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Docket #(s): SW-01428A-13-0042

W-01427A-13-0043

Exhibit #:A20-A24

Part 6 of 6. FOR PART 1 SEE BARCODE 0000151193, FOR PART 2 SEE BARCODE 0000151194, FOR PART 3 SEE BARCODE 0000151195, FOR PART 4 SEE BARCODE 0000151196, FOR PART 5 SEE BARCODE 0000151197

Arizona Corporation Commission
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Liberty Utilities

Litchfield Park Water and Wastewater Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER

SEPTEMBER 26, 2013

FINAL

Carollo

EXHIBIT
A-20
ADMITTED

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Liberty Utilities

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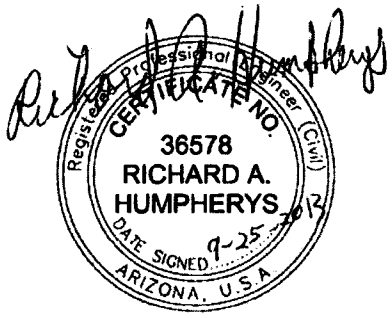

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Liberty Utilities

Litchfield Park Wastewater Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER

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LITCHFIELD PARK WASTEWATER FACILITIES ASSESSMENT, PHASE I

1.0 BACKGROUND

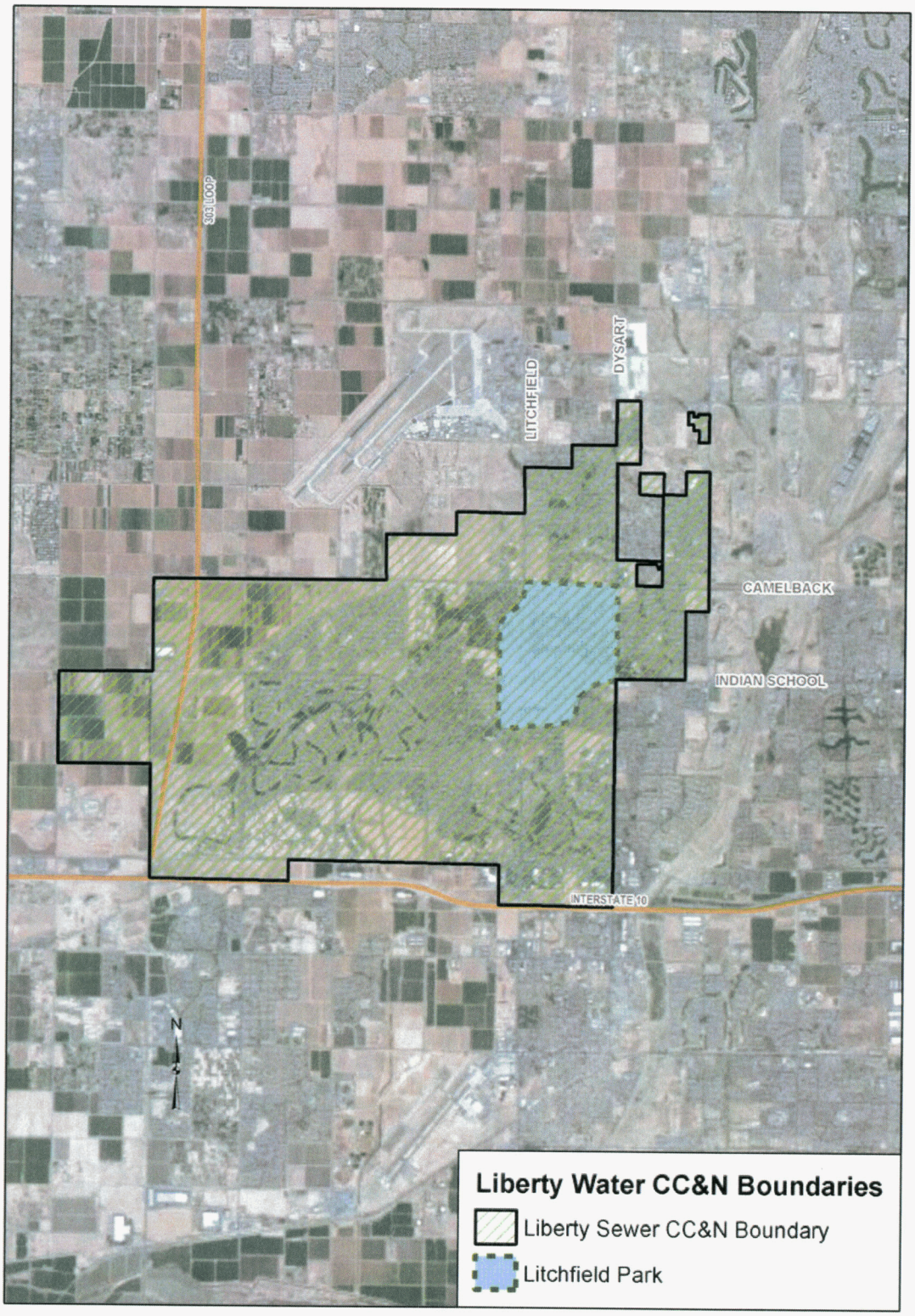
The purpose of this Wastewater Facilities Assessment Plan is to evaluate the wastewater infrastructure in the Litchfield Park (LP) portion of the Liberty Utilities, Inc. (LU) service area. Figure 1 shows the relative location of LP compared to LU service area. This facilities assessment is focused on the Litchfield Park area and not the City of Goodyear portion of the service area because the infrastructure in Goodyear has not been in service as long as the infrastructure in Litchfield Park.

The LP community's roots date back to 1910 with land claims for citrus groves. Other industries that spurred further development included cotton farming and Goodyear tire testing throughout the 1930s and 1940s. The Wigwam Resort opened for public business in 1929 and was a major attraction for people to locate to Litchfield Park.

All the while, businesses and residents were provided sewer service by the former Litchfield Park Service Company (LPSCO), which has since become LU.

The report will follow the general outline below:

1. Infrastructure inventory
2. Sewer infrastructure evaluation
3. Capital improvement project definitions



LITCHFIELD PARK SEWER SERVICE AREA RELATIVE TO LIBERTY UTILITIES SEWER CC&N

FIGURE 1

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

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1.1 System Benefits Improvement Mechanism (SIB)

In Arizona Corporation Commission Docket No. W-01445A-11-0310, Arizona Corporation Commission Staff ("Staff") and the utility industry outlined the requirements for a SIB. In particular, the Settlement Agreement entered into on April 1, 2013 details the exact supporting documentation needed to support a SIB request by a water company. The following information supporting Liberty Utilities request for a SIB in Docket Nos. SW-01427A-13-0042 and W-01427A-13-0043 is included as follows:

- Table 7 (on page 13) is a summary of all projects request for SIB recovery
- Table 8 and Table 9 (pages 18-21) are equivalent to "Table 1" outlined in the Settlement Agreement
- Figure 12 (page 29) is a visual illustration of the five years of capital projects
- Figure 13 (page 30) is a graphical illustration of the total estimated capital investment for SIB recovery
- Appendix 1 contains one page written summaries of all projects included for SIB Recovery including supporting cost detail
- Appendix 6 includes a sewer maintenance and inspection map

2.0 INFRASTRUCTURE INVENTORY

The infrastructure inventory for LP facilities was based on a combination of geographic information system (GIS) data, field staff input, and record drawing information. The following sections display the inventory in table and visual formats.

2.1 Wastewater Facilities

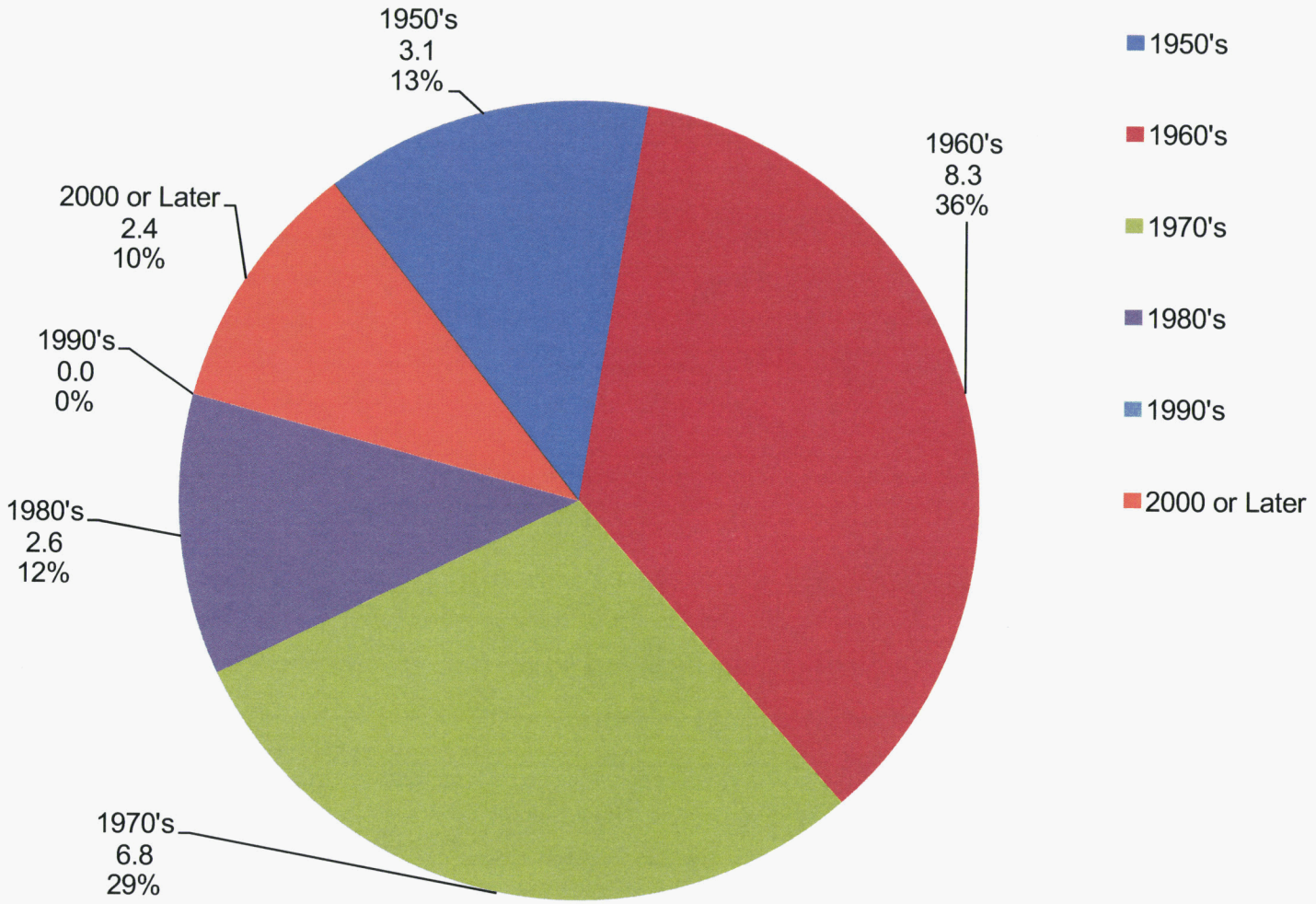
Table 1 summarizes the length of sewer pipe by age, diameter, and material as provided in LU's GIS data.

Table 1	Sewer Pipe GIS Data Inventory – Age, Diameter and Material Litchfield Park Facilities Assessment, Volume 1 - Sewer Liberty Utilities				
Construction Date	**LF**	**Pipe Diameter**	**LF**	**Pipe Material**	**LF**
1950s	20,966	4 inch	380	CIP - Cast in Place	114
1960s	43,856	6 inch	1,761	CONC - Concrete Pipe	11,050
1970s	35,819	8 inch	85,611	DIP - Ductile Iron Pipe	326
1980s	13,965	10 inch	5,296	HDPE - High Density Polyethylene	708
1990s	0	12 inch	18,983	PVC - Polyvinyl Chloride	20,004
2000 or Later	7,732	15 inch	5,081	VCP - Vitrified Clay Pipe	90,136
		18 inch	353		
		21 inch	2,465		
		24 inch	2,409		
Total Length	**122,338**	**Total Length**	**122,338**	**Total Length**	**122,338**

Table 2 summarizes the length of pipe by material and diameter combination.

Table 2	Sewer Pipe GIS Data Inventory – Age and Material Litchfield Park Facilities Assessment, Volume 1 - Sewer Liberty Utilities						
Sewer Main Material	**Construction Date**						**Length, LF**
	1950s	**1960s**	**1970s**	**1980s**	**1990s**	**2000 or Later**	
CIP - Cast in Place	0	114	0	0	0	0	114
CONC - Concrete Pipe	3,044	4,036	0	3,889	0	81	11,050
DIP - Ductile Iron Pipe	0	0	0	0	0	326	326
HDPE - High Density Polyethylene	0	0	0	0	0	708	708
PVC - Polyvinyl Chloride	0	0	7,698	6,481	0	5,826	20,004
VCP - Vitrified Clay Pipe	17,922	39,707	28,121	3,596	0	791	90,137
Total Length, LF	20,966	43,856	35,819	13,965	0	7,732	122,338

Figure 2 shows the distribution of sewer pipeline (in miles) installed by approximate decade groupings. Nearly 75 percent of the sewer pipelines are around 50 years old.



MILES OF SEWER MAINS IN SERVICE BY CONSTRUCTION DATE

FIGURE 2

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

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Table 3 summarizes number of sewer manholes and cleanouts.

Table 3	Number of Sewer Facilities by Type Litchfield Park Facilities Assessment, Volume 1 - Sewer Liberty Utilities
Manholes	445
Cleanouts	35

Appendix 2 contains a map with an aerial background that shows all sewer infrastructure in the Litchfield Park area.

3.0 WASTEWATER INFRASTRUCTURE EVALUATIONS

3.1 Physical Inspections

The goal of the inspection program was to inspect areas known to be in the worst condition, and then areas of suspected poor condition. Additional areas were inspected to obtain a representative sample of collection main and manhole condition.

The locations of the physical inspections were established collaboratively with LU staff. GIS data was reviewed to determine which pipes and manholes were the oldest and of a material that is more likely to be at the end of its useful life. Locations of past failures as well as "hot spots" (i.e., areas that are chronic odor producing, or require frequent cleaning) were also considered in the evaluation. Then a draft inspection plan was reviewed by LU operations staff, which provided valuable input on locations that should be inspected.

3.1.1 Inspection Test Plan

Appendix 3 contains maps for the field test plan with locations of sewer pipelines and manholes.

3.1.2 Inspection Methodology – Sewer Pipelines

Carollo contracted with Cleanview Sewer Inspections, LLC to conduct pipeline inspections using conventional closed-circuit television (CCTV) methods. The selected assets for inspection required minimal traffic control coordination with LU.

3.1.3 Inspection Methodology – Sewer Manholes

Carollo performed manhole inspections to assess the conditions of sewer facility assets in preparation for recommending capital improvement plans to LU in LP. Of the 396 manholes in LP, Carollo inspected 51 manholes over two days in May 2013. Inspections were conducted visually from ground level while LU technicians provided access and traffic control. The visual inspections assessed the surrounding environment, frame and cover condition, manhole material and dimensions, structural and hydraulic stability, and the presence of vermin. Each inspection was documented on a Manhole Inspection Form (Appendix 4), and the retrieved data was entered into a digital database (Appendix 4) for analysis.

Figure 3 shows the method of manhole inspection.

3.1.4 Inspection Results – Sewer Pipelines

Table 4 summarizes the sewer pipeline inspection results. Pipes that were not constructed of vitrified clay were in poor condition and in need of replacement. Pipes constructed of vitrified clay were generally structurally sound; but some pipe sections sagged or had uneven joints, which compromised the ability of these pipes to convey the wastewater flows for which the pipes were designed (see Appendix 5).

Table 4 Sewer Pipeline Inspection Results
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Location	Diameter (in)	Material	Description of Condition
Bird Lane	12	Unlined Concrete	Concrete pipes are severely deteriorated, several voids in soil at flowline and crown
Redondo Drive	8	Unlined Concrete	Pipes are deteriorated, aggregate showing
Laguna Drive and Bahia Lane	8	VCP	Excessive debris collection due to flat slopes
Neolin Interceptor	12	Various(1)	Failed HDPE, sagged line continually collecting debris
Golf Course	12	VCP	Unable to complete inspection, suspected collapsed pipe
La Loma	8 & 12	Various(2)	Concrete pipes are deteriorated, pockets of voids in soil at flowline

Note:
(1) PVC, HDPE and unlined concrete
(2) PVC, vitrified clay and unlined concrete

PHOTO OF MANHOLE INSPECTION

FIGURE 3

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

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3.1.5 Inspection Results – Sewer Manholes

Table 5 summarizes the sewer manhole inspection results. The structural stability of the manholes inspected is in moderate to severe condition. Figure 4 through Figure 10 (pages 21-27) demonstrate the various conditions and defects found during inspections.

Table 5 Sewer Manhole Inspection Results
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Defect Description	Number of Manholes
Deteriorated Benches	23
Debris Accumulation in Invert	8
Incorrectly Formed Inverts	9

Appendix 6 contains a map showing the pipe and manhole inspections in relation to the street re-pavement plan and other information on the physical condition of manholes provided by operations staff and also odor complaints that are a direct result of infrastructure condition.

4.0 CAPITAL IMPROVEMENT PROJECTS

In general, estimating service life expectancy for wastewater infrastructure is a difficult challenge for utility managers. Although a useful service life of at least 50 years is commonly accepted in the industry for most sewer pipe materials, in many sewer collection systems there are multiple factors that reduce the service life, often significantly. Those factors may include:

- Corrosion (internal and/or external)
- Improper design and/or construction
- Soil foundation failure
- Premature material aging
- Root intrusion
- Infiltration/inflow
- Structural damage from external forces

Key factors for developing condition assessments for existing sewers include information on pipe material, age, maintenance records, and construction record drawings ("desktop" evaluation). One of the best methods to accurately assess condition of existing sewers is with the use of internal video inspection of the pipes using closed circuit cameras (CCTV). Because CCTV inspection is time consuming and expensive, utility managers often utilize video inspections from strategically selected portions of the collection system as "representative" of a particular area in the system. By coupling the representative video inspection data with the applicable desktop data evaluation, accurate condition assessments can be developed for areas with similar sewer system characteristics.

The approach described above was utilized for condition assessment of the Litchfield Park sewer system. As previously described in this report, CCTV inspections were strategically accomplished for representative portions of the existing sewer collection system. That information was coupled with desktop analysis to develop condition assessments for areas sharing similar characteristics for age, material, etc. The majority of pipe in the existing system is approaching or has exceeded its original expected useful life. As evidenced by the specific video inspections and assessments, other factors have negatively affected the service life expectancy of the existing pipes. A comprehensive program for sewer rehabilitation/replacement is required to maintain the serviceability of the existing wastewater collection system. Due to the unique characteristics of each pipe material, the approach for estimating the useful life of each pipe material is explained below.

Concrete Pipe. Concrete pipe degrades when used in collection systems because the sulfuric acid reacts with the cement in the pipe. This rate of degradation can be approximated using the "nessie" degradation curves that are commonly used to describe the degradation of water and wastewater infrastructure. The nessie curves are one way to represent the expected statistical failure of an asset that could be represented by a bell curve. Figure 11 shows a typical nessie curve for concrete pipe, which has an expected life of approximately 30 years. The concrete pipe in the Litchfield Park service area is older than 30 years and the physical inspections of this pipe shows that this pipe is beyond its useful service life and should be replaced.

Vitrified Clay Pipe. The failure characteristics of vitrified clay is not represented well using the nessie curve. Because VCP is a relatively inert material, if it is constructed and bedded correctly, it may last almost indefinitely. However, the common failure mode for VCP depends on bedding, root intrusion, and external loads. These failure modes are not time dependent, so failures could occur at any time that external loads or root intrusion causes damage. Therefore, although VCP could last 100 years, it could fail much earlier if bedding conditions, root intrusion, and external loads induce failures. The Litchfield Park collection system pipes are experiencing degradation and failures due to bedding conditions, roots, and external loads.

PVC Pipe. PVC pipe is also inert, and does not degrade over time as long as it is constructed with proper bedding. PVC pipe is less susceptible to root intrusion failures. PVC pipe is typically given a 50 year design life. However, PVC pipe has not been in service for 50 years so it is difficult to determine how long the pipe will actually last. Because failure of PVC pipe is tied to bedding during construction and external loads, the failure of PVC pipe does not appear to be time dependent and therefore the nessie curves do not adequately describe pipe failure. For pipes in the Litchfield Park service area, there have been pipe degradation and failures due to external loads and bedding that has consolidated, causing pipe sags.

Degraded pipe infrastructure has the following consequences from a financial, operational, and engineering perspective:

- When sewer pipe infrastructure degrades to the point where flows cannot be conveyed, the potential of sewer backups and SSOs can be costly both in the short-term and long-term perspective. Infrastructure requiring unplanned replacement is more expensive than planned infrastructure replacement. Emergency response operations include cleanup costs, potential overtime person-hours, equipment purchase and/or rental, traffic barricade rentals, chemical purchase and delivery, site restoration, individual legal actions, regulatory agency penalties and fees as well as other potential costs, depending on the location and extent of the problem.
- From an operational and engineering perspective, sewer backups and SSOs are the events that a gravity sewer system is designed to prevent. Pipes that sag accumulate debris that restricts or prevents wastewater flow. Pipes that fail (i.e., collapse) cause exfiltration that can damage adjacent utilities as well as the environment. A gravity sewer system is the best solution to provide customers with the safest means to convey sanitary sewer in a cost-effective manner. There should be minimal time and energy spent by operations staff to ensure consistent and safe service to customers. Pipes in poor condition require significant time by operations staff as well as utility resources.

4.1 Estimated Unit Costs

Table 6 shows the estimated unit costs and describes certain cost assumptions.

4.2 Wastewater Infrastructure Projects

The priority infrastructure for replacement/renewal in the next five years are the concrete material sewer pipelines and associated manholes. Secondary priorities are identified to address reducing the risk of sewer backups and improve the hydraulic performance of the system to meet industry standards. The total length is approximately 14 miles and includes approximately 270 manholes for an approximate cost of $10.3 million. While this is only for the five-year window, additional inspections are expected to identify infrastructure that will need to be replaced.

The high priority projects for sewer improvements are briefly described below:

- Bird Lane – Recommend full trench and cover sewer pipe replacement and manhole rehabilitation. .
- Bahia Lane and Laguna Drive – Recommend surveying inverts and redesigning sewer pipelines to meet minimum slope criteria.
- Wigwam Blvd east of Neolin Avenue – Excessive sag in HDPE collects debris, is a major source of odor and presents sewer overflow risk, recommend full trench and cover replacement.
- Golf Course – Determine whether unlined concrete pipe crossing the golf course is active now or needed in the future. Exact routing of system in this area is unclear. Access is greatly restricted and the pipe structure may be severely compromised.

Table 7 contains the details, justifications, and cost estimates for the proposed projects. Table 8 and Table 9 show the proposed projects broken down by specific asset groups/types.

Figure 12 (page 29) shows the location of the proposed capital projects in Litchfield Park. Figure 13 (page 30) is a bar-chart of the overall five-year proposed CIP in millions.

Table 6 Proposed Unit Costs
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Item Description	Units	Unit Cost
8" PVC SDR-35 Remove Old Pipe Remove Asphalt/Replace	LF	$79.08
10" PVC SDR-35 Remove Old Pipe Remove Asphalt/Replace	LF	$88.48
12" PVC SDR-35 Remove Old Pipe Remove Asphalt/Replace	LF	$92.68
5' Dia. Manhole/Remove Old	EA	$3,853.70
4' Dia. Manhole/Remove Old	EA	$2,940.98
8" Cleanout	LF	$1,115.54
4" Sewer Service Remove To Property Line	LF	$278.89
12" X 4" 45° PVC Reducing Wye With Gasket	EA	$208.59
8" X 4" 45° PVC Reducing Wye With Gasket	EA	$66.18
Air Test Sewer Main - Pipelines Only	LF	$0.56
Clean For TV Inspection - Pipelines Only	LF	$0.56
Clean For Final - Pipelines Only	LF	$0.56
Bypass Pumping	LF	$7.61
Engineering Design Staking/Inspection (25%) - Pipelines Only		
Engineering Design Staking/Inspection (15%)		
Permit/Review Fee (2%) – Pipelines Only		
Estimate Contingency (10%)		

*Cost Assumptions:

(1) These assumptions may not have been applied to all assets but represent key assumptions for this type of analysis.
(2) Replacement costs rather than rehabilitation for pipelines were used due to the following common factors: shallow depth, relatively small diameter, bypass requirements, traffic control requirements and reconnecting service laterals.
(3) Pipe replacement costs are based on PVC SDR-35, however, Carollo recommends that acceptable materials be allowed to bid for price competition.
(4) The engineering, design, staking/inspection assumption is increased for pipelines only due to site specific factors that may arise during design/study.
(5) Pavement replacement is based on trench coverage only, except as noted. Asphalt thickness is 3". One sack slurry is assumed under paved areas and ABC for unpaved areas.
(6) The depth of trench is generally 10 ft. The trench width is per MAG Spec 601.
(7) Manhole replacement materials include a precast manhole with epoxy coating and a 30" ring and cover.
(8) Project delivery and execution includes an Engineering Completion document with an Arizona-registered engineer signature.
(9) Estimated costs were based on the ENR Index for August 2013 9545.

Table 7 **Sewer Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant)	Replacement Plant Description (new plant) (SIB-eligible plant)					ADEQ WW Inventory ID No.	Site (location description)	Replacement Plant			
	361 Gravity Collecting Sewers 363 Service Laterals, Manholes, Clean-outs	Description	Pipe Length/ Quantity	Diameter/ Size	Material	Installed Cost/ Unit (estimated)			Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	
1A	361	Replace sewer pipe	2,347	12-inch	PVC	$139.70	100310	Bird Lane	Year 1	$327,900	$375,200	1. This project will replace unlined concrete pipe installed in 1962 that is severely deteriorated. The conditions warrant an open cut trench method. It is located in Bird Lane between Old Litchfield Rd and Pajaro Lane. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because a blockage of the pipe would potentially affect 30+ homes with either service interruption or sewer backups. Structural collapse of the pipe would affect vehicular traffic on this major east/west leg of Litchfield Park. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4, 5 and 7.
1B	363	Replace sewer manhole	6	60-inch	Precast concrete, epoxy coated	$4,817.13	100310	Bird Lane	Year 1	$29,000		
1C	363	Replace service lateral	30	4-inch	PVC	$609.35	100310	Bird Lane	Year 1	$18,300		
2A	361	Replace sewer pipe	2,974	8-inch	PVC	$121.07	100310	Redondo Drive	Year 1	$360,100	$450,600	1. This project will replace unlined concrete pipe installed in 1955 that is moderately deteriorated. It is located in the Redondo Drive loop subdivision. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because a blockage of the pipe would potentially affect 65+ homes with either service interruption or sewer backups. Structural collapse of the pipe would endanger the community. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4 and 5.
2B	363	Replace sewer manhole	17	48-inch	Precast concrete, epoxy coated	$3,676.32	100310	Redondo Drive	Year 1	$62,500		
2C	363	Replace service lateral	65	4-inch	PVC	$431.34	100310	Redondo Drive	Year 1	$28,000		

1. **Provide narrative why Replacement Plant is necessary**
   - **replacement of existing plant that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility**
   - **addressing excessive infiltration and inflow (I/I), showing excessive I/I adversely affecting treatment plant, if applicable**
   - **replacement of existing plant for other reasons supported by persuasive showing by utility**
2. **Provide narrative explaining why this segment of plant is a priority.**
3. **Provide narrative explaining how replacing this plant will benefit existing customers.**
4. **Provide affirmation that Replacement Plant does not include the costs for extending or expanding facilities to serve new customers.**
5. **Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance and repair/replacement program.**
   If addressing I/I, evaluate the extent of I/I along with the frequency, duration and volume of wet weather conditions and any other factors contributing to I/I.

Table 7 **Sewer Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 361 Gravity Collecting Sewers 363 Service Laterals, Manholes, Clean-outs	Replacement Plant Description (new plant) (SIB-eligible plant) Description	Pipe Length/ Quantity	Diameter/ Size	Material	Installed Cost/ Unit (estimated)	ADEQ WW Inventory ID No.	Site (location description)	Replacement Plant Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	1. Provide narrative why Replacement Plant is necessary - replacement of existing plant that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - addressing excessive infiltration and inflow (I/I), showing excessive I/I adversely affecting treatment plant, if applicable - replacement of existing plant for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this segment of plant is a priority. 3. Provide narrative explaining how replacing this plant will benefit existing customers. 4. Provide affirmation that Replacement Plant does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance and repair/replacement program. If addressing I/I, evaluate the extent of I/I along with the frequency, duration and volume of wet weather conditions and any other factors contributing to I/I.
3A	361	Replace sewer pipe	4,961	8-inch	PVC	$121.07	100310	Laguna Drive and Bahia Lane	Year 2	$600,700	$727,300	1. This project will replace vitrified clay pipe installed in 1956 that has exceeded the design life. The pipelines are also lying at slopes too flat to function well as gravity sewer mains. Frequent cleaning is performed to address odor complaints and debris blockages. It is located along Laguna Drive and Bahia Lane, southeast of Old Litchfield Rd and Wigwam Blvd. The brick manholes have heavily deteriorated benches that require repair. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because a blockage of the pipe of the pipe would potentially affect 140+ homes with either service interruption or sewer backups. Structural collapse of the pipe would endanger the community and depending the location; also affect the nearby man-made Tierra Verde Lake with waterfowl or school-age pedestrians. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4, 5, 6 and 7.
3B	363	Replace sewer manhole	18	48-inch	Precast concrete, epoxy coated	$3,676.23	100310	Laguna Drive and Bahia Lane	Year 2	$66,200		
3C	363	Replace service lateral	140	4-inch	PVC	$431.34	100310	Laguna Drive and Bahia Lane	Year 2	$60,400		
4A	361	Replace sewer pipe	2,974	12-inch	PVC	$139.70	100310	Neolin Ave	Year 2	$415,500	$490,900	1. This project will replace a sewer line with multiple problems. There are different materials, the original concrete installation dated 1955, PVC with an unknown installation. It is located along Neolin Avenue and Wigwam Blvd. Frequent odor complaints are tied to this specific area as well as sewer backups into homes. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because failure of the pipe would potentially affect 13+ homes and produce sewer backups. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 12, and Appendices 3, 4, 5 and 6.
4B	363	Replace sewer manhole	14	60-inch	Precast concrete, epoxy coated	$4,817.13	100310	Neolin Ave	Year 2	$67,500		
4C	363	Replace service lateral	13	4-inch	PVC	$609.35	100310	Neolin Ave	Year 2	$7,900		

Table 7 **Sewer Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant)	Replacement Plant Description (new plant) (SIB-eligible plant)					ADEQ WW Inventory ID No.	Site (location description)	Replacement Plant			1. Provide narrative why Replacement Plant is necessary - replacement of existing plant that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - addressing excessive infiltration and inflow (I/I), showing excessive I/I adversely affecting treatment plant, if applicable - replacement of existing plant for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this segment of plant is a priority. 3. Provide narrative explaining how replacing this plant will benefit existing customers. 4. Provide affirmation that Replacement Plant does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance and repair/replacement program. If addressing I/I, evaluate the extent of I/I along with the frequency, duration and volume of wet weather conditions and any other factors contributing to I/I.
	361 Gravity Collecting Sewers 363 Service Laterals, Manholes, Clean-outs	Description	Pipe Length/ Quantity	Diameter/ Size	Material	Installed Cost/ Unit (estimated)			Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	
5A	361	Replace sewer pipe	2,094	12-inch	PVC	$104.44	100310	Golf Course	Year 2	$218,700	$262,100	1. This project will replace vitrified clay pipe installed in 1962 that has exceeded the design life. Unsuccessful field inspection attempts may indicate that the pipeline is partially collapsed under the golf course. There is an I&I potential associated with this pipeline due to it's location under the golf course. 2. This segment of pipe is a priority because the high probability of collapse would affect course users and cascade to a detrimental economic impact on the resort. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance to upstream customers; there is no direct service connections associated with this project. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 12, and Appendices 3, 4 and 5.
5B	363	Replace sewer manhole	9	60-inch	Precast concrete, epoxy coated	$4,817.13	100310	Golf Course	Year 2	$43,400		
6A	361	Replace sewer pipe	2,417	12-inch	PVC	$93.38	100310	La Loma	Year 3	$225,700	$278,200	1. This project will replace concrete pipe installed in 1965. The design life must be re-evaluated due to the corrosive effects on the unprotected concrete material. It is located along La Loma Ave and Honeysuckle St NW of Old Litchfield and Wigwam Blvd. The area has been planned out as the City of Litchfield's future City Hall when funds become available. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 10+ homes, several businesses and produce sewer backups. Structural collapse of the pipe would affect pedestrian and vehicular traffic should the City Hall construction take place. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference page 7 and Appendices 3, 4 and 5.
6B	363	Replace sewer manhole	9	60-inch	Precast concrete, epoxy coated	$4,817.13	100310	La Loma	Year 3	$43,400		
6C	363	Replace service lateral	15	4-inch	PVC	$609.35	100310	La Loma	Year 3	$9,100		
7A	361	Replace sewer pipe	15,274	8-inch & 10-inch	PVC	$124.26	100310	South Villa Nueva	Year 3	$1,898,000	$2,177,600	1. This project will replace vitrified clay pipe installed in 1966. It is located in the southeast portion of Litchfield Park throughout the Villa Nueva subdivision. The brick manholes have heavily deteriorated benches that require repair. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 160+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
7B	363	Replace sewer manhole	61	48-inch	Precast concrete, epoxy coated	$3,451.79	100310	South Villa Nueva	Year 3	$210,600		
7C	363	Replace service lateral	160	4-inch	PVC	$431.34	100310	South Villa Nueva	Year 3	$69,000		

Table 7 **Sewer Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant)	Replacement Plant Description (new plant) (SIB-eligible plant)					ADEQ WW Inventory ID No.	Site (location description)	Replacement Plant			
	361 Gravity Collecting Sewers 363 Service Laterals, Manholes, Clean-outs	Description	Pipe Length/ Quantity	Diameter/ Size	Material	Installed Cost/ Unit (estimated)			Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	1. **Provide narrative why Replacement Plant is necessary** - **replacement of existing plant that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility** - **addressing excessive infiltration and inflow (I/I), showing excessive I/I adversely affecting treatment plant, if applicable** - **replacement of existing plant for other reasons supported by persuasive showing by utility** 2. **Provide narrative explaining why this segment of plant is a priority.** 3. **Provide narrative explaining how replacing this plant will benefit existing customers.** 4. **Provide affirmation that Replacement Plant does not include the costs for extending or expanding facilities to serve new customers.** 5. **Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance and repair/replacement program.** **If addressing I/I, evaluate the extent of I/I along with the frequency, duration and volume of wet weather conditions and any other factors contributing to I/I.**
8A	361	Replace sewer pipe	7,961	8-inch, 10-inch, 12-inch	PVC	$128.45	100310	Old Litchfield Road	Year 4	$1,022,700	$1,138,100	1. This project will replace concrete pipe on an unknown age. The unprotected material is highly susceptible to advance hydrogen sulfide induced corrosion. The location of the pipeline is critical, crossing the intersection of Camelback Road and Litchfield Road. The uncoated precast manholes require extensive repair to remain as safe access points to the sewer system. Service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect downtown Litchfield Park businesses and produce sewer backups as well interrupt traffic at a major intersection. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
8B	363	Replace sewer manhole	29	48-inch	Precast concrete, epoxy coated	$3,518.86	100310	Old Litchfield Road	Year 4	$102,100		
8C	363	Replace service lateral	30	4-inch	PVC	$443.21	100310	Old Litchfield Road	Year 4	$13,300		
9A	361	Replace sewer pipe	7,846	8-inch	PVC	$121.07	100310	North of Bird Lane	Year 4	$949,900	$1,068,700	1. This project will replace vitrified clay pipe installed in 1962 that has exceeded its designated useful life of 50 years. It is located in the subdivision north of Bird Lane. The brick manholes have heavily deteriorated benches that require repair also several bricks have fallen out. This compromises the structural integrity of the manhole. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 90+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
9B	363	Replace sewer manhole	23	48-inch	Precast concrete, epoxy coated	$3,477.81	100310	North of Bird Lane	Year 4	$80,000		
9C	363	Replace service lateral	90	4-inch	PVC	$431.34	100310	North of Bird Lane	Year 4	$38,800		
10A	361	Replace sewer pipe	4,635	8-inch	PVC	$121.07	100310	North La Loma	Year 5	$561,200	$661,700	1. This project will replace vitrified clay pipe installed in 1965. It is located along La Loma Drive north of Fairway Dr and almost curving to Old Litchfield Rd. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 70+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
10B	363	Replace sewer manhole	19	48-inch	Precast concrete, epoxy coated	$3,676.22	100310	North La Loma	Year 5	$69,900		
10C	363	Replace service lateral	71	4-inch	PVC	$431.34	100310	North La Loma	Year 5	$30,600		

Table 7 **Sewer Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 361 Gravity Collecting Sewers 363 Service Laterals, Manholes, Clean-outs	Replacement Plant Description (new plant) (SIB-eligible plant) Description	Pipe Length/ Quantity	Diameter/ Size	Material	Installed Cost/ Unit (estimated)	ADEQ WW Inventory ID No.	Site (location description)	Replacement Plant Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	1. Provide narrative why Replacement Plant is necessary - replacement of existing plant that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - addressing excessive infiltration and inflow (I/I), showing excessive I/I adversely affecting treatment plant, if applicable - replacement of existing plant for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this segment of plant is a priority. 3. Provide narrative explaining how replacing this plant will benefit existing customers. 4. Provide affirmation that Replacement Plant does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance and repair/replacement program. If addressing I/I, evaluate the extent of I/I along with the frequency, duration and volume of wet weather conditions and any other factors contributing to I/I.
11A	361	Replace sewer pipe	8,758	8-inch	PVC	$121.07	100310	Tierra Verde Lake to Wigwam	Year 5	$1,060,400	$1,290,100	1. This project will replace vitrified clay pipe installed in 1967. It is located between Tierra Verde Lake and Indian School Road up to south of Wigwam Blvd. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 200+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and depending the location; also affect the nearby man-made Tierra Verde Lake with waterfowl. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
11B	363	Replace sewer manhole	44	48-inch	Precast concrete, epoxy coated	$3,209.49	100310	Tierra Verde Lake to Wigwam	Year 5	$141,300		
11C	363	Replace service lateral	205	4-inch	PVC	$431.34	100310	Tierra Verde Lake to Wigwam	Year 5	$88,400		
12A	361	Replace sewer pipe	9,656	8-inch	PVC	$121.07	100310	West of Staggs Park	Year 5	$1,169,100	$1,416,700	1. This project will replace vitrified clay pipe installed in 1973. It is located west of Staggs Park and south of Wigwam Blvd. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency. 2. This segment of pipe is a priority because the high probability of collapse would potentially affect 220+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic. 3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health. 4. This project does not include extending the sewer service facilities to serve new customers. 5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.
12B	363	Replace sewer manhole	44	48-inch	Precast concrete, epoxy coated	$3,468.79	100310	West of Staggs Park	Year 5	$152,700		
12C	363	Replace service lateral	220	4-inch	PVC	$431.34	100310	West of Staggs Park	Year 5	$94,900		
									Estimated Total Cost		**$10,337,200**	

Table 8 Sewer Capital Projects for Five Years – Pipelines
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible asset)	Site (location description)	Replacement Asset Description (SIB-eligible asset)			ADEQ WW Inventory ID No.	Proposed Phase	Total Estimated Cost
			Pipe Length	Diameter	Material			
1A	361	Bird Lane	2,347	12	VCP	100310	Year 1	$327,900
2A	361	Redondo Drive	2,974	8	VCP	100310	Year 1	$360,100
3A	361	Laguna Drive and Bahia Lane	4,961	8	VCP	100310	Year 2	$600,700
4A	361	Neolin Ave	2,974	12	VCP	100310	Year 2	$415,500
5A	361	Golf Course	2,094	12	VCP	100310	Year 2	$218,700
6A	361	La Loma	2,417	12	VCP	100310	Year 3	$225,700
7A	361	South Villa Nueva	15,274	8 & 10	VCP	100310	Year 3	$1,898,000
8A	361	Old Litchfield Road	7,961	8, 10 & 12	VCP	100310	Year 4	$1,022,700
9A	361	North of Bird Lane	7,846	8	VCP	100310	Year 4	$949,900
10A	361	North La Loma	4,635	8	VCP	100310	Year 5	$561,200
11A	361	Tierra Verde Lake to Wigwam	8,758	8	VCP	100310	Year 5	$1,060,400
12A	361	West of Staggs Park	9,656	8	VCP	100310	Year 5	$1,169,100
							Total Estimated Cost for Pipelines	**$8,809,900**

Table 9 **Sewer Capital Projects for Five Years – Manholes and Service Laterals**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible asset)	Site (location description)	Replacement Asset Description (SIB-eligible asset)	Asset Quantity (No., No.)	PWSID No.	Proposed Phase	Subtotal Estimated Cost	Total Estimated Cost
1B	363	Bird Lane	Replace Manholes	6	100310	Year 1	$29,000	$47,300
1C	363		Replace Service Laterals	30	100310		$18,300	
2B	363	Redondo Drive	Replace Manholes	17	100310	Year 1	$62,500	$90,500
2C	363		Replace Service Laterals	65	100310		$28,000	
3B	363	Laguna Drive and Bahia Lane	Replace Manholes	18	100310	Year 2	$66,200	$126,600
3C	363		Replace Service Laterals	140	100310		$60,400	
4B	363	Neolin Ave	Replace Manholes	14	100310	Year 2	$67,500	$75,400
4C	363		Replace Service Laterals	13	100310		$7,900	
5B	363	Golf Course	Replace Manholes	9	100310	Year 2	$43,400	$43,400
6B	363	La Loma	Replace Manholes	9	100310	Year 3	$43,400	$52,500
6C	363		Replace Service Laterals	15	100310		$9,100	
7B	363	South Villa Nueva	Replace Manholes	61	100310	Year 3	$210,600	$279,600
7C	363		Replace Service Laterals	160	100310		$69,000	
8B	363	Old Litchfield Road	Replace Manholes	29	100310	Year 4	$102,100	$115,400
8C	363		Replace Service Laterals	30	100310		$13,300	
9B	363	North of Bird Lane	Replace Manholes	23	100310	Year 4	$69,900	$100,500
9C	363		Replace Service Laterals	90	100310		$30,600	
10B	363	North La Loma	Replace Manholes	19	100310	Year 5	$69,900	$100,500
10C	363		Replace Service Laterals	71	100310		$30,600	

Table 9 **Sewer Capital Projects for Five Years – Manholes and Service Laterals**
Litchfield Park Facilities Assessment, Volume 1 - Sewer
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible asset)	Site (location description)	Replacement Asset Description (SIB-eligible asset)	Asset Quantity (No., No.)	PWSID No.	Proposed Phase	Subtotal Estimated Cost	Total Estimated Cost
11B	363	Tierra Verde Lake to Wigwam	Replace Manholes	44	100310	Year 5	$141,300	$229,700
11C	363		Replace Service Laterals	205	100310		$88,400	
12B	363	West of Staggs Park	Replace Manholes	44	100310	Year 5	$152,700	$247,600
12C	363		Replace Service Laterals	220	100310		$94,900	
						Total Estimated Cost		**$1,527,300**

MANHOLE IN GOOD CONDITION

FIGURE 4

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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EXPOSED AGGREGATE
MANHOLE #4214 – OLD LITCHFIELD ROAD

FIGURE 5

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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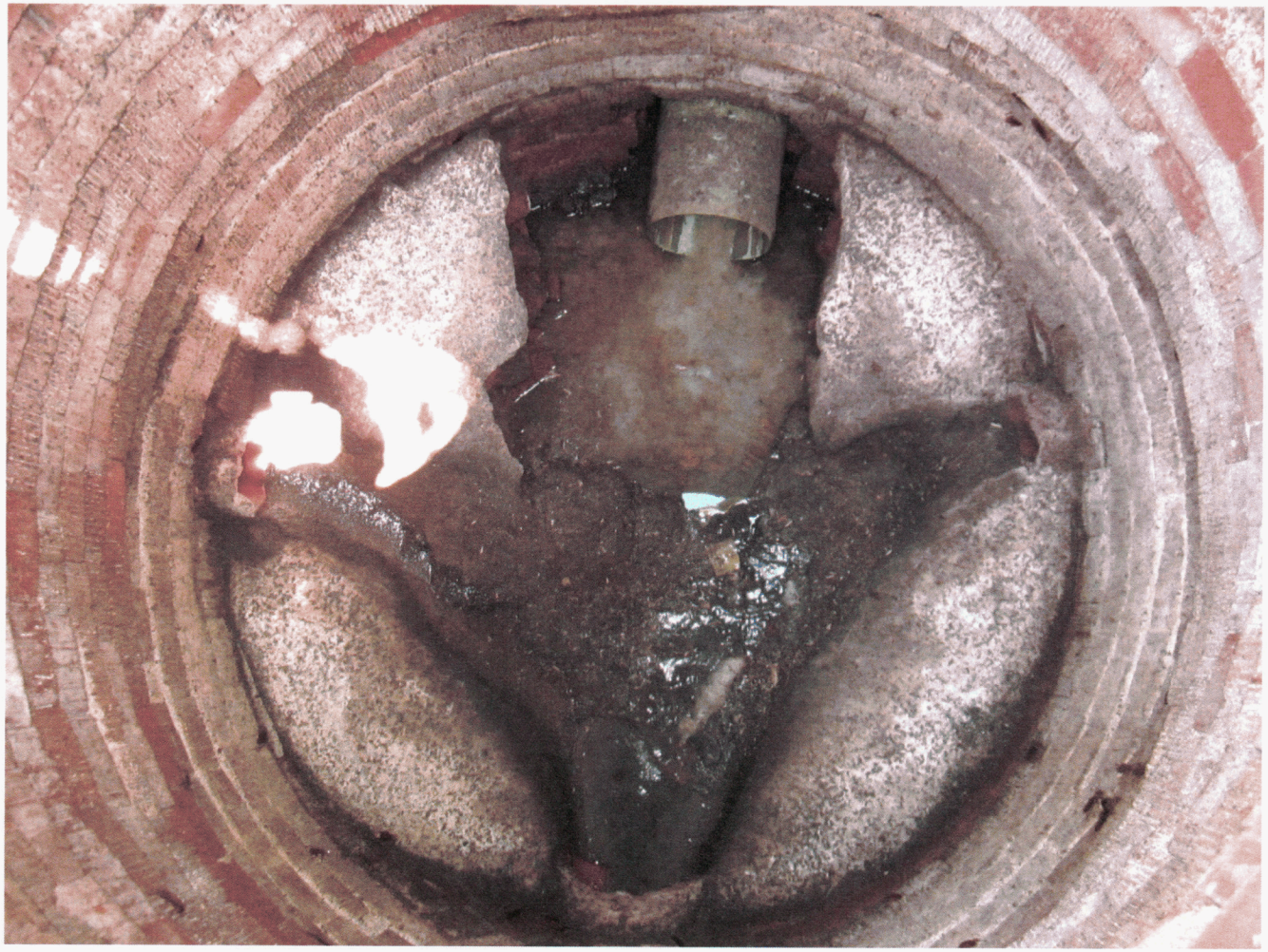

DETERIORATED BENCH
MANHOLE #2187 – LAGUNA DRIVE

FIGURE 6

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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DETERIORATED FRAME
MANHOLE #4056 – VILLA NUEVA DRIVE

FIGURE 7

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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DETERIORATED INVERT
MANHOLE #4037 – VILLA NUEVA DRIVE

FIGURE 8

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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MISSING BRICKS
MANHOLE #715 – ROBLES DRIVE

FIGURE 9

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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DEBRIS
MANHOLE #4337 – OLD LITCHFIELD ROAD

FIGURE 10

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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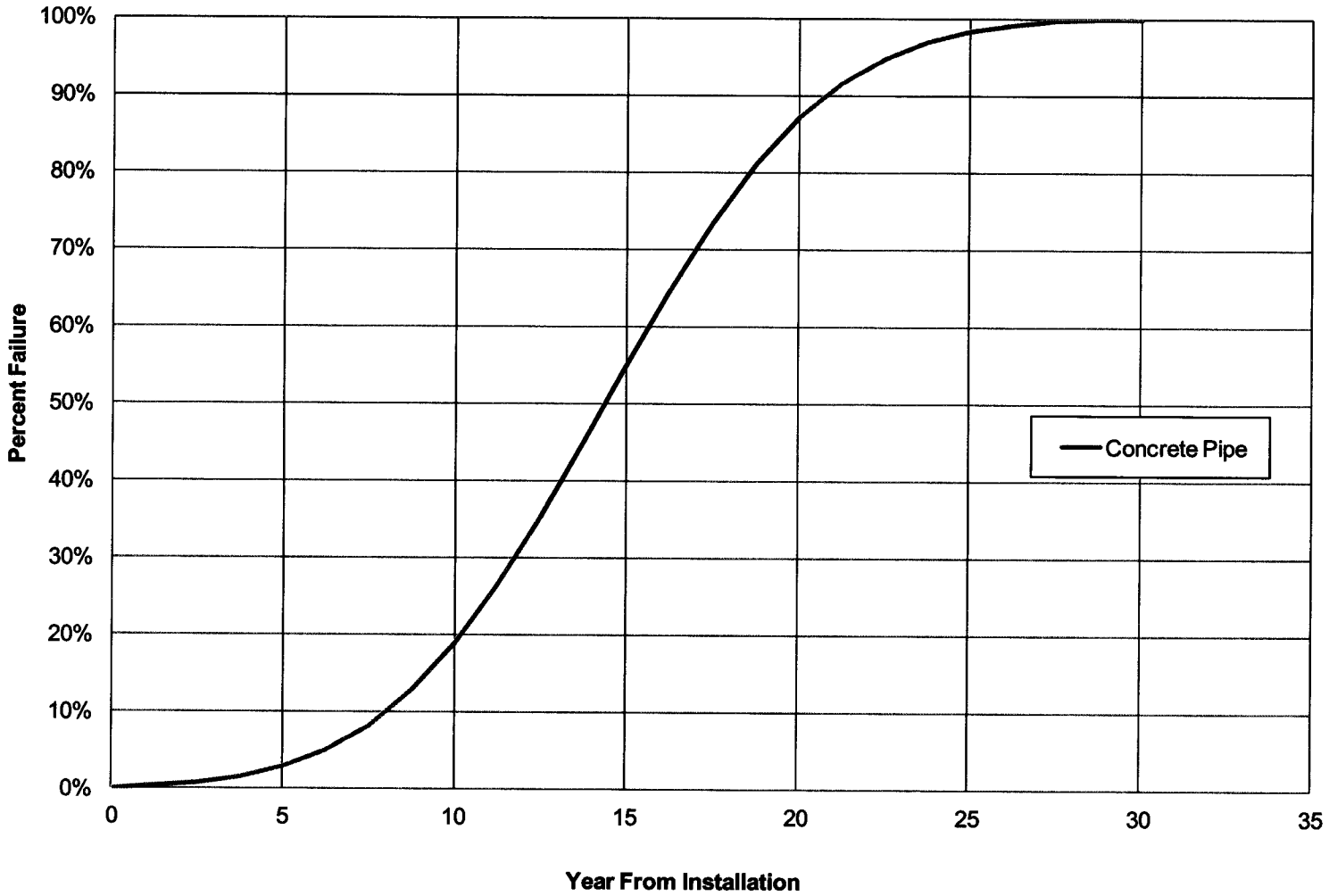

CONCRETE SEWER MAIN
ESTIMATED FAILURE CURVE

FIGURE 11

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

Carollo

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CAPITAL PROJECTS OVERVIEW MAP

FIGURE 12

LIBERTY WATER

LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

carollo

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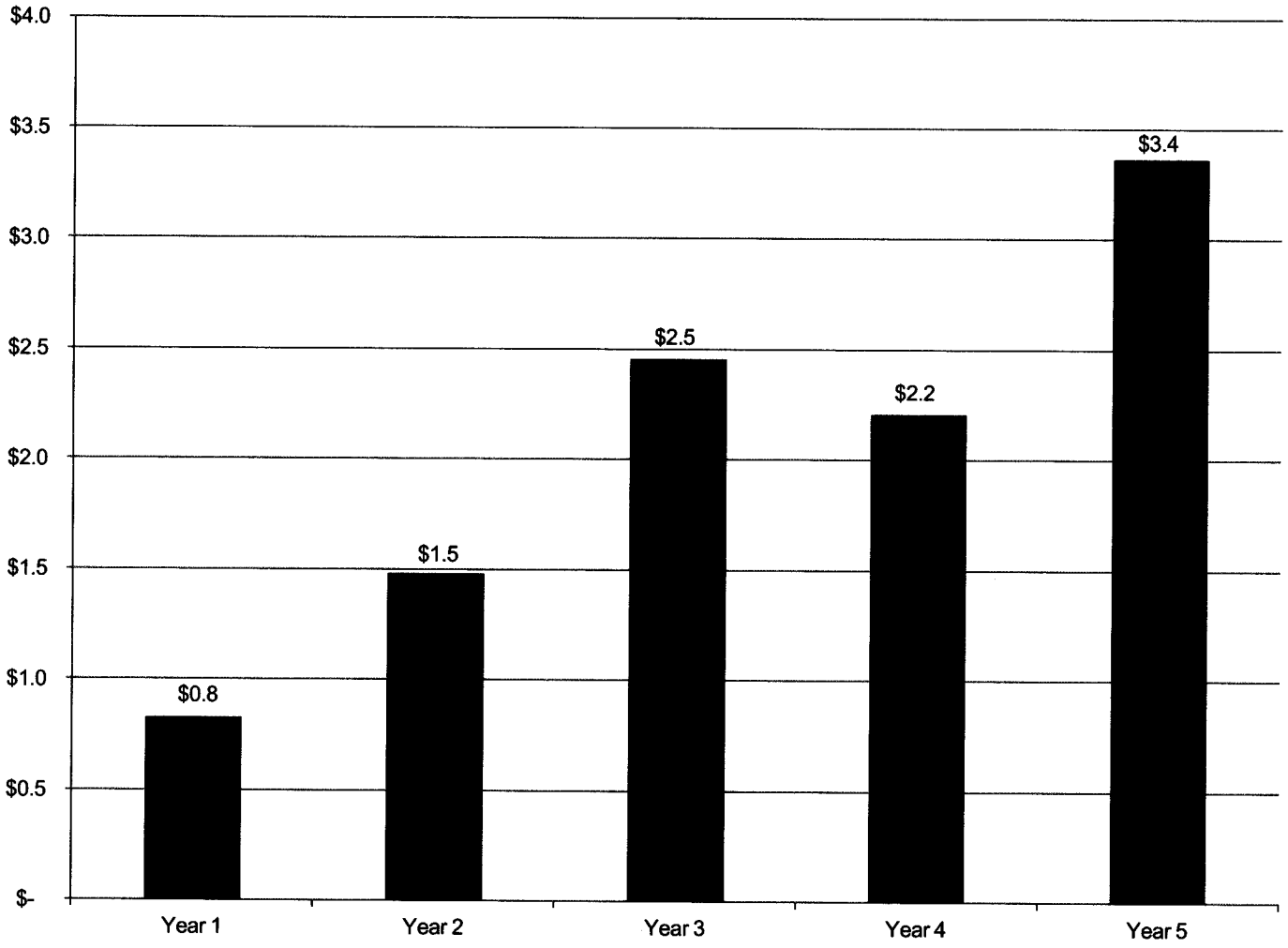

PROPOSED CAPITAL EXPENDITURES (IN MILLIONS)

FIGURE 13

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE I

Carollo

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APPENDIX 1 – PROPOSED CAPITAL IMPROVEMENT PROJECT ONE-PAGE SUMMARIES AND COST ESTIMATES

Project Number: 1

Project Phase: Year 1

Project Location: Bird Lane

Project Description:

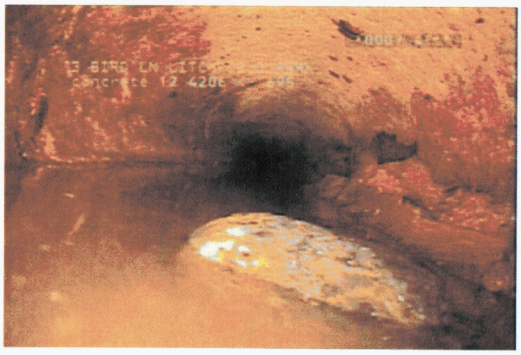
1. This project will replace unlined concrete pipe installed in 1962 that is severely deteriorated. The conditions warrant an open cut trench method. It is located in Bird Lane between Old Litchfield Rd and Pajaro Lane. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2. This segment of pipe is a priority because a blockage of the pipe would potentially affect 30+ homes with either service interruption or sewer backups. Structural collapse of the pipe would affect vehicular traffic on this major east/west leg of Litchfield Park.
3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers.
4. This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4, 5 and 7.

Estimated Capital Cost: $375,200 (in 2013 dollars)

Sewer Mains: Replace 2,347 LF of existing 12" pipe in kind

Manholes: Replace 6 manholes

Sewer Services: Replace 30 sewer laterals



CCTV photo of Bird Lane sewer pipe

Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Birdlane.mxd

Project Number: 2

Project Phase: Year 1

Project Location: Redondo Drive

Project Description:

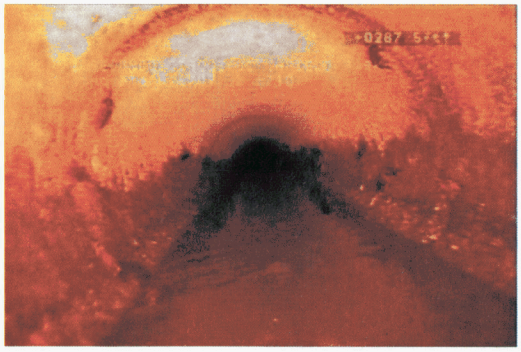
1. This project will replace unlined concrete pipe installed in 1955 that is moderately deteriorated. It is located in the Redondo Drive loop subdivision. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2. This segment of pipe is a priority because a blockage of the pipe would potentially affect 65+ homes with either service interruption or sewer backups. Structural collapse of the pipe would endanger the community.
3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers.
4. This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4 and 5.

Estimated Capital Cost: $450,600 (in 2013 dollars)

Sewer Mains: Replace 2,974 LF of existing 8" pipe in kind

Manholes: Replace 17 manholes

Sewer Services: Replace 65 sewer laterals



CCTV photo of Redondo Dr sewer pipe

Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Birdlane.mxd

Project Number: 3

Project Phase: Year 2

Project Location: Laguna Drive and Bahia Lane

Project Description:

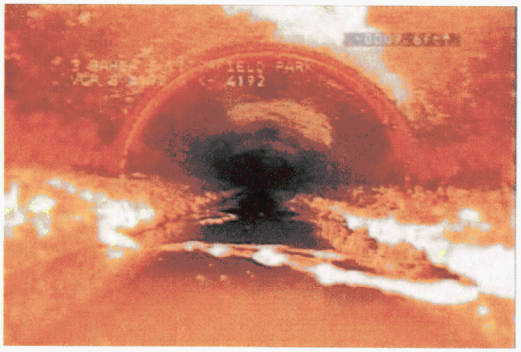
1. This project will replace vitrified clay pipe installed in 1956 that has exceeded the design life. The pipelines are also lying at slopes too flat to function well as gravity sewer mains. Frequent cleaning is performed to address odor complaints and debris blockages. It is located along Laguna Drive and Bahia Lane, southeast of Old Litchfield Rd and Wigwam Blvd. The brick manholes have heavily deteriorated benches that require repair. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2. This segment of pipe is a priority because a blockage of the pipe of the pipe would potentially affect 140+ homes with either service interruption or sewer backups. Structural collapse of the pipe would endanger the community and depending the location; also affect the nearby man-made Tierra Verde Lake with waterfowl or school-age pedestrians.
3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. This project will also prevent a sewer overflow and protect the public health.
4. This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 11, and Appendices 3, 4, 5, 6 and 7.

Estimated Capital Cost: $727,300 (in 2013 dollars)

Sewer Mains: Replace 4,961 LF of existing 8" pipe in kind

Manholes: Replace 18 manholes

Sewer Services: Replace 140 sewer laterals



CCTV photo of Bahia Lane sewer pipe

Litchfield Park Water and Wastewater Facilities Assessment, 2013

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Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Birdland.mxd

Project Number: 4

Project Phase: Year 2

Project Location: Neolin Avenue

Project Description:

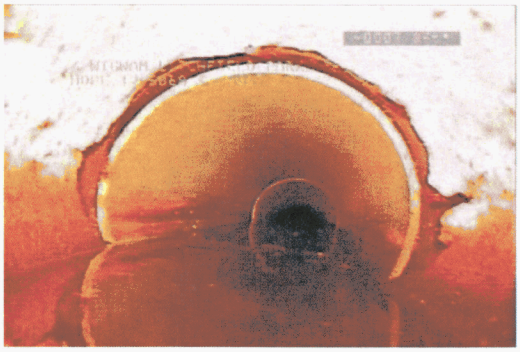
1. This project will replace a sewer line with multiple problems. There are different materials, the original concrete installation dated 1955, PVC with an unknown installation. It is located along Neolin Avenue and Wigwam Blvd. Frequent odor complaints are tied to this specific area as well as sewer backups into homes. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2. This segment of pipe is a priority because failure of the pipe would potentially affect 13+ homes and produce sewer backups.
3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance for existing customers. This project will also prevent a sewer overflow and protect the public health.
4. This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 12, and Appendices 3, 4, 5 and 6.

Estimated Capital Cost: $490,900 (in 2013 dollars)

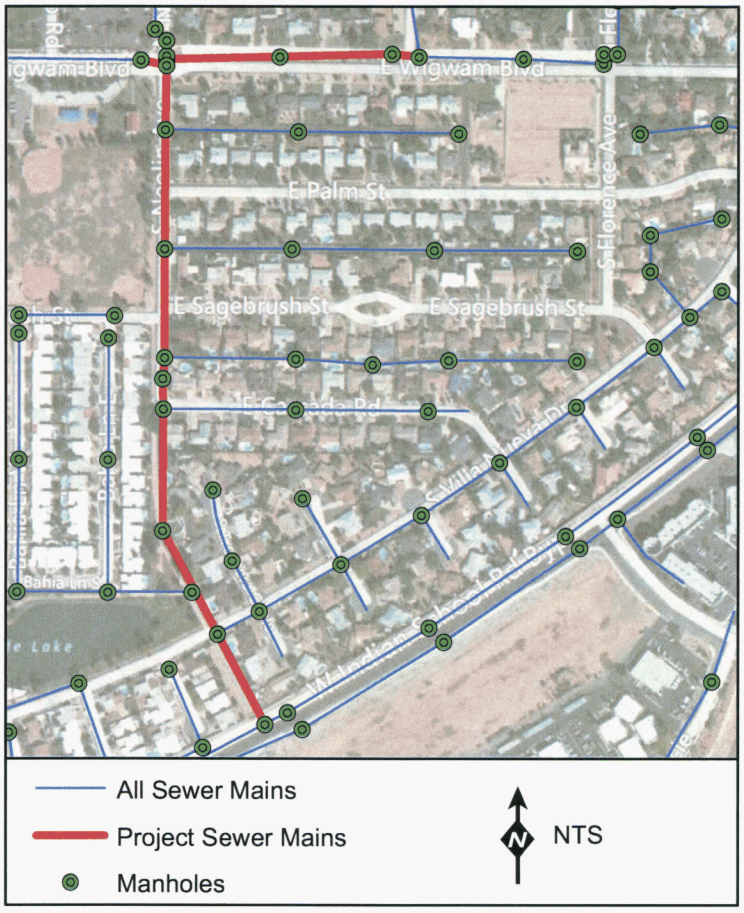
Sewer Mains: Replace 2,974 LF of existing 12" pipe in kind

Manholes: Replace 14 manholes

Sewer Services: Replace 13 sewer laterals



CCTV photo of Neolin Ave sewer pipe



Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Birdlane .mxd

Project Number: 5

Project Phase: Year 2

Project Location: Golf Course

Project Description:

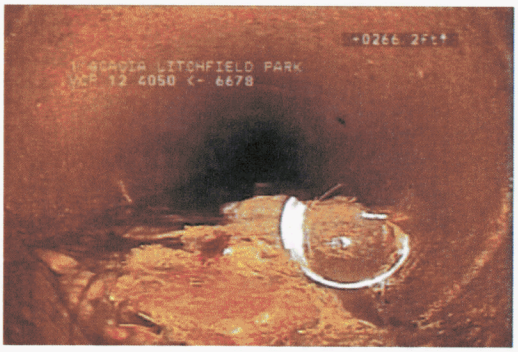
1.This project will replace vitrified clay pipe installed in 1962 that has exceeded the design life. Unsuccessful field inspection attempts may indicate that the pipeline is partially collapsed under the golf course. There is an I&I potential associated with this pipeline due to it's location under the golf course.
2.This segment of pipe is a priority because the high probability of collapse would affect course users and cascade to a detrimental economic impact on the resort.
3.Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance to upstream customers; there is no direct service connections associated with this project.
4.This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference pages 7, 12, and Appendices 3, 4 and 5.

Estimated Capital Cost: $262,100
(in 2013 dollars)

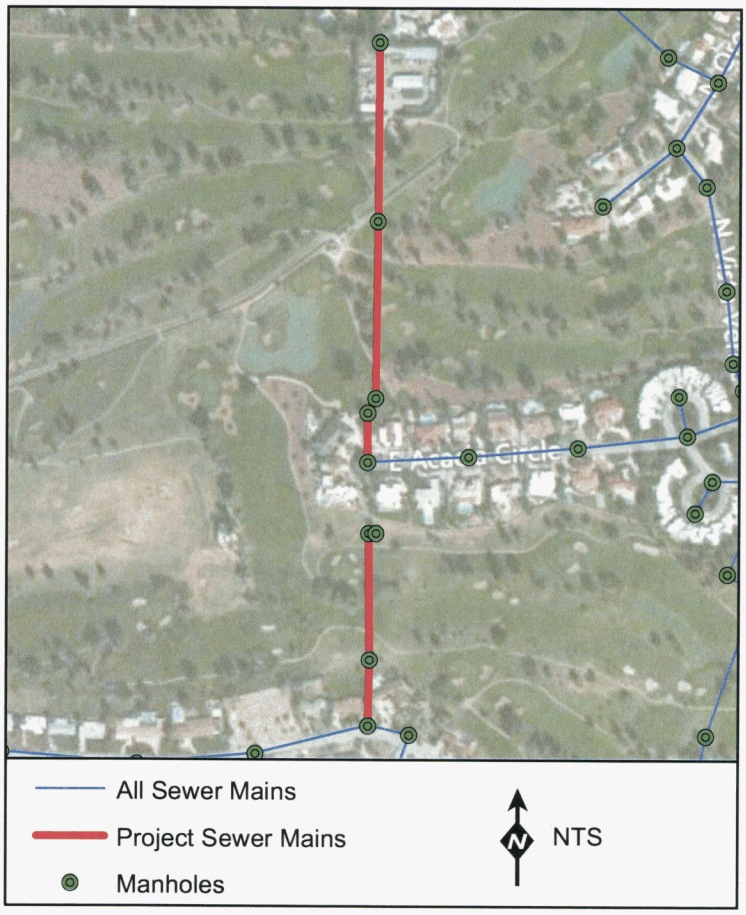
Sewer Mains: Replace 2,094 LF of existing 12" pipe in kind

Manholes: Replace 9 manholes

Sewer Services: No sewer laterals to replace



CCTV photo of Golf Course sewer pipe



Litchfield Park Water and Wastewater Facilities Assessment, 2013

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Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP GIS\MXD\CIP_01_Sewer.mxd

Project Number: 6

Project Phase: Year 3

Project Location: La Loma Avenue

Project Description:

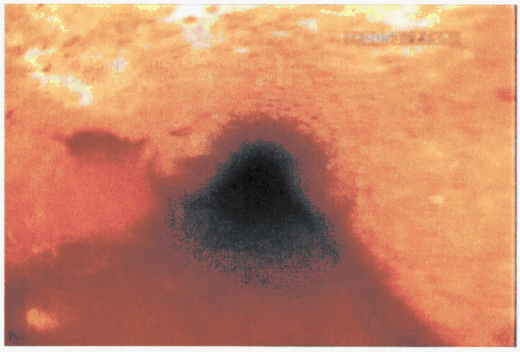
1.This project will replace concrete pipe installed in 1965. The design life must be re-evaluated due to the corrosive effects on the unprotected concrete material. It is located along La Loma Ave and Honeysuckle St NW of Old Litchfield and Wigwam Blvd. The area has been planned out as the City of Litchfield's future City Hall when funds become available.
2.This segment of pipe is a priority because the high probability of collapse would potentially affect 10+ homes, several businesses and produce sewer backups. Structural collapse of the pipe would affect pedestrian and vehicular traffic should the City Hall construction take place.
3.Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health.
4.This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference page 7 and Appendices 3, 4 and 5.

Estimated Capital Cost: $278,200
(in 2013 dollars)

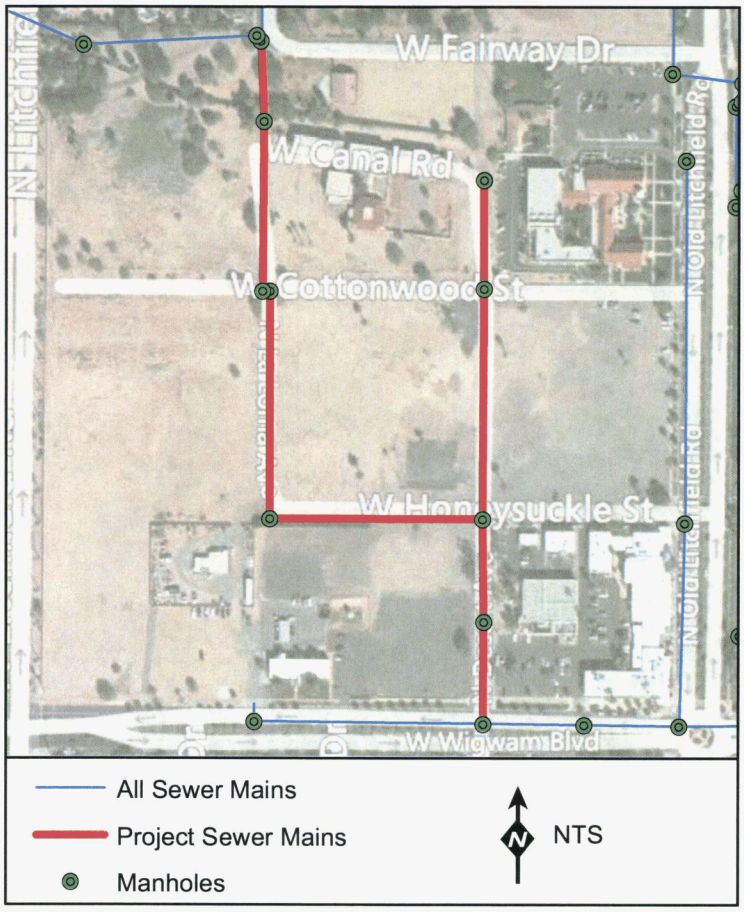
Sewer Mains: Replace 2,417 LF of existing 8" pipe in kind

Manholes: Replace 9 manholes

Sewer Services: Replace 15 sewer laterals



CCTV photo of La Loma sewer pipe



Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP GIS\MXD\CIP 01 Birdseye.mxd

Project Number: 7

Project Phase: Year 3

Project Location: South Villa Nueva Drive

Project Description:

1.This project will replace vitrified clay pipe installed in 1966. It is located in the southeast portion of Litchfield Park throughout the Villa Nueva subdivision. The brick manholes have heavily deteriorated benches that require repair. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2.This segment of pipe is a priority because the high probability of collapse would potentially affect 160+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic.
3.Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health.
4.This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.

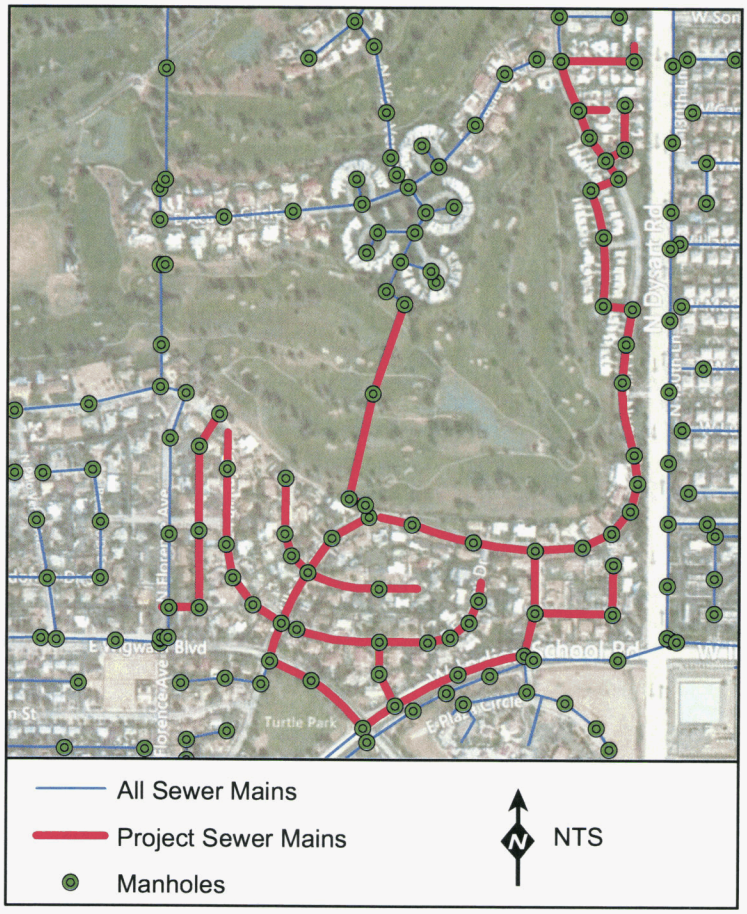
Estimated Capital Cost: $2,177,600
(in 2013 dollars)

Sewer Mains: Replace 15,274 LF of 10" and 8" pipe in kind

Manholes: Replace 55 manholes

Sewer Services: Replace 160 sewer laterals

Photo of Villa Nueva Manhole # 4081



Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP_01 Birdlane.mxd

Project Number: 8

Project Phase: Year 4

Project Location: Old Litchfield Road

Project Description:

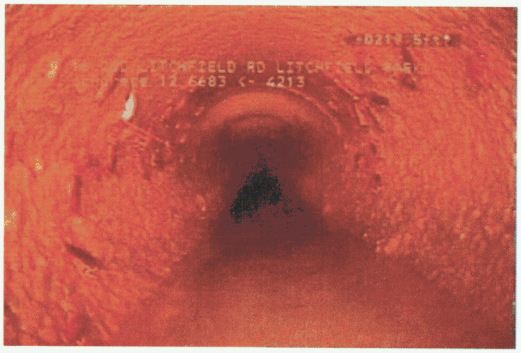
1. This project will replace concrete pipe on an unknown age. The unprotected material is highly susceptible to advance hydrogen sulfide induced corrosion. The location of the pipeline is critical, crossing the intersection of Camelback Road and Litchfield Road. The uncoated precast manholes require extensive repair to remain as safe access points to the sewer system. Service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2. This segment of pipe is a priority because the high probability of collapse would potentially affect downtown Litchfield Park businesses and produce sewer backups as well interrupt traffic at a major intersection.
3. Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health.
4. This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.

Estimated Capital Cost: $1,138,100 (in 2013 dollars)

Sewer Mains: Replace 7,961 LF of 12", 10" and 8" pipe in kind

Manholes: Replace 27 manholes

Sewer Services: Replace 30 sewer laterals



CCTV Photo of Old Litchfield sewer pipe

Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Sirdiana.mxd

Project Number: 9

Project Phase: Year 4

Project Location: North of Bird Lane

Project Description:

1.This project will replace vitrified clay pipe installed in 1962 that has exceeded its designated useful life of 50 years. It is located in the subdivision north of Bird Lane. The brick manholes have heavily deteriorated benches that require repair also several bricks have fallen out. This compromises the structural integrity of the manhole. The service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2.This segment of pipe is a priority because the high probability of collapse would potentially affect 90+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic.
3.Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health.
4.This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.

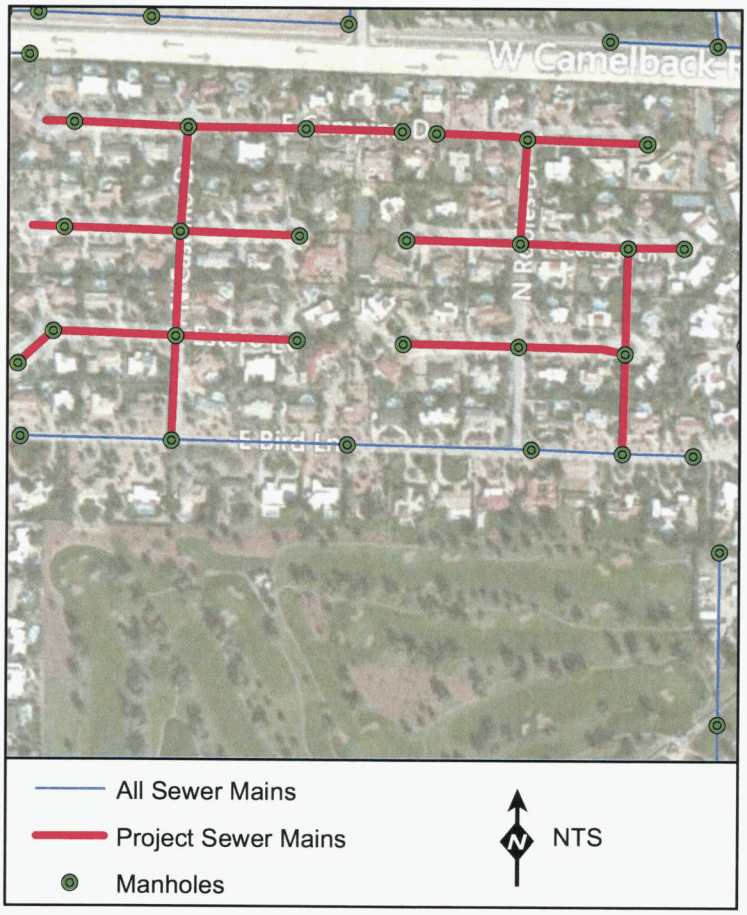
Estimated Capital Cost: $1,068,700
(in 2013 dollars)

Sewer Mains: Replace 7,846 LF of 8" pipe in kind

Manholes: Replace 21 manholes

Sewer Services: Replace 90 sewer laterals

Photo of Manhole # 700 north of Bird Ln



Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP 01 Birdlane.mxd

Project Number: 10

Project Phase: Year 5

Project Location: North La Loma Avenue

Project Description:

1.This project will replace vitrified clay pipe installed in 1965. It is located along La Loma Drive north of Fairway Dr and almost curving to Old Litchfield Rd. The manhole and service lateral replacement costs are included to take advantage of cost saving potential and increase construction efficiency.
2.This segment of pipe is a priority because the high probability of collapse would potentially affect 70+ homes and produce sewer backups. Structural collapse of the pipe would endanger the community and vehicular traffic.
3.Replacing this portion of the sewer system will provide reliable sanitary sewer conveyance. This project will also prevent a sewer overflow and protect the public health.
4.This project does not include extending the sewer service facilities to serve new customers.
5. The Engineering Analysis that supports the need for SIB can be found in the Final Litchfield Park Facilities Assessment, Volume 1 – Sewer. Reference Appendices 3, 4, 5 and 7.

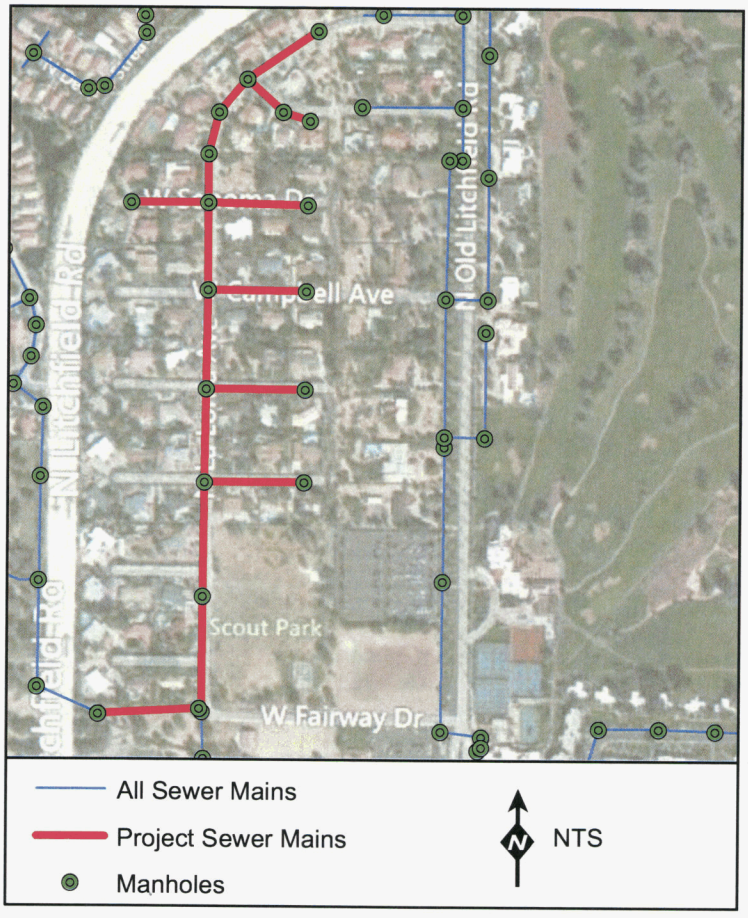
Estimated Capital Cost: $661,700
(in 2013 dollars)

Sewer Mains: Replace 4,635 LF of 8" pipe in kind

Manholes: Replace 19 manholes

Sewer Services: Replace 71 sewer laterals

Photo of La Loma Ave Manhole # 3361



Printing Date: September 06, 2013
File Path: M:\Client\Liberty Water\9249A.00 AMP GIS\MXD\CIP 01 Birdlane.mxd

Carollo

PROJECT : Liberty Water Asset Management Plan

JOB # : 9249A.00

CLIENT : Liberty Utilities

ELEMENT : Sewer Main Replacement

LOCATION FACTOR: 1.00

DATE : 9/3/2013

ENR : 9545

BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	8" SDR-35 PVC SEWER PIPE, IN TRENCH	1	LF	$12.39	$0.00	$12.39	$12.39	
	TOTAL PIPING							**$12.39**
EXCAV & BACKFILL	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.62	CY	$3.33	$0.00	$3.33	$2.06	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.11	CY	$60.54	$0.00	$60.54	$6.66	
	Backfill Above Zone (1/2 sack slurry)	0.49	CY	$41.25	$0.00	$41.25	$20.21	
	Traffic Plates, 1", (12 Uses)	5	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1	LS	$4.05	$0.00	$4.05	$4.05	
	Total Earthwork (per 1 LF)							**$44.59**
PAVING DEMO & REPLACEMENT	Remove AC Pavement	0.41	SY	$7.00	$0.66	$7.66	$3.14	
	3" AC Paving on 6" ABC	0.41	SY	$36.45	$9.80	$46.25	$18.96	
	TOTAL PAVING							**$22.10**
	TOTAL CONSTRUCTION COST PER LF							**$79.08**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

carollo

PROJECT : Liberty Water Asset Management Plan

JOB # : 9249A.00

CLIENT : Liberty Utilities

ELEMENT : Sewer Main Replacement

LOCATION FACTOR: 1.00

DATE : 9/3/2013

ENR : 9545

BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	10" SDR-35 PVC SEWER PIPE, IN TRENCH	1	LF	$17.34	$0.00	$17.34	$17.34	
	TOTAL PIPING							**$17.34**
EXCAV & BACKFILL	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.68	CY	$3.33	$0.00	$3.33	$2.26	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.13	CY	$60.54	$0.00	$60.54	$7.87	
	Backfill Above Zone (1/2 sack slurry)	0.53	CY	$41.25	$0.00	$41.25	$21.86	
	Traffic Plates, 1", (12 Uses)	5.00	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1.00	LS	$4.36	$0.00	$4.36	$4.36	
	Total Earthwork (per 1 LF)							**$47.96**
PAVING DEMO & REPLACEMENT	Remove AC Pavement	0.43	SY	$7.00	$0.66	$7.66	$3.29	
	3" AC Paving on 6" ABC	0.43	SY	$36.45	$9.80	$46.25	$19.89	
	TOTAL PAVING							**$23.18**
	TOTAL CONSTRUCTION COST PER LF							**$88.48**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

Carollo

PROJECT : Liberty Water Asset Management Plan

JOB # : 9249A.00

CLIENT : Liberty Utilities

ELEMENT : Sewer Main Replacement

LOCATION FACTOR: 1.00

DATE : 9/3/2013

ENR : 9545

BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	12" SDR-35 PVC SEWER PIPE, IN TRENCH	1	LF	$18.30	$0.00	$18.30	$18.30	
	TOTAL PIPING							**$18.30**
EXCAV & BACKFILL	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.74	CY	$3.33	$0.00	$3.33	$2.46	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.14	CY	$60.54	$0.00	$60.54	$8.48	
	Backfill Above Zone (1/2 sack slurry)	0.57	CY	$41.25	$0.00	$41.25	$23.51	
	Traffic Plates, 1", (12 Uses)	5.00	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1.00	LS	$4.61	$0.00	$4.61	$4.61	
	Total Earthwork (per 1 LF)							**$50.66**
PAVING DEMO & REPLACEMENT	Remove AC Pavement	0.44	SY	$7.00	$0.66	$7.66	$3.37	
	3" AC Paving on 6" ABC	0.44	SY	$36.45	$9.80	$46.25	$20.35	
	TOTAL PAVING							**$23.72**
TOTAL CONSTRUCTION COST PER LF								**$92.68**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 1 ENR August 2013 9545
Location Bird Lane

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 79.08	$ -	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 88.48	$ -	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2347	LF	$ 92.68	$ 217,520	
AIR TEST SEWER MAIN	2347	LF	$ 0.56	$ 1,314	
CLEAN FOR TV INSPECTION - Pipelines Only	2347	LF	$ 0.56	$ 1,314	
CLEAN FOR FINAL - Pipelines Only	2347	LF	$ 0.56	$ 1,314	
BYPASS PUMPING	2347	LF	$ 7.61	$ 17,861	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 59,831	
PERMIT/REVIEW FEE (2%)	1	LS		$ 4,786	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 23,932	Unit Cost
			Pipeline Total	$ 327,873	$ 139.70
			Rounded Pipeline Total	**$ 327,900**	
5' DIA. MANHOLE/REMOVE OLD	6	EA	$ 3,853.70	$ 23,122	
4' DIA. MANHOLE/REMOVE OLD	0	EA	$ 2,940.98	$ -	
8" CLEANOUT	0	EA	$ 1,115.54	$ -	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,468	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,312	Unit Cost
			Manhole & Cleanout Total	$ 28,903	$ 4,817.13
			Rounded Manhole & Cleanout Total	**$ 29,000**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	30	EA	$ 278.89	$ 8,367	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	30	EA	$ 208.59	$ 6,258	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	$ 66.18	$ -	
ENGINEERING DESIGN STAKING / INSPECTION (15%)	1	LS		$ 2,194	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 1,462	Unit Cost
			Service Lateral Total	$ 18,281	$ 609.35
			Rounded Service Lateral Total	**$ 18,300**	
			PROJECT TOTAL	$ 375,057	
			ROUNDED PROJECT TOTAL	**$ 375,200**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project	**2**			ENR August 2013	9545
Location	**Redondo Dr**				

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2974	LF	79.08	$ 235,184	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$ -	
AIR TEST SEWER MAIN	2974	LF	00.56	$ 1,665	
CLEAN FOR TV INSPECTION - Pipelines Only	2974	LF	00.56	$ 1,665	
CLEAN FOR FINAL - Pipelines Only	2974	LF	00.56	$ 1,665	
BYPASS PUMPING	2974	LF	07.61	$ 22,632	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 65,703	
PERMIT/REVIEW FEE (2%)	1	LS		$ 5,256	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 26,281	Unit Cost
			Pipeline Total	$ 360,053	$ 121.07
			Rounded Pipeline Total	**$ 360,100**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$ -	
4' DIA. MANHOLE/REMOVE OLD	17	EA	2940.98	$ 49,997	
8" CLEANOUT	0	EA	1115.54	$ -	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 7,500	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 5,000	Unit Cost
			Manhole & Cleanout Total	$ 62,496	$ 3,676.23
			Rounded Manhole & Cleanout Total	**$ 62,500**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	65	EA	278.89	$ 18,128	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$ -	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	65	EA	66.18	$ 4,302	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,364	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,243	Unit Cost
			Service Lateral Total	$ 28,037	$ 431.34
			Rounded Service Lateral Total	**$ 28,000**	
			PROJECT TOTAL	$ 450,586	
			ROUNDED PROJECT TOTAL	**$ 450,600**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 3 ENR August 2013 9545
Location aguna Dr & Bahia Ln

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	4961	LF	79.08	$ 392,316	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$ -	
AIR TEST SEWER MAIN	4961	LF	00.56	$ 2,778	
CLEAN FOR TV INSPECTION - Pipelines Only	4961	LF	00.56	$ 2,778	
CLEAN FOR FINAL - Pipelines Only	4961	LF	00.56	$ 2,778	
BYPASS PUMPING	4961	LF	07.61	$ 37,753	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 109,601	
PERMIT/REVIEW FEE (2%)	1	LS		$ 8,768	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 43,840	Unit Cost
			Pipeline Total	$ 600,613	$ 121.07
			Rounded Pipeline Total	**$ 600,700**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$ -	
4' DIA. MANHOLE/REMOVE OLD	18	EA	2940.98	$ 52,938	
8" CLEANOUT	0	EA	1115.54	$ -	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 7,941	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 5,294	Unit Cost
			Manhole & Cleanout Total	$ 66,172	$ 3,676.23
			Rounded Manhole & Cleanout Total	**$ 66,200**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	140	EA	278.89	$ 39,045	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$ -	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	140	EA	66.18	$ 9,265	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 7,246	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 4,831	Unit Cost
			Service Lateral Total	$ 60,387	$ 431.34
			Rounded Service Lateral Total	**$ 60,400**	
			TOTAL	$ 727,172	
			ROUNDED PROJECT TOTAL	**$ 727,300**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project	**4**			ENR August 2013	9545	
Location	**Neolin Ave**					
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	79.08	$ -		
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -		
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2974	LF	92.68	$ 275,630		
AIR TEST SEWER MAIN	2974	LF	00.56	$ 1,665		
CLEAN FOR TV INSPECTION - Pipelines Only	2974	LF	00.56	$ 1,665		
CLEAN FOR FINAL - Pipelines Only	2974	LF	00.56	$ 1,665		
BYPASS PUMPING	2974	LF	07.61	$ 22,632		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 75,815		
PERMIT/REVIEW FEE (2%)	1	LS		$ 6,065		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 30,326	Unit Cost	
			Pipeline Total	$ 415,465	$ 139.70	
			Rounded Pipeline Total	**$ 415,500**		
5' DIA. MANHOLE/REMOVE OLD	14	EA	3853.70	$ 53,952		
4' DIA. MANHOLE/REMOVE OLD	0	EA	2940.98	$ -		
8" CLEANOUT	0	EA	1115.54	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 8,093		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 5,395	Unit Cost	
			Manhole & Cleanout Total	$ 67,440	$ 4,817.13	
			Rounded Manhole & Cleanout Total	**$ 67,500**		
4" SEWER SERVICE REMOVE TO PROPERTY LINE	13	EA	278.89	$ 3,626		
12" X 4" 45° PVC REDUCING WYE WITH GASKET	13	EA	208.59	$ 2,712		
8" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	66.18	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 951		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 634	Unit Cost	
			Service Lateral Total	$ 7,922	$ 609.35	
			Rounded Service Lateral Total	**$ 7,900**		
			TOTAL	$ 490,826		
			ROUNDED PROJECT TOTAL	**$ 490,900**		

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project	**5**			ENR August 2013	9545	
Location	**Golf Course**					
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	79.08	$ -		
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -		
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2094	LF	92.68	$ 194,072		
Credit for no pavement replacement	*2094*	*LF*	*-25.74*	*$ (53,900)*		
AIR TEST SEWER MAIN	2094	LF	00.56	$ 1,173		
CLEAN FOR TV INSPECTION - Pipelines Only	2094	LF	00.56	$ 1,173		
CLEAN FOR FINAL - Pipelines Only	2094	LF	00.56	$ 1,173		
BYPASS PUMPING	2094	LF	07.61	$ 15,935		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 39,906		
PERMIT/REVIEW FEE (2%)	1	LS		$ 3,193		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 15,963	Unit Cost	
			Pipeline Total	$ 218,687	$ 104.44	
			Rounded Pipeline Total	**$ 218,700**		
5' DIA. MANHOLE/REMOVE OLD	9	EA	3853.70	$ 34,683		
4' DIA. MANHOLE/REMOVE OLD	0	EA	2940.98	$ -		
8" CLEANOUT	0	EA	1115.54	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 5,203		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 3,468	Unit Cost	
			Manhole & Cleanout Total	$ 43,354	$ 4,817.13	
			Rounded Manhole & Cleanout Total	**$ 43,400**		
4" SEWER SERVICE REMOVE TO PROPERTY LINE	0	EA	278.89	$ -		
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$ -		
8" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	66.18	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ -		
ESTIMATE CONTINGENCY (10%)	1	LS		$ -	Unit Cost	
			Service Lateral Total	$ -	$ -	
			Rounded Service Lateral Total	$ -		
			TOTAL	$ 262,041		
			ROUNDED PROJECT TOTAL	**$ 262,100**		

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project	**6**			ENR August 2013	9545	
Location	**La Loma**					
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2417	LF	79.08	$ 191,136		
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -		
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$ -		
Credit for 1 sack slurry	*2417*	*LF*	*-20.21*	*$ (48,848)*		
AIR TEST SEWER MAIN	2417	LF	00.56	$ 1,354		
CLEAN FOR TV INSPECTION - Pipelines Only	2417	LF	00.56	$ 1,354		
CLEAN FOR FINAL - Pipelines Only	2417	LF	00.56	$ 1,354		
BYPASS PUMPING	2417	LF	07.61	$ 18,393		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 41,186		
PERMIT/REVIEW FEE (2%)	1	LS		$ 3,295		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 16,474	Unit Cost	
			Pipeline Total	$ 225,698	$ 93.38	
			Rounded Pipeline Total	**$ 225,700**		
5' DIA. MANHOLE/REMOVE OLD	9	EA	3853.70	$ 34,683		
4' DIA. MANHOLE/REMOVE OLD	0	EA	2940.98	$ -		
8" CLEANOUT	0	EA	1115.54	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 5,203		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 3,468	Unit Cost	
			Manhole & Cleanout Total	$ 43,354	$ 4,817.13	
			Rounded Manhole & Cleanout Total	**$ 43,400**		
4" SEWER SERVICE REMOVE TO PROPERTY LINE	15	EA	278.89	$ 4,183		
12" X 4" 45° PVC REDUCING WYE WITH GASKET	15	EA	208.59	$ 3,129		
8" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	66.18	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 1,097		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 731	Unit Cost	
			Service Lateral Total	$ 9,140	$ 609.35	
			Rounded Service Lateral Total	**$ 9,100**		
			TOTAL	$ 278,192		
			ROUNDED PROJECT TOTAL	**$ 278,200**		

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 7 — ENR August 2013 — 9545
Location Villa Nueva

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE		EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	11490	LF	79.08	$	908,629	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	3784	LF	88.48	$	334,808	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$	-	
AIR TEST SEWER MAIN	15274	LF	00.56	$	8,553	
CLEAN FOR TV INSPECTION - Pipelines Only	15274	LF	00.56	$	8,553	
CLEAN FOR FINAL - Pipelines Only	15274	LF	00.56	$	8,553	
BYPASS PUMPING	15274	LF	07.61	$	116,235	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$	346,333	
PERMIT/REVIEW FEE (2%)	1	LS		$	27,707	
ESTIMATE CONTINGENCY (10%)	1	LS		$	138,533	Unit Cost
			Pipeline Total	$	1,897,906	$ 124.26
			Rounded Pipeline Total	**$**	**1,898,000**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$	-	
4' DIA. MANHOLE/REMOVE OLD	55	EA	2940.98	$	161,754	
8" CLEANOUT	6	EA	1115.54	$	6,693	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	25,267	
ESTIMATE CONTINGENCY (10%)	1	LS		$	16,845	Unit Cost
			Manhole & Cleanout Total	$	210,559	$ 3,451.79
			Rounded Manhole & Cleanout Total	**$**	**210,600**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	160	EA	278.89	$	44,622	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$	-	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	160	EA	66.18	$	10,589	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	8,282	
ESTIMATE CONTINGENCY (10%)	1	LS		$	5,521	Unit Cost
			Service Lateral Total	$	69,014	$ 431.34
			Rounded Service Lateral Total	**$**	**69,000**	
			TOTAL	$	2,177,479	
			ROUNDED PROJECT TOTAL	**$**	**2,177,600**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project **8** ENR August 2013 9545

Location Old Litchfield North of Bird Lane

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE		EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	4503	LF	79.08	$	356,097	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	979	LF	88.48	$	86,622	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2479	LF	92.68	$	229,754	
AIR TEST SEWER MAIN	7961	LF	00.56	$	4,458	
CLEAN FOR TV INSPECTION - Pipelines Only	7961	LF	00.56	$	4,458	
CLEAN FOR FINAL - Pipelines Only	7961	LF	00.56	$	4,458	
BYPASS PUMPING	7961	LF	07.61	$	60,583	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$	186,608	
PERMIT/REVIEW FEE (2%)	1	LS		$	14,929	
ESTIMATE CONTINGENCY (10%)	1	LS		$	74,643	Unit Cost
			Pipeline Total	$	1,022,610	$ 128.45
			Rounded Pipeline Total	**$**	**1,022,700**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$	-	
4' DIA. MANHOLE/REMOVE OLD	27	EA	2940.98	$	79,406	
8" CLEANOUT	2	EA	1115.54	$	2,231	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	12,246	
ESTIMATE CONTINGENCY (10%)	1	LS		$	8,164	Unit Cost
			Manhole & Cleanout Total	$	102,047	$3,518.86
			Rounded Manhole & Cleanout Total	**$**	**102,100**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	30	EA	278.89	$	8,367	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	2	EA	208.59	$	417	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	28	EA	66.18	$	1,853	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	1,596	
ESTIMATE CONTINGENCY (10%)	1	LS		$	1,064	Unit Cost
			Service Lateral Total	$	13,296	$ 443.21
			Rounded Service Lateral Total	**$**	**13,300**	
			TOTAL	$	1,137,953	
			ROUNDED PROJECT TOTAL	**$**	**1,138,100**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project **9** ENR August 2013 9545
Location North of Bird Lane

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE		EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	7846	LF	79.08	$	620,462	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$	-	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$	-	
AIR TEST SEWER MAIN	7846	LF	00.56	$	4,394	
CLEAN FOR TV INSPECTION - Pipelines Only	7846	LF	00.56	$	4,394	
CLEAN FOR FINAL - Pipelines Only	7846	LF	00.56	$	4,394	
BYPASS PUMPING	7846	LF	07.61	$	59,708	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$	173,338	
PERMIT/REVIEW FEE (2%)	1	LS		$	13,867	
ESTIMATE CONTINGENCY (10%)	1	LS		$	69,335	Unit Cost
			Pipeline Total	$	949,891	$ 121.07
			Rounded Pipeline Total	**$**	**949,900**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$	-	
4' DIA. MANHOLE/REMOVE OLD	21	EA	2940.98	$	61,761	
8" CLEANOUT	2	EA	1115.54	$	2,231	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	9,599	
ESTIMATE CONTINGENCY (10%)	1	LS		$	6,399	Unit Cost
			Manhole & Cleanout Total	$	79,990	$ 3,477.81
			Rounded Manhole & Cleanout Total	**$**	**80,000**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	90	EA	278.89	$	25,100	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$	-	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	90	EA	66.18	$	5,956	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	4,658	
ESTIMATE CONTINGENCY (10%)	1	LS		$	3,106	Unit Cost
			Service Lateral Total	$	38,820	$ 431.34
			Rounded Service Lateral Total	**$**	**38,800**	
			TOTAL	$	1,068,701	
			ROUNDED PROJECT TOTAL	**$**	**1,068,700**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 10 ENR August 2013 9545
Location North La Loma

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE		EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	4635	LF	79.08	$	366,536	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$	-	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$	-	
AIR TEST SEWER MAIN	4635	LF	00.56	$	2,596	
CLEAN FOR TV INSPECTION - Pipelines Only	4635	LF	00.56	$	2,596	
CLEAN FOR FINAL - Pipelines Only	4635	LF	00.56	$	2,596	
BYPASS PUMPING	4635	LF	07.61	$	35,272	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$	102,399	
PERMIT/REVIEW FEE (2%)	1	LS		$	8,192	
ESTIMATE CONTINGENCY (10%)	1	LS		$	40,960	Unit Cost
			Pipeline Total	$	561,145	$ 121.07
			Rounded Pipeline Total	**$**	**561,200**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$	-	
4' DIA. MANHOLE/REMOVE OLD	19	EA	2940.98	$	55,879	
8" CLEANOUT	0	EA	1115.54	$	-	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	8,382	
ESTIMATE CONTINGENCY (10%)	1	LS		$	5,588	Unit Cost
			Manhole & Cleanout Total	$	69,848	$ 3,676.22
			Rounded Manhole & Cleanout Total	**$**	**69,900**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	71	EA	278.89	$	19,801	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$	-	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	71	EA	66.18	$	4,699	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	3,675	
ESTIMATE CONTINGENCY (10%)	1	LS		$	2,450	Unit Cost
			Service Lateral Total	$	30,625	$ 431.34
			Rounded Service Lateral Total	**$**	**30,600**	
			TOTAL	$	661,618	
			ROUNDED PROJECT TOTAL	**$**	**661,700**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 11 ENR August 2013 9545

Location South of Tierra Verde Lake East to Wigwam

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	8758	LF	79.08	$ 692,583	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$ -	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$ -	
AIR TEST SEWER MAIN	8758	LF	00.56	$ 4,904	
CLEAN FOR TV INSPECTION - Pipelines Only	8758	LF	00.56	$ 4,904	
CLEAN FOR FINAL - Pipelines Only	8758	LF	00.56	$ 4,904	
BYPASS PUMPING	8758	LF	07.61	$ 66,648	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 193,486	
PERMIT/REVIEW FEE (2%)	1	LS		$ 15,479	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 77,394	Unit Cost
			Pipeline Total	$ 1,060,304	$ 121.07
			Rounded Pipeline Total	**$ 1,060,400**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$ -	
4' DIA. MANHOLE/REMOVE OLD	35	EA	2940.98	$ 102,934	
8" CLEANOUT	9	EA	1115.54	$ 10,040	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 16,946	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 11,297	Unit Cost
			Manhole & Cleanout Total	$ 141,218	$ 3,209.49
			Rounded Manhole & Cleanout Total	**$ 141,300**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	205	EA	278.89	$ 57,172	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$ -	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	205	EA	66.18	$ 13,567	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 10,611	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 7,074	Unit Cost
			Service Lateral Total	$ 88,424	$ 431.34
			Rounded Service Lateral Total	**$ 88,400**	
			TOTAL	$ 1,289,946	
			ROUNDED PROJECT TOTAL	**$ 1,290,100**	

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 1 - SEWER
ENGINEER OPINION OF COST

Project 12 ENR August 2013 9545
Location West of Staggs Park

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE		EXTENDED PRICE	
8" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	9656	LF	79.08	$	763,596	
10" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	88.48	$	-	
12" PVC SDR-35 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	92.68	$	-	
AIR TEST SEWER MAIN	9656	LF	00.56	$	5,407	
CLEAN FOR TV INSPECTION - Pipelines Only	9656	LF	00.56	$	5,407	
CLEAN FOR FINAL - Pipelines Only	9656	LF	00.56	$	5,407	
BYPASS PUMPING	9656	LF	07.61	$	73,482	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$	213,325	
PERMIT/REVIEW FEE (2%)	1	LS		$	17,066	
ESTIMATE CONTINGENCY (10%)	1	LS		$	85,330	Unit Cost
			Pipeline Total	$	1,169,022	$ 121.07
			Rounded Pipeline Total	**$**	**1,169,100**	
5' DIA. MANHOLE/REMOVE OLD	0	EA	3853.70	$	-	
4' DIA. MANHOLE/REMOVE OLD	40	EA	2940.98	$	117,639	
8" CLEANOUT	4	EA	1115.54	$	4,462	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	18,315	
ESTIMATE CONTINGENCY (10%)	1	LS		$	12,210	Unit Cost
			Manhole & Cleanout Total	$	152,627	$ 3,468.79
			Rounded Manhole & Cleanout Total	**$**	**152,700**	
4" SEWER SERVICE REMOVE TO PROPERTY LINE	220	EA	278.89	$	61,356	
12" X 4" 45° PVC REDUCING WYE WITH GASKET	0	EA	208.59	$	-	
8" X 4" 45° PVC REDUCING WYE WITH GASKET	220	EA	66.18	$	14,560	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$	11,387	
ESTIMATE CONTINGENCY (10%)	1	LS		$	7,592	Unit Cost
			Service Lateral Total	$	94,894	$ 431.34
			Rounded Service Lateral Total	**$**	**94,900**	
			TOTAL	$	1,416,543	
			ROUNDED PROJECT TOTAL	**$**	**1,416,700**	

APPENDIX 2 – SEWER INFRASTRUCTURE MAP

Date Revised: June 13, 2013
File Location: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer Facilities 11X17.mxd

APPENDIX 3 – SEWER FIELD INSPECTION MAPS

Litchfield Park CCTV Sewer Inspections

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan.mxd

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_Concrete.mxd

Sewer CCTV Inspection - Concrete Material (Map 1 of 2)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_Concrete.mxd

Sewer CCTV Inspection - Concrete Material (Map 2 of 2)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_GC.mxd

Sewer CCTV Inspection - Golf Course (Map 1 of 1)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_LaLoma.mxd

Sewer CCTV Inspection - La Loma (Map 1 of 1)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_Trunk.mxd

Sewer CCTV Inspection - Neolin Trunk (Map 1 of 1)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_Oeste.mxd

Sewer CCTV Inspection - Oeste and Old Litchfield (Map 1 of 1)

May 2013

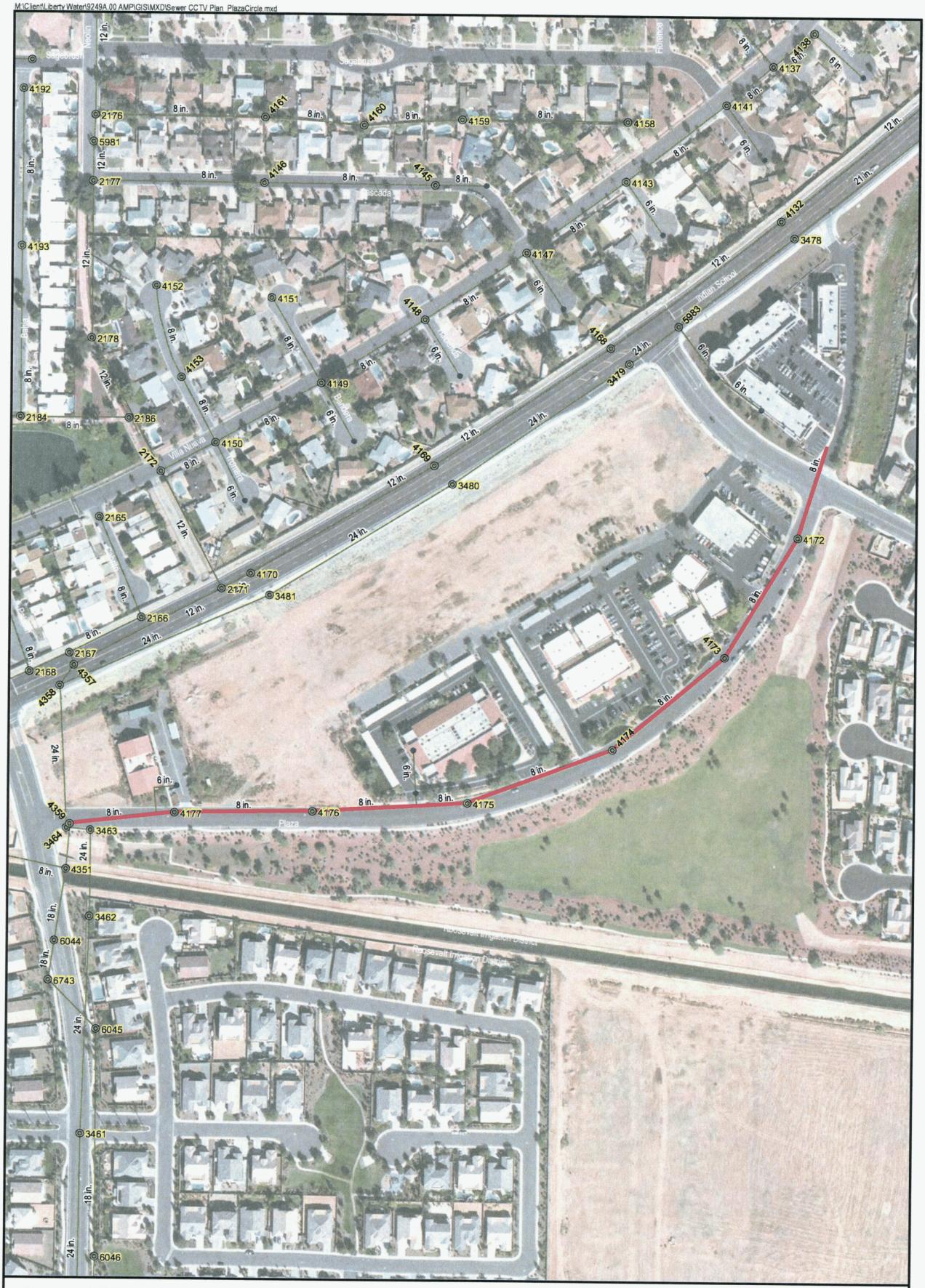
Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_PlazaCircle.mxd



Sewer CCTV Inspection - Plaza Circle (Map 1 of 1)

May 2013

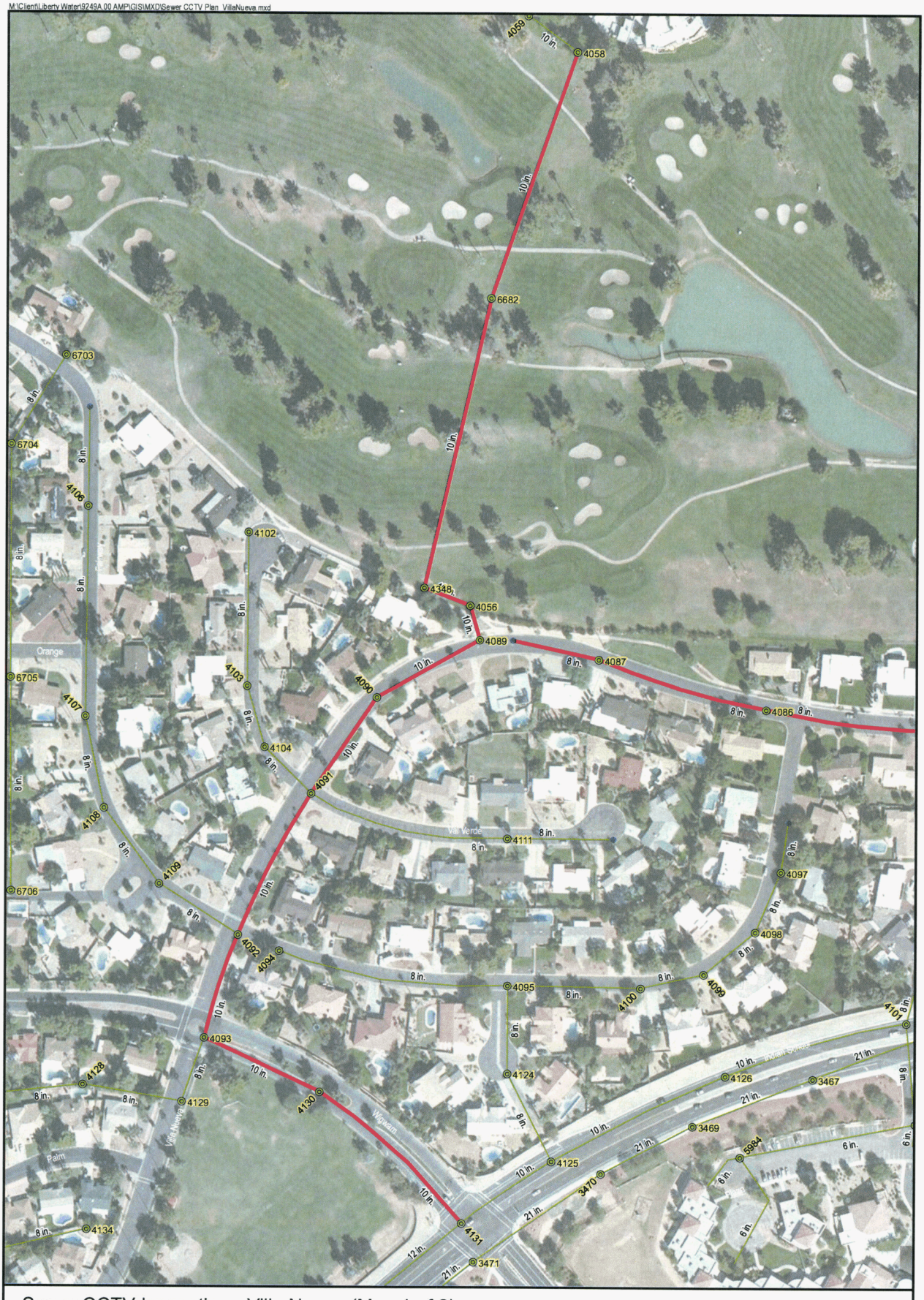
Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_VillaNueva.mxd



Sewer CCTV Inspection - Villa Nueva (Map 1 of 2)

May 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_VillaNueva.mxd

Sewer CCTV Inspection - Villa Nueva (Map 2 of 2)

May 2013

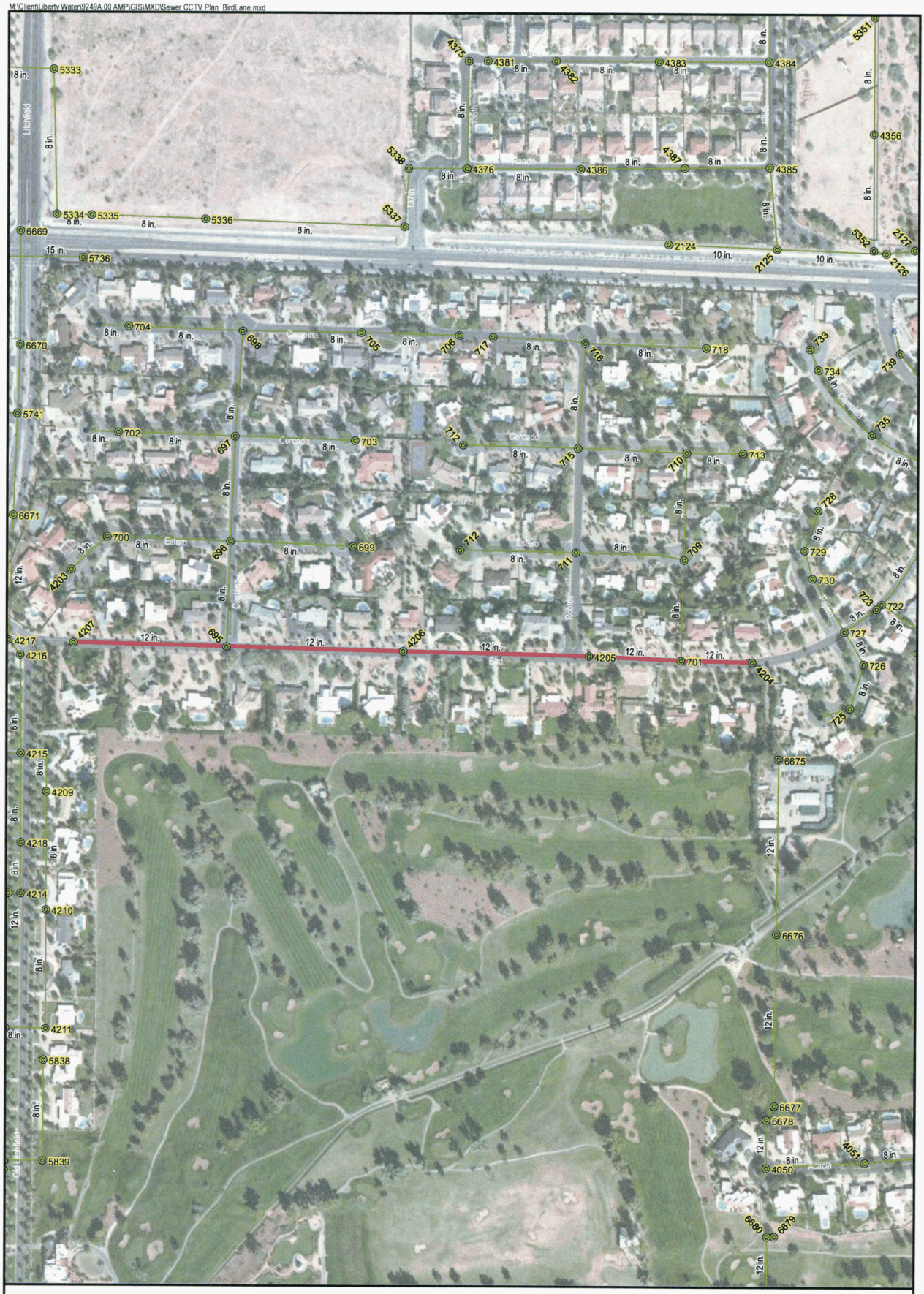
Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer CCTV Plan_BirdLane.mxd



Sewer CCTV Inspection - Bird Lane (Map 1 of 1)

June 2013

Litchfield Park Water and Wastewater Facilities Assessment - Phase I

NTS

Liberty Utilities

carollo

APPENDIX 4 – SEWER MANHOLE INSPECTION DATA AND PHOTOS

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Honeysuckle St & Desert Ave

Map# _____

Manhole Number: 6733

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition Good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 3 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☒ 30 inch ☐ Other _____

Neck Depth: 1 ft 4 in.

Manhole Diameter: ☐ 48 inch ☒ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ **Paved** ☐ **Dirt/Gravel** ☐ **Landscaped**

☐ **Other** _____

Site Access

☒ **Street** ☐ **Easement** ☐ **Alley**

☐ **Other** _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☒ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, In. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☒ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 3

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

shallow down stream line

connected to deeper pipe - drop is possible

Shallow/Deteriorated Bench

LRA - 5/21/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, '13

Street Name/Location Information: Cottonwood & La Loma (west)

Map# _____

Manhole Number: 683

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 3 ft 9 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: 0 ft 0 in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other may be smaller

Manhole Material

☐ Precast ☐ Precast (No Coating)

☐ T-Lock ☐ Coating Coating Type _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ Brick

Surface Type

☐ Paved ☐ Dirt/Gravel ☐ Landscaped

☒ Other severely deteriorated asphalt

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe cockroaches

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☒ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

concrete pipe from ~~south~~ east & west

clay from north

LRA-5/22/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 13

Street Name/Location Information: cottonwood & La Loma (east)

Map# _____

Manhole Number: 6732

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition Small lip

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft _____ in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ Precast ☐ Precast (No Coating)

☐ T-Lock ☒ Coating Coating Type Concrete

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ Brick

Surface Type

☐ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other severely deteriorated asfault

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes No ☒ Other vents plugged

Presence of Vermin

☐ No ☒ Yes - Describe lizard, cockroche

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): 0

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 0

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Deteriorated Bench

LBA - 5/22/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, '13

Street Name/Location Information: W canal Rd & La Loma

Map# _____

Manhole Number: 684

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: ____ ft ____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☐ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other severely deteriorated asfault

Site Access

☒ Street(old) ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☒ Other Phoenix

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe cockroaches

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) 0' - 5' _____ 6' - 10' _____ 11' - 15' _____ 16' - 20' _____ 21'+ _____

Corrosion and Structural Inspection

Manhole Structure

☒ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

clay pipe

severely corroded steps

LPA-[illegible]/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Old Litchfield south of Vista Paseo

Map# _____

Manhole Number: 4214

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 2 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

~~**Neck Depth:**~~ _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☐ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other _____

Site Access

☐ Street ☐ Easement ☐ Alley

☒ Other side yard (public ROW)

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☒ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 3

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

MH diameter may be < 48 in

clay pipe in to out going

LRA - 5/22/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Old Litchfield south of Vista Paseo

Map# _____

Manhole Number: 4213

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 7 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch? ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☐ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other _____

Site Access

☐ Street ☐ Easement ☐ Alley

☒ Other public ROW

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe cockroach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 3

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

MH diam < 48 in

Bench is mushy appears to be covered in mud

concrete pipe

MANHOLE INSPECTION FORM

RA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Honeysuckle & Old Litchfield

Map# _____

Manhole Number: 6727

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 13 ft 9 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** thin concrete mortar patches

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☐ No

☐ Other _____

Vented Cover? ☐ Yes ☐ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roaches

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

Concrete pipe up & down stream

coating deteriorated

bench deterioration (moderate)

LRA - 5/22/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Old Litchfield near tennis courts

Map# _____

Manhole Number: 4337

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☑ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 5

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☒ Excessive

Other Remarks

MH 6741 (to the north of MH #4337) possibly ~~abandoned~~ abandoned

Deteriorated Bench

MANHOLE INSPECTION FORM

LRA-5/22/13

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Sage Brush & Laguna

Map# _____

Manhole Number: 2187

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 3 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roaches

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, In. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☒ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

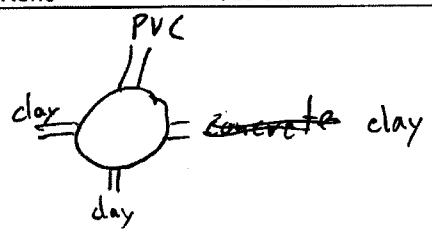
Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Beach gone / deteriorated

8' PVC from north



LRA-5/2?/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 20, 2013

Street Name/Location Information: Laguna & Oeste (east

Map# _____

Manhole Number: ~~2188~~ 4197

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 5

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

[redacted]

Possible fisical blockage

MANHOLE INSPECTION FORM

LRA 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Vista Verde & Vista Verde

Map# _____

Manhole Number: 40685

Manhole Inspector's Name:

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 7 ft 9 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: 2 ft 5 in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☒ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☐ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☐ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

MH Diam may be smaller than 48"

Bench spaling

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Acacia Circle

Map# _____

Manhole Number: 4050

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition off center (broken)

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 36

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ Precast ☐ Precast (No Coating)

☐ T-Lock ☐ Coating Coating Type _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ Brick

Surface Type

☐ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other _____

Site Access

☐ Street ☐ Easement ☐ Alley

☒ Other round about

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 3

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

used to be in road now in a round about

exposed rebar in neck of MH

apron very deteriorated, frame not alined with MH neck

MANHOLE INSPECTION FORM

LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Acacia Cir and Acacia Cir

Map# _____

Manhole Number: 4053

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ft _____in.

Manhole Diameter: ☐ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐Other_____

Vented Cover? ☐ Yes ☒No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

reinforcement (rebar) visible in neck

MANHOLE INSPECTION FORM LRA - 5/20/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Acacia Cir

Map# _____

Manhole Number: 4054

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 7 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☐ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 2

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

Bench deteriorated

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva & Acacia

Map# _____

Manhole Number: 2195

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

MANHOLE INSPECTION FORM

LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Fairway east of Florence

Map# _____

Manhole Number: 4106

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition grout to brick missing under frame (good)

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

	☐ Neck	☐ Neck
	☐ Walls	☐ Walls
	☐ Bench	☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench moderately deteriorated (smooth exposed aggregate

grout to brick missing under frame

MANHOLE INSPECTION FORM LDA -- 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Pajaro Ln.

Map# _____

Manhole Number: 730

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good /

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 0 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☑ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

frame is sitting on broken bricks & asfault

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Pajaro Ln

Map# _____

Manhole Number: 729

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good (see other Remark)

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 9 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ Precast ☐ Precast (No Coating)

☐ T-Lock ☐ Coating Coating Type _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ Brick

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) 0' - 5' _____ 6' - 10' _____ 11' - 15' _____ 16' - 20' _____ 21'+ _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

frame is sitting on broken bricks, and not centered on neck

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 26, 2013

Street Name/Location Information: Bird & Pagano Ln

Map# _____

Manhole Number: 727

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: 1 ft 8 in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) 0' - 5' _____ 6' - 10' _____ 11' - 15' _____ 16' - 20' _____ 21'+ _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 2

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Bird east of Pajaro

Map# _____

Manhole Number: 722

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition Good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 11 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: ____ ft ____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

Bench broken up

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 24, 2013

Street Name/Location Information: Bird Ln

Map# _____

Manhole Number: ~~301~~ 4204

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: ~~_____ ft _____ in.~~

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☒ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

Bench broken up

Concrete or clay

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Robles & Cercado Ln

Map# _____

Manhole Number: 715

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 7 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☐ Yes - Describe _____

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bricks missing under fram

MANHOLE INSPECTION FORM

LPA

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: E Cercada Ln.

Map# _____

Manhole Number: 710

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other .26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☒ Moderate ☐ Excessive

Other Remarks

Bench deteriorating

frame off center of neck

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Estero Ln

Map# _____

Manhole Number: 709

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Brick spalling

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Campus & Castano

Map# _____

Manhole Number: 698

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 7 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other round a bout

Site Access

☐ Street ☐ Easement ☐ Alley

☐ Other round a bout

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

MANHOLE INSPECTION FORM

LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: west Cercado Ln

Map# _____

Manhole Number: 702

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 10 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

missing bricks under frame

MANHOLE INSPECTION FORM LRA-5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Estero Ln

Map# _____

Manhole Number: 699

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good *

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: ____ ft ____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

* no flow (end of line)

missing bricks under frame

MANHOLE INSPECTION FORM

LRA-5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Estero ~~[illegible]~~ west muckle

Map# _____

Manhole Number: ~~[illegible]~~ 760

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition corroded

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 0 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: ~~[illegible]~~ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☐ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other _____

Site Access

☐ Street ☐ Easement ☐ Alley

☒ Other round about

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

LRA-5/21/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Bird Ln to Castano

Map# _____

Manhole Number: C95

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26?

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Concrete pipe east west

MANHOLE INSPECTION FORM

LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Bird Ln

Map# _____

Manhole Number: 4206

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☐ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench Deteriorated

MANHOLE INSPECTION FORM

CPA 5/21/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Camping Ln

Map# _____

Manhole Number: 734

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 2

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

mortar in invert

lots of debris on bench (bricks & mortar & step pieces)

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva

Map# _____

Manhole Number: 741

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 4 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

MH Diam maybe less than 48"

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Cra Vista Dr.

Map# _____

Manhole Number: 4030

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 11 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☒ Landscaped grass

☐ Other _____

Site Access

☒ Street ☒ Easement ☐ Alley

☐ Other median

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roaches!

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 1

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Two rows of brick below neck

MANHOLE INSPECTION FORM

LPA 1/2/12

Project Name:

Project Number:

Date of Inspection:

Street Name/Location Information: Vista Nueva Ave Vista

Map# _____

Manhole Number: 4031

Manhole Inspector's Name:

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good Aluminum

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other .26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

aluminum lid

MANHOLE INSPECTION FORM

LPA-5/21/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Liebre + Villa Nueva

Map# _____

Manhole Number: 4039

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 4 east inlet, could be due to low flow conditions

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

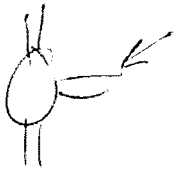
☒ None ☒ Moderate ☐ Excessive

Other Remarks

Bench Deteriorated

odor

apron cracked



bad slope
half full of solids
can not view cause

MANHOLE INSPECTION FORM

LRA-5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Tierra Sol Villa Nueva

Map# _____

Manhole Number: 403 [redacted] 7

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe coach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 4

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

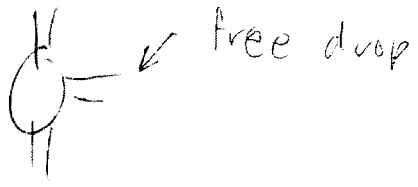
☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

Apron cracks



MANHOLE INSPECTION FORM

LPL - 5/21/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Torreon & Villa Nueva

Map# _____

Manhole Number: 4036

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 0 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roaches

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

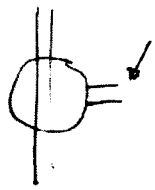
Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks



possible abandoned line
build up of solids/no flow

MANHOLE INSPECTION FORM

LRA 5/21/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Vista Verde North of Acacia

Map# _____

Manhole Number: 4026

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition Deteriorated

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 2 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): 4

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench severly deteriorated (PVC)

MANHOLE INSPECTION FORM

LRA 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Vista Verde

Map# _____

Manhole Number: 4339

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 2 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): 1

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench deteriorated

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Ova Vista & Vista Verde

Map# _____

Manhole Number: 4021

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 10 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: ____ ft ____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

LRA-5/17/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Ave Vista

Map# _____

Manhole Number: 4020

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

deteriorated steps

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva ~~South~~ of Segovia

Map# _____

Manhole Number: ~~4071~~ 5744

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 5 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: ____ ft ____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☐ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, In. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☒ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

missing bricks under frame

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Via Nueva south of Segovia

Map# _____

Manhole Number: 4071

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☐ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench deteriorated

MANHOLE INSPECTION FORM LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva

Map# _____

Manhole Number: 4081

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach (white roaches are good luck!)

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench deteriorated

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva

Map# _____

Manhole Number: 4079

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 10 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench Deteriorated

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva

Map# _____

Manhole Number: 4056

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition deteriorated

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☒ Other side walk near golf cart

Site Access

☐ Street ☐ Easement ☐ Alley

☒ Other side walk

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☐ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☐ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☐ None ☐ Moderate ☐ Excessive

Other Remarks

Bench, invert to frame deteriorated

LRA-5/21/13

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Villa Nueva

Map# _____

Manhole Number: 408 C

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 1 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☒ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench deteriorated

MANHOLE INSPECTION FORM

LRA - 5/22/13

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Desert Ave.

Map# _____

Manhole Number: ~~4265~~ 4265

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 8 ft 2 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ft _____in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Very slow flow

heavy grease on top ~~Bench~~ unable to see invert & most of bench

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Ancerra Dr S

Map# _____

Manhole Number: 4296

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 6 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☐ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: Acala & La Loma

Map# _____

Manhole Number: 4225

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition good

☐ Emergency repair required ☐ Welded ☐ Bolted ☐ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 5 ft 4 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick** Neck only, 1.5 ft

Surface Type

☒ Paved ☐ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☐ Easement ☐ Alley

☐ Other _____

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Low flow lots of solids

MANHOLE INSPECTION FORM

Project Name:

Project Number:

Date of Inspection: May 21, 2013

Street Name/Location Information: [redacted] Fairway & La Loma

Map# _____

Manhole Number: [redacted] 3361

Manhole Inspector's Name: Spencer Taylor

Initial Inspection (Surface Description, Biological and Chemical Data)

Frame & Cover Condition deteriorate

☐ Emergency repair required ☐ Welded ☐ Bolted ☒ Deteriorated ☐ Raise ☐ Lower

Atmospheric Conditions, record ppm

% of Hydrogen Sulfide (H2S) _____

% of Oxygen (O2) _____

% of (LEL) as Methane (CH4) _____

% of Carbon Monoxide (CO) _____

Manhole Depth: 6 ft 8 in.

(Inside Crown of pipe to Rim)

Frame Size: ☐ 24 inch ☐ 30 inch ☐ Other 26

Neck Depth: _____ ft _____ in.

Manhole Diameter: ☒ 48 inch ☐ 60 inch ☐ Other _____

Manhole Material

☒ **Precast** ☐ **Precast (No Coating)**

☐ **T-Lock** ☐ **Coating** **Coating Type** _____

☐ Neck ☐ Neck

☐ Walls ☐ Walls

☐ Bench ☐ Bench

☒ **Brick**

Surface Type

☐ Paved ☒ Dirt/Gravel ☐ Landscaped

☐ Other _____

Site Access

☒ Street ☒ Easement ☐ Alley

☐ Other Public ROW

Current City Logo on Cover? ☐ Yes ☒ No

☐ Other _____

Vented Cover? ☐ Yes ☒ No ☐ Other _____

Presence of Vermin

☐ No ☒ Yes - Describe roach

Manned Entry Inspection Information

Manned Entry Inspection ☐ No ☐ Yes

Drill Test Completed ☐ No ☐ Yes

Drill Test Depth, in. _____

Penetration Depth Testing: **Neck** _____ inches **Bench:** _____ inches

Walls (by increments of depths from bottom of cone) **0' - 5'** _____ **6' - 10'** _____ **11' - 15'** _____ **16' - 20'** _____ **21'+** _____

Corrosion and Structural Inspection

Manhole Structure

☐ No Defect ☐ Emergency repair required

Missing Grout/Mortar

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Missing Bricks/Blocks

☐ Minor (~10%) ☐ Moderate (~25%) ☐ Major (>50%)

Cracks

☐ Minor (hairline) ☐ Moderate (<1/8") ☐ Major (> 1/8")

Neck (soil exposed)

☐ Small (~10%) ☐ Medium (~25%) ☐ Large (>50%)

Incorrectly Formed Invert

(0 to 5 scale, 0=none, 5=excessive): _____

T-Lock Seam Leaking Location

Seam Number from Cover down: 1 2 3 4 5 6 7 8 9 10

Spalling or Peeling Coating

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Exposed Aggregate

(0 to 5 scale, 0=exposed, smooth, 5=exposed, jagged): _____

Exposed Rebar

(0 to 5 scale, 0=no defect, 5=worst condition): _____

Holes/Voids

☐ Yes, approximate diameter, in: _____

Hydraulic / Intrusion Inspection

Evidence of Surcharge on Street Level

☒ No ☐ Yes - Explain _____

Evidence of Surcharge within Manhole

☒ No ☐ Yes - estimated height (ft) _____

Hydraulic Leaks

☐ Minor ☐ Moderate ☐ Excessive

Presence of Debris or Silt

☒ None ☐ Moderate ☐ Excessive

Other Remarks

Bench aggregate exposed

Figure 1. Manhole # 683 Cottonwood Street

Figure 2. Manhole # 683 Cottonwood Street

Figure 3. Manhole # 683 Cottonwood Street

Figure 4. Manhole # 684 La Loma Avenue

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 5. Manhole # 684 La Loma Avenue

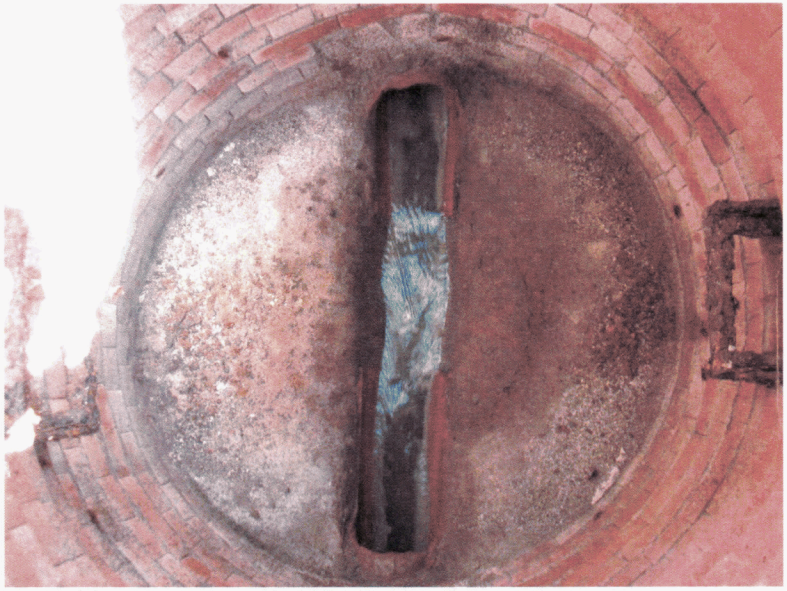


Figure 6. Manhole # 684 La Loma Avenue

Figure 7. Manhole # 684 La Loma Avenue

Figure 8. Manhole # 695 Bird Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 9. Manhole # 695 Bird Lane

Figure 10. Manhole # 695 Bird Lane

Figure 11. Manhole # 698 Castano Drive

Figure 12. Manhole # 698 Castano Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 13. Manhole # 698 Castano Drive

Figure 15. Manhole # 698 Estero Lane

Figure 14. Manhole # 698 Estero Lane

Figure 16. Manhole # 698 Estero Lane

Figure 17. Manhole # 698 Estero Lane

Figure 18. Manhole # 698 Estero Lane

Figure 19. Manhole # 700 Estero Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 20. Manhole # 700 Estero Lane

Figure 21. Manhole # 700 Estero Lane

Figure 22. Manhole # 700 Estero Lane

Figure 23. Manhole # 702 Cercado Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

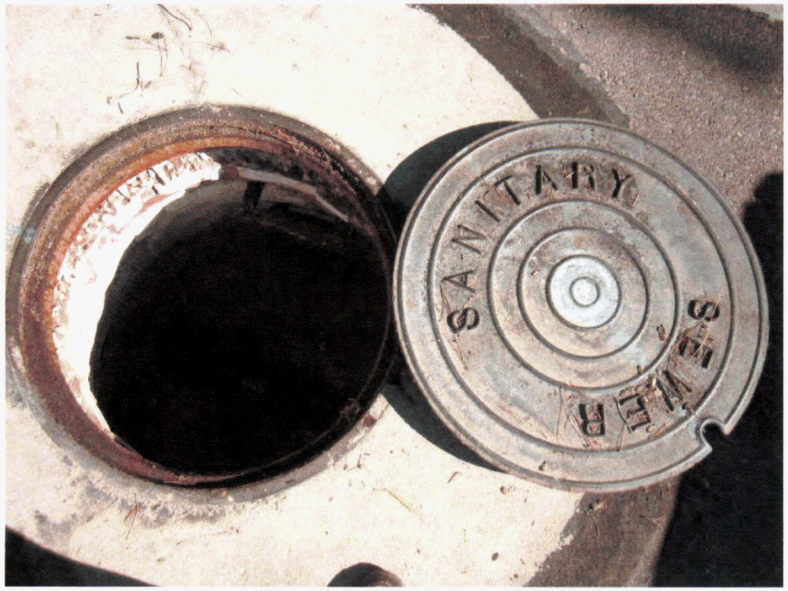


Figure 24. Manhole # 702 Cercado Lane

Figure 25. Manhole # 702 Cercado Lane

Figure 26. Manhole # 702 Cercado Lane

Figure 27. Manhole # 709 Estero Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 28. Manhole # 709 Estero Lane

Figure 29. Manhole # 709 Estero Lane

Figure 30. Manhole # 709 Estero Lane

Figure 31. Manhole # 710 Cercado Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 32. Manhole # 710 Cercado Lane

Figure 33. Manhole # 710 Cercado Lane

Figure 34. Manhole # 710 Cercado Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

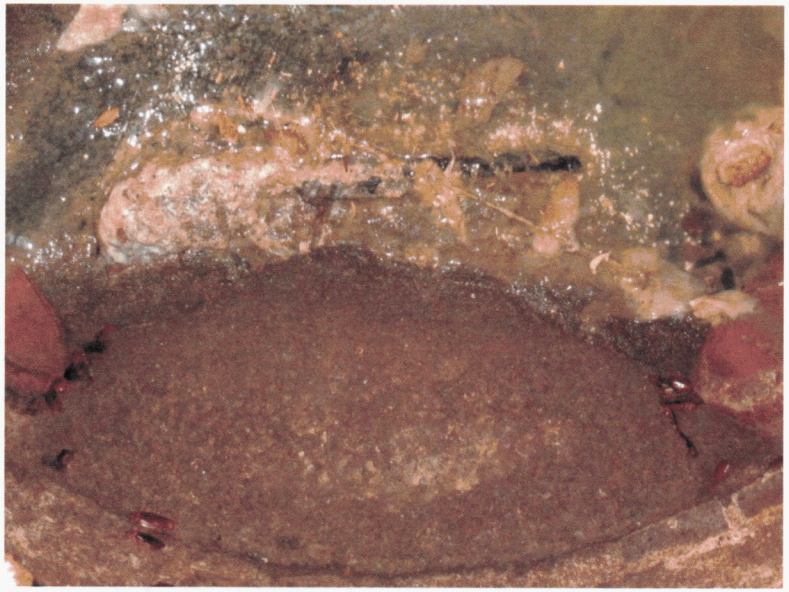


Figure 35. Manhole # 710 Cercado Lane

Figure 36. Manhole # 715 Robles Drive

Figure 37. Manhole # 715 Robles Drive

Figure 38. Manhole # 715 Robles Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 39. Manhole # 715 Robles Drive

Figure 40. Manhole # 715 Robles Drive

Figure 41. Manhole # 715 Robles Drive

Figure 42. Manhole # 722 Bird Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

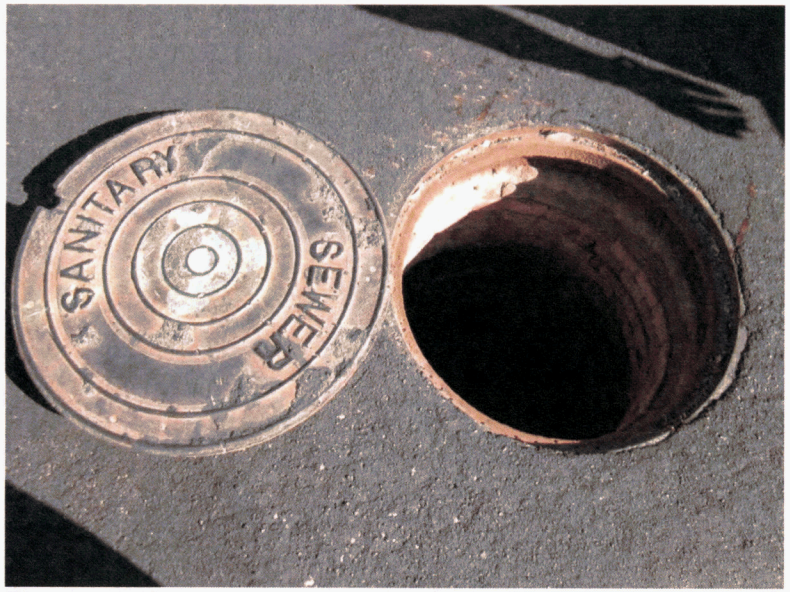


Figure 43. Manhole # 722 Bird Lane

Figure 44. Manhole # 722 Bird Lane

Figure 45. Manhole # 722 Bird Lane

Figure 46. Manhole # 722 Bird Lane

Figure 47. Manhole # 727 Pajaro Lane

Figure 48. Manhole # 727 Pajaro Lane

Figure 49. Manhole # 727 Pajaro Lane

Figure 50. Manhole # 727 Pajaro Lane

Figure 51. Manhole # 729 Pajaro Lane

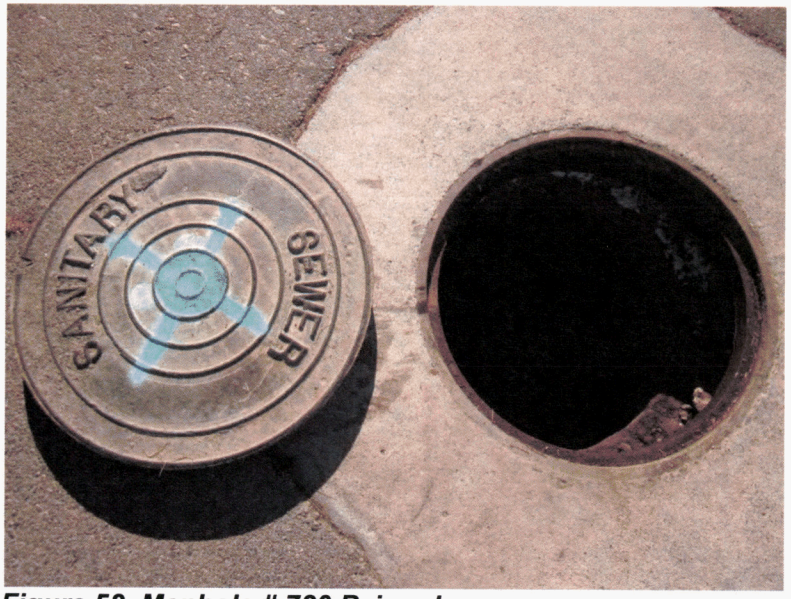


Figure 52. Manhole # 729 Pajaro Lane

Figure 53. Manhole # 729 Pajaro Lane

Figure 54. Manhole # 729 Pajaro Lane

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 55. Manhole # 729 Pajaro Lane

Figure 56. Manhole # 730 Pajaro Lane

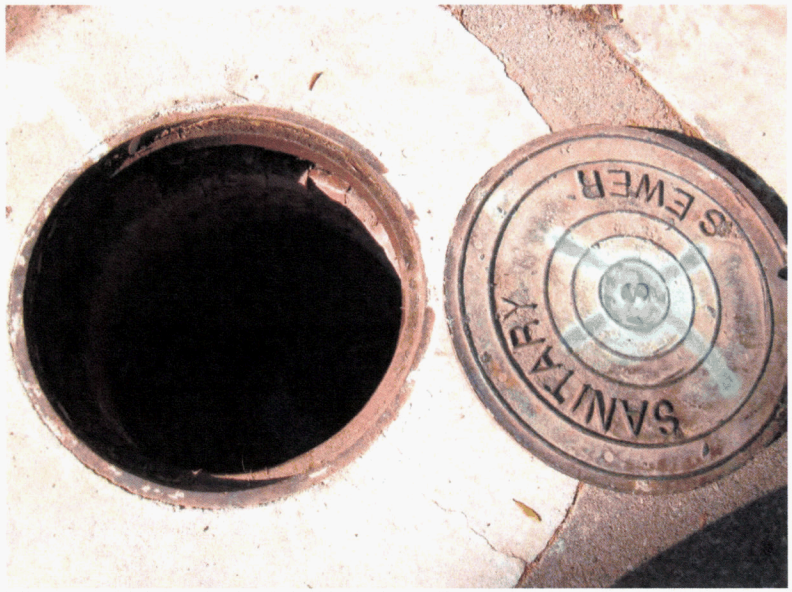

Figure 57. Manhole # 730 Pajaro Lane

Figure 58. Manhole # 730 Pajaro Lane

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 59. Manhole # 730 Pajaro Lane

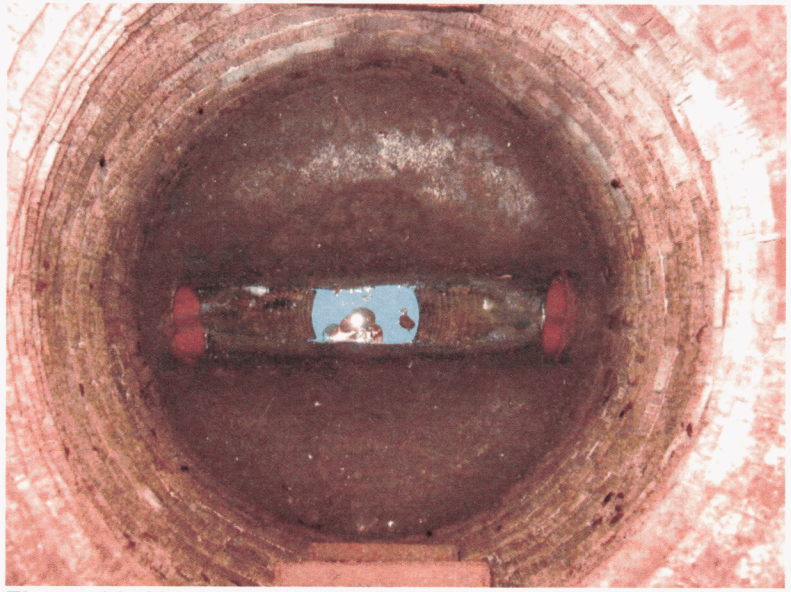

Figure 60. Manhole # 730 Pajaro Lane

Figure 61. Manhole # 734 Campina Lane

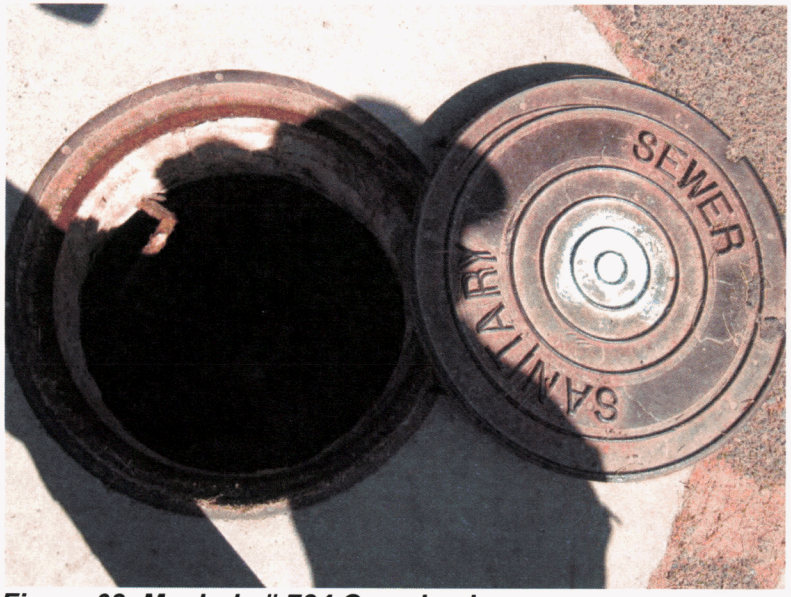

Figure 62. Manhole # 734 Campina Lane

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

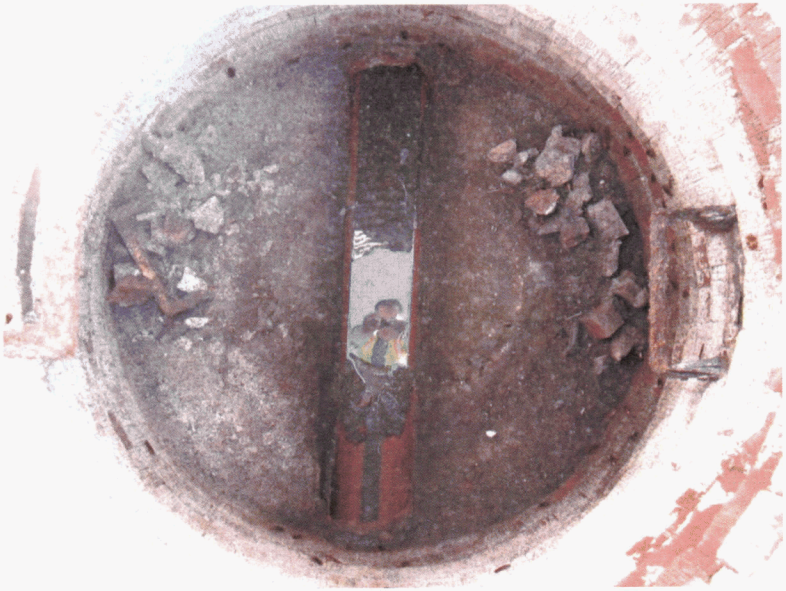

Figure 63. Manhole # 734 Campina Lane

Figure 64. Manhole # 734 Campina Lane

Figure 65. Manhole # 741 Villa Nueva Drive

Figure 66. Manhole # 741 Villa Nueva Drive

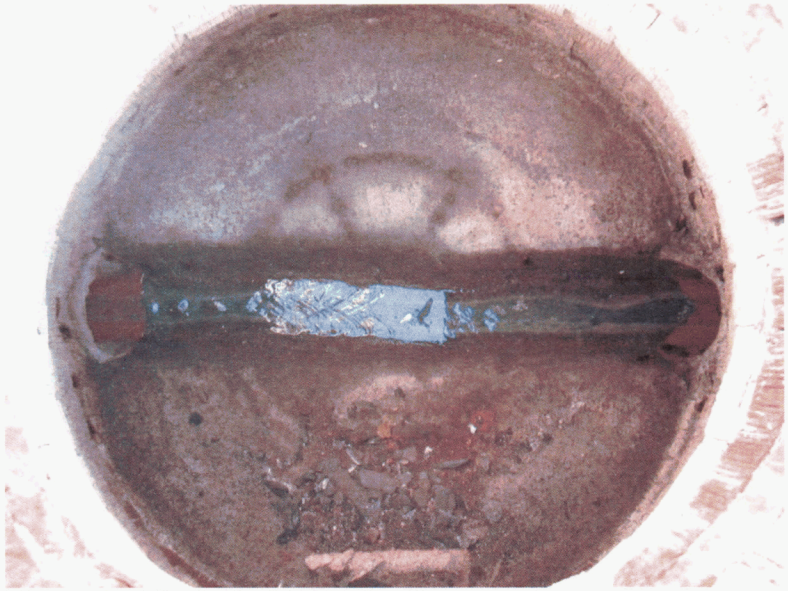

Figure 67. Manhole # 741 Villa Nueva Drive

Figure 68. Manhole # 2187 Laguna Drive

Figure 69. Manhole # 2187 Laguna Drive

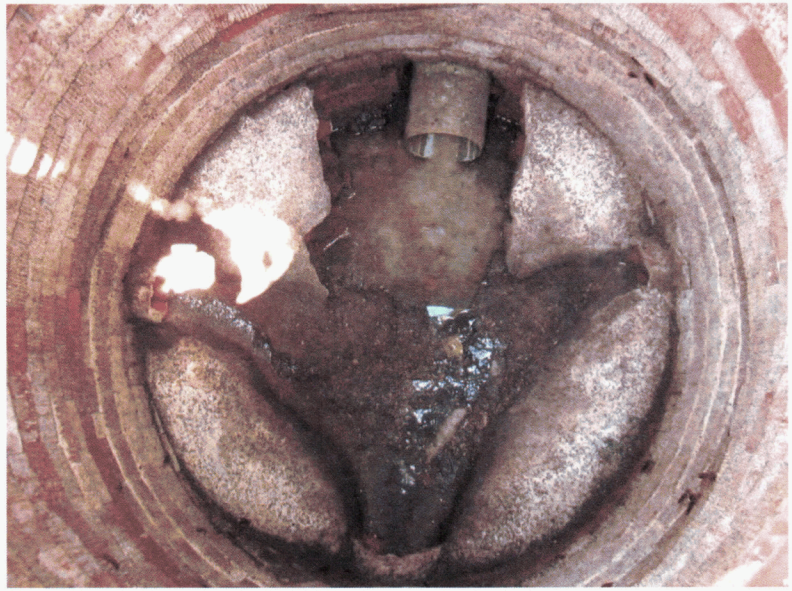

Figure 70. Manhole # 2187 Laguna Drive

Figure 71. Manhole # 2187 Laguna Drive

Figure 72. Manhole # 2195 Acacia Circle

Figure 73. Manhole # 2195 Acacia Circle

Figure 74. Manhole # 2195 Acacia Circle

Figure 75. Manhole # 3361 La Loma Avenue

Figure 76. Manhole # 3361 La Loma Avenue

Figure 77. Manhole # 3361 La Loma Avenue

Figure 78. Manhole # 3361 La Loma Avenue

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Figure 79. Manhole # 4020 Oro Vista Drive

