MISSION DISTRICT 36-INCH RECLAIMED LINE (April 19, 2011) FAILURE REPORT

This report presented by:

Tucson Water

Independent Engineering Review Conducted by:

CH2MHill

June 1, 2011

Mission District Reclaimed Failure Report

1. *Utility Background*

Tucson Water, a department of the City of Tucson, owns and operates the Tucson Water Reclaimed Water System.

The Tucson Water Reclaimed Water System is one of the largest reclaimed water systems in the State of Arizona. Started in 1984, the reclaimed water system at Tucson Water is comprised of various customers totaling near 1,000 accounts and has approximately 160 miles of large diameter transmission mains to move the water to those accounts. The reclaimed water used in this system is primarily for non-potable irrigation purposes. The reclaimed system is defined by ADEQ as a 'Class A' reclaimed system.

The reclaimed water system historically is about 10% of the total water demand for the Tucson Water service area. Tucson is committed to the continued and future use of reclaimed or recycled water to offset its total water demand for the community.

2. *Project Background*

Designed by Psomas Engineering, the relocation plan titled "Mission District Reclaimed", Tucson Water Plan Number 8-141-2010, was accepted by the City of Tucson Water Department/New Area Development for substantial conformance with Tucson Water specifications and details on February 2, 2011. KE&G, the contractor, completed the project as scheduled on April 15. The plan abandoned 658 linear feet of 36" concrete cylinder pipe (CCP) in Rio Nuevo Block 3 property owned by the City of Tucson. It installed 666 linear feet of new 36" ductile iron pipe (DIP) connecting with existing 36" CCP (PN 7-014-1990) in order to relocate the high-flow (13,000 gpm), high-pressure (150 psi) transmission line east, away from proposed construction.

The Mission District Reclaimed relocation project is contiguous with Modern Streetcar Segment 1 reclaimed water transmission main modifications (PN 4-079-2010) required to move Tucson Water assets outside of the Modern Streetcar restricted utility area. Modifications include a 22 ½ ° deflection in the 36" reclaimed main south (away from the restricted area) in a location east of the proposed Cushing Street bridge. That work, and work on additional large main relocations, was simultaneously underway, chiefly west of the eastbound I-10 Frontage Road, per PN 4-079-2010.

As this is a reclaimed water line, it did not require an Approval to Construct from PCDEQ. However, for consistency's sake, Tucson Water Inspectors utilize similar practices in the field that would be used on potable projects such as placing the pressure test information on the ADEQ forms and retaining this information in the project construction file.

There were two inspectors, which is usual only for large, high-value projects. In general, several projects are covered by one inspector. Inspectors prepare daily reports. They submit their reports to their respective supervisors (in the case of the Mission District Reclaim project, Manny Munguia), who in turn submit to the lead inspector, J.B. Celey. Prior to their acceptance, Stephanie Isaacson, a design reviewer within New Area Development, reviewed the plans for the Mission District Reclaimed relocation project with input from the Distribution Design Unit's Ed Lopez and Scott Schladweiler. Laurence Winn of New Area Development accepted the plans for Tucson Water. Psomas Engineering, in its consulting capacity for the Gadsden Company, prepared the design plans, with Regina Beem as the engineer of record, who sealed the document.

On the morning of April 19, the pressurization of the new main segment began on schedule and concluded with the separation of a joint in the existing two-decade-old main. This separation created a discharge condition to the site and the area near the intersection of W. Congress and Bonita, just west of I-10.

Figure 1 shows the location of the leak, west of I-10 and the Santa Cruz River on Congress Street.

3. Actions on the Day of the Event and Later Related Events

Refer to Figure 2 for locations and elevations along the pipeline. North is up.

April 19, 2011

08:06 – The lead Tucson Water inspector on the site, TW Inspector A of the Tucson Water Construction Unit, begins organizing the main filling operation, tells TW Inspector B to contact Maintenance Staff A, who will operate valves.

09:47 – TW Inspector A calls Maintenance Staff A to report that the inspectors are ready to begin filling and pressurizing the main.

10:11 – Maintenance Staff A starts opening the southern valve at the intersection of W. Simpson St. and S. El Paso Ave. near an elementary school on east side of the Santa Cruz River. (Maintenance Staff A's statement makes it "about 10:05.")

10:11 – TW Inspector A calls Reclaimed Operations to report that the valve is being opened. An unidentified person picks up. The call lasts 34 seconds. The reclaimed operator states in the log that he did not receive a call about the valve opening, but was alarmed by a sudden drop in pressure at the inlets of three sites where boosters or large instrumented valves exist. It is clear from Figure 3 that a steep falloff of inlet pressure to surrounding boosters and valves occurred at this time. Figure 4 shows the relative locations of sites that experienced a drop in pressure as a valve was opened to fill the new 36" main.

10:32 – TW Inspector B reports a leak in the existing main (not in the new main).

10:35 – Contractor Foreman (KE&G foreman at the site) calls TW Inspector A to report water mist geysering from an open 2" corporation stop for an air release valve at station 16+43.26 of PN 2-141-2010, and also a water jet from what turned out to be a ruptured 2" service at station 96+52.22 of PN 2-014-1990. It was initially mistaken for an emission from the existing air release valve at station 96+33.94.

10:45 – From Maintenance Staff A's statement, the valve is fully open at 10:45. Maintenance Staff A calls TW Inspector A to let him know.

10:46 – TW Inspector A calls Maintenance Staff A to close valve(s). This conflicts with Maintenance Staff B's statement that the time of the call was 11:10. Maintenance Staff A does not say when, or if, he received a call to close valves. He stated verbally afterward that he knew of the leak when he saw it at 11:10.TW Inspector A's phone log shows calls to Maintenance Staff A at 10:46 and 11:09. It is possible that information was lost in the confusion of the moment.

11:10 – Maintenance Staff B (part of the valve crew with Maintenance Staff A – this is from Maintenance Staff B's statement) starts opening the valve north of Congress on Bonita, sees water flowing from Congress, and immediately closes the valve.

11:15 – Reclaimed system operator Reclaimed Operator A reports in his log that the ruptured main has been isolated. Forty-five minutes later, at 12:00, he reports system operation back to normal.

12:00 – Tucson Water sets up an Emergency Operations Center (EOC) in the third floor director's conference room of the utilities planning and engineering building on Alameda St. The center is staffed by Engineering Administrator Pat Eisenberg, Planning Administrator Joe Olsen, Deputy Director Sandy Elder, Operations Administrator Jeff Biggs, Chief Inspector J. B. Celey, III, and others as needed.

May 11, 2011

On May 11, crews discovered a second instance of the separation failure mode, time of failure unknown, and this time not accompanied by leakage, south of the April 19th break in Segment 1 of the Modern Streetcar Transmission Main Relocation. Figure 7 shows the site. New 36" ductile iron main, about 18 feet of it, had been left uncovered at the point where it connects to existing concrete cylinder pipe at a 22 ½ °bend.

The main had been refilled using a plan devised after the initial incident. According to the plan, 36” valves on either end remained closed. The main was filled over about 10 hrs with potable water through a hose and a newly-installed 2-inch corporation stop (tapped connection with a ball valve). The source was a fire hydrant on Bonita Avenue.

After the pressure stabilized at the line pressure of the potable source (about 50 psi), a final inspection of the uncovered portions of the main found a crack in the mortar coating of one of the existing concrete cylinder pipe joints west of the connection (Figure 7). KE&G crews chipped away the mortar to inspect the joint. They reported that electrical bonding clips had bent and that the joint had moved 1½ inches. Although not discovered on April 19, the damage is difficult to explain as other than secondary, starting at the time of the Congress Avenue/Bonita leak and possibly aggravated by refilling. The joint had not been restrained because restraint was not needed with the pipe covered per the design intent. This pipe was not covered, having been left open for leak inspection. There are other methods for discovering leaks, and this was not the best choice, although it is the fastest. As will be shown, it was an important factor in both the primary main break and this later-discovered damage.

