to any other person or property.

Section 8-3-8 <u>Declaration of Public Nuisance</u>.

Every new structure, building, fill, excavation or development located or maintained within any area of special flood hazard after August 8, 1973 in violation of this ordinance is a public nuisance per se.

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Section 8-3-9 Abatement of Violations.

Within 30 days of discovery of a violation of this ordinance, the Floodplain Administrator shall submit a report to the Floodplain Board which shall include all information available to the Floodplain Administrator which is pertinent to said violation. Within 30 days of receipt of this report, the Floodplain Board shall either:

A. Take any necessary action to effect the abatement of such violation; or

B. Issue a variance to this ordinance in accordance with the provisions of Section 6.0 herein; or

C. Order the owner of the property upon which the violation exists to provide whatever additional information may be required for their determination. Such information must be provided to the Floodplain Administrator within 30 days of such order, and he shall submit an amended report to the Floodplain Board within 20 days. At their next regularly scheduled public meeting, the Floodplain Board shall either order the abatement of said violation or they shall grant a variance in accordance with the provisions of Section 6.0 herein.

D. Submit to the Administrator of Federal Insurance Administration a declaration for denial of insurance, stating that the property is in violation of a cited State or local law, regulation or ordinance, pursuant to Section 1316 of the National Flood Insurance Act of 1968 as amended.

Section 8-3-10 Unlawful Acts.

A. It is unlawful for any person to divert, retard or obstruct the flow of waters in any watercourse whenever it creates a hazard to life or property without securing the written authorization of the Floodplain Board.

B. Any person violating the provisions of this section shall be guilty of a class 2 misdemeanor.

ARTICLE 8-4 ADMINISTRATION

Section 8-4-1 Establishment of Floodplain Permit.

A Floodplain Permit shall be obtained before construction or development begins within any area of special flood hazard established in Article 8-3, Section 8-3-2. Application for a Floodplain Permit shall be made on forms furnished by the Floodplain Administrator and may include, but not be limited to: plans in duplicate drawn to scale showing the nature, location, dimensions, and elevation of the area in

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question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required:

A. Proposed elevation in relation to mean sea level, of the lowest habitable floor (including basement) of all structures; in Zone AO, elevation of existing grade and proposed elevation of lowest habitable floor of all structures.

B. Proposed elevation in relation to mean sea level to which any structure will be floodproofed;

C. Certification by a registered professional engineer or architect that the floodproofing methods for any nonresidential structure meet the floodproofing criteria in Article 8-5, Section 8-5-1.C.3; and,

D. Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

Section 8-4-2 <u>Duties and Responsibilities of the Floodplain Administrator</u>.

Duties of the Floodplain Administrator shall include, but not be limited to:

A. Review all Floodplain Permits to determine that:

1. The requirements of this ordinance have been satisfied;

2. All other required state and federal permits have been obtained;

3. The site is reasonably safe from flooding.

4. The proposed development does not adversely affect the carrying capacity of the floodway. For purposes of this ordinance, "adversely affects" means that the cumulative effect of the proposed development when combined with all other existing and anticipated development will not increase the water surface elevation of the base flood more than one foot any point.

B. Use of Other Base Flood Data. When base flood elevation data has not been provided in accordance with Article 8-3, Section 8-3-2, the Floodplain Administrator shall obtain, review, and reasonably utilize any base flood elevation data available from a Federal, State or other source, in order to administer Article 8-5. Any such information shall be submitted to the Floodplain Board for adoption.

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C. Obtain and maintain for public inspection and make available as needed for Flood Insurance Policies:

1. the certified elevation required in Article 8-5, Section 8-5-1.C.1;

2. the certification required in Article 8-5, Section 8-5-1.C.2;

3. the floodproofing certification required in Section 5.1.C.3; and

4. the certified elevation required in Article 8-5, Section 8-5-4.B.

D. Whenever a watercourse is to be altered or relocated:

1. Notify adjacent communities and the Arizona Department of Water Resources prior to such alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Insurance Administration;

2. Require that the flood carrying capacity of the altered or relocated portion of said watercourse is maintained.

E. Within one hundred twenty days after completion of construction of any flood control protective works which changes the rate of flow during the flood or the configuration of the floodplain upstream or downstream from or adjacent to the project, the person or agency responsible for installation of the project shall provide to the governing bodies of all jurisdictions affected by the project a new delineation of all flood plains affected by the project. The new delineation shall be done according to the criteria adopted by the director of water resources.

F. Advise the Flood Control District of Maricopa County and any adjunct jurisdiction having responsibility for floodplain management in writing and provide a copy of development plan of all applications for floodplain use permits or variances to develop land in a floodplain or floodway within one mile of the corporate limits of the Town of Gilbert. Also, advise the Flood Control District of Maricopa County in writing and provide a copy of any development plan of any major development proposed within a floodplain or floodway which could affect flood plains, floodways or watercourses within the District's area of jurisdiction. Written notice and a copy of the plan of development shall be sent to the District no later than three working days after having been received by the Town.

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G. Make interpretation where needed, as to the exact location of the boundaries of the areas of special flood hazards (for example, where there appears to be a conflict between a mapped boundary and actual field conditions). The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in Article 8-6.

H. Take actions on violations of this ordinance as required in Article 8-3, Section 8-3-9 herein.

ARTICLE 8-5 PROVISIONS FOR FLOOD HAZARD REDUCTION

Section 8-5-1 Standards of Construction.

In all areas of special flood hazards the following standards are required:

A. Anchoring

1. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure.

2. All manufactured homes shall meet the anchoring standards of Article 8-5, Section 8-5-5.A.

B. Construction Materials and Methods

1. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

2. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

C. Elevation and Floodproofing

1. New construction and substantial improvement of any structure shall have the lowest floor, including basement, elevated to or above the regulatory flood elevation. Nonresidential structures may meet the standards in Article 8-5, Section 8-5-1.C.3. Prior to the pre-slab inspection for the structure the elevation of the lowest floor including basement shall be certified by a registered professional engineer or surveyor and provided to the Floodplain Administrator.

2. New construction and substantial improvement of any structure in Zone AO shall have the lowest floor, including basement, higher than the highest adjacent grade at least one foot higher than the depth number on the FIRM, or at least two feet if no depth number is

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specified. Nonresidential structures may meet the standards in Article 8-5, Section 8-5-1.C. Upon completion of the structure a registered professional engineer shall certify to the Floodplain Administrator that the elevation of the structure meets this standard.

3. Nonresidential construction shall either be elevated in conformance with Article 8-5, Section 8-5-1.C.1. or 2. or together with attendant utility and sanitary facilities:

a. be floodproofed so that below the regulatory flood level the structure is watertight with walls substantially impermeable to the passage of water;

b. have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

c. be certified by a registered professional engineer or architect that the standards of this subsection are satisfied. Such certifications shall be provided to the Floodplain Administrator.

4. Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect to meet or exceed the following minimum criteria: A minimum of two openings have a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

5. Manufactured homes shall meet the above standards and also the standards in Section 5.5.

Section 8-5-2 <u>Standards for Storage of Materials and Equipment.</u>

A. The storage or processing of materials that are in time of flooding buoyant, flammable, explosive, or could be injurious to human, animal or plant life is prohibited.

B. Storage of other material or equipment may be allowed if not subject to major damage by floods and if firmly anchored to prevent flotation or if readily removable from the area within the time available after flood warning.

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Section 8-5-3 Standards for Utilities.

A. All new and replacement water supply and sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from systems into flood waters.

B. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

C. Waste disposal systems shall not be installed wholly or partially in a floodway.

Section 8-5-4 Standards for Subdivisions.

A. All preliminary subdivision proposals shall identify the flood hazard area and the elevation of the base flood.

B. All final subdivision plans will provide the elevation of proposed structure(s) and pads. If the site is filled above the base flood, the final pad elevation shall be certified by a registered professional engineer or surveyor and provided to the Floodplain Administrator.

C. All subdivision proposals shall be consistent with the need to minimize flood damage. All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage. All subdivisions shall provide adequate drainage to reduce exposure to flood hazards.

Section 8-5-5 Standards for Manufactured Homes.

All new and replacement manufactured homes and additions to manufactured homes shall:

A. Be elevated so that the bottom of the structural frame or the lowest point of any attached appliances, whichever is lower, is at the regulatory flood elevation; and

B. Be securely anchored to an adequately anchored foundation system to resist flotation, collapse or lateral movement.

Section 8-5-6 Floodways.

Located within areas of special flood hazard established in Article 8-5, Section 8-3-2 are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles, and erosion potential, the following provisions apply:

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A. Prohibit encroachments, including fill, new construction, substantial improvements, and other development unless certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

B. All new construction and substantial improvements shall comply with all other applicable flood hazard reduction provisions of Article 8-5.

ARTICLE 8-6 VARIANCE PROCEDURE

Section 8-6-1 Appeal Board.

A. The Floodplain Board of the Town of Gilbert shall hear and decide appeals and requests for variances from the requirements of this ordinance.

B. The Floodplain Board shall hear and decide appeals when it is alleged there is an error in any requirement, decision, or determination made by the Floodplain Administrator in the enforcement or administration of this ordinance.

C. In passing upon such applications, the Floodplain Board shall consider all technical evaluations, all relevant factors, standards specified in other sections of this ordinance, and:

1. the danger that materials may be swept onto other lands to the injury of others;

2. the danger of life and property due to flooding or erosion damage;

3. the susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

4. the importance of the services provided by the proposed facility to the community;

5. the necessity to the facility of a waterfront location, where applicable;

6. the availability of alternative locations for the proposed use which are not subject to flooding or erosion damage;

7. the compatibility of the proposed use with existing and anticipated development;

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8. the relationship of the proposed use to the comprehensive plan and floodplain management program for that area;

9. the safety of access to the property in time of flood for ordinary and emergency vehicles;

10. the expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site; and,

11. the costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water system, and streets and bridges.

D. Generally, variances may be issued for new construction and substantial improvements to be erected on a lot of less than 20,000 square feet in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing items 8-6-1.C.1 through 11 have been fully considered. As the lot size increases to 20,000 square feet or greater, the technical justification required for issuing the variance increases.

E. Upon consideration of the factors of Article 8-6, Section 8-6-1 and the purposes of this ordinance, the Floodplain Board may attach such conditions to the granting of variances as it deems necessary to further the purposes of this ordinance.

F. The Floodplain Administrator shall maintain the records of all appeal actions and report any variances to the Federal Insurance Administration upon request.

Section 8-6-2 <u>Conditions for Variances</u>.

A. Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed in the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this section.

B. Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

C. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

APR-24-98 FRI 16:00 TOWN OF GILBERT FAX NO. 16024974923 P.18

D. Variances shall only be issued upon:

1. a showing of good and sufficient cause;

2. a determination that failure to grant the variance would result in exceptional hardship to the applicant; and

3. a determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of, the public, or conflict with the existing local laws or ordinances.

E. Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor elevation below the regulatory flood elevation and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation. Such notice will also state that the land upon which the variance is granted shall be ineligible for exchange of State land pursuant to the flood relocation and land exchange program provided for by A.R.S. Title 26, Chapter 2, Article 2. A copy of the notice shall be recorded by the Floodplain Board in the office of the Maricopa County Recorder and shall be recorded in a manner so that it appears in the chain of title of the affected parcel of land.

APR-24-98 FRI 16:01 TOWN OF GILBERT FAX NO. 16024974923 P. 19

Appendix B

FEMA REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*

- [x] Physical change
  - [x] Existing
  - [x] Proposed
- [ ] Improved methodology
- [ ] Improved data
- [ ] Floodway revision
- [x] Other New topographic data

  Explain _____

2. Flooding Source: Queen Creek
3. Project Name/Identifier: Queen Creek - Power Road to Recker Road
4. FEMA zone designations affected: A

   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)
5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
040037	Maricopa County	Maricopa	AZ	04013C2690F	2690	12/03/93
040044	Town of Gilbert	Maricopa	AZ	04013C2695F	2695	12/03/93
040132	Town of Queen Creek	Maricopa	AZ	04013C2695F	2695	12/03/93

*Community Nos., Community name, County and State are common for the 2 maps 04013C2690F and 04013C2695F

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding

- [x] Riverine
- [ ] Coastal
- [ ] Alluvial Fan
- [ ] Shallow Flooding *(e.g. Zones AO and AH*
- [ ] Lakes

Affected by wind/wave action
- [ ] Yes
- [x] No

- [ ] Other *(describe)* _____

Structures

- [x] Channelization
- [ ] Levee/Floodwall
- [x] Bridge/Culvert
- [ ] Dam
- [ ] Coastal
- [ ] Fill
- [ ] Pump Station
- [ ] None
- [ ] Channel Relocation
- [x] Excavation
- [ ] Other *(describe)* _____

Disciplines*

- [x] Water Resources
  - [ ] Hydrology
  - [x] Hydraulics
  - [x] Sediment Transport
  - [ ] Interior Drainage
- [ ] Structural
- [x] Geotechnical
- [x] Land Surveying
- [ ] Other *(describe)* _____

* **Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? [ ] Yes [x] No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM? [ ] Yes [ ] No

   If yes, give reason: No floodway on FIRM or in this submission.

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions.

9. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☐ Yes ☒ No

If yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

3. PROPOSED ENCROACHMENTS

10. With floodways:

1A. Does the revision request involve fill, new construction, substantial improvement, or other development in the floodway? ☐ Yes ☐ No

1B. If yes, does the development cause the 100-year water surface elevation to increase at any location by more than 0.000 feet? ☐ Yes ☐ No

11. Without floodways:

2A. Does the revision request involve fill, new construction, substantial improvement, or other development in the 100-year floodplain? ☒ Yes ☐ No

2B. If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot *(or other surcharge limit if community or state has adopted more stringent criteria)*? ☐ Yes ☒ No

If the answer to either Items 1B or 2B is yes, please provide documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

4. REVISION REQUESTOR ACKNOWLEDGEMENT

12. Having read NFIP Regulations, 44 CFR Ch. I, parts 59, 60, 61, and 72, I believe that the proposed revision ☒ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGEMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ☒ Yes ☐ No

14. Does this revision request have the endorsement of the community? ☒ Yes ☐ No

If no to either of the above questions, please explain: _____

Please note that community acknowledgement and/or notification is required for all requests as outlined in Section 65.4 (b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g. levees, floodwalls, channelization, basins, dams)? ☒ Yes ☐ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by Town of Gilbert (entity) _____ with a maximum interval of 6 months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by Town of Gilbert (entity) to ensure the integrity and degree of flood protection of the structure.

C. A formal plan of operation, including documentation of the flood warning system, specific actions and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than one year, ☐ has ☒ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for [X] performing [ ] overseeing compliance with the maintenance and operation plans of the Queen Creek Channel
(Name)
flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to Flood Insurance Maps: A Guide for Community Officials," dated January 1990, this request is for a:

_X_a. CLOMR A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72).*

____b. LOMR A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. 1, Parts 60 and 65.)*

____c. PMR A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. 1, Parts 60 and 65.)*

____d. Other: Describe _____

8. FORMS INCLUDED

17. Form 2 entitled "Certification by Registered Professional Engineer And/Or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	[ ] Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	[X] Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	[X] Riverine/Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	[X] Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	[X] Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	[ ] Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	[ ] Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	[ ] Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	[ ] Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	[ ] Alluvial Fan Flooding Form (Form 12)

9. INITIAL REVIEW FEE

18. The minimum initial review fee for the appropriate request category has been included. ☒ Yes ☐ No

Initial fee amount: $ 3,100

Check or money order only. Make check or money order payable to: **National Flood Insurance Program**. If paying by Visa or Mastercard please refer to the credit card information form which follows this form.

or

19. This request is for a project that is for public benefit and is intended to reduce the flood hazard to existing development in identified flood hazard areas as opposed to planned floodplain development. ☐ Yes ☒ No

or

20. This request is to correct an error or to include the effects of natural changes within the areas of special flood hazards. ☐ Yes ☒ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requestor

George J. Geiser, P.E.
Printed Name and Title of Revision Requestor

Coe & Van Loo Consultants, Inc.
Company Name

(602) 264-6831
Telephone No. Date

Note: Signature indicates that the community understands, from the revision requestor, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Printed Name and Title of Community Official

Community Name

Date

Does this request impact any other communities? ☒ Yes ☐ No

Town of Queen Creek

If yes, attach letters from all affected jurisdictions acknowledging revision request and approving changes to floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

Appendix C

FEMA CERTIFICATION BY REGISTERED PROFESSIONAL AND/OR LAND SURVEYOR FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average .23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2.
2. I am licensed with an expertise in Water Resources
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)**, structural, geotechnical, land surveying.]
3. I have 20 years experience in the expertise listed above.
4. I have ☒ prepared ☒ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and/or designs, is/are being certified:
   Queen Creek (Power Road to Recker Road) Channelization Design
7. Based upon the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)

   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with completed projects.
   d. ☒ Other Compared proposed plans with hydraulic model.
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: George J. Geiser, P.E.
(please print or type)

Title: Director, Water Resources Group, CVL
(please print or type)

Registration No. 14723 Expiration Date: December 31, 1999

State AZ

Type of License Professional Engineer (Civil)

Signature

5-14-98
Date

*Specify Subdiscipline

Seal
(Optional)

Note: Insert not applicable (N/A) when statement does not apply.

FEDERAL EMERGENCY MANAGEMENT AGENCY
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM

O.M.B. Burden No. 3067-0148
Expires July 31, 1997

FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average .23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2.
2. I am licensed with an expertise in Geotechnical
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)**, structural, geotechnical, land surveying.]
3. I have 8 years experience in the expertise listed above.
4. I have ☒ prepared ☐ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and/or designs, is/are being certified:
   Queen Creek (Power Road to Recker Road) geotechnical soils analysis
7. Based upon the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)

   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with completed projects.
   d. ☒ Other Prepared geotechnical report
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Randolph Marwig, P.E.
(please print or type)

Title: Senior Geotechnical Engineer, Western Technologies, Inc.
(please print or type)

Registration No. 27947 Expiration Date: June 30, 2000

State AZ

Type of License Professional Engineer (Civil)

Signature

5 - 14 - 98
Date

Registered Professional Engineer (Civil) CERTIFICATE NO. 27947 RANDOLPH MARWIG Date Signed 5/14/98 ARIZONA, U.S.A.

Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) when statement does not apply.

FEDERAL EMERGENCY MANAGEMENT AGENCY **CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average .23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2.
2. I am licensed with an expertise in Land Surveying
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)**, structural, geotechnical, land surveying.]
3. I have 9 years experience in the expertise listed above.
4. I have ☐ prepared ☒ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and/or designs, is/are being certified:
   Vertical datum for proposed project is M.S.L. 1929
7. Based upon the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)

   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with completed projects.
   d. ☒ Other Vertical control based on M.S.L. 1929.
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Larry E. Sullivan, R.L.S.
(please print or type)

Title: Survey Manager, CVL
(please print or type)

Registration No. 22782 Expiration Date: June 30, 1998

State AZ

Type of License Registered Land Surveyor

Larry E. Sullivan
Signature

5-14-98
Date

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
22782
LARRY E.
SULLIVAN
Date Signed
ARIZONA, U.S.A.

Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) when statement does not apply.

FEDERAL EMERGENCY MANAGEMENT AGENCY CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM	O.M.B. Burden No. 3067-0148 Expires July 31, 1997	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average .23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2.
2. I am licensed with an expertise in Water Resources
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)**, structural, geotechnical, land surveying.]
3. I have 17 years experience in the expertise listed above.
4. I have ☒ prepared ☐ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and/or designs, is/are being certified:
   Queen Creek (Power Road to Recker Road) sediment transport model and HEC-2
7. Based upon the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)

   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with completed projects.
   d. ☒ Other Compared proposed plans with sediment models.
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Paul Hoskins, P.E.
(please print or type)

Title: President, Hoskins Engineering Consultants
(please print or type)

Registration No. 19690 Expiration Date: March 31, 2000

State AZ

Type of License Professional Engineer (Civil)

Signature

5/14/98
Date

*Specify Subdiscipline

Seal
(Optional)

Note: Insert not applicable (N/A) when statement does not apply.

Appendix D

FEMA HYDROLOGIC ANALYSIS FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.67 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Town of Gilbert Maricopa County

Flooding Source: Queen Creek
(One form for each flooding source)

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. HYDROLOGIC ANALYSIS IN FIS

- [x] Approximate study stream (Zone A)
- [ ] Detailed study stream (briefly explain methodology) _____

2. REASON FOR NEW HYDROLOGIC ANALYSIS

- [ ] No existing analysis
- [x] Improved data *(see data revision on page 3)*
- [ ] Changed physical conditions of watershed *(explain)* _____
- [ ] Alternative methodology *(justify why the revised model is better than model used in the effective FIS)*
- [ ] Evaluation of proposed conditions (CLOMRs only) (explain) _____

If a computer program/model was used in revising the hydrologic analysis, please provide a diskette with the input files for the 10-, 50-, 100- and 500-year recurrence intervals.

