LA18-1

EVALUATION OF THE CONSTRUCTABILITY, SAFETY MEASURES AND POTENTIAL CONFLICTS OF THE TRANSWESTERN PIPELINE PHOENIX EXPANSION PROJECT WITHIN THE TOWN OF BUCKEYE, ARIZONA

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ENEngineering

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LA18-1 We concur with the report's assessment that the proposed project would meet the requirements of Title 49 CFR Part 192 (the Code). The report notes that many of the design elements of the proposed project exceed Code requirements and are "state-of-the-art." We also concur with other report findings, including:

- It is common for transmission pipelines to be installed in existing electric powerline rights-of-way;
- There is physical room to install the pipeline between the existing powerline towers. However, there would be worker safety concerns, tower foundation concerns, increased potential to damage the towers, and long-term operational concerns including stray currents associated with installing the pipeline between the towers;
- The Code does not require that future development be integrated into pipeline design. However, Transwestern would be required by the Code to monitor the population density along the route and to meet all Code provisions to conform to new class locations; and
- The Code does not specify exclusion zones around transmission lines.

EN Engineering's assessment that the proposed mainline valve spacing in proximity to MPs 151.0 and 151.5 does not comply with the current class location requirements is incorrect. As indicated in table 2.1.2-2 and on sheet 49 of 92 in Appendix B of the draft EIS, Transwestern would install a mainline valve at MP 151.8. This valve would satisfy the Class 3 valve spacing requirements between MPs 147.8 and 155.8, but was omitted from the EN Engineering assessment.

The report includes street, utility, and drainage plans from the proposed developments that would be crossed in the Buckeye area. Based on these drawings, some of which were labeled "preliminary" or "conceptual," EN Engineering estimates that the proposed pipeline would cross 30 streets and that other utilities including water and sewer mains would generally be installed in the road rights-of-way. The proposed route would also cross dry washes and future stormwater detention basins. Transwestern has committed to working with the Town of Buckeye and area developers to reduce the impact of the proposed project on existing and planned developments in the Buckeye area and

LA18-1 (cont'd) would incorporate existing and planned street and utility crossings into its final pipeline design at its expense. See also the discussion of future utility crossings in section 3.4.2.5 and in the responses to comments PM3-7 and CO3-5.

In comparing the proposed alignment to the Buckeye Alternatives, EN Engineering misunderstood that the Buckeye Alternatives would terminate at a point "outside the Town of Buckeye" when, in fact, the alternatives would cross approximately 10 miles of the Buckeye planning area, including several planned and approved developments (see table 3.4.2-1). Depending on the final alignment of the Buckeye Alternative, the alternative could also cross Belmont, a large approved development in the Tonopah Valley planning area, and other developments in earlier stages of planning in Tonopah Valley. The report concludes that the alternatives would be safer because future developments could incorporate setbacks from the alternatives. As discussed in section 3.4.2.5, and in the responses to comments PM3-45, CO16-20, and CO7-3, there is no regulatory requirement or need to impose setbacks nor is it common practice for developers to voluntarily impose setbacks from pipelines as demonstrated in Maricopa and Pinal Counties where numerous existing and planned developments abut the existing EPNG natural gas transmission right-of-way.

In the event that the proposed route is approved, EN Engineering recommends measures that could be negotiated with Transwestern. The most significant of these include designing the entire length through Buckeye as Class 3, designating the entire length through Buckeye as an HCA, and installing the pipeline at least 2 feet below the planned depth of the deepest facility at each known crossing location. See the responses to comments PM3-8, PM3-56, and CO16-20 pertaining to pipeline class design, and comment PM3-7 regarding future utility crossings. As previously stated, Transwestern has committed to working with the Town of Buckeye and area developers to reduce the impact of the proposed project on the area.

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EXECUTIVE SUMMARY

EVALUATION OF CONSTRUCTABILITY, SAFETY MEASURES AND POTENTIAL FIELD CONFLICTS ASSOCIATED WITH THE PROPOSED AND ALTERNATE ROUTE CONSTRUCTION OF A NATURAL GAS PIPELINE BY TRANSWESTERN PIPELINE COMPANY THROUGH THE TOWN OF BUCKEYE, ARIZONA

The Town of Buckeye, Arizona contracted EN Engineering to provide assistance to understand the design, construction and operation of gas pipelines. Of particular concern is the understanding of any additional measures to consider in the design and operation of a pipeline in urban environments. Recognizing there are alternative routing proposals, this summary includes a comparison of the areas and surrounding communities which would be affected.

Two separate federal government agencies have direct jurisdiction over different phases of a pipeline project. The Federal Energy Regulatory Commission (FERC) is the lead agency for approving the need for the pipeline and its siting. The Department of Transportation (DOT) is responsible for regulating the safety of pipelines throughout design, construction, operation and maintenance activities for the life of the pipeline. The scope of this report is limited to discussion of DOT requirements.

Actual information that was publicly available regarding the proposed pipeline, during the timeframe of this project, was not complete. EN Engineering's analyses, conclusions and recommendations are therefore based on informed assumptions, where appropriate, of usual pipeline industry practices.

The proposed Transwestern pipeline is regulated by DOT as a transmission line in accordance with Code of Federal Regulations (CFR) Title 49, Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards (the Code). All components that comprise the pipeline are required to be manufactured in accordance with industry codes and standards maintained by organizations such as American Petroleum Institute, American Society for Testing and Materials, American Society of Mechanical Engineers, and Manufacturers Standardization Society of the Valve and Fitting Industry. These codes are regularly reviewed and updated to incorporate state-of-the-art materials and practices to ensure the highest quality products are used to construct pipelines.

Design parameters, construction practices and operating and maintenance activities are primarily specified by the Code with some references to industry standards where practical. The goal is to initially construct a pipeline that safely operates at the required pressure and to maintain that level of safety throughout its service life. Many safety (derating) factors are built into the Code so that pipelines operate below their ultimate strength. It appears, for those design elements where sufficient information was available, the proposed Transwestern pipeline meets the requirements of the Code, with

the exception that class location designations are not commensurate with the planned, permitted and on-going development within the Town of Buckeye. The designation of most of the Town as Class Location 2 was based on dwelling unit counts as they existed at the time of the "Issued for FERC Application" alignment sheet survey. The proposed and permitted development within the Town was not considered. The Code is silent on the need to factor planned future development into pipeline design. However, Transwestern is required by the Code to monitor the population density along the pipeline route. When a class location change occurs, such as when developments are constructed, Transwestern must meet all Code provisions to conform to the new class location.
Assessment of the Code compliance of several design elements could not be conducted because of insufficient information.

The proposed location of the pipeline relative to future population is a major concern of the Town of Buckeye which desires to preserve the safety, health and quality of life of its residents. The route is primarily within existing electric transmission line rights of way adjacent to a major transportation corridor through developing residential and commercial areas. Preliminary alignment of the pipeline within fifteen feet of the edge of the right of way places it virtually adjacent to developed lots along the path, potentially affecting the quality of life of those who live, work or play nearby.

An alternate route has been proposed which is located within another utility corridor adjacent to the Central Arizona Project (CAP) canal and to the west of the town. Its advantage is that it presents less risk by avoiding population centers with the tradeoff being construction of additional mileage of pipeline. Most of the area along this route is neither currently developed nor planned or permitted for development. This alternate route makes use of an approved high voltage power line corridor that would require approximately 47 miles of pipeline to be constructed. An opportunity exists for the Town of Buckeye or other jurisdictions to institute and enforce land use restrictions along the alternate route so that future development is not allowed to encroach on the pipeline within a distance set by such governing bodies.

EN Engineering has recommended some additional parameters and activities that may improve the safety of the Transwestern pipeline if it is constructed along the initially proposed route. These are items the Town of Buckeye can negotiate with Transwestern. Cost estimates for the various enhancements as a means of offsetting the additional cost of constructing a longer pipeline on the alternate route are being prepared by others at the direction of the Town of Buckeye. While a total cost offset is not foreseen, it is believed that the differential for the alternate route is reasonable when long term population growth in the area is considered.

Observations and Recommendations

Alternate route:

- The alternate route appears to be a viable option from a constructability, operations and maintenance point of view.
- The alternate route has no planned high population density developments along it.

- Land use restrictions can be implemented to keep development farther away from the pipeline.
- Depending on final alignment, this route could necessitate a directionally drilled crossing of the CAP canal.
- Approximately 1.4 miles of rocky terrain is visible that could increase pipeline installation costs where it is actually encountered.

If the alternate route cannot be achieved:

- The class locations indicated on the "Issued for FERC Application" alignment sheets are not commensurate with proposed and permitted development within the Town of Buckeye. It is recommended that the entire length of the pipeline within the Town of Buckeye be designated as a class 3 location.
- The proposed main line valve spacing does not appear to comply with the requirements of the code. Designation of the entire length as class location 3 will require two additional main line valve settings.
- Main line valve installations are proposed to be aboveground. It is recommended that these be installed below ground to improve the esthetics for the neighbors.
- The post construction test pressure was not available. It is recommended that Transwestern commit to performing the test at a pressure that will subject the pipeline to 100 percent of its specified minimum yield strength.
- It is recommended that any buildings, instrument enclosures and similar facilities be constructed of materials and design compatible with the surrounding architecture. Fencing or walls surrounding Transwestern facilities should likewise match similar nearby structures.
- Mainline valves will be remotely operable from a full time staffed control center. Automatic operating valves are available but are not recommended.
- The pipeline alignment places it on the far outside edge of the power line corridor which will be only 15 feet from many developed property lines along its route. It could be constructed at or near the center of the power line corridor to provide additional distance between it and the surrounding community. Such placement, however, will not materially improve safety of properties that abut the right of way. The distance available is less than the potential impact radius as defined in the Code. Even at the center of the corridor, the pipeline would still be subjected to roadway and utility crossings which are the higher risk activities
- Operations, maintenance and inspection procedures required by the Code provide for regular on-going care of the pipeline. Pipelines in high consequence areas are afforded additional scrutiny including specific physical assessment at a frequency not to exceed 7 years. It is recommended that the entire length of the proposed route through the Town of Buckeye be managed as a high consequence area to ensure the extra protections imparted by the Code for those pipelines.
- Damage to a pipeline by excavating equipment is the leading cause of failure. The Code requires all operators to have a damage prevention program that addresses a number of specified activities. It is recommended that Transwestern enhance their damage prevention program, because of the proximity to large numbers of people and the anticipated future construction around the pipeline as the area develops. This could include weekly patrols to observe for excavation

activity, providing an on-site person whenever excavation within 10 feet of the centerline of the pipeline is done, and quarterly notification of residents and excavators of damage prevention messages.

- Emergency response procedures and liaison with local emergency responders and other public officials is mandated by the Code. It is recommended that Transwestern establish a local field office within the Town of Buckeye. This will reduce their response time to an incident and will improve liaison and cooperation with local officials.
- The numerous planned and permitted developments within the Town of Buckeye anticipate several new road and utility crossings of the pipeline right of way. It is recommended that Transwestern install the pipeline initially at a depth that will place it at least 2 feet below the planned depth of the deepest facility at each of the known crossing locations. By so doing, future excavation damage will be less likely.