Figure 80. Manhole # 4020 Oro Vista Drive

Figure 81. Manhole # 4020 Oro Vista Drive

Figure 82. Manhole # 4020 Oro Vista Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 83. Manhole # 4021 Oro Vista Drive

Figure 84. Manhole # 4021 Oro Vista Drive

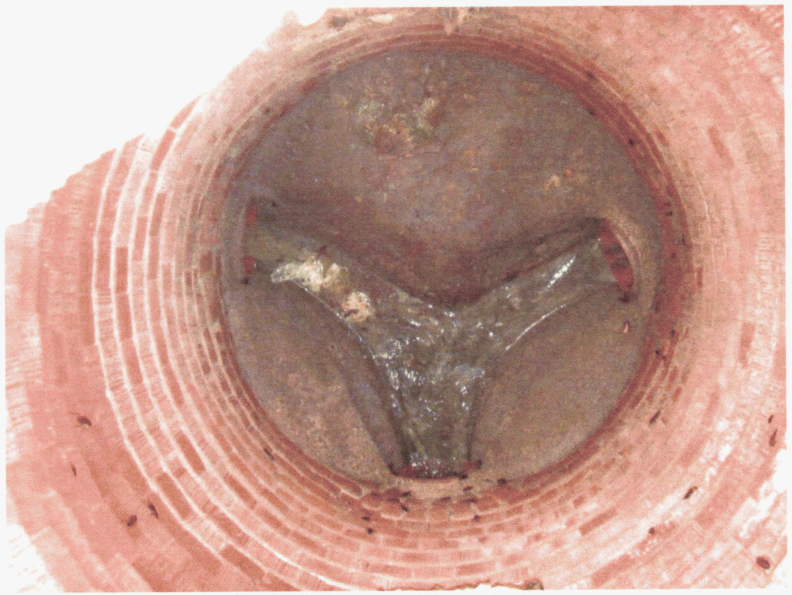

Figure 85. Manhole # 4021 Oro Vista Drive

Figure 86. Manhole # 4021 Oro Vista Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 87. Manhole # 4026 Vista Verde Drive

Figure 88. Manhole # 4026 Vista Verde Drive

Figure 89. Manhole # 4026 Vista Verde Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

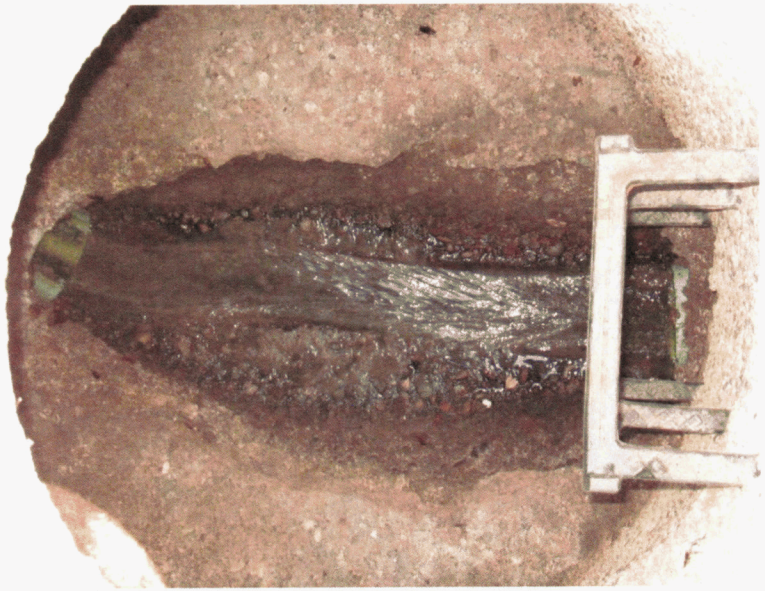

Figure 90. Manhole # 4026 Vista Verde Drive

Figure 91. Manhole # 4026 Vista Verde Drive

Figure 92. Manhole # 4030 Oro Vista Drive

Figure 93. Manhole # 4030 Oro Vista Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 94. Manhole # 4030 Oro Vista Drive

Figure 95. Manhole # 4030 Oro Vista Drive

Figure 96. Manhole # 4031 Villa Nueva Drive

Figure 97. Manhole # 4031 Villa Nueva Drive

Figure 98. Manhole # 4031 Villa Nueva Drive

Figure 100. Manhole # 4036 Villa Nueva Drive

Figure 99. Manhole # 4036 Villa Nueva Drive

Figure 101. Manhole # 4036 Villa Nueva Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 102. Manhole # 4037 Villa Nueva Drive

Figure 103. Manhole # 4037 Villa Nueva Drive

Figure 104. Manhole # 4037 Villa Nueva Drive

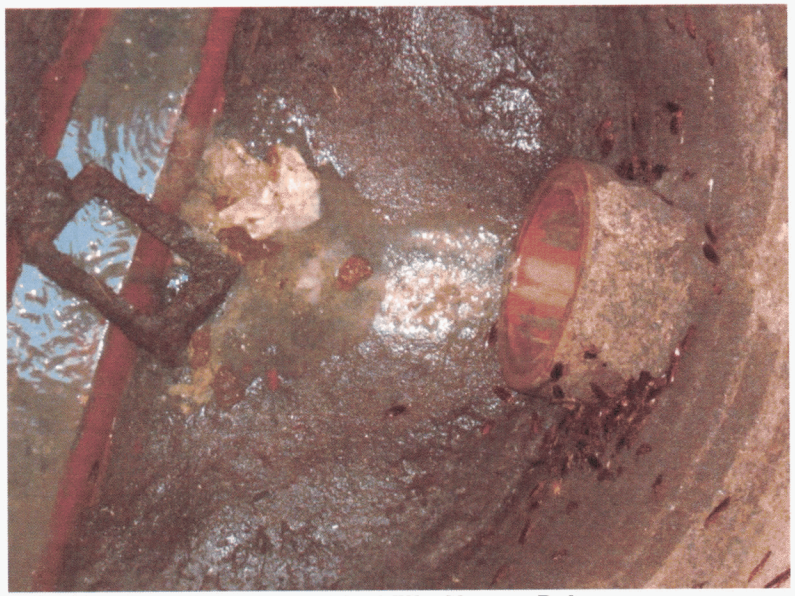

Figure 105. Manhole # 4037 Villa Nueva Drive

Figure 106. Manhole # 4039 Villa Nueva Drive

Figure 107. Manhole # 4039 Villa Nueva Drive

Figure 108. Manhole # 4039 Villa Nueva Drive

Figure 109. Manhole # 4050 Acacia Circle

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 110. Manhole # 4050 Acacia Circle

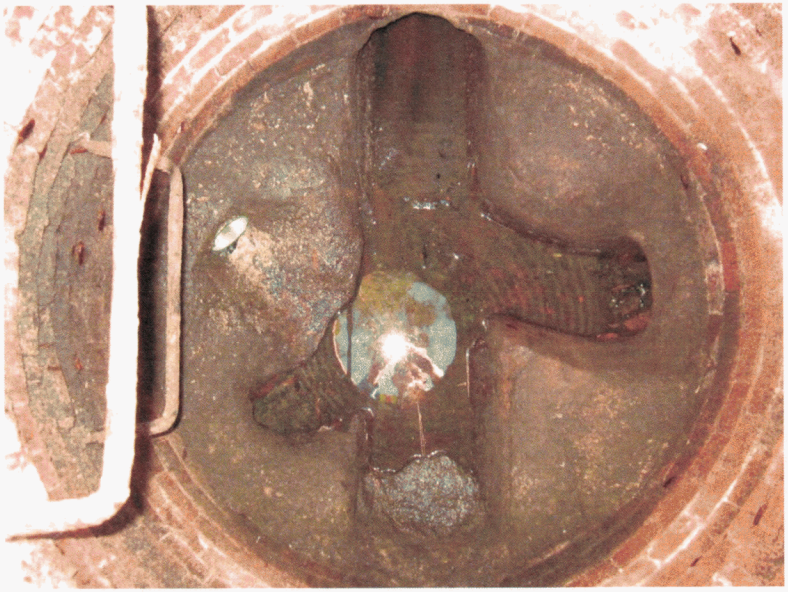

Figure 111. Manhole # 4050 Acacia Circle

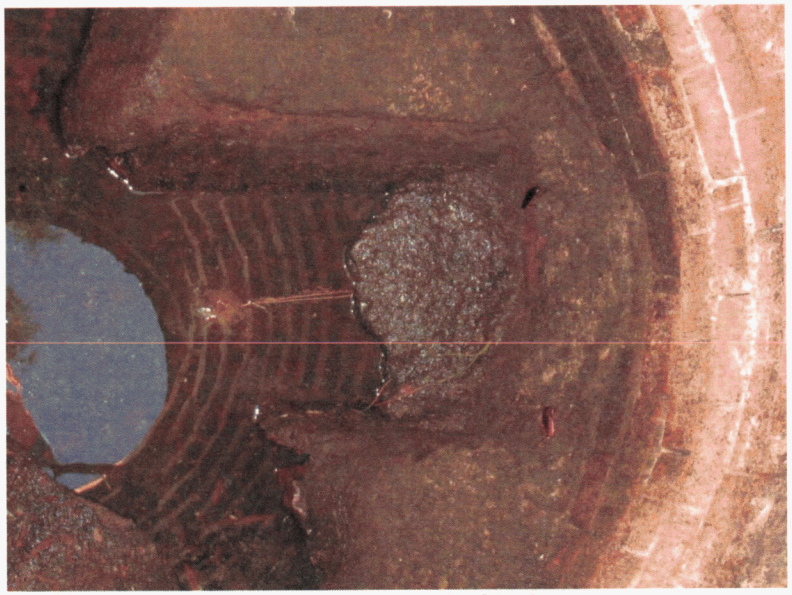

Figure 112. Manhole # 4050 Acacia Circle

Figure 113. Manhole # 4053 Acacia Circle

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 114. Manhole # 4053 Acacia Circle

Figure 115. Manhole # 4053 Acacia Circle

Figure 116. Manhole # 4053 Acacia Circle

Figure 117. Manhole # 4054 Acacia Circle

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Figure 118. Manhole # 4054 Acacia Circle

Figure 119. Manhole # 4054 Acacia Circle

Figure 120. Manhole # 4054 Acacia Circle

Figure 121. Manhole # 4056 Villa Nueva Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

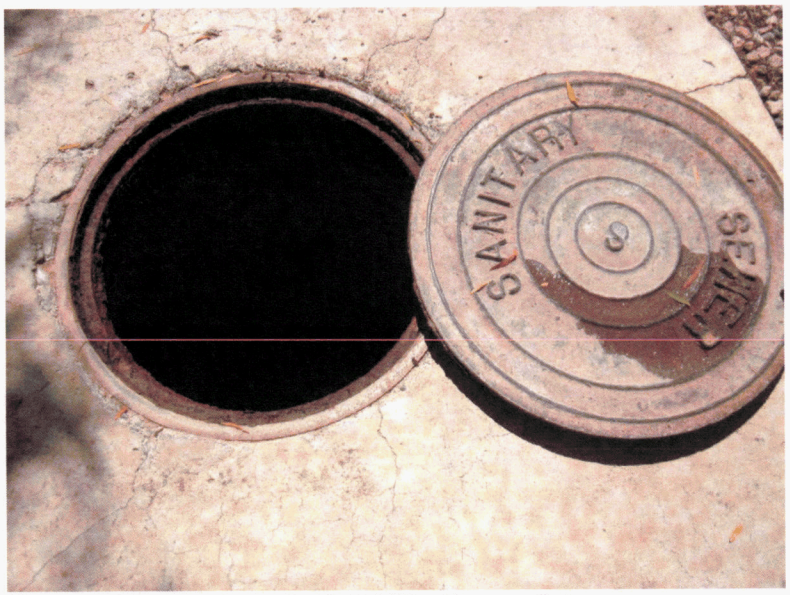

Figure 122. Manhole # 4056 Villa Nueva Drive

Figure 123. Manhole # 4056 Villa Nueva Drive

Figure 124. Manhole # 4056 Villa Nueva Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 125. Manhole # 4065 Vista Verde Drive

Figure 126. Manhole # 4065 Vista Verde Drive

Figure 127. Manhole # 4065 Vista Verde Drive

Figure 128. Manhole # 4065 Vista Verde Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 129. Manhole # 4071 Villa Nueva Drive

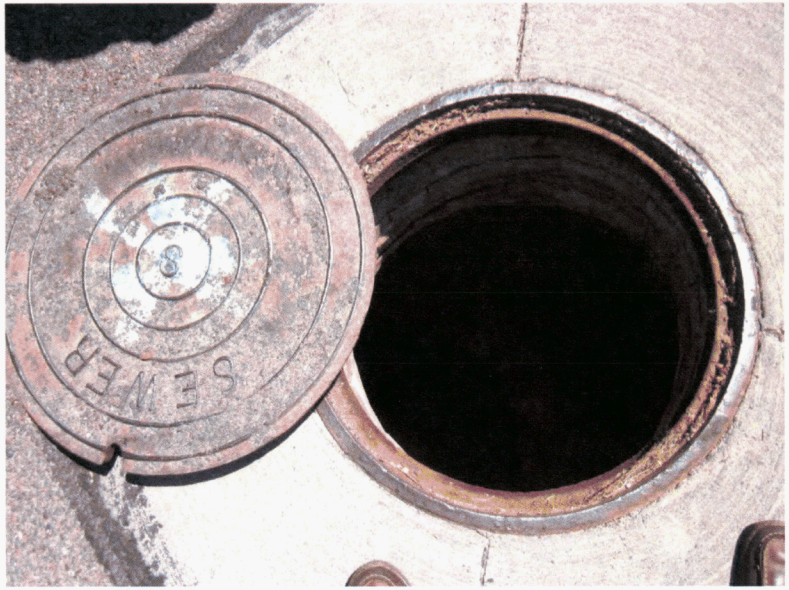

Figure 130. Manhole # 4071 Villa Nueva Drive

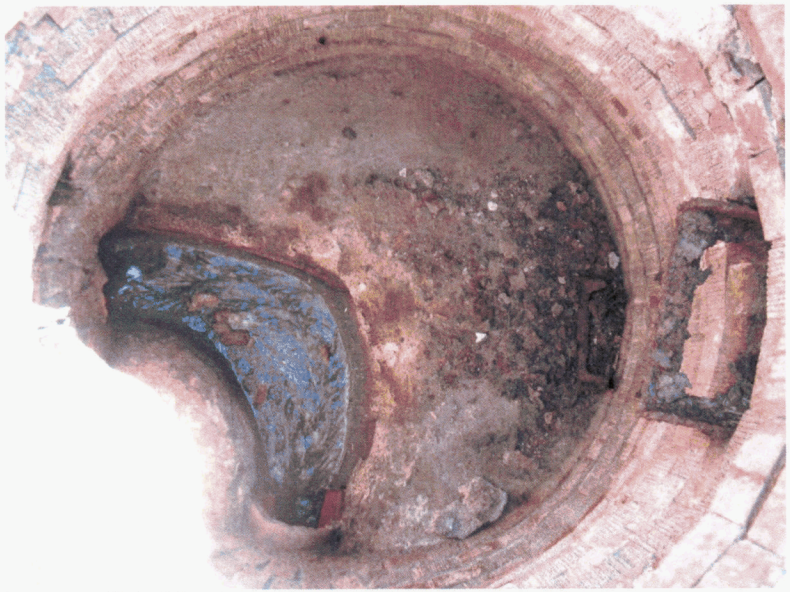

Figure 131. Manhole # 4071 Villa Nueva Drive

Figure 132. Manhole # 4079 Villa Nueva Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 133. Manhole # 4079 Villa Nueva Drive

Figure 134. Manhole # 4079 Villa Nueva Drive

Figure 135. Manhole # 4081 Villa Nueva Drive

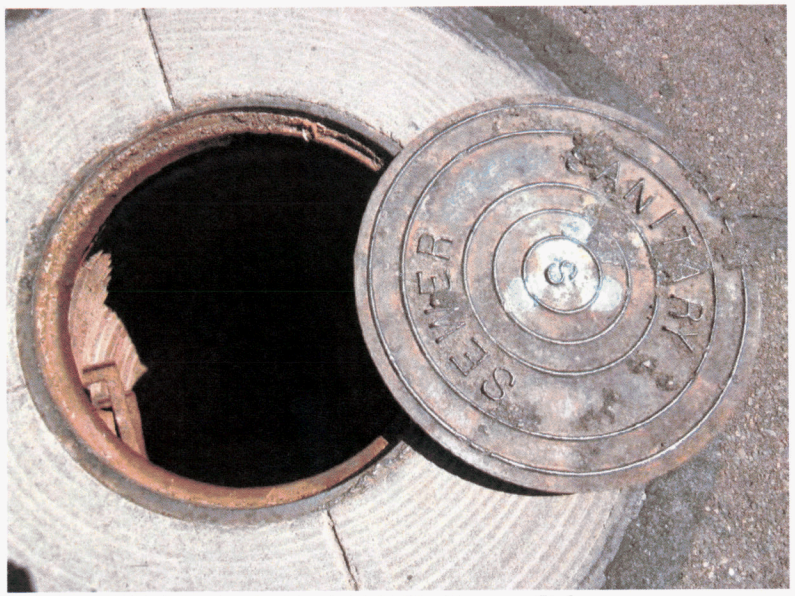

Figure 136. Manhole # 4081 Villa Nueva Drive

Figure 137. Manhole # 4081 Villa Nueva Drive

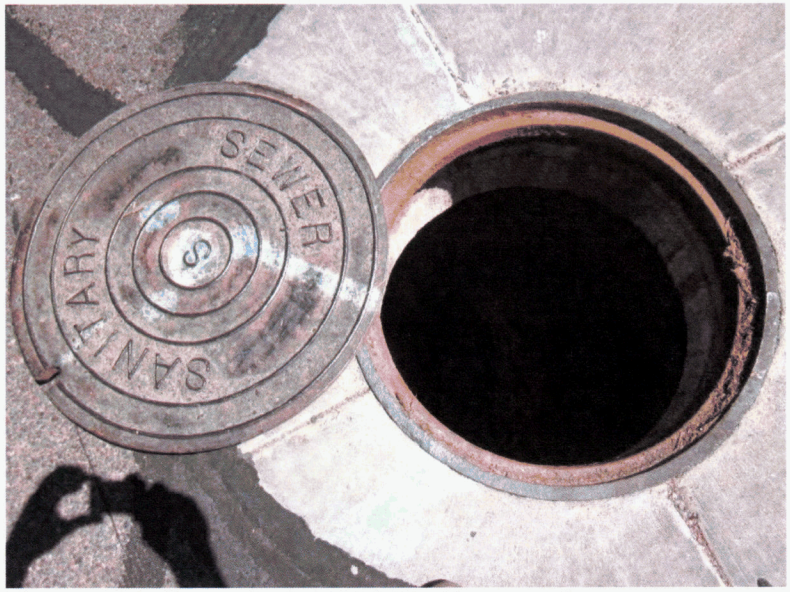

Figure 139. Manhole # 4089 Villa Nueva Drive

Figure 138. Manhole # 4089 Villa Nueva Drive

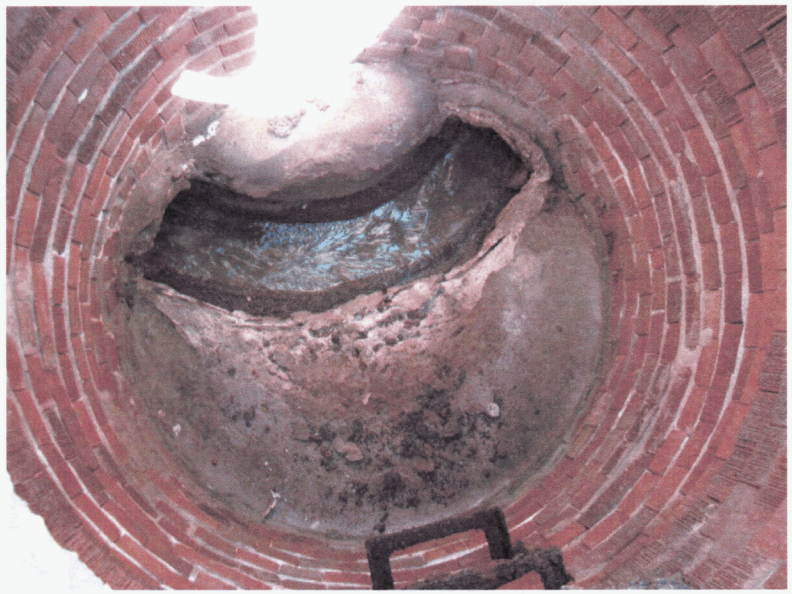

Figure 140. Manhole # 4089 Villa Nueva Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 141. Manhole # 4106 Fairway Drive

Figure 142. Manhole # 4106 Fairway Drive

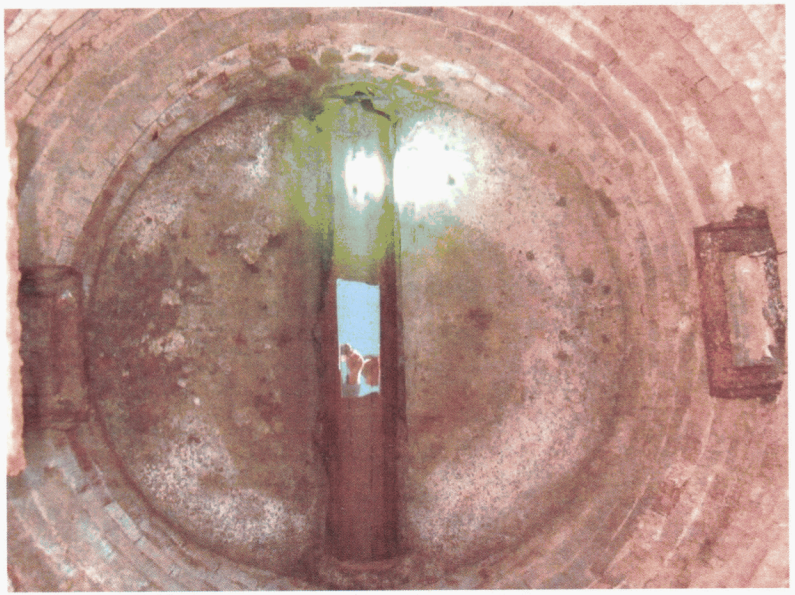

Figure 143. Manhole # 4106 Fairway Drive

Figure 144. Manhole # 4106 Fairway Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 145. Manhole # 4197 Laguna Drive

Figure 146. Manhole # 4197 Laguna Drive

Figure 147. Manhole # 4197 Laguna Drive

Figure 148. Manhole # 4197 Laguna Drive

Figure 149. Manhole # 4204 Bird Lane

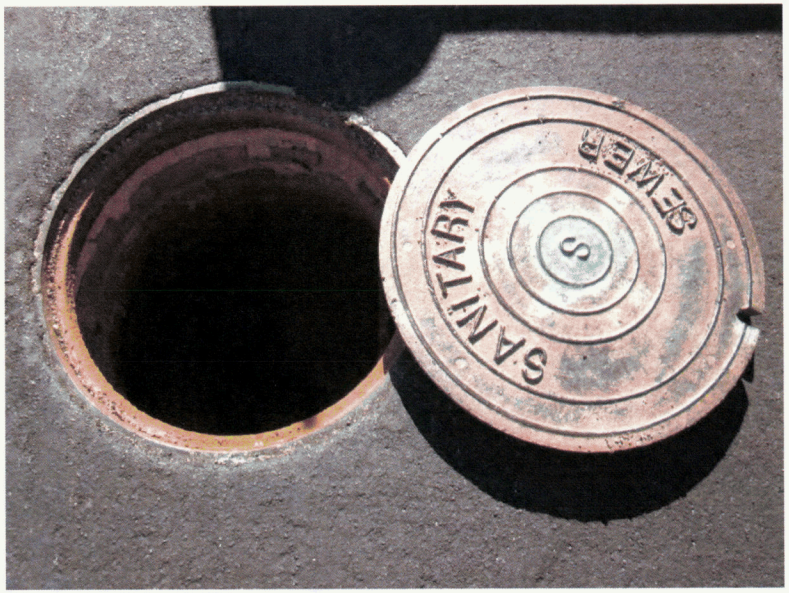

Figure 150. Manhole # 4204 Bird Lane

Figure 151. Manhole # 4204 Bird Lane

Figure 152. Manhole # 4204 Bird Lane

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 153. Manhole # 4204 Bird Lane

Figure 154. Manhole # 4206 Bird Lane

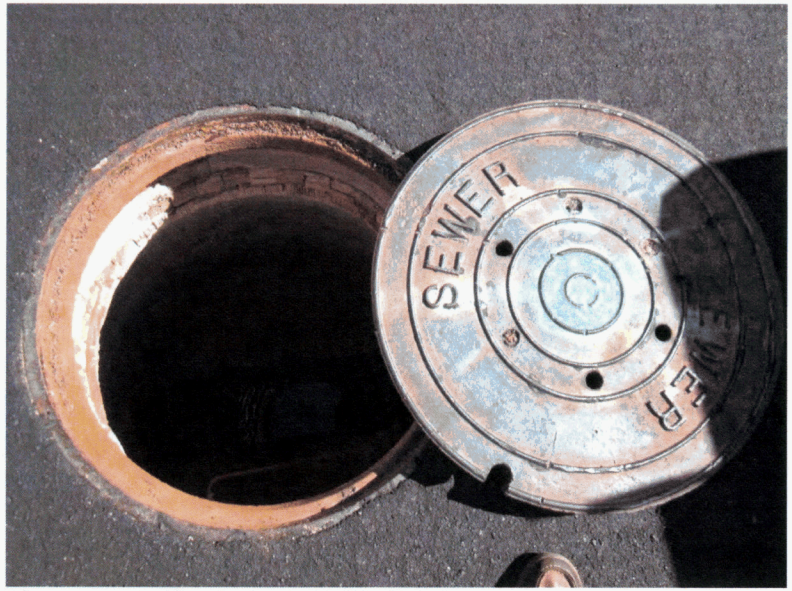

Figure 155. Manhole # 4206 Bird Lane

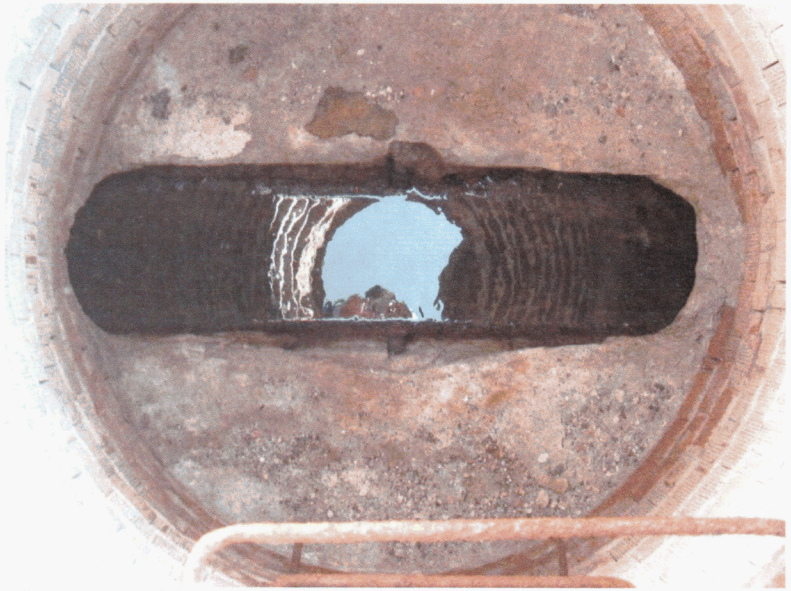

Figure 156. Manhole # 4206 Bird Lane

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 157. Manhole # 4213 Old Litchfield Road

Figure 158. Manhole # 4213 Old Litchfield Road

Figure 159. Manhole # 4213 Old Litchfield Road

Figure 160. Manhole # 4214 Old Litchfield Road

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 161. Manhole # 4214 Old Litchfield Road

Figure 162. Manhole # 4214 Old Litchfield Road

Figure 163. Manhole # 4214 Old Litchfield Road

Figure 164. Manhole # 4225 Acacia Circle

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 165. Manhole # 4225 Acacia Circle

Figure 166. Manhole # 4225 Acacia Circle

Figure 167. Manhole # 4225 Acacia Circle

Figure 168. Manhole # 4265 Desert Avenue

Figure 169. Manhole # 4265 Desert Avenue

Figure 170. Manhole # 4265 Desert Avenue

Figure 171. Manhole # 4296 Ancora Drive

Figure 172. Manhole # 4296 Ancora Drive

Figure 173. Manhole # 4296 Ancora Drive

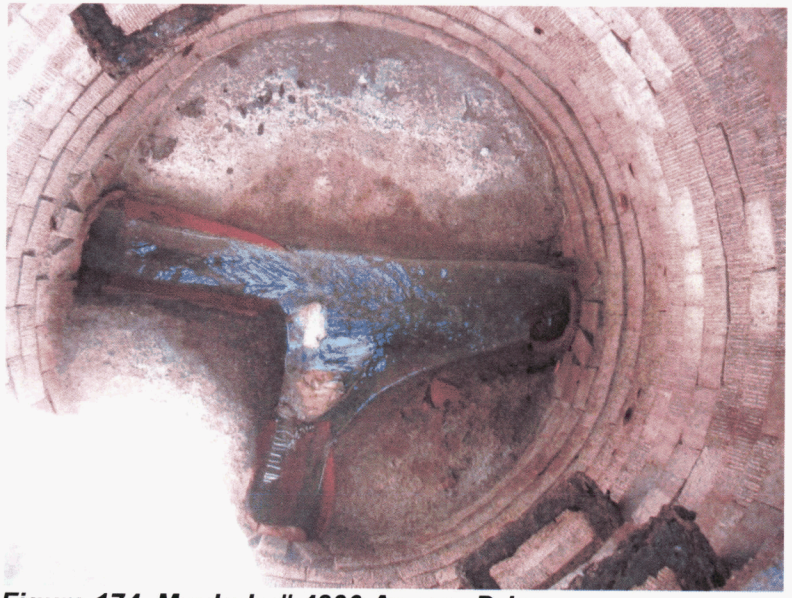

Figure 174. Manhole # 4296 Ancora Drive

Figure 175. Manhole # 4337 Old Litchfield Road

Figure 176. Manhole # 4337 Old Litchfield Road

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

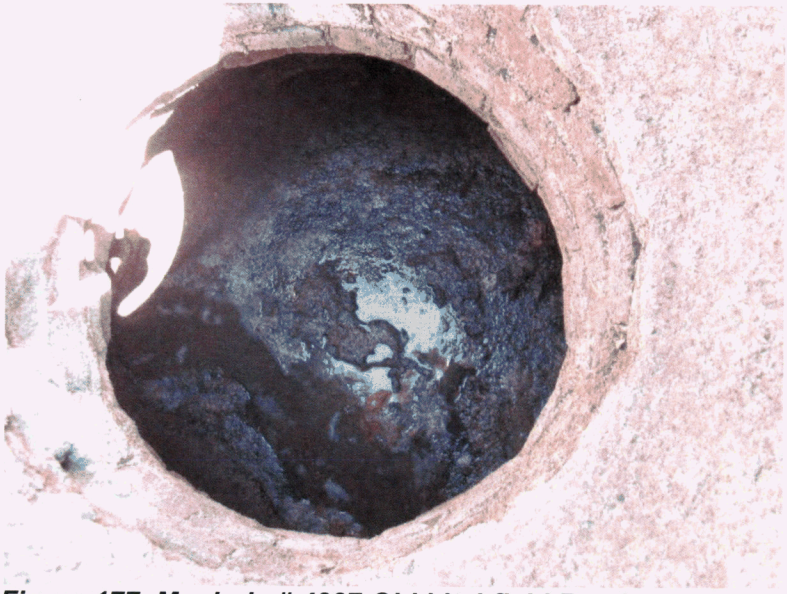

Figure 177. Manhole # 4337 Old Litchfield Road

Figure 178. Manhole # 4337 Old Litchfield Road

Figure 179. Manhole # 4337 Old Litchfield Road

Figure 180. Manhole # 4339 Vista Verde Drive

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 181. Manhole # 4339 Vista Verde Drive

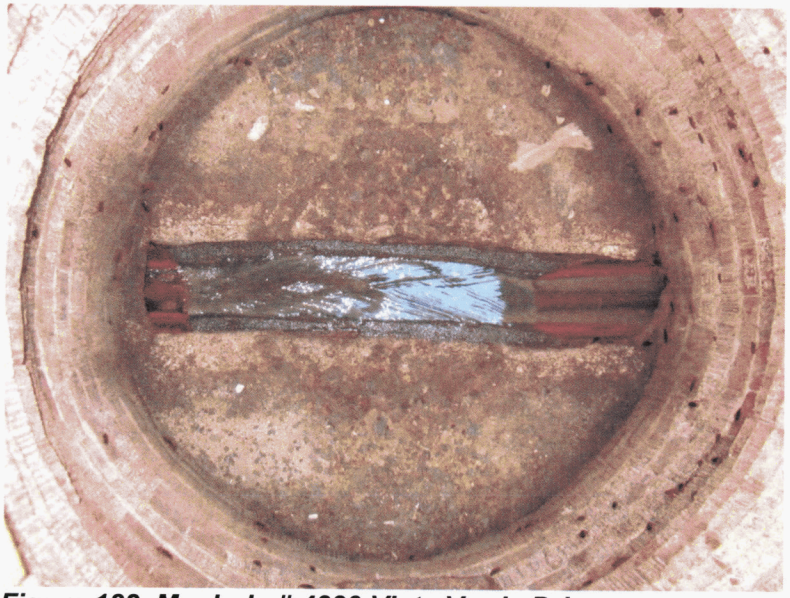

Figure 182. Manhole # 4339 Vista Verde Drive

Figure 183. Manhole # 5744 Villa Nueva Drive

Figure 184. Manhole # 5744 Villa Nueva Drive

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 185. Manhole # 5744 Villa Nueva Drive

Figure 186. Manhole # 6727 Honeysuckle Street

Figure 187. Manhole # 6727 Honeysuckle Street

Figure 188. Manhole # 6727 Honeysuckle Street

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File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 189. Manhole # 6732 Cottonwood Street

Figure 190. Manhole # 6732 Cottonwood Street

Figure 191. Manhole # 6732 Cottonwood Street

Figure 192. Manhole # 6733 Honeysuckle Street

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

Figure 193. Manhole # 6733 Honeysuckle Street

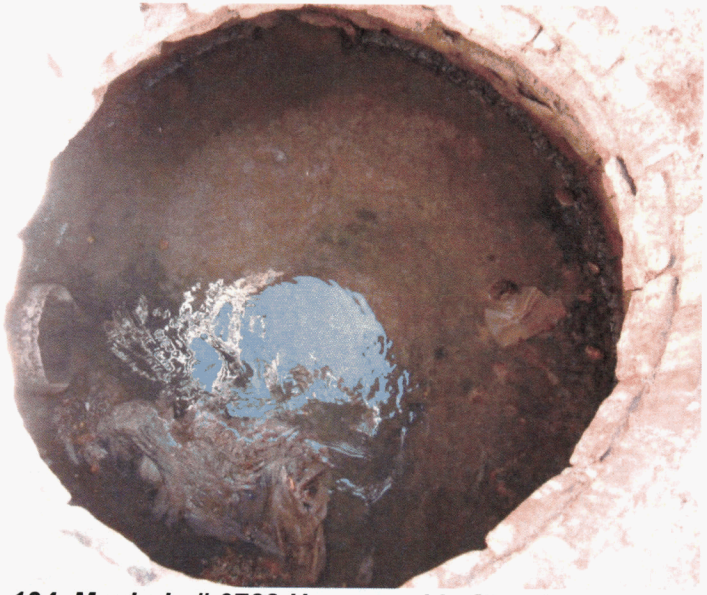


Figure 194. Manhole # 6733 Honeysuckle Street

Figure 195. Manhole # 6733 Honeysuckle Street

Revise Date: July 1, 2013
File Path: pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Wastewater Report/ManholePhotos

APPENDIX 5 – SEWER PIPELINE INSPECTION DATA

Street :
Tel:
Fax:
Email:

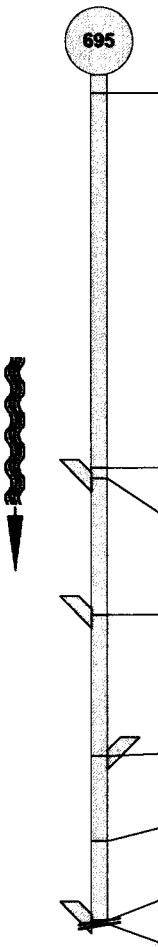
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**1**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**695**
Street 2:		Map # 2 :		To MH :	**4206**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**184.70 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:450 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole / ROACH INFESTED	00:00:02		0
85.40	0	bugs	00:01:50		1
87.70	0	service connection, at 02 o´clock	00:01:59		0
117.40	0	service connection capped, at 03 o´clock	00:02:47		0
148.10	0	service connection, at 10 o´clock	00:03:27		0
166.70	0	bugs	00:03:48		1
183.90	260	intruding service connection, at 03 o´clock	00:04:13	1_7A	2
184.70	0	camera blocked, inspection abandoned	00:04:26		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**2**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**695**
Street 2:		Map # 2 :		To MH :	**4207**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**547.80 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

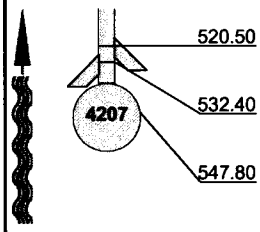
Remarks :

1:1512 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole / ROACH INFESTED	00:00:02		0
695					
32.30	0	service connection capped, at 10 o´clock	00:00:41		0
71.30	0	bugs	00:01:28		1
83.50	0	service connection, at 10 o´clock	00:01:45		0
107.80	0	service connection, at 02 o´clock	00:02:18		0
181.20	0	service connection capped, at 10 o´clock	00:03:52		0
209.80	0	bugs	00:04:30		1
212.70	0	service connection, at 09 o´clock	00:04:39		0
234.60	0	service connection, at 02 o´clock	00:05:13		0
329.90	0	service connection, at 10 o´clock	00:07:23		0
380.60	0	service connection, at 02 o´clock	00:08:32		0
395.90	0	bugs	00:08:53		1
440.20	0	service connection capped, at 10 o´clock	00:10:03		0
456.70	0	service connection, at 10 o´clock	00:10:33		0
491.00	0	pipe material changes at this point to ceramics / VCP	00:11:24		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**2**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
520.50	0	service connection capped, at 10 o´clock	00:12:06		0
532.40	0	service connection, at 02 o´clock	00:12:26		0
547.80	0	inspection ends at upstream manhole	00:12:49		0

Street :
Tel:
Fax:
Email:

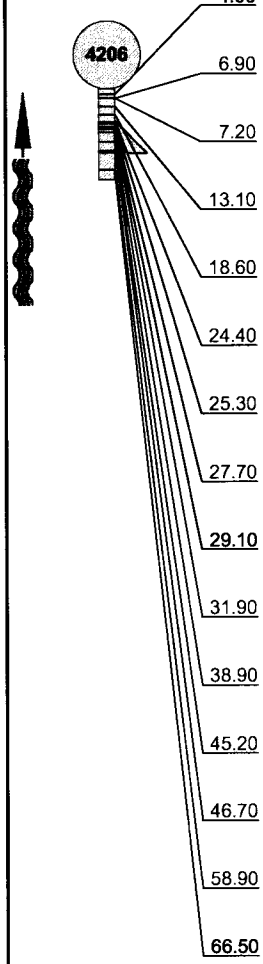
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**3**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**4206**
Street 2:		Map # 2 :		To MH :	**695**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**409.20 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

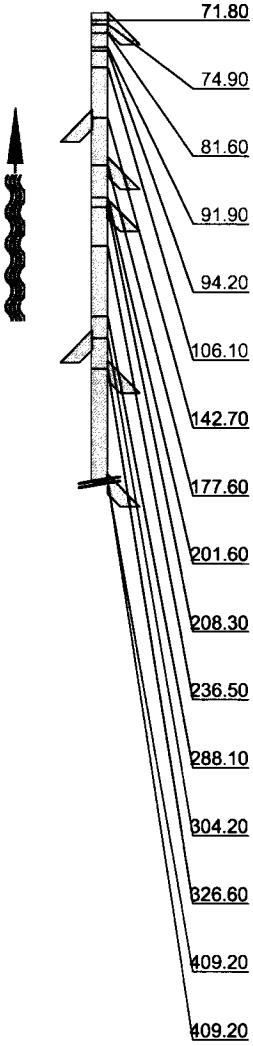


1:1512 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole / GREASE MEDIUM	00:00:01		0
6.90	0	Hole in pipe at 04 o´clock	00:00:59		3
7.20	0	Hole in pipe at 04 o´clock	00:00:22	3_2A	3
13.10	0	Hole in pipe at 04 o´clock	00:01:28	3_4A	3
18.60	0	Hole in pipe at 04 o´clock	00:01:46		3
24.40	0	Hole in pipe at 08 o´clock	00:01:58		3
25.30	0	Hole in pipe at 04 o´clock	00:02:08		3
27.70	0	Hole in pipe at 09 o´clock	00:02:16		3
29.10	0	service connection capped, at 10 o´clock	00:02:25		0
31.90	0	pipe Broken, at 12 o´clock	00:02:42		3
38.90	0	pipe Broken, at 12 o´clock	00:03:02		3
45.20	0	Hole in pipe at 12 o´clock	00:03:31		3
46.70	0	pipe Broken, at 12 o´clock	00:03:40		3
58.90	0	Hole in pipe at 12 o´clock	00:04:08		3
66.50	0	service connection capped, at 10 o´clock	00:04:23		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**3**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
71.80	0	service connection, at 10 o´clock	00:04:38		0
74.90	0	Hole in pipe at 12 o´clock	00:04:46		3
81.60	0	Hole in pipe at 12 o´clock	00:05:02		3
91.90	0	Hole in pipe at 12 o´clock	00:05:17		3
94.20	0	Hole in pipe at 12 o´clock	00:05:24		3
106.10	0	Hole in pipe at 12 o´clock	00:05:44		3
142.70	0	service connection, at 02 o´clock	00:06:35		0
177.60	0	service connection capped, at 10 o´clock	00:07:28		0
201.60	0	Longitudinal Crack, at 04 o´clock	00:08:02		2
208.30	0	service connection, at 10 o´clock	00:08:15		0
236.50	0	Longitudinal Crack, at 08 o´clock	00:08:51		2
288.10	0	Longitudinal Crack, at 04 o´clock	00:10:13		2
304.20	0	service connection, at 02 o´clock	00:10:36		0
326.60	0	service connection capped, at 10 o´clock	00:11:03		0
409.20	260	intruding service connection, at 10 o´clock	00:12:51		2
409.20	0	camera blocked, inspection abandoned	00:12:53		0

Street :
Tel:
Fax:
Email:

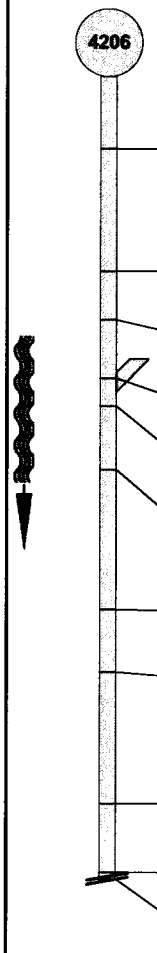
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**4**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**4206**
Street 2:		Map # 2 :		To MH :	**4205**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**46.60 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:120 Position	Code	Observation	MPEG	Photo	Rate
4.20	0	inspection begins at upstream manhole / ROACH INFESTED	00:00:01		0
11.30	0	Hole in pipe at 08 o´clock	00:00:23		3
14.10	0	Hole in pipe at 08 o´clock	00:00:30		3
17.50	0	service connection, at 09 o´clock	00:00:41		0
19.10	0	Hole in pipe at 08 o´clock	00:00:50		3
22.80	0	Hole in pipe at 09 o´clock	00:01:14		3
30.90	0	Hole in pipe at 08 o´clock	00:01:32		3
34.50	0	Hole in pipe at 08 o´clock	00:01:42		3
42.20	0	Hole in pipe at 08 o´clock	00:01:59		3
46.20	0	Hole in pipe at 08 o´clock	00:02:10		3
46.60	0	camera blocked, inspection abandoned	00:02:20		0

Street :
Tel:
Fax:
Email:

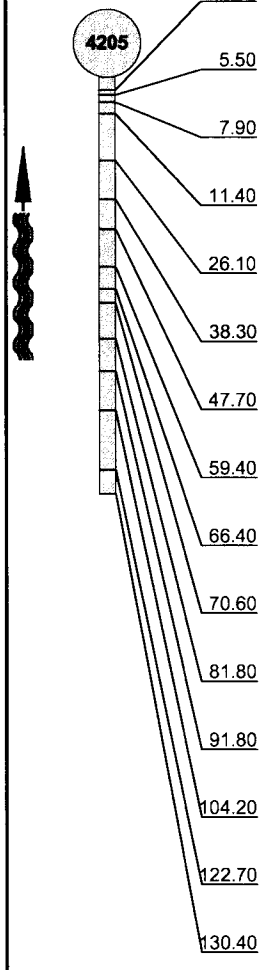
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**5**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**4205**
Street 2:		Map # 2 :		To MH :	**4206**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**148.80 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:648 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:05		0
5.50	0	Hole in pipe at 04 o´clock	00:00:20		3
7.90	0	Hole in pipe at 04 o´clock	00:00:33		3
11.40	0	Hole in pipe at 04 o´clock	00:00:44		3
26.10	0	Hole in pipe at 04 o´clock	00:01:08		3
38.30	0	bugs	00:01:21		1
47.70	0	Hole in pipe at 04 o´clock	00:01:36		3
59.40	0	Hole in pipe at 04 o´clock	00:02:01		3
66.40	0	Hole in pipe at 05 o´clock	00:02:19		3
70.60	0	Hole in pipe at 05 o´clock	00:02:28		3
81.80	0	Hole in pipe at 05 o´clock	00:02:45		3
91.80	0	Hole in pipe at 05 o´clock	00:02:59		3
104.20	0	Hole in pipe at 05 o´clock	00:03:19		3
122.70	0	Hole in pipe at 05 o´clock	00:03:50		3
130.40	0	Hole in pipe at 05 o´clock	00:04:03		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/5/2013		sunny, dry	EDDIE	5	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:648 Position	Code	Observation	MPEG	Photo	Rate
140.50	0	Hole in pipe at 05 o´clock	00:04:18		3
148.80	0	Hole in pipe at 05 o´clock	00:04:41		3
148.80	0	camera blocked, inspection abandoned / GRAVEL AN DAPIECE OF PIPE	00:04:54		0

Street :
Tel:
Fax:
Email:

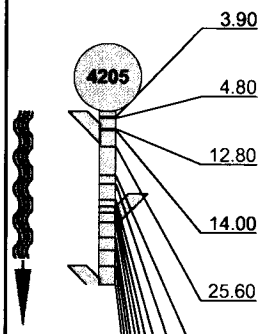
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**6**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**4205**
Street 2:		Map # 2 :		To MH :	**701**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**307.60 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

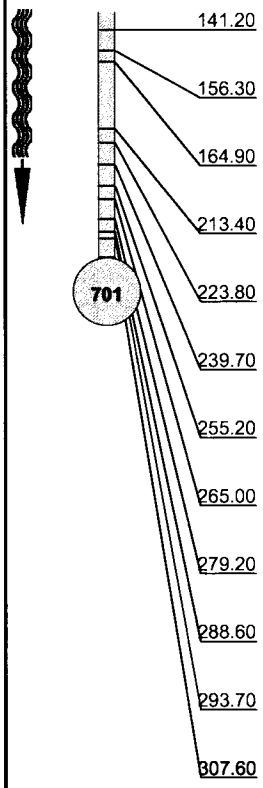


1:1512 Position	Code	Observation	MPEG	Photo	Rate
3.90	0	inspection begins at upstream manhole	00:00:02		0
4.80	0	Hole in pipe at 07 o´clock	00:00:11		3
12.80	0	Hole in pipe at 07 o´clock	00:00:31		3
14.00	260	intruding service connection, at 02 o´clock	00:00:43		2
25.60	0	Hole in pipe at 07 o´clock	00:01:13		3
46.60	0	Hole in pipe at 07 o´clock	00:01:43		3
53.00	0	Hole in pipe at 07 o´clock	00:02:01		3
64.40	0	Hole in pipe at 07 o´clock	00:02:19		3
69.50	0	Hole in pipe at 07 o´clock	00:02:28		3
74.10	0	service connection, at 09 o´clock	00:02:37		0
81.10	0	Hole in pipe at 07 o´clock	00:02:48		3
91.60	0	Hole in pipe at 07 o´clock	00:03:00		3
101.30	0	Hole in pipe at 07 o´clock	00:03:10		3
113.30	0	Hole in pipe at 07 o´clock	00:03:24		3
126.50	0	service connection, at 03 o´clock	00:03:42		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**6**	
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Rate :



1:1512 Position	Code	Observation	MPEG	Photo	Rate
141.20	0	Hole in pipe at 07 o´clock	00:04:02		3
156.30	0	Hole in pipe at 07 o´clock	00:04:17		3
164.90	0	Hole in pipe at 07 o´clock	00:04:23		3
213.40	0	Hole in pipe at 07 o´clock	00:05:15		3
223.80	0	Hole in pipe at 07 o´clock	00:05:30		3
239.70	0	Hole in pipe at 09 o´clock	00:05:51		3
255.20	0	Hole in pipe at 07 o´clock	00:06:19		3
265.00	0	Hole in pipe at 07 o´clock	00:06:32		3
279.20	0	Hole in pipe at 07 o´clock	00:06:49		3
288.60	0	Hole in pipe at 07 o´clock	00:07:02		3
293.70	0	Hole in pipe at 07 o´clock	00:07:11		3
307.60	0	inspection ends at downstream manhole	00:07:39		0

Street :
Tel:
Fax:
Email:

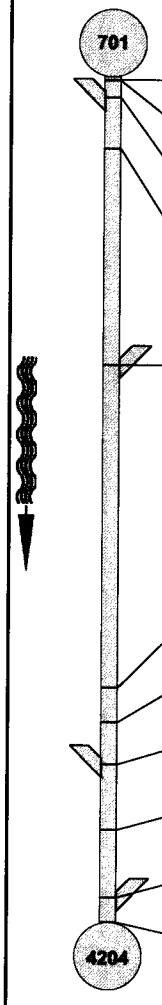
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**7**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**701**
Street 2:		Map # 2 :		To MH :	**4204**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**251.30 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:615 Position	Code	Observation	MPEG	Photo	Rate
1.00	0	inspection begins at upstream manhole	00:00:01		0
1.20	0	bugs	00:00:03		1
6.20	260	intruding service connection, at 03 o´clock	00:00:11		2
21.30	0	Hole in pipe at 07 o´clock	00:00:44		3
85.50	0	service connection, at 09 o´clock	00:02:13		0
181.70	0	Longitudinal Crack, at 07 o´clock	00:04:27		2
191.90	0	Hole in pipe at 07 o´clock	00:04:45		3
204.30	0	service connection, at 03 o´clock	00:05:08		0
224.00	0	bugs	00:05:30		1
244.10	0	service connection, at 09 o´clock	00:05:57		0
251.30	0	inspection ends at downstream manhole	00:06:11		0

Street :
Tel:
Fax:
Email:

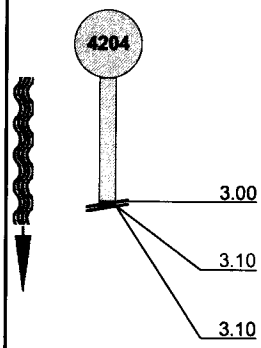
Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**8**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**4204**
Street 2:		Map # 2 :		To MH :	**727**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**3.10 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:50 Position	Code	Observation	MPEG	Photo	Rate
3.00	0	inspection begins at upstream manhole	00:00:02		0
3.10	310	Debris / GASKET	00:00:25		3
3.10	0	camera blocked, inspection abandoned	00:00:47		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: BIRD LANE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/5/2013		**sunny, dry**	**EDDIE**	**9**	**BIRD LANE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**BIRD LN**	Map # 1 :		From MH :	**727**
Street 2:		Map # 2 :		To MH :	**4204**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**273.70 ft**
Insp. method :	**CCTV**	Media # :	**050613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:660 Position	Code	Observation	MPEG	Photo	Rate
727					
4.00	0	inspection begins at downstream manhole	00:00:01		0
273.70	0	inspection ends at upstream manhole	00:05:10		0
4204					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**1**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6708**
Street 2:		Map # 2 :		To MH :	**6709**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**278.80 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:675 Position	Code	Observation	MPEG	Photo	Rate
6708					
5.00	0	inspection begins at upstream manhole	00:00:02		0
14.10	0	bugs	00:00:18		1
28.30	0	service connection, at 09 o´clock	00:00:43		0
91.90	0	bugs	00:02:04		1
106.00	0	bugs / roach infested	00:02:25		1
118.10	0	service connection, at 09 o´clock	00:03:03		0
187.20	0	service connection, at 02 o´clock	00:05:01		0
202.20	0	service connection, at 10 o´clock	00:05:33		0
278.80	0	inspection ends at downstream manhole	00:07:16		0
6709					

Street :
Tel:
Fax:
Email:

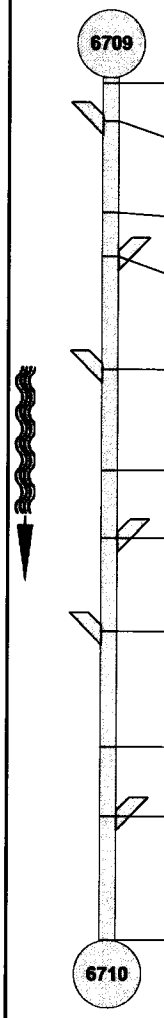
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**2**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6709**
Street 2:		Map # 2 :		To MH :	**6710**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**306.10 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:735 Position	Code	Observation	MPEG	Photo	Rate
2.00	0	inspection begins at upstream manhole	00:00:02		0
15.50	0	service connection, at 03 o´clock	00:00:27		0
47.70	0	bugs	00:01:16		1
63.50	0	service connection, at 09 o´clock / roaches	00:01:56		0
103.40	0	service connection, at 03 o´clock	00:03:14		0
139.10	210	scale/mineral deposits medium from 04 to 08 o´clock	00:04:20		2
163.20	0	service connection, at 09 o´clock	00:05:16		0
196.40	0	service connection, at 03 o´clock / full of dirt	00:06:15	2_8A	0
237.20	0	bugs	00:07:32		1
262.10	0	service connection, at 09 o´clock	00:08:24		0
306.10	0	inspection ends at downstream manhole	00:09:46		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**3**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6708**
Street 2:		Map # 2 :		To MH :	**6707**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**261.60 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:630 Position	Code	Observation	MPEG	Photo	Rate
6708					
5.70	0	inspection begins at downstream manhole	00:00:02		0
19.20	0	service connection, at 02 o´clock	00:00:21		0
38.90	0	bugs / roach infested	00:00:49		1
61.00	0	service connection, at 09 o´clock	00:01:21		0
109.80	0	service connection, at 03 o´clock	00:02:29		0
160.10	0	service connection, at 09 o´clock	00:03:35		0
198.80	110	encrustation light from 07 to 08 o´clock	00:04:42		1
200.00	0	service connection, at 03 o´clock	00:04:57		0
251.50	0	service connection, at 09 o´clock	00:06:11		0
254.80	0	service connection, at 03 o´clock	00:06:23		0
261.60	0	inspection ends at upstream manhole	00:06:46		0
6707					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**4**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6711**
Street 2:		Map # 2 :		To MH :	**6710**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**301.30 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:735 Position	Code	Observation	MPEG	Photo	Rate
6711					
5.00	0	inspection begins at downstream manhole	00:00:01		0
7.30	210	scale/mineral deposits medium from 04 to 08 o´clock	00:00:12		2
28.40	0	bugs	00:00:50		1
76.30	0	service connection, at 09 o´clock	00:02:05		0
94.00	210	scale/mineral deposits medium from 03 to 09 o´clock	00:02:38		2
117.80	0	service connection, at 03 o´clock	00:03:18		0
133.40	0	bugs	00:03:42		1
178.40	0	service connection, at 09 o´clock	00:05:04		0
206.10	0	service connection, at 03 o´clock	00:05:55		0
235.50	210	scale/mineral deposits medium from 02 to 10 o´clock	00:06:52		2
244.00	0	bugs	00:07:05		1
277.50	0	service connection, at 03 o´clock / full of dirt	00:08:06		0
301.30	0	inspection ends at upstream manhole	00:09:00		0
6710					

Street :
Tel:
Fax:
Email:

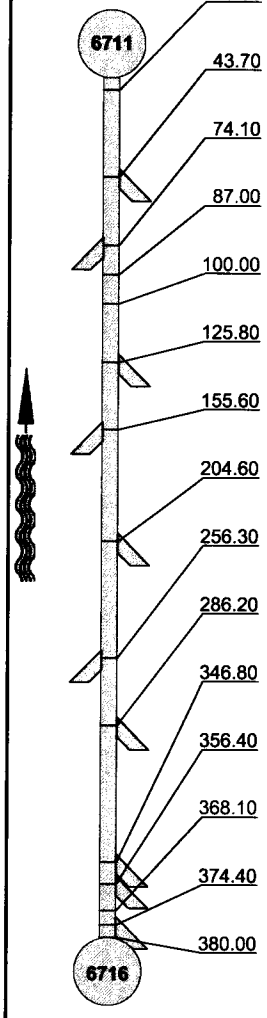
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**5**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6711**
Street 2:		Map # 2 :		To MH :	**6716**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**380.00 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:915 Position	Code	Observation	MPEG	Photo	Rate
5.50	0	inspection begins at downstream manhole	00:00:01		0
43.70	0	service connection, at 09 o´clock	00:01:04		0
74.10	0	service connection, at 03 o´clock	00:01:49		0
87.00	210	scale/mineral deposits medium from 04 to 08 o´clock	00:02:16		2
100.00	210	scale/mineral deposits medium from 04 to 08 o´clock	00:02:39		2
125.80	0	service connection, at 09 o´clock	00:03:19		0
155.60	0	service connection, at 03 o´clock	00:04:07		0
204.60	0	service connection, at 09 o´clock / dirt in it	00:05:33		0
256.30	0	service connection, at 03 o´clock	00:06:54		0
286.20	0	service connection, at 09 o´clock	00:07:46		0
346.80	0	service connection, at 09 o´clock	00:09:24		0
356.40	0	service connection capped, at 09 o´clock	00:09:44		0
368.10	210	scale/mineral deposits medium from 03 to 09 o´clock	00:10:04		2
374.40	0	service connection capped, at 09 o´clock	00:10:23		0
380.00	0	inspection ends at upstream manhole	00:10:38		0

Street :
Tel:
Fax:
Email:

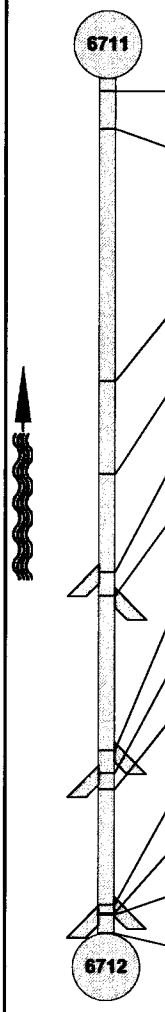
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**6**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**PALO VERDE**	Map # 1 :		From MH :	**6711**
Street 2:		Map # 2 :		To MH :	**6712**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**334.70 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:810 Position	Code	Observation	MPEG	Photo	Rate
5.10	0	inspection begins at downstream manhole	00:00:01		0
19.90	0	bugs / ROACH INFESTED	00:00:24		1
118.50	0	bugs	00:02:31		1
154.90	0	bugs / ROACH INFESTED	00:03:25		1
193.20	0	service connection, at 03 o´clock	00:04:21		0
202.40	0	service connection, at 09 o´clock	00:04:36		0
263.00	0	service connection, at 09 o´clock / DIRT MEDIUM	00:05:57		0
272.00	160	service connection with grease, at 03 o´clock	00:06:19		1
278.60	0	bugs	00:06:28		1
323.60	0	service connection, at 09 o´clock	00:07:36		0
327.20	0	service connection, at 03 o´clock	00:07:48		0
327.70	310	Debris / MUD	00:07:57	6_12A	3
334.70	0	inspection ends at upstream manhole	00:08:24		0

Street :
Tel:
Fax:
Email:

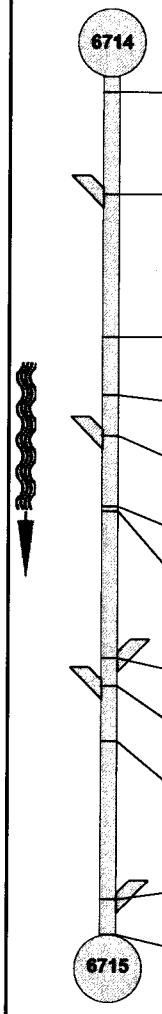
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**7**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6714**
Street 2:		Map # 2 :		To MH :	**6715**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**279.60 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:675 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at upstream manhole	00:00:02		0
38.30	0	service connection, at 03 o´clock / FULL OF DIRT	00:01:18		0
84.70	210	scale/mineral deposits medium from 02 to 10 o´clock	00:02:36		2
103.70	210	scale/mineral deposits medium from 02 to 10 o´clock	00:03:10		2
116.90	0	service connection, at 02 o´clock	00:03:36		0
140.00	210	scale/mineral deposits medium from 03 to 09 o´clock	00:04:18		2
141.50	0	bugs	00:04:20		1
189.40	0	service connection, at 09 o´clock	00:05:32		0
198.50	0	service connection, at 02 o´clock	00:05:54		0
216.40	210	scale/mineral deposits medium from 03 to 09 o´clock	00:06:20		2
268.20	0	service connection, at 09 o´clock	00:07:35		0
279.60	0	inspection ends at downstream manhole	00:08:04		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**8**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6715**
Street 2:		Map # 2 :		To MH :	**6716**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**283.80 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:690 Position	Code	Observation	MPEG	Photo	Rate
2.10	0	inspection begins at upstream manhole	00:00:01		0
20.80	210	scale/mineral deposits medium from 04 to 08 o´clock	00:00:36		2
57.50	210	debris grease medium from 04 to 08 o´clock	00:01:29		2
59.70	0	service connection, at 03 o´clock	00:01:40		0
81.20	0	service connection, at 09 o´clock	00:02:21		0
110.80	0	bugs	00:03:05		1
150.50	0	service connection, at 03 o´clock	00:04:12		0
171.40	0	service connection, at 09 o´clock / FULL OF DIRT	00:04:49	8_8A	0
230.40	0	service connection, at 03 o´clock / DIRT MEDIUM	00:06:24		0
263.30	0	bugs	00:07:19		1
283.80	0	inspection ends at downstream manhole	00:07:53		0

Street :
Tel:
Fax:
Email:

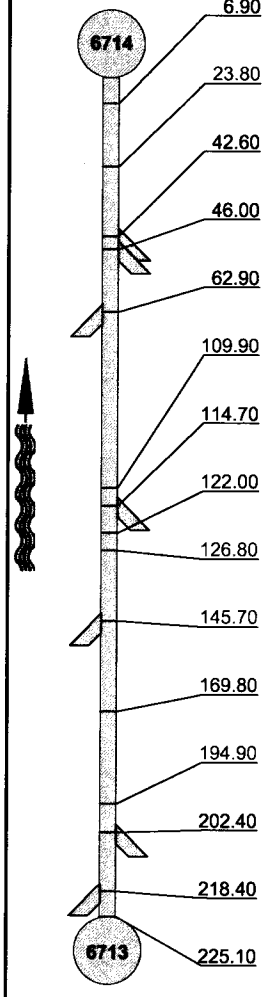
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**9**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**REDONDO CIRCLE**	Map # 1 :		From MH :	**6714**
Street 2:		Map # 2 :		To MH :	**6713**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**225.10 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:555 Position	Code	Observation	MPEG	Photo	Rate
6.90	0	inspection begins at downstream manhole	00:00:01		0
23.80	0	bugs / ROACH INFESTED	00:00:26		1
42.60	0	service connection capped, at 09 o´clock	00:00:56		0
46.00	0	service connection, at 09 o´clock	00:01:06		0
62.90	0	service connection, at 02 o´clock	00:01:35		0
109.90	210	scale/mineral deposits medium from 03 to 09 o´clock	00:02:43		2
114.70	0	service connection, at 09 o´clock	00:02:53		0
122.00	210	debris grease medium from 04 to 09 o´clock	00:03:09		2
126.80	310	Debris	00:03:19		3
145.70	160	service connection with grease, at 03 o´clock	00:03:51	9_10A	1
169.80	210	debris grease medium from 04 to 08 o´clock	00:04:31		2
194.90	0	bugs	00:05:07		1
202.40	0	service connection, at 09 o´clock	00:05:19		0
218.40	0	service connection, at 02 o´clock	00:05:48		0
225.10	0	inspection ends at upstream manhole	00:06:02		0

Street :
Tel:
Fax:
Email:

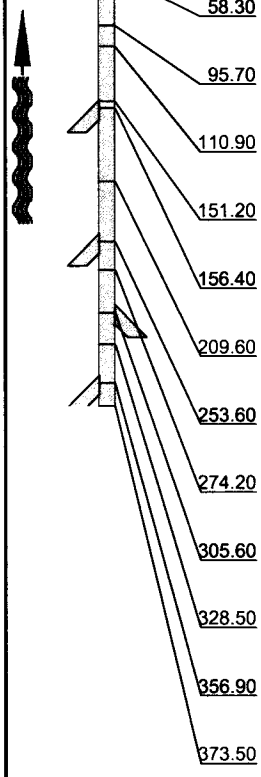
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**10**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**FAIRWAY**	Map # 1 :		From MH :	**6692**
Street 2:		Map # 2 :		To MH :	**6691**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**407.40 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:1512 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:01		0
24.40	0	bugs	00:00:26		1
42.40	210	scale/mineral deposits medium from 01 to 11 o´clock	00:00:46		2
58.30	0	service connection, at 02 o´clock	00:01:12		0
95.70	210	scale/mineral deposits medium from 01 to 11 o´clock	00:01:59		2
110.90	0	bugs	00:02:26		1
151.20	210	scale/mineral deposits medium from 01 to 11 o´clock	00:03:22		2
156.40	0	service connection, at 03 o´clock	00:03:33		0
209.60	0	bugs	00:04:50		1
253.60	0	service connection, at 02 o´clock	00:05:56		0
274.20	210	scale/mineral deposits medium from 01 to 11 o´clock	00:06:22		2
305.60	0	service connection, at 09 o´clock	00:07:11		0
328.50	210	scale/mineral deposits medium from 01 to 11 o´clock	00:07:43		2
356.90	0	service connection, at 02 o´clock	00:08:24		0
373.50	0	bugs / ROACH INFESTED	00:08:50		1

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**10**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1512	Position	Code	Observation	MPEG	Photo	Rate
6691	407.40	0	inspection ends at upstream manhole	00:09:56		0

Street :
Tel:
Fax:
Email:

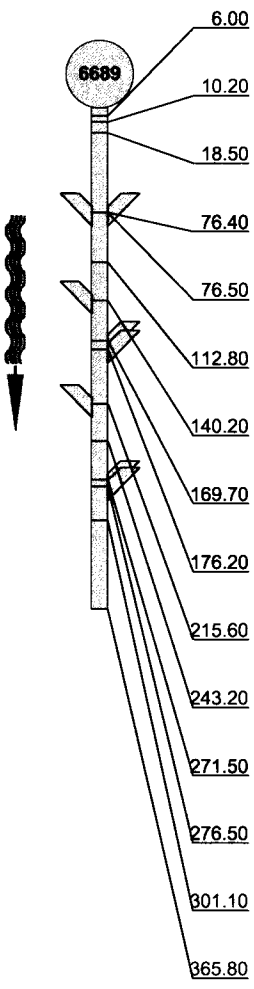
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**11**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**FAIRWAY**	Map # 1 :		From MH :	**6689**
Street 2:		Map # 2 :		To MH :	**6691**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**422.30 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

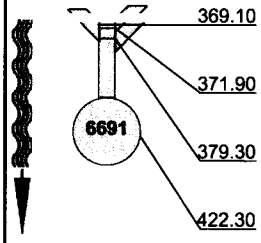


1:1512 Position	Code	Observation	MPEG	Photo	Rate
6.00	0	inspection begins at upstream manhole	00:00:01		0
10.20	0	bugs / ROACH INFESTED	00:00:09		1
18.50	210	scale/mineral deposits medium from 02 to 10 o´clock	00:00:16		2
76.40	0	service connection, at 10 o´clock	00:01:42		0
76.50	260	intruding service connection, at 03 o´clock	00:01:54	11_5A	2
112.80	210	scale/mineral deposits medium from 02 to 11 o´clock	00:02:55		2
140.20	260	intruding service connection, at 02 o´clock	00:03:40		2
169.70	0	service connection, at 10 o´clock	00:04:26		0
176.20	0	service connection capped, at 10 o´clock	00:04:42		0
215.60	260	intruding service connection, at 02 o´clock	00:05:37		2
243.20	210	scale/mineral deposits medium from 02 to 10 o´clock	00:06:20		2
271.50	0	service connection capped, at 10 o´clock	00:07:02		0
276.50	0	service connection, at 10 o´clock	00:07:14		0
301.10	210	scale/mineral deposits medium from 03 to 09 o´clock	00:07:54		2
365.80	0	bugs	00:09:29		1

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**11**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
369.10	0	service connection capped, at 10 o´clock	00:09:37		0
371.90	0	service connection, at 02 o´clock	00:09:51		0
379.30	0	service connection, at 10 o´clock	00:10:13		0
422.30	0	inspection ends at downstream manhole	00:11:20		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**12**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6685**
Street 2:		Map # 2 :		To MH :	**6686**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**454.90 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:1095 Position	Code	Observation	MPEG	Photo	Rate
5.30	0	inspection begins at upstream manhole	00:00:01		0
17.60	0	bugs	00:00:19		1
21.40	210	scale/mineral deposits medium from 02 to 10 o´clock	00:00:24		2
103.00	0	bugs	00:02:01		1
112.40	0	service connection capped, at 02 o´clock	00:02:16		0
152.10	210	scale/mineral deposits medium from 01 to 11 o´clock	00:03:09		2
258.10	210	scale/mineral deposits medium from 01 to 11 o´clock	00:05:35		2
262.50	0	service connection capped, at 02 o´clock	00:05:45		0
319.70	210	scale/mineral deposits medium from 01 to 11 o´clock	00:07:10		2
379.80	0	bugs	00:08:37		1
412.70	0	service connection capped, at 02 o´clock	00:09:39		0
454.90	0	inspection ends at downstream manhole	00:10:50		0

Street :
Tel:
Fax:
Email:

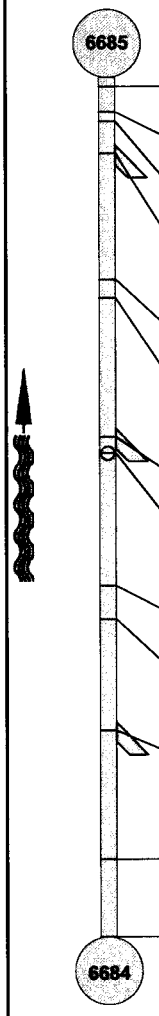
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**13**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6685**
Street 2:		Map # 2 :		To MH :	**6684**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**448.50 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:1080 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:02		0
17.90	0	bugs / ROACH INFESTED	00:00:27		1
23.20	210	scale/mineral deposits medium from 02 to 10 o´clock	00:00:30		2
39.80	0	service connection capped, at 10 o´clock	00:00:53		0
105.60	210	scale/mineral deposits medium from 01 to 11 o´clock	00:02:25		2
115.20	0	bugs	00:02:38		1
187.50	0	service connection capped, at 10 o´clock	00:04:21		0
195.90	0	service connection, at 12 o´clock	00:04:36		0
265.10	0	bugs	00:06:27		1
282.80	210	scale/mineral deposits medium from 12 to 11 o´clock	00:07:07		2
340.40	0	service connection capped, at 11 o´clock	00:08:37		0
407.80	0	bugs	00:09:24		1
448.50	0	inspection ends at upstream manhole / ROACH INFESTED	00:10:03		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**14**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6686**
Street 2:		Map # 2 :		To MH :	**6687**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**163.30 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:405 Position	Code	Observation	MPEG	Photo	Rate
5.40	0	inspection begins at upstream manhole	00:00:01		0
25.90	0	bugs	00:00:31		1
35.50	210	scale/mineral deposits medium from 01 to 12 o´clock	00:00:36		2
120.40	210	scale/mineral deposits medium from 01 to 12 o´clock	00:02:45		2
141.20	0	bugs	00:03:20		1
158.20	210	scale/mineral deposits medium from 02 to 11 o´clock	00:03:52		2
163.30	0	inspection ends at downstream manhole / ROACH INFESTED	00:04:05		0

Street :
Tel:
Fax:
Email:

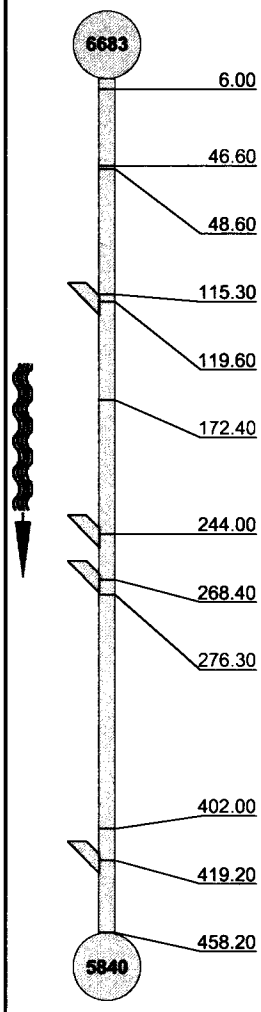
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**15**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6683**
Street 2:		Map # 2 :		To MH :	**5840**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**458.20 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:1110 Position	Code	Observation	MPEG	Photo	Rate
6.00	0	inspection begins at upstream manhole	00:00:01		0
46.60	0	bugs	00:01:05		1
48.60	210	scale/mineral deposits medium from 01 to 11 o´clock	00:01:07		2
115.30	210	scale/mineral deposits medium from 01 to 11 o´clock	00:02:39		2
119.60	0	service connection, at 01 o´clock	00:02:50		0
172.40	0	bugs	00:04:07		1
244.00	260	intruding service connection, at 02 o´clock	00:06:01		2
268.40	0	service connection capped, at 02 o´clock	00:06:44		0
276.30	0	bugs	00:06:56		1
402.00	210	scale/mineral deposits medium from 01 to 11 o´clock	00:10:06		2
419.20	0	service connection, at 02 o´clock	00:10:36		0
458.20	0	inspection ends at downstream manhole / ROACH INFESTED	00:11:41		0

Street :
Tel:
Fax:
Email:

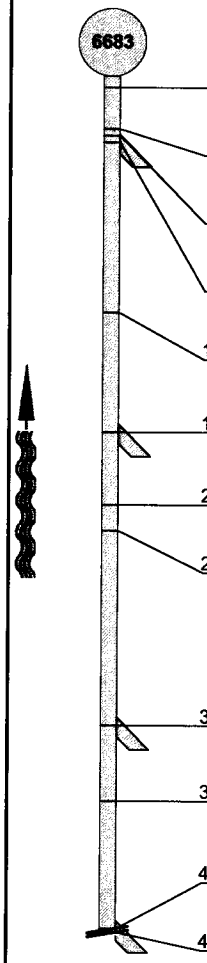
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**16**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANNY ROMO**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6683**
Street 2:		Map # 2 :		To MH :	**4213**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**440.10 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:1065 Position	Code	Observation	MPEG	Photo	Rate
6.10	0	inspection begins at downstream manhole / ROACH INFESTED	00:00:01		0
27.20	0	bugs	00:00:31		1
30.80	210	scale/mineral deposits medium from 12 to 11 o´clock	00:00:34		2
34.30	0	service connection, at 09 o´clock / ROACHES	00:00:45		0
121.70	210	scale/mineral deposits medium from 01 to 12 o´clock	00:02:59		2
183.20	0	service connection, at 10 o´clock	00:04:38		0
220.50	210	scale/mineral deposits medium from 01 to 12 o´clock	00:05:40		2
233.90	0	bugs	00:06:04		1
333.60	0	service connection capped, at 11 o´clock	00:09:05		0
372.90	210	scale/mineral deposits medium from 01 to 12 o´clock	00:10:17		2
438.40	260	intruding service connection, at 09 o´clock	00:12:13	16_11A	2
440.10	0	camera blocked, inspection abandoned	00:12:32		0

Street :
Tel:
Fax:
Email:

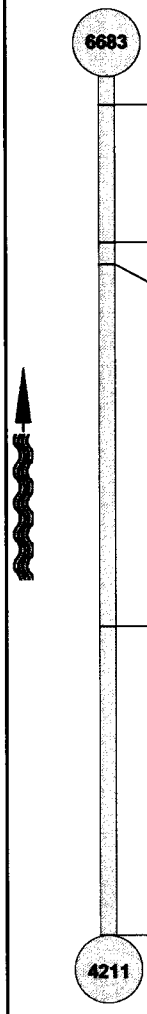
Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**17**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Inspector's Name **DANNY ROMO**

Street 1 :	**CAMPBELL**	Map # 1 :		From MH :	**6683**
Street 2:		Map # 2 :		To MH :	**4211**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**149.50 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:360 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:04		0
28.90	0	bugs	00:00:57		1
32.70	210	scale/mineral deposits medium from 02 to 10 o´clock	00:01:01		2
95.70	0	bugs	00:02:07		1
149.50	0	inspection ends at upstream manhole / ROACH INFESTED	00:03:29		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: CONCRETE MATERIAL

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**18**	**CONCRETE MATERIAL**
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Inspector's Name **DANNY ROMO**

Street 1 :	**OLD LITCHFIELD**	Map # 1 :		From MH :	**5840**
Street 2:		Map # 2 :		To MH :	**5839**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**154.80 ft**
Insp. method :	**CCTV**	Media # :	**190513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:375 Position	Code	Observation	MPEG	Photo	Rate
5840					
5.10	0	inspection begins at downstream manhole	00:00:01		0
75.10	0	sag begins	00:01:24		1
95.60	0	sag ends	00:01:49		0
154.80	0	inspection ends at upstream manhole	00:02:58		0
5839					

Street :
Tel:
Fax:
Email:

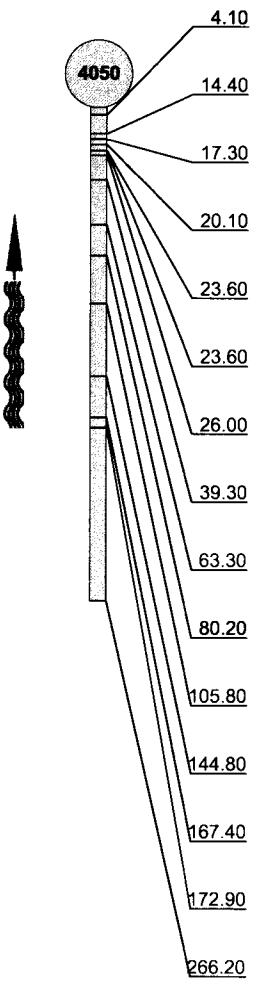
Inspection Report / Inspection: GOLF COURSE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**1**	**GOLF COURSE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**ACACIA**	Map # 1 :		From MH :	**4050**
Street 2:		Map # 2 :		To MH :	**6676**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**268.70 ft**
Insp. method :	**CCTV**	Media # :	**010613_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:1116 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole / ROOTS LIGHT	00:00:02		0
14.40	130	roots light	00:00:40		1
17.30	130	roots light	00:00:47		1
20.10	130	roots light	00:00:53		1
23.60	130	roots light	00:01:00		1
23.60	130	erosion light	00:01:02		1
26.00	130	roots light	00:01:08		1
39.30	0	bugs	00:01:24		1
63.30	500	pipe broken at joint, at 12 o'clock / LOOKS LIKE IT HAS BEEN REPAIRED	00:02:04		3
80.20	230	erosion medium	00:02:27		2
105.80	130	roots light	00:03:07		1
144.80	130	roots light	00:04:00		1
167.40	130	roots light	00:04:30		1
172.90	130	erosion light	00:04:38		1
266.20	310	Debris / ROCKS	00:06:49		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: GOLF COURSE

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**1**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1116 Position	Code	Observation	MPEG	Photo	Rate
268.70	0	camera blocked, inspection abandoned	00:07:06		0

Street :
Tel:
Fax:
Email:

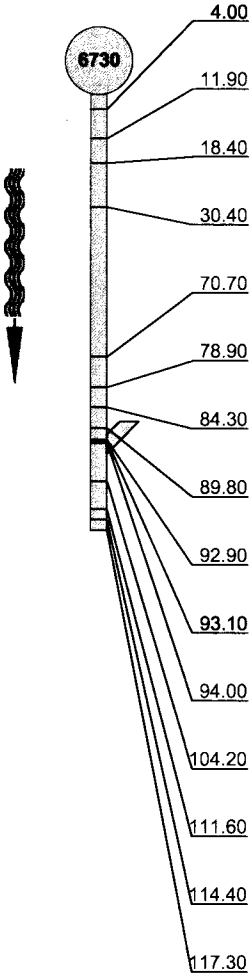
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**1**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**DESERT**	Map # 1 :		From MH :	**6730**
Street 2:		Map # 2 :		To MH :	**6731**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**129.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

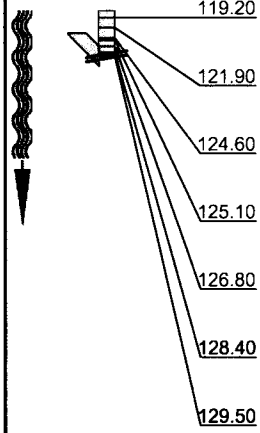


1:558 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:01		0
11.90	300	Circumferential Crack at joint, from 10 to 12 o´clock	00:00:37		3
18.40	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:01:07		3
30.40	300	Circumferential Crack at joint, from 12 to 03 o´clock	00:01:33		3
70.70	300	Circumferential Crack at joint, from 12 to 02 o´clock	00:02:39		3
78.90	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:03:03		3
84.30	400	Multiple Cracks at joint, from 07 to 01 o´clock	00:03:22		3
89.80	400	Multiple Cracks at joint, from 07 to 05 o´clock	00:03:40		3
92.90	400	Multiple Cracks at joint, from 07 to 05 o´clock	00:03:59		3
93.10	0	service connection, at 09 o´clock	00:04:09		0
94.00	300	Circumferential Crack at joint, from 01 to 03 o´clock	00:04:23		3
104.20	300	Circumferential Crack at joint, from 12 to 04 o´clock	00:04:47		3
111.60	300	Circumferential Crack at joint, from 02 to 04 o´clock	00:05:06		3
114.40	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:05:23		3
117.30	300	Circumferential Crack at joint, from 01 to 04 o´clock	00:05:36		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: LA LOMA

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/31/2013		sunny, dry	EDDIE	1	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:558 Position	Code	Observation	MPEG	Photo	Rate
119.20	400	Multiple Cracks at joint, from 07 to 05 o´clock	00:05:50		3
121.90	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:06:04		3
124.60	300	Circumferential Crack at joint, from 07 to 10 o´clock	00:06:21		3
125.10	0	Hole in pipe at 01 o´clock	00:06:33	1_19A	3
126.80	400	Multiple Cracks at joint, from 12 to 05 o´clock	00:06:50		3
128.40	260	intruding service connection, at 03 o´clock	00:07:00	1_21A	2
129.50	0	camera blocked, inspection abandoned	00:07:19		0

Street :
Tel:
Fax:
Email:

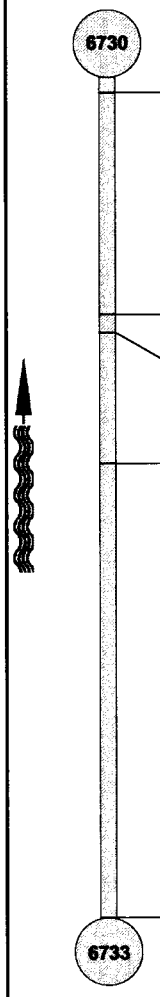
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**2**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**HONEYSUCKLE**	Map # 1 :		From MH :	**6730**
Street 2:		Map # 2 :		To MH :	**6733**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**213.10 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:525 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:02		0
60.00	0	sag begins	00:01:18		1
64.60	0	camera under water	00:01:33		1
97.90	0	camera out of water	00:02:20		0
213.10	0	inspection ends at downstream manhole	00:04:49		0

Street :
Tel:
Fax:
Email:

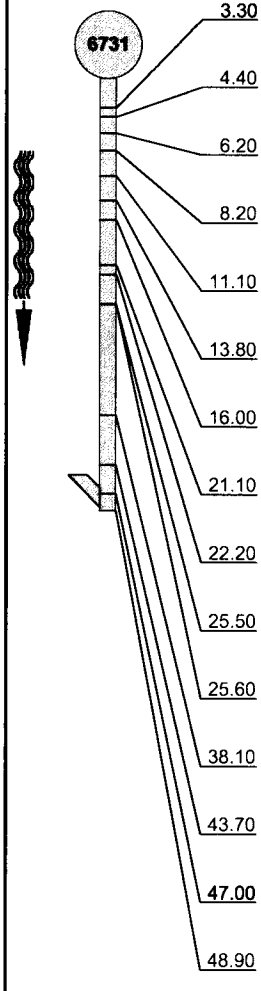
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**3**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**DESERT**	Map # 1 :		From MH :	**6731**
Street 2:		Map # 2 :		To MH :	**5842**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**51.90 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:234 Position	Code	Observation	MPEG	Photo	Rate
3.30	0	inspection begins at upstream manhole	00:00:01		0
4.40	400	Multiple Cracks at joint, from 08 to 04 o´clock	00:00:15		3
6.20	300	Circumferential Crack at joint, from 08 to 11 o´clock	00:00:25		3
8.20	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:00:45		3
11.10	400	Multiple Cracks at joint, from 06 to 05 o´clock	00:01:03		3
13.80	400	Multiple Cracks at joint, from 07 to 05 o´clock	00:01:22		3
16.00	300	Circumferential Crack at joint, from 07 to 05 o´clock	00:01:40		3
21.10	400	Multiple Cracks at joint, from 08 to 01 o´clock	00:02:02		3
22.20	0	Hole in pipe at 11 o´clock	00:02:14		3
25.50	0	Hole in pipe at 12 o´clock	00:02:28		3
25.60	400	Multiple Cracks at joint, from 07 to 05 o´clock	00:02:41		3
38.10	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:03:19		3
43.70	300	Circumferential Crack at joint, from 08 to 02 o´clock	00:03:38		3
47.00	0	service connection, at 03 o´clock	00:03:51		0
48.90	300	Circumferential Crack at joint, from 06 to 05 o´clock	00:04:10		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: LA LOMA

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**3**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:234	Position	Code	Observation	MPEG	Photo	Rate
	51.90	0	camera blocked, inspection abandoned / ROCKS	00:04:35		0

Street :
Tel:
Fax:
Email:

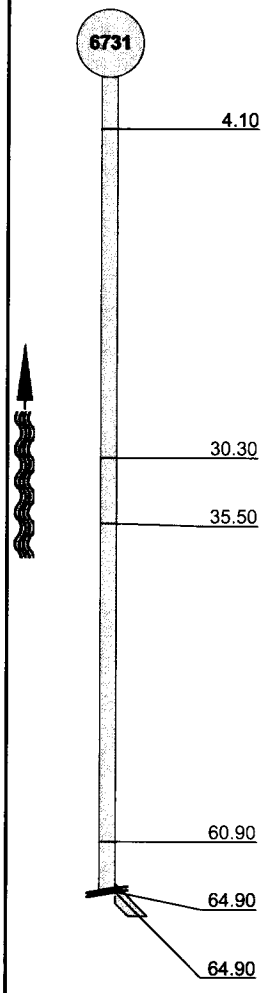
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**4**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**DESERT**	Map # 1 :		From MH :	**6731**
Street 2:		Map # 2 :		To MH :	**6730**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**64.90 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:165 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:01		0
30.30	400	Multiple Cracks at joint, from 08 to 04 o´clock	00:00:56		3
35.50	300	Circumferential Crack at joint, from 07 to 05 o´clock	00:01:23		3
60.90	300	Circumferential Crack at joint, from 11 to 02 o´clock	00:02:08		3
64.90	260	intruding service connection, at 09 o´clock	00:02:21		2
64.90	0	camera blocked, inspection abandoned	00:02:25		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**5**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**HONEYSUCKLE**	Map # 1 :		From MH :	**6733**
Street 2:		Map # 2 :		To MH :	**6733 A**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**126.70 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

1:315 Position	Code	Observation	MPEG	Photo	Rate
6733					
4.00	0	inspection begins at upstream manhole	00:00:03		0
55.20	0	Hole in pipe at 08 o´clock	00:01:18	5_2A	3
60.90	0	Hole in pipe at 08 o´clock	00:02:01	5_3A	3
70.20	0	Hole in pipe at 08 o´clock	00:02:44	5_4A	3
86.20	0	Hole in pipe at 08 o´clock	00:03:41		3
89.90	430	erosion heavy	00:03:59		3
92.90	0	Hole in pipe at 09 o´clock	00:04:05		3
101.20	430	erosion heavy	00:04:33		3
110.90	0	Hole in pipe at 08 o´clock	00:05:03	5_9A	3
117.20	430	erosion heavy	00:05:18		3
122.40	0	Hole in pipe at 08 o´clock	00:05:33		3
126.60	0	Hole in pipe at 09 o´clock	00:05:46		3
126.70	0	camera blocked, inspection abandoned	00:05:48		0

Street :
Tel:
Fax:
Email:

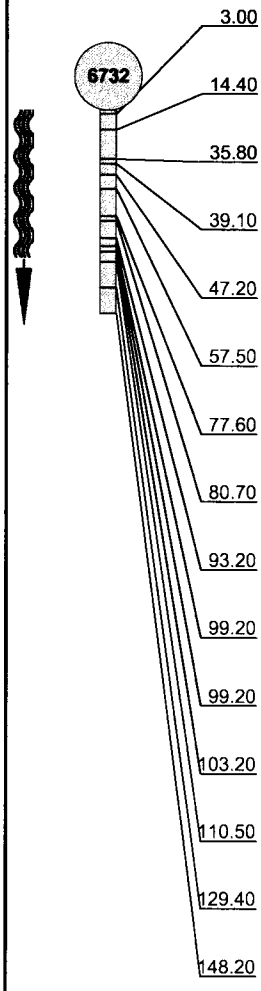
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**6**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**LA LOMA**	Map # 1 :		From MH :	**6732**
Street 2:		Map # 2 :		To MH :	**6733**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**423.80 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :

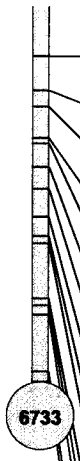


1:1512 Position	Code	Observation	MPEG	Photo	Rate
3.00	0	inspection begins at upstream manhole	00:00:01		0
14.40	230	erosion medium	00:00:23		2
35.80	230	erosion medium	00:00:55		2
39.10	0	Hole in pipe at 04 o´clock	00:01:09		3
47.20	0	Hole in pipe at 04 o´clock	00:01:33	6_5A	3
57.50	430	corrosion heavy	00:02:02		3
77.60	0	Hole in pipe at 04 o´clock	00:02:37		3
80.70	430	erosion heavy	00:02:49		3
93.20	0	Hole in pipe at 04 o´clock	00:03:11		3
99.20	0	Hole in pipe at 04 o´clock	00:03:36		3
99.20	430	erosion heavy	00:03:38		3
103.20	0	Hole in pipe at 04 o´clock	00:03:55		3
110.50	0	Hole in pipe at 03 o´clock	00:04:18		3
129.40	430	erosion heavy	00:04:53		3
148.20	430	erosion heavy	00:05:23		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: LA LOMA

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
6/1/2013		sunny, dry	EDDIE	6	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
186.50	430	erosion heavy	00:06:20		3
211.10	500	pipe broken at joint, at 03 o´clock	00:07:01		3
223.00	500	pipe broken at joint, at 03 o´clock	00:07:28		3
246.00	430	erosion heavy	00:08:01		3
249.90	500	pipe broken at joint, at 03 o´clock	00:08:16		3
267.10	0	Hole in pipe at 04 o´clock	00:08:48		3
283.70	500	pipe broken at joint, at 03 o´clock	00:09:23		3
304.00	0	Hole in pipe at 04 o´clock	00:10:04		3
317.90	0	Hole in pipe at 04 o´clock	00:10:30		3
323.20	430	erosion heavy	00:10:41		3
363.50	0	Hole in pipe at 04 o´clock	00:11:39		3
368.40	0	Hole in pipe at 04 o´clock	00:11:54		3
375.30	430	erosion heavy	00:12:08		3
416.70	430	erosion heavy	00:13:03		3
423.80	0	inspection ends at downstream manhole	00:13:17		0

Street :
Tel:
Fax:
Email:

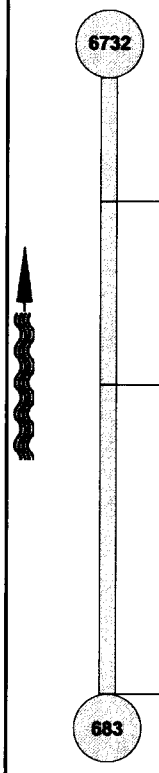
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**7**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**LA LOMA**	Map # 1 :		From MH :	**6732**
Street 2:		Map # 2 :		To MH :	**683**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**14.90 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**concrete**
		Lining :	

Remarks :



1:50 Position	Code	Observation	MPEG	Photo	Rate
3.00	0	inspection begins at downstream manhole	00:00:01		0
7.40	430	erosion heavy	00:00:14		3
14.90	0	inspection ends at upstream manhole	00:00:30		0

Street :
Tel:
Fax:
Email:

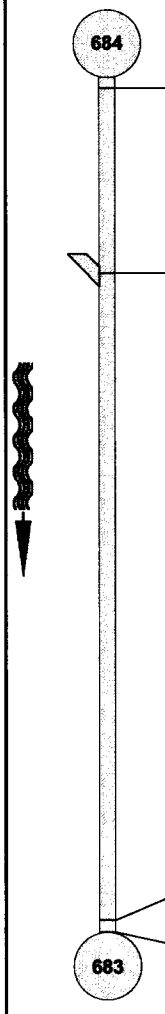
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**8**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**LA LOMA**	Map # 1 :		From MH :	**684**
Street 2:		Map # 2 :		To MH :	**683**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**328.10 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:795 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at upstream manhole	00:00:01		0
74.90	0	service connection, at 03 o´clock	00:01:30		0
323.40	300	Circumferential Crack at joint, from 11 to 01 o´clock	00:06:34		3
328.10	0	inspection ends at downstream manhole	00:06:46		0

Street :
Tel:
Fax:
Email:

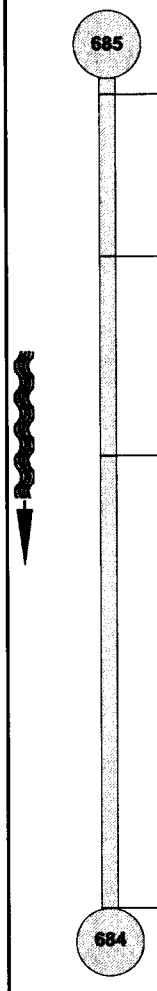
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**9**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**LA LOMA**	Map # 1 :		From MH :	**685**
Street 2:		Map # 2 :		To MH :	**684**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**150.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:375 Position	Code	Observation	MPEG	Photo	Rate
3.00	0	inspection begins at upstream manhole	00:00:01		0
32.30	210	debris grease medium from 05 to 07 o´clock	00:00:38		2
68.40	210	debris grease medium from 05 to 07 o´clock	00:01:23		2
150.50	0	inspection ends at downstream manhole	00:02:59		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**10**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM BLVD**	Map # 1 :		From MH :	**5842**
Street 2:		Map # 2 :		To MH :	**5843**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**193.00 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:465 Position	Code	Observation	MPEG	Photo	Rate
5842					
4.10	0	inspection begins at upstream manhole	00:00:01		0
170.30	0	service connection, at 02 o´clock	00:03:11		0
193.00	0	inspection ends at downstream manhole	00:03:42		0
5843					

Street :
Tel:
Fax:
Email:

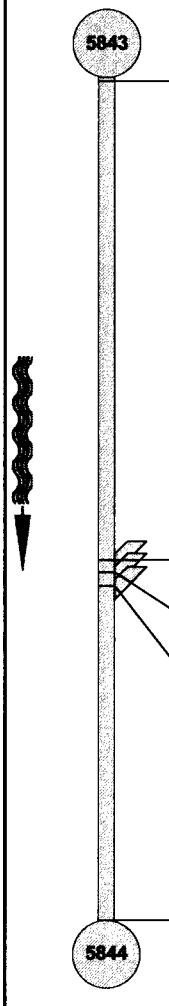
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**11**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM BLVD**	Map # 1 :		From MH :	**5843**
Street 2:		Map # 2 :		To MH :	**5844**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**195.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:480 Position	Code	Observation	MPEG	Photo	Rate
1.00	0	inspection begins at upstream manhole	00:00:01		0
111.80	0	service connection, at 09 o´clock	00:02:14		0
114.70	0	service connection, at 10 o´clock	00:02:25		0
117.80	0	service connection, at 10 o´clock	00:02:36		0
195.50	0	inspection ends at downstream manhole	00:04:29		0

Street :
Tel:
Fax:
Email:

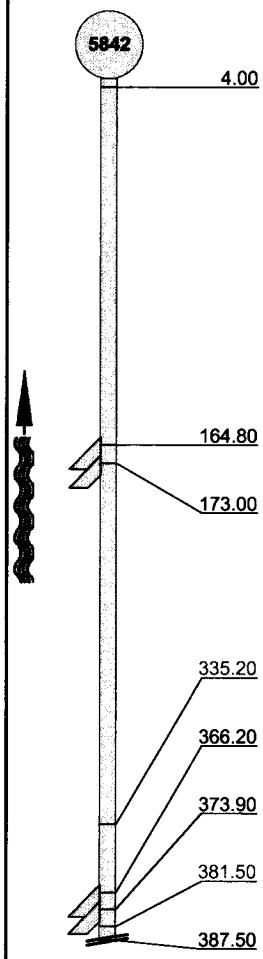
Inspection Report / Inspection: LA LOMA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/1/2013		**sunny, dry**	**EDDIE**	**12**	**LA LOMA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM BLVD**	Map # 1 :		From MH :	**5842**
Street 2:		Map # 2 :		To MH :	**5841**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**387.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:930 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
164.80	0	service connection, at 02 o´clock	00:03:16		0
173.00	0	service connection, at 02 o´clock	00:03:30		0
335.20	310	Debris / MUD	00:06:59		3
366.20	0	service connection, at 02 o´clock	00:07:48		0
373.90	0	service connection, at 03 o´clock	00:08:01		0
381.50	310	Debris / MUD HEAVY	00:08:13	12_7A	3
387.50	0	camera blocked, inspection abandoned	00:08:30		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**1**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM**	Map # 1 :		From MH :	**5867**
Street 2:		Map # 2 :		To MH :	**5868**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**57.30 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:150	Position	Code	Observation	MPEG	Photo	Rate
5867						
	5.10	0	inspection begins at upstream manhole	00:00:02		0
	57.30	0	camera blocked, inspection abandoned	00:01:32		0

Street :
Tel:
Fax:
Email:

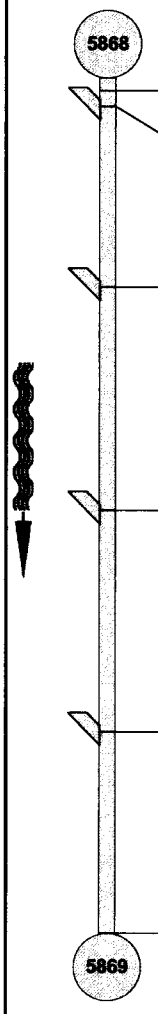
Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**2**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM**	Map # 1 :		From MH :	**5868**
Street 2:		Map # 2 :		To MH :	**5869**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**322.50 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**HDEP**
		Lining :	

Remarks :



1:780 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at upstream manhole	00:00:03		0
10.70	0	service connection, at 02 o´clock	00:00:36		0
78.70	0	service connection, at 03 o´clock	00:01:59		0
162.90	0	service connection, at 03 o´clock	00:03:49		0
246.40	0	service connection, at 03 o´clock	00:05:51		0
322.50	0	inspection ends at downstream manhole	00:07:56		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**3**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM**	Map # 1 :		From MH :	**5869**
Street 2:		Map # 2 :		To MH :	**5856**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**3.60 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**HDPE**
		Lining :	

Remarks :

1:50 Position	Code	Observation	MPEG	Photo	Rate
5869					
2.00	0	inspection begins at upstream manhole	00:00:01		0
3.60	0	camera blocked, inspection abandoned / MISALIGN JOINT	00:00:52		0

Street :
Tel:
Fax:
Email:

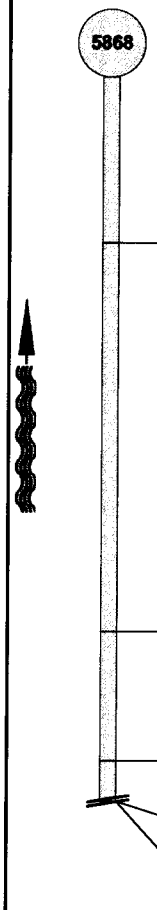
Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**4**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM**	Map # 1 :		From MH :	**5868**
Street 2:		Map # 2 :		To MH :	**5867**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**17.50 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**HDPE**
		Lining :	

Remarks :



1:50 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
13.40	0	pipe material changes at this point to polyvinyl chlorid / PVC	00:00:33		0
16.50	0	sag begins	00:01:03		1
17.50	0	camera under water	00:01:10		1
17.50	0	camera blocked, inspection abandoned	00:01:12		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**5**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2177**
Street 2:		Map # 2 :		To MH :	**2178**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**179.30 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**HDPE**
		Lining :	

Remarks :

1:435 Position	Code	Observation	MPEG	Photo	Rate
2177					
5.00	0	inspection begins at upstream manhole	00:00:06		0
33.40	210	debris grease medium from 05 to 07 o´clock	00:00:33		2
114.20	210	debris grease medium from 04 to 08 o´clock	00:02:10		2
179.30	0	camera blocked, inspection abandoned / ROCKS	00:03:39		0

Street :
Tel:
Fax:
Email:

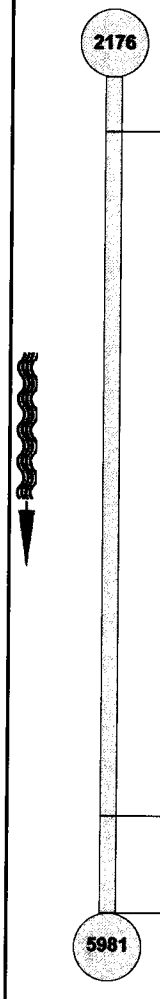
Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**6**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2176**
Street 2:		Map # 2 :		To MH :	**5981**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**60.70 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:150 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:02		0
53.60	0	pipe material changes at this point to ceramics / VCP	00:01:02		0
60.70	0	inspection ends at downstream manhole	00:01:18		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**7**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**5981**
Street 2:		Map # 2 :		To MH :	**2177**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**91.90 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:225 Position	Code	Observation	MPEG	Photo	Rate
5981					
1.90	0	inspection begins at upstream manhole	00:00:01		0
91.90	0	inspection ends at downstream manhole	00:01:41		0
2177					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**8**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2174**
Street 2:		Map # 2 :		To MH :	**2175**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**353.90 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:855 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:03		0
27.60	0	service connection, at 02 o´clock	00:00:41		0
353.90	0	inspection ends at downstream manhole	00:07:07		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**9**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2175**
Street 2:		Map # 2 :		To MH :	**2176**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**330.50 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:795 Position	Code	Observation	MPEG	Photo	Rate
2175					
1.00	0	inspection begins at upstream manhole	00:00:03		0
330.50	0	inspection ends at downstream manhole	00:07:50		0
2176					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**10**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2174**
Street 2:		Map # 2 :		To MH :	**5848**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**189.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:465 Position	Code	Observation	MPEG	Photo	Rate
2174					
4.00	0	inspection begins at downstream manhole	00:00:02		0
137.70	0	camera under water	00:02:47		1
160.50	0	service connection, at 03 o'clock	00:03:33		0
189.10	0	inspection ends at upstream manhole	00:04:24		0
5848					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**11**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**5848**
Street 2:		Map # 2 :		To MH :	**5857**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**22.50 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:60	Position	Code	Observation	MPEG	Photo	Rate
5848						
	1.20	0	inspection begins at downstream manhole	00:00:01		0
	22.50	0	inspection ends at upstream manhole	00:00:57		0
5857						

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**12**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**2172**
Street 2:		Map # 2 :		To MH :	**2171**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**305.00 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:735 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:01		0
4.10	210	debris grease medium from 03 to 09 o´clock	00:00:02		2
11.00	230	roots medium	00:00:18		2
14.50	130	roots light	00:00:40		1
29.30	230	roots medium	00:00:59		2
103.20	210	debris grease medium from 04 to 08 o´clock	00:02:42		2
167.30	210	debris grease medium from 04 to 08 o´clock	00:03:56		2
231.10	210	debris grease medium from 02 to 10 o´clock	00:05:11		2
282.50	210	debris grease medium from 02 to 10 o´clock	00:06:14		2
305.00	0	inspection ends at downstream manhole	00:06:46		0

Street :
Tel:
Fax:
Email:

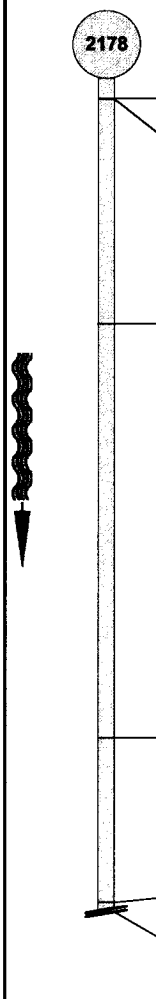
Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**13**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2178**
Street 2:		Map # 2 :		To MH :	**2186**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**169.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:420 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at upstream manhole	00:00:02		0
4.30	210	debris grease medium from 03 to 09 o´clock	00:00:04		2
49.70	210	debris grease medium from 02 to 10 o´clock	00:01:05		2
133.70	210	debris grease medium from 03 to 09 o´clock	00:02:36		2
167.20	310	Debris	00:03:27		3
169.10	0	camera blocked, inspection abandoned / GRAVEL	00:03:51		0

Street :
Tel:
Fax:
Email:

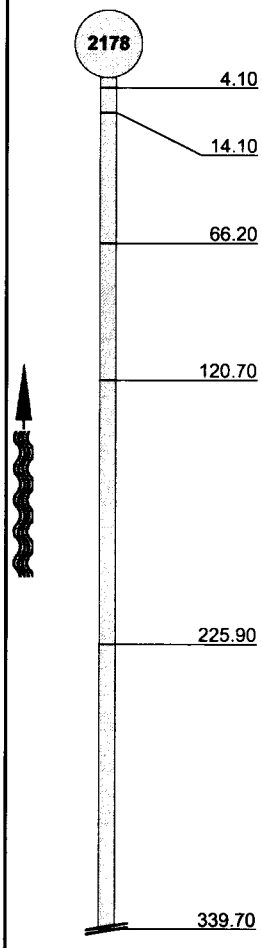
Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**14**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**NEOLIN**	Map # 1 :		From MH :	**2178**
Street 2:		Map # 2 :		To MH :	**2177**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**339.70 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:825 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:01		0
14.10	210	debris grease medium from 04 to 08 o´clock	00:00:15		2
66.20	210	debris grease medium from 03 to 09 o´clock	00:01:33		2
120.70	210	debris grease medium from 03 to 09 o´clock	00:03:04		2
225.90	210	debris grease medium from 03 to 09 o´clock	00:05:51		2
339.70	0	camera blocked, inspection abandoned	00:08:32		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: NEOLIN TRUNK

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
6/4/2013		**sunny, dry**	**EDDIE**	**15**	**NEOLIN TRUNK**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**2171**
Street 2:		Map # 2 :		To MH :	**2186**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**42.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**12.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:105	Position	Code	Observation	MPEG	Photo	Rate
2171						
	6.10	0	inspection begins at downstream manhole	00:00:01		0
	32.30	0	camera under water	00:00:36		1
	42.10	0	camera blocked, inspection abandoned	00:00:52		0

Street :
Tel:
Fax:
Email:

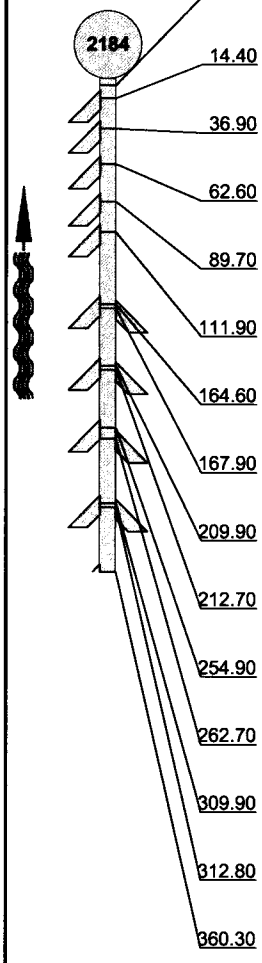
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**1**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**BAHIA E**	Map # 1 :		From MH :	**2184**
Street 2:		Map # 2 :		To MH :	**4193**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**396.80 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:1512 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:01		0
14.40	0	service connection, at 02 o´clock	00:00:21		0
36.90	0	service connection, at 02 o´clock	00:00:48		0
62.60	0	service connection, at 03 o´clock	00:01:18		0
89.70	0	service connection, at 02 o´clock	00:01:50		0
111.90	0	service connection, at 02 o´clock	00:02:18		0
164.60	0	service connection, at 02 o´clock	00:03:22		0
167.90	0	service connection, at 10 o´clock	00:03:34		0
209.90	0	service connection, at 02 o´clock	00:04:23		0
212.70	0	service connection, at 09 o´clock	00:04:31		0
254.90	0	service connection, at 03 o´clock	00:05:23		0
262.70	0	service connection, at 09 o´clock	00:05:37		0
309.90	0	service connection, at 03 o´clock	00:06:38		0
312.80	0	service connection, at 09 o´clock	00:06:45		0
360.30	0	service connection, at 03 o´clock	00:07:48		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**1**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1512 Position	Code	Observation	MPEG	Photo	Rate
362.50	0	service connection, at 09 o´clock	00:08:05		0
396.80	0	inspection ends at upstream manhole	00:09:01		0

Street :
Tel:
Fax:
Email:

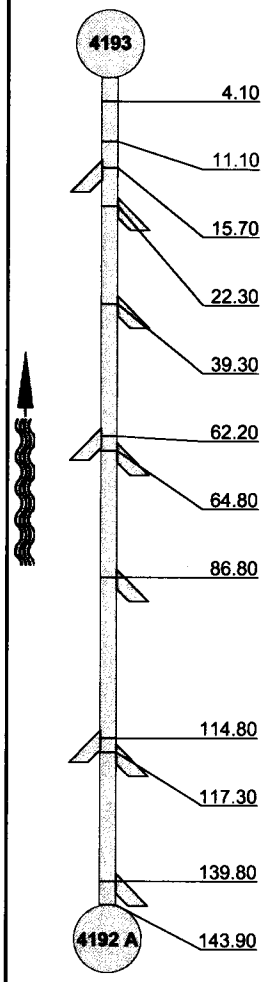
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		sunny, dry	EDDIE	2	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	BAHIA E	Map # 1 :		From MH :	4193
Street 2:		Map # 2 :		To MH :	4192 A
City :	LITCHFIELD PARK	VCR # :		Section length :	143.90 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :



1:360 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:01		0
11.10	210	debris grease medium from 04 to 08 o´clock	00:00:11		2
15.70	0	service connection, at 03 o´clock	00:00:20		0
22.30	0	service connection, at 09 o´clock	00:00:33		0
39.30	0	service connection, at 09 o´clock	00:00:57		0
62.20	0	service connection, at 03 o´clock	00:01:29		0
64.80	0	service connection, at 09 o´clock	00:01:37		0
86.80	0	service connection, at 09 o´clock	00:02:08		0
114.80	0	service connection, at 03 o´clock	00:02:48		0
117.30	0	service connection, at 09 o´clock	00:02:55		0
139.80	0	service connection, at 09 o´clock	00:03:26		0
143.90	0	inspection ends at upstream manhole	00:03:42		0

Street :
Tel:
Fax:
Email:

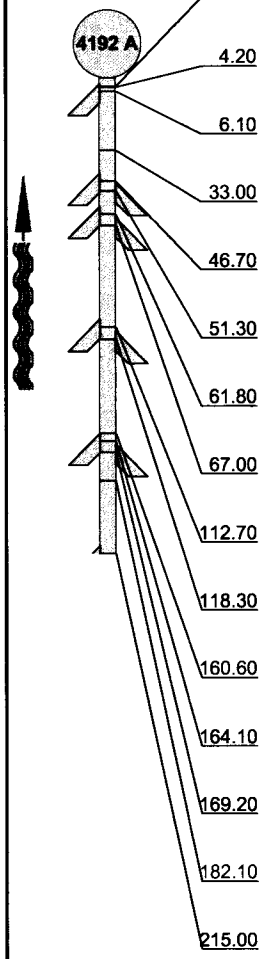
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**3**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**BAHIA E**	Map # 1 :		From MH :	**4192 A**
Street 2:		Map # 2 :		To MH :	**CO 4192**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**222.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:936 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole / CEMENT IN MH	00:00:01		0
4.20	210	debris grease medium from 03 to 09 o´clock	00:00:14		2
6.10	0	service connection capped, at 03 o´clock	00:00:23		0
33.00	210	debris grease medium from 04 to 08 o´clock	00:01:00		2
46.70	0	service connection, at 03 o´clock	00:01:18		0
51.30	0	service connection, at 09 o´clock	00:01:28		0
61.80	0	service connection, at 03 o´clock	00:01:45		0
67.00	0	service connection, at 09 o´clock	00:01:55		0
112.70	0	service connection, at 03 o´clock	00:02:56		0
118.30	0	service connection, at 09 o´clock	00:03:06		0
160.60	210	debris grease medium from 05 to 07 o´clock	00:04:01		2
164.10	0	service connection, at 03 o´clock	00:04:07		0
169.20	0	service connection, at 09 o´clock	00:04:18		0
182.10	0	bugs	00:04:36		1
215.00	0	service connection, at 03 o´clock	00:05:21		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**3**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:936 Position	Code	Observation	MPEG	Photo	Rate
220.70	0	service connection, at 09 o´clock	00:05:31		0
222.10	0	inspection ends at clean-out	00:05:40		0

Street :
Tel:
Fax:
Email:

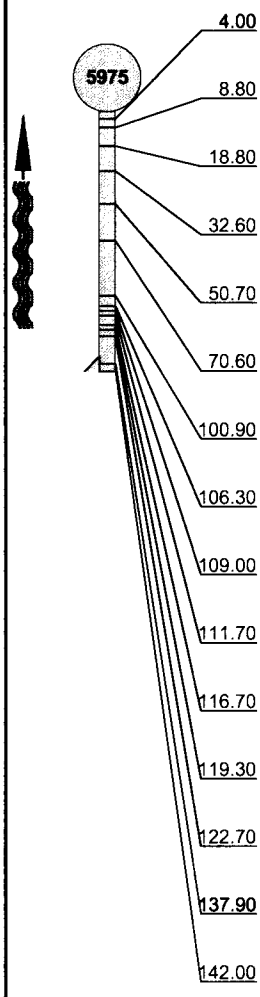
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**4**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**SAGEBRUSH**	Map # 1 :		From MH :	**5975**
Street 2:		Map # 2 :		To MH :	**5974**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**350.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:1134 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
8.80	400	Multiple Cracks at joint, from 08 to 04 o´clock	00:00:43		3
18.80	310	Debris / MUD MEDIUM	00:01:21		3
32.60	400	Multiple Cracks at joint, from 09 to 02 o´clock	00:01:54		3
50.70	400	Multiple Cracks at joint, from 09 to 02 o´clock	00:02:42		3
70.60	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:03:34		3
100.90	310	Debris / MUD	00:04:30		3
106.30	300	Circumferential Crack at joint, from 12 to 02 o´clock	00:04:46		3
109.00	400	Multiple Cracks at joint, from 08 to 03 o´clock	00:05:07		3
111.70	400	Multiple Cracks at joint, from 08 to 05 o´clock	00:05:25		3
116.70	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:05:50		3
119.30	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:06:11		3
122.70	310	Debris / MUD HEAVY	00:06:20		3
137.90	0	service connection, at 03 o´clock	00:06:51		0
142.00	400	Multiple Cracks at joint, from 11 to 02 o´clock	00:07:04		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

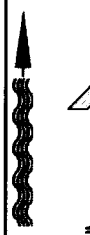
Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**4**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1134 Position	Code	Observation	MPEG	Photo	Rate
144.60	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:07:21		3
164.60	400	Multiple Cracks at joint, from 10 to 03 o´clock	00:08:07		3
172.20	400	Multiple Cracks at joint, from 10 to 02 o´clock	00:08:31		3
175.60	400	Multiple Cracks at joint, from 10 to 03 o´clock	00:08:51		3
178.50	400	Multiple Cracks at joint, from 10 to 03 o´clock	00:09:09		3
180.50	300	Circumferential Crack at joint, from 12 to 01 o´clock	00:09:23		3
185.70	400	Multiple Cracks at joint, from 10 to 02 o´clock	00:09:42		3
188.30	300	Circumferential Crack at joint, from 11 to 03 o´clock	00:10:05		3
190.20	300	Circumferential Crack at joint, from 09 to 02 o´clock	00:10:22		3
193.90	310	Debris / MUD MEDIUM	00:10:33		3
197.80	300	Circumferential Crack at joint, from 09 to 02 o´clock	00:10:56		3
203.10	300	Circumferential Crack at joint, from 09 to 02 o´clock	00:11:10		3
211.20	300	Circumferential Crack at joint, from 08 to 03 o´clock	00:11:32		3
217.90	400	Multiple Cracks at joint, from 09 to 03 o´clock	00:12:10		3
220.70	300	Circumferential Crack at joint, from 09 to 03 o´clock	00:12:20		3
225.80	300	Circumferential Crack at joint, from 09 to 03 o´clock	00:12:53		3
231.00	300	Circumferential Crack at joint, from 09 to 04 o´clock	00:13:17		3

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**4**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1134 Position	Code	Observation	MPEG	Photo	Rate
233.90	300	Circumferential Crack at joint, from 08 to 04 o´clock	00:13:34		3
236.30	300	Circumferential Crack at joint, from 01 to 02 o´clock	00:13:47		3
239.30	300	Circumferential Crack at joint, from 01 to 03 o´clock	00:14:07		3
241.30	400	Multiple Cracks at joint, from 12 to 03 o´clock	00:14:24		3
245.90	300	Circumferential Crack at joint, from 09 to 03 o´clock	00:14:48		3
268.90	300	Circumferential Crack at joint, from 09 to 04 o´clock	00:15:50		3
272.50	0	service connection, at 03 o´clock	00:16:03		0
284.80	310	Debris / MUD	00:16:34		3
315.70	310	Debris / MUD	00:17:36		3
330.10	400	Multiple Cracks at joint, from 10 to 03 o´clock	00:18:10		3
340.40	400	Multiple Cracks at joint, from 08 to 04 o´clock	00:18:42		3
350.10	0	camera blocked, inspection abandoned	00:19:10		0

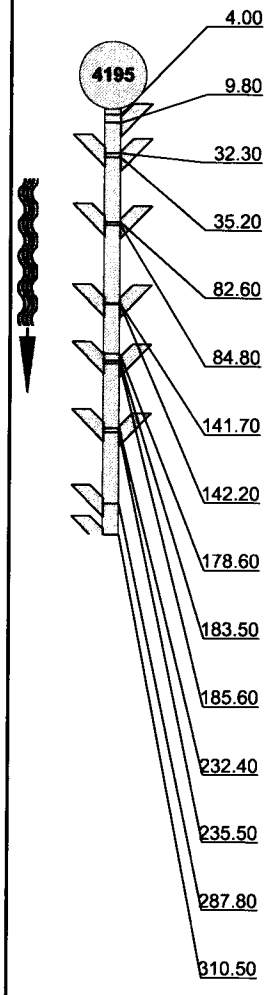
Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		sunny, dry	EDDIE	5	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	BAHIA LN W	Map # 1 :		From MH :	4195
Street 2:		Map # 2 :		To MH :	2183
City :	LITCHFIELD PARK	VCR # :		Section length :	397.20 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	
Reason of inspection :	gen. condition control			Pipe shape :	round
Section type :	waste			Pipe size :	8.00 inch
Area :				Pipe material :	VCP
				Lining :	

Remarks :

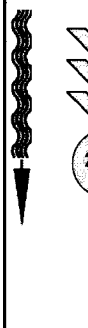


1:1512 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:02		0
9.80	0	service connection, at 09 o´clock	00:00:17		0
32.30	0	service connection, at 03 o´clock	00:00:57		0
35.20	0	service connection, at 09 o´clock	00:01:11		0
82.60	0	service connection, at 02 o´clock	00:02:11		0
84.80	0	service connection, at 09 o´clock	00:02:24		0
141.70	0	service connection, at 02 o´clock	00:03:31		0
142.20	0	service connection, at 09 o´clock	00:03:45		0
178.60	210	debris grease medium from 04 to 08 o´clock	00:04:32		2
183.50	0	service connection, at 03 o´clock	00:04:43		0
185.60	0	service connection, at 09 o´clock	00:04:55		0
232.40	0	service connection, at 03 o´clock	00:05:56		0
235.50	0	service connection, at 09 o´clock	00:06:08		0
287.80	0	service connection, at 03 o´clock	00:07:19		0
310.50	0	service connection, at 03 o´clock	00:07:55		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**5**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
338.00	0	service connection, at 03 o´clock / DIRT IN IT	00:08:39		0
360.60	0	service connection, at 03 o´clock	00:09:15		0
383.50	0	service connection, at 03 o´clock	00:10:05		0
394.00	300	Circumferential Crack at joint, from 10 to 01 o´clock	00:10:28		3
397.20	0	inspection ends at downstream manhole	00:10:40		0

Street :
Tel:
Fax:
Email:

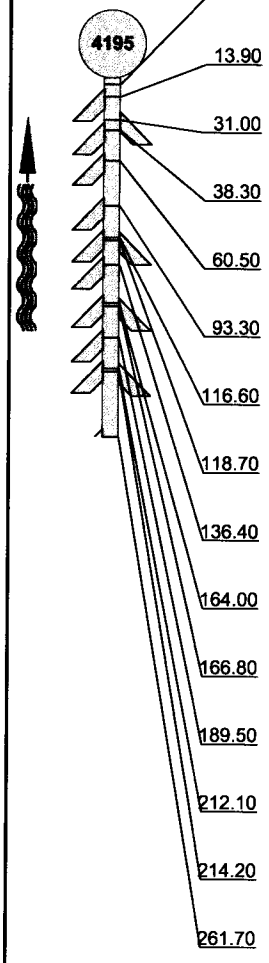
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		sunny, dry	EDDIE	6	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	BAHIA LN W	Map # 1 :		From MH :	4195
Street 2:		Map # 2 :		To MH :	4194
City :	LITCHFIELD PARK	VCR # :		Section length :	379.30 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :

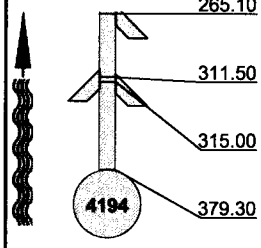


1:1512 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:02		0
13.90	0	service connection, at 03 o´clock	00:00:21		0
31.00	0	service connection, at 09 o´clock	00:00:49		0
38.30	0	service connection, at 03 o´clock	00:01:05		0
60.50	0	service connection, at 03 o´clock	00:01:39		0
93.30	0	service connection, at 03 o´clock	00:02:23		0
116.60	0	service connection, at 03 o´clock	00:02:54		0
118.70	0	service connection, at 09 o´clock	00:03:01		0
136.40	0	service connection, at 03 o´clock	00:03:25		0
164.00	0	service connection, at 03 o´clock	00:04:00		0
166.80	0	service connection, at 09 o´clock	00:04:08		0
189.50	0	service connection, at 03 o´clock	00:04:37		0
212.10	0	service connection, at 03 o´clock	00:05:07		0
214.20	0	service connection, at 09 o´clock	00:05:16		0
261.70	0	service connection, at 03 o´clock	00:06:20		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**6**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
265.10	0	service connection, at 09 o´clock	00:06:27		0
311.50	0	service connection, at 03 o´clock	00:07:29		0
315.00	0	service connection, at 09 o´clock	00:07:36		0
379.30	0	inspection ends at upstream manhole	00:09:06		0

Street :
Tel:
Fax:
Email:

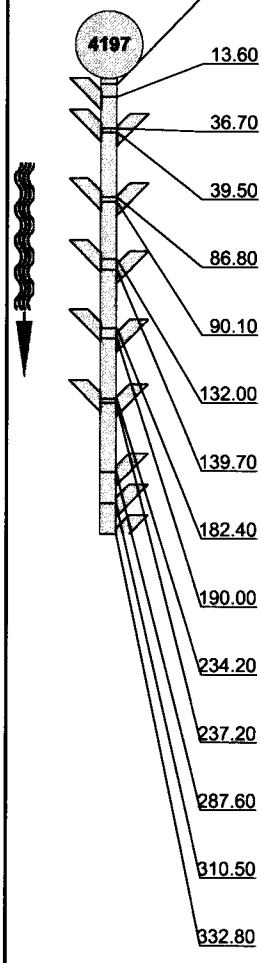
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**7**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA LN E**	Map # 1 :		From MH :	**4197**
Street 2:		Map # 2 :		To MH :	**2182**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**398.70 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

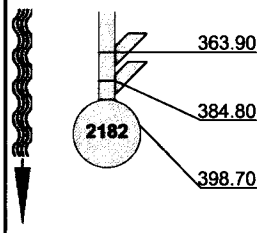


1:1512 Position	Code	Observation	MPEG	Photo	Rate
3.90	0	inspection begins at upstream manhole	00:00:01		0
13.60	0	service connection, at 03 o´clock	00:00:25		0
36.70	0	service connection, at 03 o´clock	00:01:04		0
39.50	0	service connection, at 09 o´clock	00:01:16		0
86.80	0	service connection, at 02 o´clock	00:02:16		0
90.10	0	service connection, at 09 o´clock	00:02:28		0
132.00	0	service connection, at 03 o´clock	00:03:22		0
139.70	0	service connection, at 09 o´clock	00:03:37		0
182.40	0	service connection, at 03 o´clock	00:04:36		0
190.00	0	service connection, at 09 o´clock	00:04:51		0
234.20	0	service connection, at 03 o´clock	00:05:54		0
237.20	0	service connection, at 09 o´clock	00:06:07		0
287.60	0	service connection, at 09 o´clock	00:07:13		0
310.50	0	service connection, at 10 o´clock	00:07:50		0
332.80	0	service connection, at 09 o´clock	00:08:24		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**7**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
363.90	0	service connection, at 09 o´clock	00:09:13		0
384.80	0	service connection, at 09 o´clock	00:09:51		0
398.70	0	inspection ends at downstream manhole	00:10:16		0

Street :
Tel:
Fax:
Email:

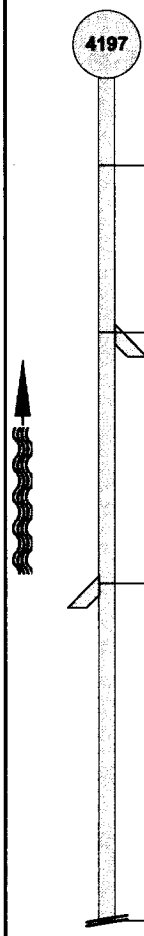
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**8**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Inspector's Name **DANIEL MARTINEZ**

Street 1 :	**LAGUNA LN E**	Map # 1 :		From MH :	**4197**
Street 2:		Map # 2 :		To MH :	**4196**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**42.70 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:105 Position	Code	Observation	MPEG	Photo	Rate
4.40	0	inspection begins at downstream manhole	00:00:02		0
12.90	0	service connection, at 09 o´clock	00:00:24		0
25.60	0	service connection, at 03 o´clock	00:00:44		0
42.70	0	camera blocked, inspection abandoned	00:01:16		0

Street :
Tel:
Fax:
Email:

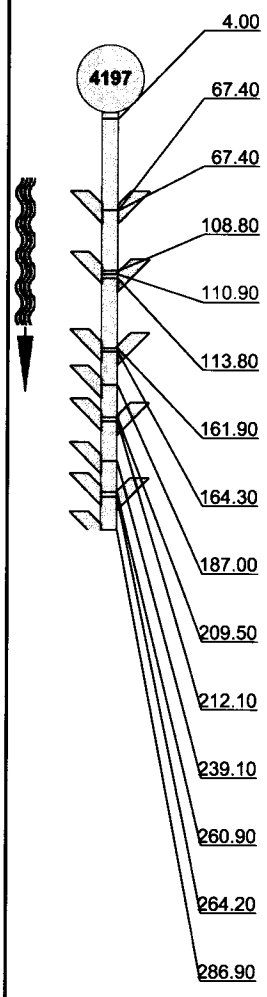
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		sunny, dry	EDDIE	9	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	LAGUNA LN E	Map # 1 :		From MH :	4197
Street 2:		Map # 2 :		To MH :	4196
City :	LITCHFIELD PARK	VCR # :		Section length :	327.00 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :



1:1422 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:01		0
67.40	0	service connection, at 03 o´clock	00:01:26		0
67.40	0	service connection, at 09 o´clock	00:01:40		0
108.80	0	service connection, at 03 o´clock	00:02:42		0
110.90	130	roots light	00:02:54		1
113.80	0	service connection, at 09 o´clock	00:03:03		0
161.90	0	service connection, at 03 o´clock	00:04:06		0
164.30	0	service connection, at 09 o´clock	00:04:18		0
187.00	0	service connection, at 03 o´clock	00:04:54		0
209.50	0	service connection, at 03 o´clock	00:05:29		0
212.10	0	service connection, at 09 o´clock	00:05:41		0
239.10	0	service connection, at 03 o´clock	00:06:20		0
260.90	0	service connection, at 03 o´clock	00:06:58		0
264.20	0	service connection, at 09 o´clock	00:07:10		0
286.90	0	service connection, at 03 o´clock	00:07:42		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**9**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1422 Position	Code	Observation	MPEG	Photo	Rate
314.30	0	service connection, at 03 o´clock	00:08:27		0
327.00	0	camera blocked, inspection abandoned / GRAVEL AND ROCKS	00:09:06		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**10**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA LN E**	Map # 1 :		From MH :	**4196**
Street 2:		Map # 2 :		To MH :	**5973**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**58.20 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:150	Position	Code	Observation	MPEG	Photo	Rate
4196						
	4.30	0	inspection begins at downstream manhole	00:00:01		0
	58.20	0	inspection ends at upstream manhole	00:01:25		0
5973						

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**11**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA DR W**	Map # 1 :		From MH :	**2187**
Street 2:		Map # 2 :		To MH :	**5971**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**51.00 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:135 Position	Code	Observation	MPEG	Photo	Rate
2187					
4.00	0	inspection begins at downstream manhole	00:00:02		0
51.00	0	inspection ends at upstream manhole	00:01:25		0
5971					

Street :
Tel:
Fax:
Email:

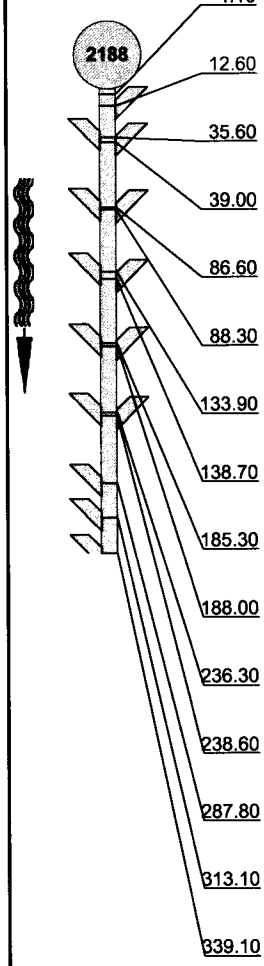
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**12**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Inspector's Name **DANIEL MARTINEZ**

Street 1 :	**LAGUNA DR W**	Map # 1 :		From MH :	**2188**
Street 2:		Map # 2 :		To MH :	**2185**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**399.00 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:1512 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at upstream manhole	00:00:01		0
12.60	160	service connection with grease, at 09 o´clock	00:00:22		1
35.60	0	service connection, at 03 o´clock	00:01:03		0
39.00	0	service connection, at 09 o´clock	00:01:16		0
86.60	0	service connection, at 03 o´clock	00:02:25		0
88.30	0	service connection, at 09 o´clock	00:02:38		0
133.90	0	service connection, at 03 o´clock	00:03:41		0
138.70	0	service connection, at 09 o´clock	00:03:56		0
185.30	0	service connection, at 03 o´clock	00:05:00		0
188.00	0	service connection, at 09 o´clock	00:05:11		0
236.30	0	service connection, at 03 o´clock	00:06:20		0
238.60	0	service connection, at 09 o´clock	00:06:31		0
287.80	0	service connection, at 03 o´clock	00:07:39		0
313.10	0	service connection, at 03 o´clock	00:08:26		0
339.10	0	service connection, at 03 o´clock	00:09:07		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**12**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	

1:1512 Position	Code	Observation	MPEG	Photo	Rate
363.80	0	service connection, at 03 o´clock	00:09:48		0
388.40	0	service connection, at 03 o´clock	00:10:29		0
399.00	0	inspection ends at downstream manhole / ROACH INFESTED	00:10:51		0

Street :
Tel:
Fax:
Email:

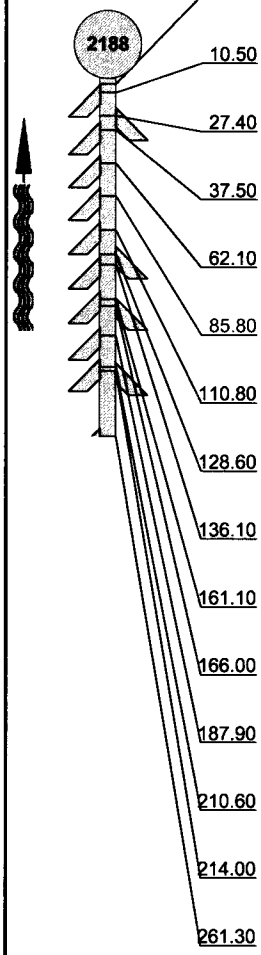
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**13**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA DR W**	Map # 1 :		From MH :	**2188**
Street 2:		Map # 2 :		To MH :	**2187**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**381.80 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

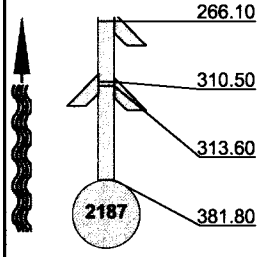


1:1512 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
10.50	0	service connection, at 03 o´clock	00:00:29		0
27.40	0	service connection, at 09 o´clock	00:00:55		0
37.50	0	service connection, at 03 o´clock	00:01:13		0
62.10	0	service connection, at 03 o´clock	00:01:50		0
85.80	160	service connection with grease, at 03 o´clock	00:02:28		1
110.80	0	service connection, at 03 o´clock	00:03:03		0
128.60	0	service connection, at 09 o´clock	00:03:29		0
136.10	0	service connection, at 03 o´clock	00:03:43		0
161.10	0	service connection, at 03 o´clock	00:04:19		0
166.00	0	service connection, at 09 o´clock	00:04:31		0
187.90	0	service connection, at 03 o´clock	00:05:06		0
210.60	0	service connection, at 03 o´clock	00:05:40		0
214.00	0	service connection, at 09 o´clock	00:05:50		0
261.30	0	service connection, at 03 o´clock	00:07:01		0

City :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date :	Job number :	Weather :	Operator :	Counter :	Section name :
5/20/2013		**sunny, dry**	**EDDIE**	**13**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				no	



1:1512 Position	Code	Observation	MPEG	Photo	Rate
266.10	0	service connection, at 09 o´clock	00:07:11		0
310.50	0	service connection, at 03 o´clock	00:08:16		0
313.60	0	service connection, at 09 o´clock	00:08:26		0
381.80	0	inspection ends at upstream manhole	00:10:07		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		sunny, dry	EDDIE	14	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	BAHIA LN S	Map # 1 :		From MH :	2183
Street 2:		Map # 2 :		To MH :	2184
City :	LITCHFIELD PARK	VCR # :		Section length :	258.50 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	PVC
		Lining :	

Remarks :

1:630 Position	Code	Observation	MPEG	Photo	Rate
2183					
4.00	0	inspection begins at upstream manhole	00:00:02		0
64.20	0	service connection, at 09 o´clock	00:01:19		0
85.90	0	service connection capped, at 09 o´clock	00:01:51		0
88.90	0	service connection, at 09 o´clock	00:02:02		0
112.20	300	Circumferential Crack at joint, from 06 to 08 o´clock	00:03:01		3
113.20	0	service connection, at 09 o´clock / DIRT IN IT	00:03:10		0
138.50	0	service connection, at 09 o´clock	00:03:49		0
162.80	0	service connection, at 09 o´clock	00:04:35		0
187.20	0	service connection, at 09 o´clock / DIRT IN IT	00:05:15		0
211.20	0	service connection, at 09 o´clock	00:05:55		0
246.60	0	service connection, at 09 o´clock / DIRT IN IT	00:07:09		0
258.50	0	camera blocked, inspection abandoned / DEBRIS	00:07:31		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**15**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA DR S**	Map # 1 :		From MH :	**2182**
Street 2:		Map # 2 :		To MH :	**2183**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**269.30 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:660 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:02		0
238.00	0	camera under water	00:05:37		1
248.50	330	roots heavy	00:06:26		3
269.30	0	inspection ends at downstream manhole	00:07:10		0

Street :
Tel:
Fax:
Email:

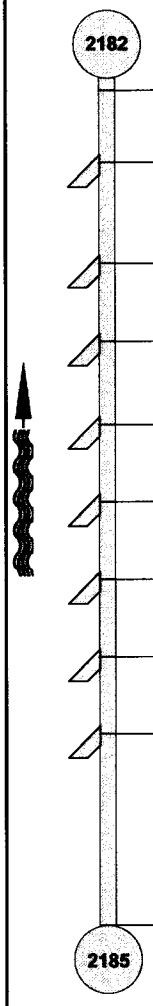
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		sunny, dry	EDDIE	16	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	LAGUNA DR S	Map # 1 :		From MH :	2182
Street 2:		Map # 2 :		To MH :	2185
City :	LITCHFIELD PARK	VCR # :		Section length :	270.00 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	PVC
		Lining :	

Remarks :



1:660 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
26.80	0	service connection, at 03 o´clock / DIRT IN IT	00:00:39		0
59.00	0	service connection, at 03 o´clock	00:01:22		0
83.90	0	service connection, at 03 o´clock / FULL OF DIRT	00:01:58		0
110.20	0	service connection, at 03 o´clock	00:02:39		0
134.90	0	service connection, at 03 o´clock	00:03:19		0
159.50	0	service connection, at 03 o´clock / DIRT IN IT	00:04:03		0
184.30	0	service connection, at 03 o´clock	00:04:44		0
208.80	0	service connection, at 03 o´clock	00:05:20		0
270.00	0	inspection ends at upstream manhole	00:06:49		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**17**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**LAGUNA DR S**	Map # 1 :		From MH :	**2185**
Street 2:		Map # 2 :		To MH :	**2181**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**240.20 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :

1:585 Position	Code	Observation	MPEG	Photo	Rate
2185					
1.10	0	inspection begins at downstream manhole	00:00:01		0
240.20	0	inspection ends at upstream manhole	00:05:51		0
2181					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		sunny, dry	EDDIE	18	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	OLD LITCHFIELD RD	Map # 1 :		From MH :	2179
Street 2:		Map # 2 :		To MH :	2180
City :	LITCHFIELD PARK	VCR # :		Section length :	386.10 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :

1:930 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at upstream manhole	00:00:01		0
71.00	0	service connection, at 09 o´clock	00:01:26		0
119.70	0	service connection, at 09 o´clock	00:02:36		0
173.30	0	service connection, at 03 o´clock	00:03:53		0
221.80	0	service connection, at 09 o´clock	00:04:56		0
273.60	0	service connection, at 09 o´clock	00:06:10		0
357.90	0	service connection, at 09 o´clock	00:08:16		0
386.10	0	inspection ends at downstream manhole / ROACH INFESTED	00:08:58		0

Street :
Tel:
Fax:
Email:

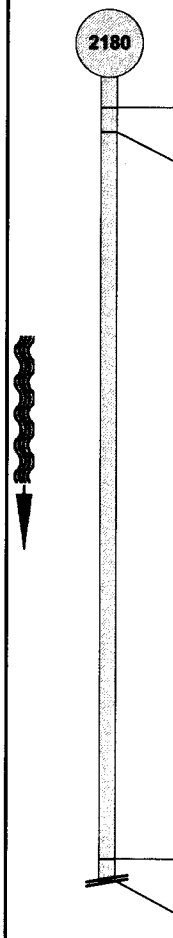
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**19**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**2180**
Street 2:		Map # 2 :		To MH :	**2181**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**29.10 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:75 Position	Code	Observation	MPEG	Photo	Rate
1.10	0	inspection begins at upstream manhole	00:00:01		0
2.00	0	Circumferential Crack, from 07 to 04 o´clock	00:00:20		2
28.30	310	Debris / ROCKS	00:01:12		3
29.10	0	camera blocked, inspection abandoned	00:01:28		0

Street :
Tel:
Fax:
Email:

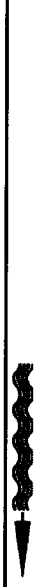
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**20**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**5965**
Street 2:		Map # 2 :		To MH :	**5966**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**379.00 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:915 Position	Code	Observation	MPEG	Photo	Rate
5965					
4.00	0	inspection begins at upstream manhole	00:00:01		0
84.30	0	service connection, at 03 o´clock	00:01:30		0
247.00	150	separated joint slight	00:04:32	20_3A	1
250.50	0	service connection, at 03 o´clock	00:04:54		0
379.00	0	inspection ends at downstream manhole	00:07:17		0
5966					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		sunny, dry	EDDIE	21	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	OLD LITCHFIELD RD	Map # 1 :		From MH :	5966
Street 2:		Map # 2 :		To MH :	6742A
City :	LITCHFIELD PARK	VCR # :		Section length :	17.80 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	PVC
		Lining :	

Remarks :

1:50 Position	Code	Observation	MPEG	Photo	Rate
5966					
1.00	0	inspection begins at upstream manhole	00:00:02		0
17.80	0	inspection ends at downstream manhole	00:00:27		0
6742A					

Street :
Tel:
Fax:
Email:

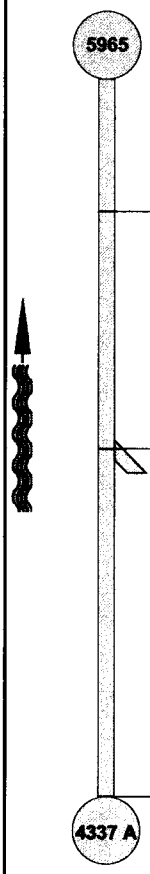
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**22**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**5965**
Street 2:		Map # 2 :		To MH :	**4337 A**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**26.00 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:75 Position	Code	Observation	MPEG	Photo	Rate
4.80	0	inspection begins at downstream manhole	00:00:04		0
13.40	0	service connection, at 09 o´clock	00:00:18		0
26.00	0	inspection ends at clean-out	00:00:47		0

Street :
Tel:
Fax:
Email:

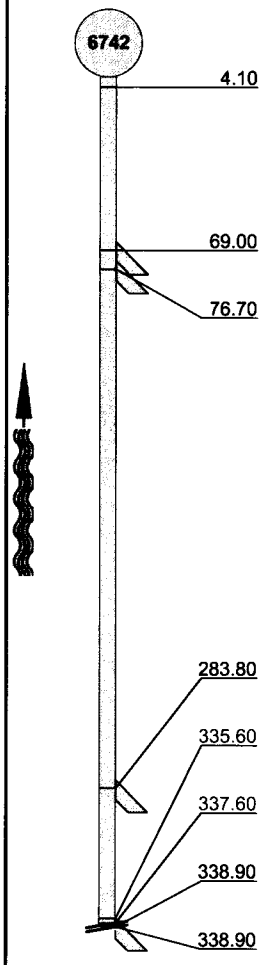
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**23**	**OESTE AND OLD LITCHF**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL MARTINEZ**

Street 1 :	**OLD LITCHFIELD RD**	Map # 1 :		From MH :	**6742**
Street 2:		Map # 2 :		To MH :	**6742 A**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**338.90 ft**
Insp. method :	**CCTV**	Media # :	**200513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**PVC**
		Lining :	

Remarks :



1:825 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:01		0
69.00	0	service connection capped, at 09 o´clock	00:01:14		0
76.70	0	service connection capped, at 09 o´clock	00:01:28		0
283.80	0	service connection, at 09 o´clock	00:05:17		0
335.60	0	sag begins	00:06:20		1
337.60	115	gasket exposed	00:06:34		1
338.90	0	service connection, at 09 o´clock	00:06:43		0
338.90	0	camera blocked, inspection abandoned	00:07:03		0

Street :
Tel:
Fax:
Email:

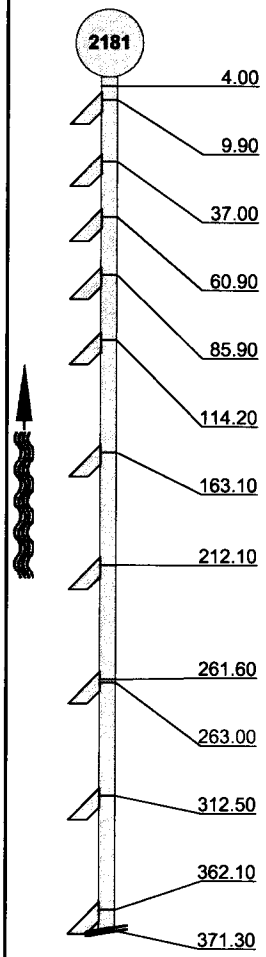
Inspection Report / Inspection: OESTE AND OLD LITCHFIELD

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		sunny, dry	EDDIE	24	OESTE AND OLD LITCHF
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL MARTINEZ

Street 1 :	OLD LITCHFIELD RD	Map # 1 :		From MH :	2181
Street 2:		Map # 2 :		To MH :	2180
City :	LITCHFIELD PARK	VCR # :		Section length :	371.30 ft
Insp. method :	CCTV	Media # :	200513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :



1:900 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
9.90	0	service connection, at 03 o´clock	00:00:31		0
37.00	0	service connection, at 03 o´clock	00:01:06		0
60.90	0	service connection, at 03 o´clock	00:01:38		0
85.90	0	service connection, at 03 o´clock	00:02:10		0
114.20	0	service connection, at 02 o´clock	00:02:48		0
163.10	0	service connection, at 03 o´clock	00:03:51		0
212.10	0	service connection, at 03 o´clock	00:04:56		0
261.60	0	service connection, at 03 o´clock	00:06:04		0
263.00	150	offset joint, slight	00:06:18		1
312.50	0	service connection, at 03 o´clock	00:07:27		0
362.10	0	service connection, at 02 o´clock	00:08:39		0
371.30	0	camera blocked, inspection abandoned / ROCKS	00:08:54		0

Street :
Tel:
Fax:
Email:

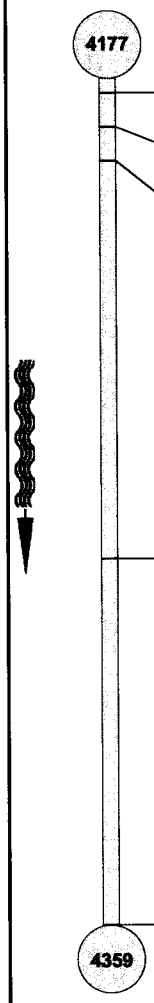
Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**1**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4177**
Street 2:		Map # 2 :		To MH :	**4359**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**245.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:600 Position	Code	Observation	MPEG	Photo	Rate
4.40	0	inspection begins at upstream manhole	00:00:02		0
14.10	0	bugs	00:00:12		1
24.00	210	debris grease medium from 05 to 07 o´clock	00:00:22		2
139.20	210	debris grease medium from 05 to 07 o´clock	00:02:28		2
245.50	0	inspection ends at downstream manhole	00:04:43		0

Street :
Tel:
Fax:
Email:

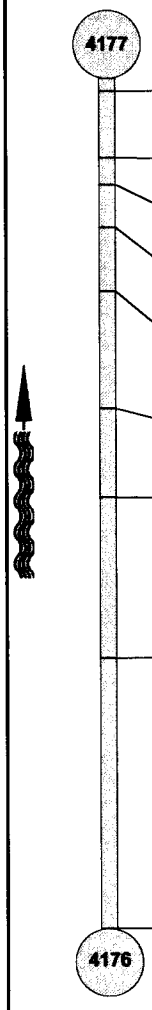
Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**2**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4177**
Street 2:		Map # 2 :		To MH :	**4176**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**320.70 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:780 Position	Code	Observation	MPEG	Photo	Rate
4.90	0	inspection begins at downstream manhole	00:00:02		0
30.00	210	debris grease medium from 05 to 07 o´clock	00:00:34		2
40.10	210	debris grease medium from 04 to 06 o´clock	00:00:48		2
56.20	210	debris grease medium from 05 to 07 o´clock	00:01:07		2
80.30	0	bugs	00:01:36		1
124.40	210	debris grease medium from 05 to 07 o´clock	00:02:32		2
158.00	0	bugs	00:03:21		1
218.60	0	bugs	00:05:07		1
320.70	0	inspection ends at upstream manhole / ROACH INFESTED	00:07:42		0

Street :
Tel:
Fax:
Email:

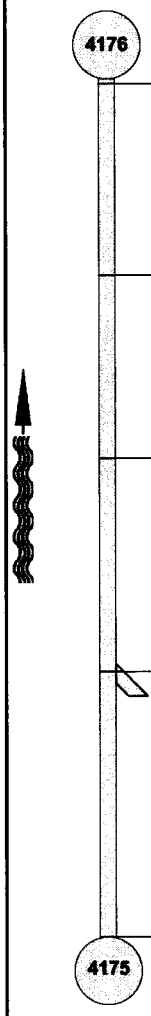
Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**3**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4176**
Street 2:		Map # 2 :		To MH :	**4175**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**366.80 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:885 Position	Code	Observation	MPEG	Photo	Rate
2.00	0	inspection begins at downstream manhole	00:00:01		0
83.80	0	bugs	00:01:55		1
161.90	0	bugs	00:03:50		1
253.10	0	service connection, at 09 o´clock	00:06:17		0
366.80	0	inspection ends at upstream manhole / ROACH INFESTED	00:09:12		0

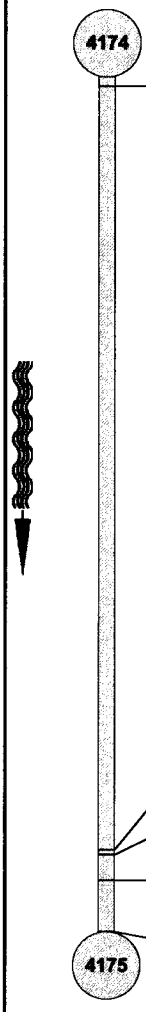
Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**4**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned : **no**	Inspector's Name **DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4174**
Street 2:		Map # 2 :		To MH :	**4175**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**359.30 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	
Reason of inspection :	**gen. condition control**			Pipe shape :	**round**
Section type :	**waste**			Pipe size :	**8.00 inch**
Area :				Pipe material :	**VCP**
				Lining :	

Remarks :



1:870 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at upstream manhole	00:00:02		0
325.10	0	bugs	00:06:30		1
327.00	210	debris grease medium from 06 to 08 o´clock	00:06:36		2
338.10	210	debris grease medium from 04 to 08 o´clock	00:06:52		2
359.30	0	inspection ends at downstream manhole	00:07:24		0

Street :
Tel:
Fax:
Email:

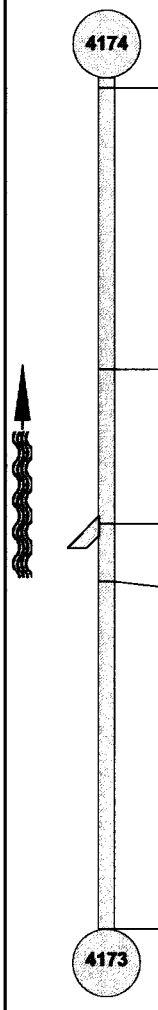
Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**5**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4174**
Street 2:		Map # 2 :		To MH :	**4173**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**339.40 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:825 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:02		0
116.10	210	debris grease medium from 05 to 07 o´clock	00:02:25		2
177.70	0	service connection, at 03 o´clock	00:03:48		0
200.70	210	debris grease medium from 04 to 08 o´clock	00:04:28		2
339.40	0	inspection ends at upstream manhole / ROACH INFESTED	00:07:35		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**6**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4172**
Street 2:		Map # 2 :		To MH :	**4173**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**339.50 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:825 Position	Code	Observation	MPEG	Photo	Rate
4172					
4.10	0	inspection begins at upstream manhole	00:00:02		0
14.30	0	bugs	00:00:25		1
42.10	0	bugs	00:01:01		1
57.20	210	debris grease medium from 03 to 09 o´clock	00:01:18		2
61.30	0	service connection, at 03 o´clock	00:01:34		0
116.00	0	bugs	00:02:43		1
259.90	0	bugs	00:05:41		1
339.50	0	inspection ends at downstream manhole / ROACH INFESTED	00:07:30		0
4173					

Street :
Tel:
Fax:
Email:

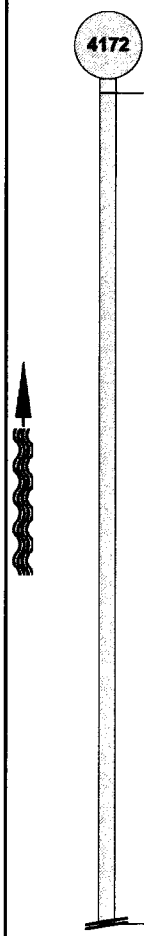
Inspection Report / Inspection: PLAZA CIRCLE

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013		**sunny, dry**	**EDDIE**	**7**	**PLAZA CIRCLE**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**PLAZA CL**	Map # 1 :		From MH :	**4172**
Street 2:		Map # 2 :		To MH :	**CO**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**238.90 ft**
Insp. method :	**CCTV**	Media # :	**310513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:585 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:02		0
238.90	0	camera blocked, inspection abandoned / BRICK IN LINE	00:05:03	7_2A	0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**1**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**2193**
Street 2:		Map # 2 :		To MH :	**5744**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**157.60 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:390 Position	Code	Observation	MPEG	Photo	Rate
2193					
5.00	0	inspection begins at upstream manhole	00:00:04		0
157.60	0	inspection ends at downstream manhole	00:03:09		0
5744					

Street :
Tel:
Fax:
Email:

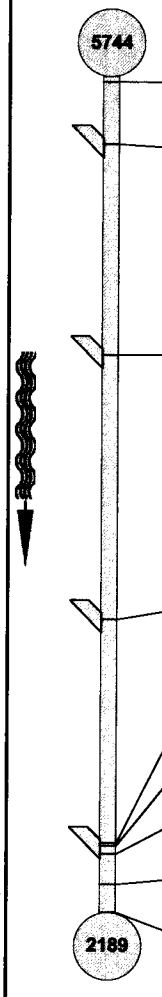
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**2**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**5744**
Street 2:		Map # 2 :		To MH :	**2189**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**151.50 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:375 Position	Code	Observation	MPEG	Photo	Rate
1.00	0	inspection begins at upstream manhole	00:00:01		0
12.30	0	service connection, at 02 o´clock	00:00:17		0
50.50	0	service connection, at 02 o´clock	00:01:10		0
98.30	0	service connection, at 02 o´clock	00:02:14		0
138.90	0	Longitudinal Crack, at 03 o´clock	00:03:28		2
139.40	0	service connection, at 02 o´clock	00:03:44		0
140.80	0	Multiple Cracks, from 03 to 09 o´clock	00:04:12		2
146.40	0	Multiple Cracks, from 08 to 04 o´clock	00:04:41		2
151.50	0	inspection ends at downstream manhole	00:05:24		0

Street :
Tel:
Fax:
Email:

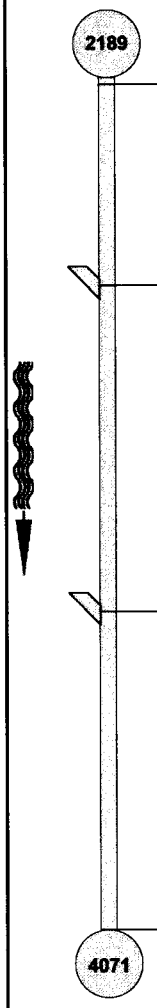
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**3**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**2189**
Street 2:		Map # 2 :		To MH :	**4071**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**123.60 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:300 Position	Code	Observation	MPEG	Photo	Rate
1.00	0	inspection begins at upstream manhole	00:00:02		0
30.10	0	service connection, at 02 o´clock	00:00:45		0
77.40	0	service connection, at 02 o´clock	00:01:53		0
123.60	0	inspection ends at downstream manhole	00:03:01		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**4**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**2195**
Street 2:		Map # 2 :		To MH :	**2193**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**278.10 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:675 Position	Code	Observation	MPEG	Photo	Rate
5.10	0	inspection begins at upstream manhole	00:00:01		0
278.10	0	inspection ends at downstream manhole	00:05:41		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**5**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**SIERRA HERMOSA**	Map # 1 :		From MH :	**4072**
Street 2:		Map # 2 :		To MH :	**4071**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**153.30 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:375 Position	Code	Observation	MPEG	Photo	Rate
4072					
5.00	0	inspection begins at downstream manhole	00:00:01		0
153.30	0	inspection ends at upstream manhole	00:02:50		0
4071					

Street :
Tel:
Fax:
Email:

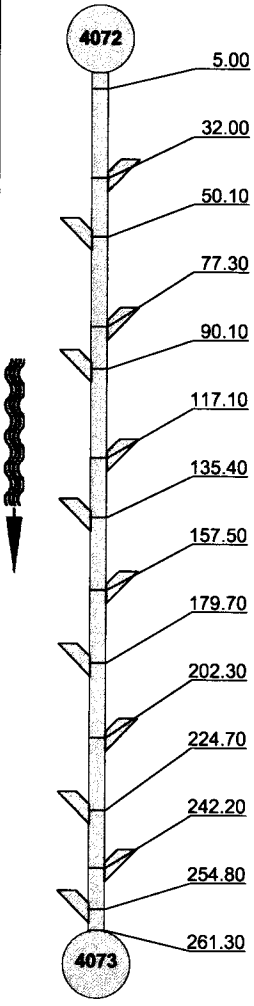
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**6**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**SIERRA HERMOSA**	Map # 1 :		From MH :	**4072**
Street 2:		Map # 2 :		To MH :	**4073**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**261.30 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:630 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at upstream manhole	00:00:01		0
32.00	0	service connection, at 09 o´clock	00:00:46		0
50.10	0	service connection, at 02 o´clock	00:01:13		0
77.30	0	service connection, at 09 o´clock	00:01:53		0
90.10	0	service connection, at 03 o´clock	00:02:14		0
117.10	0	service connection, at 09 o´clock	00:02:49		0
135.40	0	service connection, at 03 o´clock	00:03:15		0
157.50	0	service connection, at 09 o´clock	00:03:49		0
179.70	0	service connection, at 03 o´clock	00:04:21		0
202.30	0	service connection, at 09 o´clock	00:04:52		0
224.70	0	service connection, at 03 o´clock	00:05:28		0
242.20	0	service connection, at 09 o´clock	00:05:56		0
254.80	0	service connection, at 03 o´clock	00:06:21		0
261.30	0	inspection ends at downstream manhole	00:06:37		0

Street :
Tel:
Fax:
Email:

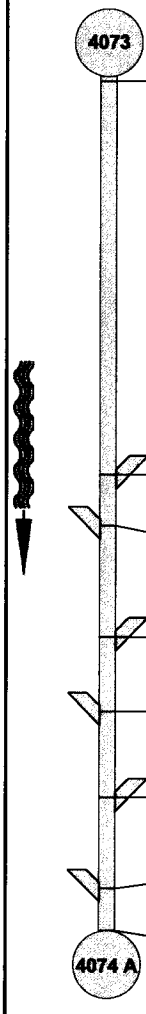
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**7**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**SIERRA HERMOSA**	Map # 1 :		From MH :	**4073**
Street 2:		Map # 2 :		To MH :	**4074 A**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**210.40 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:510 Position	Code	Observation	MPEG	Photo	Rate
1.10	0	inspection begins at upstream manhole	00:00:01		0
98.00	0	service connection, at 09 o´clock	00:02:03		0
110.60	0	service connection, at 03 o´clock	00:02:26		0
137.90	0	service connection, at 09 o´clock	00:03:07		0
156.20	0	service connection, at 03 o´clock	00:03:37		0
177.50	0	service connection, at 09 o´clock	00:04:11		0
200.00	0	service connection, at 03 o´clock	00:04:49		0
210.40	0	inspection ends at downstream manhole	00:05:11		0

Street :
Tel:
Fax:
Email:

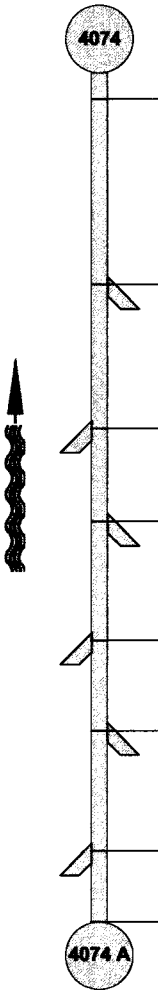
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**8**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**SIERRA HERMOSA**	Map # 1 :		From MH :	**4074**
Street 2:		Map # 2 :		To MH :	**4074 A**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**160.10 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:390 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at downstream manhole	00:00:01		0
39.90	0	service connection, at 09 o´clock	00:00:50		0
67.00	0	service connection, at 03 o´clock	00:01:30		0
84.60	0	service connection, at 09 o´clock	00:01:55		0
107.00	0	service connection, at 03 o´clock	00:02:26		0
124.00	0	service connection, at 09 o´clock	00:02:52		0
146.80	0	service connection, at 03 o´clock	00:03:26		0
160.10	0	inspection ends at upstream manhole	00:03:48		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**9**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**SIERRA HERMOSA**	Map # 1 :		From MH :	**4074**
Street 2:		Map # 2 :		To MH :	**4075**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**156.40 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:390 Position	Code	Observation	MPEG	Photo	Rate
4074					
5.20	0	inspection begins at upstream manhole	00:00:01		0
156.40	0	inspection ends at downstream manhole	00:02:57		0
4075					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

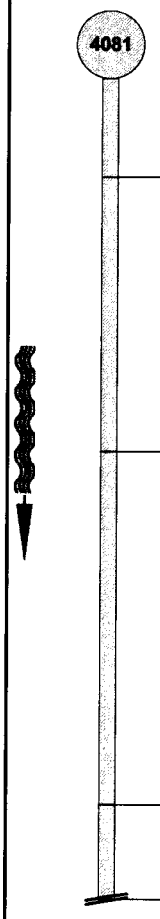
Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**10**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4081**
Street 2:		Map # 2 :		To MH :	**4080**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**41.60 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:105 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at upstream manhole	00:00:01		0
18.90	150	offset joint, slight	00:00:25		1
36.80	310	Debris / ROCKS	00:00:58		3
41.60	0	camera blocked, inspection abandoned	00:01:10		0



Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**11**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4081**
Street 2:		Map # 2 :		To MH :	**4341**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**198.30 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:480 Position	Code	Observation	MPEG	Photo	Rate
4081					
5.70	0	inspection begins at downstream manhole	00:00:01		0
41.20	0	service connection, at 09 o´clock	00:00:56		0
96.90	0	service connection, at 09 o´clock	00:02:07		0
138.90	0	service connection, at 09 o´clock	00:03:01		0
177.80	0	service connection, at 09 o´clock	00:03:51		0
198.30	0	inspection ends at upstream manhole	00:04:21		0
4341					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			EDDIE	12	VILLA NUEVA
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	DANIEL ROMO

Street 1 :	VILLA NUEVA	Map # 1 :		From MH :	4341
Street 2:		Map # 2 :		To MH :	4075
City :	LITCHFIELD PARK	VCR # :		Section length :	189.10 ft
Insp. method :	CCTV	Media # :	210513_1	Joint length :	

Reason of inspection :	gen. condition control	Pipe shape :	round
Section type :	waste	Pipe size :	8.00 inch
Area :		Pipe material :	VCP
		Lining :	

Remarks :

1:465 Position	Code	Observation	MPEG	Photo	Rate
4341					
1.10	0	inspection begins at downstream manhole	00:00:01		0
13.90	0	service connection, at 09 o´clock	00:00:18		0
49.90	0	service connection, at 09 o´clock	00:01:09		0
92.60	0	service connection, at 09 o´clock	00:02:09		0
140.50	0	service connection, at 10 o´clock	00:03:11		0
189.10	0	inspection ends at upstream manhole	00:04:19		0
4075					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**13**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4080**
Street 2:		Map # 2 :		To MH :	**4081**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**360.70 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:870 Position	Code	Observation	MPEG	Photo	Rate
4080					
5.10	0	inspection begins at downstream manhole	00:00:01		0
360.70	0	camera blocked, inspection abandoned	00:07:35		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**14**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4080**
Street 2:		Map # 2 :		To MH :	**4079**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**153.60 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:375 Position	Code	Observation	MPEG	Photo	Rate
4080					
5.20	0	inspection begins at upstream manhole	00:00:01		0
102.50	0	service connection, at 03 o´clock	00:02:18		0
153.60	0	inspection ends at downstream manhole	00:03:29		0
4079					

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**15**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4077**
Street 2:		Map # 2 :		To MH :	**4078**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**156.80 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:390 Position	Code	Observation	MPEG	Photo	Rate
4077					
5.10	0	inspection begins at downstream manhole	00:00:01		0
49.90	0	service connection, at 09 o´clock	00:01:02		0
54.20	0	service connection, at 03 o´clock	00:01:12		0
156.80	0	inspection ends at upstream manhole	00:03:26		0
4078					

Street :
Tel:
Fax:
Email:

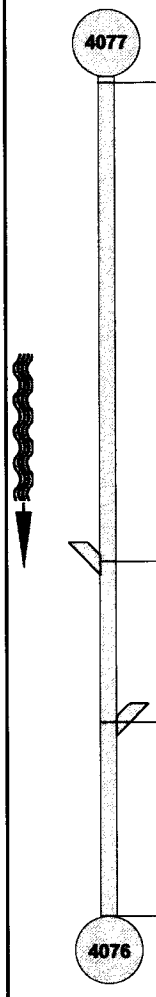
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**16**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4077**
Street 2:		Map # 2 :		To MH :	**4076**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**170.40 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:420 Position	Code	Observation	MPEG	Photo	Rate
1.20	0	inspection begins at upstream manhole	00:00:01		0
98.40	0	service connection, at 03 o´clock	00:02:04		0
131.00	0	service connection, at 09 o´clock	00:02:50		0
170.40	0	inspection ends at downstream manhole	00:03:46		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**17**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4078**
Street 2:		Map # 2 :		To MH :	**4079**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**154.70 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:375 Position	Code	Observation	MPEG	Photo	Rate
4078					
4.50	0	inspection begins at downstream manhole	00:00:01		0
44.60	0	service connection, at 09 o´clock	00:00:55		0
154.70	0	inspection ends at upstream manhole	00:03:15		0
4079					

Street :
Tel:
Fax:
Email:

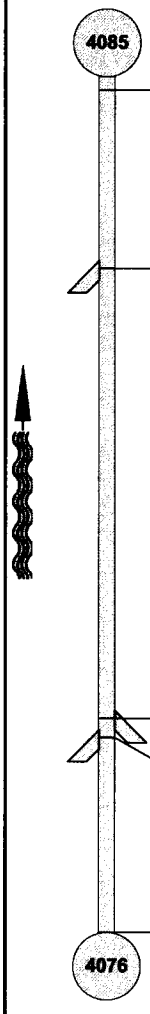
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**18**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4085**
Street 2:		Map # 2 :		To MH :	**4076**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**248.10 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:600 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:02		0
55.40	0	service connection, at 03 o´clock	00:01:34		0
186.00	0	service connection, at 09 o´clock	00:04:32		0
191.50	0	service connection, at 03 o´clock	00:04:47		0
248.10	0	inspection ends at upstream manhole	00:06:07		0

Street :
Tel:
Fax:
Email:

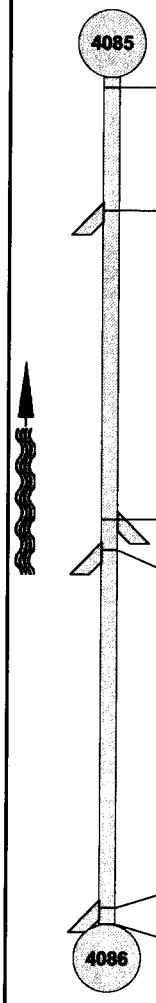
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**19**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4085**
Street 2:		Map # 2 :		To MH :	**4086**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**344.00 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:840 Position	Code	Observation	MPEG	Photo	Rate
4.10	0	inspection begins at downstream manhole	00:00:01		0
54.00	0	service connection, at 03 o´clock	00:01:13		0
179.30	0	service connection, at 09 o´clock	00:04:03		0
191.80	0	service connection, at 03 o´clock	00:04:26		0
337.30	0	service connection, at 03 o´clock	00:08:02		0
344.00	0	inspection ends at upstream manhole	00:08:18		0

Street :
Tel:
Fax:
Email:

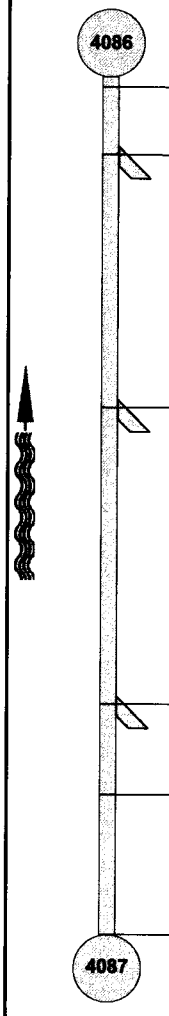
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**20**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4086**
Street 2:		Map # 2 :		To MH :	**4087**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**335.50 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:810 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:01		0
30.20	0	service connection, at 09 o´clock	00:00:40		0
129.10	0	service connection, at 09 o´clock	00:02:45		0
245.10	0	service connection, at 09 o´clock	00:05:19		0
280.60	300	Longitudinal Crack at joint, at 01 o´clock	00:06:19		3
335.50	0	inspection ends at upstream manhole / ROACHES	00:07:38		0

Street :
Tel:
Fax:
Email:

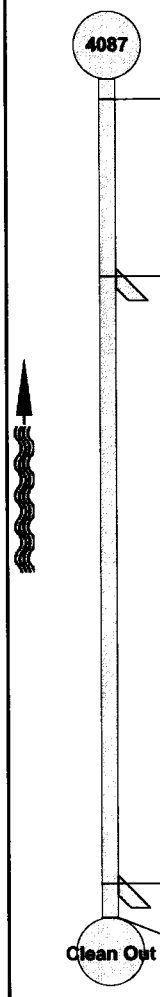
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/21/2013			**EDDIE**	**21**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4087**
Street 2:		Map # 2 :		To MH :	**Clean Out**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**164.20 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**8.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:405 Position	Code	Observation	MPEG	Photo	Rate
4.00	0	inspection begins at downstream manhole	00:00:02		0
38.60	0	service connection, at 09 o´clock	00:01:02		0
157.60	0	service connection, at 09 o´clock	00:04:05		0
164.20	0	inspection ends at clean-out	00:04:20		0

Street :
Tel:
Fax:
Email:

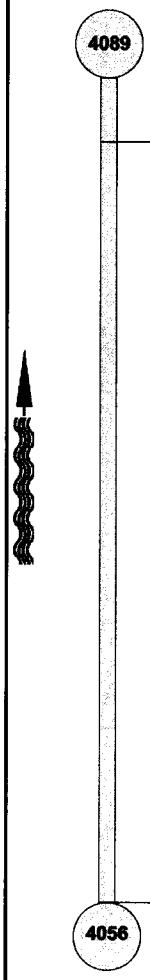
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**22**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4089**
Street 2:		Map # 2 :		To MH :	**4056**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**65.70 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:165 Position	Code	Observation	MPEG	Photo	Rate
5.10	0	inspection begins at downstream manhole	00:00:02		0
65.70	0	inspection ends at downstream manhole	00:01:16		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**23**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4056**
Street 2:		Map # 2 :		To MH :	**4348**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**69.60 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:180	Position	Code	Observation	MPEG	Photo	Rate
4056						
	1.50	0	inspection begins at downstream manhole	00:00:01		0
	49.10	0	camera under water	00:00:52		1
	69.60	0	camera blocked, inspection abandoned	00:01:39		0

Street :
Tel:
Fax:
Email:

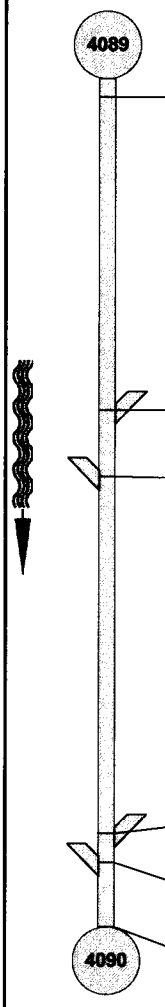
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**24**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4089**
Street 2:		Map # 2 :		To MH :	**4090**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**233.70 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:570 Position	Code	Observation	MPEG	Photo	Rate
5.00	0	inspection begins at upstream manhole	00:00:01		0
91.30	0	service connection, at 10 o´clock	00:01:31		0
109.60	0	service connection, at 02 o´clock	00:01:55		0
207.90	0	service connection, at 09 o´clock	00:03:36		0
216.00	0	service connection, at 02 o´clock	00:03:50		0
233.70	0	inspection ends at downstream manhole	00:04:15		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**25**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4091**
Street 2:		Map # 2 :		To MH :	**4092**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**302.70 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:735 Position	Code	Observation	MPEG	Photo	Rate
4091					
5.00	0	inspection begins at upstream manhole	00:00:01		0
302.70	0	inspection ends at downstream manhole	00:04:55		0
4092					

Street :
Tel:
Fax:
Email:

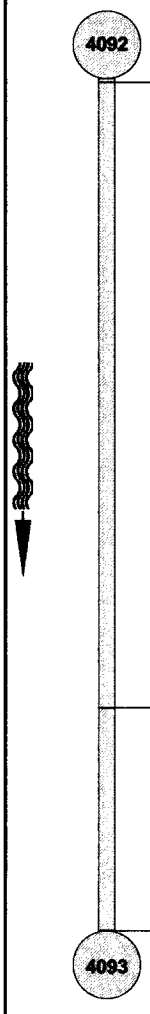
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**26**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4092**
Street 2:		Map # 2 :		To MH :	**4093**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**210.10 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:510 Position	Code	Observation	MPEG	Photo	Rate
1.00	0	inspection begins at upstream manhole	00:00:01		0
155.10	310	Debris	00:03:01		3
210.10	0	inspection ends at downstream manhole	00:04:14		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**27**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**VILLA NUEVA**	Map # 1 :		From MH :	**4091**
Street 2:		Map # 2 :		To MH :	**4090**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**221.00 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:540	Position	Code	Observation	MPEG	Photo	Rate
4091						
	6.00	0	inspection begins at downstream manhole	00:00:01		0
	221.00	0	inspection ends at upstream manhole	00:04:06		0
4090						

Street :
Tel:
Fax:
Email:

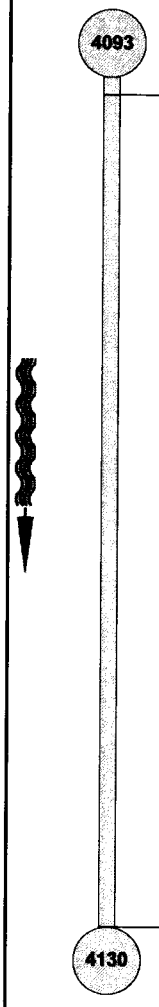
Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**28**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM BLVD**	Map # 1 :		From MH :	**4093**
Street 2:		Map # 2 :		To MH :	**4130**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**252.40 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :



1:615 Position	Code	Observation	MPEG	Photo	Rate
5.20	0	inspection begins at upstream manhole	00:00:02		0
252.40	0	inspection ends at downstream manhole	00:04:11		0

Street :
Tel:
Fax:
Email:

Inspection Report / Inspection: VILLA NUEVA

Date:	Job # :	Weather :	Operator :	Section # :	Section name :
5/31/2013			**EDDIE**	**29**	**VILLA NUEVA**
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Inspector's Name
				no	**DANIEL ROMO**

Street 1 :	**WIGWAM BLVD**	Map # 1 :		From MH :	**4130**
Street 2:		Map # 2 :		To MH :	**4131**
City :	**LITCHFIELD PARK**	VCR # :		Section length :	**379.10 ft**
Insp. method :	**CCTV**	Media # :	**210513_1**	Joint length :	

Reason of inspection :	**gen. condition control**	Pipe shape :	**round**
Section type :	**waste**	Pipe size :	**10.00 inch**
Area :		Pipe material :	**VCP**
		Lining :	

Remarks :

1:915 Position	Code	Observation	MPEG	Photo	Rate
4130					
1.00	0	inspection begins at upstream manhole	00:00:01		0
338.80	310	Debris	00:06:28		3
379.10	0	inspection ends at downstream manhole	00:07:26		0
4131					

APPENDIX 6 – SEWER MANHOLE CONDITION INFORMATION

APPENDIX 6 – SEWER MANHOLE CONDITION INFORMATION

This appendix contains a map showing areas of the Litchfield Park collection system with documented problems caused by the condition of existing infrastructure. The map shows where inspections occurred. The map also shows which manholes are in poor condition due to deterioration based on physical inspections. During the inspections, some manholes or associated pipes that were planned for inspection could not be inspected because the manholes were not found. These expected manhole locations are also shown. Liberty Utilities provided records from operations staff of other manholes that were damaged and these damaged manholes are also shown on the map.

Liberty Utilities has received odor complaints from customers in some parts of the service area. Work orders from two of these complaints are shown in this appendix, and the location of the odor problems are shown on the map.

Date Revised: July 01, 2013
File Location: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Sewer Maintenance_Inspection.mxd

carollo

Sewer Maintenance and Inspection Map

Litchfield Park Service Company

Service Order **No:** SORD00000194886

Request 8600300 Sewer / Collections Service Call

Instructions DEODORIZE MANHOLES IN AREA ORlando 105

Scheduled Date 10/2/2012

Scheduled Time 1:14:00 PM

Service Address 8600400329 409 E BIRD LN LITCHFIELD PARK AZ USA 85340-4214

Location Notes LP SUB 9 LOT 202 | Meter Location 1009020220 | Key # | Lot Number | Plan #

Bill To Customer 500695 WILLIAM & MARY LUECK
409 E BIRD LN LITCHFIELD PARK AZ USA 85340-4214

Customer Notes 10090202 | Last Statement US$369.91 9/19/2012 | Deposit Balance US$0.00

Move In Customer

	Last Reading				Current Reading			
Meter ID	Cons1	Cons2	Cons3	Date	Cons1	Cons2	Cons3	Type
63199137	4672	0	0					
Class:1.5 5 DIGIT	Last Reading Date:9/10/2012		Type:Actual					

Task ID	Description	Charge	Employee	Completed
SERVICE CALL	Service Call	0.00000		No
ACTION	What Action Was Taken	0.00000		No

Comments

CALLED ORLANDO

Spoke w/ Rust Concerning the Problem will get Line.

OR MGH

☐ Locked/Left notice ☐ Entry refused ☐ Bad key ☐ Entry blocked ☐ Gate locked

From:623-935-1020 OCT-02-2012 13:21

Litchfield Park Service Company

Service Order

No: SORD00000173016

Request 8600410 Operations Service Call

Instructions CUSTOMER COMPLAINinG ABOUT SEWER SMEL

409 BIRD LN

105

FILE COPY

Scheduled Date 4/25/2012

Scheduled Time 1:06:00 PM

Servi[redacted]

Locati[redacted]

Bill To [redacted]

Custo[redacted] US$179.00 4/1[redacted]

US$0.00

Move In [redacted]

	Last Reading			Current Reading			
Meter ID	Cons1	Cons2	Cons3	Date	Cons1	Cons2	Cons3	Type
63199137	4243	0	0					

Class:1.5 5 DIGIT Last Reading Date:4/12/2012 Type:Actual

Task ID	Description	Charge	Employee	Completed
SERVICE CALL	Service Call	0.00000		No
READ	Read Meter	0.00000		No
ACTION	What Action Was Taken	0.00000		No

Comments

602-550-1036

Talked to Cust Concerning smells -> told Cust we will treat Line 4/25 / 4/26 Next Day - / Treated Line @ manhole at side Front OF property w/ Lime Chemical mix - Attempted to Contact UNSUCCESSFull Left Filbert G Card @ door - QR

QR

☐ Locked/Left notice ☐ Entry refused ☐ Bad key ☐ Entry blocked ☐ Gate locked

APR-25-2012 13:58 From:623-935-1020

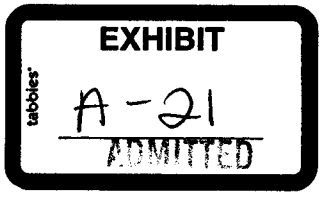
Liberty Utilities

Litchfield Park Water and Wastewater Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 2 - WATER

SEPTEMBER 26, 2013

FINAL



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Liberty Utilities

Litchfield Park Water and Wastewater Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 2 - WATER

SEPTEMBER 26, 2013

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Litchfield Park Water and Wastewater Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 2 - WATER

SEPTEMBER 26, 2013

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EXPIRES 09-30-2013

EXPIRES 12-31-2013

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Liberty Utilities

Litchfield Park Water Facilities Assessment, 2013

LITCHFIELD PARK FACILITIES ASSESSMENT, VOLUME 2 - WATER

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LITCHFIELD PARK WATER FACILITIES ASSESSMENT, PHASE 2

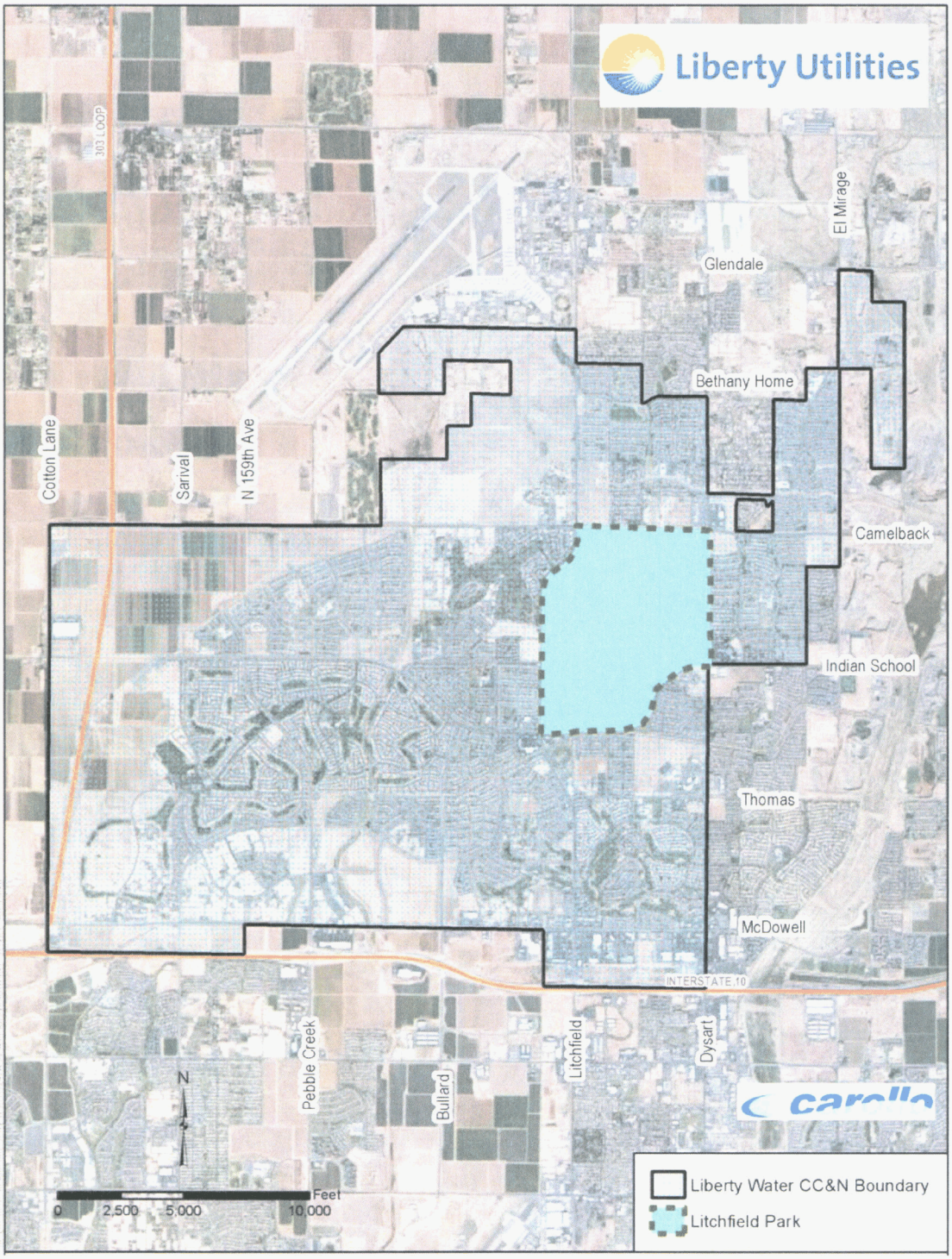
1.0 BACKGROUND

The purpose of this Water Facilities Assessment Plan is to evaluate the water infrastructure in the Litchfield Park (LP) portion of the Liberty Utilities, Inc. (LU) service area. Figure 1 shows the relative location of LP compared to LU service area. This facilities assessment is focused on the Litchfield Park area and not the City of Goodyear portion of the service area because the infrastructure in Litchfield Park has been in service longer and therefore is closer to the end of its useful life.

This report is intended to work in tandem with the previously published Litchfield Park Sewer Facilities Assessment, Phase 1 (September 2013). The Phase 1 report provided the basis for establishing a 5-year capital improvement program for the sewer system with an approximate construction cost of $10.3 million. This Phase 2 report provides the justification for a similar program to repair and renew the potable water system in the LP area.

A common broad based infrastructure assessment method used throughout the industry follows the general outline below:

1. Infrastructure inventory – Accumulating basic historical information on the system's infrastructure (i.e., miles of pipe in system, age of pipe, pipe material)
2. Water infrastructure desktop evaluation – Categorizing and analyzing this information. Estimating life expectancies of the different types of mains.
3. Capital improvement project definitions – Summarizing results and defining projects.



LITCHFIELD PARK WATER SERVICE AREA RELATIVE TO LIBERTY UTILITIES WATER CC&N

FIGURE 1

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

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1.1 System Benefits Improvement Mechanism (SIB)

In Arizona Corporation Commission Docket No. W-01445A-11-0310, Arizona Corporation Commission Staff ("Staff") and the utility industry outlined the requirements for a SIB. In particular, the Settlement Agreement entered into on April 1, 2013 details the exact supporting documentation needed to support a SIB request by a water company. The following information supporting Liberty Utilities request for a SIB in Docket Nos. SW-01427A-13-0042 and W-01427A-13-0043 is included as follows:

- Table 7 (on page 18) is a summary of all projects request for SIB recovery
- Table 8, Table 9, Table 10 and Table 11 (pages 22 – 28) are equivalent to "Table 1" outlined in the Settlement Agreement
- Figure 7 (page 27) is a visual illustration of the five years of capital projects
- Figure 8 (page 28) is a graphical illustration of the total estimated capital investment for SIB recovery
- Appendix 1 contains one-page written summaries of all projects included for SIB recovery

2.0 INFRASTRUCTURE INVENTORY

The data for buried assets is usually stored in geographical information systems (GIS), and typically contains information on a pipe-by-pipe basis, so a database of pipes usually contains many thousands of entries. Pipes are typically installed over the life of a water utility and in most cases, many years before a GIS database was constructed. As a result, the actual pipe material and installation date may not be available in some cases, or it may be difficult to obtain. The age of a pipe can be estimated from the property plat date or subdivision date when no other information is available. The pipe material can be estimated by knowing the pipe materials that were typically used during the time when the main was placed in service, and operator experience from performing taps, excavations, and repairs.

The following sections will describe the efforts to "clean up" and correct the GIS data, and present an inventory of the data after this process was completed.

2.1 Data Review and Improvement

Buried infrastructure data on pipelines was obtained from LU's GIS database. For pipelines, diameter, material, and age are the attributes that are most useful for a desktop analysis of pipeline condition, so wherever possible, this information was populated using the information available from LU staff, record drawings and other utility records. Table 1 shows the percentage of attribute values that were populated before and after the pipe records investigation was completed.

Table 1 Degree of Data Completion for Pipe Data Attributes
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Water Pipeline Attributes	Initial Percent Complete	Final Percent Complete
Diameter	100%	100%
Material	42%	100%
Age	0%	100%

The LU staff is encouraged to continually update and correct the GIS data with all fieldwork that is already part of their regular maintenance duties. Most of the data entered to obtain 100 percent completion was based on record drawing archives.

2.2 Water Facilities Inventory

Table 2 summarizes the length of water pipe by age, diameter, and material as provided in LU's GIS data after data improvement tasks were completed.

Table 2 Water Pipe GIS Data Inventory – Age, Diameter and Material
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Construction Date	LF	Pipe Diameter	LF	Pipe Material	LF
1950s	16,066	4" or smaller	12,998	ACP – Asbestos Cement	123,154
1960s	60,017	6"	80,683	CIP – Cast Iron	5,733
1970s	39,991	8"	10,007	DIP - Ductile Iron Pipe	11,584
1980s	19,339	12"	34,976	PVC – Polyvinyl Chloride	6,350
1990s	7,672	16"	735		
2000 or Later	3,736	24"	7,282		
Total Length	**146,821**	**Total Length**	**146,821**	**Total Length**	**146,821**

Table 3 summarizes the length of pipe by material and diameter combination.

Table 3 Water Pipe GIS Data Inventory – Age and Material Litchfield Park Facilities Assessment, Volume 2 - Water Liberty Utilities							
	Construction Date						
Water Pipe Material	1950s	1960s	1970s	1980s	1990s	2000 or Later	Length, LF
ACP – Asbestos Cement	14,258	56,109	39,778	13,010	0	0	123,155
CIP – Cast Iron	1,808	3,820	105	0	0	0	5,733
DIP – Ductile Iron	0	0	0	442	7,549	3,594	11,585
PVC – Polyvinyl Chloride	0	89	108	5,888	123	143	6,351
Total Length, LF	16,066	60,017	39,991	19,340	7,672	3,737	146,823

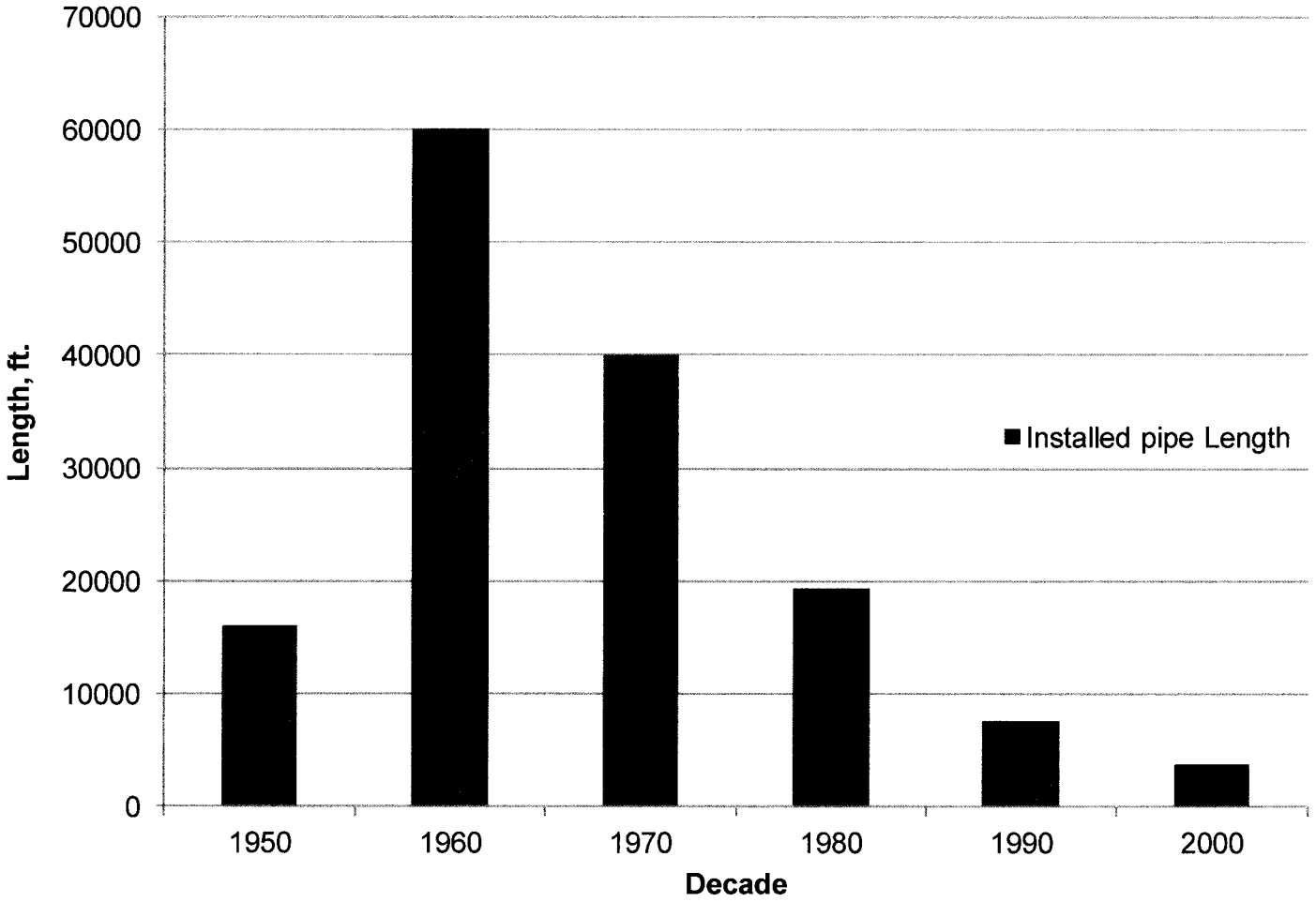
Figure 2 shows the distribution of water pipeline (in miles) installed by approximate decade groupings. Figure 3 is a map showing the pipe installed by approximate decade. Nearly 70 percent of the water pipelines are around 45 years old and composed of either cast iron or asbestos cement material. Section 3.0 will discuss the importance of the pipe material as it relates to remaining useful life.

In addition to pipelines, the water system includes service lines, fire hydrants, valves, and meters. LU has been replacing service lines that have failed or are in poor condition. LU has also been replacing or rehabilitating fire hydrants that are in need of repair. Valves are also in the process of being replaced over time as other repairs are being made. Customer water meters are replaced on an ongoing basis to maintain an accurate measurement of the water being metered.

Table 4 summarizes number of water facilities in Litchfield Park.

Table 4 Number of Water Facilities by Type Litchfield Park Facilities Assessment, Volume 2 - Water Liberty Utilities		
	Total	Replacements
Service Lines, LF	35,869	3,203
Fire Hydrants	160	10
Valves	469	33
Meters	1,082	ongoing replacements

Appendix 2 contains a map with an aerial background that shows all water infrastructure in the LP area as well as the status of service lines and other facilities that have been replaced or repaired in recent years.



LENGTH OF WATER PIPELINES INSTALLED BY DECADE

FIGURE 2

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

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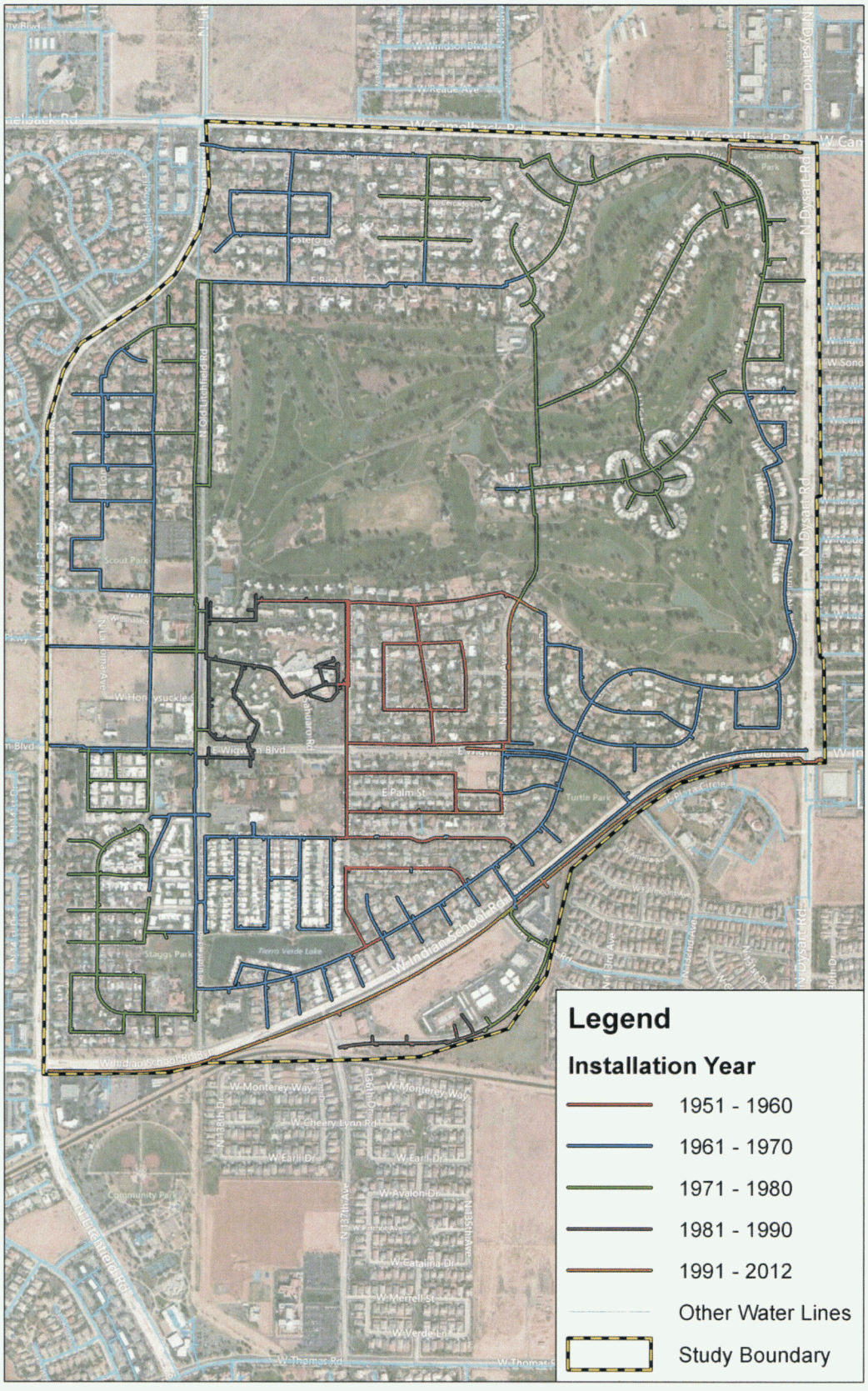


PIPES WITH INSTALLATION YEARS

FIGURE 3

LIBERTY WATER

LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

carollo

pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Water Report/Fig_03

3.0 WATER INFRASTRUCTURE CONDITION ASSESSMENT

Physical inspections of buried pipelines can be costly and resource intensive. In pressurized piping systems, destructive testing to cut the pipe and determine its condition is very expensive. Tapping coupon sampling has some value in determining pipe condition, but service line taps are not necessarily installed in locations where physical testing is needed, and tapping is not done in a systematic fashion across the water system in a way that makes it easy to determine pipeline condition. Therefore, the Litchfield Park water system assessment was completed using the desktop evaluation explained below.

Infrastructure may be rendered unusable for a variety of reasons. This desktop investigation was completed by:

1. Defining the criteria that would be used to evaluate the water infrastructure;
2. Comparing the infrastructure against the criteria, and then
3. Identifying the projects that need to be implemented to address deficiencies.

Two EPA white papers are included in Appendix 4; "Deteriorating Buried Infrastructure Management Challenges and Strategies" and "Distribution System Inventory, Integrity and Water Quality." The papers describe common methodologies used throughout the industry to assess water infrastructure. Carollo has adapted these common practices and customized them to fit LU's needs in this condition assessment.

3.1 Evaluation Criteria

The following classifications are commonly used to identify the reason that a pipeline asset should be replaced:

- **Capacity** – The flows that need to be conveyed by the pipeline are greater than the pipeline capacity. These mains are typically required to deliver flows that are greater than the individual design flows because growth and development is different than was originally planned.
- **Performance Criteria** – The functional requirements exceed the asset capability. One example of an asset that can no longer be used due to a change in the performance criteria is an older, smaller diameter pipe that operates reliably, but may not deliver a sufficient fire flow according to current standards. In this case, the fire flow requirement may have changed since the pipeline was installed, so the smaller pipe no longer serves current needs.

- **Mortality** – The physical deterioration of a pipe may result in an unacceptable level of breaks and service interruptions. Most of the mains that will be identified for replacement as part of an asset management program are assets with a mortality failure mode. These mains may be correctly sized, but they have deteriorated for any number of reasons, and main breaks or leakage is becoming increasingly common, so the risk of these mains failing becomes unacceptably high. Pipes that have exceeded their design life are most often replaced due to mortality.
- **Operating Efficiency** – The operating costs of the current asset exceed the cost of replacement or rehabilitation, or the timing of the replacement is set to minimize overall costs.

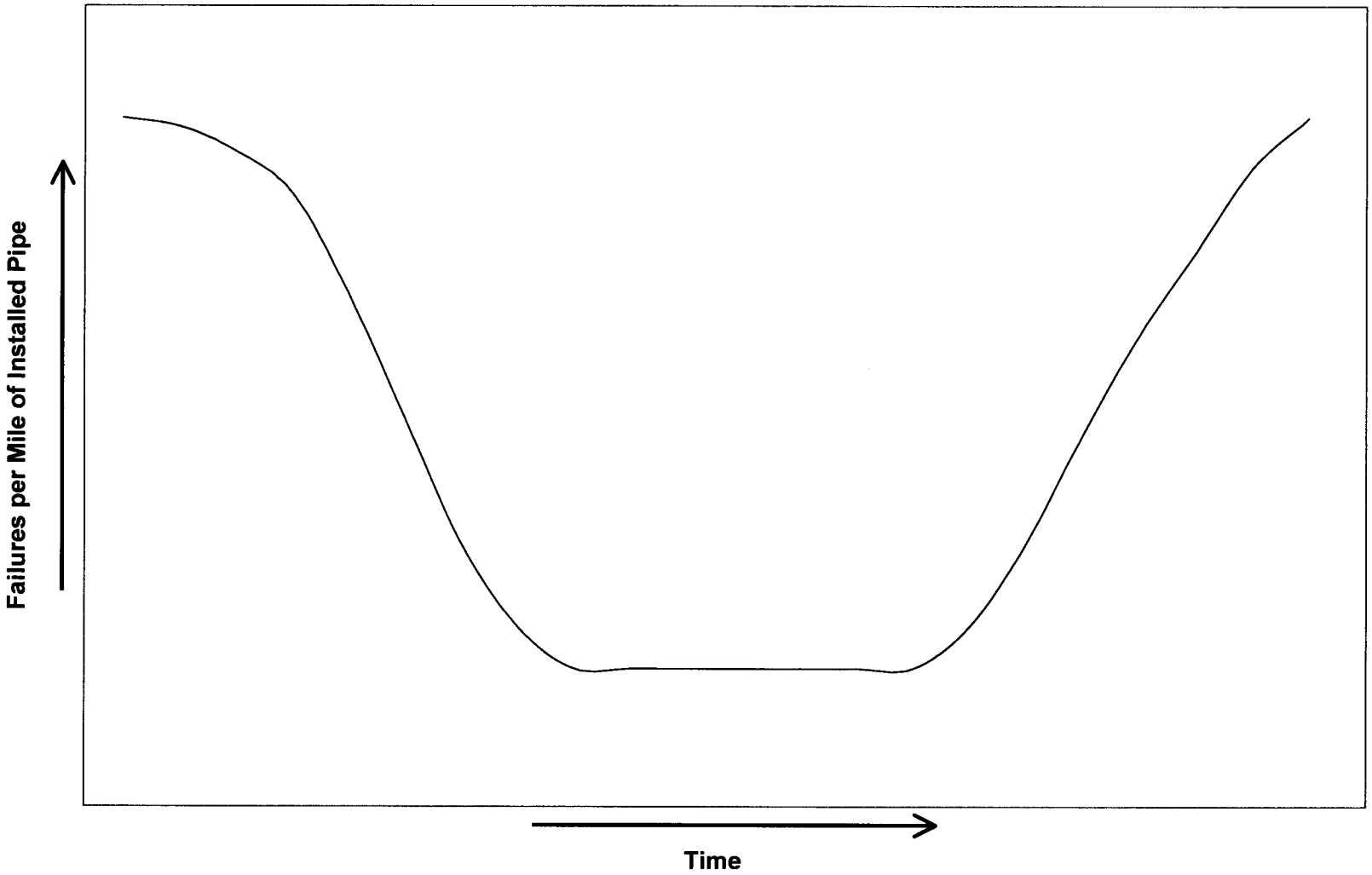
3.2 Water Asset Evaluation

Capacity – Capacity evaluations have not been performed as a part of this study; however, capacity evaluations were performed in the previous 2012 Master Plan Update and no bottlenecks or similar restrictions were found.

Performance Criteria – Residential emergency flow requirements are typically one thousand to fifteen hundred gpm. The resort, school, or some churches in Litchfield Park have emergency flow requirements that likely to be between twenty-five hundred and four thousand gpm. The Litchfield Park water mains include pipes that have diameters of four or six inches. Although these main sizes have been used in the past, four-inch mains are no longer installed in water systems designed for current demands and emergency flows. Six-inch water mains are rarely used because the head losses in a main this size conveying 1,000 gpm or more will cause friction losses that quickly reduce pressures below the threshold needed to deliver emergency flows. However, 6-inch mains are an acceptable diameter as long as pressure and emergency flow performance criteria can be met.

Eight-inch mains are the minimum pipe size that is usually constructed today in water systems that deliver emergency flows. As the water system is being evaluated, hydrant spacing should be reviewed and brought up to standard as well.

Mortality – The cast iron and asbestos cement pipes installed in the Litchfield Park area are at or approaching the end of their fifty-year design life. The pattern of failures for pipelines is sometimes described using a "bathtub" curve. When pipelines are initially constructed, failures may occur a short time after construction as a result of faulty construction or faulty pipe materials. Once the initial failures have occurred and are corrected, the remaining pipes may have a very low failure rate for many years, because the initial cause of failure has been removed. Then as pipes reach the end of their useful life, the pipe material may have deteriorated and mains begin to fail. Figure 4 is an example of a bathtub curve.



BATHTUB FAILURE CURVE

FIGURE 4

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

Carollo

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The actual useful life of pipes varies based on several factors other than pipe age and material, but these other factors are often difficult to quantify. Factors affecting pipe failures are listed below:

- Pipe bedding that is substandard
- Loadings from traffic above pipes in the street
- Freeze and thaw action of surrounding soils
- Soil conditions and corrosivity
- Construction methods, primarily shoddy or poor quality work
- Pipe lining issues
- Level of and need for cathodic protection.

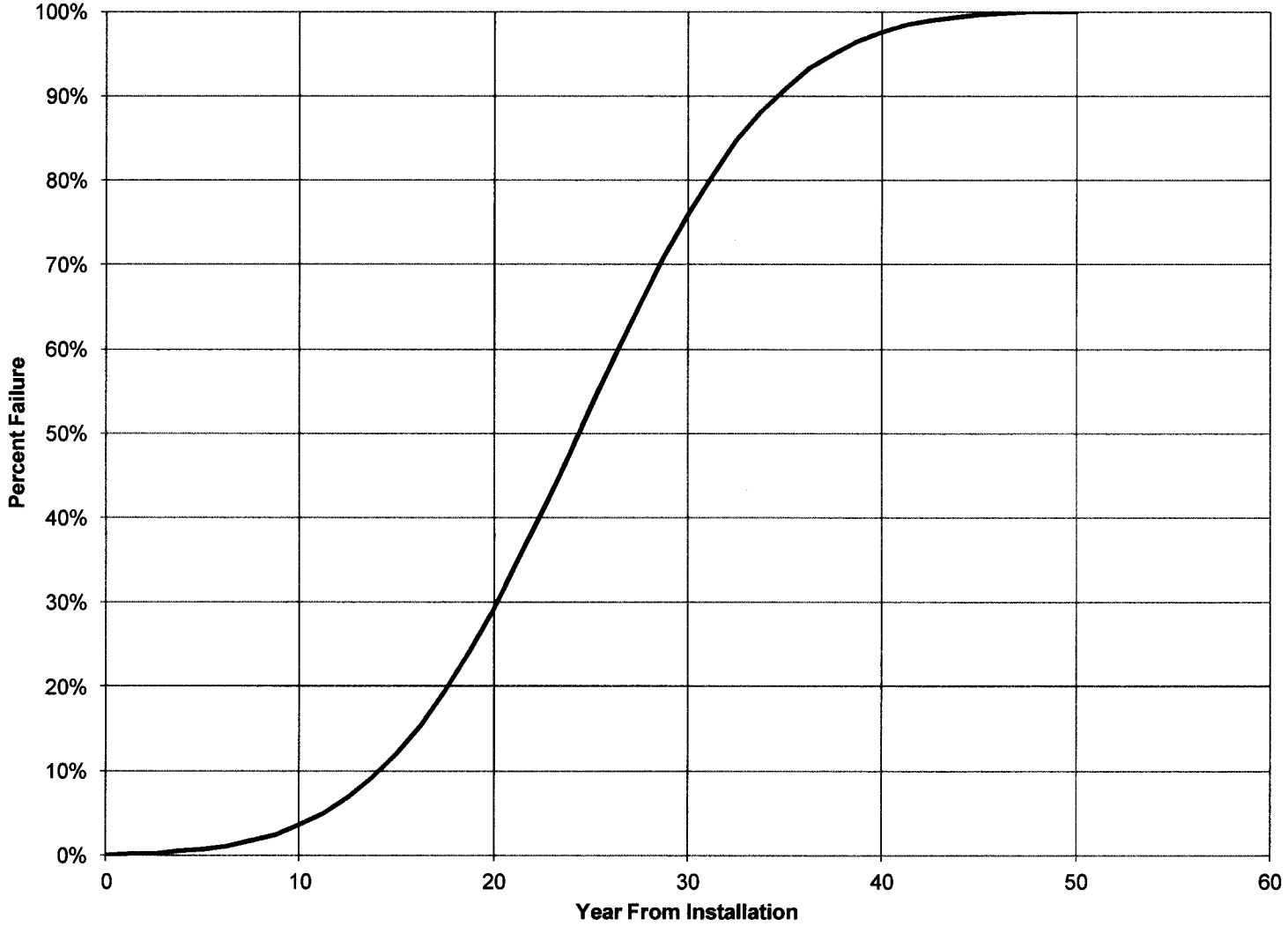
Because the useful life of a pipeline asset depends upon a variety of factors that are often not well defined (or understood), pipeline age is often used as an indicator of condition and therefore remaining life. Pipelines are designed to operate for many years with little or no maintenance, so if a main is operating satisfactorily, as it should, then it usually does not receive any attention. However, pipeline condition can degrade as a result of a variety of factors and when a main fails, the consequences can be catastrophic. When a pipeline condition is compromised, the poor condition may not be known until a failure occurs because the asset is out of sight. Once a pipe approaches the end of its useful life, it will tend to leak or rupture with increasing frequency until it is more economical to replace the pipe. The cost of emergency repairs to replace pipes that have ruptured is significantly more expensive than replacing the pipe prior to failure.

Appendix 3 contains a letter that documents a water pipe failure and references several other pipe failures in the Litchfield Park area that indicate pipe failures due to mortality.

The use of infrastructure degradation curves, or "nessie" curves is commonly used to predict the useful life of water infrastructure assets. The curves show the expected useful life of an "average" asset, and the percent failure over time. (See Figure 5.)

A literature search was conducted to identify trends in water pipe failures to evaluate the expected useful life of water mains and the causes of failure. Two documents are provided in Appendix 4 that provide information on the useful life of water mains. A brief statement of the conclusions from these two documents relative to this study is provided below.

"Asbestos Cement Pipe: What if it needs to be Replaced?", G. Eric Williams and Kent Von Aspern. This report by Williams indicated that the expected useful life of asbestos cement pipe is 50 years and after that time, the expected failure rate for a mile of pipe is one break per year.



TYPICAL PIPELINE – FIFTY-YEAR NESSIE CURVE

FIGURE 5

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

Carollo

pw://Carollo/Documents/Client/AZ/Liberty Utilities/9249A00/Deliverables/Water Report/Fig_05

"Water Main Breaks in the USA and Canada: A Comprehensive Study," April 2012, Utah State University Buried Structures Laboratory, Steven Folkman, PHD, PE. This report by Folkman contains an in-depth review of water mains across the United States and Canada. The survey covers 117,603 miles of pipe from 188 different water utilities. This survey comprises a statistically significant sample (10 percent of water pipes in service) of water mains. The following findings are significant for this study:

1. The average age of a water main that fails is 47 years.
2. Survey respondents indicated that 55.3 percent of their failures were in cast iron pipe and 17 percent of recorded failures were in asbestos cement pipe.
3. During the five-year period of the study, asbestos cement pipe had a failure rate of 10 breaks/100 miles/year and cast iron pipe had a failure rate of 28 breaks/100 miles/year.
4. 49.8 percent of the cast iron pipe failures during the study occurred with pipes with ages between 41 and 60 years. 44.5 percent of the asbestos cement pipe failed during the same time period.

Cast iron pipe commonly fails due to corrosion. Cast iron pipe is no longer used for new water main construction, having been replaced by ductile iron pipe.

Asbestos cement pipe degrades with corrosion and leaching of the cement material, so over time the pipe becomes more brittle and susceptible to breaks. Asbestos cement pipe has not been used in new pipe construction for over thirty years because of the risk asbestos dust particles pose to human health. Water mains made of this material remain in service until they are replaced.

Efficiency – Service lines have been problematic for LU in recent years due to failures and ongoing maintenance. For this reason, LU has been replacing service lines as shown on the map in Appendix 2. Fire hydrants and valves are also being replaced as the maintenance on hydrants due to leaky seals has increased. Service lines, hydrants, and valves are failing in Litchfield Park due to efficiency, and are in need of replacement.

The Phase 1 report on the Litchfield Park wastewater pipes provided recommendations for the sewer pipes to be replaced in a number of areas. While a street is being torn up to replace sewer pipes, it is most efficient to also replace the water mains in the same street so that both the pipes, service lines, and sewer laterals are all replaced before the street is paved over again. Replacing all the pipe infrastructure at once is the most efficient way to provide new infrastructure that is intended to provide years of trouble free service. The project team met with representatives from the City of Litchfield Park to discuss the timing of water and sewer main replacements. The expressed desire of the City is to replace the water and sewer pipes at the same time to reduce street re-pavement costs and to reduce the disruption to customers. The City has a ten-year pavement repair or replacement

program and to the extent possible, this street repair program will be coordinated with the water and sewer pipe replacement program.

The projects defined in the following section were established to replace water pipes based on the mortality and deficiency criteria, and in some cases the capacity criteria. These projects are scheduled at the same time as sewer pipes to the extent that this is possible.

4.0 CAPITAL IMPROVEMENT PROJECTS

In Litchfield Park, pipe replacement projects have been identified to correspond to sewer pipe replacements over the five-year replacement program. The replacement construction cost of these projects is approximately $10.3 million.

The majority of pipe in the existing system is approaching or has exceeded its original expected useful life. A comprehensive program for water rehabilitation/replacement is required to maintain the serviceability of the existing water distribution system.

4.1 Estimated Unit Costs

Table 6 (page 17) shows the estimated unit costs and describes certain cost assumptions.

4.2 Water Infrastructure Projects

Priorities are identified to address reducing the risk of pipe failure and improve the hydraulic performance of the system to meet industry standards. The total length is approximately 10 miles for an approximate cost of $9.2 million. While this is only for the five-year window, additional infrastructure is expected to be replaced beyond this window.

The high priority projects for water improvements are mirrored with the sewer CIP plan. Appendix 5 contains maps that show the coordination of the water and sewer improvements from a spatial perspective. From a project efficiency standpoint, coordinating the water and sewer projects optimizes the expenditure of capital funds as well as minimizes disturbances to the community over a period of time. Replacing water and sewer infrastructure in the same project provides the opportunity for cost savings up to 20 percent of the indirect costs, which could be up to $200,000. In fact, the City of Litchfield Park is responsible for the road maintenance activities and Liberty Utilities is coordinating with the City's maintenance planners.

Given the typical street width of 32 feet, if Liberty Utilities does not coordinate the water pipeline replacement with the City of Litchfield Park, LU risks the additional cost of $70 per linear foot to pay for street mill and overlay. This is quite substantial compared to the excavated trench installation cost for pipelines within the range of $80-$100 per linear foot. Table 5 lists the mill and overlay costs by project area, which sums up to over $3.0 million.

Figure 6 is a map with the proposed water and sewer projects overlaid.

Table 5 **Pavement Cost for Mill and Overlay in Proposed Water Capital Project Areas**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	Project Description	Street Name	Street Length	Street Width	SY Paving	Cost per SY	Cost per Street	Total Cost
1	Bird Lane	Bird	2593	33	9508	$20.00	$190,153	**$190,153**
2	Redondo Drive	Palo Verde	937	36	3748	$20.00	$74,960	**$230,578**
		Redondo	2501	28	7781	$20.00	$155,618	
3	Laguna Drive and Bahia Lane	Bahia	1876	29	6045	$20.00	$120,898	**$393,333**
		Laguna	1874	29	6038	$20.00	$120,769	
		Oeste	548	28	1705	$20.00	$34,098	
		Old Litchfield	357	50	1983	$20.00	$39,667	
		Sagebrush	1252	28	3895	$20.00	$77,902	
4	Neolin Avenue	Neolin	823	34	3109	$20.00	$62,182	**$105,342**
		Wigwam	747	26	2158	$20.00	$43,160	
5	South La Loma Avenue	Cotton	918	28	2856	$20.00	$57,120	**$101,493**
		Desert	832	24	2219	$20.00	$44,373	
		La Loma Cart Path	1738	12	2317	$-	$-	
6	Villa Nueva	Acacia	358	28	1114	$20.00	$22,276	**$896,418**
		Castillo	1128	28	3509	$20.00	$70,187	
		Fairway	3057	28	9511	$20.00	$190,213	
		Indian School	1627	28	5062	$20.00	$101,236	
		Segovia	546	28	1699	$20.00	$33,973	
		Sierra Hermosa	679	24	1811	$20.00	$36,213	
		Val Verde	1098	28	3416	$20.00	$68,320	
		Villa Nueva	4021	36	16084	$20.00	$321,680	
		Wigwam	654	36	2616	$20.00	$52,320	
7	Old Litchfield Road	Alcala	221	36	884	$20.00	$17,680	**$77,396**
		La Loma	502	28	1562	$20.00	$31,236	
		Old Litchfield	4073	50	22628	$-	$-	
		Vista Paseo	356	36	1424	$20.00	$28,480	
8	North of Bird Lane	Campina	2167	36	8668	$20.00	$173,360	**$616,284**
		Castano	1104	28	3435	$20.00	$68,693	
		Cercado	1748	36	6992	$20.00	$139,840	
		Estero	1706	36	6824	$20.00	$136,480	
		Robles	1103	28	3432	$20.00	$68,631	
		Villa Nueva	366	36	1464	$20.00	$29,280	
9	North La Loma Avenue	Alegre	658	36	2632	$20.00	$52,640	**$415,560**
		Campbell	701	26	2025	$20.00	$40,502	
		La Loma	2474	28	7697	$20.00	$153,938	
		Llano	658	36	2632	$20.00	$52,640	
		Luchana	307	36	1228	$20.00	$24,560	
		Modesto	295	36	1180	$20.00	$23,600	
		Sonoma	589	36	2356	$20.00	$47,120	
		Vista Paseo	257	36	1028	$20.00	$20,560	
							Total Cost	**$3,026,558**

Proposed Water and Sewer Projects

Figure 6

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase I

Table 7 contains the details, justifications, and cost estimates for the proposed projects. Table 8, Table 9, Table 10 and Table 11 show the proposed projects broken down by specific asset groups/types.

Figure 7 (page 27) shows the location of the proposed capital projects in Litchfield Park. Figure 8 (page 28) is a bar chart of the overall five-year proposed CIP in millions.

Table 6 Proposed Unit Costs
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Item Description	Units	Unit Cost
6" DIP CL350 Remove Old Pipe Remove Asphalt/Replace	LF	$77.29
8" DIP CL350 Remove Old Pipe Remove Asphalt/Replace	LF	$83.11
12" DIP CL350 Remove Old Pipe Remove Asphalt/Replace	LF	$97.13
1" Water Service Remove To Property Line New Box and Meter	EA	$2,900
Engineering Design Staking/Inspection (25%) - Pipelines Only		
Engineering Design Staking/Inspection (15%)		
Permit/Review Fee (4% Const.)		
Estimate Contingency (10%)		

*Cost Assumptions:

1) Replacement costs rather than rehabilitation for pipelines were used due to the following common factors: shallow depth, relatively small diameter, traffic control requirements, and reconnecting services.
2) Pipe replacement costs are based on DIP.
3) The engineering, design, staking/inspection assumption is increased for pipelines only due to site-specific factors that may arise during design/study.
4) Pavement replacement is based on trench coverage only, except as noted. Asphalt thickness is 3". Half sack slurry is assumed under paved areas and ABC for unpaved areas.
5) The depth of trench is generally 5 ft. The trench width is per MAG Spec 601.
6) Project delivery and execution includes an Engineering Completion document with an Arizona registered engineer signature.

Appendix 6 contains the record drawings for the proposed areas for water capital improvements.

Table 7 **Water Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant					1. Provide narrative why Replacement Asset is necessary - replacement of existing asset that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - replacement of existing asset for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this asset is a priority. 3. Provide narrative explaining how replacing this asset will benefit existing customers. 4. Provide affirmation that Replacement Asset does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance, and repair/replacement program.
		Pipe Length / Quantity	Diameter/ Size	Material	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	
1A	331	2,579	6"	DIP	$105.89	04-07046	Bird Lane	Year 1	$273,100	$404,300	1. Water main replacement is necessary because the pipe is at the end of its design life, installed in 1962. Also, this stretch of Bird Lane from Old Litchfield Road to Pajaro Lane requires open cut trench replacement of the sewer pipeline and laterals. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
1B	333	30	1"	Type "K" Copper	$2,500.00	04-07046	Bird Lane		$75,000		
1C	334	30	1"	Sensus or Equal	$626.67	04-07046	Bird Lane		$18,800		
1D	335	6	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,233.33	04-07046	Bird Lane		$37,400		
2A	331	3,440	6" & 12"	DIP	$105.90	04-07046	Redondo Drive	Year 1	$364,300	$551,700	1. Water main replacement is necessary because the pipe is at the end of its design life, installed in 1955. It is located in the Redondo Drive loop subdivision and the sewer pipes are recommended for replacement due to deteriorated condition. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
2B	333	46	1"	Type "K" Copper	$2,500.00	04-07046	Redondo Drive		$115,000		
2C	334	46	1"	Sensus or Equal	$626.09	04-07046	Redondo Drive		$28,800		
2D	335	7	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,228.57	04-07046	Redondo Drive		$43,600		

Table 7 **Water Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description: Pipe Length / Quantity	Diameter/ Size	Material	Installed Cost per Unit (Estimated)	Replacement Plant: PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	1. Provide narrative why Replacement Asset is necessary - replacement of existing asset that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - replacement of existing asset for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this asset is a priority. 3. Provide narrative explaining how replacing this asset will benefit existing customers. 4. Provide affirmation that Replacement Asset does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance, and repair/replacement program.
3A	331	6,330	6" & 12"	DIP	$105.89	04-07046	Laguna Drive and Bahia Lane	Year 2	$670,300	$1,195,100	1. Water main replacement is necessary because the pipe is approaching the end of its design life (installed in 1968) and replacement will satisfy current design criteria for fire flows. It is located along Laguna Drive and Bahia Lane, southeast of Old Litchfield Rd and Wigwam Blvd. Service line replacement is necessary to ensure system integrity. The sewer pipelines in the vicinity are recommended for replacement due to inadequate slopes and debris accumulation. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
3B	333	142	1"	Type "K" Copper	$2,500.00	04-07046	Laguna Drive and Bahia Lane		$355,000		
3C	334	142	1"	Sensus or Equal	$625.35	04-07046	Laguna Drive and Bahia Lane		$88,800		
3D	335	13	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,230.77	04-07046	Laguna Drive and Bahia Lane		$81,000		
4A	331	2,357	6" & 12"	DIP	$114.30	04-07046	Neolin Ave	Year 2	$269,400	$338,100	1. Water main replacement is necessary because the pipe is at the end of its design life (installed in 1956) and replacement will satisfy current design criteria for fire flows. It is located along Neolin Avenue and Wigwam Blvd. The sewer pipelines in the vicinity are recommended for replacement due to failed materials and conditions that can lead to overflows. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
4B	333	12	1"	Type "K" Copper	$2,500.00	04-07046	Neolin Ave		$30,000		
4C	334	12	1"	Sensus or Equal	$625.00	04-07046	Neolin Ave		$7,500		
4D	335	5	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,240.00	04-07046	Neolin Ave		$31,200		

Table 7 **Water Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description: Pipe Length / Quantity	Diameter/ Size	Material	Installed Cost per Unit (Estimated)	Replacement Plant: PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)	Estimated Subtotal Cost (by project)	1. Provide narrative why Replacement Asset is necessary - replacement of existing asset that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility - replacement of existing asset for other reasons supported by persuasive showing by utility 2. Provide narrative explaining why this asset is a priority. 3. Provide narrative explaining how replacing this asset will benefit existing customers. 4. Provide affirmation that Replacement Asset does not include the costs for extending or expanding facilities to serve new customers. 5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance, and repair/replacement program.
5A	331	3,942	6" & 12"	DIP	$127.04	04-07046	South La Loma Ave	Year 3	$500,800	$560,000	1. Water main replacement is necessary because the pipe is approaching the end of its design life, installed in 1965. It is located along La Loma Ave and Honeysuckle St NW of Old Litchfield and Wigwam Blvd. The area has been planned out as the City of Litchfield's future City Hall when funds become available. The sewer lines are recommended for replacement due to corroded material and overflow potential. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
5B	333	3	1"	Type "K" Copper	$2,500	04-07046	South La Loma Ave		$7,500		
5C	334	3	1"	Sensus or Equal	$633.33	04-07046	South La Loma Ave		$1,900		
5D	335	8	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,225.00	04-07046	South La Loma Ave		$49,800		
6A	331	14,630	6" & 12"	DIP	$119.79	04-07046	Villa Nueva	Year 3	$1,752,500	$2,458,100	1. Water main replacement is necessary because the pipe is approaching the end of its design life (installed in 1966) and replacement will satisfy current design criteria for fire flows. It is located in the southeast portion of Litchfield Park throughout the Villa Nueva subdivision. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
6B	333	166	1"	Type "K" Copper	$2,500.00	04-07046	Villa Nueva		$415,000		
6C	334	166	1"	Sensus or Equal	$625.30	04-07046	Villa Nueva		$103,800		
6D	335	30	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,226.67	04-07046	Villa Nueva		$186,800		
7A	331	7,693	6" & 12"	DIP	$107.34	04-07046	Old Litchfield Rd	Year 4	$825,800	$1,053,600	1. The sewer pipes are recommended for replacement due to deteriorated condition and overflow potential. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. Water main replacement will also satisfy current design criteria for fire flows by upsizing pipelines. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
7B	333	41	1"	Type "K" Copper	$2,500.00	04-07046	Old Litchfield Rd		$102,500		
7C	334	41	1"	Sensus or Equal	$626.83	04-07046	Old Litchfield Rd		$25,700		
7D	335	16	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,225.00	04-07046	Old Litchfield Rd		$99,600		

Table 7 **Water Capital Project Summary**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

		Replacement Plant Description				Replacement Plant					
Project No.	**NARUC Acct No. (SIB-eligible plant)** 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	**Pipe Length / Quantity**	**Diameter/ Size**	**Material**	**Installed Cost per Unit (Estimated)**	**PWS ID No.**	**Site (location description)**	**Expected In-Service Date**	**Estimated Subtotal Cost (by NARUC Acct No.)**	**Estimated Subtotal Cost (by project)**	**1. Provide narrative why Replacement Asset is necessary** - **replacement of existing asset that has exceeded its designated useful life and has worn out or is in deteriorating condition due to no fault of the utility** - **replacement of existing asset for other reasons supported by persuasive showing by utility** **2. Provide narrative explaining why this asset is a priority.** **3. Provide narrative explaining how replacing this asset will benefit existing customers.** **4. Provide affirmation that Replacement Asset does not include the costs for extending or expanding facilities to serve new customers.** **5. Provide reference to related page No. in the submitted detailed Engineering Analysis supporting the need for SIB. Engineering Analysis shall also include narrative explaining the utility's systematic assessment, inspection, maintenance, and repair/replacement program.**
8A	331	10,283	6" & 12"	DIP	$116.76	04-07046	North of Bird Lane	Year 4	$1,200,600	$1,631,400	1. Water main replacement is necessary because the pipe is at the end of its design life (installed in 1962) and replacement will satisfy current design criteria for fire flows. It is located in the subdivision north of Bird Lane. The sewer infrastructure in the vicinity is also recommended for replacement due to deteriorated conditions. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
8B	333	96	1"	Type "K" Copper	$2,500.00	04-07046	North of Bird Lane		$240,000		
8C	334	96	1"	Sensus or Equal	$625.00	04-07046	North of Bird Lane		$60,000		
8D	335	21	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,228.57	04-07046	North of Bird Lane		$130,800		
9A	331	6,282	6"	DIP	$105.89	04-07046	North La Loma Ave	Year 5	$665,200	$968,100	1. Water main replacement is necessary because the pipe is nearing the end of its design life (installed in 1965) and replacement will satisfy current design criteria for fire flows. It is located along La Loma Drive north of Fairway Dr and almost curving to Old Litchfield Rd. The sewer infrastructure in the vicinity is also recommended for replacement due to deteriorated conditions. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. 2. Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs. 3. Replacing pipes and service lines benefits existing customers by improving water supply reliability. 4. Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers. 5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.
9B	333	71	1"	Type "K" Copper	$2,500.00	04-07046	North La Loma Ave		$177,500		
9C	334	71	1"	Sensus or Equal	$625.35	04-07046	North La Loma Ave		$44,400		
9D	335	13	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,230.77	04-07046	North La Loma Ave		$81,000		
										$9,160,400	

Table 8 **Water Capital Projects for Five Years – Pipelines**
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant			
		Pipe Length	Diameter / Size	Material	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)
1A	331	2,579	6"	DIP	$105.89	04-07046	Bird Lane	Year 1	$273,100
2A	331	3,440	6" & 12"	DIP	$105.90	04-07046	Redondo Drive	Year 1	$364,300
3A	331	6,330	6" & 12"	DIP	$105.89	04-07046	Laguna Drive and Bahia Lane	Year 2	$670,300
4A	331	2,357	6" & 12"	DIP	$114.30	04-07046	Neolin Ave	Year 2	$269,400
5A	331	3,942	6" & 12"	DIP	$127.04	04-07046	South La Loma Ave	Year 3	$500,800
6A	331	14,630	6" & 12"	DIP	$119.79	04-07046	Villa Nueva	Year 3	$1,752,500
7A	331	7,693	6" & 12"	DIP	$107.34	04-07046	Old Litchfield Rd	Year 4	$825,800
8A	331	10,283	6" & 12"	DIP	$116.76	04-07046	North of Bird Lane	Year 4	$1,200,600
9A	331	6,282	6"	DIP	$105.89	04-07046	North La Loma Ave	Year 5	$665,200
								Total Estimated Cost	**$6,522,000**

Table 9 Water Capital Projects for Five Years – Services
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant			
		Quantity	Diameter / Size	Material	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)
1B	333	30	1"	Type "K" Copper	$2,500.00	04-07046	Bird Lane	Year 1	$75,000
2B	333	46	1"	Type "K" Copper	$2,500.00	04-07046	Redondo Drive	Year 1	$115,000
3B	333	142	1"	Type "K" Copper	$2,500.00	04-07046	Laguna Drive and Bahia Lane	Year 2	$355,000
4B	333	12	1"	Type "K" Copper	$2,500.00	04-07046	Neolin Ave	Year 2	$30,000
5B	333	3	1"	Type "K" Copper	$2,500.00	04-07046	South La Loma Ave	Year 3	$7,500
6B	333	166	1"	Type "K" Copper	$2,500.00	04-07046	Villa Nueva	Year 3	$415,000
7B	333	41	1"	Type "K" Copper	$2,500.00	04-07046	Old Litchfield Rd	Year 4	$102,500
8B	333	96	1"	Type "K" Copper	$2,500.00	04-07046	North of Bird Lane	Year 4	$240,000
9B	333	71	1"	Type "K" Copper	$2,500.00	04-07046	North La Loma Ave	Year 5	$177,500
									$1,517,500

Table 10 Water Capital Projects for Future Years – Meters
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant			
		Quantity	Diameter / Size	Manufacturer	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)
1C	334	30	1"	Sensus or Equal	$626.67	04-07046	Bird Lane	Year 1	$18,800
2C	334	46	1"	Sensus or Equal	$626.09	04-07046	Redondo Drive	Year 1	$28,800
3C	334	142	1"	Sensus or Equal	$625.35	04-07046	Laguna Drive and Bahia Lane	Year 2	$88,800
4C	334	12	1"	Sensus or Equal	$625.00	04-07046	Neolin Ave	Year 2	$7,500
5C	334	3	1"	Sensus or Equal	$633.33	04-07046	South La Loma Ave	Year 3	$1,900
6C	334	166	1"	Sensus or Equal	$625.30	04-07046	Villa Nueva	Year 3	$103,800
7C	334	41	1"	Sensus or Equal	$626.83	04-07046	Old Litchfield Rd	Year 4	$25,700
8C	334	96	1"	Sensus or Equal	$625.00	04-07046	North of Bird Lane	Year 4	$60,000
9C	334	71	1"	Sensus or Equal	$625.35	04-07046	North La Loma Ave	Year 5	$44,400
									$379,700

Table 11 Water Capital Projects for Future Years – Hydrants
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant			
		Quantity	Diameter / Size	Material	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)
1D	335	6	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,233.33	04-07046	Bird Lane	Year 1	$37,400
2D	335	7	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,228.57	04-07046	Redondo Drive	Year 1	$43,600
3D	335	13	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,230.77	04-07046	Laguna Drive and Bahia Lane	Year 2	$81,000
4D	335	5	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,240.00	04-07046	Neolin Ave	Year 2	$31,200
5D	335	8	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,225.00	04-07046	South La Loma Ave	Year 3	$49,800
6D	335	30	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,226.67	04-07046	Villa Nueva	Year 3	$186,800

Table 11 Water Capital Projects for Future Years – Hydrants
Litchfield Park Facilities Assessment, Volume 2 - Water
Liberty Utilities

Project No.	NARUC Acct No. (SIB-eligible plant) 309 - Supply Mains 331 - T&D Mains 333 - Services 334 - Meters 335 - Hydrants	Replacement Plant Description				Replacement Plant			
		Quantity	Diameter / Size	Material	Installed Cost per Unit (Estimated)	PWS ID No.	Site (location description)	Expected In-Service Date	Estimated Subtotal Cost (by NARUC Acct No.)
7D	335	16	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,225.00	04-07046	Old Litchfield Rd	Year 4	$99,600
8D	335	21	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,228.57	04-07046	North of Bird Lane	Year 4	$130,800
9D	335	13	5 1/4"	Waterous Pacer, Mueller Centurion, Clow Medallion or Equal	$6,230.77	04-07046	North La Loma Ave	Year 5	$81,000
									$741,200

CAPITAL PROJECTS OVERVIEW MAP

FIGURE 7

LIBERTY WATER

LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

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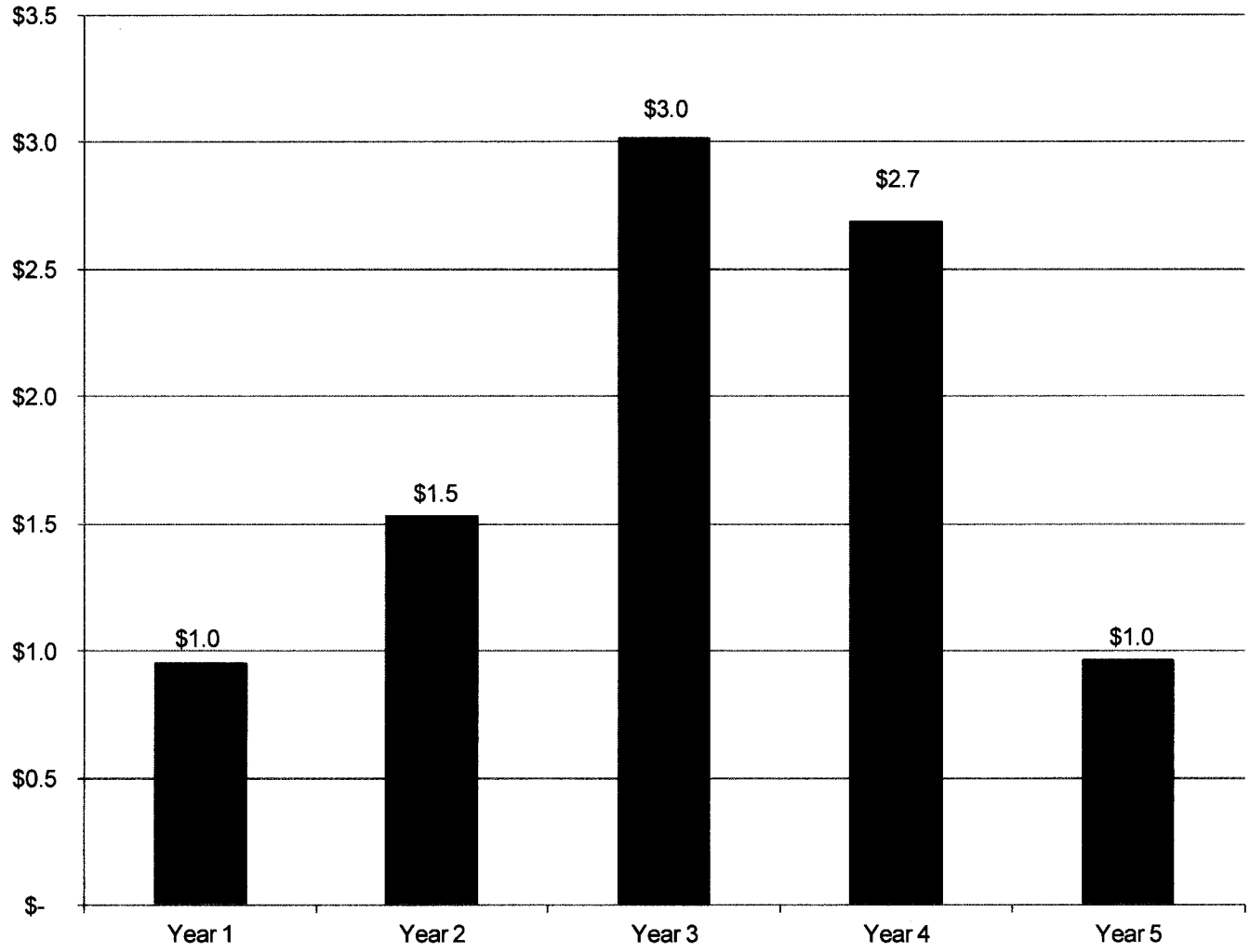

PROPOSED CAPITAL EXPENDITURES (IN MILLIONS)

FIGURE 8

LIBERTY WATER
LITCHFIELD PARK WATER AND WASTEWATER FACILITIES ASSESSMENT, PHASE 2

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APPENDIX 1 – PROPOSED CIP ONE-PAGE SUMMARIES AND DETAILED COST INFORMATION

Project Number: 1

Project Phase: Year 1

Project Location: Bird Lane

Project Description:

1.Water main replacement is necessary because the pipe is at the end of its design life, installed in 1962. Also, this stretch of Bird Lane from Old Litchfield Road to Pajaro Lane requires open cut trench replacement of the sewer pipeline and laterals. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5. Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $404,300 (in 2013 dollars)

Water Mains: Replace 2,579 LF of existing 6" pipe in kind

Water Services: Replace 30 water services to property line

All Water Mains

Project Water Mains

NTS

Litchfield Park Water and Wastewater Facilities Assessment, 2013

Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 01 BirdLane.mxd

Project Number: **2**

Project Phase: Year 1

Project Location: Redondo Drive

Project Description:

1.Water main replacement is necessary because the pipe is at the end of its design life, installed in 1955. It is located in the Redondo Drive loop subdivision and the sewer pipes are recommended for replacement due to deteriorated condition. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $551,700
(in 2013 dollars)

Water Mains: Replace 3,440 LF of existing 6" and 12" pipe in kind

Water Services: Replace 46 water services to property line

Litchfield Park Water and Wastewater Facilities Assessment. 2013

Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 02 Redondo.mxd

Project Number: 3

Project Phase: Year 2

Project Location: Laguna Drive and Bahia Lane

Project Description:

1.Water main replacement is necessary because the pipe is approaching the end of its design life (installed in 1968) and replacement will satisfy current design criteria for fire flows. It is located along Laguna Drive and Bahia Lane, southeast of Old Litchfield Rd and Wigwam Blvd. Service line replacement is necessary to ensure system integrity. The sewer pipelines in the vicinity are recommended for replacement due to inadequate slopes and debris accumulation. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $1,195,100 (in 2013 dollars)

Water Mains: Replace 6,330 LF of existing 6" pipe in kind

Water Services: Replace 142 water services to property line

All Water Mains

Project Water Mains

NTS

Litchfield Park Water and Wastewater Facilities Assessment. 2013

Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 03 Laguna.mxd

Project Number: 4

Project Phase: Year 2

Project Location: Neolin Avenue

Project Description:

1.Water main replacement is necessary because the pipe is at the end of its design life (installed in 1956) and replacement will satisfy current design criteria for fire flows. It is located along Neolin Avenue and Wigwam Blvd. The sewer pipelines in the vicinity are recommended for replacement due to failed materials and conditions that can lead to overflows. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $338,100 (in 2013 dollars)

Water Mains: Replace 2,357 LF of existing 6" and 12" pipe in kind

Water Services: Replace 12 water services to property line

Litchfield Park Water and Wastewater Facilities Assessment. 2013

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File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 04 Neolin.mxd

Project Number: **5**

Project Phase: Year 3

Project Location: South La Loma Avenue

Project Description:

1.Water main replacement is necessary because the pipe is approaching the end of its design life, installed in 1965. It is located along La Loma Ave and Honeysuckle St NW of Old Litchfield and Wigwam Blvd. The area has been planned out as the City of Litchfield's future City Hall when funds become available. The sewer lines are recommended for replacement due to corroded material and overflow potential.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $560,000
(in 2013 dollars)

Water Mains: Replace 3,924 LF of existing 6" and 12" pipe in kind

Water Services: Replace 3 water services to property line

All Water Mains
Project Water Mains
N
NTS

Litchfield Park Water and Wastewater Facilities Assessment. 2013

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File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 05 SouthLaLoma.mxd

Project Number: 6

Project Phase: Year 3

Project Location: Villa Nueva Drive

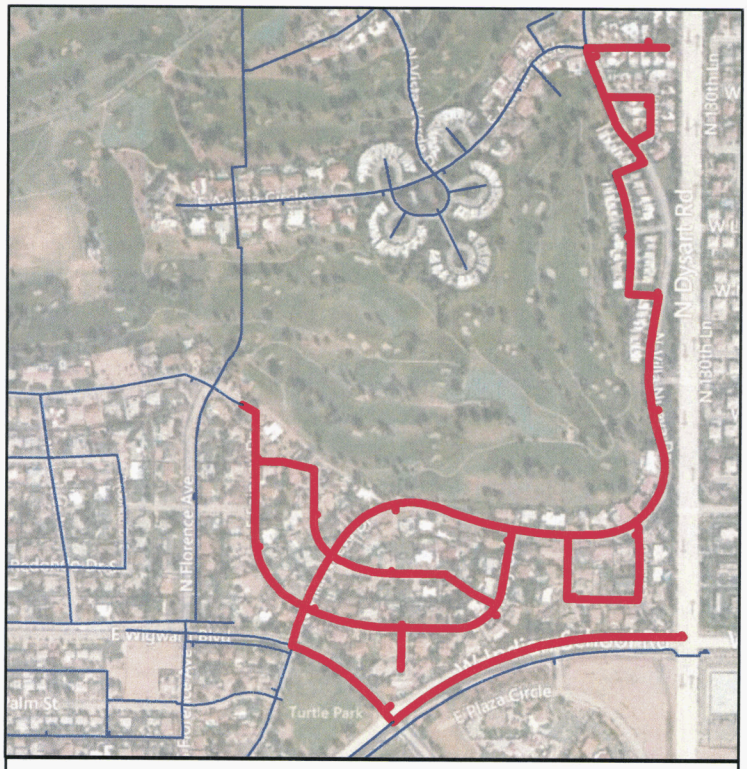
Project Description:

1.Water main replacement is necessary because the pipe is approaching the end of its design life (installed in 1966) and replacement will satisfy current design criteria for fire flows. It is located in the southeast portion of Litchfield Park throughout the Villa Nueva subdivision. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $2,458,100
(in 2013 dollars)

Water Mains: Replace 14,630 LF of existing 6" and 12" pipe in kind

Water Services: Replace 166 water services to property line



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Project Number: 7

Project Phase: Year 4

Project Location: Old Litchfield Road

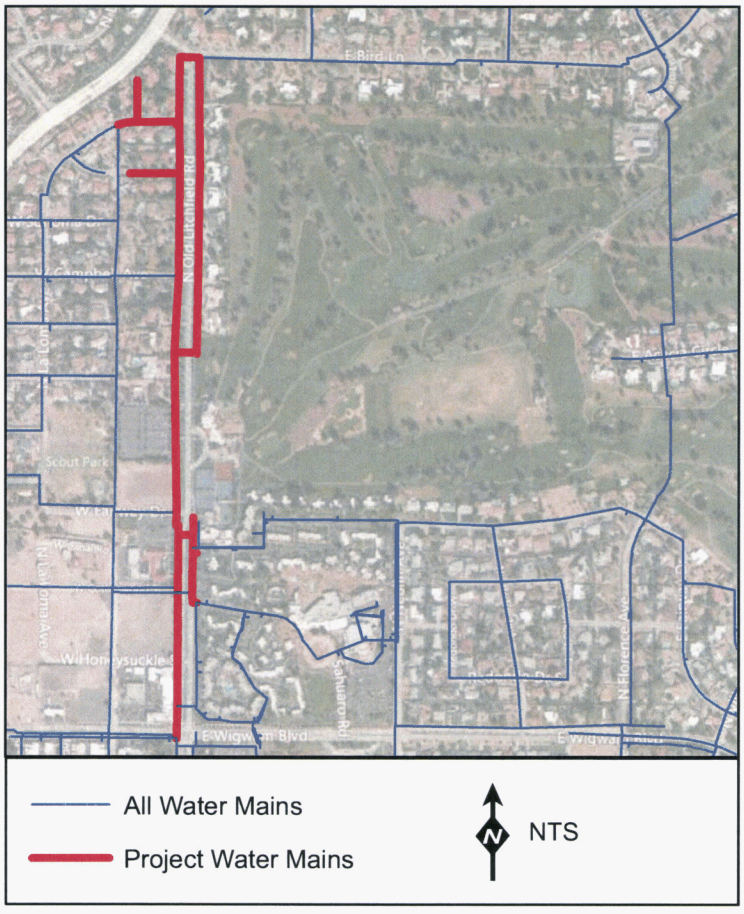
Project Description:

1.The sewer pipes are recommended for replacement due to deteriorated condition and overflow potential. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time. Water main replacement will also satisfy current design criteria for fire flows by upsizing pipelines.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $1,053,600
(in 2013 dollars)

Water Mains: Replace 7,693 LF of existing 6" and 12" pipe in kind

Water Services: Replace 41 water services to property line



Litchfield Park Water and Wastewater Facilities Assessment. 2013

Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 07 OldLitchfield.mxd

Project Number: 8

Project Phase: Year 4

Project Location: North of Bird Lane

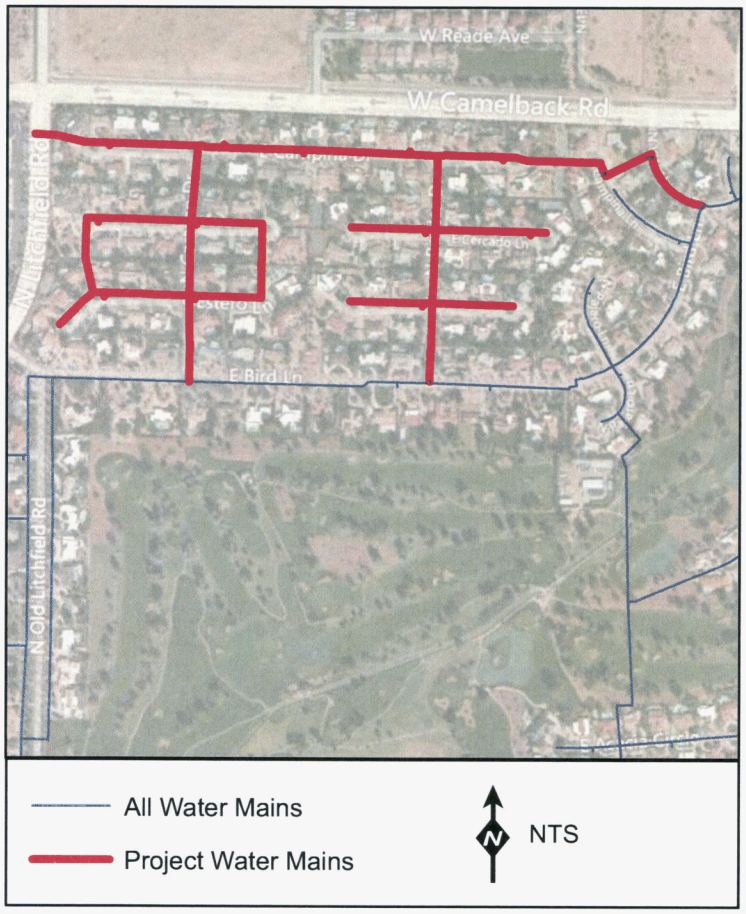
Project Description:

1.Water main replacement is necessary because the pipe is at the end of its design life (installed in 1962) and replacement will satisfy current design criteria for fire flows. It is located in the subdivision north of Bird Lane. The sewer infrastructure in the vicinity is also recommended for replacement due to deteriorated conditions. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $1,631,400
(in 2013 dollars)

Water Mains: Replace 10,283 LF of existing 6" and 12" pipe in kind

Water Services: Replace 96 water services to property line



Litchfield Park Water and Wastewater Facilities Assessment. 2013

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Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 08 NorthBird.mxd

Project Number: **9**

Project Phase: Year 5

Project Location: North La Loma Avenue

Project Description:

1.Water main replacement is necessary because the pipe is nearing the end of its design life (installed in 1965) and replacement will satisfy current design criteria for fire flows. It is located along La Loma Drive north of Fairway Dr and almost curving to Old Litchfield Rd. The sewer infrastructure in the vicinity is also recommended for replacement due to deteriorated conditions. It would be advantageous from a surface restoration cost perspective, to replace the aging water pipeline and services at the same time.
2.Replacing pipes and service lines are a priority to avoid water delivery interruptions and avoid expensive repairs.
3.Replacing pipes and service lines benefits existing customers by improving water supply reliability.
4.Pipe replacements are entirely in established, fully developed neighborhoods and do not serve new water customers.
5.Sections 3.1 and 3.2 in the report explain the modes of pipeline failure. In this case, the failure mode is mortality and efficiency.

Estimated Capital Cost: $968,100
(in 2013 dollars)

Water Mains: Replace 6,282 LF of existing 6" and 12" pipe in kind

Water Services: Replace 71 water services to property line

Litchfield Park Water and Wastewater Facilities Assessment. 2013

Printing Date: September 10, 2013

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\Water CIP 09 NorthLaLoma.mxd

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PLANNING COST ESTIMATE

F... Plan

LOCATION FACTOR: 1.00

JOB # : 9249A.00

DATE : 9/5/2013

CLIENT : Liberty Utilities

ENR : 9545

ELEMENT : Water Main Replacement

BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	6" CL52 CLDI PUSH-ON JT PIPE IN OPEN TRENCH	1	LF	$16.81	$0.00	$16.81	$16.81	
	TOTAL PIPING							**$16.81**
EXCAV								
& BACKFILL	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.28	CY	$3.33	$0.00	$3.33	$0.93	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.09	CY	$60.54	$0.00	$60.54	$5.45	
	Backfill Above Zone (1/2 sack slurry)	0.18	CY	$41.25	$0.00	$41.25	$7.43	
	Traffic Plates, 1", (12 Uses)	5	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1	LS	$2.54	$0.00	$2.54	$2.54	
	Total Earthwork (per 1 LF)							**$27.95**
PAVING								
DEMO &	Remove AC Pavement	0.39	SY	$7.00	$0.70	$7.70	$3.00	
REPLACEMENT	3" AC Paving on 6" ABC	0.39	SY	$36.45	$9.80	$46.25	$18.04	
	TOTAL PAVING							**$21.04**
	6" 45 or 90 degree fitting	2	EA	$278.49	$0.00	$278.49	$556.98	
FITTINGS	6" BFV and Valve Box	1	EA	$10,959.13	$0.00	$10,959.13	$10,959.13	
& VALVES	Air Release Valve Assembly	1	EA	$3,598.74	$0.00	$3,598.74	$3,598.74	
	Fire Hydrant Assembly	1	EA	$4,979.14	$0.00	$4,979.14	$4,979.14	
	TOTAL (per 1/4 Mile)						$15,114.85	
	TOTAL FITTINGS & VALVES (PER LF)							**$11.49**
	TOTAL CONSTRUCTION COST PER LF							**$77.29**

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PLANNING COST ESTIMATE

PROJECT : Liberty Water Asset Management Plan
LOCATION FACTOR: 1.00
JOB # : 9249A.00
DATE : 9/5/2013
CLIENT : Liberty Utilities
ENR : 9545
ELEMENT : Water Main Replacement
BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	8" CL52 CLDI PUSH-ON JT PIPE IN OPEN TRENCH	1	LF	$19.56	$0.00	$19.56	$19.56	
	TOTAL PIPING							**$19.56**
EXCAV	EARTHWORK							
& BACKFILL	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.31	CY	$3.33	$0.00	$3.33	$1.03	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.11	CY	$60.54	$0.00	$60.54	$6.66	
	Backfill Above Zone (1/2 sack slurry)	0.19	CY	$41.25	$0.00	$41.25	$7.84	
	Traffic Plates, 1", (12 Uses)	5	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1	LS	$2.71	$0.00	$2.71	$2.71	
	Total Earthwork (per 1 LF)							**$29.84**
PAVING								
DEMO &	Remove AC Pavement	0.41	SY	$7.00	$0.70	$7.70	$3.16	
REPLACEMENT	3" AC Paving on 6" ABC	0.41	SY	$36.45	$9.80	$46.25	$18.96	
	TOTAL PAVING							**$22.12**
	8" 45 or 90 degree fitting	2	EA	$341.24	$0.00	$341.24	$682.48	
FITTINGS	8" BFV and Valve Box	1	EA	$10,959.13	$0.00	$10,959.13	$10,959.13	
& VALVES	Air Release Valve Assembly	1	EA	$3,598.74	$0.00	$3,598.74	$3,598.74	
	Fire Hydrant Assembly	1	EA	$4,979.14	$0.00	$4,979.14	$4,979.14	
	TOTAL (per 1/4 Mile)						$15,240.35	
	TOTAL FITTINGS & VALVES (PER LF)							**$11.59**
	TOTAL CONSTRUCTION COST PER LF							**$83.11**

carollo

PLANNING COST ESTIMATE

PROJECT : Liberty Water Asset Management Plan
JOB # : 9249A.00
CLIENT : Liberty Utilities
ELEMENT : Water Main Replacement

LOCATION FACTOR: 1.00
DATE : 9/5/2013
ENR : 9545
BY : GAI

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	12" CL52 CLDI PUSH-ON JT PIPE IN OPEN TRENCH	1	LF	$ 28.94	$0.00	$28.94	$28.94	
	TOTAL PIPING							**$28.94**
EXCAV & BACKFILL	EARTHWORK							
	Cat 225 Trackhoe, 1CY Bucket, Class A (Easy Digging), 0-16' D	0.37	CY	$3.33	$0.00	$3.33	$1.23	
	Excavation Shoring	1.00	LF	$4.50	$0.00	$4.50	$4.50	
	Imported Pipe Bed & Zone	0.14	CY	$60.54	$0.00	$60.54	$8.48	
	Backfill Above Zone (1/2 sack slurry)	0.20	CY	$41.25	$0.00	$41.25	$8.25	
	Traffic Plates, 1", (12 Uses)	5	SF	$1.42	$0.00	$1.42	$7.10	
	10% Site Specific Requirements	1	LS	$2.96	$0.00	$2.96	$2.96	
	Total Earthwork (per 1 LF)							**$32.51**
PAVING DEMO & REPLACEMEN								
	Remove AC Pavement	0.44	SY	$7.00	$0.70	$7.70	$3.39	
	3" AC Paving on 6" ABC	0.44	SY	$36.45	$9.80	$46.25	$20.35	
	TOTAL PAVING							**$23.74**
FITTINGS & VALVES	12" 45 or 90 degree fitting	2	EA	$571.65	$0.00	$571.65	$1,143.31	
	12" BFV and Valve Box	1	EA	$10,959.13	$0.00	$10,959.13	$10,959.13	
	Air Release Valve Assembly	1	EA	$3,598.74	$0.00	$3,598.74	$3,598.74	
	Fire Hydrant Assembly	1	EA	$4,979.14	$0.00	$4,979.14	$4,979.14	
	TOTAL (per 1/4 Mile)						$15,701.17	
	TOTAL FITTINGS & VALVES (PER LF)							**$11.94**
	TOTAL CONSTRUCTION COST PER LF							**$97.13**

LITCHFIELD PARK FACILITIES [illegible]SSMENT, VOLUME 2 - WATER
ENGINEER O[illegible]ION OF COST

Project	**1**			ENR August 2013	9545	
Location	**Bird Lane**					
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2579	LF	$ 77.29	$ 199,331		
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -		
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 97.13	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 49,833		
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 3,987		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 19,933		
			Pipeline Total	$ 273,083	Unit Cost	
			Rounded Pipeline Total	**$ 273,100**		$105.89
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX	30	EA	$ 2,000.00	$ 60,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 9,000		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 6,000		
			Service Total	$ 75,000	Unit Cost	
			Rounded Service Total	**$ 75,000**	$	2,500.00
New Meter	30	EA	$ 500.00	$ 15,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 2,250		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 1,500		
			Meter Total	$ 18,750	Unit Cost	
			Rounded Meter Total	**$ 18,800**	$	626.67
Fire Hydrant Assembly	6	EA	$ 4,979.14	$ 29,875		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 4,481		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,987		
			Hydrant Total	$ 37,344	Unit Cost	
			Rounded Fire Hydrant Total	**$ 37,400**	$	6,233
			TOTAL	$ 404,177		
			ROUNDED PROJECT TOTAL	**$ 404,300**		

LITCHFIELD PARK FACILITIES [illegible]SSMENT, VOLUME 2 - WATER
ENGINEER OF[illegible]ON OF COST

	Project 2				ENR August 2013	9545
	Location Redondo					
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	3440	LF	$ 77.29	$ 265,878		
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -		
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 97.13	$ -		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 66,469		
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 5,318		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 26,588		
			Pipeline Total	$ 364,253	Unit Cost	
			Rounded Pipeline Total	**$ 364,300**	$105.90	
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX	46	EA	$ 2,000.00	$ 92,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 13,800		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 9,200		
			Service Lateral Total	$ 115,000	Unit Cost	
			Rounded Service Total	**$ 115,000**	$ 2,500.00	
New Meter	46	EA	$ 500.00	$ 23,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,450		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,300		
			Meter Total	$ 28,750	Unit Cost	
			Rounded Meter Total	**$ 28,800**	$ 626.09	
Fire Hydrant Assembly	7	EA	4979.14	$ 34,854		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 5,228		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 3,485		
			Hydrant Total	$ 43,567	Unit Cost	
			Rounded Fire Hydrant Total	**$ 43,600**	$ 6,228.57	
			TOTAL	$ 551,570		
			ROUNDED PROJECT TOTAL	**$ 551,700**		

Project 3 ENR August 2013 9545
Location Laguna Dr & Bahia Ln

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	6330	LF	$ 77.29	$ 489,246	
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -	
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 97.13	$ -	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 122,311	
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 9,785	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 48,925	
			Pipeline Total	$ 670,267	Unit Cost
			Rounded Pipeline Total	**$ 670,300**	$105.89
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX	142	EA	$2,000.00	$ 284,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 42,600	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 28,400	
			Service Lateral Total	$ 355,000	Unit Cost
			Rounded Service Total	**$ 355,000**	$ 2,500.00
New Meter	142	EA	$ 500.00	$ 71,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 10,650	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 7,100	
			Meter Total	$ 88,750	Unit Cost
			Rounded Meter Total	**$ 88,800**	$ 625.35
Fire Hydrant Assembly	13	EA	4979.14	$ 64,729	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 9,709	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 6,473	
			Hydrant Total	$ 80,911	Unit Cost
			Rounded Fire Hydrant Total	**$ 81,000**	$ 6,230.77
			TOTAL	$ 1,194,928	
			ROUNDED PROJECT TOTAL	**$ 1,195,100**	

LITCHFIELD PARK FACILITIES [illegible]SSMENT, VOLUME 2 - WATER
ENGINEER O[illegible]ON OF COST

Project Location	**4 Neolin**			ENR August 2013	9545	
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	1629	LF	$ 77.29	$ 125,905		
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -		
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	728	LF	$ 97.13	$ 70,711		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 49,154		
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 3,932		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 19,662		
			Pipeline Total	$ 269,364	Unit Cost	
			Rounded Pipeline Total	**$ 269,400**	$114.30	
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX	12	EA	$ 2,000.00	$ 24,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,600		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,400		
			Service Lateral Total	$ 30,000	Unit Cost	
			Rounded Service Total	**$ 30,000**	$ 2,500.00	
New Meter	12	EA	$ 500.00	$ 6,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 900		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 600		
			Meter Total	$ 7,500	Unit Cost	
			Rounded Meter Total	**$ 7,500**	$ 625.00	
Fire Hydrant Assembly	5	EA	4979.14	$ 24,896		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,734		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,490		
			Hydrant Total	$ 31,120	Unit Cost	
			Rounded Fire Hydrant Total	**$ 31,200**	$ 6,240.00	
			TOTAL	$ 337,984		
			ROUNDED PROJECT TOTAL	**$ 338,100**		

Project 5 ENR August 2013 9545
Location South La Loma

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	875	LF	$ 77.29	$ 67,629	
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -	
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	3067	LF	$ 97.13	$ 297,898	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 91,382	
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 7,311	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 36,553	
			Pipeline Total	$ 500,772	Unit Cost
			Rounded Pipeline Total	**$ 500,800**	$127.04
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX	3	EA	$ 2,000.00	$ 6,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 900	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 600	
			Service Lateral Total	$ 7,500	Unit Cost
			Rounded Service Total	**$ 7,500**	$ 2,500.00
New Meter	3	EA	$ 500.00	$ 1,500	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 225	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 150	
			Meter Total	$ 1,875	Unit Cost
			Rounded Meter Total	**$ 1,900**	$ 633.33
Fire Hydrant Assembly	8	EA	4979.14	$ 39,833	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 5,975	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 3,983	
			Hydrant Total	$ 49,791	Unit Cost
			Rounded Fire Hydrant Total	**$ 49,800**	$ 6,225.00
			TOTAL	$ 559,938	
			ROUNDED PROJECT TOTAL	**$ 560,000**	

LITCHFIELD PARK FACILITIES [illegible]SSMENT, VOLUME 2 - WATER
ENGINEER O[illegible]ON OF COST

	Project	6			ENR August 2013	9545
	Location	Villa Nueva				
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE		
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	7151	LF	$ 77.29	$ 552,701		
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -		
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	7479	LF	$ 97.13	$ 726,435		
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 319,784		
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 25,583		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 127,914		
			Pipeline Total	$ 1,752,417	Unit Cost	
			Rounded Pipeline Total	**$ 1,752,500**	$119.79	
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX AND METER	166	EA	$ 2,000.00	$ 332,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 49,800		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 33,200		
			Service Lateral Total	$ 415,000	Unit Cost	
			Rounded Service Total	**$ 415,000**	$ 2,500.00	
New Meter	166	EA	$ 500.00	$ 83,000		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 12,450		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 8,300		
			Meter Total	$ 103,750	Unit Cost	
			Rounded Meter Total	**$ 103,800**	$ 625.30	
Fire Hydrant Assembly	30	EA	4979.14	$ 149,374		
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 22,406		
ESTIMATE CONTINGENCY (10%)	1	LS		$ 14,937		
			Hydrant Total	$ 186,718	Unit Cost	
			Rounded Fire Hydrant Total	**$ 186,800**	$ 6,226.67	
			TOTAL	$ 2,457,885		
			ROUNDED PROJECT TOTAL	**$ 2,458,100**		

Project **7** ENR August 2013 9545
Location Old Litchfield

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	7150	LF	$ 77.29	$ 552,624	
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	186	LF	$ 83.11	$ 15,458	
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	357	LF	$ 97.13	$ 34,675	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 150,689	
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 12,055	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 60,276	
			Pipeline Total	$ 825,778	Unit Cost
			Rounded Pipeline Total	**$ 825,800**	$107.34
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX AND METER	41	EA	$ 2,000.00	$ 82,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 12,300	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 8,200	
			Service Lateral Total	$ 102,500	Unit Cost
			Rounded Service Total	**$ 102,500**	$ 2,500.00
New Meter	41	EA	$ 500.00	$ 20,500	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 3,075	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 2,050	
			Meter Total	$ 25,625	Unit Cost
			Rounded Meter Total	**$ 25,700**	$ 626.83
Fire Hydrant Assembly	16	EA	4979.14	$ 79,666	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 11,950	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 7,967	
			Hydrant Total	$ 99,583	Unit Cost
			Rounded Fire Hydrant Total	**$ 99,600**	$ 6,225.00
			TOTAL	$ 1,053,486	
			ROUNDED PROJECT TOTAL	**$ 1,053,600**	

LITCHFIELD PARK FACILITIES [redacted]SSMENT, VOLUME 2 - WATER
ENGINEER O[redacted]ON OF COST

Project 8 ENR August 2013 9545
Location North of Bird Lane

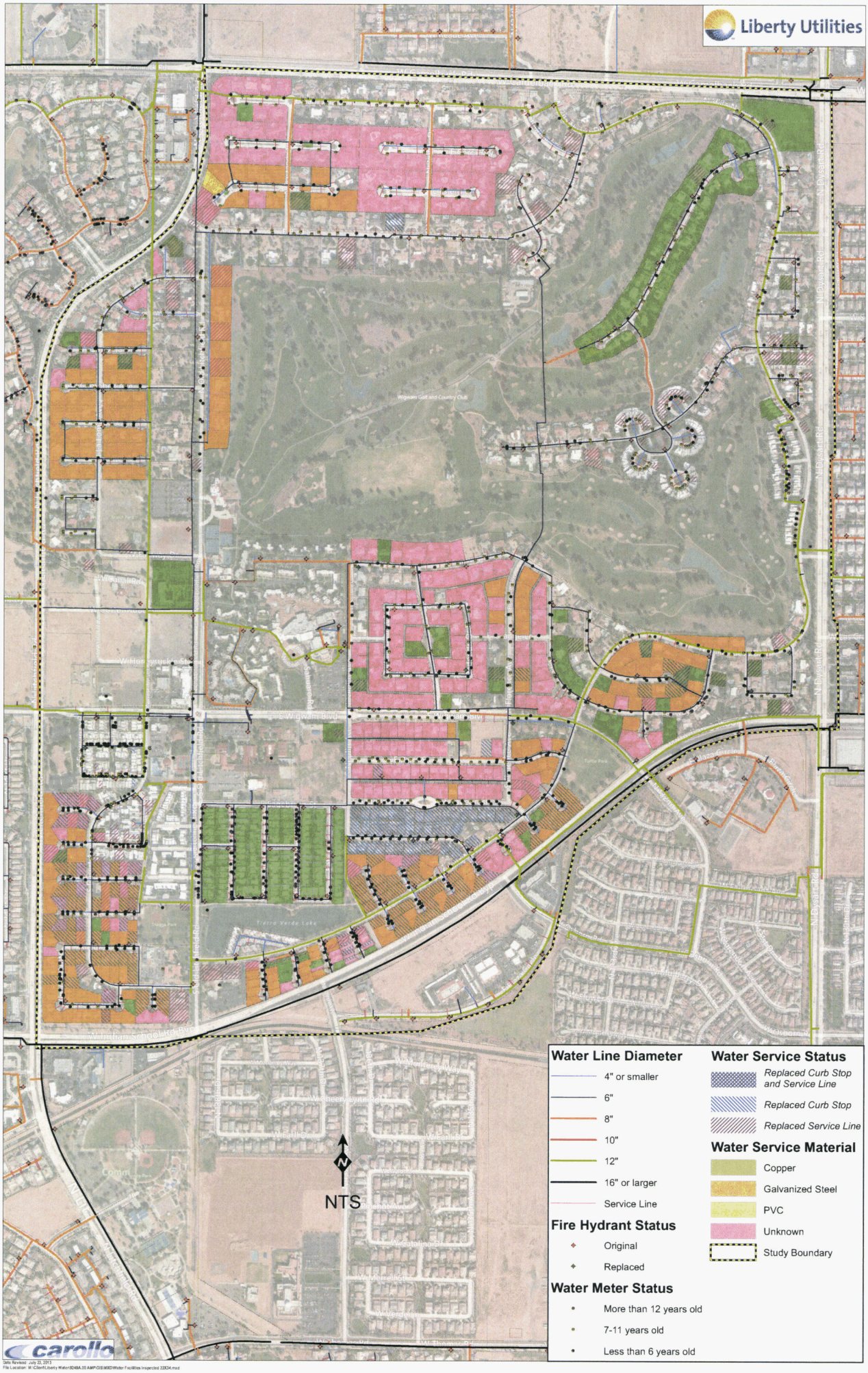
ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	4599	LF	$ 77.29	$ 355,457	
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	2230	LF	$ 83.11	$ 185,335	
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	3454	LF	$ 97.13	$ 335,487	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 219,070	
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 17,526	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 87,628	
			Pipeline Total	$ 1,200,502	Unit Cost
			Rounded Pipeline Total	**$ 1,200,600**	$116.76
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX AND METER	96	EA	$ 2,000.00	$ 192,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 28,800	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 19,200	
			Service Lateral Total	$ 240,000	Unit Cost
			Rounded Service Total	**$ 240,000**	$ 2,500.00
New Meter	96	EA	$ 500.00	$ 48,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 7,200	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 4,800	
			Meter Total	$ 60,000	Unit Cost
			Rounded Meter Total	**$ 60,000**	$ 625.00
Fire Hydrant Assembly	21	EA	4979.14	$ 104,562	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 15,684	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 10,456	
			Hydrant Total	$ 130,702	Unit Cost
			Rounded Fire Hydrant Total	**$ 130,800**	$ 6,228.57
			TOTAL	$ 1,631,205	
			ROUNDED PROJECT TOTAL	**$ 1,631,400**	

LITCHFIELD PARK FACILITIES [illegible]SSMENT, VOLUME 2 - WATER
ENGINEER O[illegible]ON OF COST

Project 9 ENR August 2013 9545
Location North La Loma

ITEM QUANTITY	QUANTITY	UNIT	UNIT PRICE	EXTENDED PRICE	
6" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	6282	LF	$ 77.29	$ 485,536	
8" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 83.11	$ -	
12" DIP CL350 REMOVE OLD PIPE REMOVE ASPHALT/REPLACE	0	LF	$ 97.13	$ -	
ENGINEERING DESIGN STAKING/INSPECTION (25%)	1	LS		$ 121,384	
PERMIT/REVIEW FEE (2% CONST.)	1	LS		$ 9,711	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 48,554	
			Pipeline Total	$ 665,184	Unit Cost
			Rounded Pipeline Total	**$ 665,200**	$105.89
1" WATER SERVICE REMOVE TO PROPERTY LINE NEW BOX AND METER	71	EA	$ 2,000.00	$ 142,000	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 21,300	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 14,200	
			Service Lateral Total	$ 177,500	Unit Cost
			Rounded Service Total	**$ 177,500**	$ 2,500.00
New Meter	71	EA	$ 500.00	$ 35,500	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 5,325	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 3,550	
			Meter Total	$ 44,375	Unit Cost
			Rounded Meter Total	**$ 44,400**	$ 625.35
Fire Hydrant Assembly	13	EA	4979.14	$ 64,729	
ENGINEERING DESIGN STAKING/INSPECTION (15%)	1	LS		$ 9,709	
ESTIMATE CONTINGENCY (10%)	1	LS		$ 6,473	
			Hydrant Total	$ 80,911	Unit Cost
			Rounded Fire Hydrant Total	**$ 81,000**	$ 6,230.77
			TOTAL	$ 967,970	
			ROUNDED PROJECT TOTAL	**$ 968,100**	

APPENDIX 2 – WATER INFRASTRUCTURE MAP


Liberty Utilities
Water Line Diameter
4" or smaller
6"
8"
10"
12"
16" or larger
Service Line
Fire Hydrant Status
Original
Replaced
Water Meter Status
More than 12 years old
7-11 years old
Less than 6 years old
Water Service Status
Replaced Curb Stop and Service Line
Replaced Curb Stop
Replaced Service Line
Water Service Material
Copper
Galvanized Steel
PVC
Unknown
Study Boundary
N
NTS
carollo

APPENDIX 3 – CITY OF LITCHFIELD PARK LETTER

Liberty Utilities℠
WATER | GAS | ELECTRIC

June 21, 2013

Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007-2996

Attention: Ms. Jenny Gomez

RE: 20013- 111257 Customer Complaint at 13817 E. Keim Dr.

Dear Jenny Gomez,

Further to your letter of June 18, 2013, regarding a Sewer Outage at 13817 E, Keim Dr. The information reported in the complaint was in error; no sewer outage occurred at this residence but rather an emergency water main break.

The following is the timeline of events that occurred during the emergency water main repair on June 2, 2013 at the above residence.

At approximately 9:30 am on June 2, 2013, Litchfield Park Service Company dba Liberty Utilities ("Liberty") water operations on-call staff received a call from Liberty's after hours answering service, informing Liberty that water was coming up from the street between addresses 13810 and 13814 W. Keim Dr. in Litchfield Park, Arizona. Operations staff arrived on-site and verified the water main break. The operator notified the Liberty supervisor of the water main break and repair. The operator then proceeded to notify the repair contractor and then immediately notified all listed utilities within the area of the break, at approximately 10:00 am. Liberty then began going door to door to notify the affected customers (22 customers in total) that they will be experiencing low water pressure over the next several hours until the shutdown occurs in which they would be without water during the repair. For residents not at home, Liberty would contact as they returned from home of the emergency repair. Operations staff proceeded to shut-down the water main greatly reducing the flow in the water main in order to reduce the amount of damage to the street and maintain positive pressure in the water main. This is done to reduce the potential contamination of the water main by foreign debris entering the water main.

At approximately 1:00 pm utility location contractor (ELM) arrived on-site to locate cable and communication lines. At 3:20 pm, the operations staff recalled the blue-stake ticket as both APS

Liberty Utilities℠
WATER | GAS | ELECTRIC

and SWG had not yet located their utility lines. As you are aware, it would be very dangerous and ill advised to begin excavation work without knowing what utilities are present in the area of the repair. At 4:10 pm, both APS and SWG cleared their utilities, in which Liberty shut the water main down for emergency repairs.

After several hours of repair work, the emergency water main repair was completed and the customers were back in service at 7:10PM. The estimated water emergency outage was approximately 3 hours in length.

Unfortunately, in the last six weeks Liberty has encountered three emergency water main breaks within an one block area of the residence. During the water main repair it was observed that all the emergency water main repairs within this area have occurred where dry utilities have crossed Liberty water lines. Liberty suspects that damage at these locations occurred during the installation of dry utilities several years ago.

We apologize for any inconvenience this may have caused. Please feel free to contact me at your earliest convenience should clarification or further information be required.

Sincerely,
Matthew E. Garlick

Matthew Garlick

Liberty Utilities
Director – Arizona Operations

Liberty Utilities℠

WATER | GAS | ELECTRIC

APPENDIX 4 – LITERATURE REFERENCES AND ARTICLES

EPA
United States
Environmental Protection
Agency

Office of Water (4601M)
Office of Ground Water and Drinking Water
Distribution System Issue Paper

Deteriorating Buried Infrastructure Management Challenges and Strategies

May, 2002

PREPARED FOR:

U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
Standards and Risk Management Division
1200 Pennsylvania Ave., NW
Washington DC 20004

Prepared by:
American Water Works Service Co., Inc.
Engineering Department

Background and Disclaimer

The USEPA is revising the Total Coliform Rule (TCR) and is considering new possible distribution system requirements as part of these revisions. As part of this process, the USEPA is publishing a series of issue papers to present available information on topics relevant to possible TCR revisions. This paper was developed as part of that effort.

The objectives of the issue papers are to review the available data, information and research regarding the potential public health risks associated with the distribution system issues, and where relevant identify areas in which additional research may be warranted. The issue papers will serve as background material for EPA, expert and stakeholder discussions. The papers only present available information and do not represent Agency policy. Some of the papers were prepared by parties outside of EPA; EPA does not endorse those papers, but is providing them for information and review.

Additional Information

The paper is available at the TCR web site at:

http://www.epa.gov/safewater/disinfection/tcr/regulation_revisions.html

Questions or comments regarding this paper may be directed to **TCR@epa.gov.**

DETERIORATING BURIED INFRASTRUCTURE MANAGEMENT CHALLENGES AND STRATEGIES

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DETERIORATING BURIED INFRASTRUCTURE MANAGEMENT CHALLENGES AND STRATEGIES

I. Introduction

The findings of several prominent studies forecasting capital investment needs for water systems has brought the subject of buried infrastructure asset management to the forefront of priority issues facing the water industry. The capital investment focus of these studies and numerous other published articles has overshadowed any discussion or concern of the potential health risks associated with deteriorating distribution systems. The United States Environmental Protection Agency (USEPA), in an effort to assess the need for regulatory action, has directed preparation of several White Papers (including this paper) to address health risks related to specific water distribution system topics. The characteristics of deteriorating water distribution systems include the increased frequency of leaks, main breaks, taste, odor and red water complaints, reduced hydraulic capacity due to internal pipe corrosion, and increased disinfectant demands due to the presence of corrosion products, biofilms, and regrowth. Each of these conditions presents the potential for water quality degradation, and the specific causes, health risks and mitigation strategies are appropriately being addressed by individual White Papers dedicated to these topics. This paper will not duplicate that work but rather will compliment these papers by providing a broad assessment of current buried infrastructure management challenges and strategies for addressing them.

These broader challenges associated with buried infrastructure include establishing a means for monitoring and measuring all impacts associated with deteriorating water systems and their relative importance. These impacts include health risks as well as customer service, community disruption, customer confidence, public perception, fire protection, and other less tangible variables. State and Federal subsidies will likely be unavailable or insufficient to fully address this issue, and the needed capital funds will be limited by increasing demands to keep water rates affordable. Investment in buried infrastructure will also be in direct competition with other more visible and regulatory driven infrastructure needs. Historically, buried infrastructure investment, absent regulatory compliance directives, or gross system failures, have been subordinate to regulatory driven investment or capital needs associated with more highly visible projects. The competition for capital funds is made more difficult when a comparison of "direct" costs of repair versus rehabilitation or replacement almost always favors continuing to repair a deteriorated water main. Therefore, a utility must measure and present credible evidence of the indirect costs and impacts associated with poorly performing systems including service interruptions, community disturbance, and health risks in order to support the need for capital investment.

The rate of deterioration of a water system is not a function of material age but rather the cumulative effect of the external forces acting on it. During a recent water system valuation, 70+-year-old unlined cast iron main was found to be in excellent condition with negligible internal or external corrosion. Based on the field observations, there is no reason to believe that these mains will not provide another 70+ years of satisfactory service. Conversely, in another system, cast iron mains less than 50 years old are experiencing excessive and rapidly increasing break rates and severe corrosion activity. Planned replacement of these mains is needed in the

near future. Therefore, broad based decision factors regarding infrastructure replacement, whether based on age, pipe size, pipe material, linings, etc. will not result in an effective use of limited capital resources. Better information and decision making is needed. Lastly, with numerous pipeline rehabilitation technologies and new pipeline materials emerging, the question of how best to remedy a poorly performing water main must be answered. This question can only be answered through actual knowledge of the conditions and service characteristics of the existing main, comparative repair, replacement, and rehabilitation costs, and an understanding of what is being gained via the various rehabilitation techniques available. This paper will address these issues and provide a basis for sound management of buried infrastructure assets moving foreword.

II. Buried Infrastructure Challenges Facing the Water Industry

The buried infrastructure challenges facing the water industry are an interrelated mix of technology, financial, customer and community service, and regulatory issues. This section will summarize the condition of buried infrastructure in this country, the positions of various industry groups and organizations including their estimates of needed capital, the concerns with justifying the capital expenditures, and potential new regulations that may affect the future management of buried infrastructure.

A. Current Condition/Status of Buried Infrastructure

The majority of distribution piping installed in the United States, beginning in the late 1800's up until the late 1960's, was manufactured from cast iron. The first cast iron pipe manufacturing process consisted of pouring molten iron into a sand mold, which stood on end in a pit in the ground, similar to how concrete is poured into a form. Pipe manufactured by this method is referred to today as "pit" cast iron pipe. Due to the potential inconsistencies that could occur in the pipe wall thickness, the pipe was designed with a wall thickness that was much greater than that required for the internal working pressure or external loading to which the pipe would be subjected. When installing the pipe in the field, the joints were sealed with rope and lead that was heated, poured in a molten state, and allowed to cool. Although pit cast iron pipe has no interior or exterior corrosion protection, it has performed well within the industry as a result of the added wall thickness.

In 1920, the process of centrifugally casting pipe in a sand mold was introduced. Pipe that was manufactured by this process is referred to as "spun" or "centrifugally" cast iron pipe. The centrifugal forces that are induced on the molten iron alter the molecular composition of the metal and increase its tensile strength. The higher strength coupled with the lack of inconsistencies in the wall thickness resulting from the centrifugal action allowed the pipe to have a much thinner wall than pit cast iron pipe. Interior lining of the pipe with cement to prevent corrosion was also introduced in the early 1920's; however, it did not gain wide acceptance until the late 1930's. The process of centrifugally casting pipe was improved in the early 1930's with the use of a water-cooled metal mold that allows the pipe to be immediately withdrawn from the centrifuge. This process, which is known as the "deLavaud" process, is still in use today for the manufacturing of ductile iron pipe. Although the centrifugal casting process improved pipe strength and minimized casting imperfections, the reduction in wall thickness

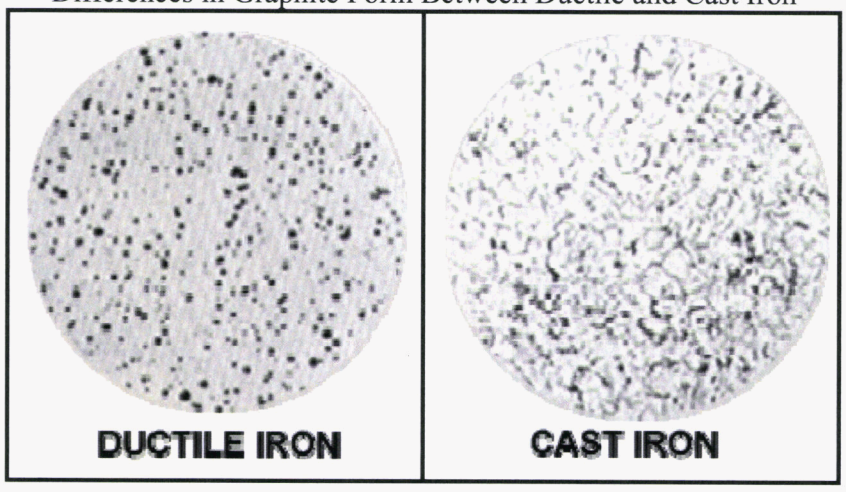
coupled with the lack of exterior corrosion protection has resulted in a failure rate in the industry that is higher than the older pit cast iron pipe.

In the late 1920's a plasticized sulfur cement compound was developed as an alternate to lead for sealing the pipe joints in the field. This compound is referred to as "leadite". Leadite was commercially produced up until the early 1970's, and was used extensively from 1941 to 1945 when lead was scarce as a result of raw material needs associated with World War II. Ultimately, leadite was found to be an inferior product to lead for two reasons. First, leadite has a different coefficient of thermal expansion than cast iron and results in additional internal stresses that can ultimately lead to longitudinal splits in the pipe bell. Secondly, the sulfur in the leadite can facilitate pitting corrosion resulting in circumferential breaks on the spigot end of the pipe near the leadite joint. The failure rate in the industry for leadite joint pipe is significantly higher than for lead joint pipe even though the pipe may not be as old.

Beginning in the mid-1950's, improvements in iron pipe manufacturing and technology began to emerge. The first improvement was the advent of the rubber gasketed joint that alleviated shortcomings associated with leadite and rigid joints. The next major improvement was the introduction of ductile iron pipe in the late 1960's. Ductile iron differs from cast iron in that its graphite form is spheroidal, or nodular, instead of the flake form found in cast iron. This change in graphite form is accomplished by adding an inoculant, usually magnesium, to molten iron of appropriate composition during manufacture. Not only is ductile iron pipe stronger than cast iron pipe, it is also more resistant to corrosion. Cast iron pipes, whether pit cast or spun cast, are susceptible to "graphitic" corrosion where which an electrochemical reaction occurs between the cathodic graphite component (flakes) and the anodic iron matrix causing metal loss. Due to its spheroidal graphite form, ductile iron is not subject to graphitic corrosion and also has approximately twice the strength of cast iron as determined by its mechanical properties. Its impact strength and elongation are also many times greater than cast iron. Exhibit No. 1 below shows the molecular differences in ductile iron and cast iron.

Exhibit No. 1

Differences in Graphite Form Between Ductile and Cast Iron



Polyethylene encasement was also introduced about the same time as ductile iron pipe. This even further prevented the potential for external corrosion to occur. In addition to the improvements made in iron pipe technology, the use of both polyvinyl chloride (PVC) and high-density polyethylene (HDPE) in this country began to emerge in the 1970's and 1990's respectively. Although these pipes did not have the strength of ductile iron, their resistance to corrosion is unsurpassed. The advent of all of these new pipe technologies has resulted in a significantly lower failure rate in the industry.

Exhibit No. 2 shows the progression of pipe technology in this country during the 20th century. The first four columns represent 1.) The material from which the pipe is manufactured, 2.) The type of joint, 3.) The interior corrosion protection, and 4.) The exterior corrosion protection.

The concern in the water industry revolves around the three older vintages of cast iron pipe (pit cast, spun cast, and spun cast with leadite joints) that were primarily installed prior to the 1960's (highlighted in yellow in Exhibit No. 2). As technology was thought to be improving the performance of the pipe during this period, it would ultimately be found that the failure rate would increase. The result is that the three vintages of pipe, installed in different time periods, may be reaching the end of their respective service lives at approximately the same time. This will increase the financial burden on the industry, as the cost of replacement will be borne over a shorter time span than that of the original installation period.

Exhibit No. 2

Timeline of Pipe Technology in the U.S. in the 20th Century

MATERIAL	JOINT	Corrosion Protection		1900's	1910's	1920's	1930's	1940's	1950's	1960's	1970's	1980's	1990's
		INTERIOR	EXTERIOR										
Steel	Welded	None	None										
Steel	Welded	Cement	None										
Cast Iron (pit cast)	Lead	None	None										
Cast Iron	Lead	None	None										
Cast Iron	Lead	Cement	None										
Cast Iron	Leadite	None	None										
Cast Iron	Leadite	Cement	None										
Cast Iron	Rubber	Cement	None										
Ductile Iron	Rubber	Cement	None										
Ductile Iron	Rubber	Cement	PE Encasement										
Asbestos Cement	Rubber	Material	Material										
Reinforced Conc. (RCP)	Rubber	Material	Material										
Prestressed Conc. (PCCP)	Rubber	Material	Material										
Polyvinyl Chloride	Rubber	Material	Material										
High Density Polyethylene	Fused	Material	Material										
Molecularly Oriented PVC	Rubber	Material	Material										

B. Industry Assessment and Estimate of Costs

In March of 2001, the American Society of Civil Engineers (ASCE) released their "Report Card for America's Infrastructure". Overall, this report card indicated that the nation's infrastructure is in poor condition. Drinking Water, Wastewater, and Dams, received very low grades in relation to other categories of infrastructure. The only category receiving lower grades was public school infrastructure.

A number of professional organizations have addressed infrastructure concerns related to drinking water, and some have developed cost estimates. In addition to ASCE, these organizations include the USEPA, the American Water Works Association (AWWA), the Water Infrastructure Network (WIN), and the Help to Optimize Water (H_2O) Coalition. WIN is a broad-based coalition of local elected officials, drinking water and waste water service providers, state environmental and health administrators, and engineers and environmentalists who support the concept of federal financial assistance. The H_2O coalition is comprised of the National Association of Water Companies (NAWC), the Water and Wastewater Equipment Manufacturers Association, and the National Council for Public-Private Partnerships. This coalition recognizes that short term federal financial assistance may be needed, but wants water utilities to be self-sustaining, not subsidized enterprises, over the long term. A summary of the professional organization cost estimates related to drinking water infrastructure are provided in Exhibit No. 3 below. Except where noted, these estimates are for all drinking water infrastructure, including treatment plants, and encompass infrastructure needs due to regulation and deterioration but not new infrastructure associated with growth.

Exhibit No. 3

Cost Estimates for Drinking Water Infrastructure

Professional Organization	Cost Estimate	Period	Comments
ASCE	$11 B	per year	
USEPA	$151 B	next 20 years	$83 B of this amount for transmission and distribution piping
AWWA	$250 B	next 30 years	
WIN	$460 B	next 20 years	includes both water and wastewater
H2O Coalition	none	none	believes more analysis is needed

C. Verification of Industry Cost Estimates

In order to conduct a rough, order of magnitude, check of the industry cost estimates, a methodology was used whereby an annual range of costs for buried infrastructure was calculated based on the industry estimates, then verified by comparing it with known information for a large water utility.

First, the USEPA was the only organization that provided a breakdown between transmission/distribution and treatment plant cost estimates. Their transmission and distribution cost estimate was 55% of their total cost estimate ($83B of $151B). Thus, it was assumed that approximately 55% of the cost estimates provided by each of the other organizations was allocated for transmission and distribution. Applying this to each of the industry estimates and annualizing them results in a range of costs between $4.2B to $6.3B per year.

Second, the population served by community water systems was compared to the population served by the selected utility. As of April, 2000, approximately 264 M people were served by community water systems, and approximately 10M people were served by the selected utility (3.8%). Thus, taking 3.8% of the annualized range of costs calculated above results in an annual range of costs for transmission and distribution piping of $160M to $240M per year, with an average of $200M per year for the utility, based on industry estimates.

Lastly, the selected utility has approximately 40,000 miles of main. Assuming an average pipe installation cost of $75 per foot, and a range of pipe life between 75 to 100 years, the estimated range of expenditures is $158M to $211M per year. This compares favorably with the industry cost estimate range of $160M to $240M per year. However, it is important to note that this range of costs would not reflect the degree to which a utility may be behind in terms of pipe replacement. Thus, based on this rough analysis, it appears that the industry cost estimates for buried infrastructure are reasonable.

D. Justifying Capital Investments

One of the key components of infrastructure assessment is the estimate of the useful life of the asset. When is it time to replace the pipe? The following case history illustrates this challenge in more detail. A large mid-western water utility has done considerable work in their efforts to manage main breaks over the last few years. The system serves over 300,000 customers with a distribution system of over 4,000 miles of mains. They currently experience about 2,000 breaks per year. This equates to about 5½ breaks per day. In December 1999 during a particularly cold period, it experienced 1,000 main breaks. Exhibit No. 4 shows that main breaks in the system have been increasing over the years, especially the rigid joint, spun cast iron pipe. Using this data, an engineering economic analysis was performed by analyzing data from a computerized leak database containing over 30,000 records since 1983. The result was a main break forecasting model for individual mains in the system and an engineering economic model to estimate the total life cycle costs of each pipe with three or more breaks.

Exhibit No. 4
Main Breaks Since 1965

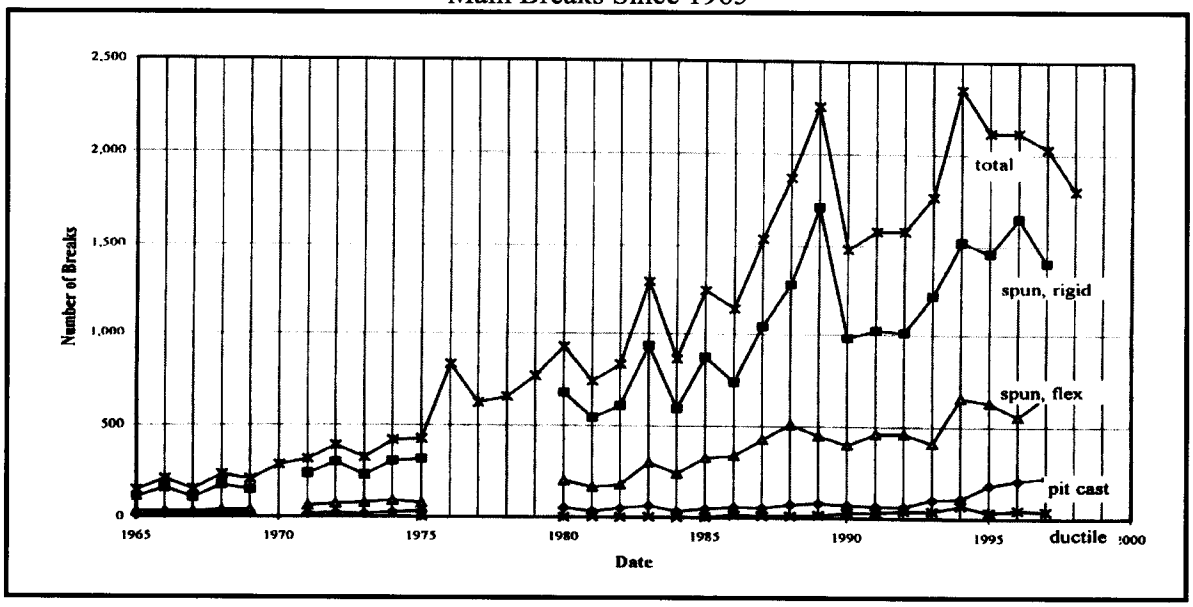
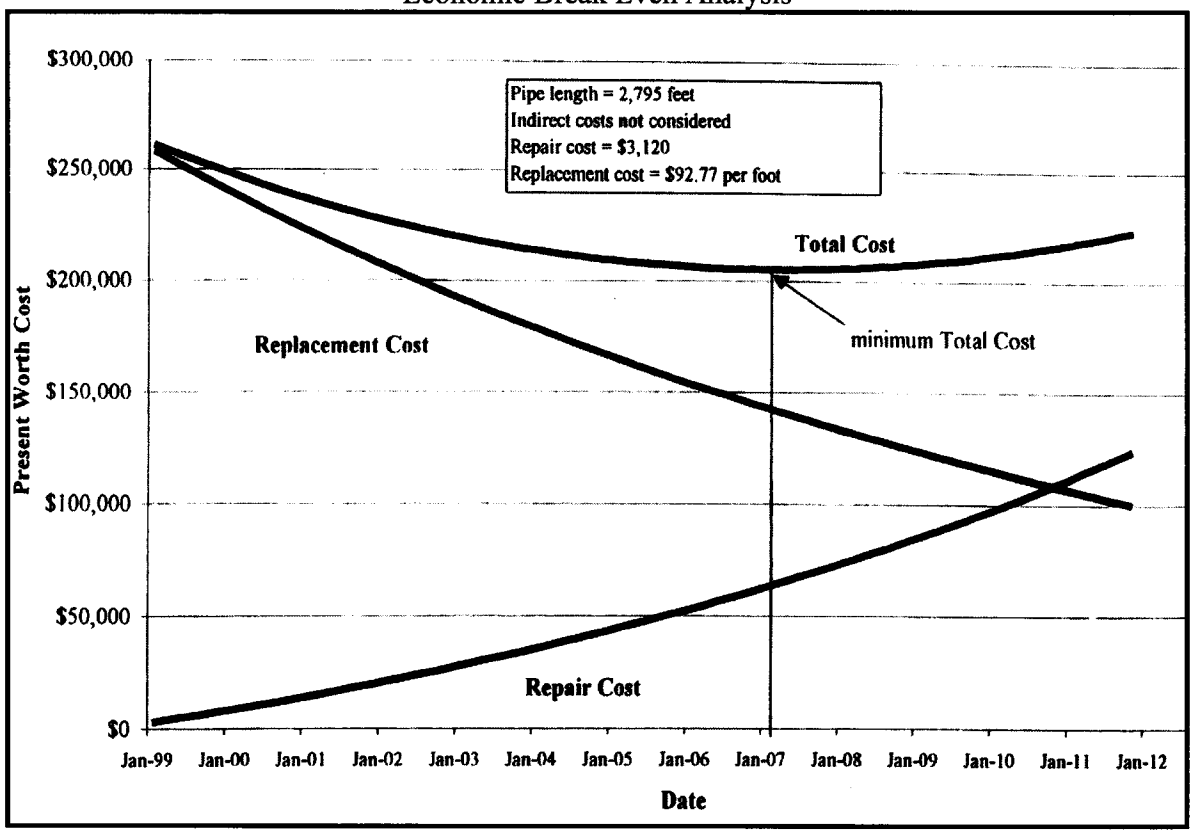


Exhibit No. 5 presents an example of a pipeline's total life cycle costs derived from the model. The line sloping downward indicates the present worth of the replacement cost. The line sloping upward indicates the cumulative costs to repair the pipe. The top line indicates the addition of the other two curves, which represents the total life cycle cost of the pipeline. In other words, it shows how much money must be set aside today to finance the continual repair and/or eventual replacement of this pipeline. From the graph, it can be concluded that the optimal time to replace the pipe is when the total life cycle cost reaches a minimum.

By applying this approach the utility could support that 146 miles of pipe should be replaced today, and furthermore, could identify the individual pipes that should be replaced. Although more analysis is required, the initiative is moving forward to phase in an accelerated main replacement program.

Exhibit No. 5
Economic Break Even Analysis



This is an extraordinary case due to the unusually high number of main breaks. Most water utilities are not experiencing main breaks at such a rate and cannot economically justify replacement over repair. It also is important to note that the economic model is based on standard engineering economics, and does not incorporate financial factors such as taxes on capital investment and depreciation. If these additional factors were considered, the analysis would slant further in favor of repairing instead of replacing mains.

Consider the following example where actual direct costs for replacement and repair are compared. Average replacement costs are approximately $100/foot for 6-inch main. Therefore, for a 1,000-foot main, total replacement costs would be approximately $100,000. If the utility expects to recover that investment, the annualized revenue requirement or cost would be $10,000 to $15,000, depending on financing cost or economic regulation (investor-owned utilities). Repair costs on the main are approximately $3,000 per break. Consequently, in order to justify replacing that pipe purely from a cost standpoint, the main must experience breaks at a rate of approximately 3 to 5 per year. A rate of 4 breaks per year is a break every 3 months for a length of pipe slightly longer than a city block. Such a high break rate is very unlikely and certainly would not be tolerated by customers subjected to such frequent service and traffic disruptions. Therefore, other factors such as the stakeholder and liability costs associated with main breaks must also be considered.

Liabilities associated with main breaks can be quite significant. A single break can incur liability costs that total more than the replacement cost of the main. Service disruptions can result in lost revenue and other risks to customers that depend on reliable water service (e.g. hospitals, restaurants, commercial properties, laundry mats, etc.). Traffic disruptions equate to lost time from work for stakeholders. Consideration should also be given to the monetary value of water lost during the break, including pumping, chemical, and waste disposal costs. These costs can be significant for large main breaks, especially if they empty tanks. One study estimated that these indirect costs could equal 20% to 40% of the repair costs.

Other important issues should be considered, including effects on water quality and the reputation of the utility. Main breaks can cause loss of system pressure, which poses the threat of contamination. Neglected distribution piping often breeds poor water quality due to corroded pipelines, resulting in numerous customer complaints. These problems result in poor customer service that can damage the reputation and credibility of the utility.

It is difficult to justify replacement of mains on direct costs alone. Although this can be done in some circumstances where break rates are excessive and/or replacement costs are very low, for most pipelines it will be less costly to continually repair the main than to replace it if direct costs alone are considered. However, direct costs do not present the full impact to the utility. Instead, we must consider the indirect costs and stakeholder issues discussed above in order to maintain system integrity and reliability so that acceptable customer service can be assured.

E. Regulations Affecting Buried Infrastructure

1. *Potential Health Effects*

In addition to this paper, other White Papers being prepared in response to the USEPA assessment of health risks and the need for distribution system regulation include:

a. Contamination of New or Repaired Mains
b. Permeation and Leaching
c. Intrusion into Pipes
d. Microbial Regrowth/Biofilms
e. Covered Storage Vessels
f. Decay of Water Quality in Pipe with Time
g. Cross Connections
h. Nitrification

Papers a through d above cover the specific causes, health risks, and mitigation strategies associated with the characteristic signs of deteriorated water distribution systems. These papers discuss the deleterious effects of internal corrosion on water quality and also address external sources of contamination and the potential pathways into the distribution system during repair activities or during negative pressure events associated with water hammer occurrences. In general, internal corrosion by-products, including the formation of tubercles (oxidized metals at the anode deposited back on the pipe wall), cause taste, odor and color problems and impart a

disinfectant demand on distributed water. Additionally, corrosion by-products can shield microorganisms from disinfectants and serve as a nutrient and physical substrate for their growth. Leaking mains and repair activities introduce pathways for external contamination including pathogen and harmful chemical intrusion. Sources of these contaminants include adjacent soils harboring microbial activity, leaking sanitary sewers, storm water runoff, chemically contaminated soils, and exposure to animal wastes. The findings of these papers needs to be incorporated in the overall management planning for aging distribution systems and used to clearly support the need for capital investment.

2. *New Accounting Regulation*

The Governmental Accounting Standards Board (GASB) was formed in 1984 to develop and improve financial reporting rules for the 85,000 state and local governments in the United States. It operates under the auspices of the not-for-profit Financial Accounting Foundation, which oversees, funds, and appoints the members of the GASB, as well as the Financial Accounting Standards Board (FASB). GASB is not part of the government, federal or otherwise. Its rules are required in most states for financial reporting at the local and state level. GASB rules also are required to be followed when a state or local government's audit reports that it follows Generally Accepted Accounting Principles (GAAP). Bond covenants associated with government debt often require them to follow GAAP.

GASB Statement No. 34 (GASB 34) was modified in June 1999. It requires, for the first time, that governments begin including infrastructure assets on their balance sheets. After estimating the initial cost of each infrastructure asset and including that cost in the balance sheet, governments will be required to either depreciate those assets, or manage them using an asset management system. GASB 34 prefers that municipalities implement an asset management system referred to as the "modified approach" because it better models the way infrastructure should be treated. There are specific requirements for the implementation of the asset management system, and reporting that must be produced.

Whichever method is used, a fundamental requirement is a good inventory of assets. The inventory must include the actual or estimated historical cost of construction. The most straightforward method for valuing assets is depreciation, but this method ignores the extended life of the asset provided by continued maintenance. The modified approach incorporates the benefits, or value, of such maintenance activities. GASB 34 provides the following minimum guidelines as to what the modified approach should include:

a. The assessed physical condition of infrastructure assets (governments must perform such assessments at least every three years, and disclose the results of at least the three most recent condition assessments).
b. Descriptions of the criteria the government uses to measure and report asset condition.
c. The condition level at which the government intends to maintain the assets.
d. A comparison of the annual dollar amount estimated to be required to maintain and preserve the assets at the condition level established by the government with the actual expenses, for at least the last five years.

Although not prescribed in detail, GASB 34 requires that governmental entities use "consistent" and "reasonable" methods for valuing assets. The GASB 34 rule should have a positive effect on addressing aging infrastructure by continuously measuring the condition of a buried water system and quantifying investment needs and past deficiencies.

Municipalities must be in compliance with GASB 34 by July 2001, 2002, or 2003 depending on the government's annual revenue base in 1999. Only new infrastructure (added or reconstructed) need be included beginning on those dates. An additional four years are granted before pre-existing infrastructure need be reported. If revenue base was less than $10 million in FY 1999, a municipality is encouraged, but not required, to report pre-existing infrastructure.

III. Buried Infrastructure Technical Considerations

In order to address the concerns raised by the water industry, it is first necessary to further understand the technical aspects of buried infrastructure in order to develop appropriate management strategies. This section will address the failure mechanisms of pipe, potential rehabilitative and preventative technologies, and recommendations for pipe materials for future use.

A. Recommendations for Extending Pipe Life

In order to minimize main failures and maximize the life of the assets, it is necessary to understand the failure mechanisms of pipe. These failure mechanisms, which are a result of either Operational/Physical or Chemical means, are identified in Exhibit No. 6.

Exhibit No. 6
Pipe Failure Mechanisms

Operational/Physical	Applies to	Options	Chemical	Applies to	Options
Manufacturing defects	M,P,C	No	Internal corrosion	M,C	Yes
Improper design/installation	M,P,C	No	External corrosion - soil	M,C	Yes
Geologic instability	M.P.C	No	External corrosion - other	M,C	Yes
Higher operating pressures	M,P,C	Yes	Leadite corrosion	M	Yes
Hydraulic transients	M,P,C	Yes	Leadite expansion	M	Yes
Change in water temperature	M	Yes	Material incompatibilities	M	Yes
Excessive external loads	M,P,C	No	Gasket deterioration	M,P,C	Yes
Damage from digging	M.P.C	No	Material fatigue	P	No

M = Metallic (ductile iron and/or cast iron)
P = Plastic (PVC or HDPE)
C = Concrete (RCP or PCCP)

This exhibit indicates the type of pipe to which the failure mechanism is applicable (metallic, plastic, or concrete) and whether there are any options to reduce or eliminate the failure mechanism for pipes that are already installed in the ground. If so, these are addressed in a subsequent exhibit. Nearly all of these failure mechanisms can be addressed or controlled for new installations as a result of newer pipe materials, current manufacturing technology, and improved utility operational practices.

A few of these failure mechanisms warrant additional discussion as follows:

1. *Hydraulic Transients*: Hydraulic transients (water hammer) occur as a result of a sudden change in flow velocity. Some ways that this can occur are due to a sudden starting or stopping of a pump, closing or opening a hydrant too quickly, or sudden starting and stopping of water usage by large customers. As a rule of thumb, for every 1 ft/sec instantaneous change in flow velocity, the pressure can change by 100 ft (43.3. psi). It is important to understand the variables which effect the magnitude of the pressure change as defined by the Joukowsky equation:

$$H = \frac{4660}{\left(1 + \frac{Mw}{Mp} * \frac{ID}{th}\right)^{0.5*g}} * (Vi - Vf) \quad \text{where:}$$

H = pressure increase (ft)
Mw = bulk modulus of water (psi)
Mp = bulk modulus of pipe materials (psi)
ID = inside diameter of the pipe (in)
th = wall thickness of the pipe (in)
g = acceleration due to gravity (ft/sec^2)
Vi = initial water velocity (ft/sec)
Vf = final water velocity (ft/sec)

It can be seen in this equation that the materials of construction (Mp) and the geometrical strength of the pipe (ID/th) also affect the magnitude of the pressure change. With the same change in velocity, a stronger, more rigid pipe will experience a higher pressure change. The second item to note is that water hammer is independent of volume. It is also important to be aware of operational situations that could promote hydraulic transient events as listed below:

- Pipeline velocities > 5 ft/sec
- Non-networked pipelines (transmission mains)
- Dead end pipelines and closed (no tanks) systems
- Undulating topography
- Combination vacuum relief/air release valves of the same size
- Pumps with swing check valves or no control valves
- Frequent power failures at pump stations

2. *Change in Temperature*: Utilities with cast iron pipe typically experience an increase in main failures with freezing temperatures. Although plastic pipes also are affected by a change in temperature due to their high coefficient of thermal expansion, it is less of an issue due to the flexibility of the pipe, and the phenomena of concern discussed here applies only to iron pipes. One theory of why iron pipes fail in freezing temperatures is that the ground movement imposes a stress on the pipe. Although this may be true, the primary reason for the failures relates to the differences in thermal expansion between water and iron. As water and the pipe cool, they are both contracting until the temperature reaches 39 deg

F. At this point, the pipe continues to contract, but the water begins to expand. This can result in a stress equivalent to that of increasing the hydrostatic pressure in the pipe by approximately 200 psi.