Repairs reflected the recommendations given below for dealing with and preventing the failure mode. Following a dewatering procedure, the offending segment of concrete cylinder pipe (CCP) was removed and a new ductile iron segment was installed in its place. The new ductile iron segment was joined to the undamaged CCP with a welded and flanged assembly (a spool piece and butt strap). A cement thrust block further restrained the joint at the bend. The uncovered sections were backfilled to specification.

Once the repairs were complete, filling and pressurization of the pipe came to a successful conclusion. Joints to be inspected visually for leakage were uncovered one at a time.

4. Damage Assessment

Collateral damage included the loss of an 80-foot section of 10” potable water main in Congress St. The main was exposed, but not ruptured, in the incident. It was isolated, removed, and capped to make room for repairs to the large main. Crews tied the affected services to a surface “high line” from a nearby fire hydrant. A connecting 6” potable water main in Bonita Ave. was temporarily capped. Crews later replaced the section of 10” main with 12” main to facilitate repairs, as 10” is not a current standard size.

An 8” sewer main was breached, and a manhole destroyed. However, the sewer main was a dead-end branch with zero flow. No sewage was released in the incident. No service was interrupted.

Electrical conduit for street lighting was cut at the intersection of Congress Street and Bonita Ave.

A 2” reclaimed water service south of the proposed Cushing Street bridge on the west side of the river split as a result of overpressure during the incident.

Tucson Water staff from the System Planning and Evaluation section prepared an estimate of lost reclaimed water based on recorded Supervisory and Control and Data Acquisition (SCADA) data. That estimate was derived from monitored outflow to the system minus the sum of monitored demands (the greatest part being monitored) and extrapolated normal, non-monitored demand across the time of the incident. The result, 660,000 gallons, agrees roughly with an estimate based on the capacity of the pipe and the time interval between leak detection and isolation. Figure 5 illustrates the method.

The less rigorous calculation, which nevertheless produces a similar result, is based on the assumptions that the distance between closed valves was 5,000 ft., that the main was full when the leak started, that the line subsequently emptied fully, and that the flow into the pipe was constant through the time of filling and the start of leakage (10:46) to the time the pipe was isolated (11:15). If the main was full when the leak started, the fill rate was the length of the pipe (5,000 ft) divided by the fill time (start to leakage) of 35 minutes, or 2.38 ft/sec. Assuming the flow remained constant for the full 30 minutes that the line was not isolated, the amount of additional flow after leakage was rate of fill times flow area times 30 minutes, or 226,508 gal. The sum of this flow volume plus the volume of the pipe (264, 366 gal), is the total loss of 490, 874 gal.

These two different techniques produce a range, 490,000 to 660,000 gallons, which is the estimated loss of water during the incident.

The discharge traveled on Bonita Avenue and intercepted a storm drain that had a direct connection to the west bank of the Santa Cruz River. The discharged water traveled approximately 1500 feet north in the ephemeral portion of the Santa Cruz River bed.

5. Corrective Action Plan

5.1. Failure Mode
The existing main separated at a joint about 25 feet north of the connection point, the ends spaced two inches apart, having moved perhaps 8” from their undisturbed position (assuming 6” of engagement).

5.2. Probable Cause

5.2.1. The contractor had previously installed, backfilled, and tested the bulk of the new pipeline from the downstream end to near the Bonita and W. Congress Street intersection. It is most desirable to pressure test as close as possible to the connection point, however, installing the two 45

degree bends and approximately 46 feet of pipe across the intersection would have closed Congress Street for up to 4-6 days in a very high-traffic season. This pipe and the final connection were completed at a later date. It was decided to leave the excavation open during filling to make sure there were no visible leaks that would compromise the long-term operation and integrity of the pipeline (see Figure 6). Unfortunately, however, the open trenches did not provide the needed skin friction to restrain the pipe and the two 45 degree bends. As the joints on the new pipe were restrained into the first joint of the existing concrete cylinder pipeline, the thrust forces were then transferred into the existing pipe. The first joint, nearest the connection with the new pipe, subsequently separated.

Records indicated that the design of the existing concrete cylinder (steel) pipeline should have included some minimal welding of the joints (three 2-inch long beads) which may have provided some restraint. Other than a single weld (possibly a 2" bead) to provide electrical continuity for the corrosion monitoring system, there was no evidence of welding on the separated joint of the existing steel pipeline. The lack of welding is thought to have possibly been a field change. Records indicated that design bends were replaced with a curved alignment of pipe that was statically adequate under normal backfill conditions. The exact intent is unknowable from the records because engineering review of as-built project documentation was not implemented until 1998 or thereabouts, and this project was completed in 1991.

5.2.2. There was no formal fill plan. Verbal and written statements by the valve crew, project inspectors, and Reclaimed System operators show that the pipe filled in about 30 minutes after the southern valve at Simpson and El Paso started opening. The intended fill time was 8-12 hours. The resulting surge-induced pressure spike (the result of fast flow coming to a sudden stop during filling) elevated the pressure in the pipeline above anticipated conditions. This was evidenced by the resulting damage at existing nearby service connections.

5.2.3. The routing chosen for the pipe was optimized to accommodate planned development of the subject land parcel (Mission District Block 3, Parcel No. 116-20-6350) and for limiting traffic disruption on Congress during construction, which occurred in the peak season. The addition of the two 45 degree bends, however, added a significant resulting thrust force that the existing system did not have with an essentially straight run of pipe.

6. *Estimated Cost Incurred Due to Failure Event*

Costs, rounded up to the nearest $1,000, were as follows:

Source	Purpose	Amount
Tucson Water Maintenance Division	Excavation, high line supply, 36” line filling and dewatering	$16,000
Rain for Rent	Pump rental for dewatering excavation	$5,000
Congress Street repairs	Pipe removal and replacement, sewer repairs, pavement, etc.	$264,000
Segment 1 repairs (site of secondary failure)	Excavation, removal replacement, welding, thrust block	$16,000
Independent Review	Provide peer-reviewed assurance of impartial judgment	$11,000
TOTAL		$312,000

7. *Corrective Action*

7.1.1. At this time, construction procedures do not require consideration of fill strategy. Revised procedures will make the preparation of a written, detailed fill plan a requirement, at least for mains above a size and pressure determined to be critical. Cover requirements limiting the amount of open trench over a pressurized pipe will be a part of that plan. Exactly how control will be implemented in the standards remains to be identified.

7.1.2. In the future, a pre-action planning meeting will precede any line-filling or pressure-testing procedure involving mains that carry large flows or operate at high pressures. Representatives of the owner, operations, maintenance, the contractor, and the designer will coordinate to prevent misunderstandings, or procedures not in conformance with the plan or the design intent.

7.1.2.1. Participants will review the plans to make sure all thrust controls are in place and complete. This includes reviewing

plans for restrained joints and making sure these joints are completely backfilled.

7.1.2.2. Whenever possible, participants will require filling pipelines from the low elevations to high elevations. Velocities in the pipelines are much easier to control in this process. Plans will avoid the use of line-sized mainline valves as they are difficult to throttle for controlling flow rate. The use of bypass valves, blow-offs, hydrants, or other smaller connections and valves are preferred. Control filling velocities to not more than 2 feet per second.

7.1.3. The absence of a weld in the existing pipe played a role in the separation, but was not necessarily an error. It was likely a field change that could have been appropriate at the time with the change from bend fittings to a curved alignment with deflected joints. The problem was more likely improper documentation through as-built drawings. Lessons learned:

7.1.3.1. Perform a more comprehensive review of as-built drawings to assure that ancillary documents, such as shop drawings, are updated appropriately, and that explanatory or reference notes are added to plans as needed.

7.1.3.2. Revised design standards for large mains will prohibit reliance on restraints in an existing pipe unless they can be verified.

7.1.4. Revised design standards for large mains shall take special cognizance of pressures likely to be encountered during extreme operations.

7.1.4.1. Where appropriate, for large mains (16” nominal diameter and larger), standards shall require that designers check the shutoff head of the pumps supplying the distribution system and ensure that the pipe’s pressure class and thrust restraint are adequate under shutoff conditions.