ARTICLE 1

EVALUATION OF CONSTRUCTABILITY AND SAFETY MEASURES ASSOCIATED WITH THE PROPOSED TRANSWESTERN PIPELINE THROUGH THE TOWN OF BUCKEYE, ARIZONA

I. Scope

Article I provides an understanding of the design, construction and operation of gas pipelines including additional measures to consider in the design and operation of a pipeline operating in urban environments. Recognizing there are alternative routing proposals, a high level comparison of the affects on the surrounding community by the different routes is included.

As used herein, 'proposed route' is the route requested in the FERC application through the Town of Buckeye nominally parallel to the Sun Valley Parkway and 'alternate route' is the route requested by the Town of Buckeye for analysis and consideration that runs along the CAP canal and in the APS right of way north and west of the Town of Buckeye. **See Appendix A for proposed and alternate route map.**

II. Background

The proposed route of the pipeline is located primarily within existing electric transmission line rights of way adjacent to a major transportation corridor through developing residential and commercial areas. Interveners in the case have proposed a 47 mile alternate route which passes north and west of Buckeye, AZ to avoid population centers.

Natural gas pipelines must be designed, constructed, operated and maintained in accordance with the regulations contained in the Code of Federal Regulations (CFR) Title 49, Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards (49 CFR Part 192 or the Code). Individual states, under certain conditions, may institute additional regulations on pipelines within their state that are more stringent than the Federal minimum standards.

Analyses, conclusions and recommendations of this report are based on actual information about the proposed pipeline that is publicly available. Where such data were not received within the time frame of this analysis and report, EN Engineering proceeded based on informed assumptions, where appropriate, of usual pipeline industry practices.

The proposed Transwestern pipeline is regulated as a transmission line in accordance with the definitions in the Code. Transmission lines are generally large diameter (greater

than 12 inches) pipelines that operate at a high pressure (over 700 psig). They often traverse long distances in mostly undeveloped areas and usually serve very few customers along the route. These are broad characterizations for the purpose of understanding the nature of a transmission line, none of which are specified in the technical definition contained in the Code.

Another type of line subject to regulation by the Code is a distribution line. Their general properties are smaller diameter (mostly less than 6 inch), lower operating pressure (usually less than 60 psig and as low as ¼ psig) and connection to numerous customers. Distribution lines are primarily installed in the streets, across private property, and connect to the gas meter at the premise supplied. Generally, distribution lines are installed and operate within populated areas.

The majority of the rules contained in the Code apply to both transmission and distribution pipelines. Some of the individual sections, however, are applicable to only transmission lines or only distribution facilities. This is generally in recognition of greater potential consequences resulting from a failure of a transmission line modified to an extent by the human population near the right-of-way.

The remainder of this report discusses the requirements for transmission line unless specifically identified comparisons to distribution lines are made.

III. Review of Design Criteria

The information available at the time of this report did not specify the design elements related to most of these activities. Therefore, detailed evaluation is not possible.

A. Pipe

The operating pressure and diameter of a pipeline dictates the volume of gas that can be transported. Various combinations of those two factors will yield the desired capacity. The pressure that can be applied to the gas in the pipeline is constrained by the strength of the steel from which the pipe is made, the method used to fabricate the pipe, the number and horsepower of compressors available or required to be installed to supply the pressure along with numerous other lesser considerations. The size of the pipeline is similarly constrained by the strength of the steel from which the pipe is made, the method used to fabricate the pipe, the ability to be able to handle and transport the pipe, external loads on the pipe after installation and other features. The final determination of these factors is a balance of the physical limitations and economics.

The capacity of the pipeline through the Town of Buckeye is in excess of 375,000 dekatherms per day which is approximately equivalent to 363 million cubic feet per day of natural gas. (1 dekatherm ~ 1,000,000 BTU ~ 970 cu. ft. natural gas)

From available information, the design pressure of the Transwestern pipeline is 1000 psig. The Code will designate that as the maximum allowable operating pressure (MAOP). This pressure is usually measured at the outlet of a compressor station. Since the portion of the pipeline through the Town of Buckeye appears to be significantly downstream from a compressor station; the actual pressure in that part of the line will be somewhat less than 1000 psig during normal operations. The pressure could approach 1000 psig if the pipeline were completely shut in and allowed to rise to its MAOP. Since the entire length of the pipe is designed, constructed and operated to withstand the MAOP, an additional margin of safety is realized the further from a compressor station the pipe is located. 1000 psig is a high pressure but it is within the range that transmission lines are currently operated. Some transmission pipelines in United States have an MAOP as much as 1900 psig.

The 36 inch diameter size of the proposed pipeline through the Town of Buckeye is about normal for current transmission line construction. Larger pipelines are not uncommon as evidenced by the 42 inch diameter pipe proposed for other portions of this Transwestern project. As the diameter increases, the hoop stress in the pipe increases for the same pressure to be contained. In order to limit that stress to a level that is within the capability of the steel, the wall thickness of the pipe is increased. This is governed by calculations made as specified in the Code as the design formula for steel pipe (§192.105). Other factors of the design formula are discussed in the following paragraphs.

The Code requires that pipe be manufactured in accordance with an industry standard that has been proven over time to produce sound pipe. The natural gas pipeline industry virtually exclusively specifies pipe made to American Petroleum Institute (API) 5L specifications. In recent years transmission pipe has been fabricated from X70 steel indicating that its specified minimum yield strength (SMYS) is 70,000 psi. This is one of the key factors in the design formula of the Code and represents the hoop stress that can be imposed on the steel without its failing. While X70 steel is at the high end of the range of available steels for API 5L pipe manufacture, it has been used in numerous transmission pipelines with success.

Another factor in the design formula is related to the class location of the immediate surroundings of the pipeline. Class locations are defined in the Code (§192.5) in accordance with the number of dwelling units within an area 220 yards (660 feet) either side of the centerline of the pipeline along any continuous 1 mile length of the pipeline. Each separate unit in a multiple unit building, such as an apartment building or condominium, is counted in the above totals. With certain specified exceptions, class locations and their corresponding factors that are used in the design formula are designated as shown in the following table.

Class Location	Number of Dwelling Units	Design Factor
1	10 or fewer	0.72
2	More than 10 but fewer than 46	0.60
3	46 or more or A frequently used area or public building	0.50
4	Buildings with 4 or more stories aboveground are prevalent	0.40

Because the design factors are all less than 1.00, they function as safety factors by reducing the allowable design pressure of pipe below its ultimate strength. A greater difference is provided between ultimate strength and allowable operating pressure when the population in the pipeline vicinity is more dense.

The proposed pipeline through the Town of Buckeye is designated as primarily class location 2 with two segments (2 ½ miles between mile posts 134 and 136.5 and 2 miles between mile posts 149.5 and 151.5) of class location 3. The Town of Buckeye has indicated that additional development has been permitted or planned along the pipeline corridor. These developments will likely raise the class location to 3 in their vicinity.

Transmission pipeline operators are required by the Code to monitor the population density along the pipeline route, usually done annually. When a class location change occurs, the pipeline operator must confirm or revise (reduce) the MAOP of the line, within 24 months, to conform to the new class location. A required reduction in MAOP will cause a loss of capacity of the pipeline which operators need to avoid in order to continue supplying contracted volumes of gas to customers downstream of the class location change. When this situation occurs, it is common for the operator to replace the pipe within the changed class location with pipe that meets the new design requirements. This activity is invasive to the community as well as expensive for the operator.

It should be noted that in recent years there has been a trend for operators to be granted waivers of the Code by the regulatory agency regarding class location changes that allows them to continue operation of the pipeline at higher stress levels than would otherwise be allowed. Such waivers generally impose additional actions on the operator to ensure that safety of the pipeline and the surrounding public is maintained.

Due to the additional development that has been permitted or planned along the pipeline corridor, the Town of Buckeye may have compelling grounds to require the entire segment of pipeline within that corridor be designed and installed to class location 3 requirements.

B. Components

Valves, fittings, flanges and their accessories, and any other gas carrying components in the pipeline are all required by the Code to be manufactured in accordance with industry standards developed and maintained by organizations such as the API, the American Society of Mechanical Engineers (ASME), the Manufacturers Standardization Society (MSS) and the American National Standards Institute (ANSI). Further assurance is required of the designer that the application of the component in the particular pipeline will withstand the operating pressure, stresses and other anticipated loadings without impairment of its serviceability.

With limited exceptions, all new transmission lines and components must be designed and constructed to permit the passage of instrumented, internal in-line inspection (ILI or smart pig) tools. This is important for the long term inspection and maintenance of the pipeline. Such tools provide diagnostic information on the condition of the steel in the pipeline. The Transwestern pipeline design includes permanently installed launcher and receiver facilities for ILI tools. Such installation is not specifically required by the Code.

Further requirements provide for flexibility, anchors and supports to prevent undue strain or stress, unusual loads at joints, undesirable forces or moments and minimization of other potential detrimental affects on the serviceability of the pipeline.

Most of these items are not specifically addressed in currently available data. Transwestern does state that the pipeline will be constructed to accommodate ILI and that concrete coated pipe will be installed in areas that are subject to flooding. The weight of the concrete counteracts the buoyancy of the pipe to prevent it from floating out of its embedment.

The main line valves on this project are designed to be installed aboveground. While this is common industry practice, the facility when built may be aesthetically objectionable in developed communities. The large diameter pipe is directed above ground with long radius smooth bends and connected to the valve and its operator which together are a substantial fabrication. Usually a smaller diameter valve cluster is installed around each main line valve to provide bypass and blow down capability. A small building is also needed at the location to house equipment required to operate the valve. Pipeline valves can be buried although usually the valve operator, bypass and blow down facilities and the equipment building are still visible. In extreme cases, the entire installation can be installed belowground in a properly constructed underground vault. The alignment sheets indicate that a 150 ft. x 150 ft. area adjacent to the right of way is being reserved at each main line valve location although it is unclear what it is intended for.

The Code does not address issues of aesthetics. This however is often imposed by the community in which the pipeline is installed. Valves installed aboveground are easier for the operator to inspect, maintain and repair if necessary. There is the potential for objectionable noise under certain pipeline flow conditions. In addition, its visibility could make it the target of vandalism. Equipment in below ground structures, such as

vaults, is more readily subject to atmospheric corrosion, elevated temperatures that could affect control and monitoring equipment, and flooding as applicable to its environment. The option of burying the valve at the same depth as the pipeline and constructing a building to cover the operator and its control equipment may be an acceptable middle ground. The building can be designed to blend in with its surroundings by using the same style and materials of construction as other buildings in the area.

C. Construction Methods

The pipeline will be assembled by welding of the steel components together. Welding is virtually the exclusive method of joining for transmission lines. The welding process and the qualification of welders is governed by industry standard API 1104, that is referenced in the Code and has been proven over many decades to produce welds that are stronger than the pipe they join. All welds are visually inspected and most are additionally non-destructively tested such as with x-rays. The non-destructive methods examine the interior of the weld for defects that could affect the quality of the weld. Companies that specialize in constructing transmission pipelines employ highly qualified welders that generally have significant field experience.