3. *Corrosion (internal)*: Internal corrosion of water distribution systems leads to two major problems for water utilities. The first is the failure of distribution system pipes which can result in water leakage, loss of pressure, and potential contamination during main installation and repair. The second problem is an unwanted change in water quality as the water is being transported through the distribution system (Snoeyink et al, 1996). Corrosion can occur without metals leaching, i.e., oxidized metals released at the anode can be deposited back on the pipe wall in the form of tubercles (Snoeyink et al, 1996).

During iron corrosion, the metal dissolves and the electrons are accepted in cathodic reactions such as those involving the reaction of protons and oxygen. These reactions are shown in Equations a through c (Snoeyink et al, 1996).

a. $Me \leftrightarrow Me^{z+} + z\,e^-$
b. $2H^+ + 2e^- \leftrightarrow H_2$
c. $O_2 + 2H_2O + 4e^- \leftrightarrow 4OH^-$

According to Benjamin, Sontheimer, and Leroy (1996), the corrosion of iron piping in distribution systems can be either uniform or localized. Localized corrosion can be caused by local nonuniformities in the pipe or the water quality adjacent to it, and often leads to tuberculation.

When potable water containing dissolved oxidants (such as oxygen or chlorine) is in contact with metallic iron, there is a driving force for active corrosion under any realistic water quality conditions (Benjamin et al, 1996). The authors also state that the corrosion rate is probably limited by the rate at which oxygen is provided to the surface, which in turn is limited by molecular diffusion through the layers of stagnant water and scale adjacent to the metal.

Ferrous ions or compounds in scales can be oxidized directly or microbially mediated, resulting in a variety of end products. These corrosion products can be released into the water due to physical or water quality factors, and therefore the iron release rate often bears no relation to the overall corrosion rate (Benjamin et al, 1996). Corrosion and the release of corrosion products can lead to chemical, physical, and microbial degradation of distribution system water quality.

The internal corrosion of cement-based materials can impact both water quality and infrastructure integrity. Cement-based materials include reinforced or prestressed concrete pipes, cement-mortar linings, and asbestos-cement pipe. Two general components of cement-based materials include the aggregates and the binder. The binder consists of calcium silicates and calcium aluminates in various proportions depending on the type of the cement (Leroy, Schock, Wagner, and Holtschulte, 1996).

Several types of degradation of cement materials can occur in the presence of acid waters or waters aggressive to calcium carbonate (Leroy, Schock, Wagner, and Holtschulte, 1996). Degradation can result in weakening of the material as well as leaching of calcium carbonate and metals into the water. Water quality impacts associated with lime and metals leaching from cement-based materials are discussed further under Metals and Chemical leaching. Health effects associated with the release of asbestos fibers from asbestos-cement pipe are addressed in the Phase II National Primary Drinking Water Regulations (USEPA, 1991).

Microorganisms have the ability to induce or promote corrosion as well as take advantage of corrosion deposits as growth habitats (Snoeyink et al, 1996). Corrosion by-products such as tubercles, iron oxides, and other precipitates can shield microorganisms from disinfectants and can serve as a physical substrate for growth. Organisms such as *Bacillus, Escherichia coli, Psuedomonas*, and *Citrobacter* have the ability to reduce Fe(III) to Fe(II) and have been found in tubercles, but the role these organisms play in the corrosion process has not been delineated (Snoeyink et al, 1996). Microbial regrowth and associated health effects are discussed in a separate White Paper.

Internal corrosion can result in leaking or failure of distribution system pipes. Leaks and breaks can serve as pathways for contamination from harmful organisms originating exterior to the pipe environment. Potential health impacts associated with pathogen intrusion are discussed in a separate White Paper.

4. *Corrosion (external)*: The two basic types of external corrosion which can occur in a water system are galvanic and electrolytic. The galvanic corrosion process occurs when electrons flow from one metal (anode) to a dissimilar metal (cathode) via an electrolyte (soil) with a return current path (the pipe). Electrolytic corrosion is similar to galvanic corrosion with the exception that the return current path includes a direct current source (stray current) which drives the reaction.

Some of the specific types of external corrosion in pipelines include:

a. Pitting Corrosion - Occurs when protective films covering a metal break down.

b. Bacteriological Corrosion - The result of sulfate reducing bacteria giving off sulfides which are excellent electrolytes.

c. Soil Corrosion - Mostly occurs in soils with high electrical conductivity.

d. Graphitic Corrosion - Corrosion can occur in any metallic pipe. However, the potential for corrosion is higher in cast iron pipes than in ductile iron pipes. The corrosion phenomenon that occurs in cast iron (pit cast or spun

cast) is called graphitic corrosion. Graphitic corrosion of cast iron is a form of selective leaching where the iron matrix corrodes, leaving behind porous graphite mass. The process affects buried cast iron pipe in relatively mild aqueous environments. The corrosion mechanism involves an electrochemical reaction between the cathodic graphite component and the anodic iron matrix. Graphitic corrosion generally is a slow process. It can cause significant problems since no dimensional or physical changes occur which are visible, yet the cast iron loses its strength and becomes brittle.

5. *Leadite Corrosion and Expansion*: As previously discussed, leadite has a different coefficient of thermal expansion than cast iron resulting in stress on the pipe which can ultimately result in longitudinal splits in the pipe bell. Secondly, the sulfur in the leadite allows for bacteriological corrosion that can lead to circumferential breaks on the spigot end of the pipe near the leadite joint.

6. *Material Fatigue*: There is no measurable relationship between ductile iron's applied tensile strength and time to failure. However, both PVC and HDPE pipe experience a reduction in strength over time.

Exhibit No. 7 identifies the strategies for reducing or eliminating pipe failures for those pipes that are already installed in the ground. The potential for implementing these strategies is also indicated.

Exhibit No. 7

Operational Strategies for Reducing or Eliminating Pipe Failures

Failure Mechanism	Strategy	Potential
Higher operating pressures	Redistribution of pressure zones	Low
Hydraulic transients	Surge control and operator training	Medium/High
Change in water temperature	Blending with ground water sources, where possible	Low
Internal corrosion	Cleaning and lining	High
External corrosion - soil	Cathodic protection	Medium
External corrosion - other	Cathodic protection	Medium
Leadite corrosion	Replace the joint only	Low
Leadite expansion	Replace the joint only	Low
Material incompatibilities	Install dielectrics at corporation stops	Medium
Gasket deterioration	Replace the joint only	High

Additional information regarding some of the potential rehabilitation or prevention strategies (e.g. cleaning and lining, cathodic protection) is discussed subsequently in this section.

B. Rehabilitation Technologies

Once a water main has been identified as failing to meet its service requirements, the method of replacement or renewal should be considered. Currently, the majority of water main replacement is performed using open-cut or open-trench methods. Conventional open-trench construction is still the most frequently and cost-effective method of water main replacement in the United States, and therefore, contractors are usually easy to find and locally available. For

many water utilities, the practice is to install the new main in a trench parallel to the old main. In some cases, removal of the old main in not worthwhile or necessary, and old, damaged water mains are simply abandoned or given to electric or cable utilities. Because the old main is kept in service until the new main is in place and ready for connection to the customers' service lines, service interruptions are minimized. In those cases where the old main has to be shut down before the new main is in place, bypass pipes can be laid to provide uninterrupted service to customers.

Though popular, open-cut methods can create considerable inconveniences to customers, businesses, residences, and traffic in the area. In some cases these inconveniences can also become very costly. As a result, trenchless technologies have attracted the attention of the water industry as an alternative to open-trench methods. Based on the site-specific main replacement, trenchless technologies can frequently reduce both direct rehabilitation costs and the additional financial and commercial costs associated with holes in the road.

For over 20 years, trenchless renovation technologies have been steadily increasing and playing an increasingly important role in the wastewater and gas industries, and for many of those utilities, it is now their method of choice. In the United Kingdom, where extensive privatization of the water supply industry has greatly accelerated rehabilitation expenditures, numerous trenchless techniques are in widespread use. There is; however, some reluctance on the part of U.S. water utilities to use trenchless technologies due to their inexperience with the technology and questions regarding the use of the materials in a potable water system.

Recently, the AWWA Research Foundation (AWWARF) and a number of AWWA technical committees have evaluated alternative rehabilitation technologies for application in the water utility industry and developed guidelines for those technologies that have a proven track record within the industry. The following paragraphs will briefly describe the alternative technologies that could be considered by American Water utility subsidiaries to successfully rehabilitate water mains and identify conditions under which each technology can best be applied within American Water.

Alternative rehabilitation techniques can be classified into three categories according to their effect on the performance of the existing pipe. The three categories include: non-structural systems, semi-structural systems, and structural systems.

1. Nonstructural Lining Techniques

One of the most common and effective renewal methods used in the piping industry is the application of a non-structural protective lining on the interior of the water main. Nonstructural lining systems are used primarily to protect the inner surface of the host pipe from corrosion and tuberculation. They have no effect on the structural performance of the host pipe and have a minimal ability to bridge any existing discontinuities, such as corrosion holes or joint gaps. Hence, non-structural lining systems have minimal effect on leakage. Their use is indicated in pipes that are structurally sound and leak tight at the time of lining and expected to remain so for the foreseeable future. Examples of nonstructural techniques include cement-mortar lining and epoxy resin lining. Statements regarding the effect of service connections, valves, bends, and

appurtenances on efficiency and the expected service life extension from non-structural pipe lining apply to both lining methods discussed.

The advantages of non-structural pipe lining are that a smooth protective non-structural coating is applied to the interior surface of the pipe that restores hydraulic capacity to the water main. A limitation is that service connections, valves, bends, and appurtenances will affect the cost of lining projects. The expected service life of the pipe with reasonably good structural condition can be extended 30 to 50 years with cement mortar lining or epoxy lining procedures. Cement mortar lining is the most common rehabilitation technique in use today and is effective and reliable. Cement mortar linings were first installed in existing pipelines using the centrifugal process in the mid-1930s to rehabilitate pipelines. However, this method was limited to pipes large enough for a person to enter. In the 1960s, remote lining processes were introduced. Today, cement mortar is applied to new ductile iron pipes and most new steel pipes before installation, making this method a standard in the water industry. Service lines and laterals less than 2 inches in diameter must be cleared after the lining application. This is done about 1 hour after the lining is completed, using compressed air to blow open the service line at the connection to the main. Laterals over 2 inches are not plugged by centrifugal lining and do not require excavation or blow back. Cement mortar lining may increase the pH of water and therefore is not recommended for soft or aggressive water.

The process for in-situ epoxy resin lining of iron and steel pipelines was developed in the United Kingdom in the late 1970's and has been performed in North America since the early 1990's. The process has been used effectively to rehabilitate old, unlined water mains. Epoxy lining of water mains is also classified as a nonstructural renewal method. As with other lining techniques, pipelines must be thoroughly cleaned and dried before application of the epoxy lining. The epoxy resin is applied to the interior of the pipeline using a centrifugal method. A spinning head is winched through the pipeline at a constant rate spraying a thin (1 mm) liquid epoxy coating onto the inner wall of the pipe. The coating cures in 16 hours and provides a smooth and durable finish resistant to mineral deposits and future tuberculation buildup. Several epoxy-lining materials are currently approved for use in the potable water systems under ANSI/NSF 61. Epoxy resin linings do not normally block service lines and laterals. They do not affect the pH of the water and may be used for soft water supplies. Problems can occur if water is accidentally introduced in the main during the lining process. The lining will be damaged and may cure incorrectly, creating water quality problems. Mix ratio errors will also cause failures in the lining.

2. Semi-Structural Lining Techniques

Semi-Structural renovation systems generally involve the installation of a thin plastics-based lining tube that achieves a "tight fit" to the pipe wall. Since the stiffness of the liner is less than that of the host pipe, all internal pressure loads are almost entirely transferred to the original pipe. Such a lining is required only to independently sustain internal pressure loads at discontinuities, in the host pipe, such as corrosion holes or joint gaps. Semi-structural lining techniques are best suited for long transmission mains with few service connections and for situations in which obstacles such as buildings, underground utilities, and railroads do not permit the excavation of the old pipes. Mains with corrosion holes and leaks, which would not be suited

for cement mortar or epoxy lining but that have not experienced structural failures (i.e. breaks), are good candidates for semi-structural lining. Semi-structural liners do reduce the effective cross-sectional area of the pipe. Therefore, post lining flow requirements must be considered when deciding to slip-line. However, the reduction in the friction factor of the liner pipe as compared to the old, unlined pipe should compensate for the reduced cross sectional area. In addition, the flow rate will not be reduced by corrosion over time. The geometry of the unlined pipe must also be considered, as liners generally do not turn well through elbows. Excavations will be required at branch connections, bends and service connections in order to complete the installation. Examples of semi-structural lining techniques include: slip-lining, close-fit slip-lining and cured in place pipe lining

3. Structural Lining Techniques

Structural lining techniques are capable of sustaining a long-term (50-year) internal burst strength, when tested independently from the host pipe, equal or greater than the Maximum Allowable Operating Pressure (MAOP) of the pipe to be rehabilitated. Additionally, structural linings have the ability to survive any dynamic loading or other short-term effects associated with sudden failure of the host pipe due to internal pressure loads. Structural lining techniques are sometimes considered to be equivalent to the replacement pipe, although they may not be designed to meet the same requirements for external buckling or longitudinal/bending strength as the original pipe.

Structural linings will be used in circumstances similar to those for semi-structural lining, but their use is essential for host pipes suffering from generalized external corrosion where the mode of failure has been, or is likely to be, catastrophic longitudinal cracking. Examples of structural lining techniques include structural slip lining and pipe bursting. Structural slip-lining techniques are similar to the semi-structural slip lining methods, but with varying design parameters for the new pipe regarding wall thickness, pressure rating, and operating requirements.

Pipe bursting is a patented process of replacing existing water mains by breaking and displacing them and installing a replacement pipe along the same route and in the void created. The pipe bursting technology is a total pipe replacement method. The pipe bursting process replaces the original pipe with a new pipe of the same diameter or larger. The system consists of a pneumatic, hydraulic or static bursting unit that splits the existing pipe while simultaneously installing a replacement pipe of the same or larger diameter and pressure rating. The pipe-bursting tool is designed to force its way through the existing pipe by fragmenting or splitting the pipe and compressing the materials into the surrounding soil as it progresses. The use of high density polyethylene pipes as the replacement pipe is desirable due to their flexibility, especially when the pipes to be replaced are not straight. Pipe-bursting demonstrations using ductile iron pipe have not been proven successful. All service connections should be completely disconnected and isolated from the existing pipe before pipe-bursting operations begin. All service connections, valves, bends, and appurtenances must be individually excavated and connected to the new main. A temporary bypass system is usually provided to maintain service to consumers. Breaking of existing repair clamps may also be a problem. If the pipe-bursting heads cannot break a repair clamp, the pipe needs to be excavated and the repair clamps must be

removed or cut with a pipe saw.

4. Cost Considerations

Compared to open-cut pipe replacement methods, the potential cost savings for alternative rehabilitation methods are dependant on the minimization of site restoration activities and the number of service connections on the existing main. All trenchless technologies require excavations for insertion and receiving of pipes, and local excavations for service connections. However, there are usually less excavations for alternative technologies than compared with traditional open cut replacement methods. In order to avoid disruption of water supply to customers, temporary service connections may be required to serve customers during the construction period. Equipment and crew mobilization costs, length of mains being replaced, and the "learning curve" all affect the unit cost of the alternative methods.

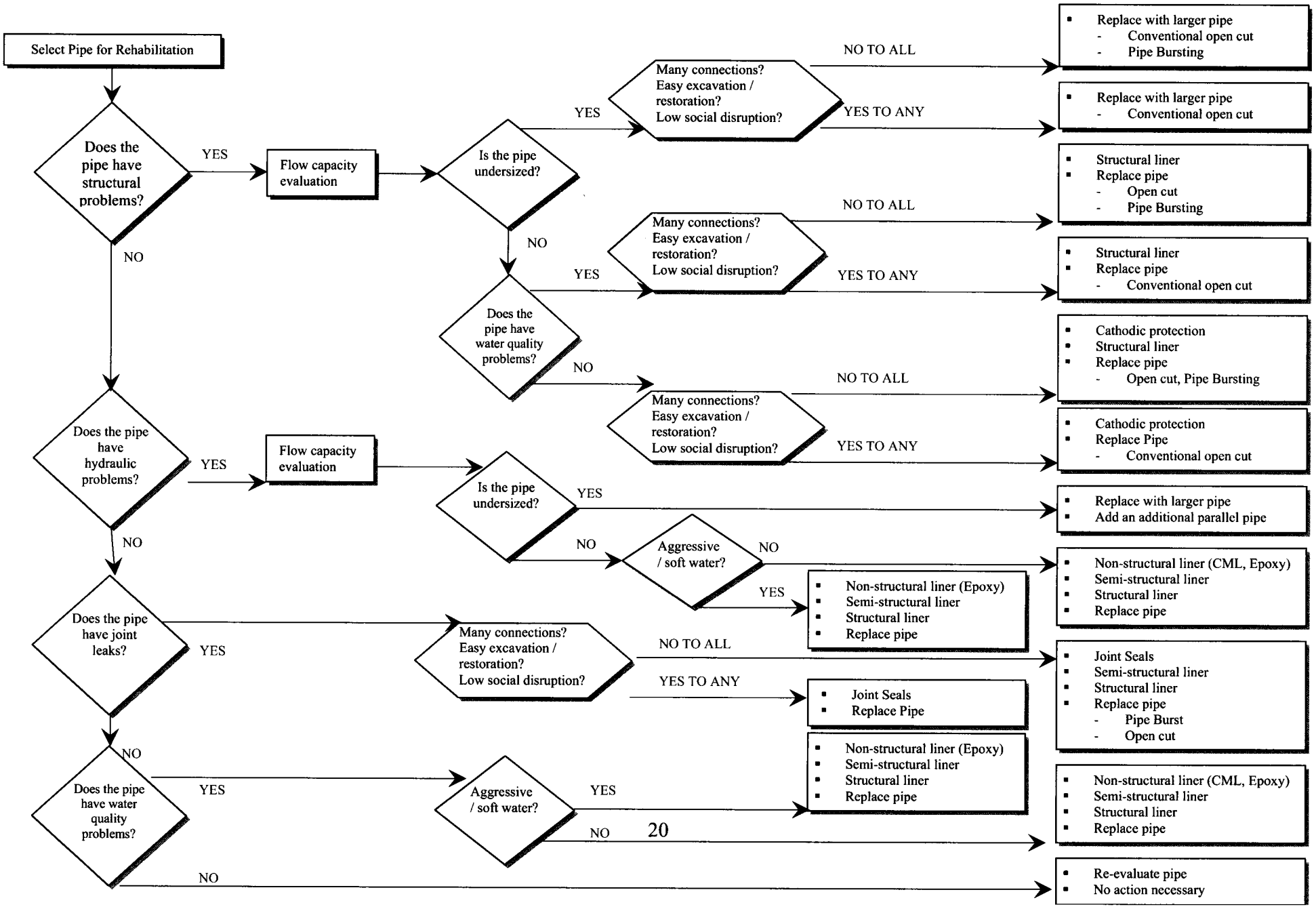
In order to satisfy the rehabilitation and replacement needs of water mains, it is essential for the water utilities to consider alternative rehabilitation technologies along with traditional open-cut technologies for cost-effective construction. Trenchless technologies will create less disruption of public life than open-cut methods, although they may not be suitable for all pipe rehabilitation and replacement. Key elements in the selection of a rehabilitation method are:

a. The exact nature of the problem(s) to be solved.
b. The hydraulic and operating pressure requirements for the rehabilitated main.
c. The materials, dimensions, and geometry of the water main.
d. The types and locations of valves, fittings, and service connections.
e. The length of time in which the main can be taken out of service.
f. Site-specific factors.

The selection of renewal technologies depends on pipe characteristics and site characteristics as well as the techniques themselves. The aim of the selection process is to consider all these factors to arrive at the most cost-effective, technically viable solution. Ideally, the cost estimate should include not only direct contracting and related costs, but also indirect costs associated with public disruption and longer-term maintenance. The most cost effective technology can then be selected using present worth (PW) analysis or equivalent uniform annual cost (EUAC) analysis. One approach to rehabilitation/replacement technique selection is summarized in Exhibit No. 8. This chart provides a framework for selecting or rejecting groups of techniques, depending on the nature of the performance problems, hydraulic requirements, and some site-specific factors.

Exhibit No. 8

Rehabilitation Decision Tree



Generally four types of problems (structural, hydraulic, joint leaks, and water quality) need to be evaluated in determining the options available for the pipe. This evaluation is performed in a hierarchical order, with the most critical pipe problems being addressed first and any remaining problems associated with the pipe being addressed by default. The following pipe problems should be evaluated when selecting renewal technologies:

a. If the problem is structural (loss of strength), the options are replacing the pipe (same size or larger) or installing a structural liner. Using these options will also address hydraulic, joint leak, and water quality problems.

b. If the problem is hydraulic (lack of adequate flow capacity) the options are replacing the pipe (same size or larger) or installing a structural, semi-structural, or non-structural liner provided the existing pipe diameter is adequate. Using these options will also address joint leak and water quality problems.

c. If the problem is joint leaks, the options are replacing the pipe (same size or larger), and installing a structural or semi-structural liner. Using these options will also address water quality problems.

d. If the problem is water quality, the options are replacing the pipe (same size or larger), and installing a liner. The lining can be structural, semi-structural, or non-structural.

Once the pipe problem and available renewal options have been determined, the applicable renewal methods should be selected based on pipe and site characteristic information. Exhibit No. 9 lists a summary of the technologies discussed and recommended applicable use.

Exhibit No. 9

Summary of Applicable Technology and Recommended Use

Technology	Recommended Application
Cement Mortar Lining	• Prevent scale formation, internal corrosion and reduce pipe roughness (improve Hazen Williams C-value). • Considered with hydraulic and wq problems when there are no structural and joint leaks and original pipe material is cast iron, ductile iron or steel. • Should not be considered when soft or acidic water is conveyed due to possible deterioration of CML.
Epoxy Resin Lining	• Protects original pipe against corrosion and provides an increased Hazen-Williams C-value. • Considered with hydraulic and water quality (WQ) problems when there are no structural and joint leak problems.
Conventional Slip Lining	• Effective diameter of pipe is reduced, with a new pipe have a smooth interior surface. • Excavations are required for service connections, entrance pits and exit pits. • Various pipe materials (DI, PVC, HDPE and steel) may be used as new pipe. No strength is added to the host pipe in conventional slip lining.
Close-Fit Slip-lining	• Classified as structural or semi-structural lining depending on the thickness of the liner. The inserted pipe add strength, prevents further internal corrosion and improves Hazen-Williams C-value. • Considered for hydraulic, joint leak and water quality problems with no structural problems are involved.
Cured in Place Pipe	• Compared to close-fit lining, the thickness of CIPP liner is typically less than a close-fit liner. • As with the close-fit liner, the loss of diameter is compensated for by an improved Hazen-William C-value. • As opposed to epoxy lining, CIPP also provides a certain measure of leakage protection. • Considered a semi-structural liner and is applicable for hydraulic, joint leak and water quality problems when no structural problems are involved.
Pipe Bursting	• Pipe bursting is a structural lining technique and is considered suitable for CI, PVC, AC and thin wall steel pipes. • Pipe Bursting recommended for deep mains with sufficient cover to avoid heaving. • Host pipe should not have offset pipe joints or clamps with bolts. • Applicable for replacing pipes of the same diameter or larger. • Excavations are required for service connections, entrance pits and exit pits.

Generally, conventional open-cut methods would be the preferred method of main rehabilitation. Installation of polyethylene encased ductile iron pipe has an anticipated service life well over 100 years. However, when the situation (financial or technical) warrants the use of an alternative technology, a potential cost savings may be realized. Industry and vendor cost estimates for the various alternative technologies indicate a potential savings as follows:

a. Non-structural (cement mortar and epoxy lining) – 40%-60% less than conventional open cut replacement.

b. Semi-structural (slip lining and close fit slip lining) – 30%-40% less than conventional open cut replacement.

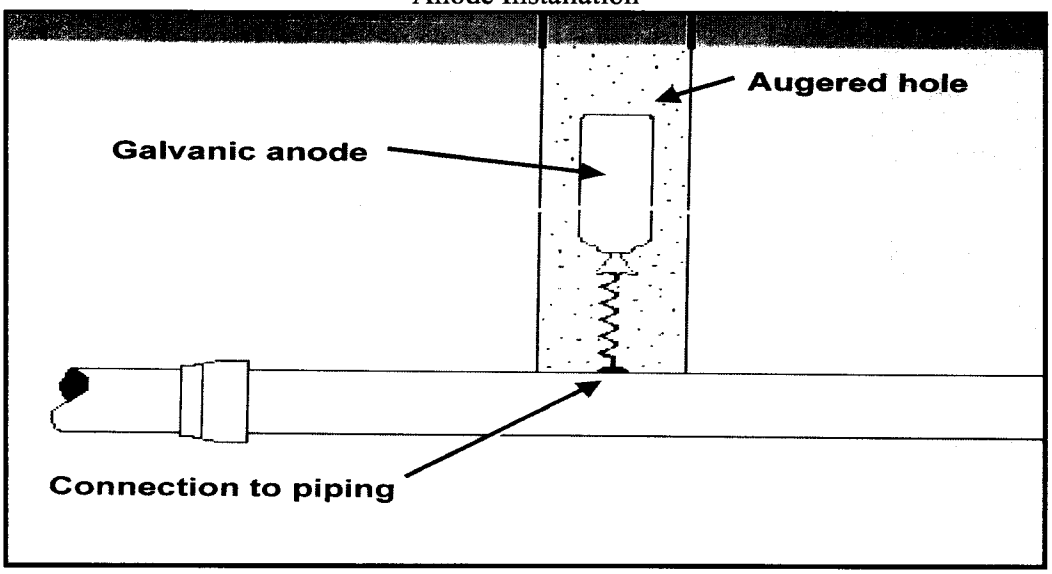
c. Structural (pipe bursting) – 20%-30% less than conventional open cut replacement.

Selecting the optimal solution to a specific pipeline problem is a complex process involving both technical and economical considerations. AWWARF is currently developing a computer-based decision tool to assist utilities in this selection process. The computer model is expected to be published by AWWARF in the Spring, 2002 and will provide guidance to utilities in considering the important criteria for selecting suitable technologies and pipe materials based on present worth and environmental considerations. The computer model is expected to assist utilities in selecting several renewal technologies that are appropriate for the pipe and site characteristics of the associated project, allowing utilities to compare different technologies that they may not have considered in the past.

C. Preventative Technologies

Cathodic Protection is a technology for reducing corrosion of a metal water main by turning the entire main into the cathode of a galvanic or electrolytic corrosion cell. Normally, sacrificial anodes are used as the galvanic cell to minimize the effects of external corrosion on existing metal water mains, thus reducing water main breaks and extending the useful life of the mains. A sacrificial anode system does not stop the process of corrosion but rather redirects the corrosion from the water main to the anode. Exhibit No. 10 shows a typical installation of a galvanic anode. Sacrificial anode protection may be used in selective "hot spot" (highly corrosive soils) areas that have been located by soil-survey procedures. In corrosive soils, sacrificial anodes should be installed during the repair of water mains. Typically this would only increase the total cost of the repair by approximately $200 - $300 per break.

Exhibit No. 10
Anode Installation



As a preventative maintenance program, sacrificial anodes are typically installed at 40-foot spacing (at every other joint) to be cost effective. This requires that rubber-gasketed joints be electrically bonded along the protected water main. It is also recommended that test-monitoring stations be installed at selected intervals along the water main to verify that the

systems are operating as intended, to assess the break reduction efficiency and to monitor the replacement timeframe for anodes.

D. Analysis of Distribution Pipe Materials for Future Use

In order to make recommendations regarding future pipe material usage, it is necessary to understand the differences between each of the potential pipe materials. This investigation is limited to "distribution size" materials (up to approximately 24") which includes ductile iron (DI), polyvinyl chloride (PVC), and high density polyethylene (HDPE). Pipes larger than 24" are typically evaluated on a case by case basis, and also include steel and concrete pipes which are typically not cost effective in the smaller sizes. Exhibits No. 11a, 11b, and 11c below list the material properties, pipe properties, and operational considerations for each of the three types of pipes.

Exhibit No. 11a

Comparison of Distribution Size Pipe Materials - Material Properties

Material Property	DI	PVC	HDPE
Tensile strength	60,000 psi	7,000 psi	3,200 psi
Compressive strength	48,000 psi	9,000 psi	1,600 psi
Yield strength	42,000 psi	14,500 psi	5,000 psi
Ring bending stress	48,000 psi	none specified	none specified
Impact strength	17.5 ft-lbs/in	0.75 ft-lbs/in	3.5 ft-lbs/in
Density	441 lbs/ft^3	88.6 lbs/ft^3	59.6 lbs/ft^3
Modulus of elasticity	24,000,000 psi	400,000 psi	110,000 psi
Temperature range	< 150° F	< 140° F	-50 to 140° F under press.
Thermal expansion	0.07" per 10° F per 100'	0.33" per 10° F per 100'	1" per 10° F per 100'
Corrosion resistance (int)	Good - w/cement lining	Excellent	Excellent
Corrosion resistance (ext)	Good - w/polywrap	Excellent	Excellent
UV resistance	Excellent	Gradual strength decline	Yes - w/carbon black
Abrasion resistance	Excellent	Good	Good
Cyclic resistance	Excellent	Fair	Good
Permeation resistance	Yes	No - solvents & petroleum	No - solvents & petroleum
Scale & growth resistance	Good	Excellent	Excellent

The primary difference between the three materials is that DI is much stronger than PVC or HDPE. However, DI is susceptible to corrosion which is not an issue with the other two materials. PVC pipe is very similar to DI pipe in terms of installation, repair, and tapping, and thus it was easy for water utilities, which had historically used cast iron pipe, to transition to PVC pipe. HDPE is just starting to gain acceptance in the United States. It is flexible and less brittle than PVC pipe, and has been popular in applications such as directional drilling, slip lining, and pipe bursting. 70% of all new pipe installed in the United Kingdom is HDPE, and it has successfully been utilized in that country for over 50 years. Gas utilities in the United States, which have a much lower leak tolerance than water utilities, use HDPE almost exclusively. However, since gas mains are typically smaller in diameter than water mains, the gas industry also enjoys the advantage of purchasing 500' coils in the smaller sizes and eliminating the labor associated with 10 joints. One of the main disadvantages of HDPE had been that it required specialized equipment to create the joints. The size and weight of the machine required that the

joints be fused above ground which could be difficult in congested areas. However, the technology for heat fusing HDPE pipe has improved in recent years with the advent of electrofusion couplings which can be utilized in the trench.

Exhibit No. 11b

Comparison of Distribution Size Pipe Materials - Pipe Properties

Pipe Property	DI	PVC	HDPE
Trade organization	DIPRA	Uni-Bell	PPI
AWWA designation	C151	C900 and C905	C906
Diameter range	3" - 64"	4" - 12" (C900) 14" - 48" (C905)	4" - 63"
Pressure range	350 psi	100 psi - 200 psi	50 psi - 255 psi
ID range (8")	8.425"	7.76" - 8.33"	6.918" - 8.136"
Wall thickness range (8")	0.25"	0.362" - 0.646"	0.265" - 1.182"
Weight range (8")	21.1 lbs/ft	6.6 lbs/ft - 11.4 lbs/ft	5.1 lbs/ft - 11.06 lbs/ft
OD nominal (8")	9.05"	9.05"	9.05"
Buoyant (8" 100 psi)	No	Yes	Yes
Surge allowance	100 psi	125 - 200% of press. rating None for 14" - 48" (C905)	50 - 100% of press. rating
Surge potential (8" 100 psi)	53.6 psi per 1 ft/sec <V	17.6 psi per 1 ft/sec <V	9.8 psi per 1 ft/sec <V
Integrity under vacuum	Excellent	Good	Poor
C-factor	140	150	150
Standard pipe lengths (8")	18 ft or 20 ft	20 ft	40 ft or 50 ft
Type of joints	Push-on or mechanical	Push-on or mechanical	Heat fused
Max joint deflection (8")	5°	3°	Radius = 20 - 50 times OD
Compatible w/DI fittings	Yes	Yes	Yes - in DI sizes

Exhibit No. 11c

Comparison of Distribution Size Pipe Materials - Operational Considerations

Operational Consideration	DI	PVC	HDPE
Ease of installation	Subjective	Subjective	Subjective
Can be direct tapped	Yes	Yes	No
Need for special installation equipment	No	No	Yes
Need for special bedding for typical installations	No	Yes	No
Need for joint restraint	Yes	Yes	No
Ability to locate underground	Excellent	Poor - needs tracer wire	Poor - needs tracer wire
Applicable for above ground installations	Yes	With opaque material for UV resistance	Yes - w/proper support
Applicable for aqueous installations	Yes	Yes	Yes - but potential for flattening is high
Anticipated service life	100 years	50 - 100 years	50 years

Although PVC and HDPE pipe have their place in the market and in specific areas of the country, some concerns need to be considered. PVC in sizes 14" and greater is not designed with a surge allowance. Another consideration is the design life of HDPE, which, per the

manufacturers, is 50 years. Although PVC manufacturers state that their pipe has an estimated 100-year life (similar to DI), there are concerns similar to that of HDPE of strength reduction over time due to cyclic loading. Relative life cycle costs should be considered when selecting the best pipe material for both new and replacement mains.

IV. Value Added Management Strategies for Buried Infrastructure

This section presents and evaluates various management strategies for addressing the challenges discussed in the previous sections. This includes broad based assessment methods and a proposed performance based management approach.

A. Broad Based Infrastructure Assessment Methods

Broad-based assessment methods refer to those methods that provide an overview of the replacement needs of a distribution system. In other words, they present the big picture as to the condition of the system. Broad-based assessments typically include:

1. Accumulating basic historical information on the system's infrastructure (miles of pipe in system, age of the pipe, and material of pipe).
2. Categorizing and analyzing this information.
3. Estimating life expectancies of the different types of mains.
4. Summarizing results.

Broad-based assessment methods help determine whether a utility is currently spending enough capital on its infrastructure maintenance. These methods are forecasting tools that predict future infrastructure replacement needs and can provide insight as to the appropriate level of investment for the system. They help answer questions such as "how much pipe should be replaced each year in the distribution system?" and "is the current expenditure level adequate, or is the utility facing a major financial burden in the next few years?" Consequently, they can provide guidance in helping to determine a utility's long-term capital investment plan to address infrastructure renewal.

Two of the most prominent broad-based infrastructure models are KANEW and NESSIE. Both models provide a forecast of the amount of infrastructure that will need to be replaced each year over a future time period. KANEW provides results in terms of miles of main, whereas NESSIE provides it in dollars. With just a limited amount of data that should be readily available for most utilities, broad-based infrastructure assessment methods can provide a reasonable estimate of the amount of pipe that should be replaced each year in the system, thus providing a benchmark with which to compare current levels of spending. However, life expectancies of mains are simply estimates provided by utility personnel. There is no engineering or economic determination that supports these estimates; consequently, results are very subjective. Such models do not identify or prioritize individual mains to be replaced. Consequently, broad-based assessment models are useful, but alone are insufficient to manage buried infrastructure.

B. Performance Based Buried Infrastructure Management Approach

A performance based buried infrastructure management approach involves a detailed inventory by pipeline segment and monitoring how well individual pipelines are meeting the level of service that is required of them. This type of approach is more commonly used for above ground infrastructure, and in particular, mechanical equipment which requires routine preventative maintenance. Since buried infrastructure primarily consists of pipe which has no moving parts and is not readily accessible, performance based management of these buried assets has historically not been performed in the water industry. However, the following are reasons for implementing such a plan:

a. Current infrastructure planning for water utilities primarily addresses pipe replacement needs from a reliability and hydraulic standpoint. Another tool is needed to complement this which will address pipe replacement needs from a maintenance and customer service perspective.

b. Currently, pipe replacement decisions are made, for the most part, reactively. Once a pipe stops providing the level of service expected of it, it is targeted for replacement. A performance based management approach would allow for proactive planning. For example, if specific vintages of pipe are reactively being replaced at a high rate, proactive decisions can be made for similar vintages of pipe exposed to similar operating conditions before they stop providing an acceptable level of service to the customer.

c. It is the preferred approach of GASB 34, and is also recommended by the H_2O Coalition for private utilities that would potentially apply for federal assistance.

It is important to selectively identify the data that would be required in a performance based management plan. If the data requirements are too high, it could hinder the implementation of the plan and also put an unnecessary and costly workload requirement on the utility. However, if the data requirements are too low, the information needed to make appropriate and justifiable management decisions will not be available. Exhibit No. 15 outlines the recommended data requirements for both existing infrastructure and new infrastructure. This data is broken down into physical, performance, and commercial/service information. The requirements for existing and new infrastructure are different since certain historical data may simply not be available, or the effort to acquire the historical information could not be justified when considering the additional value it would provide in making informed management decisions.

Exhibit No. 15

Data Requirements for a Detailed Management Plan

Physical	Exist	New	Performance	Exist	New	Commercial/Service	Exist	New
Year of Installation	Y	Y	Complaint Frequency	A	Y	Critical Customer	Y	Y
Diameter	Y	Y	Type of Complaint	A	Y	Affect on Community	Y	Y
Material	Y	Y	Break Frequency	A	Y	No. of People Served	A	A
Length	Y	Y	Type of Break	A	Y	Length of Shutdown	A	A
Location	Y	Y	Reason for Break	A	Y	Coordination w/Others	A	A
Interior Lining	A	Y	Service (hydraulic) Adequacy	Y	Y			
Exterior Protection	A	Y	Fire Flow Adequacy	Y	Y			
Joint	A	Y						
Wall Thickness	A	Y						
Soil conditions	A	A						
Internal Condition	A							
External Condition	A							

Y = yes, in all cases
A = as needed, or as available

It is necessary to know specific physical information for all existing and new buried assets as identified in the first set of columns in Exhibit No. 15. It is not possible to manage the assets without knowing the basic "what, where, and when". Tracking additional information, which is available for new installations but might not be readily available for existing assets, is useful in understanding service characteristics and potential deficiencies associated with the pipe and what remedial actions could potentially be considered. Although this information may not have been recorded at the time of installation, much of it can be obtained when performing maintenance on the pipe. One important physical parameter that warrants additional discussion is the "length" of the main. Length is defined as a section of main which has similar physical, operational, and commercial/service characteristics that can be isolated in the field. It does not necessarily correlate exactly with the work order under which the main was installed since the diameter or other property might not be the same for the entire length. To simplify the data requirements, the specified length of main should be as long as possible, and relate to the street on which it is installed, if possible.

Regardless of what is physically located in the ground, the performance information, as defined in the middle set of columns in Exhibit No. 15, is the most important to know. Decisions on the need for maintenance or replacement of a pipe should be based solely on how the pipe performs. Similar types of pipes in different operating conditions will perform differently. For example, a thin walled spun cast pipe operating under low pressure and installed in non-corrosive soil may provide considerably longer service than one operating at a higher pressure in corrosive soils. Pipes should remain in service, regardless of their physical attributes, until they stop providing the level of service that is expected of them, or until it can be proactively predicted that they will soon stop providing this level of service.

Commercial/Service aspects of the pipe performance, as defined in the last set of columns in Exhibit No. 15, provide a further distinction on the importance of the performance parameters. Factoring this aspect into a performance based management plan results in more intelligent

decision making. Defining the "level of service" that is expected from a pipe is dependant on the specific customers that it is serving. For example, a relatively low main break frequency may be acceptable in most instances; however, if the main is serving a critical customer, such as a hospital, or would have a great impact on the community (such as closing down a major road), even a low break frequency may not be tolerable. Other information, such as coordination with municipal work (e.g. street paving) is also important to factor into any decisions regarding pipe maintenance vs. replacement.

In order to prioritize the mains which should be targeted for replacement, rehabilitation, or preventative measures, a rating system is needed. In developing such as system, it is important to only rate the variables which pertain to the basic question - "is the main providing the level of service that is expected of it?". Referring back to Exhibit No. 9, this would include the following four performance variables:

- Complaint Frequency
- Break Frequency
- Service (hydraulic) Adequacy
- Fire Flow Adequacy

The other three performance variables - Type of Complaint, Type of Break, and Reason for Break - are useful in determining how to address the potential lack of adequate service being provided by the main, and would factor into decisions such as whether to replace or to rehabilitate the main.

Simply rating each of these four operational variables; however, does not fully address the issue of "level of service" since the necessary level of service can vary for each main as previously discussed. For this reason, all of the commercial/service variables defined in Exhibit No. 15 also need to be included in the rating system. These variables are as follows:

- Critical Customer
- Affect on Community
- Number of People Served
- Length of Shutdown
- Coordination with Others

Although the physical information is not included directly in the rating system, it is still extremely useful in making ultimate decisions regarding the need to replace mains. However, attempting to include it in the rating system could skew the results. For example, if a rating were provided for the type of joint, all leadite joints would receive the worst rating since they have historically performed poorly in the industry. However, if these joints are performing well at a specific location under specific operating conditions, why "penalize" that main by giving it a poor rating simply based on the physical properties of the joint and not its performance? Another example would be year of installation (i.e. the age of the pipe). Many mains in this country that were installed in the 1800's continue to provided adequate and reliable service, and again, there is no need to skew the rating of a pipe by arbitrarily including this information in the rating system. However, this information can and should ultimately factor into the final

decisions regarding pipe replacement once the rating system, which is based on performance and commercial/service variables, identifies those critical mains which need attention. For example, if two mains score equally poor in the rating system (based on performance), and one has leadite joints and is older than the other main, then that information should be brought into the final decision making process and considered at that time.

C. Data Management

There are three options to consider for maintaining the data that is recommended for a detailed management plan. The first option would be to utilize a simple personal computer spreadsheet or database. Although this would be the least costly solution, it would also be the most labor intensive. An important factor when implementing a computerized program is to assure, where possible, that the required data is entered in the course of doing daily business (a self populating database) thus minimizing duplication of data entry. A personal computer spreadsheet or database would likely not meet this criteria.

The other two software options would utilize either an infrastructure management software package or a computerized maintenance management system (CMMS). The two are similar, and vary mainly in that infrastructure management software is typically less flexible and more specifically geared to the municipal market, whereas CMMS software is more powerful and more customizable (and ultimately more costly). Again, the key with either is that they integrate with other software currently utilized by the utility and that they meet the needs of other operations, customer service, and maintenance tasks in addition to buried infrastructure management. For example, if a new main is being installed, and information is being entered into a utility's asset management system, this information needs to populate the database selected for use in managing buried infrastructure. A customer complaint that is recorded in a Customer Information System would be another example of information that needs to link with the buried infrastructure software. The other advantage that these types of software packages have over simple spreadsheets or databases is that they allow integration with Geographical Information System (GIS) software. The value of GIS is that it provides the necessary geographical information which should factor into decisions regarding pipe replacement. For example, if main replacement is warranted in a particular geographical area, it might be appropriate to replace other mains in the area to avoid future disruption to the customers and the community. Without GIS, it would be difficult to perform the same type of evaluation except possibly in very small systems.

V. **Implementation**

a. *Data Collection & Buried Asset Inventory*: The data necessary for a performance based management plan (see Exhibit No. 15) can be found in a variety of places that would include:

- Distribution drawings
- Work orders
- Asset records
- Customer Information Systems

- Maintenance records
- Tapping records

As a last resort, information such as material type could be estimated based on information provided in Exhibit No. 2 of this report.

b. *Integrated Buried Asset Inventory and Performance Monitoring and Reporting System*: Formulate the systematic process for tracking performance variables for individual pipeline segments included in the Buried Asset Inventory. Develop a system that allows the review of pipeline segment performance in conjunction with the commercial/service importance of the main. The need for geographical interface (GIS) should also be considered. The ability to query, select, sort, and prioritize buried asset information, based on multiple selection criteria, is needed to facilitate decision making.

c. *Training and Education*: Formal training is important to address relevant technical issues such as hydraulic transients, pipe failure mechanisms, operational strategies for reducing or eliminating pipe failures, and pipe rehabilitation techniques. The data collection needs and the importance of maintenance activity feedback should be covered.

VI. Conclusions

a. The industry's assessment of buried infrastructure needs appears to be reasonable although health risks have not factored into the analysis to date.

b. Utilities have begun addressing the issue, although primarily with a reactive approach. A pro-active, uniform, and systematic approach would be more efficient. The current level of investment may be inadequate.

c. Direct costs (repair vs. replace) will not drive the decision making process. Health risks, commercial and service impacts must be considered. The appropriate time to replace or rehabilitate a main is when it stops providing the level of service that is expected of it. This requirement will vary, even within the same physical system.

d. Operational strategies, rehabilitation technologies, and preventative technologies have merit and should be considered in the decision making process.

e. Broad based assessment methods are useful planning tools but are not adequate to use as a management tool.

f. A performance based management plan is valuable, and integration with operations and information management strategies is essential.

g. A prudent and systematic management process will better serve a utility in the

support of capital investment needed to properly replace or rehabilitate distribution systems.

h. "Knowing your system" and organizing the data is the first and most critical step in any buried infrastructure management approach.

i. Training and education of personnel regarding technical issues associated with buried infrastructure is critical. Specifically, the technical content would include hydraulic transients, pipe failure mechanisms, operational strategies for reducing or eliminating pipe failures, pipe rehabilitation techniques, and corrosion control.

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Office of Ground Water and Drinking Water
Total Coliform Rule Issue Paper

Distribution System Inventory, Integrity and Water Quality

January 2007

PREPARED FOR:

U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
Standards and Risk Management Division
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Background and Disclaimer

The USEPA is revising the Total Coliform Rule (TCR) and is considering new possible distribution system requirements as part of these revisions. As part of this process, the USEPA is publishing a series of issue papers to present available information on topics relevant to possible TCR revisions. This paper was developed as part of that effort.

The objectives of the issue papers are to review the available data, information and research regarding the potential public health risks associated with the distribution system issues, and where relevant identify areas in which additional research may be warranted. The issue papers will serve as background material for EPA, expert and stakeholder discussions. The papers only present available information and do not represent Agency policy. Some of the papers were prepared by parties outside of EPA; EPA does not endorse those papers, but is providing them for information and review.

Additional Information

The paper is available at the TCR web site at:

http://www.epa.gov/safewater/disinfection/lt2/compliance.html

Questions or comments regarding this paper may be directed to **TCR@epa.gov.**

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Distribution System Infrastructure Inventory and Integrity

Abstract

This white paper reports on the availability of data about distribution system infrastructure, and the ability to answer selected questions using these data. The paper does not address water quality, policy needs, or potential research projects. Water distribution systems comprise complex networks of infrastructure components. Currently, available data provide more information on distribution systems than existed a decade ago. At the national level, data with which to describe distribution systems is good, but the information has not in all cases been verified. The data reported are mainly from recent AwwaRF reports, AWWA's Water Industry Data Base and Water://Stats surveys, and EPA's Community Water System Survey (CWSS) and Needs Survey. Data on the extent of water mains, finished water storage, hydrants, some types of valves, and customer service lines are generally good. Very little data are available on other components of distribution systems or on premise plumbing. The practice of condition assessment is intended to support asset management programs rather than general conclusions about the overall condition of the nation's water distribution system infrastructure. Implementation of asset management systems that require condition assessment varies from utility to utility – some utilities have complex data systems, while many utilities rely on paper files, maps, and the experience of the utility staff.

Distribution System Infrastructure Inventory and Integrity

1.0 Introduction

The purposes of this white paper are to report on the availability of data about distribution system infrastructure and to summarize answers to selected questions that can be supported by the data. In simple terms the purpose of the water distribution system infrastructure is to supply water to all customers at sufficient pressure and volume to provide for their needs as well as for fire suppression (water quantity aspects), while also protecting the quality of the water as prescribed by various standards (water quality aspect). It is important that distribution systems deliver water reliably and protect the quality of the water that is delivered (National Research Council, 2006). These water distribution systems involve complex networks of infrastructure components consisting of pipes, joints, valves, and other appurtenances. In addition, water travels through service lines and premise plumbing systems before arriving at the customer's tap.

Throughout the paper, infrastructure issues are discussed using terminology that is not in all cases standardized. When terms are introduced, working definitions are presented, and acronyms are explained when they appear.

The term "inventory" refers to the identification, location, and description of distribution system components such as pipe segments, valves, and other parts. The term "condition" refers to appraisal of the current physical integrity of a component compared to its original designed condition. In this instance "physical integrity" of a component is a measure or estimate of flaws, defects, or decay that could reduce its service life (time from installation to replacement), as compared to original physical condition.

While distribution systems may affect drinking water quality and while water quality may affect health, this paper does not address these possible effects. It also does not make recommendations about policies or needed research. The paper is principally focused on reporting about sources and extent of data that is available and how it bears on the following questions:

- How much and what types of pipe and fittings are in service today?
- How much and what types of pipe are being installed and renewed today?
- How many and what types of storage tanks exist?
- How many and what types of fire hydrants and valves are in service today?
- How is the condition of distribution systems assessed? What is the knowledge base about the condition of distribution systems?
- What other appurtenances can be assessed?

The knowledge base about distribution system infrastructure has improved greatly since the 1986 Amendments to the Safe Drinking Water Act (SDWA). Prior to that date, neither individual utility studies nor national surveys were very extensive in their reporting of infrastructure data. The emergence of electronic database and Geographic Information System (GIS) technology, along with recent waves of activity in vulnerability assessment and "asset management" have led to more interest in conducting infrastructure inventories. An inventory of a distribution system comprises identification, location, and description of components such as pipe segments, valves, and other appurtenances.

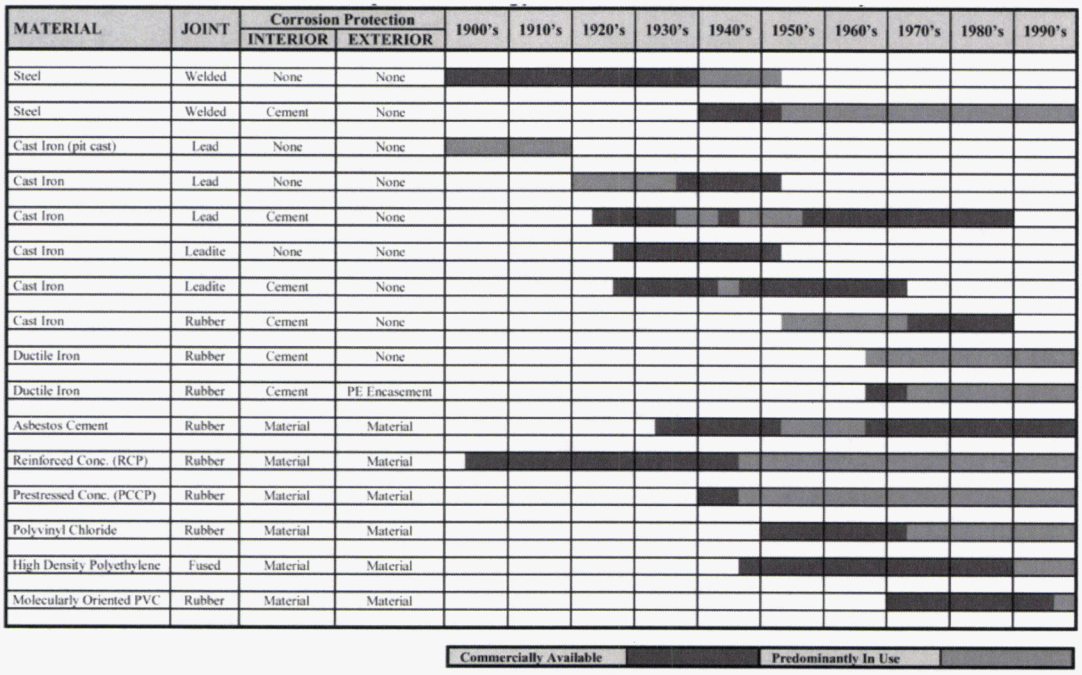
Although extensive distribution system infrastructure data were not published prior to about 1986, utility surveys by the American Water Works Association (AWWA) actually began much earlier. Additionally, prior to about 1960 the literature contains a number of short papers about problems and remedies with cast iron water mains. During the 1970s more information and basic data were collected, but the data available increased more rapidly after 1986. The data available has been collected using different means. The primary categories of data are AWWA and EPA surveys and AwwaRF case studies of one or more utilities. Other studies have been published, but they rely on data from these primary sources. A list of references is available in Grigg (2004), which provides a synthesis of the information available on water distribution system infrastructure.

2.0 Buried Infrastructure Challenges Facing the Water Industry

The buried infrastructure challenges facing the water industry were summarized in one of a series of papers that were prepared for EPA to provide information about potential distribution system requirements being evaluated under the 6-year review of the Total Coliform Rule (TCR) (American Water Works Service Co., Inc., May 2002).

The paper outlines how most distribution pipes installed from the late 1800s to the late 1960s in the United States were of cast iron. It describes how casting technologies changed from pit casting to centrifugal casting, which made a thinner pipe wall and lighter pipe possible. The paper also outlines how cement mortar pipe lining improved resistance to internal corrosion, how jointing changed from lead to a plasticized sulfur cement compound called "leadite," and how "leadite" joints failed more often than the older lead joints. Further improvements in jointing occurred with the introduction of rubber gaskets. The next major advancement was the development of ductile iron pipe, which has a different internal metallic structure due to the metal's graphite content. Then, polyvinyl chloride (PVC) and high-density polyethylene (HDPE) pipe technologies were developed, that are not subject to the corrosion processes that affect iron pipe. The paper does not discuss reinforced concrete pipe or prestressed concrete cylinder pipe (PCCP). Some PCCP has experienced catastrophic failures due to production processes that led to failure of reinforcing bands. The paper does not discuss the use of asbestos cement (AC) pipe, which was significantly used in the 1950s and 1960s but was discontinued due to concerns over asbestos. However, the paper does contain a diagram, which is reproduced here as Figure 1, which shows the eras when asbestos cement and other types of pipe were predominant.

Figure 1. Timeline of Pipe Technology in the U.S. in the 20th Century (American Water Works Service Co., Inc., 2002)



3.0 AWWA and AwwaRF Studies and Surveys

The most comprehensive inventory information on distribution systems is furnished by AWWA's Water Industry Data Base and Water://Stats surveys. In addition, AWWA and the AWWA Research Foundation (AwwaRF) have conducted a number of studies about distribution systems, both relying on existing data and on limited surveys and/or case studies. These studies report on problems and management practices by utilities, and taken together, provide a valuable set of data about distribution system infrastructure.

3.1 AWWA and AwwaRF Studies

Table 1 provides a list of AWWA and AwwaRF studies that contain data about distribution system infrastructure.

These and other studies are summarized in Grigg (2004), which also presented information collected from approximately 50 utilities in three workshops, site visits, and surveys. Results of this canvassing showed that use of technologies is advancing in asset management, but a very significant gap remains between utilities that use sophisticated technologies and practices and others that do not. Examples of leading practices include: materials analyses, comprehensive condition assessment, use of GIS, maintenance scheduling, databases to manage pipe data and track leaks and main breaks, capital improvement planning for renewal, and use of trenchless renewal methods.

Table 1. List of AWWA and AwwaRF studies on distribution system infrastructure

Study author	Summary
O'Day et al. (1986)	Surveyed six utilities (New York, Denver, Philadelphia, Louisville, East Bay, and Kenosha). Report contains often-cited information about failure mechanics, condition assessment, management methods and other topics.
Deb et al. (1990)	Studied seven utilities and surveyed 35 utilities about renewal practices. Most appurtenances were replaced rather than rehabilitated. Valves and hydrants were both replaced and rehabilitated. Shows that renewal is practiced, especially in large utilities, but other than cleaning and lining, new technologies were not in widespread use.
Kirmeyer et al. (1994)	Surveyed twenty utilities in 1992. Also summarized AwwaRF's three expert workshops on distribution systems, held in 1990, 1991, and 1992. This research needs section of this report is often cited for its presentation of distribution system statistics.
Stratus Consulting (1998)	AWWA commissioned an independent assessment of distribution system needs that led to a 20–year estimate of $325 billion.
Deb et al. (1998)	This report about a prioritization model also reviewed distribution system statistics.
Deb et al. (2000)	Surveyed 37 utilities about O&M, including European utilities. Leak detection was the least common maintenance activity, among tasks such as hydrant flushing and testing. 81% had corrosion control procedures and 60% had procedures for main breaks. 70% had maintenance history databases. While statistics show that utilities engage in the activities, they do not reveal the extent to which they implement them.
Cromwell et al. (2001a)	Surveyed 20 utilities and reported needs of more than $250 billion over the next 30 years to replace pipes and infrastructure. This does not include more than $12 billion per year that utilities spend on infrastructure repairs or Safe Drinking Water Act compliance.
Cromwell et al. (2001b)	Benchmarking and process comparisons of asset management practices between 15 North American and 2 Australian utilities.
Deb et al. (2002)	Found from WATER:\STATS that in 1995 there were 23-breaks/100 miles/year. Break rates in Europe are higher, on the order of 50-breaks/100 miles/year. The data show scatter in break rates, especially for small utilities.
Grigg (2004)	Collected and synthesized data from approximately 50 utilities in three workshops, site visits, and surveys

While these are examples of leading practices, the effectiveness and extent to which they are used varies widely. Two utilities may report in a survey that they use a computer-based maintenance management system, but one may have a system that is highly integrated with their asset management strategy and yielding significant benefits, while the other may have just purchased a stand-alone work order management system off the shelf, which limits the benefits obtainable in asset management unless it is used in an integrated fashion. So far, the extent to which utilities are benefiting from these technologies is mostly contained in case studies, such as those in the reports given in Table 1.

While more recent survey data is available, the Kirmeyer et al. (1994) report for AwwaRF offers a comprehensive view and useful statistics because a main activity of the study was to process and analyze the available AWWA and utility data about distribution system infrastructure, whereas data from more recent AWWA surveys requires further analysis to determine trends and conclusions. The study's authors conducted their own surveys, used the AWWA Water Industry Data Base (WIDB) survey data, and visited utilities. Tables 2, 3, and 4 are based on the Kirmeyer et al. (1994) study, and present in a capsule form key data about inventories and management practices. The more recent surveys confirm the basic data in these tables.

The data in Table 2 was compiled using a number of approaches. First, data was compiled from results of AwwaRF projects available at the time, including three expert workshops on distribution systems. Twenty utilities were studied in depth. The expertise of a project advisory committee that included experts who had completed past projects was tapped. And, a special workshop during AWWA's 1992 Distribution Systems Symposium was conducted to collect data and opinions from additional utilities. The data in Table 2 is described by Kirmeyer et al. (1994) as based on the above project information, AWWA's Water Industry Data Base (predecessor to AWWA's Water://Stats database), and reports of the Water Industry Technical Action Fund (WITAF).

Table 2. Statistics of U.S. distribution systems (Kirmeyer et al., 1994)

Distribution system elements	Project findings
Estimated length of distribution piping	880,000 miles
Estimated replacement value of piping	$348 billion
Condition of piping more than 30 years old	28% excellent, 43% good, 26% fair, 3% poor (these composite figures are based on surveys of 20 utilities and their reports of condition for water quality, structural performance, and hydraulic performance)
Estimated number of pipe breaks	237,600 breaks/year (27-breaks/100 mi/yr) (note: this is a different data set than Deb et al., 2002, which reported 23-breaks/100 mi/yr)
Primary types of existing piping	48% cast iron, 19.2% ductile iron, 15.1% AC*
Estimated new piping	13,200 miles/year (DIP*47.7%. PVC* 38.7%), CPP* 12.5%) (cost $2.8 billion per year)
Estimated pipe replacement	4,400 miles per year
Value of replacement	$1.742 billion per year
Lead service lines	2.3 to 5.1 million
Cost to replace lead service lines	$10-14 billion
Fire hydrants	5.85 million
Percent of O&M* budgets to T&D*	36.2%
Total O&M budget to T&D	$4.5 billion per year
Inadvertent system losses (defined as losses other than "authorized" losses, e.g., leaks, inaccurate meters, etc.)	10%
Cost of water losses	$2.8 billion per year

* Key to table: AC = asbestos-cement; DIP = ductile iron pipe; PVC = polyvinyl chloride; CPP = concrete pressure pipe; O&M = operations and maintenance; T&D = transmission and distribution.

As shown above, Kirmeyer et al. (1994) estimated that some 2.3 to 5.1 million lead service lines are still in service. Replacement of the utility portion was estimated to cost $3.4 to $5.1 billion. Complete replacement of the utility and residential portions of existing lead service lines was estimated to cost $10 to $14.1 billion.

Table 3 was prepared from a survey question posed by Kirmeyer et al. (1994) that asked utilities to list the five most common causes of main breaks. The data did not distinguish between types of materials. Table 4 is based on survey responses to the question: "What are your criteria for deciding whether a particular section of pipe is to be replaced?" Note that the top criterion for pipe replacement is "number of leaks or breaks." This might be construed to imply a reactive approach, but some would argue that leaks and breaks are, in fact, the most cost-effective and integrated measures of pipe condition that are available to support a predictive approach to replacement (Cromwell, 2001b; Hughes, 2002).

Table 3. Causes of main breaks (Kirmeyer et al., 1994)

Causes of main breaks	Percent of utilities reporting
Materials/deterioration	55
Weak joints	35
Earth movement or settling	30
Freezing	30
Internal corrosion	25
Corrosive soils	25
Construction or utility digging	25
Stray DC current	20
Seasonal changes in water temperature	15
Heavy traffic load	10
Tidal influences	5
Changes in system pressure	5
Water hammer	5
Air entrapment	5

Table 4. Criteria for pipe replacement (Kirmeyer et al., 1994)

Criteria for pipe replacement	Percent reporting
Number of leaks or breaks	75
Age of pipe	45
Low flow	40
Condition or type of material	30
Size changes required	30
Water quality	15
Soil condition	15
Location	10
Street construction work	10
Elimination of dead ends	5
Amount of damage by leaks/breaks	5

A survey by CH2M Hill was reported at AWWA's 1985 Distribution System Symposium and described by (O'Day et al., 1986). This limited survey is significant in that it demonstrates the variability in distribution system management actions taken among small, medium, and large utilities. Percentages of reported actions are shown in Table 5. The data show the expected results that small utilities participated in infrastructure management activities to a lesser extent than larger utilities.

Table 5. Percentage of surveyed utilities practicing management activities shown (O'Day et al., 1986)

Management activity	Small < 5 mgd	Medium 5-50 mgd	Large > 50 mgd
Leak detection surveys	16	19	40
Method to determine replacement need	63	77	100
Computer model of system hydraulics	48	58	90
Reports of main breaks	27	66	80
Steps to remove scale and tuberculation	13	31	30
Revenue to finance renewal program	59	69	80
Budget and planning for replacement	48	67	90

3.2 AWWA's Water://Stats Database

AWWA's Water://Stats database (AWWA, 2004) is the most current survey of the drinking water industry produced by AWWA. AWWA's water industry surveys began before 1900, and the information they provide can serve as a historical reference and current source of information about water distribution infrastructure.

A compilation of the surveys since 1945 was provided by AWWA (Keeley, 2003). It shows that surveys were conducted every five years from 1945 through 1970, then surveys were conducted more frequently. The number of utilities responding varies from a low of 211 (1985 survey) to a high of 1,397 (1981 survey), with the average between 1945 and 1985 being 770 utilities (Seidel, 1985). Grigg (1988) reviewed data in the 1984 survey. Prior to about 1980, the surveys focused on water production and rates. Survey data and associated reports show that management attitudes have changed, requiring the collection of different data. For example, discussion at the 1985 AWWA annual conference stressed the need for capital management programs to sustain infrastructure (O'Day et al., 1986). However, the attitude among 33 of the large utilities surveyed was that O&M expenditures were adequate to maintain reliability even though 23 of them had reported some deferred maintenance.

The modern survey effort was launched as a joint AWWA/AwwaRF project in 1989/1990 as the Water Industry Data Base (WIDB). It was intended to develop detailed profiles of individual utilities that could also be aggregated to profile the large system segment of the industry (Cromwell et al., 1990). The initial survey was sent only to the 3,000 water systems that serve more than 10,000 people. Some 1097 responses were obtained, representing only 2% of community water systems, but about half of the total population served by community water systems (112 million). Respondents reported a total of 436,000 miles of distribution pipe, broken

down as: 50% cast iron, 20% ductile iron, 15% AC pipe, and 15% other materials. Pipe replacement rates were 0.6%/yr versus 1.6%/yr for pipe expansion. The survey also documented the presence of 11,000 storage facilities, broken down as: 60% steel tanks, 15% concrete tanks, and 20% below-ground clearwells and reservoirs.

The AWWA/AwwaRF Water Industry Data Base effort was renamed WATER://STATS in 1996, and since then, surveys focus on specific subjects, such as finance (1999 survey of 672 utilities), distribution systems (2002 survey of 337 utilities) and rates (2004 survey of more than 250 utilities).

The 2002 Water://STATS Distribution Survey (AWWA, 2004) includes a set of questions that focus on the distribution system rather than on general utility profiles. It was sent to 3,000 water utilities and the response rate was 11%. Data were collected between June 2002 and April 2003. The survey covers pipe materials, valves, fire hydrants, finished water storage facilities, corrosion control, pumping capacity, metering, customer service lines, water auditing, leakage management and infrastructure needs. Water audit and leakage management data is in a format developed in 2000 by the International Water Association.

The 337 utilities that were surveyed served 59,389,902 in population, and had 14,339,261 customer service lines, and 146,435 wholesale connections. Total length of pipe was 202,000 miles for the population served, and if increased by ratio to current total population (2004 US population of 292.5 million), it reaches 980,000 miles, a figure that is roughly comparable to the 1992 estimate of 880,000 miles (Table 2, above) drawn from the prior WIDB survey (Kirmeyer et al., 1994). It is noted, however, that both WIDB and WATER://STATS results indicate that the length of pipe per capita varies with system size, so using overall averages to extrapolate is only a broad approximation.

Data available are summarized in the next section. They include utility information, types of services provided, pipe material, finished water storage, water conveyance, valves, fire hydrants and flushing, customer metering, customer service lines, customer service lines responsibilities, corrosion control, water supply auditing, leakage management, and infrastructure.

More analysis is needed to separate wholesale and retail customers before ratios such as miles of line and valves per capita can be compared meaningfully. Also, the data must be processed to homogenize values and to facilitate comparison. Data in the 2002 survey do not show expansion and replacement by pipe type.

The data from the 2002 survey might suggest that both pipe expansion and replacement have slowed since the WIDB-based estimates by Kirmeyer et al. (1994). But interpretation of these broad extrapolations should not be stretched that far. In contrast, the more detailed inventory of distribution system components, profiled in the 2002 Water://Stats Survey is useful in providing deeper insights into more parameters.

Table 6. Comparison of population-based extrapolations to national totals from AWWA 1989/90 WIDB survey results and AWWA 2004: Water://Stats 2002 survey

Item	WIDB (1097 utilities) (Kirmeyer et al., 1994)	Water://Stats 2002 (337 Utilities) (AWWA, 2003)
Miles of pipe	880,000	980,000
Expansion per year, miles	13,200	5,100
Replacement per year, miles	4,400	3,590

Shown below are:

- A matrix showing availability/quality of the data available for each subject;
- An assessment of the capability to disaggregate national figures into regional and/or system size categories; and,
- An analysis of whether trends can be observed for regions or system sizes

Table 7. Matrix of data availability in AWWA 2004: Water://Stats 2002 survey

Data	Available	Quality of data
Pipe data	Yes	Data on miles of pipe by type is very detailed. Data on expansion and renewal does not specify pipe materials. Data on pipe condition and on failure mechanics is only anecdotal.
Finished water storage tanks	Yes	Inventory data is very detailed by type of tank. Condition data is not available. Data is available on maintenance.
Joints and gaskets (not included)	No	Data not available.
Hydrants	Yes	Inventory data and data on maintenance and exercising is detailed.
Customer service lines	Yes	Inventory data on customer service lines is provided. Data is available on type of line, but not on condition of lines.
Distribution system meters	No	No data is available.
Customer meters	Yes	Inventory data is provided, but no data on condition or reliability is available.
Valves (gate, butterfly, PRV)	Yes	Data on number of gate, butterfly, and pressure reducing valves is available, but condition data is not available.
Pumps	No	Data not available
Backflow preventers	No	Data not available in Water://Stats.
Other system appurtenances (e.g., blowoffs, air release valves)	No	Data not available

Table 8 presents the results from the 2002 Water://Stats data. The raw data could be disaggregated by size of pipe and size of system, But such assessment was beyond the scope of this paper to address. Note that the data on percent of total miles of pipe is based on averages of reported data by utilities of this statistic, and is not computed from the data on miles in place as reported in Table 8. This method of computing the averages will produce small differences in the right hand column of Table 8, but is not significant in terms of estimating the national inventory of pipe.

Table 8. Pipe Inventory of AWWA 2004: Water://Stats 2002 Survey

Pipe material	Miles in place (WaterStats, 2002)	% of total miles of pipe * (as reported by utilities)
Ductile iron, CML	35,118	19.7
PVC	29,835	16.6
Asbestos cement	30,484	15.2
Cast iron, unlined	37,433	14.4
Cast iron, CML	34,039	14.4
Ductile iron, unlined	9,886	4.3
Steel	7,821	3.8
Other 1	3,071	2.4
Concrete pressure	4,774	1.9
Polyethylene	1,377	1.1
Other 2	2,294	0.3
Other 3	977	0.2
Other 4	5,049	0.1
Misc./unknown	6,000	N/A
Total	202,158	*

* (Percentages do not add to 100 because of data inconsistencies).

Responses for the "other" categories were: galvanized iron, HDPE, wrought iron, black iron, copper, steel cylinder pipe, plastic, cement-stove, fiberglass (Permastrand), concrete lined steel cylinder, steel, arch concrete masonry, polybutylene, and unknown. Utilities listed different materials for "Other (1, 2, 3, 4)," and these cannot be correlated with pipe material type, such as HDPE, black iron, etc.

Finished water storage tank data from the 2002 Water://Stats survey show a total of 4,929 storage tanks among the surveyed utilities. The types of tanks are shown in the Table 9. Capacities are also reported, but quality of the data in the survey tables should be assessed before totals can be reported. Some utilities may have reported capacity in gallons, rather than millions of gallons, and an analysis of the data should be carried out before total capacities are reported. Hydrant data from the 2002 survey are reported in Table 10. Data on repairs and inspections are on an annual basis.

In Table 11, data on customer service lines are shown. The total number of lines surveyed was 14,120,646, which serve a population of over 59 million customers. Extrapolation of the reported value of 3.3% for lead pipe suggests that there are some 2.3 million lead service lines in use, and this estimate compares well to the estimate by (Kirmeyer et al., 1994) of 2.3 to 5.1 million lead service lines still in service.

Table 9. Storage facilities (AWWA 2004: Water://Stats 2002 survey)

Storage tank type	Number in service
Welded ground storage	1,395
Welded elevated	910
Reinforced Concrete	577
Basins	522
Welded standpipes	427
Other	406
Wirewound	353
Bolted ground storage	224
Bolted standpipes	47
Tendons	38
Composite	30
Total	4,929

Table 10. Hydrant data (AWWA 2004: Water://Stats 2002 survey)

Item	Profile data
Hydrants in system, dry barrel	959,437
Hydrants in system, wet barrel	415,751
Total hydrants	1,375,188
Hydrant repairs, dry barrel	77,082
Hydrant repairs, wet barrel	15,852
Hydrant inspection, dry barrel	614,277
Hydrant inspection, wet barrel	216,051
Miles of pipe flushed annually	67,655
Hydrants flushed	437,696

Table 11. Customer service lines (AWWA 2004: Water://Stats 2002 survey)

Service line type	Percent *
Copper pipe	56.3
Lead pipe	3.3
Polybutylene	2.4
Polyethylene	11.4
Polyvinyl chloride	5.8
Steel	1.5
Cast iron	1.2
Galvanized	8.0
Asbestos cement	0.2
Other 1	1.8
Other 2	0.3

* Percentages do not sum to 100 due to inconsistencies in reporting of data.

Reported in "other" categories are: ductile iron, plastic, brass, CAI, DUC, wrought iron, Tubelog, cement lined wrought iron, KITEC (aluminum/PE composite), Tuballoy, and HDPE. Data summaries do not clearly distinguish which are "Other 1" and "Other 2."

Data in Table 12 represents the data available on the valve types and size in service as reported by the surveyed utilities.

Table 12. Valve data (AWWA 2004: Water://Stats 2002 survey)

Valve type	Number in service
Gate valves, 12 in and smaller	2,575,071
Gate valves, larger than 12 in	200,988
Butterfly valves, 12 in and smaller	92,110
Butterfly valves, larger than 12 in	58,421
PR valves, 12 in and smaller	37,993
PR valves, larger than 12 in	804

Other equipment and appurtenances (general data is not available on these elements of the distribution system):

- Pumps
- Backflow preventers
- Other system appurtenances (e.g., blowoffs, air release valves)
- Joints and gaskets
- Distribution system meters
- Customer meters

The surveyed population of 59,389,902 is about 20% of the national population in 2004. Table 13 summarizes data and extrapolates it to the year 2004 population, simply on the basis of population. The tenuous nature of such extrapolation should be respected.

Table 13. Summary of population extrapolations from AWWA 2004: Water://Stats 2002 survey

Dist. system infrastructure components	Surveyed population served of 59.4 million	Extrapolated to 2004 U.S. population of 292.5 million
Pipe miles	202,158	995,644
Storage tanks	4,929	24,276
Total hydrants	1,375,188	6,772,910
Total service lines	14,120,646	69,545,307
Total valves	2,965,387	14,604,767
Expansion, miles	1,052	5,181
Replacement, miles	740	3,645

4.0 EPA Surveys and Other Federal Government Analyses

Studies sponsored by the Environmental Protection Agency (EPA) include surveys and case-based research. Surveys were produced to support needs studies for infrastructure funding, and case-based research studies include studies by the Cincinnati and Edison Laboratories, and comprehensive reports such as Smith et al. (2000).

EPA's Community Water Systems Survey is based on an extensive, stratified sample of systems (EPA, 2002a). It includes estimates of miles of pipe in place (by diameter), miles replaced, and replacement costs. The survey also includes information on storage facilities (by type), connections, customers, and cross connection and backflow controls. It provides information on pipe age, but not about materials. It does not include information on appurtenances.

EPA's Drinking Water Infrastructure Needs Survey collects data on funding needs that include replacement of distribution infrastructure, but it does not inventory the actual infrastructure in place or its condition (EPA, 2001a). EPA has also conducted a study on modeling the costs of infrastructure (2001c) in support of the Needs Survey.

EPA's 2002 Clean Water and Drinking Water Infrastructure Funding Gap Analysis (EPA, 2002b) makes national projections of pipe replacement investment needs derived from estimated pipe age profiles in 20 cities developed by AWWA (Cromwell, 2001a). It concludes that most of the funding need for pipe replacement lies beyond the 20-year horizon of the study, with needs ramping up continually through a projected peak in 2040.

The General Accounting Office and Congressional Budget Office also conduct studies of distribution system issues from time to time, but they normally do not conduct original surveys (GAO, 1980, 2001; CBO, 2002). These studies rely on data available from other sources and on limited surveys to develop policy recommendations with budgetary implications for the federal

government. They have broadly concurred that investment needs for replacement investment are growing and will present a large need.

4.1 EPA Community Water System Survey (EPA, 2002a)

The Community Water System Survey (CWSS) is a broad profile survey of the industry that has been replicated by EPA in 1976, 1982, 1986, 1995, and 2000. The most recent replications introduced a carefully designed stratified sampling design intended to represent the diversity of systems types and sizes. The 1,806 systems included in the 2000 survey sample represent a census of systems serving more tan 100,000 population. The response rates ranged from 56 to 63% for system serving more than 3,300 persons. EPA performed field visits to boost response rates to the 85 to 99% range in systems size categories serving fewer than 3,300 persons. EPA also applied a QA protocol to review of the 1,246 survey responses.

The 2000 CWSS results show that, overall, 47% of all capital expenditures is devoted to distribution and transmission infrastructure, a proportion that is fairly consistent across system size categories. The overall proportion of capital expenditures for storage facilities is 12%, which tends to be higher - up to 20% - of total outlays in small systems.

Data on pipe age shows 78% is less than 40 years old; 18% is 40 to 80 years old; and only 4% is more than 80 years old. As shown in Table 14, the age profile of pipe assets documented in the 2000 CWSS is markedly different by system size, with large systems being generally older than small systems. This is consistent with the fact that roughly half of all small systems are suburban systems that are necessarily younger than the urban areas they adjoin. Overall replacement rates are less than 1% per year, varying from 0% to almost 2%, from small to large systems.

Table 14. EPA 2000 Community Water System Survey Data on Pipe Assets

System size (pop served)	Percent of pipe per system by age class (yrs)			Average miles of pipe per system by diameter (inches)		
	< 40	40 - 80	> 80	< 6	6 – 10	> 10
< 100	90.6	9.4	0.1	1.1	0.1	0
101-500	88.3	11.7	0.1	3.4	0.5	0.1
501-3300	85.7	13.3	1	23.9	3.0	0.7
3300-10,000	84.3	12.9	2.8	60.8	18.0	4.5
10-50,000	81.4	15.3	3.4	121.4	78.0	31.1
50-100,000	70.2	23.4	6.4	141.6	121.6	78.7
100,000-500,000	60.9	29.7	9.4	259.9	181.8	139.5
500,000 +	56.3	34.4	9.2	819.0	915.7	684.0
Overall	78.0	18.0	4.0			

The 2000 CWSS provides data for each system size category on the total miles of pipe in place by diameter. As shown in Table 14, mains greater than 10-inches in diameter exist mainly in larger systems. Systems serving fewer than 3,300 persons typically have less than 1-mile of such pipe. In addition, the CWSS has data on the number of service connections in each system size category, enabling estimates of the total number of service lines in place nationally, by extrapolation. This combination of factors should also enable a good basis for developing miles of pipe/connection relationships by system size that could be used for extrapolation to estimate national totals for pipe assets by diameter and age. Since the CWSS also documents the number of storage facilities and their capacities, extrapolation to national totals for storage tanks should also be possible.

The 2000 CWSS also contains details about the presence of cross connection and backflow controls. It clearly documents a lesser degree of penetration of such practices in small systems.

4.2 EPA Drinking Water Infrastructure Needs Survey (EPA, 2005)

The EPA Needs Survey has been replicated in 1995, 1999, and 2003 to serve as the basis for reports to Congress documenting the extent of investment requirements in support of the State Revolving Loan Fund program. The survey is conducted with the assistance of state governments who have a stake in assuring a high response rate in order to substantiate the need for their share of SRF funds. The 2003 survey was conducted as a census for 1,342 systems serving more than 40,000 persons and as a random sampling of 2,553 systems serving between 3,300 and 40,000 people. For systems serving fewer than 3,300, the 2003 needs estimates were developed by extrapolation from the 1999 results that were based on a sample of 599 systems for which needs were documented by field visits conducted by EPA.

The analytical objective of the Needs Survey is to document projected capital investment needs over a 20-year horizon based on site-specific information provided by respondents to document planned investment projects. The data is subjected to QA protocols at both the state and EPA levels. Because specific projects are less formulated when they are farther off in time, the earlier versions of the Needs Survey were suspected to have understated the total needs by missing some longer term needs. The 2003 survey was implemented with extra measures to enhance the articulation of long-term needs. The result was an estimated total 20-year need of $277 billion, 60% more than the previous estimates of $167 billion. EPA concluded the increase is attributable to longer-term projects. The system size breakdown of the $277 billion total is as follows: $123 billion for large systems (> 50,000 people); $103 billion for medium size systems; and $34 billion for small systems (< 3,300 people). The order of magnitude of the 2003 total needs estimate is consistent with other major national estimates of investment needs.

Of the total estimated need of $277 billion, $184 billion is estimated to be required for transmission and distribution projects and $25 billion is identified for storage projects. Table 15 presents the breakdown of these projected needs by system size.

Table 15. EPA needs survey data on distribution, transmission and storage needs

System size (pop served)	Source & treatment needs	Distribution & transmission needs	Storage needs	Other needs	Total needs ($ 2003)
Large systems (>50,000)	24,807.1	89,779.9	6,994.5	1,270.2	122,851.7
Medium systems (3,300-50,000)	19,299.0	73,454.4	9,473.3	790.9	103,017.6
Small systems (< 3,300)	9,035.1	18,624.3	6,263.8	248.3	34,171.5
All community systems	53,141.2	181,858.6	22,731.6	2309.4	260,040.8

4.3 EPA White Papers on Distribution Systems

As mentioned earlier, a white paper that was prepared for EPA offered a summary of distribution system infrastructure issues facing the nation (American Water Works Service Co., Inc., 2002). Eight other white papers were prepared to address issues about distribution systems and are listed in this section because they may contain information that will help the reader understand infrastructure-related distribution system issues.

The paper on infrastructure covers the problems of aging and corrosion (American Water Works Service Company, 2002). It discusses general issues, such as the current condition of buried infrastructure, capital needs, technical issues of buried infrastructure, and assessment methods.

Several of the papers discuss how infrastructure failures can open paths to contamination. One paper covers how installation and repair of water mains might introduce possible routes to contamination (AWWA and Economic and Engineering Services Inc., 2002a), and another covers the potential health implications of failures at covered storage facilities (AWWA and Economic and Engineering Services Inc., 2002b). A paper on intrusion explains the possible roles of pressure transients, or specialized backflow situations, in contaminating water mains (LeChavallier, Gullick, and Karim, 2002). Another paper, on cross-connection control, explains backflow and cross-connection risks (EPA Office of Ground Water and Drinking Water, 2002). A paper on permeation and leaching is about external threats to pipes, or how chemicals can penetrate plastic pipes (AWWA and Economic and Engineering Services Inc., 2002c).

Three papers focus on water quality issues. One explains decay of water quality over time in distribution systems (AWWA and Economic and Engineering Services Inc., 2002d). Another paper discusses microbes associated with biofilms, diseases, pathogen routes to the DS, and management indicators (EPA, 2002). A third paper (AWWA and Economic and Engineering Services Inc., 2002e) explains nitrification and especially the associated health risks. Nitrification

is explained as a microbial process that mainly involves oxidation of ammonia to nitrite and nitrate.

5.0 Condition Assessment of Water Distribution Pipes

Effective assessment of pipe condition is required to plan renewal programs for water distribution systems. This section of the paper describes utility condition assessment practices as observed in an industry survey, workshops, case studies and various publications. It also summarizes issues faced by utilities in implementing condition assessment.

In March 2002, WERF convened a workshop to define research priorities in asset management (WERF, 2002). The top-ranked research need arose from the lack of standardized guidelines for conducting condition assessments and using such data to understand asset condition and performance. AwwaRF and WERF have a joint project ongoing to address fill this gap (Urquhart, 2004).

The context for understanding the objective of condition assessment is anchored in principles that have been established in the global best practice of asset management, as documented by utility practitioners in Australia and New Zealand in the International Infrastructure Management Manual (NAMS, 2006). The objective of asset condition and performance assessment is not to manage asset condition, but to manage failure risk (Urquhart, 2005). The purpose of condition data is to make an assessment of the remaining life of the asset so that rehabilitation or replacement investment can be planned and implemented before failures occur that would cost the utility more than it would to have avoided such failures through asset management. This risk management context provides the basis on which the cost of condition assessment is justified. In the standard practice of asset management, there is an important risk prioritization step in which a differentiation can be made between "reactive" assets and "proactive" assets (Urquhart, 2004). It is worth noting that the best practice in applying this risk management protocol takes full account of the environmental and social costs of failures in applying the risk management discipline in a triple bottom line sense.

Reactive assets are those for which the consequences of failure are quite low. Main breaks on small lines on residential streets would be an example. Given the cost of condition assessment on small lines and the difficulty of predicting specific failures on a hundred miles or more of individual small lines, it is much more cost-effective to simply fix lines when they break. Some Australian utilities have in fact focused their entire small mains asset management program on that objective by focusing on responsiveness to failure as the best risk management approach – reducing the cost per break repair and the time-out-of-water (Cromwell, 2001b). Condition data is useful in planning rehabilitation and replacement investments for small mains, but these reactive assets are approached as a population of assets, using statistical analysis of pooled data on such parameter as break trends segmented by pipe material and soil type in order to assess overall replacement needs. This type of statistical analysis of aggregate performance data, such as breaks, does not cost as much as some other forms of actual condition assessment of specific lines and is therefore more suitable to lower priority risks.

Typical data used for such analysis includes pipe age, pipe material, pipe diameter, soil conditions, number of breaks, any rehabilitation that might have been conducted on the pipe, pressure of operation, and complaints of taste, odor, color, or low pressure associated with the delivered water. However, the lack of standardized procedures and common terminology for recording data on leaks and breaks has challenged adoption of such programs. For instance, some utilities do not differentiate by pipe failure type, yet the mode of failure can provide insight on the condition of the pipe. It is often assumed that the mode of failure is corrosion failure. While this is an important type of failure, there are a variety of factors that contribute to failure (pipe break). As another example, many northern climate pipe failures occur in the fall and spring, as soil temperatures are either decreasing with the advent of winter, or increasing with spring. These pipe failures tend to be circumferential failures typically due to soil movement, and have little or nothing to do with corrosion. Other types of failures, when properly identified and analyzed, can also yield useful condition information

New factors to consider within this risk management framework have recently come to light and will have to be incorporated. First, there is growing evidence that pipes very often leak before they break. Further, it may be the case that some breaks would not even occur if the leaks had been fixed when they first began, preventing them from potentially undermining pipe foundations and producing stresses where there were none (Hughes, 2002). This suggests that leak detection could become a much more significant tool for proactive efforts, even applied to small mains.

A second major area of concern involves not just the physical condition of pipes (especially small mains), but also their water quality performance. Performance failure is just as important as physical failure. With tightening regulatory requirements on water quality at the tap and the potential disruption of the chemical and biological equilibrium in old pipes when subjected to different waters produced by advanced treatment processes, the useful life of some pipes may be shortened if stable performance in terms of delivered water quality cannot be recovered. Thus, water quality monitoring must be regarded as an essential component of asset condition assessment. In addition to these concerns, there is also growing concern that repeated main breaks in small lines may be an important source of contamination threats. This could have the effect of either increasing the cost of main repairs or decreasing the number of failures that should be endured prior to replacement. The effect is the same - shorter pipe life.

"Proactive" assets are those for which the consequences of failure are quite high, making it worthwhile to be proactive about managing failure risk. An example would be the loss of a large main lying under Main Street, causing significant damage and disruption in addition to substantial service outage. Because so much is at stake, the cost entailed in conducting and evaluating condition assessment data is more than justified for such "proactive" assets that are also called "critical assets" in the parlance of vulnerability assessments recently conducted in the US.

At this time the accepted method of recording results of condition assessments for 'proactive" assets (or, critical assets) is a five-point scoring system, such as the following (Morrison, 2005):

1. Little or no deterioration, performance more than adequate.
2. Minor deterioration, performance adequate.
3. Mildly deteriorated, short-term performance just adequate, however will require renewal or replacement soon.
4. Severely deteriorated and in need of repair, renewal or replacement.
5. In danger of immediate failure, requires emergency repair or replacement.

Non-destructive inspection is commonly done in wastewater lines using closed-circuit television (CCTV) cameras. This technology has provided valuable information to wastewater managers and the five point scoring system has actually been put to use for wastewater mains using such data. However, the application of CCTV is much less valuable in the potable water environment where failure modes are different, access to these pressurized systems is much more limited, and pipes are usually smaller. The unique nature of pressurized water distribution system presents a significant technical challenge for universal scoring protocols. This requires adaptable tools and training to address the myriad pipe sizes, materials, and ages, as well as fittings with tight bends and other constrictions. Advanced applications will be required for the future, which may include real-time assessment, smart pigs, automated pipe data registration and other technologies.

Most non-destructive inspection technologies require some type of hardware access to the interior of the pipe, and for the pipe to be dewatered for effective inspection. The requirement for access to the interior of the pipe can result in high first-time inspection costs because water systems may need to modify their system. For instance, a major US city recently spent approximately $700,000 for inspection of one mile of 36-inch diameter pipe. Most of this cost was associated with gaining access to the interior of the pipe. Approximately 17% of the cost was the actual inspection. The dewatering requirement, traffic control, inspection manhole installations, and pavement restoration in an urban environment can result in high indirect costs, and also severely limit the timeframes when inspection is feasible. The overall cost of nondestructive inspection at this time limits the economic application of these technologies to larger diameter pipe (typically 24-inches or greater in the US). The failure of large pipes in this size range is a rare event, but typically creates significant direct damage and service outage issues and thus makes the associated cost justifiable — if the utility recognizes the inherent risk management context of asset management.

One of the greatest success stories of non-destructive testing in the potable water sector has resulted from a number of catastrophic failures of large diameter PCCP due to failure of metal reinforcing bands. Ingenious use of magnetic, acoustic and fiber optic technologies have produced a substantial toolkit for utilities facing this risk (Johnson and Shenkiryk, 2006), demonstrating that perhaps technology can rise to the challenge in this area.

Additional research has been called for during the past decade (Kleiner, 2005) to include nondestructive test methods for determining the condition of existing pipe, improved leak detection equipment and methods to measure losses, studies of causes for pipe, joint, lining,

and coating deterioration, including corrosion, and development of better in-situ methods to test condition. Taking into account the evolution of research and trends in the water supply industry, it seems likely that in the future utilities will more actively manage distribution systems with more monitors, safeguards, and protective systems. For instance, recent work on water accounting has developed a defined set of terms and a considerably increased understanding of water leakage. Partly due to these developments work is now ongoing to improve real-time pressure management, which is directly related to leakage, and leak detection hardware. While this is just one example, it is representative of a general trend.

Both technologies and methods are evolving to improve condition assessment capabilities. This conclusion is based on a recent synthesis of AwwaRF reports on distribution system infrastructure. AwwaRF has commissioned a number of recent studies on distribution system infrastructure, and experts recommended more and continued research on failure mechanisms with different types of pipe, causes for pipe, joint, lining, and coating deterioration, and continuing integration of results, along with more focused and practical guidance for utilities in this complex arena. In general, the goal is to develop more accurate, user-friendly test methods to determine condition of pipe, to expand understanding of causes for deterioration, leaks, and breaks, and to prevent problems and predict length of life under various conditions.

6.0 Conclusions

The paper summarized the available data on the inventory and condition of the nation's water distribution infrastructure. Taken together, the available data and companion studies provide much more information on distribution systems than existed even as recently as a decade ago. EPA has conducted a number of studies about distribution systems, including surveys and research investigations, and more detailed data is available in AWWA's Water://Stats program. AWWA and AwwaRF have also conducted a number of separate studies, both relying on existing data and on surveys and/or case studies.

At the national level, the database of inventory information on distribution systems is fairly good. However, the national database is built from utility-level information that has not in all cases been verified. While some data on age of constructed facilities is available, data on condition of systems is weak.

The paper reported on data contained in the literature and distribution system data from AWWA's 2002 Water://Stats survey, which is the latest available. The matrix of data availability shows that data on pipes, finished water storage, hydrants, some types of valves, and customer service lines is generally good. Very little data is available on other components of distribution systems.

National data from EPA surveys and the AWWA Water://Stats surveys can be disaggregated to provide regional and/or system size categorical data. Trends can be analyzed for regions or system sizes, and by comparisons with previous surveys, time trends can be evaluated.

From recent research, the water industry has a good understanding of how condition assessment is practiced by utilities. Condition assessment is not done consistently by utilities, and system condition is not well known by most utilities. Gross indicators such as "poor" or "good" condition are normally reported, rather than remaining life and more definite indicators. The art and science of condition assessment need further improvements. While tools for condition assessment hold promise, more development and training are necessary to advance the state of knowledge.

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ASBESTOS CEMENT PIPE: WHAT IF IT NEEDS TO BE REPLACED?

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ABSTRACT: Asbestos cement (AC) pipe, also known as "transite," was a popular choice of engineers for potable water, sanitary sewer, and storm drain pipelines during the 1940s, 1950s, and 1960s. AC pipe was touted for its light weight and ease of handling, low coefficient of friction (Manning's "n" = 0.010), and corrosion resistant properties. An estimated 600,000 miles of AC pipe were installed in the U.S. and Canada.

Due to health concerns associated with the manufacturing process, production of AC pipe ceased in the United States in the early 1970s. The U.S. Environmental Protection Agency (EPA) issued a complete ban on all asbestos-containing products in 1979, but was defeated in the U.S. Fifth Circuit Court of Appeals and the ban was lifted. The Court did, however, reinforce the EPA's responsibility to regulate asbestos.

Hundreds of thousands of miles of AC pipe are beyond or are approaching the end of their 50-year design lives. Two very effective technologies for replacing AC pipe are pipe bursting and pipe reaming. However, existing regulations limit the use of these trenchless construction methods.

Many public agency officials and engineers are not familiar with the regulations restricting pipe bursting and pipe reaming of AC pipe. Regulatory application is not consistent from one state to the next, or even within the same state in many instances. Enforcement is occurring much more frequently; however, and it is important for those in our industry to clearly understand the restrictions. This paper will examine the regulations on AC pipe rehabilitation and replacement, evaluate the impacts of the restrictions, and discuss the current position of the regulators.

INTRODUCTION

Asbestos cement (AC) pipe became a viable option for water, wastewater, and storm drainage systems beginning in the mid-1940s. The materials used to fabricate AC pipe included Portland cement, up to 12 percent asbestos fibers, water, and silica or silica-containing materials. The pipe was formed under pressure and heat cured in an autoclave. The presence of the asbestos fibers in lieu of reinforcing steel provided adequate strength with lower weight. In addition to its light unit weight, AC pipe was marketed as having very good resistance to the effects of hydrogen sulfide corrosion and soils that were aggressive to steel, and low operating costs because the smooth walls of the pipe provided low friction factors. The major U.S. manufacturers of AC pipe are shown in Table 1.

Table 1. Manufacturers of Asbestos Cement Pipe

Company Name	Headquarters Location
Cement-Asbestos Product Company	Woodward, Alabama
Certain-teed Products, Company	Ambler, Pennsylvania
Flintkote Company (Orangeburg Mfr. Div.)	Orangeburg, New York
Johns-Manville Company	New York, New York

AC pipe was manufactured in four different classes, for various applications. Each type of pipe was manufactured to specific ASTM standards. The individual characteristics for each material are shown in Table 2. Each section of pipe and each fitting were marked with the size and pipe class, manufacturer's

name or trademark, and date of manufacture. Each rubber gasket was also marked with the manufacturer's trademark and date of manufacture.

Table 2. Characteristics of Asbestos Cement Pipe

Type of Pipe	Typical Use	ASTM Standard	Size Range (in.)	Crush Strength (lb/ft)	Pressure Class (psi)
Nonpressure	Sanitary sewers	C 428	4–42	1,500–7,000	--
Pressure	Local water mains, sewer force mains	C 296	4–18	4,100–17,400	100, 150, 200
Storm Drain	Storm drains	C 663	4–42	1,500–3,750	--
Transmission	Water mains	C 668	6–42	2,000–42,000	300–900

Due to its light unit weight, relatively low installation cost, superior corrosion resistance, and low friction factor (Manning's "n" = 0.010), AC pipe was very popular during the 1950s, 1960s, and early 1970s. Vitrified clay pipe provided a competitive alternative for use in sanitary sewer systems, but AC pipe soon became the pipe of choice for water and storm drainage systems. A survey conducted by the American Water Works Association (AWWA) in 2004 found that, on average, AC pipes constitute approximately 15–18 percent of the nation's water distribution and transmission systems. In North Carolina, AC pipe comprises nearly 5,000 miles of pipeline or approximately 6.5 percent of all water mains installed. The amount of AC pipe installed in various entities within North Carolina ranges from zero to ninety-eight (98) percent. This illustrates that there is a substantial quantity of AC pipe installed in North Carolina and is quite prevalent in some communities.

Communities that experienced significant growth during the 1950s and 1960s, however, constructed their infrastructure systems when the use of AC pipe was prevalent. These cities have percentages of AC pipe that are much higher than the national average, especially if one or more AC pipe manufacturing facilities were located nearby. Through our research, we found that AC pipes comprised from 50-80% of typical storm drain systems in the western U. S. and Canada; water systems included 40-75% AC pipes; sewer systems included 10-25% AC pipe (mostly in force mains). Usage rates as found through our literature search for the various systems are shown in Figure 1. As a comparison, the AWWA survey of 50 responding communities (mainly large municipalities in the eastern U. S.) reported that 15% of infrastructure systems are comprised of AC pipe as a national average. Overall, it is estimated that more than 600,000 miles of AC pipe are in use throughout the U.S and Canada.

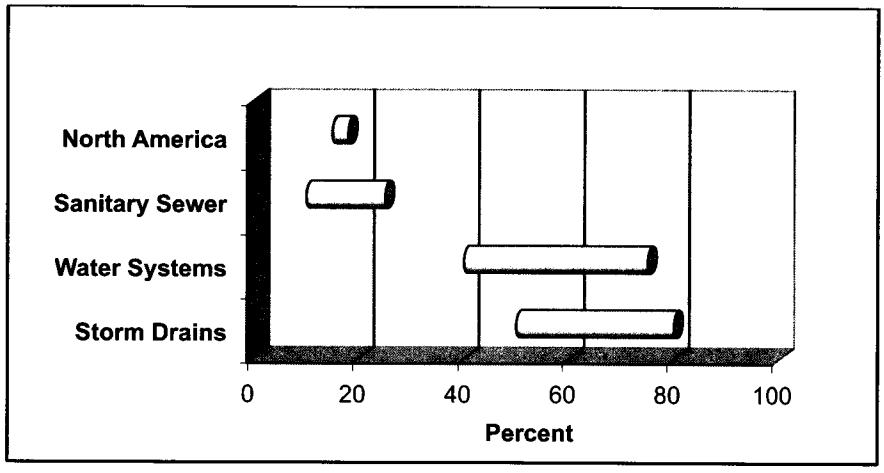

Figure 1. Asbestos cement pipe was used extensively in water and storm drainage systems built between 1950 and 1969

Under certain conditions, AC pipe has experienced failures at rates that are similar to other pipe types during their 50-year design lives. However, many public agencies have reported significantly higher failure rates for AC pipe than for other pipe materials. Ironically, the major factor in predicting failures of AC pipe appears to be aggressive soils—one of the conditions that AC pipe was supposed to protect against. Overall, however, studies have shown that the failure rate for AC pipe increases dramatically with age. After 50 years of use, AC pipe failure rates are about one per year per mile of pipe.

THE HISTORY OF ASBESTOS REGULATION

In 1973 the National Emissions Standards for Hazardous Air Pollutants (NESHAP) was implemented by the United States Environmental Protection Agency (EPA) when it was determined that asbestos was a leading contributor to asbestosis and certain forms of cancer. Through NESHAP, the EPA sought to protect the public by controlling exposure to asbestos during the milling, manufacture, common use, spraying, renovation, demolition, and disposal of more than 3,000 asbestos-containing products.

Effectively regulating such a large class of diverse products proved to be a daunting task. In 1979 the EPA announced its intent to ban all asbestos-containing materials. By 1986 the EPA proposed a rule to ban asbestos. The EPA's Asbestos Ban and Phaseout Rule was published in the Federal Register[1] in 1989, proposing to eliminate all asbestos-containing materials in three stages between 1990 and 1997.

The Asbestos Information Administration and the Asbestos Institute (with major funding from the government of Canada) conducted significant lobbying efforts against the Asbestos Ban and Phaseout Rule. One large manufacturer of asbestos-containing products, Corrosion-Proof Fittings, successfully sued the EPA to block implementation of the ban. The U.S. Fifth Circuit Court of Appeals ruled that the EPA had failed to present a compelling case for banning all asbestos-containing materials. The Court did, however, reinforce the EPA's responsibility to regulate asbestos, and new products containing asbestos were banned.

The impact on the asbestos pipe industry was uncertainty and fear. After 1973, the asbestos fiber content in AC pipe was reduced from 12 percent to less than 0.2 percent. By the 1980s the popularity of AC pipe had waned dramatically due to fears of liability and the availability of PVC pipe. Manufacturers stopped producing AC pipe in the United States; however, the machines were moved to other countries (including Mexico and Saudi Arabia), and AC pipe is still produced and available today.

ASTM Subcommittee C17.03 remains active and tasked with maintaining a series of ASTM specifications related to the manufacture, installation, and testing of AC pipe. Table 3 lists the ASTM specifications for AC pipe.

Table 3. Asbestos Cement Pipe ASTM Specifications

Specification Number	Subject
C296	Pressure Pipe
C428	Non-pressure Sewer Pipe
C458	Organic Fiber Content
C500	Test Methods for AC Pipe
C663	Storm Drain Pipe
C668	Transmission Pipe
C966	Installing AC Non-pressure Pipe
D1869	Rubber Rings for AC Pipe

Table 4 shows the AC pipe standards promulgated by the American Water Works Association (AWWA). In November 2008, the AWWA withdrew its AC pipe standards.

Table 4. Asbestos Cement Pipe AWWA Specifications

Specification Number	Subject
C400	Pressure Pipe, 4"-16"
C401	AC Pipe Selection, 4"-16"
C402	Pressure Pipe, 18"-42"
C403	AC Pipe Selection, 18"-42"

REGULATIONS FOR AC PIPE

In most states, public agencies are *not* required to remove and replace AC pipe. Studies have indicated that, in normal use, AC pipe does not pose a threat to public health; however, certain activities—including tapping, cutting, crushing/removing, and disposing—are regulated.

Contrary to common belief, in many states specially licensed contractors are not required when working with AC pipe. Many states have developed programs to train individual employees in safe practices involving the regulated AC pipe practices. These training programs provide an employer exemption for registration requirements. In addition, guidelines have been established for licensing of course providers in order to extend the available training resources while maintaining consistency in content and message.

The EPA has addressed replacement of AC pipe using the pipe bursting method. In a letter issued July 17, 1991, the EPA stated its position that "the crushing of asbestos cement pipe with mechanical equipment would cause this material to become 'regulated asbestos containing material' (RACM)" and ". . . the crushed asbestos cement pipe in place would cause these locations to be considered active waste disposal sites and therefore, subject to the requirements of §61.154 (NESHAP)." Furthermore, in this same letter, the EPA goes on to advise that "In order to avoid the creation of a waste disposal site which is subject to the Asbestos NESHAP, the owners or operators of the pipe may want to consider other options for dealing with the abandoned pipe." Since the EPA's letter did not specifically identify pipe bursting, interpretation of the intent was inconsistent throughout the industry.

260-foot Exclusion: NESHAP includes an important exclusion for pipeline replacements. This exclusion allows single renovations of up to 260 linear feet or within a calendar year for nonscheduled operations. Although the exclusion was likely intended to allow some flexibility for small replacement projects, the exclusion also provides us with the opportunity to pilot test rehabilitation methods for AC pipe and test the impacts of construction.

CURRENT EPA ACTIVITIES

Key EPA staff members continue to survey the industry to learn about pipe bursting, pipe reaming, and AC pipe. They are trying to gain an in-depth understanding of the rehabilitation techniques in order to determine the extent to which pipe bursting or pipe reaming of AC pipes constitutes a threat to public health. They are also trying to determine whether existing restrictions are reasonable (either too much or too little).

Currently, the EPA staff has expressed a preference for pipe reaming over pipe bursting because reaming can remove a portion of the asbestos pipe fragments through the downstream receiving pit. Pipe bursting, on the other hand, leaves all of the broken pieces of pipe entombed in the soil surrounding the new pipe. Concerns seem to be centered on possible exposures during future excavations.

A pair of Florida contractors have recently (separately) approached the EPA in Washington D.C. to request issuance of a perpetual notification determination that would allow pipe bursting of AC pipe in the

State of Florida. EPA, through their lawyers and biologists, wanted to know what studies had been done to guarantee that the asbestos fibers wouldn't migrate up through the soil, groundwater and pavement to become airborne. Based on the meetings to date, EPA is willing to allow pipe bursting on a case-by-case basis, but it will not issue a unilateral exemption from notification of the potential impacts inherent to this type of project.

Independently, organizations such as the Government Regulations Subcommittee of the International Pipe Bursters Association (IPBA) are trying to develop a science-based argument with which to approach the EPA. The goal is to convince the EPA to modify the AC pipe regulations to specifically address the public health impacts of replacement by pipe bursting or pipe reaming. In the meantime, the EPA and local air quality boards are aggressively enforcing current restrictions.

SPECIFIC STATE REGULATIONS

The EPA has delegated administration and enforcement of asbestos regulations to many of the individual states. Program administration often falls to a statewide department that enforces many environmental policies. In North Carolina, enforcement of the NESHAP regulations is managed by the Health Hazards Control Unit of the Division of Public Health of the North Carolina Department of Health and Human Services. There are also three local programs in the State of North Carolina responsible for enforcing the NESHAP regulations within their jurisdiction. These three programs are the WNC Regional Air Pollution Control Agency of Buncombe County, the Environmental Affairs Department of Forsyth County, and the Department of Environmental Protection of Mecklenburg County.

As the title of this paper poses, if a segment of asbestos cement pipe needs to be replaced, what are the requirements? Under the North Carolina rules, individual asbestos removals where 160 square feet, 260 linear feet, or 35 cubic feet or greater of RACM is to be demolished or renovated, a permit application is required.

Policies in other states are different. In South Carolina, a project license for the work to be performed must be obtained before beginning work and any person or contractor engaged in this activity must be RACM licensed. In Arizona and New Mexico, AC pipes can be replaced by pipe bursting or pipe reaming following filing of a notice of intent. In Oregon, specially licensed abatement contractors are required to remove and dispose of AC pipe. Oregon is also the only state that requires all AC pipe to be removed if it is exposed for any reason. In Nevada, New Jersey, and New York, specially licensed contractors are required for any work (including taps) performed on AC pipe.

PIPE BURSTING VS. PIPE REAMING FOR AC PIPE

Pipe bursting is a construction method that allows an existing pipe to be replaced with a new pipe of the same or larger diameter with limited excavation. Several different types of equipment, including static, pneumatic, or hydraulic equipment, are available to break the host pipe and pull or push a new pipe into the open cavity. As recently as 2010, the EPA cited pipe bursting as an effective means for rehabilitating force mains[2] and wastewater collection systems[3].

Pipe reaming is similar to pipe bursting in that it is a process to replace an existing pipe with a new pipe of the same or larger diameter; however, the equipment used to create the cavity involves modified horizontal directional drilling equipment. Whereas in pipe bursting, the host pipe is broken into fragments and pushed into the surrounding soil, in pipe reaming, the host pipe is ground into smaller fragments.

During pipe reaming, drilling fluid is pumped into the borehole to flush pipe fragments and soil to the downstream receiving pit. The mixture of mud, soil, and pipe fragments can be collected for disposal. When the host pipe is AC, the collected mixture must be containerized and disposed of at an appropriate landfill site. This ability to contain and appropriately dispose of the AC pipe fragments is the primary reason that the EPA favors pipe reaming. To date, no studies have been done to quantify how much of the pipe is recovered during reaming, but an EPA staff member was quoted in offering an opinion that up to 90% of the pipe fragments may be removed.

Whereas pipe reaming is a patented process, the patent on pipe bursting has expired. There are far more contractors who are experienced pipe bursters. The number of projects completed by pipe bursting is much greater than pipe reaming. Only a few projects resulting in installation of pipes over 18 inches have been performed by pipe reaming. Pipe bursting can be used to install pipe up to 48 inches in diameter. The unit cost of pipe bursting is less than pipe reaming.

Certain EPA staff members are of the opinion that matters such as number of contractors, installation size range, and cost are market driven. If there is more demand for pipe reaming, then more contractors will become licensed and experienced, resulting in a wider installation range and more competition (leading to lower costs).

THE FUTURE OF AC PIPE REPLACEMENT

Hundreds of thousands of miles of AC pipe are reaching the end of their 50-year useful lives and will need to be replaced soon. Each engineer, contractor, and public official responsible for replacing AC pipe should be aware of the policies in place in the area where they work.

Since the EPA is soliciting input from the industry prior to revising existing regulations regarding replacement of AC pipe, now is an excellent time to contact the EPA to offer the benefit of your knowledge and to voice your opinions. These revisions are critical to our industry and it is important that the EPA have all of the available information in order to make prudent decisions.

The Water Research Foundation is currently leading a study to establish tools to predict the long term performance of AC pipes. Additional research is underway to develop bentonite lubricants that solidify after pipe installation to form a conglomerate with the pipe fragments, similar to a controlled low-strength material used for backfill. Such a product could substantially reduce the risk of future exposure to friable material.

Administrative procedures need to be developed to ensure that AC pipes replaced by either pipe bursting or pipe reaming are adequately marked so that maintenance activities can be properly planned and safely performed. Using the 260-foot exclusion, testing should be conducted to definitely determine the condition of pipe fragments remaining in the soil and the extent of pipe fragment removal accomplished.

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2. State of Technology Report for Force Main Rehabilitation United States Environmental Protection Agency, Office of Research and Development, EPA/600/R-10/044, March 2010.
3. State of Technology for Rehabilitation of Wastewater Collection Systems, United States Environmental Protection Agency, Office of Research and Development, EPA/600/R-10/078, July 2010.

Water Main Break Rates In the USA and Canada:

A Comprehensive Study

April 2012

Utah State University
Buried Structures Laboratory

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UtahStateUniversity

Executive Summary

Modern societies base their economic prosperity on a standard of living which includes a complex network of infrastructure, both above and below ground. Quality drinking water brought to the tap through elaborate underground distribution systems is a critical component to our public health and economic well-being. In the USA and Canada, it has been the hallmark of our industry and cooperation.

EVIDENCE OF DECLINE

Our water infrastructure is now in decline after decades of service. The signs of distress surface daily as water mains break, creating floods and sink holes. The loss of water service is more than an inconvenience, since it causes significant social and economic disruptions and jeopardizes public health.

THE MEASUREMENT

One factor used to quantify the occurrences of failing underground pipe networks is **water main break rates**. Water main break rates are calculated for all pipe materials used in the transport of water to create a measurement to judge pipe performance and durability. Water main break rates can vary year to year and by utility. However, in aggregate, break rates produce a compelling story which can aid our prudent decision making as it relates to repairing and replacing our underground pipes.

PURPOSE AND HIGHLIGHTS

This Comprehensive Water Main Break Rate Study for the USA and Canada compiles the collective experience of 188 utilities which can be used for making future critical pipe replacement decisions. It is the desire of the researchers and participants to offer data and analysis that utility managers and elected officials can apply to the circumstances of their own operations. Highlights of the Comprehensive Water Main Break Study include a new national metric for citizens served per one mile of pipe, aggregate data on pipe material break rates, analysis of age and corrosion in failure modes, and related observations on pressure, temperature and trenchless technology practices.

Introduction

In the United States and Canada, underground water infrastructure was installed during three main time periods because of the population growth in the 1800s, 1900–1945, and post 1945. Pipes constructed in each of these three eras will all start to fail at nearly the same time over the next couple of decades for a number of reasons ranging from age and corrosion to inadequate design and poor installation. Additionally, the life span of the materials used has become shorter with each new investment cycle (WIN, 2002). In 2009, the American Society of Civil Engineers issued a USA Infrastructure Report Card and gave a D- to drinking water and wastewater infrastructure (ASCE, 2009).

In 2001, an AWWA study called "Dawn of Replacement" pointed out: *The oldest cast iron pipes—dating to the late1800s—have an average useful life of about 120 years. This means that, as a group, these pipes will last anywhere from 90 to 150 years before they need to be replaced, but on average they need to be replaced after they have been in the ground about 120 years. Because manufacturing techniques and materials changed, the roaring '20s vintage of cast-iron pipes has an average life of about 100 years. And because techniques and materials continued to evolve, pipes laid down in the Post-World War II boom have an average life of 75 years, more or less. Using these average life estimates and counting the years since the original installations shows that these water utilities will face significant needs for pipe replacement over the next few decades. Replacement of pipes installed from the late1800s to the 1950s is now hard upon us, and replacement of pipes installed in the latter half of the 20th Century will dominate the remainder of the 21st. We believe that we stand today at the dawn of a new era—the replacement era—for water utilities.* (AWWA, 2001) In an update to the "Dawn of Replacement", AWWA has published "Buried No Longer" which states, *"More than a million miles of pipes are nearing the end of its useful life and approaching the age at which it needs to be replaced."* (AWWA 2012) These replacement costs combined with projected expansion costs will cost more than $1 trillion over the next couple of decades.

Over 54,000 community water systems face the inevitable cost of pipe repair and replacement. The United States EPA states that nearly 60% of the total system costs are found in the distribution and transmission pipe lines. Infrastructure asset management is an approach which can help utilities bring together the concepts, tools, and techniques to manage assets at an acceptable service level at the lowest life-cycle cost. Asset management practices applied to underground infrastructure help utilities understand the timing and costs associated with replacement activities. The knowledge gained from these efforts also helps in the development of pipe material selection criteria as part of the replacement strategies and funding plans.

AGING WATER INFRASTRUCTURE

The EPA's Aging Water Infrastructure research program (http://www.epa.gov/awi/) is working toward the goal of making our nation's water infrastructure sustainable by supporting research and by promoting strategic asset management. This comprehensive water main break study is part of the continuing credible, analysis-based effort to support the EPA's program goals including:

- Reduced life-cycle costs for water infrastructure management
- Extended service life of existing infrastructure
- Reduced high-risk water main breaks
- Improved condition assessment and decision- making capabilities
- Reduced potable water leakage and intrusion potential
- Increased use of performance and cost data for decision support, and the adoption of asset management
- Increased adoption of innovative technologies

The water industry has seen many types of academic surveys and studies on water main replacement programs and the benefits of asset management and prioritization. However, many utilities have not historically tracked all of the elements of water main break data. As this trend changes, more data and analysis will be available to the industry to improve water distribution system repair and replacement decision making. This comprehensive report based on statistically significant experiences from 188 utilities also draws from other relevant studies to be the most complete study on water main break data.

THE PRIMARY RESEARCHER

Dr. Steven Folkman is a registered Professional Engineer, a member of American Society for Testing and Materials (ASTM) F17 Plastic Piping Systems, a member of AWWA and a member of the Transportation Research Board Committee on Culverts and Hydraulic Structures, and has oversight of the prestigious Utah State University's (USU) Buried Structures Laboratory. The Buried Structures Laboratory at USU has been involved in analysis and testing of all kinds of pipe and associated structures for over 50 years. Previous directors include Dr. Reynold Watkins and Dr. Al Moser who are internationally recognized experts. Dr. Moser and Dr. Folkman are coauthors of the widely used text, Buried Pipe Design (Mc Graw Hill, 3rd Edition). Dr. Folkman's research assistant for this project was Ammon Sorensen. Dr. Folkman's expertise includes structural dynamics, linear and nonlinear finite element analysis utilizing soil/structure interaction, and testing. The USU Buried Structures Laboratory is recognized as one of two laboratories in the United States for performing large scale tests on buried pipes. It is from this expertise and background that the surveys of water main breaks were developed and analyzed to complete this comprehensive study.

UtahStateUniversity

THE METHODOLOGY

During 2011, Utah State University conducted a study of utilities across the USA and Canada to obtain data on water main failures of municipal and private water supply systems. The study was comprised of two parts: a basic survey and a more detailed survey. The focus of the basic survey was to examine the number of failures utilities were experiencing and how those failures related to the pipe materials used. This effort focused on water supply mains (sewer and force main pipes were excluded). A variety of pipe materials are used in water supply systems and over the past 100 years the materials have evolved with different manufacturing technologies. As a result, pipe performance has changed. A goal of the more detailed level of analysis was to look at which materials were performing best at a snapshot in time and to track how pipe age affects failure rates.

A total of 1,051 surveys were mailed out to USA and Canadian water utilities in May and June of 2011. The participants were asked for data from a previous 12 month time period and thus the results represent a time period that mostly coincides with the year 2010. A total of 188 utilities responded and completed the basic survey with 47 of these also responding to the detailed survey. 117,603 miles of pipe are represented in this comprehensive study. The USA and Canada were divided into nine regions and the 188 survey respondents were categorized according to the region and the size of the utility based on amount of pipe. This comprehensive study documents the results from both surveys and draws from other relevant industry sources.

OBJECTIVES AND GOALS OF THE STUDY

There were many objectives of the surveys. These objectives include:

- Understanding the age and pipe size distribution of pipe in the respondent's system
- Reviewing delivery and fluctuations of water pressure
- Itemizing pipe failures over a time period with the data broken down by material type
- Identifying the most common pipe failure modes and materials as identified by the utility
- Determining whether corrosive soils are present and whether corrosion prevention methods were used
- Highlighting pipe replacement plans, expected pipe life of new pipe and leak detection methods
- Considering contractor selection based on contractor experience and which pipe materials are allowed
- Quantifying experience with pipe relining, pipe bursting, and directional drilling to examine future directions of pipe repair and installation.

MAJOR FINDINGS

The comprehensive nature of this study has provided several national-level metrics and rules of thumb which utilities can use for benchmarking purposes.

1. **This Survey Achieved Wide Participation**
   A total of 117,603 miles of pipe were reported by the 188 survey participants. This represents approximately 10% of the total length of water mains in the USA. This is one of the largest surveys conducted on water mains failures and the results give an accurate representation water main behavior in the USA and Canada.

2. **Nationwide One Mile of Installed Water Main Serves 264 People**
   While in urban areas the industry has assumed 325 people are served for 1 mile of distribution system pipe, this survey suggests a new national metric of 264 people served per 1 mile of pipe regardless of utility size. Also, 66% of all water mains are 8" or less in diameter and the range of 10" to 14" make up another 18% of all installed water mains.

3. **Most Utilities Use Several Kinds of Pipe Materials**
   80% of the installed water mains utilize a combination of Cast Iron (CI) at 28%, Ductile Iron (DI) at 28% and PVC pipe at 23%. This fact is supported by a relative low amount (13%) of utilities which avoid DI due to corrosion concerns.

4. **Pipe Material Use Differs by Region**
   Water main pipe material usage varies significantly over geographic regions (see Figure 9). The Northeast and North Central region of the USA (Regions 6 and 8 as illustrated in Figure 1) uses either CI or DI pipe for approximately 90% of its length. In Region 9, Canada, PVC pipe makes up 43% of the total.

5. **There is Considerable Scatter in Pipe Failure Rate Data**
   The water main break experiences of one utility may not represent another. Factors such as climate, installation practices, and soil corrosivity can greatly affect failure rates. Every utility should properly install pipe - regardless of material. In order to have an accurate water main break survey, a large number of respondents are required.

6. **PVC Pipe Has the Lowest Overall Failure Rate**
   When failures rates of Cast Iron, Ductile Iron, PVC, Concrete, Steel, and Asbestos Cement pipes were compared, PVC is shown to have the lowest overall failure rate.

7. **Corrosion is a Major Cause of Water Main Breaks**
   75% of all utilities have corrosive soil conditions and combined with a high portion of CI and DI pipes, one in four main breaks is caused by corrosion which is ranked the second highest reason for water main pipe failure. Northeast and North Central USA utilities (Region 6 and 8) will experience a higher percentage of corrosion breaks due to a higher concentration of CI and DI pipes (90%) installed.

8. **The Average Age of Failing Water Mains is 47 years old**
   43% of water mains are between 20 and 50 years old and 22% of all mains are over 50 years old. While pipe life can be estimated at over 100 years, actual life is affected by soil corrosivity and installation practices. Based on the detailed survey, the average expected life of pipe being put in the ground today is 79 years. For example, non-corrosive materials like PVC have an estimated life over 110 years (Burn, 2006). Regardless of the pipe material selected, installation practices will affect the actual life that can be achieved.

9. **The Average Supply Pressure is 77 psi with Pressure Fluctuations less than 20 psi.**
   Pressure events can contribute to water main breaks for pipes that have internal corrosion (tuberculation) or weakened areas due to external corrosion. Pressure is an important component to pipe design and material selection. A well-controlled system operated below design limits will lead to extended pipe life.

10. **The Use of Trenchless Technologies will continue to Increase**
    While 57% of utilities use some form of leak detection, fewer utilities have engaged in trenchless technologies like pipe relining, pipe bursting and directional drilling. Over 40% are considering pipe relining and pipe bursting in the future. Directional drilling is more widely accepted and has a higher satisfaction rating and as a result, 74% of utilities are considering it in the future.

11. **Over 8% of Installed Water Mains are Beyond Their Useful Life**
    This figure corresponds well with an EPA study (EPA, 2002) that shows the amount of pipe needing immediate replacement is growing rapidly. Improved asset management will be essential to all utilities to survive this trend.

SURVEY REGIONS

In total, 188 utilities participated in the surveys and are representative of the nine survey regions in the United States and Canada.

Figure 1. Regions used to report survey results.

The regions defined in the study are used here to indicate the wide geographical distribution of the respondents. Table 1 lists the number of respondents in the basic and detailed surveys from each region, and Figure 1 illustrates the locations of the nine different regions used in this report. The provinces in Canada with a white color did not have respondents to the survey. Figure 2 illustrates the miles of water main pipe that were reported in the basic survey on a regional basis. Similarly, Figure 3 illustrates the miles of water main pipe on a regional basis from the detailed survey. A total of 32,130 miles of pipe was reported by respondents in the detailed survey. It is noted that the respondents were distributed across a large survey area, but this study is still more comprehensive than other studies to date.

Table 1. Number of Survey Respondents by region.

REGION	NUMBER OF RESPONDENTS	
	BASIC SURVEY	DETAILED SURVEY
1	19	7
2	20	4
3	26	5
4	22	6
5	18	3
6	28	11
7	23	2
8	20	4
9	12	5

Figure 2. Length of pipe from each region that responded to the basic survey.

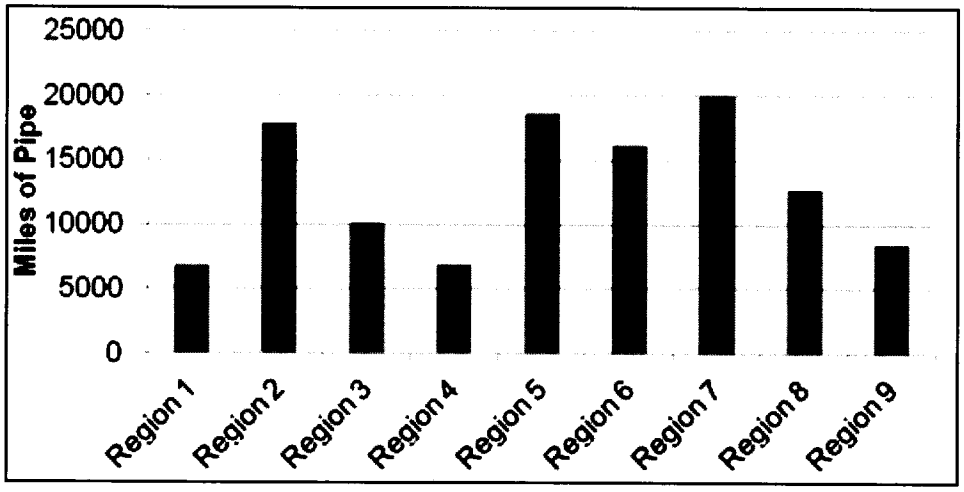
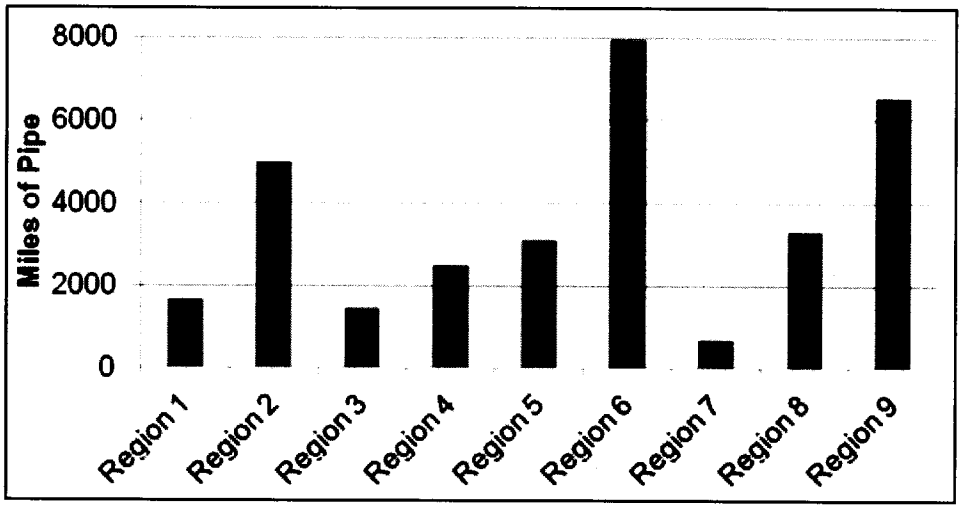


Figure 3. Length of pipe from each region that responded to the detailed survey.



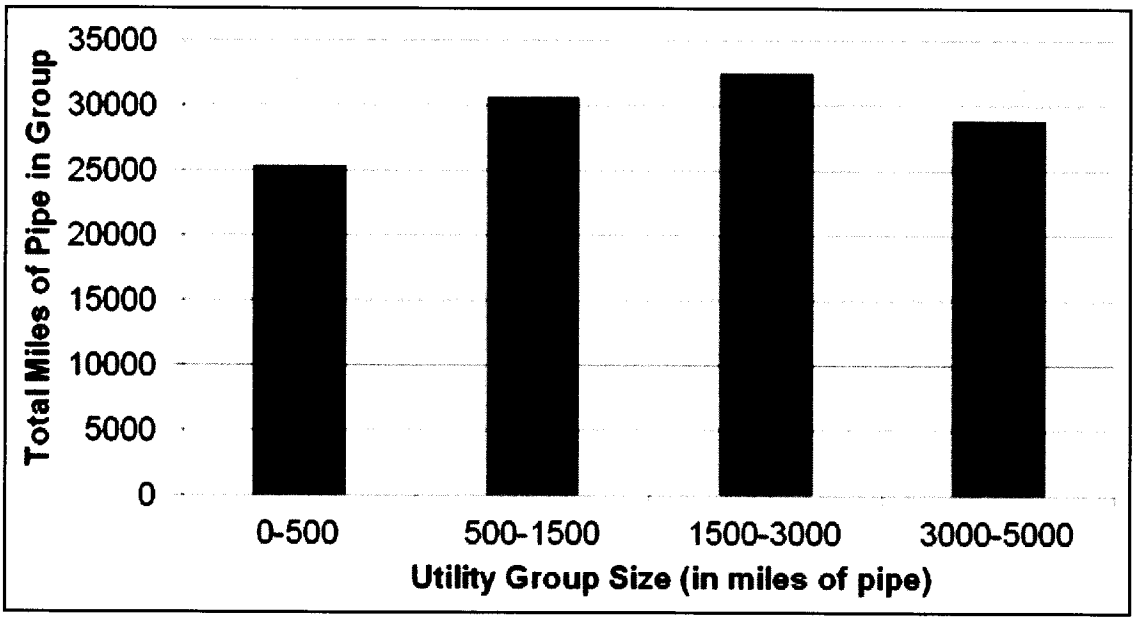
SIZE OF SURVEY PARTICIPANTS

Four categories were established as shown in Table 2 and each survey participant was allocated to one of the categories. Figure 4 shows the distribution of total miles from the basic survey based on these categories. Respondents covered the range from very small to very large with each group from Table 2 well represented.

Table 2. Grouping of utility size.

DESCRIPTION	MILES OF PIPE INSTALLED
Small Utility/City	0 to 500 miles
Medium Utility/City	500 to 1000 miles
Large Utility/City	1000 to 3000 miles
Very Large Utility/City	3000 to 5000 miles

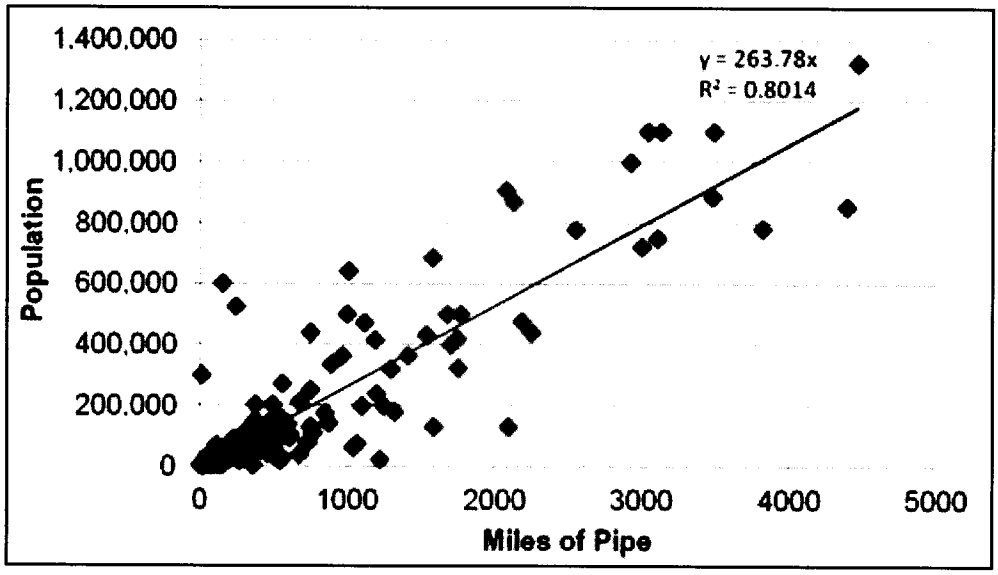
Figure 4. Total miles of pipe in each size group defined in Table 2 based on the basic survey respondents.



MILES OF PIPE VS. POPULATION

Figure 5 illustrates the relationship between the population served by the utilities participating in the basic survey and the number of miles of water main pipe. The trend line and equation are a best fit to the data. The slope of this line indicates that there are on average 264 people served for each mile of water main installed.

Figure 5. Population served relative to total pipe line miles from the basic survey.



SURVEY SAMPLE SIZE: 10% OF INSTALLED WATER MAIN PIPE IN THE US

The total length of water main pipe reported by the 188 basic survey participants was 117,603 miles (the survey did not include sewer or force mains). The average utility surveyed had 626 miles of water main with the largest having 4,468 miles and the smallest having 2 miles. Based on an EPA report (EPA, 2007), there are approximately 880,000 miles of distribution pipe in the USA. Another EPA report (EPA, 2008) estimates the amount of installed water main pipe in the USA at over 1,000,000 miles. The current population of the USA is 312 million (US Census, 2011). Using the estimate from the previous section of 264 people served per mile of water main, one can estimate the length of water mains as (312 million people)/(264 people/mile) = 1.18 million miles of water main pipe. Using this last estimate, the total length of pipe in the survey would represent approximately 10% of the installed water main pipe in the USA. Thus, the survey sample size is significant in size and therefore provides reliable results. Note that the Canadian provinces provided 8,423 miles of pipe to this survey or 7.4% of the total.

PIPE MATERIALS

Table 3 lists the pipe materials and their abbreviation used in this report. Many pipe products have evolved over the years of use, and most pipe products could be broken down into subcategories based on pipe manufacturing and surface treatments. These changes along with new installation techniques should affect life expectancy of the pipe. Both the basic and detailed surveys were intended to be relatively simple to complete and, thus, encourage wide scale participation of the water utilities. Most utilities have limited records as to which specific pipe materials were installed decades ago and what corrosion protection measures were used. Therefore, tracking subcategories of material types was not completed as part of this study. The results reported represent generic pipe material behavior but may not represent a specific product material on the market today.

Table 3. Material abbreviations.

ABBREVIATION	DESCRIPTION
CI	Cast Iron
DI	Ductile Iron
PVC	Polyvinyl Chloride
CPP	Concrete Pressure Pipe
Steel	Steel
AC	Asbestos Cement

Figure 6 illustrates the length of pipe reported in the basic survey broken down by pipe material. The "Other" category in Figure 6 includes materials such as HDPE, galvanized steel, and copper. Figure 7 illustrates the length of pipe reported in the detailed survey broken down by pipe material. Figure 8 illustrates the pipe material distribution as a percentage of the total length from both the basic and detailed surveys. The distribution of miles of pipe is quite similar in Figure 8 indicating that the detailed survey with a smaller number of respondents still gives similar results.

Figure 6. Length of pipe broken down by material type from the basic survey.

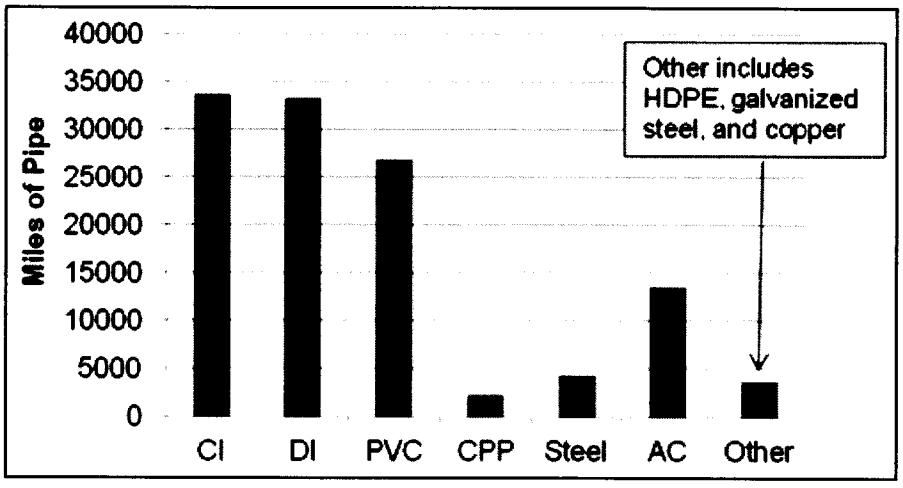


Figure 7. Length of pipe broken down by material type from the detailed survey.

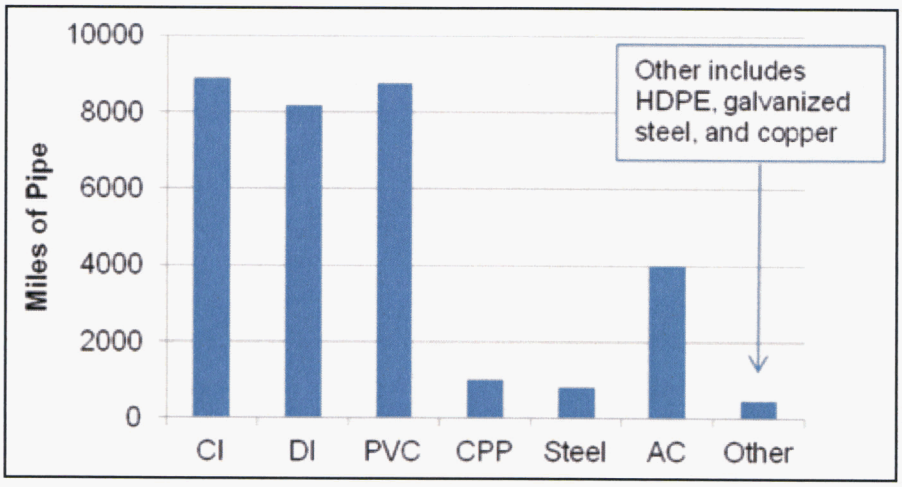


Figure 8. Percentage of total length of pipe by material type from both the basic and detailed surveys.

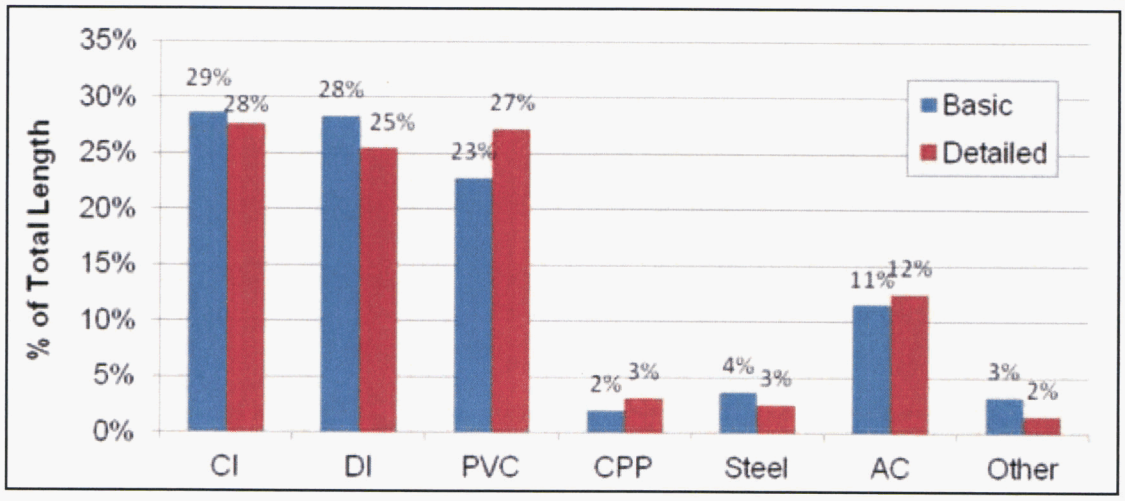
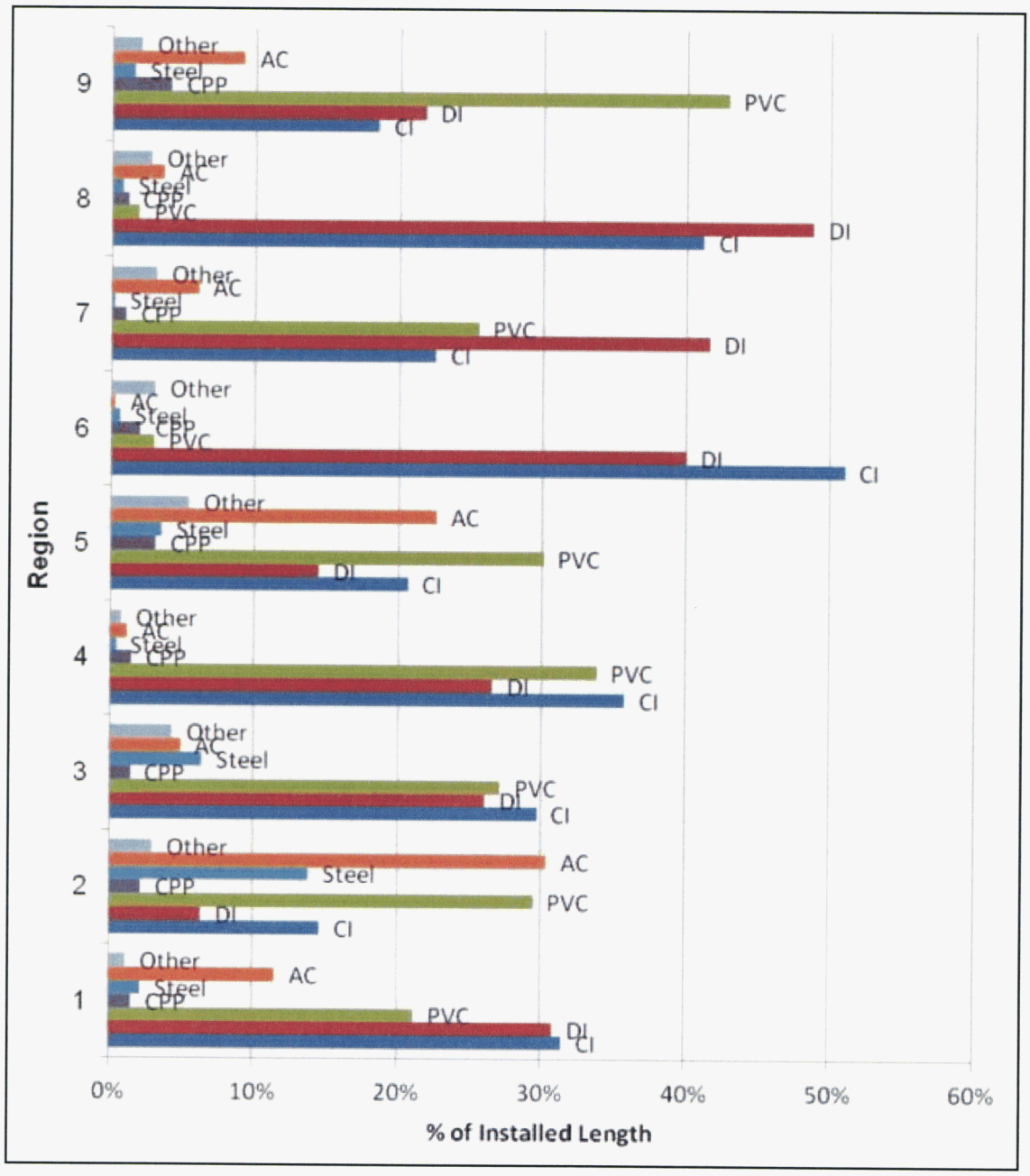


Figure 9 illustrates the regional distribution of pipe material usage as a percentage of the total length in that region. It is interesting to note the significant differences in regional pipe material utilization. Cast and Ductile Iron represent approximately 90% of the pipe in regions 6 and 8. PVC has a dominant role in region 9 and is well established in regions 2, 3, 4, 5, and 7.

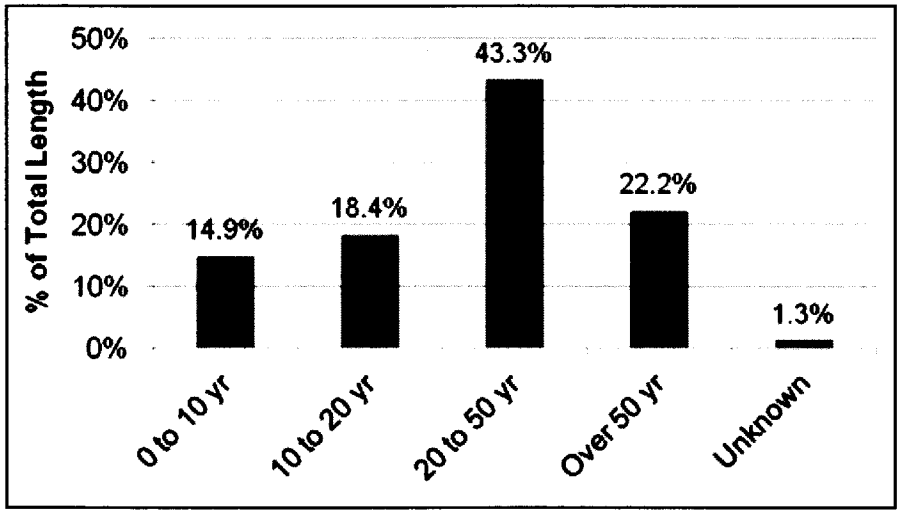
Figure 9. Regional percentage of length of pipe by material type from the basic survey.



PIPE AGE AND DIAMETER

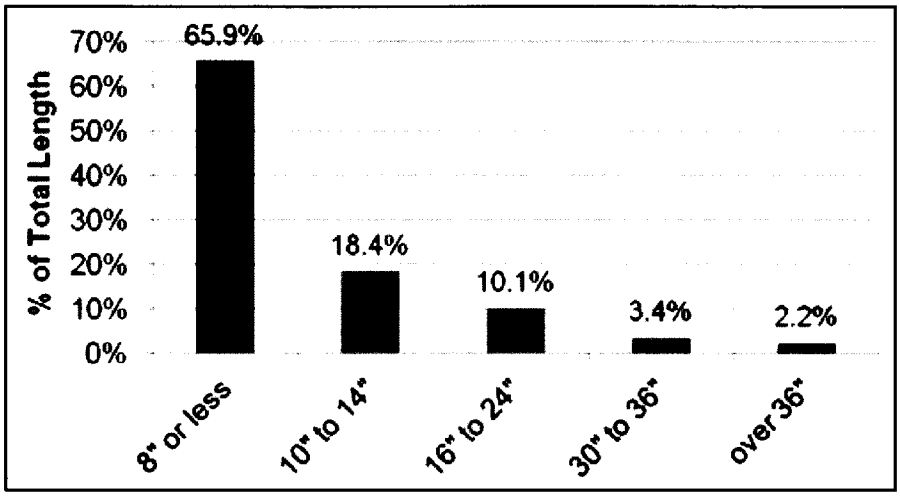
The detailed survey asked respondents to provide the distribution of installed pipe by age. Four age groups were provided; zero to 10 years, 10 to 20 years, 20 to 50 years, and over 50 years. Figure 10 lists the percentage of water main length that fits in each age category. Figure 10 indicates that approximately 43% of installed pipe are in the 20 to 50 year age category and 22% are over 50 years of age. This finding is consistent with other industry sources.

Figure 10. Percent of length of pipe by age from the detailed survey.



The respondents were also asked to break down the fraction of total installed pipe length by five pipe diameter categories. Figure 11 illustrates the percentage of water main that fit into each size range. Figure 11 indicates that approximately 66% of the installed pipe is 8 inches or less in diameter.

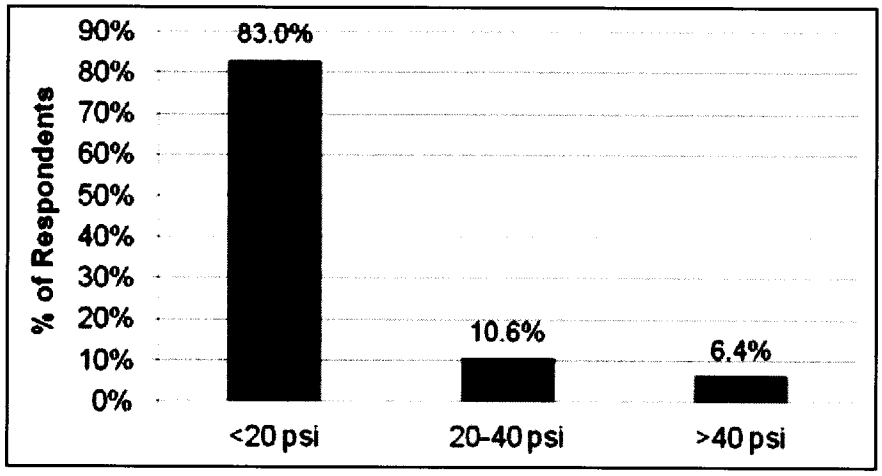
Figure 11. Percent of length of pipe by pipe diameter from the detailed survey.



DELIVERY PRESSURE

Based on the detailed survey, the average delivery pressure is 77 psi. The range of values reported for average delivery pressure was 45 to 150 psi. The detailed survey also asked how much does the water pressure fluctuate at any given point in their system during a typical day. The respondents were asked to select one of three ranges. Figure 12 illustrates the percentage of respondents that fit into each pressure range. About 83% are able to limit pressure fluctuations to be less than 20 psi.

Figure 12. Percentage of respondents with one of three pressure fluctuation ranges.



MOST COMMON FAILURE MODE, MATERIAL, AND AGE

The detailed survey asked the respondents to identify the most common failure mode by selecting from one of the following; corrosion, circumferential crack, longitudinal crack, leakage at joints, fatigue, or other. Figure 13 identifies a circumferential crack as the most common failure mode followed by corrosion. The detailed survey also asked respondents to identify the pipe material that was failing most often. Figure 14 shows that 55.3% of respondents identified Cast Iron as the most common failing pipe material followed by Asbestos Cement at 17.0%. The respondents also reported the typical age of a failing water main. The average result was 47 years with a range of values from 20 to 86 years. The survey also asked what the expected life should be when installing new pipe. The average expected life of new pipe was 79 years with a range of responses from 30 to 200 years.

Figure 13. Percent of respondents selecting a most common failure.

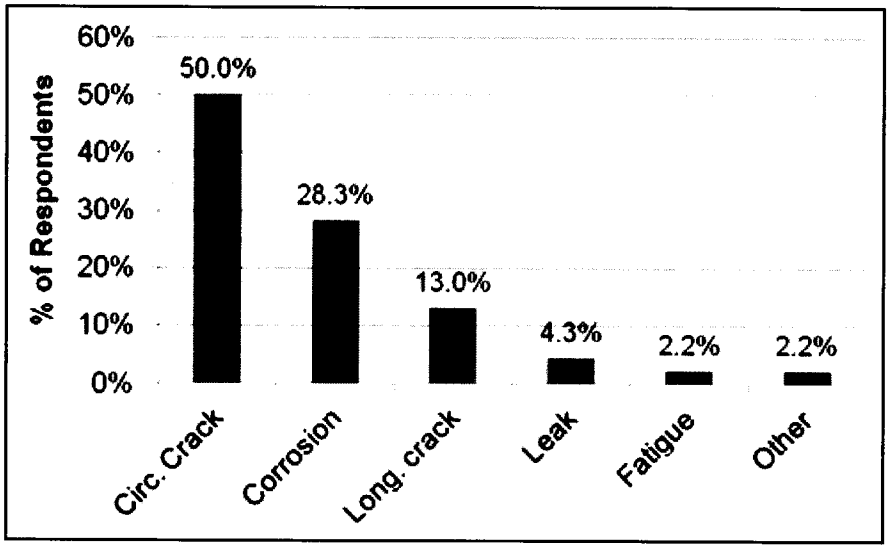
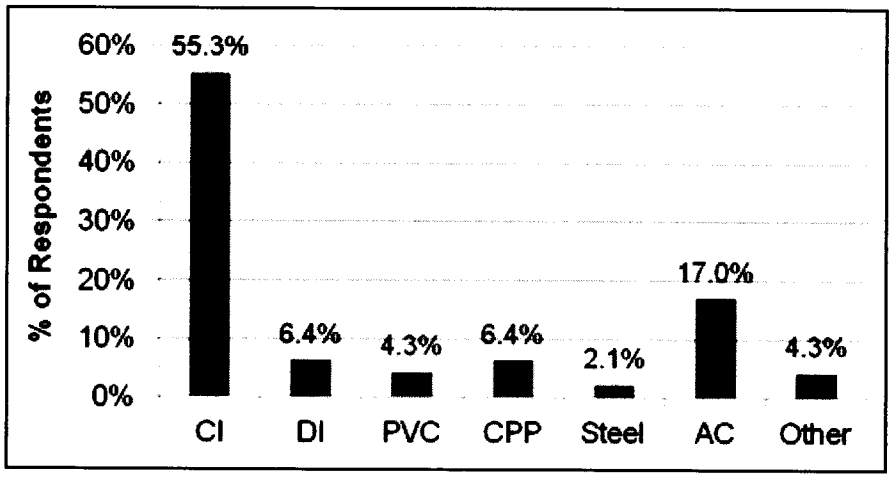


Figure 14. Percent of respondents selecting a most common failure material.



COMPUTING WATER MAIN FAILURE RATES

Both the basic and detailed surveys asked respondents to consider a water main failure as one where leakage was detected and repairs were made. However, they were requested to not report failures due to joint leakage, construction damage, or tapping of service lines. The goal was to examine how installed pipe performs.

Utilities reported the number of failures over a recent 12 month period for each pipe material and the installed length of each pipe material. The failure rate was computed by dividing the total number of failures from all utilities for a particular pipe material by the total length of that pipe material.

For example, the survey reported a total of 12,963 failures of water mains during a recent 12 month period for all pipe materials. The total installed water main length from the survey was 117, 603 miles (or 1176.03 hundreds of miles). Thus the overall failure rate is 12,963/1176.03 = 11.0 failures/(100 miles)/year.

This simple method for computing failure rates was used because it discourages biases toward large or small utilities. It is noted that utilities experience widely different failure rates for the same pipe material. Several significant variables affect the results including pipe age, soil types (corrosive or noncorrosive), different corrosion prevention techniques, different installation practices, and climate.

FAILURE RATES FOR EACH PIPE MATERIAL

The survey measured pipe failures over a recent 12 month period, broken down by material type. Table 4 lists the total length of pipe by material type, the number of failures over a recent 12 month period, and the failure rate for each pipe material. Figure 15 illustrates the failure rates as a function of material type. If one assumes a utility had equal lengths of each material installed, then Figure 16 would illustrate the percentage of failures as a function of pipe material. Figure 17 gives the failure rates broken down by material type and by respondents from the USA and Canada.

Table 4. Summary of failure data from the basic survey over a 12 month period.

PIPE MATERIAL	LENGTH MILES	NUMBER OF FAILURES	FAILURE RATE #/(100mi)/(year)
CI	33611.0	8204	24.4
DI	33238.7	1620	4.9
PVC	26840.3	689	2.6
CPP	2355.3	128	5.4
Steel	4300.1	581	13.5
AC	13502.8	954	7.1
Other	3755.3	787	21.0
TOTAL	**117603.4**	**12963**	**11.0**

Figure 15. Failure rates of each pipe material from the basic survey.

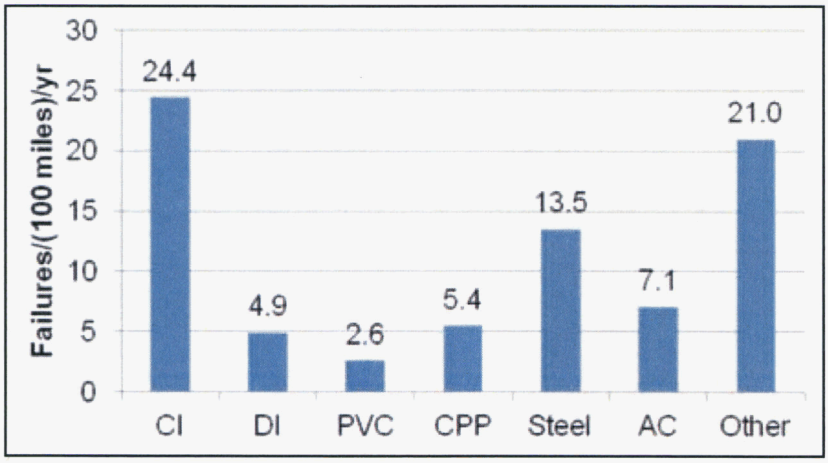


Figure 16. Percentage of failures attributed to each pipe material assuming equal lengths of material were installed.

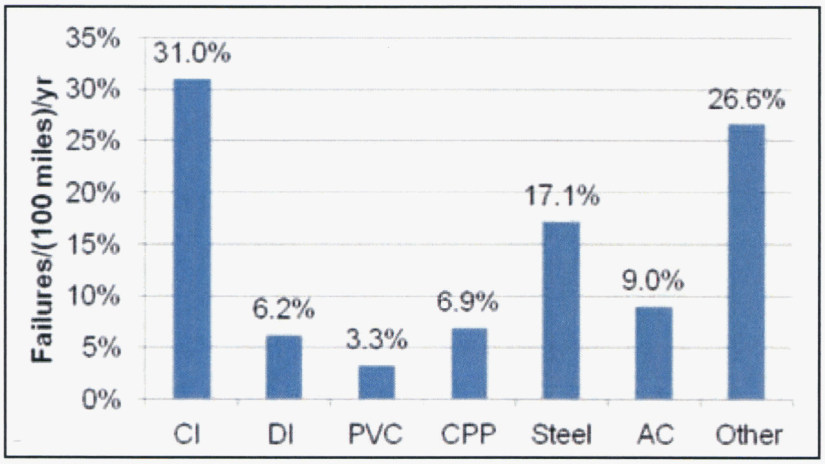
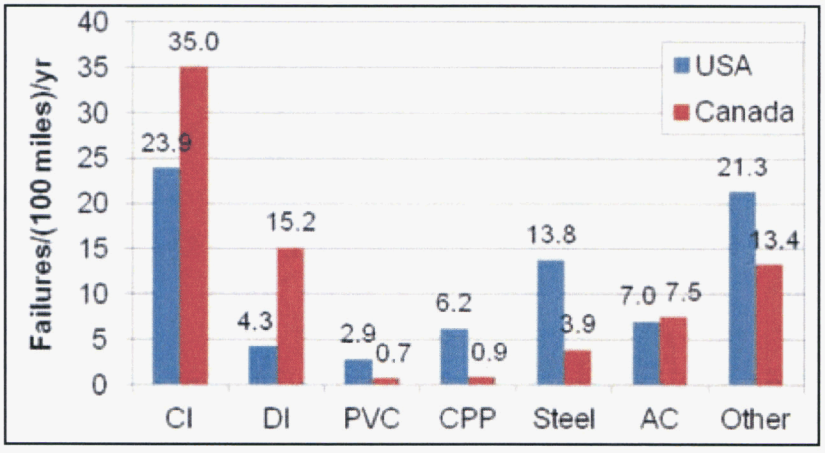


Figure 17. Comparison of failure rates from USA and Canada.