7.1.4.2. A surge analysis shall be conducted prior to filling large mains to ensure that the pipe material, thrust restraints, and surge protection, if needed, are adequate.

7.1.4.3. Standards shall require, where appropriate, a warning note to be added to future plans to promote awareness of any special high-pressure hazards.

8. Schedule for Return to Normal Operations

The 10” (upgraded to 12” in the area of the leak) potable water line was returned to service on Friday April 29, 2011. Repairs in the area of Congress Street to the 36”

main as well as to the damaged 8” sewer, and electrical conduit have been completed and paving on Congress Street has been restored as of May 6, 2011. Work on Bonita, including filling by the new method, was completed on Monday May 16, 2011, when normal operations resumed. Paving on Bonita, including decorative concrete work, is complete as of Monday May 23, 2011.

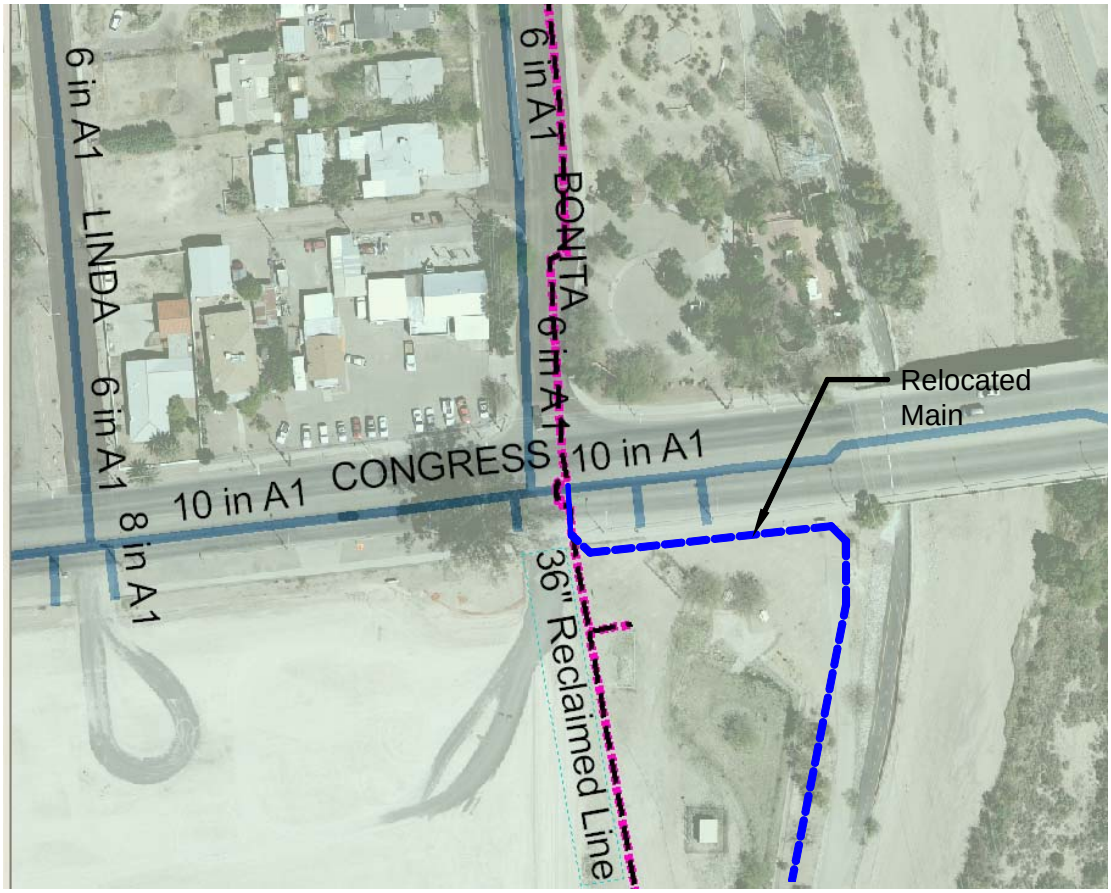

Figure 1: The location of the reclaimed water main break was at the intersection of Congress St. and Bonita Ave. Tucson Water assets in the area include the following: 1) a 10" cement asbestos potable water main in Congress St installed in the year 1960, 2) a 6" cast iron potable water main in Bonita Ave installed in the year 1960, and 3) a 36" Concrete Cylinder pipe installed 1990.

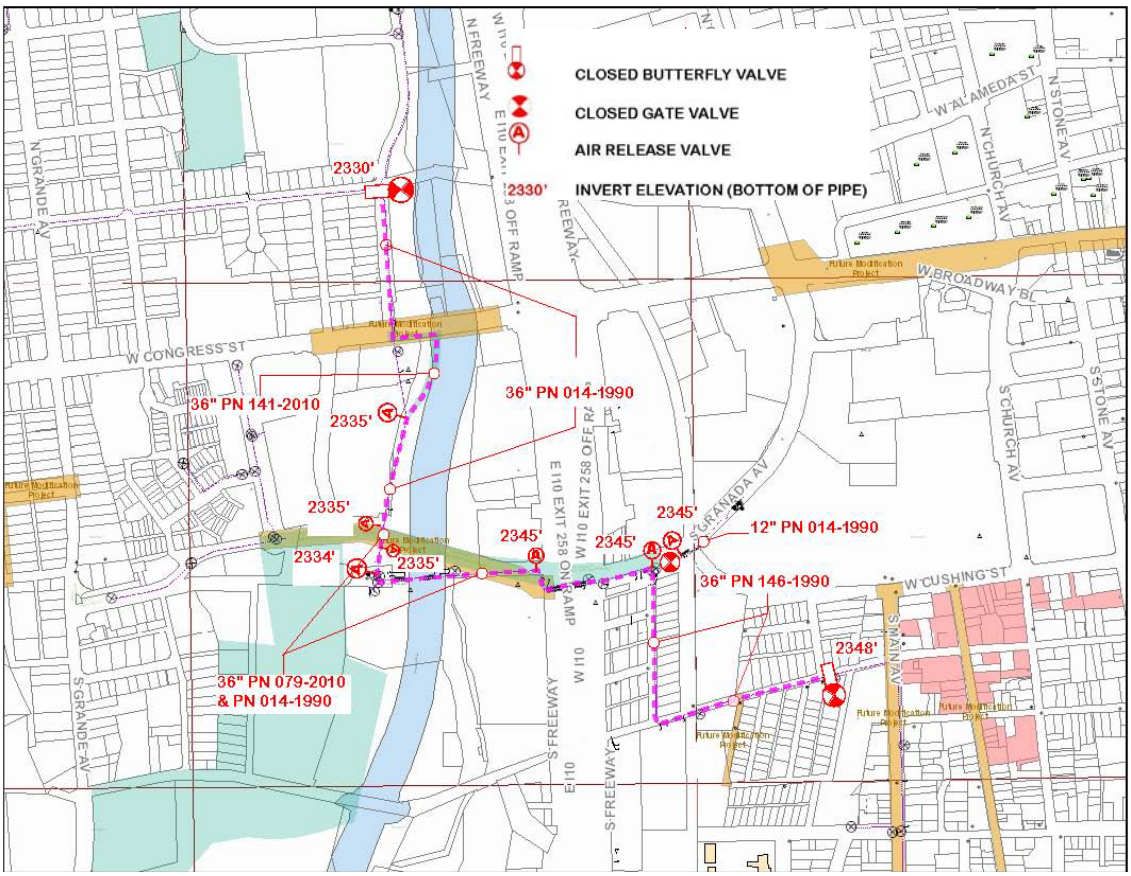

Figure 2: The as-built 36" reclaimed main configuration above shows the route together with Tucson Water plan numbers, valve locations and elevations, and the locations and elevations of air release valves. North is up.