The preferred and most common method of installing transmission pipelines is known as the open cut method. This involves opening a trench in the soil that is wide enough to accommodate the size of pipe being installed and deep enough so that the top of the pipe is the required or specified depth below the surface of the surrounding earth. This is referred to as the depth of cover. Transwestern indicates that the pipeline will typically have the minimum of 36 inches of cover that is required by the Code for normal soils. Additionally, where appropriate because of agricultural surface usage, the pipeline will be buried deeper than the Code states to avoid damage and interference. An exception to the Code requirement is allowed where an underground structure prevents achieving the minimum cover. In such a case, less cover is permitted if the line is provided with additional protection that will withstand anticipated external loads, such as placing an adequately supported concrete slab above the pipeline.

When the pipe is installed in the ditch the Code requires that it fit the contour of the ditch to minimize imposing stresses. It is also required to be backfilled in a manner that provides firm support under the pipe and prevents damage to the pipe and its coating from the equipment and backfill material used. In order to accomplish this, the contractor may perform field bending of the pipe which is a common pipeline construction practice. Field bends are made in small increments (not like electrical conduit) so the strength of the pipe is not adversely affected. In some cases, especially very rocky areas, select back fill such as sand may need to be placed on the bottom of the trench and possibly to completely cover the pipe, in order that the pipe coating is not damaged by, or in contact with rock that could cause damage.

The open cut is normally excavated by a backhoe or trenching machine through soils that are amenable to those methods. Where consolidated rock occurs along the pipeline right of way, blasting may be employed to remove the rock deep enough to install the pipe.

There are no requirements in the pipeline safety code that address blasting. More than one third of the Transwestern pipeline is anticipated to require blasting for rock removal. Although there are no detailed locations in the information available, it is assumed that some blasting will be required in the segment traversing the Town of Buckeye. Transwestern states that it will require its contractors to comply with all federal and state regulations regarding the transportation, storage and use of blasting materials. If the Town of Buckeye has any local requirements covering blasting activities, these need to be made known to Transwestern to ensure they are followed. Test shots will occur prior to any blasting activities and all companies or entities that may be affected by blasting will be notified at least 7 days in advance of the test shots so representatives can be present if desired. The Town of Buckeye should ensure they are on the notification list.

Where there are existing surface structures such as hard surface roads or features such as creeks or rivers, the pipeline is usually installed by a boring method. Currently the most common method is directional drilling where a hole larger in diameter than the pipe is mechanically drilled under the feature and the pipe pulled into the opening. Physical constraints generally dictate that the final depth of cover of the pipe below the feature is significantly greater than the rest of the pipeline. A variation of this method installs a larger diameter pipe first through which the actual line pipe is inserted. The perception is that the outer pipe (casing) provides additional protection to the inserted pipe primarily from surface loads that are anticipated and to some extent protection from damage to the pipe from excavation activity around the pipeline. Drawbacks include ensuring adequate corrosion protection to the pipeline segment that is within the casing and restriction of the ability to perform maintenance on the cased pipe. The Code contains specific provisions covering casings when they are used but does not dictate conditions or locations where they must be used.

The Code specifies that transmission lines be installed with at least 12 inches of clearance from any other underground structure not associated with the pipeline, such as water and sewer lines, electrical or fiber optic facilities, etc.

Pipeline facilities that will remain aboveground, such as the main line valves, are required by the Code to be protected from accidental damage by vehicles or similar causes. Remedies run the gamut from providing sufficient distance from traffic routes, to installing concrete filled posts, to providing highway-type barriers depending on each individual circumstance.

Buried pipelines must have visible markers placed and maintained as close as practical over the line at each public road crossing, each railroad crossing and wherever necessary to identify the location of the pipeline to reduce the possibility of damage or interference. Similar markings are required for pipelines installed aboveground where they are accessible to the public. Markers must contain the word "Warning", "Caution", or "Danger" followed by the words "Gas Pipeline", the name of the pipeline operator and a telephone number that is answered 24 hours per day by the operator. Such markers are often placed at areas where future excavation or damage is likely such as drainage or other ditches subject to periodic cleaning or grading and in other areas such as at fence

lines and locations where the pipeline changes direction. Pipeline markers are most effective when at least two of them can be seen from any point along the pipeline. They are usually a bright color that stands out from the surroundings. These markers supplement the "call-before-you-dig" programs of the state and the operator.

D. Pressure Testing

A strength test of the pipeline, after construction is completed, is a requirement of the Code. This is usually a hydrostatic test performed by completely filling the test section with water, pressurizing it to at least the required test pressure and holding it at that pressure for 8 or more hours. The tests take into account the elevation changes of the test section to ensure that all points on the pipeline are subjected to the minimum required pressure.

The Code does not directly specify the minimum test pressure. It is indirectly determined by applying factors used in the determination of the MAOP of a pipeline based on the pressure to which it was tested. For class location 2, the MAOP is limited by dividing the test pressure by 1.25, meaning the test pressure needs to be at least 25 percent greater than the maximum gas pressure that can be placed on the pipeline during operation. The factor for class locations 3 and 4 is 1.5, or a 50 percent difference between test and operating pressure. Most transmission line operators perform the strength test at a pressure that will produce between 95 and 100 percent of the SMYS of the pipe. This causes the pipe to be stressed between 20 and 40 percent more than the pressure needed to establish the MAOP and provides an additional margin of safety for the pipeline operation.

E. Corrosion Control

The Code contains an entire subpart of twenty two separate rules dedicated to the design, installation, operation and maintenance of corrosion control systems for metallic pipelines. Corrosion is the second leading cause of pipeline incidents and can occur externally, internally or due to action of atmospheric conditions. If allowed to happen and not controlled, corrosion can deteriorate the pipe to an unsafe condition. Operators are allowed twelve months after completion of construction of the pipeline to have an operating corrosion control system. This provides time for tests and analyses of the actual pipeline environment so that components of a system tuned to the pipeline and its location can be designed and installed. In most locations, including Arizona, corrosion when it is present, occurs slowly. A delay in implementing the system for this period of time is not detrimental. Regularly scheduled surveys, once the system is in place, are required to measure the level of corrosion protection being provided to the piping.

The first line of defense against corrosion of a pipeline is a protective coating that is applied to the external surface of the pipe and components. The Transwestern pipeline will have a fusion bonded epoxy (FBE) coating. This is the state of the art and has been used on virtually all pipelines constructed recently. The coating is applied under controlled conditions at a coating mill before the pipe is transported to the right of way.

Weld joints are coated in the field before the pipe is lowered into the ground. The entire line is inspected with an instrument that detects any defects in the coating and repairs are made to those locations just before the pipe is placed into the ditch. The Code does not specify the type of coating (e.g. FBE) that must be applied but it does contain a number of properties that any coating used must have.

The cathodic protection system required by the Code, to protect buried pipelines from external corrosion, may be of any design that provides a level of protection that complies with at least one of several criteria specified. Transwestern proposes to install rectifiers and anode groundbeds at selected points along the pipeline that will provide an adequate level of corrosion mitigation along the entire length of the pipeline. This type of system is designed to impress a low voltage current on the pipeline to offset natural soil and groundwater corrosion potential. It is also designed to protect areas where the coating is damaged during backfill or otherwise gets damaged over time. It is the system of choice for transmission pipelines and has proven effective.

Transwestern does not anticipate internal corrosion to take place since the gas to be transported does not contain corrosive constituents or free water, both of which are necessary for internal corrosion to occur. The quality of the gas and its constituents is to be regularly monitored to assure that the gas remains dry and uncontaminated.

Atmospheric corrosion that could occur on above ground facilities must be controlled by the application and maintenance of a coating, usually paint, on the piping that is exposed to the atmosphere in order to be in compliance with the Code. The type of paint or other coating is generally specified by a corrosion control expert and can be required to blend in with the surroundings. Regular monitoring for atmospheric corrosion is required to ensure the viability of the coating is maintained.

F. Odorization

Transwestern states that the gas in the pipeline will be odorized. Since natural gas is nominally not detectable by sense of smell, operators add a chemical such as mercaptan that has a strong, distinctive odor. This allows gas to be smelled at very low concentrations as a means of spotting leaks before they become large enough to be hazardous.

The Code requires odorization of gas transported in a new transmission line that is in a class 3 or class 4 location, unless at least half of the pipeline downstream is in class 1 or class 2 locations. Several other exceptions that do not appear to apply to Transwestern are also allowed. There is no information on the class locations of the downstream piping.

There is no numerical odorant concentration level specified in the Code. Instead a performance requirement is stated of being sufficient so that at a concentration in air of one fifth of its lower explosive limit, the gas is readily detectable by a person with a normal sense of smell. The explosive limits for natural gas in air are approximately 5

percent to 15 percent. The range of 0.4 to 0.6 pounds of odorant per one million cubic feet of natural gas provides the required detection level for most pipelines.

The location of odorization facilities on the Transwestern pipeline is unknown.

IV. Valve Spacing and Valve Isolation Measures

The Code requires that sectionalizing block valves (often called main line valves or MLV) be installed on transmission pipelines at specified maximum spacing as summarized in the following table.

Code Required Valve Spacing		
For the following Class location	Each point on the pipeline must be within the following miles of a MLV	Nominal spacing (miles)
1	10	20
2	7 ½	15
3	4	8
4	2 ½	5

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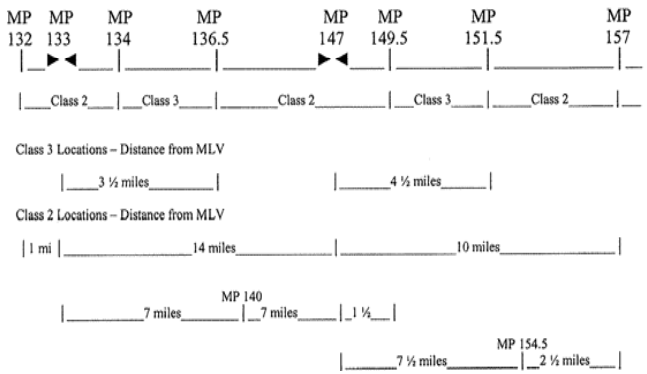
The primary reason for a maximum spacing between main line valves on a transmission line is to reduce the volume of gas that can be released in the event of a pipeline failure. They are closer together in more populated areas to reduce the consequences to people living near the pipeline. The initial response to a failure emergency is to stop the flow of gas to the failure point. Since gas is compressible, it will continue to release from the failure until the pressure in the pipe is reduced to atmospheric pressure. By closing the nearest valve on each side of the incident, only the volume of gas between those two points is released and the closer together the valves are, the less the volume is available for release.

A secondary reason is to reduce the volume of gas that could be released during a depressuring of the pipeline for maintenance work. Even though such a blow down would be controlled and released to a safe location, the potential noise, gas concentration and odorant level in the vicinity of the release point may be of concern to the surrounding population. Rather than shutting down an entire pipeline, the operator can block in and work on a short section.