Only the 100-year recurrence interval need be included for SFHAs designated as Zone A.

3. APPROVAL OF ANALYSIS

- [x] Approval of the hydrologic analysis, including the resulting peak discharge value(s) has been provided by the appropriate local, state, or Federal Agency. (i.e., Flood Control District of Maricopa County)

  Attach evidence of approval.
- [ ] Approval of the hydrologic analysis is not required by any local, State or Federal Agency.

4. REVIEW OF RESULTS

Stream: Queen Creek

Comparison of 100-year Discharges

Location:	Drainage area (Sq. mi.)	FIS (cfs):	Revised (cfs):
Queen Creek at Power Road		(not estimated)	3006

Note: When revised discharges are not significantly different than FIS discharges, FEMA may require a confidence limits analysis on attachment D at a later date to complete the review.

As is often the case with revision requests, only a portion of a stream may actually be revised or be affected by a revision. Therefore, transition to the unrevised portion is important to maintain the continuity of the study. NFIP regulations stipulate that such a transition must be assured. What is the transition from the proposed discharges to the effective discharges? Please explain how the transition was made *(attach separate sheet if necessary)*.

ATTACH A COMPLETED REVIEW OF RESULTS PAGE FOR EACH FLOODING SOURCE.

Is the new hydrologic analysis being developed solely to revise the flow values presented in the FIS *(i.e. no changed hydraulic conditions)?*
☐ Yes ☒ No

If yes, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

FEMA does not normally revise NFIP maps solely due to insignificant flow changes where changes in 100-year water surface elevation are less than 1.0 foot.

5. HISTORICAL FLOODING INFORMATION

Is historical data available for the flooding source? ☐ Yes ☒ No

If yes, provide the following:

Location along flooding source: _____

Maximum peak discharge: _____ cfs

Second highest peak discharge: _____ cfs

Source of information: _____

6. GAGE RECORD INFORMATION

Location of nearest gage to project site *(along flooding source or similar watershed; specify)*

_____

Gaging Station: _____

Drainage area at gage: _____ mi^2

Number of years of data: _____

7. DATA REVISION

Please use the following table to list all the data and/or parameters affected by this request and identify them as new data *(New)* or as revising existing data *(Revised)*. *(If necessary, attach a separate sheet.)*

Data Parameter	New	Revised	Data Source
100-yr peak discharge	☒	☐	Queen Creek ADMS by Wood &
	☐	☐	Associates (1991) for Flood Control
	☐	☐	District of Maricopa County (FCDMC)
	☐	☐	
	☐	☐	

- Data source can be from a Federal, State, or local government agency, or from a private source. Some State and local governments may have less strict data requirements than Federal agencies, in which case the hydrologic data may not be accepted by FEMA unless it is demonstrated that the data give a better estimate of the flood discharge.
- Attach documentation corroborating each data source *(i.e., certified statement, report, bibliographical reference to a published document)*. In the case of a published document or a government report, providing copies of the cover and pertinent pages may be helpful.

8. METHODOLOGY FOR NEW ANALYSIS

☐ Statistical Analysis of Gage Records *(use Attachment A)*

☐ Regional Regression Equations *(use Attachment B)*

☐ Precipitation/Runoff Model *(use Attachment C)*

☒ Other *(specify; attach backup computations and supporting data)* Queen Creek ADMS by Wood & Associates (1991) for FCDMC (see attachment)

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

Gaging Station: _____

Gage Location (latitude and longitude): _____

		FIS:	Revised:
1.	Number of years of data	_____	_____
	Systematic	_____	_____
	Historical	_____	_____
2.	Homogeneous data	☐ Yes ☐ No	☐ Yes ☐ No
3.	Data adjustments	☐ Yes ☐ No	☐ Yes ☐ No
4.	Number of high outliers	_____	_____
	Low outliers	_____	_____
	Zero events	_____	_____
5.	Generalized skew	_____	_____
6.	Station skew	_____	_____
7.	Adopted skew	_____	_____
8.	Probability distribution used (justify if log-Pearson III was not used)	_____	_____
9.	Transfer equations to ungaged sites. If yes, specify method		☐ Yes ☐ No

_____

_____

_____

10.	Expected probability*	☐ Yes ☐ No
11.	Comparison of results with other analyses. If yes, describe comparison	☐ Yes ☐ No

_____

_____

_____

* FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data is not available, indicate by N/A.

Attach analysis including plot of flood frequency curve.

ATTACHMENT B: REGIONAL REGRESSION EQUATIONS

1. Bibliographical Reference:

_____

_____

_____

(Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. Gaged or ungaged stream: _____

3. Hydrologic region(s): _____
Attach backup map.

4. Provide parameters, values, and source of data used to define parameters.

_____

_____

_____

		FIS:	Revised:
5.	Urbanized conditions calculations	☐ Yes ☐ No	☐ Yes ☐ No
6.	Percent of watershed urbanization	_____	_____
7.	Is the watershed controlled?	☐ Yes ☐ No	☐ Yes ☐ No
8.	Comparison with other analyses	☐ Yes ☐ No	☐ Yes ☐ No

If the answer to 5, 7, or 8 is yes, explain methodology in Comments.

If data is not available, indicate by N/A.

Comments

_____

_____

_____

_____

Attach computation and supporting maps, delineating the watershed boundary and drainage area divides.

ATTACHMENT C: PRECIPITATION/RUNOFF MODEL

		FIS:	Revised:
1.	Method or model used:		
	Version:		
	Date:		
2.	Source of rainfall depth:		
3.	Source of rainfall distribution:		
4.	Rainfall duration:		
5.	Areal adjustment to precipitation (%):		
6.	Hydrograph development method:		
7.	Loss rate method:		
	Source of soils information:		
	Source of land use information:		
8.	Channel routing method:		
9.	Reservoir routing:	☐ Yes ☐ No	☐ Yes ☐ No
10.	Baseflow considerations:	☐ Yes ☐ No	☐ Yes ☐ No
	If yes, explain how baseflow was determined:		
11.	Snowmelt considerations:	☐ Yes ☐ No	☐ Yes ☐ No
12.	Model calibration:	☐ Yes ☐ No	☐ Yes ☐ No
	If yes, explain how calibration was performed		
13.	Future land use condition:		☐ Yes ☐ No
	If yes, explain why:		

Note: FEMA policy is to base flooding on existing conditions.

If data is not available, indicate by N/A.

Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.

Stream: _____

Select one location for Confidence Limits Evaluation *(describe location)*: _____

_____

Discharges for selected location:

Exceedance Probability	FIS		Revised	
10% (10-year)	_____	cfs	_____	cfs
2% (50-year)	_____	cfs	_____	cfs
1% (100-year)	_____	cfs	_____	cfs
0.2% (500-year)	_____	cfs	_____	cfs

1% (100-year) Flood Confidence Intervals

90% Confidence Interval: 5% limit _____ cfs
95% limit _____ cfs

50% Confidence Interval: 25% limit _____ cfs
75% limit _____ cfs

If the value of the 100-year frequency flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the 100-year water surface elevation change by 1.0 foot or more?

☐ Yes ☐ No

An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

ttach Confidence Limits Analysis.

Appendix E

FEMA RIVERINE/HYDRAULIC ANALYSIS FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Town of Gilbert, Maricopa County

Flooding Source: Queen Creek
(One form for each flooding source)

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. REACH TO BE REVISED

Downstream limit: Recker Road @ Queen Creek

Upstream limit: Power Road @ Queen Creek

2. EFFECTIVE FIS

☐ Not studied

☒ Studied by approximate methods

Downstream limit of study East Maricopa Floodway

Upstream limit of study Maricopa-Pinal County Line

☐ Studied by detailed methods

Downstream limit of study _____

Upstream limit of study _____

☐ Floodway delineated

Downstream limit of Floodway _____

Upstream limit of Floodway _____

3. HYDRAULIC ANALYSIS

Why is the hydraulic analysis different from that used to develop the FIRM? *(Check all that apply)*

☒ Not studied in FIS

☐ Improved hydrologic data/analysis. Explain: _____

☒ Improved hydraulic analysis. Explain: FIRM panel of record is reportedly based on channel section between banks/man-made berms or earthen dikes.

☒ Flood control structure. Explain: New flood control channel to be constructed.

☒ Other. Explain: The new channel will provide for flow in a fully-incised facility and eliminate the possibility of dike failure.

3. RIVERINE HYDRAULIC ANALYSIS FORM
Models Submitted

For areas which have detailed flooding:

Full input and output listings along with files on diskette *(if available)* for each of the models listed below (items 1, 2, 3, 4, and 5) and summary of the source of input parameters used in the models must be provided. The summary must include a complete description of any changes made from model to model (e.g. duplicate effective model to corrected effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.

For areas which do not have detailed flooding:

Only the 100-year flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses for existing or pre-project conditions and revised or post-project conditions must be submitted. All calculations must be submitted for these analyses. (See item 6 below)

1. Duplicate Effective Model — Natural ☐ Floodway ☐ N/A

Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models *(10-, 50-, 100-, and 500-year multi-profile runs and the floodway run)* must be obtained and then reproduced on the requestor's equipment to produce the duplicate effective model. This is required to assure that the effective model input data has been transferred correctly to the requestor's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model — Natural ☐ Floodway ☐ N/A

The corrected effective model is the model that corrects any errors that occur in the duplicate effective model, adds any additional cross sections to the duplicate effective model, or incorporates more detailed topographic information than that used in the currently effective model. The corrected effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model — Natural ☒ Floodway ☐

The duplicate effective or corrected model is modified to produce the existing or pre-project conditions model to reflect any modifications that have occurred within the floodplain since the date of the effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the corrected effective or duplicate effective model.

4. Revised or Post-Project Conditions Model — Natural ☒ Floodway ☐

The existing or pre-project conditions model *(or duplicate effective or corrected effective model, as appropriate)* is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for proposed project this model should reflect proposed conditions.

5. Other: Please attach a sheet describing all other models or calculations submitted. — Natural ☐ Floodway ☐ N/A

6. Hydraulic Analyses (Only if Hydraulic Models are not developed) — Natural ☐ Floodway ☐ N/A

Please attach all calculations for the existing or pre-project conditions and the revised or post-project conditions. Proceed to Form 5, "Riverine/Coastal Mapping Form".

4. MODEL PARAMETERS (from model used to revise 100-year water surface elevation)

1. Discharges:

	Upstream Limit	Downstream Limit
10-year		
50-year		
100-year	3,000 cfs	3,000 cfs
500-year		

Attach diagram showing changes in 100-year discharge (See Figure 6, Exhibit 1 and HEC-2 modeling)

2. Explain how the starting water surface elevations were determined Normal depth using Manning's eq. @ downstream end.

3. Give range of friction loss coefficients *(Manning's "N")* Channel ..... 0.025 - 0.035

Overbanks .... 0.035 - 0.050

If friction loss coefficients are different anywhere along the revised reach from those used to develop the FIRM, give location, value used in the effective FIS, and revised values and an explanation as to how the revised values were determined.

Location	FIS	Revised
N/A		

Explain: FIRM based on approximate methods only. Friction losses in this submittal based on field reconnaissance.

4. Describe how the cross section geometry data were determined *(e.g., field survey, topographic map, taken from previous study)* and list cross sections that were added.

New Topographic Mapping by Aerial Mapping Company, Inc.,- flown in February 1997

5. Were natural channel banks selected as the location of the left and right channel banks in the model?

☐ Yes ☒ No If no, explain why not: Existing channel has man-made berms.

4. MODEL PARAMETERS (Cont'd)

6. Explain how reach lengths for channel and overbanks were determined:

Channel reach lengths are measured as distances along the channel thalweg (low point of channel).

Overbank reach lengths are estimated as lengths between the center of mass of overbank flow between cross sections.

5. RESULTS (from model used to revise 100-year water surface elevations)

1. Do the results indicate:

   a. Water surface elevations higher than end points of cross sections? (In CLOMR Area) ..... ☐ Yes ☒ No

   b. Supercritical depth? ..... ☐ Yes ☒ No

   c. Critical depth? ..... ☐ Yes ☒ No

   d. Other unique situations? ..... ☐ Yes ☒ No

   If yes to any of the above, attach an explanation that discusses the situation and how it is presented on the profiles, tables, and maps. **Overbank areas beyond end points are non-effective flow areas.**

2. What is the maximum change in energy gradient between cross-sections? (In CLOMR Area) ..... 0.0359 ft/ft

   Specify location ..... SEC 4.07

3. What is the distance between the cross-sections in 2 above? ..... 100 ft.

4. What is the maximum distance between cross-sections? (In CLOMR Area) ..... 540 ft.

   Specify location ..... SEC 3.44

5. Floodway determination **No Floodway Run**

   a. What is the maximum surcharge allowed by the community or State? ..... N/A foot

   b. What is the maximum surcharge for the revised conditions? ..... N/A foot

   Specify location ..... N/A

   c. What is the maximum velocity? ..... N/A fps

   Specify location ..... N/A

   d. Are there any negative surcharge values at any cross-section? ☐ Yes ☐ No
   If yes, the floodway may need to be widened. If it is not widened, please explain and indicate the maximum negative surcharge.

Explain: _____

5. RESULTS (Cont'd)

6. Is the discharge value used to determine the floodway anywhere different from that used to determine the natural 100-year flood elevations? . . . . . ☐ Yes ☒ No

If Yes, explain:

_____

_____

_____

7. Do 100-year water surface elevations increase at any location? . . . . . ☐ Yes ☒ No

If yes, please attach a list of the locations where the increases occur, state whether or not the increases are located on the requestor's property, and provide an explanation of the reason for the increases. (For example: State if the increase is due to fill placed within the floodway fringe or placed within the currently adopted floodway)

_____

_____

_____

Please attach a completed comparison table entitled: Water Surface Elevation Check (See page 6 of 6)

6. REVISED FIRM/FBFM AND FLOOD PROFILES

A. The revised water surface elevations tie into those computed by the effective FIS Model *(10-, 50-, 100-, and 500-year),* downstream of the project at cross-section _____ within_____ feet (vertical) and upstream of the project at cross section _____ within_____ feet (vertical). **Form 4, page 6 of 6 compares pre-project and post-project models. The effective FIS does not provide any elevations or profiles as it was based on approximate methods.**

B. The revised floodway elevations tie into those computed by the effective FIS model, downstream of the project at cross section _____ within_____ feet (vertical) and upstream of the project at cross section_____ within_____ feet (vertical). **No floodway run.**

C. Attach profiles, at the same vertical and horizontal scale as the profiles in the effective FIS report, showing stream bed and profiles of all floods studied (without encroachment). Also, label all cross sections, road crossings (including low chord and top-of-road data), culverts, tributaries, corporate limits, and study limits. If channel distance has changed, the stationing should be revised for all profile sheets. **Attached profiles compare pre-project and post-project models.**

D. Attach a Floodway Data Table showing data for each cross section listed in the published Floodway Data Table in the FIS report. **FIS does not have a floodway data table.**

Proceed to Riverine/Coastal Mapping Form.

FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	Town of Gilbert	FLOODING SOURCE	Queen Creek	PROJECT NAME/IDENTIFIER	Queen Creek - Power Road to Recker Road

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
1.330										1313.66			1313.66		
1.425										1316.94			1316.94		
1.520										1317.89			1317.89		
1.615										1319.19			1319.19		
1.710										1320.02			1320.02		
1.805										1320.78			1320.78		
1.900										1321.15			1321.15		
1.995										1321.79			1321.79		
2.090										1322.80			1322.80		
2.109										1322.80			1322.80		
2.185										1323.46			1323.44		
2.280										1324.48			1323.99		
2.375										1326.12			1324.64		

COMMENTS:

Section 5.700 is at upstream end of study area
Section 1.330 is at downstream end of study area
CLOMR Area is between Section 4.085 and 3.135

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

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1 - 100-year (natural) Water Surface Elevation 2 - Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME Town of Gilbert

FLOODING SOURCE Queen Creek

PROJECT NAME/IDENTIFIER Queen Creek - Power Road to Recker Road

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
2.470										1327.25			1325.34		
2.565										1328.05			1325.97		
2.660										1329.30			1326.72		
2.755										1330.85			1327.77		
2.850										1331.79			1328.68		
2.945										1332.87			1329.49		
3.040										1333.93			1330.26		
3.115										-			1330.75		
3.130										-			1331.43		
3.135										1334.83			-		
3.150										-			1331.58		
3.230										1335.54			-		
3.240										-			1331.64		

COMMENTS:

Section 5.700 is at upstream end of study area
Section 1.330 is at downstream end of study area
CLOMR area is between Section 4.085 and 3.135

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

1 - 100-year (natural) Water Surface Elevation 2 - Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME Town of Gilbert

FLOODING SOURCE Queen Creek

PROJECT NAME/IDENTIFIER Queen Creek - Power Road to Recker Road

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
3.325										1336.62			-		
3.340										-			1331.67		
3.420										1337.48			-		
3.440										-			1331.85		
3.515										1338.77			-		
3.530										-			1332.69		
3.610										1339.71			1333.69		
3.620										-			1334.80		
3.670										-			1335.46		
3.705										1340.91			-		
3.730										-			1335.82		
3.800										1342.18			-		
3.820										-			1336.04		

COMMENTS:

Section 5.700 is at upstream end of study area
Section 1.330 is at downstream end of study area
CLOMR area is between Section 4.085 and 3.135

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

1 - 100-year (natural) Water Surface Elevation	2 - Encroachment (floodway) Water Surface Elevation	3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

Sheet 4 of 4

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FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODING SOURCE	PROJECT NAME/IDENTIFIER
Town of Gilbert	Queen Creek	Queen Creek - Power Road to Recker Road

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
3.895										1343.22			-		
3.900										-			1338.04		
3.970										-			1338.75		
3.990										1344.20			-		
4.040										-			1340.33		
4.050										-			1340.71		
4.062										1345.43			-		
4.070										-			1342.97		
4.080										1345.27			-		
4.085										1345.45			1344.88		
4.180										1346.22			1346.04		
4.275										1349.15			1349.19		
4.370										1350.69			1350.70		

COMMENTS:

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

1 - 100-year (natural) Water Surface Elevation 2 - Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME Town of Gilbert

FLOODING SOURCE Queen Creek

PROJECT NAME/IDENTIFIER Queen Creek - Power Road to Recker Road

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
4.465										1352.00			1352.00		
4.560										1353.12			1353.12		
4.655										1354.23			1354.23		
4.750										1355.75			1355.75		
4.845										1356.86			1356.86		
4.940										1357.70			1357.70		
5.026										1361.40			-		

COMMENTS: 1 - 100-year (natural) Water Surface Elevation 2 - Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

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1 - 100-year (natural) Water Surface Elevation	2 - Encroachment (floodway) Water Surface Elevation	3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

Sheet 4 of 4

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Appendix F

FEMA RIVERINE/COASTAL MAPPING FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE/COASTAL MAPPING FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Town of Gilbert, Maricopa County, AZ

Flooding Source: Queen Creek

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. MAPPING CHANGES

1. A topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing *(indicate N/A when not applicable)*:

		Included		
A.	Revised approximate 100-year floodplain boundaries (Zone A)	☐ Yes	☒ No	☐ N/A
B.	Revised detailed 100- and 500-year floodplain boundaries **(100-year only)**	☒ Yes	☐ No	☐ N/A
C.	Revised 100-year floodway boundaries	☐ Yes	☐ No	☒ N/A
D.	Location and alignment of all cross sections used in the revised hydraulic model with stationing control indicated	☒ Yes	☐ No	☐ N/A
E.	Stream alignments, road and dam alignments	☒ Yes	☐ No	☐ N/A
F.	Current community boundaries	☒ Yes	☐ No	☐ N/A
G.	Effective 100- and 500-year floodplain and 100-year floodway boundaries from the FIRM/FBFM reduced or enlarged to the scale of the topographic work map	☒ Yes	☐ No	☐ N/A
H.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries	☒ Yes	☐ No	☐ N/A
I.	The requestor's property boundaries and community easements	☒ Yes	☐ No	☐ N/A
J.	The signed certification of a registered professional engineer	☒ Yes	☐ No	☐ N/A
K.	Location and description of reference marks	☒ Yes	☐ No	☐ N/A
L.	Vertical datum (example: NGVD, NAVD, etc.)	☒ Yes	☐ No	☐ N/A
M.	Coastal zone designations tie into adjacent areas not being revised	☐ Yes	☐ No	☒ N/A
N.	Location and alignment of all coastal transects used to revise the coastal analyses	☐ Yes	☐ No	☒ N/A

If any of the items above are marked no or N/A, please explain: A. Detailed Zone A submitted-not approximate. C. No floodway determined. M. & N. No coastal zone. Please note, that due to scale factors, information is presented on 1" = 100' and 1" = 300' maps.

