Scour Evaluation for Pipeline Crossing of Tuthill Dike Wash at McDowell Road

Maricopa County, Arizona

WEST CONSULTANTS, INC.

Water • Environmental • Sedimentation • Technology

Hydraulics • Hydrology • Sedimentation • Water Quality • Erosion Control • Environmental Services

Scour Evaluation for Pipeline Crossing of Tuthill Dike Wash at McDowell Road

Maricopa County, Arizona

Prepared for:

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August 2007

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 8/20/07
ARIZONA, U.S.A.

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INTRODUCTION

WEST Consultants, Inc. (WEST) was retained by Sunrise Engineering, Inc. to conduct a scour evaluation for a 6-inch natural gas pipeline crossing of Tuthill Dike Wash at a location just north of McDowell Road. The McDowell Road crossing of Tuthill Dike Wash lies in the Section 31 of T2N R2W in Maricopa County, Arizona. The project location is shown in Figure 1.

In its natural condition, Tuthill Dike Wash and Bulldozer Wash conveyed flows from the north in a southerly and a southeasterly direction, respectively, into McDowell Basin, which is an existing storage pit located northwest of the McDowell Road and Tuthill Dike Road intersection. In the initial stages of the Verrado Master Plan, Bulldozer Wash was re-aligned and channelized to accommodate future residential parcels. The new channel alignment was still referred to as Bulldozer Wash and it still flows into McDowell Basin. Flows leaving McDowell Basin continue to flow along Tuthill Dike Wash in a southern direction towards I-10. The retention basin is a key element of the Verrado Master Drainage Plan where Tuthill Dike Wash and Bulldozer Wash drain directly into it. The McDowell Basin's location is shown in the *Verrado Planning Unit Drainage Plan for Portions of Planning Unit V (Phase 3 North – South of Tractor Wash and Intrawest Resort) and Update to Master Drainage Plan* (Wood, Patel and Associates, Inc., 2006). The proposed natural gas pipeline crosses the Tuthill Dike Wash north of the newly realigned McDowell Road (see Figure 1).

DATA COLLECTION

The outflow of McDowell Basin flows into Tuthill Dike Wash, where the flow immediately crosses under McDowell Road through two temporary 5-foot culverts (see Figure 2). From there, Tuthill Dike Wash continues to flow south under I-10 (see Figure 3).

Tuthill Dike Wash is a sand and gravel bed channel (see Figure 4). The particle size distribution at the proposed pipeline location was not available; however, information regarding the particle size distribution of the bed material near the study area could be found in the report *Results of Geotechnical Engineering Services, Verrado-Bulldozer Wash, Thomas Road to Waste Water*

Treatment Plant (Geotechnical and Environmental Consultants, Inc., 2005). Their field exploration included the excavation of six exploratory test pits (Nos. TP-1 through TP-6) along Bulldozer Wash. The approximate locations of the exploratory test pits are shown on Figure 5. The project site is very close to the exploratory test pits TP-5 and TP-6. Laboratory tests were performed by Geotechnical and Environmental Consultants, Inc. on the field exploration samples to obtain the information about the existing soil conditions. The laboratory results are presented in Appendix A. In summary, the D_{50} of the bed material for TP-5 was 1.1 mm (0.0-3.0 ft depth) and 0.4 mm (3.0-10.0 ft depth). The D_{50} of the bed material for TP-6 was 1.3 mm (0.0-5.0 ft depth) and 4.1 mm (5.0-10.0 ft depth). Based on field observations, the bed material in the study area ranges from coarse gravel to very fine sand (see Figure 4). Thus, the laboratory test results are consistent with field observation.

In the area where the proposed natural gas pipeline crosses the Tuthill Dike Wash, the banks do not contain engineered gravels and rocks (i.e., raprap) to prevent bank erosion during flood events. Therefore, it was assumed that the channel banks have the same erosion potential as the native bed material.

Figure 1. Project location map

Figure 2. Two 5-foot culverts at McDowell Road

Figure 3. Tuthill Dike Wash looking downstream from McDowell Road

Figure 4. Tuthill Dike Wash bed material near McDowell Road

HYDROLOGY

The base model for computation of the hydrology was provided by the Flood Control District of Maricopa County (FCDMC) from the *Loop 303 Corridor/White Tanks Area Drainage Master Plan Update* report (URS, 2001). The proposed condition land use plan, as prepared by EDAW for the entire Verrado development, was incorporated into the base model to determine the discharges for the future development. The scour analysis for this study was conducted only for the 100-year discharge. The 100-year discharge leaving the McDowell Basin along the Tuthill Dike Wash was 5,399 cfs, which was obtained from *Verrado Planning Unit Drainage Plan for Portions of Planning Unit V (Phase 3 North – South of Tractor Wash and Intrawest Resort) and Update to Master Drainage Plan* (Wood, Patel and Associates, 2006).

