APPENDIX A

Final Pipeline Route Study
South Plant, Task 6.2
Technical Memorandum No. 1

FINAL
PIPELINE ROUTE STUDY - SOUTH PLANT
NEWMARK RD, TASK 6.2
TECHNICAL MEMORANDUM NO. 1

NEWMARK OPERABLE UNIT
REMEDIAL DESIGN

Prepared for:

Contract No. 68-W9-0054 / WA No. 54-37-9NJ5
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

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May 17, 1995

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1.0 INTRODUCTION

This report presents a pipeline route study for the South Plant, which consists of a connection of five proposed groundwater extraction wells to an existing City of San Bernardino Municipal Water Department (SBMWD) water treatment plant located at Sierra Way and 17th Street (17th Street Plant) and then to a proposed expansion to the existing SBMWD water treatment plant located near Waterman Avenue and Marshall Boulevard (Waterman Plant) (see Figure 1).

The distance between the extraction wells and the Waterman Plant site is approximately 2 miles, including a freeway crossing at U.S. Route 30 (Crosstown Freeway/Foothill Freeway). This report describes how the pipeline alignment was selected and the recommended freeway crossing method.

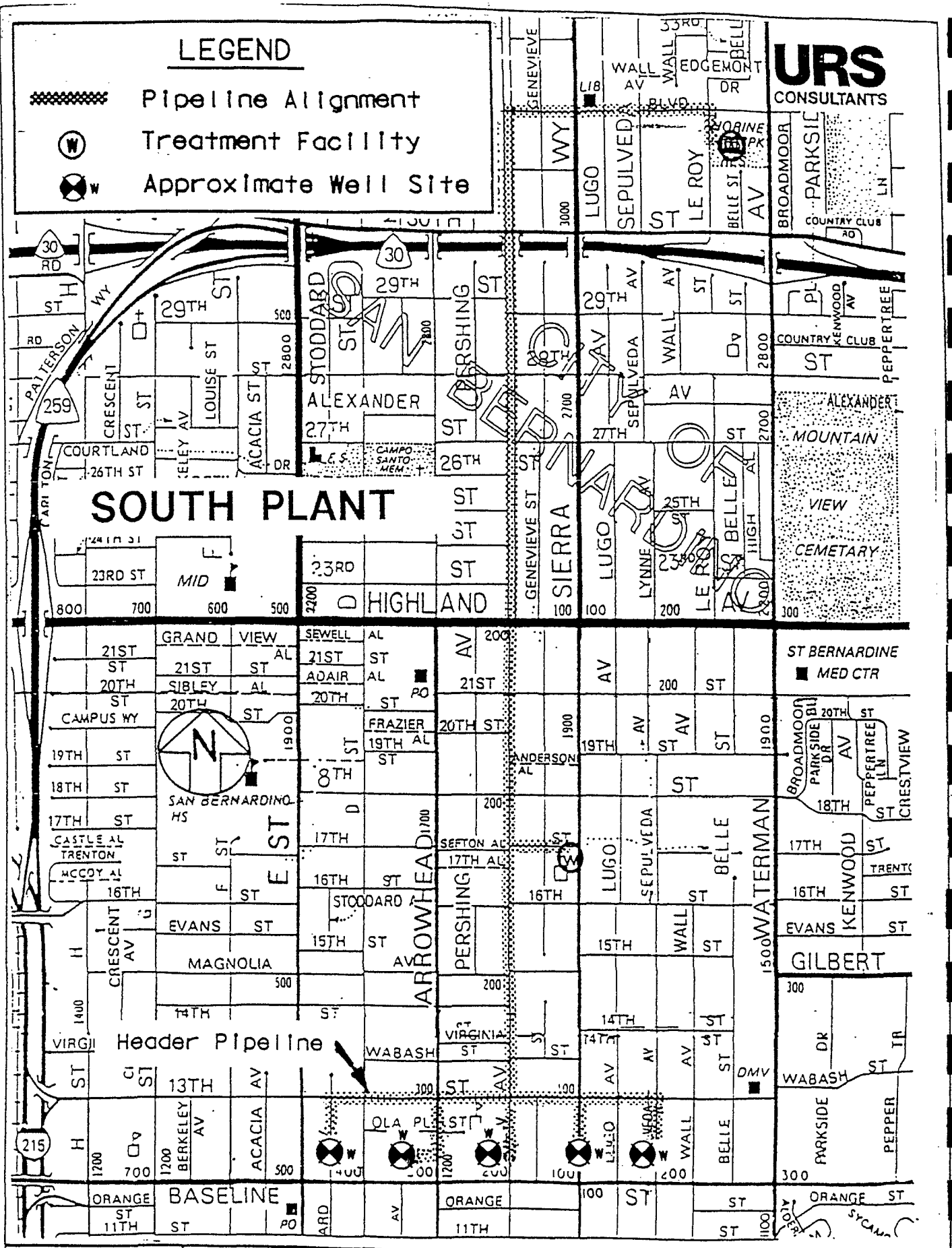
1.1 BACKGROUND

This study is within the scope of Task 6.2 of the Newmark Operable Unit Remedial Design Work Assignment (No. 54-37-9NJ5) under URS Consultants, Inc. (URS) Contract No. 68-W9-0054 with the U.S. Environmental Protection Agency (EPA). Chlorinated solvents exceeding drinking water standards were discovered in municipal water wells in northern San Bernardino in the early 1980s. EPA placed the Newmark Groundwater Contamination Superfund Site on the National Priorities List in 1989 and signed a Record of Decision for the Newmark Operable Unit (the eastern portion of the site) in August 1993, based on the Newmark OU RI/FS Report prepared by URS.

EPA selected the Newmark OU remedy to control the spread of the groundwater contamination by construction of two extraction well systems along with transmission pipelines and water treatment systems. The first extraction system includes the Newmark Wellfield and is located just north of the Shandin Hills.

The second system includes an extraction well system located near the leading edge of the contaminated plume located along Baseline Avenue (Baseline). This report addresses the second system, the proposed collections and transmission pipeline route to the treatment locations (17th Street and Waterman Plants).

Design of the groundwater treatment systems and the extraction wellhead facilities is presented separately and is not a part of this route study.



URS CONSULTANTS

FIGURE 1

PROPOSED PIPELINE ALIGNMENT