FAILURE RATES OVER FIVE YEARS

The detailed survey requested the respondents to list the number of failures per year for five years, broken down by material type. The desired focus was to examine the year to year variations by pipe material. A single utility might have large year to year variations, but if the number of utilities sampled is sufficient, the year to year variation should be small. Figure 18 shows the failure rates from the detailed survey from each of the five years covered by the survey. Respondents that did not have five years of data were not included in these results.

Figure 18. Pipe failure rates over a five year period as a function of pipe material.

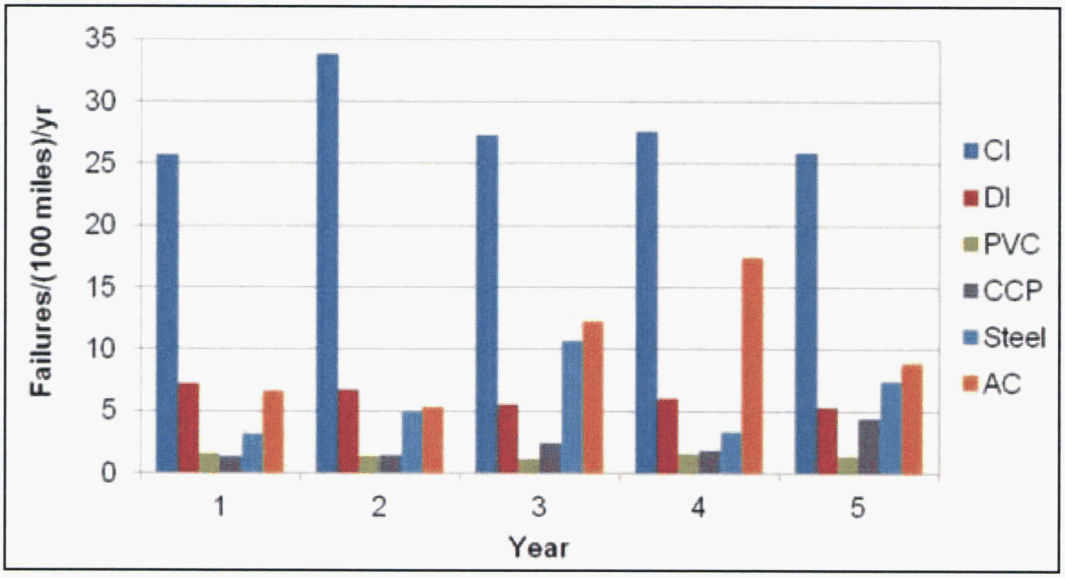


Table 5 lists the average of the failure rates over the five year period along with the standard deviation and the coefficients of variation (the standard deviation divided by the average). The coefficients of variations for CI, DI, and PVC are similar indicating they have approximately the same variability. The widest variation in rates was associated with CPP, steel and AC pipe. The length of pipe in the detailed survey for these materials was small and more respondents could likely reduce the variability.

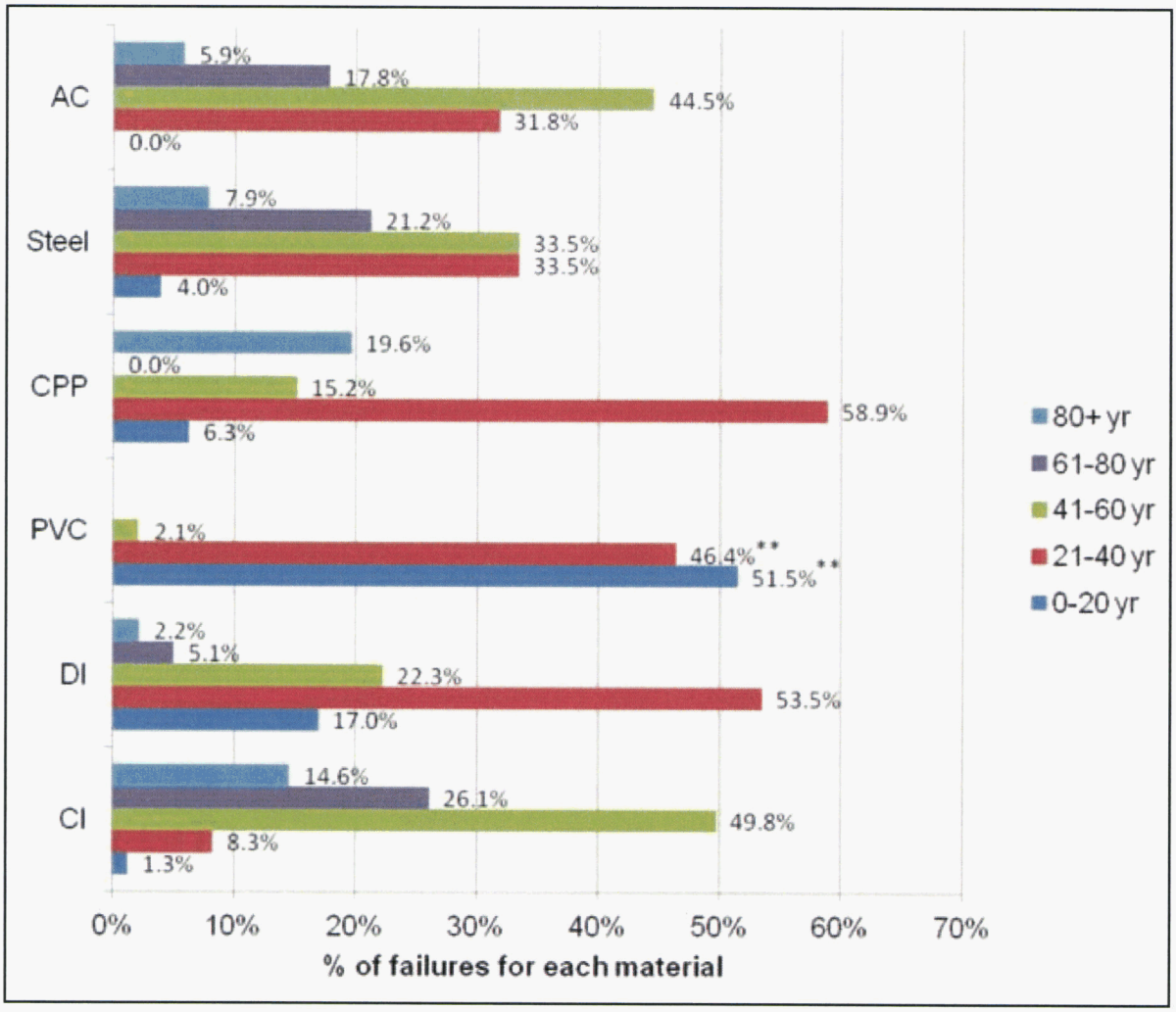
Table 5. Statistical summary of the five year failure rate data.

	CI	DI	PVC	CPP	Steel	AC
Average (failures/(100 mi)/yr)	28.03	6.15	1.38	2.25	5.90	10.10
Standard Deviation	3.34	0.79	0.16	1.27	3.18	4.88
Coefficient of Variation	0.12	0.13	0.12	0.56	0.54	0.48

EFFECTS OF AGE

Clearly, pipe age will affect failure rates. The basic survey asked respondents to break down the failures into five different pipe age categories. It is noted that some of the respondents did not know the age of the failed pipes, and they were not included in the results below. For each material type, the fraction of failures in each age group is examined in Figure 19 based on the basic survey results. For example, 49.8% of the reported cast iron failures occurred with a pipe age between 41 and 60 years. Note that the largest percentage of failures is not in the oldest pipes, which has several possible causes. First, the older pipe is being replaced, and, thus, there is less available to fail.

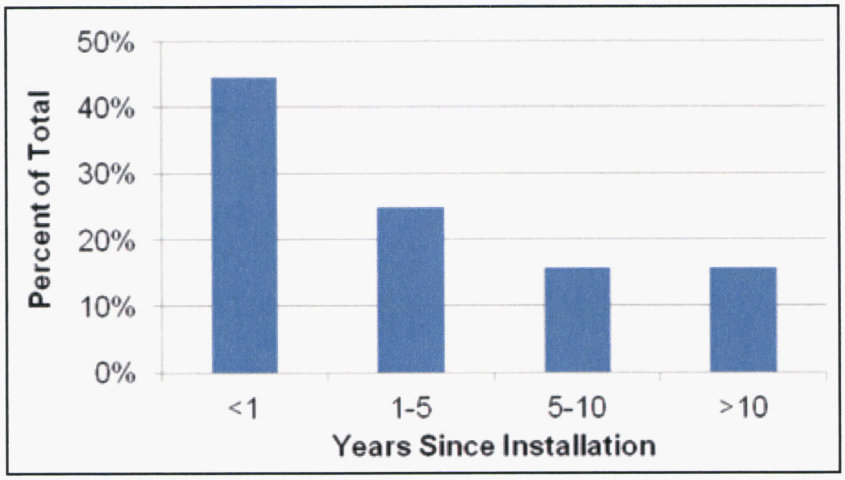
Figure 19. Percent of failures as a function of age and pipe material.



The results in Figure 19 are related to when a pipe material was introduced or removed from the market. Asbestos Cement pipe has not been installed in the USA and Canada in the past 20 years, and, thus, all AC pipe failures exceed 20 years of age. Widespread DI and PVC pipe production in the USA did not start until about 1970, so we should expect to see a small failure percentage for both DI and PVC in the 41 to 60 year age group and none for the 61 to 80 and 80+ age groups. PVC follows that trend in Figure 19. Figure 19 shows the majority of DI pipe failures occur at an age between 21 and 40 years. The DI results in Figure 19 for the 61 to 80 and the 80+ age groups are possibly caused by incorrect records on the age of those failed pipes.

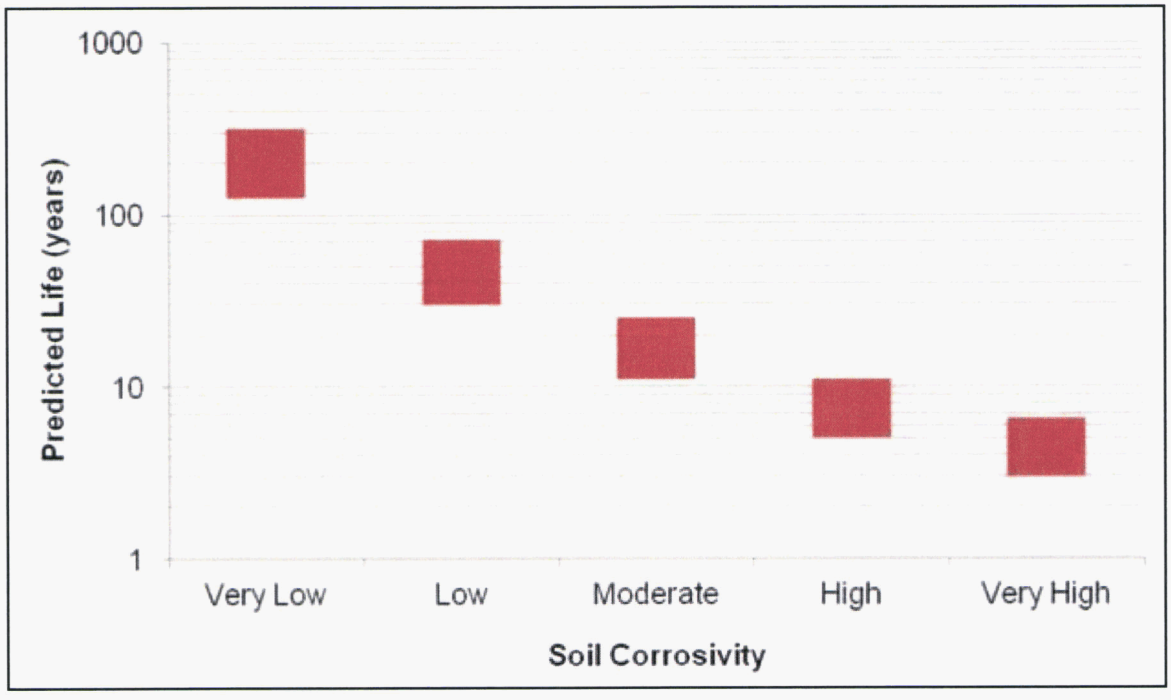
It is of interest that Figure 19 shows a greater percentage of PVC pipes fail in the first 20 years of use than in the next 20 years**. This was investigated in a previous survey funded by AWWARF (Moser, 1994). Figure 20 illustrates the percent of failures as a function of time for AWWA rated PVC pipe. As shown below, over 40% of the reported failures occurred in the first year. Often the cause of these failures in PVC pipe is related to improper installation practices and not a defect in the pipe. The city of Calgary has been able to achieve remarkably small PVC failure rates due to enforced construction standards (Brander, 2004). In addition, Calgary requires new subdivision infrastructure to remain the property of the private developer for a period of two years. During this two year period, most construction related problems will occur. An AWWARF study (Burn, 2006) estimates the design life of PVC to be in excess of 110 years.

Figure 20. PVC failures as a function of time (adapted from Moser, 1994).



The expected life in years of an unprotected DI pipe was estimated in a recent Water Research Foundation study (Rajani, 2011). Figure 21 illustrates the published results as a function of a relative scale of soil corrosivity. Figure 19 indicates that the majority of DI pipe failures occur at an age between 21 and 40 years. A 21 to 40 year life in Figure 21 would correspond to a low to moderate soil corrosivity for an unprotected pipe. This would indicate that corrosion is a significant problem in all regions of this study. When a comparison is made between Cast Iron and Ductile Iron, thinner-walled Ductile Iron is experiencing failures more rapidly (21-40 year period) than the thicker- walled cast iron (41-60 year period). Concrete Pressure Pipe also shows failures rates that are impacted by corrosion in the 21-40 year period. The study also notes that "aging or deterioration of ductile iron pipes can vary significantly from one geographical region to another within a city, let alone from city to city."

Figure 21. Predicted life of unprotected class 350 DI pipe (from Rajani, 2011).



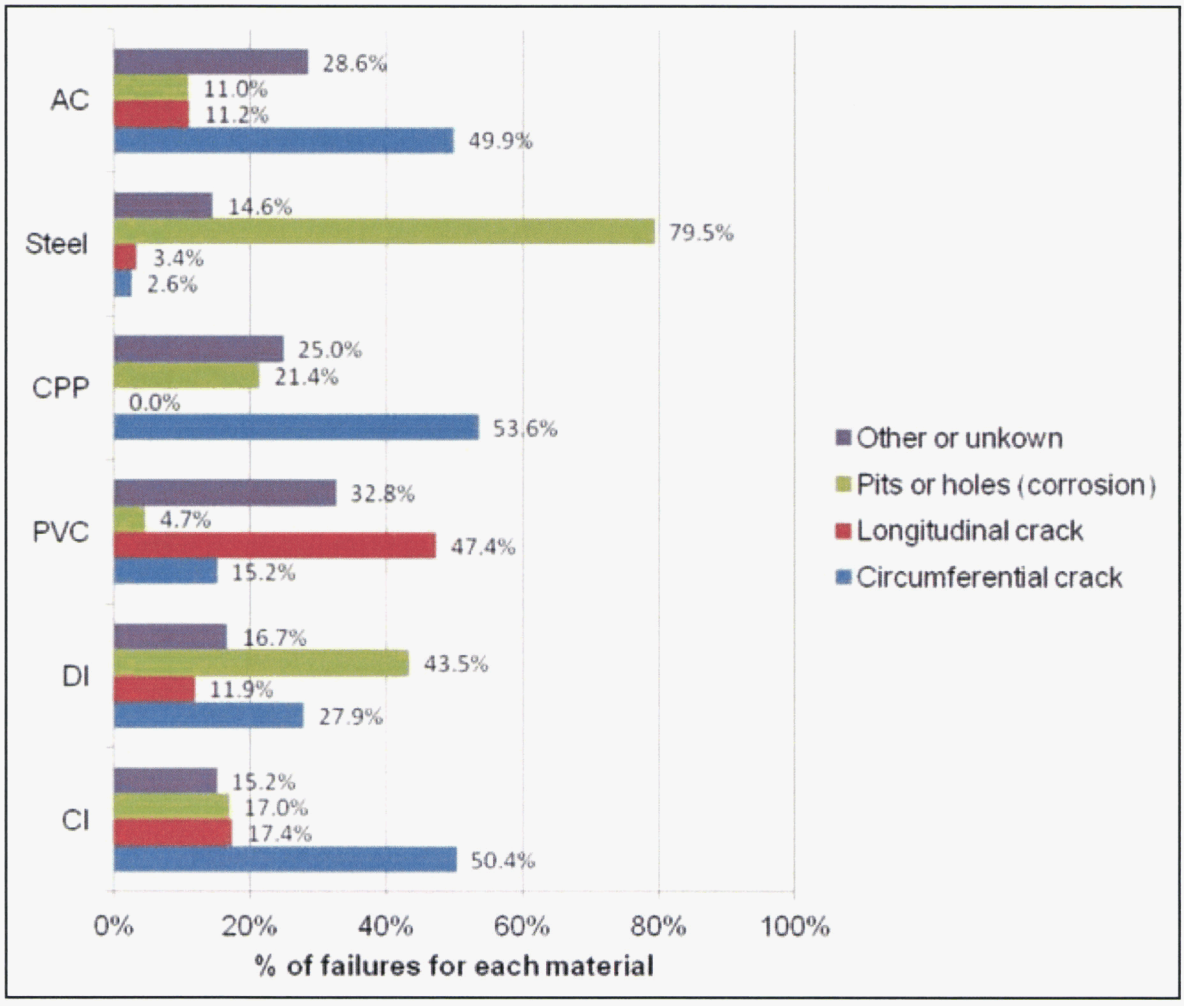
DESCRIPTION OF FAILURES

Respondents to the basic survey were asked to describe the type of failures observed by picking from the following list:

- Circumferential crack or fracture
- Longitudinal crack or split
- Pits or holes (corrosion)
- Other or Unknown

Figure 22 summarizes the percentage of failures that were reported to fit in each description. A circumferential crack is the primary failure mode for Cast Iron, Concrete and Asbestos Cement pipe. Corrosion is the primary failure mode of Ductile Iron and Steel pipe. A longitudinal crack is the primary failure mode of PVC.

Figure 22. Description of failure for each pipe material.

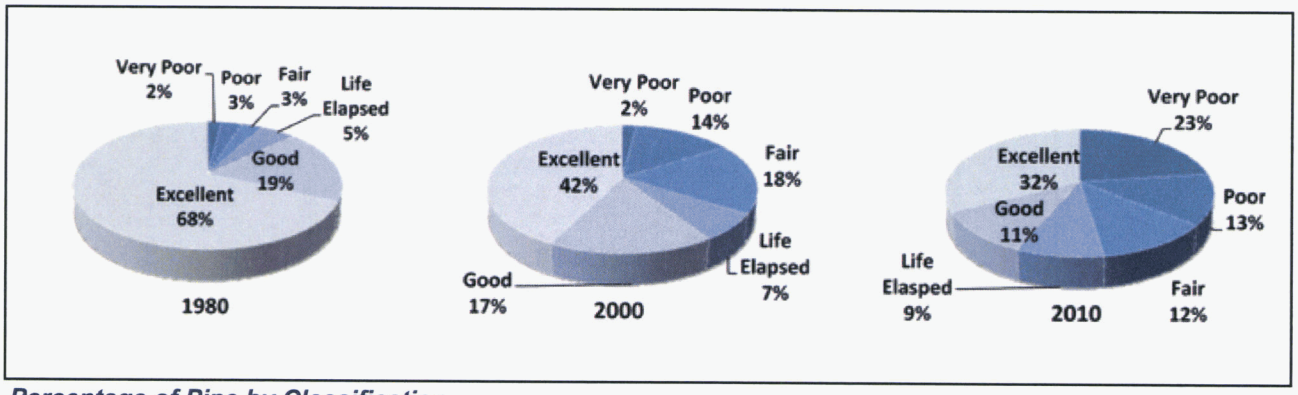


PLANS FOR REPLACING WATER MAINS

The detailed survey asked if the respondents had a plan for regular replacement of water mains that are nearing their end of useful life. Over 77% reported they do have a replacement plan. The survey also asked what percentage of water mains are beyond their useful life but have yet to be repaired/replaced due to a lack of funds. The survey results showed a range of answers from zero to 75% of their pipe was beyond its useful life and the average of all respondents was that 8.4% of the pipe is beyond its useful life.

It is of interest to compare these results with a study done by the EPA (EPA, 2002). This study classified water main pipe condition into six categories; Excellent, Good, Fair, Poor, Very Poor, and Life Elapsed. The study examined data for years 1980 and 2000 and forecasted data for 2020. Figure 23 below is reproduced from their report and shows that the above mentioned survey average response of 8.4% of pipe are beyond their useful life would correspond well with the "Life Elapsed" category in Figure 23. It is very important to note the projected growth in the "Very Poor" condition category in Figure 23. The rate of growth in that category will make it much more difficult for utilities to get that pipe replaced before it reaches the "Life Elapsed" category. An AWWA study (AWWA, 2012) echoes this trend as illustrated in Table 6. Table 6 shows aggregate costs to cover both replacement and growth in water mains in the USA.

Figure 23. Assessment of pipe condition with time (from EPA, 2002).



Percentage of Pipe by Classification

Table 6. Aggregate needs for investment in water mains through 2035 and 2050 by region of the United States (from AWWA, 2012).

2011–2035 TOTALS			
(2010 $M)	REPLACEMENT	GROWTH	TOTAL
Northeast	$92,218	$16,525	$108,744
Midwest	$146,997	$25,222	$172,219
South	$204,357	$302,782	$507,139
West	$82,866	$153,756	$236,622
TOTAL	**$526,438**	**$498,285**	**$1,024,724**

2011–2050 TOTALS			
(2010 $M)	REPLACEMENT	GROWTH	TOTAL
Northeast	$155,101	$23,200	$178,301
Midwest	$242,487	$36,755	$279,242
South	$394,219	$492,493	$886,712
West	$159,476	$249,794	$409,270
TOTAL	**$951,283**	**$802,242**	**$1,753,525**

CONTRACTOR EXPERIENCE

Proper installation is very important to getting the maximum life out of a water main. The detailed survey asked if their utility utilized contractor experience used as a weighting factor when selecting a contractor. There are 66% of the respondents that do consider contractor experience. Many of those who do not consider contractor experience reported that state or local laws prevented them from doing so.

ALLOWED PIPE MATERIALS

The detailed survey also asked what water main pipe materials are currently excluded from being installed at their utility. Figure 24 illustrates the percentage of respondents that allow a particular pipe material to be installed. The reasons used for excluding a pipe material were also requested in the survey. Table 7 summarizes the most common comments made for exclusion of a pipe material.

Figure 24. Percent of respondents that will allow installation of these water main pipe materials.

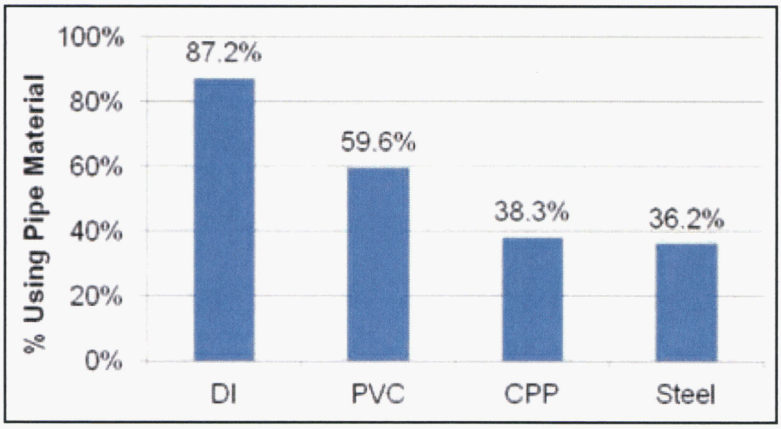


Table 7. Typical comments for exclusion.

MATERIAL	COMMENTS
DI	Corrosion
PVC	Strength, tapping difficulties, bedding concerns
CPP	Difficult to install, tapping difficulties, difficult to repair
Steel	Corrosion

LEAK DETECTION METHODS

The detailed survey asked if regular leak detection methods were utilized at their utility and 57% of the respondents indicated that they did. The methods of leak detection that were used included acoustic leak detectors, visual inspection of lines, digital correlation sensors, and eddy current detectors.

CORROSIVE SOILS AND CORROSION PREVENTION TREATMENTS

The detailed survey asked respondents if they have one or more regions in their service area with soils that tend to be corrosive. A total of 75% of the respondents reported that they do have at least one area with corrosive soils. The survey also asked what kind of corrosion treatments they are utilizing for DI, CPP, and Steel pipes. The typical results are summarized in Table 8.

Table 8. Typical corrosion prevention treatments.

MATERIAL	TREATMENT
DI	Polywrap and installation of magnesium anodes
CPP	Bedding improvements, type 50 concrete, coatings, and anodes
Steel	Impressed current, anodes, and protective coatings

EFFECT OF AMBIENT TEMPERATURE ON FAILURES

The detailed survey asked if the utility observed an increase in water main failures with extreme ambient temperatures, either warm or cold. The results of the survey indicated that 72% of the respondents did note an increase in pipe failures with extreme cold ambient temperatures and only 13% reported a correlation with warm temperatures. Clearly this result would be dependent on the climate at each utility. The average depth of burial was also reported. An effort was made to see if there is a correlation between temperatures extremes and burial depths. For each utility the temperature extremes were derived from average monthly temperatures. The highest average monthly temperature in the summer and the lowest average monthly temperature during the winter were recorded for each utility location.

Figure 25 plots the lowest average minimum monthly temperature during the year for each respondent versus their reported average burial depth. The utilities with the blue symbols indicated they are not sensitive to cold ambient temperatures and the red colored symbols are sensitive. It was thought that with sufficient burial depth, the low temperature sensitivity might be reduced, but the data in Figure 25 does not support that conjecture.

Figure 25. Correlation of the lowest average minimum monthly temperature during the year and burial depth. Red symbols note locations where failures increase with low ambient temperatures.

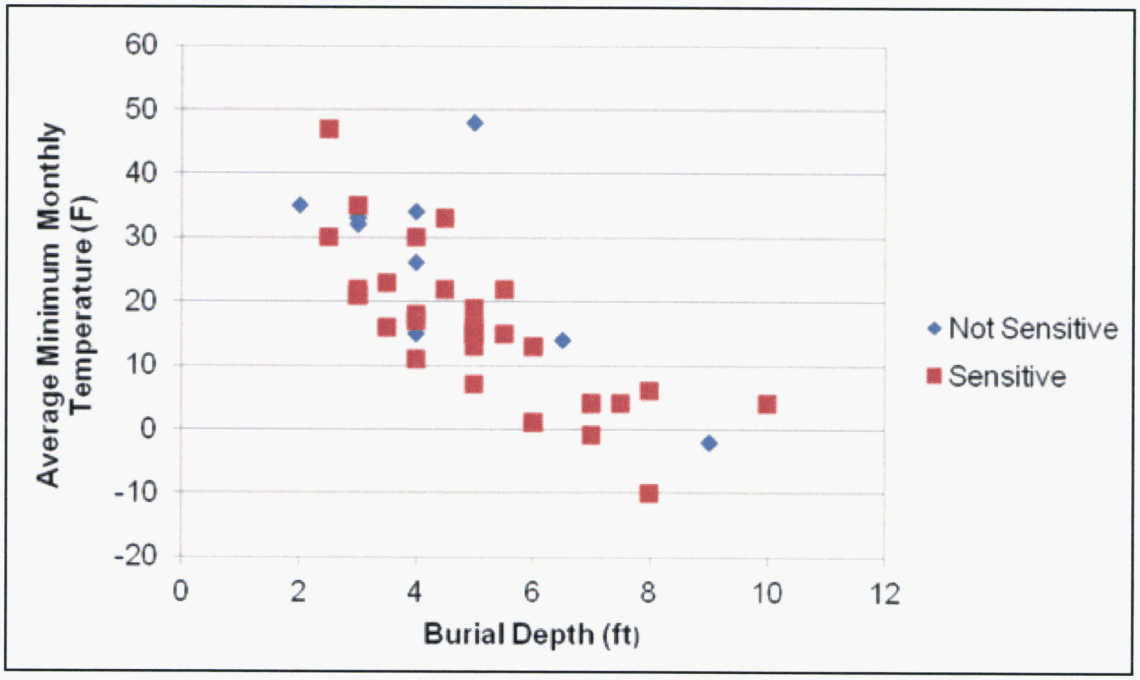
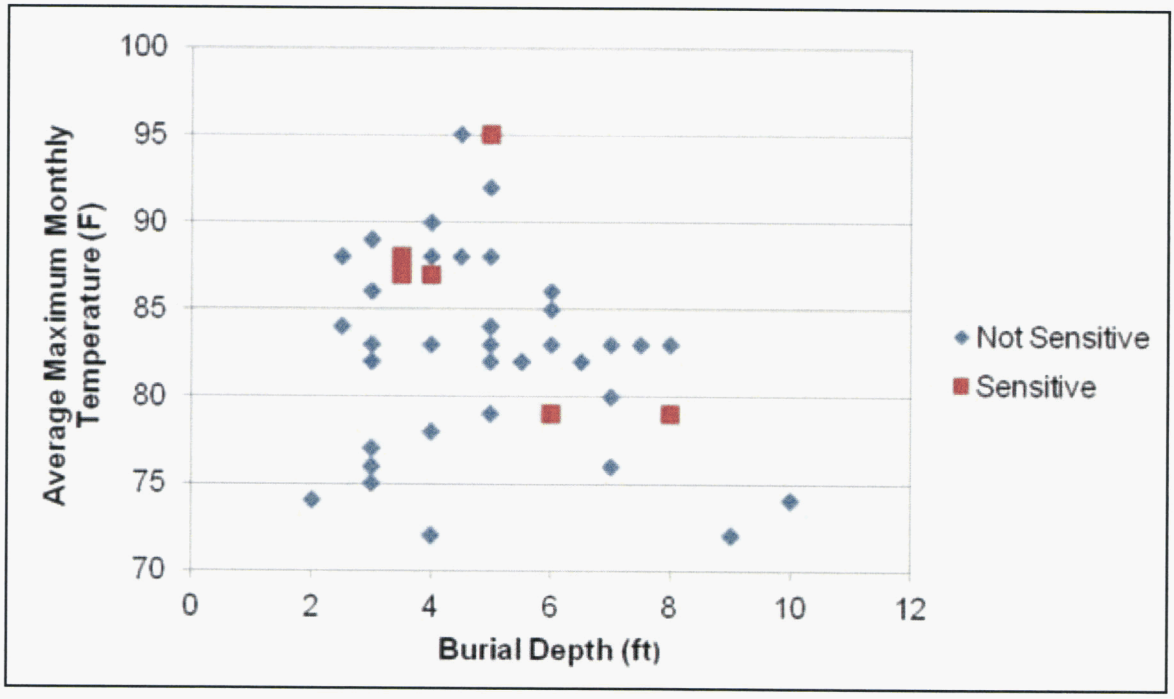


Figure 26 plots the highest average maximum monthly temperature during the year for each respondent versus their reported average burial depth. Again, the color of the symbol indicates whether that utility reported to be sensitive to high ambient temperatures. Again, no correlation was observed.

It is noted that one respondent reported that failures increase when large and rapid ambient temperature changes occurred, but not necessarily reaching extreme temperatures.

Figure 26. Correlation of the highest average maximum monthly temperature during the year and burial depth. Red symbols note locations where failures increase with high ambient temperatures.



TRENCHLESS TECHNOLOGY USE

The detailed survey asked respondents about experiences with three techniques of repairing, replacing, and installing water main pipes. They were relining deteriorated pipes, replacing pipes with a pipe bursting technique, and installation of new pipes using directional drilling. Table 9 summarizes their responses. The rating scale in Table 9 is from 1 to 5 with 1 being "Not Satisfied" to 5 being "Very Satisfied". Not many respondents have utilized pipe bursting, but an increasing number are looking at using both pipe relining and pipe bursting techniques. A majority of respondents have utilized directional drilling and are very happy with the results.

Table 9. Summary of responses for relining, bursting, and directional drilling.

	PIPE RELINING	PIPE BURSTING	DIRECTIONAL DRILLING
% of respondents that have used this technique	32%	17%	62%
Average Rating 1 to 5	3.9	3.8	4.4
% of respondents that will use this technique in the future	43%	40%	74%
Comments	High cost, several will consider use in future	High cost, useful in some situations	Worked well particularly for river and street crossings, Happy with most contractors

CONCLUSION

This Comprehensive Water Main Break Study surveyed a statistically significant amount of utilities that have collected data on their underground infrastructure. This survey was focused on material usage in water mains across the USA and Canada. This effort was successful in getting 188 participants to respond to a basic survey and 47 of those to respond to a more detailed survey. Significant results from this study include:

- A correlation of people served per mile
- Current pipe material usage with a regional breakdown
- Pipe age and size distribution
- Average operation and fluctuation pressures
- Most common pipe failure mode and materials
- Pipe failure rates for six mostly commonly used pipe materials
- The distribution of pipe failures with pipe age for each material
- The distribution of pipe failure modes for each material
- Percentage of utilities that allow installation of certain pipe materials
- Percentage of utilities with corrosive soils and prevention techniques
- Effects of ambient temperature swings on failures
- Attitudes about use of pipe relining, pipe bursting, and directional drilling.

It is hoped that these results would be helpful to utility managers in comparing their experiences with these survey results and thereby make better decisions regarding possible changes in their management practices. Through understanding more about the issues surrounding the performance of our underground water infrastructure, utilities will be able to successfully make cost-effective pipe replacement decisions.

ACKNOWLEDGEMENTS

This work was completed with support from Uni-Bell PVC Pipe Association and the Water Finance Research Foundation.

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UtahStateUniversity
4130 Old Main Hill
Logan, UT 84322 4130

APPENDIX 5 – WATER AND SEWER CIP COORDINATION MAPS

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP Overview Both 6A.mxd

Proposed Water and Sewer Projects for Year 1

APPENDIX 5.1

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase 2

File Path: M:\Client\Liberty Water\9249A.00 AMP\GIS\MXD\CIP Overview Both 6B.mxd

Proposed Water and Sewer Projects for Year 2

APPENDIX 5.2

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase 2

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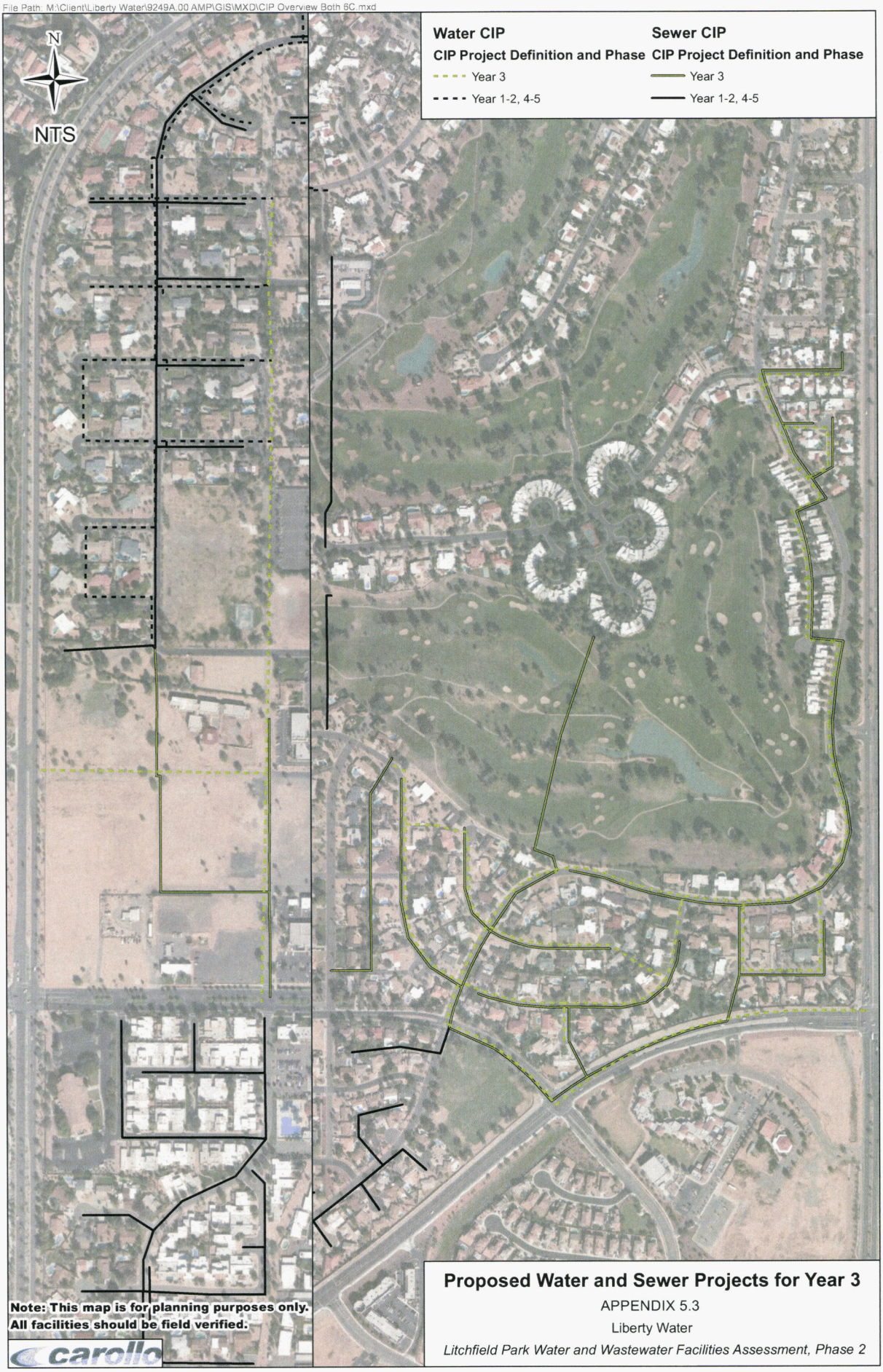

Proposed Water and Sewer Projects for Year 3

APPENDIX 5.3

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase 2

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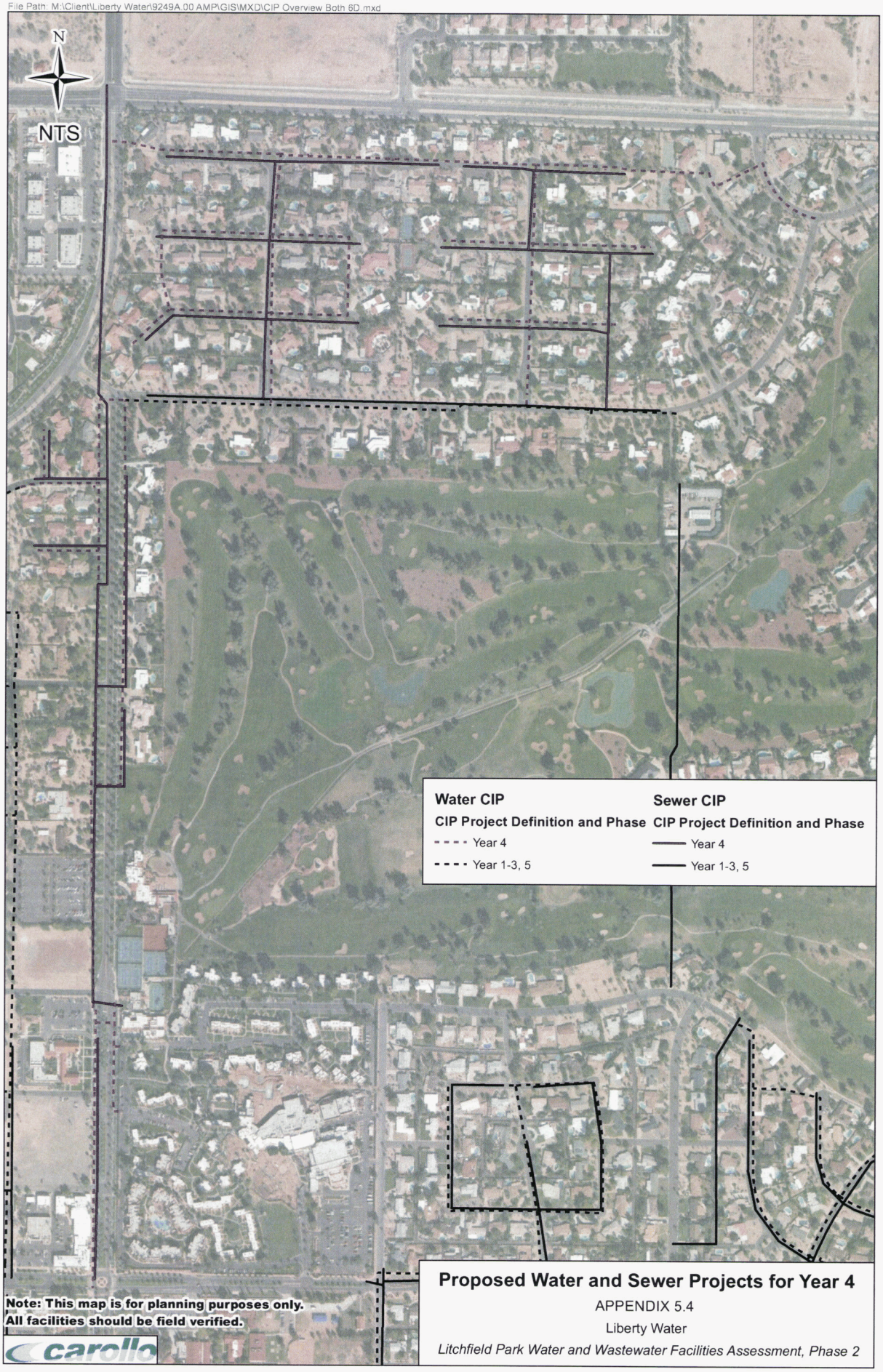

Proposed Water and Sewer Projects for Year 4

APPENDIX 5.4

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase 2

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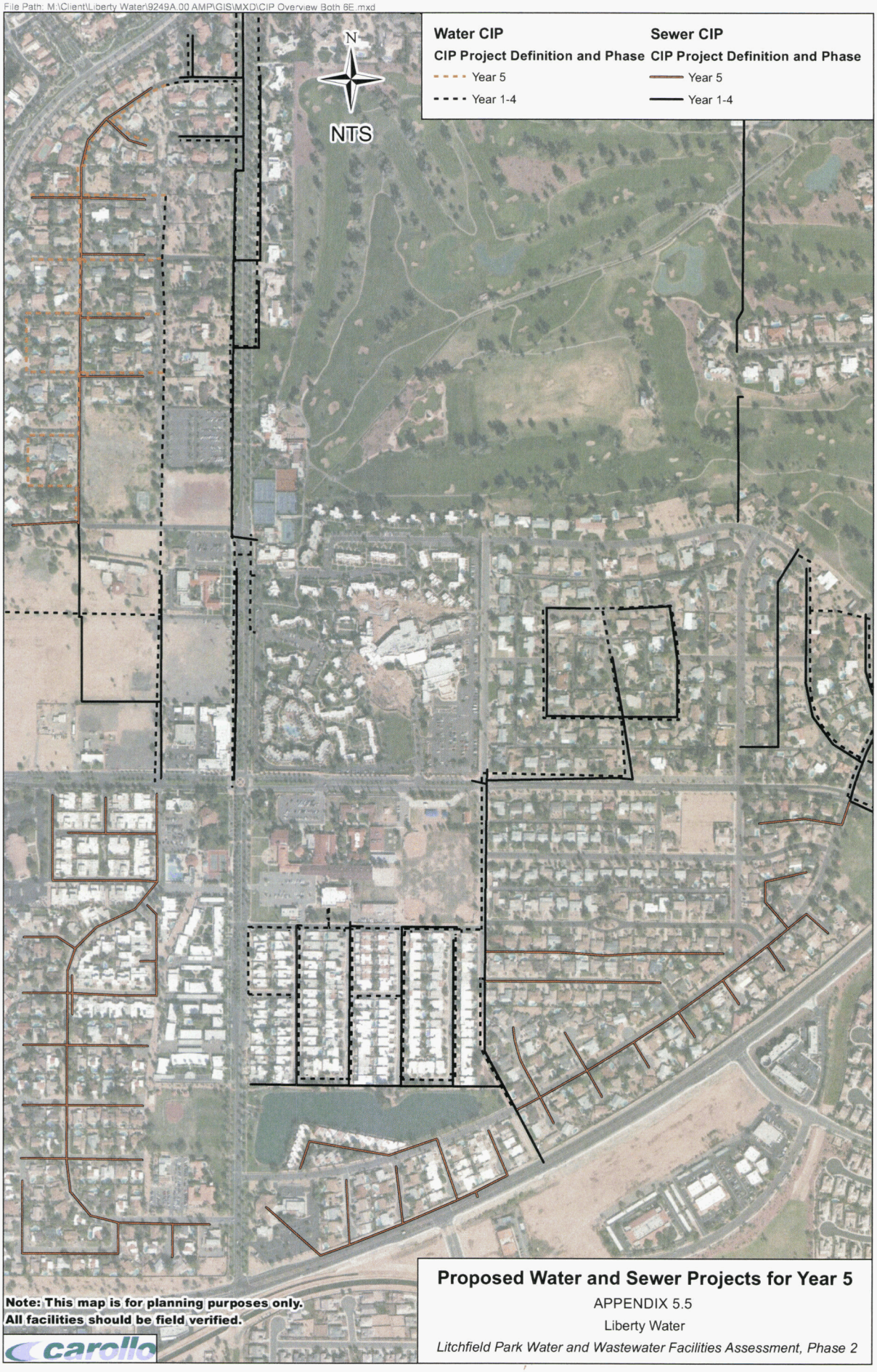


Proposed Water and Sewer Projects for Year 5

APPENDIX 5.5

Liberty Water

Litchfield Park Water and Wastewater Facilities Assessment, Phase 2

APPENDIX 6 – WATER FACILITIES RECORD DRAWINGS

WATER AND SANITARY SEWER PLANS

LITCHFIELD PARK SUBDIVISION NO. 12

FOR

LITCHFIELD PARK LAND

AND

DEVELOPMENT COMPANY

CONTRACT NO. LPL-WS-3002-66

WILLIAMS and ELLIS

CONSULTING ENGINEERS

PHOENIX——————————ARIZONA

GENERAL NOTES

1. SANITARY SEWER MANHOLES, CLEANOUTS AND WATER VALVE BOXES WHICH FALL IN PAVEMENT AREAS ARE TO BE BUILT ONLY TO THE TOP OF FUTURE PAVEMENT SUBGRADE. (SEE WILLIAMS AND ELLIS DRAWING NO. 9980 (5-P)) MANHOLES ARE TO BE PROTECTED BY ONE-HALF INCH MINIMUM THICK STEEL COVER PLATES WHICH THE SEWER AND WATER LINE CONTRACTOR SHALL OBTAIN FROM THE PAVING CONTRACTOR PRIOR TO CONSTRUCTION. FRAMES AND COVERS FOR MANHOLES, CLEANOUTS AND WATER VALVE BOXES ARE TO BE FURNISHED BY THE SEWER AND WATER LINE CONTRACTOR, BUT SHALL NOT BE DELIVERED TO THE SITE OF THE WORK UNTIL CALLED FOR BY THE PAVING CONTRACTOR.

2. THE SEWER LINE IS TO BE INSTALLED PRIOR TO THE WATER LINE AND WATER SERVICES TO PREVENT CONFLICT BETWEEN WATER AND SEWER LINE CONSTRUCTION.

3. IT IS EXPECTED THAT THE ARIZONA PUBLIC SERVICE COMPANY AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY WILL INSTALL THEIR UTILITY LINES AFTER THE WATER AND SEWER LINES ARE INSTALLED. HOWEVER, IT WILL BE THE WATER AND SEWER LINE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE ARIZONA PUBLIC SERVICE COMPANY AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY AND COORDINATE CONSTRUCTION OPERATIONS TO PREVENT DAMAGE TO THE VARIOUS UTILITIES.

4. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION, BOTH HORIZONTALLY AND VERTICALLY, OF ALL UTILITY CROSSINGS BY OPEN TRENCHING FAR ENOUGH IN ADVANCE OF PIPE LAYING TO PERMIT GRADE OR LINE CHANGE IF NECESSARY. ANY DAMAGE TO UTILITIES CAUSED BY THE CONTRACTOR'S OPERATIONS WILL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AND THE OWNING UTILITY AT THE EXPENSE OF THE CONTRACTOR.

5. WATER METERS AND WATER METER BOXES WILL BE INSTALLED BY LITCHFIELD PARK SERVICE COMPANY.

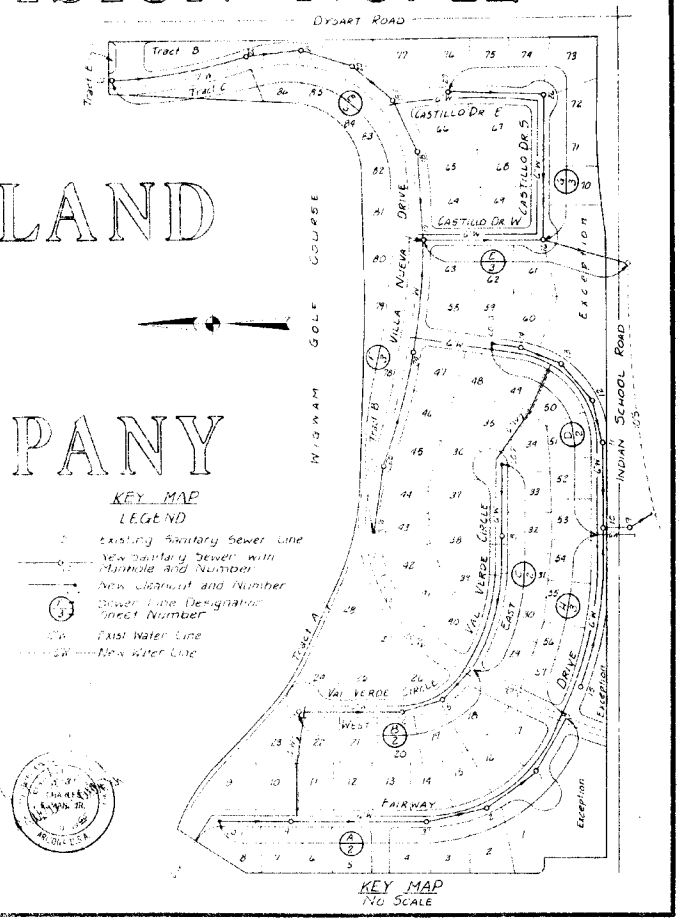
6. AT ALL WATER AND SEWER LINE CROSSINGS WHERE THE VERTICAL SEPARATION IS LESS THAN TWO FEET CLEAR, THE CONTRACTOR SHALL ENCASE THE SEWER LINE IN CONCRETE OF SIX INCH MINIMUM THICKNESS FOR A DISTANCE OF AT LEAST TEN FEET IN EACH DIRECTION FROM THE CROSSING, OR SHALL CONSTRUCT THE SEWER OF CAST IRON WITH LEADED OR MECHANICAL JOINTS FOR THE SAME DISTANCE SPECIFIED HEREIN.

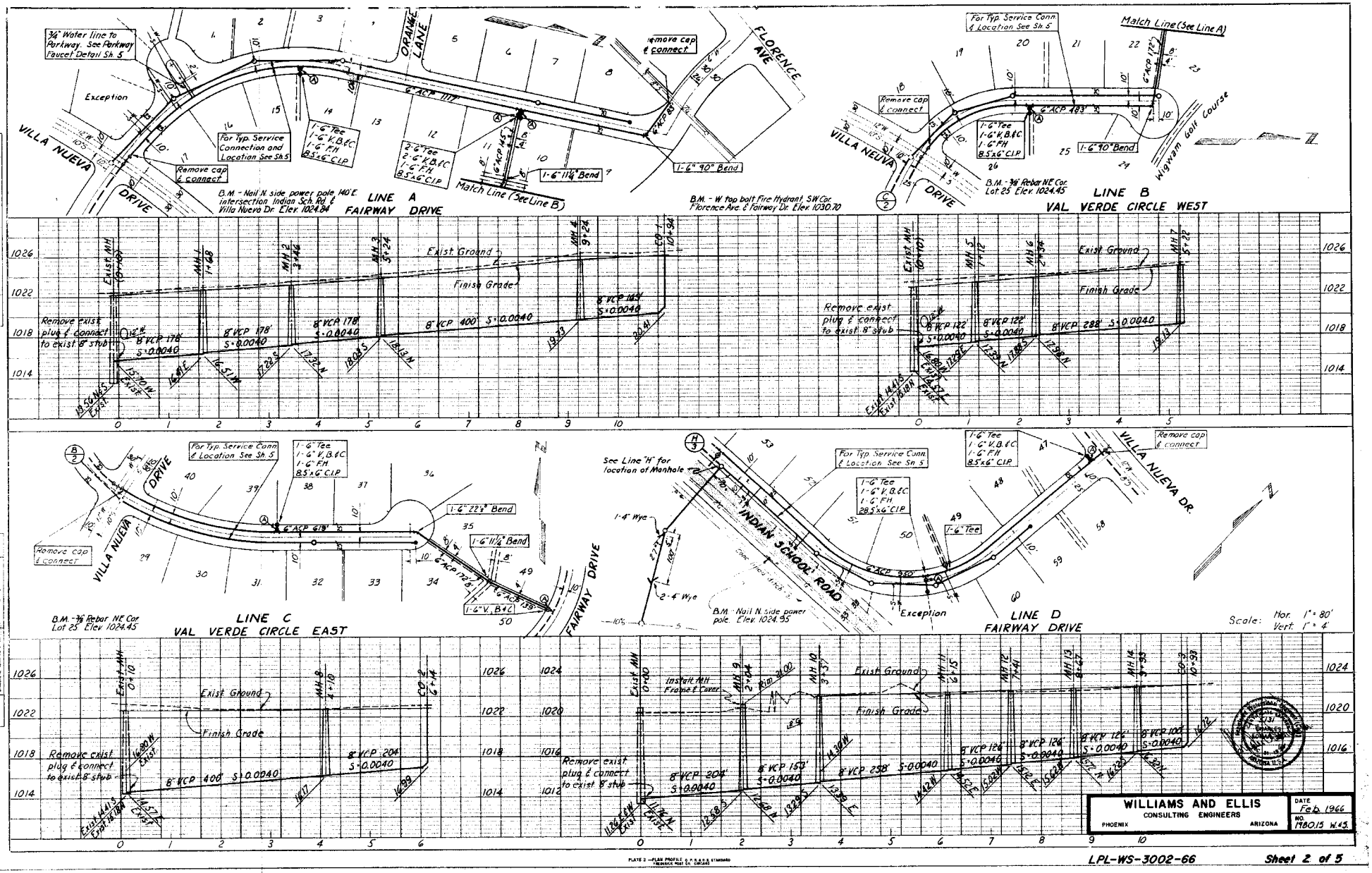
7. AN ACCURATE "AS BUILT" SET OF PLANS WILL BE FURNISHED THE PAVING CONTRACTOR AND UTILITY COMPANIES PRIOR TO THE START OF THEIR CONSTRUCTION OPERATIONS.

APPROVAL:

JOSEPH J. WEINSTEIN, SANITARY ENGR. ——— DATE

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION





WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA

DATE Feb 1966
NO. 18015 W.45

LPL-WS-3002-66

Sheet 2 of 5

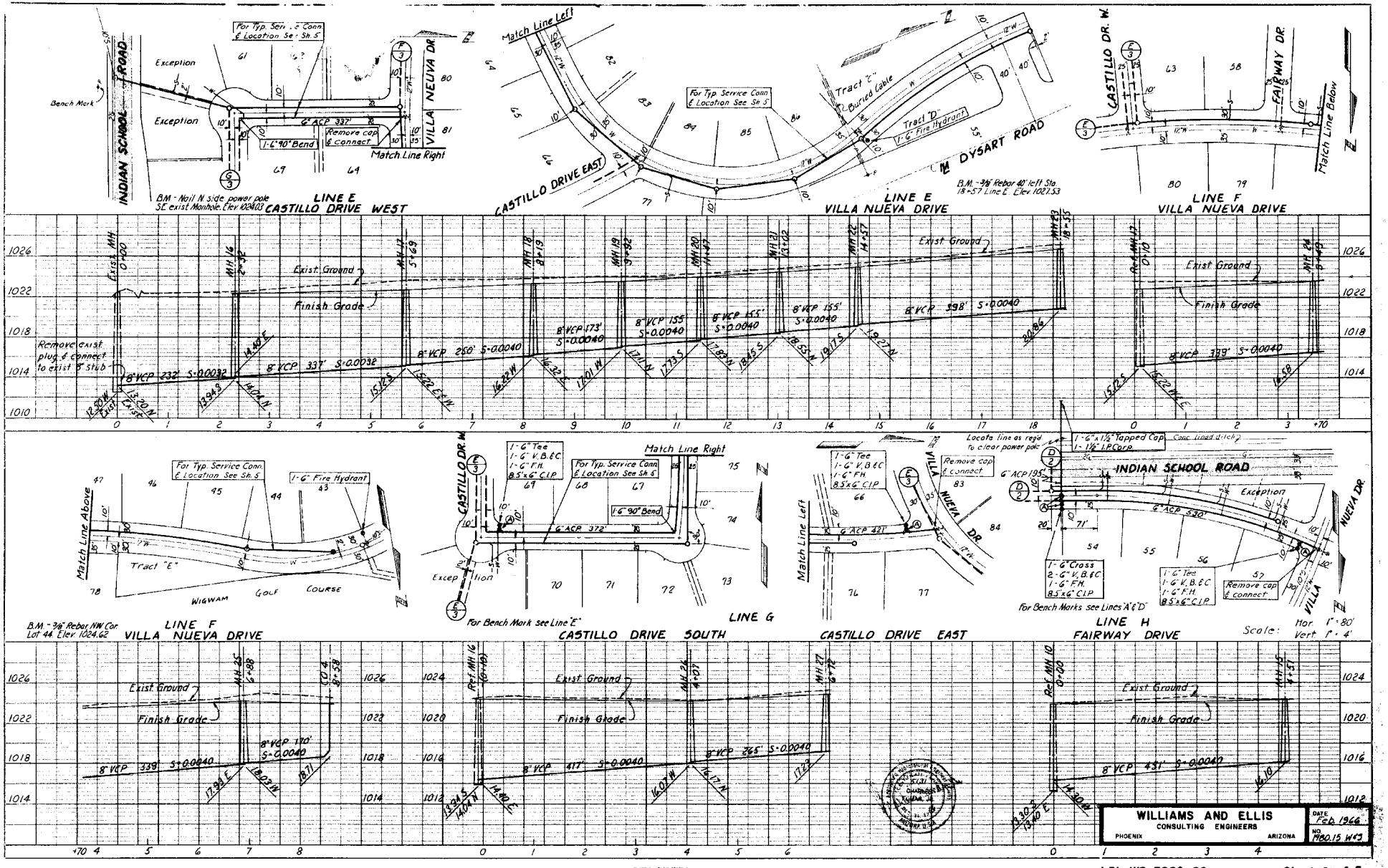
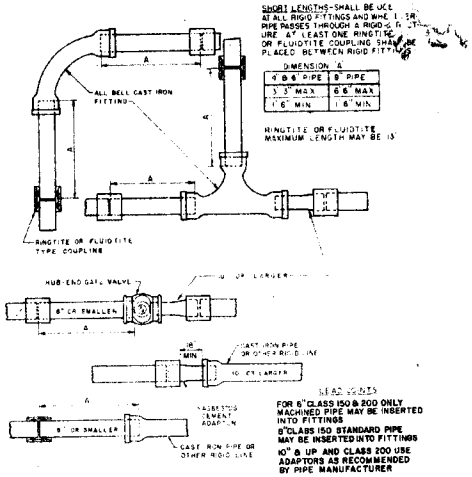


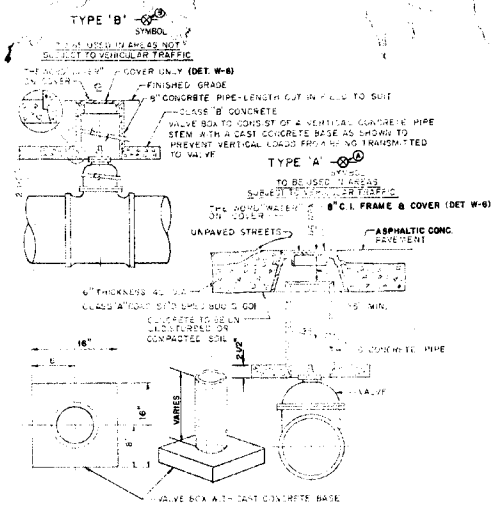
PLATE 2 — PLAN PROFILE A.P.W.A. Standard

LPL-WS-3002-66

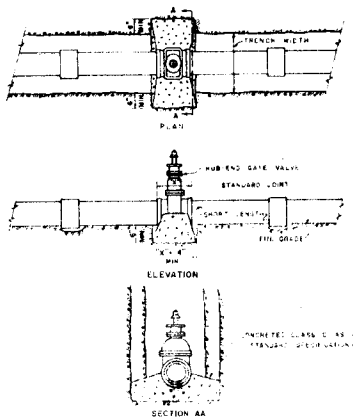
Sheet 3 of 5



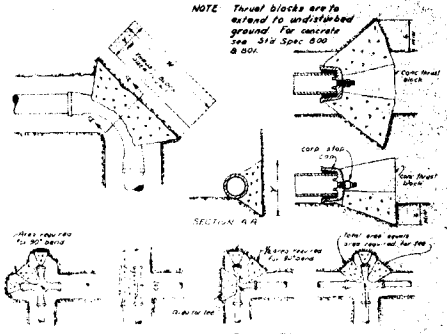
FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE
DETAIL W-1



VALVE BOX INSTALLATION
DETAIL W-2

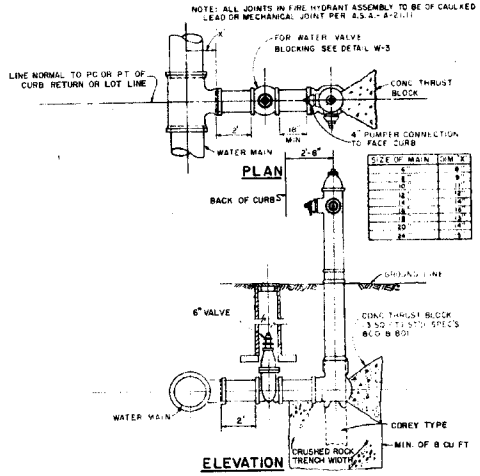


WATER VALVE BLOCKING
DETAIL W-3

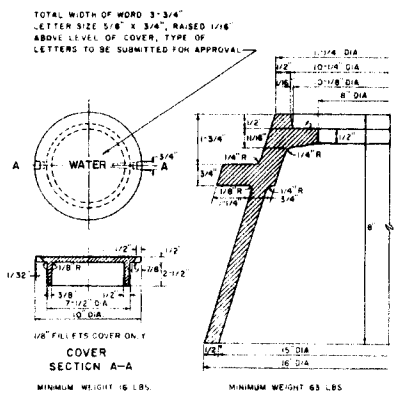


MINIMUM THRUST BLOCK AREA REQUIRED (Y x W)				
	ASBESTOS CEMENT PIPE		CAST IRON PIPE	
PIPE SIZE	Tee Deadend 90° Bend	45° & 22½° Bends	Tee Deadend 90° Bend	45° & 22½° Bends
4" - 150	3 Sq. Feet	3 Sq. Feet	5 Sq. Feet	3 Sq. Feet
6"	3 "	3 "	3 "	3 "
8"	4 "	3 "	3 "	3 "
10"	6 "	5 "	3 "	3 "
12"	9 "	7 "	5 "	4 "

THRUST BLOCKS
DETAIL W-4

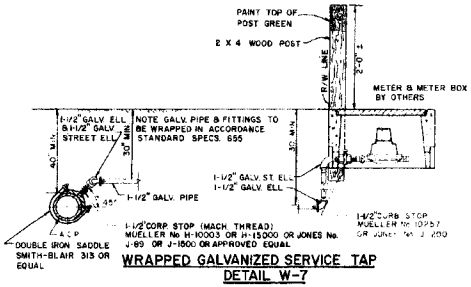


SETTING FIRE HYDRANT
DETAIL W-5



TOLERANCE FOR MACHINE FINISH ± 1/64"
* INDICATES ORDINARY MACHINING

8"C.I. FRAME & COVER
DETAIL W-6



WRAPPED GALVANIZED SERVICE TAP
DETAIL W-7

NOTE: SERVICE TAPS SHALL INCLUDE ALL FITTINGS FROM WATER MAIN TO AND INCLUDING CURB STOP.

WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA

DATE Feb. 1966
NO. 1980.15 W45

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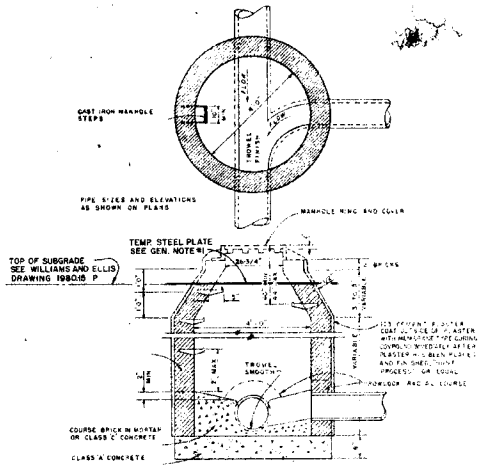
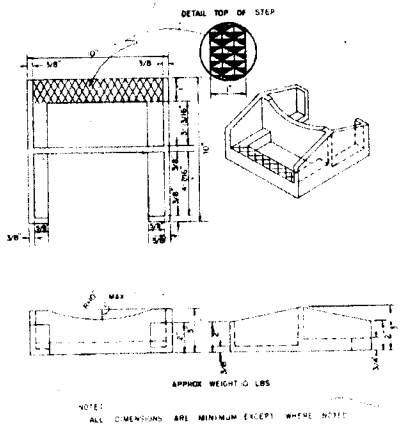
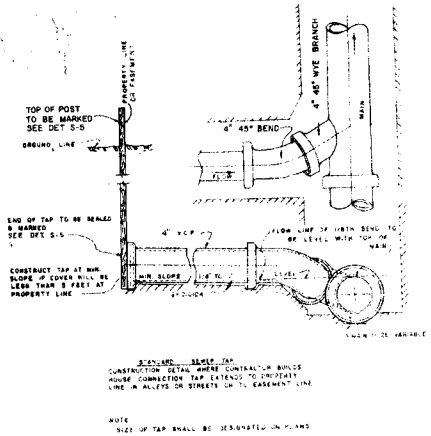


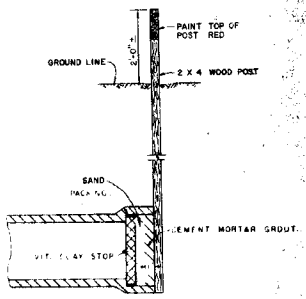
SEWER MANHOLE
DETAIL S-1



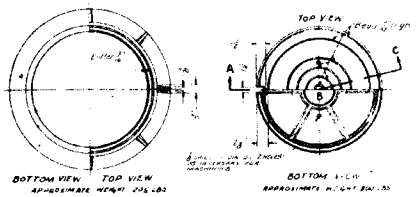
CAST IRON MANHOLE STEP
DETAIL S-3

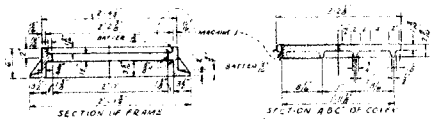


SEWER BUILDING CONNECTION
DETAIL S-4



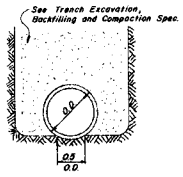
PLUG FOR SEWERS
DETAIL S-5





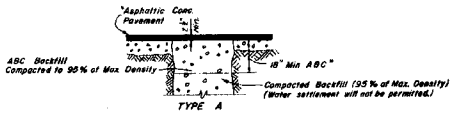
Lettering on manhole cover to be as follows "SANITARY SEWER". Total width of individual letters to be such that letters and words are equally spaced and beginning to form complete circle. Letters to be 2" in height and raised ¼ above level of cover. Type of letters to be submitted for approval.

24" MANHOLE FRAME & COVER
DETAIL S-2



CLASS C BEDDING ORDINARY

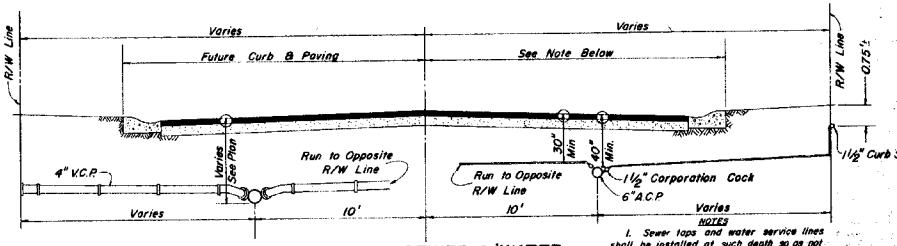
TRENCH BEDDING FOR UNDERGROUND CONDUITS
DETAIL S-6



" The actual compacted thickness placed shall be to this minimum requirement or to thickness of the existing pavement and/or base whichever is greater.

PAVEMENT & SURFACING REPLACEMENT
DETAIL S-7

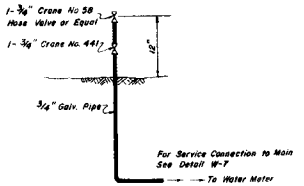
Note: Pavement cut and replacement shall be in accordance with applicable Maricopa County Standard Specifications for Construction of Highways, Streets and Bridges and Maricopa County Special Provisions for Installation of Underground Utilities, latest revisions, and shall include Item 17, Aggregate Base Course; Item 20-A-¾ Asphaltic Cement Concrete and Item 46, Pavement Cut Replacement.



TYPICAL SEWER & WATER SERVICE CONNECTION

NOTES

1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction. See Williams & Ellis 1980.15 P for finish grade elevation.
2. Locate sewer taps and water service lines as follows unless otherwise directed by Engineer.
   1. Water service line on centerline of lot.
   2. Sewer tap a minimum distance of 10 feet downstream from water service line.



PARKWAY FAUCET
DETAIL S-8

Registered Professional Engineer — Certificate No. 5731 — Charles L. Ellis Jr. — Date Signed 12-31-66 — Arizona U.S.A.

WILLIAMS AND ELLIS CONSULTING ENGINEERS PHOENIX ARIZONA	DATE Feb 1966 NO. 1980.15 W-5

LPL-WS-3002-66

Sheet 5 of 5

REVISIONS
SURVEY
DESIGN
DRAWN
CHECKED

LITCHFIELD PARK PROPERTIES

LITCHFIELD PARK ——— ARIZONA

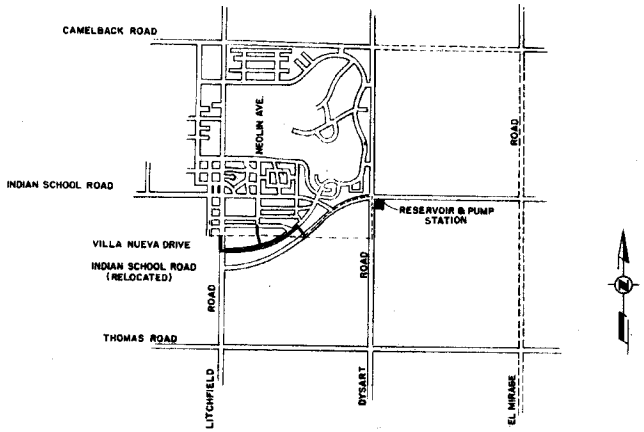
WATER MAIN RELOCATION

1967

CONTRACT NO. L.P.P.-W-1001-67

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

APPROVED: _____ DATE: 5-15-67



KEY MAP

INDEX

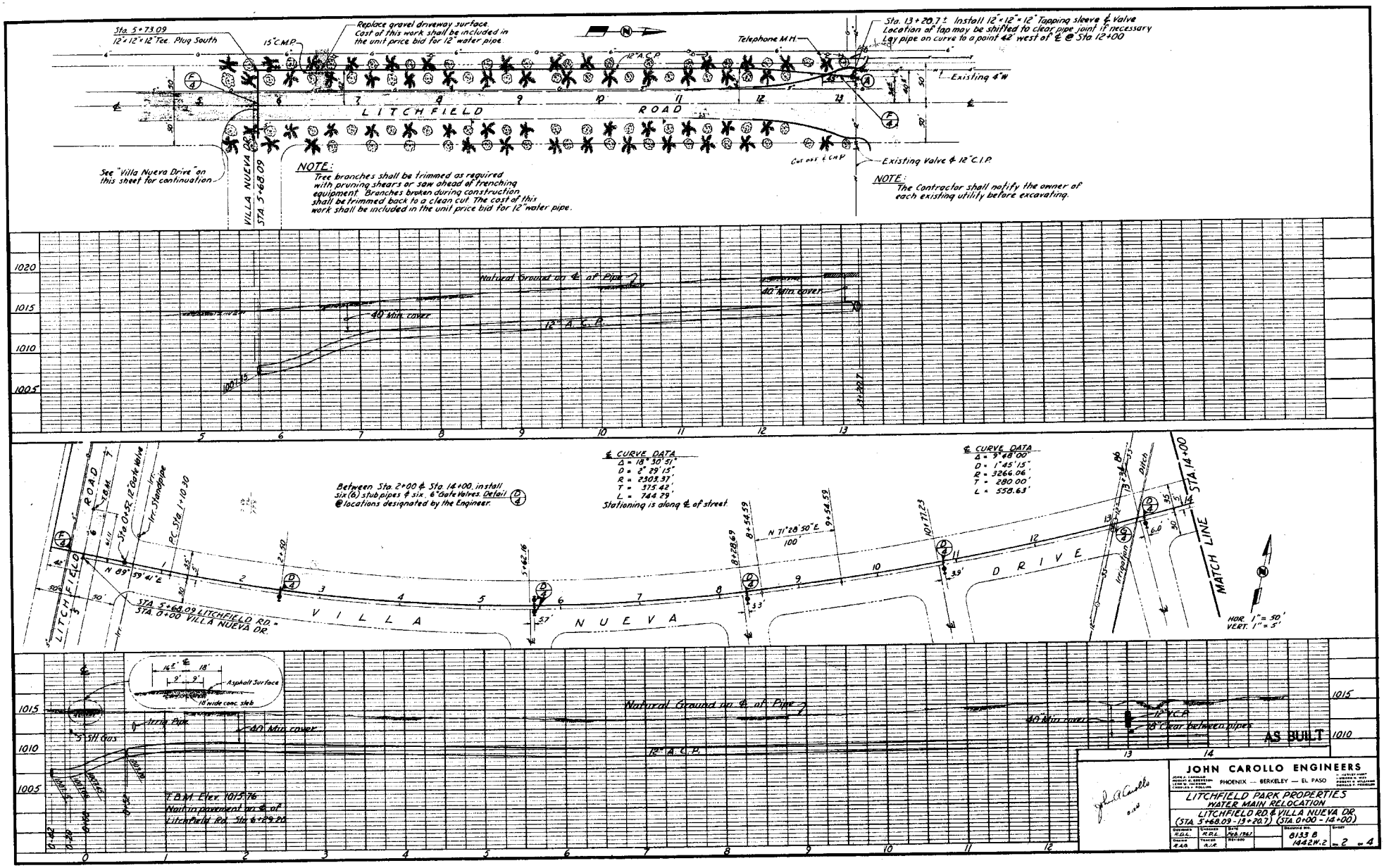
SHEET NO.	DESCRIPTION
1	TITLE SHEET, KEY MAP
2	LITCHFIELD ROAD, STA. 6+34 TO STA. 13+20 VILLA NUEVA DRIVE, STA. 0+00 TO STA. 14+00
3	VILLA NUEVA DRIVE, STA. 14+00 TO STA. 31+68 NEOLIN AVENUE, STA. 0+00 TO STA. 7+21
4	CONSTRUCTION DETAILS

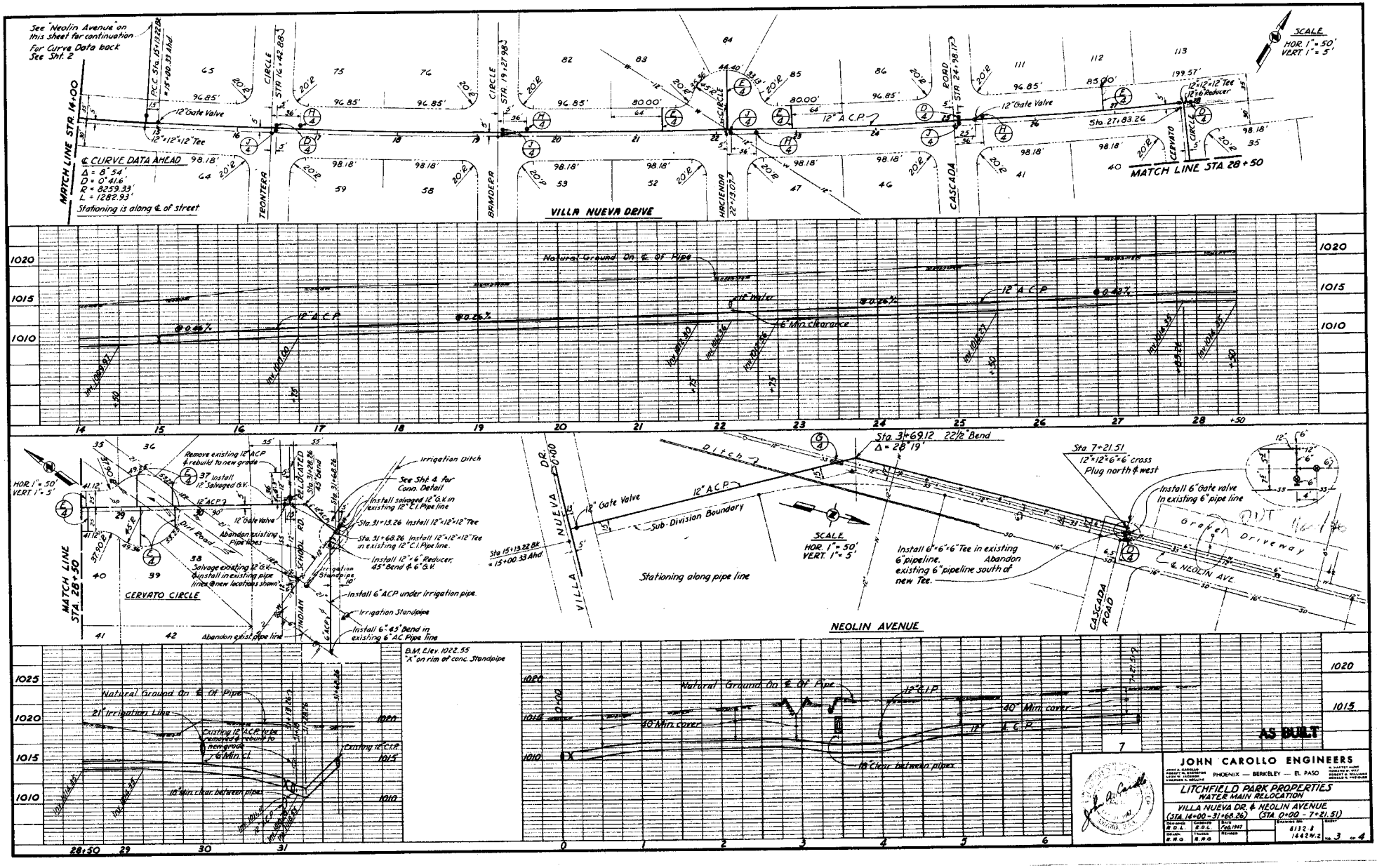
JOHN CAROLLO ENGINEERS
PHOENIX , ARIZONA
BERKELEY , CALIFORNIA ——— EL PASO , TEXAS

JOHN A. CAROLLO
ROBERT M. BRERETON
CHARLES A. ROLLINS
M. HARVEY HUNT
HOWARD M. WAY
ROBERT G. WILLIAMS
DONALD R. PRESSLER

AS BUILT

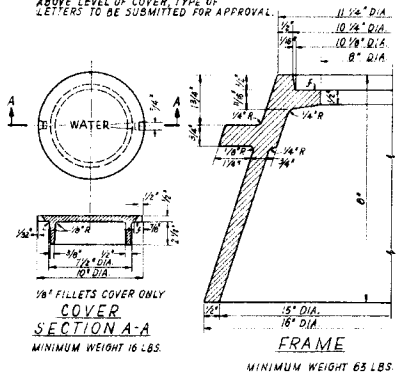
DWG No. 8136-8-144 W.2


Sta. 5+73.09
12"x12"x12" Tee. Plug South
15" C.M.P.
Replace gravel driveway surface. Cost of this work shall be included in the unit price bid for 12" water pipe.
12" A.C.P.
Telephone M.H.
Sta. 13+20.7± Install 12"x12"x12" Tapping sleeve & Valve
Location of tap may be shifted to clear pipe joint if necessary
Lay pipe on curve to a point 42' west of ℄ @ Sta 12+00
Existing 4"W
LITCHFIELD ROAD
See "Villa Nuera Drive" on this sheet for continuation.
VILLA NUEVA DR. STA 5+68.09
NOTE:
Tree branches shall be trimmed as required with pruning shears or saw ahead of trenching equipment. Branches broken during construction shall be trimmed back to a clean cut. The cost of this work shall be included in the unit price bid for 12" water pipe.
Cut out & CAP
Existing Valve & 12" C.I.P.
NOTE:
The Contractor shall notify the owner of each existing utility before excavating.
1020
1015
1010
1005
Natural Ground on ℄ of Pipe
40" Min. cover
12" A.C.P.
Between Sta. 2+00 & Sta. 14+00, install six (6) stub pipes & six 6" Gate Valves. Detail (D 4) @ locations designated by the Engineer.
℄ CURVE DATA
Δ = 18° 30' 51"
D = 2° 29' 15"
R = 2303.37'
T = 375.42'
L = 744.29'
Stationing is along ℄ of street.
℄ CURVE DATA
Δ = 9° 48' 00"
D = 1° 45' 15"
R = 3266.06'
T = 280.00'
L = 558.63'
ROAD 1
18" M.
Sta 0+52 12" Gate Valve
Inv. Stormpipe
PC Sta 1+10.30
N 89° 59' 41" E
LITCHFIELD
STA 5+68.09 LITCHFIELD RD. = STA. 0+00 VILLA NUEVA DR.
VILLA NUEVA DRIVE
N 71° 28' 50" E
100'
101.77
Ditch
STA 14+00
MATCH LINE
HOR. 1" = 50'
VERT. 1" = 5'
16'
18'
9'
9'
Asphalt Surface
18" wide conc. slab
Irrig. Pipe
40" Min cover
5" Sill Gas
Natural Ground on ℄ of Pipe
12" A.C.P.
40" Min cover
12" V.C.P.
18" Clear between pipes
T.B.M. Elev. 1015.76
Nail in pavement on ℄ of Litchfield Rd. Sta 6+29.86
AS BUILT
JOHN CAROLLO ENGINEERS
PHOENIX — BERKELEY — EL PASO
LITCHFIELD PARK PROPERTIES
WATER MAIN RELOCATION
LITCHFIELD RD. & VILLA NUEVA DR.
(STA. 5+68.09 - 13+20.7) (STA. 0+00 - 14+00)
Designed R.G.L.
Checked R.D.L.
Date 9/6/1961
Drawn A.A.B.
Traced A.J.C.
Record Dwg. 61/33 B
1442W.2
Sheet 2 of 4


See "Neolin Avenue" on this sheet for continuation
For Curve Data back See Sht. 2
MATCH LINE STA. 14+00
PCC Sta. 15+13.22 Bk = 15+00.33 Ahd
CIRCLE
STA 16+42.86
CIRCLE
STA 19+27.98
CIRCLE
STA 22+25.36
ROAD
STA 24+98.17
SCALE
HOR. 1" = 50'
VERT. 1" = 5'
12" Gate Valve
12"-12"-12" Tee
12" A.C.P.
12"-12"-6" Reducer
Sta. 27+83.26
MATCH LINE STA 28+50
℄ CURVE DATA AHEAD
Δ = 8° 54'
D = 0° 41.6'
R = 8259.33'
L = 1282.93'
Stationing is along ℄ of street
TRONTERA
BRAMDERA
VILLA NUEVA DRIVE
HACIENDA
CASCADA
CERVATO
Natural Ground On ℄ Of Pipe
12" A.C.P.
6" Min. clearance
Sta. 3+69.12 22½° Bend
Δ = 28° 19'
Sta. 7+21.51
12"-12"-6"-6" cross
Plug north & west
Install 6" Gate valve in existing 6" pipe line
Ditch
Graded Driveway
℄ NEOLIN AVE.
VILLA NUEVA DR.
Sta 0+00
Sta 15+13.22 Bk = 15+00.33 Ahd
12" Gate Valve
Sub-Division Boundary
Stationing along pipe line
Install ℄ 6"-6" Tee in existing 6" pipeline. Abandon existing 6" pipeline south of new Tee.
CASCADA ROAD
NEOLIN AVENUE
MATCH LINE STA. 28+50
CERVATO CIRCLE
Remove existing 12" A.C.P. & rebuild to new grade
37° Install 12" Salvaged G.V.
12" A.C.P.
12" Gate Valve
Abandon existing pipe lines
Dirt Road
Salvage existing 12" G.V. & install in existing pipe lines @ new locations shown
Abandon exist. pipe line
RELOCATED SCHOOL RD.
Sta. 31+88.86 45° Bend
Sta. 31+68.26
Irrigation Ditch
See Sht. 4 for Conn. Detail
Install salvaged 12" G.V. in existing 12" C.I. Pipe line
Sta. 31+13.26 Install 12"-12"-12" Tee
Sta. 31+68.26 Install 12"-12"-12" Tee in existing 12" C.I. Pipe line.
Install 12"-6" Reducer, 45° Bend & 6" G.V.
Irrigation Standpipe 10"
Install 6" A.C.P. under irrigation pipe.
Irrigation Standpipe
Install 6" 45° Bend in existing 6" A.C. Pipe line
INDIAN
B.M. Elev. 1022.55
"X" on rim of conc. Standpipe
Natural Ground On ℄ Of Pipe
21" Irrigation Line
Existing 12" A.C.P. to be removed & reused to reinforce 6" Min. ℄
Existing 12" C.I.P.
18" Min. clear. between pipes
12" C.I.P.
40" Min. cover
18" Clear. between pipes
AS BUILT
JOHN CAROLLO ENGINEERS
PHOENIX — BERKELEY — EL PASO
LITCHFIELD PARK PROPERTIES
WATER MAIN RELOCATION
VILLA NUEVA DR. & NEOLIN AVENUE
(STA. 14+00 - 31+68.26) (STA. 0+00 - 7+21.51)
Designed R.O.L.
Detailed R.O.L.
Checked R.H.O.
Traced B.R.O.
Date FEB. 1981
Drawing No. 8132-8 16429N-2
Sheet No. 3 of 4

LETTERS ON COVER TO BE AS FOLLOWS:

"WATER" OR AS DIRECTED
TOTAL WIDTH OF WORD 3 3/4"
LETTER SIZE 3/4" x 3/4" RAISED 1/16"
ABOVE LEVEL OF COVER. TYPE OF LETTERS TO BE SUBMITTED FOR APPROVAL.



COVER
SECTION A-A

MINIMUM WEIGHT 16 LBS.

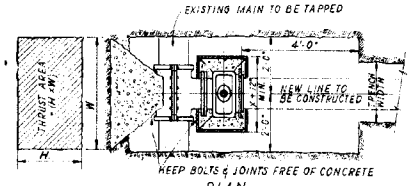
FRAME

MINIMUM WEIGHT 65 LBS.

TOLERANCE FOR MACHINE FINISH ± 1/64"
± INDICATES ORDINARY MACHINING

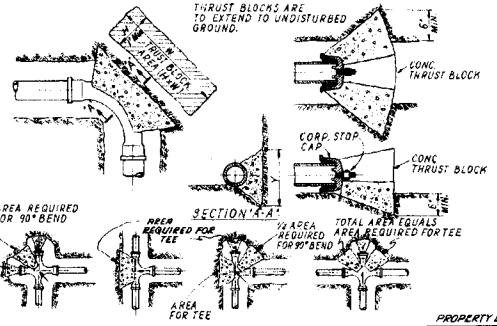
8" C.I. FRAME AND COVER

NO SCALE



INSTALLING TAPPING SLEEVE AND VALVE

NOTE:
THRUST BLOCKS ARE TO EXTEND TO UNDISTURBED GROUND.

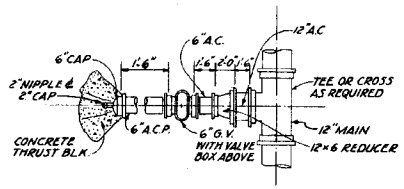


TYPICAL LOCATIONS OF THRUST BLOCKS

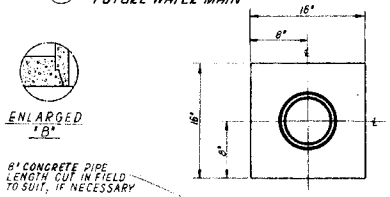
THRUST BLOCK TABLE

MINIMUM SIZE OF THRUST BLOCKS FOR CLASS 150 PIPE
AREA (SQ.FT.) = H(FT.) x W(FT.)
Test Pressure 150 P.S.I.

		90° Bend	Dead End Tee	45° Bend	22½° Bend
4"	Thrust	2,670	1,890	1,450	740
	Area	1	1	1	1
6"	Thrust	6,000	4,240	3,250	1,650
	Area	2	1½	1	1
8"	Thrust	10,600	7,520	5,780	2,940
	Area	3½	2½	2	1
10"	Thrust	16,650	11,800	9,030	4,600
	Area	5½	4	3	2
12"	Thrust	23,000	16,950	13,000	6,610
	Area	8	6	4½	2½

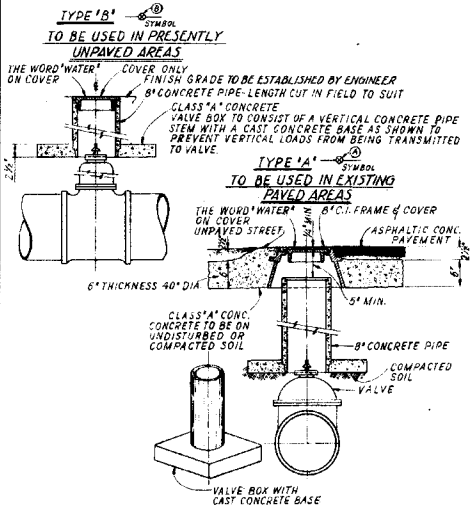


(D) STUB PIPE FOR 6" FUTURE WATER MAIN



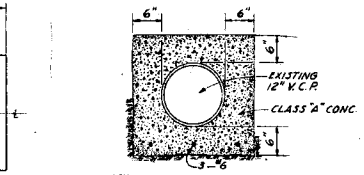
VALVE BOX WITH CAST CONCRETE BASE

NO SCALE



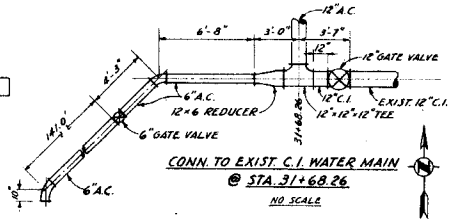
VALVE BOX INSTALLATION

NO SCALE

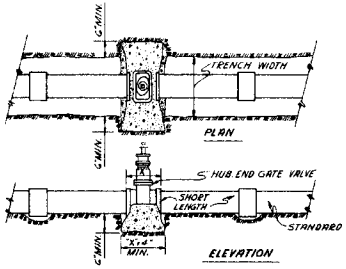


NOTE:
ENCASEMENT SHALL EXTEND A MINIMUM OF 3'-0" BEYOND LIMITS OF WATER LINE TRENCH - MEASURED AT RIGHT ANGLES TO WATER LINE TRENCH.

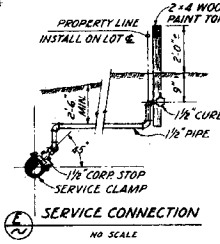
(G) CONCRETE PIPE ENCASEMENT



NO SCALE

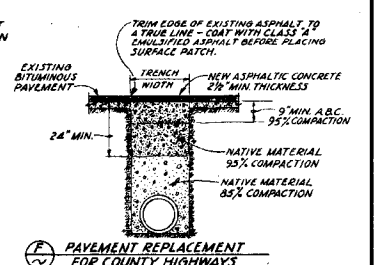


BLOCKING FOR WATER VALVES

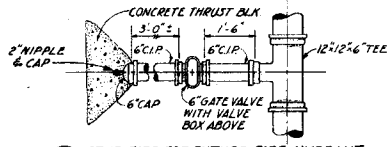


(E) SERVICE CONNECTION

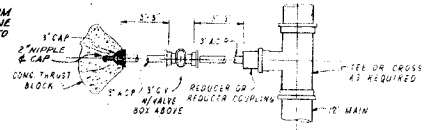
NO SCALE



(F) PAVEMENT REPLACEMENT FOR COUNTY HIGHWAYS



(H) STUB PIPE FOR FUTURE FIRE HYDRANT



(I) STUB PIPE FOR 3" INCH FUTURE WATER MAIN

AS BUILT

REGISTERED CIVIL ENGINEER CERTIFICATE NO. 7,000 JOHN C. CAROLLO DEC. 31, 1966 ARIZONA, U.S.A.

JOHN CAROLLO ENGINEERS
PHOENIX — BERKELEY

LITCHFIELD PARK PROPERTIES
WATER MAIN RELOCATION

CONSTRUCTION DETAILS

Designed	Checked	Date	Drawing No.	Sheet
R.D.L.	G.D.L.	Feb. 1967	6131-8	4 of 4
Revised 3/20/67	Revised 4/28/67		1442W.2	

LITCHFIELD PARK SERVICE COMPANY

LITCHFIELD PARK ——— ARIZONA

WATER DISTRIBUTION MAINS

1966

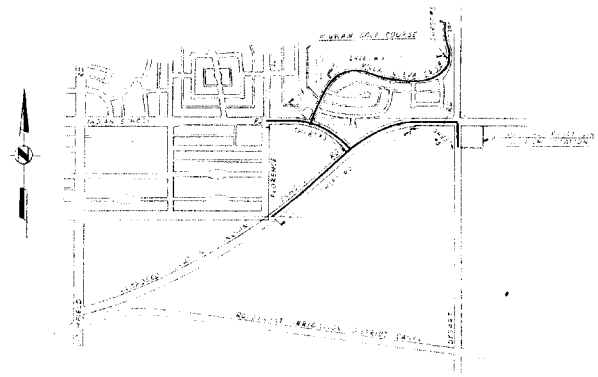
CONTRACT NO. LPS-W-1001-66

INDEX

SHEET NO	DESCRIPTION
1	TITLE SHEET – KEY MAP – INDEX
2	PLAN AND PROFILE – INDIAN SCHOOL ROAD
3	PLAN AND PROFILE – INDIAN SCHOOL RD. & DYSART RD.
4	PLAN AND PROFILE – VILLA NUEVA DRIVE
5	PLAN AND PROFILE – VILLA NUEVA DRIVE
6	DETAIL SHEET – WATER MAIN DETAILS

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

APPROVED: ..... DATE: .....



KEY MAP

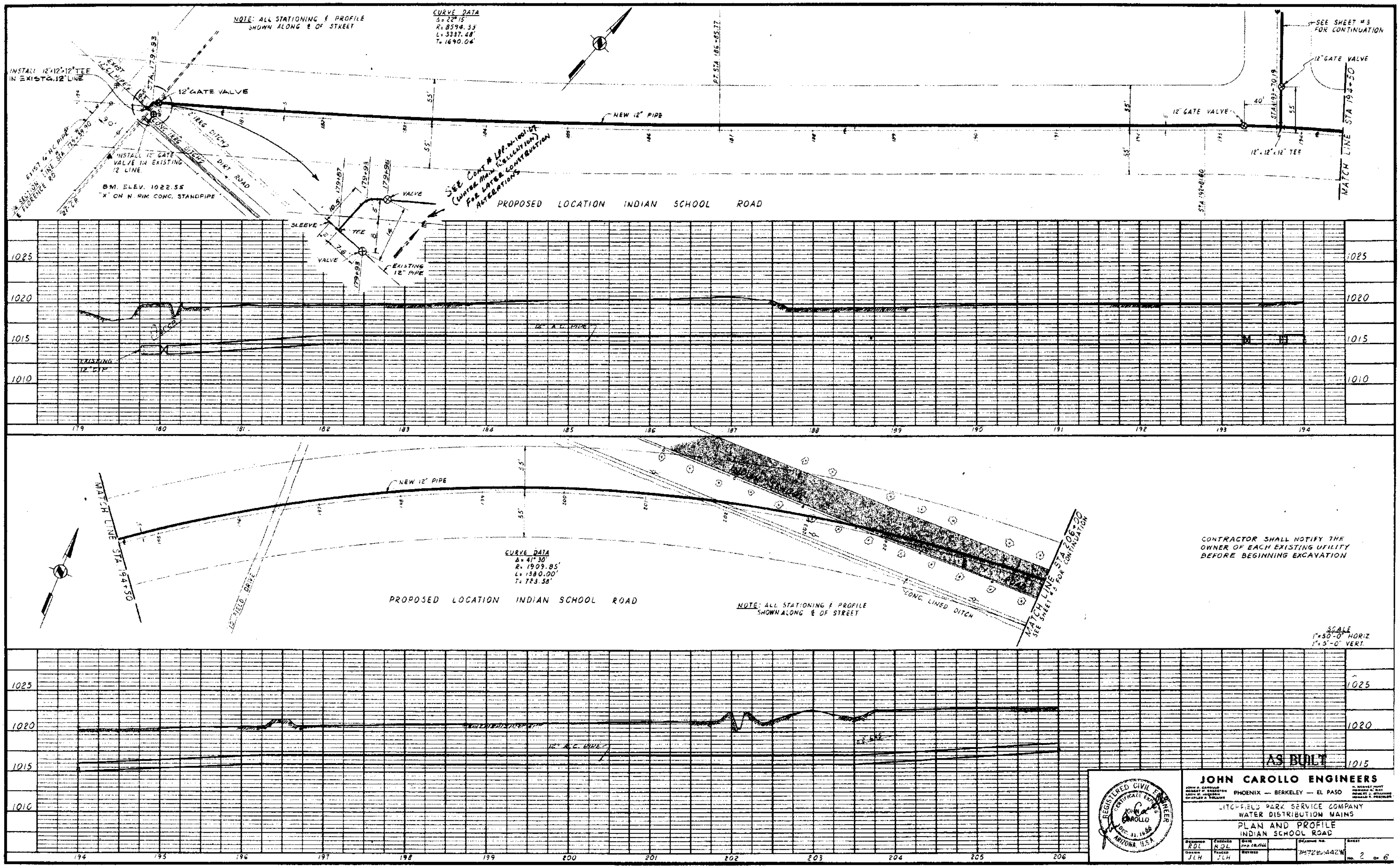
	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
MOUNTAIN STATES TELEPHONE SOUTHERN PACIFIC PIPE LINES INC. ARIZONA PUBLIC SERVICE COMPANY			

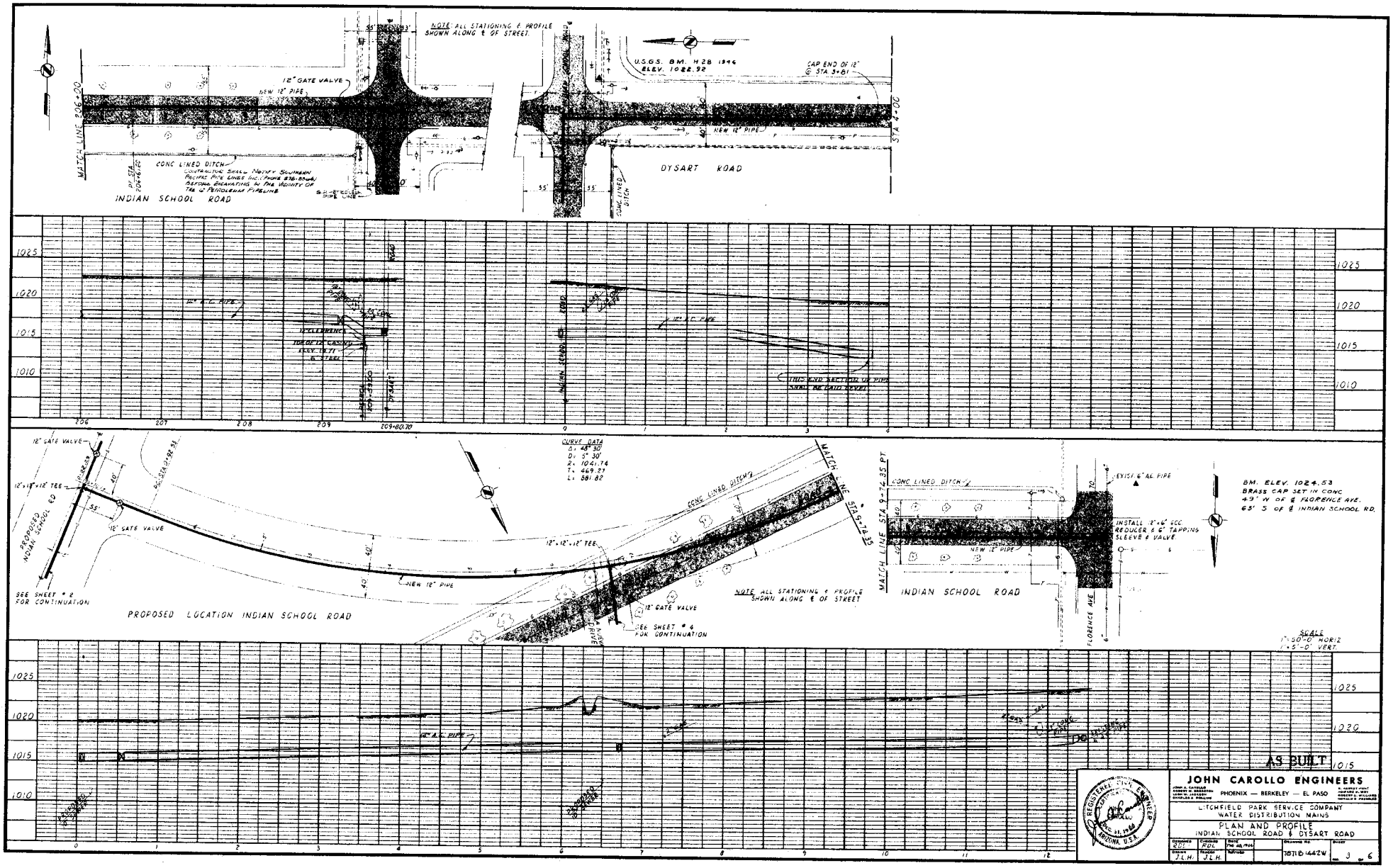
(AS BUILT)

JOHN CAROLLO ENGINEERS
PHOENIX, ARIZONA
BERKELEY, CALIFORNIA ——— EL PASO, TEXAS

JOHN A. CAROLLO
ROBERT M. BRERETON
LEON W. JACKSON
CHARLES A. ROLLINS
H. HARVEY HUNT
HOWARD M. WAT
ROBERT C. WILLIAMS
DONALD R. PRESSLER

John A. Carollo


NOTE: ALL STATIONING & PROFILE SHOWN ALONG ℄ OF STREET
CURVE DATA
Δ= 22°15'
R= 8594.33
L= 3337.48'
T= 1690.04'
INSTALL 12"x12"x12" TEE IN EXISTG. 12" LINE
STA. 179+93
12" GATE VALVE
INSTALL 12" GATE VALVE IN EXISTING 12" LINE
BM. ELEV. 1022.55 "X" ON N. RIM CONC. STANDPIPE
DIRT ROAD
P.T. STA 186+65.77
NEW 12" PIPE
12" GATE VALVE
STA 193+70.19
12"x12"x12" TEE
SEE SHEET #3 FOR CONTINUATION
MATCH LINE STA 194+50
STA 192+81.60
SLEEVE
TEE
VALVE
179+87
179+93
179+96
EXISTING 12" PIPE
PROPOSED LOCATION INDIAN SCHOOL ROAD
1025
1020
1015
1010
12" A.C. PIPE
EXISTING 12" C.I.P.
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
NEW 12" PIPE
MATCH LINE STA 194+50
CURVE DATA
Δ= 41°30'
R= 1909.85'
L= 1380.00'
T= 723.58'
PROPOSED LOCATION INDIAN SCHOOL ROAD
NOTE: ALL STATIONING & PROFILE SHOWN ALONG ℄ OF STREET
CONC. LINED DITCH
MATCH LINE STA 206+00
SEE SHEET #4 FOR CONTINUATION
CONTRACTOR SHALL NOTIFY THE OWNER OF EACH EXISTING UTILITY BEFORE BEGINNING EXCAVATION
SCALE
1"=50'-0" HORIZ.
1"=5'-0" VERT.
12" A.C. PIPE
195
196
197
198
199
200
201
202
203
204
205
206
AS BUILT
REGISTERED CIVIL ENGINEER
JOHN CAROLLO
ARIZONA, U.S.A.
JOHN CAROLLO ENGINEERS
PHOENIX — BERKELEY — EL PASO
LITCHFIELD PARK SERVICE COMPANY
WATER DISTRIBUTION MAINS
PLAN AND PROFILE
INDIAN SCHOOL ROAD
RDL
JLH
NO. 2 OF 6



AS BUILT

JOHN CAROLLO ENGINEERS

PHOENIX — BERKELEY — EL PASO

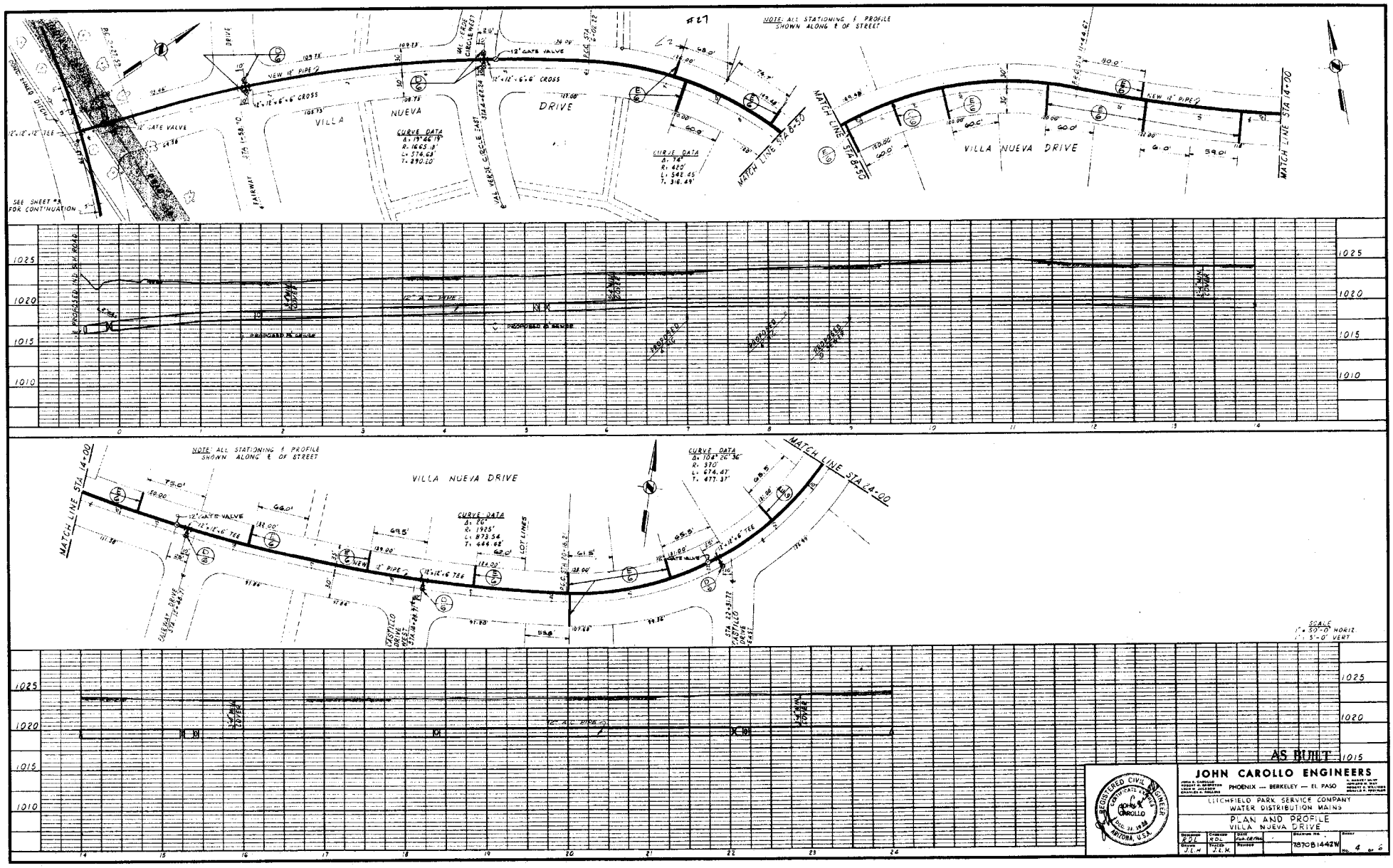
LITCHFIELD PARK SERVICE COMPANY

WATER DISTRIBUTION MAINS

PLAN AND PROFILE

INDIAN SCHOOL ROAD & DYSART ROAD

Designed	Checked	Date	Drawing No.	Sheet
201	RDL	Feb. 28, 1986		
Drawn	Traced	Revised		
J.L.H.	J.L.H.		2871B-1442W	3 of 6



JOHN CAROLLO ENGINEERS

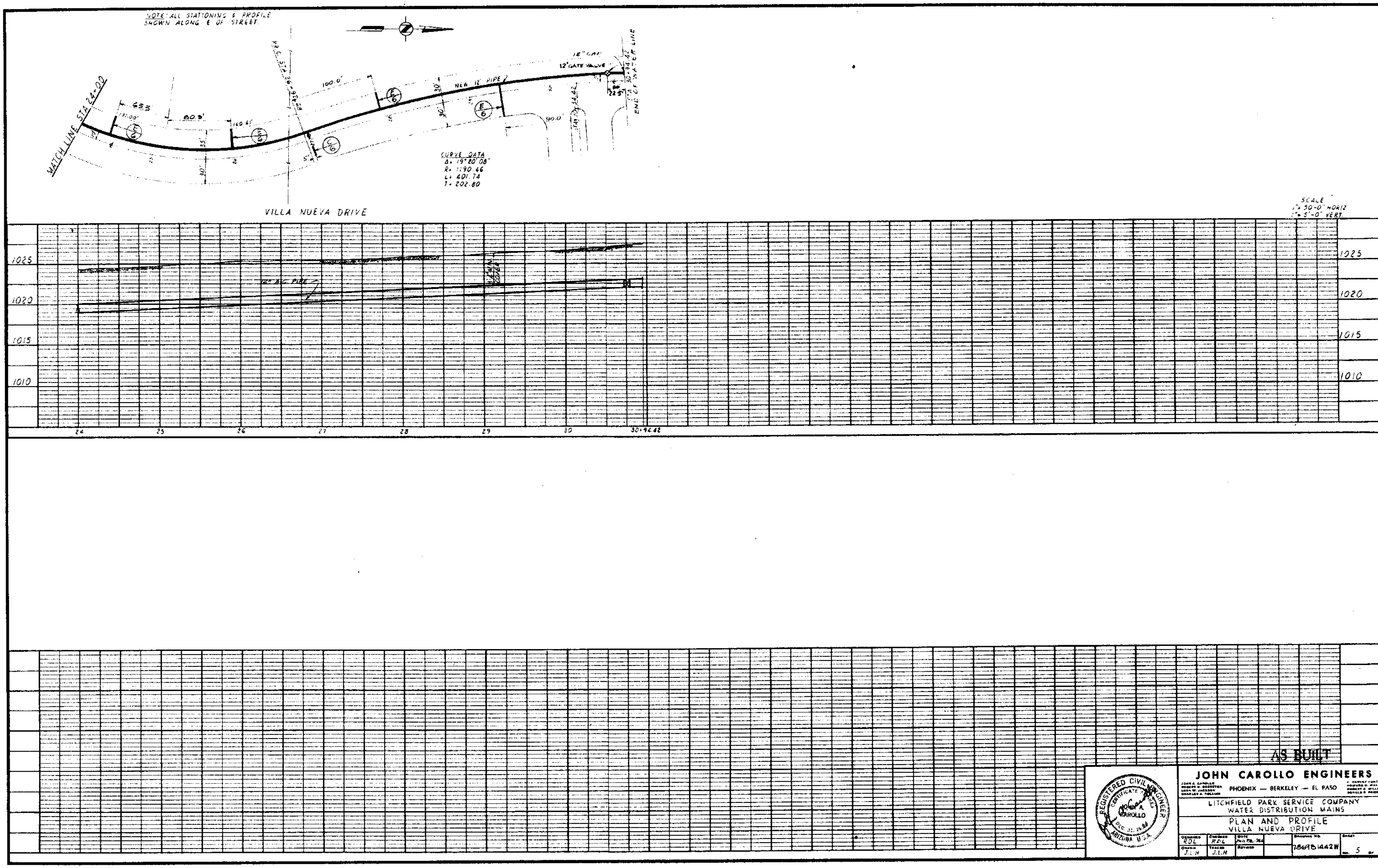
PHOENIX — BERKELEY — EL PASO

LITCHFIELD PARK SERVICE COMPANY
WATER DISTRIBUTION MAINS

PLAN AND PROFILE
VILLA NUEVA DRIVE

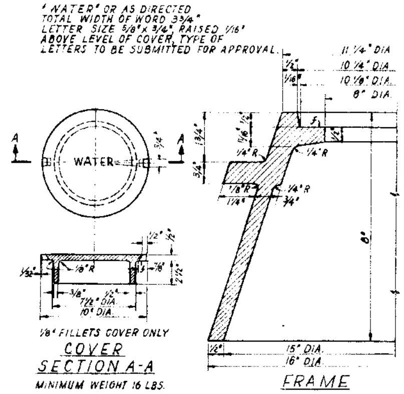
DRAWING NO. 7870B1442W

SHEET No. 4 OF 6


NOTE: ALL STATIONING & PROFILE SHOWN ALONG ℄ OF STREET.
MATCH LINE STA 24+00
NEW 12" PIPE
12" GATE VALVE
12" CAP
END OF WATER LINE
CURVE DATA
Δ = 19°20'08"
R = 1190.46
L = 401.74
T = 202.80
VILLA NUEVA DRIVE
SCALE
1" = 50'-0" HORIZ
1" = 5'-0" VERT
1025
1020
1015
1010
24
25
26
27
28
29
30
30+94.42
AS BUILT
REGISTERED CIVIL ENGINEER
CERTIFICATE
JOHN A. CAROLLO
ARIZONA, U.S.A.
JOHN CAROLLO ENGINEERS
PHOENIX — BERKELEY — EL PASO
LITCHFIELD PARK SERVICE COMPANY
WATER DISTRIBUTION MAINS
PLAN AND PROFILE
VILLA NUEVA DRIVE
DESIGNED RDL
CHECKED RDL
DRAWN J.L.H
TRACED J.L.H.
DRAWING NO. 7869B1442W
SHEET NO. 5 OF 6

LETTERS ON COVER TO BE AS FOLLOWS:

"WATER" OR AS DIRECTED. TOTAL WIDTH OF WORD 3 3/4". LETTER SIZE 5/8" x 3/4" RAISED 1/16" ABOVE LEVEL OF COVER. TYPE OF LETTERS TO BE SUBMITTED FOR APPROVAL.



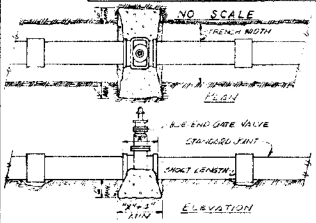
COVER
SECTION A-A
MINIMUM WEIGHT 16 LBS.

FRAME
MINIMUM WEIGHT 63 LBS.

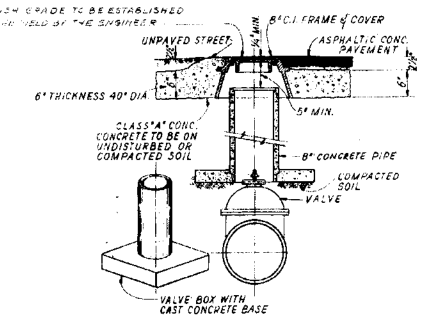
TOLERANCE FOR MACHINE FINISH ± 1/64"
§ INDICATES ORDINARY MACHINING

8" C.I. FRAME AND COVER

NO SCALE

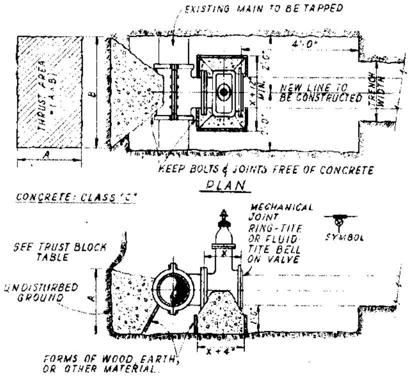


BLOCKING FOR WATER VALVES



VALVE BOX INSTALLATION

NO SCALE

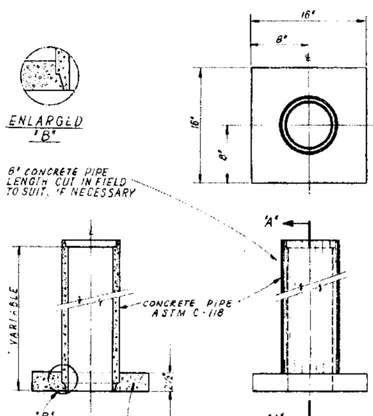


NOTES:

1. BLOCKS ARE TO EXTEND TO UNDISTURBED GROUND.
2. INSTALL PERMANENT BLOCKING UNDER VALVE BEFORE TAP IS MADE. ALL FLANGE BOLTS SHALL BE CLEAR OF FOOTING.
3. CONTRACTOR SHALL EXCAVATE AS SHOWN AND SHALL SET TAPPING SLEEVE AND VALVE, TIGHTEN ALL BOLTS, AND CLARK AND LEAD AS A STANDARD JOINT PRIOR TO MAKING TAP.
4. TAPPING SLEEVE TO BE PLACED A MINIMUM OF 18" FROM ANY BELL, COUPLING, VALVE, OR OTHER OBSTRUCTION.

INSTALLING TAPPING SLEEVE AND VALVE

NO SCALE

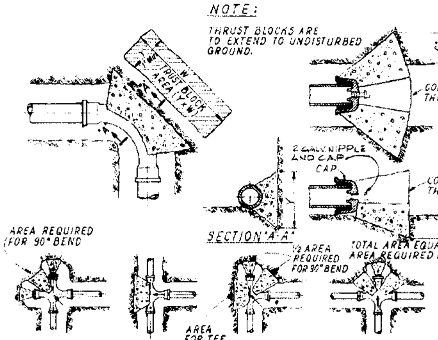


VALVE BOX WITH CAST CONCRETE BASE

NO SCALE

NOTE:

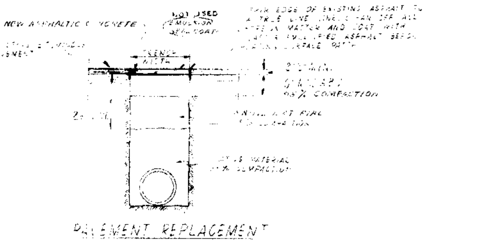
THRUST BLOCKS ARE TO EXTEND TO UNDISTURBED GROUND.



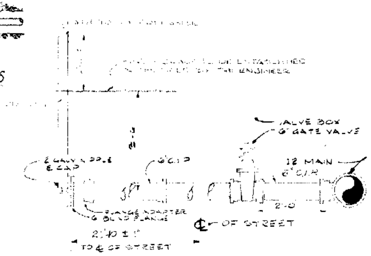
TYPICAL LOCATIONS OF THRUST BLOCKS

NO SCALE

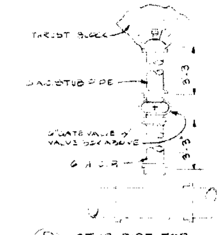
TRENCH WIDTHS FOR WATER MAINS - AC PIPE		
PIPE SIZE INCHES	MAX. TRENCH WIDTH INCHES	MIN. TRENCH WIDTH INCHES
6	24	20
8	24	20
10	24	20
12	26 1/2	20 1/2
14	29 1/2	23 1/2
16	32 1/2	26
18	35	28 1/2
20	38	31
24	44	36 1/2
30	53	44 1/2
36	60	51



PAVEMENT REPLACEMENT FOR COUNTY HIGHWAYS



(C 4.5) STUB PIPE FOR FUTURE FIRE HYDRANT



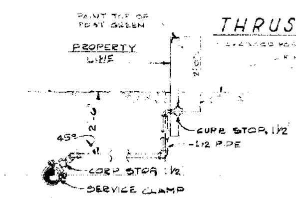
(D 4) STUB PIPE FOR FUTURE WATER MAIN

MINIMUM SIZE OF THRUST BLOCKS FOR CAST IRON PIPE, FOR AC PIPE USE NEXT 25 PSI HIGHER

AREA (SQUARE FEET) = H (FEET) x L (FEET)

PRESSURE		100 P.S.I. 90° BEND	100 P.S.I. DEAD END TEE	100 P.S.I. 45° BEND	100 P.S.I. 22½° BEND	125 P.S.I. 90° BEND	125 P.S.I. DEAD END TEE	125 P.S.I. 45° BEND	125 P.S.I. 22½° BEND	150 P.S.I. 90° BEND	150 P.S.I. DEAD END TEE	150 P.S.I. 45° BEND	150 P.S.I. 22½° BEND	175 P.S.I. 90° BEND	175 P.S.I. DEAD END TEE	175 P.S.I. 45° BEND	175 P.S.I. 22½° BEND	200 P.S.I. 90° BEND	200 P.S.I. DEAD END TEE	200 P.S.I. 45° BEND	200 P.S.I. 22½° BEND
4"	THRUST	1,780	1,260	960	490	2,230	1,570	1,200	610	2,670	1,890	1,450	740	3,110	2,200	1,680	860	3,560	2,510	1,930	980
	AREA	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6"	THRUST	4,000	2,830	2,170	1,100	5,000	3,540	2,710	1,380	6,000	4,240	3,250	1,650	7,000	4,950	3,790	1,930	8,000	5,650	4,330	2,200
	AREA	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8"	THRUST	7,130	5,030	3,850	1,960	8,900	6,280	4,810	2,450	10,680	7,550	5,780	2,940	12,450	8,800	6,750	3,430	14,230	10,050	7,700	3,930
	AREA	3	3	3	3	3	3	3	3	3	3	3	3	3½	3	3	3	4	3	3	3
10"	THRUST	11,130	7,880	6,030	3,060	13,880	9,830	7,530	3,830	16,650	11,800	9,030	4,600	19,425	13,750	10,550	5,380	22,200	15,730	12,050	6,130
	AREA	3	3	3	3	3½	3	3	3	4½	3	3	3	5	3½	3	3	6	4	3	3
12"	THRUST	16,000	11,300	8,660	4,400	20,000	14,150	10,820	5,510	24,000	16,950	13,000	6,610	28,000	19,800	15,150	7,710	32,000	22,600	17,300	8,810
	AREA	4	3	2½	1½	5	4	3	1½	6	4½	3½	2	7	5	4	2	8	6	5	2½
14"	THRUST	21,800	15,400	11,800	6,000	27,200	19,250	14,750	7,500	32,700	23,100	17,700	9,000	38,100	26,900	20,600	10,500	43,500	30,800	23,600	12,000
	AREA	5½	4	3	1½	7	5	4	2	8	6	4½	2½	10	7	5½	2½	11	8	6	3
16"	THRUST	28,500	20,100	15,400	7,840	35,600	25,100	19,250	9,800	42,700	30,200	23,100	11,750	49,800	35,200	26,900	13,700	56,900	40,200	30,800	15,700
	AREA	7½	5	4	2	9	6½	5	2½	11	8	6	3	12½	9	7	3½	14½	10½	8	4
18"	THRUST	36,000	25,500	19,500	9,950	45,000	31,800	24,400	12,450	54,000	38,200	29,200	14,950	63,000	43,600	34,100	17,400	72,000	50,900	39,000	19,900
	AREA	9	8½	5	2½	11½	8	6	3	14	10	7½	4	16	11	9	4½	18	13	10	5
20"	THRUST	44,500	31,500	24,100	12,250	55,500	39,300	30,100	15,300	66,600	47,200	36,100	18,400	77,700	55,000	42,200	21,500	88,800	62,900	48,200	24,500
	AREA	11	8	6	3	14	10	7½	4	17	12	9	4½	19½	14	11	5½	22	16	12	6
24"	THRUST	64,000	45,250	34,700	17,600	80,000	56,600	43,300	22,100	96,000	67,900	52,000	26,400	112,000	79,200	61,700	30,800	128,000	90,500	69,400	35,300
	AREA	16	11½	9	4½	20	14½	11	5½	24	17	13	6½	29	20	16	8	33	23	17½	9

THRUST BLOCK TABLE



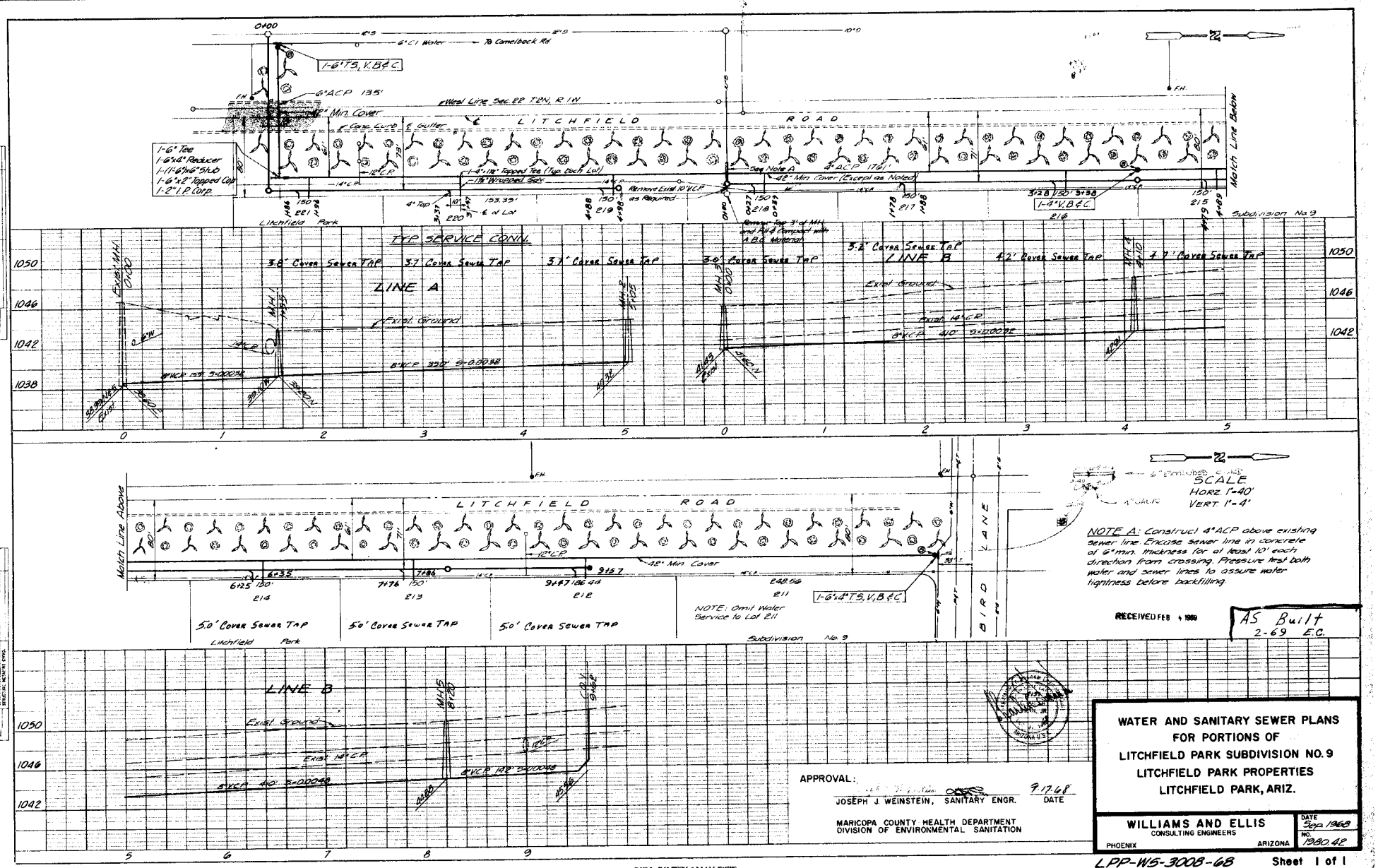
(E 4.5) SERVICE CONNECTION

JOHN CAROLLO ENGINEERS
PHOENIX – BERKELEY

LITCHFIELD PARK SERVICE COMPANY
WATER DISTRIBUTION MAINS

DETAIL SHEET WATER MAIN DETAILS

75688 1442 H — SHEET No. 6 of 6



RECEIVED FEB 4 1969

AS Built
2-69 E.C.

APPROVAL:

JOSEPH J. WEINSTEIN, SANITARY ENGR. — DATE 9.17.68

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

WATER AND SANITARY SEWER PLANS FOR PORTIONS OF LITCHFIELD PARK SUBDIVISION NO. 9 LITCHFIELD PARK PROPERTIES LITCHFIELD PARK, ARIZ.

WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA

DATE Sep 1968
NO. 1980.42

LPP-WS-3008-68

Sheet 1 of 1

WATER AND SANITARY SEWER PLANS

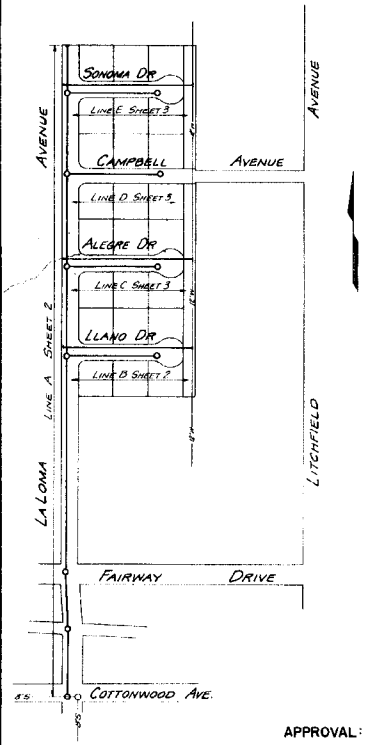
LITCHFIELD PARK SUBDIVISION NO. 10

FOR

LITCHFIELD PARK LAND

AND

DEVELOPMENT COMPANY



KEY MAP
No Scale

WILLIAMS and ELLIS
CONSULTING ENGINEERS & ARCHITECTS
PHOENIX — ARIZONA

APPROVAL:

JOSEPH J. WEINSTEIN, SANITARY ENGR. — DATE

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

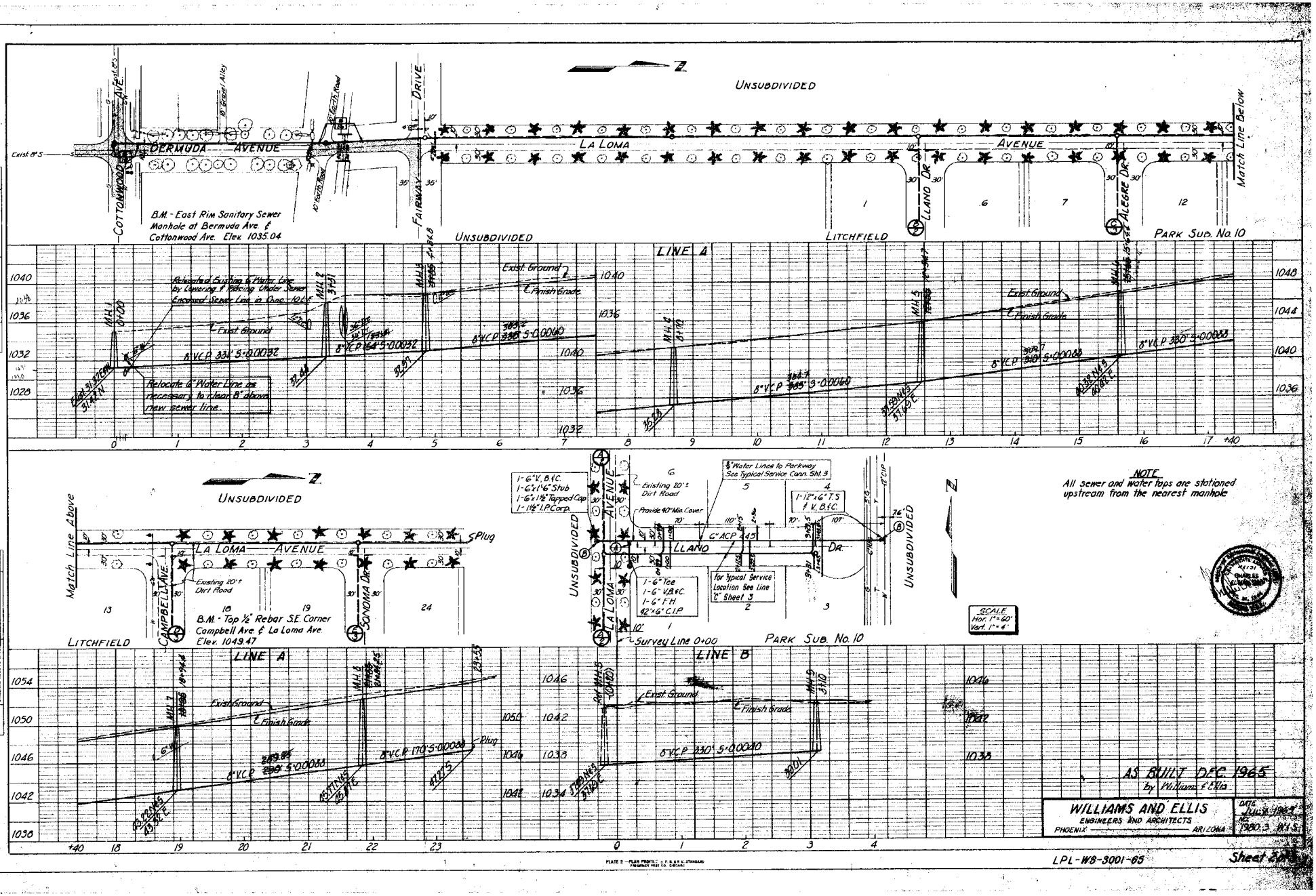
	N. SERVICE WITH N. PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE		Ronan Weikel	
MOUNTAIN STATES TEL & TEL CO		Elmo Parkman	
LITCHFIELD PARK SERVICE CO		Carroll Parkman	

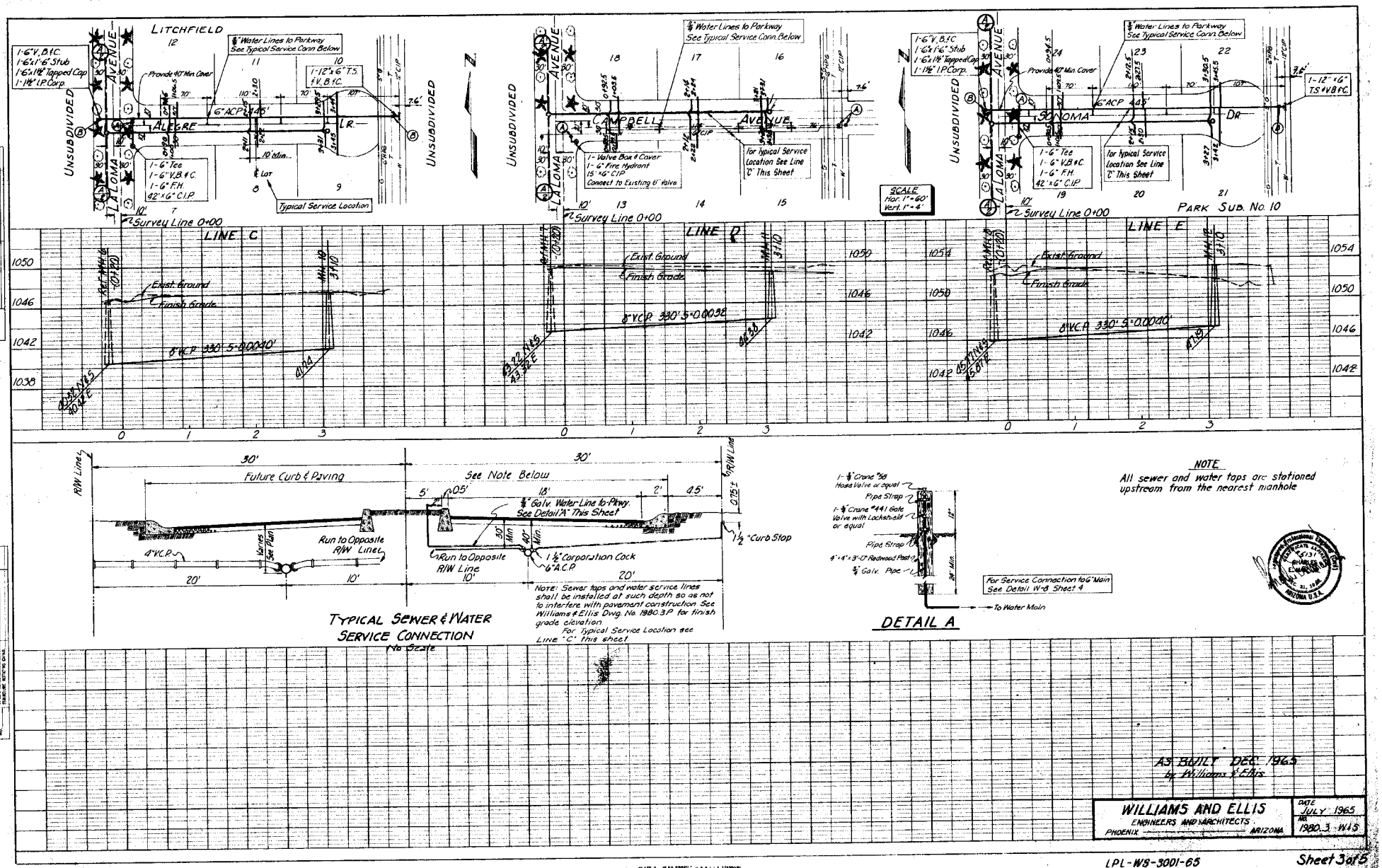
GENERAL NOTES

1. SANITARY SEWER MANHOLES, CLEANOUTS AND WATER VALVE BOXES WHICH FALL IN PAVEMENT AREAS ARE TO BE BUILT TO TOP OF FUTURE PAVEMENT SUBGRADE, (FOR TOP OF FUTURE PAVEMENT SUBGRADE SEE WILLIAMS AND ELLIS DRAWING NO. 1965-S-P2). THE FRAMES AND COVERS ARE TO BE FURNISHED BY THE SEWER AND WATER LINE CONTRACTOR AND SET LOOSELY IN PLACE. PAVING CONTRACTOR WILL BRING MANHOLES, CLEANOUTS AND WATER VALVE BOXES TO FINISH GRADE AND SET FRAMES AND COVERS IN ACCORDANCE WITH APPLICABLE CITY OF PHOENIX STANDARDS. TO PREVENT CONFLICT BETWEEN WATER AND SEWER LINE CONSTRUCTION, THE SEWER LINE IS TO BE INSTALLED PRIOR TO THE WATER LINE AND WATER SERVICES.
2. IT IS EXPECTED THAT THE ARIZONA PUBLIC SERVICE COMPANY AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY WILL INSTALL THEIR UTILITY LINES AFTER THE WATER AND SEWER LINES ARE INSTALLED. HOWEVER, IT WILL BE THE WATER AND SEWER LINE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE ARIZONA PUBLIC SERVICE COMPANY AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY AND COORDINATE CONSTRUCTION OPERATIONS TO PREVENT DAMAGE TO THE VARIOUS UTILITIES.
3. WATER METERS AND WATER METER BOXES WILL BE INSTALLED BY LITCHFIELD PARK SERVICE COMPANY.
4. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION, BOTH HORIZONTALLY AND VERTICALLY, OF ALL UTILITY CROSSINGS BY OPEN TRENCHING FAR ENOUGH IN ADVANCE OF PIPE LAYING TO PERMIT GRADE OR LINE CHANGE IF NECESSARY. ANY DAMAGE TO UTILITIES CAUSED BY THE CONTRACTOR'S OPERATIONS WILL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AND THE OWNING UTILITY AT THE EXPENSE OF THE CONTRACTOR.
5. AN ACCURATE "AS BUILT" SET OF PLANS WILL BE FURNISHED THE PAVING CONTRACTOR AND UTILITY COMPANIES PRIOR TO THE START OF THEIR CONSTRUCTION OPERATIONS.

AS BUILT DEC 1965
by Williams & Ellis

REVISIONS
SURVEY
LEGEND
DRAWN
CHECKED


UNSUBDIVIDED
BERMUDA AVENUE
LA LOMA AVENUE
COTTONWOOD AVE.
FAIRWAY DRIVE
LLANO DR.
ALEGRE DR.
Match Line Below
B.M. - East Rim Sanitary Sewer Manhole at Bermuda Ave. & Cottonwood Ave. Elev. 1035.04
LITCHFIELD
PARK SUB. No. 10
LINE A
Existing Ground
Finish Grade
Relocate & Water Line by Lowering & Placing Under Sewer Encased Sewer Line in Conc. 10 L.F.
Relocate 6" Water Line as necessary to clear 8" above new sewer line.
8" V.C.P. 331' S=0.00132
8" V.C.P. 154' S=0.00132
8" V.C.P. 330' S=0.00080
8" V.C.P. 330' S=0.00060
Match Line Above
Existing 20'± Dirt Road
B.M. - Top ½" Rebar S.E. Corner Campbell Ave. & La Loma Ave. Elev. 1049.47
CAMPBELL AVE.
SONOMA DR.
1-6"V. B&C.
1-6"x1"x6" Stub
1-6"x1½" Tapped Cap
1-1½" I.P. Corp.
⅝" Water Lines to Parkway See Typical Service Conn. Sht. 3
Provide 40" Min. Cover
1-12"x6" T.S & V. B&C.
6" ACP 145
1-6" Tee
1-6" V.B&C.
1-6" F.H.
42"x6" C.I.P.
For Typical Service Location See Line "L" Sheet 3
Survey Line 0+00
LINE B
8" V.C.P. 170' S=0.00088
8" V.C.P. 230' S=0.00040
Plug
NOTE
All sewer and water taps are stationed upstream from the nearest manhole
SCALE
Hor. 1"=60'
Vert. 1"=4'
AS BUILT DEC 1965
by Williams & Ellis
WILLIAMS AND ELLIS
ENGINEERS AND ARCHITECTS
PHOENIX ARIZONA
DATE Jul. 9 1962
JOB 1980.3 W.S.
LPL-WB-3001-65
Sheet 2 of 3



TYPICAL SEWER & WATER SERVICE CONNECTION
No Scale

Note: Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction See Williams & Ellis Dwg. No. 1980.3-P for finish grade elevation.
For Typical Service Location see Line "C" this sheet

DETAIL A

For Service Connection to 6" Main See Detail W-8 Sheet 4

NOTE
All sewer and water taps are stationed upstream from the nearest manhole

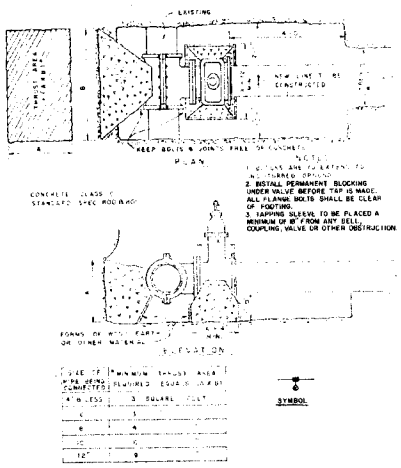
AS BUILT DEC. 1965
by Williams & Ellis

WILLIAMS AND ELLIS
ENGINEERS AND ARCHITECTS
PHOENIX ARIZONA

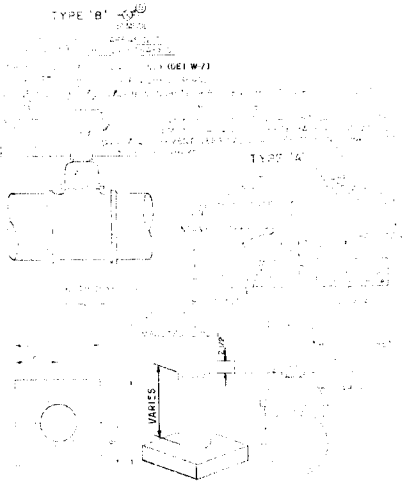
DATE JULY 1965
JOB 1980.3 W-S

LPL-WS-3001-65

Sheet 3 of 5

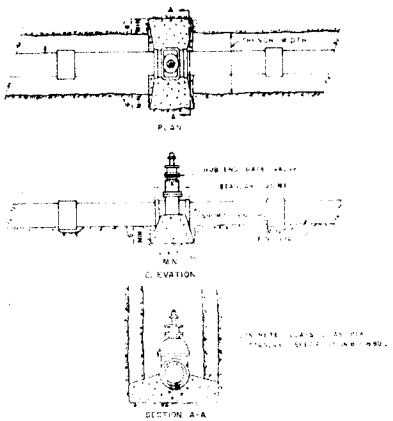


INSTALLING TAPPING SLEEVES & VALVES
DETAIL W-1

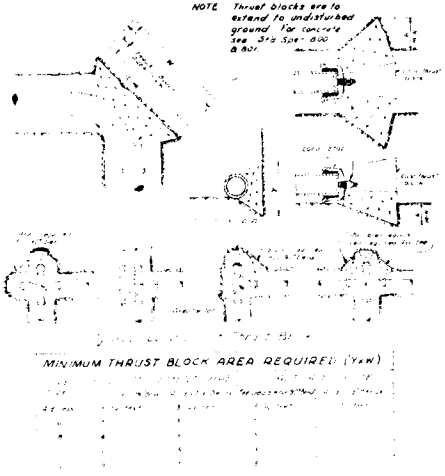


VALVE BOX WITH CAST CONCRETE BASE

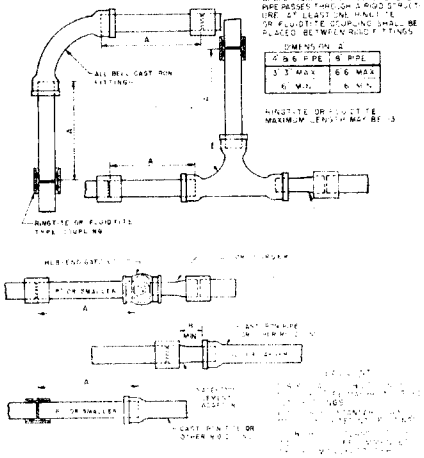
VALVE BOX INSTALLATION
DETAIL W-2



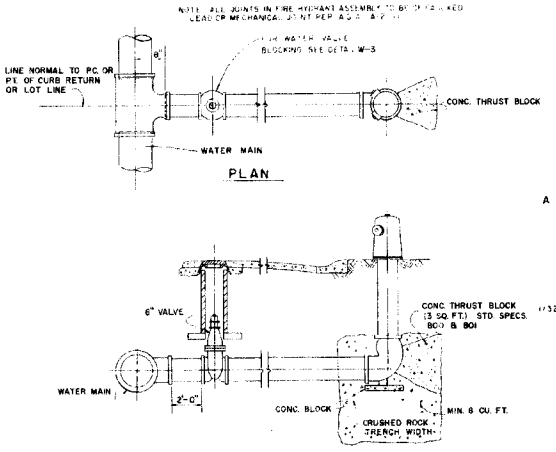
WATER VALVE BLOCKING
DETAIL W-3



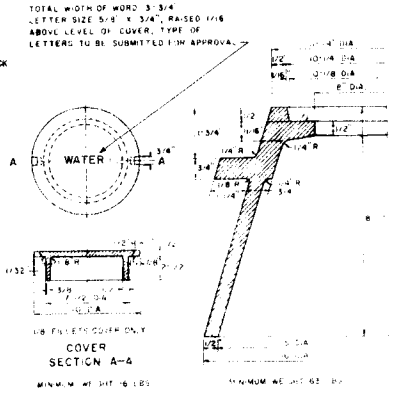
THRUST BLOCKS
DETAIL W-4



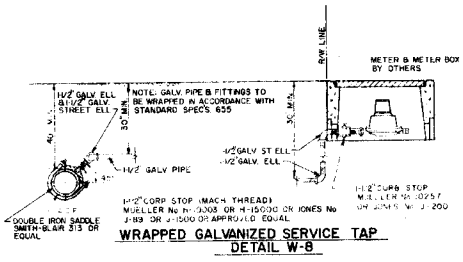
FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE
DETAIL W-5



ELEVATION
SETTING FIRE HYDRANT
DETAIL W-6



8"C.I. FRAME & COVER
DETAIL W-7



WRAPPED GALVANIZED SERVICE TAP
DETAIL W-8

NOTE: SERVICE TAPS SHALL INCLUDE ALL FITTINGS FROM WATER MAIN TO AND INCLUDING THE CURB STOP

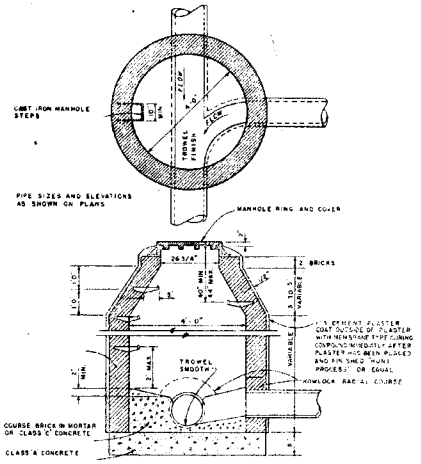
AS BUILT DEC. 1965
BY WILLIAMS AND ELLIS

WILLIAMS AND ELLIS
ENGINEERS AND ARCHITECTS
PHOENIX GLOBE YUMA

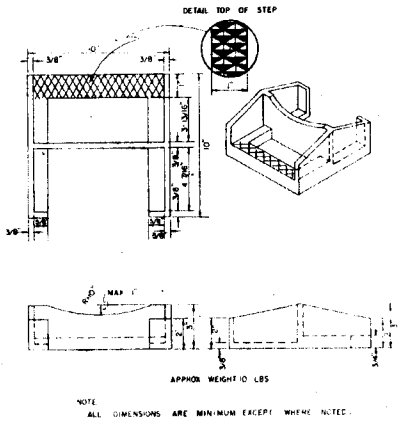
DATE JULY 1965
NO 1980.3 WS

LPL-WS-3001-65

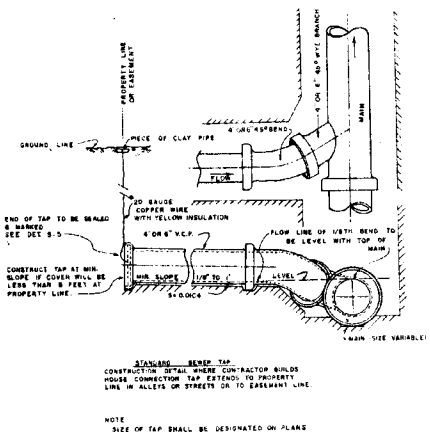
Sheet 4 of 5



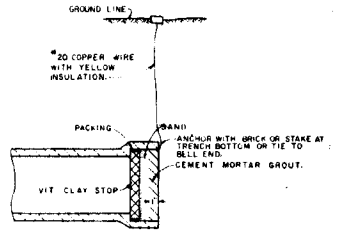
SEWER MANHOLE
DETAIL S-1



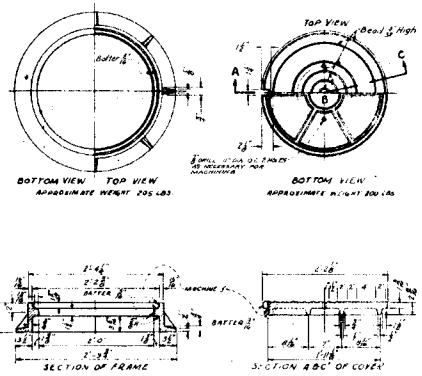
CAST IRON MANHOLE STEP
DETAIL S-3



SEWER BUILDING CONNECTION
DETAIL S-4

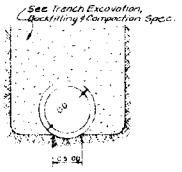


PLUG FOR SEWERS
DETAIL S-5

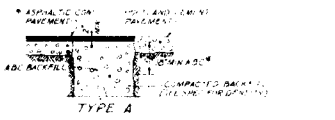


Lettering on manhole cover to be as follows: "SANITARY SEWER" Total width of individual letters to be such that letters and words are equally spaced and balanced to form complete circle. Letters to be 2" in height and raised ⅛ above level of cover. Type of letters to be submitted for approval.

24" MANHOLE FRAME & COVER
DETAIL S-2

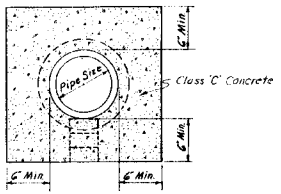


TRENCH BEDDING FOR
UNDERGROUND CONDUITS
DETAIL S-6



*The actual compacted thickness placed shall be to this minimum requirement or to thickness of the existing pavement and/or base, whichever is greater.