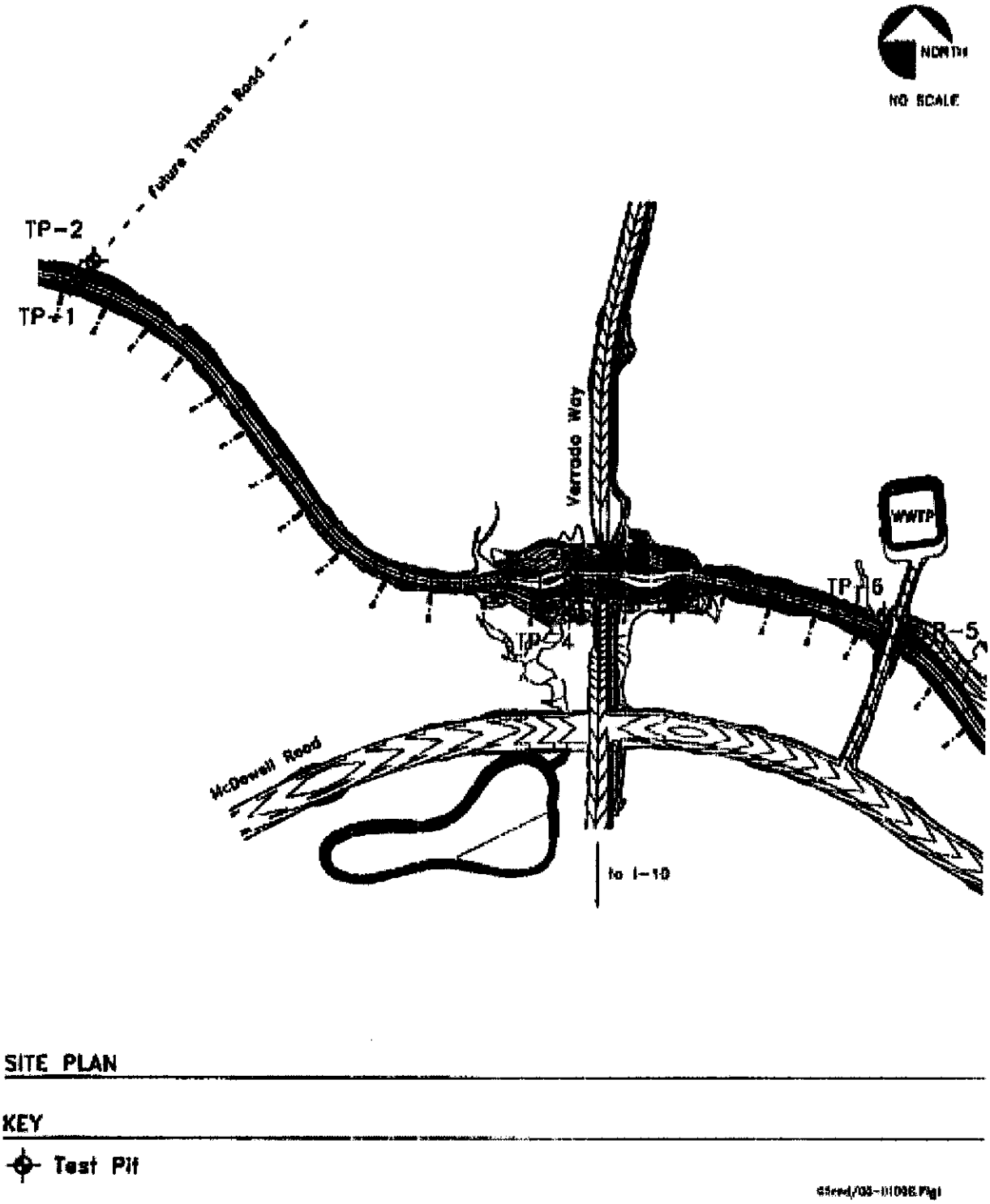

Figure 5. Exploratory test pits (Geotechnical and Environmental Consultants, Inc., 2005)

HYDRAULICS

The US Army Corps of Engineers' River Analysis System standard-step backwater computer program (HEC-RAS, Version 3.1.3) was used to the compute channel hydraulics (USACE 2005). The hydraulic model for the Tuthill Dike Wash was originally developed by FEMA and it was reviewed by WEST. Small corrections were made to the model, which included:

- The newly aligned McDowell Road crossing and culverts were added.
- The cross-sections for Tuthill Dike Wash were update based on the existing topography, which was obtained from Wood, Patel, and Associates, from the McDowell Basin to I-10.
- Ineffective flow areas were added around the culverts and at appropriate locations along Tuthill Dike Wash from McDowell Basin to I-10.
- The Manning *n*-values in the areas around the new McDowell Road culvert were increased to account for the large rocks that were scattered around the entrance and exit of the culverts.

The revised hydraulic model was used in the scour calculations. In the FEMA model, the Manning *n*-value used for the main channel in the hydraulic model of Tuthill Dike Wash ranges from 0.016 to 0.030. Based on the field survey, the Manning *n*-value of the cross-sections around McDowell Road was increased to 0.045 due to the large rocks and cobbles that were placed around the entrance and exit of the culverts (see Figure 2).