The following diagram indicates the class locations shown on the available alignment sheets in relation to distance from the MLVs. The area between mile post 151 and 151.5 is not in compliance with the minimum valve spacing requirement of the Code. Additionally, as the area develops, future potential for valve spacing excursions exists. Providing MLVs at class 3 spacing in the initial design could alleviate the need for future additions. This would require the installation of two additional MLV settings within the Town of Buckeye. Assuming that the valve at MP 133 remains fixed, MLVs at MP 141, MP 149 and MP 157 would be necessary to meet the minimum spacing of the Code. To comply with class location 4 spacing, six MLVs at MP 133, MP138, MP 143, MP 148,

MP 153 and MP 158 would be required. As noted in Section III.A above, waivers are regularly sought and granted for the valve spacing requirements of the Code when class locations change.

Approximate mile post (MP) locations from alignment sheets
(not to scale)



The Transwestern design calls for the main line valves to be fitted with valve operators that can be "push button" operated from a remote location. The type of operator was not specified in the available information. In general they are powered either electrically or from the pressure of the gas in the pipeline. Communication with the control instrumentation for the valve operator may be by dedicated wire or fiber optic cable installed along with the pipeline, over the telephone system, via microwave or by satellite as selected by the pipeline operator. It is commonly referred to as a data acquisition system. Normally such valves can be closed from the remote location but require personnel on site to be opened. Valves that do not have remote operation capability are manually operated by one or more persons at the physical location of the valve. Local operation depends on the dispatching of personnel and waiting for them to travel to the valve location which often leads to more gas release before an incident is brought under control.

The Code does not globally require that remotely controlled operators be installed on transmission line valves. However, for pipelines that are in high consequence areas (HCA), which are discussed in Section VI, operators may be required to install either remote or automatic controlled valves based on a risk assessment analysis covering the particular HCA.

Remote controlled valves still need the intervention of a person to initiate the closing action. For the Transwestern pipeline this will occur at their centralized gas control

center located in Houston, Texas. The gas control center is staffed 24 hours per day, 365 days a year. System pressures, flows and customer deliveries are monitored by computer and humans from data constantly being supplied to the center over the communication system from all appropriate parts of the pipeline. Area and sub-area offices will be maintained along the pipeline route and staffed by personnel who can provide appropriate response to emergency situations. They can be dispatched by the gas control center operators.

Automatic control valve operators employ a pressure and/or flow sensing device. When the parameters for which it is set stray from acceptable limits, instrumentation at the valve location causes the valve to close without the need for a person to push a button. As with remote operated valves, on site personnel are generally needed to reopen the valve. These types of operators are not commonly installed on transmission pipelines.

V. Location of the Pipeline within the Right of Way of the Proposed Route

A. General Description

The majority of the Transwestern pipeline through the Town of Buckeye is proposed to be installed on an existing electric transmission tower line right of way apparently controlled by the Salt River Project (SRP). Approximately 2 ¼ miles of the pipeline deviates onto a dedicated right of way in order to avoid the Buckeye dam approximately 1000 feet to the west. The proposed alignment will traverse numerous planned and already permitted developments abutting the route for approximately 75 percent of its 25 mile distance through the Town of Buckeye.

The width of the SRP right of way was scaled from the alignment sheets as 400 feet in some locations, 300 feet in other locations and is unclear for the remainder. There are two SRP electric transmission tower lines occupying the entire length of the right of way. The towers are approximately 100 feet from the edge of the right of way and 100 feet away from each other. A third electric transmission tower line, identified as WAPA, is on the right of way from the northern-most mile post shown on the available alignment sheets to approximately mile post 136.3 separated an additional 100 feet from the neighboring SRP tower line. At mile post 154.7, south of the Buckeye dam, to the southern-most mile post shown on the available alignment sheets, a third SRP electric transmission tower line joins the right of way separated 100 feet from the other SRP towers.

The line of lay of the Transwestern pipeline is shown at 15 feet from one extreme edge or the other where it is on the SRP right of way. At the Buckeye dam it is located in the center of a dedicated 50 foot right of way where it is not on the SRP right of way. At several locations there appears to be an electric distribution pole line at the same edge of the SRP right of way allocated to the Transwestern pipeline and in one stretch a similar indication shows between the two SRP tower lines.

B. Discussion

It is common practice for transmission pipelines to be installed in existing electric power rights of way. They provide a generally uninhibited corridor over long distances. Often multiple pipelines share the right of way especially in the vicinity of more developed areas. Other siting options include establishing an easement through property owned by others and outright purchase of land required for the pipeline by the operator. In all cases the operator needs to retain the right of access to its pipeline in order to perform operation, inspection, maintenance and emergency response activities.

The Code does not contain any requirements concerning the physical location of pipeline facilities. This issue is the domain of the FERC for interstate transmission pipelines and usually a matter of franchise agreement with local authorities for distribution lines and intrastate pipelines. Those regulatory and legal issues are beyond the scope of this review.

A relatively wide temporary construction corridor is needed to build a pipeline. The alignment sheets show 100 feet for the Transwestern pipeline, which is normal within the industry. The construction strip is used for an access road for material delivery, equipment and workers; space for the pipe to be off loaded and stored temporarily; adequate room around the pipe for welding, coating and handling; and access for equipment to lower the pipe into the ground and backfill it. Since it is most efficient for these activities to all occur on the same side of the pipeline, the final line of lay is usually located to one side of the designated final right of way allotment. From the construction point of view it would be physically possible to place the Transwestern pipeline on the "interior" edge of the proposed construction corridor rather than the outer edge as currently shown. Doing so would locate the line approximately 70 feet further from the boundary of the right of way.

On the SRP right of way through the Town of Buckeye the SRP electric transmission tower line centerlines are approximately 100 feet apart. This would provide sufficient space for the pipeline to be constructed between the tower lines. Because of the asymmetrical nature of the construction process the pipeline would end up closer to one tower line than the other. In the 300 foot wide portions of the right of way the maximum distance from the edge would be around 125 feet and in the 400 foot wide areas about 175 feet.

Safety is a major concern when constructing a pipeline within an existing electric transmission tower corridor. Worker safety must be maintained due to the proximity of very high voltage electrical lines. The location, width and depth of the pipeline trench needs to be considered in relation to the foundations and ultimate support of the towers themselves. Excavation too close could undermine the foundations. The potential for accidental damage to the tower structures is also increased when large construction equipment is active in close proximity.

Equipment necessary to cut the trench, unload pipe from the transport trucks and lower the finished pipeline into the ground can project ten to twenty feet above the ground bringing it that much closer to potential contact with the electric lines. Many electric companies specify the maximum height of equipment that is allowed around their power lines. Depending on the height of the electric lines above ground, there may be insufficient clearance for pipeline equipment to operate safely around those lines.

Another issue of concern that is related to the proximity of a pipeline to electric tower lines is the potential for stray electrical current from the power grid and its grounding facilities affecting the corrosion protection system installed on the pipeline. Pipeline operators measure, monitor and design for stray currents in the vicinity of their pipelines. Being located between tower lines as opposed to on one side of a single tower line may cause additional, long term operational difficulties.

Distance of the population of the community from transmission pipelines is perceived as the ultimate safety measure. The Code does not specify an exclusion zone around transmission lines, but it does recognize distance in several sections. The defined class location unit (discussed in section III.A above) covers a distance of 660 feet each side of the centerline of the pipeline. The concentration of population within that distance is used to impose stricter design requirements of a pipeline as it becomes greater. No differentiation is made for the lessened effect as one is further from a potential incident site.

A rule in Subpart O, Pipeline Integrity Management, of the Code addresses the distance from the pipeline by defining a "potential impact radius (PIR)". This is the radius of a circle within which the potential failure of a pipeline could have a significant impact on people or property. The PIR is calculated by the operator and is dependent on the size of the pipeline and the pressure at which it operates. For the Transwestern pipeline the PIR is approximately 800 feet. This radius is used in the determination of high consequence areas along the routes of transmission pipelines.

The additional setback from the edge of the right of way of an estimated 70 to 175 feet by locating the line closer to electric towers may not increase the actual safety of the community when that distance is compared to distances in the Code that recognize a pipeline's area of influence.

VI. Additional Design Parameters and Operational Procedures to Increase Safety of the Proposed Pipeline

A. Design Parameters

Since the Town of Buckeye anticipates continued development along significant sections of the proposed Transwestern pipeline, designation of all areas within the town as class location 3 should be considered. This would ensure a heavier wall thickness pipe is installed which reduces the hoop stress on the pipe when it is pressurized. It would also require that main line valves be placed closer together. As the population grows, the

Code will require pipeline to meet all the provisions applicable to the higher class location

Transwestern should address the capabilities and feasibility of installing a leak detection system that operates through their computer control center system. Such systems are not typically used by gas transmission pipeline operators. Another monitoring system that is still in the trial phase uses a detector, usually a wire cable, installed along the pipeline to sense excavation activity in the vicinity of the pipeline location. An alert and the location are sent to the control center which can dispatch local personnel to inspect the area on site. This has the potential of preventing damage to the pipeline from digging equipment but is not currently commercially feasible.

Pipeline markers in addition to those required by the Code should be installed and maintained along the route of the pipeline. Potential locations could be any known or proposed future road crossing and any areas where people tend to congregate, e.g., camping or picnic sites, off road vehicle usage, hunting spots, etc.

Main line valves should be installed below ground to reduce potential vandalism and potential negative aesthetic impacts. Fencing around these and any other facilities associated with the pipeline can be made to blend with the surroundings or comply with any ordinance covering fence requirements. Aboveground piping should be painted with a color that blends in. Buildings and similar structures should be of a design and construction that is compatible with the surrounding area.

In locations where gravity flow sewers are planned, the pipeline should be installed with off sets or a greater depth of cover so that it does not have to be relocated in the future and would not need to be disturbed or uncovered for installation of those facilities.

Pursue having the line of lay of the pipeline within the SRP right of way designated at a more interior position. This is often at the discretion of the owner of the right of way. This should be required at the locations where structures have already been built abutting the edge of the right of way and could be considered through permitted future development areas or within the entire town limits.

B. Operational Procedures

The Code contains many regulations governing the operation, maintenance, inspection, surveying, patrolling and repair of gas pipelines. Operators are required to have and follow a number of written plans and programs covering all such procedures including:

- Operations and Maintenance Plan
- Corrosion Control Procedures
- Damage Prevention Program
- Emergency Plan
- Public Awareness Program
- Program for Qualification of Pipeline Personnel

- Integrity Management Program

Many inspections, surveys and the like are required at specified or periodic intervals including:

- External and atmospheric corrosion monitoring
- Review of adequacy and effectiveness of procedures
- Continuing surveillance
- Communication with excavators
- Liaison with fire, police and other public officials
- Communicate with various stakeholders regarding public education about the pipeline
- Investigate accidents and failures
- Sample for proper odorant concentration
- Patrol pipeline to observe for factors affecting safety and operation
- Perform leakage surveys
- Inspect and test pressure limiting and regulating equipment
- Re-evaluate the qualification of personnel
- Perform an integrity assessment of pipe in high consequence areas

Two high consequence areas (HCAs) have been identified by Transwestern within the Town of Buckeye. These are between mile posts 133.9 and 136.5 and between mile posts 149.6 and 151.4. HCAs contain segments of a transmission pipeline that are subject to the Pipeline Integrity Management regulations of Subpart O of the Code. These rules impose inspection, operation, repair and other requirements that are additional to what the remainder of the Code requires for all other gas piping in an operator's system. The entire segment within the town borders should be designated as an HCA so that all the required activities would apply to that section of the pipeline. This would provide closer attention to that piece of pipe than is actually required by the Code.