PAVEMENT & SURFACING REPLACEMENT
DETAIL S-7



CONCRETE ENCASEMENT FOR
VITRIFIED CLAY PIPE
DETAIL S-8

As Built Dec. 1965
By Williams and Ellis

REVISIONS
SURVEY
DESIGN
DRAWN
CHECKED

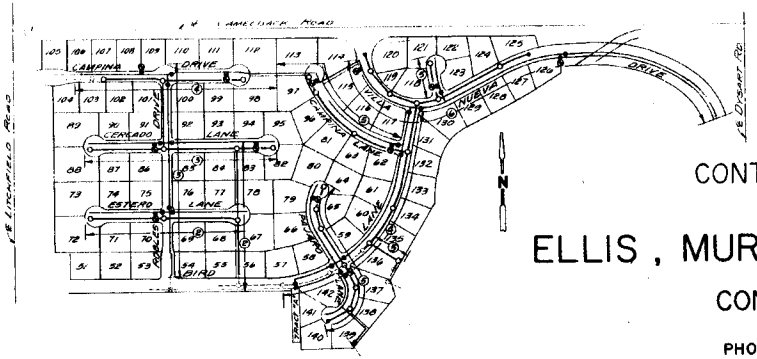
WILLIAMS AND ELLIS
ENGINEERS AND ARCHITECTS
PHOENIX GLOBE YUMA

DATE July 1965
NO. 1980 3 WP

LPL-WS-3001-65

Sheet 5 of 5

WATER AND SANITARY SEWER PLANS
LITCHFIELD PARK SUBDIVISION NO. 11
UNIT II
LITCHFIELD PARK PROPERTIES
LITCHFIELD PARK
ARIZONA



LOCATION MAP
Not To Scale

CONTRACT NO. LPP-WS-4018-73

ELLIS, MURPHY, HOLGATE AND JOHNSON

CONSULTING CIVIL ENGINEERS

PHOENIX ——— ARIZONA

GENERAL NOTES:

1. ALL WATER AND SANITARY SEWER LINE CONSTRUCTION SHALL BE IN ACCORDANCE WITH APPLICABLE CITY OF PHOENIX STANDARD DETAILS AND SPECIFICATIONS UNLESS OTHERWISE NOTED.
2. TRENCH BACKFILL AND COMPACTION FOR WATER AND SANITARY SEWER LINES IN STREET RIGHT OF WAY SHALL BE IN ACCORDANCE WITH MARICOPA COUNTY HIGHWAY DEPARTMENT SPECIAL PROVISIONS FOR INSTALLATION OF UNDERGROUND UTILITIES, DATED FEBRUARY, 1972.
3. SANITARY SEWER MANHOLES WHICH FALL IN PAVEMENT AREAS ARE TO BE BUILT TO 8" BELOW THE TOP OF FUTURE PAVEMENT SUBGRADE. (SEE ELLIS, MURPHY, HOLGATE & JOHNSON, INC. DRAWING, CONTRACT NO. LPP-P-3005-73). MANHOLES SHALL BE PROTECTED BY ONE-HALF INCH MINIMUM THICK STEEL COVER PLATES WHICH THE WATER AND SEWER LINE CONTRACTOR SHALL OBTAIN FROM THE PAVING CONTRACTOR. WATER VALVE BOXES AND FRAMES AND COVERS FOR MANHOLES AND WATER VALVES ARE TO BE FURNISHED BY THE WATER AND SEWER LINE CONTRACTOR FOR INSTALLATION BY THE PAVING CONTRACTOR AND SHALL NOT BE DELIVERED TO THE SITE OF THE WORK UNTIL CALLED FOR BY THE PAVING CONTRACTOR.
4. THE WATER AND SEWER LINE CONTRACTOR SHALL COMPLETE ALL SANITARY SEWER MANHOLES AND WATER VALVE INSTALLATIONS THAT FALL OUTSIDE PAVEMENT AREAS IN ACCORDANCE WITH THE PLANS INCLUDING THE SETTING OF WATER VALVE BOXES AND ALL FRAMES AND COVERS.
5. THE SEWER LINE IS TO BE INSTALLED PRIOR TO THE WATER LINE AND WATER SERVICES TO PREVENT CONFLICT BETWEEN WATER AND SEWER LINE CONSTRUCTION.
6. AT ALL WATER AND SEWER LINE CROSSINGS WHERE THE VERTICAL SEPARATION IS LESS THAN TWO FEET CLEAR, THE CONTRACTOR SHALL ENCASE THE SEWER LINE IN CONCRETE OF SIX INCH MINIMUM THICKNESS FOR A DISTANCE OF AT LEAST TEN FEET IN EACH DIRECTION FROM THE CROSSING, OR SHALL CONSTRUCT THE SEWER OF CAST IRON WITH LEADED OR MECHANICAL JOINTS FOR THE SAME DISTANCE SPECIFIED HEREIN.
7. WATER METERS AND WATER METER BOXES WILL BE INSTALLED BY LITCHFIELD PARK SERVICE CO.
8. WATER METER BOXES AND COVERS FOR 2" BLOW-OFF SHALL BE FURNISHED AND INSTALLED BY WATER AND SEWER LINE CONTRACTOR AFTER CONSTRUCTION OF CONCRETE CURBS BY THE PAVING CONTRACTOR.
9. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION, BOTH HORIZONTALLY AND VERTICALLY, OF ALL UTILITY CROSSINGS BY OPEN TRENCHING FAR ENOUGH IN ADVANCE OF PIPE LAYING TO PERMIT GRADE OR LINE CHANGE IF NECESSARY. ANY DAMAGE TO UTILITIES CAUSED BY THE CONTRACTOR'S OPERATIONS WILL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AND THE OWNING UTILITY AT THE EXPENSE OF THE CONTRACTOR.
10. IT IS EXPECTED THAT ARIZONA PUBLIC SERVICE CO. AND MOUNTAIN BELL WILL INSTALL THEIR UTILITY LINES AFTER THE WATER AND SEWER LINES ARE INSTALLED. HOWEVER, IT WILL BE THE WATER AND SEWER LINE CONTRACTOR'S RESPONSIBILITY TO CONTACT ARIZONA PUBLIC SERVICE CO. AND MOUNTAIN BELL AND COORDINATE CONSTRUCTION OPERATIONS TO PREVENT DAMAGE TO THE VARIOUS UTILITIES.
11. TO AVOID CONFLICT, ALL A.C.P. SLEEVES AND P.V.C. SLEEVES FOR FUTURE PARKWAY SPRINKLER SYSTEMS SHALL BE INSTALLED AFTER COMPLETION OF WATER AND SANITARY SEWER LINES AND SERVICES UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
12. EXISTING WATER SERVICE LINES AND SEWER TAPS TO LOTS 51 THROUGH 57 AND 103 THROUGH 106 WERE INSTALLED UNDER CONTRACT NO. LPP-WS-3006-68.

	No Services Within Project	Plans Reviewed By
ARIZONA PUBLIC SERVICE		Ken Pearl
MOUNTAIN STATES TEL. CO.		Bill Cutellier
LITCHFIELD PARK SERVICE CO.		Jeff Bonar

11-21-73 Q.S.

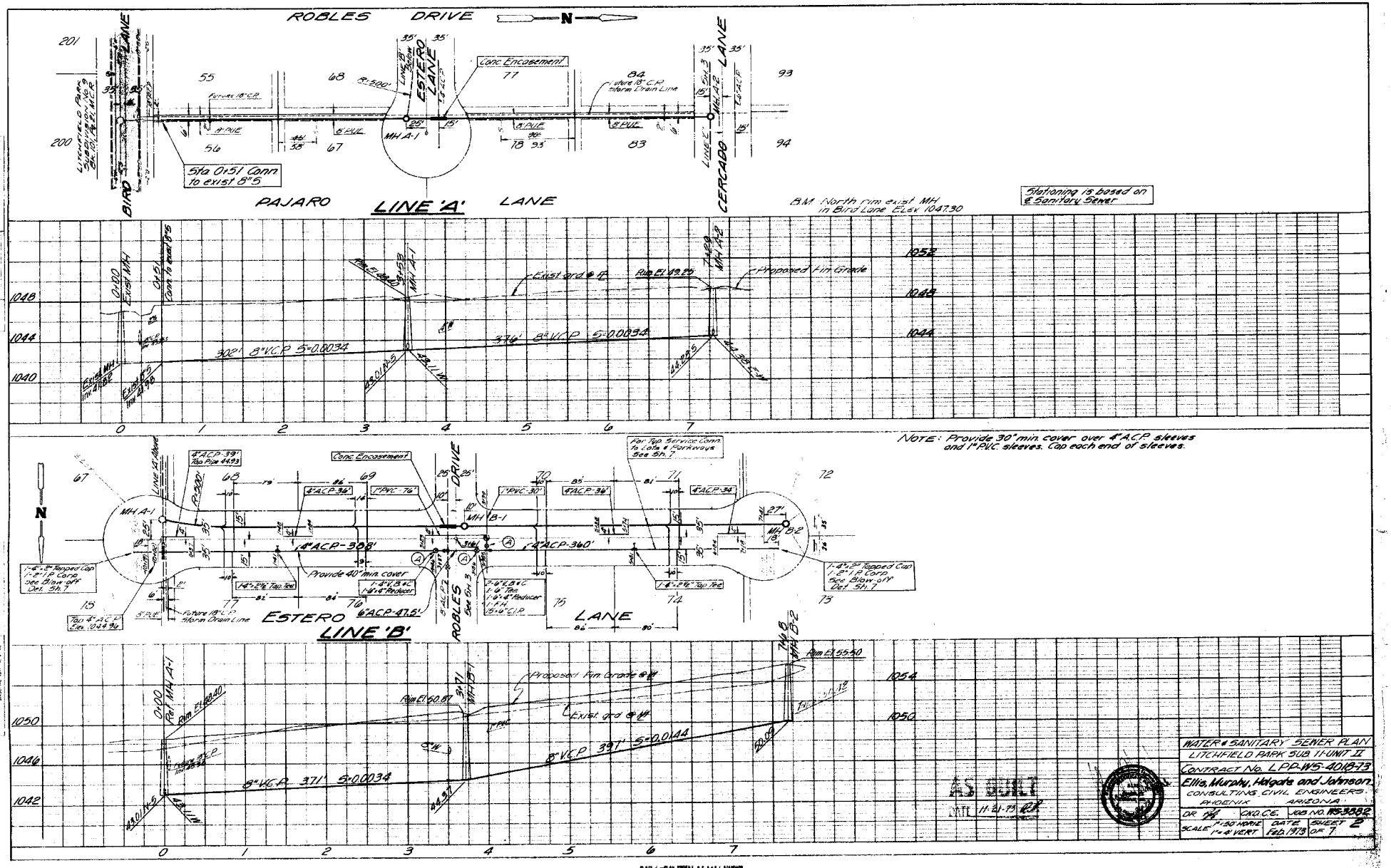
APPROVAL: _____ Date

SANITARY ENGINEER
Maricopa County Health Department
Division of Environmental Sanitation

Plans Revised Apr. 24, 1973 BF

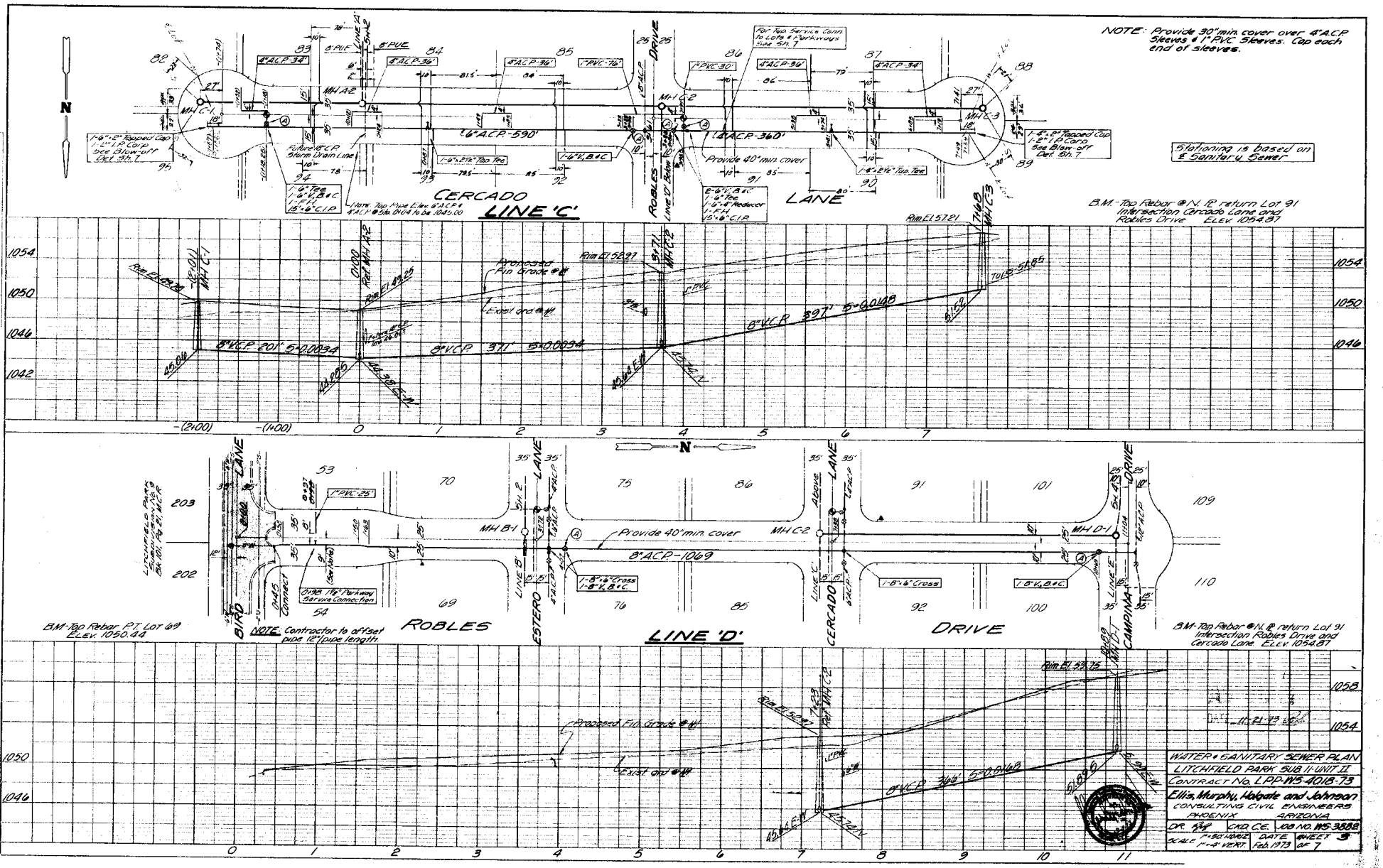
SHEET 1 OF 7

Job No. WS-3882



WATER & SANITARY SEWER PLAN
LITCHFIELD PARK SUB 11-UNIT II
CONTRACT No. LPD-WS-4018-79
Ellis, Murphy, Holgate and Johnson
CONSULTING CIVIL ENGINEERS
PHOENIX ARIZONA
DR ___ CKD. C.E. ___ JOB NO. 115-3082
SCALE 1"=30' HORIZ 1"=6' VERT
DATE Feb. 1979
SHEET 2 OF 7

A.S. GURLI
REG. 11-21-79


NOTE: Provide 30" min. cover over 4" A.C.P. Sleeves & 1" P.V.C. Sleeves. Cap each end of sleeves.
Stationing is based on ℄ Sanitary Sewer
CERCADO LINE 'C'
LANE
ROBLES DRIVE
LINE 'D'
MH A-2
MH C-1
MH C-2
MH C-3
MH A-1
MH B-1
MH C-2
MH D-1
Provide 40" min. cover
Proposed Fin Grade @ ℄
Exist. Grd @ ℄
8"VCP 201' S=0.0094
8"VCP 371' S=0.0094
8"VCP 397' S=0.0148
8"VCP 368' S=0.0148
8"ACP-1069
B.M.-Top Rebar @ N. ℙ return Lot 91 Intersection Cercado Lane and Robles Drive Elev. 1054.87
B.M.-Top Rebar P.T. Lot 69 Elev. 1050.44
NOTE: Contractor to offset pipe 12" pipe length
BIRD LANE
ESTERO LANE
CERCADO LANE
CAMPANA DRIVE
ROBLES DRIVE
LINE 'D'
LITCHFIELD PARK SUB II UNIT II
WATER & SANITARY SEWER PLAN
LITCHFIELD PARK SUB II-UNIT II
CONTRACT No. LPP-115-4018-73
Ellis, Murphy, Holgate and Johnson
CONSULTING CIVIL ENGINEERS
PHOENIX ARIZONA
DR. RAH CHD. CE. JOB NO. 115-3888
SCALE 1"=50' HORIZ. 1"=5' VERT. DATE Feb 1973 SHEET 3 OF 7
PLATE 2 — PLAN PROFILE

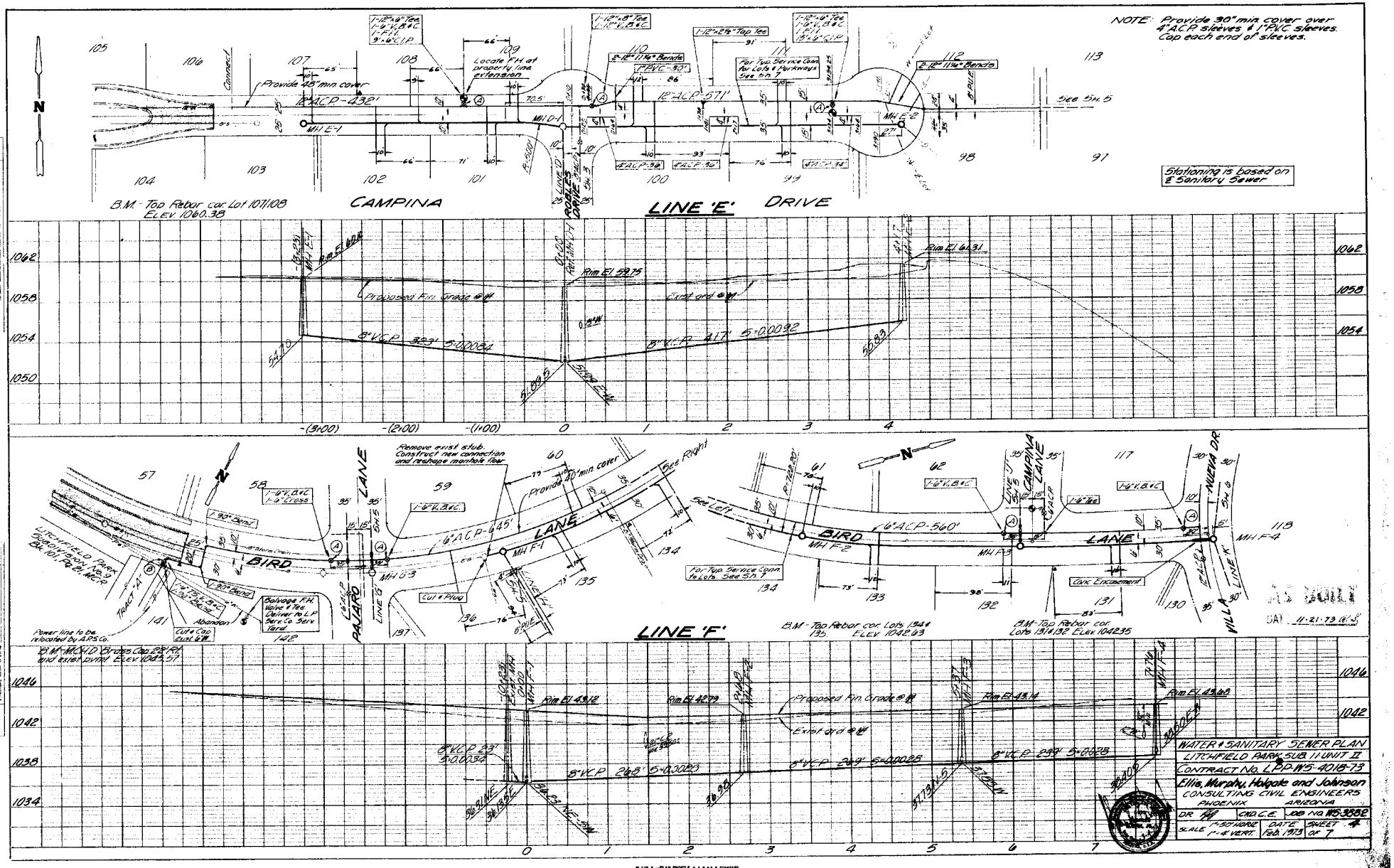
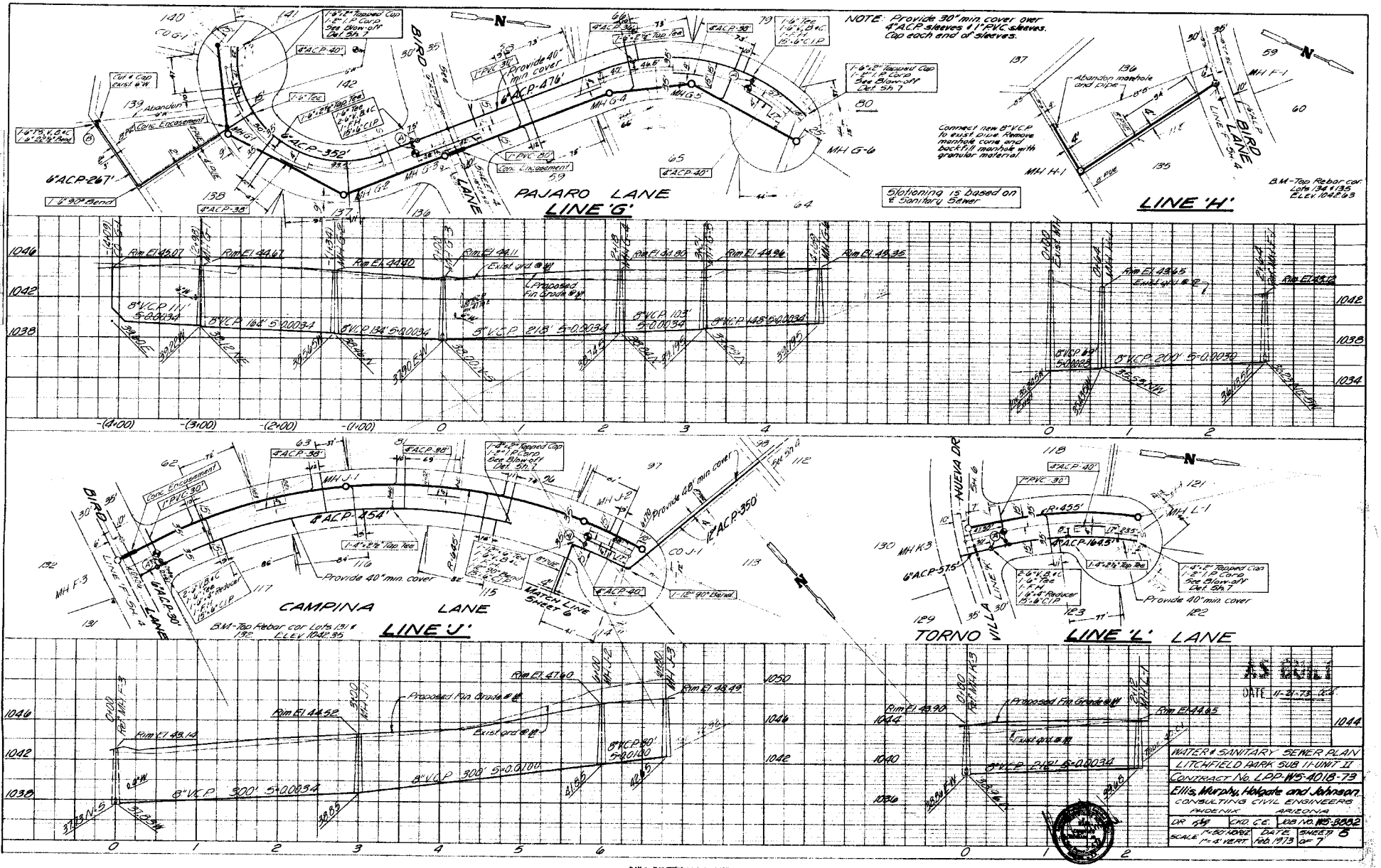
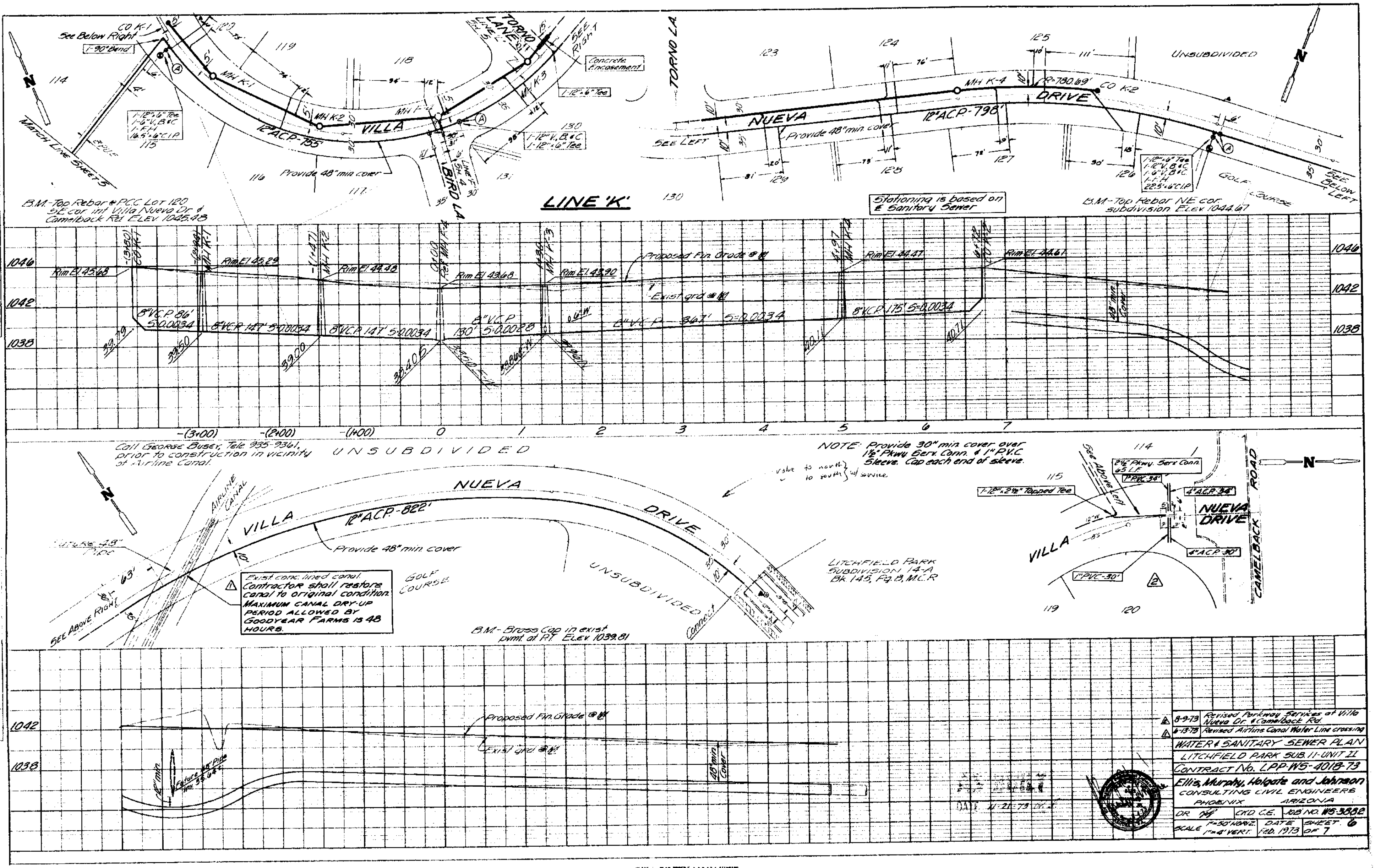
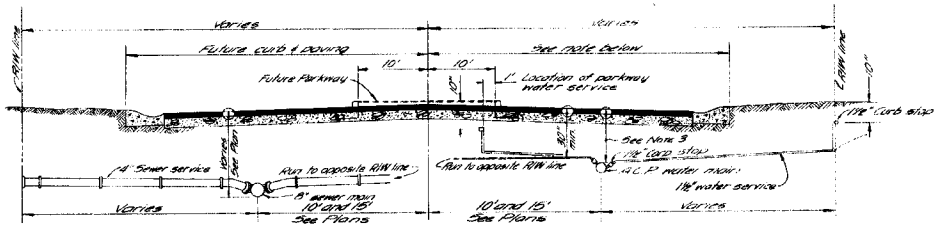


PLATE F — PLAN PROFILE C. F. & A. E. STANDARD


PAJARO LANE
LINE 'G'
LINE 'H'
BIRD LANE
CAMPINA LANE
LINE 'J'
TORNO VILLA
LINE 'L'
NUEVA DR
NOTE: Provide 30" min. cover over 4" A.C.P. sleeves & 1" P.V.C. sleeves. Cap each end of sleeves.
Sloping is based on 8" Sanitary Sewer
Connect new 8" V.C.P. to exist. pipe. Remove manhole cone and backfill manhole with granular material.
B.M.-Top Rebar cor. Lots 134 & 135 ELEV. 1042.03
B.M.-Top Rebar cor Lots 131 & 132 ELEV. 1042.95
Provide 40" min. cover
Provide 30" min. cover
Abandon manhole and pipe
Cut & Cap Exist. 6" W.
8' P.U.E.
Conc. Encasement
Exist grd @ M
Proposed Fin Grade @ M
Rim El 45.07
Rim El 44.67
Rim El 44.80
Rim El 44.11
Rim El 43.80
Rim El 44.96
Rim El 45.35
Rim El 44.65
Rim El 47.60
Rim El 48.49
Rim El 44.52
Rim El 49.14
Rim El 48.90
Rim El 44.65
MH G-1
MH G-2
MH G-3
MH G-4
MH G-5
MH G-6
MH H-1
MH F-1
MH F-3
MH J-1
MH J-2
MH K-3
MH L-1
6"ACP-267'
6"ACP-352'
6"ACP-476'
8"ACP-454'
12"ACP-350'
6"ACP-517'
8"VCP 111' S=0.0034
8"VCP 162' S=0.0034
8"VCP 194' S=0.0034
8"VCP 218' S=0.0034
8"VCP 103' S=0.0034
8"VCP 148' S=0.0034
8"VCP 69' S=0.0028
8"VCP 200' S=0.0030
8"VCP 300' S=0.0034
8"VCP 80' S=0.0130
8"VCP 300' S=0.0100
8"VCP 210' S=0.0034
PROFILE
PLAN
WATER & SANITARY SEWER PLAN
LITCHFIELD PARK SUB I-UNIT II
CONTRACT No. LPP-WS-4018-73
Ellis, Murphy, Holgate and Johnson
CONSULTING CIVIL ENGINEERS
PHOENIX ARIZONA
DR. CKD. C.E. JOB NO. WS-8002
SCALE 1"=50' HORIZ. 1"=5' VERT.
DATE Feb. 1973
SHEET 5 OF 7
DATE 11-21-73


LINE 'K'
VILLA NUEVA DRIVE
TORNO LANE
BIRD LA.
12"ACP-755'
12"ACP-798'
12"ACP-822'
Provide 48" min cover
Stationing is based on ℄ Sanitary Sewer
B.M.-Top Rebar @ PCC Lot 120 S.E. cor. int. Villa Nueva Dr. & Camelback Rd. ELEV 1045.48
B.M.-Top Rebar NE cor. subdivision ELEV 1044.67
B.M.-Brass Cap in exist. pvmt. at P.T. ELEV. 1039.81
Call George Buser, Tele. 935-9361, prior to construction in vicinity of Airline Canal.
NOTE: Provide 30" min cover over 1½" Pkwy Serv. Conn. & 1" P.V.C. Sleeve. Cap each end of sleeve.
Exist. conc. lined canal. Contractor shall restore canal to original condition. MAXIMUM CANAL DRY-UP PERIOD ALLOWED BY GOODYEAR FARMS IS 48 HOURS.
LITCHFIELD PARK SUBDIVISION 14-A Bk 145, Pg. 8, M.C.R.
UNSUBDIVIDED
GOLF COURSE
CAMELBACK ROAD
Match Line Sheet 5
Proposed Fin. Grade @ ℄
Exist. grd @ ℄
8-9-73 Revised Parkway Services at Villa Nueva Dr. & Camelback Rd.
6-13-73 Revised Airline Canal Water Line crossing
WATER & SANITARY SEWER PLAN
LITCHFIELD PARK SUB. 11-UNIT 21
CONTRACT No. LPP-WS-4018-73
Ellis, Murphy, Holgate and Johnson
CONSULTING CIVIL ENGINEERS
PHOENIX ARIZONA
JOB NO. WS-3382
SCALE 1"=50' HORIZ. 1"=4' VERT.
DATE Feb. 1973
SHEET 6 OF 7



TYPICAL SEWER AND WATER SERVICE CONNECTION

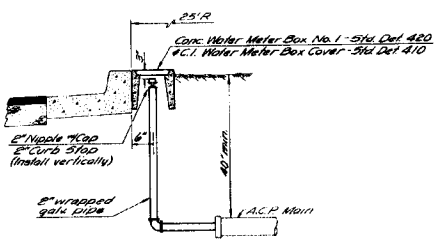
NOTE: 1. Sewer taps and water service lines shall be installed at such depths so as not to interfere with pavement construction. See Ellis, Murphy, Holgate And Johnson paving plans for finish grade elevations.

2. Locate sewer taps and water service lines as follows unless otherwise shown or directed by the Engineer:

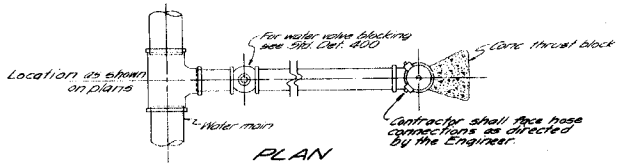
a. Water service line on center line of lot over sewer tap a minimum distance of ten feet downstream from water service line.

b. 1" and 2" water service lines to parkways where indicated on the plans.

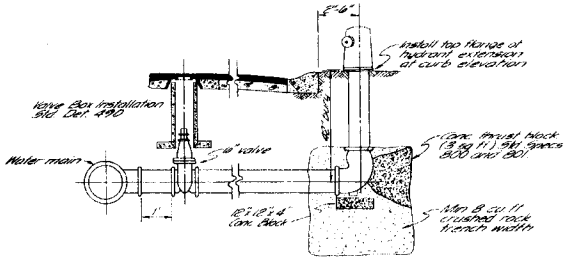
3. Contractor shall provide 40" or 48" minimum cover from proposed finish grade to top of water main as called for on the plans.



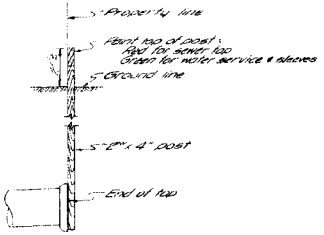
DETAIL - 2" BLOW-OFF



PLAN



ELEVATION



MARKER FOR END OF SEWER TAP, WATER SERVICES & SLEEVES

SETTING FIRE HYDRANT

ALL JOINTS IN FIRE HYDRANT ASSEMBLY TO BE OF CAULKED LEAD OR MECHANICAL JOINT PER A.S.A. - A - 21.11

11-21-73 RD

REVISIONS

SURVEY
DESIGN
DRAWN
CHECKED

WATER & SANITARY SEWER PLAN
LITCHFIELD PARK SUB. II - UNIT II
CONTRACT NO. L.P.P.-WS-4018-73
Ellis, Murphy, Holgate and Johnson
CONSULTING CIVIL ENGINEERS
PHOENIX ARIZONA
DR. [illegible] CKD C.E. JOB NO. WS-3882
SCALE No Scale DATE Feb. 1973 SHEET No. 7

WATER AND SANITARY SEWER PLANS

LITCHFIELD PARK SUBDIVISION NO. 11

UNIT ONE

LITCHFIELD PARK PROPERTIES

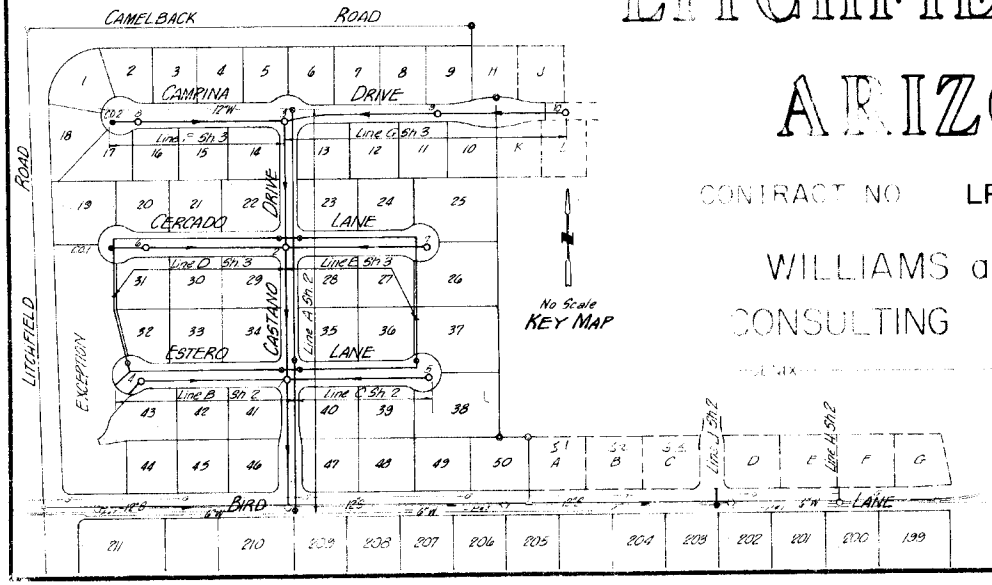
LITCHFIELD PARK

ARIZONA

CONTRACT NO LPP–WS–3006–68

WILLIAMS and ELLIS

CONSULTING ENGINEERS



APPROVAL:

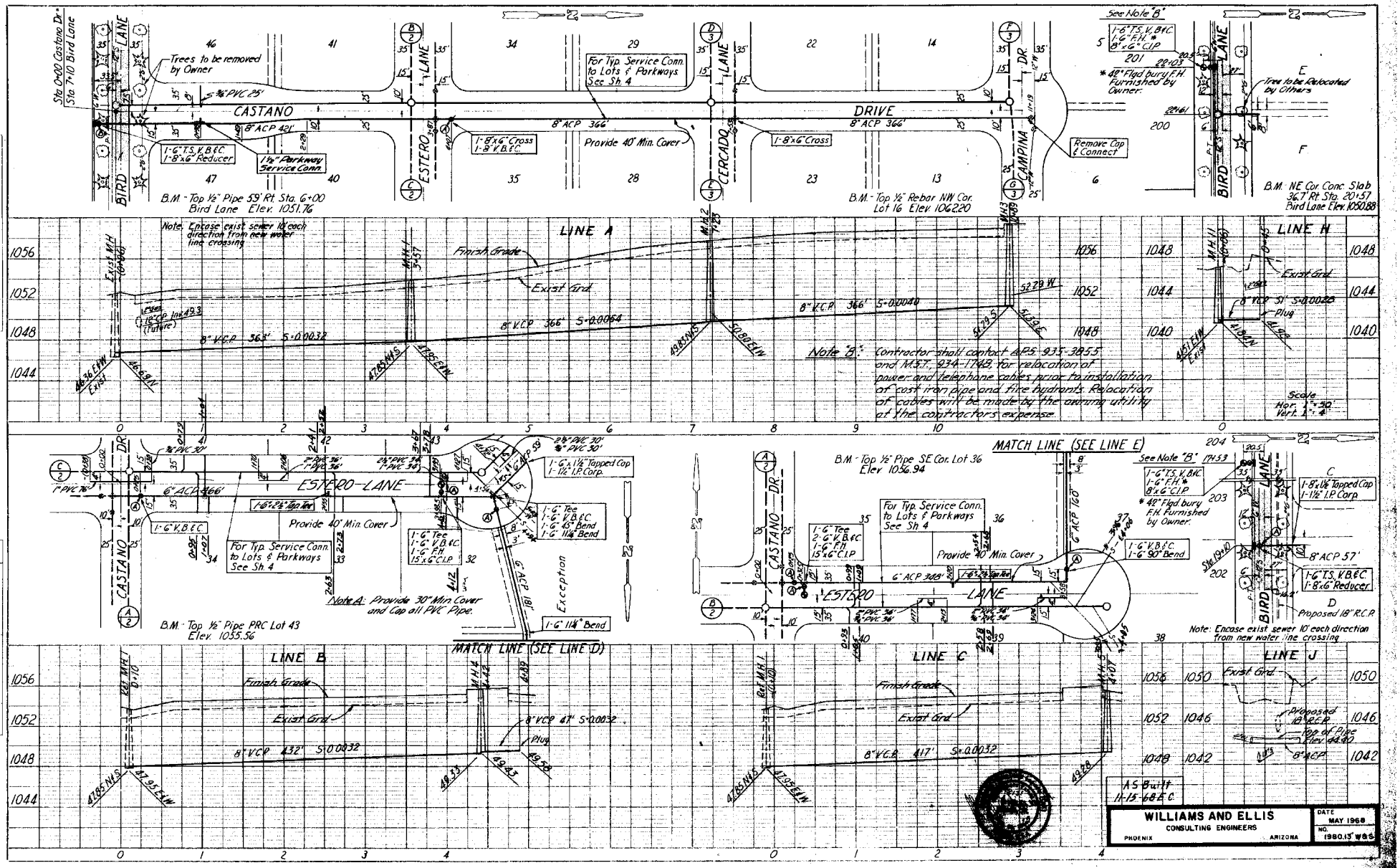
JOSEPH J. WEINSTEIN, SANITARY ENGR. DATE

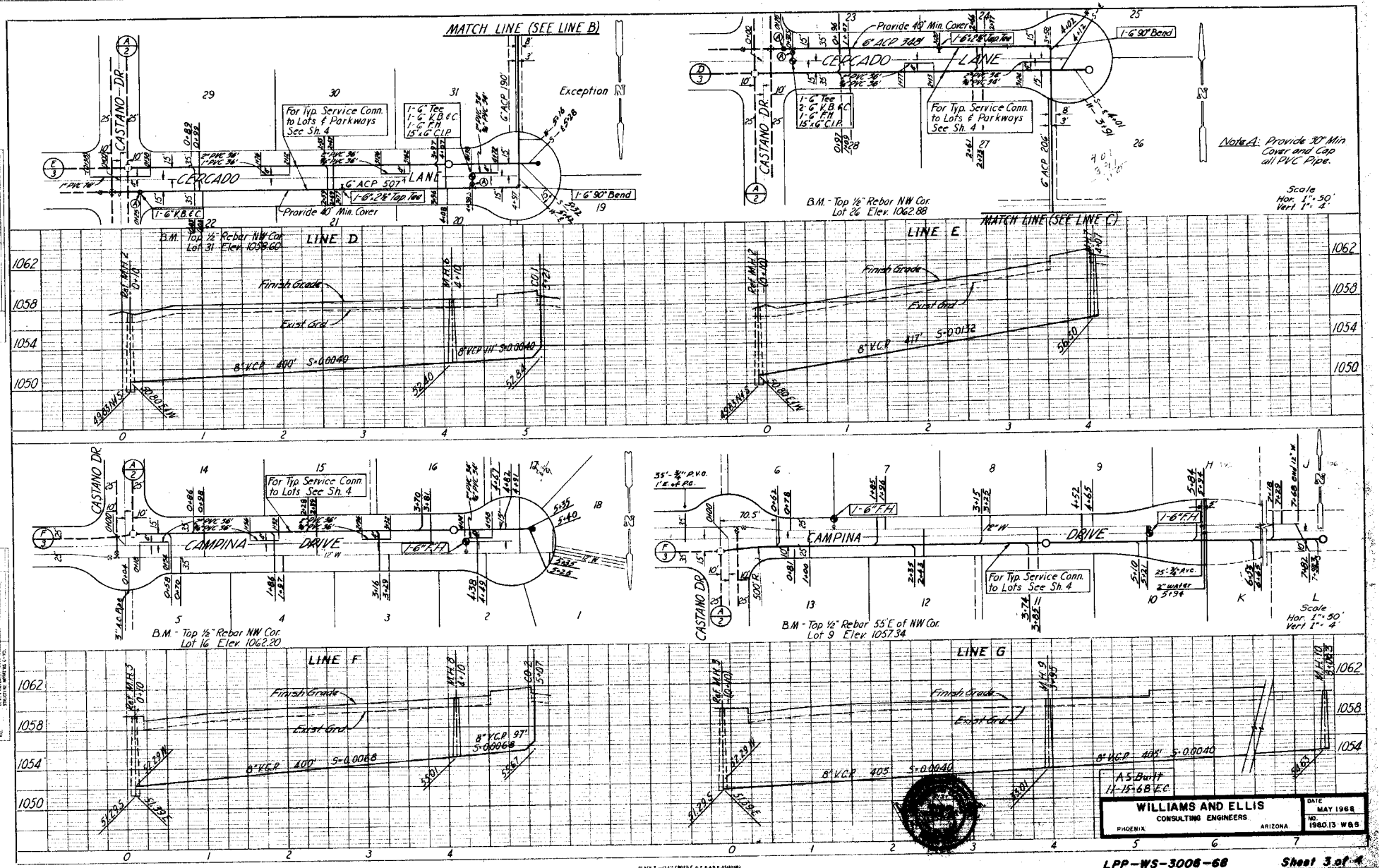
MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

AS Built
11-15-68 E.C.

	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE		M.A. Reed	
MOUNTAIN STATES TEL. & TEL. CO.		C.R. Johnson	
LITCHFIELD PARK SERVICE CO.		Carroll Parkman	

RECEIVED JAN 2 1969


Sta 0+00 Castano Dr.
Sta 7+10 Bird Lane
CASTANO DRIVE
8" ACP 366'
8" ACP 42'
BIRD LANE
ESTERO LANE
CERCADO LANE
CAMPINA DR.
Trees to be removed by Owner
For Typ. Service Conn. to Lots & Parkways See Sh. 4
1-8"x6" Cross
Provide 40" Min. Cover
1-8"x6" Cross
Remove Cap & Connect
See Note "B"
1-6" T.S. V. B.F.C.
1-6" F.H.
8"x6" C.I.P.
* 42" Rgd bury F.H. Furnished by Owner.
Tree to be Relocated by Others
1-6" T.S. V. B.F.C.
1-8"x6" Reducer
1½" Parkway Service Conn.
B.M. - Top ½" Pipe 59' Rt. Sta. 6+00 Bird Lane Elev. 1051.76
B.M. - Top ½" Rebar NW Cor. Lot 16 Elev. 1062.20
B.M. NE Cor. Conc. Slab 367' Rt. Sta. 20+57 Bird Lane Elev. 1050.88
LINE A
LINE N
Note: Encase exist sewer 10' each direction from new water line crossing
Finish Grade
Exist Grd.
Exist MH
8" V.C.P. 366' S=0.0032
8" V.C.P. 366' S=0.0054
8" V.C.P. 366' S=0.0040
8" R.C.P. 31' S=0.0020
Plug
Note "B": Contractor shall contact APS 935-3855 and M.S.T. 934-1748 for relocation of power and telephone cables prior to installation of cast iron pipe and fire hydrants. Relocation of cables will be made by the owning utility at the contractors expense.
Scale Hor. 1" = 30' Vert. 1" = 4'
MATCH LINE (SEE LINE E)
B.M. - Top ½" Pipe PRC Lot 43 Elev. 1055.56
B.M. - Top ½" Pipe SE Cor. Lot 36 Elev. 1056.94
1-6" Tee
2-6" V.B.F.C.
1-6" F.H.
15"x6" C.I.P.
1-6" V.B.F.C.
1-6" 90° Bend
1-6" V.B.F.C.
1-6" F.H.
15"x6" C.I.P.
1-6" Tee
1-6" V.B.F.C.
1-6" 45° Bend
1-6" 11¼° Bend
1-6"x1½" Tapped Cap
1-1½" I.P. Corp.
1-8"x1½" Tapped Cap
1-1½" I.P. Corp.
1-6" T.S. V.B.F.C.
1-8"x6" Reducer
Proposed 18" R.C.P.
Note A: Provide 30" Min Cover and Cap all PVC Pipe.
Exception
1-6" 11¼° Bend
Note: Encase exist sewer 10' each direction from new water line crossing
LINE B
LINE C
LINE J
MATCH LINE (SEE LINE D)
Finish Grade
Exist Grd.
8" V.C.P. 432' S=0.0032
8" V.C.P. 417' S=0.0032
Plug
Proposed 18" R.C.P.
Top of Pipe Elev. 44.90
8" A.C.P.
As Built 11-15-68 E.C.
WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA
DATE MAY 1968
NO. 1980.13 W&E
LPP-WS-3006-68
Sheet 2 of 4



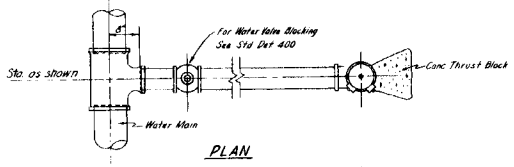
WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA

DATE MAY 1968
NO. 1980.13 W&S

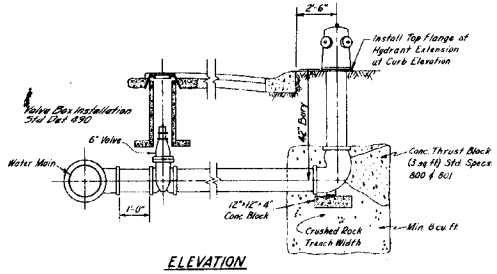
LPP-WS-3006-68

Sheet 3 of 4

NOTE: All joints in Fire Hydrant Assembly to be of Caulked Lead or Mechanical Joint per A.S.A.-A-21.11

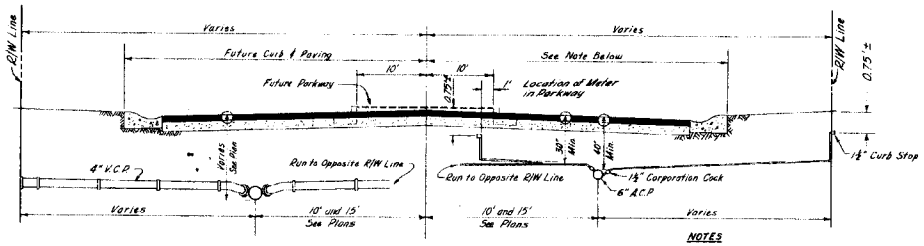


PLAN



ELEVATION

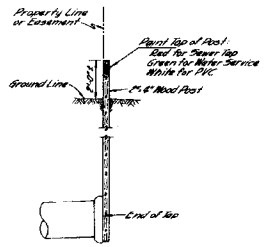
SETTING FIRE HYDRANT



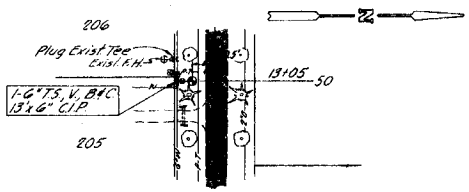
TYPICAL SEWER & WATER SERVICE CONNECTION

NOTES

1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with permanent construction. See Williams & Ellis 1980.13 P for finish grade elevations.
2. Locate sewer taps and water service lines as follows unless otherwise shown on the plans or directed by the Engineer:
   a. Water service line on centerline of lot
   b. Sewer tap a minimum distance of 10 feet downstream from water service line
   c. 1" and 2" water service lines to Parkways as indicated by Stationing.



MARKER FOR END OF SEWER TAP, WATER SERVICES AND PVC



RELOCATION OF EXISTING FIRE HYDRANT

SCALE: 1"=50'

Note: Salvage 6" Valve and deliver to Litchfield Park Service Co.

REVISIONS
SURVEY
DESIGN
DRAWN
CHECKED

WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA

DATE MAY 1968
NO. 1980.13 W & S

LPP-WS-3006-68

Sheet 4 of 4

WATER AND SEWER AS STAKED
SUB 15-B UNIT TWO

LITCHFIELD PARK, ARIZONA

WATER & SEWER PLANS

OF

LITCHFIELD PARK SUBDIVISION NO. 15-B
UNIT TWO

BENCH MARKS

B.M. No. 28-2 (easst) Mark "□" on NNW Cor of flag pole base, ℄ of Litchfield Road & Indian School Road
ELEVATION 1028.09

B.M. No. 5 Top & South end of exist. Vert. Curb on the West side of Litchfield Rd., 14+48.50 ft. South of ℄ of Indian School Rd.
ELEVATION 1019.02

B.M. No. 2 "X" in top of curb at the N. P.C. of curb return at the N.E. cor. of int. of Neolin Ave. & Sagebrush Ave.
ELEVATION 1020.64

PREPARED FOR

LITCHFIELD PARK PROPERTIES

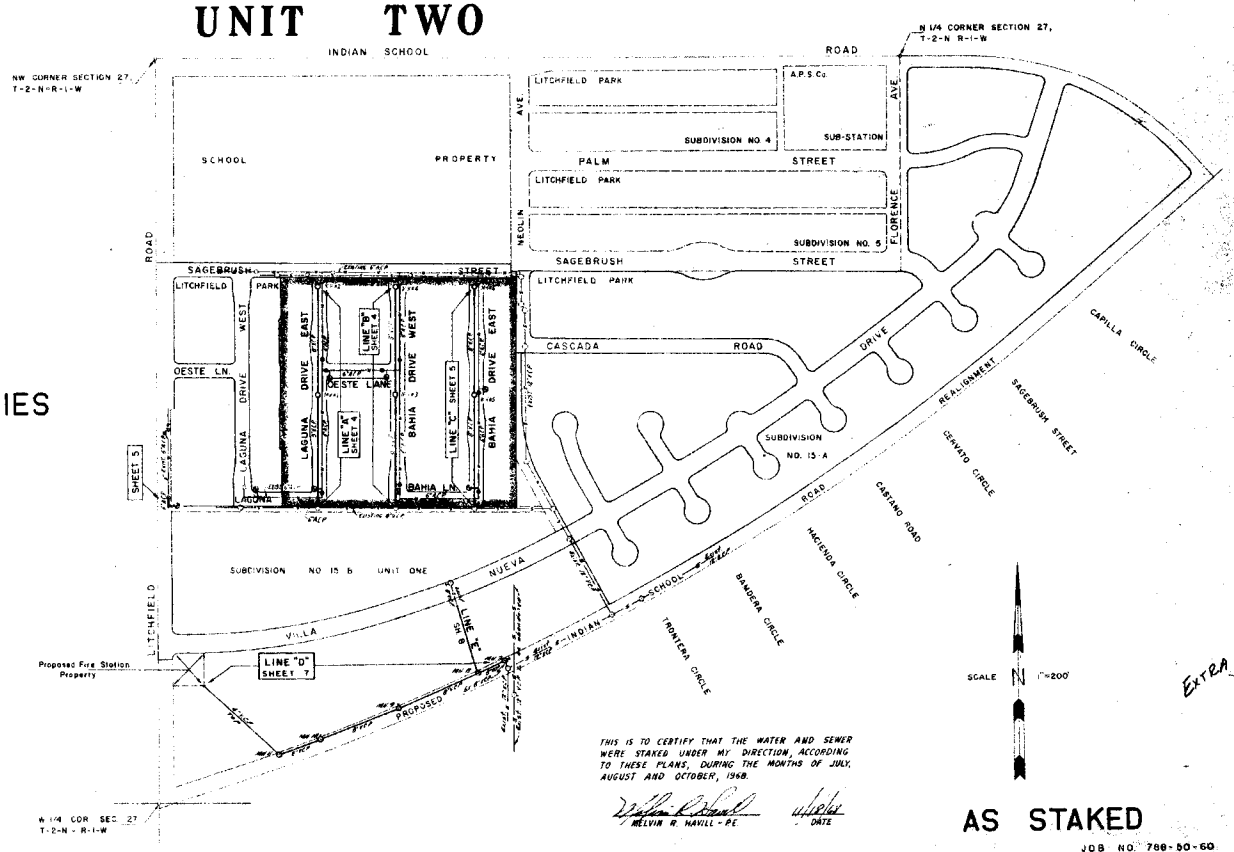
BY

HAVILL ENGINEERING CO.
3015 E THOMAS RD. 956-3210
PHOENIX, ARIZONA

CONTRACT NO. LPP-W.S. 3007(68)

Approved by Maricopa County Health Dept. (Division of Environmental Sanitation) this 22nd day of May 1968

Approved by _____
SANITARY ENGINEER



THIS IS TO CERTIFY THAT THE WATER AND SEWER WERE STAKED UNDER MY DIRECTION, ACCORDING TO THESE PLANS, DURING THE MONTHS OF JULY, AUGUST AND OCTOBER, 1968.

MELVIN R. HAVILL - P.E. DATE

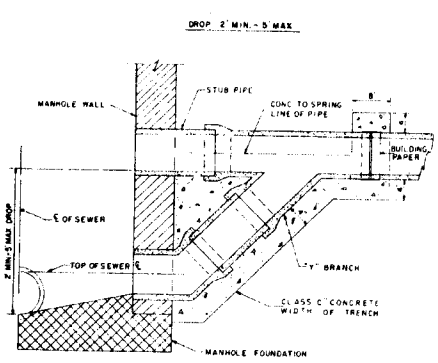
AS STAKED

JOB NO. 788-50-60

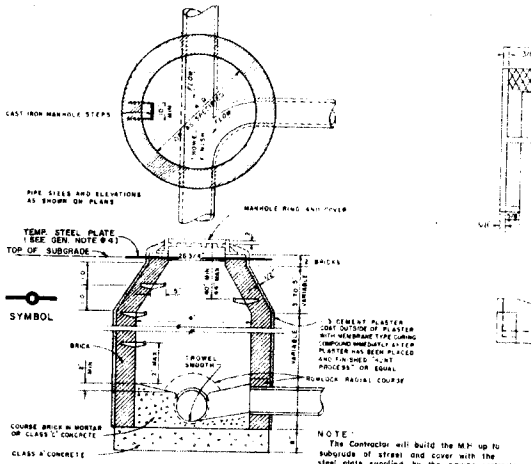
EXTRA

DATE	REVISIONS	APPROVED BY	DATE
31 July 68	LINE "D" ADDITION		

SHEET 1 OF 8 SHEETS

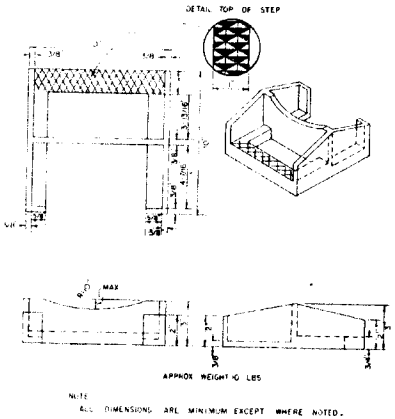


DROP SEWER CONNECTION



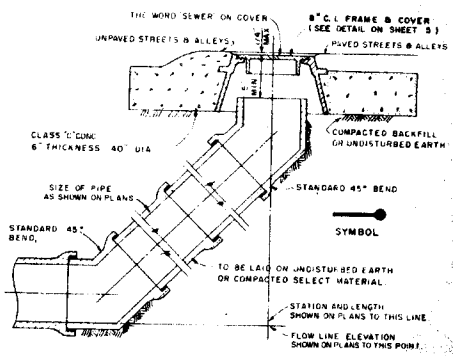
NOTE:
The Contractor will build the M.H. up to subgrade of street and cover with the steel plate supplied by the paving contractor EXCEPT where M.H. is not under pvt. or sidewalk, in which case the M.H. will be completely built

SEWER MANHOLE

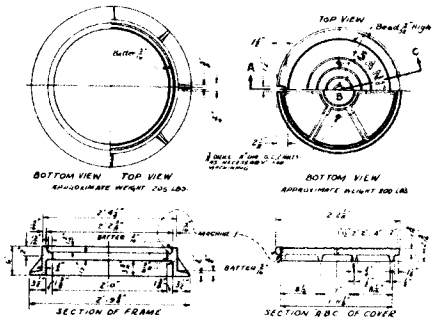


NOTE
ALL DIMENSIONS ARE MINIMUM EXCEPT WHERE NOTED.

CAST IRON MANHOLE STEP

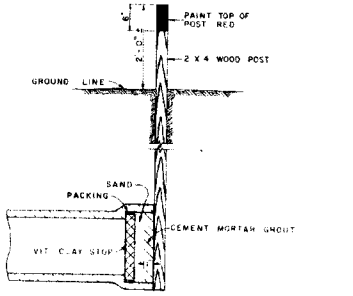


CLEANOUT INSTALLATION

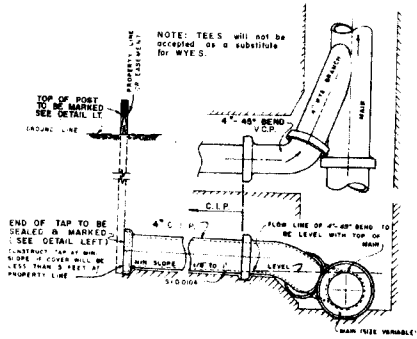


LETTERING ON MANHOLE COVER TO BE AS FOLLOWS:
"SANITARY SEWER". Total width of individual letters to be such that letters and words are equally spaced and balanced to form complete circle. Letters to be 6" in height and raised ⅛" above level of cover. Type of letters to be submitted for approval.

24" MANHOLE FRAME & COVER



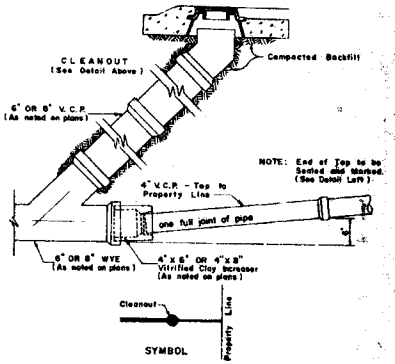
PLUG FOR SEWERS



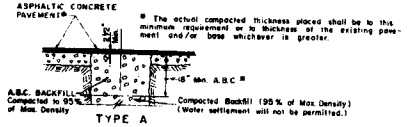
STANDARD 4" SEWER TAP
CONSTRUCTION DETAIL WHERE CONTRACTOR BUILDS HOUSE CONNECTION TAP EXTENDS TO PROPERTY LINE IN ALLEYS OR STREETS OR TO EASEMENT LINE.

NOTE
SIZE OF TAP SHALL BE DESIGNATED ON PLANS

SEWER BUILDING CONNECTION



SEWER TAP DETAIL AT C.O.

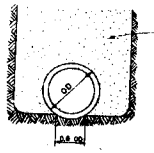


* The actual compacted thickness placed shall be to the minimum requirement or to thickness of the existing pavement and/or base whichever is greater.

TYPE A

NOTE: Pavement cut and replacement shall be in accordance with applicable Maricopa County Standard Specifications for Construction of Highways, Streets and Bridges and Maricopa County Special Provisions for Installation of Underground Utilities, latest revisions, and shall include Item 17, Aggregate Base Course, Item 20-A-3/4" Asphaltic Cement Concrete and Item 46, Pavement Cut Replacement.

PAVEMENT REPLACEMENT



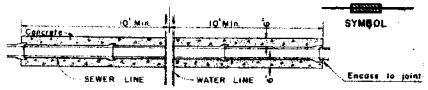
CLASS C BEDDING
ORDINARY

TRENCH BEDDING FOR UNDERGROUND CONDUITS

Encase full lengths of pipe. Do not end encasement at center of lengths. Encase to nearest joint at or beyond the 10' Min.

When a water line crosses over a sewer line with less than 2 feet vertical separation between pipes, the SEWER LINE shall be Cast Iron Pipe with leaded or mechanical joints a minimum of 10 ft. in each direction from the crossing, or Vitrified Clay Pipe encased in concrete 6" thick, 10 ft. each side of the crossing. This applies to planned and existing WATER LINES. All SEWER SERVICE CONNECTIONS TO BE CAST IRON PIPE.

The cost of encasement or the use of Cast Iron Pipe, on main lines and service lines shall be incidental, and the cost for such shall be included in the unit price bid for Vitrified Clay Pipe and Taps.



SEWER LINE ENCASEMENT

GENERAL NOTES

1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction.

2. Locate sewer taps and water service lines as follows unless otherwise directed by the Engineer:
   (a.) Water service line on centerline of lot.
   (b.) Sewer tap a minimum distance of 10 feet downstream from the water service line.

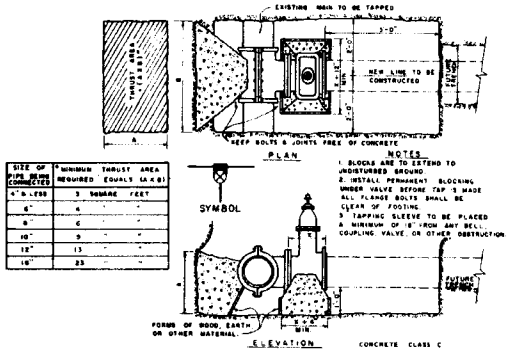
3. All Taps to be bid to include 4" V.C.P. from Sewer Main to Property Line, or beyond Property Line as shown.

4. Steel plates will be furnished by the Paving Contractor

AS STAKED

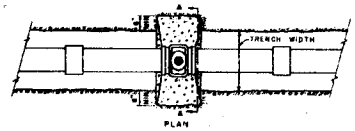
UNIT TWO (JOB NO. 788 60)

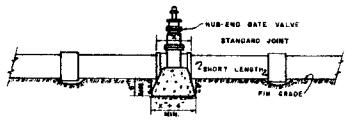
LITCHFIELD PARK SUBDIVISION NO. 18-B SHEET 2 OF 8 SHEETS MAP NO. 216



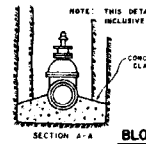
SIZE OF MAIN (PIPE OR CYLINDER)	MINIMUM THRUST AREA REQUIRED EQUALS (A x B)
4" & LESS	3 SQUARE FEET
6"	4 " "
8"	6 " "
10"	9 " "
12"	13 " "
16"	23 " "

INSTALLING TAPPING SLEEVES AND VALVES

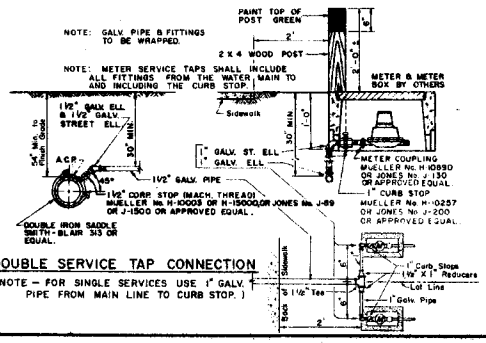




NOTE: THIS DETAIL COVERS WATER VALVES, 4 INCH TO 12 INCH, INCLUSIVE, REGARDLESS OF TYPE OF PIPE USED.

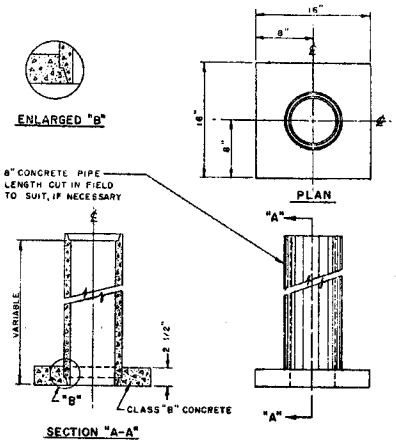


BLOCKING FOR WATER VALVES

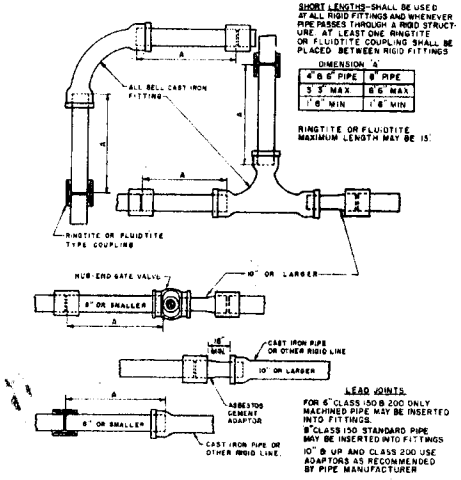


DOUBLE SERVICE TAP CONNECTION

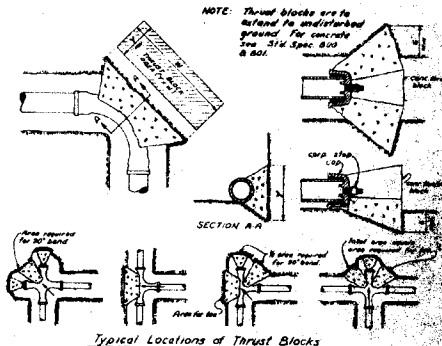
(NOTE – FOR SINGLE SERVICES USE 1" GALV. PIPE FROM MAIN LINE TO CURB STOP.)



VALVE BOX WITH CAST CONCRETE BASE



FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE

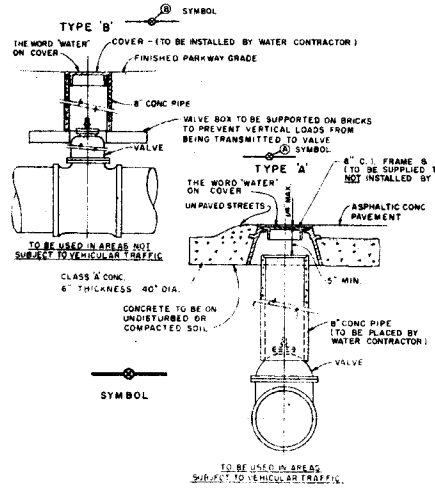


MINIMUM THRUST BLOCK AREA REQUIRED (sq ft)

PIPE SIZE	WATER PIPE	
	Tee, Dead end, 90° Bend	45° & 22½° Bends
4" & Less	3 Sq. Feet	3 Sq. Feet
6"	4 "	3 "
8"	6 "	3 "
10"	9 "	5 "
12"	13 "	7 "
16"	23 "	12 "

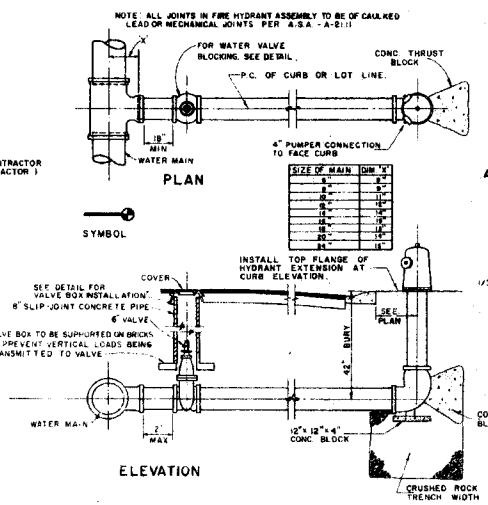
NOTES.
1. Table is based on 2,000 lb/sq ft soil. If conditions are found to indicate soil bearing is less, the bearing shall be increased.
2. Areas for pipe larger than 16" shall be calculated for each project.

THRUST BLOCKS FOR WATER LINES

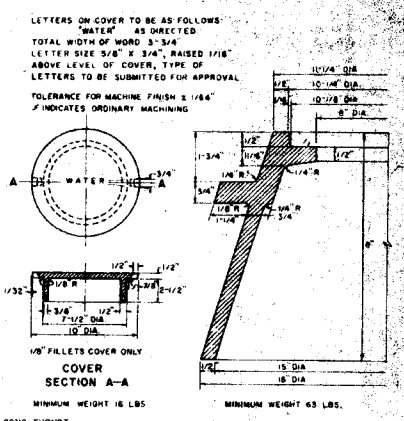


VALVE BOX INSTALLATION

NOTE: USE C.I.P WHERE WATER CROSSES SEWER WITH LESS THAN 1' CLEARANCE.



METHOD OF SETTING FIRE HYDRANT

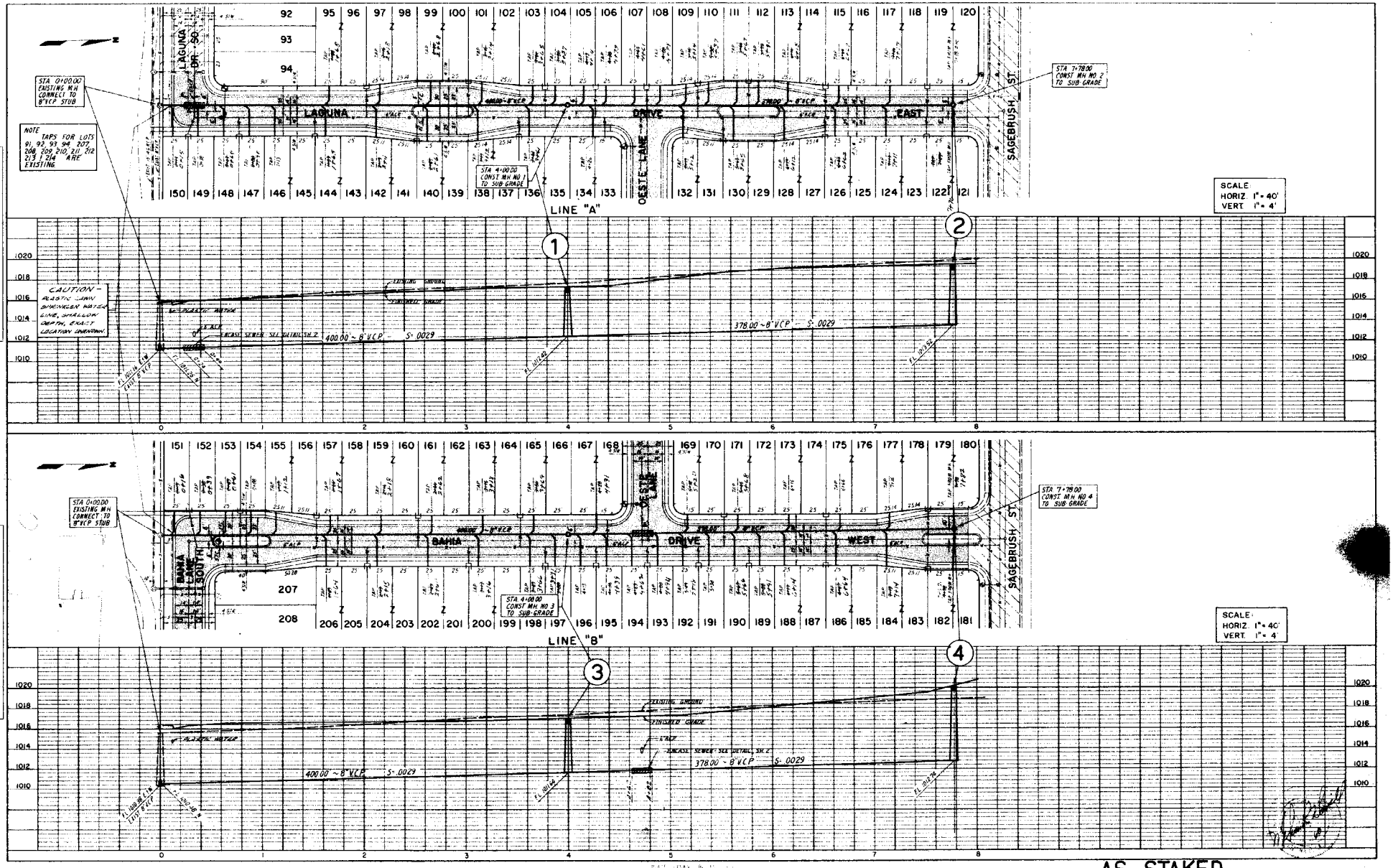


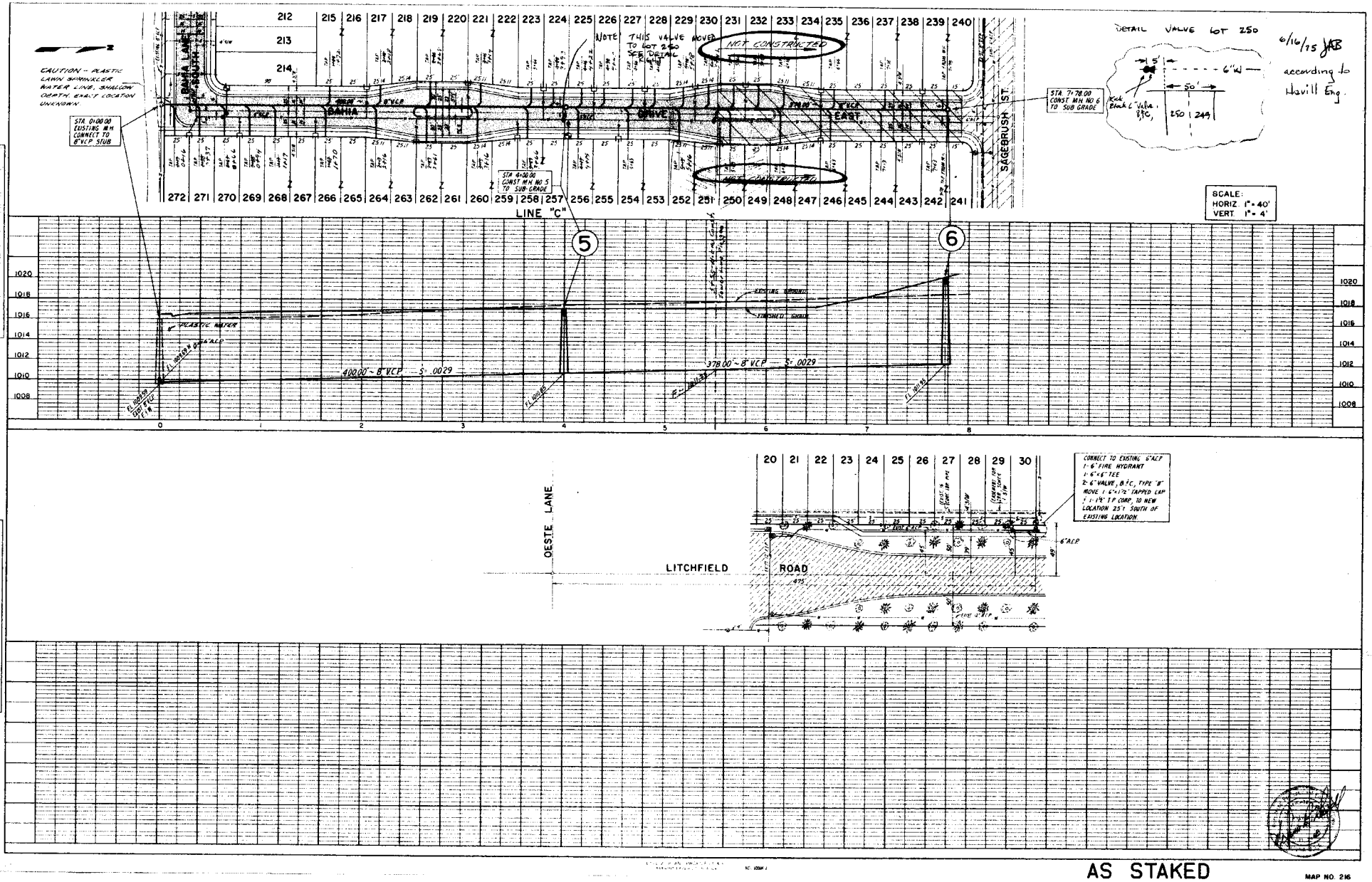
8" C.I. FRAME AND COVER

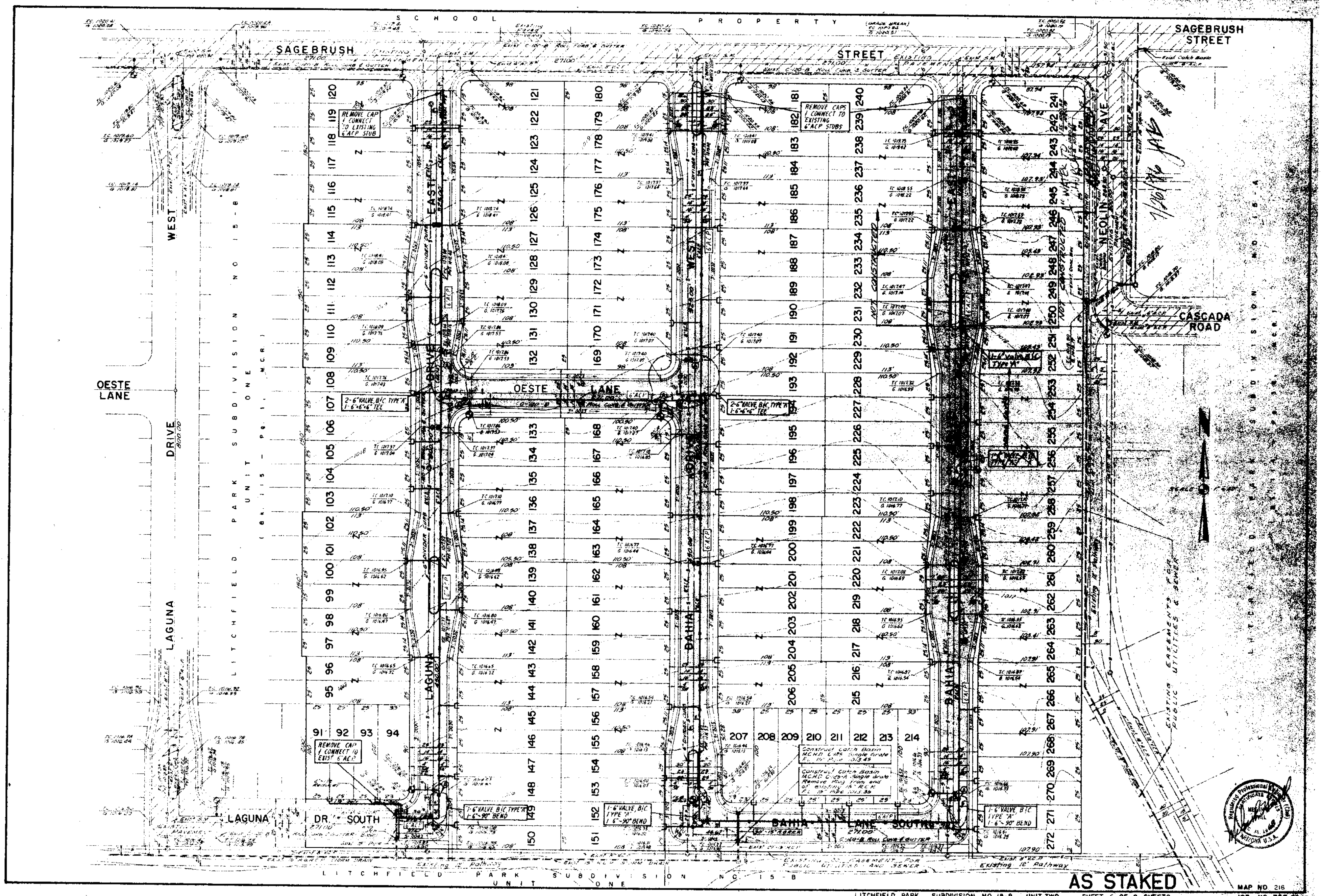
AS STAKED

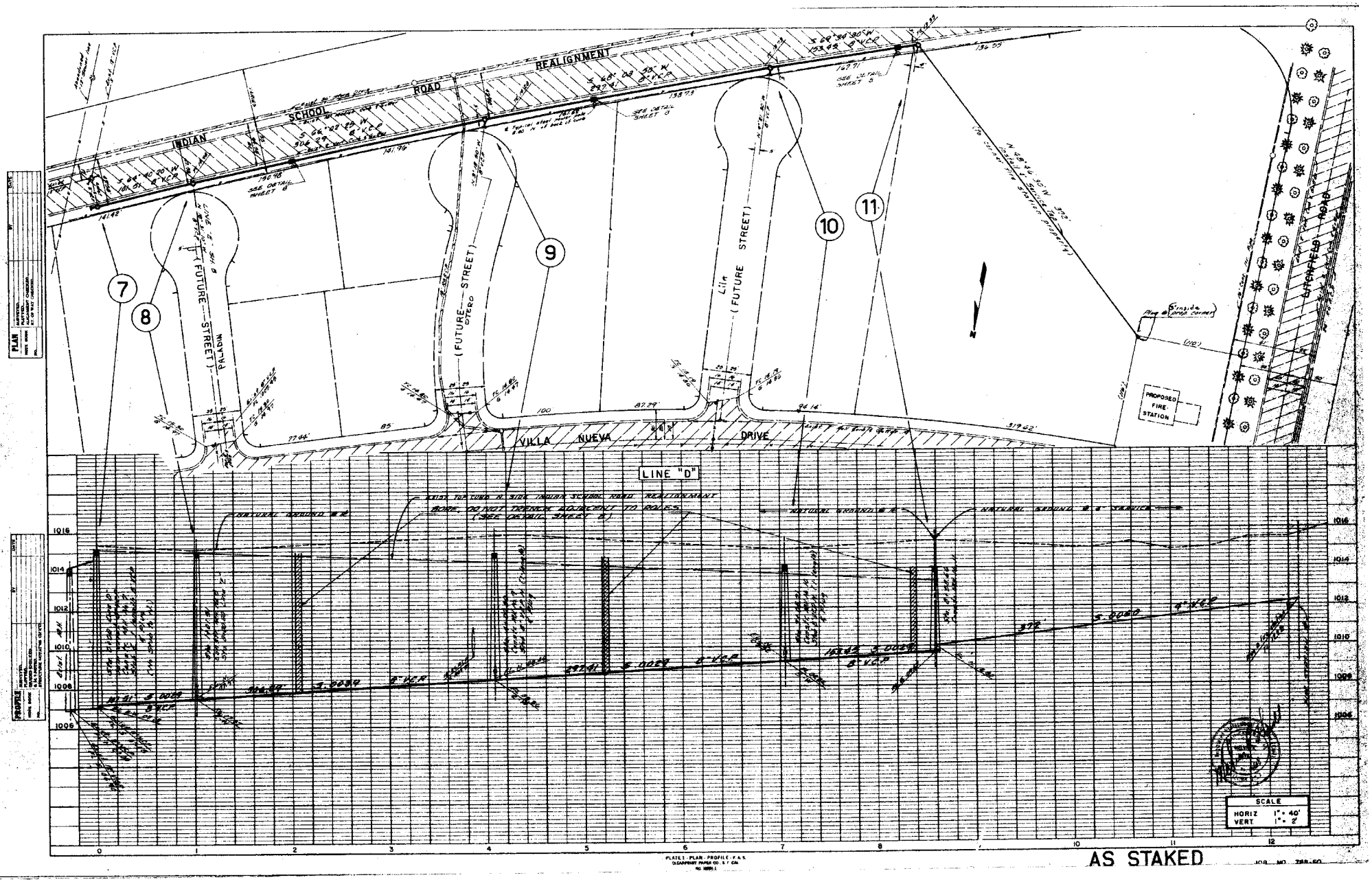
JOB NO. 786-60

LITCHFIELD PARK SUBDIVISION NO. 15-B UNIT TWO SHEET 3 OF 6 SHEETS MAP NO. 6


LAGUNA DR. SO.
LAGUNA DRIVE EAST
OESTE LANE
SAGEBRUSH ST.
STA 0+00.00 EXISTING MH CONNECT TO 8"VCP STUB
STA 1+78.00 CONST MH NO. 2 TO SUB-GRADE
STA 4+00.00 CONST MH NO. 1 TO SUB-GRADE
NOTE TAPS FOR LOTS 91, 92, 93, 94, 207, 208, 209, 210, 211, 212, 213 & 214 ARE EXISTING
LINE "A"
SCALE: HORIZ. 1"= 40' VERT. 1"= 4'
CAUTION - PLASTIC LAWN SPRINKLER NOTED LINE, SHALLOW DEPTH, EXACT LOCATION UNKNOWN.
EXISTING GROUND
FINISHED GRADE
PLASTIC NOTED
8" EXIST.
INCASE SEWER - SEE DETAIL SH. 2
400.00 ~ 8" VCP S= .0029
378.00 ~ 8" VCP S= .0029
BAHIA LANE SOUTH
BAHIA DRIVE WEST
STA 0+00.00 EXISTING MH CONNECT TO 8"VCP STUB
STA 1+78.00 CONST MH NO. 4 TO SUB-GRADE
STA 4+00.00 CONST MH NO. 3 TO SUB-GRADE
LINE "B"
SCALE: HORIZ. 1"= 40' VERT. 1"= 4'
PLAN
PROFILE
AS STAKED


CAUTION - PLASTIC LAWN SPRINKLER WATER LINE, SHALLOW DEPTH, EXACT LOCATION UNKNOWN
STA. 0+00.00 EXISTING MH CONNECT TO 8" VCP STUB
BAHIA LANE SOUTH
BAHIA
8" VCP
NOTE: THIS VALVE MOVED TO LOT 250 PER DENAL
NOT CONSTRUCTED
SAGEBRUSH ST.
STA. 7+78.00 CONST. MH. NO. 6 TO SUB GRADE
DETAIL VALVE LOT 250
6"W
5'
50'
Kick Block
6" Valve, B'C,
250
249
6/16/15 JAB according to Havill Eng.
STA. 4+30.00 CONST. MH. NO. 5 TO SUB-GRADE
LINE "C"
SCALE: HORIZ. 1"=40' VERT. 1"=4'
PLAN
PROFILE
6" PLASTIC WATER
6" ALP
40.00'-8" VCP S=.0029
378.00'-8" VCP S=.0029
EXISTING GROUND
FINISHED GRADE
OESTE LANE
LITCHFIELD ROAD
CONNECT TO EXISTING 6" ALP
1-6" FIRE HYDRANT
1-6"x6" TEE
2-6" VALVE, B'C, TYPE "B"
MOVE 1-6"x12" TAPPED LAP
1-18" T.P. COMP. TO NEW LOCATION 25' SOUTH OF EXISTING LOCATION
6" ALP
AS STAKED
MAP NO. 215


SCHOOL PROPERTY
SAGEBRUSH STREET
NEOLIN AVE
CASCADA ROAD
OESTE LANE
WEST LAGUNA DRIVE
EAST LAGUNA DRIVE
LAGUNA DR. SOUTH
WEST BAHIA DRIVE
EAST BAHIA DRIVE
BAHIA LANE SOUTH
NOT CONSTRUCTED
REMOVE CAP & CONNECT TO EXISTING 6"ACP STUB
REMOVE CAPS & CONNECT TO EXISTING 6"ACP STUBS
REMOVE CAP & CONNECT TO EXIST. 6"ACP
2-6"VALVE, B/C TYPE "A" 1-6"x6"x6" TEE
1-6"VALVE B/C TYPE "A" 1-6"x90° BEND
Existing Easements for Public Utilities & Sewer
Existing 12' Pathway
LITCHFIELD PARK SUBDIVISION NO 15-B UNIT ONE (Bk. 115 - Pg. 1, MCR)
AS STAKED
LITCHFIELD PARK SUBDIVISION NO 15-B UNIT TWO SHEET 6 OF 8 SHEETS
MAP NO. 216
JOB NO. 788-50


INDIAN SCHOOL ROAD REALIGNMENT
VILLA NUEVA DRIVE
(FUTURE STREET)
PALOMA
OTERO
LILA
7
8
9
10
11
PROPOSED FIRE STATION
LINE "D"
NATURAL GROUND @ ℄
SCALE
HORIZ 1" = 40'
VERT 1" = 2'
AS STAKED

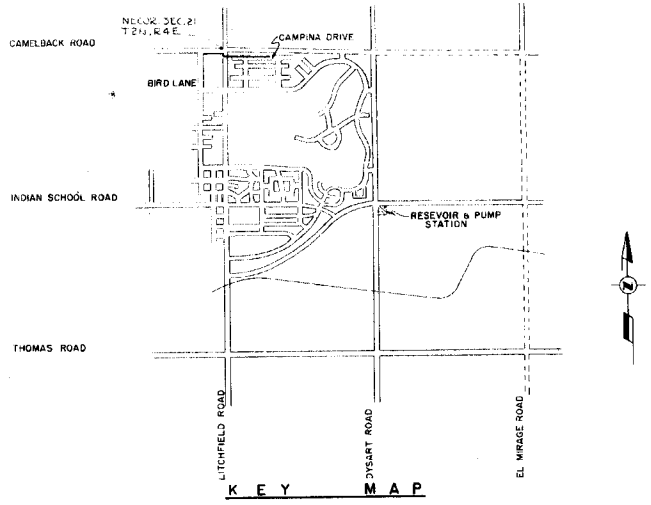
LITCHFIELD PARK SERVICE COMPANY

LITCHFIELD PARK ——— ARIZONA

CAMPINA DRIVE WATER MAIN

1968

CONTRACT NO. L.P.S.-W-1003-68



KEY MAP

INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET, KEY MAP
2	PLAN & PROFILE, STA. 0+00 TO STA. 15+00
3	PLAN & PROFILE, STA. 15+00 TO STA. 20+84
4	DETAILS

MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

APPROVED: _____ DATE: 4-10-68

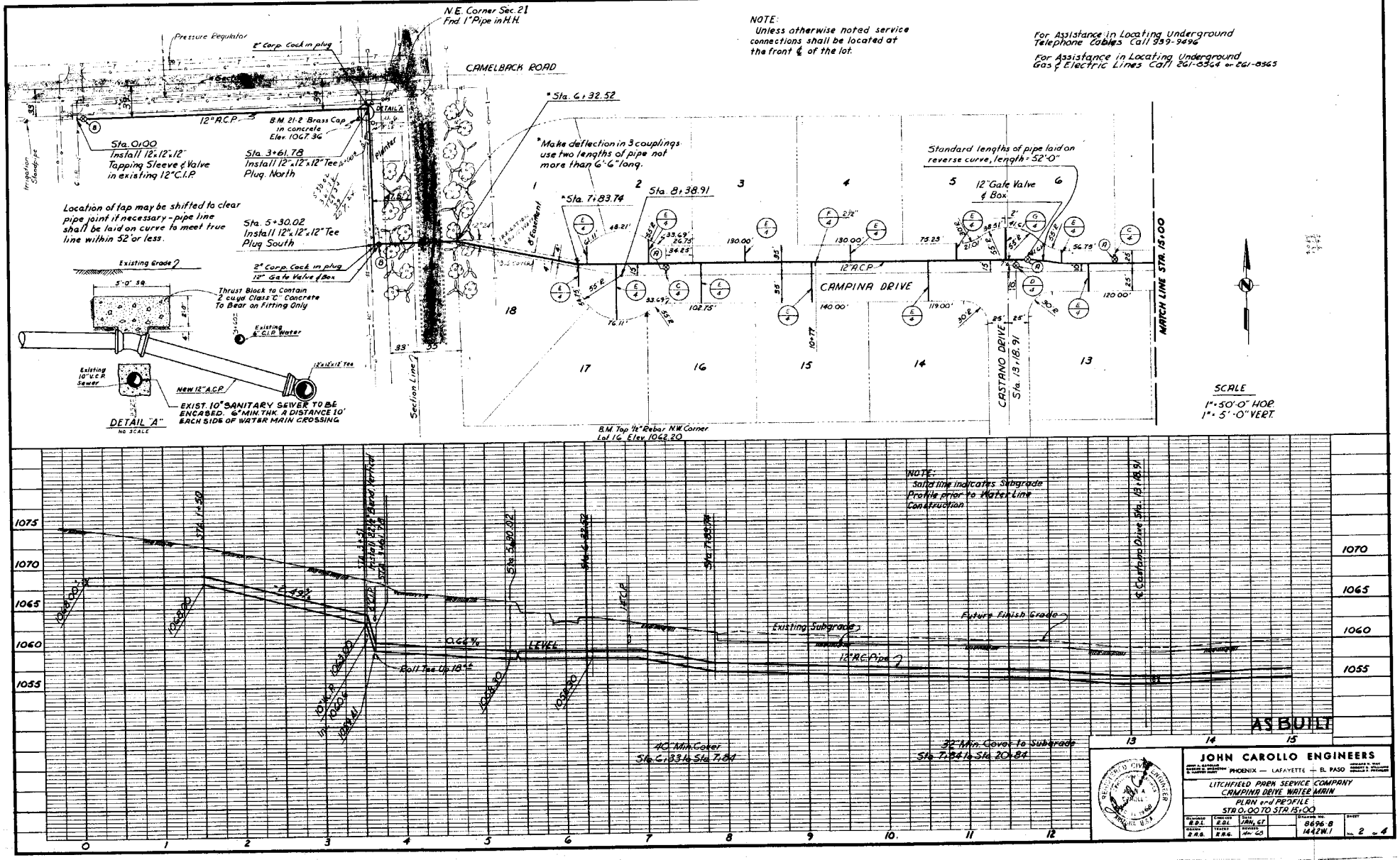
RECEIVED JAN 15 1969

AS BUILT

JOHN CAROLLO ENGINEERS
PHOENIX , ARIZONA
LAFAYETTE , CALIFORNIA ——— EL PASO , TEXAS

JOHN A. CAROLLO
ROBERT M. BRERETON
H. HARVEY HUNT
HOWARD M. WAY
ROBERT G. WILLIAMS
DONALD R. PREISLER

8697-R-1442W.1

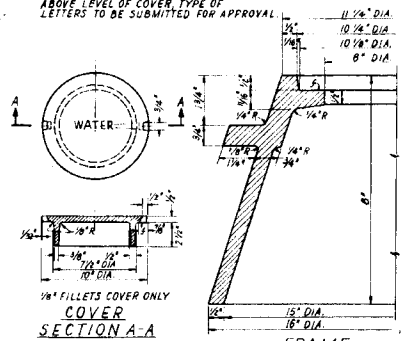

N.E. Corner Sec. 21
Fnd. 1" Pipe in H.H.
NOTE:
Unless otherwise noted service connections shall be located at the front ℄ of the lot.
For Assistance in Locating Underground Telephone Cables Call 939-9496
For Assistance in Locating Underground Gas & Electric Lines Call 261-8364 or 261-8365
Pressure Regulator
2" Corp. Cock in plug
CAMELBACK ROAD
12"A.C.P.
B.M. 21.8 Brass Cap in concrete Elev. 1067.36
Sta. 0+00
Install 12"x12"x12" Tapping Sleeve & Valve in existing 12"C.I.P.
Sta. 3+61.78
Install 12"x12"x12" Tee Plug North
Location of tap may be shifted to clear pipe joint if necessary - pipe line shall be laid on curve to meet true line within 52' or less.
Sta. 5+30.02
Install 12"x12"x12" Tee Plug South
2" Corp. Cock in plug
12" Gate Valve & Box
Existing Grade
Thrust Block to Contain 2 cu.yd. Class 'C' Concrete To Bear on Fitting Only
Existing 6" C.I.P. Water
Existing 10" V.C.P. Sewer
NEW 12" A.C.P.
EXIST. 10" SANITARY SEWER TO BE ENCASED. 6" MIN. THK. A DISTANCE 10' EACH SIDE OF WATER MAIN CROSSING
DETAIL "A"
NO SCALE
Section Line
Sta. 6+32.52
*Make deflection in 3 couplings use two lengths of pipe not more than 6'-6" long.
Sta. 7+83.74
Sta. 8+38.91
Standard lengths of pipe laid on reverse curve, length - 52'-0"
12" Gate Valve & Box
12"A.C.P.
CAMPINA DRIVE
CASTANO DRIVE
Sta. 13+18.91
MATCH LINE STA. 15+00
B.M. Top 1/2" Rebar N.W. Corner Lot 16 Elev. 1062.20
SCALE
1" = 50'-0" HOR.
1" = 5'-0" VERT.
NOTE:
Solid line indicates Subgrade Profile prior to Water Line Construction
Existing Subgrade
Future Finish Grade
12" A.C. Pipe
Roll Tee Up 18 1/2°
40" Min. Cover
Sta. 6+33 to Sta. 7+84
32" Min. Cover to Subgrade
Sta. 7+84 to Sta. 20+84
℄ Castano Drive Sta. 13+18.91
AS BUILT
JOHN CAROLLO ENGINEERS
PHOENIX — LAFAYETTE — EL PASO
LITCHFIELD PARK SERVICE COMPANY
CAMPINA DRIVE WATER MAIN
PLAN and PROFILE
STA 0.00 TO STA 15+00
DRAWING NO. 8696 B 1442 W.1
SHEET No. 2 of 4

Error

An error occurred while processing this page. See the system log for more details.

LETTERS ON COVER TO BE AS FOLLOWS:

"WATER" OR AS DIRECTED
TOTAL WIDTH OF WORD 3 3/4"
LETTER SIZE 5/8" x 3/4" RAISED 1/16" ABOVE LEVEL OF COVER, TYPE OF LETTERS TO BE SUBMITTED FOR APPROVAL

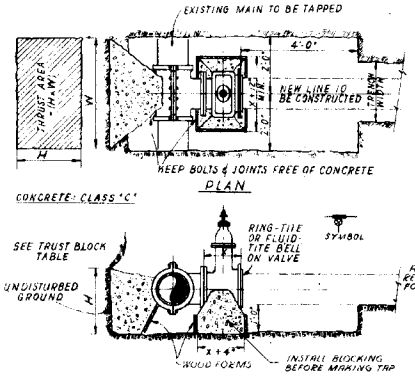


COVER
SECTION A-A
MINIMUM WEIGHT 16 LBS.

FRAME
MINIMUM WEIGHT 63 LBS.

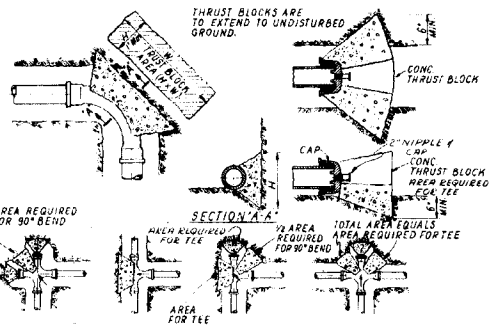
TOLERANCE FOR MACHINE FINISH ± 1/64"
F INDICATES ORDINARY MACHINING

8" C.I. FRAME AND COVER
NO SCALE

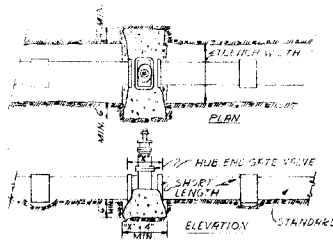


INSTALLING TAPPING SLEEVE AND VALVE
NO SCALE

NOTE:
THRUST BLOCKS ARE TO EXTEND TO UNDISTURBED GROUND.



TYPICAL LOCATIONS OF THRUST BLOCKS

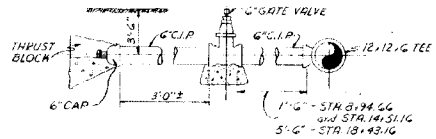


BLOCKING FOR WATER VALVES

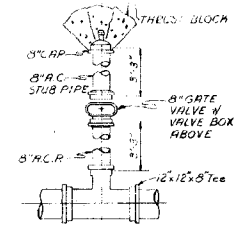
THRUST BLOCK TABLE

MINIMUM SIZE OF THRUST BLOCKS FOR CLASS 150 PIPE
AREA (SQ. FT.) - H (FT.) x W (FT.)
Test Pressure 150 P.S.I.

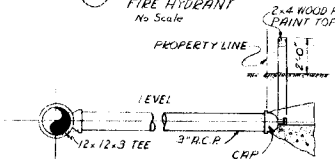
		90° Bend	Dead End Tee	45° Bend	22½° Bend
4"	Thrust	2,670	1,890	1,450	740
	Area	2	2	1	1
6"	Thrust	6,000	4,240	3,250	1,650
	Area	3	3	2	1
8"	Thrust	10,630	7,530	5,780	2,940
	Area	6	4	3	2
10"	Thrust	16,650	11,800	9,030	4,600
	Area	5	4	3	3
12"	Thrust	24,000	16,960	13,000	6,610
	Area	12	7	7	3



C STUB PIPE FOR FUTURE FIRE HYDRANT
No Scale

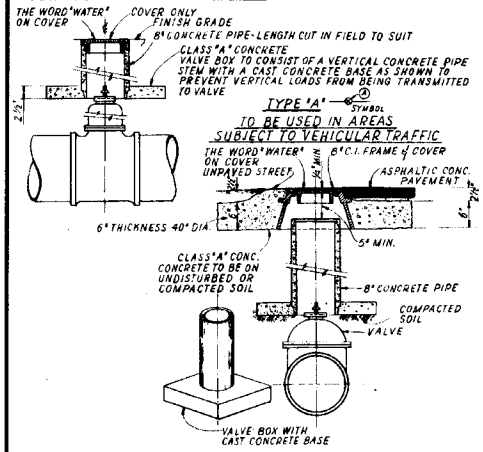


D STUB PIPE FOR FUTURE WATER MAIN

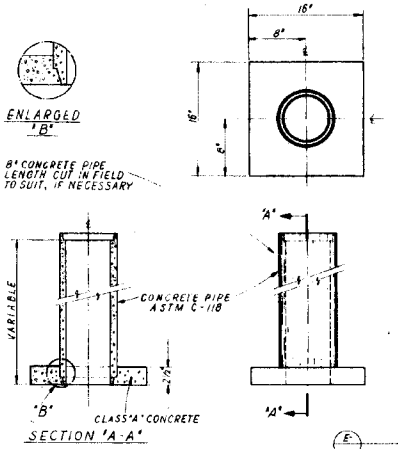


G IRRIGATION CONNECTION
No Scale

TYPE 'B' (B) SYMBOL
TO BE USED IN AREAS NOT SUBJECT TO VEHICULAR TRAFFIC

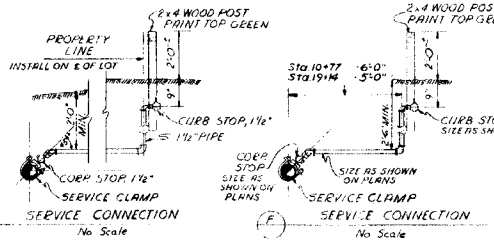


VALVE BOX INSTALLATION
NO SCALE



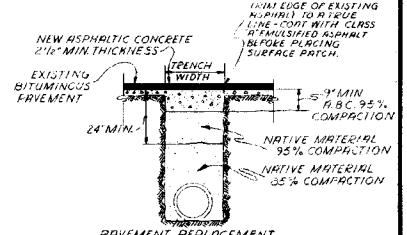
SECTION "A-A"

VALVE BOX WITH CAST CONCRETE BASE
NO SCALE



E SERVICE CONNECTION
No Scale

F SERVICE CONNECTION
No Scale



PAVEMENT REPLACEMENT FOR COUNTY HIGHWAYS

AS BUILT

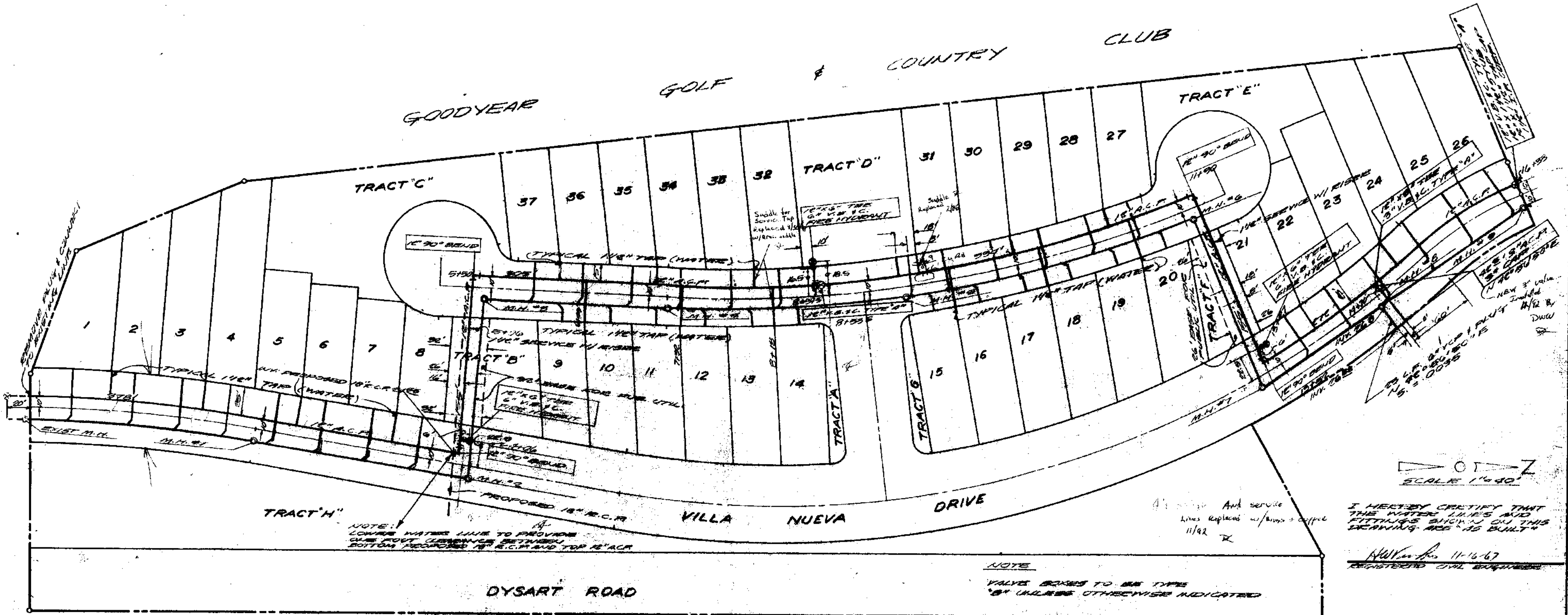
REGISTERED CIVIL ENGINEER — CERTIFICATE NO. 5969 — JOHN CAROLLO — ARIZONA, U.S.A.

JOHN CAROLLO ENGINEERS
PHOENIX — LAFAYETTE — EL PASO

LITCHFIELD PARK SERVICE COMPANY
CAMPINA DRIVE WATER MAIN

DETAILS

Designed	Submitted	Date	Blueprint No.	Sheet
R.D.L.	R.D.L.	JAN. 67	8694-8	
Drawn	Checked	Approved	1442W.I.	No. 4 of 4
R.R.G.	P.B.G.	MAY '65		



NOTE

VALVE BOXES TO BE TYPE "B" UNLESS OTHERWISE INDICATED

SUBMITTED BY ________ REGISTERED CIVIL ENGINEER 5-31-67 DATE

APPROVED BY ________ MARICOPA COUNTY HEALTH DEPT. 6-1-67 DATE

BENCH MARKS:

TOP B.C. IN M.H. @ E 1/4 CORNER ELEV. - 1030.96
TOP N. END N/W RETURN @ INTERSECTION DYSART ROAD & VILLA NUEVA DRIVE ELEV. - 1006.57

AS BUILT

RECEIVED NOV 20 1967

REVISED WATER "AS BUILT" 8-8-67

SEWER & WATER PLANS
FOR
TIERRA VERDE TOWNHOUSES NO. ONE
FOR
LITCHFIELD PARK PROPERTIES
CONTRACT NO. LPP-WS-3004-67

SHEET 1 OF 4
218-01-064A

GENERAL NOTES:

SANITARY SEWER MANHOLES, CLEANOUTS AND WATER VALVE BOXES WHICH FALL IN PAVEMENT AREAS ARE TO BE BUILT ONLY TO THE TOP OF THE FUTURE PAVEMENT SUBGRADE. (SEE COE & VAN LOO DRAWING NO. 218-0107) MANHOLES ARE TO BE PROTECTED BY ONE-HALF INCH MINIMUM THICK STEEL COVER PLATES WHICH THE SEWER & WATER LINE CONTRACTOR SHALL OBTAIN FROM THE PAVING CONTRACTOR PRIOR TO CONSTRUCTION. FRAMES AND COVERS FOR MANHOLES, CLEANOUTS AND WATER VALVE BOXES ARE TO BE FURNISHED BY THE SEWER & WATER LINE CONTRACTOR, BUT SHALL NOT BE DELIVERED TO THE SITE OF WORK UNTIL CALLED FOR BY THE PAVING CONTRACTOR.

THE SEWER LINE IS TO BE INSTALLED PRIOR TO THE WATER LINE AND WATER SERVICES TO PREVENT CONFLICT BETWEEN WATER AND SEWER CONSTRUCTION.

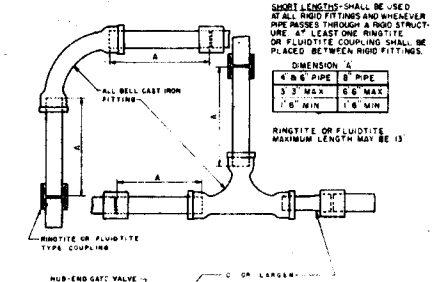
IT IS EXPECTED THAT THE ARIZONA PUBLIC SERVICE AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY WILL INSTALL THEIR UTILITY LINES AFTER THE WATER AND SEWER LINES ARE INSTALLED. HOWEVER, IT WILL BE THE WATER AND SEWER LINE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE ARIZONA PUBLIC SERVICE COMPANY AND THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY AND COORDINATE CONSTRUCTION OPERATIONS TO PREVENT DAMAGE TO THE VARIOUS UTILITIES.

THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION, BOTH HORIZONTALLY AND VERTICALLY, OF ALL UTILITY CROSSINGS BY OPEN TRENCHING FAR ENOUGH IN ADVANCE OF PIPE LAYING TO PERMIT GRADE OR LINE CHANGE IF NECESSARY. ANY DAMAGE TO UTILITIES CAUSED BY THE CONTRACTOR'S OPERATIONS WILL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AND THE OWNING UTILITY AT THE EXPENSE OF THE CONTRACTOR.

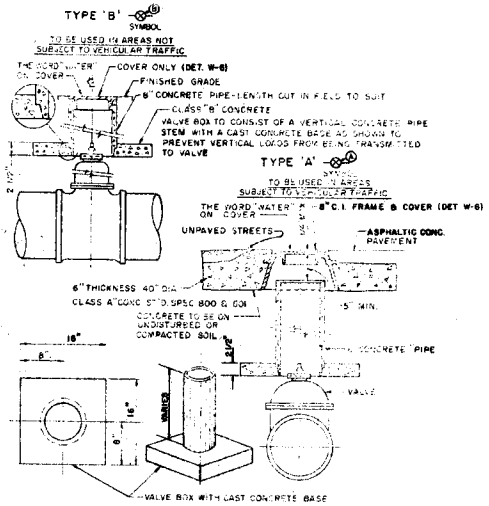
WATER METERS AND WATER METER BOXES WILL BE INSTALLED BY LITCHFIELD PARK SERVICE COMPANY.

AT ALL WATER AND SEWER LINE CROSSINGS WHERE VERTICAL SEPARATION IS LESS THAN TWO FEET CLEAR, THE CONTRACTOR SHALL ENCASE THE SEWER LINE IN CONCRETE OF SIX INCH MINIMUM THICKNESS FOR A DISTANCE OF AT LEAST TEN FEET IN EACH DIRECTION FROM THE CROSSING, OR SHALL CONSTRUCT THE SEWER OF CAST IRON WITH LEADED OR MECHANICAL JOINTS FOR THE SAME DISTANCE SPECIFIED HEREIN.

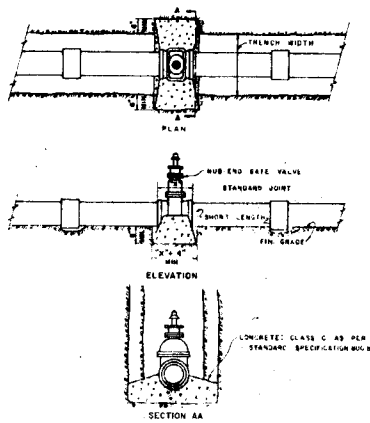
AN ACCURATE "AS BUILT" SET OF PLANS WILL BE FURNISHED THE PAVING CONTRACTOR AND UTILITY COMPANIES PRIOR TO THE START OF THEIR CONSTRUCTION OPERATIONS.



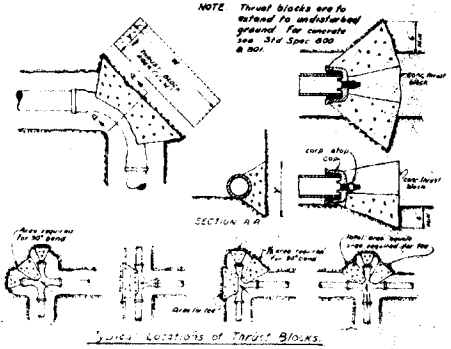
FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE
DETAIL W-1



VALVE BOX INSTALLATION
DETAIL W-2



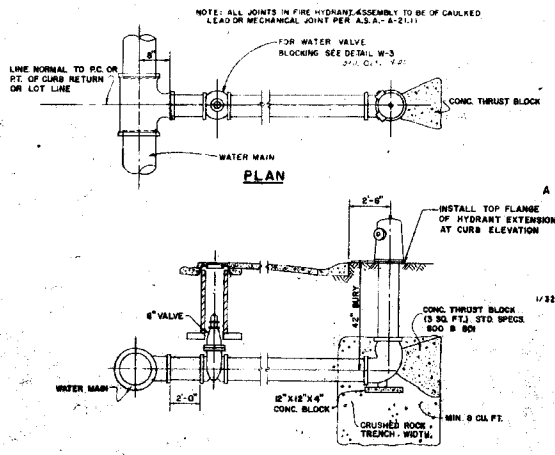
WATER VALVE BLOCKING
DETAIL W-3



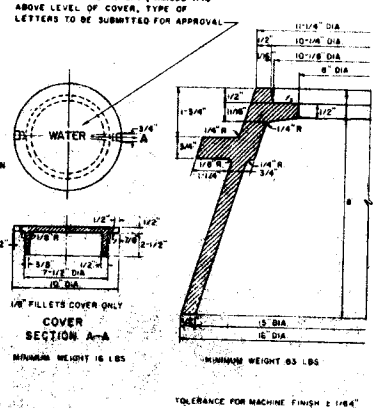
MINIMUM THRUST BLOCK AREA REQUIRED (Y&M)

Size of Tee & Cross	ASBESTOS CEMENT PIPE		CAST IRON PIPE	
	Tee, Dead end, 90° Bend	45°, 22½° Bends	Tee, Dead end, 90° Bend	45°, 22½° Bends
4 & less	3 Sq. Feet	3 Sq. Feet	3 Sq. Feet	3 Sq. Feet
6"	3 " "	3 " "	3 " "	3 " "
8	4 " "	3 " "	3 " "	3 " "
10	6 " "	3 " "	3 " "	3 " "
12"	9 " "	7 " "	5 " "	4 " "

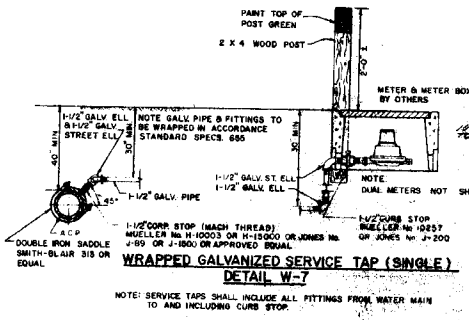
THRUST BLOCKS
DETAIL W-4



SETTING FIRE HYDRANT
DETAIL W-5



8" C.I. FRAME & COVER
DETAIL W-6



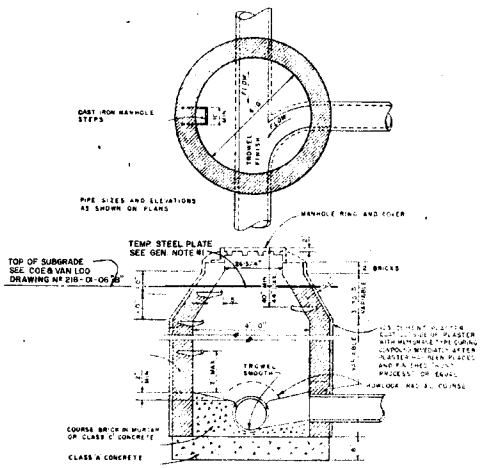
WRAPPED GALVANIZED SERVICE TAP (SINGLE)
DETAIL W-7

NOTE: SERVICE TAPS SHALL INCLUDE ALL FITTINGS FROM WATER MAIN TO AND INCLUDING CURB STOP.

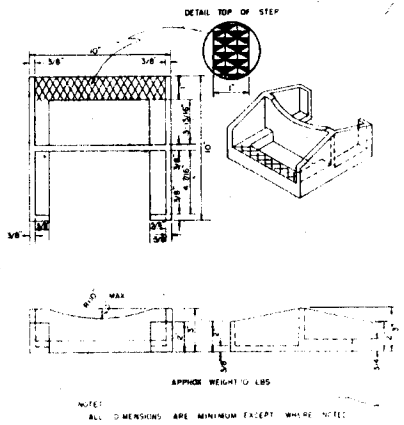
TERMINATION DETAIL
SERVICES TO TWO LOTS
(DETAILS NOT SHOWN SIMILAR TO SINGLE SERVICES)

SEWER & WATER PLANS
FOR
TIERRA VERDE TOWNHOMES NO. ONE
FOR
LITCHFIELD PARK
CONTRACT NO. [illegible]
SHEET 12 OF 41
216-21-06 AA

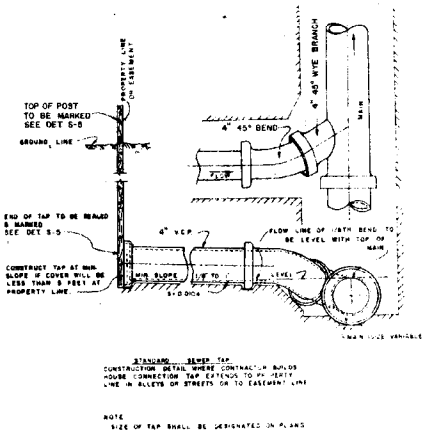
SURVEY
DESIGN
DRAWN
CHECKED
REVISIONS



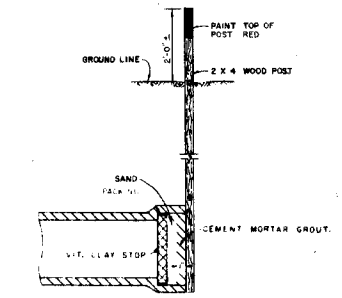
SEWER MANHOLE
DETAIL S-1



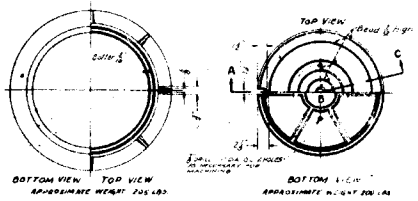
CAST IRON MANHOLE STEP
DETAIL S-3

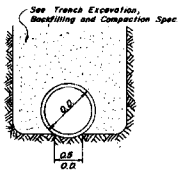


SEWER BUILDING CONNECTION
DETAIL S-4

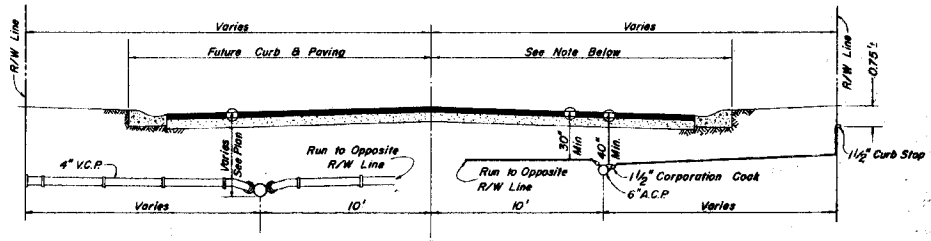


PLUG FOR SEWERS
DETAIL S-5





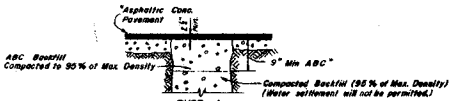
TRENCH BEDDING FOR UNDERGROUND CONDUITS
DETAIL S-6



TYPICAL SEWER & WATER SERVICE CONNECTION

Lettering on manhole cover to be as follows: "SANITARY SEWER" Total width of individual letters to be such that letters and words are equally spaced and balanced to form complete circle. Letters to be 2" in height and raised ¼" above level of cover. Type of letters to be submitted for approval

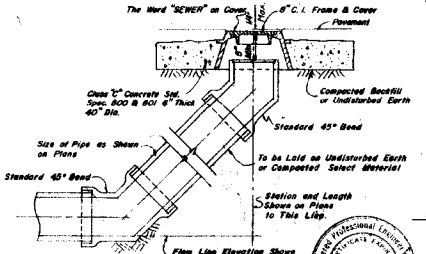
24" MANHOLE FRAME & COVER
DETAIL S-2



* The actual compacted thickness placed shall be to the minimum requirement or to thickness of the existing pavement and/or base whichever is greater.

PAVEMENT & SURFACING REPLACEMENT
DETAIL S-7

Note: Pavement cut and replacement shall be in accordance with applicable Maricopa County Standard Specifications for Construction of Highways, Streets and Bridges and Maricopa County Special Provisions for Installation of Underground Utilities, latest revisions, and shall include Item 17, Aggregate Base Course, Item 20-A-¾ Asphaltic Cement Concrete and Item 46, Pavement Cut Replacement.



CLEANOUT INSTALLATION
DETAIL S-8

SEWER & WATER PLANS FOR TIERRA VERDE TOWNHOUSES PHASE ONE FOR LITCHFIELD PARK PROPERTIES CONTRACT NO. LPP-WS-80-67

SHEET 3 OF 4

218-01-06 "B"

COE & VAN LOO

REVISIONS
SURVEY
DESIGN
DRAWN
CHECKED

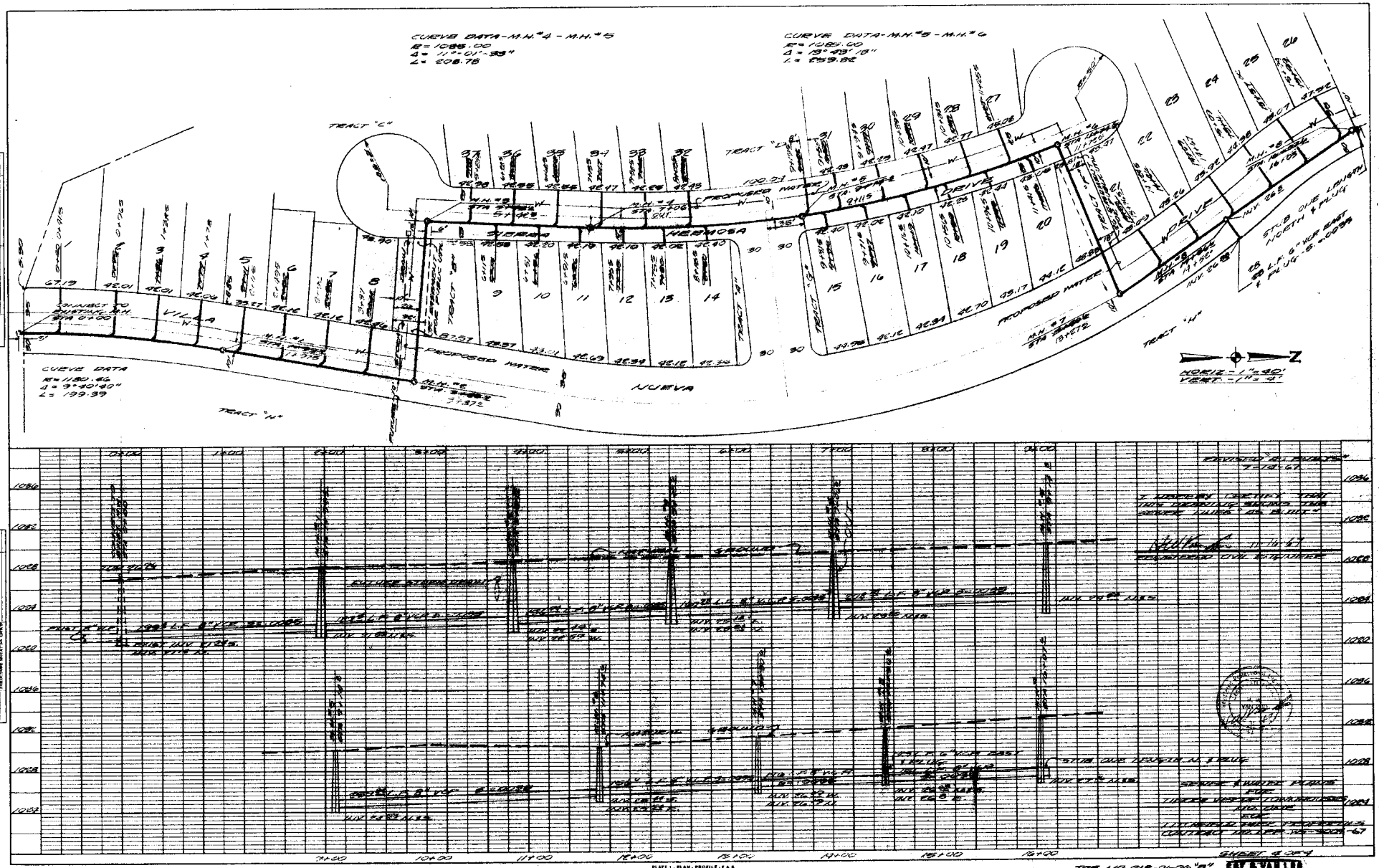


PLATE 1 - PLAN - PROFILE - F.A.S.
OLD ORCHARD PAPER CO. & F. GAL.
NO. 5000-1

JOB NO. 318-01-06 "2"

SHEET 4 OF 4

OLIVARES

PAVING AND GRADING PLANS

LITCHFIELD PARK SUBDIVISION NO. 20

LITCHFIELD PARK PROPERTIES

LITCHFIELD PARK

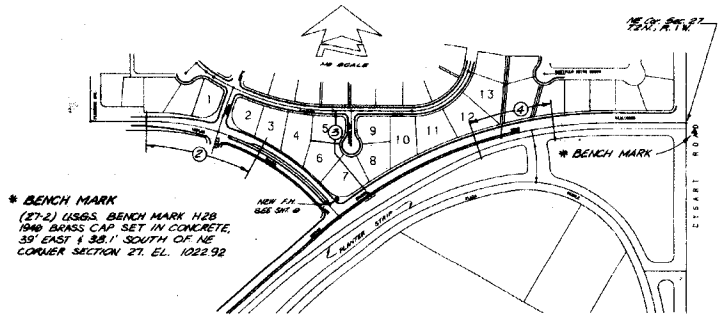
ARIZONA

CONTRACT NO. LPP-P-4032-83

APPROVALS

MARICOPA COUNTY DEPT. OF HEALTH SERVICES

APPROVED BY LETTER 5/21/84
MARICOPA COUNTY HIGHWAY DEPT.



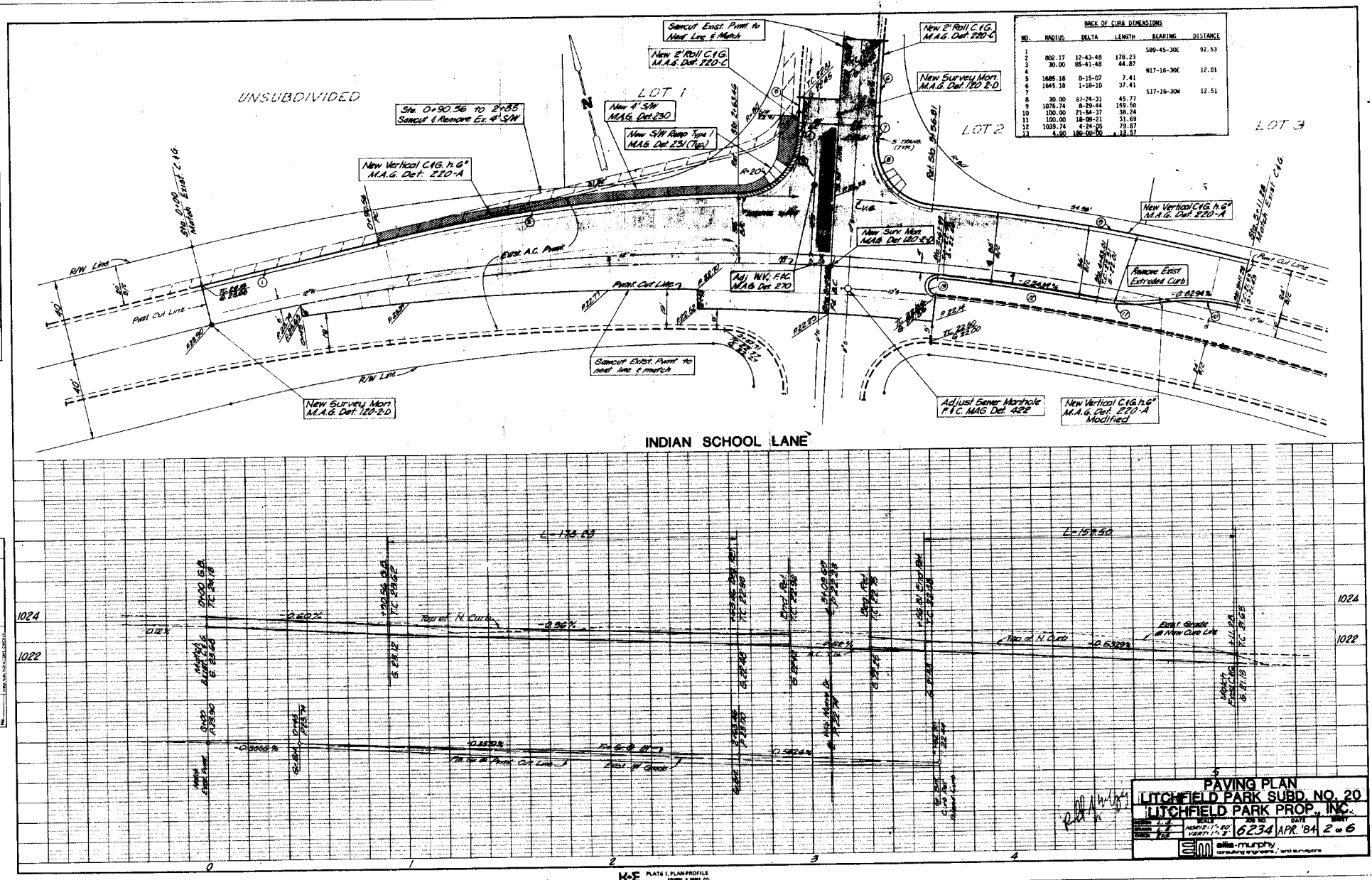
INDEX & VICINITY MAP

ELLIS-MURPHY INC.

CONSULTING ENGINEERS/LAND SURVEYORS

2417 WEST COLTER PHOENIX, ARIZONA 85015 PH. (602) 242-4411

JOB NO. 6234 - SEPT. 1983



BACK OF CURB DIMENSIONS

NO.	RADIUS	DELTA	LENGTH	BEARING	DISTANCE
1				S89-45-30E	92.53
2	802.17	12-43-48	178.23		
3	30.00	85-41-48	44.87		
4				N17-16-30E	12.01
5	1685.18	0-15-07	7.41		
6	1645.18	1-18-10	37.41		
7				S17-16-30W	12.51
8	30.00	87-24-31	45.77		
9	1075.74	8-29-44	159.50		
10	100.00	21-54-37	38.24		
11	100.00	18-08-21	31.69		
12	1039.74	4-24-06	79.87		
13	4.00	180-00-00	A 12.57		

PLAN — NOTE BOOK — No.

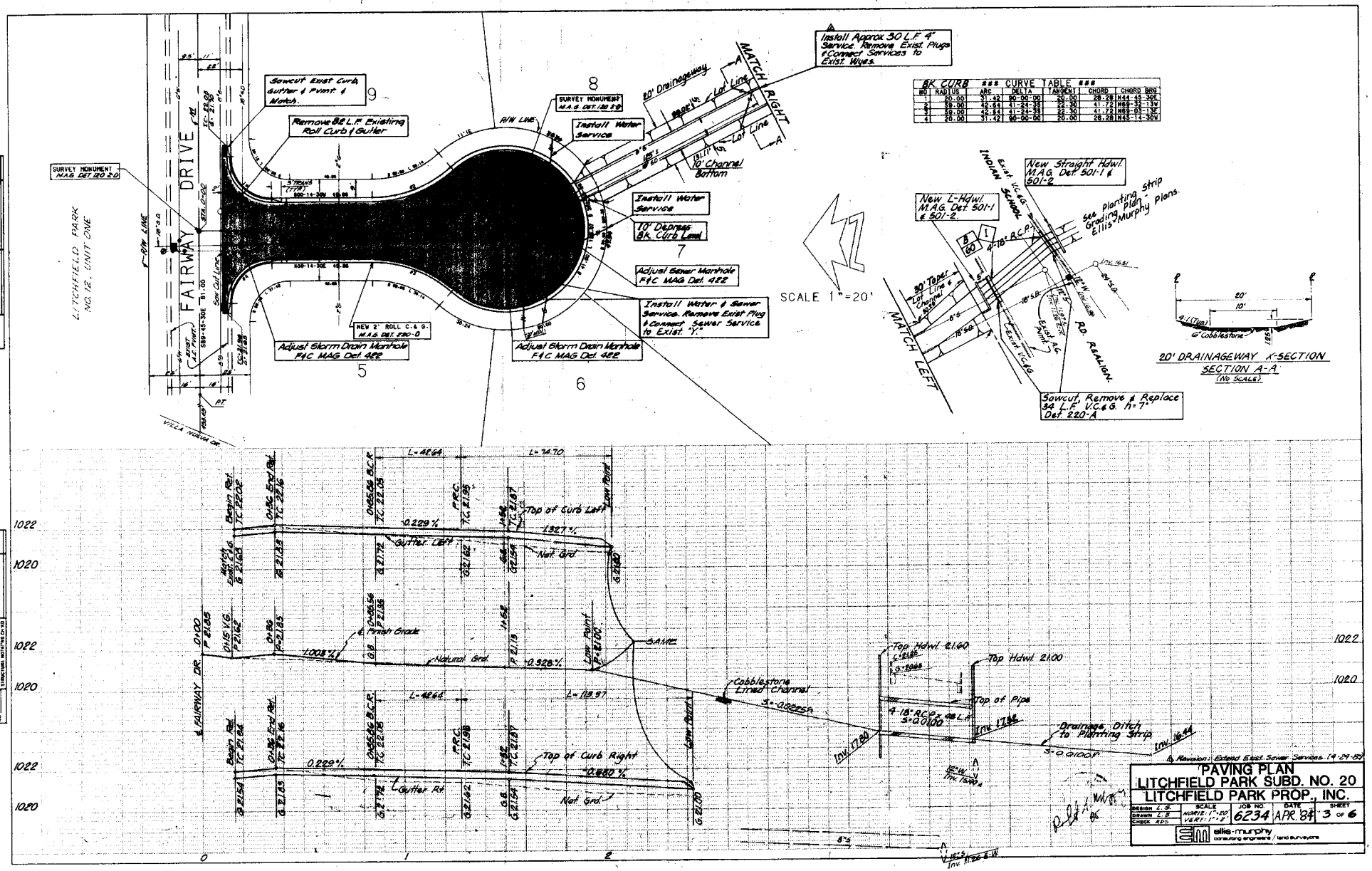
PROFILE — NOTE BOOK — No.

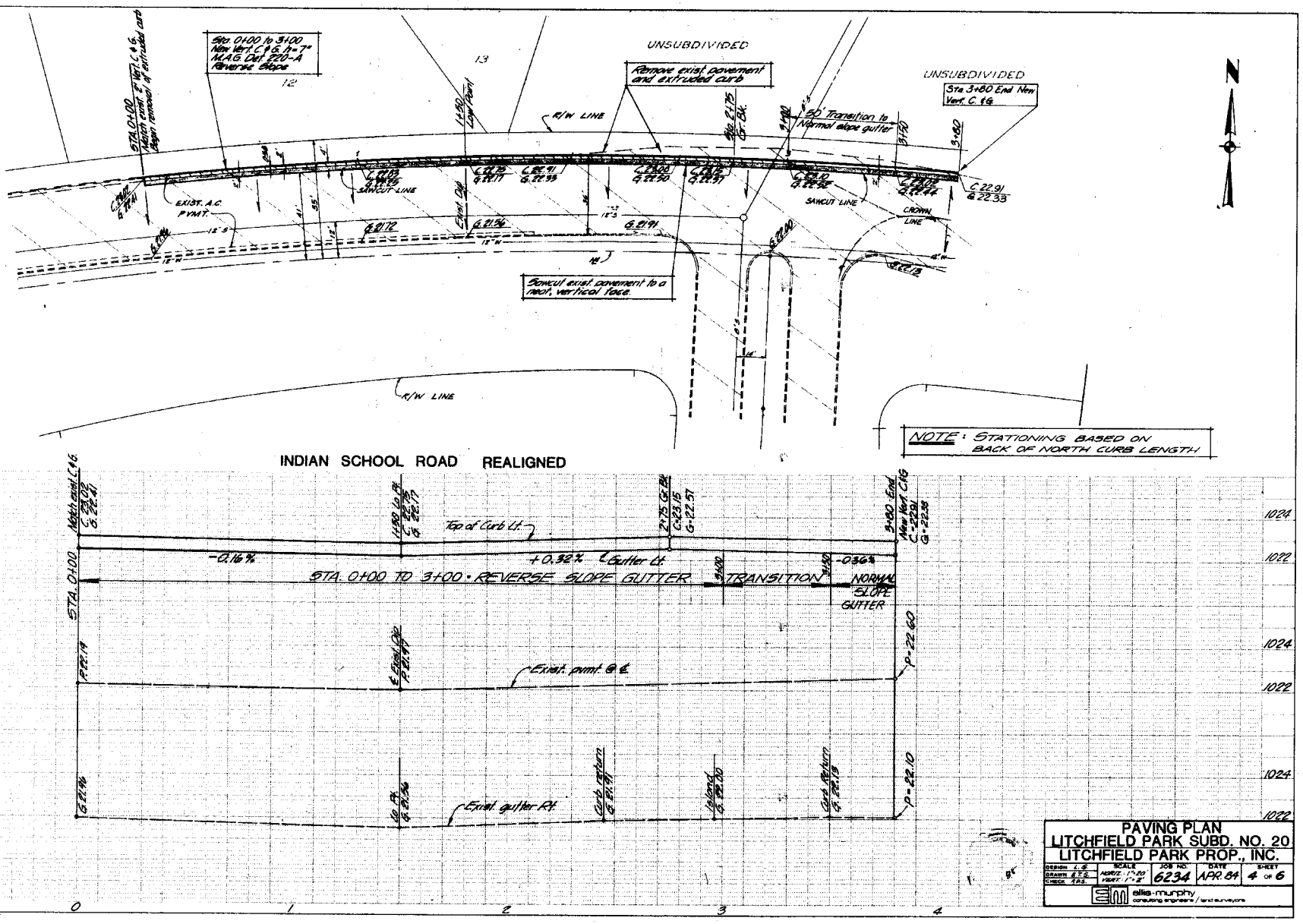
PAVING PLAN
LITCHFIELD PARK SUBD. NO. 20
LITCHFIELD PARK PROP., INC.

DESIGN	DRAWN	CHECKED	SCALE	JOB NO.	DATE	SHEET
L.S.	L.S.	R.S.E.	HORIZ: 1"=50' VERT: 1"=5'	6234	APR. '84	2 of 6

ellis-murphy consulting engineers / land surveyors

K+E PLATE 1, PLAN-PROFILE

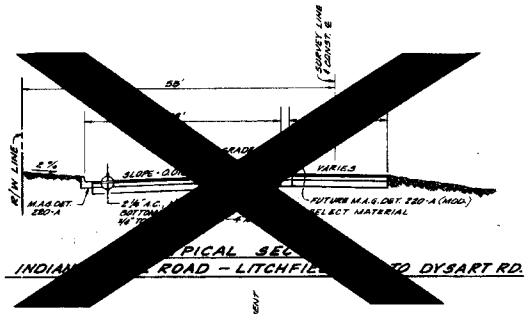

LITCHFIELD PARK
NO. 12, UNIT ONE
FAIRWAY DRIVE
VILLA NUEVA DR.
SURVEY MONUMENT M.A.G. DET. 120-2-0
Sawcut Exist Curb, Gutter & Pvmt. & Match.
Remove 82 L.F. Existing Roll Curb & Gutter
Install Water Service
Install Water Service
10' Depress 8" Curb Level
Adjust Sewer Manhole F1C MAG Det. 422
Install Water & Sewer Service. Remove Exist Plug & Connect Sewer Service to Exist. "Y"
Adjust Storm Drain Manhole F1C MAG Det. 422
NEW 2' ROLL C & G M.A.G. DET. 220-0
Adjust Storm Drain Manhole F1C MAG Det. 422
Install Approx. 30 L.F. 4" Service. Remove Exist. Plugs & Connect Services to Exist. Wyes.
20' Drainageway
MATCH RIGHT
10' Channel Bottom
SCALE 1"=20'
8K CURB ### CURVE TABLE ###
NO | RADIUS | ARC | DELTA | TANGENT | CHORD | CHORD BRG
1 | 20.00 | 31.42 | 90°00'00" | 20.00 | 28.28 | N44°45'30"E
2 | 59.00 | 42.64 | 41°24'35" | 22.30 | 41.72 | N69°32'13"W
3 | 59.00 | 42.64 | 41°24'35" | 22.30 | 41.72 | N69°08'13"E
4 | 20.00 | 31.42 | 90°00'00" | 20.00 | 28.28 | N45°14'30"W
New Straight Hdwl. M.A.G. Det. 501-1 & 501-2
New L-Hdwl. M.A.G. Det. 501-1 & 501-2
Set planting strip Grading Plan Ellis Murphy Plans.
2-18" R.C.P.
30' Taper
MATCH LEFT
Sawcut, Remove & Replace 34 L.F. V.C.& G. R=7' Det. 220-A
RD. REALIGN.
20' DRAINAGEWAY X-SECTION
SECTION A-A
(NO SCALE)
Top of Curb Left
Gutter Left
Natural Grd.
Top of Curb Right
Gutter Rt.
Cobblestone Lined Channel
Top Hdwl 2160
Top Hdwl 2100
Top of Pipe
Drainage Ditch to Planting Strip
Revision: Extend Exist. Sewer Services (4-29-85)
PAVING PLAN
LITCHFIELD PARK SUBD. NO. 20
LITCHFIELD PARK PROP., INC.
DESIGN L.S.
DRAWN L.S.
CHECK R.D.S.
SCALE HORIZ. 1"=20' VERT. 1"=2'
JOB NO. 6234
DATE APR. '84
SHEET 3 OF 6
ellis-murphy consulting engineers / land surveyors



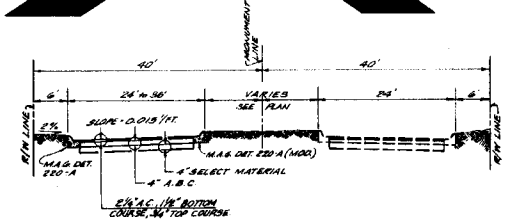
PAVING PLAN
LITCHFIELD PARK SUBD. NO. 20
LITCHFIELD PARK PROP., INC.

DESIGN L.E.	SCALE	JOB NO.	DATE	SHEET
DRAWN E.T.E.	HORIZ. 1"=50	6234	APR. 84	4 OF 6
CHECK E.D.S.	VERT. 1"=5			

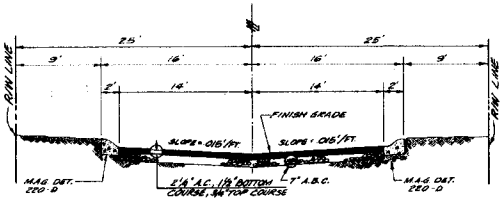
ellis-murphy
consulting engineers / land surveyors



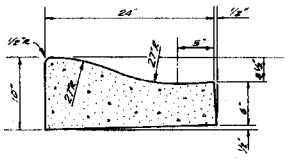
~~TYPICAL SEC~~
~~INDIAN ROAD – LITCHFI~~ ~~TO DYSART RD.~~



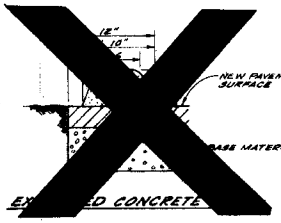
TYPICAL SECTION
INDIAN SCHOOL LANE
STA. 3+52.5 to 5+11.28



TYPICAL SECTION
FAIRWAY CIRCLE



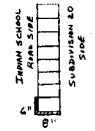
M.A.G. 220 TYPE-O
ROLL CURB & GUTTER
FAIRWAY CIRCLE



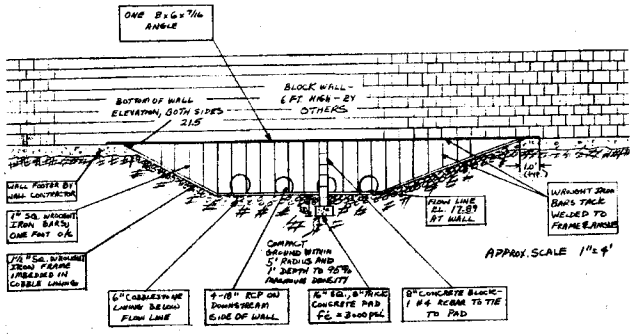
~~EX D CONCRETE~~

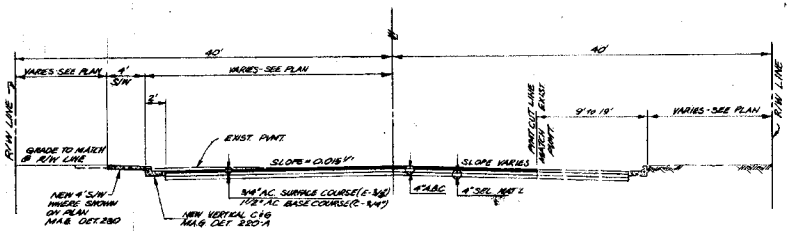
LINTEL DRAINAGE DETAIL FOR LITCHFIELD PARK SUBDIVISION 20

NOTE: WALL CONTRACTOR RESPONSIBLE FOR INSTALLATION OF LINTEL SYSTEM AS SHOWN, EXCEPT FOR ALL RCP AND COBBLES.

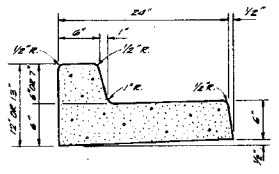


SIDE VIEW OF WALL (TYP) (NTS)

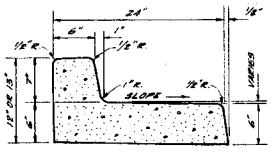




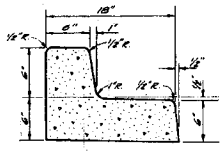
TYPICAL SECTION
INDIAN SCHOOL LANE
STA. 0+00 to 3+57.5



M.A.G. 220 TYPE "A" VERT. CURB & GUTTER
INDIAN SCHOOL RD. REALIGNED
STA. 3+50 to 3+80, 1" FACE
INDIAN SCHOOL LANE
STA. 0+00 TO 5+11.28, 6" FACE



M.A.G. 220 TYPE "A" REVERSE
SLOPE VERT. CURB & GUTTER
INDIAN SCHOOL RD. REALIGNED
STA. 0+00 TO 3+00, 1" FACE

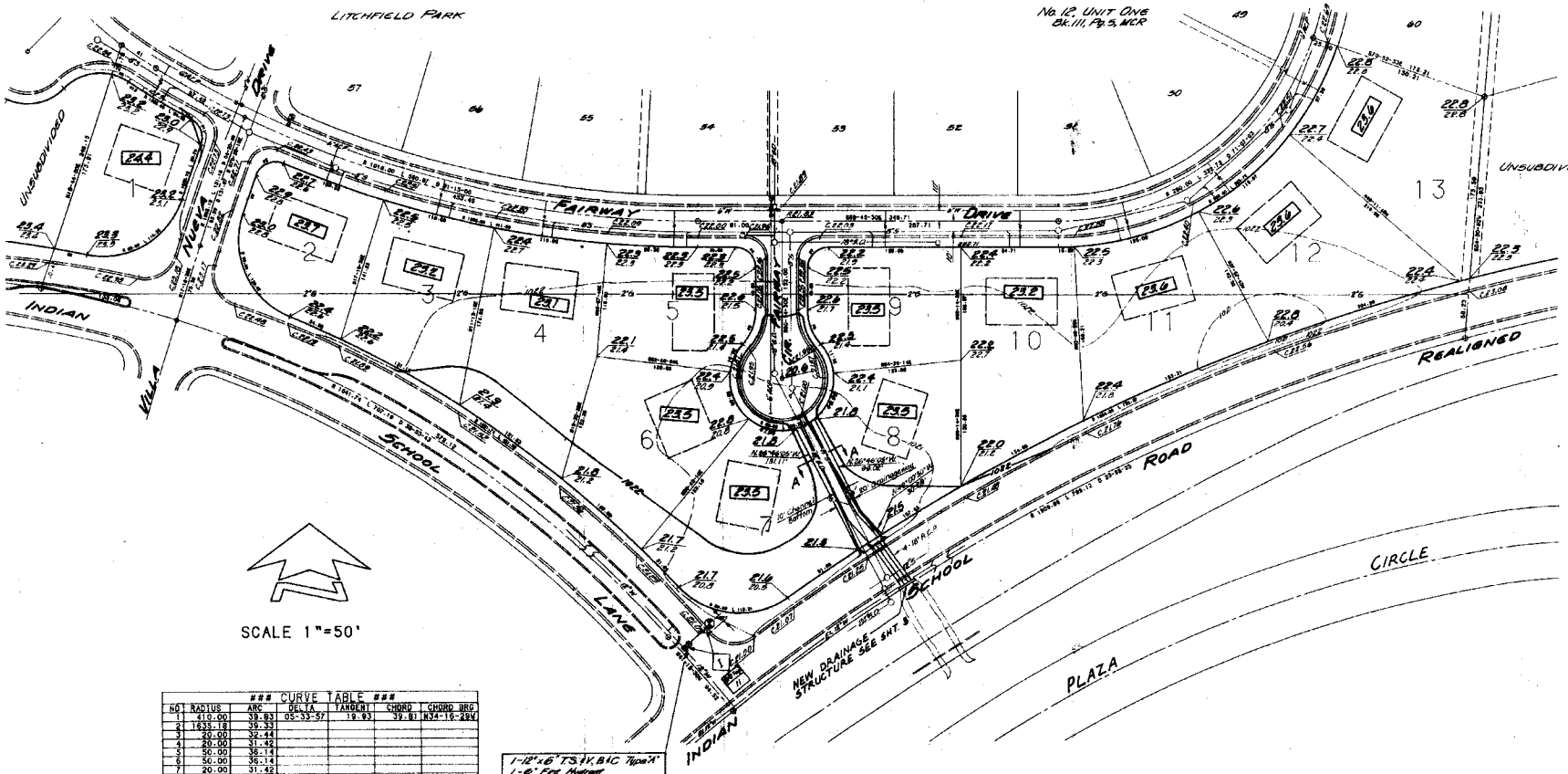


M.A.G. 220 TYPE "A" MODIFIED
VERT. CURB & GUTTER
INDIAN SCHOOL LANE MEDIAN

Rec'd Aug '85

LITCHFIELD PARK SUBD. NO. 20				
LITCHFIELD PARK PROP. INC				
DESIGN L.E.	SCALE	JOB NO.	DATE	SHEET
DRAWN E.T.S.	NONE	6234	APR. '84	5 OF 6
CHECK R.T.S.				

ellis-murphy
consulting engineers / land surveyors



### CURVE TABLE ###						
NO	RADIUS	ARC	DELTA	TANGENT	CHORD	CHORD BRG
1	410.00	38.83	05-33-57	19.93	38.81	N34-16-28W
2	1635.18	39.33				
3	20.00	32.44				
4	60.00	31.42				
5	50.00	36.14				
6	50.00	36.14				
7	20.00	31.42				
8	1081.74	31.82				
9	50.00	17.51				
10	435.00	15.95				
11	20.00	28.60				

1-12"x6" T.S.&V. BIC Tapx"
1-6" Fire Hydrant
32 L.F. x 6" C.I.P.
M.A.G. Det. 340 & 392

20' DRAINAGEWAY X-SECTION
SECTION A-A
(No Scale)

LEGEND

- Existing Contour Line
- Finish Contour Line
- Top Curb Elev. (New/Exist.)
- 236 Min. Pad Elev. *
- 236.5 Finish Grading Elev.
- 237.6 Existing Elev.
- Existing Manhole
- Exist. San. Sewer
- Exist. Storm Sewer
- Exist. Water
- Exist. Catch Basin
- Exist. Gas Line
- * Finish Floors to be 8 inches above pad elev.