SOUTH PLANT

Drawn P.H. Date
Checked D.H.D. Scale N.T.S
Appr'd. DEUTSCHER

2.0 PROPOSED EXTRACTION WELL SYSTEM

The goal of this project is to inhibit further migration of the Newmark groundwater contaminant plume. The proposed extraction well system for the South Plant is located near the Newmark plume front along Baseline Road. Determination of the well location, number of wells, and pumping rates are contained in the report "Newmark Plume Front Extraction Well Technical Memorandum — Newmark Operable Unit Remedial Design" prepared by URS Consultants, Inc. (dated February 1995). In that report, an extraction well system located on Baseline Road (see Figure 1) consisting of five new wells pumping at a total flow rate of 7,000 gpm was selected.

3.0 WATER TRANSMISSION PIPELINE ALIGNMENT

Contaminated groundwater pumped from one or more of the extraction wells will be conveyed to the existing 17th Street Plant for treatment. Groundwater pumped from the other wells will be conveyed to the expanded Waterman Plant. The well piping on 13th Street will be combined with a common east/west pipeline header. This header will then be connected to the Waterman Plant via a transmission pipeline. The transmission pipeline, based on preliminary calculations, is sized at 24-inch diameter.

3.1 SELECTION CRITERIA

Parameters affecting the selection of a route for the transmission pipeline are:

- Width of the north/south streets.
- Width of possible east/west connecting streets.
- Traffic level of the potential roadways investigated for pipe routing.
- Connection to the existing SBMWD water treatment facility at 17th Street and Sierra Way.
- Connection to the proposed Waterman water treatment facility expansion at Horine Park.
- Crossing at the Route 30 freeway which is an east/west roadway located north of the City of San Bernardino. The freeway is a "depressed" roadway section.

3.2 FREEWAY CROSSING

Two different methods of crossing the Route 30 Freeway were evaluated. The first is to cross under the roadway by "jacking", which would require approximately 30-foot deep pits on both sides of the freeway. The other method is to cross the freeway through an existing bridge structure.

Undercrossing (Jacking). This method requires digging a "sending" pit on one side of an obstacle so a pipe can be pushed or tunneled through the soil to a "receiving" pit of equal depth on the other side of the obstacle. The freeway section requiring crossing by this project is a depressed segment approximately 23 feet below the original ground level. Because of the depth of cut and minimum required soil cover over the pipe, the minimum burial depth below the original ground surface is estimated at approximately 30 feet.