SCOUR CALCULATIONS

The proper consideration of scour at a site requires a determination of the total scour. Total scour refers to the total depth of scour at a given location and is the sum of all scour components that apply to the site of interest. These scour components can include:

- General scour or contraction scour
- Bedform scour
- Bend scour
- Local scour
- Long-term degradation
- Low-flow incisement scour

Two conditions were considered in determining the total scour depth.

Condition 1 (Failure of Culverts)

Downstream of the McDowell Basin, water will flow through and over the two culverts at McDowell Road. As mentioned earlier, the two culverts are temporary and they will be replaced when McDowell Road is updated in 2012. Unfortunately, design information does not exists for the proposed McDowell Road crossing. The existing culverts can only convey a small portion of the 100-year flood discharge of 5,399 cfs. Thus, a large portion of the 100-year flood discharge will overtop McDowell Road. The overtopping flow will create a scour hole downstream of the crossing. Because the culverts are not protected from being undermined, there is a high potential for the scour hole to migrate upstream and completely wash out the road and culverts. For this condition, the total scour for the pipeline crossing was determined by considering the local scour and long-term degradation components.

A factor of safety may be applied to account for uncertainty of the data, degree of variability of the channel conditions, level of risk, etc. The factor of safety may be applied to some or all of the scour components. A factor of safety of 1.3 was assumed for this study. However, in this study, the local scour component was calculated based on a conservative worst-case scenario. So, a factor of safety of 1 was used for this scour component.

Local Scour

Local scour is the scour that results from an obstruction and abrupt change in the direction of flow. Local scour is caused by an acceleration of flow and resulting vortices induced by the obstruction. It occurs at bridge piers, abutments, embankments, and other structures obstructing the flow.

The proposed gas pipeline crossing of Tuthill Dike Wash will be located just upstream of McDowell Road. As previously mentioned, the 100-year flood will overtop the temporary McDowell Road crossing and create a large local scour hole downstream of the crossing. This scour hole has a high potential to migrate upstream and wash out the McDowell Road crossing. To conservatively estimate the local scour under this scenario, the local scour hole that would develop downstream of the crossing was assumed to migrate upstream to the location of the

proposed gas pipeline crossing. The local scour downstream of the crossing was estimated using the equation developed by the U.S. Bureau of Reclamation (1977) for an unsubmerged drop:

$$Z_{lsf} = 1.32q^{0.54} H_t^{0.225} - TW$$

where: Z_{lsf} = Depth of local scour due to a free-overfall drop, in feet, measured below the streambed surface downstream of the drop;

q = Discharge per unit width of the channel bottom, in cubic feet per second per foot;

H_t = Total drop in head, measured from the upstream energy grade line to the downstream energy grade line, in feet; and

TW = Tailwater depth (difference between downstream water-surface elevation and downstream channel bottom elevation), in feet.

Figure 6 shows the relationship of the parameters defined in the above equation.

The HEC-RAS hydraulic model for Tuthill Dike Wash from FEMA was revised to include cross-sections (1.24 and 1.22) at the upstream and downstream of the McDowell Road crossing for the scour elevation. Hydraulic characteristics from these cross sections were used in the scour analysis.