2. What is the source and date of the updated topographic information *(example: orthophoto maps, July 1985; field survey, May 1979, beach profiles, June 1987, etc.)*? Orthophoto flight date: February 1997

3. What is the scale and contour interval of the following workmaps?
   a. Effective FIS 1 in = 2000 ft. scale N/A Contour interval
   b. Revision Request 1 in = 100 ft. scale 1 ft. Contour interval

   NOTE: Revised topographic information must be of equal or greater detail.

4. Attach an annotated FIRM and FBFM at the scale of the effective FIRM and FBFM showing the revised 100-year and 500-year floodplains and the 100-year floodway boundaries and how they tie into those shown on the effective FIRM and FBFM downstream and upstream of the revision or adjacent to the area of revision for coastal studies.

   Attach additional pages if needed.

5. Flood Boundaries and 100-year water surface elevations:

Has the 100-year floodplain been shifted or increased or the 100-year water surface elevation increased at any location on property other than the requestor's or community's? ☐ Yes ☒ No

If yes, please give the location of shift or increase and an explanation for the increase.

a. Have the affected property owners been notified of this shift or increase and the effect it will have on their property? . . . . . ☐ Yes ☐ No

If yes, please attach letters from these property owners stating they have no objections to the revised flood boundaries if a LOMR is being requested.

b. What is the number of insurable structures that will be impacted by this shift or increase? _____

6. Have the floodway boundaries shifted or increased at any location compared to those shown on the effective FBFM or FIRM? . . . . . ☐ Yes ☒ No

If yes, explain:

7. If a V-zone has been designated, has it been delineated to extend landward to the heel of the primary frontal dune? ☐ Yes ☐ No

If no, explain:

N/A

8. Manual or digital map submission:

☒ Manual
☐ Digital

Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance of submission as possible.

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☒ Proposed

2. Has fill been/will be placed in the regulatory floodway? . . . . . ☐ Yes ☒ No

   If yes, please attach completed Riverine Hydraulic Analysis Form.

3. Has fill been/will be placed in floodway fringe *(area between the floodway and 100-year floodplain boundaries)*? **Floodway not mapped** . . . . . ☐ Yes ☐ No

   If yes, then complete A, B, C, and D below.

   A. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? . . . . . ☐ Yes ☒ No

      If yes, justify steeper slopes _____

      _____

   B. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? *(Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)* . . . . . ☒ Yes ☐ No

      If no, describe erosion protection provided Channel velocities through the CLOMR area will range from 2 to 11 fps. Channel side slopes will be turfed. Reinforcing mats will be included with the turf where velocities exceed 5 fps.

   C. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? . . . . . ☐ Yes ☒ No
      No Fill Has Been Placed Yet

   D. Can structures conceivably be constructed on the fill at any time in the future? . . . . . ☒ Yes ☐ No

      If yes, provide certification of fill compaction (item C. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer. **After construction.**

4. Has fill been/will be placed in a V-zone? . . . . . ☐ Yes ☒ No

   If yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall? . . . . . ☐ Yes ☒ No

   If yes, attach the coastal structures form.

Appendix G

FEMA CHANNELIZATION FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **CHANNELIZATION FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Town of Gilbert, Maricopa County, AZ

Flooding Source: Queen Creek

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. EXTENT OF CHANNELIZATION

Downstream limit: 800 feet downstream from Recker Road Culverts

Upstream limit: Power Road.

2. CHANNEL DESCRIPTION

1. Describe the inlet to the channel Man-made channel transitions from existing bridge at Power Road.

2. Briefly describe the shape of the channel *(both cross sectional and planimetric configuration)* and its lining *(channel bottom and sides)* A low flow meandering trapezoidal channel within a larger trapezoidal channel - see drawings. Between Power Road and Recker roads, portions of the channel banks will be grassed.

3. Describe the outlet from the channel Downstream from Recker Road box culverts, the channel transitions to the natural channel section and daylights.

4. The channelization includes:

- ☐ Levees *(Attach Levee Form)*
- ☐ Drop structures
- ☐ Superelevated sections
- ☒ Transitions in cross sectional geometry
- ☐ Debris basin/detention basin
- ☐ Energy dissipater
- ☐ Other

5. Attach the following:

a. Certified engineering drawings showing channel alignment and locations of inlet, outlet, and items checked in Item 4.
As-Builts will be provided for the LOMR.

b. Typical cross sections and profiles of channel banks and invert
See HEC-2 modeling and attached typical section.

3. HYDRAULIC CONSIDERATIONS

1. What is the 100-year discharge? . . . . . 3,000 cfs
2. Do the cross sections in the hydraulic model match the typical cross sections in the plans? . . . . . ☒ Yes ☐ No
3. Are the channel banks higher than the 100-year flood elevations everywhere? . . . . . ☒ Yes ☐ No
4. Are the channel banks higher than the 100-year flood energy grade lines everywhere? . . . . . ☒ Yes ☐ No
5. Is the land on both sides of the channel above the adjacent 100-year flood elevation at all points along the channel? . . . . . ☐ Yes ☒ No
6. What is the range of freeboard? . . . . . 1 - 2 feet
7. What is the range of the 100-year flood velocities? See attached table for CLOMR area . . . . . 2 - 11 ft/sec
8. What is the lining type? (both bottom and sides) See table, Attachment 1

   Explain how the channel lining prevents erosion and maintains channel stability *(attach documentation)*

   In the CLOMR area, the channel side slopes will be stabilized with grass or geotextile reinforced grass compatible with the expected velocities - see Attachment 2.
9. What is the design elevation in the channel based on?

   ☒ Subcritical flow

   ☐ Critical flow

   ☐ Supercritical flow

   ☐ Energy grade line

   Is 100-year flood profile based on the above type of flow? . . . . . ☒ Yes ☐ No

   If no, explain: _____
10. Is there the potential for a hydraulic jump at the following locations?

    Inlet to channel . . . . . ☐ Yes ☒ No

    Outlet of channel . . . . . ☐ Yes ☒ No

    At Drop Structures . . . . . ☐ Yes ☒ No

    At Transitions . . . . . ☐ Yes ☒ No

    Other locations. Explain: _____

    If the answer to any of the above is yes, please explain how the hydraulic jump is controlled and the effects of the hydraulic jump on the stability of the channel.

    Explain: _____

1. A. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations and/or the capacity of the channel? . . . . . ☐ Yes ☒ No

B. Based on the conditions of the watershed and stream bed, is there a potential for sediment transport (including scour and deposition) to affect the 100-year water surface elevations and/or the capacity of the channel? . . . . . ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes: **See Enclosures 1 and 2**

A. What is the estimated sediment (bed) load?

6.4 cfs (attach gradation curve) - See enclosed Sediment Routing report.

Explain method used to estimate load Due to lack of suspended sediment data, the sediment carrying capacity of the immediate upstream reach was estimated and used as inflow sediment load. This was estimated by trial and error until the sediment inflow equals sediment outflow for the upstream reach.

B. Is the 100-year flood velocity anywhere within the channel less than the 100-year flood velocity of the inlet? ☒ Yes ☐ No

C. Will sediment accumulate anywhere within the channel? ☒ Yes ☐ No

D. Will deposition or scour occur at or near the inlet? ☐ Yes ☒ No

E. Will deposition or scour occur at or near the outlet? ☒ Yes ☐ No

Attach documentation showing affects on the Hydrologic and Hydraulic analyses

(The hydraulic model was revised to include these effects. There is no effect on the hydrologic analysis.)

QUEEN CREEK
POWER ROAD TO RECKER ROAD
POST-PROJECT CONDITIONS
FEMA Channelization Form MT-2 Form 6 - Attachment 1

Reach	Study Reach Description	Section Range STA to STA	Range of 100-year Velocities, fps	Sideslope/Bed Lining	Overbank Lining
1	Downstream limit to Recker Road	-	3 - 10	Existing material	Existing material
2	Recker Road to Power Road		2 - 11	Reinforced Grass/ Existing Material	Existing material
3	Power Road to Upstream Limit		0.5 - 10	Existing material	Existing material

Notes: 1) CLOMR Area is Reach 2 only.
2) New channel construction is for Reaches 1 through 3.
3) Higher velocities in (e.g., 7-11 feet/sec) are in the vicinity of the bridges and culverts.
4) Existing bridge includes in-place local channel bank lining.

QUEEN CREEK
POWER ROAD TO RECKER ROAD
EROSION PROTECTION
FEMA CHANNELIZATION FORM MT-2 FORM 6 - ATTACHMENT 2

The following excerpted pages provide guidance for erosion protection for the proposed channel side slopes. Note that the "slopes" listed in the excerpts from EM-1110-2-1601 and the Drainage Design Manual for Maricopa County, Volume II, Hydraulics, are the hydraulic slopes. No concentrated flows will be allowed to discharge down the 4:1 channel side slopes over grassed areas. Therefore, the potentially eroding flow will be parallel to the grassed side slopes and the hydraulic slope will be essentially flat (or 0%).

The following erosion references are included:

Pages A-1 and A-2 are from EM 1110-2-1601 which shows that coarse sand can withstand velocities up to 4.0 feet per second (fps) and that good cover of well-maintained Bermuda grass can withstand up to 5 fps.

Pages B-1 and B-2 are from the Maricopa County Drainage Design Manual - Volume II, Hydraulics. Table 6.2 indicates that even easily eroded soils covered with well-maintained Bermuda grass can withstand velocities up to 4.5 fps.

Page C-1 was prepared by the City of Scottsdale, Arizona for its Indian Bend Wash and this table shows that reinforced grass can withstand velocities up to 20 fps.

REPRINT WITH CHANGE 1 thru 4 INCLUDED.

ENGINEER MANUAL

EM 1110-2-1601

1 JULY 1970

ENGINEERING AND DESIGN

HYDRAULIC DESIGN OF FLOOD CONTROL CHANNELS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
OFFICE OF THE CHIEF OF ENGINEERS

velocity or shear that will erode the channel. The adoption of maximum permissible velocities that are used in the design of channels has been widely accepted since publication of a table of values by Fortier and Scobey.[51] The latest information on critical scour velocities is given in reference 50. The tabulation below gives a set of permissible velocities that can be used as a guide to design nonscouring flood control channels. Lane[46] presents curves showing permissible channel shear stress to be used for design, and

Suggested Maximum Permissible Mean Channel Velocities†

Channel Material	Mean Channel Velocity, fps
Fine sand	2.0
Coarse sand	4.0
Fine gravel††	6.0
Earth	
Sandy silt	2.0
Silt clay	3.5
Clay	6.0
Grass-lined earth (slopes less than 5%)‡	
Bermuda grass - sandy silt	6.0
- silt clay	8.0
Kentucky Blue Grass - sandy silt	5.0
- silt clay	7.0
Poor rock (usually sedimentary)	10.0
Soft sandstone	8.0
Soft shale	3.5
Good rock (usually igneous or hard metamorphic)	20.0

† Based on TM 5-886-4 and CE Hydraulic Design Conferences of 1958-1960.

†† For particles larger than fine gravel (about 20 mm = 3/4 in.), see plate 29.

‡ Keep velocities less than 5.0 fps unless good cover and proper maintenance can be obtained.

DRAINAGE DESIGN MANUAL

for Maricopa County, Arizona

Volume II

HYDRAULICS

January 28, 1996

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OCE & VAN LOO
PHOENIX, AZ

Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501

Table 6.2
Roadside Channels with Uniform Stand of Various Grass Cover and Well Maintained (1)(2)
(Adapted from USDOT, FHWA 1961 and 1983)

Cover	Slope Range, %	Permissible Velocity, fps	
		Erosion Resistant Soils	Easily Eroded Soils
Bermuda Grass	0 to 5 5 to 10 Over 10	6.0 5.5 5.0	4.5 4.0 3.0
Desert Salt Grass Vine Mesquite	0 to 5 5 to 10 Over 10	5.0 4.5 4.0	4.0 3.0 2.5
Lehman Lovegrass Big Galleta Purple Threeawn Sand Dropseed	0 to 5 (3)	3.5	2.5
Sudangrass (4) Barley (4)	0 to 5 (3)	3.5	2.5

(1) Use velocities over 5 fps only where good covers and proper maintenance can be obtained.
(2) Grass is accepted only if an irrigation system is provided.
(3) Not recommended for use on slopes steeper than 5 percent.
(4) Annuals, used on mild slopes or as temporary protection until permanent covers are established.

lawn irrigation and other outside uses of water, including crop irrigation return flows for developments on the edge of urbanizing areas. Maricopa County is generally typified by low groundwater tables, porous surface materials and limited irrigation, which tend to reduce low flows and short-term problems of aggradation and wet channel bottoms.

Base flows for larger drainage basins can be a significant stability and maintenance problem for earth- or grass-bottomed channels. In this discussion, base flows can be considered as flow rates that are less than the 5- or 10-year storm events. If grass and earth channels are too wide, the low flows will tend to incise a channel within the bottom, giving rise to both higher maintenance requirements and more channel instability when larger storms occur. Because flows of sufficient size to cause a low flow channel to form may not occur for several years, the magnitude of this problem may not be observed for several years.

Table 1. Slope Protection or Channel Lining Types

Type	Maximum Side Slope	Stability Maximum Velocity	Durability	Maintenance	Safety	Access	Aesthetics	Footprint	Revegetation Potential	Wildlife
Reinforced										
Natural Bank (dependent on soil erodibility)	VARIES	2.5 - 6.0 fps	VARIES	VARIES	E	VARIES	E	0	YES	E
Earthen Cut (dependent on soil erodibility)	4:1	2.5 - 6.0 fps	VARIES	VARIES	G	P	P	0	YES	G - F
Vegetation (dependent on soil erodibility)	4:1	2.5 - 6.0 fps	VARIES	VARIES	G	P	P	VARIES	YES	G - F
Vegetation (requires irrigation)	4:1	2.5 - 8.0 fps	F	VARIES	G	F	G	0.5 - 1'	YES	G
Flexible Reinforced (permanent)										
Loose Rock (rip rap)	3:1	<10 fps[1]	P	P	P	P	P	1.5 x D100	NO	F - P
Reinforced Turf	2.5:1	15-20	F	Varies	G	F	G	1-2'	YES	G
Wire Enclosed Rock (rip rap)										
Gabion Baskets	2:1	<10 to <15 fps	G	G	P-F	F	P - G	1 - 3'	P - G	P
Reno Mattresses	2:1	<10 to <15 fps	G	G	P-F	F	P - G	1 - 2'	P - G	P
Sack Gabions	2:1	<10 to <15 fps	G	G	P-F	F	P - G	1 - 3'	P - G	P
Flexible Reinforced (temporary)										
Hydro mulch	4:1	F	VP	NONE	G	F	F	1 - 2'	YES	G - P
Synthetic/Geo textile Mats/Netting	4:1	F	F	NONE	G	F	F - P	1 - 2'	YES	G - P
Jute Netting	4:1	P	P	NONE	G	F	F - P	1 - 2'	YES	G - P
Rigid Reinforced (permanent)										
Shotcrete Gunite	VERT	15[1,2]	F	F	VP	F	F - P	1 - 2'	NONE	P
Grouted Rock (rip rap)	3:1	<10 to 15[1,2]	F	F	F	P	F - P	1 - 2'	NONE	P
Pre formed Block	70°	10 - 15	E	G	P	VP	G - F	4 - 8'	YES	F - P
Soil Cement	2:1SS	<15	E	E	F	P	P	8 - 8.5'	NONE	P
Soil Cement	4:1SS	<15	E	E	G	G	P	8 - 8.5'	NONE	F
Concrete (cast in place)	VERT	15 - 35[1]	E	E	VP	P	VP	1 - 2'	NONE	P - P
Concrete with Fusion Surface Treatment	VERT	15 - 25	G	G	VP	VP	E	2 - 4'	NONE	F - P
Pre formed Block (Keystone)	2:1	10 - 15	E	G	F	P	G - F	4 - 8'	NONE	P
Cellular System (Geoweb)	2:1	15 - 20	F	G	F	P	G - F	1 - 2'	YES	F

[1] Other factors may dictate such as Froud No. > 1.13 and less than 2.0
[2] UCDMC Recommends Subcritical Flow Only

E = Excellent
VP = Very Poor
G = Good
P = Poor
VP = Very Poor

Appendix H

FEMA BRIDGE/CULVERT FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

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Community Name: Town of Gilbert, Maricopa County, AZ

Flooding Source: Queen Creek

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. IDENTIFIER

1. Name of roadway, railroad, etc.: Power Road
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): Section 4.070 and 4.085
3. This revision reflects *(check one of the following)*:

   [x] New bridge/culvert not modeled in the FIS

   [ ] Modified bridge/culvert previously modeled in the FIS

   [ ] New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed)

2. BACKGROUND

Provide the following information about the structure:

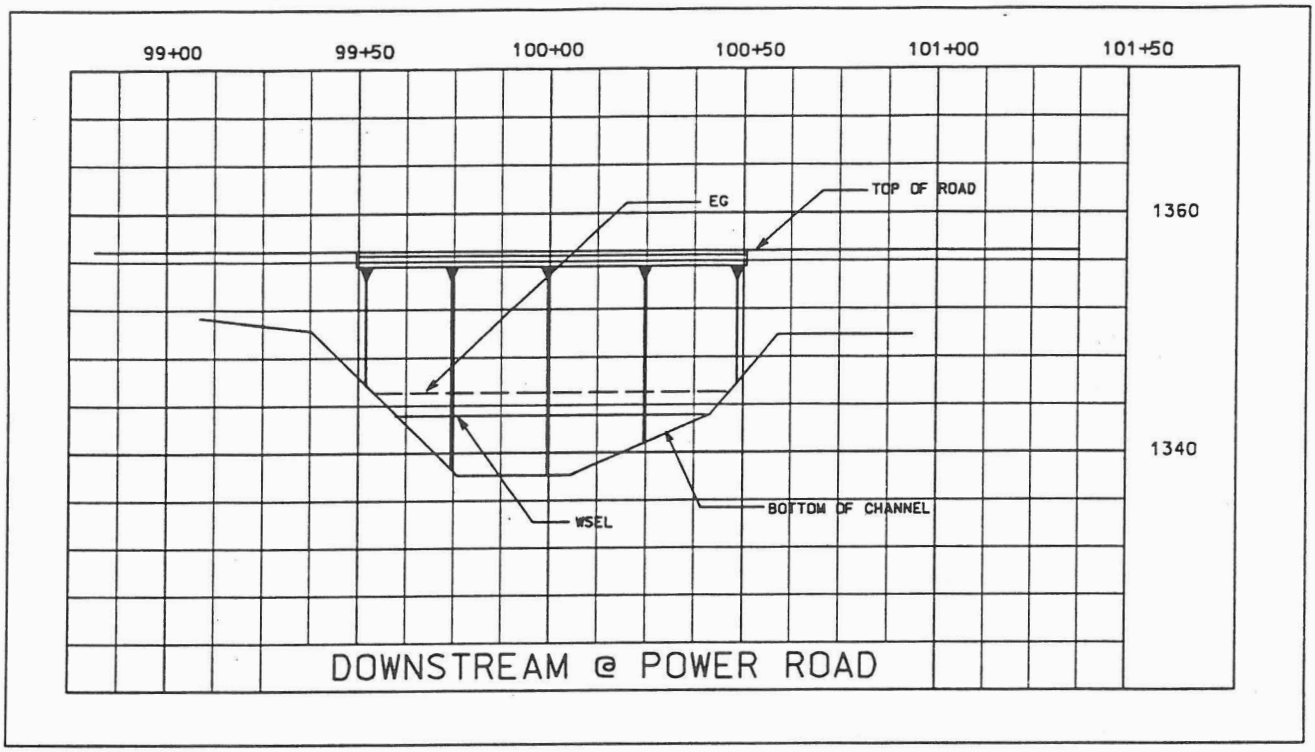
1. Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of two 3-foot diameter circular piers; 40-foot wide ogee shape spillway) See attached drawing
2. Entrance geometry of culvert/type of bridge opening (e.g. 30°-75° wing walls with square top edge, sloping embankments and vertical abutments) See attached as-built drawings in Appendix H.
3. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)* HEC-2

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)* Previously completed by approximate methods only.