To have the least impact to the motoring public and residents or businesses along the freeway, sites for jacking operation at cul-de-sac streets are the preferred locations as follows:

- 29th Street cul-de-sac on the south side and intersection with 30th Street on the north side;
- Lugo Avenue cul-de-sac on the south side and intersection with 30th Street on the north side;

- Sepulveda Avenue cul-de-sac on the south side and intersection with 30th Street on the north side;
- Wall Avenue cul-de-sac on the south side and apartments on the north side;
- Leroy Street cul-de-sac on the south side and intersection with 30th Street on the north side; and
- Belle Street cul-de-sac on the south side and intersection with 30th Street on the north side. This street dead-ends at the water reservoir north of 30th Street.

The preferred location for a jacking operation is the site at Leroy Street. This location for crossing the freeway is close to the Waterman water treatment facility. It also allows residential traffic to be easily detoured during construction and provides the shortest jacking length.

Bridge Crossings. There are five possible bridge crossing sites over the freeway. These locations are at "E" Street, Arrowhead Avenue, Mountain View Avenue, Sierra Way, and Waterman Avenue. The sites at "E" Street and Waterman Avenue were eliminated from further consideration because they are major thoroughfares with very heavy traffic due to their connection to freeway interchanges. Sierra Way is a major thoroughfare, but the traffic is lower since it is not a freeway interchange. The crossings at Arrowhead Avenue and Mountain View Avenue were considered the best crossing candidates.

The Caltrans as-builts for the Arrowhead Avenue, Mountain View Avenue, and Sierra Way overcrossings were obtained and reviewed.

Arrowhead Avenue	Overcrossing #54-766	Post Mile 23.588 Station 724+88
Mountain View Avenue	Overcrossing #54-767	Post Mile 23.721 Station 731+91
Sierra Way	Overcrossing #54-768	Post Mile 23.847 Station 738+51

The Arrowhead overcrossing is a single-bridge structure 77'-08" wide with double column median supports. The Mountain View overcrossing is a split roadway double-bridge facility with two 43'-10" wide bridge structures each with a single column median support. The Sierra Way overcrossing is the same type of structure as the Arrowhead structure.

On reviewing the as-built plans, it was determined that the bridges do not have provisions for future utility crossings as part of the design and no crossings have been constructed. This was verified with Caltrans staff. A discussion with Caltrans was therefore initiated to investigate the possibility of cutting through the bridge abutments and bridge cells to push through a pipe sleeve. This process would require cutting through structural steel as well as concrete.

Since the bridge clearance is greater than 17 feet, the idea of attaching the pipe to the outside facing of the bridge structure was suggested by Caltrans. Caltrans rarely allows utilities to be attached to the side facing of structures over freeways because of the possibility of damage from over-height trucks and the poor aesthetics of pipes with supports attached to bridges. The Mountain View dual structure facility would allow pipes to be attached to the median side of the bridge facing. The bridge cantilever overhang is approximately 36 inches wide, and a 24-inch pipe may require a 30-inch casing. Caltrans suggested that the transmission pipe be divided into two smaller pipes attached to the inside facing of each structure. This would assure that no pipe support element would stick out beyond the bridge overhang. After the two pipes cross the freeway, they could then be rejoined to a single 24-inch pipe. Though visible to the public, the pipes would not be visibly intrusive and would be protected from possible damage by over-height vehicles on the freeway. Recently, Caltrans approved the attachment of a utility pipe to the side facing of the bridge at the Interstate 215/Washington Street Interchange in the City of Colton. This structure only has a 14.5-foot bridge clearance but the bridge is scheduled to be replaced in about 5 years. The Mountain View overcrossing, at its lowest point, is 17.5 feet above the freeway roadbed. The pipes attached to the inside facings of the Mountain View structures could be part of the future median widening if the City constructs a light-rail project at this location. It is therefore concluded that this crossing location be selected and a detailed structural design be submitted to Caltrans for approval.

3.3 PIPELINE ALIGNMENT ALTERNATIVES

The proposed concept of mounting pipes to the Mountain View Avenue bridge structures appears to be the least costly option for crossing the Route 30 freeway and is recommended as the preferred freeway crossing alternative. With the pipeline crossing at this location, Mountain View Avenue would become the preferred roadway alignment for the remaining water pipelines (the common transmission pipeline as well as the pipeline dedicated to 17th Street Plant) from Baseline Road to the Waterman Plant.

East-West Header. A pipeline routing review was conducted in the field with the following findings for the east-west extraction well collection header:

- Baseline Road is a 4-lane major arterial with high traffic volumes, making construction potentially difficult for the extraction well system.
- The next street north of Baseline Road that could be used to construct the five well interconnection is 13th Street, which is a 2-lane facility with curb side parking on both sides of the street.