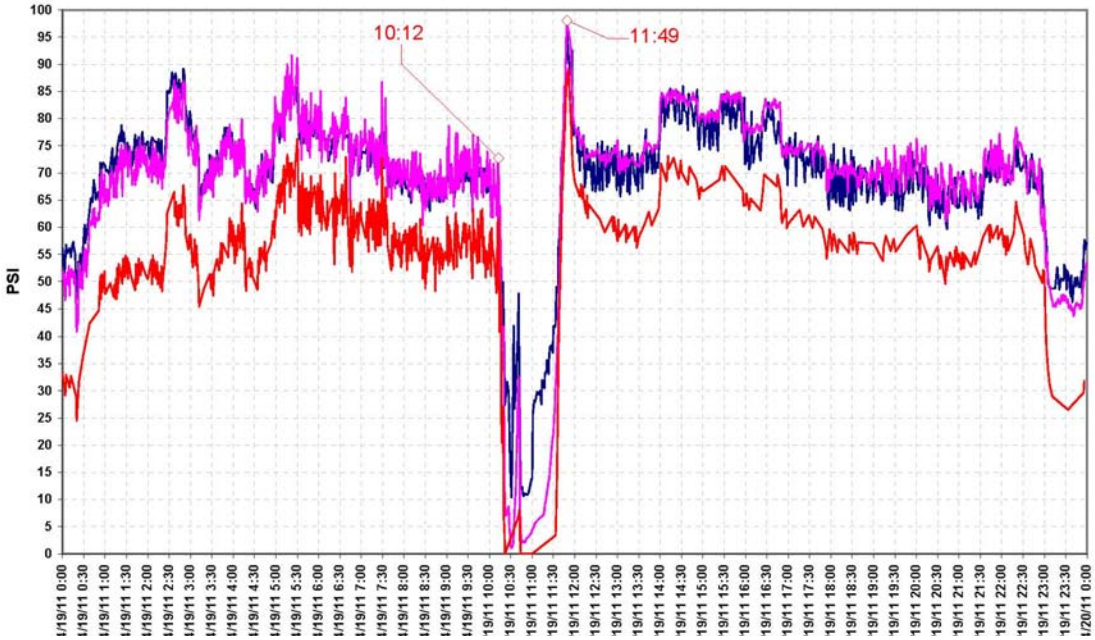

Figure 3: According to the reclaimed water systems operator on duty at the time, the first indication of a system-wide anomaly was a drop in pump inlet pressures.

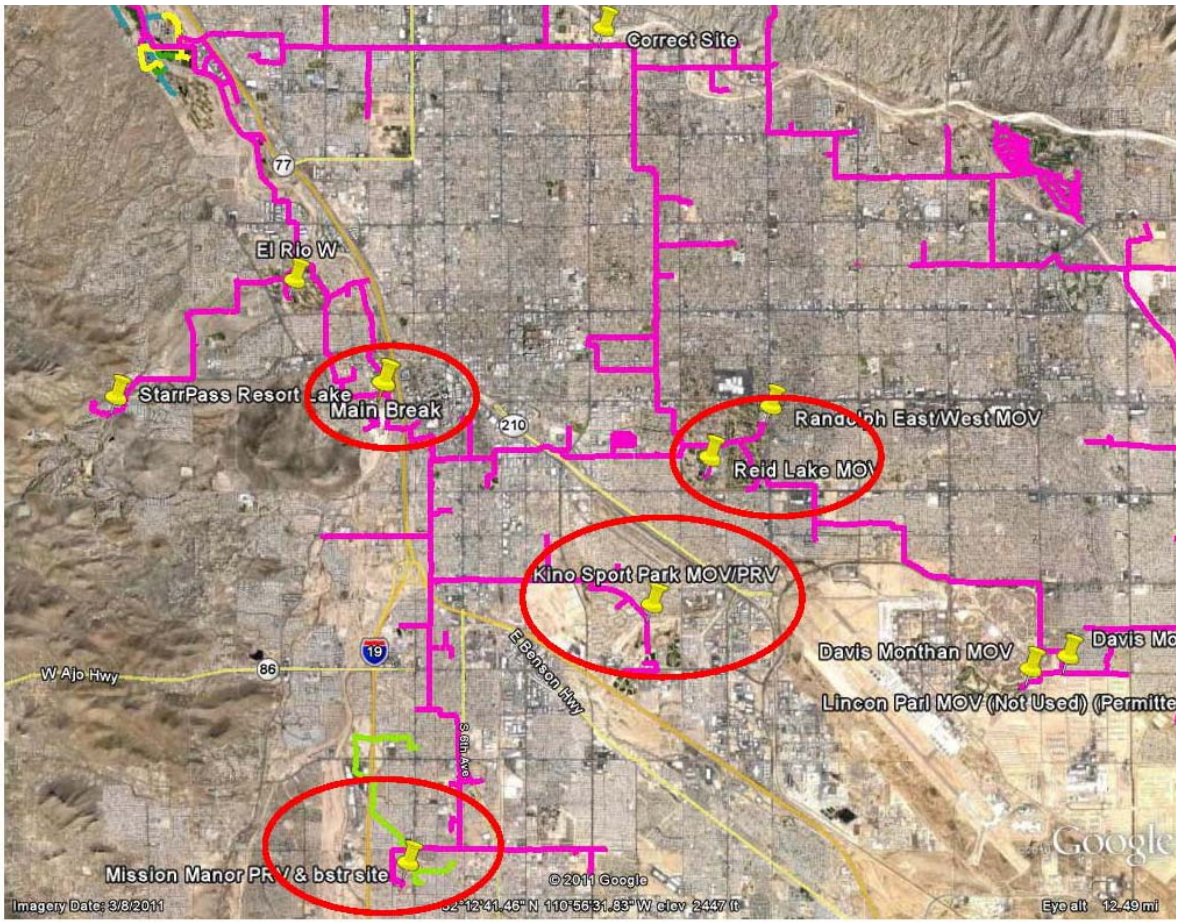

Figure 4: Overlay of the reclaimed water system on an aerial photograph shows relative locations of the main break and sites that experienced loss of pressure.