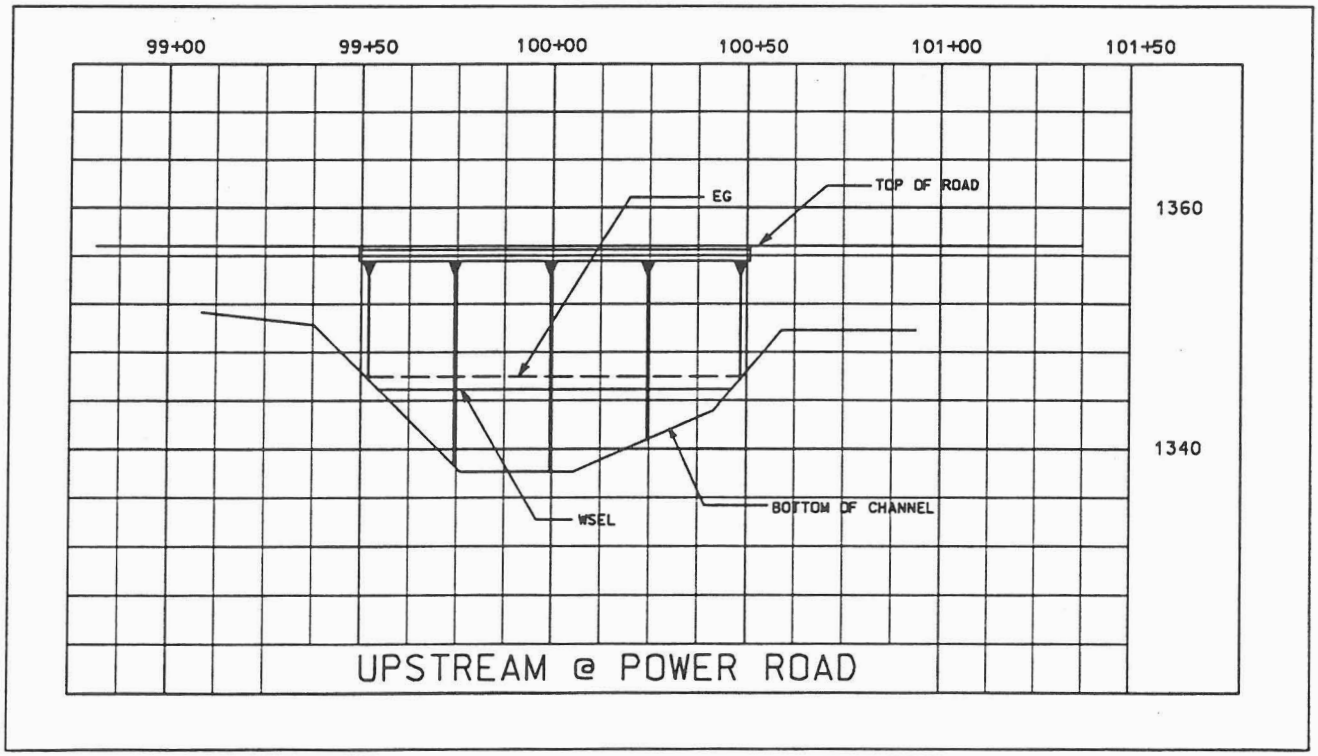
Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A

*One form per new/revised bridge/culvert

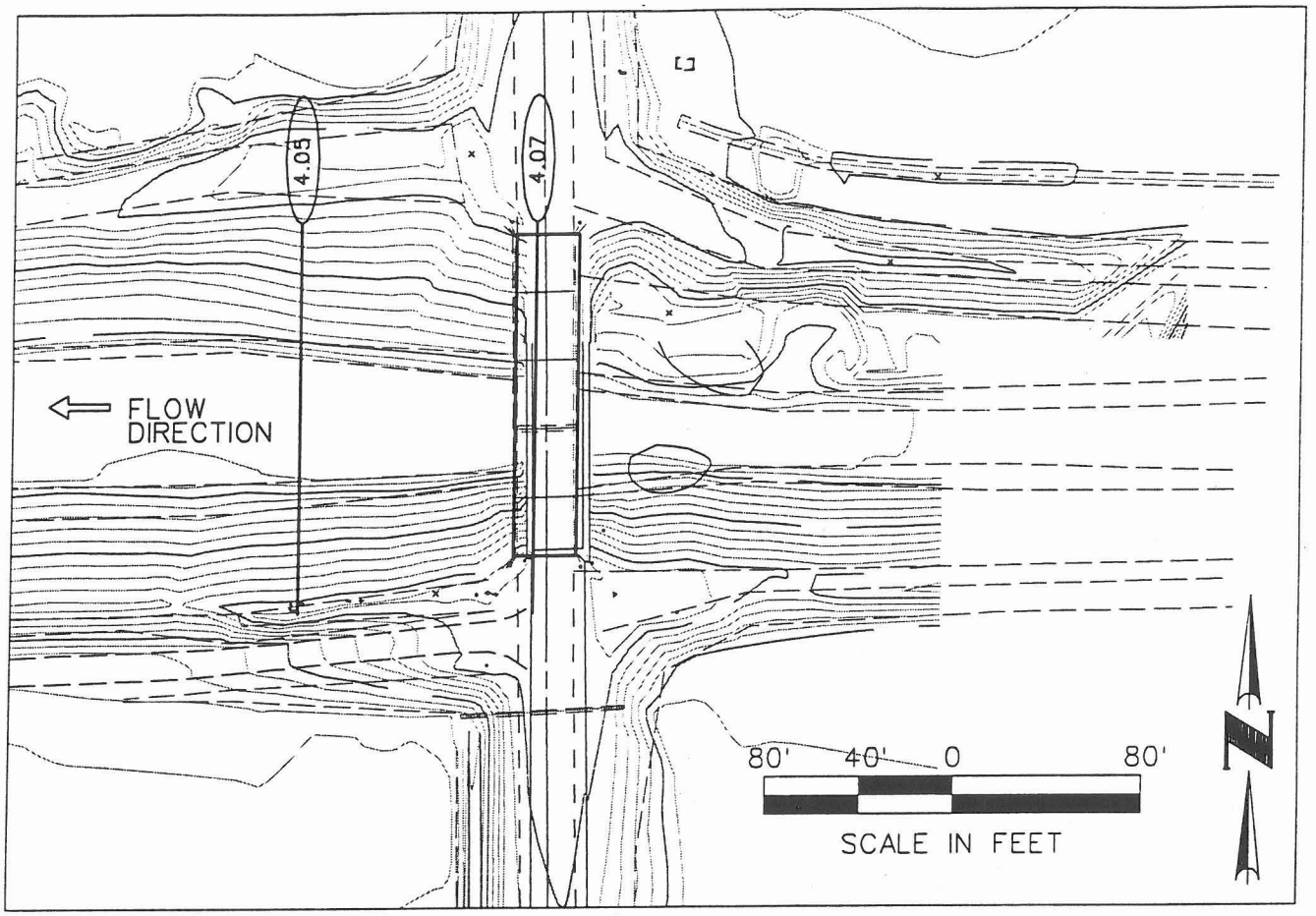
Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



Sketch the upstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, and minimum top of road elevation.



Sketch the plan view of the structure(s). Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure(s).



POWER ROAD BRIDGE PLAN VIEW

Attach plans of the structure(s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft.)	24
Calculated culvert/bridge (ft^2) by the hydraulic model, if applicable	941.6
Total culvert/bridge area (ft^2)	>980

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face Section 4.085	1350.9	1350.9
Downstream face Section 4.070	1348.4	1348.4

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	1350.9	1350.9
Downstream face	1350.9	1350.9

100-Year Elevations

	Water-Surface Elevations	Energy Gradient Elevations
Upstream face Section 4.085	1344.88	1345.62
Downstream face Section 4.070	1342.97	1344.82

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure(s) (cfs)	3,000 cfs	0	0	3,000 cfs
The maximum depth of flow over the roadway/railroad (ft.)	.....	.....	0	
Weir length (ft.)	.....	.....	--	

Top Widths

	Total Floodplain Width	Total Effective Flow Width	Floodway Width
Upstream face Section 4.085	90.88	90.88	90.88
Downstream face Section 4.070	75.52	75.52	75.52

3. ANALYSIS (Cont'd)

Loss Coefficients

Entrance loss coefficient	0.2
Manning's "n" value assigned to the structure(s)	0.015
Friction loss coefficient through structure(s)	N/A
Other loss coefficients (e.g., bend, manhole, etc.)	N/A
Total loss coefficient	N/A
Weir coefficient	2.6
Pier coefficient	N/A
Contraction loss coefficient	0.3
Expansion loss coefficient	0.5

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? . . . . . ☐ Yes ☒ No

   B. Based on the conditions *(such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? . . . ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes: **See Enclosures 1 and 2**

   A. What is the estimated sediment *(bed material)* load?

   6.4 cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and the depth of scour and/or deposition Due to lack of suspended sediment data, the sediment carrying capacity of the immediate upstream reach was estimated and used as inflow sediment load. This was estimated by trial and error until the sediment inflow equals sediment outflow for the upstream reach.

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☒ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert?

5. FLOODWAY ANALYSIS

5. FLOODWAY ANALYSIS (Cont'd)

Comments *(explain any unusual situations)*:

Attach analysis.

No Floodway Analysis

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

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Community Name: Town of Gilbert, Maricopa County, AZ

Flooding Source: Queen Creek

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. IDENTIFIER

1. Name of roadway, railroad, etc.: Meadowbrook Village Parkway
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): Sections 3.61 and 3.62
3. This revision reflects *(check one of the following)*:

   [X] New bridge/culvert not modeled in the FIS

   [ ] Modified bridge/culvert previously modeled in the FIS

   [ ] New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed)

2. BACKGROUND

Provide the following information about the structure:

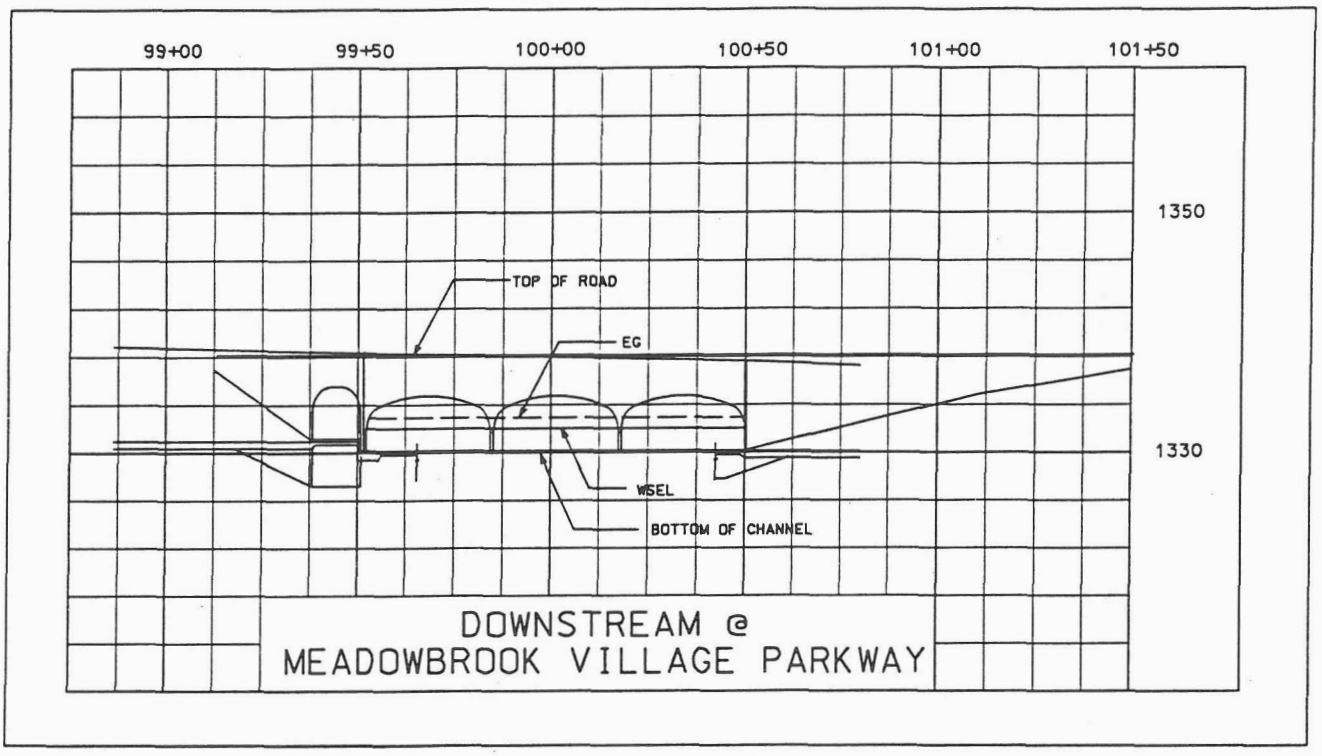
1. Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of two 3-foot diameter circular piers; 40-foot wide ogee shape spillway) See attached drawing
2. Entrance geometry of culvert/type of bridge opening (e.g. 30°-75° wing walls with square top edge, sloping embankments and vertical abutments) See attached construction drawings in Appendix I.
3. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)* HEC-2

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)* Previously computed by approximate methods only.

Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A

*One form per new/revised bridge/culvert

Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



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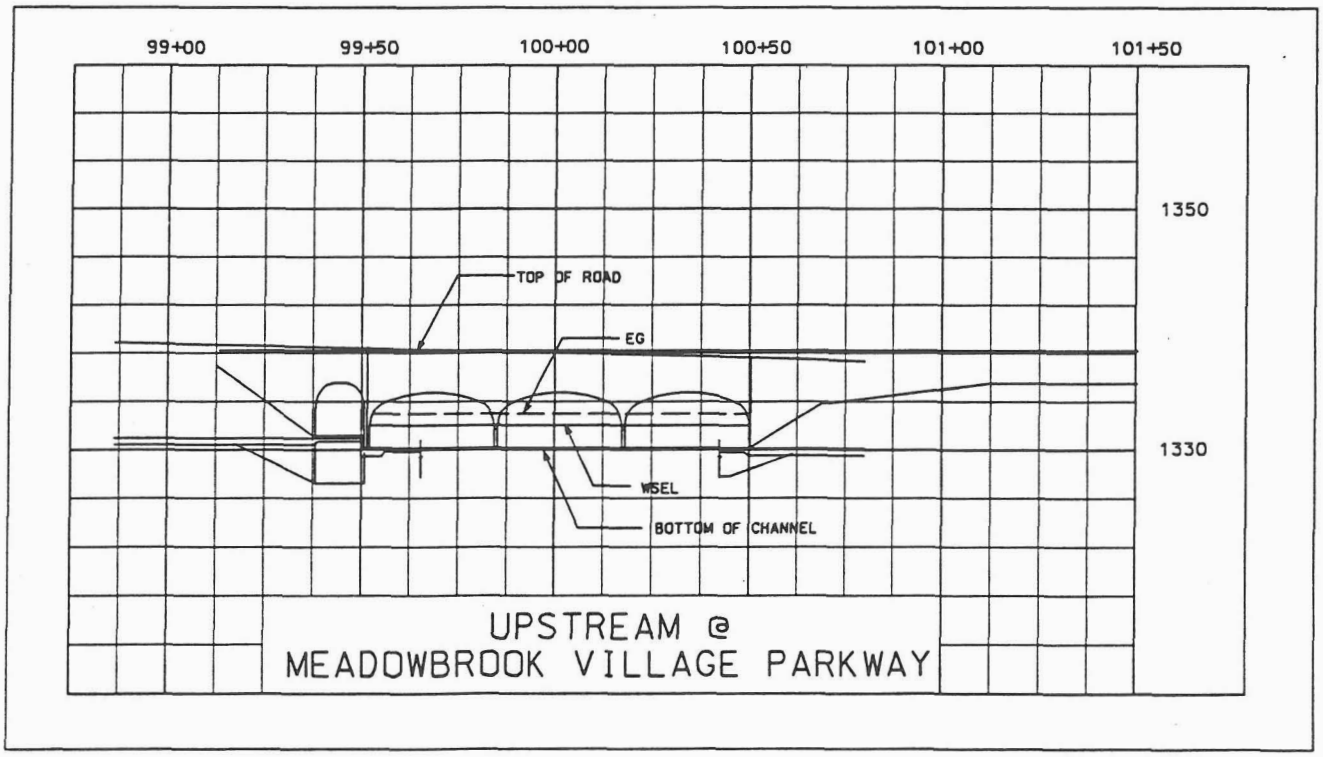
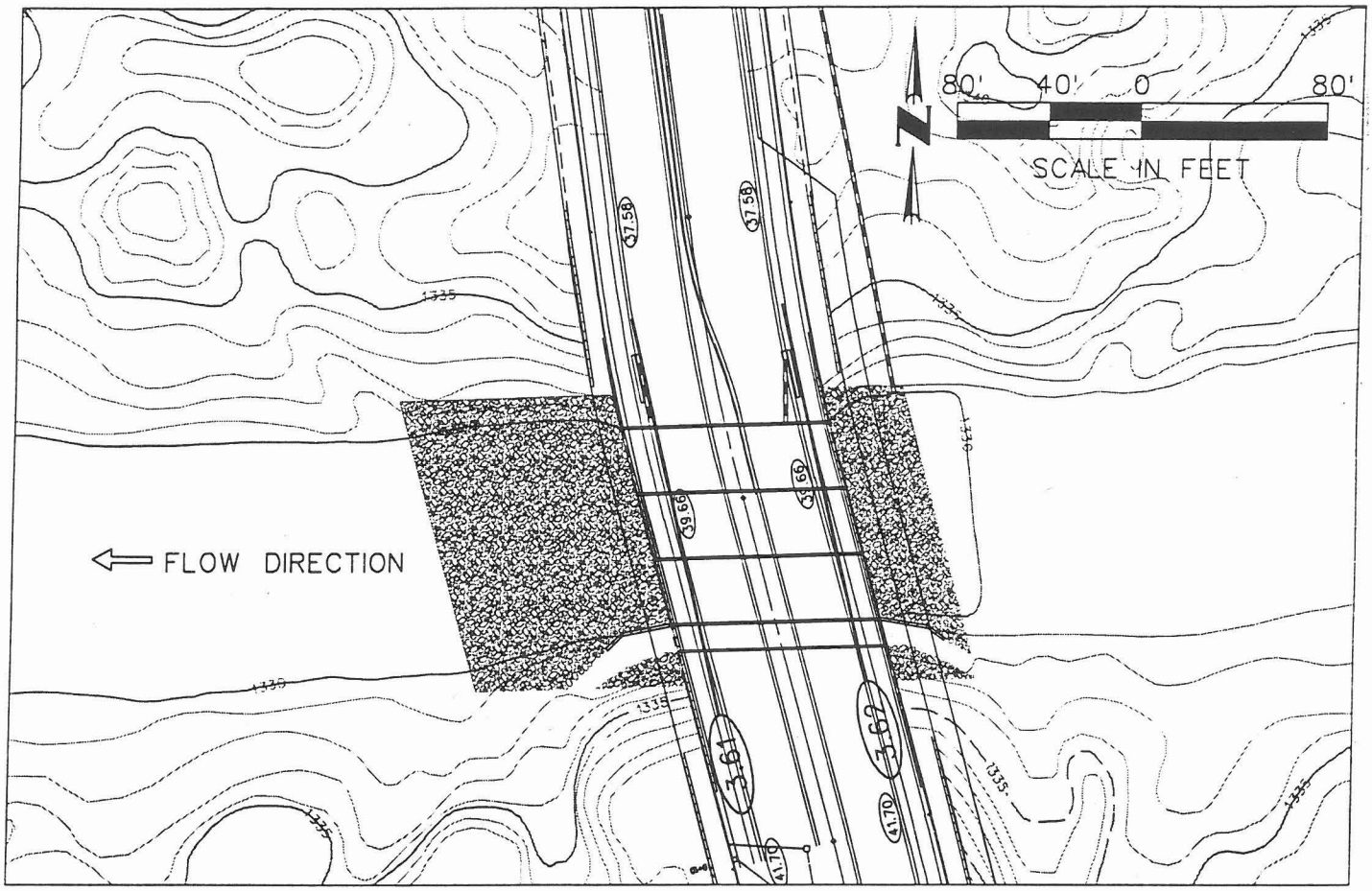


Sketch the plan view of the structure(s). Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure(s).