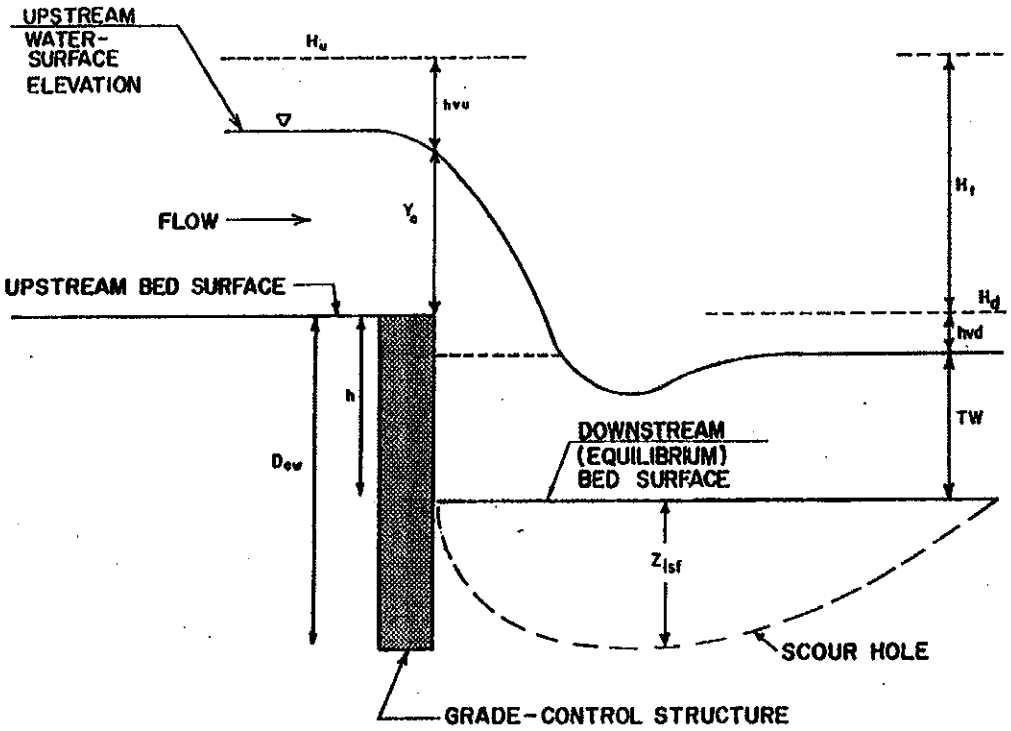

Figure 6. Depth of scour below a free overfall (USBR, 1977)

For this study, the design discharge, Q, is the 100-year discharge (5,399 cfs), and the width of the McDowell Road contributing flow to the downstream channel is approximately 100 feet. Thus, the discharge per unit width of the channel bottom was approximately 54.0 cfs/ft.

Based on the HEC-RAS model results, the upstream energy elevation will be 1101.76 feet, downstream energy elevation will be 1096.11 feet, and downstream water surface elevation will be 1094.67 feet (and the elevation of the channel bed downstream of the culverts is 1085.63 feet). Therefore, the total drop in head and tailwater depth were computed to be 5.65 feet and 9.04 feet, respectively:

$$H_t = 1101.76 - 1096.11 = 5.65 \text{ feet}$$

$$TW = 1094.67 - 1085.63 = 9.04 \text{ feet}$$

Then, the depth of local scour below the drop should be computed as:

$$Z_{lsf} = 1.32(54.0)^{0.54}(5.65)^{0.225} - 9.04 = 7.8 \text{ feet}$$

Since the proposed nature gas pipeline will be located upstream of the McDowell Road crossing and there is a high potential for the McDowell crossing to wash out, the local scour below the drop was extended upstream to the proposed pipeline location. The elevation of the channel bottom upstream of the culverts is 1088.13 feet., which is 2.5 feet higher than the elevation of the channel bed downstream of the culverts. Thus, the local scour depth was estimated to be 10.3 feet (i.e., 7.8 + 2.5).

Long-Term Degradation

Long-term degradation can often be evaluated using equilibrium, or stable, slope analysis and/or historic cross-section data. A stable slope analysis can be utilized if there is an appropriate "pivot" point located a short distance downstream. There are four culverts that run underneath I-10 approximately ¼ of a mile downstream of the McDowell Road crossing. These culverts could serve as a "pivot" point if they had a concrete floor. However, a field investigation revealed that these culverts do not have a concrete floor and can not be used as a "pivot" point. Thus, a stable slope analysis was not utilized since the location of a stable or "pivot" point could not be identified with any degree of certainty downstream of the McDowell Road crossing.

Arizona State Standard 5-96 (ADWR, 1996) provides an equation for computing long-term degradation when no downstream controls exist within the channel system. The long-term degradation can be conservatively computed as follows:

$$y_{lts} = 0.02(Q_{100})^{0.6}$$

where: y_{lts} = long-term scour depth, in feet, and

Q_{100} = 100-year discharge, in cubic feet per second.

This equation should only be used for long-term degradation when no downstream controls exist within the channel. Using a 100-year discharge of 5,399 cfs, the long-term scour was calculated to be 3.5 feet:

$$y_{lts} = (0.02)(5{,}399)^{0.6} = 3.5 \text{ feet}$$

Using a factor of safety of 1.3, the long-term degradation, y_{lts}, was estimated to be 4.5 feet.

Total Scour

The total scour at the proposed pipeline crossing near McDowell Road on Tuthill Dike Wash is the sum of the local scour and long-term degradation, which is estimated to be 15 feet (10.3 feet + 4.5 feet ≈ 15 feet). Therefore, a burial depth of the crown of 15 feet below the thalweg of the channel is considered sufficient to protect the pipe from failure due to scour. This scour depth should be deep enough to allow the installation of the permanent culvert crossing for McDowell Road. Note that this evaluation does not take into account any local scour due to bridge piers and abutments that may exist in the future.

Condition 2 (Culverts Remain In-Place)

As described in Condition 1, the existing culverts can only convey a small portion of the 100-year flood discharge of 5,399 cfs. Thus, a large portion of the 100-year flood discharge will overtop McDowell Road. If the culverts and the road are not washed out, the scour depths should be calculated differently. In this case, local scour would not be included because it would not have migrated upstream of the culvert to the gas pipeline crossing location. Also, the proposed pipeline crossing of Tuthill Dike Wash is located in a straight section of the wash just upstream of the McDowell Road crossing. Thus, there would be no bend scour near the pipeline crossing, so this scour component was not considered in the determination of the total scour depth.

A factor of safety of 1.3 was used for all the scour components for this condition.

General Scour

General scour is the lowering of the streambed across the channel or stream over relatively short time periods (e.g., the general scour in a given reach after the passage of a single flood event). The lowering may be uniform across the bed or non-uniform (i.e., the depth of scour may be deeper in some parts of the cross-section).