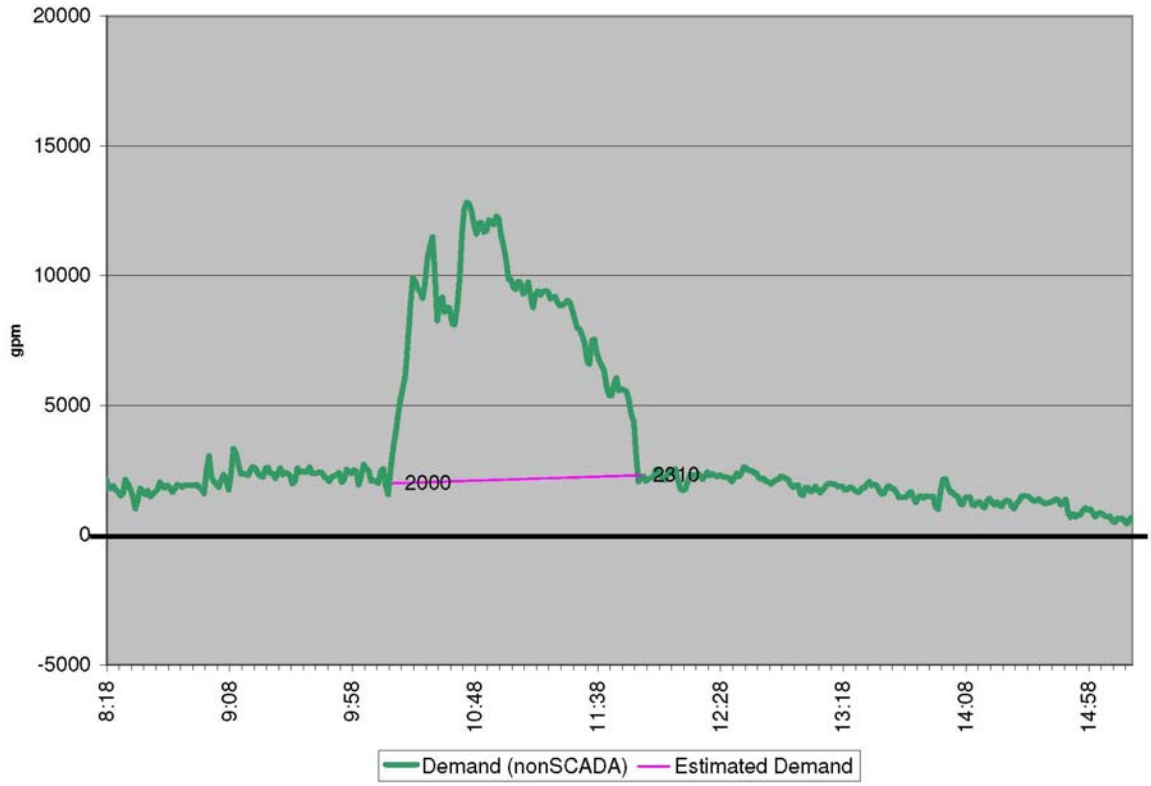

Figure 5: Integration under the demand curve in the time interval of the leak provides an estimate of the volume lost. In this instance, we are seeing outflow from the system that is NOT accounted for by SCADA, which monitors most of the demand. Non-monitored normal demand is subtracted out by extrapolating normal usage (magenta line).

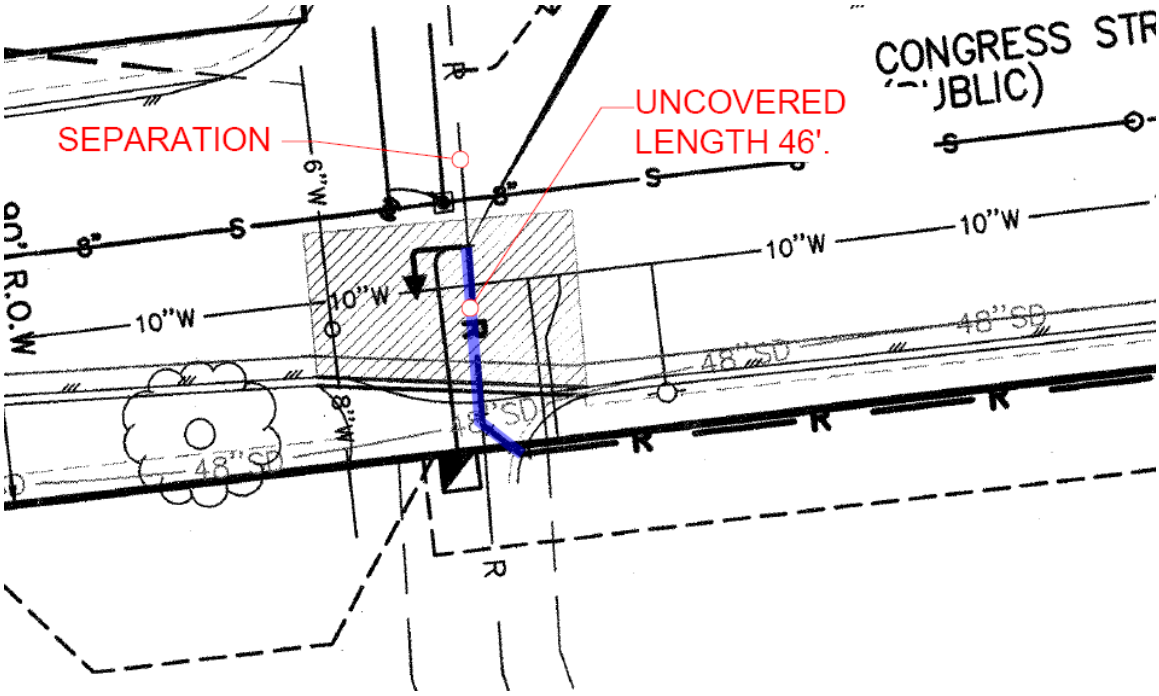

Figure 6: An excessive length of pipe left uncovered for leak detection during the filling operation was a contributor to the main failure.

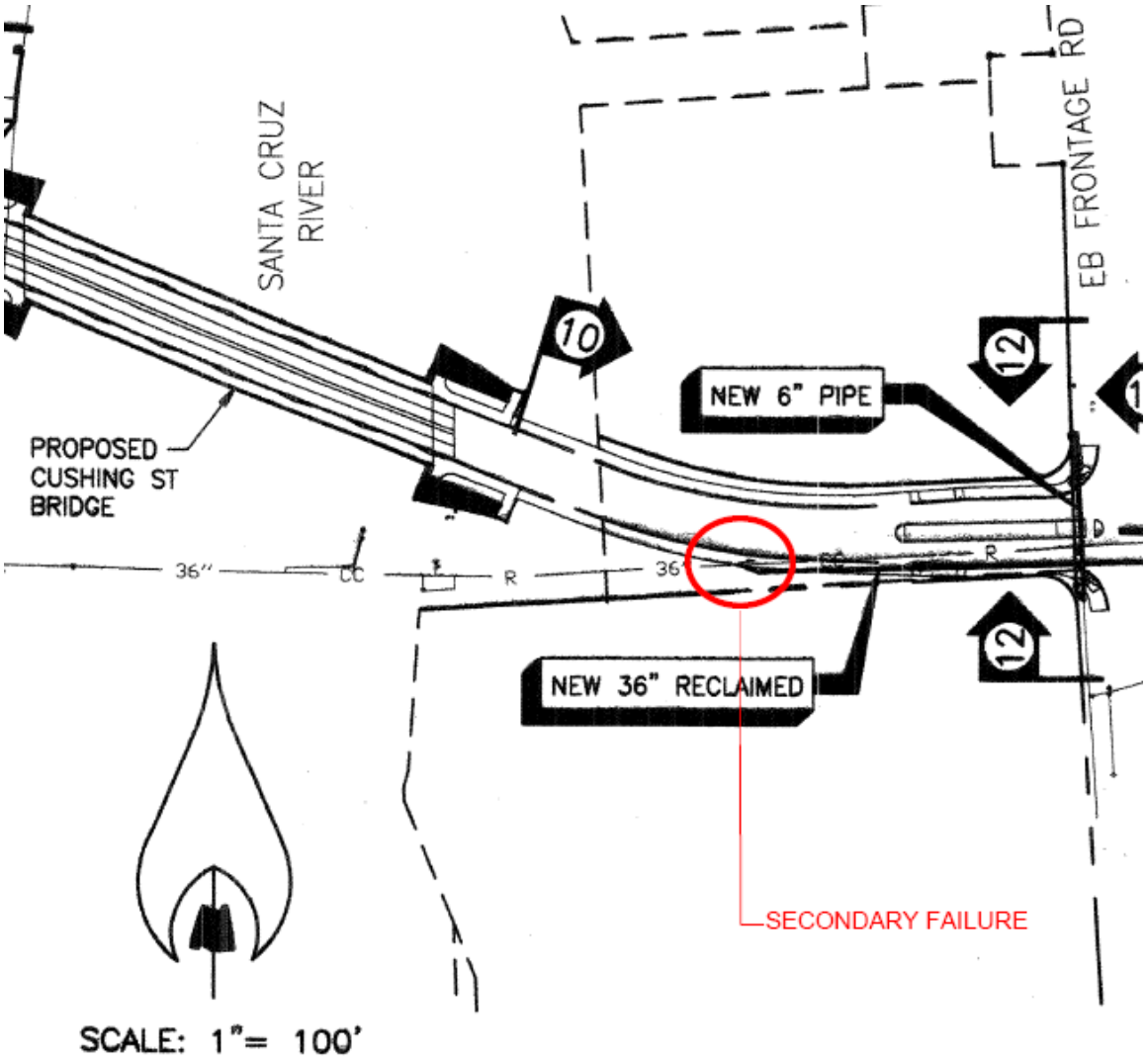

Figure 7: Secondary failure location.