MEADOWBROOK VILLAGE PARKWAY BRIDGE
PLAN VIEW

Attach plans of the structure(s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft.)	88
Calculated culvert/bridge (ft^2) by the hydraulic model, if applicable	N/A
Total culvert/bridge area (ft^2)	7582

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face Section 3.62	1337	1334
Downstream face Section 3.61	1337	1339

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	1338.5	1338.5
Downstream face	1338.5	1338.5

100-Year Elevations

	Water-Surface Elevations	Energy Gradient Elevations
Upstream face Section 3.62	1334.80	1335.38
Downstream face Section 3.61	1333.69	1334.60

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure(s) (cfs)	3,000 cfs	0	0	3,000 cfs
The maximum depth of flow over the roadway/railroad (ft.)	.....	.....	0	
Weir length (ft.)	.....	.....	--	

Top Widths

	Total Floodplain Width	Total Effective Flow Width	Floodway Width
Upstream face Section 3.62	110	110	110
Downstream face Section 3.61	110	110	110

3. ANALYSIS (Cont'd)

Loss Coefficients

Entrance loss coefficient	0.2
Manning's "n" value assigned to the structure(s)	0.015
Friction loss coefficient through structure(s)	N/A
Other loss coefficients (e.g., bend, manhole, etc.)	N/A
Total loss coefficient	N/A
Weir coefficient	2.6
Pier coefficient	N/A
Contraction loss coefficient	0.3
Expansion loss coefficient	0.5

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? . . . . . ☐ Yes ☒ No

   B. Based on the conditions *(such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? . . . ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes: **See Enclosures 1 and 2**

   A. What is the estimated sediment *(bed material)* load?

   6.4 cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and the depth of scour and/or deposition Due to lack of suspended sediment data, the sediment carrying capacity of the immediate upstream reach was estimated and used as inflow sediment load. This was estimated by trial and error until the sediment inflow equals sediment outflow for the upstream reach.

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☒ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert?

5. FLOODWAY ANALYSIS

Comments *(explain any unusual situations)*:

Attach analysis.

N/A

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Town of Gilbert, Maricopa County, AZ

Flooding Source: Queen Creek

Project Name/Identifier: Queen Creek - Power Road to Recker Road

1. IDENTIFIER

1. Name of roadway, railroad, etc.: Recker Road
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): Section 3.115 and 3.13
3. This revision reflects *(check one of the following)*:

   [X] New bridge/culvert not modeled in the FIS

   [ ] Modified bridge/culvert previously modeled in the FIS

   [ ] New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed)

2. BACKGROUND

Provide the following information about the structure:

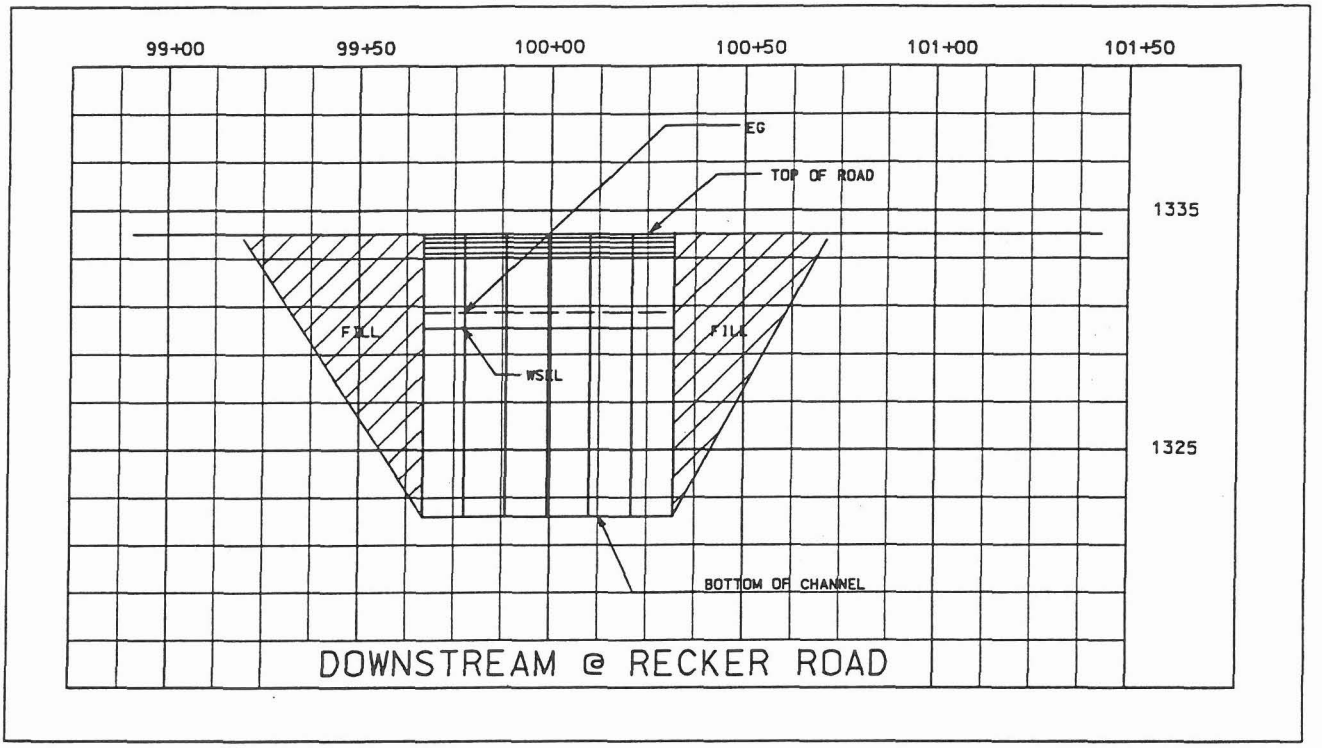
1. Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of two 3-foot diameter circular piers; 40-foot wide ogee shape spillway) See attached drawing
2. Entrance geometry of culvert/type of bridge opening (e.g. 30°-75° wing walls with square top edge, sloping embankments and vertical abutments) See attached construction drawings in Appendix J.
3. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)* HEC-2

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)* Previously completed by approximate methods only.

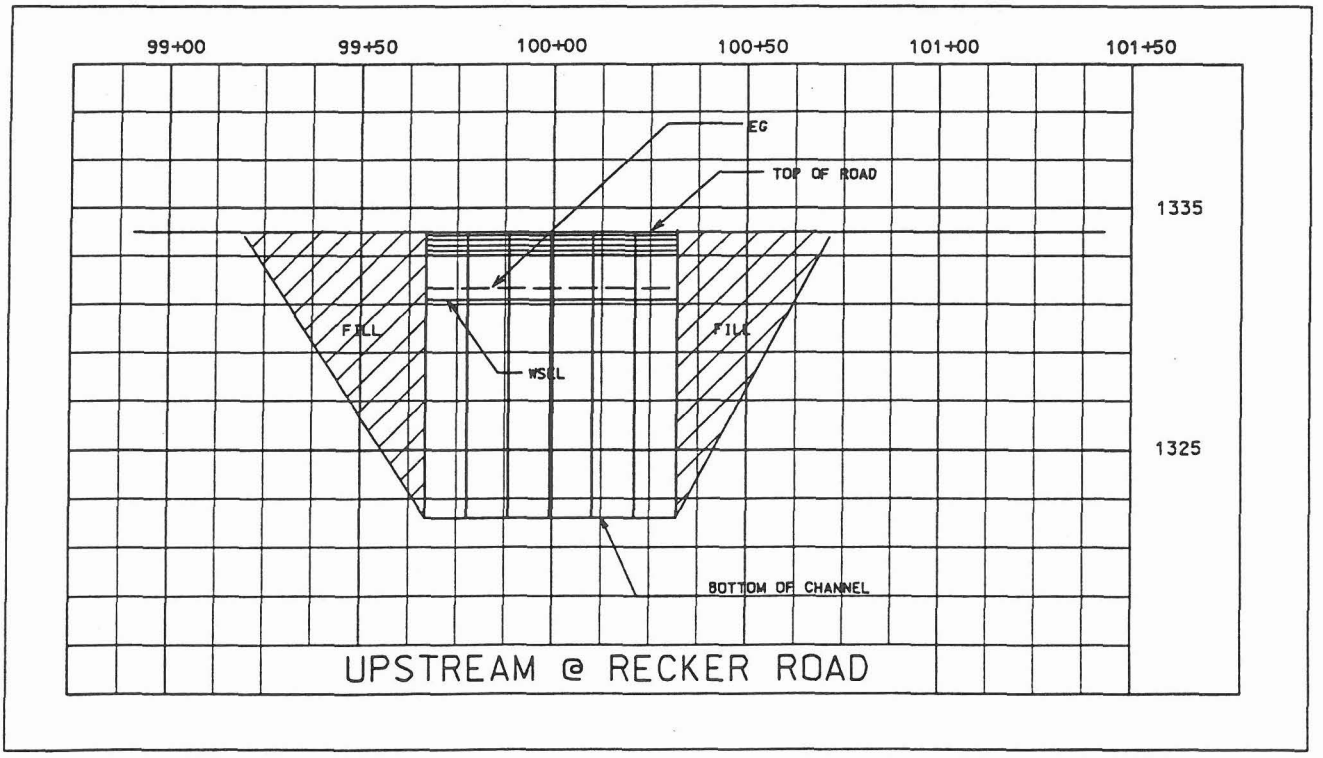
Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A

*One form per new/revised bridge/culvert

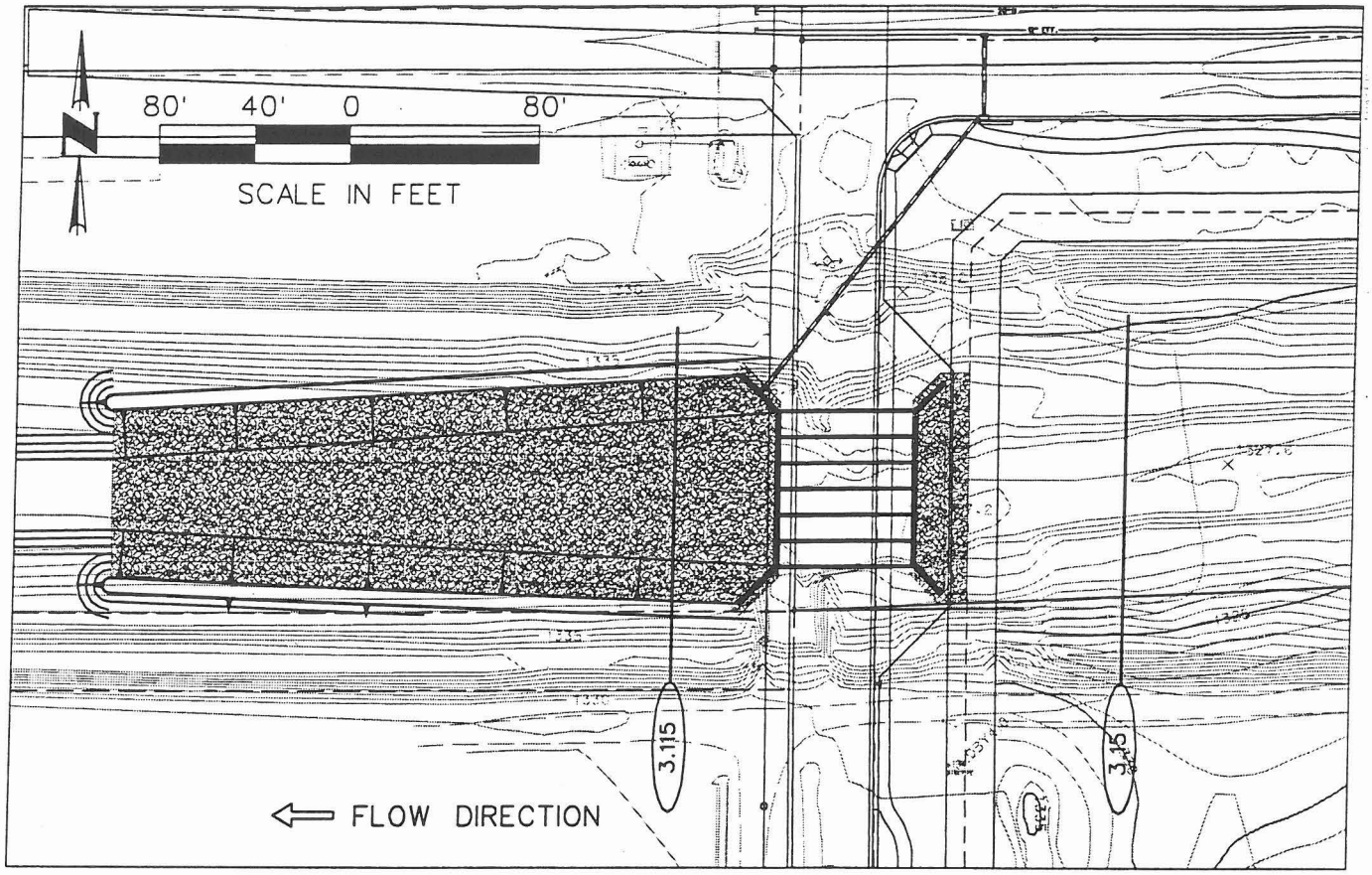
Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



Sketch the upstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, and minimum top of road elevation.



Sketch the plan view of the structure(s). Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure(s).



RECKER ROAD BRIDGE PLAN VIEW

Attach plans of the structure(s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft.)	48
Calculated culvert/bridge (ft^2) by the hydraulic model, if applicable	N/A
Total culvert/bridge area (ft^2)	480

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face Section 3.13	1333.2	1333.2
Downstream face Section 3.12	1332.7	1332.7

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	1333.2	1333.2
Downstream face	1333.2	1333.2

100-Year Elevations

	Water-Surface Elevations	Energy Gradient Elevations
Upstream face Section 3.13	1331.43	1331.62
Downstream face Section 3.115	1330.75	1330.93

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure(s) (cfs)	3,000 cfs	0	0	3,000 cfs
The maximum depth of flow over the roadway/railroad (ft.)	.....	.....	0	
Weir length (ft.)	.....	.....	--	

Top Widths

	Total Floodplain Width	Total Effective Flow Width	Floodway Width
Upstream face Section 3.13	70	70	70
Downstream face Section 3.12	70	70	70

3. ANALYSIS (Cont'd)

Loss Coefficients

Entrance loss coefficient	0.2
Manning's "n" value assigned to the structure(s)	0.015
Friction loss coefficient through structure(s)	N/A
Other loss coefficients (e.g., bend, manhole, etc.)	N/A
Total loss coefficient	N/A
Weir coefficient	2.6
Pier coefficient	N/A
Contraction loss coefficient	0.3
Expansion loss coefficient	0.5

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? . . . . . ☐ Yes ☒ No

   B. Based on the conditions *(such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? . . . ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes: **See Enclosures 1 and 2**

   A. What is the estimated sediment *(bed material)* load?

   6.4 cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and the depth of scour and/or deposition Due to lack of suspended sediment data, the sediment carrying capacity of the immediate upstream reach was estimated and used as inflow sediment load. This was estimated by trial and error until the sediment inflow equals sediment outflow for the upstream reach.

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☒ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert? _____

5. FLOODWAY ANALYSIS

Comments *(explain any unusual situations)*:

Attach analysis.

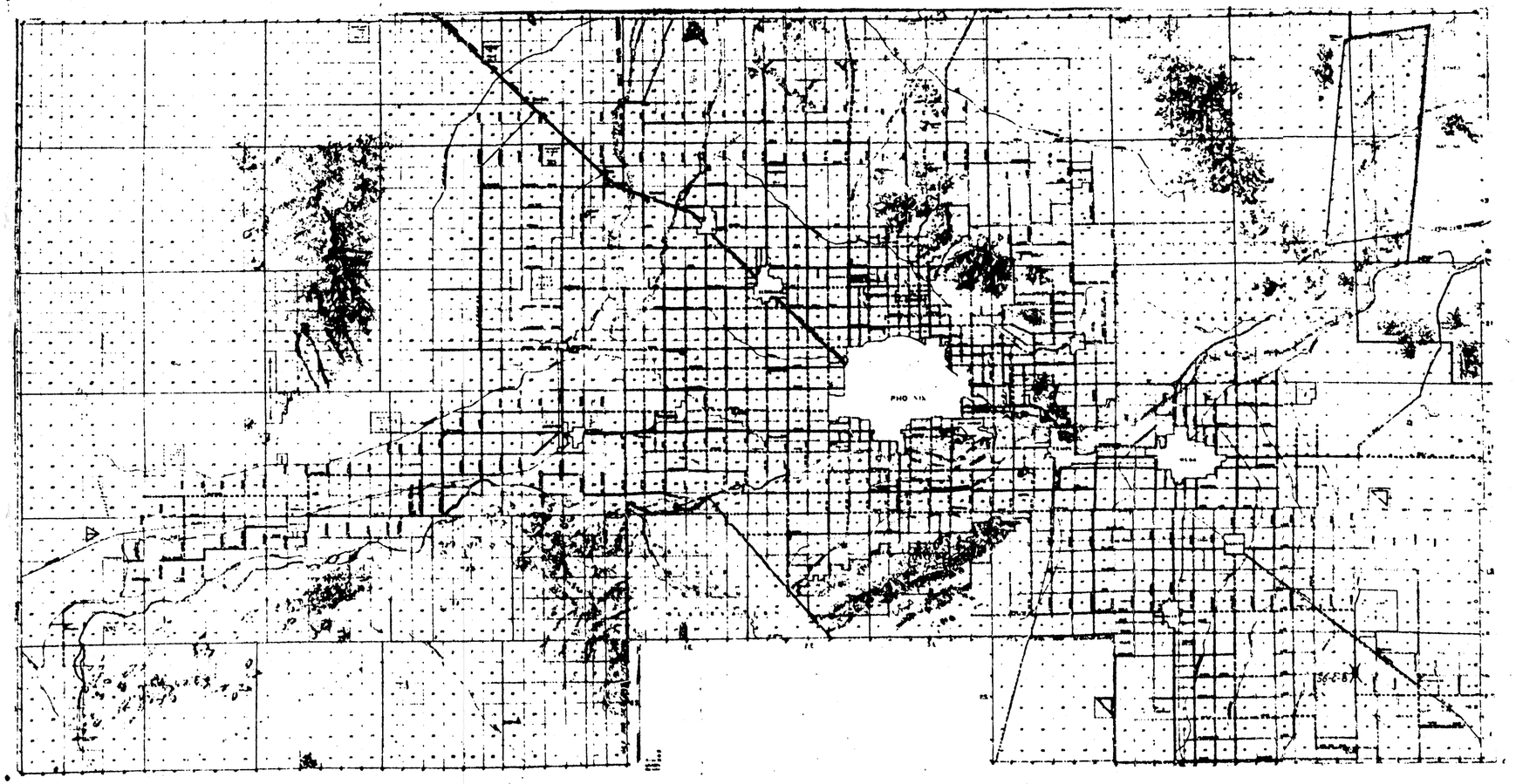
N/A

Appendix I

AS-BUILT CONSTRUCTION DRAWINGS FOR EXISTING BRIDGE AT POWER ROAD

COUNTY OF MARICOPA
COUNTY HIGHWAY DEPARTMENT

PLANS FOR THE CONSTRUCTION OF POWER ROAD & QUEEN CREEK BRIDGE PROJECT NO. 56-C-8



CONVENTIONAL SIGNS

COUNTY LINE	LEVEE
CITY, VILLAGE OR BOROUGH	CULVERT
TOWNSHIP LINE	DROP INLET
SECTION LINE	POWER POLE
GRANT LINE	TELEPHONE AND TELEGRAPH POLES
FENCE LINE	MARSH
GUARD RAIL	HEDGE
UNFENCED PROPERTY	BRIDGE
RIGHT OF WAY LINE	GRADE LINE
TRAVELED WAY	GROUND LINE
RAILROAD	SECTION CORNER
RETAINING WALL	R/W LINE MARKERS
BASE OR CURBS LINE	ROUNDING OF SLOPE LINE
ROAD TRAFFIC SIGNS	