General scour may result from concentration of the flow when the flow area of a stream is decreased from the normal either by a natural constriction or a manmade constriction (i.e., local encroachment, bridge, etc.). With the decrease in flow area there is an increase in average velocity and bed shear stress.

In this study, the general scour was computed by the Lacey's equation (1930), which is applicable to natural river systems and provided as follows:

$$y_{gs} = Zy_m = Z(0.47(\frac{Q}{f})^{\frac{1}{3}})$$

where: y_m = mean depth at design discharge;

Q = design discharge (cfs);

f = Lacey's silt factor = $1.76 \times D_m^{1/2}$;

D_m = mean grain size (mm);

y_{gs} = general scour depth (ft);

Z = multiplying factor, taken to be 0.25 for straight reaches.

For a median grain diameter of 1.1 mm (0.0036 feet), general scour was evaluated using the hydraulic parameters in the reach of Tuthill Dike Wash at the pipeline crossing (cross-section 1.24). The Lacey's silt factor at this location for the 100-year event was determined to be 1.85, and the corresponding general scour was calculated to be 1.7 feet:

$$y_{gs} = 0.25(0.47(\frac{5{,}399}{1.85})^{\frac{1}{3}}) = 1.68 \text{ feet}$$

Using a factor of safety of 1.3, the general scour was estimated to be 2.2 feet.

Since there are four median grain size diameters from the samples measured near the project site (TP-5 and TP-6), the general scour analysis was performed for all of median grain size diameters and results are shown in Table 1. The results indicate that the general scour is not sensitivity to the D_{50} value. To be conservative, the maximum calculated value of 2.5 feet was used as the adopted scour depth for the general scour component.

Table 1. General scour results for all D_{50} values

D_{50} (mm)	y_{gs} (ft)
1.1	2.2
0.4	2.5
1.3	2.1
4.1	1.8

Bedform Scour

For sand bed channels, natural or manmade, it is necessary to estimate the height of the bedforms moving through the channel. Dunes form in lower regime flow with antidunes forming in transitional or upper flow regime flow. A bedform trough is a component of total scour in this study. The Froude number in Tuthill Dike Wash at cross-section 1.24 for a 100-year event is approximately 0.3, which would indicate that the flow can be classified in the lower flow regime. The scour depth due to dunes is equal to one-half of the height of dunes.

$$y_{bedform} = 0.5 d_h$$

Dune height is estimated by the following equation from Simons and Senturk (1992):

$$d_h = 0.066 Y_h^{1.21}$$

where, $y_{bedform}$ = bedform scour;

d_h = dune height, in feet, and

Y_h = hydraulic depth of flow, in feet.

From the HEC-RAS model, the hydraulic depth of flow at the pipeline crossing is 7.8 feet. Therefore, the bedform scour was computed to be 0.4 feet.

$$y_{bedform} = 0.5(0.066(7.83)^{1.21}) = 0.40 \text{ feet}$$

Using a factor of safety of 1.3, the bedform scour was estimated to be 0.5 feet.

Long-Term Degradation

The details of computation of long-term degradation have been introduced in Condition 1. In summary, the long-term degradation is calculated with following equation:

$$y_{lts} = 0.02(Q_{100})^{0.6}$$

where: y_{lts} = long-term scour depth, in feet, and

Q_{100} = 100-year discharge, in cubic feet per second.

Using a 100-year discharge of 5,399 cfs, the long-term scour was calculated to be 3.5 feet:

$$y_{lts} = 0.02(5{,}399)^{0.6} = 3.5 \text{ feet}$$

Using a factor of safety of 1.3, the long-term degradation was estimated to be 4.5 feet.

Low-flow Incisement Scour

The normal irregularities in the bed of a watercourse (i.e., Tuthill Dike Wash) could result in a low-flow channel. That channel is formed by the predominance of a low-flow condition or due to low-flows that persist after a flood. The magnitude of low-flow incisement scour can be estimated as no less than 1 foot and possibly in excess of 2 feet (FCDMC, 2007). In this study, the low-flow incisement scour was assumed to be 2.0 feet. Using a factor of safety of 1.3, this scour component is computed as 2.6 feet.

Total Scour

The total scour at the proposed pipeline crossing near McDowell Road on Tuthill Dike Wash is the sum of the general scour, bedform scour, long-term degradation, and low-flow incisement scour, and it is estimated to be 10.1 feet (2.5 feet + 0.5 feet + 4.5 feet + 2.6 feet). Note that this

evaluation does not take into account any local scour due to bridge piers and abutments that may exist in the future.

Condition 1 is a more conservative estimate of the total scour than Condition 2. Therefore, the total scour depth for Condition 1 were adopted for the design scour depth. A burial depth of the crown of 15 feet below the thalweg of the channel is considered sufficient to protect the pipe from failure due to scour. This scour depth should be deep enough to allow the installation of the permanent culvert crossing for McDowell Road. Note that this evaluation does not take into account any local scour due to bridge piers and abutments that may exist in the future.