Appendix

- Independent Review Letter
- KE&G Project Log for 4/19
- Phone Records for 4/19
- Valve Crew Statements
- Tucson Water Reclaimed Water Treatment Plant Daily Diary
- Pressure Test Results
- Names and Affiliations of Selected Subjects

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May 31, 2011

Mr. Joe Olsen
Tucson Water Department
310 W. Alameda
Tucson, AZ 85726-7210

Subject: Independent Review of Mission District Reclaimed Failure Report

Dear Mr. Olsen:

CH2M HILL Engineers, Inc. (CH2M HILL) is providing this letter as follow-up to our third party review of the subject Failure Report produced by Tucson Water staff. As requested, CH2M HILL conducted an independent review of the report and supporting documentation provided by Tucson Water the week of May 9th, 2011. In addition, engineers with CH2M HILL attended an information exchange and review meeting hosted by Tucson Water on May 11th, 2011. Following this meeting, CH2M HILL convened a team of technical experts (senior engineers with expertise in the design and construction of large-diameter pipelines) to review Tucson Water's final report and render a professional opinion on the validity of the report.

In general, CH2M HILL's review concluded that the report developed by Tucson Water provides a clear and logical accounting of the events and conditions that contributed to the Congress District reclaimed water pipeline failure and we concur with Tucson Water's findings as they relate to the probable cause(s) of the failure. Specifically, we concur with Tucson Water's findings that several "unique" site conditions contributed to the failure:

- Section 5.2.1 – To minimize impacts to traffic at the intersection of Bonita and Congress, the northernmost portion of the new 36-inch reclaimed water pipeline (approximately 46 feet) was pressure tested separately from the remaining 620-feet of newly installed ductile iron pipeline. This portion of the trench was left open for the pressure test to make sure there were no visible leaks that would compromise the long-term operation and integrity of the pipeline. The lack of soil cover in the open trench made it possible for the exposed pipeline, including two 45 degree elbows on the north side of Congress, to be subjected to thrust forces during filling without the benefit of soil frictional restraint. Although the exposed section of new reclaimed water pipeline and the connection point to the existing pipeline were properly protected from thrust forces through the use of restrained joints, the portion of the existing pipeline immediately prior to the connection point was not. As a result, the first joint of the existing pipeline nearest the connection point with the new pipe separated.

Record drawings (dated 1990) for the existing concrete cylinder (steel) pipeline indicated that the existing pipeline design originally included welding at the joints (three 2-inch long beads) which may have provided some thrust restraint; however, upon post-failure inspection there was no evidence of welding on the separated joint of the existing steel pipeline. The lack of welding is thought to have possibly been due to a field change at the time of construction, where the alignment was revised such that the original 11.25 degree bends located in the vicinity of the future connection location were replaced with "rolled", or deflected, joints that ordinarily do not require thrust restraint. Regardless, the lack of thrust restraint on the existing pipeline coupled with the thrust forces exerted by the two new 45 degree bends in an open-trench condition likely contributed to the failure.

- Section 5.2.2 – Verbal and written statements by the valve crew, project inspectors, and reclaimed system operators show that the pipe filled in about 30 minutes after the southern valve at Simpson and El Paso started opening – the intended fill time was 8-12 hours. The rapid fill time is likely to have induced a pressure surge (the result of fast flow coming to a sudden stop during filling) and elevated the pressure in the pipeline above anticipated conditions. This is evidenced by the resulting damage at existing nearby service connections.

- Section 5.2.3 – The selected alignment for the new pipeline was optimized to accommodate planned development of an adjacent land parcel while also limiting traffic disruption to Congress Street during construction. The selected alignment required the use of two 45 degree bends that generate thrust forces.

It is the opinion of CH2M HILL that all of the above described conditions contributed to the failure, which is consistent with the stated conclusions in Tucson Water's Mission District Reclaimed Failure Report.

We appreciate the opportunity to work with you and your staff on this very important project and please do not hesitate to contact me if you have any questions related to the above information.

Sincerely,

CH2M HILL Engineers, Inc.

Alan D. Forrest, P.E.
Vice President
Principal Project Manager

Registered Professional Engineer (Civil)
CERTIFICATE NO.
22187
ALAN D.
FORREST
Date signed 5/31/2011
ARIZONA, U.S.A.

Expires 12/31/2011

PROJECT LOG

NUMBER	DAY	DATE	C.D. CHARGED	C.D. REMAINING	TEMPERATURE						GENERAL WEATHER CONDITIONS
	Tu	4/19/11	YES / NO		8 AM	600	MID	1200	4 PM	1230	

OWNER CONTACTS — CONVERSATIONS, UNDERSTANDINGS, MEETINGS, & VERBAL INSTRUCTIONS.

CHECK HERE IF REGULAR RESIDENT INSPECTOR WAS ON JOB THIS DATE ☐

KE&G OPERATIONS: Time 10:30 am to 10:45
Tucson water started To Energize 36" main at About 10:30
They were filling line to fast called chris with Tucson water
Told him They going to fast. Then existing 36" in congress
came apart at about 10:49, we shut Down traffic on congress
Tucson water shut 36" main Back off

PRODUCTION:

MATERIAL DELIVERIES:
6" Pump see invoice

SUBCONTRACTOR OPERATIONS:

TOTAL KE&G CREW				KE&G EQUIPMENT	NO.		NO.
SUPERVISORS	1	TEAMSTERS		PICKUPS/FLATBEDS		DOZERS	
ENGR/SURVEYORS		IRONWORKERS		MOTORGRADERS		FORKLIFTS	
TIMEKEEPER/CLERKS		PILEBUCKS		DUMP TRUCKS		COMPRESSORS	
LABORERS	2	MILLWRIGHTS		WATER TRUCKS	1	WELDERS	
CARPENTERS		MECHANICS		CRANES		COMPACTORS	
OPERATORS	2	PIPELAYERS	1	SCRAPERS		ROLLERS	
FINISHERS		GRADECHECKERS		LOADERS	1	AC PAVER	
				EXCAVATORS	2	PCCP PAVER	

SUPERVISOR SIGNATURE

CHRIS ROGERS

Details for: 520-349-7165
Anytime Minutes Used : 170 minutes
Cycle ends: 05/09/2011

Date	Time	Number	Minutes	Description	
4/19/2011	12:25PM	5208505608	1	TUCSON	Manny Munguia
4/19/2011	12:12PM	5203499696	2	INCOMING	Tim Jacobs
4/19/2011	11:58AM	5204190340	5	INCOMING	Lorenzo Hernandez
4/19/2011	11:56AM	5204190340	2	TUCSON	Lorenzo Hernandez
4/19/2011	11:47AM	5205762395	1	INCOMING	
4/19/2011	11:09AM	5204194778	1	TUCSON	Johnny Mena
4/19/2011	11:05AM	5204194778	1	INCOMING	Johnny Mena
4/19/2011	10:56AM	5203827398	1	INCOMING	
4/19/2011	10:52AM	5208505608	1	TUCSON	Manny Munguia
4/19/2011	10:51AM	5206318189	2	TUCSON	Woody Skinner
4/19/2011	10:48AM	5208505608	1	TUCSON	Manny Munguia
4/19/2011	10:47AM	5204194778	1	INCOMING	Johnny Mena
4/19/2011	10:46AM	5204194778	1	TUCSON	Johnny Mena
4/19/2011	10:46AM	5203496446	1	INCOMING	Eddie Frias
4/19/2011	10:37AM	5204194778	2	TUCSON	Johnny Mena
4/19/2011	10:35AM	5203496446	1	INCOMING	Eddie Frias
4/19/2011	10:34AM	5209406376	1	INCOMING	Contractor-KE&G
4/19/2011	10:32AM	5203496446	2	TUCSON	Eddie Frias
4/19/2011	10:24AM	5208382820	3	TUCSON	
4/19/2011	10:12AM	5208372264	2	TUCSON	Joanne Walker
4/19/2011	10:11AM	5207915001	1	TUCSON	Reclaim Plant
4/19/2011	10:11AM	5204194778	1	INCOMING	Johnny Mena
4/19/2011	10:08AM	5204194778	1	INCOMING	Johnny Mena
4/19/2011	09:47AM	5204194778	1	TUCSON	Johnny Mena
4/19/2011	09:24AM	5204194778	2	INCOMING	Johnny Mena
4/19/2011	08:41AM	5208505608	3	TUCSON	Manny Munguia
4/19/2011	08:06AM	5206318189	1	TUCSON	Woody Skinner
4/19/2011	08:05AM	5205762395	1	INCOMING	
4/19/2011	07:49AM	5209406376	1	TUCSON	Contractor-KE&G
4/19/2011	07:28AM	5204190340	2	INCOMING	Lorenzo Hernandez
4/19/2011	07:17AM	5204190340	4	INCOMING	Lorenzo Hernandez
4/19/2011	06:45AM	5206315768	2	INCOMING	
4/19/2011	06:38AM	5206318189	2	TUCSON	Woody Skinner
4/19/2011	06:25AM	5203496446	2	INCOMING	Eddie Frias