CONSTRUCTION NOTES
REGARDING UTILITIES

The Contractor is responsible for:

1. Providing all trench, backfill and compaction for TELCO's conduit per its specifications and plans.
2. Providing all splice pits for TELCO per its specifications and plans.
3. Providing all trench, bedding, backfill and compaction for Arizona Public Service electrical conduit per APS specifications and plans.
4. Providing APS approved shading for electrical conduit to be installed by APS.
5. Providing trench, approved bedding, shading and backfill materials for gas lines per APS/Southwest Gas Co. specifications.
6. Contacting APS (Lou Gray at 271-7119) and Mountain Bell (Mary Chriscaden at 842-7720) to obtain a complete set of plans and to coordinate utility work on the project.

Revision: Show Exist Services @ Lot 1 (4-29-85)

GRADING PLAN
LITCHFIELD PARK SUBD. NO. 20
LITCHFIELD PARK PROP., INC.

DESIGN: RMS/RLS	SCALE	JOB NO.	DATE	SHEET
DRAWN: RS	1"= 50'	6234	APR. '84	8 of 8
CHECK: RLS				

ellis-murphy
consulting engineers/land surveyors

WATER AND SANITARY SEWER PLANS
LITCHFIELD PARK SUBDIVISION NO. 17
UNIT II

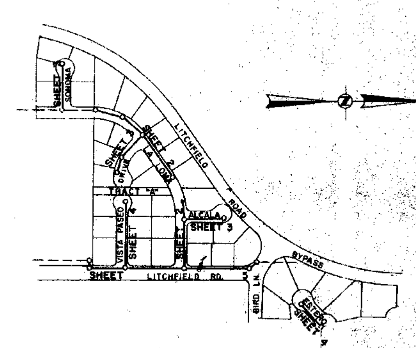
LITCHFIELD PARK PROPERTIES
LITCHFIELD PARK
ARIZONA

CONTRACT NO. LPP-WS-3023-78

APPROVAL ____ /AM 4-15-80
Maricopa County Health Department
Environmental Services Division
Date

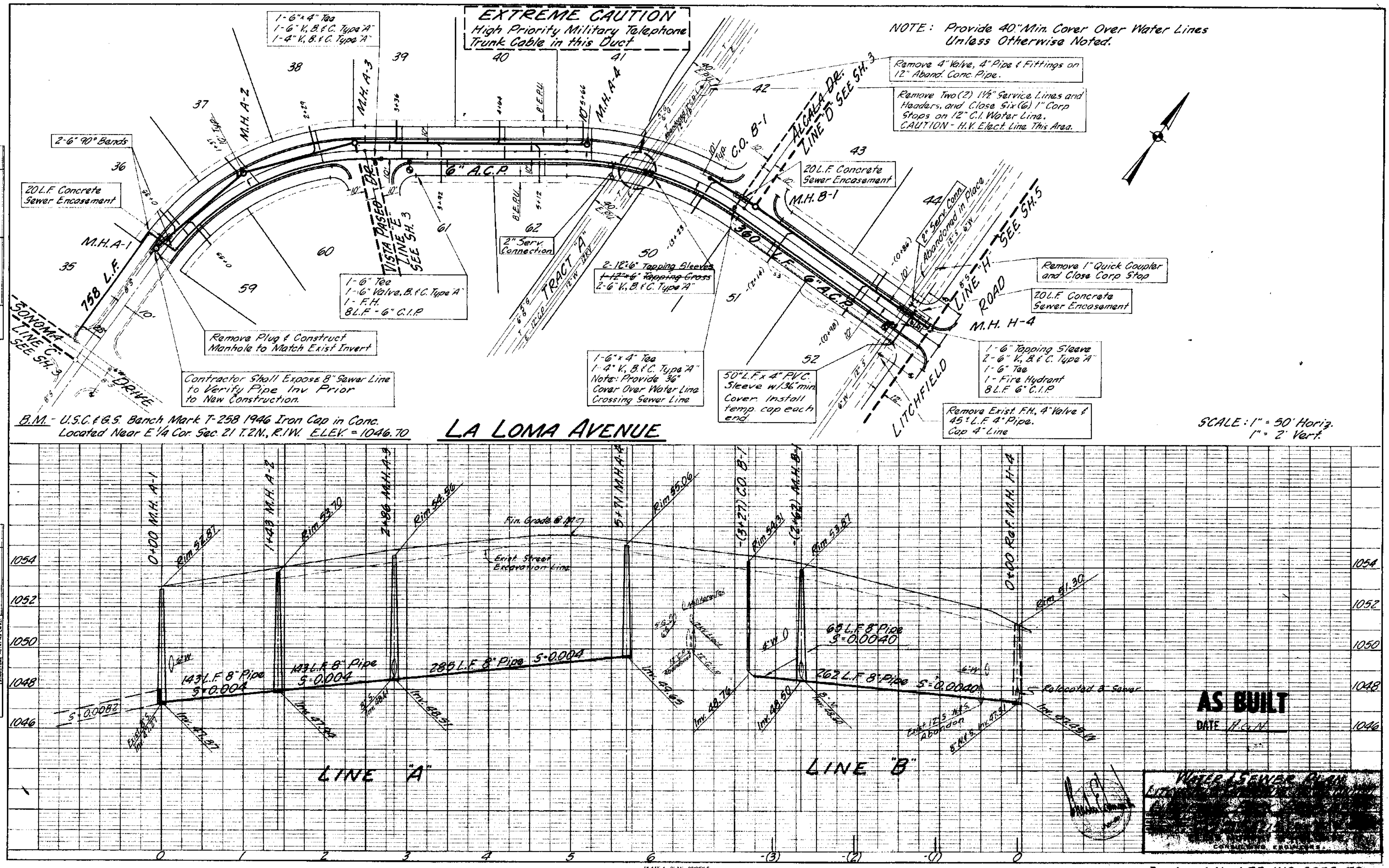
ELLIS, MURPHY & HOLGATE

CONSULTING ENGINEERS
PHOENIX, ARIZONA



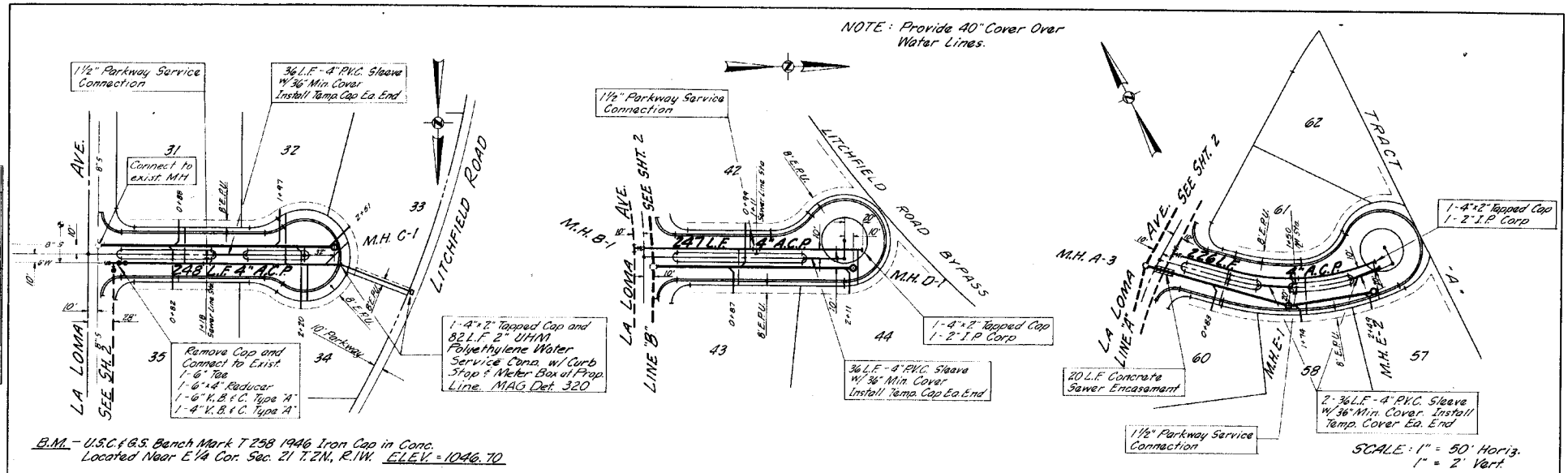
INDEX & VICINITY MAP
NO SCALE

AS BUILT
DATE 11-6-80



EXTREME CAUTION
High Priority Military Telephone Trunk Cable in this Duct
NOTE: Provide 40" Min. Cover Over Water Lines Unless Otherwise Noted.
1-6"x4" Tee
1-6" V., B.&C. Type "A"
1-4" V., B.&C. Type "A"
Remove 4" Valve, 4" Pipe & Fittings on 12" Aband. Conc. Pipe.
Remove Two (2) 1½" Service Lines and Headers, and Close Six (6) 1" Corp Stops on 12" C.I. Water Line.
CAUTION - H.V. Elect. Line This Area.
2-6" 90° Bends
20 L.F. Concrete Sewer Encasement
M.H. A-1
M.H. A-2
M.H. A-3
M.H. A-4
M.H. B-1
M.H. H-4
C.O. B-1
6" A.C.P.
VISTA PASEO DR. LINE "E" SEE SH. 3
ALCALA DR. LINE "D" SEE SH. 3
LINE "H" SEE SH. 5
ROAD
LITCHFIELD
TRACT "A"
SONOMA LINE "C" SEE SH. 3
DRIVE
158 L.F.
360 L.F. 6" A.C.P.
2" Serv. Connection
2-12"x6" Tapping Sleeves
2-6" V., B.&C. Type "A"
1-6" Tee
1-6" Valve, B.&C. Type "A"
1-F.H.
8 L.F. - 6" C.I.P.
Remove Plug & Construct Manhole to Match Exist Invert
Contractor Shall Expose 8" Sewer Line to Verify Pipe Inv Prior to New Construction.
1-6"x4" Tee
1-4" V., B.&C. Type "A"
Note: Provide 36" Cover Over Water Line Crossing Sewer Line
50 L.F. x 4" P.V.C. Sleeve w/36" min Cover. Install temp. cap each end
2" Serv. Conn. Abandoned in Place
Remove 1" Quick Coupler and Close Corp Stop
20 L.F. Concrete Sewer Encasement
1-6" Tapping Sleeve
2-6" V., B.&C. Type "A"
1-6" Tee
1-Fire Hydrant
8 L.F. 6" C.I.P.
Remove Exist. F.H., 4" Valve & 45± L.F. 4" Pipe. Cap 4" Line
B.M. - U.S.C.&G.S. Bench Mark T-258 1946 Iron Cap in Conc. Located Near E 1/4 Cor. Sec. 21 T.2N., R.1W. ELEV. = 1046.70
LA LOMA AVENUE
SCALE: 1" = 50' Horiz. 1" = 2' Vert.
0+00 M.H. A-1
1+43 M.H. A-2
2+86 M.H. A-3
5+71 M.H. A-4
(3+27) C.O. B-1
(2+62) M.H. B-1
0+00 Ref. M.H. H-4
Rim 52.87
Rim 53.70
Rim 54.56
Rim 55.06
Rim 54.31
Rim 53.87
Rim 51.30
Fin. Grade
Exist. Street Excavation Line
143 L.F. 8" Pipe S=0.004
143 L.F. 8" Pipe S=0.004
285 L.F. 8" Pipe S=0.004
65 L.F. 8" Pipe S=0.0040
262 L.F. 8" Pipe S=0.0040
S=0.0082
Inv. 47.87
Inv. 47.24
Inv. 48.51
Inv. 49.65
Inv. 48.76
Inv. 48.50
Relocated 8" Sewer
Abandon
LINE "A"
LINE "B"
1054
1052
1050
1048
1046
0 1 2 3 4 5 6 (3) (2) (1) 0
AS BUILT
DATE
PLAN
PROFILE
PLATE 1 - PLAN - PROFILE
Contract No. LPP-WS-3023-78

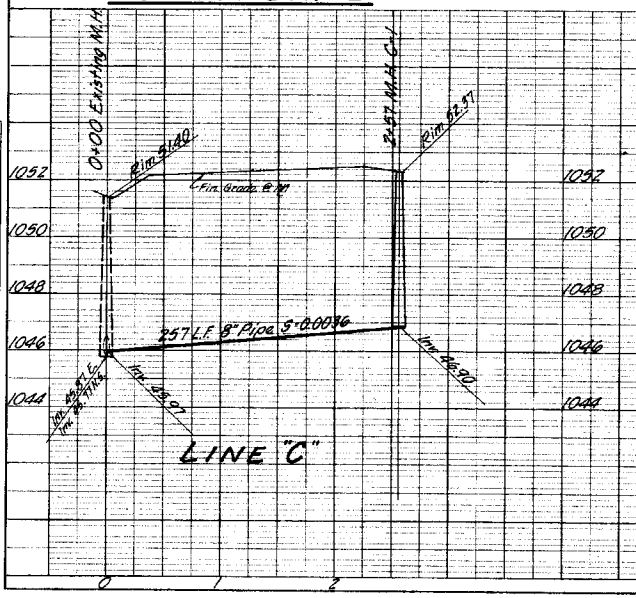
NOTE: Provide 40" Cover Over Water Lines.



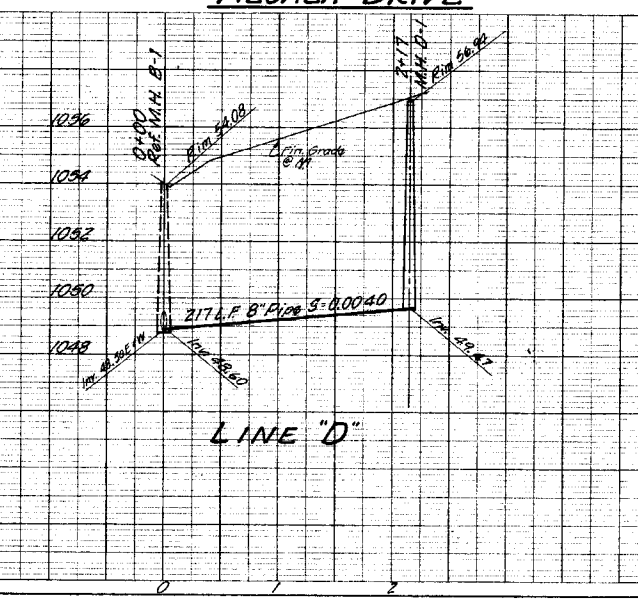
B.M. – U.S.C. & G.S. Bench Mark T 258 1946 Iron Cap in Conc. Located Near E¼ Cor. Sec. 21 T.2N., R.1W. ELEV. = 1046.70

SCALE: 1" = 50' Horiz.
1" = 2' Vert.

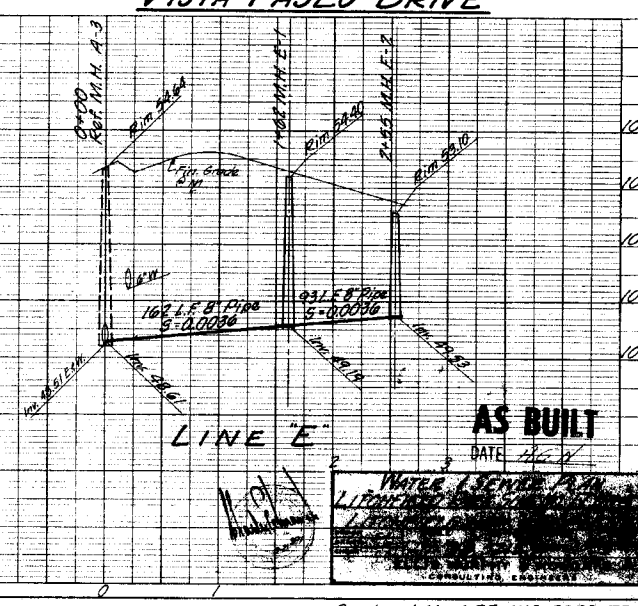
SONOMA DRIVE



ALCALA DRIVE



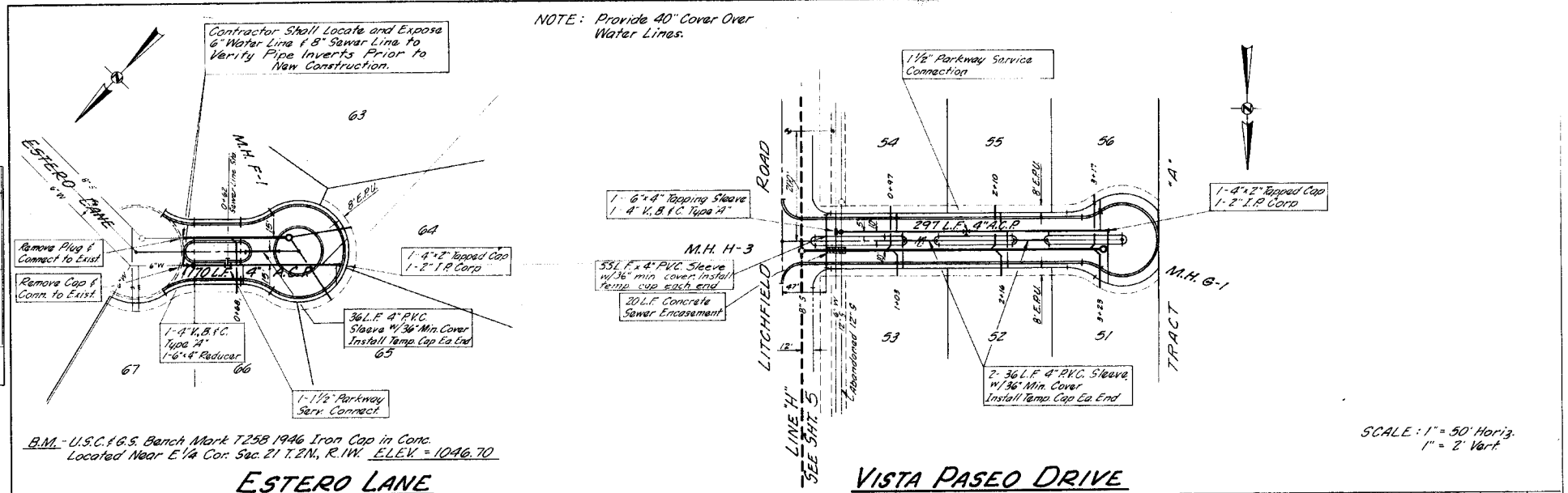
VISTA PASEO DRIVE



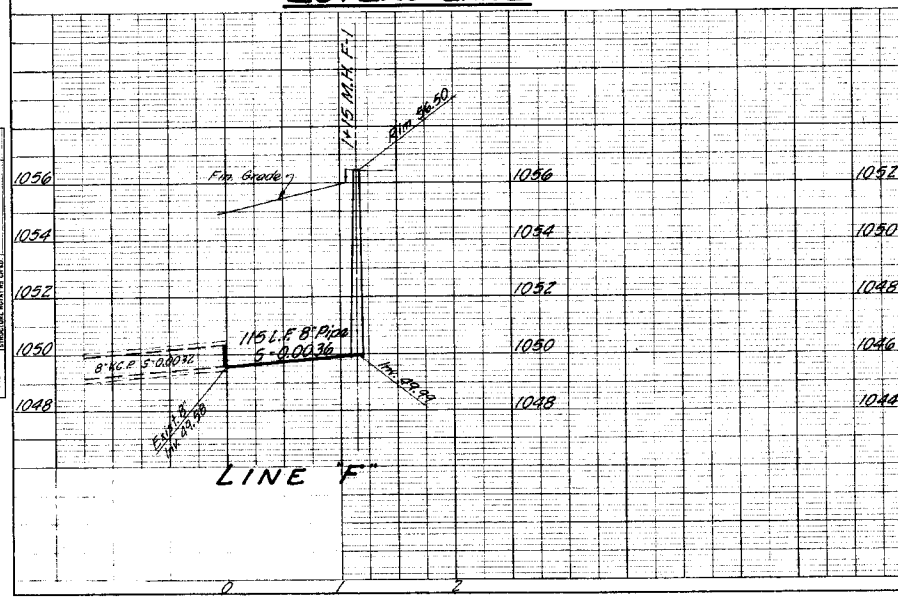
AS BUILT
DATE 12-6-79

PLATE 1—PLAN—PROFILE C. P. R. & R. E.

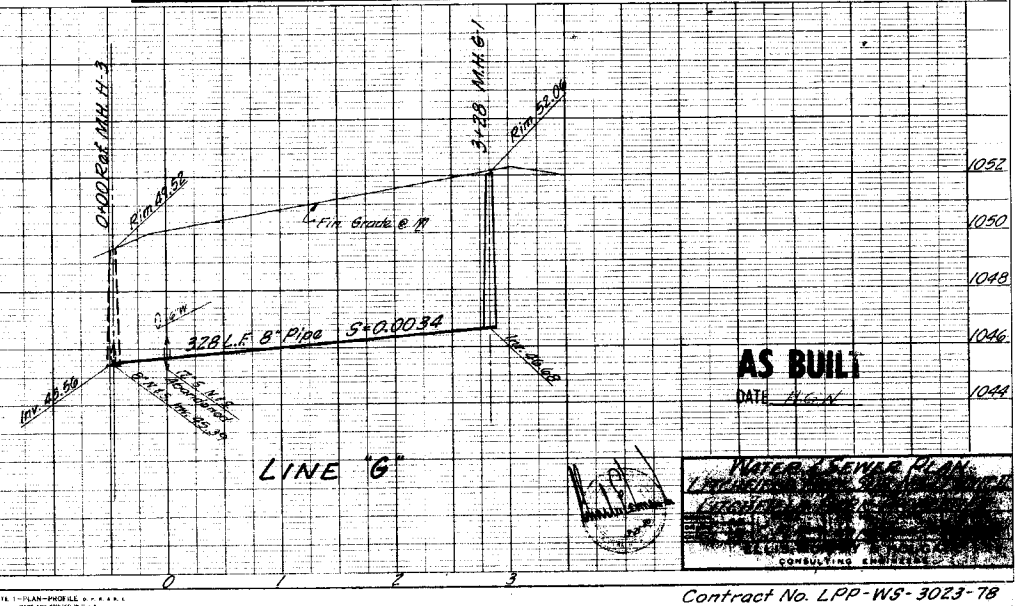
Contract No. LPP-WS-3023-78



ESTERO LANE



VISTA PASEO DRIVE

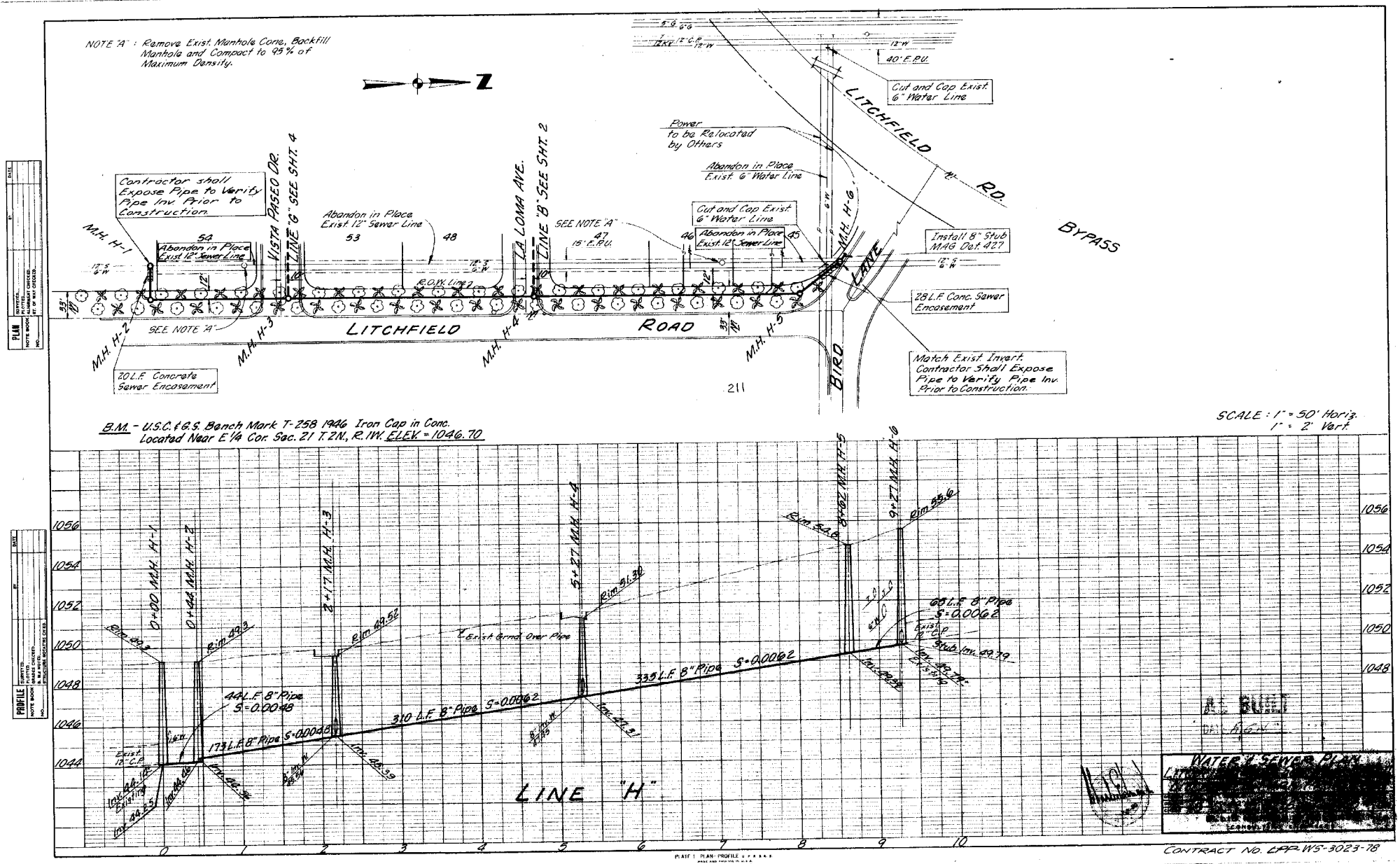


AS BUILT
DATE 11-6-78

WATER & SEWER PLAN
GRAHAM ENGINEERING
CONSULTING ENGINEERS

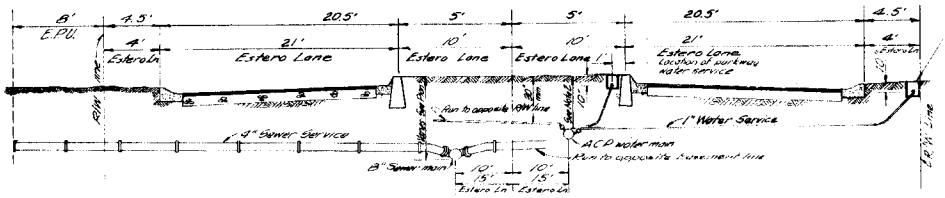
PLATE 1—PLAN—PROFILE

Contract No. LPP-WS-3023-78

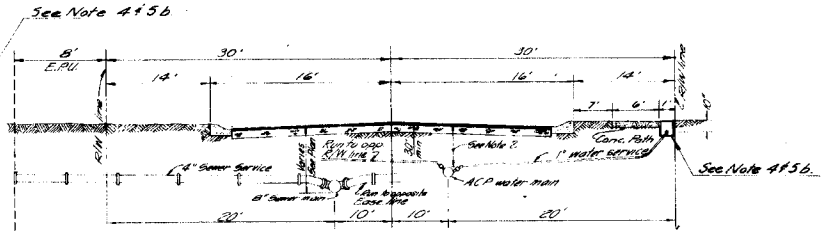


CONTRACT NO. CAP-WS-3023-78

17-4



CUL-DE-SACS



LA LOMA AVENUE

TYPICAL WATER AND SEWER SERVICE CONNECTIONS

GENERAL NOTE:

The Contractor shall locate both vertically and horizontally all utility crossings and connections in the field prior to commencing trenching to permit grade change if required.

SPECIFICATIONS FOR WATER AND SEWER

All construction shown on these plans shall be in conformance with applicable MAG specifications for public works construction, Maricopa County Highway Department special provisions for installation of underground utilities, MAG and City of Phoenix Standard Details, latest revision.

NOTES:

1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction. See Ellis, Murphy and Holgate paving plans for finish grade elevations.
2. Contractor shall provide 40" minimum cover from proposed finish grade to top of water main unless otherwise shown.
3. Locate sewer taps and water service lines as follows unless otherwise shown or directed by the Engineer:
   a. 1" PE Water service line on center line of residential lot and sewer tap a minimum distance of six feet downstream from water service line unless otherwise indicated.
   b. 1½" PE Water Service lines to parkways where indicated on the plans, and ¾" water service lines in parkways on Indian School Road - See detail below.
   c. 2" PE Water service lines at La Loma Ave. and Litchfield Road and at the North end of Tract "A" in La Loma Ave. (Sheet 2)
4. 1" Meters for residential lots will be furnished by Litchfield Park Service Co and shall be installed by the Contractor.
5. All meter boxes Mag Det. 320, shall be furnished and installed by the Contractor with long dimension parallel with property line
   a. Install No1 meter boxes at Indian School Road parkways.
   b. Install No. 2 meter boxes at all residential lots.
   c. Install No 3 meter boxes at all parkways.
   d. Install No. 4 meter boxes at service connection at La Loma Ave. and Litchfield Park Road and at the North end of Tract "A" (Sh. 2).
6. Manhole frame and cover shall be MAG Std. Det. 424. Lettering shall be "Sanitary Sewer" only.

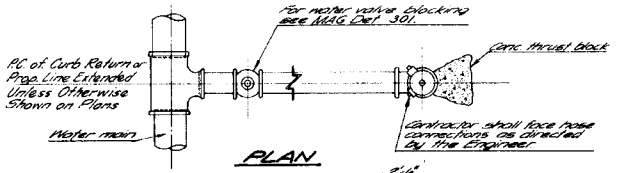
QUANTITIES

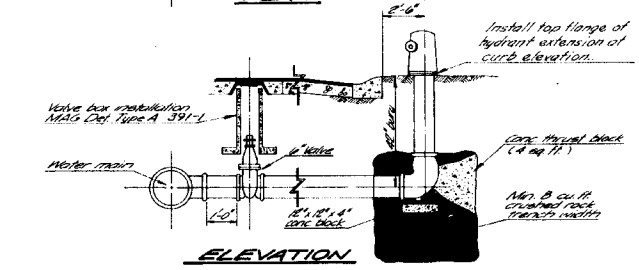
WATER

ITEM	DESCRIPTION	QUANTITY	UNIT
1	6" Asbestos Cement Pipe	1,118	L.F.
2	4" Asbestos Cement Pipe	1,188	L.F.
3	6" Cast Iron Pipe	16	L.F.
4	12" x 6" Tapping Cross, Valve Box & Cover (Type A)	1	EA.
5	6" x 4" Tapping Sleeve, Valve Box & Cover (Type A)	1	EA.
6	6" Tapping Sleeve, Valve Box & Cover (Type A)	1	EA.
7	6" Valve Box & Cover (Type A)	4	EA.
8	4" Valve Box & Cover (Type A)	4	EA.
9	Fire Hydrant	2	EA.
10	2" Water Service Connection	2	EA.
11	1-1/2" Water Service Connection	5	EA.
12	1" Water Service Connection	35	EA.
13	2" P.E. Pipe	82	L.F.

SEWER

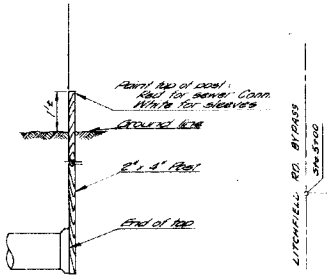
1	8" Sewer Pipe	2,997	L.F.
2	4' Diameter Sewer Manhole	17	EA.
3	4" Sewer Service Connections	35	EA.
4	Sewer Line Encasement	148	L.F.



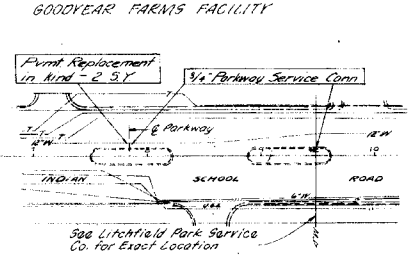


GETTING FIRE HYDRANT

ALL JOINTS IN FIRE HYDRANT ASSEMBLY TO BE OF CAULKED LEAD OR MECHANICAL JOINT PER AWWA - A - 21.11



MARKER FOR END OF SEWER TAPS & SLEEVES



Plan - Parkway Service Conn. Indian School Road

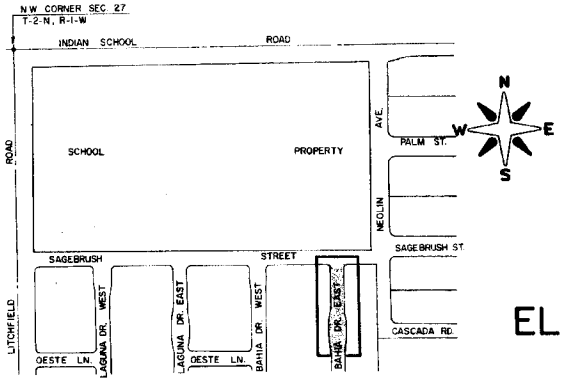
WATER & SEWER PLAN
LITCHFIELD PARK SUB. No. 17 UNIT 1
LITCHFIELD PARK PROPERTIES

DESIGN		SCALE	JOB NO.	DATE	SHEET
DRAWN		NONE	5215	Mar. 80	6 OF 6
CHECK					

ELLIS, MURPHY & HOLGATE
CONSULTING ENGINEERS

Contract No. LPP-WS-3023-78

PAVING, WATER, & SANITARY SEWER PLAN
LITCHFIELD PARK SUBDIVISION NO. 15-B
BAHIA DRIVE EAST
LITCHFIELD PARK PROPERTIES
LITCHFIELD PARK
ARIZONA



LOCATION MAP
NO SCALE

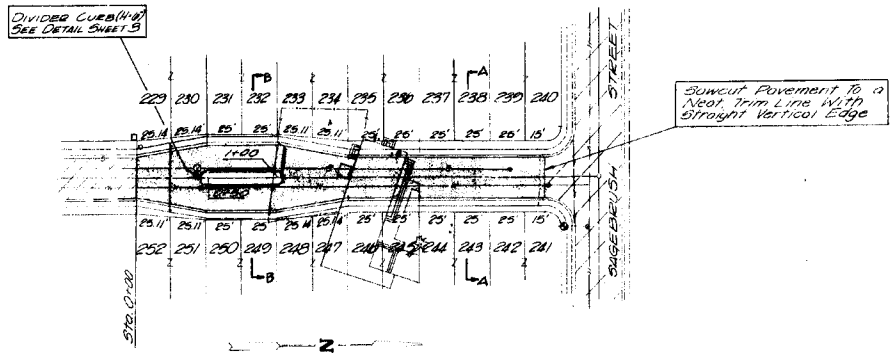
CONTRACT NO. LPP-P 4023-74
CONTRACT NO. LPP-W S 3020-74

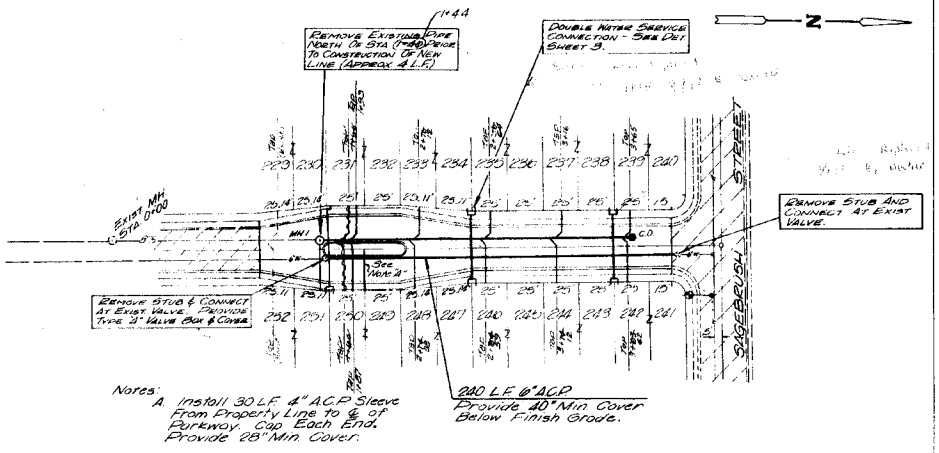
ELLIS, MURPHY, HOLGATE AND JOHNSON
CONSULTING CIVIL ENGINEERS
PHOENIX — ARIZONA

APPROVAL: [signature] 10-16-75
Sanitary Engineer Date
Maricopa County Health Dept.
Division of Environmental Sanitation

AS BUILT
DATE Oct. 15, 75

Sheet 1 of 9
EMH&J #4473

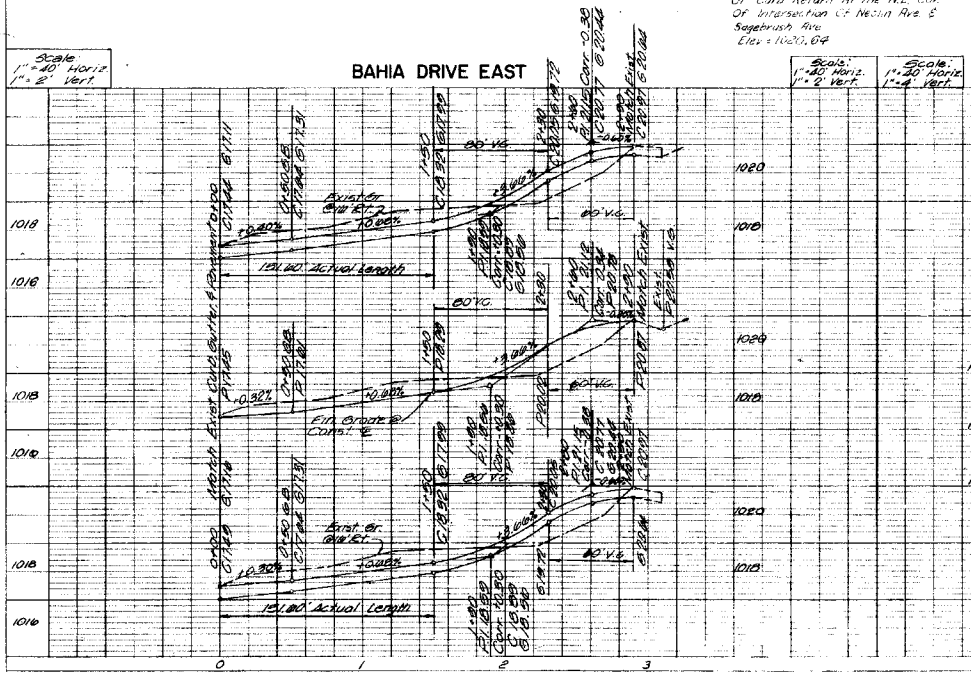


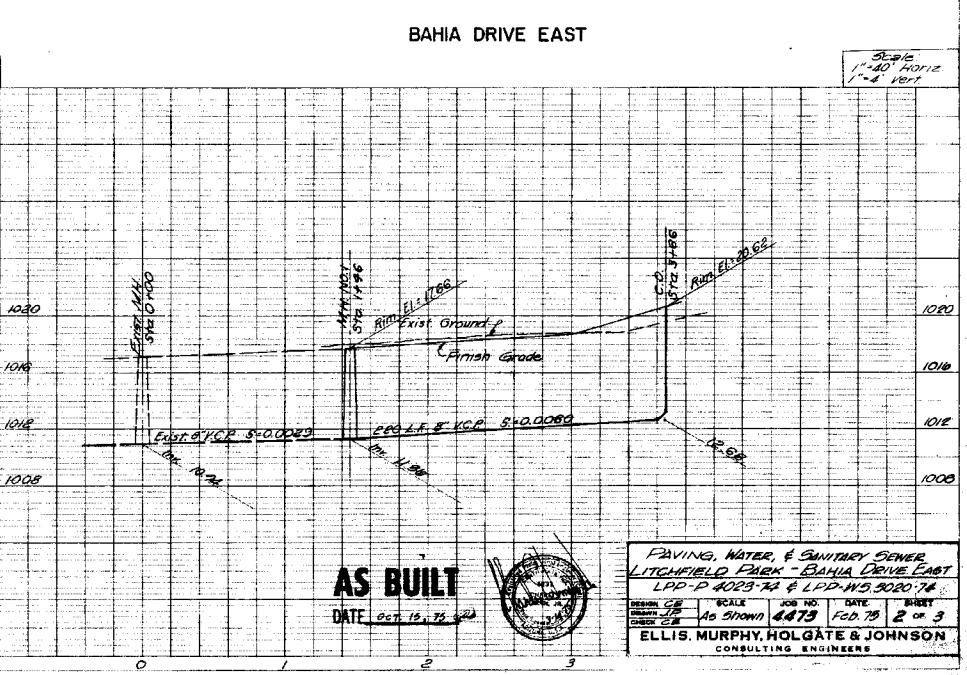


Notes:
A. Install 30 L.F. 4" A.C.P. Sleeve From Property Line to ℄ of Parkway. Cap Each End. Provide 28" Min. Cover.

240 L.F. 6" A.C.P. Provide 40" Min. Cover Below Finish Grade.

BM - "X" On Top Of Curb At North P.C. Of Curb Return At The N.E. Cor. Of Intersection Of Nesbin Ave. & Sagebrush Ave. Elev. = 1030.64





AS BUILT

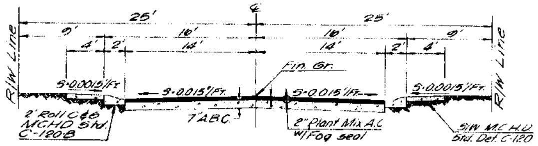
DATE Oct. 15, 75

PAVING, WATER, & SANITARY SEWER
LITCHFIELD PARK - BAHIA DRIVE EAST
LPD-P 4023-74 & LPD-WS 3020-74

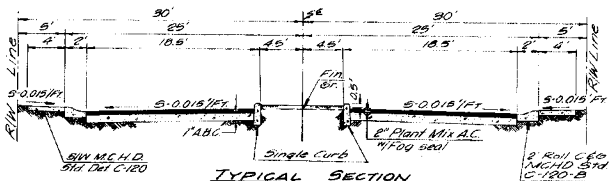
DESIGN CE	SCALE	JOB NO.	DATE	SHEET
DRAWN CE	As Shown	4473	FEB. 75	2 OF 3
CHECK CE				

ELLIS, MURPHY, HOLGATE & JOHNSON
CONSULTING ENGINEERS

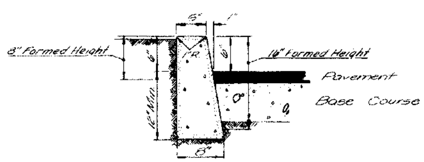
PLATE 1 SINGLE PLAN - PROFILE
CHARLES BRUNING CO
MADE IN U.S.A.



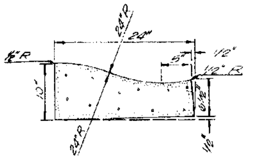
TYPICAL SECTION
SECTION A-A
No Scale



TYPICAL SECTION
SECTION B-B
No Scale



SINGLE CURB DETAIL
No Scale



MCHD STD C-120-B
ROLL CURB & GUTTER
No Scale

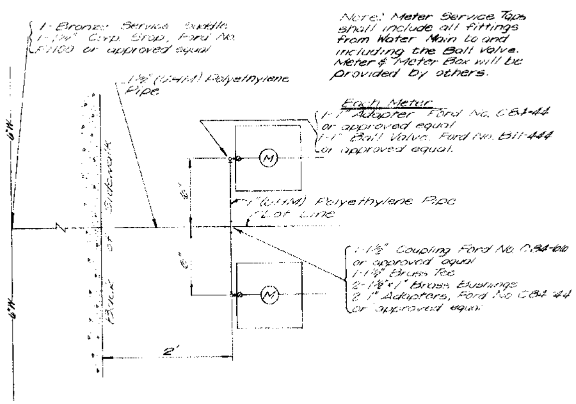
SPECIFICATIONS FOR PAVING

ALL CONSTRUCTION SHOWN ON THESE PLANS SHALL BE IN ACCORDANCE WITH [illegible] SPECIFICATIONS FOR [illegible] CONSTRUCTION, MARICOPA COUNTY HIGHWAY STANDARDS AND MARICOPA COUNTY SPECIAL PROVISIONS FOR CONSTRUCTION OF STREET IMPROVEMENTS, LATEST REVISION.

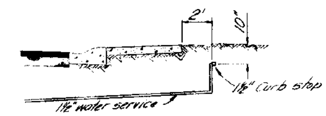
PAVING QUANTITIES

ITEM	DESCRIPTION	QUANTITY	UNIT
1	2" Asphaltic Concrete, fog seal and 7" ABC	[illegible]	
2	Roll Curb [illegible] (Std. [illegible] 120-B)	[illegible]	[illegible]
3	6" Divider [illegible] (Special Detail)	[illegible]	[illegible]
4	Concrete Sidewalk	2,[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]

NOTE: Trench backfill and compaction shall be in accordance with Maricopa County Highway Department Special Provisions for Installation of Underground Utilities, latest revision.



DOUBLE WATER SERVICE CONNECTION DETAIL
No Scale



WATER SERVICE CONNECTION
No Scale

AS BUILT
DATE Oct. 15, 75

DETAIL SHEET			
LITCHFIELD PARK - BAHIA DRIVE EAST			
LPP-P 4023-74 & LPP-W.S. 3020-74			
DESIGN C.E. / DRAWN J.P. / CHECK C.E.	SCALE As Shown	JOB NO. 4473	DATE Feb. 75	SHEET 3 of 3

ELLIS, MURPHY, HOLGATE & JOHNSON
CONSULTING ENGINEERS

LITCHFIELD PARK, ARIZONA

WATER & SEWER PLANS

OF

LITCHFIELD PARK SUBDIVISION NO. 15-B
UNIT ONE

PREPARED FOR

LITCHFIELD PARK PROPERTIES

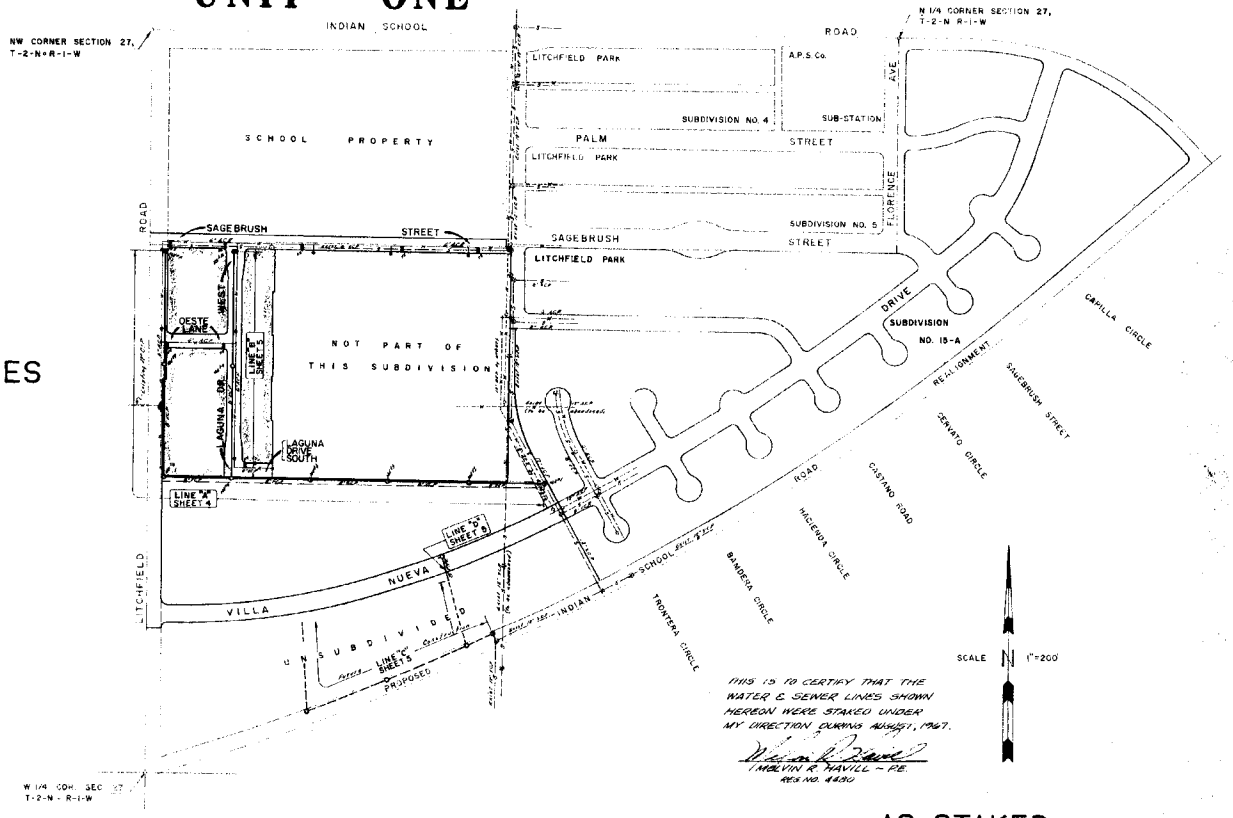
BY

HAVILL ENGINEERING CO.
3015 E. THOMAS RD. 956-3210
PHOENIX, ARIZONA

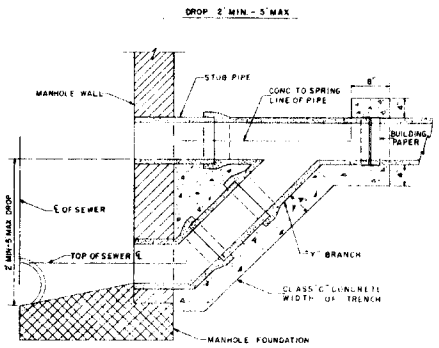
CONTRACT NO. LPP-WS- 3005-67

Approved by Maricopa County Health Dept. (Division of Environmental Sanitation) this 8th day of August, 1967.

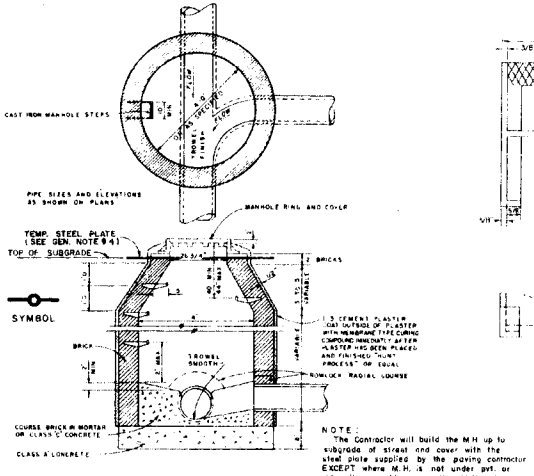
Approved by: _____
SANITARY ENGINEER



AS-STAKED JOB NO. 711

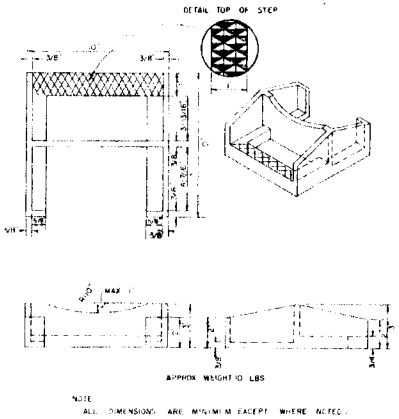


DROP SEWER CONNECTION



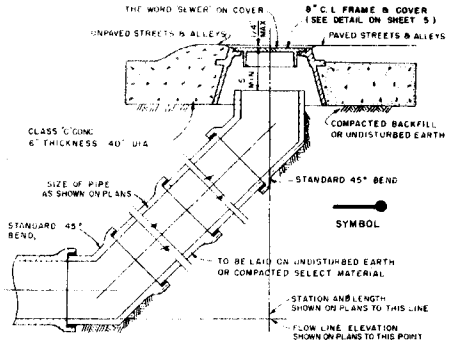
NOTE:
The Contractor will build the M.H. up to subgrade of street and cover with the steel plate supplied by the paving contractor EXCEPT where M.H. is not under pvt. or sidewalk, in which case the M.H. will be completely built.

SEWER MANHOLE

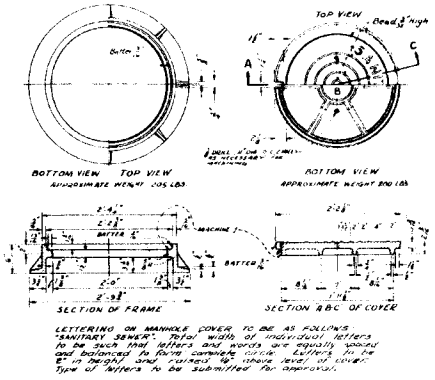


NOTE
ALL DIMENSIONS ARE MINIMUM EXCEPT WHERE NOTED.

CAST IRON MANHOLE STEP

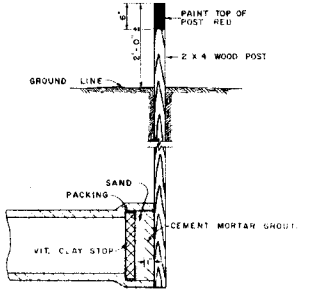


CLEANOUT INSTALLATION

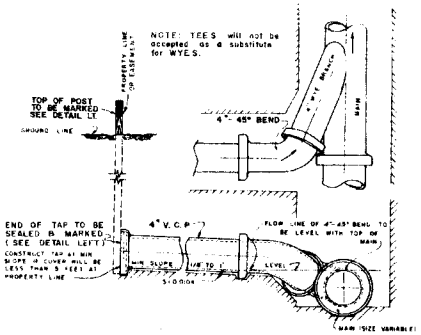


LETTERING ON MANHOLE COVER TO BE AS FOLLOWS: "SANITARY SEWER". Total width of individual letters to be such that letters and words are equally spaced and balanced to form complete circle. Letters to be 6" in height and raised ¼" above level of cover. Type of letters to be submitted for approval.

24" MANHOLE FRAME & COVER



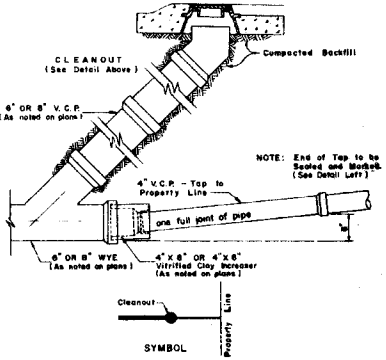
PLUG FOR SEWERS



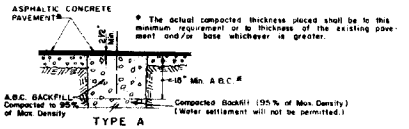
STANDARD SEWER TAP
CONSTRUCTION DETAIL WHERE CONTRACTOR BUILDS HOUSE CONNECTION TAP EXTENDS TO PROPERTY LINE IN ALLEYS OR STREETS OR TO EASEMENT LINE.

NOTE
SIZE OF TAP SHALL BE DESIGNATED ON PLANS

SEWER BUILDING CONNECTION



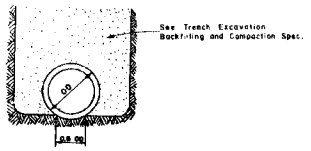
SEWER TAP DETAIL AT C.O.



TYPE A

NOTE: Pavement cut and replacement shall be in accordance with applicable Maricopa County Standard Specifications for Construction of Highways, Streets and Bridges and Maricopa County Special Provisions for Installation of Underground Utilities, latest revisions, and shall include Item 17, Aggregate Base Course; Item 20-A-3.4" Asphaltic Cement Concrete and Item 46, Pavement Cut Replacement.

PAVEMENT REPLACEMENT



CLASS C BEDDING
ORDINARY

TRENCH BEDDING FOR UNDERGROUND CONDUITS

GENERAL NOTES

1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction.

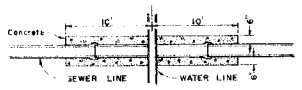
2. Locate sewer taps and water service lines as follows unless otherwise directed by the Engineer:
   (a.) Water service line on centerline of lot.
   (b.) Sewer tap a minimum distance of 10 feet downstream from the water service line.

3. All Taps to be bid to include 4" V.C.P. from Sewer Main to Property Line, or beyond Property Line as shown.

4. Steel plates will be furnished by the Paving Contractor.

When the vertical clearance between crossing WATER and SEWER LINES is less than 2 ft., or if the SEWER is any distance above the WATER LINE, the SEWER LINE shall be Cast Iron Pipe with leaded or mechanical joints a minimum of 10 ft. in each direction from the crossing, or Vitrified Clay Pipe encased in concrete 6" thick, 10 ft. each side of the crossing. This applies to planned and existing WATER LINES and all SEWER SERVICE CONNECTIONS.

The cost of encasement or the use of Cast Iron Pipe, on main lines and service lines shall be incidental, and the cost for such shall be included in the unit price bid for Vitrified Clay Pipe and Taps.

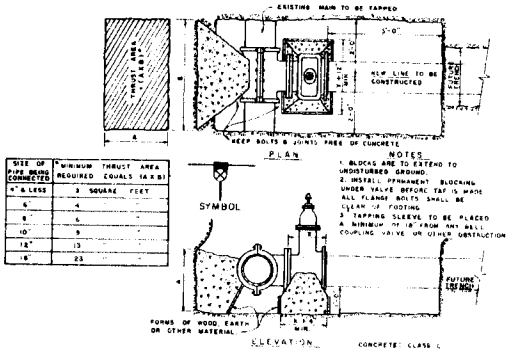


SYMBOL

SEWER LINE ENCASEMENT

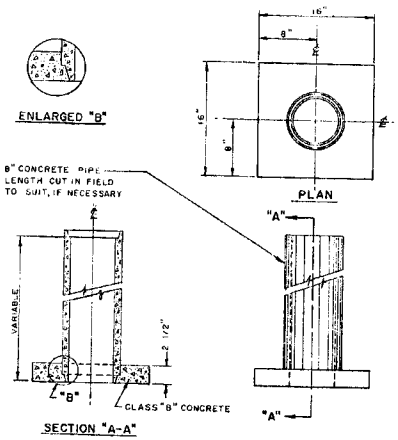
AS-STAKED

(JOB NO. 711-6-50)

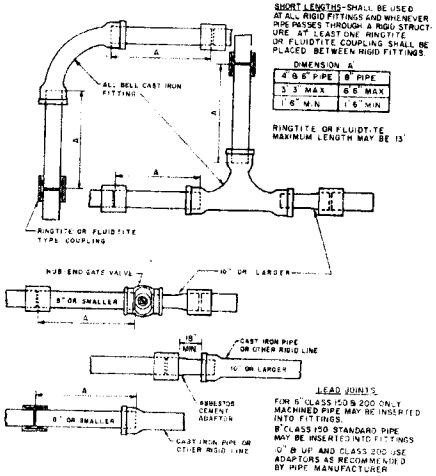


SIZE OF PIPE BEING CONNECTED	MINIMUM THRUST AREA REQUIRED EQUALS (A x B)
4" & LESS	3 SQUARE FEET
6"	4
8"	6
10"	9
12"	13
16"	23

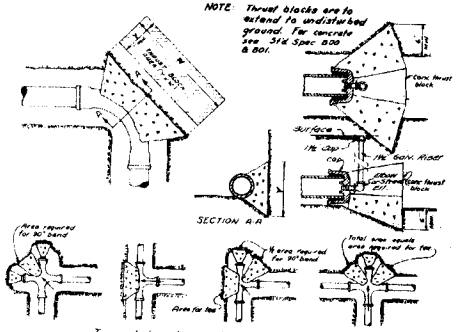
INSTALLING TAPPING SLEEVES AND VALVES



VALVE BOX WITH CAST CONCRETE BASE



FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE

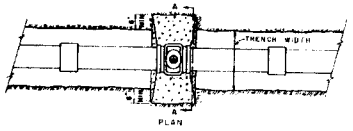


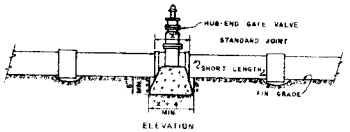
MINIMUM THRUST BLOCK AREA REQUIRED (Y=W)

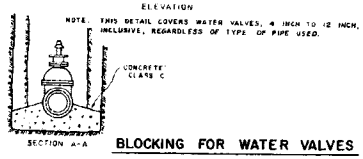
TYPE SIZE	WATER Pressure 150 psi	PIPE 45° & 22½° Bends
4" & Less	3 Sq. Feet	3 Sq. Feet
6"	4	3
8"	6	3
10"	9	5
12"	13	7
16"	23	12

NOTES
1. Table is based on 3,000 #/sq.ft soil if conditions are found to indicate soil bearing is less, the areas shall be increased.
2. Areas for pipe larger than 16" shall be calculated for each project.

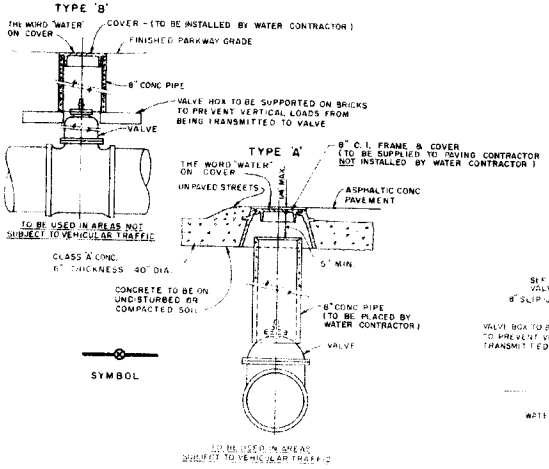
TAPPED CAP W' RISER & THRUST BLOCKS FOR WATER LINES



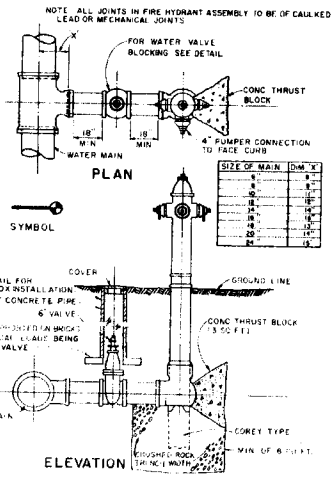




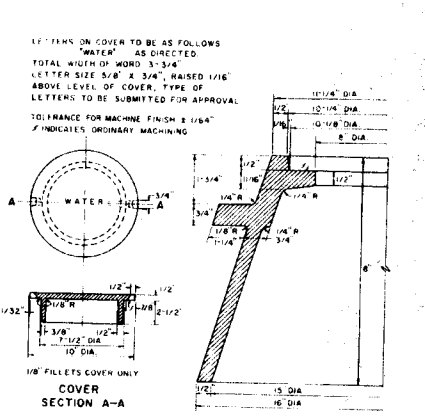
BLOCKING FOR WATER VALVES



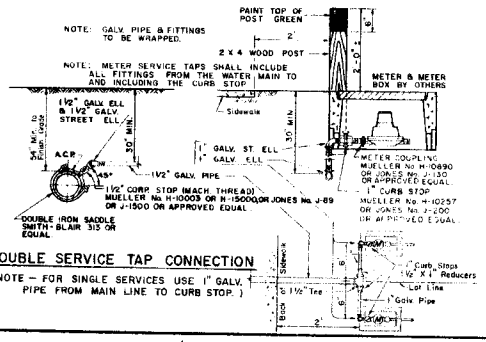
VALVE BOX INSTALLATION



METHOD OF SETTING FIRE HYDRANT



8" C.I. FRAME AND COVER



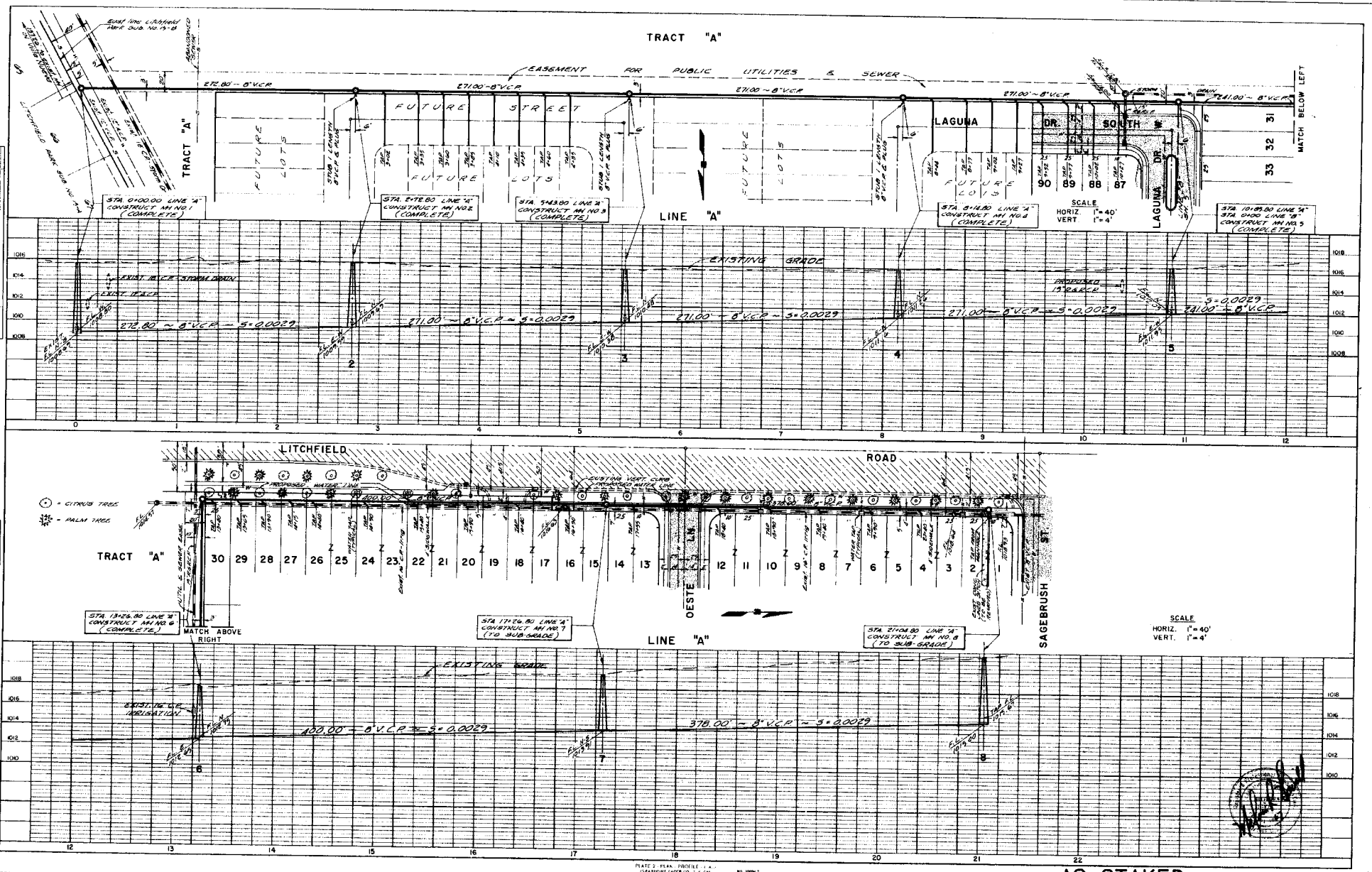
DOUBLE SERVICE TAP CONNECTION

(NOTE – FOR SINGLE SERVICES USE 1" GALV. PIPE FROM MAIN LINE TO CURB STOP.)

AS-STAKED

(JOB NO. 711-5-40)

LITCHFIELD PARK SUBDIVISION NO. 15-B SHEET 3 OF 8 SHEETS MAP NO. 203



AS-STAKED

(JOB NO. 711-6-50)

LITCHFIELD PARK SUBDIVISION NO. 15-B SHEET 4 OF 8 SHEETS MAP NO. 203

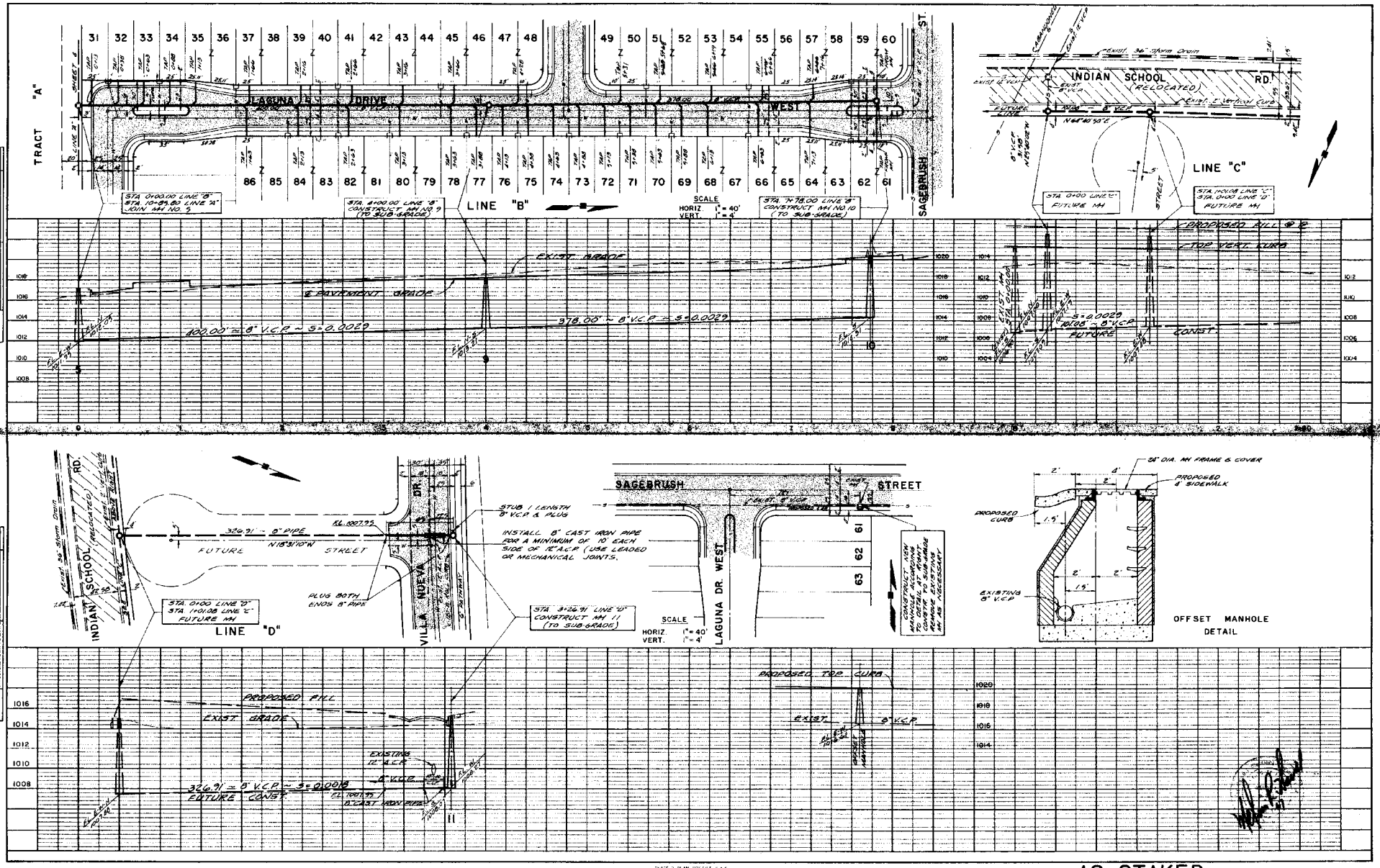
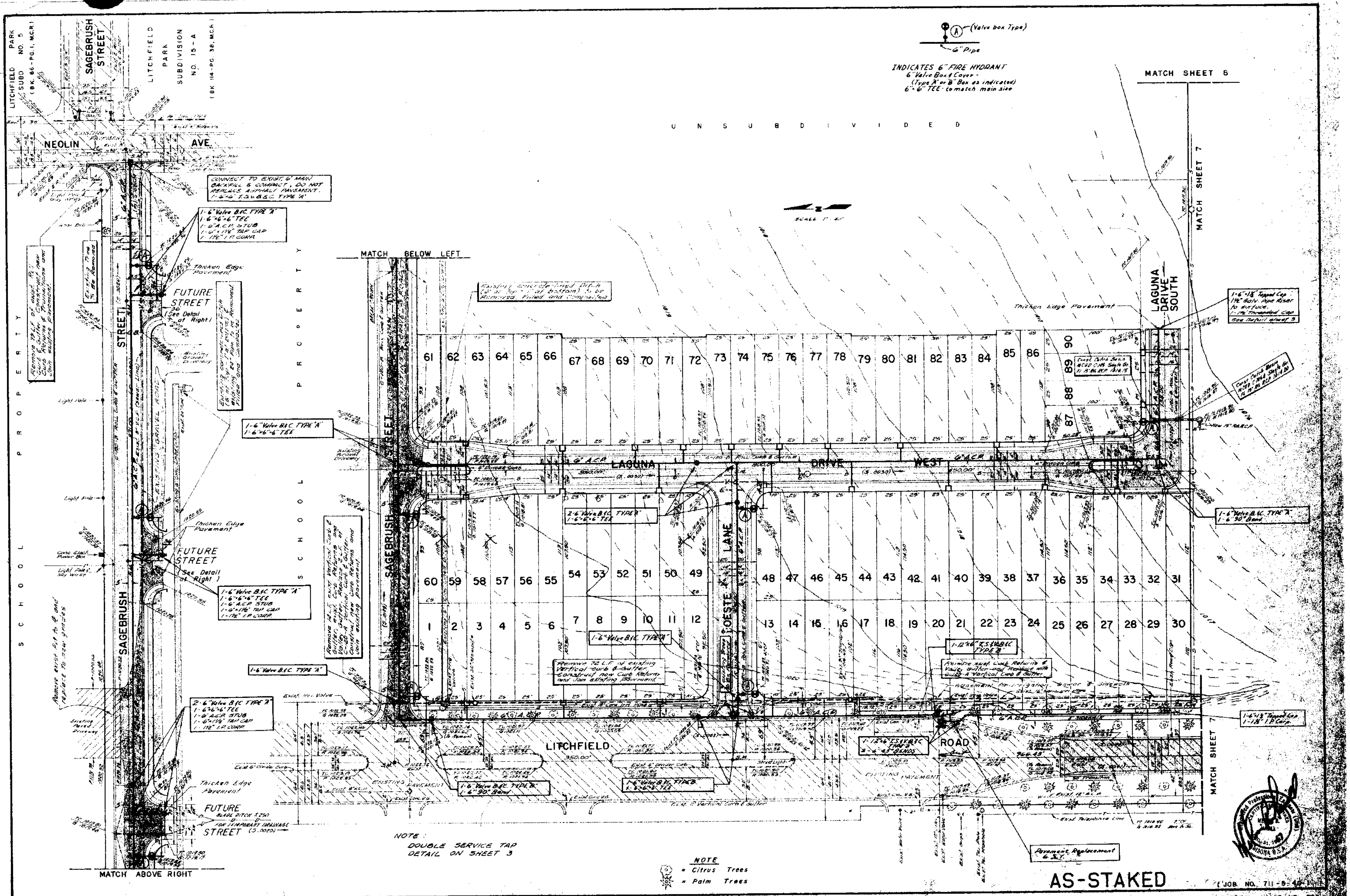


PLATE 2 - PLAN, PROFILE & M.H.
ELLSWORTH PAPER CO., T. CAL.
NO. 10501-2

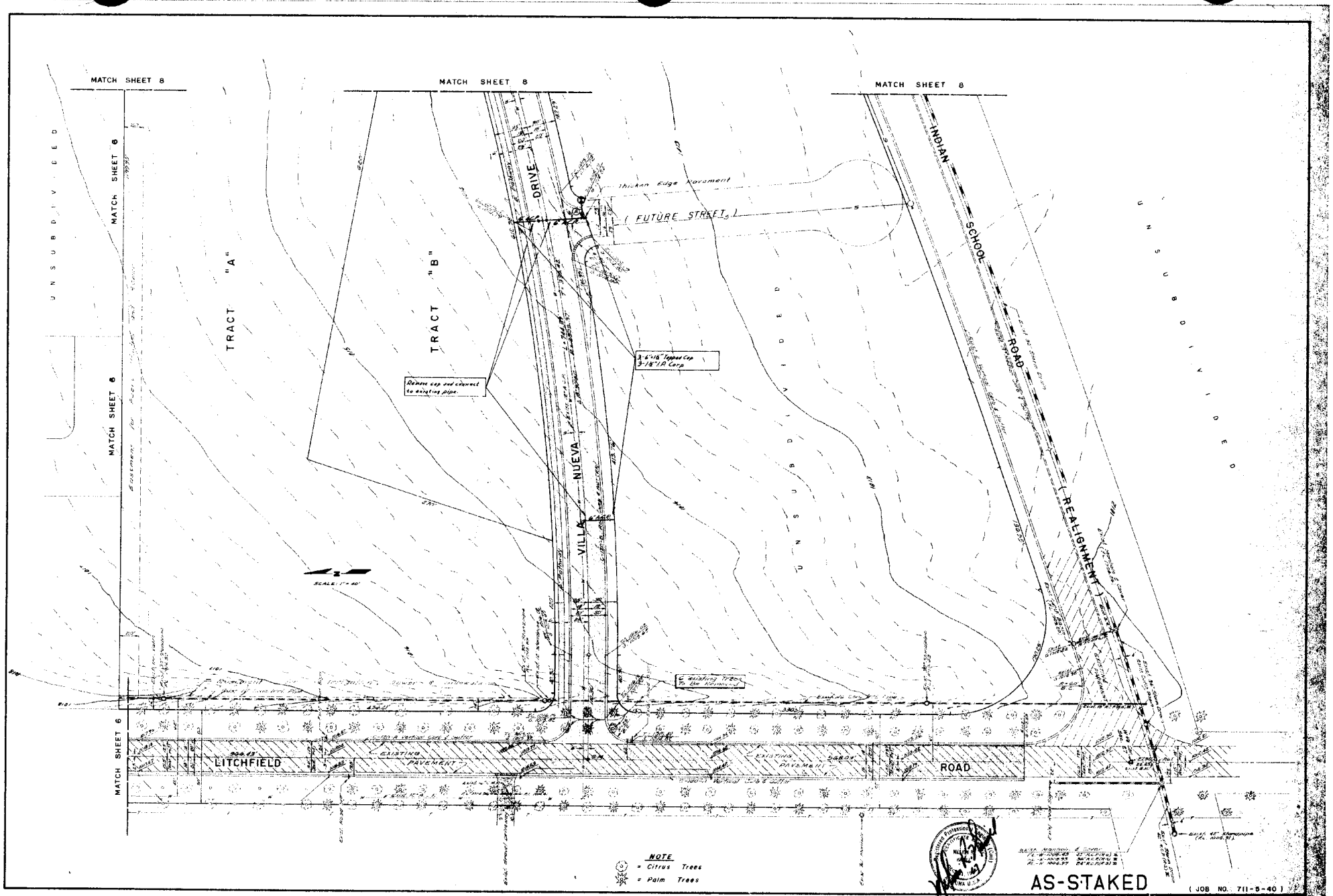
AS-STAKED

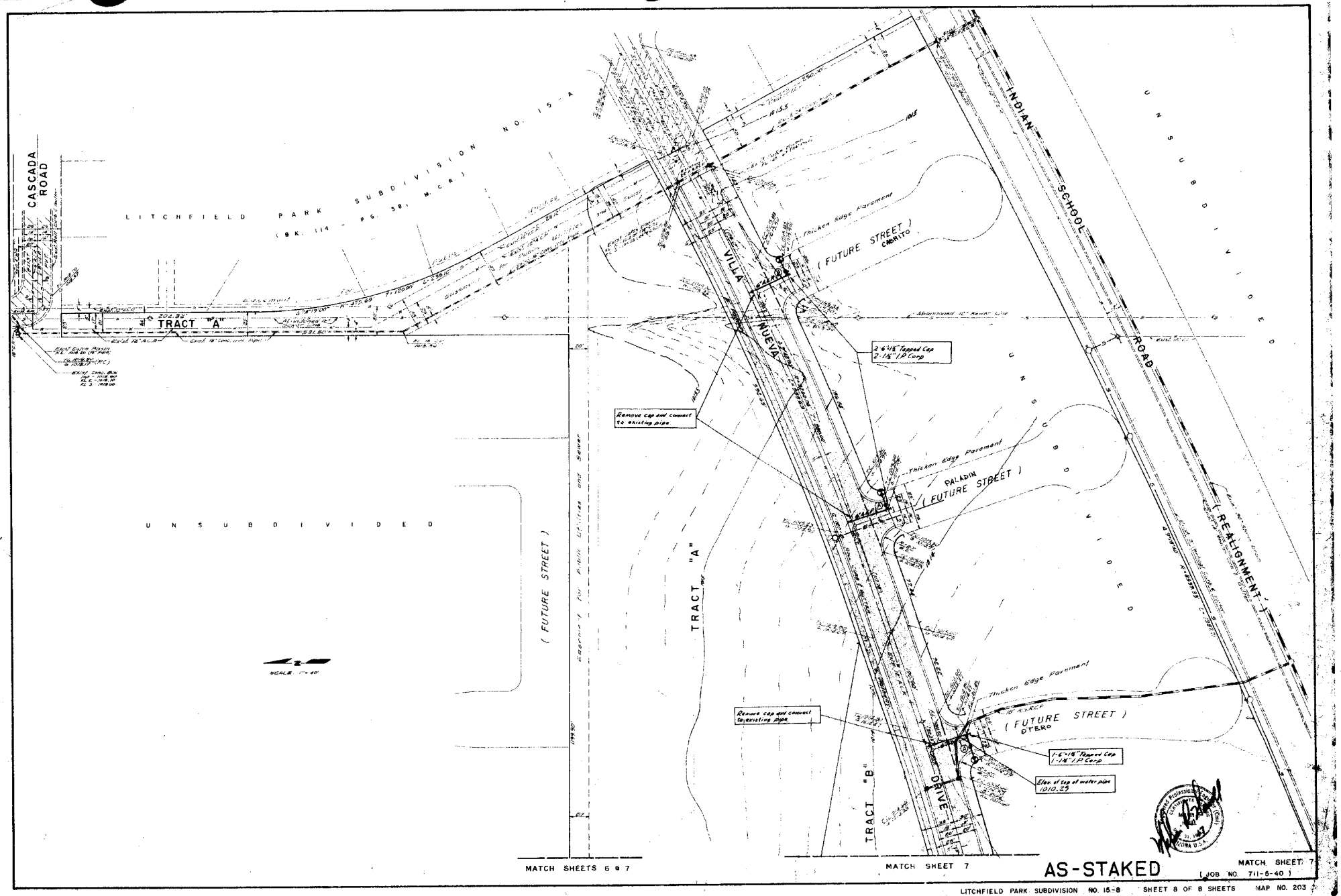
JOB NO. 711-6-50

LITCHFIELD PARK SUBDIVISION NO. 15-B SHEET 5 OF 8 SHEETS MAP NO. 203



LITCHFIELD PARK SUBD NO. 5 (BK. 66-PG. 1, MCR)
LITCHFIELD PARK SUBDIVISION NO. 15-A (BK 114-PG. 38, MCR)
SAGEBRUSH STREET
NEOLIN AVE.
SCHOOL PROPERTY
UNSUBDIVIDED
INDICATES 6" FIRE HYDRANT
6" Valve Box & Cover - (Type "A" or "B" Box as indicated)
6" x 6" TEE to match main size
(Valve box Type)
6" Pipe
MATCH SHEET 6
MATCH SHEET 7
MATCH BELOW LEFT
MATCH ABOVE RIGHT
CONNECT TO EXIST. 6" MAIN
BACKFILL & COMPACT. DO NOT REPLACE ASPHALT PAVEMENT.
FUTURE STREET
(See Detail at Right)
Thicken Edge Pavement
LAGUNA DRIVE WEST
LAGUNA DRIVE SOUTH
SAGEBRUSH STREET
FOESTE LANE
LITCHFIELD ROAD
EXISTING PAVEMENT
Pavement Replacement
NOTE:
DOUBLE SERVICE TAP DETAIL ON SHEET 3
NOTE
= Citrus Trees
= Palm Trees
AS-STAKED
LITCHFIELD PARK SUBDIVISION NO. 15-B
SHEET 6 OF 8 SHEETS
MAP NO. 203


MATCH SHEET 8
MATCH SHEET 8
MATCH SHEET 8
MATCH SHEET 6
MATCH SHEET 6
MATCH SHEET 6
UNSUBDIVIDED
TRACT "A"
TRACT "B"
VILLA NUEVA DRIVE
INDIAN SCHOOL ROAD
REALIGNMENT
(FUTURE STREET)
Thicken Edge Pavement
3-6"x18" Tapped Cap
3-18"x18" Corp
Remove cap and connect to existing pipe.
SCALE 1"=40'
LITCHFIELD ROAD
EXISTING PAVEMENT
EXISTING PAVEMENT
ROAD
NOTE
= Citrus Trees
= Palm Trees
AS-STAKED
(JOB NO. 711-5-40)
LITCHFIELD PARK SUBDIVISION NO. 15-B
SHEET 7 OF 8 SHEETS
MAP NO. 203



LITCHFIELD PARK SUBDIVISION NO. 15-8 SHEET 8 OF 8 SHEETS MAP NO. 203

LITCHFIELD PARK, ARIZONA

WATER & SEWER PLANS

OF

LITCHFIELD PARK SUBDIVISION NO. 15-A

PREPARED FOR

LITCHFIELD PARK PROPERTIES

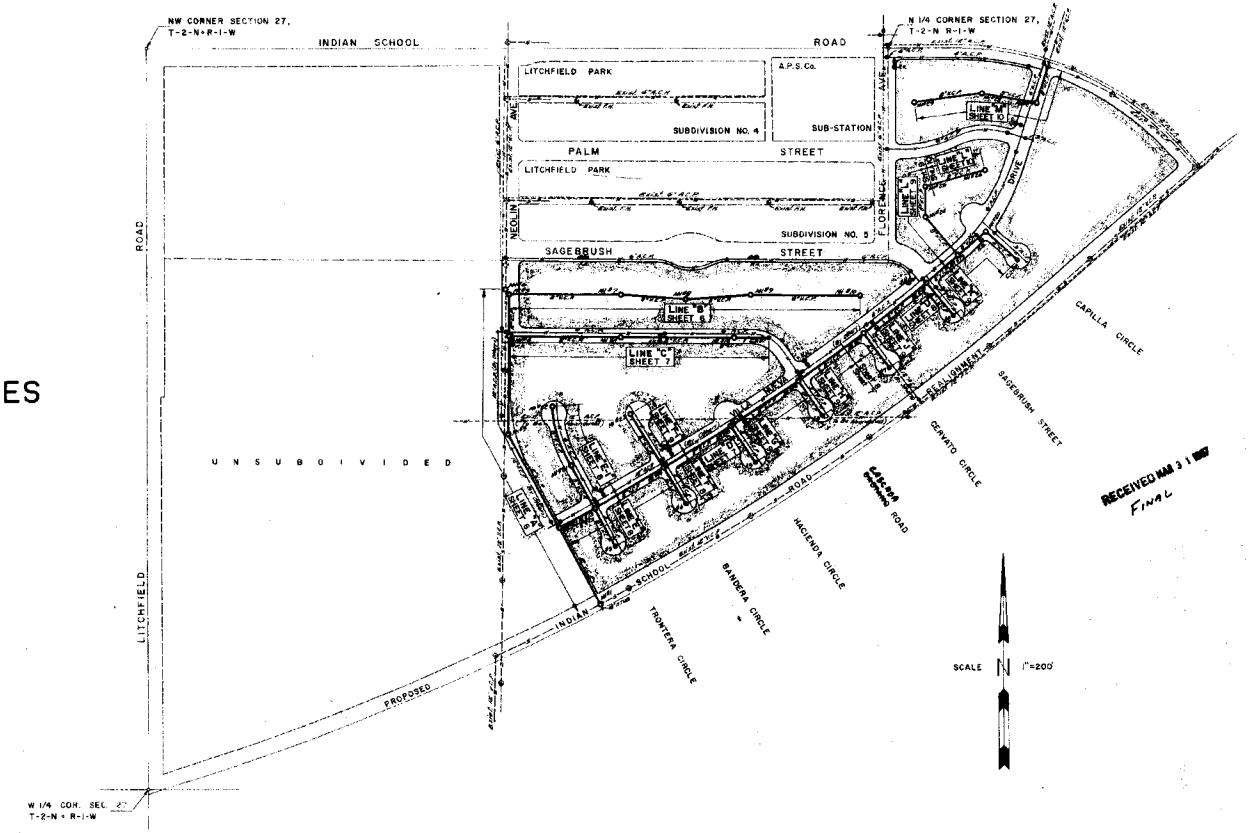
BY

HAVILL ENGINEERING CO.
3016 E. THOMAS RD. 264-9839
PHOENIX, ARIZONA

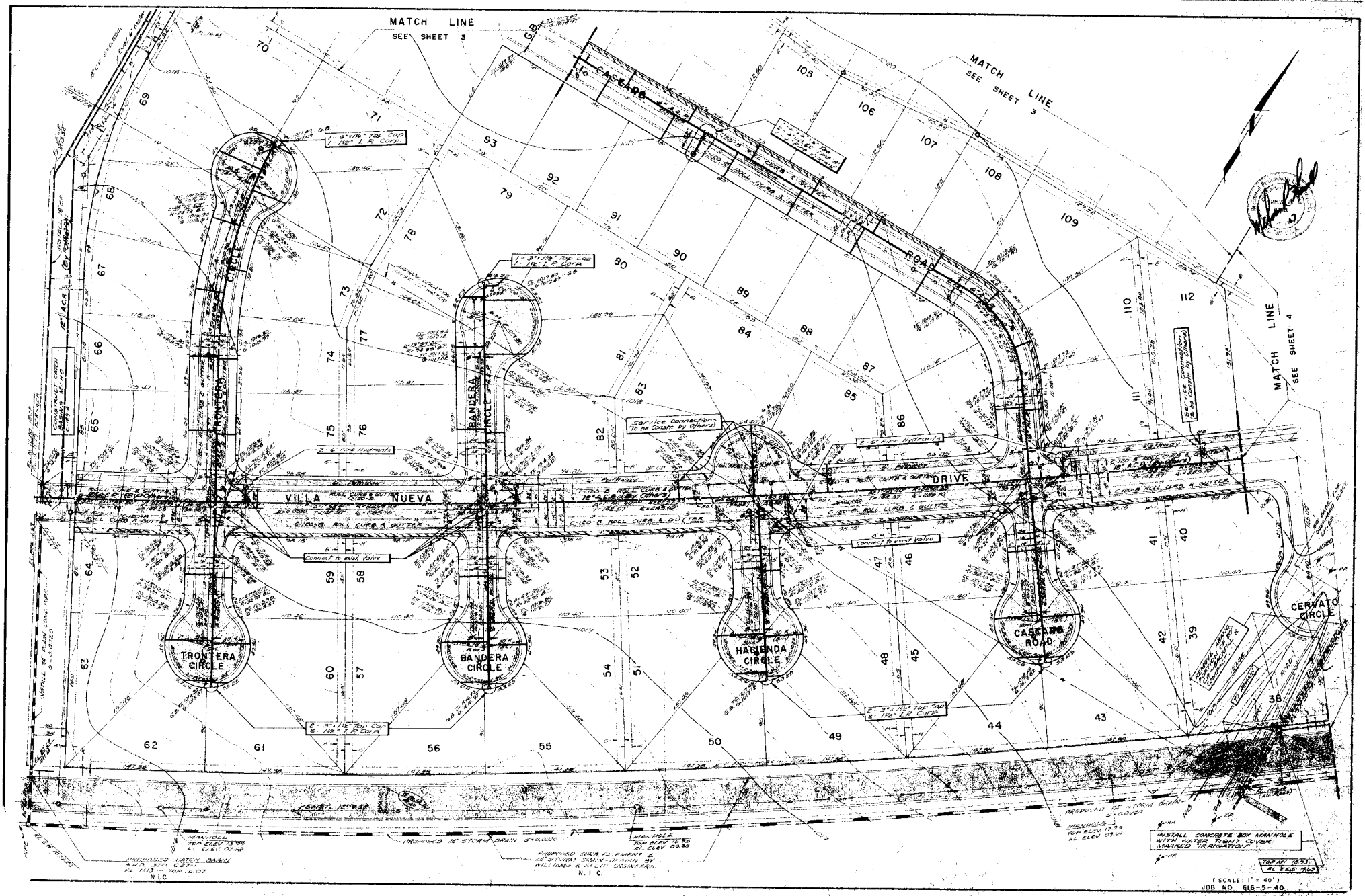
CONTRACT NO. LPP-WS-3003-67

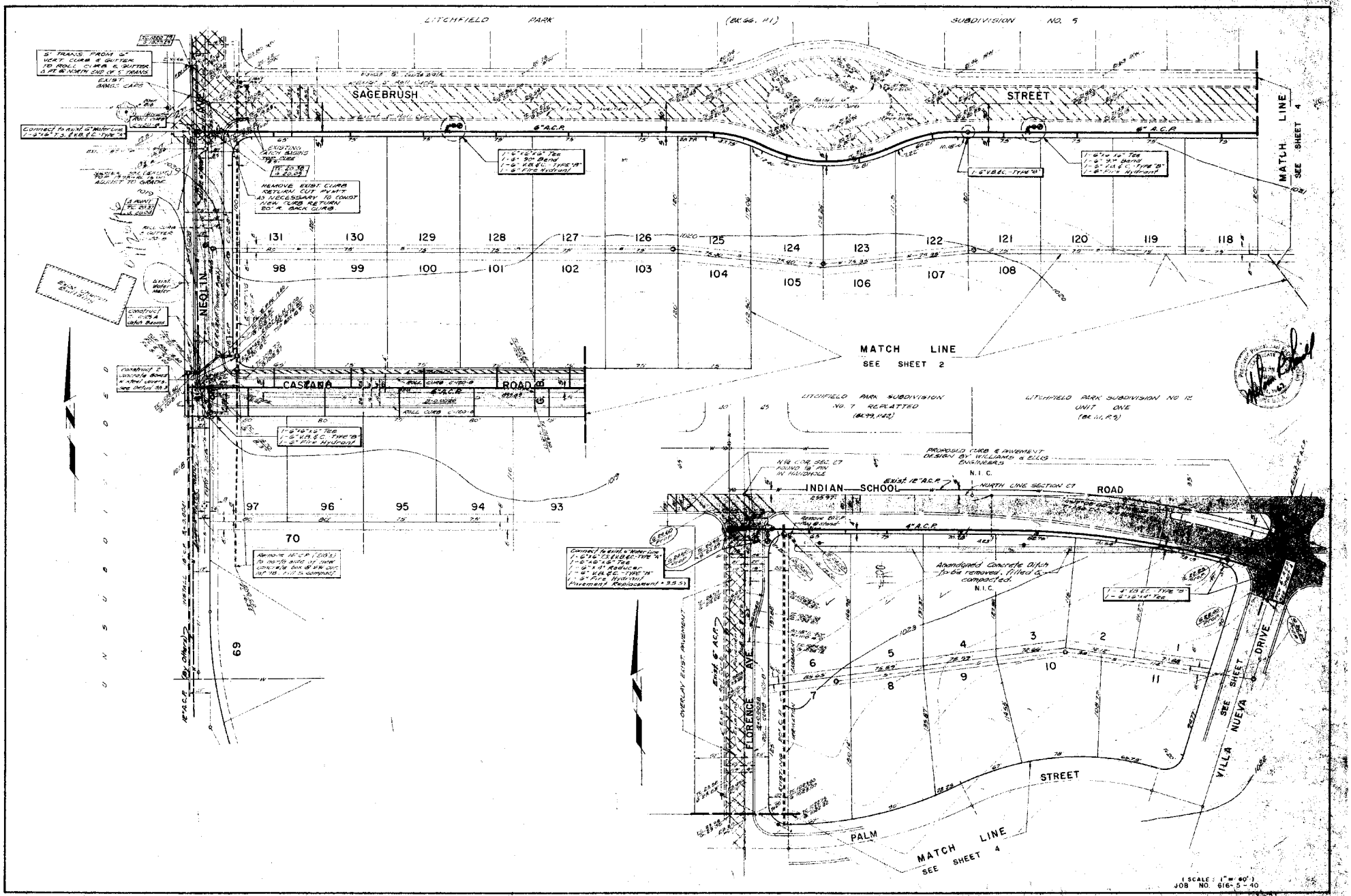
Approved by Maricopa County Health Dept. (Div. of Environmental Sanitation) this 27th day of February, 1967.

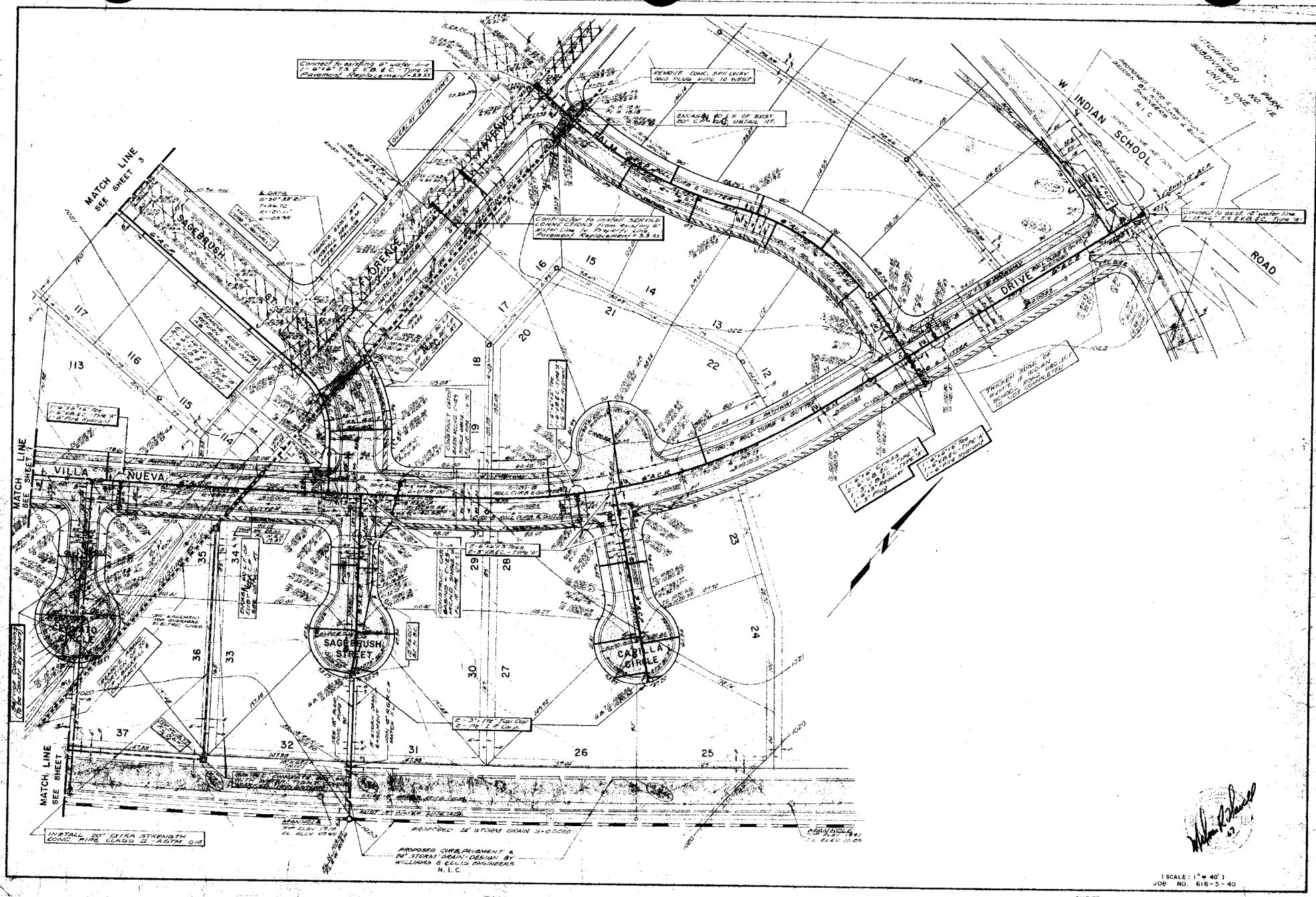
Approved By _____
SANITARY ENGINEER



RECEIVED MAR 3 1 1967
FINAL

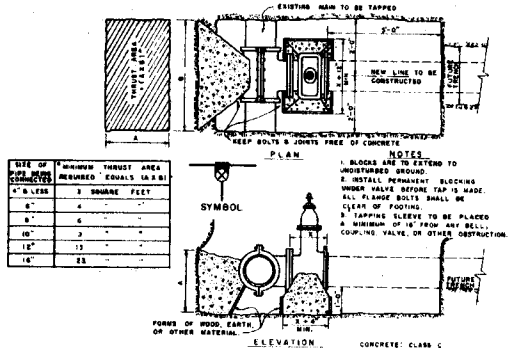

MATCH LINE
SEE SHEET 3
MATCH LINE
SEE SHEET 3
MATCH LINE
SEE SHEET 4
CASCADA ROAD
VILLA NUEVA DRIVE
TRONTERA CIRCLE
BANDERA CIRCLE
HACIENDA CIRCLE
CERVATO CIRCLE
Service Connections (To be Constr. by Others)
Connect to exist. Valve
2 - 6" Fire Hydrants
PROPOSED 36" STORM DRAIN
MANHOLE
INSTALL CONCRETE BOX MANHOLE WITH WATER TIGHT COVER MARKED "IRRIGATION"
(SCALE: 1" = 40')
JOB NO. 616-5-40
SHEET 2 OF 11 SHEETS
MAP NO. 194


LITCHFIELD PARK (BK.56, PI) SUBDIVISION NO. 5
SAGEBRUSH STREET
MATCH LINE SEE SHEET 4
MATCH LINE SEE SHEET 2
CASCADE ROAD
INDIAN SCHOOL ROAD
NEOLIN AVE.
FLORENCE AVE.
VILLA NUEVA DRIVE
PALM STREET
LITCHFIELD PARK SUBDIVISION NO. 7 REPLATTED (BK.99, M42)
LITCHFIELD PARK SUBDIVISION NO 12 UNIT ONE (BK.111, P.5)
131 130 129 128 127 126 125 124 123 122 121 120 119 118
98 99 100 101 102 103 104 105 106 107 108
97 96 95 94 93
70
69
1 2 3 4 5 6 7 8 9 10 11
Abandoned Concrete Ditch to be removed, filled & compacted N.I.C.
PROPOSED CURB & PAVEMENT DESIGN BY WILLIAMS & ELLIS ENGINEERS
OVERLAY EXIST. PAVEMENT
SCALE: 1" = 40'
JOB NO. 616-5-40
SHEET 3 OF 11 SHEETS
MAP NO. 194



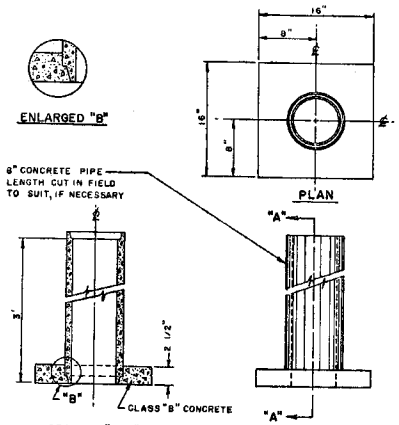
(SCALE: 1" = 40')
JOB NO. 616-5-40

SHEET 4 OF 11 SHEETS. MAP NO. 194

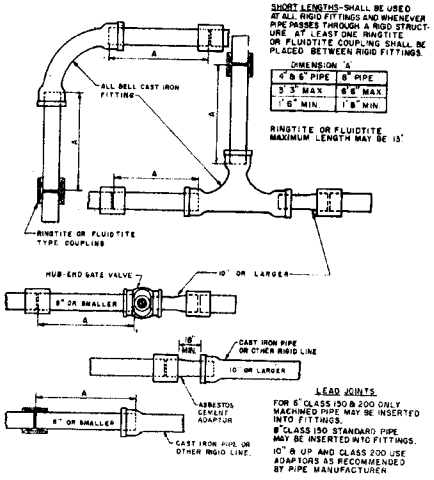


SIZE OF PIPE BEING CONNECTED	MINIMUM THRUST AREA REQUIRED EQUALS (A X B)
4" & LESS	3 SQUARE FEET
6"	4 " "
8"	6 " "
10"	9 " "
12"	13 " "
16"	23 " "

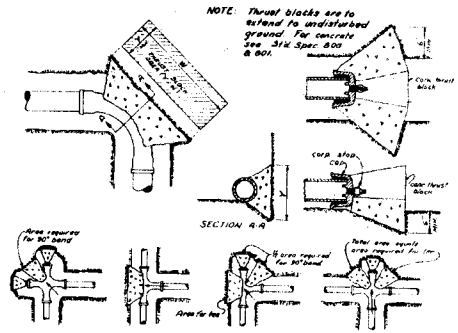
INSTALLING TAPPING SLEEVES AND VALVES



VALVE BOX WITH CAST CONCRETE BASE



FLEXIBLE JOINTS FOR ASBESTOS CEMENT PIPE

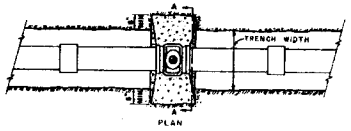


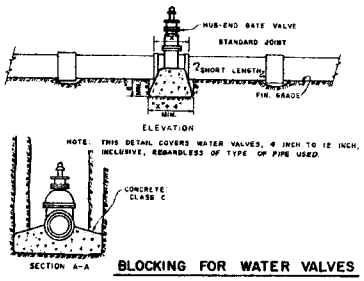
MINIMUM THRUST BLOCK AREA REQUIRED (Y x W)

PIPE SIZE	WATER PRESSURE 150 lbs/sq inch	PIPE 45° & 22½° Bends	PIPE Tees, Crosses & Dead Ends
4" & Less	3 Sq. Feet	3 Sq. Feet	3 Sq. Feet
6"	4 "	3 "	3 "
8"	6 "	3 "	3 "
10"	9 "	6 "	5 "
12"	13 "	7 "	7 "
16"	23 "	12 "	-

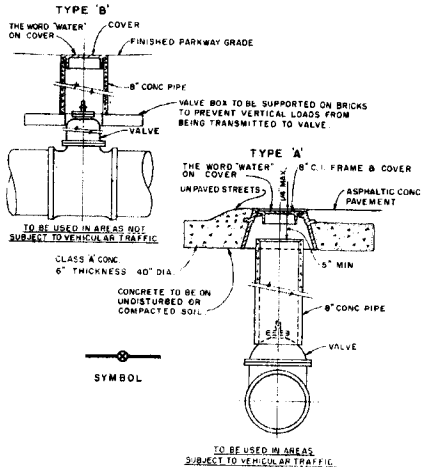
NOTES
1. Table is based on 2000 lbs/sq ft soil if conditions are found to indicate soil bearing is less, the areas shall be increased.
2. Areas for pipe larger than 16" shall be calculated for each project.

THRUST BLOCKS FOR WATER LINES

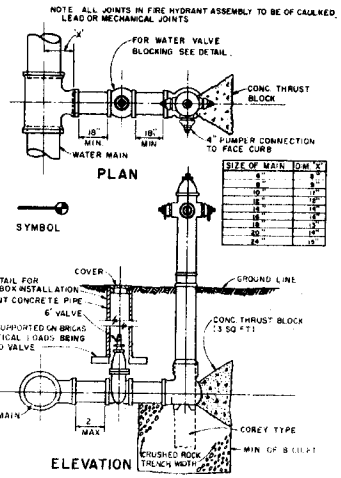




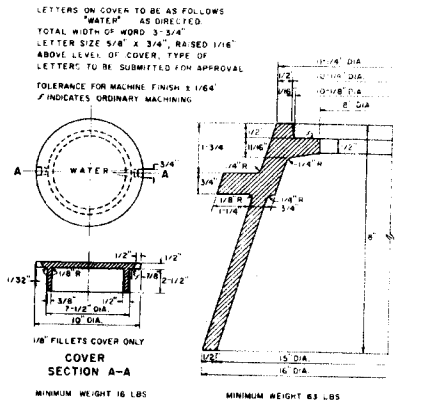
BLOCKING FOR WATER VALVES



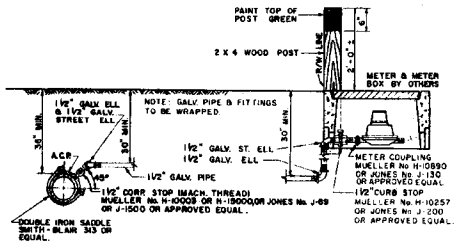
VALVE BOX INSTALLATION



METHOD OF SETTING FIRE HYDRANT

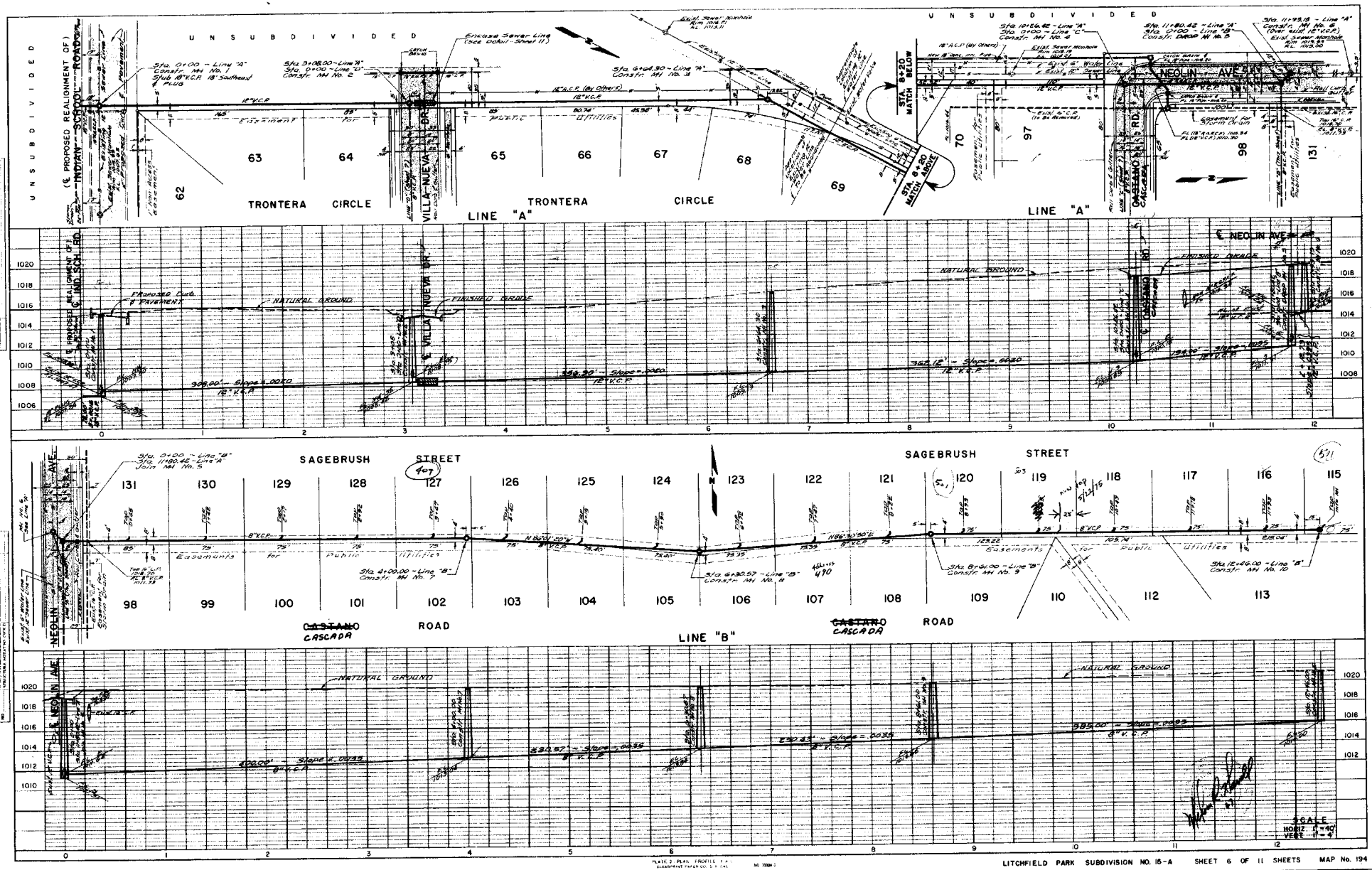


8" C.I. FRAME AND COVER

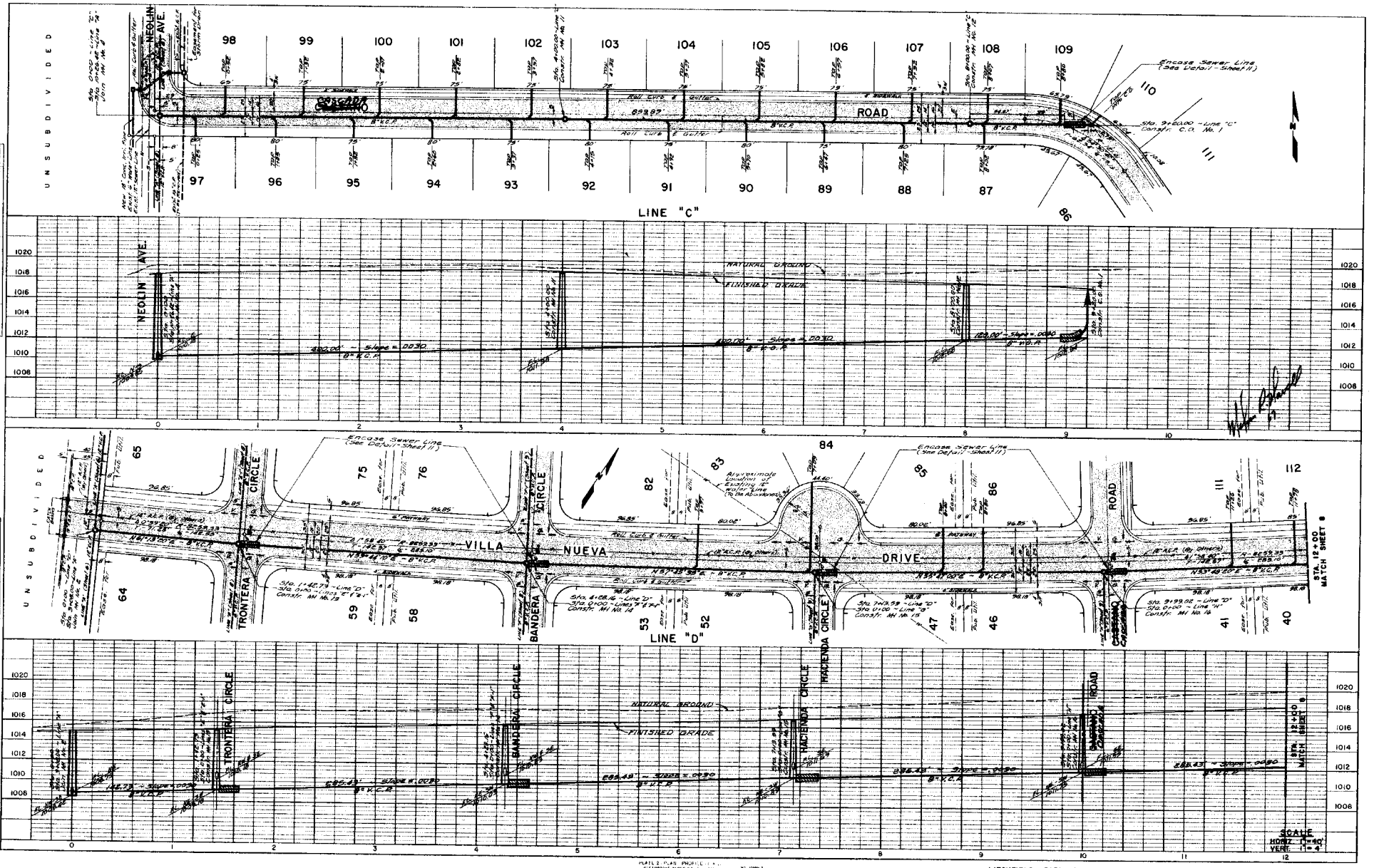


WRAPPED GALV SERVICE TAP

(JOB NO. 616-5-40)



LITCHFIELD PARK SUBDIVISION NO. 15-A SHEET 6 OF 11 SHEETS MAP No. 194


UNSUBDIVIDED
NEOLIN AVE.
ROAD
LINE "C"
NATURAL GROUND
FINISHED GRADE
UNSUBDIVIDED
VILLA NUEVA DRIVE
TRONTERA CIRCLE
BANDERA CIRCLE
HACIENDA CIRCLE
LINE "D"
Encase Sewer Line (See Detail - Sheet 11)
STA. 12+00 MATCH SHEET 8
SCALE
HORIZ. 1"=40'
VERT. 1"=4'

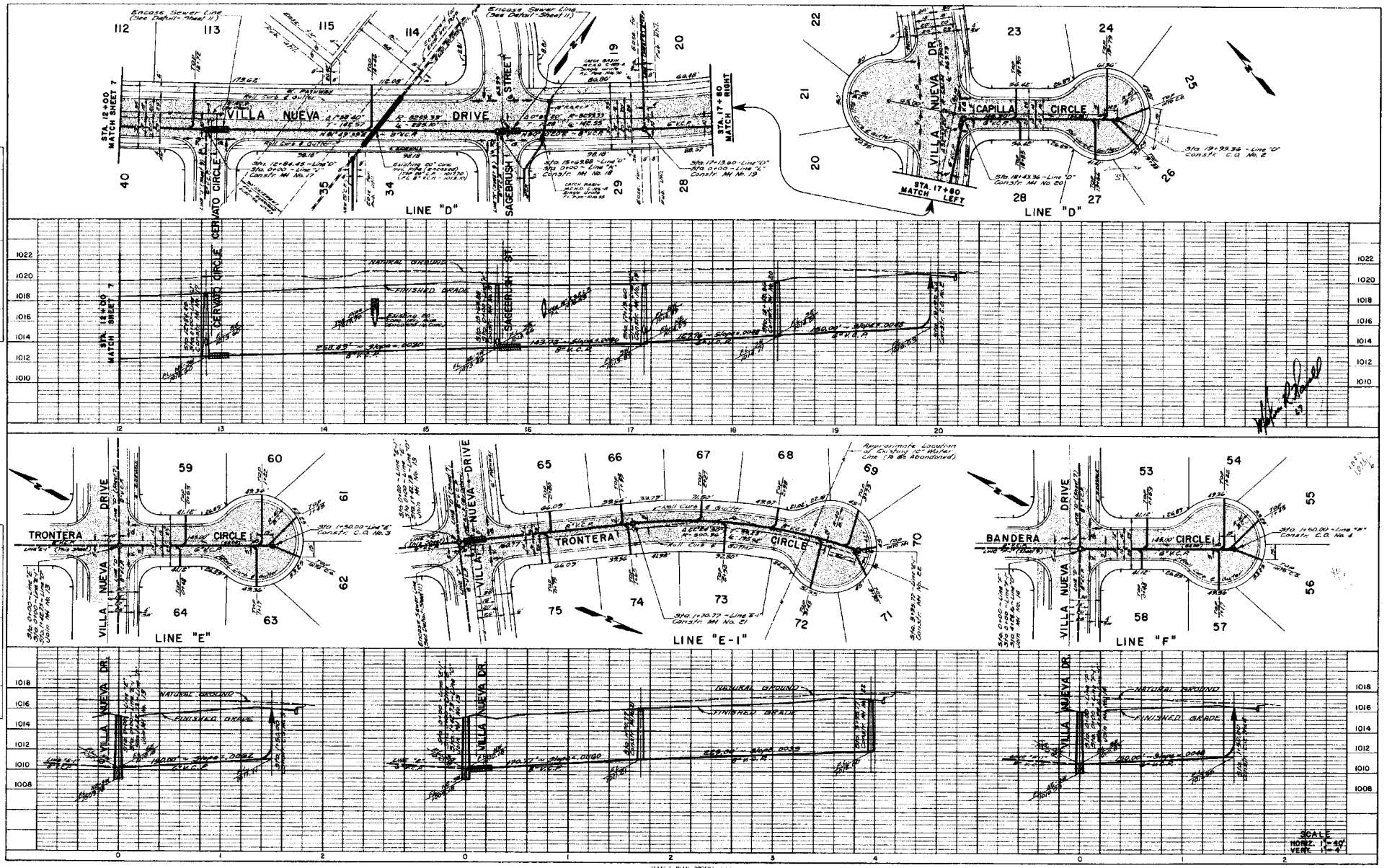
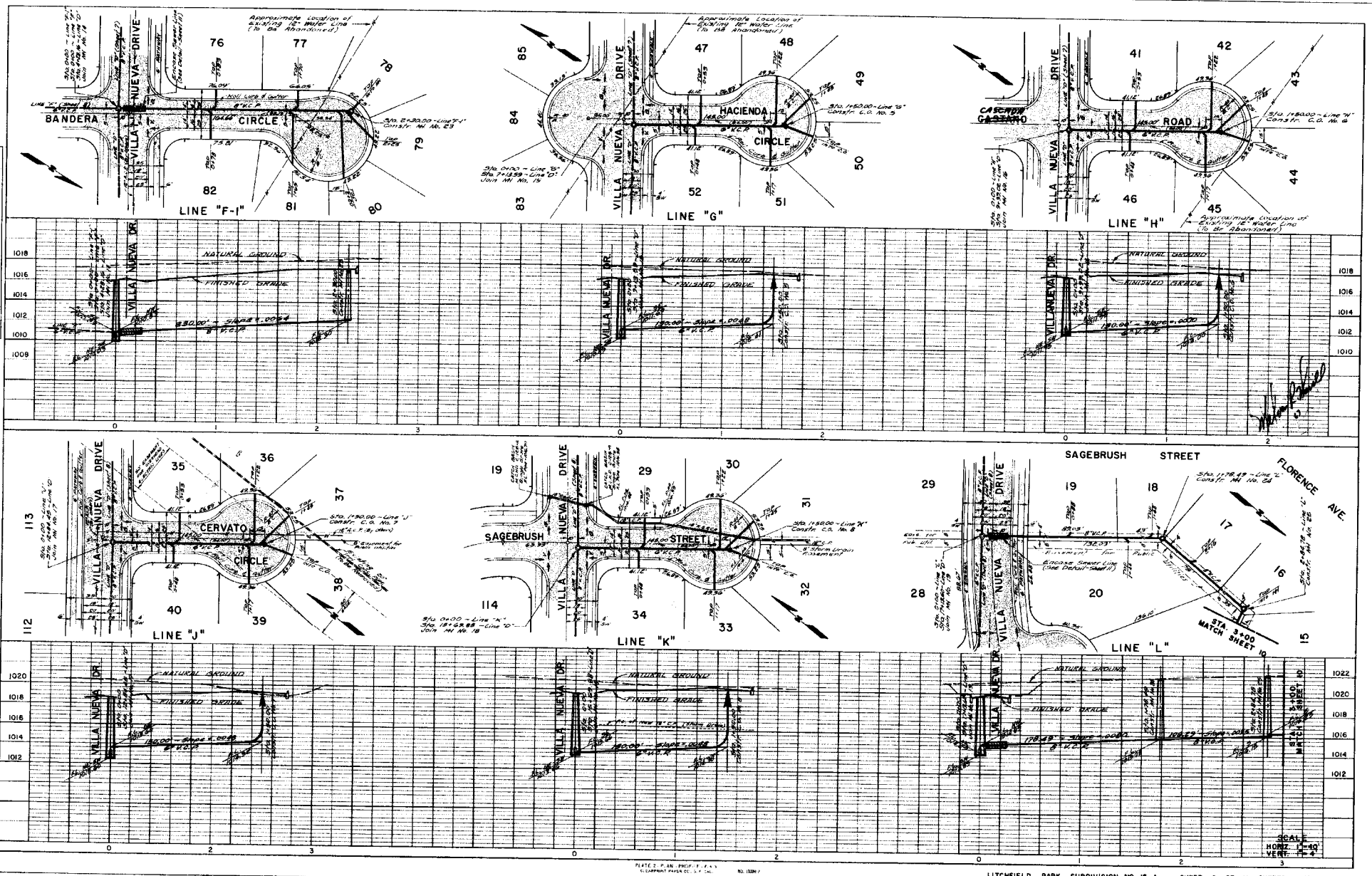


PLATE 2 - PLAN - PROFILE

LITCHFIELD PARK SUBDIVISION NO. 15-A SHEET 8 OF 11 SHEETS MAP No. 194



LITCHFIELD PARK SUBDIVISION NO. 15-A SHEET 9 OF 11 SHEETS MAP No. 194

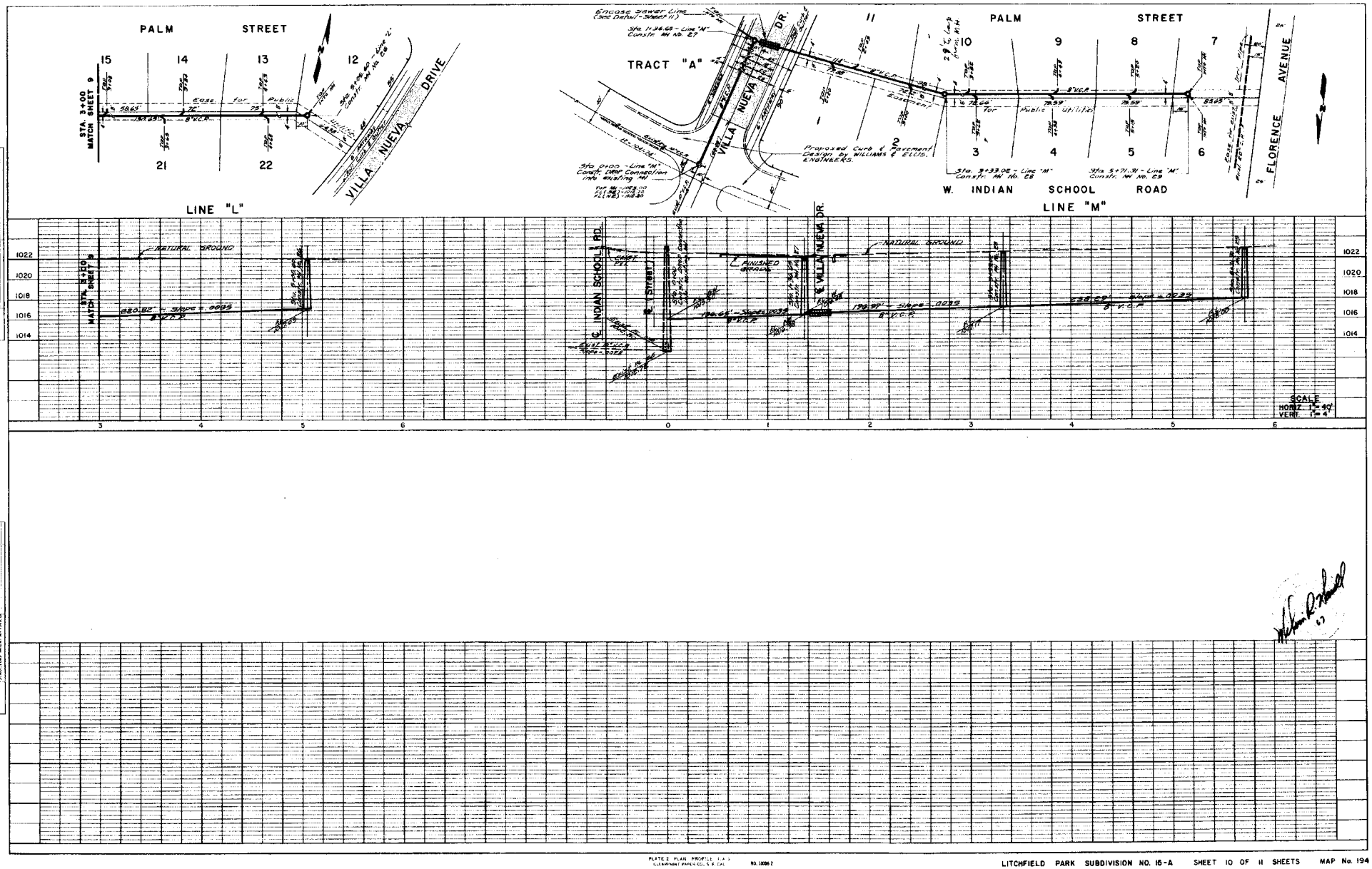
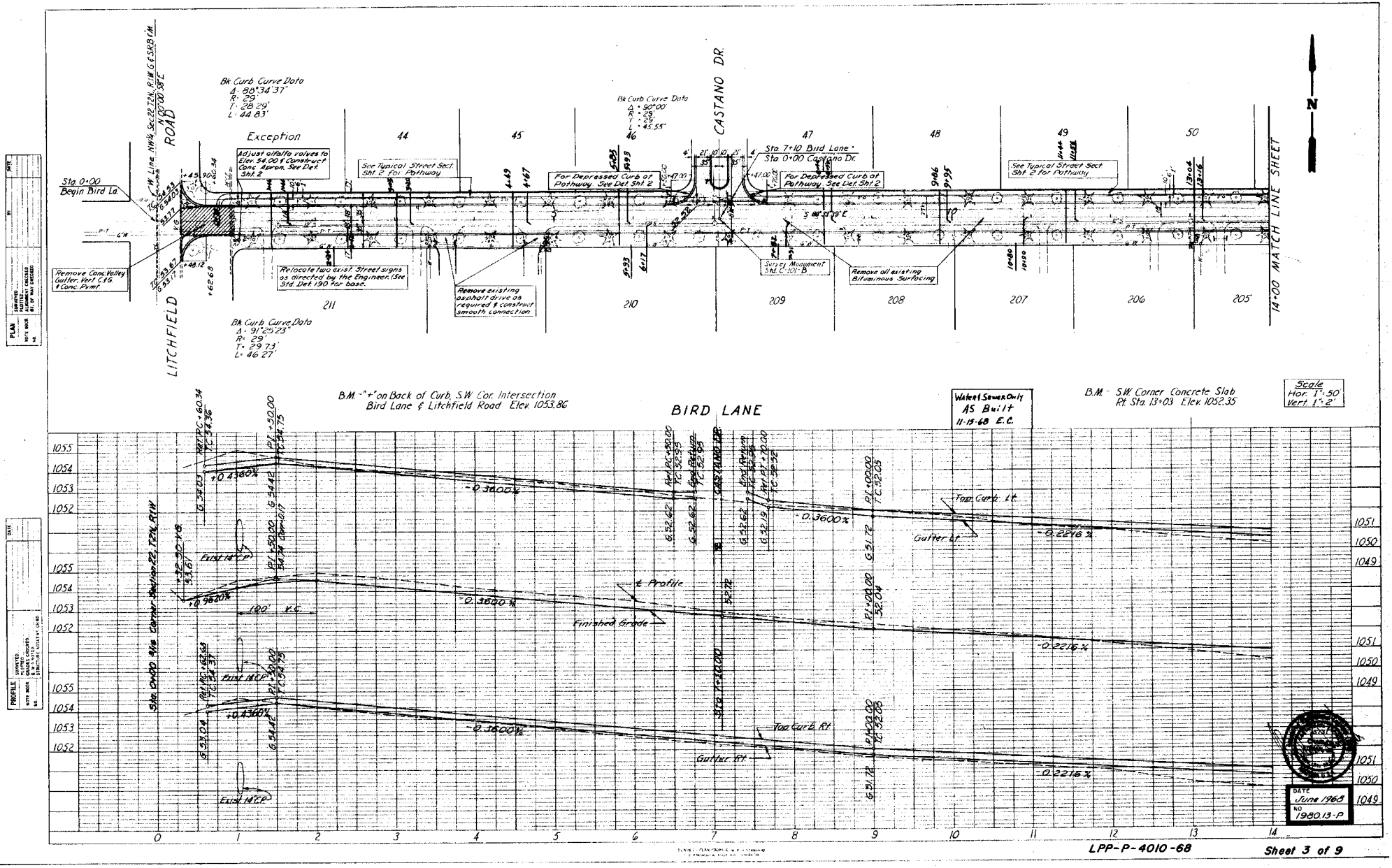
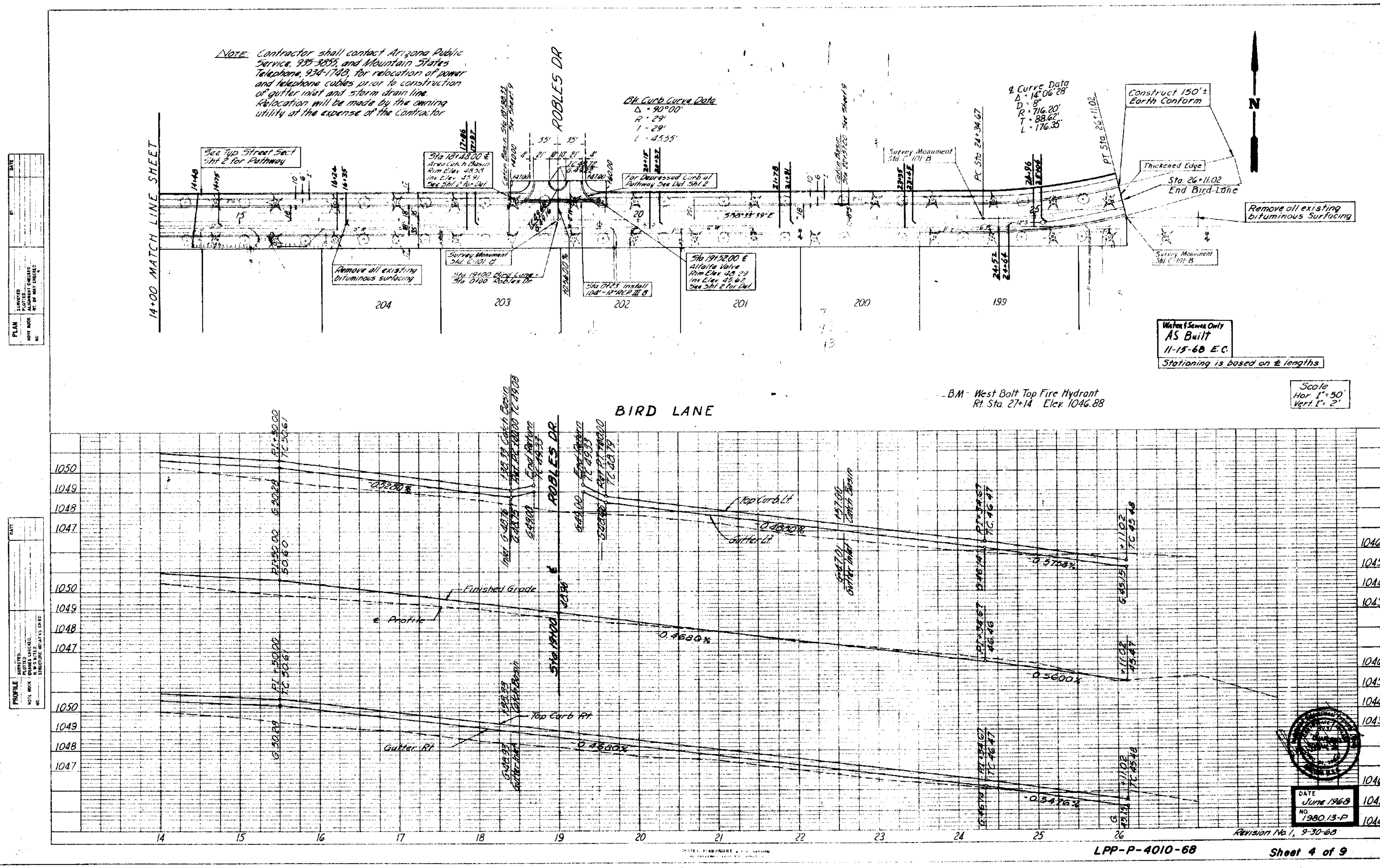


PLATE 2 PLAN PROFILE 11 x 17
CLAREMONT PAPER CO., S. F. CAL. NO. 18086-2

LITCHFIELD PARK SUBDIVISION NO. 15-A SHEET 10 OF 11 SHEETS MAP No. 194


LITCHFIELD ROAD
CASTANO DR.
BIRD LANE
Sta 0+00 Begin Bird La.
Exception
Bk Curb Curve Data
Δ- 88°34'37"
R- 29'
T- 28.29'
L- 44.83'
Bk Curb Curve Data
Δ- 91°25'23"
R- 29'
T- 29.73'
L- 46.27'
Bk Curb Curve Data
Δ- 90°00'
R- 25'
T- 25'
L- 45.55'
Sta 7+10 Bird Lane = Sta 0+00 Castano Dr.
Adjust oilrite valves to Elev. 54.00 & Construct Conc. Apron, See Det. Sht 2
See Typical Street Sect. Sht. 2 for Pathway
For Depressed Curb at Pathway See Det Sht 2
Remove Conc. Valley Gutter, Part C.I.G. & Conc. Pvmt.
Relocate two exist. Street signs as directed by the Engineer. (See Std. Det. 190 for base.
Remove existing asphalt drive as required & construct smooth connection
Survey Monument Sht. C-101-B
Remove all existing Bituminous Surfacing
See Typical Street Sect Sht 2 for Pathway
14+00 MATCH LINE SHEET
N
B.M. - "+" on Back of Curb, S.W. Cor. Intersection Bird Lane & Litchfield Road Elev. 1053.86
Water & Sewer Only AS Built 11-19-68 E.C.
B.M. - S.W. Corner Concrete Slab Pt. Sta. 13+03 Elev. 1052.35
Scale Hor. 1"=50 Vert. 1"=2'
Sta 0+00 B/S Corner Section 23, T2N, R1W
Existing 18" CP
Existing 14" CP
+0.4360%
-0.3600%
+0.9620%
180' V.C.
Finished Grade
& Profile
Top Curb Lt.
Gutter Lt.
Top Curb Lt. Rt.
Gutter Rt.
-0.2216%
DATE June 1968
NO 1980.13-P
LPP-P-4010-68
Sheet 3 of 9


NOTE: Contractor shall contact Arizona Public Service, 955-3855, and Mountain States Telephone, 934-1748, for relocation of power and telephone cables prior to construction of gutter inlet and storm drain line. Relocation will be made by the owning utility at the expense of the Contractor
14+00 MATCH LINE SHEET
ROBLES DR
BIRD LANE
Bk. Curb Curve Data
Δ = 90°00'
R = 29'
T = 29'
L = 45.55'
℄ Curve Data
Δ = 14°06'28"
D = 8°
R = 716.20'
T = 88.62'
L = 176.35'
Construct 150'± Earth Conform
Thickened Edge
Sta. 26+11.02
End Bird Lane
Remove all existing bituminous Surfacing
See Typ. Street Sect. Sht 2 for Pathway
Remove all existing bituminous surfacing
For Depressed Curb at Pathway See Det. Sht 2
Water & Sewer Only
AS Built
11-15-68 E.C.
Stationing is based on ℄ lengths
BM - West Bolt Top Fire Hydrant
Rt. Sta. 27+14 Elev. 1046.88
Scale
Hor. 1" = 50'
Vert. 1" = 2'
Top Curb Lt
Gutter Lt
Finished Grade
℄ Profile
Top Curb Rt
Gutter Rt
0.4680%
0.5600%
0.4860%
0.5476%
0.5758%
0.4830%
0.5280%
DATE June 1968
NO. 1980.13-P
Revision No 1, 9-30-68
LPP-P-4010-68
Sheet 4 of 9
PLAN
PROFILE

WATER AND SANITARY SEWER PLANS

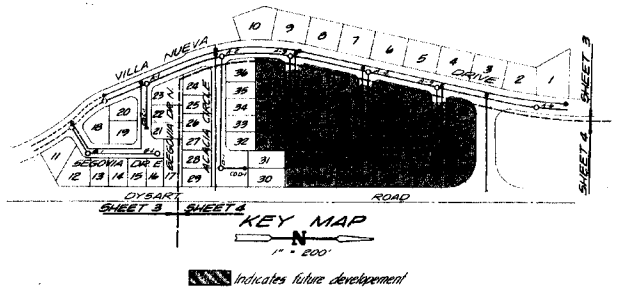
LITCHFIELD PARK SUBDIVISION NO. 14

UNIT ONE

LITCHFIELD PARK PROPERTIES

LITCHFIELD PARK

ARIZONA



Indicates future development

CONTRACT NO. LPP-WS-3009-68

WILLIAMS and ELLIS
CONSULTING ENGINEERS
PHOENIX — ARIZONA

APPROVAL :

JOSEPH J. WEINSTEIN, SANITARY ENGR. DATE
MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL SANITATION

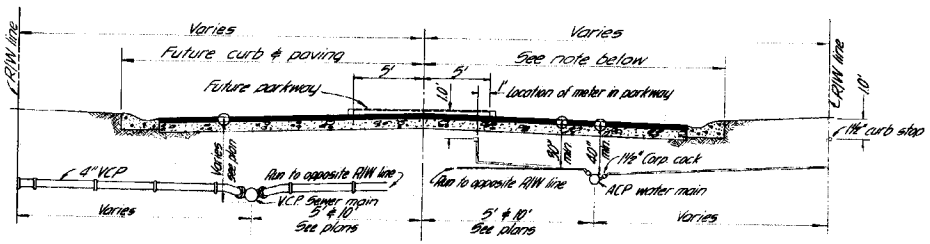
RECEIVED FEB 2 0 1969

		NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
	ARIZONA PUBLIC SERVICE		Dave Ellis	
AS Built	MOUNTAIN STATES TEL CO.		J.R. McDavid	
1-69 E.C.	LITCHFIELD PARK SERVICE CO.		Carroll Parkinson	

SURVEY
DESIGN
DRAWN
CHECKED
REVISIONS

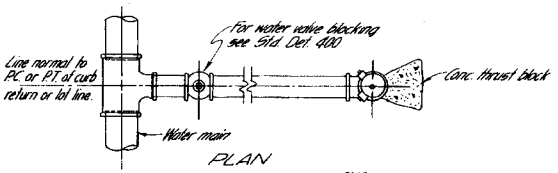
GENERAL NOTES

1. Sanitary sewer manholes and cleanouts which fall in pavement areas are to be built to 6" below the top of future pavement subgrade. (See Williams and Ellis Drawing No. 1980.46 P.) Manholes are to be protected by one half inch minimum thick steel cover plates which the sewer & water contractor shall obtain from the paving contractor prior to construction. Water valve boxes, frames & covers for manholes, cleanouts and water valve boxes are to be furnished by the sewer and water line contractor, but shall not be delivered to the site of the work until called for by the paving contractor.
2. The sewer line is to be installed prior to the water lines and water services to prevent conflict between water and sewer line construction.
3. At all water and sewer line crossings where the vertical separation is less than two feet clear, the contractor shall encase the sewer line in concrete of six inch minimum thickness for a distance of at least ten feet in each direction from the crossing, or shall construct the sewer of cast iron with leaded or mechanical joints for the same distance specified herein.
4. Water meters & water meter boxes will be installed by Litchfield Park Service Co.
5. The contractor shall determine the exact location, both horizontally and vertically, of all utility crossings by open trenching far enough in advance of pipe laying to permit grade or line change if necessary. Any damage to utilities caused by the contractors operations will be repaired by the contractor to the satisfaction of the Engineer and the owning utility at the expense of the contractor.
6. It is expected that the Arizona Public Service Company and the Mountain States Telephone Company will install their utility lines after the water and sewer lines are installed. However, it will be the water & sewer line contractor's responsibility to contact the Arizona Public Service Co. and the Mountain States Telephone Co. and coordinate construction operations to prevent damage to the various utilities.
7. To avoid conflict, all plastic pipe lines for future parkway sprinkler systems shall be installed after completion of water and sewer lines and services.
8. All construction to be done according to all applicable City of Phoenix Standard Details and Specifications unless noted otherwise.

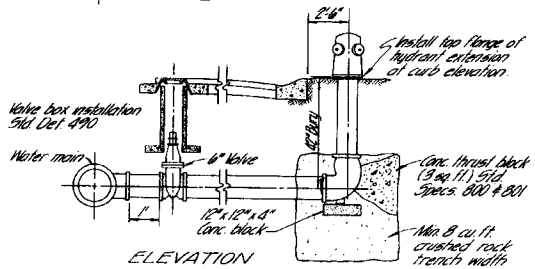


TYPICAL SEWER AND WATER SERVICE CONNECTION

NOTE:
1. Sewer taps and water service lines shall be installed at such depth so as not to interfere with pavement construction. See Williams and Ellis 1980.46 P for finish grade elevations.
2. Locate sewer taps and water service lines as follows unless otherwise directed by the Engineer:
   a. Water service line on lot line when serving two lots and sewer tap on center line of each lot.
   b. Water service line on center line of lot when serving one lot and sewer tap a minimum distance of ten feet downstream from water service line.



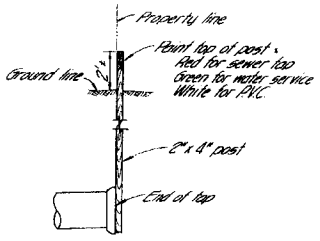
PLAN



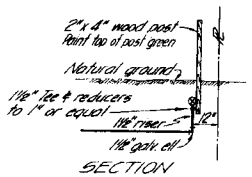
ELEVATION

SETTING FIRE HYDRANT

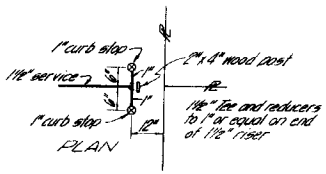
ALL JOINTS IN FIRE HYDRANT ASSEMBLY TO BE OF CAULKED LEAD OR MECHANICAL JOINT PER A.S.A.-A-21.11



MARKER FOR END OF SEWER TAP, SINGLE WATER SERVICES AND PVC



SECTION



PLAN

TERMINATION DETAIL FOR SERVICES TO TWO LOTS

(DETAILS NOT SHOWN SIMILAR TO SINGLE SERVICE)

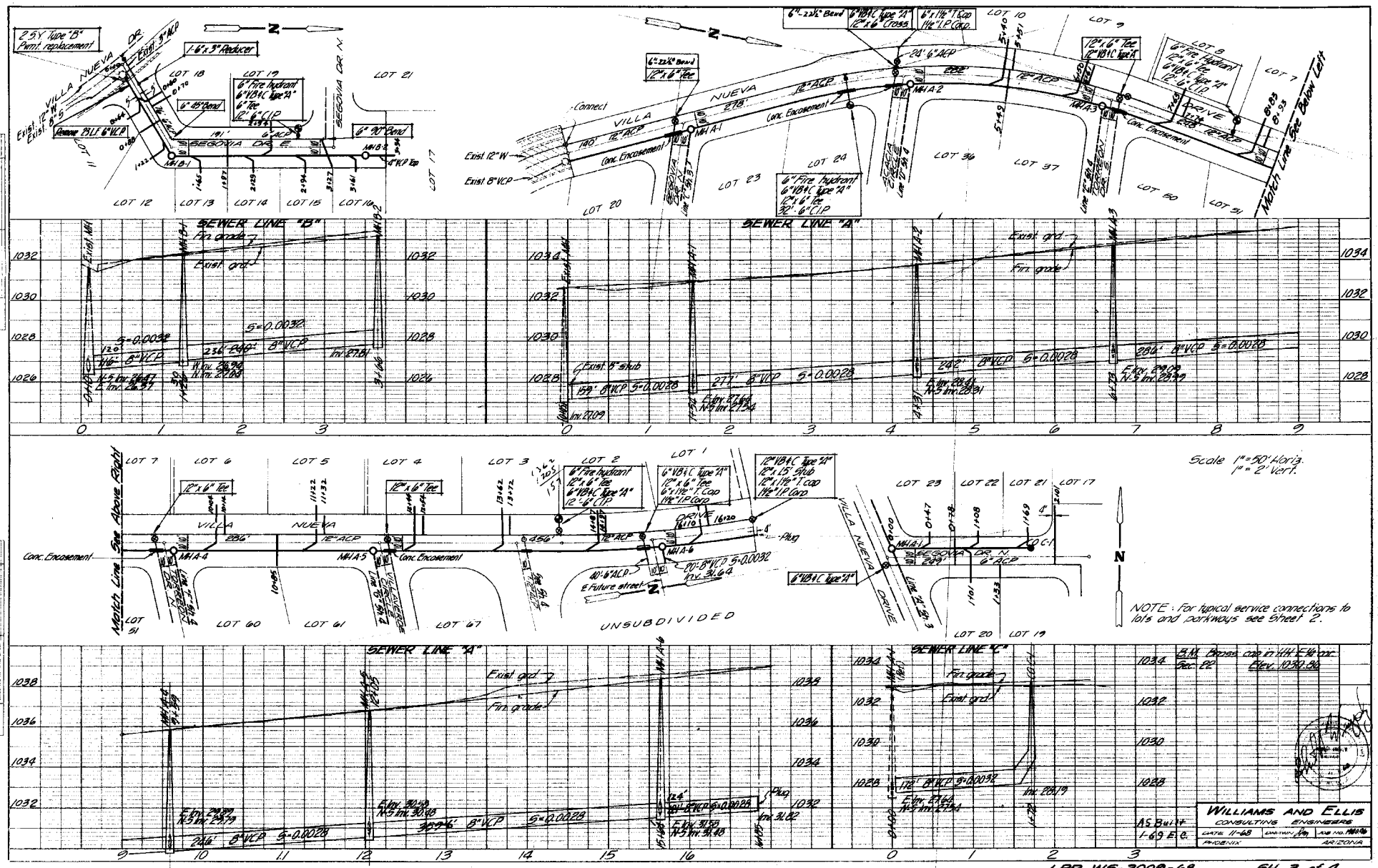
REVISIONS

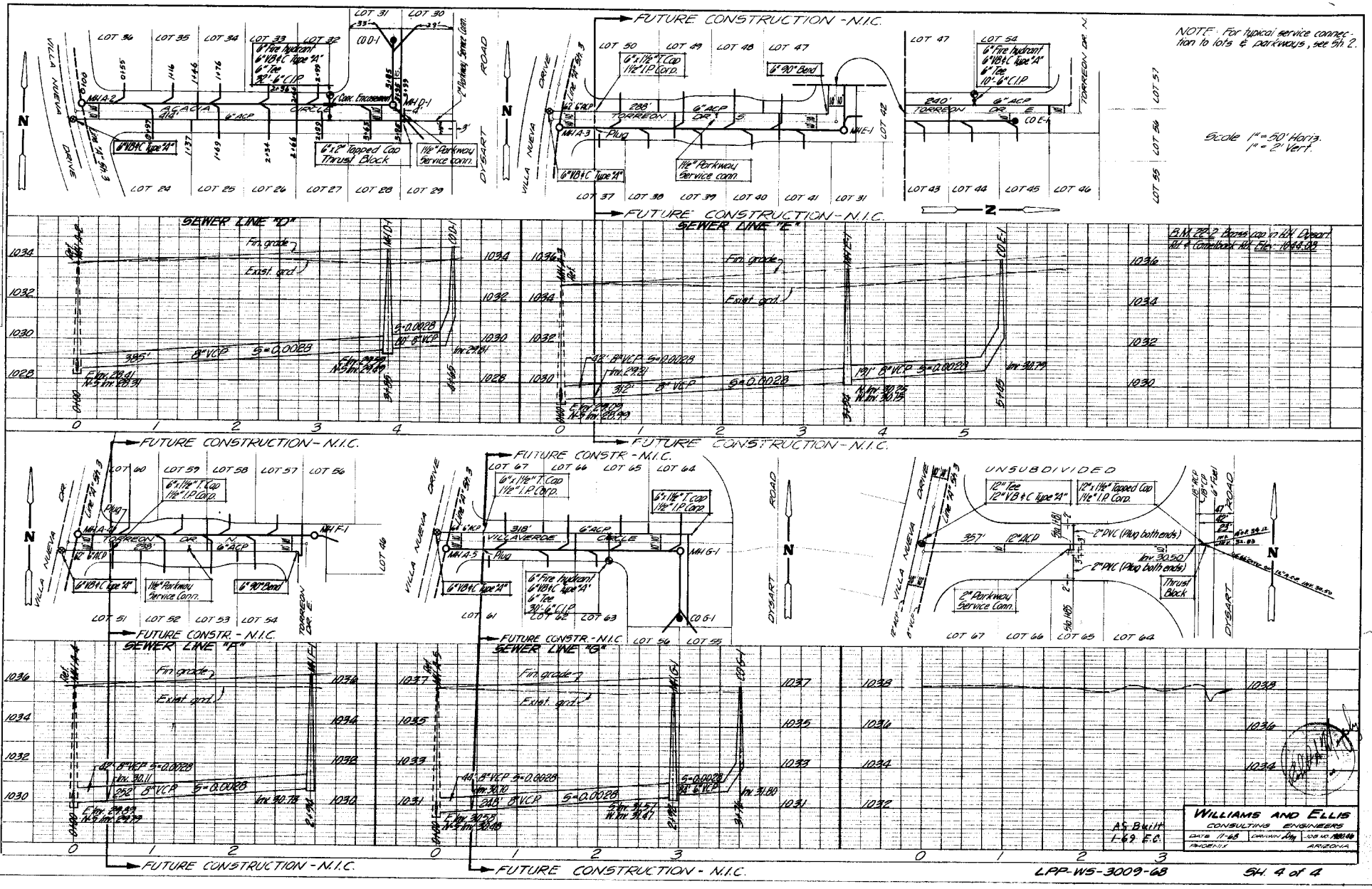
SURVEY
DESIGN
DRAWN
CHECKED

WILLIAMS AND ELLIS CONSULTING ENGINEERS			
AS Built 1-69 E.C.	DATE 11-68	DRAWN JM	JOB NO. 1980.46
	PHOENIX		ARIZONA

LPP-WS-3009-68

SH. 2 of 4


SEWER LINE "B"
SEWER LINE "A"
SEWER LINE "A"
SEWER LINE "C"
VILLA NUEVA DR.
SEGOVIA DR. E.
SEGOVIA DR. N.
ACACIA DRIVE
TORREON DR. S.
LOT 10
LOT 9
LOT 8
LOT 7
LOT 18
LOT 19
LOT 21
LOT 12
LOT 13
LOT 14
LOT 15
LOT 16
LOT 17
LOT 20
LOT 23
LOT 24
LOT 36
LOT 37
LOT 50
LOT 51
LOT 6
LOT 5
LOT 4
LOT 3
LOT 2
LOT 1
LOT 22
LOT 60
LOT 61
LOT 67
UNSUBDIVIDED
Match Line See Above Right
Match Line See Below Left
Connect
Exist 12" W
Exist 8" VCP
Exist 6" S
Remove BLF 6" VCP
6" 45° Bend
6" 90° Bend
6" 22½° Bend
6" Fire hydrant 6" MJ x 6" Tee 6" MJ x 6" GLIP
6" MJ x 3" Reducer
6" MJ x 6" Tee
6" MJ x 6" GLIP
12" MJ x 6" Tee
12" MJ x 6" Cross
6" MJ x 1½" T Cap 1½" IP Cap
12" MJ x 15" Stub
12" MJ x 1½" T Cap
1½" IP Cap
24" 6" ACP
18" ACP
12" ACP
10" ACP
8" VCP
6" ACP
Conc. Encasement
MH B-1
MH B-2
MH A-1
MH A-2
MH A-3
MH A-4
MH A-5
MH A-6
Exist. MH
Fin grade
Exist grd.
S=0.0032
S=0.0028
S=0.0022
S=0.0020
S=0.0032
Inv. 27.84
Inv. 27.64
Inv. 27.54
Inv. 27.44
Inv. 28.09
Inv. 28.19
Inv. 31.64
Inv. 31.48
Inv. 31.32
Inv. 31.82
N.S Inv. 28.39
N.S Inv. 28.34
N.S Inv. 28.24
N.S Inv. 28.14
N.S Inv. 30.98
N.S Inv. 30.88
N.S Inv. 27.64
E Future street
Plug
Scale 1"=50' Horiz.
1"=2' Vert.
NOTE: For typical service connections to lots and parkways see Sheet 2.
B.M. Brass cap in MH Elev. 1030.86
Sec. 22
AS Built
1-69 E.C.
WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX
ARIZONA
LPP-WS-3009-68
SH. 3 of 4


FUTURE CONSTRUCTION - N.I.C.
SEWER LINE "D"
SEWER LINE "E"
SEWER LINE "F"
SEWER LINE "G"
FUTURE CONSTR. - N.I.C.
UNSUBDIVIDED
ACACIA CIRCLE
TORREON DR. E.
VILLA NUEVA DRIVE
VILLA AVERDE CIRCLE
DYSART ROAD
6" VB & C Type "A"
6" Fire Hydrant
6" Tee
30"-6" C.I.P.
6" ACP
6" 90° Bend
6" x 1 1/2" T Cap
1 1/2" I.P. Conn.
1 1/2" Parkway Service Conn.
6" x 1 1/2" Tapped Cap
Thrust Block
12" Tee
12" VB & C Type "A"
12" x 1 1/2" Tapped Cap
2" PVC (Plug both ends)
2" Parkway Service Conn.
8" VCP
12" ACP
Fin. grade
Exist. grad
LOT 31
LOT 30
LOT 36
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LOT 63
LOT 56
LOT 55
MH A-2
MH A-3
MH A-4
MH A-5
MH C-1
MH D-1
MH E-1
MH F-1
MH G-1
CO D-1
CO E-1
CO F-1
CO G-1
NOTE: For typical service connection to lots & parkways, see Sh 2.
Scale 1" = 50' Horiz.
1" = 2' Vert.
B.M. ZZ-2 Brass cap in H.H. Cleanout at Centerline Alt. Elev. 1044.89
AS Built 1-69 E.C.
WILLIAMS AND ELLIS
CONSULTING ENGINEERS
PHOENIX ARIZONA
LPP-WS-3009-68
SH. 4 of 4

IMPROVEMENT PLANS
FOR THE
DISTRICT OFFICE/TEMPORARY CLASSROOMS

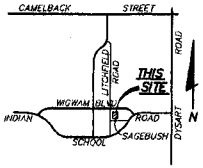
SITE ADDRESS: 13825 WEST WIGWAM BLVD.
LITCHFIELD PARK, ARIZONA 85340
PHONE: (623) 935-3779
FOR:
LITCHFIELD ELEMENTARY SCHOOL DISTRICT #79
533 PLAZA CIRCLE
LITCHFIELD PARK, ARIZONA 85340-4996
PHONE: (623) 535-6000

ENGINEER:
HESS-ROUNTREE, INC.
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044
TEL: (480)496-0244
FAX: (480)496-0094
CONTACT: PERCY MYRON, JR., P.E.