LATERAL MIGRATION

The Arizona Department of Water Resources' (ADWR) State Standard for Watercourse System Sediment Balance (ADWR 1996) provides a procedure for estimating the "safe" setback or distance beyond the existing stream banks that the pipeline should remain at the design burial depth to prevent scour due to lateral migration of the channel. The equation recommended for straight channels with minor curvature is:

$$M_{LS} = 1.0(Q_D)^{0.5}$$

where: M_{LS} = minimum "safe" setback distance necessary, in feet, and

Q_D = design discharge, in cubic feet per second.

For this study, the design discharge, Q_D, was equal to the 100-year discharge (5,399 cfs). Using this information, the minimum "safe" setback distance necessary was calculated to be 73.5 feet:

$$M_{LS} = 1.0(5{,}399)^{0.5} = 73.5 \text{ feet}$$

A minimum setback distance of 74 feet is required at the proposed pipeline crossing. This setback distance should be measured from the channel banks or the 100-year floodway, which ever is greater. In this study, the floodway extends beyond the banks of the Tuthill Dike Wash. Thus, a scour depth of 15 feet should be maintained for at least 74 feet beyond the 100-year

floodway limits shown on page 1 of Southwest Gas Corporation's Verrado – McDowell/Tuthill plans.

SUMMARY

A scour analysis and lateral migration analysis for a 6-inch natural gas pipeline crossing of Tuthill Dike Wash at McDowell Road was conducted. The total scour depth at the proposed pipeline crossing was determined to be 15 feet for the 100-year event. Therefore, it is recommended that the crown of the pipeline at the proposed crossing be a minimum of 15 feet below the thalweg of the channel.

The minimum "safe" setback distance is 74 feet from the existing unprotected banks. This setback distance should be measured from the channel banks or floodway, which ever is greater. In this study, the floodway extends beyond the banks of the Tuthill Dike Wash. Thus, a scour depth of 15 feet should be maintained for at least 74 feet beyond the 100-year floodway limits shown on page 1 of Southwest Gas Corporation's Verrado – McDowell/Tuthill plans.

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WEST CONSULTANTS, INC.

MEMORANDUM

Registered Professional Engineer (Civil) CERTIFICATE NO. 41980 BRIAN THOMAS WAHLIN Date Signed 7/18/07 ARIZONA, U.S.A.

Project:	Pipeline Crossing of Bulldozer Wash at McDowell Road
Subject:	**Scour Evaluation**
Date:	July 18, 2007
To:	Jim MacDonald, Sunrise Engineering
From:	Brian Wahlin, WEST Consultants, Inc.

WEST Consultants, Inc. (WEST) was contracted by Sunrise Engineering, Inc. to conduct a scour evaluation for a 6-inch natural gas pipeline crossing of Bulldozer Wash at McDowell Road. The McDowell Road crossing of Bulldozer Wash lies in Section 31 of T2N R2W of Maricopa County, Arizona. The project location is shown in Figure 1.