Transmission Main. A review of Mountain View Avenue as north/south route for the transmission main yielded the following observations:

- Mountain View Avenue is a 4-lane roadway from Baseline Road to 40th Street.
- Mountain View Avenue has a landscaped grass median dividing the 4-lane roadway from Highland Avenue north to Palmdale Drive.

- Mountain View Avenue is a collector street for intracity circulation of residential automobile traffic, having potentially low impact to traffic circulation during construction since there are many parallel north/south surface streets.

- The existing 17th Street Plant is approximately 650 feet east of Mountain View Avenue along 17th Street.

After crossing to the north side of the freeway, the following routes were investigated to complete the pipeline installation to the South Plant.

- 30th Street is a north side 4-lane freeway frontage road parallel to Route 30 and has potential for high traffic volumes, making pipeline construction difficult.

- The next major through-street north of 30th Street is Marshall Boulevard, a 4-lane collector street similar to Mountain View Avenue in traffic volume, which runs in an east/west direction.

- Leroy Street is a 2-lane roadway with curbside parking on both sides of the roadway and fronts the west side of the Waterman Plant at Horine Park.

- Waterman Avenue is a 4-lane major arterial roadway with a continuous left turn lane from Baseline to 40th Street and is the major roadway access to the Route 30/Waterman Avenue Interchange.

3.4 UTILITY IMPACT

One important criterion in the selection of a pipeline route was the impact of the proposed pipeline to existing underground utilities which, in this study, include water, sewer, and storm drains.

Based on as-built drawings provided by the SBMWD, there is a 12-inch diameter waterline on Mountain View Avenue and a 6-inch diameter waterline on Sierra Way from Baseline Road to Highland Boulevard. Both waterlines appear to be located on the southbound side of the street. These two water mains continue northward to Marshall Boulevard.

There are two existing gravity sewers in Mountain View Avenue and one in Sierra Way. One of the sewers in Mountain View Avenue is on the southbound side of the street and the other is on or near the centerline of the street. The sewer under Sierra Way is in the southbound side of the street.

There is no parallel storm drains under Mountain View Avenue. A major storm drain, known as the Virginia Street Storm Drain, is located under Sierra Way near the Highland Avenue intersection.

Since both Mountain View Avenue and Sierra Way are wide streets with relatively few parallel pipelines, and with both northbound lanes appearing to be open for any additional parallel pipeline, it is concluded that impact to existing underground utilities by the selected pipeline route is relative minor.

4.0 RECOMMENDATION

Based on our investigation as discussed in Section 3, our recommended pipeline route for this project is as follows:

- Interconnect the five well sites just north of Baseline Road into two pipeline headers along 13th Street.
- Connect the headers on 13th Street to two transmission pipelines constructed in the Mountain View Avenue roadway. These pipelines would be located on the northbound lane of Mountain View Avenue, with the smaller one (approximately 18-inch diameter) terminating at the existing 17th Street Plant, and the larger one (approximately 24-inch diameter) crossing Highland Avenue and proceeding under the median to Marshall Boulevard.
- At the Route 30 freeway crossing, split the 24-inch pipe into two smaller (approximately 18-inch diameter) pipes crossing the freeway, then rejoin north of the freeway into a 24-inch pipeline.
- At Marshall Boulevard, construct the 24-inch pipeline eastward to Leroy Street.
- At Leroy Street, construct the pipeline southward along Leroy Street to the northwest corner of the reservoir.
- At the northwest corner of the reservoir, construct the pipeline eastward, north of the reservoir. The water treatment facility expansion will be located north of the existing water treatment facility.

The proposed routing is shown on Figure 1.

5.0 SYSTEM PLANNING

For this project to be approved for construction, several agencies would need to review and approve the construction plan. The City of San Bernardino should review the design plans for traffic impacts during construction and potential utility impacts along the proposed route. Local utility agencies should be contacted for potential utility impacts. Caltrans needs construction plans to initiate its review process for approval of the pipeline crossing proposal. SBMWD will need to review the construction plans to assure their compliance to meet USEPA requirements for water utilization and distribution.

A Traffic Management Plan for traffic impact mitigation during construction should be developed and presented to the City for concurrence.