ARCHITECT:
ORCUTT WINSLOW
3003 N. CENTRAL AVE., 16TH FLOOR
PHOENIX, ARIZONA 85012
TEL: (602)257-1764
FAX: (602)257-9092
CONTACT: DAVID SCHMIDT, ARCHITECT

OWNER:
LITCHFIELD ELEMENTARY DISTRICT NO. 79
533 PLAZA CIRCLE
LITCHFIELD PARK, ARIZONA 85340-4996
TEL: (623)535-6000
FAX: (623)935-1448
CONTACT: KEN AXFORD, BUSINESS MANAGER

WATER AND SEWER PROVIDER:
LITCHFIELD PARK SERVICE COMPANY
12725 WEST INDIAN SCHOOL ROAD, SUITE D101
AVONDALE, ARIZONA 85323
TEL: (623)935-9367
CONTACT: ROVELL FOGGY



VICINITY MAP
NOT TO SCALE

SHEET INDEX:

C-1	COVER SHEET
C-2	DETAILS AND LEGEND
C-3	PARTIAL TOPOGRAPHIC SURVEY AND DEMOLITION PLAN
C-4	GRADING AND DRAINAGE PLAN
C-5	PRIVATE DOMESTIC WATER, PRIVATE SANITARY SEWER AND PRIVATE FIRE LINE PLAN

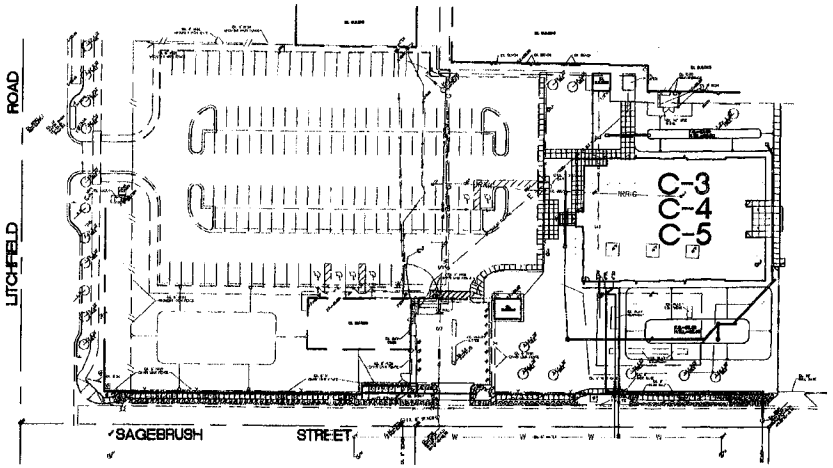
ESTIMATED EARTHWORK QUANTITIES:
CUT: 500 CY
FILL: 750 CY

ESTIMATED ONSITE QUANTITIES:

ITEM NO.	DESCRIPTION	QUANTITY
1.	CONCRETE SIDEWALK	3,325 SF
2.	A.C. PAVEMENT	23 SY
3.	CONCRETE SINGLE CURB	16 LF
4.	CATCH BASIN	2 EA
5.	12" H.D.P.E. STORM DRAIN	295 LF
6.	STORM DRAIN CLEANOUT	3 EA
7.	8" DUCTILE IRON STORM DRAIN	40 LF
8.	8" H.D.P.E. STORM DRAIN	30 LF
9.	CONCRETE SPLASH PAD	4 EA
10.	DRYWELL	1 EA
11.	OIL/GRASE INTERCEPTOR	1 EA
12.	6" DUCTILE IRON PIPE	6 LF
13.	6" DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTER	1 EA
14.	6" P.V.C. (AWWA C-900, CLASS 200) WATER LINE	87 LF
15.	2" COPPER (TYPE K) WATER LINE	8 LF
16.	2" WATER VALVE WITH VALVE BOX AND COVER	1 EA
17.	2" REDUCED PRESSURE PRINCIPAL BACKFLOW PREVENTER	1 EA
18.	3" P.V.C. (SCHEDULE 40) WATER LINE	88 LF
19.	4" P.V.C. SEWER LINE	208 LF
20.	SEWER CLEANOUT	3 EA

ESTIMATED OFFSITE QUANTITIES:

ITEM NO.	DESCRIPTION	QUANTITY
1.	CONCRETE SIDEWALK	2071 SF
2.	A.C. PAVEMENT	13 SY
3.	CONCRETE SINGLE CURB	10 LF



SHEET INDEX MAP
NOT TO SCALE

DESIGN CIVIL ENGINEER'S NOTES TO CONTRACTOR:

1. NOTHING CONTAINED IN THE CONTRACT DOCUMENTS SHALL CREATE, NOR SHALL BE CONSTRUED TO CREATE, ANY CONTRACTUAL RELATIONSHIP BETWEEN THE DESIGN CIVIL ENGINEER AND THE CONTRACTOR OR ANY SUBCONTRACTOR.
2. THE DESIGN CIVIL ENGINEER WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OR FOR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED IN CONNECTION WITH THE WORK. THESE ARE SOLELY THE CONTRACTOR'S RESPONSIBILITY. THE DESIGN CIVIL ENGINEER WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING TRUCKS AND/OR OTHER EQUIPMENT OF MUD PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT ALL ROADWAYS ARE MAINTAINED IN A CLEAN, MUD AND DUST-FREE CONDITION AT ALL TIMES.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE BLUE STAKE CENTER TWO WORKING DAYS PRIOR TO ANY CONSTRUCTION. THE UNDERGROUND UTILITY LOCATIONS AS SHOWN HEREON ARE BASED ON THE BEST INFORMATION AVAILABLE FROM UTILITY RECORDS AND OTHER DATA AS SUPPLIED TO THIS DESIGN ENGINEER. THERE MAY BE OTHER UNDERGROUND UTILITY LINES, SERVICE LINES AND STRUCTURES PRESENT IN THE SUBJECT AREA. CONTRACTOR TO VERIFY LOCATIONS AND ELEVATIONS OF ALL UTILITIES PRIOR TO START OF CONSTRUCTION.
5. THE DESIGN CIVIL ENGINEER MAKES NO REPRESENTATION OR GUARANTEE REGARDING EARTHWORK QUANTITIES OR THAT THE EARTHWORK FOR THIS PROJECT WILL BALANCE. PRIOR TO BIDDING WORK THE CONTRACTOR SHALL THOROUGHLY SATISFY HIMSELF THE AS TO THE ACTUAL CONDITIONS, EARTHWORK QUANTITIES AND REQUIREMENTS OF THE WORK AND EXCESS OR DEFICIENCY THEREIN, ACTUAL OR RELATIVE.
6. THE CONTRACTOR SHALL ADJUST ALL EXISTING AND NEW CLEANOUTS, WATER VALVE BOXES, MANHOLES, IRRIGATION BOXES, ETC. IN THE CONSTRUCTION AREA TO FINISH GRADE PER THE APPLICABLE MAG STANDARD DETAIL.

BENCHMARK:
TOP 3 INCH BRASS CAP FLUSH, STAMPED LS 6221, 1967 AT THE INTERSECTION OF WIGWAM BOULEVARD AND FLORENCE AVENUE.

ELEVATION=1026.167 (NAVD 1988 DATUM)

APPROVAL:

CITY OF LITCHFIELD PARK ENGINEER — DATE 6-19-08

THE CITY APPROVES THESE PLANS FOR CONCEPT ONLY AND ACCEPTS NO LIABILITY FOR ERRORS OR OMISSIONS

AS-BUILT CERTIFICATION:

I HEREBY CERTIFY THAT THE "AS-BUILT" INFORMATION AS SHOWN HEREON WAS MADE UNDER MY SUPERVISION, OR AS NOTED, AND IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

5277 — DATE 7-11-08
REGISTERED PROFESSIONAL ENGINEER OR REGISTERED LAND SURVEYOR

ROBERT M. HARMON, PE / R.L.S.
BRADY-ADLERICH & ASSOCIATES
1020 EAST GUADALUPE ROAD
TEMPE, ARIZONA 85283
(480) 820-4900

EXP. 9-31-09

NOTE:

THESE DRAWINGS ARE AN INSTRUMENT OF SERVICE ONLY AND ARE AND SHALL REMAIN THE EXCLUSIVE PROPERTY OF HESS-ROUNTREE, INC. NO REPRODUCTION OR OTHER USE SHALL BE MADE BY ANY PERSON OR FIRM OTHER THAN HESS-ROUNTREE, INC., AND THE CITY OF LITCHFIELD PARK WITHOUT EXPRESS PERMISSION OF HESS-ROUNTREE, INC. ANY UNAUTHORIZED USE SHALL VOID THE ENGINEER'S SEAL AND SIGNATURE HEREON AND NO PROFESSIONAL RESPONSIBILITY WILL REMAIN.

THESE PLANS HAVE BEEN SUBMITTED TO THE FOLLOWING UTILITY COMPANIES AND THE WORK CONTAINED IN THESE PLANS HAS BEEN APPROVED BY THESE COMPANIES WITHIN THEIR AREA OF INTEREST. THE SIZE AND LOCATIONS, AS SHOWN OF THE GAS, TELEPHONE AND POWER LINES, AND CONNECTIONS AGREE WITH THE INFORMATION CONTAINED IN THE UTILITY COMPANY'S RECORDS. WHERE THE WORK TO BE DONE CONFLICTS WITH ANY OF THESE UTILITIES, THE CONFLICTS SHALL BE RESOLVED AS SPECIFIED IN THE SPECIAL PROVISIONS AND/OR AS OTHERWISE NOTED ON THESE PLANS. CONFLICTS ARISING DURING THE COURSE OF CONSTRUCTION FROM UNFORSEEN CIRCUMSTANCES SHALL BE REPORTED TO THE INTERESTED UTILITY COMPANY AND BE RESOLVED BY THEM AND THE DESIGN ENGINEER.

COX COMMUNICATIONS	TRAFFIC MANAGEMENT CENTER - DV 64 (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)
ARIZONA PUBLIC SERVICE	VIRGINIA NISKALA (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)
QWEST COMMUNICATIONS	CONFLICT LIAISON DEPARTMENT (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)
EL PASO NATURAL GAS COMPANY	DENNIS SEGARS (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)
LITCHFIELD PARK SERVICE COMPANY	R. FOGGY (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)
SOUTHWEST GAS COMPANY	G. LOPEZ (CO. REPRESENTATIVE CONTACTED)	01/18/08 (DATE SUBMITTED)

REVISED 5/2/08 PER CITY COMMENTS

AS-BUILT

CALL TWO WORKING DAYS BEFORE YOU DIG
602-263-1100
1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

HESS -- ROUNTREE, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044 (480)496-0244

EXPIRES 9-30-10

DES. PM	DRN. TMH	CKD. PM	JOB NO. 0706-14

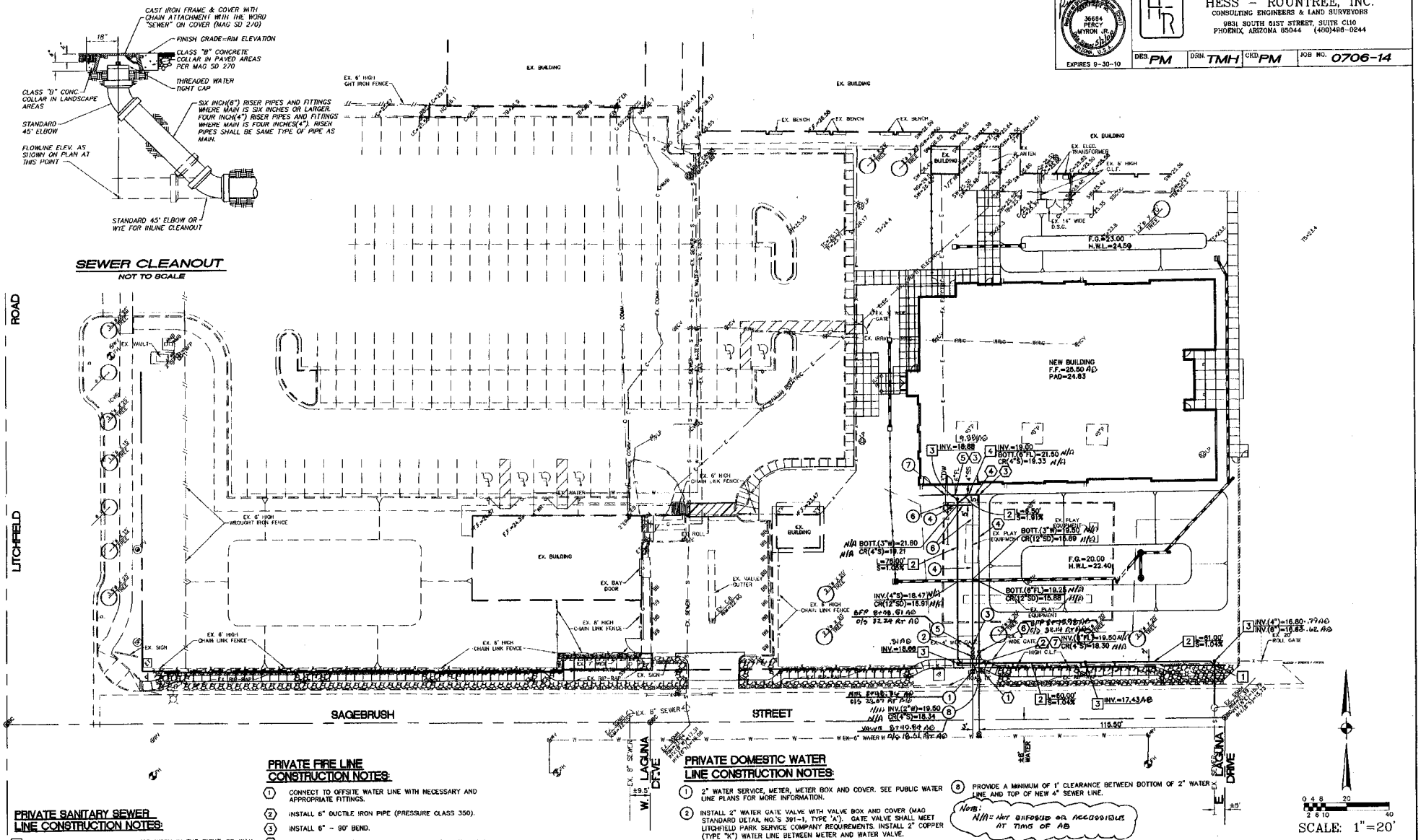
COVER SHEET
LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79
DISTRICT OFFICE/
TEMPORARY CLASSROOMS

SCALE	SHEET	OF	08-02-07
HORIZONTAL: NONE	1	5	C-1
VERTICAL: NONE			
REV. DATE:			

A3-134

P:\DRAWINGS\DWG

SEWER CLEANOUT
NOT TO SCALE



PRIVATE SANITARY SEWER LINE CONSTRUCTION NOTES:

1. SEE OFFSITE SEWER LINE PLAN FOR WORK IN THE RIGHT-OF-WAY.
2. INSTALL 4" P.V.C. SEWER LINE (ASTM D3034, SDR-35).
3. INSTALL SANITARY SEWER CLEANOUT (SEE DETAIL ON THIS SHEET).
4. SEE PLUMBING PLANS FOR CONTINUATION.

PRIVATE FIRE LINE CONSTRUCTION NOTES:

1. CONNECT TO OFFSITE WATER LINE WITH NECESSARY AND APPROPRIATE FITTINGS.
2. INSTALL 6" DUCTILE IRON PIPE (PRESSURE CLASS 350).
3. INSTALL 6" - 90° BEND.
4. INSTALL 6" P.V.C. (AWWA C-900, CLASS 200) WATER LINE.
5. CONNECT TO BUILDING FIRE PROTECTION SYSTEM WITH NECESSARY AND APPROPRIATE FITTINGS. SEE BUILDING FIRE PROTECTION DRAWINGS FOR EXACT LOCATION AND CONTINUATION.
6. INSTALL 6" DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTION ASSEMBLY WITH BYPASS RPZ (REDUCED PRESSURE ZONE) BACKFLOW PREVENTION ASSEMBLY AND SENSUS SR11, OR APPROVED EQUAL, APPROVED BY LPSCO. (CITY OF GOODYEAR STANDARD DETAIL NO. G-3362). PIPE BETWEEN OFFSITE WATER LINE AND BACKFLOW PREVENTOR SHALL BE 6" DUCTILE IRON (CLASS 350).
7. PROVIDE A MINIMUM OF 1' CLEARANCE BETWEEN BOTTOM OF 6" FIRELINE AND TOP OF NEW 4" SEWER LINE.

PRIVATE DOMESTIC WATER LINE CONSTRUCTION NOTES:

1. 2" WATER SERVICE, METER, METER BOX AND COVER. SEE PUBLIC WATER LINE PLANS FOR MORE INFORMATION.
2. INSTALL 2" WATER GATE VALVE WITH VALVE BOX AND COVER (MAG STANDARD DETAIL NO.'S 391-1, TYPE 'A'). GATE VALVE SHALL MEET LITCHFIELD PARK SERVICE COMPANY REQUIREMENTS. INSTALL 2" COPPER (TYPE "K") WATER LINE BETWEEN METER AND WATER VALVE.
3. INSTALL 3" X 2" REDUCER.
4. INSTALL 3" P.V.C. (SCHEDULE 40) WATER LINE.
5. INSTALL 2" RPZ (REDUCED PRESSURE ZONE) BACKFLOW PREVENTION ASSEMBLY PER LITCHFIELD PARK SERVICE COMPANY REQUIREMENTS. INSTALL COPPER (TYPE "K") WATER LINE BETWEEN WATER VALVE AND BACKFLOW PREVENTER.
6. INSTALL 3" - 90° BEND.
7. CONNECT TO BUILDING DOMESTIC WATER LINE WITH NECESSARY AND APPROPRIATE FITTINGS. SEE BUILDING PLUMBING DRAWINGS FOR EXACT LOCATION AND CONTINUATION.
8. PROVIDE A MINIMUM OF 1' CLEARANCE BETWEEN BOTTOM OF 2" WATER LINE AND TOP OF NEW 4" SEWER LINE.

Note: N/A = not surveyed as accessible at time of AS

AS-BUILT

REVISED 5/2/08 PER CITY COMMENTS
REVISED 3/20/08 PER LPSCO COMMENTS

CALL THE BLUE STAKE, INC. BEFORE YOU DIG
602-263-1100
1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

SCALE: 1"=20'

PRIVATE DOMESTIC WATER, PRIVATE SANITARY SEWER AND PRIVATE FIRE LINE PLAN

LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79

DISTRICT OFFICE/ TEMPORARY CLASSROOMS

SCALE	SHEET	OF	08-02-07
HORIZONTAL: 1"=20'	5	5	C-5
VERTICAL: NONE			
REV. DATE:			

36684 PERCY MYRON JR. STRUCTURAL
EXPIRES 9-30-10

HESS - ROUNTREE, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044 (480)496-0244

DES. PM | DRN. TMH | CKD. PM | JOB NO. 0706-14

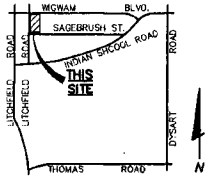
07061MASD.DWG

OFFSITE WATER LINE AND SEWER LINE PLANS
FOR THE
DISTRICT OFFICE/TEMPORARY CLASSROOMS

SITE ADDRESS: 13825 WEST WIGWAM BLVD.
LITCHFIELD PARK, ARIZONA 85340
PHONE: (623) 935-3779

FOR

LITCHFIELD ELEMENTARY SCHOOL DISTRICT #79
533 PLAZA CIRCLE
LITCHFIELD PARK, ARIZONA 85340-4996
PHONE: (623) 535-6000
CONTACT: KEN AXFORD, BUSINESS MANAGER



SHEET INDEX:

C-6 COVER SHEET
C-7 NOTES AND LEGEND
C-8 OFFSITE WATER LINE AND SEWER LINE PLAN

ENGINEER:

HESS-ROUNTREE, INC.
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044
TEL: (480)496-0244
FAX: (480)496-0094
CONTACT: PERCY MYRON, JR., P.E.

ARCHITECT:

ORCUTT WINSLOW
3003 N. CENTRAL AVE., 16TH FLOOR
PHOENIX, ARIZONA 85012
TEL: (602)257-1794
FAX: (602)257-9092
CONTACT: DAVID SCHMIDT, ARCHITECT

OWNER:

LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79
533 PLAZA CIRCLE
LITCHFIELD PARK, ARIZONA 85340-4996
TEL: (623)535-6000
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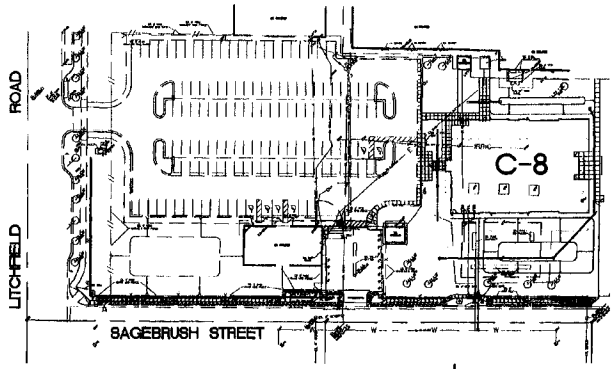

SHEET INDEX MAP
NOT TO SCALE

OFFSITE PUBLIC WATER QUANTITIES:

ITEM NO.	DESCRIPTION	QUANTITY/UNIT
1.	6" DUCTILE IRON PIPE (CLASS 350)	34 LF
2.	6" X 6" TAPPING SLEEVE WITH 6" WATER GATE VALVE WITH VALVE BOX AND COVER	1 EA
3.	2" WATER SERVICE, METER, METER BOX AND COVER	1 EA
4.	6" WATER GATE VALVE WITH VALVE BOX AND COVER	1 EA
5.	REMOVE AND REPLACE EX. A.C. PAVEMENT	22 SY
8.	REMOVE AND REPLACE EX. CONCRETE ROLL CURB.	7 LF

OFFSITE PRIVATE SEWER QUANTITIES:

ITEM NO.	DESCRIPTION	QUANTITY/UNIT
1.	6" P.V.C. SEWER SERVICE LINE	20 LF
2.	6" CONNECTION TO EX. MANHOLE	1 EA
3.	REMOVE AND REPLACE EX. A.C. PAVEMENT	7 SY
4.	REMOVE AND REPLACE EX. CONCRETE ROLL CURB.	5 LF

WATER/SEWER OWNER/OPERATOR

LPSCO
LITCHFIELD PARK SERVICE COMPANY
12725 W. INDIAN SCHOOL RD., SUITE D101
AVONDALE, AZ 85323
MAIN OFFICE: 623-935-9367
CONSTRUCTION INSPECTOR: 602-757-6064

NOTE

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THESE PLANS HAVE BEEN SUBMITTED TO THE FOLLOWING UTILITY COMPANIES AND THE WORK CONTAINED IN THESE PLANS HAS BEEN APPPOVED BY THESE COMPANIES WITHIN THEIR AREA OF INTEREST. THE SIZE AND LOCATIONS, AS SHOWN OF THE GAS, TELEPHONE AND POWER LINES, AND CONNECTIONS AGREE WITH THE INFORMATION CONTAINED IN THE UTILITY COMPANY'S RECORDS. WHERE THE WORK TO BE DONE CONFLICTS WITH ANY OF THESE UTILITIES, THE CONFLICTS SHALL BE RESOLVED AS SPECIFIED IN THE SPECIAL PROVISIONS AND/OR AS OTHERWISE NOTED ON THESE PLANS. CONFLICTS ARISING DURING THE COURSE OF CONSTRUCTION FROM UNFORSEEN CIRCUMSTANCES SHALL BE REPORTED TO THE INTERESTED UTILITY COMPANY AND BE RESOLVED BY THEM AND THE DESIGN ENGINEER.

	CO. REPRESENTATIVE CONTACTED	DATE SUBMITTED
COX COMMUNICATIONS	TRAFFIC MANAGEMENT CENTER - DV 64	01/18/08
ARIZONA PUBLIC SERVICE	VIRGINIA NISKALA	01/18/08
QWEST COMMUNICATIONS	CONFLICT LIAISON DEPARTMENT	01/18/08
EL PASO NATURAL GAS COMPANY	DENNIS SEGARIS	01/18/08
LITCHFIELD PARK SERVICE COMPANY	R. FOGGY	01/18/08
SOUTHWEST GAS COMPANY	G. LOPEZ	01/18/08

REVISED 3/26/08 PER LPSCO COMMENTS
REVISED 3/20/08 PER LPSCO COMMENTS

AS-BUILT

CALL TWO WORKING DAYS BEFORE YOU DIG
602-263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

HESS - ROUNTREE, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044 (480)496-0244

DES. PM	DRN. TMH	CKD. PM	JOB NO. 0706-14

Expires 9/30/10

DESIGN CIVIL ENGINEER'S NOTES TO CONTRACTOR:

1. NOTHING CONTAINED IN THE CONTRACT DOCUMENTS SHALL CREATE, NOR SHALL BE CONSTRUED TO CREATE, ANY CONTRACTUAL RELATIONSHIP BETWEEN THE DESIGN CIVIL ENGINEER AND THE CONTRACTOR OR ANY SUBCONTRACTOR.
2. THE DESIGN CIVIL ENGINEER WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OR FOR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED IN CONNECTION WITH THE WORK. THESE ARE SOLELY THE CONTRACTOR'S RESPONSIBILITY. THE DESIGN CIVIL ENGINEER WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRYOUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING TRUCKS AND/OR OTHER EQUIPMENT OF MUD PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREET, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT ALL ROADWAYS ARE MAINTAINED IN A CLEAN, MUD AND DUST-FREE CONDITION AT ALL TIMES.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE BLUE STAKE CENTER TWO WORKING DAYS PRIOR TO ANY CONSTRUCTION. THE UNDERGROUND UTILITY LOCATIONS AS SHOWN HEREON ARE BASED ON THE BEST INFORMATION AVAILABLE FROM UTILITY RECORDS AND OTHER DATA AS SUPPLIED TO THIS ENGINEER. THERE MAY BE OTHER UNDERGROUND UTILITY LINES, SERVICE LINES AND STRUCTURES PRESENT IN THE SUBJECT AREA. CONTRACTOR TO INCLUDE IN HIS BID THE COST OF HIRING A UTILITY LOCATING SERVICE FOR THE PURPOSE OF LOCATING ALL UNDERGROUND UTILITIES. CONTRACTOR WILL COORDINATE WITH THE OWNER AND ARCHITECT TO DETERMINE WHETHER SAID UTILITIES ARE TO BE ABANDONED OR PROTECTED FROM DAMAGE.
5. THE DESIGN CIVIL ENGINEER MAKES NO REPRESENTATION OR GUARANTEE REGARDING THE EARTHWORK QUANTITIES OR THAT THE EARTHWORK FOR THIS PROJECT WILL BALANCE DUE TO THE VARYING FIELD CONDITIONS, CHANGING SOIL TYPES, ALLOWABLE CONSTRUCTION TOLERANCES AND CONSTRUCTION METHODS THAT ARE BEYOND THE CONTROL OF THE DESIGN CIVIL ENGINEER. PRIOR TO BIDDING THE WORK, THE CONTRACTOR SHALL THOROUGHLY SATISFY HIMSELF AS TO THE ACTUAL CONDITIONS, EARTHWORK QUANTITIES AND REQUIREMENTS OF THE WORK AND EXCESS OR DEFICIENCY THEREIN, ACTUAL OR RELATIVE.
6. THE CONTRACTOR SHALL ADJUST ALL EXISTING AND NEW CLEANOUTS, WATER VALVE BOXES, MANHOLES, IRRIGATION BOXES, ETC. IN THE CONSTRUCTION AREA TO FINISH GRADE PER THE APPLICABLE MAG STANDARD DETAIL.

NOTE:

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY, AND ARE BASED ON RECORDS PROVIDED BY THE SERVING UTILITY COMPANIES AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THIS SURVEYOR.

BENCH MARK:

TOP 3 INCH BRASS CAP FLUSH, STAMPED LS 6221, 1967 AT THE INTERSECTION OF WIGWAM BOULEVARD AND FLORENCE AVENUE.

ELEVATION=1026.167 (NAVD 1988 DATUM)

APPROVAL:

Randall Jorgen 8600-10008-LX1088 — 7/7/08
LITCHFIELD PARK SERVICE COMPANY (LPSCO) — DATE

CITY OF LITCHFIELD PARK ENGINEER — DATE
THE CITY APPROVES THESE PLANS FOR CONCEPT ONLY AND ACCEPTS NO LIABILITY FOR ERRORS OR OMISSIONS

WATER/SEWER "AS-BUILT" CERTIFICATION:

I, HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED, AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. ADDITIONALLY, I HEREBY CERTIFY THAT ALL MAINS AND SERVICES HAVE BEEN INSTALLED WITHIN THE LIMITS OF DEDICATED LITCHFIELD PARK SERVICE COMPANY EASEMENTS OR INSIDE DEDICATED STREET RIGHT-OF-WAYS.

SEAL

COVER SHEET- WATER PLANS

LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79
DISTRICT OFFICE/
TEMPORARY CLASSROOMS

SCALE	SHEET	OF	08-02-07
HORIZONTAL NONE	1	3	C-6
VERTICAL: NONE			

D:\08\HOW.DWG

LITCHFIELD PARK SERVICE COMPANY (LPSCO) WATER AND WASTEWATER GENERAL NOTES:

1. IT IS THE CONTRACTORS RESPONSIBILITY TO FIELD VERIFY THE LOCATION OF ALL FACILITIES PRIOR TO CONSTRUCTION.
2. ALL CONSTRUCTION IS TO CONFORM TO THE LATEST M.A.G. SPECIFICATION AND DETAILS AND TO ANY M.A.G. SUPPLEMENTS PROVIDED BY LITCHFIELD PARK SERVICE COMPANY UNLESS OTHERWISE INDICATED ON THE APPROVED PLANS.
3. LPSCO SHALL BE CONTACTED 72 HOURS PRIOR TO ANY CONSTRUCTION LPSCO OFFICE (623-935-9367) or CONSTRUCTION INSPECTOR (602-757-6064). CONSTRUCTION WORK CONCEALED WITHOUT PRIOR INSPECTION BY LPSCO OR ITS DESIGNATED REPRESENTATIVES SHALL BE SUBJECT TO REMOVAL AND REPLACEMENT AT THE CONTRACTOR'S EXPENSE.
4. LPSCO IS NOT RESPONSIBLE FOR ERRORS IN DEVELOPMENT GUIDE AND OR PLANS, AND LPSCO HAS THE RIGHT TO REQUIRE CORRECTION OF ERRORS IN PLANS, WHICH ARE FOUND TO BE IN VIOLATION OF ANY LAW OR LPSCO STANDARD.
5. THIS PLAN SET SHALL AUTOMATICALLY TERMINATE IF DEVELOPER FAILS TO BEGIN CONSTRUCTION WITHIN ONE YEAR FROM THE PLAN APPROVAL DATE, UNLESS OTHERWISE AGREED TO IN WRITING BY UTILITY.
6. THE CONTRACTOR SHALL CONTACT THE BLUESTAKE CENTER (602-263-1100) AT LEAST 48 HOURS PRIOR TO COMMENCING ANY UNDERGROUND EXCAVATION.
7. THE CONTRACTOR IS RESPONSIBLE TO OBTAIN ALL NECESSARY PERMITS PRIOR TO STARTING CONSTRUCTION.
8. A SIGNED AND APPROVED SET OF LPSCO CONSTRUCTION PLANS MUST BE ON THE JOB SITE AT ALL TIMES.
9. WATER AND SEWER LINE SEPARATION SHALL BE AS DEFINED IN MAG STANDARD DETAIL 404.
10. MINIMUM 2-FOOT SEPARATION IS REQUIRED BETWEEN LPSCO OWNED LINES AND STORM DRAIN AND DRY UTILITIES.
11. STORM DRAIN AND DRY UTILITIES WILL NOT BE INSTALLED WITHIN LITCHFIELD PARK SERVICE COMPANY EASEMENTS WHEN PARALLEL TO LPSCO OWNED LINES.
12. LPSCO TESTING WILL NOT BE DONE UNTIL AFTER THE CONTRACTOR HAS PRE-TESTED 100% OF THE MAINS. FINAL TESTING MUST BE SCHEDULED WITH LPSCO 72 HOURS IN ADVANCE LPSCO OFFICE (623-935-9367) or CONSTRUCTION INSPECTOR (602-757-6064).
13. ALL MAINS SHALL BE CHLORINATED PER M.A.G. SPECIFICATION SECTION 611. MAINS SHALL BE FLUSHED THROUGH FIRE HYDRANT METERS SUPPLIED BY LPSCO AND PAID FOR BY THE CONTRACTOR. FINAL BACTERIA SAMPLING WILL BE PERFORMED BY LPSCO AND MUST BE COORDINATED 24 HOURS IN ADVANCE.
14. THE CONTRACTOR SHALL NOT MAKE MORE THAN ONE CONNECTION TO THE EXISTING LPSCO WATER SYSTEM UNTIL ALL TESTING IS COMPLETE AND HAS PASSED LABORATORY ANALYSIS. LPSCO WILL ADVISE THE CONTRACTOR WHEN LAB RESULTS INDICATE SATISFACTORY COMPLETION.
15. ALL NEW AND ACTIVE UNDERGROUND FACILITIES INSTALLED IN ANY REAL PROPERTY AFTER DECEMBER 31, 2005 SHALL BE INSTALLED WITH A DETECTABLE UNDERGROUND LOCATION DEVICE UNLESS THE FACILITY IS CAPABLE OF BEING DETECTED FROM ABOVE GROUND WITH AN ELECTRONIC LOCATING DEVICE PER ARS 40-360.22-J.
16. GREASE, OIL, OR SAND INTERCEPTORS MUST BE PROVIDED FOR RESTAURANTS, FAST FOOD ESTABLISHMENTS, AUTO REPAIR SHOPS, CARWASHES AND OTHER FACILITIES, WHERE OIL AND GREASE MAY BE DISCHARGED INTO A PUBLIC SEWER AND MUST MEET ALL CITY, COUNTY, UPC AND LPSCO REQUIREMENTS, EXCEPT THAT SUCH INTERCEPTORS SHALL NOT BE REQUIRED FOR PRIVATE LIVING QUARTERS OR DWELLING UNITS. ALL SYSTEMS MUST BE APPROVED BY THE LPSCO PRETREATMENT DEPARTMENT BEFORE RECEIVING WTER/SEWER SERVICE. ALL INDUSTRIAL FACILITIES MUST MEET LPSCO PRETREATMENT REQUIREMENTS BEFORE RECEIVING WATER/SEWER SERVICE.
17. ONE SET OF 4-MIL MYLAR, TWO BLACK LINE ON BOND AS-BUILTS AND AN AUTOCAD DISC OF CONSTRUCTION DRAWINGS MUST BE SUMITTED TO AND APPROVED BY LPSCO PRIOR TO RECEIVING A FINAL APPROVAL. THE AS-BUILT PLANS SHALL INCLUDE THE LOCATIONS OF ALL VERTICAL AND HORIZONTAL PIPE BENDS, VALVES, MANHOLES, SEWER TAPS, ETC., BY STATION/OFFSET. AS-BUILTS SHALL BE SUBMITTED AND APPROVED PRIOR TO FINAL INSPECTION BEING CONDUCTED.
18. THE CONTRACTOR SHALL FOLLOW OSHA GUIDELINES AND REGULATIONS AT ALL TIMES.
19. EXISTING WATERLINE VALVES SHALL ONLY BE OPERATED BY LPSCO PERSONNEL.
20. LPSCO WILL FURNISH AND INSTALL ALL WATER METERS ONCE PREVAILING FEES ARE PAID AND ANY OTHER APPLICABLE REQUIREMENTS HAVE BEEN FULFILLED.
21. LPSCO WILL PROVIDE FIRE HYDRANT METERS TO CONTRACTORS FOR THE USE OF CHARGING AND CHLORINATING WATER LINES ONCE THE PREVAILING FEES ARE PAID. CONTRACTORS SHOULD NOTE THAT THE UNLAWFUL EXTRACTION OF WATER FROM A FIRE HYDRANT IS A CRIMINAL OFFENSE. LPSCO WILL ACTIVELY AND AGGRESSIVELY PURSUE PROSECUTION OF PERSONS ILLEGALLY EXTRACTING WATER FROM WATER SYSTEM HYDRANTS. HYDRANT METERS CAN BE OBTAINED BY CALLING 623-935-9367. ALL CONSTRUCTION WATER (REGARDLESS OF USE) IS TO BE METERED.
22. ALL PAVEMENT REPLACEMENT SHALL CONFORM TO M.A.G. SPECIFICATIONS AND DETAILS OR ANY ADDITIONAL AGENCY STANDARDS, WHICHEVER ARE GREATER.
23. THE CONTRACTOR IS HEREBY ADVISED THAT THE PRODUCTS AND WORKMANSHIP FOR THIS PROJECT ARE WARRANTED TO LPSCO FOR A PERIOD OF TWO (2) YEARS FROM THE DATE OF THE SIGNED LPSCO FINAL ACCEPTANCE LETTER.
24. THE CONTRACTOR WILL COORDINATE WORK EFFORTS WITH ANY CURB AND GUTTER CONTRACTORS FOR THE PLACEMENT OF "W" AND "S" SYMBOLS INTO THE WET CONCRETE AT TIME OF INSTALLATION. THE "W" AND "S" SYMBOLS WILL BE AT EACH LOCATION WHERE A WATER OR SEWER SERVICE CONNECTION CROSSES THE CURB AND GUTTER.
25. ALL CONSTRUCTION MATERIALS ARE TO BE BROUGHT TO THE CURRENT STANDARDS.

LITCHFIELD PARK SERVICE COMPANY WATER SERVICE NOTES:

1 ALL WATER SERVICES SHALL BE INSTALLED TO LITCHFIELD PARK SERVICE COMPANY STANDARDS.
2 EVERY RESIDENTIAL UNIT MUST HAVE ITS OWN SEPARATE WATER SERVICE CONNECTION AND METER THIS EXCLUDES CONDOMINIUMS AND APARTMENTS.
3 ALL WATER SERVICES SHALL USE DOUBLE STRAP BRONZE SERVICE SADDLES, BRASS CORPORATION STOPS, AND ALL SERVICE LINES SHALL CONSIST OF AONE CONTINUOUS PIECE (NON-SPLICED) TYPE "K" COPPER (WITH FLARED OR COMPRESSION FITTINGS) FROM THE MAIN CORPORATION STOP TO THE METER LOCATION. POLYETHYLENE OR PLASTIC PIPE IS NOT ALLOWED. ALL SERVICE LINES FOR METERS 3-INCH AND LARGER SHALL BE DUCTILE IRON.
4 MINIMUM WATER SERVICE LINE SIZE DIAMETER SHALL BE 1-INCH FOR IRRIGATION. MINIMUM SERVICE LINE SIZE SHALL BE 2-INCH FOR COMMERCIAL AND APARTMENT DEVELOPMENTS OR SIMILAR PROJECTS. MINIMUM SERVICE LINE SIZE DIAMETER SHALL BE 1-1/2 INCH FOR IRRIGATION.
5 WATER METERS 2-INCH AND SMALLER SHALL BE SENSUS SR 11 OR EQUAL APPROVED BY LPSCO.
6 WHEN WATER METER IS LESSER SIZE THEN SERVICE LINE REDUCERS ARE TO BE FURNISHED AND INSTALLED BY CONTRACTOR.
7 ALL METER SERVICES SHALL HAVE A SHUT OFF VALVE INSTALLED IN LINE AFTER THE METER ON THE CUSTOMER'S SIDE OF THE SERVICE THAT MUST MEET LITCHFIELD PARK SERVICE COMPANY STANDARDS FOR PRESSURE AND MATERIAL, THAT IS PLACED WITHIN 18 INCHES OF THE OUTSIDE OF THE METER BOX AND MUST BE ACCESSIBLE AT ALL TIMES.
8 WATER METER BOXES SHALL BE INSTALLED BY THE CONTRACTOR AND SHALL BE SET 12 INCHES BEHIND THE SIDEWALK. IF NO SIDEWALK IS PRESENT, THE METER BOX SHALL BE SET 12 TO 36 INCHES BEHIND THE CURB AND BE 2.5 INCHES HIGHER THAN THE BACK OF THE SIDEWALK/CURB. COMPACTION AROUND AND UNDER THE WATER METER BOXES SHALL BE PERFORMED USING MECHANICAL COMPACTORS.
9 WATER SERVICES INSTALLED FOR COMMERICAL AND APARTMENT DEVELOPMENT OR SIMILAR PROJECTS SHALL BE OUTFITTED WITH AN APPROVED RPZ (REDUCED PRINCIPLE ZONE) BACKFLOW PREVENTION DEVICE LOCATED 24 INCHES PAST THE WATER METER BOX. A CERTIFIED TEST MUST BE SUBMITTED TO LPSCO PRIOR TO INSTALLATION OF A PERMANENT WATER METER. THE DEVICE MUST BE INSPECTED BY AN ARIZONA CERTIFIED BACKFLOW TECHNICIAN AND TESTING RESULTS SENT TO LPSCO PRIOR TO PLACEMENT OF A METER.
10 AFTER OPERATIONAL APPROVAL AND PLACEMENT OF CURB/GUTTER AND OR SIDEWALK ALSO INCLUDING ASPHALT CONCRETE A PERCENTAGE (20% + -) OF THE WATER METERS WILL BE RELEASED. THE REMAINING METERS WILL NOT BE RELEASED UNTIL COMPLETION OF THE PROJECT BEING THE PROJECT HAS BEEN GRANTED FINAL APPROVAL AND ALL REQUIRED PAPERWORK HAS BEEN RECEIVED AND REVIEWED. SEE LXA (LINE EXTENSION AGREEMENT) AND LPSCO DEVELOPMENT GUIDE FOR REQUIRED PAPERWORK.
11 LPSCO REPRESENTATIVE WILL INSPECT THE FINAL PLACEMENT AND ELEVATION OF EACH METER BOX PRIOR TO FINAL APPROVAL.

LITCHFIELD PARK SERVICE COMPANY FIRE HYDRANTS AND "PRIVATE FIRE SYSTEMS" NOTES:

1 FIRE HYDRANTS SHALL BE DRY BARREL TYPE WATEROUS PACER OR MUELLER CENTURION, CLOW MEDALLION OR EQUAL AND SHALL BE INSTALLED ACCORDING TO M.A.G. STANDARD DETAIL 360. A VALVE SHALL BE PLACED AT THE TEE BETWEEN THE WATER MAIN AND EACH FIRE HYDRANT.
2 PRIOR TO FINAL INSPECTION, THE CONTRACTOR SHALL REPAINT ALL HYDRANTS OSHA SAFETY YELLOW (T-12).
3 EACH HYDRANT SHALL BE FLOW TESTED AT WALKTHROUGH AND THE MAIN STEAMER NOZZLE CAP SHALL BE COLOR-CODED BASED UPON THE HYDRANT DISCHARGE FLOW. LITCHFIELD PARK SERVICE COMPANY WILL PROVIDE COLOR-CODING INFORMATION TO THE CONTRACTOR PRIOR TO THE FINAL WALKTHROUGH.
4 ALL FIRE HYDRANT PIPING SHALL BE RESTRAINED JOINT DUCTILE IRON.
5 ALL FIRE HYDRANTS MUST BE MARKED OR INDICATED AS "OUT OF SERVICE" UNTIL FINAL APPROVAL.
6 ANY FACILITIES INSTALLED ON THE CUSTOMER SIDE OF BACKFLOW PREVENTION DEVICES ARE CONSIDERED "PRIVATE" AND WILL NOT BE OWNED, OPERATED, OR MAINTAINED BY LITCHFIELD PARK SERVICE COMPANY.
7 FIRE LINES REQUIRE A DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTION ASSEMBLY WITH BYPASS RPZ (REDUCED PRINCIPLE ZONE) BACKFLOW PREVENTION ASSEMBLY AND SENSUS SR 11 OR EQUAL APPROVED BY LPSCO. A VALVE SHALL BE PLACED AT THE TEE BETWEEN THE WATER MAIN AND BACKFLOW PREVENTION ASSEMBLY.

LITCHFIELD PARK SERVICE COMPANY VALVES AND VALVE BOX NOTES:

1 ALL VALVES SHALL BE RESILIENT-SEAT NON-RISING STEM GATE VALVES AND SHALL OPEN TO THE LEFT. APPROVED MANUFACTURERS SHALL INCLUDE CLOW AND MUELLER.
2 VALVE EXTENSIONS SHALL BE INSTALLED SO THAT THE MAXIMUM DEPTH TO OPERATING NUT IS 16 INCHES FROM FINAL GRADE.
3 ALL VALVE BOXES SHALL BE CONCRETE AND INSTALLED PER M.A.G. STANDARD DETAIL 391-1 TYPE "A" (PVC OR OTHER MATERIAL IS NOT ACCEPTABLE).
4 ALL VALVES SHALL CONFORM TO M.A.G. SPECIFICATIONS 610.6 AND 630.
5 THREE VALVES SHALL BE PRESENT ON ANY CROSS, AND TWO VALVES ON ANY TEE CONNECTIONS. VALVES SHALL BE FLANGED BY MECHANICAL JOINT AND BE LOCATED FREE OF THE CURB, GUTTER, VALLEY GUTTER OR APRON.

LITCHFIELD PARK SERVICE COMPANY WATER MAINS NOTES:

1 WATER PIPELINES SHALL BE CONSTUCTED OF DUCTILE IRON PIPE CLASS 350.
2 WATER LINE EXCAVATION, BACKFILL AND COMPACTION WILL CONFORM TO M.A.G. STANDARD 601 AND ANY SUBSEQUENT M.A.G. SPECIFICATIONS AND DETAILS. BACKFILL AND BEDDING MATERIAL SHALL CONSIST OF IMPORTED AGGREGATE BASE COURSE (ABC) AT A MINIMUM OF 4" BENEATH AND 12" ABOVE ALL WATER MAINS. PIPE LINE BEDDING SHALL CONFORM TO M.A.G. SPECIFICATION 601.4 MODIFIED TO MECHANICAL COMPACTION ONLY. WATER SETTLING OF PIPELINES MAY BE ALLOWED WITH PRIOR APPROVAL BY LPSCO. ANY WATER REQUIRED FOR BACKFILL OPERATIONS WILL BE METERED THROUGH A LPSCO PROVIDED FIRE HYDRANT METER.
3 PIPELINE BLOW-OFFS AND SAMPLING TAPS SHALL BE REQUIRED FOR EACH 1500 LINEAL FEET OF PIPE PLACED. BLOWOFFS SHALL HAVE A 2" BRASS BALL VALVE AND A 2" COPPER RISER TO A POINT 3 FEET ABOVE GRADE. UPON COMPLETION OF WATER SAMPLING ACTIVITIES, THE RISER WILL BE SHORTENED SO AS TO FIT INTO A CONCRETE WATER METER BOX.
4 "MEGALUG" OR OTHER APPROVED MECHANICAL JOINT RESTRAINT SYSTEM SHALL BE INSTALLED ON EVERY DIP SECTION. JOINT RESTRAINT LENGTHS WILL FOLLOW M.A.G. STANDARD DETAILS 303-1 AD 303-2.
5 THRUST BLOCKS SHALL BE INSTALLED PER M.A.G. STANDARD DETAILS 301, 380 AND 381.
6 TRANSMISSION MAINS 24 INCHES AND LARGER WILL BE CONSTRUCTED OF DUCTILE IRON PIPE OR STEEL CYLINDER PIPE AS AN OPTION WITH LITCHFIELD PARK SERVICE COMPANY APPROVAL.
7 IN ACCORDANCE EITH AAC R18-4-119, ALL MATERIALS, WHICH COME INTO CONTACT WITH DRINKING WATER, SHALL CONFORM TO NATIONAL SANITATION FOUNDATION STANDARDS 60 AND 61.

LITCHFIELD PARK SERVICE COMPANY SEWER MAINS NOTES:

1 SEWER PIPELINES SHALL BE CONSTRUCTED OF PROTECTO 401 CERAMIC EPOXY LINED DUCTILE IRON PIPE OR PRODUCT APPROVED BY LPSCO AND OR LPSCO APPROVED PVC MATERIAL, SDR 35 PVC SEWER PIPE.
2 SEWER LINE EXCAVATION, BACKFILL AND COMPACTION WILL CONFORM TO M.A.G. STANDARD 601 AND 615 AND ANY SUBSEQUENT M.A.G. SPECIFICATIONS AND DETAILS. LPSCO RESERVES THE RIGHT TO REQUIRE THE DESIGN ENGINEER TO PROVIDE TRENCH LOADING AND BACKFILL CALCULATIONS FOR THE TYPE OF PIPE DESIGNED. BACKFILL AND BEDDING MATERIAL SHALL CONSIST OF IMPORTED AGGREGATE BASE COURSE (ABC) AT A MINIMUM OF 4" BENEATH AND 12" ABOVE ALL SEWER LINES AND SERVICES. PIPELINE BEDDING SHALL CONFORM TO M.A.G. SPECIFICATION 601.4 MODIFIED TO MECHANICAL COMPACTION ONLY. WATER SETTLING OF PIPELINES MAY BE ALLOWED WITH PRIOR APPROVAL BY LPSCO. ANY WATER REQUIRED FOR BACKFILL OPERATIONS WILL BE METERED THROUGH A LPSCO PROVIDED FIRE HYDRANT METER.
3 PRIOR TO BEGINNING ANY PIPE INSTALLATION, CONTRACTOR SHALL FURNISH AND PLACE A WATERTIGHT PLUG IN THE EXISTING SEWER MAINS AT ALL POINTS OF CONNECTION TO THE EXISTING SEWER SYSTEM. THE PLUGS SHALL REMAIN IN PLACE THROUGHOUT THE PROJECT UNTIL THE PROJECT IS GIVEN OPERATIONAL APPROVAL. UNDER NO CIRCUMSTANCES SHALL THE DEVELOPER/CONTRACTOR ALLOW FLOW FROM THE NEW SEWER MAIN TO FLOW INTO THE EXISTING SEWER SYSTEM UNTIL AUTHORIZED BY LPSCO.
4 NO SEWER LINE WILL BE ACCEPTED OR PLACED INTO SERVICE UNTIL IT HAS PASSED ALL TESTING AND INSPECTIONS AS REQUIRED BY LPSCO AND OTHER GOVERNMENT AGENCIES. ONLY AT THIS TIME WILL SEWER SERVICE BE PROVIDED.
5 ALL INSTALLED SEWER MAINS WILL BE VIDEOTAPED AND A DVD SUBMITTED TO LPSCO FOR INSPECTION. ANY PORTION OF THE PIPELINE INSTALLATION DEEMED UNACCEPTABLE BY LPSCO SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE. THE MAXIMUM ALLOWABLE SEWER SAG IS 0.5-INCHES. THE FINAL DVD AND INSPECTION REPORT SHALL BE SUBMITTED TO LPSCO AS PART OF THE PERMANENT RECORD. THE COSTS FOR THE VIDEO TAPING AND VIDEO INSPECTION SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

LITCHFIELD PARK SERVICE COMPANY SEWER MANHOLE AND CLEANOUTS NOTES:

1 ALL SEWER MANHOLES WILL BE 5-FOOT IN DIAMETER WITH 30" RING AND COVER. NO STEPS IN ANY MANHOLES.
2 ALL MANHOLE CONSTRUCTION SHALL CONFORM TO M.A.G. SPECIFICATIONS AND DETAILS AND ANY SUPPLEMENTAL SPECIFICATIONS AND DETAILS PROVIDED BY LITCHFIELD PARK SERVICE COMPANY.
3 WATERTIGHT MANHOLE COVERS ARE REQUIRED WHEN THE EDGE OF THE MANHOLE COVERS ARE CONSTRUCTED WITHIN 2-FEET OF THE EDGE OF GUTTER, IN AREAS THAT ARE UNPAVED AND AREAS PRONE TO FLOODING. MANHOLE SHOULD BE SET 2-TENTHS ABOVE FINISH GRADE IN ALL UNPAVED AREAS.
4 ALL MANHOLE LIDS AND RINGS SHALL BE CAST IRON AND SHALL BE IMPRINTED "LPSCO SANITARY SEWER".
5 DROP MANHOLES SHALL CONFORM TO M.A.G. DETAIL 426.
6 SEWER CLEAN-OUTS MAY BE INSTALL AT THE END OF LINES THAT DO NOT EXCEED 200 FEET FROM THE NEAREST MANHOLE. SEWER CLEAN-OUTS SHALL CONFORM TO M.A.G. SPECIFICATIONS 615.7 AND M.A.G. DETAIL 441.
7 SEWER CLEAN-OUTS SHALL BE FITTED WITH IRON ACCESS COVERS AND SHALL BE ENCASED IN CONCRETE.
8 ALL MANHOLES ARE TO BE TREATED WITH A ROACH PESTICIDE PAINT TYPE APPLICATION. PESTICIDE SHALL BE EFFECTIVE FOR A MINIMUM OF TWO (2) YEARS.
9 AFTER ALL PAVING ADJUSTMENTS HAVE BEEN MADE; ALL SEWER LINES WILL BE HYDROVAC AND CERTIFIED TO BE CLEAN AND CLEAR OF ANY OBSTRUCTIONS. A COPY OF THE CERTIFICATION IS REQUIRED PRIOR TO ANY ACCEPTANCE.
10 ALL MANHOLES WILL BE WATER TIGHTNESS TESTED AS PER A.A.C. R18-9-E301.
11 ALL SEWER MANHOLE ADJUSTMENTS WILL NOT EXCEED 24" FROM TOP OF THE CORBEL TO FINISH GRADE.

LITCHFIELD PARK SERVICE COMPANY SEWER SERVICE TAP NOTES:

1 EVERY RESIDENTIAL UNIT MUST HAVE ITS OWN SEPARATE SEWER SERVICE CONNECTION.
2 ALL SEWER CONNECTIONS SHALL CONFORM TO M.A.G. SPECIFICATION 615.6 AND M.A.G. DETAIL 440-2.
3 ALL TAPS SHALL BE WYE TYPE AND SHALL BE AT LEAST 4.5 FEET DEEP AT THE PROPERTY LINE.
4 AN ELDER VALVE SHALL BE INSTALLED ON EACH SEWER SERVICE LINE (FOR PROJECTS LPSCO ONLY OWNS/OPERATES THE SEWER FACILITIES).

36664 PERCY MYRON JR. — EXPIRES 9-30-10

HESS - ROUNTREE, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044 (480)496-0244

DES. PM	DRN. TMH	CKD. PM	JOB NO. 0706-14

LEGEND

TC×25.51	EXISTING TOP OF CURB ELEVATION
TRC×23.58	EXISTING TOP OF ROLL CURB ELEVATION
G×24.08	EXISTING GUTTER ELEVATION
C×24.98	EXISTING CONCRETE ELEVATION
SW×24.25	EXISTING SIDEWALK ELEVATION
PL×27.12	EXISTING PLANTER ELEVATION
LC×25.56	EXISTING LANDSCAPE CURB ELEVATION
F.F.×24.37	EXISTING FINISH FLOOR ELEVATION
NG×26.7	EXISTING GROUND ELEVATION
TB×26.9	EXISTING TOP OF BERM ELEVATION
TS×22.5	EXISTING TOE OF SLOPE ELEVATION
WV	EXISTING WATER VALVE
ICV	EXISTING IRRIGATION CONTROL VALVE
4" WR	EXISTING WATER RISER W/ SIZE
2" BFP	EXISTING BACKFLOW PREVENTER
2" R	EXISTING RISER W/ SIZE
2" P	EXISTING POST W/ SIZE
	EXISTING STREET SIGN
	EXISTING IRRIGATION STAND PIPE
2" ER	EXISTING ELECTRIC RISER
LP	EXISTING LIGHT POLE W/ CONCRETE STAND
	EXISTING STREET LIGHT
	EXISTING ELECTRIC TRANSFORMER
	EXISTING TRANSFORMER PAD
EB	EXISTING ELECTRIC BOX
GM	EXISTING GAS METER
WMB	EXISTING WATER METER BOX
DF	EXISTING DRINKING FOUNTAIN
FH	EXISTING FIRE HYDRANT
PV	EXISTING PASTURE VALVE W/ CONCRETE COLLAR
SSCO	EXISTING SANITARY SEWER CLEANOUT
BC	EXISTING BRASS CAP
BBG	EXISTING BASKETBALL GOAL
6'	EXISTING BUSH W/ DIAMETER
—//—	EXISTING WROUGHT IRON FENCE
—x—	EXISTING CHAIN LINK FENCE
EX. 1.5' AREA DRAIN RIM=24.89	EXISTING AREA DRAIN W/ CONCRETE COLLAR, SIZE AND RIM ELEVATION
EX. SSMH RIM=25.47	EXISTING SANITARY SEWER MANHOLE W/ RIM ELEVATION
1.5'ø X 15' TREE	EXISTING TREE W/TRUNK DIAMETER, HEIGHT AND TYPE

AS-BUILT

CALL TWO WORKING DAYS BEFORE YOU DIG
602-263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

NOTES AND LEGEND

LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79

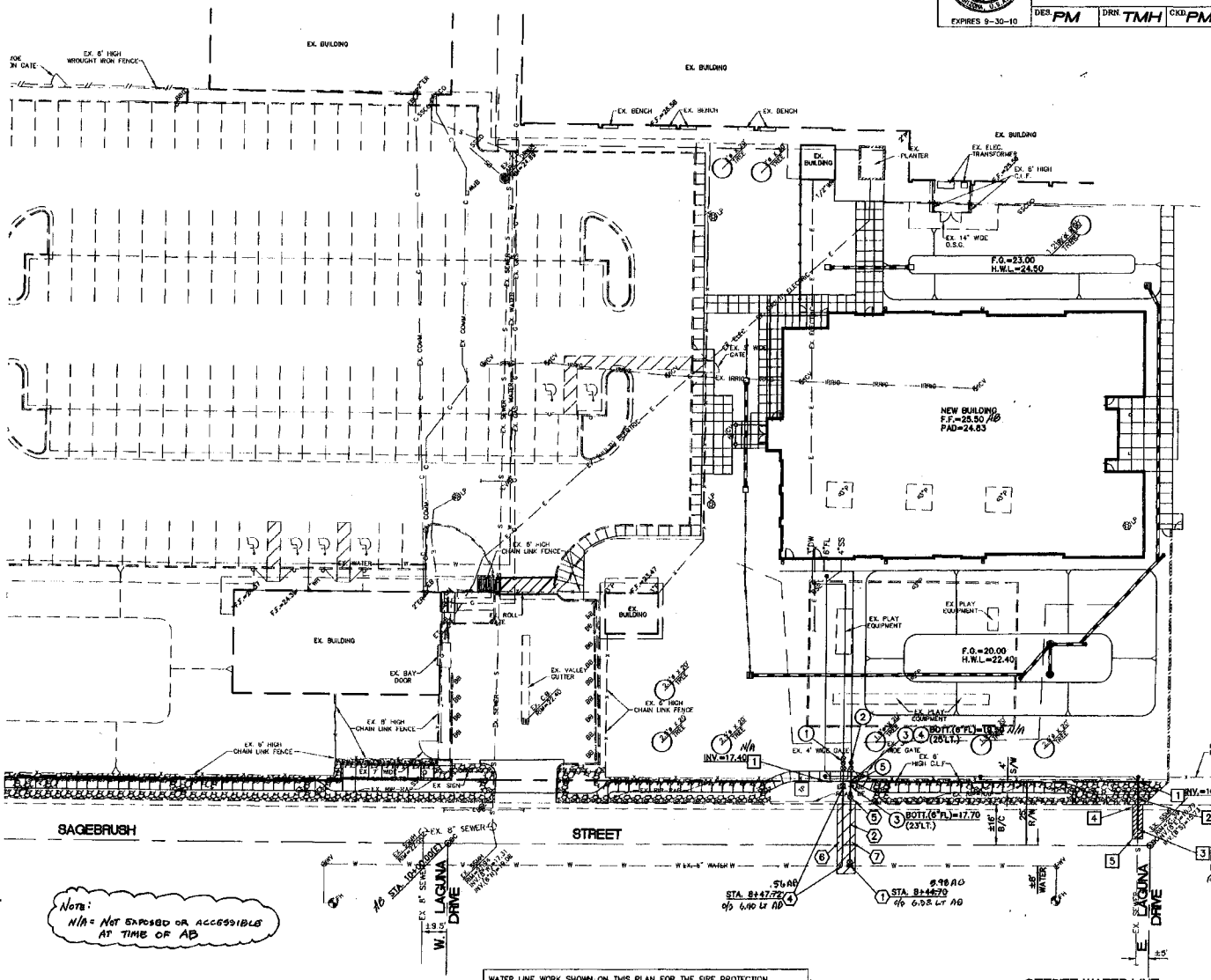
DISTRICT OFFICE/ TEMPORARY CLASSROOMS

SCALE	SHEET	OF	08-02-07
HORIZONTAL: NONE			
VERTICAL: NONE	2	3	C-7
REV. DATE			

HESS - ROUNTREE, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
9831 SOUTH 51ST STREET, SUITE C110
PHOENIX, ARIZONA 85044 (480)496-0244

36084 PERCY MYRON JR
EXPIRES 9-30-10

DES.	DRN.	CKD.	JOB NO.
PM	TMH	PM	0706-14



SCALE: 1"=20'

OFFSITE PRIVATE SEWER LINE CONSTRUCTION NOTES:

1. CONNECT TO PRIVATE ONSITE SEWER LINE WITH NECESSARY AND APPROPRIATE FITTINGS. IF PRIVATE SEWER HAS NOT BEEN INSTALLED, INSTALL PLUG PER MAG DETAIL 427.
2. INSTALL 6" P.V.C. SEWER SERVICE LINE (ASTM D3034, SDR35).
3. CONNECT NEW 6" SEWER LINE TO EXISTING MANHOLE. REFORM MANHOLE BOTTOM. INSTALL WATERTIGHT MORTAR ON BOTH INSIDE AND OUTSIDE OF MANHOLE AT PIPE PENETRATION. FIELD VERIFY ELEVATION OF EXISTING SEWER MANHOLE INVERTS PRIOR TO CONSTRUCTION.
4. SAWCUT REMOVE AND REPLACE EXISTING CONCRETE ROLL CURB AND GUTTER (MAG STANDARD DETAIL NO. 220-1, TYPE C). BACKFILL WITH 1/2 SACK CLSM.
5. SAWCUT AND REMOVE AND REPLACE EXISTING ASPHALTIC CONCRETE PAVEMENT (MAG STANDARD DETAIL NO. 200, T-TOP). BACKFILL WITH 1/2 SACK CLSM.

OFFSITE PUBLIC WATER LINE CONSTRUCTION NOTES:

1. INSTALL 6" X 6" TAPPING SLEEVE WITH 6" WATER GATE VALVE WITH VALVE BOX AND COVER (MAG STANDARD DETAIL NO.'S 340 AND 391-1, TYPE 'A').
2. INSTALL 6" DUCTILE IRON PIPE (PRESSURE CLASS 350).
3. NOT USED
4. INSTALL 2" TYPE K COPPER DOMESTIC WATER SERVICE, INSTALL SHUT OFF VALVE ON CUSTOMER SIDE OF SERVICE.
5. INSTALL 6" WATER GATE VALVE WITH VALVE BOX AND COVER (MAG STANDARD DETAIL NO. 391-1, TYPE "A").
6. SAWCUT REMOVE AND REPLACE EXISTING CONCRETE ROLL CURB AND GUTTER (MAG STANDARD DETAIL NO. 220-1, TYPE C). BACKFILL WITH 1/2 SACK CLSM.
7. SAWCUT AND REMOVE AND REPLACE EXISTING ASPHALTIC CONCRETE PAVEMENT (MAG STANDARD DETAIL NO. 200, T-TOP). BACKFILL WITH 1/2 SACK CLSM.

ONSITE PRIVATE WATER LINE CONSTRUCTION NOTES:

1. INSTALL 2" RPZ (REDUCED PRESSURE ZONE) BACKFLOW PREVENTION DEVICE PER LITCHFIELD PARK SERVICE COMPANY REQUIREMENTS. SEE PRIVATE DOMESTIC WATER, PRIVATE SANITARY SEWER AND PRIVATE FIRE LINE PLAN C-5 FOR ADDITIONAL INFORMATION.
2. INSTALL 6" DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTION ASSEMBLY PER CITY OF GOODYEAR STANDARD DETAIL G-3352 WITH BYPASS RPZ (REDUCED PRESSURE ZONE) BACKFLOW PREVENTION ASSEMBLY AND SENSUS SR11 WATER METER, OR APPROVED EQUAL. SEE PRIVATE DOMESTIC WATER, PRIVATE SANITARY SEWER AND PRIVATE FIRE LINE PLAN C-5 FOR ADDITIONAL INFORMATION.
3. VERTICALLY REALIGN WATER LINE TO ELEVATIONS SHOWN ON PLAN WITH MEGA LUG JOINT RESTRAINTS PER MAG STANDARD DETAIL NO. 303-2.
4. SEE SHEET C-5 FOR CONTINUATION OF ONSITE PRIVATE FIRE LINE CONSTRUCTION.
5. INSTALL 6" DUCTILE IRON PIPE (PRESSURE CLASS 350).

NOTE: N/A = NOT EXPOSED OR ACCESSIBLE AT TIME OF AB

WATER LINE WORK SHOWN ON THIS PLAN FOR THE FIRE PROTECTION SYSTEM WATER SUPPLY, LOCATED AFTER (NORTH OF) THE NEW 6" GATE VALVE TO BE INSTALLED NORTH OF THE EXISTING ROLL CURB, IS CONSIDERED PRIVATE, EVEN THOUGH IT IS LOCATED WITHIN THE RIGHT OF WAY. THE SCHOOL DISTRICT WILL OWN AND MAINTAIN THE WATER LINE NORTH OF THE WATER VALVE UP TO THE NEW ONSITE BUILDING. LITCHFIELD PARK SERVICE COMPANY (LPSCO) WILL OWN AND MAINTAIN THE WATER LINE FROM THE WATER MAIN IN THE STREET UP TO AND INCLUDING THE WATER VALVE.

AS-BUILT

REVISED 5/2/08 PER CITY COMMENTS
REVISED 3/26/08 PER LPSCO COMMENTS
REVISED 3/20/08 PER LPSCO COMMENTS

CALL FOR UTILITY LOCATIONS
602-263-1100
1-800-STAKE-IT

OFFSITE WATER LINE AND SEWER LINE PLAN

LITCHFIELD ELEMENTARY SCHOOL DISTRICT NO. 79

DISTRICT OFFICE/ TEMPORARY CLASSROOMS

SCALE	SHEET	OF	08-02-07
HORIZONTAL: 1"=20'			
VERTICAL: NONE	3	3	C-8
REV. DATE:			

C:\706\14DRG2.DWG

GOODYEAR FARMS INC.

LITCHFIELD PARK, ARIZONA

WATER SYSTEM EXPANSION
AND
IMPROVEMENTS
1982

APPROVAL: _____ 3/15/82
SANITARY ENGINEER DATE
MARICOPA COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL HEALTH

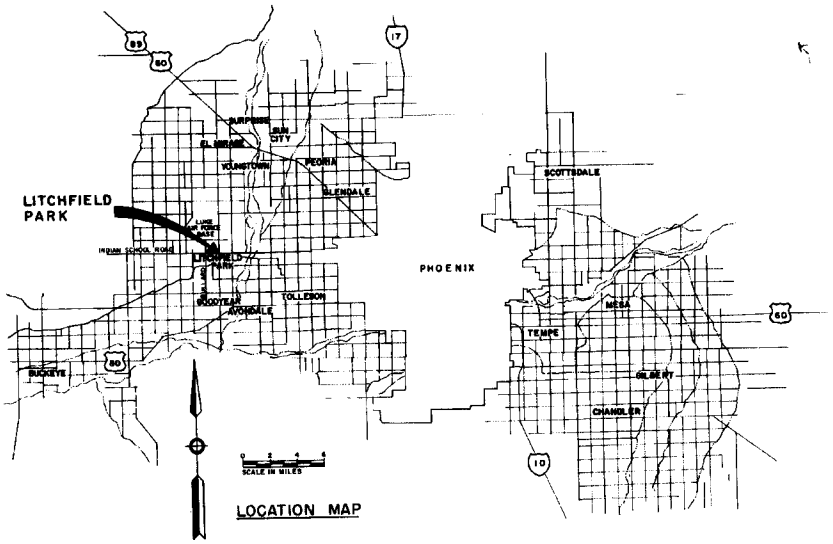
JOHN CAROLLO ENGINEERS
PHOENIX - WALNUT CREEK - FOUNTAIN VALLEY

CONFORMS TO RECORD DOCUMENTS
DATE: October 11, 1982

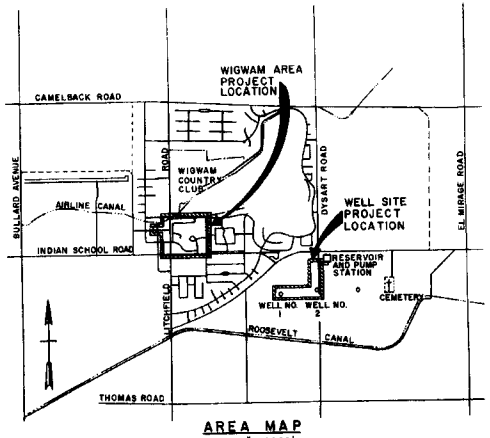
THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date October 11, 1982
By _____

Drawing No. G-1, Sheet 1 of 12

14,208 B-P2522 A1



LOCATION MAP



AREA MAP
SCALE: 1" = 2000'

DRAWING INDEX

SHEET NO.	DRAWING NO.	TITLE
1	G-1	COVER SHEET
2	G-2	LOCATION MAP, AREA MAP, DRAWING INDEX
3	M-1	EXISTING WELL SITE CONDITIONS AND DEMOLITION REQUIREMENTS
4	M-2	TANK WELLS NO. 1 AND NO. 2 PIPING MODIFICATIONS
5	M-3	WELL PIPING SECTIONS AND DETAILS
6	M-4	PLAN & PROFILE, WELLS TO RESERVOIR PIPELINE, STA. 0+76 TO 12+00
7	M-5	PLAN & PROFILE, WELLS TO RESERVOIR PIPELINE, STA. 12+00 TO 21+32
8	FP-1	PLAN & PROFILE, FAIRWAY DR., STA. 0+12 TO 12+60
9	FP-2	PLAN & PROFILE, MOULIN AVE. & WIGWAM AREA, STA. 12+60 TO 25+40
10	FP-3	PLAN & PROFILE, WIGWAM AREA & LITCHFIELD RD., STA. 25+40 TO 38+27.95
11	FP-4	PLAN & PROFILE, COTTONWOOD ST., STA. 0-12 TO 4+66
12	E-1	ELECTRICAL PLANS & DETAILS

UTILITIES LOCATION THE CONTRACTOR, 48 HOURS PRIOR TO PERFORMING UNDERGROUND EXCAVATION, SHALL TELEPHONE BLUE STAKE CENTER AT 263-1100 TO OBTAIN FIELD UNDERGROUND UTILITIES LOCATION MARKING. THE CONTRACTOR SHALL UNCOVER AHEAD OF CONSTRUCTION, ALL LINES BEING TIED INTO AND ALL INTERSECTING UTILITIES SHOWN ON THE PLANS OR MARKED BY BLUE STAKE TO VERIFY THEIR LOCATION AND DEPTH. UTILITY SERVICES SHALL BE LOCATED AND PROTECTED BY THE CONTRACTOR. ALL PRECAUTIONS SHALL BE USED WHILE WORKING NEAR ABOVE AND BELOW-GROUND UTILITIES, TO AVOID INJURY OR DEATH TO PERSONNEL, PROPERTY DAMAGE AND/OR INTERRUPTION OF SERVICE. (SEE OSHA STD. 1926-651 (a)). INDICATED UTILITY LOCATIONS WERE OBTAINED FROM SYSTEM AND RECORD DRAWINGS.

CONFORMS TO RECORD DOCUMENTS
DATE: 10/11/88

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date 10/11/88
By

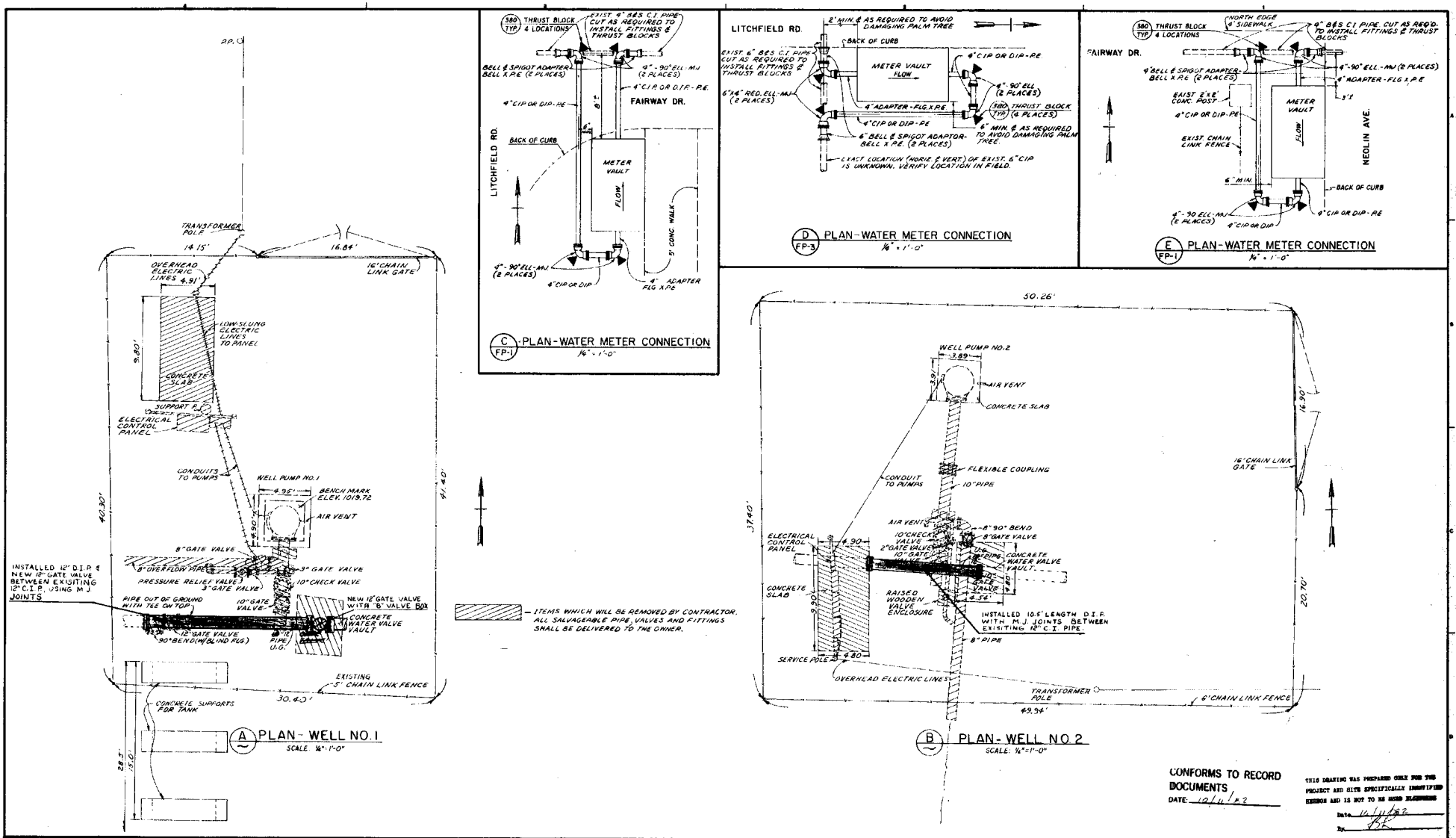
JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA | WALNUT CREEK CALIFORNIA | FOUNTAIN VALLEY CALIFORNIA | VISALIA CALIFORNIA
JOHN A. CAROLLO, P.E. (1909-1971)
H. HARVEY HUNT, P.E.
RICHARD M. WAIT, P.E.
DONALD H. MEINBLER, P.E.
EARL P. LYNCH, P.E.
WALTER E. HOWARD, P.E.
A. DAVID SHIPPEN, P.E.
G. WILLIAM KNOPF, P.E.

GOODYEAR FARMS
LOCATION MAP, AREA MAP AND DRAWING INDEX

DRAWING NO. G-2
SHEET NO. 2 OF 12
DATE

14.207 B-P2522 A1

ABCDEFGHJKLMNPQRSUVWXYZ



CONFORMS TO RECORD DOCUMENTS
DATE: 10/14/82

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE

Date 10/14/82
By

JOHN CAROLLO ENGINEERS

PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · FOUNTAIN VALLEY CALIFORNIA · VISALIA CALIFORNIA

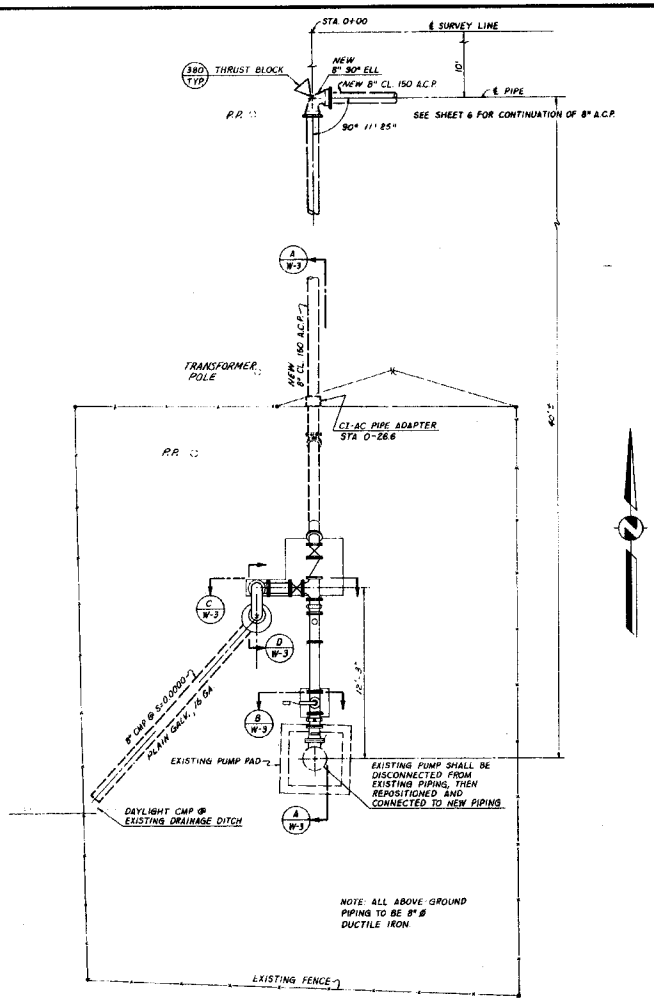
JOHN A. CAROLLO, P.E. (1908-1971)
H. HARVEY HUNT, P.E.
HOWARD M. WAY, P.E.
DONALD R. PHEMISTER, P.E.
GAIL P. LYNCH, P.E.
WALTER R. HOWARD, P.E.
J. DAVID GRIFFITH, P.E.
O. WILLIAM KNOPP, P.E.

GOODYEAR FARMS

EXISTING WELL SITE CONDITIONS AND DEMOLITION REQUIREMENTS

DRAWING NO. W-1
SHEET NO. 3 OF 12
DATE

14,206 B - P2522 A1



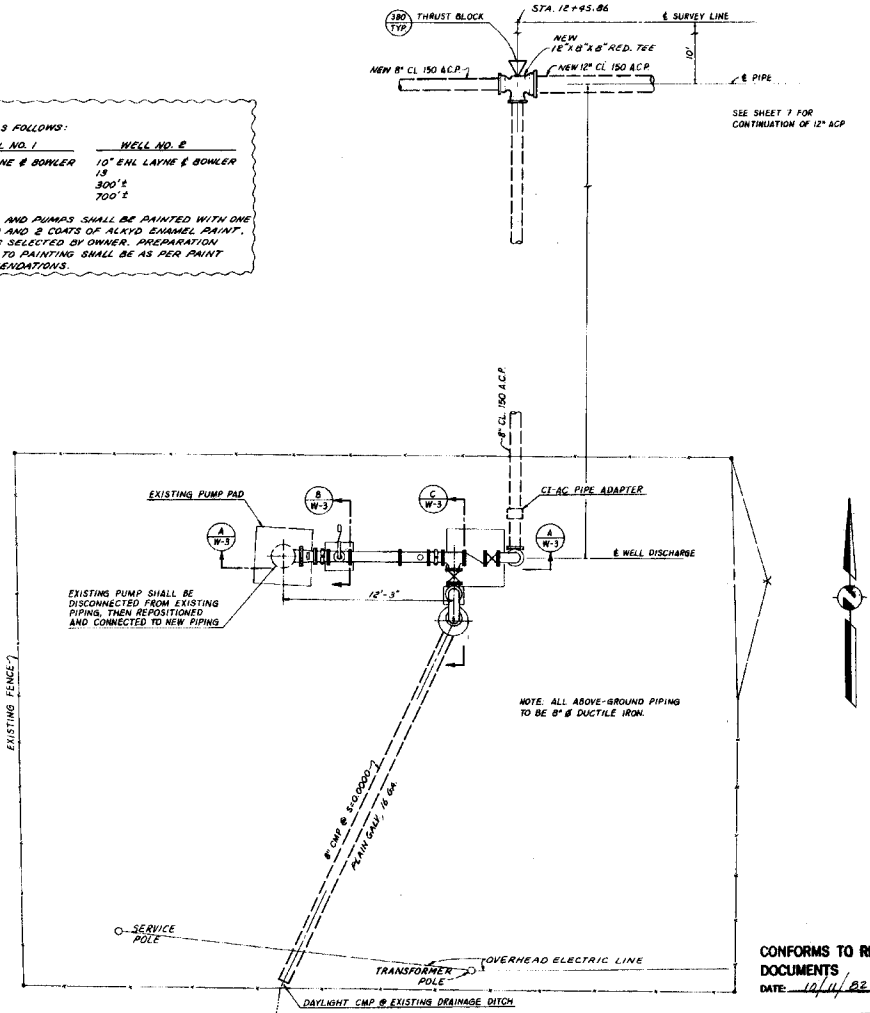
A PLAN WELL NO. 1
SCALE: 1/4" = 1'-0"

NOTES:

1. EXISTING WELL PUMPS ARE AS FOLLOWS:

	WELL NO. 1	WELL NO. 2
PUMP	10" RL LAYNE & BOWLER	10" ENL LAYNE & BOWLER
STAGES	12	13
BOWL SETTING	390'±	300'±
WELL DEPTH	402'±	700'±

2. ALL EXPOSED METAL PIPING AND PUMPS SHALL BE PAINTED WITH ONE COAT OF RED OXIDE PRIMER AND 2 COATS OF ALKYD ENAMEL PAINT. COLOR OF PAINT SHALL BE AS SELECTED BY OWNER. PREPARATION OF METAL SURFACES PRIOR TO PAINTING SHALL BE AS PER PAINT MANUFACTURER'S RECOMMENDATIONS.



B PLAN WELL NO. 2
SCALE: 1/4" = 1'-0"

CONFORMS TO RECORD DOCUMENTS
DATE: 12/11/82

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date 12/11/82
By

REV.	DATE	BY	DESCRIPTION
1	9/7/82	FRD	ADDED NOTES PER ADDENDUM NO. 2

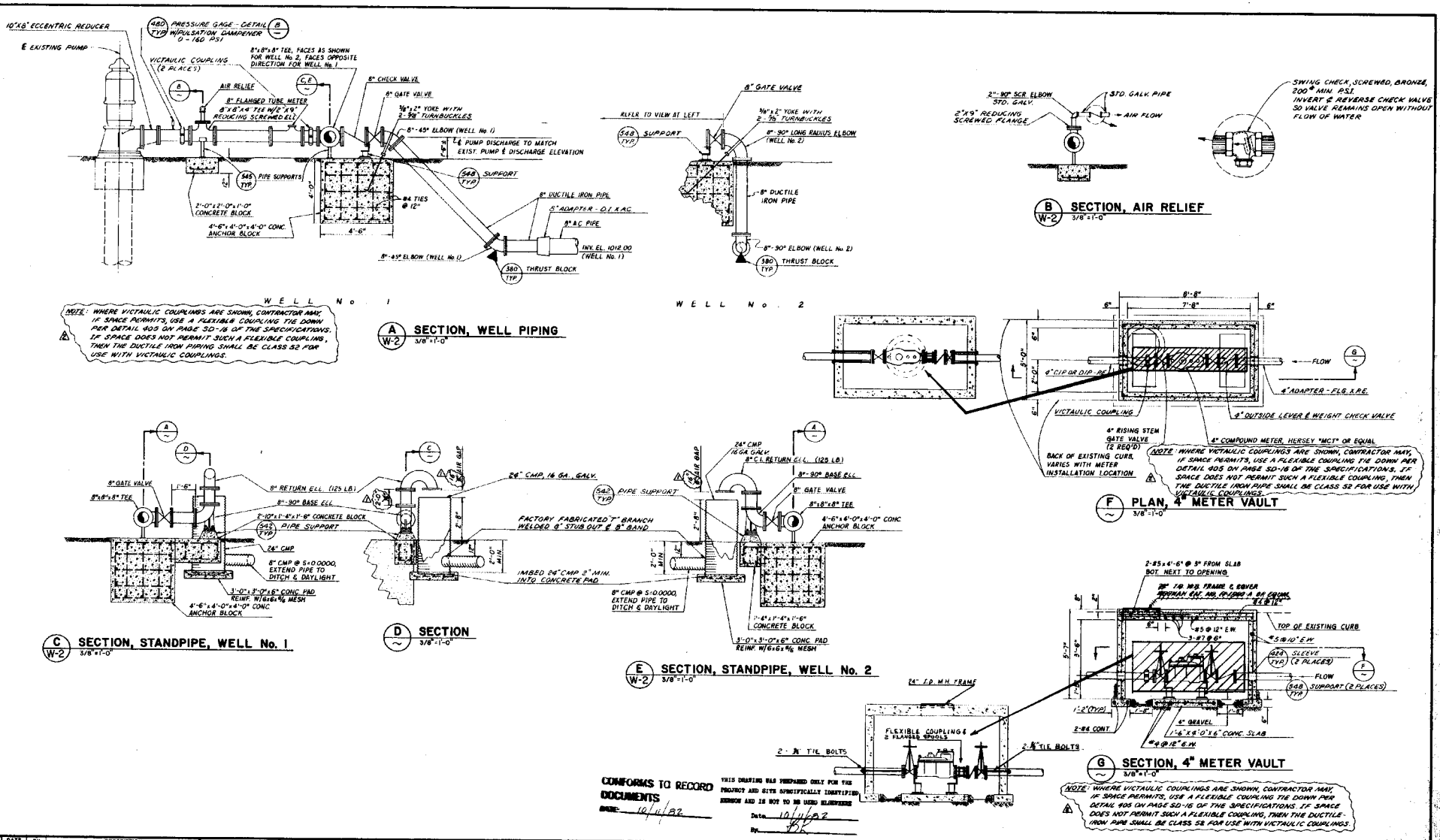
DESIGNED JNA
DRAWN CMD-SLB-FRD
CHECKED AED

JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · FOUNTAIN VALLEY CALIFORNIA · VISALIA CALIFORNIA
JOHN A. CAROLLO, P.E. (1906-1971)
H. HARVEY HUNT, P.E.
HOWARD M. WAY, P.E.
DONALD R. PREIBLER, P.E.
GAIL P. LYNCH, P.E.
WALTER R. HOWARD, P.E.
J. DAVID GRIFFITH, P.E.
G. WILLIAM KNOPF, P.E.

GOODYEAR FARMS
TOWN WELLS NO. 1 AND NO. 2
PIPING MODIFICATIONS

DRAWING NO. W-2
SHEET NO. 4 OF 12
DATE

14,205 B - P2522 A1



CONFORMS TO RECORD DOCUMENTS
DATE: 10/4/82

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date 10/4/82
By

REV.	DATE	BY	DESCRIPTION
1	9/24/82	FRD	REVISED PER ADDENDUM NO. 1
2	9/29/82	FRD	REVISED PER ADDENDUM NO. 2

DESIGNED JNA, FRD
DRAWN SLB, FRD
CHECKED AED

JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · FOUNTAIN VALLEY CALIFORNIA · VISALIA CALIFORNIA
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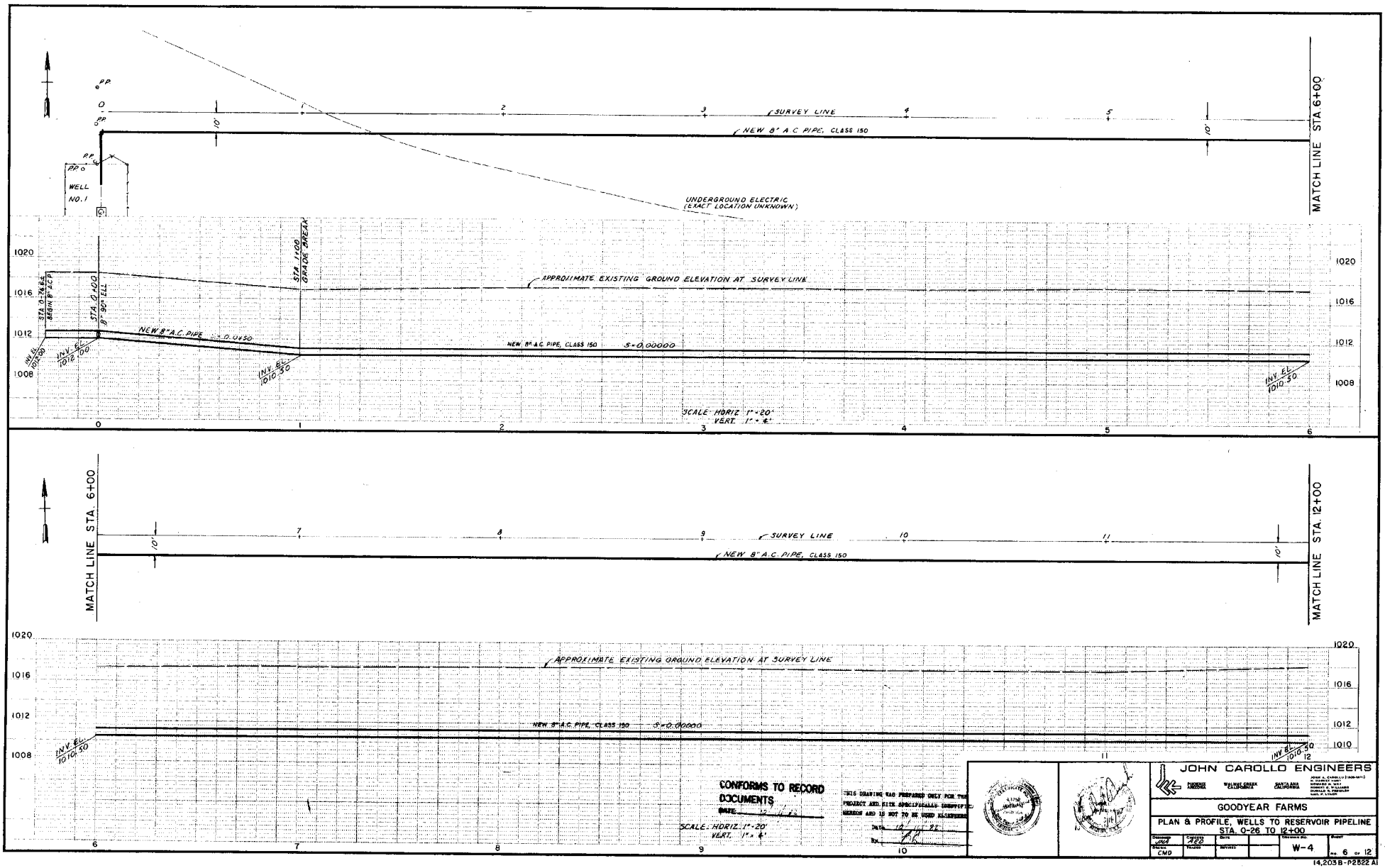
WALTER R. HOWARD, P.E.
J. DAVID GRIFFITH, P.E.
G. WILLIAM KNOPF, P.E.

GOODYEAR FARMS
WELL PIPING SECTIONS & DETAILS

DRAWING NO. W-3
SHEET NO. 5 OF 12
DATE

14,204 B-P2623 R1



CONFORMS TO RECORD DOCUMENTS

DATE: 12/[illegible]/82

SCALE: HORIZ. 1"=20'
VERT. 1"=4'

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE.

Date 12/[illegible]/82

By [illegible]

JOHN CAROLLO ENGINEERS

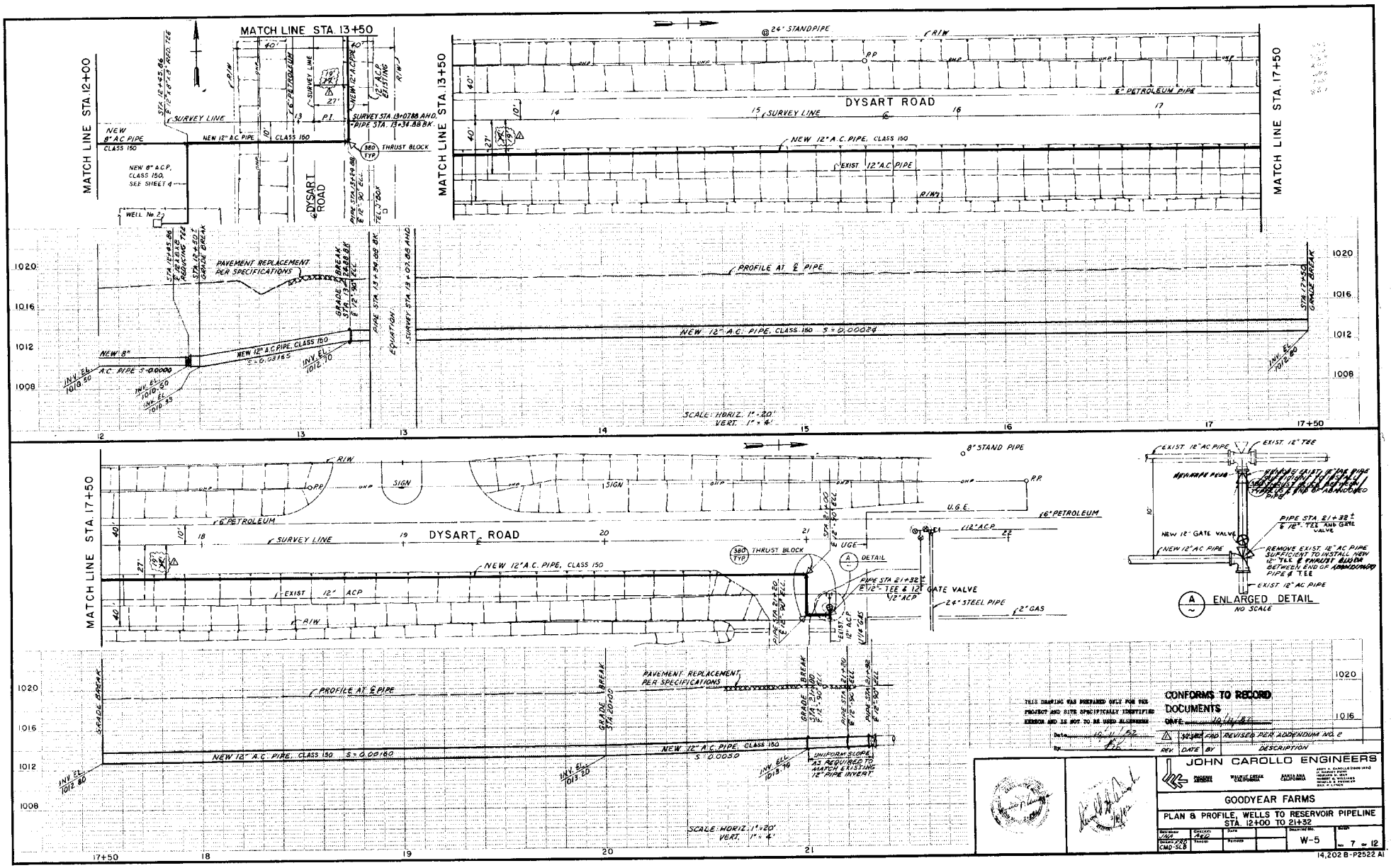
PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · SANTA ANA CALIFORNIA

GOODYEAR FARMS

PLAN & PROFILE, WELLS TO RESERVOIR PIPELINE
STA. 0+26 TO 12+00

Drawn	Checked	Date	Revision No.	Sheet
JMA	RED		W-4	no. 6 of 12
Traced CMD	Revised			

14,203B-P2522 A1



THIS DRAWING WAS PREPARED ONLY FOR USE ON PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE

Date 10-11-82 By P.C.

CONFORMS TO RECORD DOCUMENTS
DATE 10/11/82

REV	DATE	BY	DESCRIPTION
△	10-7-82	FRD	REVISED PER ADDENDUM NO. 2

JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · SANTA ANA CALIFORNIA

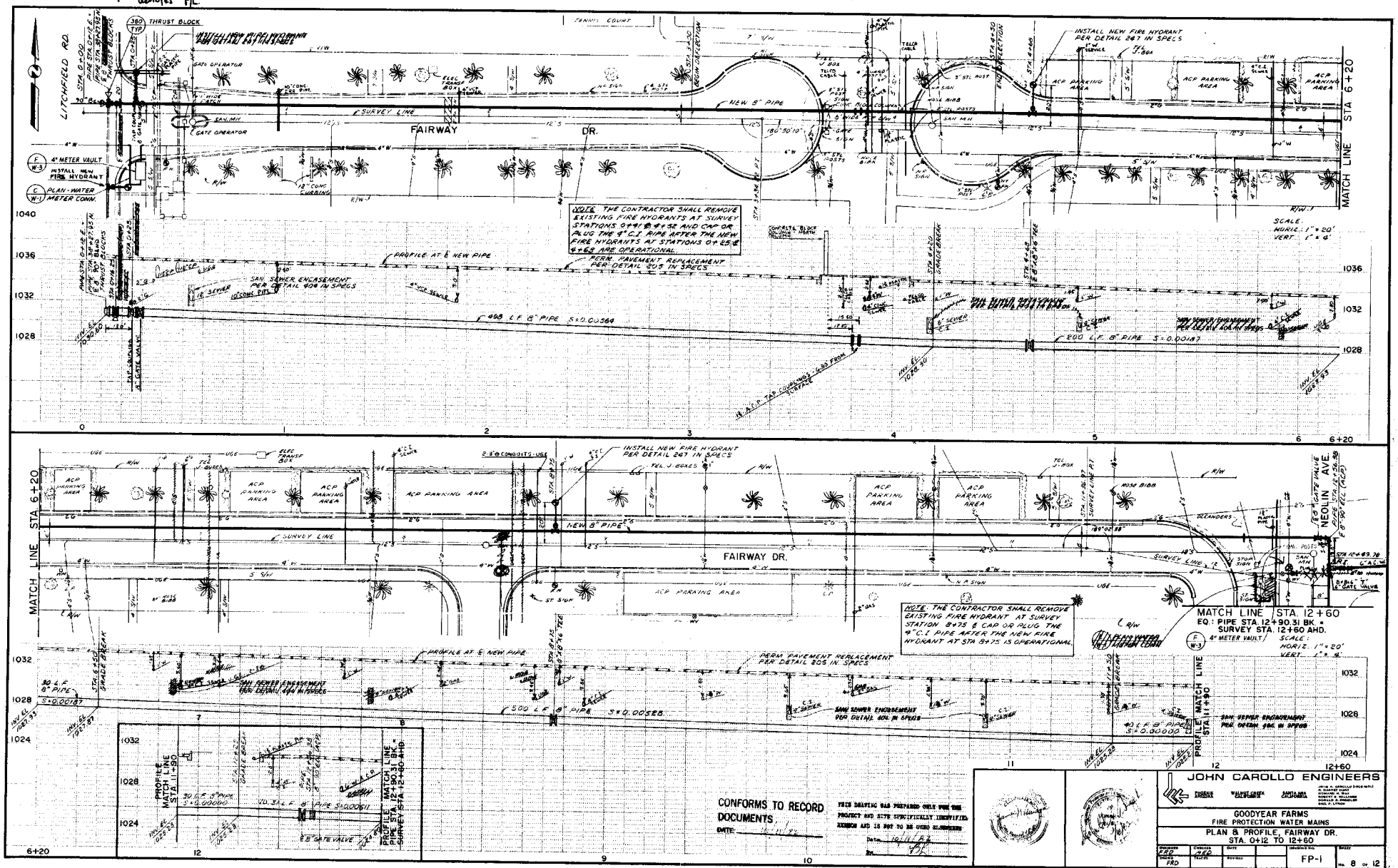
GOODYEAR FARMS

PLAN & PROFILE, WELLS TO RESERVOIR PIPELINE STA. 12+00 TO 21+32

DESIGNED	CHECKED	DATE	DRAWING NO.
VMA	PJC		W-5
DRAWN BY	TRACED	REVISED	SHEET NO.
CMD-SLB			7 OF 12

14,202 B-P2522 A1

1 - denotes P/L



CONFORMS TO RECORD DOCUMENTS,
DATE: 10-11-72

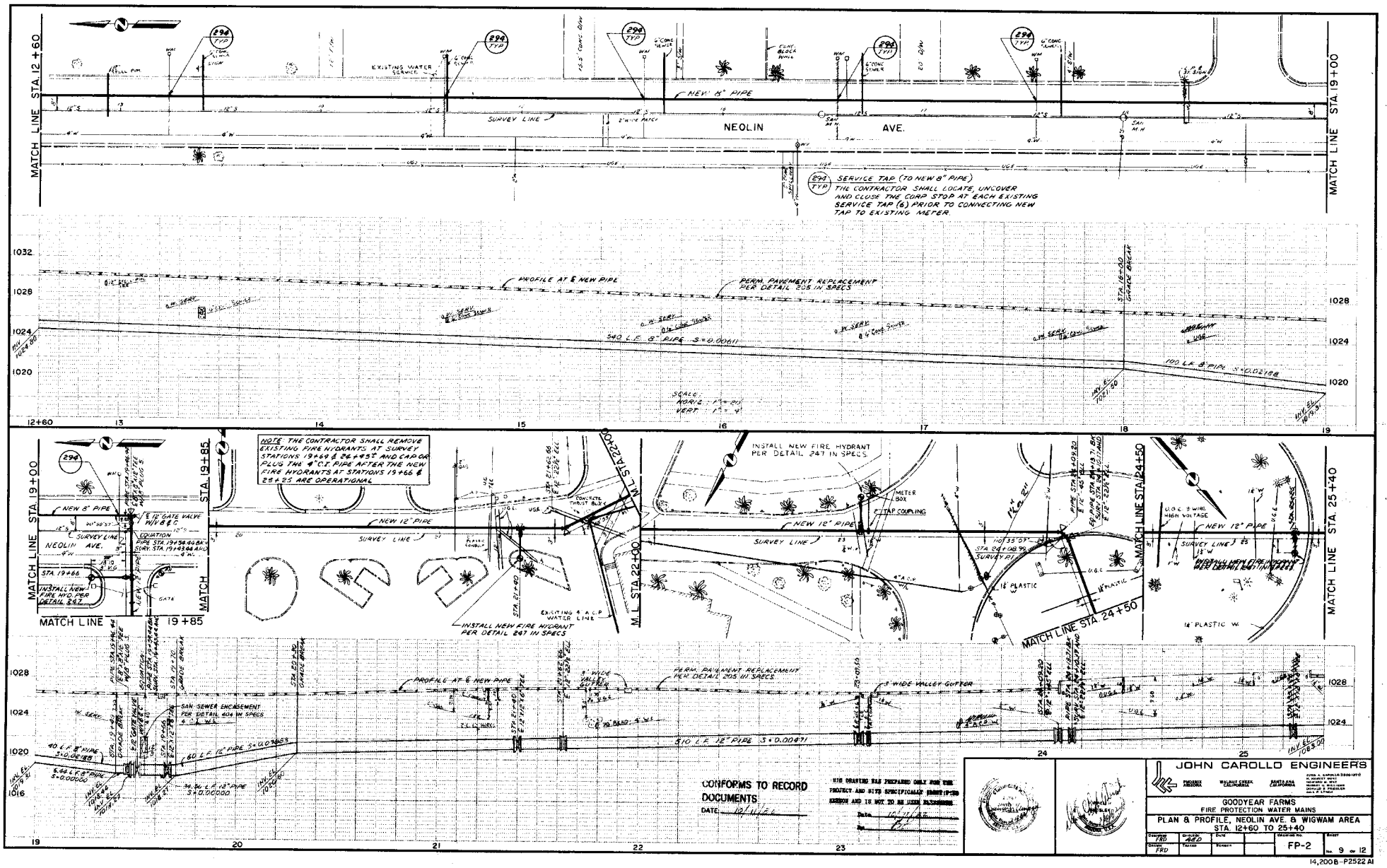
THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date: 10-11-72
By:

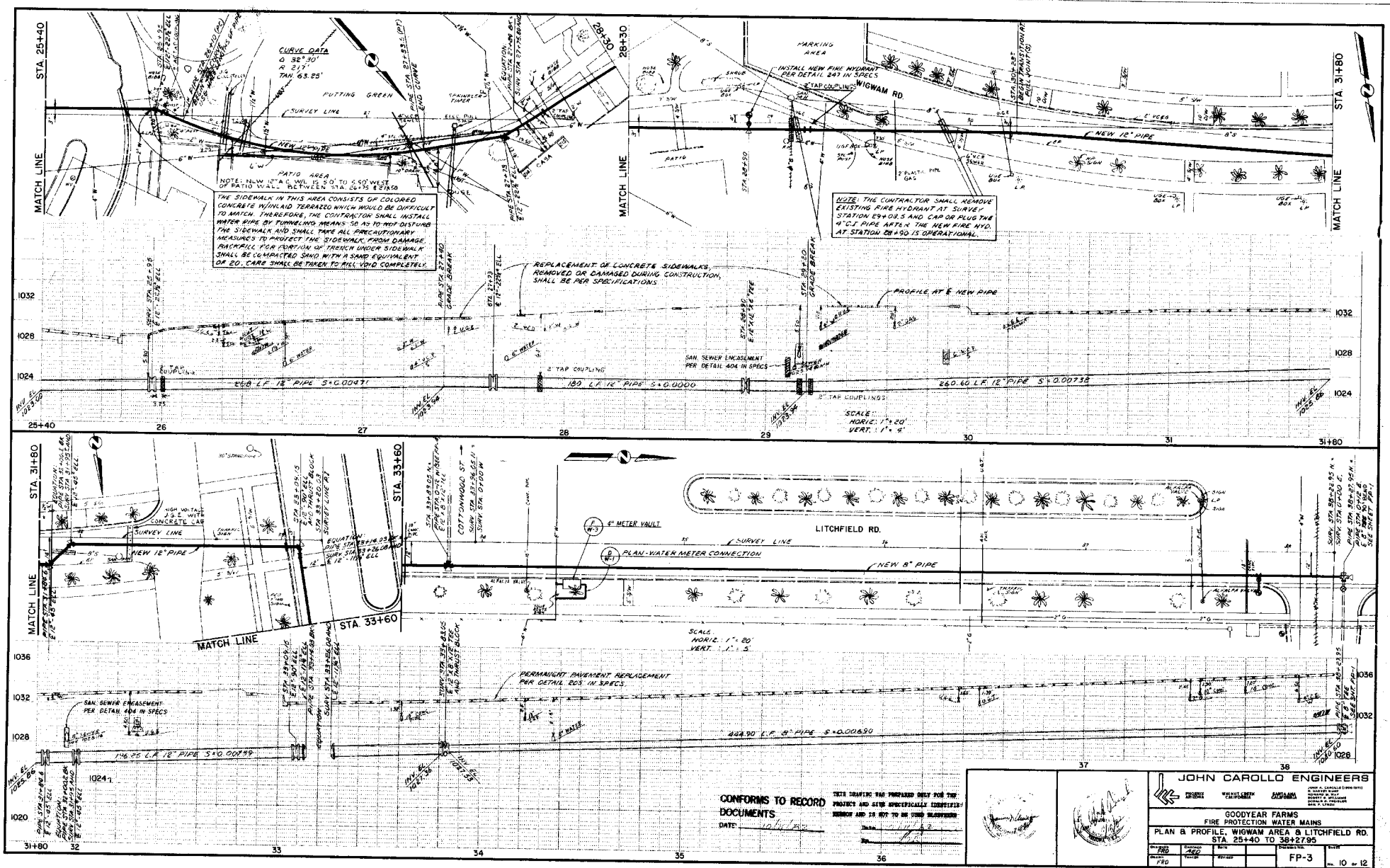
JOHN CAROLLO ENGINEERS

GOODYEAR FARMS
FIRE PROTECTION WATER MAINS
PLAN & PROFILE, FAIRWAY DR.
STA. 0+12 TO 12+60

DESIGNED	CHECKED	DATE	DRAWING NO.	SHEET
FRD			FP-1	No. 8 OF 12

14,201 8-P2522 A1


MATCH LINE STA. 12+60
MATCH LINE STA. 19+00
NEOLIN AVE.
NEW 8" PIPE
SURVEY LINE
EXISTING WATER SERVICE
294 TYP
SERVICE TAP (TO NEW 8" PIPE)
THE CONTRACTOR SHALL LOCATE, UNCOVER AND CLOSE THE CORP STOP AT EACH EXISTING SERVICE TAP (S) PRIOR TO CONNECTING NEW TAP TO EXISTING METER.
PROFILE AT ℄ NEW PIPE
PERM. PAVEMENT REPLACEMENT PER DETAIL 205 IN SPECS
540 L.F. 8" PIPE S=0.00611
100 L.F. 8" PIPE S=0.02188
SCALE: HORIZ. 1"=20' VERT. 1"=4'
MATCH LINE STA. 19+00
MATCH LINE 19+85
STA. 19+85
NEW 8" PIPE
NEW 12" PIPE
12" GATE VALVE W/V B & C
EQUATION PIPE STA 19+56.46 BK = SURV. STA 19+65.66 AHD
STA. 19+66
INSTALL NEW FIRE HYD. PER DETAIL 242
NOTE: THE CONTRACTOR SHALL REMOVE EXISTING FIRE HYDRANTS AT SURVEY STATIONS 19+69 & 24+45± AND CAP OR PLUG THE 8" C.I. PIPE AFTER THE NEW FIRE HYDRANTS AT STATIONS 19+66 & 24+25 ARE OPERATIONAL.
M.L. STA 22+00
STA. 21+40
EXISTING 6" A.C.P. WATER LINE
INSTALL NEW FIRE HYDRANT PER DETAIL 247 IN SPECS
METER BOX
2" TAP COUPLING
MATCH LINE STA 24+50
MATCH LINE STA. 25+40
U.G.E. 3 WIRE HIGH VOLTAGE
18" PLASTIC
PROFILE AT ℄ NEW PIPE
PERM. PAVEMENT REPLACEMENT PER DETAIL 205 III SPECS
3' WIDE VALLEY GUTTER
SAN. SEWER ENCASEMENT PER DETAIL 404 IN SPECS
40 L.F. 8" PIPE S=0.02188
60 L.F. 12" PIPE S=0.00833
54.44 L.F. 8" PIPE S=0.00000
96.94 L.F. 12" PIPE S=0.00000
510 L.F. 12" PIPE S=0.00471
CONFORMS TO RECORD DOCUMENTS
DATE 12/11/86
THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE.
Date 10/17/86
JOHN CAROLLO ENGINEERS
GOODYEAR FARMS
FIRE PROTECTION WATER MAINS
PLAN & PROFILE, NEOLIN AVE. & WIGWAM AREA
STA. 12+60 TO 25+40
FP-2
No. 9 OF 12
14,200B-P2522 A1



CONFORMS TO RECORD DOCUMENTS

DATE: 10/1/62

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Date: 10/1/62

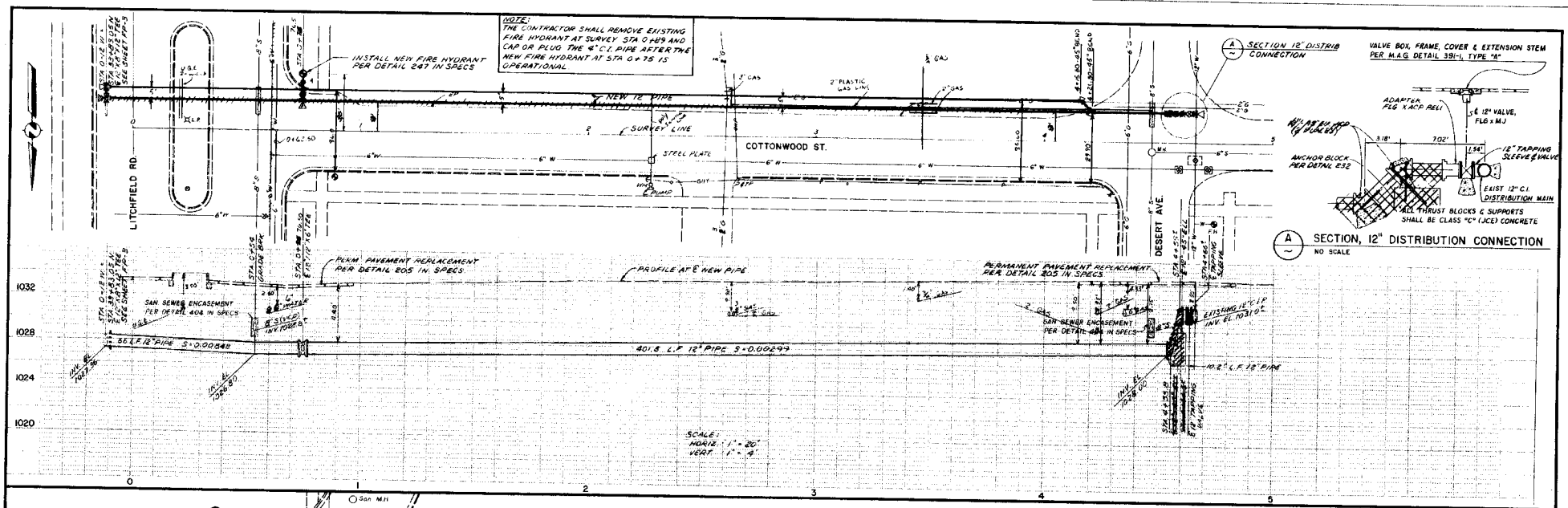
By:

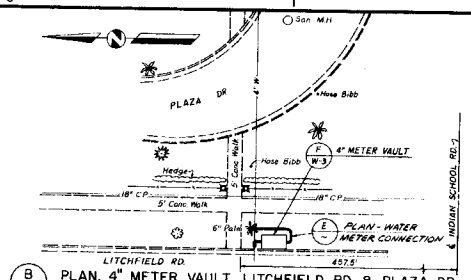
JOHN CAROLLO ENGINEERS

GOODYEAR FARMS
FIRE PROTECTION WATER MAINS
PLAN & PROFILE, WIGWAM AREA & LITCHFIELD RD.
STA. 25+40 TO 38+27.95

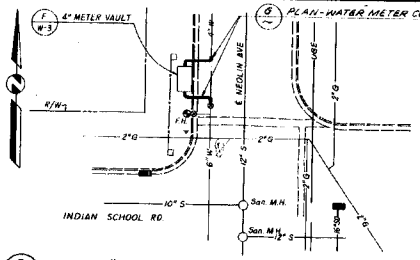
Designed	Drawn	Date	Drawing No.	Sheet
FRD	AEO		FP-3	No. 10 of 12
Checked	Traced			
FRD				

14,998-P2522 A1

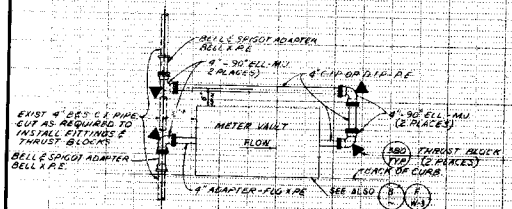




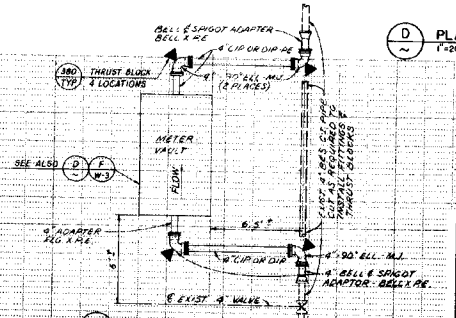
B PLAN, 4" METER VAULT, LITCHFIELD RD. & PLAZA DR.
1"=20'



D PLAN, 4" METER VAULT, INDIAN SCHOOL RD. & NEOLIN AVE.
1"=20'



E PLAN-WATER METER CONNECTION
1/4"=1'-0"



G PLAN-WATER METER CONNECTION
1/4"=1'-0"

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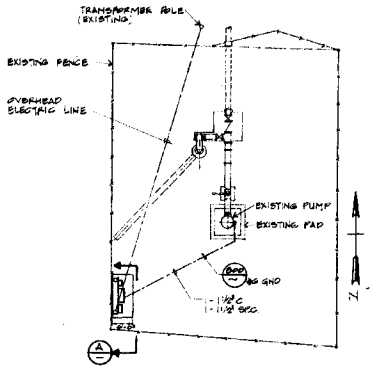
CONFORMS TO RECORD DOCUMENTS
DATE: 10-11-82

JOHN CAROLLO ENGINEERS

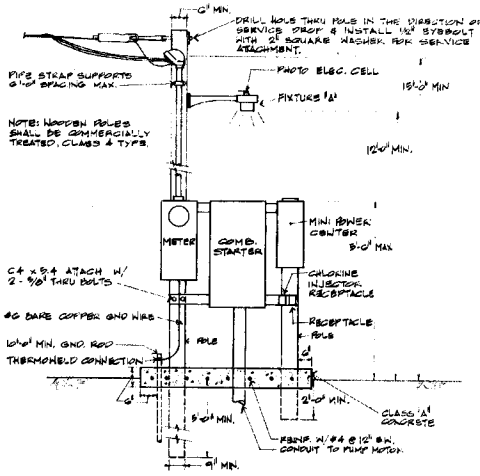
GOODYEAR FARMS
FIRE PROTECTION WATER MAINS
PLAN & PROFILE, COTTONWOOD ST.
STA 0+12 TO 4+66

Drawn SLB	Checked	Date		Drawing No. FP-4	Sheet No. 11 of 12
Traced SLB-FRD	Verified	Revised			

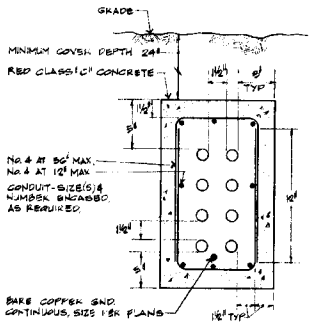
14,198-P2522 A1



ELECTRICAL PLAN - WELL No.1
SCALE 1/8" = 1'-0"



(A) ELECTRICAL PANEL LAYOUT
(TYPICAL FOR PUMP STATIONS 1 & 2)
NTS



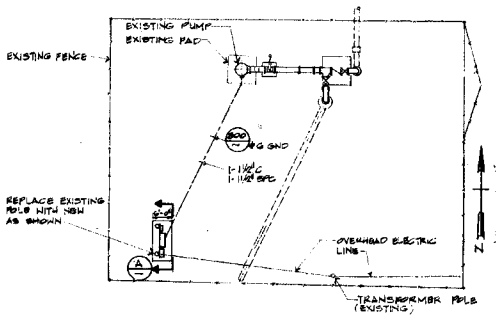
ALL DIMENSIONS ARE MINIMUM.

GROUND CONDUCTOR SHALL RUN CONTINUOUSLY THROUGH MANHOLES & SHALL CONTINUE FROM DUCT BANK INTO SWITCHGEAR OF BUILDING GROUNDING SYSTEM & SHALL BE BONDED TO EACH RIGID METAL CONDUIT.

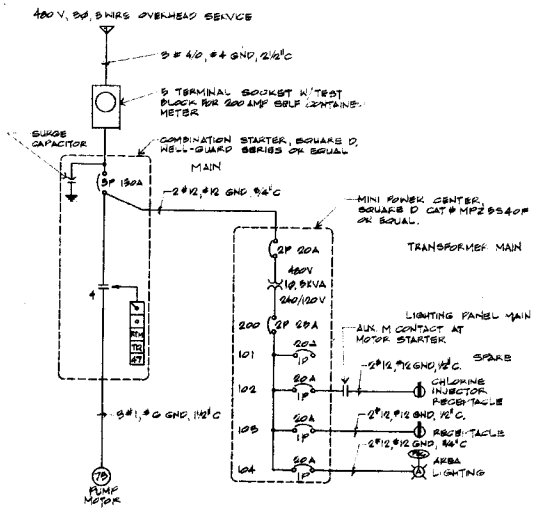
(800 TYP) ENCASED CONDUIT
NTS

LEGEND

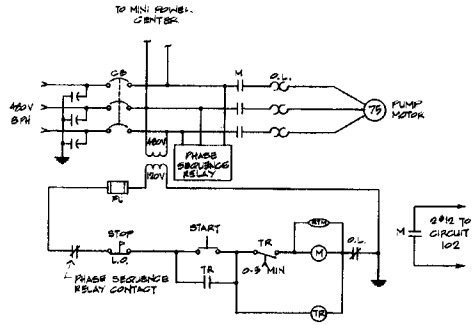
- BURIED CONCRETE ENCASED CONDUIT
- EXPOSED CONDUIT
- SURGE CAPACITOR
- (75) MOTOR (NUMBER DENOTES HORSEPOWER)
- THERMAL OVERLOAD
- CIRCUIT BREAKER
- (RT) OR (TM) RUNNING TIME METER
- (TR) OR (TR) TIMER RELAY
- NORMALLY OPEN CONTACTS WITH TIME DELAY CLOSING.
- NORMALLY OPENED RELAY OR MOTOR STARTER CONTACTS
- OR STOP PUSHBUTTON WITH LOCKOUT CAPABILITY
- OR START PUSHBUTTON
- (PS) PHASE SEQUENCE/LOSS OF PHASE RELAY
- TRANSFORMER
- 120 VOLT, 20 AMPERE RATED RECEPTACLE
- (A) LIGHTING FIXTURE (LETTER DENOTES TYPE)
- (PEC) PHOTO ELECTRIC CELL
- (M) MOTOR STARTER COIL



ELECTRICAL PLAN - WELL No.2
SCALE 1/8" = 1'-0"



SINGLE LINE DIAGRAM
TYPICAL FOR PUMP STATIONS 1 & 2



PUMP CONTROL SCHEMATIC
TYPICAL FOR PUMPS 1 & 2

NOTES:

1. CONTRACTOR SHALL DISCONNECT REMOVE & RETURN TO OWNER ALL EXISTING ELECTRICAL DEVICES & MATERIALS.
2. CONTRACTOR SHALL COORDINATE ELECTRICAL INSTALLATION WITH SERVICING UTILITY (ARIZONA PUBLIC SERVICE)
3. EXTENSION OF THE EXISTING OVERHEAD LINES, AS NEEDED SHALL BE COORDINATED WITH A.P.S. BY THE CONTRACTOR.
4. CAP SPARE CONDUITS, APPROXIMATELY 2' ABOVE GRADE ON BOTH SIDES.

CONFORMS TO RECORD DOCUMENTS
DATE: 10/4/82

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE
Date 10/4/82
By

REV.	DATE	BY	DESCRIPTION

DESIGNED JCR
DRAWN LAURI G
CHECKED NVSS

JOHN CAROLLO ENGINEERS
PHOENIX ARIZONA · WALNUT CREEK CALIFORNIA · FOUNTAIN VALLEY CALIFORNIA · VISALIA CALIFORNIA
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GOODYEAR FARMS
ELECTRICAL PLANS & DETAILS

DRAWING NO. E-1
SHEET NO. 12 OF 12
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I. GENERAL DESCRIPTION

This document is the Plan of Administration ("POA") for the System Improvement Benefits ("SIB") Mechanism approved for the Wastewater Division of Liberty Utilities (Litchfield Park Water & Sewer) Corp.) ("Company") by the Arizona Corporation Commission ("ACC" or "Commission") in Decision No. _____ on _____. The SIB provides for recovery of the capital costs (return on investment, income taxes and depreciation expense) associated with collection system improvement projects listed in SIB Plant Table I that have been verified to be completed[1] and placed in service per SIB Plant Table II and where costs have not been included in rate base for recovery in Decision No._____. Any expenditures offset by contributions in aid of construction or advances in aid of construction are not eligible for inclusion in the SIB.

II. DEFINITIONS

- NARUC – National Association of Regulatory Utility Commissioners.
- SIB – System Improvement Benefit mechanism to be implemented between rate proceedings to support investment in plant recorded in SIB Eligible NARUC accounts.
- SIB Eligible Plant – Investments in plant recorded in SIB Eligible NARUC accounts.
- SIB Eligible NARUC accounts:
  - NARUC Account No. 361 – Collection Sewers - Gravity
  - NARUC Account No. 363 – Services to Customers
- SIB Plant Table I (Excerpt attached as Exhibit 1) – The schedule of planned SIB eligible projects approved in the Company's most recent rate case decision.
- SIB Plant Table II (Sample attached as Exhibit 2) – The schedule of completed and verified SIB eligible projects, from SIB Plant Table I and associated retirements.

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[1] Acceptable forms of verifications may include the Maricopa County Environmental Services Department Approval of Construction, a Professional Engineer's Certificate of Completion, etc.

- SIB Revenue Requirement – The revenue requirement equal to the return on investment, income taxes and depreciation expense necessary to support the SIB Plant Table II amounts.

- SIB Revenue Requirement Efficiency Credit – An amount equal to 5 percent of the SIB Revenue Requirement.

- SIB Authorized Revenue – Amount equal to the SIB Revenue Requirement less the SIB Revenue Requirement Efficiency Credit plus any SIB True up Adjustment.

- Gross SIB Surcharge – Amount to be shown on customers' bills based on service sizes without consideration to the SIB Surcharge Efficiency Credit.

- SIB Surcharge Efficiency Credit – An amount equal to 5 percent of the Gross SIB Surcharge to be shown on customers' bills.

- SIB Surcharge – The amount equal to the Gross SIB Surcharge less the SIB Surcharge Efficiency Credit to be charged based on service size, calculated to recover the SIB Authorized Revenue, to be shown on the customers' bills.

- SIB True-up Adjustment – An amount to adjust for over or under collection of the SIB Authorized Revenues as compared with the total Net SIB Surcharges collected for the preceding 12 month period. Each true–up shall also analyze the cumulative over or under collections to include a comparison of all past SIB Authorized Revenues, total Net SIB Surcharges, and prior true-ups to be used in calculation of the SIB true-up surcharge or credit.

III. SIB RELATED FILINGS

A. Progress Reports – Once a SIB is approved in a decision, the Company must file with Docket Control semi-annual status reports delineating the status of all SIB Eligible Plant, on a project by project basis as listed in SIB Plant Table I, starting 6 months after the decision and every 6 months thereafter.

B. Reconciliation and True Up – Once a SIB Surcharge is implemented, the Company must file annually to true up its SIB Surcharge collections over the preceding twelve months with the SIB Authorized Revenue for that period and establish a surcharge or credit to true up over or under collections, regardless of whether it seeks a new surcharge. The filing dates for these annual true-ups shall be as established in the Commission's Decision approving the SIB Surcharge.

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C. SIB Surcharge Requests – To obtain its SIB Surcharge the Company must file the following:

1. SIB Plant Table II (with supporting information and documentation), showing the SIB eligible projects completed for which the Company seeks cost recovery. Such projects must:

   a) be projects listed in the Company's initial SIB Plant Table I, approved in Decision No._____, or have been added to said SIB Plant Table I pursuant to Section V of this POA;

   b) have been completed by the Company;

   c) have been verified; and

   d) be actually serving customers.

2. A summary of Commission approved SIB-eligible projects contemplated for the next twelve (12)-month SIB surcharge period from SIB Plant Table I.

3. SIB Schedule A (sample attached as Exhibit 3), showing a calculation of the SIB Revenue Requirement and SIB Revenue Requirement Efficiency Credit, SIB Authorized Revenue, Gross SIB Surcharge, SIB Surcharge Efficiency Credit, and the SIB Surcharge. Schedule A shall be supported by revenue requirements schedules supporting the revenue requirements in Decision No._____ and the pro-forma revenue requirements including the effects of SIB Eligible Plant.

4. Schedule B (sample as attached Exhibit 4) showing the overall SIB True-up Adjustment calculation for the prior twelve-month SIB Surcharge period, as well as the individual SIB True-up Adjustment for each service size.

5. SIB Schedule C (sample as attached as Exhibit 5) showing the effect of the SIB Surcharge on a typical residential customer bill.

6. SIB Schedule D (sample as attached Exhibit 6) which shall include an analysis of the impact of the SIB Eligible Plant on the fair value rate base, revenue, and the fair value rate of return. The Company shall also file the following:

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a) the most current balance sheet at the time of the filing;

b) the most current income statement;

c) an earnings test schedule;

d) a rate review schedule (including the incremental and pro forma effects of the proposed increase);

e) an adjusted rate base schedule; and

f) a Construction Work in Progress ledger (for each project showing accumulation of charges by month and paid vendor invoices).

D. The Company will maintain and provide Excel schedules with formulae intact supporting the revenue requirements approved in the rate decision that approved the SIB and provide same Excel schedules to incorporate the effects of SIB Eligible Plant for the current SIB Surcharge Request and any previously approved Surcharge and True-up requests.

E. The Company may make its initial SIB Surcharge Request through Docket Control no earlier than twelve months after the entry of Decision No._____.

F. The Company may make no more than one SIB Surcharge Request every twelve months with no more than five SIB Surcharge Requests between rate case decisions. A True-up must be filed with each Surcharge Request, except the first.

G. Unless otherwise authorized by the Commission, the Company shall be required to file its next general rate case no later than June 30, 2019, with a test year ending no later than December 31, 2018.

H. Any SIB Surcharges that are in effect shall be reset to zero upon the date new rates become effective in the Company's next general rate case.

I. The Company may request to add Plant to SIB Table I only under emergency circumstances. Any additions or modifications to SIB Plant Table I must be approved by the Commission.

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IV. SURCHARGE CALCULATIONS

A. Calculations of Amounts to Be Collected By the SIB Surcharge

1. The amount to be collected by the SIB Authorized Revenue shall be equal to the SIB Revenue Requirement minus the SIB Revenue Requirements Efficiency Credit plus any SIB True up Adjustment.

   For purposes of calculating the SIB Revenue Requirement:

   a. The required rate of return is equal to the overall rate of return authorized in Decision No. _____.

   b. The gross revenue conversion factor/tax multiplier is equal to the gross revenue conversion factor/tax multiplier approved in Decision No. _____; and

   c. The applicable depreciation rate(s) is equal to the depreciation rate(s) approved in Decision No. _____.

2. The project cost to be used in calculating the SIB Revenue Requirement shall be the lesser of the actual project cost listed in SIB Plant Table II or 110 percent of the estimated cost listed in SIB Plant Table I as approved in Decision No. _____. Unit costs shall be used if actual units constructed are less than estimated in SIB Plant Table I.

3. The amount to be collected by each SIB Surcharge Request shall be capped annually at five percent of the revenue requirement authorized in Decision No. _____.

B. Reconciliation And True-Ups

1. The revenue collected by the total SIB Surcharges over the preceding twelve months shall be trued-up and reconciled with the SIB Authorized Revenue for that period.

2. A new SIB Surcharge shall be combined with an existing SIB Surcharge such that a single SIB surcharge and SIB Efficiency Credit are shown on a customer's bill.

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3. For each twelve (12) month period that a SIB surcharge is in effect, the Company shall reconcile the amounts collected by the SIB Surcharge with the SIB Authorized Revenue, for that twelve (12)-month period, consistent with Schedule B, attached hereto as Exhibit B.

4. Any under- or over-collected SIB Authorized Revenues shall be recovered or refunded, without interest, over a twelve-month period by means of a SIB True-up Surcharge or Credit.

5. Starting with the second annual SIB Surcharge, where there are over or under-collected balances, such over or under-collected balances shall be carried over to the next year, and considered in the calculation of the new SIB True-up Surcharge or Credit. If, after the five-year period there remains an over or under-collected balance, such balance shall be reset to zero, and addressed in the next rate case.

C. Earnings Test

1. Once a SIB Surcharge is in effect, the Company shall be required to perform an annual earnings test calculation for each SIB Surcharge Request to determine whether the actual rate of return reflected by the operating income for the affected system or division for the relevant 12-month period exceeded the most recently authorized fair value rate of return for the affected system or division.

2. The earnings test shall be:

a) based on the most recent available operating income,

b) adjusted for any operating revenue and expense adjustments adopted in the most recent general rate case; and

c) based on the rate base adopted in the most recent general rate case, updated to recognize changes in plant, accumulated depreciation, contributions in aid of construction, advances in aid of construction, and accumulated deferred income taxes through the most recent available financial statement (quarterly or longer).

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V. ADDING PROJECTS TO SIB TABLE I UNDER EMERGENCY CIRCUMSTANCES

A. The Company can seek Commission approval to add projects in SIB Plant Table I only in the event of emergency circumstances. No such changes may be made without Commission approval.

B. Any addition to SIB Plant Table I must be plant investment that maintains or improves existing customer service, system reliability, integrity and safety. Eligible plant additions are limited to plant replacement projects. The costs of extending facilities or capacity to serve new customers are not recoverable through the SIB mechanism.

C. To be eligible for SIB treatment, a project must be SIB Eligible Plant.

D. SIB Eligible Plant must satisfy at least one of the following conditions:

1. Replacement Plant is necessary to address excessive infiltration and inflow ("I/I") adversely affecting treatment plant, and indicating the probability of sewer system collapse causing a public health and safety hazard.

2. Plant assets that have remained in service beyond their useful service lives (based on the Company's system's authorized utility plant depreciation rates) and are in need of replacement due to being worn out or in a deteriorating condition through no fault of the Company;

3. Any other engineering, operational or financial justification supporting the need for a plant asset replacement, other than the Company's negligence or improper maintenance, including, but not limited to:

   a. A documented increasing level of repairs to, or failures of, a plant asset justifying its replacement prior to reaching the end of its useful service life;

   b. Assets that are required to be moved, replaced or abandoned by a governmental agency or political subdivision if the Company can show that it has made a good faith effort to seek reimbursement for all or part of the costs incurred.

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VI. RATE DESIGN

A. The SIB Surcharge rate design shall be calculated as follows:

1) The SIB Surcharge shall be a fixed monthly surcharge containing a Gross SIB Surcharge and the SIB Surcharge Efficiency Credit as its two components.

2) The SIB Surcharge shall be calculated by dividing the SIB Authorized Revenue by the number of equivalent active 4-inch services at the end of the most recent twelve (12) month period, and shall increase with service size based on the following meter capacity multipliers:

Service Lateral Size	Factor
4-inch	1
6-inch	2.25
8-inch	4
10-inch	6.25

B. The SIB Surcharge shall apply to all of the Company's customers, including private fire service customers.

VII. SURCHARGE IMPLEMENTATION

A. SIB surcharges shall not become effective until approved by the Commission.

B. At least 30 days prior to the SIB surcharge becoming effective, the Company shall provide public notice in the form of a billing insert or customer letter in a form acceptable to Staff. Such notice shall include the following information:

1. The individual Gross SIB Surcharge, by service size;

2. The individual SIB Surcharge Efficiency Credit, by service size;

3. SIB Surcharge, by service size; and

4. Directions where the customer may obtain a summary of the projects included in the current SIB Surcharge Request, including a description of each project and its cost.

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Wastewater System Name and APP Permit No. _____

SIB PLANT TABLE II (Page 1 of 2)

Information to be included with SIB-Eligible Completed Project Filings

	NARUC Acct No. (SIB-eligible plant)	New Plant Description (SIB-eligible plant)					Site (location description)	Replacement Plant			Original Plant (Plant Being Retired)			
Project No.	**361 Collecting Sewers - Gravity** **363 Services to Customers**	Description	Installed Pipe/Plant Length/ Quantity	Diameter/ Size	Material	Installed Cost/Unit (actual cost)		In-Service Date (provide MSECD AOC and other related approvals by state and/or federal agencies when applicable; pictures of installed plant)	Subtotal Actual Cost (by NARUC Acct No)	Subtotal Actual Cost (by project)	Actual Retirement Date	Original In-Service Date	Original Cost	Accumulated Depreciation Reserve (as of the actual retirement date)
Total Actual Cost														

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Wastewater System Name and APP Permit No. _____
SIB PLANT TABLE II (Page 2 of 2, Summary)

Information to be included with SIB-Eligible Completed Project Filings

Project No.	Project Description	Estimated Cost (from TABLE I)	Actual Cost	The project cost to be used in calculating the SIB Revenue Requirement shall be the lesser of the actual project cost listed in SIB Plant Table II or 110 percent of the estimated cost listed in SIB Plant Table I as approved in Decision No. _____. Unit costs shall be used if actual units constructed are less than estimated in SIB Plant Table I.
Total Cost				

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Liberty Utilities (Litchfield Park Water & Sewer) Corp.
Plan of Administration
System Improvement Benefit Mechanism ("SIB")-Water
Docket No. W-01428A-13-0043

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SIB SCHEDULE B - CALCULATION OF SIB TRUE-UP REVENUE REQUIREMENTS ADJUSTMENT ..... Exhibit 4

SIB SCHEDULE C - TYPICAL BILLS ANALYSIS ..... Exhibit 5

SIB SCHEDULE D - SUMMARY OF REVENUE AND RATE BASE IMPACTS INCLUDING EARNINGS TEST ..... Exhibit 6

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I. GENERAL DESCRIPTION

This document is the Plan of Administration ("POA") for the System Improvement Benefits ("SIB") Mechanism approved for the Water Division of Liberty Utilities (Litchfield Park Water & Sewer) Corp. ("Company") by the Arizona Corporation Commission ("ACC" or "Commission") in Decision No. _____ on _____. The SIB provides for recovery of the capital costs (return on investment, income taxes and depreciation expense) associated with distribution system improvement projects listed in SIB Plant Table I that have been verified to be completed[1] and placed in service per SIB Plant Table II and where costs have not been included in rate base for recovery in Decision No._____. Any expenditures offset by contributions in aid of construction or advances in aid of construction are not eligible for inclusion in the SIB.

II. DEFINITIONS

- NARUC – National Association of Regulatory Utility Commissioners.
- SIB – System Improvement Benefit mechanism to be implemented between rate proceedings to support investment in plant recorded in SIB Eligible NARUC accounts.
- SIB Eligible Plant – Investments in plant recorded in SIB Eligible NARUC accounts.
- SIB Eligible NARUC accounts:
  - NARUC Account No. 309 – Supply Mains
  - NARUC Account No. 331 –Transmission and Distribution Mains
  - NARUC Account No. 333 – Services
  - NARUC Account No. 334 - Meters and Meter Installations;
  - NARUC Account No. 335 – Hydrants
- SIB Plant Table I (Excerpt attached as Exhibit 1) – The schedule of planned SIB eligible projects approved in the Company's most recent rate case decision.

[1] Acceptable forms of verifications may include the Maricopa County Environmental Services Department Approval of Construction, a Professional Engineer's Certificate of Completion, etc.

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- SIB Plant Table II (Sample attached as Exhibit 2) – The schedule of completed and verified SIB eligible projects, from SIB Plant Table I and associated retirements.

- SIB Revenue Requirement – The revenue requirement equal to the return on investment, income taxes and depreciation expense necessary to support the SIB Plant Table II amounts.

- SIB Revenue Requirement Efficiency Credit – An amount equal to 5 percent of the SIB Revenue Requirement.

- SIB Authorized Revenue – Amount equal to the SIB Revenue Requirement less the SIB Revenue Requirement Efficiency Credit plus any SIB True up Adjustment.

- Gross SIB Surcharge – Amount to be shown on customers' bills based on meter sizes without consideration to the SIB Surcharge Efficiency Credit.

- SIB Surcharge Efficiency Credit – An amount equal to 5 percent of the Gross SIB Surcharge to be shown on customers' bills.

- SIB Surcharge – The amount equal to the Gross SIB Surcharge less the SIB Surcharge Efficiency Credit to be charged based on meter size, calculated to recover the SIB Authorized Revenue, to be shown on the customers' bills.

- SIB True-up Adjustment – An amount to adjust for over or under collection of the SIB Authorized Revenues as compared with the total Net SIB Surcharges collected for the preceding 12 month period. Each true–up shall also analyze the cumulative over or under collections to include a comparison of all past SIB Authorized Revenues, total Net SIB Surcharges, and prior true-ups to be used in calculation of the SIB true-up surcharge or credit.

III. SIB RELATED FILINGS

A. Progress Reports – Once a SIB is approved in a decision, the Company must file with Docket Control semi-annual status reports delineating the status of all SIB Eligible Plant, on a project by project basis as listed in SIB Plant Table I, starting 6 months after the decision and every 6 months thereafter.

B. Reconciliation and True Up – Once a SIB Surcharge is implemented, the Company must file annually to true up its SIB Surcharge collections over the preceding twelve months with the SIB Authorized Revenue for that period and

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establish a surcharge or credit to true up over or under collections, regardless of whether it seeks a new surcharge. The filing dates for these annual true-ups shall be as established in the Commission's Decision approving the SIB Surcharge.

C. SIB Surcharge Requests – To obtain its SIB Surcharge the Company must file the following:

1. SIB Plant Table II (with supporting information and documentation), showing the SIB eligible projects completed for which the Company seeks cost recovery. Such projects must

   a) be projects listed in the Company's initial SIB Plant Table I, approved in Decision No._____, or have been added to said SIB Plant Table I pursuant to Section V of this POA;

   b) have been completed by the Company;

   c) have been verified; and

   d) be actually serving customers.

2. A summary of Commission approved SIB-eligible projects contemplated for the next twelve (12)-month SIB surcharge period from SIB Plant Table I.

3. SIB Schedule A (sample attached as Exhibit 3), showing a calculation of the SIB Revenue Requirement and SIB Revenue Requirement Efficiency Credit, SIB Authorized Revenue, Gross SIB Surcharge, SIB Surcharge Efficiency Credit, and the SIB Surcharge. Schedule A shall be supported by revenue requirements schedules supporting the revenue requirements in Decision No. _____ and the pro-forma revenue requirements including the effects of SIB Eligible Plant.

4. Schedule B (sample as attached Exhibit 4) showing the overall SIB True-up Adjustment calculation for the prior twelve-month SIB Surcharge period, as well as the individual SIB True-up Adjustment for each meter size.

5. SIB Schedule C (sample as attached as Exhibit 5) showing the effect of the SIB Surcharge on a typical residential customer bill for both median and average usage.

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6. SIB Schedule D (sample as attached Exhibit 6) which shall include an analysis of the impact of the SIB Eligible Plant on the fair value rate base, revenue, and the fair value rate of return. The Company shall also file the following:

   a) the most current balance sheet at the time of the filing;

   b) the most current income statement;

   c) an earnings test schedule;

   d) a rate review schedule (including the incremental and pro forma effects of the proposed increase);

   e) an adjusted rate base schedule; and

   f) a Construction Work in Progress ledger (for each project showing accumulation of charges by month and paid vendor invoices).

D. The Company will maintain and provide Excel schedules with formulae intact supporting the revenue requirements approved in the rate decision that approved the SIB and provide same Excel schedules to incorporate the effects of SIB Eligible Plant for the current SIB Surcharge Request and any previously approved Surcharge and True-up requests.

E. The Company may make its initial SIB Surcharge Request through Docket Control no earlier than twelve months after the entry of Decision No._____.

F. The Company may make no more than one SIB Surcharge Request every twelve months with no more than five SIB Surcharge Requests between rate case decisions. A True-up must be filed with each Surcharge Request, except the first.

G. Unless otherwise authorized by the Commission, the Company shall be required to file its next general rate case no later than June 30, 2019, with a test year ending no later than December 31, 2018.

H. Any SIB Surcharges that are in effect shall be reset to zero upon the date new rates become effective in the Company's next general rate case.

I. The Company may request to add Plant to SIB Table I only under emergency circumstances. Any additions or modifications to SIB Plant Table I must be approved by the Commission.

IV. SURCHARGE CALCULATIONS

A. Calculations of Amounts to Be Collected By the SIB Surcharge

1. The amount to be collected by the SIB Authorized Revenue shall be equal to the SIB Revenue Requirement minus the SIB Revenue Requirements Efficiency Credit plus any SIB True up Adjustment.
For purposes of calculating the SIB Revenue Requirement:

   a. The required rate of return is equal to the overall rate of return authorized in Decision No. _____.

   b. The gross revenue conversion factor/tax multiplier is equal to the gross revenue conversion factor/tax multiplier approved in Decision No. _____; and

   c. The applicable depreciation rate(s) is equal to the depreciation rate(s) approved in Decision No. _____.

2. The project cost to be used in calculating the SIB Revenue Requirement shall be the lesser of the actual project cost listed in SIB Plant Table II or 110 percent of the estimated cost listed in SIB Plant Table I as approved in Decision No. _____. Unit costs shall be used if actual units constructed are less than estimated in SIB Plant Table I.

3. The amount to be collected by each SIB Surcharge Request shall be capped annually at five percent of the revenue requirement authorized in Decision No. _____.

B. Reconciliation And True-Ups

1. The revenue collected by the total SIB Surcharges over the preceding twelve months shall be trued-up and reconciled with the SIB Authorized Revenue for that period.

2. A new SIB Surcharge shall be combined with an existing SIB Surcharge such that a single SIB surcharge and SIB Efficiency Credit are shown on a customer's bill.

3. For each twelve (12) month period that a SIB surcharge is in effect, the Company shall reconcile the amounts collected by the SIB Surcharge with

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the SIB Authorized Revenue, for that twelve (12)-month period, consistent with Schedule B, attached hereto as Exhibit B.

4. Any under- or over-collected SIB Authorized Revenues shall be recovered or refunded, without interest, over a twelve-month period by means of a SIB True-up Surcharge or Credit.

5. Starting with the second annual SIB Surcharge, where there are over or under-collected balances, such over or under-collected balances shall be carried over to the next year, and considered in the calculation of the new SIB True-up Surcharge or Credit. If, after the five-year period there remains an over or under-collected balance, such balance shall be reset to zero, and addressed in the next rate case.

C. Earnings Test

1. Once a SIB Surcharge is in effect, the Company shall be required to perform an annual earnings test calculation for each SIB Surcharge Request to determine whether the actual rate of return reflected by the operating income for the affected system or division for the relevant 12-month period exceeded the most recently authorized fair value rate of return for the affected system or division.

2. The earnings test shall be:

a) based on the most recent available operating income,

b) adjusted for any operating revenue and expense adjustments adopted in the most recent general rate case; and

c) based on the rate base adopted in the most recent general rate case, updated to recognize changes in plant, accumulated depreciation, contributions in aid of construction, advances in aid of construction, and accumulated deferred income taxes through the most recent available financial statement (quarterly or longer).

V. ADDING PROJECTS TO SIB TABLE I UNDER EMERGENCY CIRCUMSTANCES

A. The Company can seek Commission approval to add projects in SIB Plant Table I only in the event of emergency circumstances. No such changes may be made without Commission approval.

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B. Any addition to SIB Plant Table I must be plant investment that maintains or improves existing customer service, system reliability, integrity and safety. Eligible plant additions are limited to plant replacement projects. The costs of extending facilities or capacity to serve new customers are not recoverable through the SIB mechanism.

C. To be eligible for SIB treatment, a project must be SIB Eligible Plant.

D. SIB Eligible Plant must satisfy at least one of the following conditions:

1. Water loss for the system exceeds ten (10) percent, as calculated by the following formula: ((Volume of Water Produced and/ or Purchased) – (Volume of Water Sold + Volume of Water Put to Beneficial Use)) divided by (Volume of Water Produced and/or Purchased). If the Volume of Water Put to Beneficial Use is not metered, it shall be established in a reliable, verifiable manner.

2. Plant assets that have remained in service beyond their useful service lives (based on the Company's system's authorized utility plant depreciation rates) and are in need of replacement due to being worn out or in a deteriorating condition through no fault of the Company;

3. Any other engineering, operational or financial justification supporting the need for a plant asset replacement, other than the Company's negligence or improper maintenance, including, but not limited to:

   a. A documented increasing level of repairs to, or failures of, a plant asset justifying its replacement prior to reaching the end of its useful service life (e.g. black poly pipe);

   b. Assets that are required to be moved, replaced or abandoned by a governmental agency or political subdivision if the Company can show that it has made a good faith effort to seek reimbursement for all or part of the costs incurred.

VI. RATE DESIGN

A. The SIB Surcharge rate design shall be calculated as follows:

1) The SIB Surcharge shall be a fixed monthly surcharge containing a Gross SIB Surcharge and the SIB Surcharge Efficiency Credit as its two components.

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2) The SIB Surcharge shall be calculated by dividing the SIB Authorized Revenue by the number of equivalent active 5/8-inch meters at the end of the most recent twelve (12) month period, and shall increase with meter size based on the following meter capacity multipliers:

5/8-inch x ¾-inch	1.0 times
¾-inch	1.5 times
1-inch	2.5 times
1½-inch	5 times
2-inch	8 times
3-inch	16 times
4-inch	25 times
6-inch	50 times
8-inch	80 times
10-inch	115 times
12-inch & above	215 times

B. The SIB Surcharge shall apply to all of the Company's metered customers, including private fire service customers.

VII. SURCHARGE IMPLEMENTATION

A. SIB surcharges shall not become effective until approved by the Commission.

B. At least 30 days prior to the SIB surcharge becoming effective, the Company shall provide public notice in the form of a billing insert or customer letter in a form acceptable to Staff. Such notice shall include the following information:

1. The individual Gross SIB Surcharge, by meter size;

2. The individual SIB Surcharge Efficiency Credit, by meter size;

3. SIB Surcharge, by meter size; and

4. Directions where the customer may obtain a summary of the projects included in the current SIB Surcharge Request, including a description of each project and its cost.

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Water System Name and PWS ID No.

SIB PLANT TABLE II (Page 1 of 2)

Information to be included with SIB-Eligible Completed Project Filings

	NARUC Acct No. (SIB-eligible plant)	New Plant Description (SIB-eligible plant)					Site (location description)	Replacement Plant			Original Plant (Plant Being Retired)			
Project No.	**309 Supply Mains** **331 T&D Mains** **333 Services** **334 Meters** **335 Hydrants**	Description	Installed Pipe/Plant Length/ Quantity	Diameter/ Size	Material	Installed Cost/Unit (actual cost)		In-Service Date (provide MSECD AOC and other related approvals by state and/or federal agencies when applicable; pictures of installed plant)	Subtotal Actual Cost (by NARUC Acct No)	Subtotal Actual Cost (by project)	Actual Retirement Date	Original In-Service Date	Original Cost	Accumulated Depreciation Reserve (as of the actual retirement date)

DRAFT

Total Actual Cost						

Water System Name and PWS ID No.

SIB PLANT TABLE II (Page 2 of 2, Summary)

Information to be included with SIB-Eligible Completed Project Filings

Project No.	Project Description	Estimated Cost (from TABLE I)	Actual Cost	The project cost to be used in calculating the SIB Revenue Requirement shall be the lesser of the actual project cost listed in SIB Plant Table II or 110 percent of the estimated cost listed in SIB Plant Table I as approved in Decision No. _____. Unit costs shall be used if actual units constructed are less than estimated in SIB Plant Table I.

DRAFT

Total Cost			

DRAFT

Litchfield Park Service Company

Docket No. SW-01428A-13-0042 ET AL.

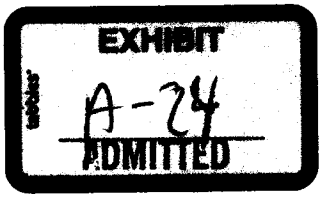
Rate Application

RUCO's Second Set Of Data Responses

The following data responses apply to both the Water and Wastewater Division's in the above-referenced consolidated docket number. Accordingly, separate responses are provided, where applicable, for each division.

2.8 If a SIB has been approved for a water company, what difference does it make that the Commission has not previously approved a similar mechanism for wastewater utilities?

RESPONSE:

Water leakage is not an issue in wastewater systems' rate cases. The original purpose of a SIB filing was to replace aging and deteriorating water mains and service lines, which cause water loss, non-accounted for water revenues, and reduce purchased power expense, and O&M expenses for constant repairs that should have been properly maintained in the first place. The same conditions do not exist for a Wastewater System.

In addition, while a SIB has been approved by the Commission on several Water Company filings, the Commission will be breaking new ground again if approving a SIB for a Wastewater System. RUCO disagrees with a SIB for a Wastewater System for the same reasons they have filed in the previous rate cases related to Water Systems. Those reasons were filed in RUCO's direct testimony.