Damage to a pipeline by excavation in its vicinity is the leading cause of failure, both immediate and delayed. The Code requires pipeline operators to develop and maintain a damage prevention program and become a member of the appropriate one-call system ("blue stake"). At a minimum, the damage prevention program must include identification of all excavators that operate in the vicinity of the pipeline; actual notification of each excavator and notification of the public of the damage prevention program and how to learn the location of the pipeline before excavating; a means to receive and record notifications of planned excavation activities; provision of temporary marking of the pipeline location in the field; and inspection of the pipeline if there is reason to believe the pipeline was damaged by the excavation. Many transmission line operators enhance their program beyond the minimum Code requirements by providing an employee on-site to monitor excavation activity when it is occurring near the pipeline. Another tool is to patrol the pipeline right of way on as frequent as a weekly basis (usually by aircraft) to observe activity that is near or approaching the line location. Other things that could be considered are more frequent notification of the public and the

Local Agencies

excavators or informational meetings and workshops designed specifically for excavators.

Liaison with local fire and police departments and emergency response or emergency management agencies is required as a fundamental part of an operator's emergency plan. Such liaison needs to be often enough and in sufficient detail to accomplish the following objectives:

- Learn the responsibility and resources of each organization that may respond to a gas pipeline emergency.
- Acquaint the agencies with the operator's abilities in responding to an emergency situation including the availability of personnel, tools, equipment and materials.
- Identify the types of gas pipeline emergencies which will trigger notification of public emergency response officials.
- Plan how the operator and the public officials can engage in mutual assistance in order to minimize any hazards to life and property including both planned and actual responses.

The liaison process would be enhanced if Transwestern were to establish a local, staffed field office within the Town of Buckeye to ensure rapid response when required and quick deployment of the equipment, tools, etc. needed at the scene of an emergency. Having responsible operator personnel nearby should improve communication and planning among all interested parties. Town officials could require face to face meetings to implement the liaison practices even though such are not required by the Code. Transwestern personnel should be required to participate in any field emergency response drills conducted by local officials and to provide training to emergency responders of the area in the characteristics and procedures for safely handling a gas pipeline emergency. It should be noted that emergency response drills in the Town of Buckeye include scenarios involving Palo Verde Nuclear Generating Plant. The information provided by Transwestern does not address these matters.

All pipeline operators are required by the Code to have public awareness programs that are customized for different stakeholder audiences near the pipeline. The messages may be different for different groups and include the purpose and reliability of pipelines, hazard awareness and prevention measures, leak recognition and appropriate response, emergency preparedness communications, damage prevention activities, pipeline location information, high level description of integrity management programs for high consequence areas, right of way encroachment prevention, operation and maintenance activities associated with the pipeline, and security issues. The frequency of communication with each applicable stakeholder audience and method of presenting the messages may be selected by the operator subject to specified minimum Code requirements. The stakeholder audiences are defined as Affected Public such as residents along the pipeline and places of congregation, Emergency Officials such as fire department and other emergency response agencies, Local Public Officials including those of cities, towns and counties traversed by the pipeline, and Excavators including contractors, land developers and one-call centers. Frequency minimums range from

annually to every three years. The primary means of communication used by most pipelines relies heavily on targeted distribution of printed materials (mailings). Additional awareness leading to additional public safety could be attained by requiring Transwestern to communicate by means of personal contact with members of these audiences at intervals more frequent than the minimum required. This method ensures that the audience members actually receive and understand the messages being sent.

ARTICLE 2

EVALUATION OF POTENTIAL FIELD CONFLICTS ASSOCIATED WITH TRANSWESTERN'S PROPOSED NATURAL GAS PIPELINE THROUGH THE TOWN OF BUCKEYE, ARIZONA

I. Scope

EN Engineering has conducted a field analysis and a review of available documents and drawings to determine areas of potential conflict between existing and proposed improvements and the proposed natural gas pipeline within the Town of Buckeye, Arizona. EN Engineering has examined potential conflicts with irrigation lines, sanitary sewer lines, telephone lines, cable lines, electric lines, natural gas distribution lines, fiber optic lines, etc. Article 2 summarizes the areas of potential conflict and provides a brief discussion of the impacts to the existing and proposed infrastructure, both man-made and naturally occurring.

II. Potential Conflicts with Existing and Proposed Subdivisions

EN Engineering has reviewed potential conflicts in each sub-division along Transwestern's proposed pipeline corridor. These subdivision/master-planned communities are Sun City Festival, Sun Valley Villages I, II, III and IV, Anthem West at Sun Valley South, Elianto, Tartesso and Desert Creek. **See Appendix B for all referenced Exhibits.**

A. Sun City Festival

The Sun City Festival sub-division is a proposed 3,100 acre master-planned community that lies at the northern end of the Town of Buckeye. This community consists primarily of high density residential units. This community lies between mile posts 131.9 and 137.77 of the proposed Transwestern natural gas pipeline, in the general area bounded by Desert Oasis Boulevard on the west and Canyon Springs Boulevard on the east, and bounded on the north by the CAP Canal, and on the south by Sun Valley Parkway. The proposed Transwestern pipeline runs north of and parallel with Beardsley Parkway where it bisects the community. **See Exhibit #1** – "Sun City Festival by Del Webb Lot Mix Map".

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (4) proposed roadways. **See Exhibit #3** – "Festival Ranch Del Webb Planning Units 1, 2, 3, Buckeye, Arizona Conceptual Development Plan".

2. The proposed pipeline will cross a total of (1) proposed reclaimed water main (size unknown). **See Exhibit #2** – "Festival Ranch, HEC-1\ Schematic (Plate #1)".

3. The proposed pipeline will cross a total of (3) proposed water mains. **See Exhibit #2** – "Festival Ranch, HEC-1 Schematic (Plate #1)".

4. The proposed pipeline will cross a total of (10) proposed sanitary sewer pipes. **See Exhibit #2** – "Festival Ranch, HEC-1 Schematic (Plate #1)".

a. Pipe # I-1
b. Pipe # H-1
c. Pipe # G-1
d. Pipe # D-1-2
e. Pipe # C-1-3
f. Pipe # 10
g. Pipe # 17
h. Pipe # 13
i. Pipe # 3
j. Pipe # 2

5. The proposed pipeline will cross a total of (3) proposed storm drains. **See Exhibit #3** – "Festival Ranch Del Webb Planning Units 1, 2, 3, Buckeye, Arizona Conceptual Development Plan".

6. The proposed pipeline will cross a total of (3) proposed detention basins. **See Exhibit #2** – "Festival Ranch, HEC-1 Schematic (Plate #1)".

a. Retention Pond #1
b. Retention Pond #R1
c. Retention Pond #2

7. The proposed pipeline will cross a total of (4) planned 36" Box Culverts. **See Exhibit #2A** – "Master Drainage Plan".

B. Sun Valley Village I & II

The Sun City Festival sub-division is a proposed 5,960 acre master-planned community that lies at the northern end of the Town of Buckeye. This community consists primarily of medium and high density residential units, commercial space, commerce and business parks, office space and public use facilities. The community lies between mile posts 137.78 and 141.00 of the proposed Transwestern natural gas pipeline, in the general area bounded by the Hassayampa River on the west, a State Land parcel on the east, and bounded on the north by Sun Valley Parkway, and on the south by a major arterial road and a minor arterial road. The proposed Transwestern pipeline runs south and east of Sun Valley Parkway where it bisects the community. **See Exhibit # 4** – "Plate 2 Land Use Exhibit".

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (4) proposed roadways. **See Exhibit #5 -** "Sun Valley Community – Villages I and II Master Street and Circulation Plan".

a. Sun Valley Parkway
b. Minor Arterial Roadway (Name TBD)
c. Minor Arterial Roadway (Name TBD)
d. Major Arterial Roadway (Name TBD)

2. The proposed pipeline will cross a total of (4) proposed water mains. **See Exhibit #6** – "Ultimate Water Master Plan".

a. 12" Water Distribution Main (#P-21)
b. 36" Water Transmission Main (Pipe # Unknown)
c. 12" Water Distribution Main (#P-29)
d. 12" Water Distribution Main (#P-31)

3. The proposed pipeline will cross a total of (1) proposed sanitary sewer pipe. **See Exhibit #7** – "Master Waste Water Plan Plate 3 – Infrastructure Exhibit".

a. Sanitary Sewer Pipe (#P44)

4. The proposed pipeline will cross a total of (4) drainage basins. **See Exhibit #8 –** "Sun Valley Master Drainage Plan".

a. Basin #SB23c
b. Basin #SB26b
c. Basin #SB35
d. Basin #SB41

C. Sun Valley Village III & IV

Sun Valley Villages III & IV is a proposed 6,100 acre master-planned community that lies in the central part of the Town of Buckeye. This community consists of low, medium and high density residential units, commercial space, a business park, light industrial development, schools and parks. This community lies between mile posts 141.00 and 146.00 of the proposed Transwestern natural gas pipeline, in the general area bounded by the Hassayampa River on the west, a State Land parcel on the east, and bounded on the north by Greenway Road, and on the south by Northern Avenue. The proposed Transwestern pipeline runs east of Sun Valley Parkway where it bisects the community. **See Exhibit # 9** – "Sun Valley Villages III and IV Land Use Plan".
Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (9) proposed roadways. **See Exhibit #10 -** "Figure 12: Master Street and Circulation Plan".

a. Northern Avenue
b. Road K
c. Olive Avenue
d. Street A
e. Peoria Avenue
f. Cactus Road
g. Waddell Road (South)
h. Waddell Road (North)
i. Greenway Road

2. The proposed pipeline will cross a total of (4) proposed water mains. **See Exhibit #11 -** "Sun Valley Villages III&IV".

a. 8" Water Main (Pipes #27, #22)
b. 8" Water Main (Pipe #6)
c. 8" Water Main (Pipe #1)
d. 8" Water Main (Pipe #12)

3. The proposed pipeline will cross a total of (6) proposed drainage basins. **See Exhibit #12** – "Pre Development Drainage Sub Basin Map".

a. Basin #SA-38
b. Basin #SA-37
c. Basin #SA-35
d. Basin #SA-31
e. Basin #SA-23
f. Basin #SA-22

4. The proposed pipeline will cross a total of (10) proposed sanitary sewer pipes. **See Exhibit #12A** – "Sanitary Master Schematic Line Diagram".

a. 12" Pipe #P-58
b. 12" Pipe #P-10
c. 12" Pipe #P-54
d. Pipe #P-77 (Size Unknown)
e. 10" Pipe #P-49
f. 15" Pipe #P-17
g. 10" Pipe #P-52
h. 10" Pipe #P-60
i. 10" Pipe #P-59
j. 8" Pipe #P-2

D. Anthem West at Sun Valley South

The Anthem West subdivision is a master-planned community that is located in the central part of the Town of Buckeye. This community consists of high density residential units, active adult living units, retail space, commercial space, a community center, schools, churches and parks. The community lies between mile posts 146.00 and 147.55 of the proposed Transwestern natural gas pipeline, in the general area bounded by Johnson Road on the west and just east of Turner Road, and bounded on the north by Northern Avenue, and south of Anthem Way. The proposed Transwestern pipeline runs parallel with Sun Valley Parkway to the east where it bisects the community.