EDDIE FRIAS

Details for: 520-349-6446
Anytime Minutes Used : 252 minutes
Cycle ends: 05/09/2011

Date	Time	Number	Minutes	Description	
4/19/2011	12:58PM	5208505608	1	TUCSON	Manny Munguia
4/19/2011	12:42PM	5208505608	2	TUCSON	Manny Munguia
4/19/2011	12:36PM	5208505608	2	INCOMING	Manny Munguia
4/19/2011	11:51AM	5204191452	1	INCOMING	Hector Estrada
4/19/2011	10:46AM	5203497165	1	TUCSON	Chris Rogers
4/19/2011	10:35AM	5203497165	1	TUCSON	Chris Rogers
4/19/2011	10:32AM	5203497165	2	INCOMING	Chris Rogers
4/19/2011	09:21AM	9177935694	1	INCOMING	
4/19/2011	09:18AM	5203437699	1	TUCSON	
4/19/2011	07:57AM	7770000001	1	DATA	
4/19/2011	06:29AM	5209406376	1	TUCSON	KE&G Contractor
4/19/2011	06:25AM	5203497165	2	TUCSON	Chris Rogers

Tucson Water Case # _____

TUCSON WATER
INCIDENT STATEMENT FORM

☑ Employee ☐ Supervisor ☐ Witness

☐ Property Damage ☐ Injury ☐ Vehicle Accident

John M Mena — Name

4-22-2011 — Date

WTC — Classification

Woody Skinner — Supervisor

40398

Incident

ON 19 of April at 10 AM Called Chris Rodgers To inform him That we were Ready to open The 36" Valve at Simpson and El Paso, Asked if Reclaim operator was aware of what we were doing, Chris said He would Call, we started to open The Valve about 10:05 and Opened The Valve with 4 Turns and shut down actuator to listen for flow, didn't Hear anyt, Turned Valve 10 More Turns and shut actuator off heard flow and waited Till flow stopped 10:30, Turned Valve about 15 Turns and CHECKED IF THERE WAS ANY MORE FLOW RUNNING THROUGH VALVE. ~~Checked if There was any more flow running thru Valve~~, Valve was quite, opened Valve 30 Turns and checked Valve again, Valve was quite, Valve was fully opened at 10:45 called Chris To let him know That Valve was open.

Employee Signature — 4-22-2011 Date

Superintendent Signature — 5/2/2011 Date

Tucson Water Case # _____

TUCSON WATER
INCIDENT STATEMENT FORM

- [x] Employee
- [ ] Supervisor
- [ ] Witness
- [ ] Property Damage
- [ ] Injury
- [ ] Vehicle Accident

RICHARD SANDERS
Name

4-22-11
Date

UT-A
Classification

WOODY SKINNER
Supervisor 40398

Incident: ON TUESDAY APRIL 19TH OF 2011 I SET UP THE VALVE TRUCK ON THE SECOND VALVE LOCATED AT BONITA & ALAMEDA AT ABOUT 11:10 AM. I OPENED THE VALVE 4 TURNS AND I SHUT OFF THE MACHINE. I DIDN'T HEAR ANY WATER GOING THREW SO I THEN OPENED THE VALVE 3 MORE TURNS SHUT OFF ONCE AGAIN. I HEARD WATER SO I LOOKED UP THE STREET AND I SAW WATER COMING FROM EXCAVATION SITE SO I IMMEDIATELY SHUT IT DOWN. THATS WHEN CHRIS ROGERS CALLED JOHN MENA AND WE WENT TO SHUT DOWN THE VALVE AT EL PASO AND SIMPSON

R Sanders
Employee Signature

4-22-11
Date

Superintendent Signature

5/2/2011
Date

TUCSON WATER
RECLAIMED WATER TREATMENT PLANT
DAILY DIARY

DATE: 04/19/11

MIDNIGHT SHIFT

Initials: Rgh

Basins	1	2	3	4	5	6	7	8

Bleach Sys. & filters on.

When 1 main Pump @ THV. RES. down. that feeds. Dove Mtn. (#4 Seal repair) Had to choke Gallery 7 inorder to feed Gallery #1 from going Low in Lake level.

Higher demand then output @ Dove Mtn.

DAY SHIFT

Randolph 1.937
Oro Valley 3.2

Initials: BTC

Filter 1-3 on. Bleach on.
Recharge per schedule. Wetlands only to basin #5

Chris Rogers/ Cushing
10:30 Lost PSI @ Starrpass Reservoir / Mission Manor / Reid Park
10:45 Main Break - Congress & Bonita. Chris Rogers notified Central. Central Notified Albert. Albert Notified Brian M. Nobody notified Control B. or the reclaim operator.?
11:15 Main isolated. Inspector Chris Rogers 349-7165
12:00 System back to normal.

EVENING SHIFT

Initials: M

1448 call from control trico power into.
1845 over

Crew is closing more valve at break site for better seal

Diary.XLS

(3)

ADEQ Arizona Department of Environmental Quality

ENGINEERING REVIEW SECTION
DATA REQUIRED WITH ECC

INSTRUCTIONS

Please complete the test data and submit this form with the Engineers Certificate of Completion. An Approval of Construction cannot be issued without the data identified below in accordance with Arizona Administrative Code (A.A.C.) R18-5-508(C). Please attach all supplemental information and calculations to this form.

DATA

1.

PRESSURE TEST DATA				
Indicate Segment Tested				
Pressure and Leakage Test Results (Pass/Fail)	PASS			
Date Tested	5-2-11			
Time Started	10:11 AM			
Time Finished	12:11 PM			
Pipe Diameter	36"			
Footage Tested	1300'			
Allowable Leakage	13.92			
Leakage Observed	~~0~~			
Pressure at Test Point	175			
Employee Observing the Test (Please Print Legibly)	EDDIE FRIAS			
Signature of Employee Observing the Test	EF			

2.

DISINFECTION SAMPLING					
Initial Sampling (Minimum 50 ppm available chlorine)	Date				
	Time	N/A			
	ppm Cl_2				
After 24 Hours Detention Time (Minimum 10 ppm free chlorine)	Date				
	Time	N/A			
	ppm Cl_2				
After Sufficient Flushing (Water is clear and system Cl_2 residual is measured)	Date				
	Time	N/A			
	ppm Cl_2				
Bacteriological Sampling(s):	Date				
	Time	N/A			
	Attached (Y/N)				
		Yes/No	Yes/No	Yes/No	Yes/No

RECLAIM →

3.

Certification

I, EDDIE FRIAS, certify that I have inspected the work performed and have found it to be satisfactory and in accordance with Arizona Administrative Code, Arizona Engineering Bulletins, and the approved specifications.

Eddie Frias — Authorized Persons Signature

5-2-11 — Date

Professional Seal
As per A.A.C. R18-5-507(B)(1)

FEBRUARY 3RD, 2009

PAGE 1 OF 1

http://www.azdeq.gov/environ/water/dw/download/data.pdf
1110 WEST WASHINGTON, PHOENIX, AZ 85007
HTTP://WWW.AZDEQ.GOV/ENGINEERINGREVIEW/

ADEQ Arizona Department of Environmental Quality

ENGINEERING REVIEW SECTION
DATA REQUIRED WITH ECC

INSTRUCTIONS

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DATA

1.