APPROVED
BY [signature]
DATE 8-31-55 COUNTY ENGINEER

RECOMMENDED FOR APPROVAL
BY [signature]
DATE 8/31/55 ASST. COUNTY ENGINEER DESIGN & PLANS

BY [signature]
DATE 8-31-55 ASST. COUNTY ENGINEER CONSTRUCTION & MAINTENANCE

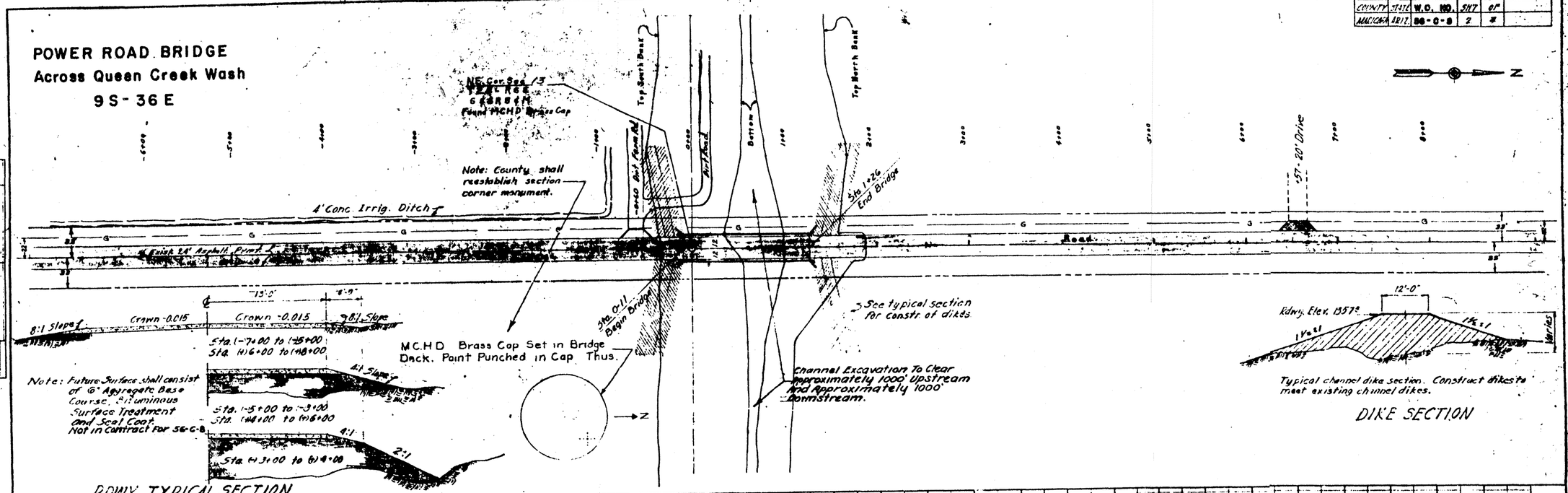
COUNTY BOARD OF SUPERVISORS

JAMES T. O'NEIL	DISTRICT 3	CHAIRMAN
JAMES G. HART	DISTRICT 2	VICE CHAIRMAN
JAMES E. LINDSAY	DISTRICT 1	MEMBER

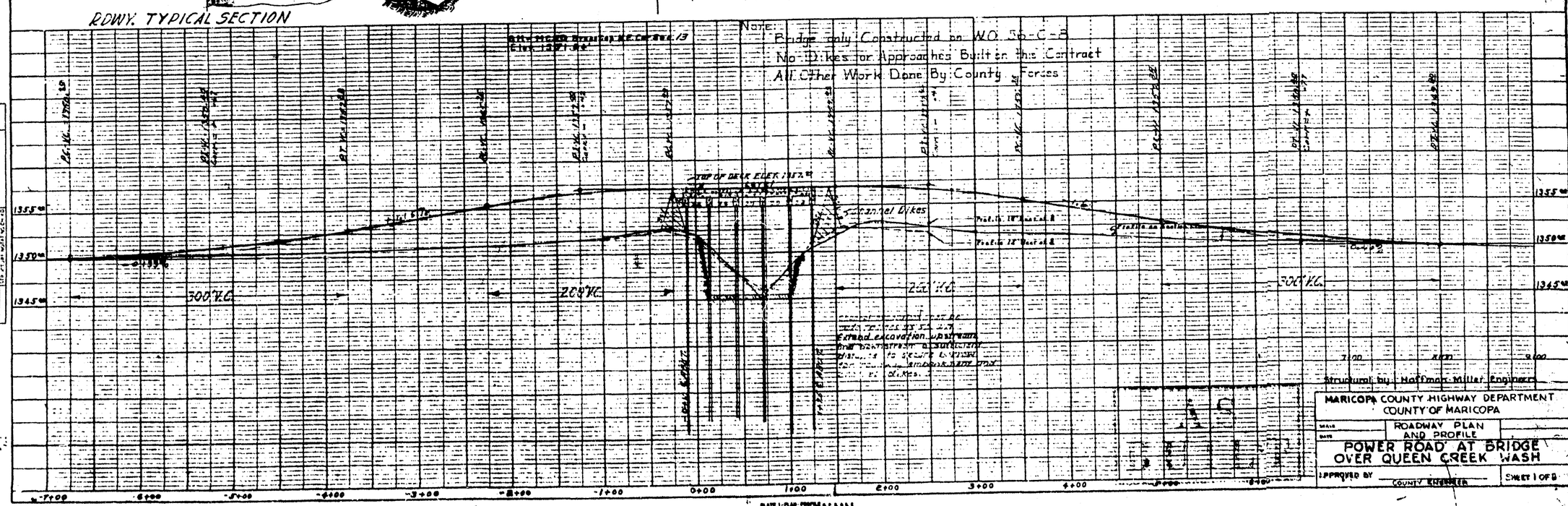
APPROVED [signature]
DATE _____ CHAIRMAN

COUNTY	STATE	W.O. NO.	SHT	OF
MARICOPA	ARIZ.	56-C-B	2	2

POWER ROAD BRIDGE
Across Queen Creek Wash
9S-36E



Note: Bridge only Constructed on W.O. 56-C-B
No Dikes or Approaches Built on this Contract
All Other Work Done By County Forces



MARICOPA COUNTY HIGHWAY DEPARTMENT
COUNTY OF MARICOPA

ROADWAY PLAN AND PROFILE

POWER ROAD AT BRIDGE OVER QUEEN CREEK WASH

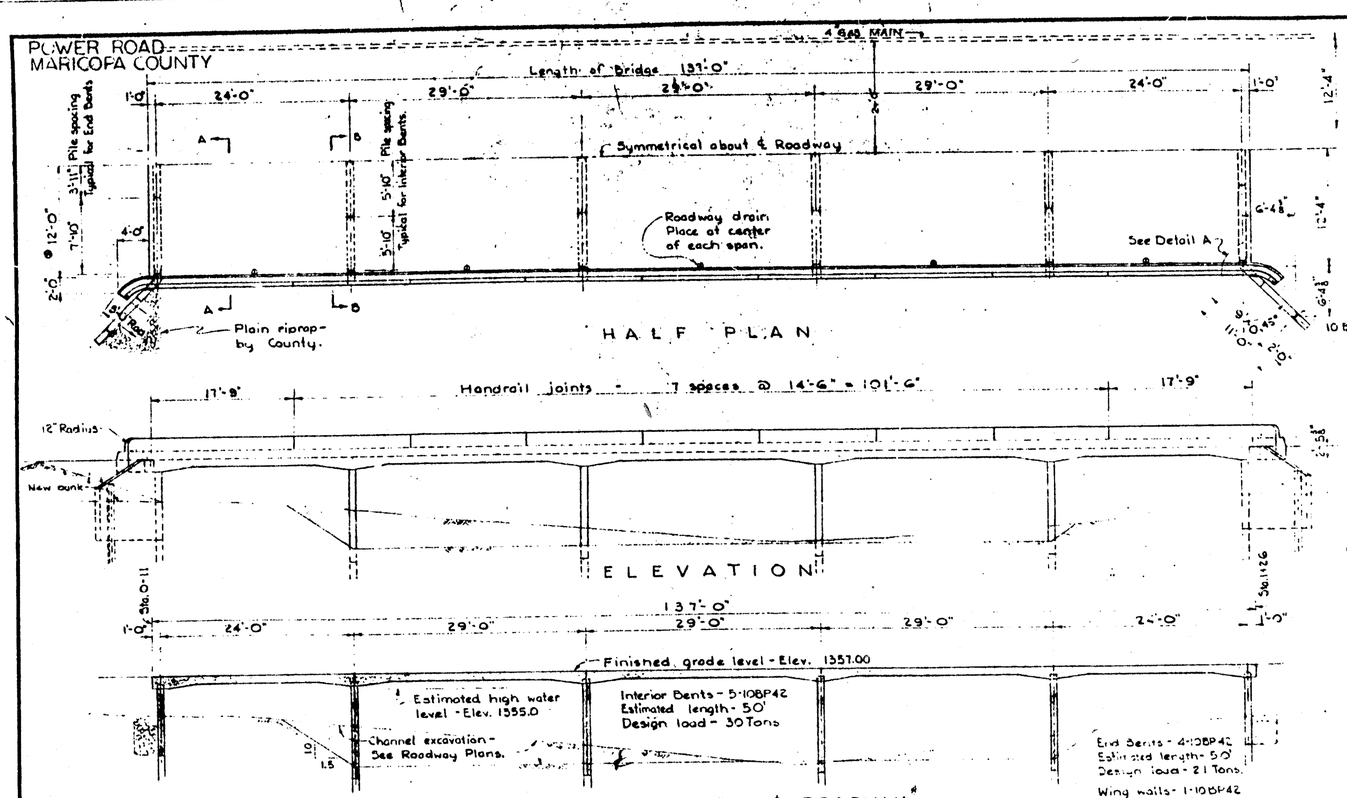
APPROVED BY _____ COUNTY ENGINEER

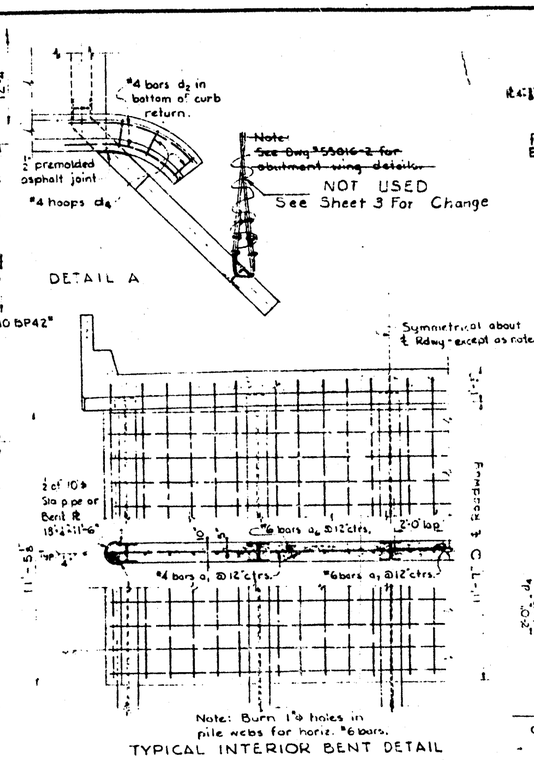
SHEET 1 OF 2

PLATE 1-PLAN-PROFILE & P.A.&S.E.

2 OF 5

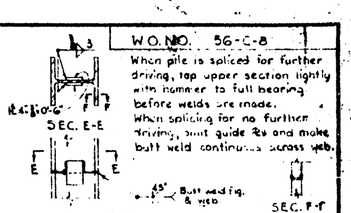
POWER ROAD
MARICOPA COUNTY





W.O. NO. 56-C-8

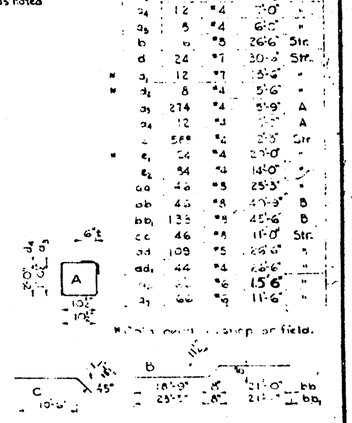
When pile is spliced for further driving, top upper section tightly with hammer to full bearing before welds are made. When splicing for no further driving, omit guide ⅝ϕ and make butt weld continuous across web.

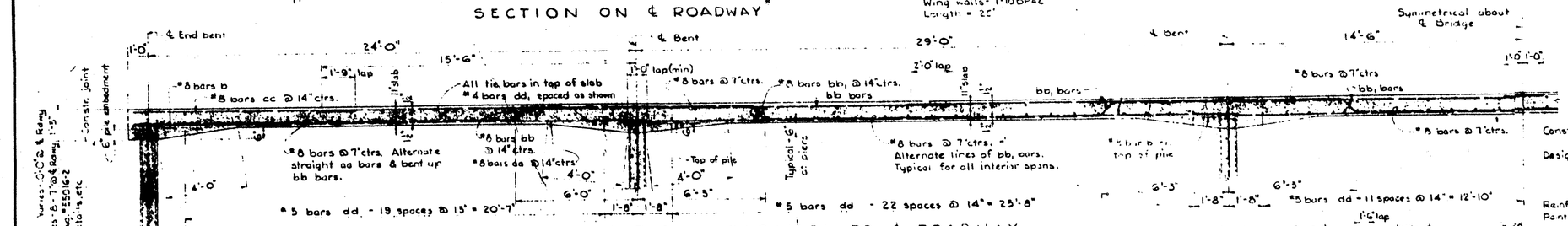


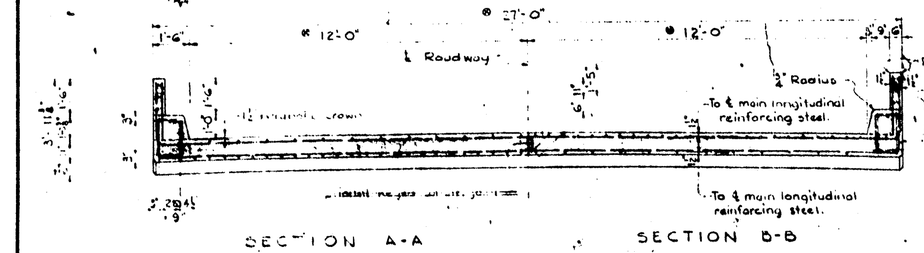
PILE SPLICE DETAIL

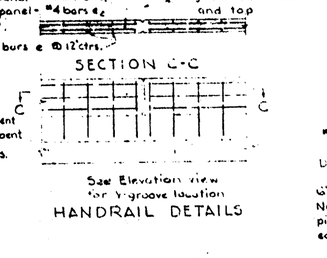
Mark	No.	Size	Length	Bend
a	10	*4	9'-6"	Str
a_1	104	*4	[illegible]	"
a_2	44	*5	[illegible]	C
a_3	8	*4	[illegible]	Str
a_4	12	*4	[illegible]	"
a_5	5	*4	6'-0"	"
b	[illegible]	*5	26'-6"	Str
d	24	*7	30'-6"	Str
d_1	12	*7	5'-6"	"
d_2	8	*4	5'-6"	"
d_3	274	*4	5'-9"	A
d_4	12	*4	[illegible]	A
e	56*	*4	[illegible]	Str
e_1	54	*4	2'-0"	"
e_2	54	*4	14'-0"	"
aa	46	*5	25'-3"	"
ab	45	*8	[illegible]	B
bb_1	135	*8	45'-6"	B
cc	46	*8	11'-0"	Str
dd	109	*5	26'-6"	"
dd_1	44	*4	26'-6"	"
[illegible]	[illegible]	*6	15'-6"	"
[illegible]	66	*9	11'-6"	"

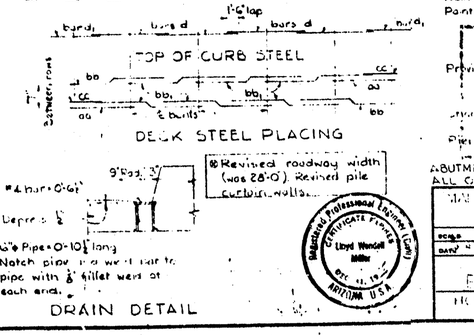
*Bars marked shop or field.











APPROXIMATE QUANTITIES

* Structural excavation	160	C.Y.
Class A Concrete	60.24	C.Y.
Class D Concrete	163.22	C.Y.
Reinforcing steel	40,150	Lbs.
Steel H-piling - 23 pcs - 55' lg. 4 pcs - 25' lg.	1500	Lin. Ft.

* Neither the quantity paid for will be used for structural excavation (footing, wing, and pier footing) and structural excavation.

GENERAL NOTES

Construction - Standard Specifications, Maricopa County Highway Department, July, 1955
Design - AASHO Specifications 1955, Revised to site
Loading class: HS-S12-1944 No wearing surface.
Class D Concrete: [illegible]
Class A Concrete: [illegible]
Reinforcing steel - Intermediate grade, AASHO Design, HS15-44
Paint piling & pier nosing: [illegible] Paint and Painting
1st coat Field paint - No. 5 - [illegible] 3 of 9
2nd coat Field paint - No. 5 - [illegible] 5 of 9
3rd coat Field paint - No. 5 - [illegible] 5 of 9
Provide ⅛" camber [illegible]
[illegible] concrete
[illegible] shall be [illegible] 13210
ABUTMENTS, WINGS, [illegible] CLASS A CONCRETE
ALL OTHER - CLASS D CONCRETE

Registered Professional Engineer (Civil) Certificate Expires Lloyd Wendell Miller Dec. 31, 19[illegible] Arizona U.S.A.

MARICOPA COUNTY HIGHWAY DEPARTMENT
STATE OF ARIZONA

SCALE [illegible] | DRAWN BY [illegible]
DATE [illegible] | REVISED [illegible]

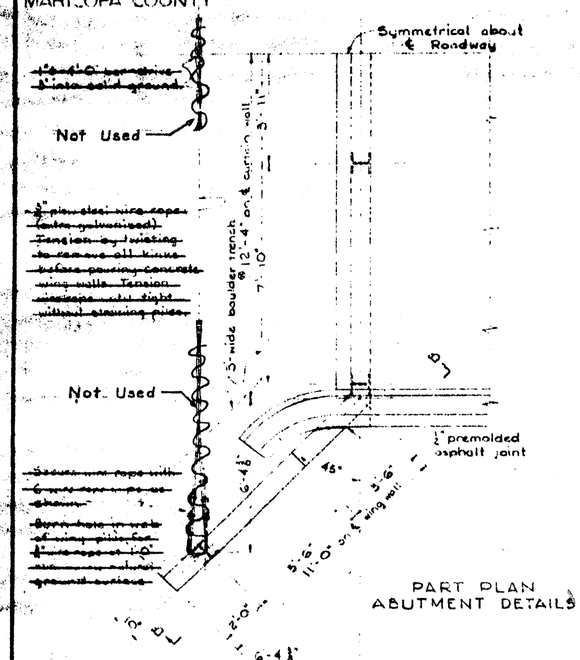
BRIDGE OVER POWER ROAD
EAST OF QUEEN CREEK

[illegible] PHOENIX, ARIZONA | DRAWING NUMBER 55016-1

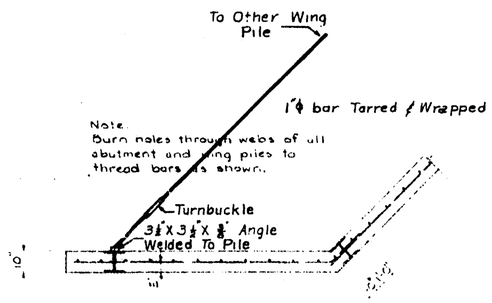
3 OF 5

POWER ROAD
MARICOPA COUNTY

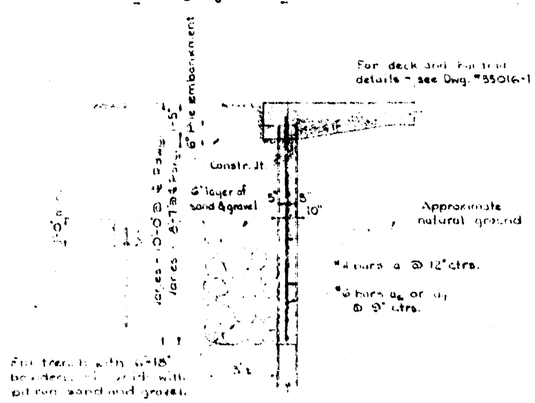
W.O. NO. 56-C-8



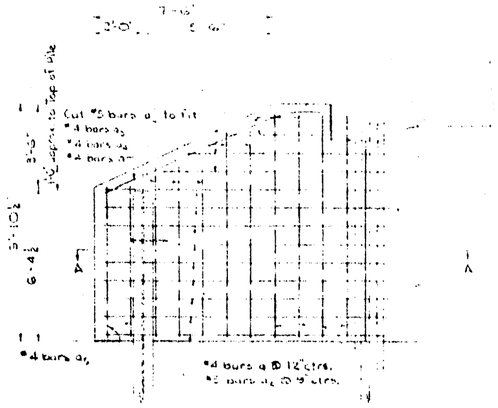
PART PLAN
ABUTMENT DETAILS



SECTION A-A



SECTION ON ℄ ROADWAY



VIEW B-B

AS BUILT

ABUTMENT AND WING PILES & CONCRETE

MARICOPA COUNTY HIGHWAY DEPARTMENT
STATE OF ARIZONA

ABUTMENT DETAILS

STA. POWER ROADS
BELOW QUEEN CREEK

HIGHWAY DESIGN ENGINEER
PHOENIX, ARIZONA

35016-2

SHEET 3 OF 5

4 OF 5

POWER ROAD
MARICOPA COUNTY

W.O.NO. 56-C-8

HALF PLAN

ELEVATION

SECTION ON ℄ ROADWAY

HALF LONGITUDINAL SECTION - PARALLEL TO ℄ ROADWAY

SECTION A-A

SECTION B-B

SECTION C-C

HANDRAIL DETAILS

DETAIL A

TYPICAL INTERIOR BENT DETAIL

Alternate for W.O. 57-C-2

SEC. E-E

PILE SPLICE DETAIL

TOP OF CURB STEEL

DECK STEEL PLACING

DRAIN DETAIL

GENERAL NOTES

Mark	No.	Size	Length	Bend
a	1	#4	9'-6"	Str
a1	34	#4	[illegible]	-
a2	44	#5	[illegible]	C
a3	8	#4	[illegible]	Str.
a4	[illegible]	#4	[illegible]	-
a5	4	#4	6'-0"	-
b	[illegible]	#5	26'-6"	Str.
c	24	#7	5'-0"	Str.
c1	12	#7	5'-6"	-
c2	8	#4	5'-6"	-
c3	274	#4	5'-9"	A
c4	[illegible]	#4	[illegible]	A
c5	285	#4	[illegible]	Str
c6	24	#4	2'-10"	-
c7	34	#4	[illegible]	-
c8	[illegible]	#5	25'-3"	-
c9	40	#4	27'-9"	B
c10	12	#4	45'-6"	B
c11	46	#4	11'-0"	Str.
c12	129	#5	[illegible]	-
c13	[illegible]	#4	[illegible]	-
c14	[illegible]	#4	13'-6"	-
c15	64	#4	11'-6"	-

GENERAL NOTES

Construction - Standard Specifications, Maricopa County [illegible]

Design - AASHTO Specifications [illegible] 1961, Revised to date [illegible]

Loading - Class HS-[illegible] 1964 No wearing surface.