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (3) proposed roadways. **See Exhibit #23** – "Village 3 Water – Transmission System".

   a. Northern Avenue
   b. Glendale Avenue
   c. Anthem Way

2. The proposed pipeline will cross a total of (4) proposed water mains. **See Exhibit #24** – "Fig 4: Water Master Plan Distributor System".

   a. 16" Water Main (P-145)
   b. 16" Water Main (P-152)
   c. 16" Water Main (P-459)
   d. 16" Water Main (P-294)

3. The proposed pipeline will cross a total of (3) proposed sanitary sewer pipes. **See Exhibit #25** – "Fig 3: Wastewater Master Plan System".

   a. 15" Pipe # P-P4.2
   b. 24" Pipe #P-P3.3
   c. 24" Pipe #P-P1.1

E. Elianto

The Elianto sub-division is a proposed 6,100 acre master-planned community that lies in the central part of the Town of Buckeye. This community consists of medium, medium-high and high density residential units, commercial space, schools, mixed use areas and parks. The community lies between mile posts 147.55 and 148.57 of the proposed Transwestern natural gas pipeline, in the general area bounded by Sun Valley Parkway on the west and Turner Road on the east, and bounded on the north by Missouri Road, and on the south by Thomas Road. The proposed Transwestern pipeline runs on the northwest portion of Sun Valley Parkway where it runs parallel with the community.

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (2) proposed roadways. **See Exhibit #13** – "Water Distribution System".

   a. Bethany Home Road
   b. Camelback Road

2. The proposed pipeline will cross a total of (2) proposed water mains. **See Exhibit #13** – "Water Distribution System".

   a. 16" Water Main (P-120)
   b. 16" Water Main (P-129)

3. The proposed pipeline will cross a total of (6) proposed drainage basins. **See Exhibit #14** – "Elianto Wastewater Collection System Plan".

   a. Basin #SA-38
   b. Basin #SA-37
   c. Basin #SA-35
   d. Basin #SA-31
   e. Basin #SA-23
   f. Basin #SA-22

F. Tartesso

The Tartesso sub-division is a 3,889 acre master-planned community that lies at the southern end of the Town of Buckeye. Some areas of this community have already been constructed, or are in the progress of being developed. This community consists primarily of low, medium-low, medium, medium-high and high density residential units, as well as commercial space, schools, parks, mixed use areas and public use facilities. The community lies between mile posts 148.57 and 153.24 of the proposed Transwestern natural gas pipeline, in the general area bounded by the Hassayampa River on the west and Sun Valley Parkway on the east, and bounded on the north by Glendale Avenue, and on the south by the Tonopah Salome Highway. The proposed Transwestern pipeline runs southwest diagonally on the southeast corner where it bisects the community.

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (4) roadways. **See Exhibit #15** – "Tartesso Unit 2A Buckeye, AZ On-Site Drainage Exhibit A".

a. Celeborn Drive
b. 303rd Avenue
c. Tartesso Parkway
d. Valinor Drive

2. The proposed pipeline will cross a total of (3) water mains. **See Exhibit #16** – "Water Master Plan".

a. 20" Well Transmission Line
b. 20" Distribution Line
c. 16" Distribution Line

3. The proposed pipeline will cross a total of (4) sanitary sewer pipes. **See Exhibit #17** – "Exhibit 6 Tartesso Ultimate Sewer System".

a. 12" Sanitary Sewer Pipe
b. 15" Sanitary Sewer Pipe
c. 16" Sanitary Sewer Pipe
d. 27" Sanitary Sewer Pipe

4. The proposed pipeline is along a total of (10) Retention basins – **See Exhibit #15** – "Tartesso Unit 2A Buckeye, AZ On-Site Drainage Exhibit A".

a. Drainage Area 1
b. Drainage Area 2
c. Drainage Area 3.1
d. Drainage Area 3.2
e. Drainage Area 4
f. Drainage Area 31.1
g. Drainage Area 31.2
h. Drainage Area 24.1
i. Drainage Area 41
j. Drainage Area 52

G. Desert Creek

The Desert Creek sub-division is a proposed 2,233 acre community that lies at the southern part of the Town of Buckeye south of Interstate 10. This community consists of low, medium, medium-high and high density residential units as well as commercial areas and parks. This community lies between mile posts 153.77 and 155.24 of the proposed Transwestern natural gas pipeline, in an area bounded by the Hassayampa River on the west and 315th Avenue on the east, and bounded to the north by Interstate 10 and to the south by Southern Avenue. The proposed Transwestern pipeline bisects diagonally the north part of this community as seen on **Exhibit #18** – "Conceptual Land Use Plan Figure 2".

Transwestern's proposed pipeline route within this community may be in conflict with the following items:

1. The proposed pipeline will cross a total of (4) proposed roadways. **See Exhibit #18** – "Conceptual Land Use Plan Figure 2".

   a. Interstate 10
   b. Proposed Collector A
   c. 323rd Avenue
   d. Yuma Road

2. The proposed pipeline will cross a total of (3) proposed water mains. **See Exhibit #19** – "Desert Creek Water System Map".

   a. 16" Water Main (Pipe #47)
   b. 20" Water Main (Pipe #41)
   c. 12" Water Main (Pipe #163)

3. The proposed pipeline will cross a total of (3) proposed sanitary sewer pipes. **See Exhibit #20** – "Desert Creek Sewer System Map".

   a. 8" Sanitary Sewer (Pipe # P-68)
   b. 12" Sanitary Sewer (Pipe #P-63)
   c. 12" Sanitary Sewer (Pipe P-27)

III. Discussion of Potential Conflicts

A. Roadways

- Vertical conflicts with grading – Because of the large acreage of the development areas, it is anticipated that the impact of grading will be substantial for underground utilities. Primary risks are that the pipeline may be left shallow or exposed due to grading of the area. The pipeline should be installed at a depth sufficient enough to ensure adequate depth after grading operations have been completed, to avoid possibly having to lower the pipeline at a later date.
- Roadbed excavation and installation – The pipeline may be susceptible to damage during the excavation and installation of road beds. After grading is complete, road bed installation may extend several feet deeper than the final finished grade.
- Unsuitable soil removal and replacement – The pipeline may be exposed, undermined, or damaged if it is necessary to remove additional unsuitable soil in the road way. If the unsuitable soil removal is deeper than the pipeline itself, the pipeline may be over-stressed and risk failure if enough area under the pipe is removed. The pipeline may need to be supported during construction.
- Curb and gutter installation – The curb and gutter sub-bases may be in vertical conflict with the pipeline during their installation, and this introduces a potential for damage to the pipeline. Based on the discussion of drainage and flood water

control in some of the communities, it appears that the curbs and gutters within some of the subdivisions have been designed to hold and channel water in the roadway in case of flooding; therefore, the foundations for the curbs may be somewhat deeper than that of normal installations, thereby potentially increasing the risk for excavation damage. Further information regarding the curb and gutter design will be needed to make a final determination as to the potential impact to the pipeline.

- Under-drains along edge of the road way – The installation of these drains are typically below the sub-base of the road. The pipeline may pose a vertical conflict with the pipeline or introduce risk of damage to the pipeline.
- Compaction of the proposed roadway - Stress may be introduced onto the pipeline by large road construction equipment such as vibratory rollers and the sheep's foot roller. The pipeline should be installed to a depth sufficient to mitigate these external loads and forces.
- Heavy equipment crossings – During road installation, heavy road construction equipment such as the pan truck, final grading equipment, proof rolling equipment, asphalt and material semi-trucks, and final paving operations roller equipment all introduce stress on the pipeline due to their heavy loadings, potentially weakening or deforming the pipeline.
- Bridge, bridge culvert, and pylon installation – Vertical conflicts with the pipeline are possible since the foundations for these structures can be deep and can span outward (e.g. wing walls). Pylon installation and placement associated with deep excavation also introduces the risk of horizontal conflicts which may result in stress and failure of the pipeline due to vibration. At this time, the number and location of these structures could not be determined; however it was noted in some areas that culverts will be installed, although the exact type and installation method could not be determined. Further review of these potential structures will be needed to determine potential impacts to the pipeline.

Final roadway plans were not available during the time of review; therefore, the type and size of structures, elevations, topography, grading, soil borings, and other specific details for the roadway could not be ascertained. Analysis was based on preliminary road schematics and assumptions were made based on typical road construction techniques.

B. Reclaimed Water and Potable Water Mains

- Vertical conflicts with the elevation of proposed water mains – Water mains are typically installed between 4 ft. to 6 ft. below final grade. Because of the size of the water mains, the potential for the proposed transmission line to be installed at the same elevation as the proposed water mains is a concern, and will result in either the water main being installed under or over the proposed transmission pipeline. Any excavation near the transmission pipeline poses a risk for damage.
- Installing the pipeline at a deeper elevation than the water mains will reduce the risk of damage to the pipeline during installation and future maintenance of these water mains. In addition, installing the pipeline under any proposed water mains

reduces the risk of undermining the gas pipeline and damage from digging equipment.

- Corrosion - the pipeline may be susceptible to corrosion due to the proximity to the water mains. If ductile iron water mains are utilized, the potential for corrosion activity is heightened between the two metallic structures. More information is needed to determine if the method of corrosion control to be used on the pipeline introduces corrosion risk on other neighboring structures such as the water mains.