PRESSURE TEST DATA				
Indicate Segment Tested	C. SIDE OF I-10			
Pressure and Leakage Test Results (Pass/Fail)	PASS			
Date Tested	3.30.11			
Time Started	12:50 PM			
Time Finished	2:50 PM			
Pipe Diameter	36"			
Footage Tested	110'			
Allowable Leakage	.75			
Leakage Observed	Ø			
Pressure at Test Point	200			
Employee Observing the Test (Please Print Legibly)	CHRISTOPHER D. ROGERS			
Signature of Employee Observing the Test				

2.

DISINFECTION SAMPLING					
Initial Sampling (Minimum 50 ppm available chlorine)	Date				
	Time N/A				
	ppm Cl_2				
After 24 Hours Detention Time (Minimum 10 ppm free chlorine)	Date				
	Time N/A				
	ppm Cl_2				
After Sufficient Flushing (Water is clear and system Cl_2 residual is measured)	Date				
	Time N/A				
	ppm Cl_2				
Bacteriological Sampling(s):	Date				
	Time N/A				
	Attached (Y/N)				
		Yes/No	Yes/No	Yes/No	Yes/No

3.

Certification	Professional Seal As per A.A.C. R18-5-507(B)(1)
I, CHRISTOPHER D. ROGERS, certify that I have inspected the work performed and have found it to be satisfactory and in accordance with Arizona Administrative Code, Arizona Engineering Bulletins, and the approved specifications. Authorized Persons Signature: [signature] Date: 3.30.11	

WATER MAIN PRESSURE TESTING FORM

JOB NO.: 79-2010 DATE OF TEST: 3·30·11

JOB NAME/DESCRIPTION: MODERN STREET CAR SEGMENT 1 (EAST SIDE OF I-10)

CONTRACTOR: K&G

Size	Length (ft)	Pipe Type	Test Pressure	Allowable Loss Per Hour (gal)
36"	110	D.I.	200	.37

Total gallons per hour: _____

Allowable total loss (gal/hrx2)	Time Started	Time Finished	Actual Total Loss	Results (Pass/Fail)
.75	12:50 PM	2:50 PM	Ø	PASS

NOTES: _____

(If failed, note total loss) _____

(Indicate if retest) _____

Observed Signature: _____

ADEQ Arizona Department of Environmental Quality

ENGINEERING REVIEW SECTION
DATA REQUIRED WITH ECC

INSTRUCTIONS

Please complete the test data and submit this form with the Engineers Certificate of Completion. An Approval of Construction cannot be issued without the data identified below in accordance with Arizona Administrative Code (A.A.C.) R18-5-508(C). Please attach all supplemental information and calculations to this form.

DATA

1.

PRESSURE TEST DATA				
Indicate Segment Tested	WSIDE OF I-10			
Pressure and Leakage Test Results (Pass/Fail)	PASS			
Date Tested	3·22·11			
Time Started	2:03 PM			
Time Finished	4:03 PM			
Pipe Diameter	36"			
Footage Tested	390'			
Allowable Leakage	2.68			
Leakage Observed	0			
Pressure at Test Point	200			
Employee Observing the Test (Please Print Legibly)	CHRISTOPHER D. ROGERS			
Signature of Employee Observing the Test	[signature]			

2.

DISINFECTION SAMPLING					
Initial Sampling (Minimum 50 ppm available chlorine)	Date				
	Time N/A				
	ppm Cl_2				
After 24 Hours Detention Time (Minimum 10 ppm free chlorine)	Date				
	Time N/A				
	ppm Cl_2				
After Sufficient Flushing (Water is clear and system Cl_2 residual is measured)	Date				
	Time N/A				
	ppm Cl_2				
Bacteriological Sampling(s):	Date N/A				
	Time				
	Attached (Y/N)				
		Yes/No	Yes/No	Yes/No	Yes/No

3.

Certification

I, CHRISTOPHER D. ROGERS, certify that I have inspected the work performed and have found it to be satisfactory and in accordance with Arizona Administrative Code, Arizona Engineering Bulletins, and the approved specifications.

[signature] 3·22·11

Authorized Persons Signature — Date

Professional Seal
As per A.A.C. R18-5-507(B)(1)

FEBRUARY 3RD, 2009

PAGE 1 OF 1

http://www.azdeq.gov/environ/water/dw/download/data.pdf
1110 WEST WASHINGTON, PHOENIX, AZ 85007
HTTP://WWW.AZDEQ.GOV/ENGINEERINGREVIEW/

WATER MAIN PRESSURE TESTING FORM

JOB NO.: 79-2010 DATE OF TEST: 3-22-11

JOB NAME/DESCRIPTION: MODERN STREET CAR SEGMENT 1

CONTRACTOR: KE+G

Size	Length (ft)	Pipe Type	Test Pressure	Allowable Loss Per Hour (gal)
36"	390'	D.I.	200	1.34

Total gallons per hour: 1.34

Allowable total loss (gal/hrx2)	Time Started	Time Finished	Actual Total Loss	Results (Pass/Fail)
2.68	2:05 Am	4:03 pm	Ø	PASS

NOTES:

(If failed, note total loss)

(Indicate if retest)

Observed Signature: D. R.

141-2010

ADEQ Arizona Department of Environmental Quality

ENGINEERING REVIEW SECTION
DATA REQUIRED WITH ECC

INSTRUCTIONS

Please complete the test data and submit this form with the Engineers Certificate of Completion. An Approval of Construction cannot be issued without the data identified below in accordance with Arizona Administrative Code (A.A.C.) R18-5-508(C). Please attach all supplemental information and calculations to this form.

DATA

1.

PRESSURE TEST DATA				
Indicate Segment Tested				
Pressure and Leakage Test Results (Pass/Fail)	Pass			
Date Tested	4-14-11			
Time Started	7:47 AM			
Time Finished	9:47 AM			
Pipe Diameter	36"			
Footage Tested	590'			
Allowable Leakage	4.50			
Leakage Observed	0			
Pressure at Test Point	200			
Employee Observing the Test (Please Print Legibly)	EDDIE FRIAS			
Signature of Employee Observing the Test	EF			

2.

DISINFECTION SAMPLING					
Initial Sampling (Minimum 50 ppm available chlorine)	Date				
	Time	N/A			
	ppm Cl_2				
After 24 Hours Detention Time (Minimum 10 ppm free chlorine)	Date	N/A			
	Time				
	ppm Cl_2				
After Sufficient Flushing (Water is clear and system Cl_2 residual is measured)	Date	N/A			
	Time				
	ppm Cl_2				
Bacteriological Sampling(s):	Date	N/A			
	Time				
	Attached (Y/N)				
		Yes/No	Yes/No	Yes/No	Yes/No

3.

Certification

I, _____, certify that I have inspected the work performed and have found it to be satisfactory and in accordance with Arizona Administrative Code, Arizona Engineering Bulletins, and the approved specifications.

Eddie Frias — 4-14-11

Authorized Persons Signature — Date

Professional Seal
As per A.A.C. R18-5-507(B)(1)

FEBRUARY 3RD, 2009

PAGE 1 OF 1

http://www.azdeq.gov/environ/water/dw/download/data.pdf
1110 WEST WASHINGTON, PHOENIX, AZ 85007
HTTP://WWW.AZDEQ.GOV/ENGINEERINGREVIEW/

Names and Affiliations of Abbreviated Subjects

Inspector A - Chris Rogers, Tucson Water

Inspector B - Eddie Frias, Tucson Water

Maintenance Staff A - John Mena, Tucson Water

Maintenance Staff B - Richard Sanders, Tucson Water

Contractor Foreman - Jeff Olejnik, KE&G

Reclaimed Operator A - Brian Cubbon, Tucson Water