Reinforcing steel - [illegible] AASHTO Design M31-49

Paint piling & pier [illegible]

Provide [illegible]

Pier [illegible] shall be driven to bearing [illegible] 3210

ABUTMENTS, WINGS, etc. - [illegible] CONCRETE

ALL OTHER - [illegible]

MARICOPA COUNTY [illegible] DEPARTMENT

DESIGN | DRAWN BY HE

ROAD OVER [illegible] CREEK

HOPEFUL [illegible] CREEK

PHOENIX, ARIZONA

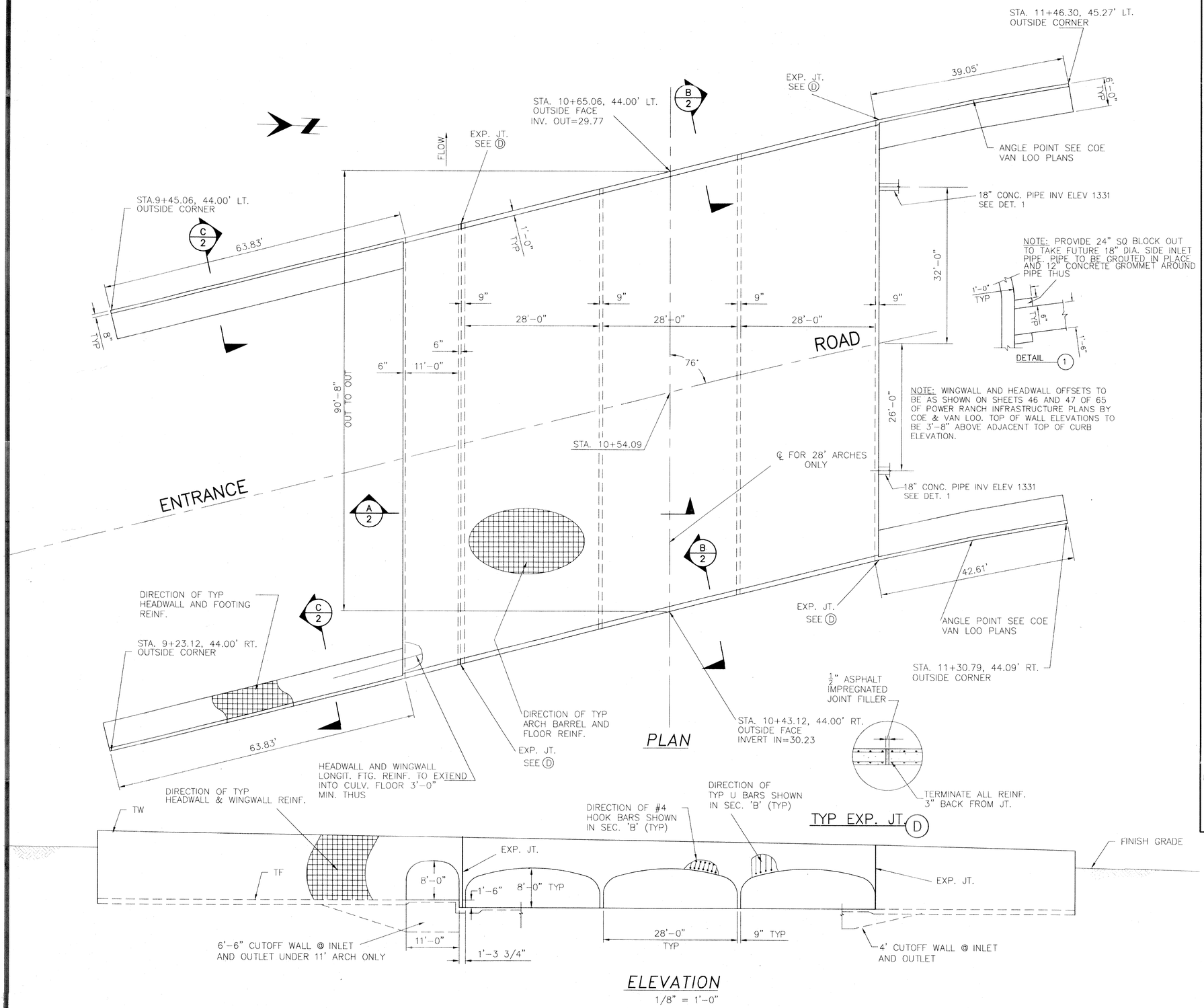
DRAWING NUMBER 55016-[illegible]

SHEET [illegible]

5 OF 5

Appendix J

CONSTRUCTION DRAWINGS FOR PROPOSED CULVERT AT MEADOWBROOK PARKWAY



ELEVATION
1/8" = 1'-0"

GENERAL NOTES

1.) DESIGN SPECIFICATIONS: AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES," 1996 ED. AND REVISIONS THERETO EXCEPT WHERE NOTED OTHERWISE.

2.) CONSTRUCTION SPECIFICATIONS: ADOT STANDARD SPECIFICATIONS, CURRENT EDITION, EXCEPT WHERE NOTED OTHERWISE.

3.) LOADING CLASS: HS20-44

4.) DEAD LOADS: FOR SELF WEIGHT OF STRUCTURE, REINF. CONCRETE = 150 POUNDS PER CUBIC FOOT (PCF), BACKFILL AROUND STRUCTURE = 120 PCF.

5.) DESIGN METHODOLOGY:

A.) CONCRETE ARCH: DESIGN BASED ON FINITE ELEMENT SOIL-STRUCTURE INTERACTION COMPUTER PROGRAM STUDIES UTILIZING SERVICE LOAD STRESSES. PROGRAM CALCULATES DESIGN MOMENTS FOR ARCH, WALLS, AND SLAB ACTING AS A UNIT WITH SURROUNDING SOIL.

B.) CONCRETE REINFORCING REQUIREMENTS COMPUTED BY THE ULTIMATE STRENGTH DESIGN METHOD.

6.) REINFORCING STEEL:

A.) CONVENTIONAL REINFORCEMENT: ASTM A615 GRADE 60 EXCEPT #3 BARS WHICH MAY BE GRADE 40 OR GRADE 60. MINIMUM COVER 3 INCHES WHERE CONCRETE CAST AGAINST EARTH, 2 INCHES FOR #6 THROUGH #11 OR 1 1/2 INCHES FOR #5 AND SMALLER BARS WHERE CONCRETE SURFACE IS EXPOSED TO EARTH BACKFILL OR WEATHER U. N O. (UNLESS NOTED OTHERWISE).

B.) ALTERNATE WELDED WIRE FABRIC REINFORCEMENT: WELDED DEFORMED WIRE FABRIC, FY = 80,000 PSI, CONFORMING TO AASHTO M 55 OR M 221, LAPS AND CLEARANCES PER AASHTO OR ACI, WHICHEVER APPLIES.

7.) REINFORCING BENDS AND LAPS: BENDS AND HOOKS SHALL CONFORM TO A. C. I. STD. 315-80 U. N. O. BEND DIMENSIONS ARE FROM OUT TO OUT AND LAPS SHALL BE 40 BAR DIAMETERS MINIMUM U. N. O. W.W.F. LAPS 1'-0" MIN. U. N. O.

8.) CONCRETE AND SHOTCRETE:

A.) SHOTCRETE: FC' = 4,000 PSI @ 28 DAYS MIXED FOR AND PLACED BY THE WET MIX PLACEMENT PROCESS.

B.) CONCRETE: FC' = 3,000 PSI @ 28 DAYS.

C.) ALL EXPOSED SHOTCRETE SURFACES SHALL BE FINISHED

9.) WORKMANSHIP: CHAMFER EXPOSED CORNERS 3/4 INCHES U. N. O. FINISH EXPOSED CONCRETE SURFACES PER STANDARD SPECIFICATIONS.

10.) SCALE: DO NOT SCALE DIMENSIONS FROM THE DRAWINGS.

11.) CURING: AFTER SPRAY ON CURING COMPOUND HAS BEEN APPLIED AND SHOTCRETE HAS TAKEN SET TO ALLOW FOOT TRAFFIC, ARCH BARRELS SHALL BE COVERED WITH 6 MIL CLEAR OR BLACK POLYETHYLENE SHEETING SECURED AGAINST WIND UPLIFT. SHEETING SHALL BE LEFT IN PLACE DURING BACKFILLING.

12.) STRIPPING: FORMS MAY BE STRIPPED AFTER AN EIGHT HOUR INITIAL SET OR WHEN, IN THE OPINION OF THE ENGINEER, THE SHOTCRETE HAS TAKEN ADEQUATE SET TO ALLOW STRIPPING TO TAKE PLACE. BACKFILLING MAY PROCEED WHEN ARCH SHOTCRETE CYLINDER STRENGTH HAS REACHED F'c=1,500 PSI OR WHEN, IN THE OPINION OF THE ENGINEER, THE ARCH SHOTCRETE HAS TAKEN ADEQUATE SET TO ALLOW BACKFILLING TO PROCEED.

13.) BACKFILLING:

A.) BACKFILL SHALL BE PLACED IN NO GREATER THAN ONE FOOT LIFTS WITH NO GREATER THAN A ONE FOOT DIFFERENTIAL IN BACKFILL HEIGHT TO EACH SIDE OF ANY INDIVIDUAL ARCH. NO EQUIPMENT HEAVIER THAN A RUBBER TIRED THREE YARD CAPACITY FRONT END LOADER IS PERMITTED TO PASS OVER THE STRUCTURE UNTIL THE BACKFILL, AS SPECIFIED, IS COMPLETE IN PLACE. SCRAPERS AND OTHER SUCH HEAVY EQUIPMENT SHALL NOT BE ALLOWED TO PASS OVER THE STRUCTURE UNLESS SPECIFIC PERMISSION IN WRITING IS ISSUED BY THE ENGINEER.

B.) DENSITY: 95% OF STD. PROCTOR MAXIMUM DENSITY AS DETERMINED BY ASTM D-698.

C.) BACKFILL ZONE: THE BACKFILL ZONE SHALL EXTEND OUT TO THE LESSOR OF 1.5 TIMES THE ARCH SPAN FROM THE OUTSIDE EDGE OF THE ARCH OR THE DISTANCE TO THE ADJACENT SLOPED NATIVE MATERIAL. THIS ZONE SHALL EXTEND UPWARD TO THE HEIGHT OF THE PAVEMENT SUBGRADE.

D.) MATERIALS: NATIVE AND IMPORTED GRANULAR SOILS WITH MAXIMUM EXPANSIVE POTENTIALS OF 1.8% AND A MAXIMUM PARTICLE SIZE OF 3".

E.) PROVIDE POSITIVE DRAINAGE (DAYLIGHT) AWAY FROM SITE. REMOVE WATER SOFTENED MATERIAL FROM BENEATH SLABS OR FOOTINGS.

14.) WEEP DRAINS: ONE AND ONE HALF INCH DIAMETER HOLES SHALL BE PLACED IN THE INVERT BETWEEN ARCH BARRELS AT 4 FOOT CENTERS TO DRAIN THE FILL BETWEEN THE ARCH BARRELS. THE HOLES MAY BE EITHER DRILLED INTO THE SHOTCRETE OR PLACED AS 1 1/2" DIA SHED 40 PVC PIPE. AREA AROUND THE INLET TO THE HOLES SHALL BE COVERED WITH FILTER FABRIC EXTENDING AT LEAST ONE FOOT TO EACH SIDE OF EACH HOLE.

15.) USE TABLE BELOW IF REBAR HAS 'SOFT' METRIC DESIGNATIONS.

NOTE: WHEN USING REINF. WITH
METRIC BAR NUMBERS:
#3 = #9 (METRIC)
#4 = #13 (METRIC)
#5 = #16 (METRIC)
#6 = #19 (METRIC)

TW=TOP OF WALL
TF=TOP OF FOOTING

WATSON ENGINEERING
CONSULTING ENGINEERS
2450 WEST POPPY AVENUE
TUCSON, ARIZONA 85705
PH: (520) 888-6468
FAX: (520) 292-6974

CON-ARCH

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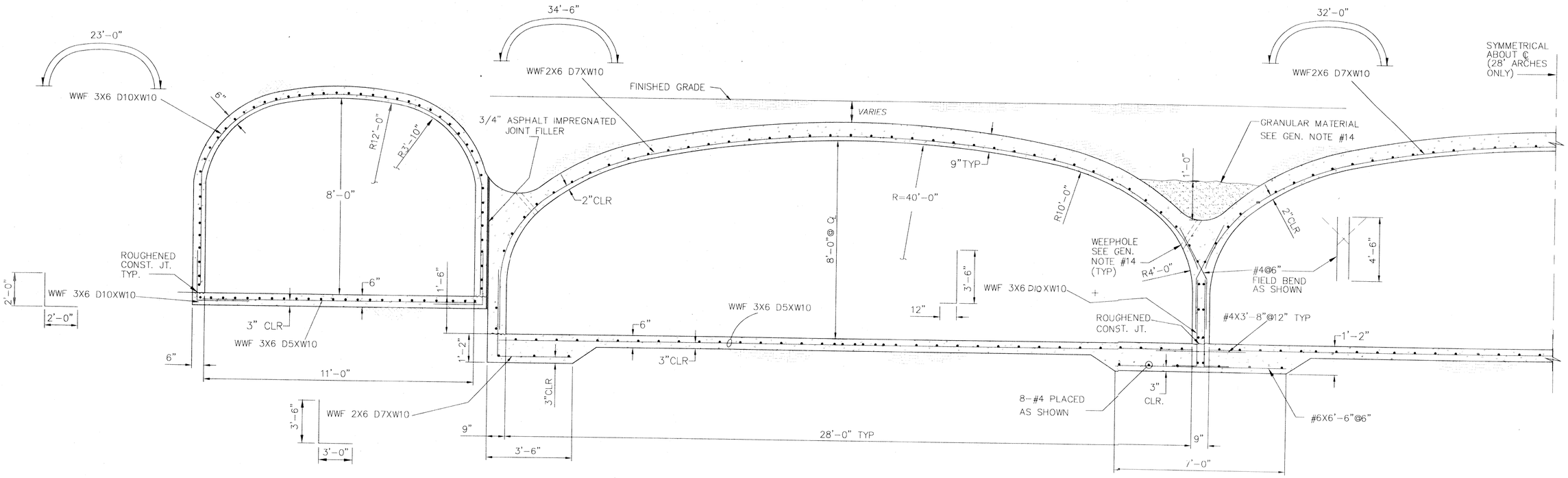
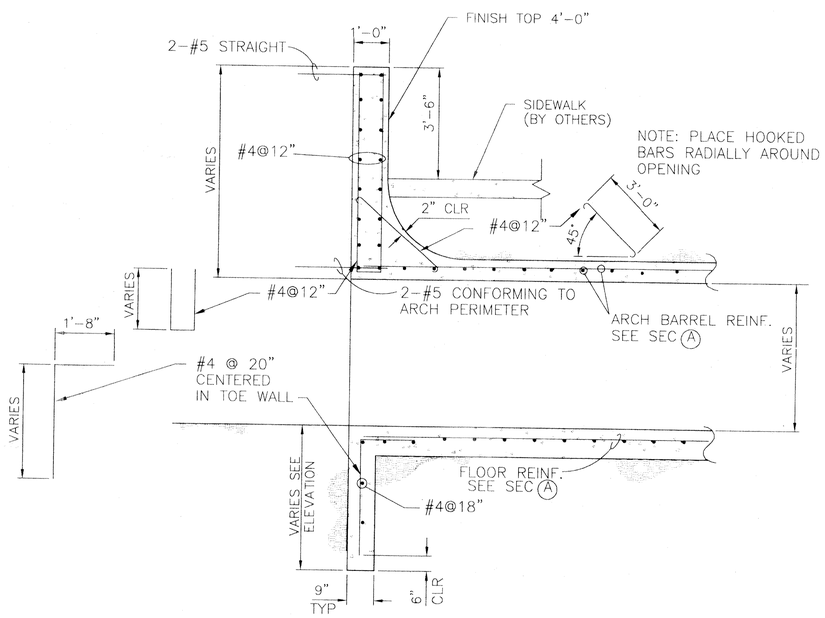
POWER RANCH INFRASTRUCTURE
ARCH-CULVERT DETAILS
CITY OF GILBERT, ARIZONA

Dsgn:	TAS
Drwn:	ATS
Rvsd:	—
Chk:	TAS
Date:	3/13/98
SCALE:	AS NOTED
SHEET NO.	Proj. No.
1 OF 2	98009



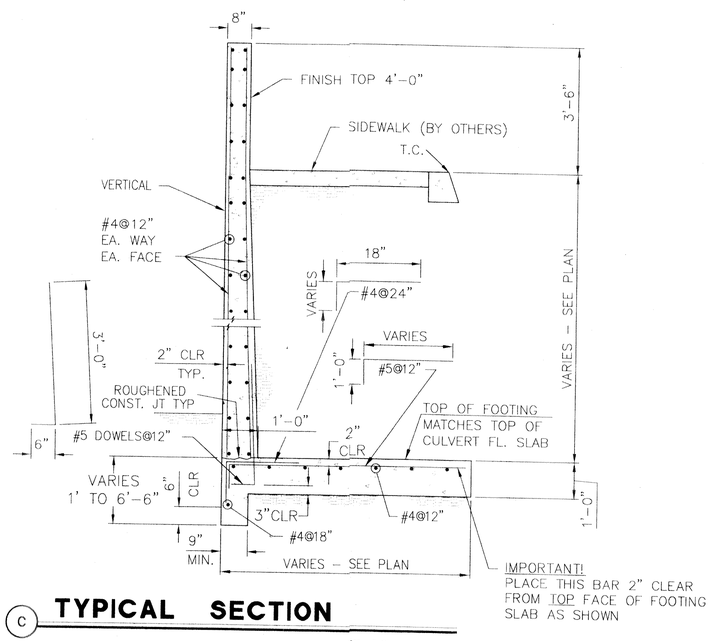
(A) TYPICAL SECTION

1/2" = 1'-0"



(B) TYPICAL SECTION

1/2" = 1'-0"



(C) TYPICAL SECTION

1/2" = 1'-0"

WATSON ENGINEERING
CONSULTING ENGINEERS
2450 WEST POPPY AVENUE
TUCSON, ARIZONA 85705
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CON-ARCH