C. Sanitary Sewers, Storm Drains, and Retention Ponds and Basins

- Vertical conflicts – The pipeline may be in vertical conflict with the many proposed sanitary sewer crossings. The sanitary sewers within the sub-divisions are gravity-fed; therefore, the flow elevations of these pipes cannot be changed easily. Any vertical conflicts with the sanitary gravity-fed system may require substantial re-engineering of the sub-division's sanitary system, that may include pipe re-sizing, additional structure installation, sewer re-routing, and the installation of pump stations.
- Construction – Sanitary sewers are typically installed at significant depths and require large openings for installation. For example, in Sun Valley Village III & IV, the depths of the sanitary sewers vary from 8 ft. to 20 ft. below proposed grade. Installation of the pipeline above the sanitary sewers will result in difficulty installing trench boxes and shoring. Also, the use of large excavating equipment to excavate and install the sewer pipe all pose risks for damage to the pipeline. It is possible that without supporting the pipeline during these deep excavations that the pipeline can be overstressed and risk damage.
- Structures - Large sanitary structures such as mixing basins, man-holes, and clean-outs are all potential conflicts with the proposed transmission line. The locations of these structures are typically fixed by the gravity-fed system, and adjustment of these structures may be limited.
- Storm drains – The proposed transmission gas pipeline will need to be installed at a deep enough elevation to avoid the proposed reinforced storm drains that will utilize the existing alluvial fan formations within the sub-division. The construction of these drains will require widening and deepening of the existing fans below the existing scour zones to facilitate the installation of a concrete base. In addition, concrete pillars will be installed to a greater depth to control flow and sediment. The proposed storm drain system is gravity-fed, and as such, modification to the flow elevation will be difficult and may impact flood control mitigation. Additional research and investigation, which is beyond the scope of this report, with the Flood Control District of Maricopa County, US Army Corp of Engineers, FEMA, and the US EPA will be required.
- Retention ponds – The proposed transmission gas line may impact the proposed retention ponds. The alignment of the transmission line appears to place it within the area of retention ponds. Since the retention ponds are typically designed to hold large amounts of water, and are installed at elevations significantly below

grade, the transmission pipeline may vertically conflict with these retention ponds.

Final sanitary sewer and drainage plans were not available during the time of review; therefore, the type and size of structures, elevations, topography, grading, soil borings, and other specific details on the overall drainage could not be ascertained. Analysis was based on preliminary sewer and drainage schematics.

Crossing utilities and excavations near the pipeline introduces the possibility of damage to the pipeline that can lead to a leak or failure. At times, pipelines are struck but do not immediately fail; however, damage such as to the protective coating on the outside of the pipeline, or dents, create an environment where the pipe is weakened and starts the process for eventual failure. The transmission pipeline will cross other utilities such as gas, electric, telephone, cable TV, etc., in numerous areas, increasing the possibility for damage and pipeline failure. Utilities are generally installed in the road right-of-way, under or alongside of roadways and at shallower depths than water mains and sewer lines. Installation of the Transwestern pipeline at a depth sufficient to be below the lowest utility at each known and proposed road crossing right-of-way would remove it from interference from these facilities.

The placement of the transmission gas pipeline along the existing electric transmission line corridor introduces the risk of a potential pipeline failure due in large part to third-party damage during excavation near the pipeline. The area of development will require new underground infrastructure. In addition to the initial installation of these facilities, all underground utilities will require periodic inspection, maintenance, repair and replacement. These excavation events all introduce a potential for damage to the pipeline, namely damage to the pipeline great enough to cause a gas leak that results in significant gas escape and ignition.

D. Summary

As a result of the risks of third party damage from the installation or inspection, maintenance, repair or replacement of various utilities as described in this discussion, it would be prudent to design the pipeline in such a way to reduce the likelihood of damage to the pipeline by excavations. Typical utility crossings result in a depth of installation of approximately 4 ft. to 6 ft. below the finished grade, while sanitary sewers are typically installed at depths of 8 ft. to 12 ft. below the finished grade. Therefore, one way to avoid the risk of damage to the pipeline would be to install the pipeline initially at a depth that would result in a minimum of 2 ft. of vertical separation between the top of the pipeline and the invert (bottom) of the deepest structure or utility that will be crossed by the pipeline. Installing the pipeline at this depth also helps to protect the pipeline from external stresses introduced by heavy equipment crossings, further mitigating risks. The deepest areas of installation would be in some areas where the sanitary sewer depths reach 20 ft. below proposed grade.

It is likely that installation of the pipeline at road crossings would require installation via directional boring if the roadway has been installed prior to pipeline construction. Otherwise, open-cut trenching can be used. Directional boring will add significant costs to the project. If soil conditions indicate rock, or rocky conditions, additional costs will be incurred to bore these areas. If these areas cannot be bored, rock blasting may need to be utilized, which is an additional cost item.

In areas involving alluvial fan/wash crossings, it is recommended that the pipeline be installed at depths recommended by appropriate jurisdictional authorities (US Army Corp. of Engineers, US EPA, Flood Control District of Maricopa County, etc.). It is assumed that the installation depth of the pipeline across these structures will need to be at a sufficient depth below the scour zone to negate the effects of future erosion of grade over the pipeline. It is further assumed that because of Section 404, Permitting of the Clean Water Act and other environmental permitting, those pipeline crossings involving the larger alluvial fans/washes may require the pipeline to be installed via directional boring rather than via the open cut/trenching method. Again, the jurisdictional authority will need to make a decision on the manner of installation of the pipeline across these washes.

IV. Discussion of Alluvial Fans

The area of planned development and a majority of Transwestern's proposed transmission corridor reside in an alluvial environment in which flood water runoff emerges from the mountain outcroppings of the White Tank Mountain range. The mountain range is located to the east of and adjacent to the area of proposed development. These outcroppings emerge at multiple apices (the head or highest point) that expand in a chain of multi-directional drainage patterns traveling towards lower ground elevations. In the area of development, these alluvial fans meet other drainage corridors and channels, both manmade and natural, where the flood waters ultimately make their way to the Flood Retarding Structures and to the Hassayampa River.

An alluvial fan is described as a sedimentary deposit with a semi-conical, downstream broadening fan-shape form where the topographic gradient reduces or breaks and where the transporting capacity is diminished as the width of flow increases, such as along a mountain front, fault scarps, valley sides, escarpment, or at glacier margins. **Exhibit #21** offers Typical Alluvial Fan Photos, from the Alluvial Fan Flood Hazard Management Symposium, Maricopa County Flood Control District.

These alluvial environments are characterized by multiple pathways where conveyance capacity is limited by the erosive force of the runoff and the erodibility of the soil strata. Therefore, the greater the flow, the greater the force of the flood water runoff, the easier for channels to form especially if the soil is easily eroded. Unlike river flood plains, alluvial floodplains effectively add deposits to the terrain since they carry mud and other debris with the flow, more so than what rivers carry. Also, unlike a river where the flow is generally confined to a relatively fixed channel area, the alluvial fan environment is characterized by substantial flow outside of a single boundary area. The flows are

unconfined with an ever-changing, haphazard, non-fixed alignment and are of varying depths. Also, unlike a river environment where flooding is confined to an area adjacent to the banks and expands outward, any flooding in an alluvial fan area is distributed over a larger area.

The complexity of these changing drainage passageways results in unique drainage solutions usually consisting of the collection of these waters on the alluvial fan and channeling the flow of water from these natural corridors, resulting in a system of primary channels, piping, detention and debris basins, and other storm water structures to address flood mitigation.

For example, the drainage facilities for the proposed Elianto development in the west slope watershed of the White Tank Mountains include 100 ft. to 300 ft. wide natural drainage corridors located along fixed alignments that parallel the natural drainage paths. The corridor will convey flood runoff emerging from the White Tank Mountains through four alluvial fans apices in a southwesterly direction to the Sun Valley Parkway. Each of the other developments also addresses their unique alluvial flow issues with a similar methodology and solution.

The proposed drainage infrastructure contains elements of collector channels, box culverts, levees, detention/sediment basins, and drainage corridors. The drainage corridors will essentially utilize the existing alluvial fan corridor in the area, but will be reinforced with concrete to stabilize and fix the corridor. The movement and channeling of this runoff is entirely by gravity through these proposed drainage corridors.

These drainage corridors will be designed with erosion walls and buried grade control structures to control long term erosion. Construction within the corridors will be done to satisfy the constraints imposed by Section 404 and to minimize artificial impact. A concrete scour curtain will provide protection against lateral channel migration. A concrete base will also be a characteristic of the design. **See attached Exhibit # 22 -** "Elianto Village IV – Town of Buckeye, Maricopa County AZ, Grade Control Design Profile Corridor No. 1, COE & VAN LOO, Phoenix, AZ".

Note: Information on alluvial fans from the following sources:

Final Drainage Report for Elianto Phases 1 & 2 Infrastructure, Town of Buckeye Arizona, January 15, 2007, prepared by Coe & Van Loo Consultants, Inc. For Lennar Communities Development, Inc.

Alluvial Fan – Flood Hazard Management Symposium, April 21-22, 2005, Mountain Preserve Reception Center, Phoenix, Arizona, presented by the Flood Control District of Maricopa County

The potential conflicts of the proposed Transwestern transmission pipeline with the proposed alluvial corridors/alluvial fans are as follows:

1. The aerial map of the proposed transmission pipeline indicates a large number of crossings with existing alluvial fans, both large and small, along the proposed transmission corridor. Because of local flood control permitting issues, hazard and risk control, flood control, sedimentation and erosion, and Section 404 permitting issues, the overall management strategy for excavation and restoration in these areas will vary and will pose challenges. Section 404 regulates the discharge of dredged or fill material into the waters of the United States and guidelines require avoidance of these areas first. The pipeline in these areas may need to be installed by directional boring to avoid negative impacts to the alluvial formations. **Exhibit #26** is a spreadsheet indicating the type of alluvial formation visible on an aerial map of the proposed pipeline corridor and its location based on the pipeline mileposts.

   Because EN Engineering is not an expert in alluvial fans or requirements for permitting, technical issues relating to alluvial fans should be directed to the US Army Corp. of Engineers, the EPA, the Flood Control District of Maricopa, and other required agencies. If the pipeline construction involves eliminating conflicts with the alluvial fans, it is estimated that approximately 18,200 ft. of pipe across (129) crossings may need to be directionally bored in areas appearing as larger alluvial fan formations (drains/washes) that may be subject to Section 404 permitting restrictions. It is also estimated that if directional boring is required in the smaller alluvial areas, approximately 12,100 ft. of additional boring across (121) crossings may be required. These quantities are based on available aerial maps.

   The proposed alluvial corridors will entail the construction of reinforced concrete walls and reinforced channel ways. The bottom of these proposed structures will be placed to an elevation below the existing scour area for the proposed concrete foundation installation. The depths of these structures vary from a few feet to more than 20 ft. deep in some areas. The flow of water through these channels is gravity-driven; therefore, any vertical conflicts with the proposed transmission pipeline may result in the pipeline having to be lowered to avoid such conflict. If a determination can be made to the exact placement of these proposed structures, it is recommended that the pipeline be installed at a depth that will avoid the proposed structure.

2. The proposed buried grade control structures may extend up to 8 ft. below the proposed bottom of the alluvial corridor. There is a potential for vertical conflicts with the proposed transmission gas pipeline since these structures do cross the pipeline in different areas, and the exact location of these drainage corridors varies in each of the proposed communities. It is recommended that the natural gas transmission pipeline be installed at an elevation deep enough to avoid the construction of these structures.