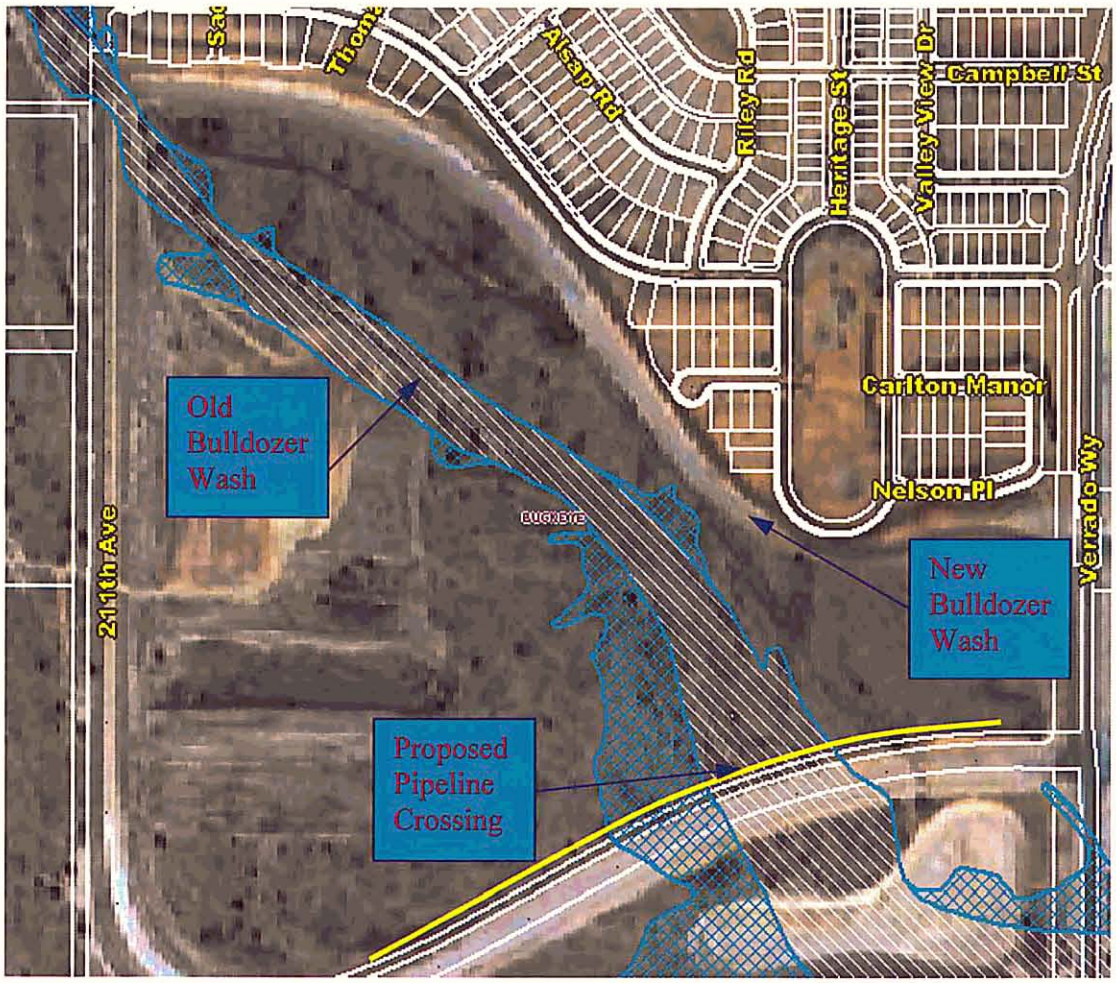

Figure 1. Project location map

In its natural condition, Bulldozer Wash conveyed flows from the north in a southeasterly direction and into McDowell Basin, which is an existing storage pit located northwest of the McDowell Road and Tuthill Dike Road intersection. In the initial stages of the Verrado Master Plan, Bulldozer Wash was re-aligned and channelized to accommodate future residential parcels. The new channel alignment is still referred to as Bulldozer Wash. The new Bulldozer Wash no longer crosses McDowell Road where the proposed pipeline crossing is labeled in Figure 1.

A Conditional Letter of Map Revision (CLOMR) was prepared by Wood, Patel, and Associates. The CLOMR was approved by the Federal Emergency Management Agency (FEMA) on June 5, 2006. The CLOMR approval letter states that Special Flood Hazard Area (SFHA), which is the area that would be inundated by the 100-year flood event, and the regulatory floodway will shift to the north along the new Bulldozer Wash compared to the SFHA and floodway shown in Figure 1. The base flood elevations (BFEs) will also be removed and shifted north. A copy of the approval letter is provided at the end of this memorandum.

Since Bulldozer Wash has been regraded to flow north of the proposed pipeline and FEMA has approved the CLOMR associated with the regrading, a scour analysis for the proposed pipeline is not required.

Federal Emergency Management Agency

Washington, D.C. 20472

RECEIVED

JUN 09 2006

WOOD/PATEL

JUN 05 2006

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 06-09-B229R

The Honorable Dustin "Dusty" Hull
Mayor, Town of Buckeye
100 North Apache Road
Buckeye, AZ 85326

Community: Town of Buckeye, AZ
Community No.: 040039

104

Dear Mayor Hull:

This responds to a request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) comment on the effects that a proposed project would have on the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) report for Maricopa County, Arizona and Incorporated Areas (the effective FIRM and FIS report for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated January 18, 2006, Mr. Ashok C. Patel, P.E., R.L.S., CFM, Principal, Wood, Patel & Associates, Inc., requested that FEMA evaluate the effects along Bulldozer Wash that a revised detailed hydraulic analysis, updated topographic information, placement of fill, channelization from the confluence with Tuthill Dike Wash (confluence) to just upstream of Airport Road, and construction of a 20-foot by 10-foot concrete box culvert approximately 1,500 feet upstream of the confluence and three 12-foot by 10-foot box culverts approximately 2,700 feet upstream of the confluence would have on the flood hazard information shown on the effective FIRM and FIS report.

All data required to complete our review of this request for a Conditional Letter of Map Revision (CLOMR) were submitted with letters from Mr. Patel.

We reviewed the submitted data and the data used to prepare the effective FIRM for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. The submitted corrected effective hydraulic computer model, dated January 25, 2006, which was converted from the effective HEC-2 model and incorporated additional cross sections and updated topographic information, was used as the base conditions model in our review of the proposed conditions model for this CLOMR request. We believe that, if the proposed project is constructed as shown on the map entitled "Verrado Bulldozer Wash & McDowell Basin," prepared by Wood, Patel & Associates, Inc., dated December 28, 2005, and the data listed below are received, a revision to the FIRM and FIS report would be warranted.

As a result of the proposed project along Bulldozer Wash from the confluence to approximately 750 feet upstream of Airport Road, both the Special Flood Hazard Area (SFHA), the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), and the regulatory floodway will shift to the north compared to the SFHA and floodway shown on the effective FIRM panel. Therefore, the effective Base Flood Elevations (BFEs) will be removed and shifted.