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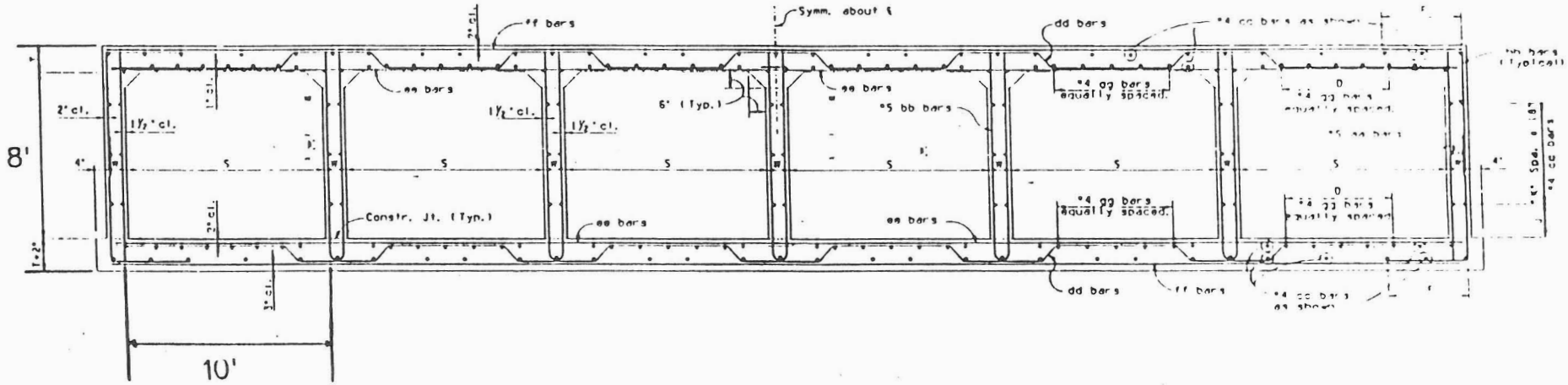
POWER RANCH INFRASTRUCTURE
ARCH-CULVERT DETAILS

CITY OF GILBERT, ARIZONA

Dsgn:	TAS
Drwn:	ATS
Rvsd:	–
Chk:	TAS
Date:	3/13/98
SCALE:	AS NOTED
SHEET NO.	Proj. No.
2 OF 2	98009

Appendix K

CONSTRUCTION DRAWINGS FOR PROPOSED CULVERT AT RECKER ROAD



PROPOSED RECKER ROAD BRIDGE

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

SIX BARREL
BOX CULVERT

FIGURE 1

JOB NO
610002-02

RECKER ROAD BRIDGE
CONSTRUCTION DRAWING

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

QUEEN CREEK
CHANNEL IMPROVEMENT

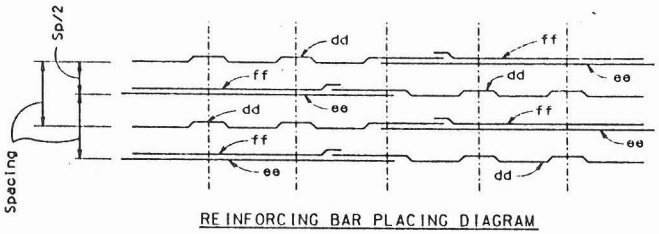
COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

FILE: Q:\610002\LAND\SDMAP .DGN DATE: 8-97

TABLE I
0'-10" FILL

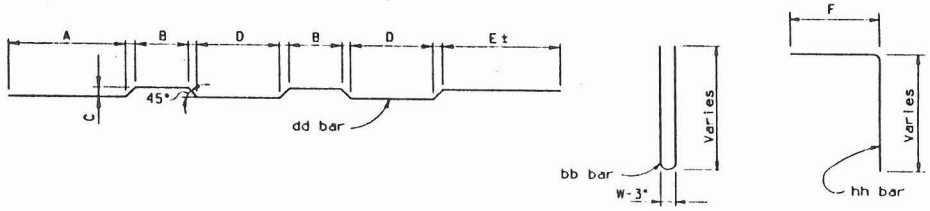
Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number*	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	dd E	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number*	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	9½"	8"	12"	4'-4	12"	8'-9	128	5	14"	26'-2	4'-7	2'-7	6½"	3'-1	6'-9	5	14"	20'-9	5	14"	16'-0	48	4	7"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	142	5	14"	26'-2	4'-7	2'-7	6½"	3'-1	6'-9	5	14"	20'-9	5	14"	16'-0	48	4	7"	5'-7	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	142	5	14"	26'-2	4'-7	2'-7	6½"	3'-1	6'-9	5	14"	20'-9	5	14"	16'-0	48	4	7"	6'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	156	5	14"	26'-2	4'-7	2'-7	6½"	3'-1	6'-9	5	14"	20'-9	5	14"	16'-0	48	4	7"	6'-7	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	170	5	13"	26'-2	4'-7	2'-7	6½"	3'-1	6'-9	5	13"	20'-9	5	13"	16'-0	48	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	12"	4'-4	12"	8'-9	128	6	14"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	14"	27'-0	6	14"	21'-0	96	6	7"	5'-6	2'-6
	4'	9½"	9"	12"	5'-4	12"	10'-9	142	6	14"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	14"	27'-0	6	14"	21'-0	96	6	7"	6'-0	2'-6
	5'	9½"	9"	12"	6'-4	12"	12'-9	142	6	14"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	14"	27'-0	6	14"	21'-0	96	6	7"	6'-6	2'-6
	6	9½"	9"	12"	7'-4	12"	14'-9	156	6	14"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	14"	27'-0	6	14"	21'-0	96	6	7"	7'-0	2'-6
	7'	9½"	9"	12"	8'-4	12"	16'-9	170	6	13"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	13"	27'-0	6	13"	21'-0	96	5	6½"	7'-5	2'-6
	8'	9½"	9"	12"	9'-4	12"	18'-9	170	6	13"	33'-9	6'-1	3'-8	6½"	4'-2	8'-7	6	13"	27'-0	6	13"	21'-0	96	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	12"	4'-6	12"	9'-2	128	7	17"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	6	17"	33'-6	7	17"	26'-6	132	6	8½"	6'-1	3'-0
	4'	10½"	11"	12"	5'-6	12"	11'-2	142	7	17"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	6	17"	33'-6	7	17"	26'-6	132	6	8½"	6'-7	3'-0
	5'	10½"	11"	12"	6'-6	12"	13'-2	142	6	12"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	5	12"	33'-6	6	12"	26'-6	132	5	6"	6'-8	2'-8
	6'	10½"	11"	12"	7'-6	12"	15'-2	156	6	12"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	5	12"	33'-6	6	12"	26'-6	132	5	6"	7'-2	2'-8
	7'	10½"	11"	12"	8'-6	12"	17'-2	170	7	15"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	5	15"	33'-6	7	15"	26'-6	132	6	7½"	7'-9	2'-8
	8'	10½"	11"	12"	9'-6	12"	19'-2	170	7	15"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	5	15"	33'-6	7	15"	26'-6	132	6	7½"	8'-3	2'-8
	9'	10½"	11"	12"	10'-6	12"	21'-2	184	7	15"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	6	15"	33'-6	7	15"	26'-6	132	6	7½"	8'-9	2'-8
	10	10½"	11"	12"	11'-6	12"	23'-2	198	7	14"	42'-3	7'-7	4'-8	7½"	5'-2	11'-1	5	14"	33'-6	7	14"	26'-6	132	6	7"	9'-3	2'-8
12	8'	12½"	13"	12"	9'-10	12"	20'-0	170	7	13"	50'-8	9'-1	5'-6	9½"	6'-2	13'-3	5	13"	40'-0	7	13"	31'-8	156	6	6½"	8'-7	2'-10
	9'	12½"	13"	12"	10'-10	12"	22'-0	184	8	16"	50'-8	9'-1	5'-6	9½"	6'-2	13'-3	5	16"	40'-0	8	16"	31'-8	156	6	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	198	8	16"	50'-8	9'-1	5'-6	9½"	6'-2	13'-3	5	16"	40'-0	8	16"	31'-8	156	6	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	198	7	12"	50'-8	9'-1	5'-6	9½"	6'-2	13'-3	6	12"	40'-0	7	12"	31'-8	156	6	6"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	214	7	12"	50'-8	9'-1	5'-6	9½"	6'-2	13'-3	5	12"	40'-0	7	12"	31'-8	156	6	6"	10'-7	2'-10

*Total number of bars in the cross-section.

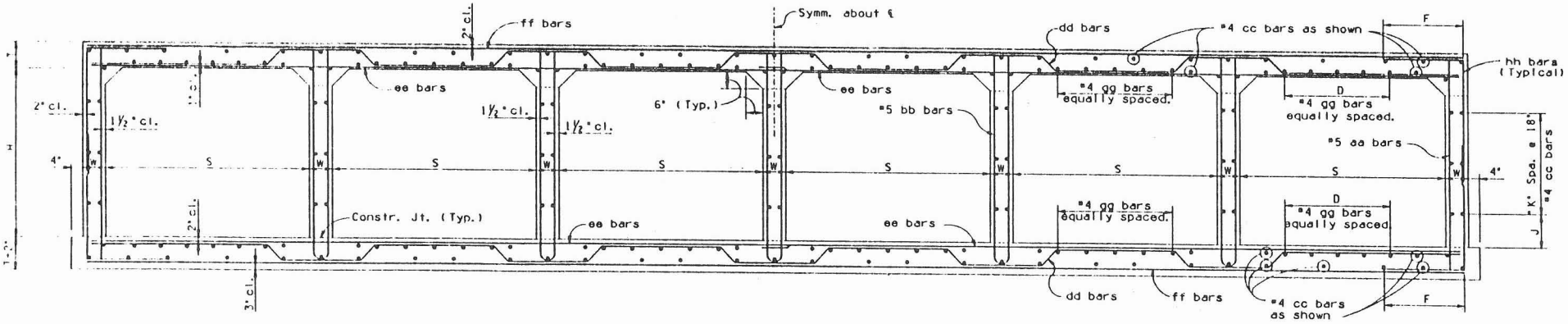


REINFORCING BAR PLACING DIAGRAM

Span "S"	Height "H"	"J" Dim.	"K" Spaces
6'	3'	9"	1
	4'	3"	2
	5'	12"	2
	6'	9"	3
	7'	3"	4
8'	8'	12"	4
	9'	9"	5
10'	10'	3"	6
	11'	12"	6
12'	12'	9"	7



BENDS



TYPICAL SECTION

NOTE:
See B-02.65 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 4-92
APPROVED FOR DISTRIBUTION	SIX BARREL BOX CULVERT	STANDARD NO. B-02.60

Appendix L

EXISTING LEVEE EVALUATION BY WESTERN TECHNOLOGIES, INC.

Western Technologies Inc.
The Quality People
Since 1955

737 East Broadway Road
Phoenix, Arizona 85040-2966
(602) 437-3737 • fax 470-1341

Job: 41000201 -12
Date: 11/13/97
Correspondence
Transmittal
Survey/Description
Notes
404 permit
CR

RECEIVED
NOV 13 1997
COE & VAN LOO
PHOENIX, AZ

November 5, 1997

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014

Attn: George J. Geiser, P.E.

Re: Existing Levee Evaluation
Queen Creek West of Power Road
Gilbert, Arizona

Job No. 2127JI314

In accordance with your request and authorization, we have completed the geotechnical evaluation of the existing north and south levees along Queen Creek, west of Power Road. This letter presents the results of our evaluation, along with our conclusions.

PROJECT DESCRIPTION

Queen Creek has been channelized in the area west of Power Road, near the town of Gilbert, Arizona. There are existing earthen levees that bound the north and south sides of the creek. The levees appear to have been constructed with nearby soil, and are approximately 10 to 12 feet high. The inclination of the levees varies, and is between 2 and 4 horizontal to 1 vertical. The levees are covered with a small amount of vegetation, and have areas where erosion and minor sloughing has occurred.

SCOPE OF WORK

The scope of work for this study included the excavation of two test pits. The test pits were excavated to depths of 7 and 9 feet, and were at the approximate locations shown on the attached Plate 1. A log was prepared for each pit. The logs describe the soils encountered, their thicknesses, and the depths where samples were collected. The logs are included as Plates 2 and 3.

The in-situ density and moisture content of the soil exposed in the test pits was measured as the pits were excavated using a nuclear density gauge. Laboratory analyses was performed on a representative soil sample to determine the maximum dry density and optimum moisture content as specified in ASTM Standard D1557. The maximum dry density was then compared to the existing in-situ density of the levees.

The relative density of the soil exposed in the levees and below the levees was also evaluated using a dynamic cone penetrometer. The dynamic cone penetrometer was use in accordance with ASTM Special Technical Publication 399 at several elevations within the levee fill, and at the native soil interface below the levee.

The soil samples from the levee were also subjected to crumb and modified pinhole dispersion tests (ASTM D4647). All testing was generally performed in accordance with applicable ASTM specifications.

Our scope of work also included a surficial reconnaissance of the levee from the area west of Power Road to approximately the Recker Road alignment. We also reviewed recent and historical aerial photographs of Queen Creek in the subject area.

SOIL CONDITIONS

The test pits were excavated within the side of the levee facing the wash. The pits penetrated the levee material and encountered the native soil below the levees. It should be noted that the test pits in the levees were backfilled as engineered fill. The fill was placed in lifts, and observed and testing by an engineering technician with Western Technologies. The fill was compacted to densities in excess of the in-situ density, and to approximately 90 percent of the dry density as determined by ASTM D1557.

The levee soils consisted of tan-brown, loose to medium dense silty sands with some gravels. Test Pit No. 1 also encountered a coarse sand and gravel from a depth of 2 to 6 feet. Underlying the levee fill is a native, clayey sand that is dark brown and dense.

The maximum dry density of the levee soil was determined in accordance with ASTM D1557 to be 124 pcf with an optimum moisture content of 10.5 percent. Based on this maximum dry density, the in-situ densities of the levee fill, as presented on the logs, are extremely low. The results of the dynamic cone penetrometer also indicated that the levee fills are loose, and are not well compacted.

The results of the crumb testing and the modified pinhole tests indicate that the soil is not dispersive. The soil from the levee fill classified as ND3 to ND2, in accordance with the ASTM Test D4647.

Several sloughs and areas of erosion were noted within the levees. These appeared to have occurred over an extended period of time. The top elevation of the levees were variable, possibly indicating settlement of the levees or variations that may have occurred during construction or repair. We understand from Coe & Val Loo Consultants, Inc. that the levees have been breached during previous flood events.

CONCLUSIONS

Based on the results of the geotechnical work performed as part of this evaluation, it is our opinion that the existing levees were not constructed in accordance with the current standard of practice for flood control levees. The variability in the density of the levee fill, the slope inclinations, height, and width, all impact the potential for failure of the levees during extreme flow events.

Based on a preliminary stability analysis, using an estimated angle of internal friction of 28 degrees and no cohesion, and assuming the levee fill is saturated, the factor of safety against shallow slope stability failures is only slightly above 1.0, and well below 1.5. Typically, a minimum factor of safety of 1.5 would be required for any flood control levee or levee.

During flood events, the existing levees could be subjected to fairly high hydraulic gradients. While the levee soil is not dispersive, it is possible that the levee could undergo erosion or minor piping, thus further reducing the factor of safety against slope failure.

LIMITATIONS

The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon conditions at the location of specific tests, observations and data developed to satisfy the scope of services defined by the contract documents. Work on your project was performed in accordance with generally accepted industry standards and practices by professionals providing similar services in this locality. No other warranty, express or implied, is made.

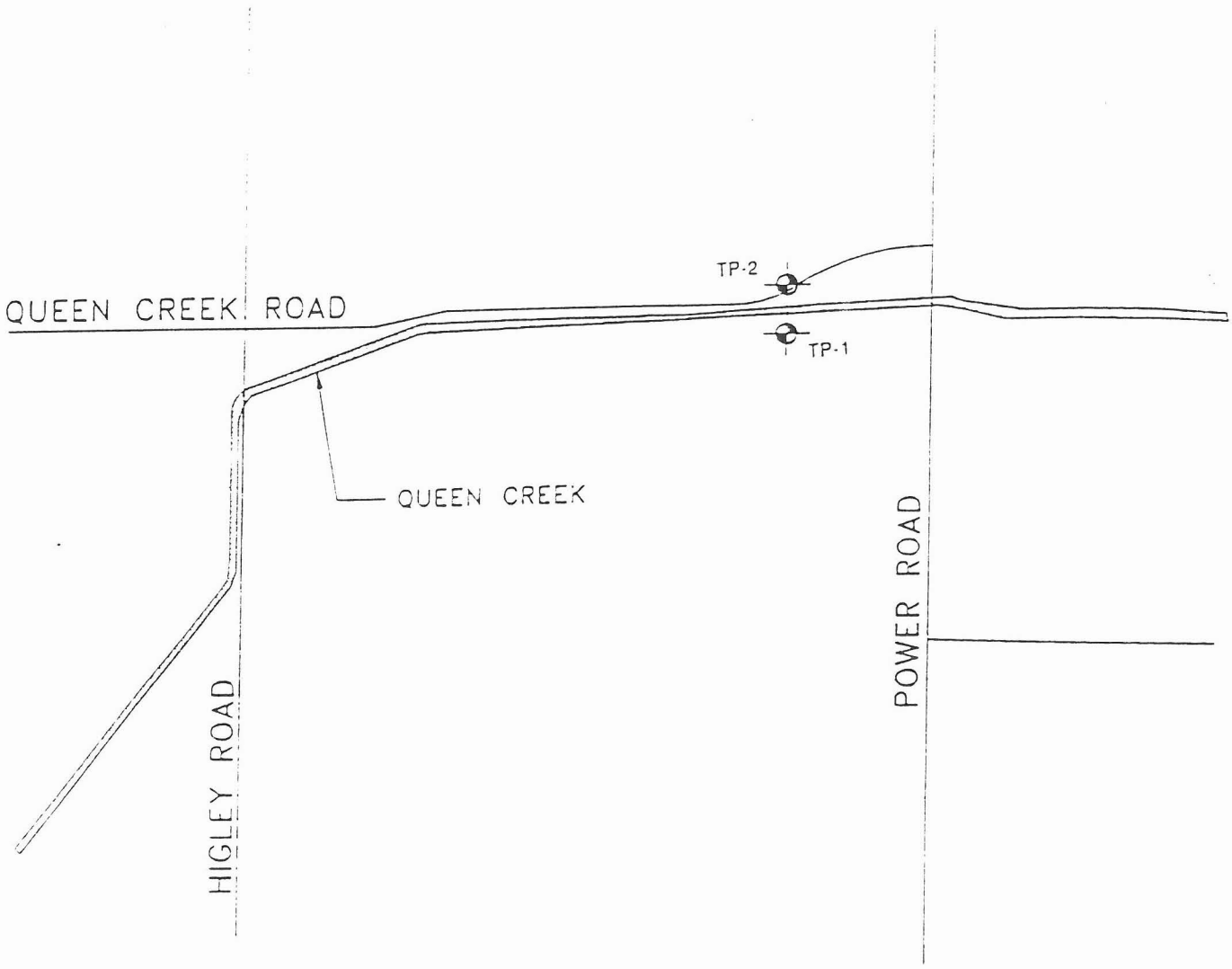
Variations from the field conditions represented by the pits may become evident during future investigations. If variations appear, we should be contacted to reevaluate our conclusions. We believe the findings in our report address the requirements for this project and are responsive to your concerns.

We appreciate the opportunity to be of service. Should you have any questions regarding this report, please contact me at 437-3737.

Respectfully submitted,
WESTERN TECHNOLOGIES INC.

Jeff M. Boyd, P.E.
Geotechnical Engineer

Randolph [illegible] P.E.
Principal



LEGEND

APPROXIMATE LOCATION OF TEST PIT

N

NOT TO SCALE

QUEEN CREEK LEVEE EVALUATION

Test Pit Location Diagram

Western Technologies Inc.

Job No.: 21270314

Plate:

EXPLORATION DATE: 10-29-1997

RIG TYPE: Case 580

BUCKET SIZE: 18"

TEST PIT NO. 1

LOCATION: See Plate 1

ELEVATION: Not Determined

FIELD ENGR: R. Marwig

WATER CONTENT (%)	DRY DENSITY (LBS/CU.FT)	SAMPLE TYPE	SAMPLE	DEPTH (FT.)	USCS	GRAPHIC	SOIL DESCRIPTION
9.7	95	G			SM		SILTY SAND; with gravel, tan-brown, loose to medium dense, slightly moist
4.7	88	G					
					SP		SAND; with gravel, brown, medium dense, slightly moist
6.4	101	G		5			
					SC		CLAYEY SAND; brown to dark-brown, dense, slightly moist
							Stopped At 7 Feet
				10			
				15			
				20			

GROUNDWATER ENCOUNTERED NO: X YES ____ DEPTH ____ DATE: 10-29-1997

NOTES

GLEEN CREEK LEVEE EVALUATION

Test Pit Log

Western Technologies Inc.

Job No.: 2127JI314 Plate: 2

THE DATA PRESENTED APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

Appendix M

DISKETTE OF COMPUTER MODELS