3. Installation of the pipeline by open-cut method (trenching) may damage the existing alluvial fan formations, possibly changing the primary water flow capacity and alluvial fan integrity. The resulting impact can be flooding of the area and damage to potential dwellings. Although hydrological studies have been performed on the effects of grading large areas of land, and the effect on water flow and channeling of

runoff, there is a potential risk that if a significant rainfall event exceeding the 100 year flow were to result, possible alluvial corridor failure may result in damage to the pipeline through the effects of erosion, soil wash out, and debris. A consideration of this possibility may be prudent in the determination of the depth of the pipeline in these areas.

See also Exhibit # 27 - "Elianto Village I – Infrastructure – Hydraulic Stationing and Water surface elevations (Plate #2)".

See also Exhibit # 28 - "Elianto – Regional Hydrology Maricopa County, Arizona – White Tank Mountains Riverine & Stage III Alluvial Flood Zones (Plate #3)".

V. Land Usage along Corridor

Based on land use maps by subdivision provided by the respective developers, it appears that a pipeline failure would impact the residential area. Below is a list by sub-division of the approximate number of homes and other buildings that will be constructed adjacent to the proposed gas transmission line along the proposed route within the potential impact radius for the Transwestern pipeline. This potential impact radius, which is further explained in the next section, is a calculated radius of impact measured from the centerline of the pipeline. The potential impact radius for the Transwestern pipeline was calculated to be approximately 800 ft. as specified in the Department of Transportation federal regulations covering pipeline safety.

The methodology employed in populating the following table involved first examining the land use maps provided by the developers. These maps showed the location of planned development within the proposed community. The area of review was along the corridor and the land usage on either side of the transmission line. Based on the analysis, it was found that low, medium, and high density residential areas are proposed within this area. It was discovered that in some developments, schools are also planned within the impact zone. Using the average developed units per acre data provided by the developers for each of the areas, the approximate number of units potentially affected was calculated using the impact radius and length of development along the corridor. The following table indicates the approximate number of homes and schools within the entire transmission pipeline corridor that fall within the calculated 800 foot impact radius:

Development	Homes	Schools	Rec Areas	Fire/Police Stations
Sun City Festival	908	1		
Sun Valley Villages 1 & 2	2551	3		
Sun Valley Villages III & IV	2877	0		
Elianto	101	0		
Tartesso	1918	0		1
Desert Creek	1335	0		
Totals*	**9690**	**4**		**1**

* NOTE: Data for Anthem West was not available at the time of analysis.

It appears that there are additional areas along the corridor where developments could be constructed in the future, thus significantly increasing the population along the corridor. Note that the total number of homes along the corridor within the impact radius does not represent the maximum or minimum number of homes that could be affected by an incident; rather, these are the total number of homes along the corridor that face the risk of being impacted.

The maps examined show the transmission pipeline in proximity to a well (Structure #W-5) near transmission pipeline mile post 151 in the Tartesso community. This area, noted on the aerial map as a "No refueling zone," is a potential ignition source for a leak generated by a pipeline failure due to the generators used for water pumping within these facilities. Information to determine other well locations and specific pumping equipment along the proposed pipeline corridor were not available at the time of assessment.

VI. Discussion of the Proposed East-West Alternate Route

An alternative to the proposed route chosen by Transwestern for the natural gas transmission pipeline is to utilize the APS 500 kv electrical transmission corridor known as the Palo Verde-Devers Utility corridor. This corridor extends from the proposed APS Harquahala Switch Yard, a 40 acre site located north of the existing APS Palo Verde Nuclear Power Generating Station and continues northward across Interstate 10 to meet the existing CAP canal corridor. At this point the pipeline would then continue eastward and parallel to the CAP canal along a 2000 ft. right of way area located to the north of the canal, to a point outside the Town of Buckeye. This route would position the transmission gas pipeline outside the town limits of Buckeye into unplanned, unpermitted and mostly undeveloped lands.

The east-west alternative route avoids the proposed and existing utility crossings, road crossings, and possibly some of the environmental issues involving alluvial fan drainage. In addition, this area is relatively secluded, and will substantially reduce, if not eliminate, the risks to life and property associated with a pipeline leak and failure within the Town of Buckeye. Transwestern's proposed alignment of the pipeline will place it in an area of thousands of homes versus the alternative route that has no planned, permitted or existing structures within the 800 ft. potential impact radius. There would be full knowledge of the transmission gas pipeline for any future development and Maricopa County could permit future communities in a manner that would avoid the potential impact radius and minimize conflicts associated with construction near the pipeline. The safety of the future community would be significantly enhanced as well since the developments could design and incorporate adequate safety measures to address potential impacts to life and property, such as adequate setbacks and/or buffer zones near the pipeline for homes, schools, businesses, commercial districts and public buildings.

Based on driving the alternate route, it appeared that this route had fewer existing alluvial fan areas (dry washes). This may reduce the need for installing the pipeline at deeper elevations and the possibility of directional boring in these areas. Since it is estimated that approximately six residences are located along the alternate route and no development in this area is planned for the foreseeable future, this area could be considered as a Class 1 pipeline installation area. This in turn reduces the required wall thickness on the pipeline, the material cost per mile of pipe installed, and the number of valves on the pipeline, which ultimately reduces the cost of pipeline installation.

APPENDIX A:

PROPOSED AND ALTERNATE ROUTE MAP

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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
PROPOSED PHOENIX EXPANSION PROJECT
Docket No. CP06-459-000

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APPENDIX B:

Exhibit Listing

Exhibit # 1	"Sun City Festival by Del Webb Lot Mix Map"
Exhibit # 2	"Festival Ranch, HEC-1 Schematic (Plate #1)"
Exhibit # 2A	"Master Drainage Plan"
Exhibit # 3	"Festival Ranch Del Webb Planning Units 1, 2, 3, Buckeye, Arizona Conceptual Development Plan"
Exhibit # 4	"Plate 2 Land Use Exhibit"
Exhibit # 5	"Sun Valley Community – Villages I and II Master Street and Circulation Plan"
Exhibit # 6	"Ultimate Water Master Plan"
Exhibit # 7	"Master Waste Water Plan Plate 3 – Infrastructure Exhibit"
Exhibit # 8	"Sun Valley Master Drainage Plan"
Exhibit # 9	"Sun Valley Villages III and IV Land Use Plan"
Exhibit # 10	"Figure 12: Master Street and Circulation Plan"
Exhibit # 11	"Sun Valley Villages III&IV"
Exhibit # 12	"Pre Development Drainage Sub Basin Map"
Exhibit # 12A	"Sanitary Master Schematic Line Diagram"
Exhibit # 13	"Water Distribution System"
Exhibit # 14	"Elianto Wastewater Collection System Plan"
Exhibit # 15	"Tartesso Unit 2A Buckeye, AZ On-Site Drainage Exhibit A"
Exhibit # 16	"Water Master Plan"
Exhibit # 17	"Exhibit 6 Tartesso Ultimate Sewer System"
Exhibit # 18	"Conceptual Land Use Plan Figure 2"

Exhibit # 19	"Desert Creek Water System Map"
Exhibit # 20	"Desert Creek Sewer System Map"
Exhibit # 21	Typical Alluvial Fan Photos, from the Alluvial Fan Flood Hazard Management Symposium, Maricopa County Flood Control District
Exhibit # 22	"Elianto Village IV – Town of Buckeye, Maricopa County AZ, Grade Control Design Profile Corridor No. 1, COE & VAN LOO, Phoenix, AZ"
Exhibit # 23	"Village 3 Water – Transmission System"
Exhibit # 24	"Fig 4: Water Master Plan Distributor System"
Exhibit # 25	"Fig 3: Wastewater Master Plan System"
Exhibit # 26	Spreadsheet indicating the type of alluvial formation visible on aerial maps
Exhibit # 27	"Elianto Village I – Infrastructure – Hydraulic Stationing and Water Surface Elevations – Plate #2, COE & VAN LOO"
Exhibit # 28	"Elianto – Regional Hydrology, Maricopa County, Arizona – White Tank Mountains, Riverine & Stage III Alluvial Flood Zones, COE & VAN LOO"

The attachments to this letter are too voluminous to include in this EIS. They are available for public inspection from the FERC's Office of External Affairs at 1-866-208-FERC or on the FERC Internet website (www.ferc.gov) using the eLibrary link. Click on the eLibrary link, click on "General Search," and enter the docket number excluding the last three digits in the Docket Number field (i.e., CP06-459). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676, or for TTY, contact (202) 502-8659. **The Category/Accession number for this submittal is 20070731-5091.**

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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Transwestern Pipeline Company, LLC **Docket No. CP06-459-000**

TOWN OF BUCKEYE'S RESPONSE TO TONOPAH VALLEY ASSOCIATION'S COMMENTS ON THE PROPOSED ALTERNATIVE EAST WEST PIPELINE AROUND BUCKEYE

The Town of Buckeye ("Buckeye") gives the following response to the Tonopah Valley Association's ("Tonopah") comments opposing the east-west route proposed by Buckeye and others as an alternative to Transwestern's pipeline route through the heart of the Sun Valley Parkway in Buckeye. Tonopah expresses concern that the alternative route will accomplish nothing more than shifting the burden of the pipeline from Buckeye and the master planned developments approved in and around the Sun Valley Parkway to those developments planned for the Tonopah Valley. Tonopah's concerns are unfounded.

LA19-1 The map attached hereto identifies each of the developments that have either been approved or are in the process of seeking approval from Maricopa County. Unlike the proposed Transwestern route, which is also included on the map, the alternative route is nowhere near any of the proposed Tonopah developments, maintaining a buffer of at least one mile. As a result, Tonopah's objection to the alternative route should have no bearing on the Federal Energy Regulatory Commission's consideration of the viability of the alternative route.

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LA19-1 Section 3.4.2.5 has been revised to include additional discussion of the relative degree and stages of development in the Buckeye and Tonopah Valley planning areas.

The TVA's concerns (see comment letter CO15) that the Buckeye Alternatives could impact planned and approved developments in the Tonopah Valley planning area are not unfounded. For example, the map included in the Town of Buckeye's response to the TVA's comments indicates that the South Buckeye Alternative would cross Belmont, an approved development in Tonopah Valley consisting of 78,423 residential units, for approximately 5 miles. In various filings, the TVA and Transwestern identified other planned developments in Tonopah Valley that would be crossed by the Buckeye Alternatives (see table 3.4.2-1). These other developments are at an earlier stage of planning than those identified in the Town of Buckeye's response to the TVA's comments but could come to completion within the time frame of the several decades estimated for completion of the Buckeye area developments. Market conditions and other factors will determine which developments are actually constructed and when.

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Respectfully submitted this 31st day of July, 2007.

By: /s/ *Richard B. Hood*

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CERTIFICATE OF SERVICE

I hereby certify that, on this 1st day of August, 2007, I caused the foregoing document to be served, by electronic mail, upon each person designated on the official service list compiled by the Secretary of the Federal Energy Regulatory Commission in this proceeding.

Dated at Phoenix, Arizona this 1st day of August, 2007.

By: /s/ *Richard B. Hood*

GUST ROSENFELD P.L.C.
201 E. Washington Street, Suite 800
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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
PROPOSED PHOENIX EXPANSION PROJECT
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