As a result of the updated topographic information and proposed project, the width of the SFHA will increase in some areas and decrease in other areas compared to the effective SFHA width along Bulldozer

Wash from the confluence to just upstream of Airport Road. The maximum increase in SFHA width, approximately 130 feet, will occur approximately 1,800 feet upstream of the confluence. The maximum decrease in SFHA width, approximately 1,200 feet, will occur approximately 3,700 feet upstream of the confluence.

As a result of the updated topographic information and proposed project, the width of the regulatory floodway will increase in some areas and decrease in other areas compared to the effective floodway width along Bulldozer Wash from the confluence to just upstream of Airport Road. The maximum increase in floodway width, approximately 130 feet, will occur approximately 1,800 feet upstream of the confluence. The maximum decrease in floodway width, approximately 400 feet, will occur approximately 3,100 feet upstream of the confluence. In addition, the BFEs will be contained in the channel and culverts from approximately 750 feet upstream of the confluence to just downstream of Airport Road.

Upon completion of the project, your community may submit the data listed below and request that we make a final determination on revising the effective FIRM and FIS report.

- Detailed application and certification forms, which were used in processing this request, must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview & Concurrence Form," must be included. (A copy of this form is enclosed.)

- The detailed application and certification forms listed below may be required if as-built conditions differ from the preliminary plans. If required, please submit new forms (copies of which are enclosed) or annotated copies of the previously submitted forms showing the revised information.

  Form 2, entitled "Riverine Hydrology & Hydraulics Form"

  Form 3, entitled "Riverine Structures Form"

  Hydraulic analyses, for as-built conditions, of the base flood and the regulatory floodway, together with a topographic work map showing the revised floodplain and floodway boundaries, must be submitted with Form 2.

- Effective October 30, 2005, FEMA revised the fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps. In accordance with this schedule, the current fee for this map revision request is $4,000 and must be received before we can begin processing the request. Please note, however, that the fee schedule is subject to change, and requesters are required to submit the fee in effect at the time of the submittal. Payment of this fee shall be made in the form of a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card. The payment must be forwarded to the following address:

  Federal Emergency Management Agency
  Fee-Charge System Administrator
  P.O. Box 22787
  Alexandria, VA 22304

- As-built plans, certified by a registered professional engineer, of all proposed project elements

- Community acknowledgment of the map revision request

- A copy of the public notice distributed by your community stating its intent to revise the regulatory floodway, or a statement by your community that it has notified all affected property owners and affected adjacent jurisdictions

- A request for a CLOMR for areas along Tuthill Dike Wash for the Lower Tuthill Dike Wash Channelization project (Case No. 05-09-A217R) is currently under review. This CLOMR reach encompasses the downstream portion of the reach for which this CLOMR is being issued. Upon completion of the project for which this CLOMR is issued, please comply with one of the following requirements:

    - If a Letter of Map Revision (LOMR) for the Tuthill Dike Wash Channelization project is issued before completion of the Bulldozer Wash Channelization project, the hydraulic model submitted for the Bulldozer Wash Channelization LOMR that follows this CLOMR must tie into the hydraulic model submitted for the Tuthill Dike Wash Channelization LOMR. Therefore, please submit a hydraulic model in which the revised SFHA and floodway boundary delineations tie into the SFHA and floodway boundary delineations in the hydraulic model for the Tuthill Dike Wash LOMR at the downstream end of the revision.

    - If the LOMR submittal for the proposed Bulldozer Wash Channelization project is received before issuance of a LOMR for the Tuthill Dike Wash Channelization project, then the SFHA and floodway boundary delineations must tie into the currently effective information.

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM and FIS report. Because the BFEs would change as a result of the project, a 90-day appeal period would be initiated, during which community officials and interested persons may appeal the revised BFEs based on scientific or technical data.

The basis of this CLOMR is, in whole or in part, a channel-modification/culvert project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the modified channel and culverts rests with your community.

This CLOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the SFHA. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please contact the Consultation Coordination Officer (CCO) for your community. Information on the CCO for your community may be obtained by calling the Director, Federal Insurance and Mitigation

Division of FEMA in Oakland, California, at (510) 627-7175. If you have any questions regarding this CLOMR, please call our Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Michael B. Godesky, Project Engineer
Engineering Management Section
Mitigation Division

For: William R. Blanton Jr., CFM, Acting Chief
Engineering Management Section
Mitigation Division

Enclosures

cc: Mr. Woodrow C. Scoutten, P.E.
Town Engineer
Town of Buckeye

Ms. Lynn M. Thomas, P.E., CFM
Principal Engineer
Floodplain Management Branch
Flood Control District of Maricopa County

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Mr. Ted Collins, CFM
Principal Floodplain Coordinator
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM
NFIP Coordinator
Office of Dam Safety and Flood Mitigation
Arizona Department of Water Resources

Mr. Ashok C. Patel, P.E., R.L.S., CFM
Principal
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