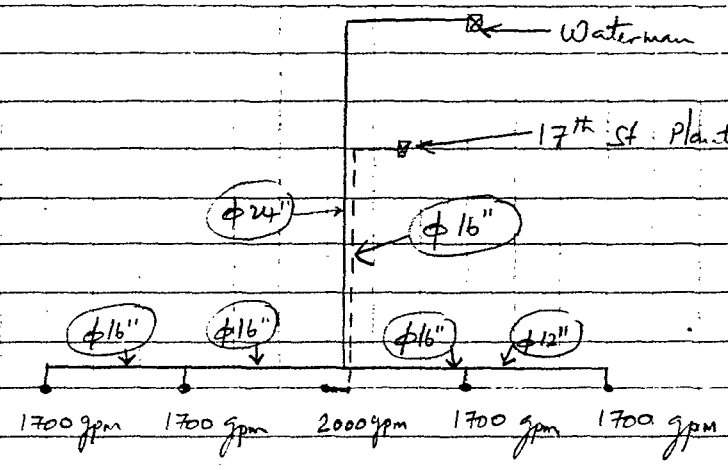
APPENDIX B

Design Calculations

URS Consultants, Inc.

Sheet No. 1/2
Calc No.
Rev. No. 1
By NN Date 5-29-97
Chk'd Date 6/11/97

Job no. 62370.60.20 Job Newmark - South
Client EPA
Subject Air Vacuum Valve Sizing for South Plant Pipe



Newmark South Wells & Pipeline

φ-12" Pipe Q = 1700 gpm x 1.1 ← 10% additional flow

= 1700 x 1.1 / 449 = 4.16 cfs

Collapsing Pressure $P = 12,500,000 \left(\frac{T}{D}\right)^3$ (P: psi; T, D: inch)

(from APCO Valve Catalog 726, 1990)

PP 82

$= 12,500,000 \times \left(\frac{0.31}{12}\right)^3$

= 215.5 psi > working 5 psi

⟹ Select 2" Air & Vacuum Valve (APCO)

φ-16" Pipe

Q = 1700 x 1.1 gpm

= 4.16 cfs

⟹ Select 2" Air & Vacuum Valve (APCO)

URS Consultants, Inc.

Sheet No. 2/2
Calc No.
Rev. No. 1

Job no. _____ Job Newmark - Smith
Client EPA
Subject Air Vacuum Valve Sizing for 8m = 12best Pipe

By NN Date 5-29-97
Chk'd [illegible] Date 6/11/97

$Q = (1700 + 1700) \times 1.1$ gpm

$= 8.32$ cfs

⟹ Select 2" Air & Vacuum Valve (APCO)

Φ-24" Pipe

$Q = (1700 + 1700 + 1700 + 1700) \times 1.1$ gpm

$= 16.64$ cfs

$P = 12,500,000 \left(\frac{T}{D}\right)^3$

$= 12,500,000 \left(\frac{0.38}{24}\right)^3$

$= 49.62$ psi

use 5 psi

⟹ Select 3" Air & Vacuum Valve (APCO)

URS Consultants, Inc.

Sheet No. 1/3
Calc No.
Rev. No. 1

Job no. _____ Job Newmark - South
Client EPA
Subject Pipe Sizing — South (Waterman) Plants at 17th Street
By NN Date 5-29-97
Chk'd [signature] Date 6/11/97

In ϕ-12" (DI Pipe - Class 50)

$Q = 1,700 \times 1.1$ gpm (10% additional flow) $= 1870$ gpm

From DI Pipe Hand Book, ϕ12": Pipe thickness = 0.31" OD = 13.20"

$\therefore$ ID $= 13.20 - 2 \times 0.31 = 12.58$"

Velocity in Pipe:

$$V = \frac{Q}{\pi D^2/4} = \frac{1700 \times 1.1 \times (0.13368 \times \frac{1}{60})}{\frac{\pi}{4}\left(\frac{12.58}{12}\right)^2} = 4.83 \text{ ft/s}$$

(gpm; ft³/gallon; m/s; ft)

Head Loss in Pipe:

$$H = 10.44 \times \frac{Q^{1.85}}{C^{1.85} \times D^{4.865}}$$

(Hazen-William Formula)

Q - gpm
D - inch
H - Headloss in ft per 1 foot long pipe
C = 120

$\Rightarrow H = 7.50 \times 10^{-3}$ ft

$\therefore$ Head Loss Per 1000 ft Pipe = 7.50 ft

URS Consultants, Inc.

Sheet No. 2/3
Calc No.
Rev. No. 1

Job no. _____ Job Newmark - Smith
Client EPA
By NN Date 5-29-97
Subject Pipe Sizing - Smith (Waterman) Plants. 17th Street
Chk'd DHW Date 6/11/97

Dn ϕ-16" (DI Pipe - Class 50)

10% additional capacity

I $Q = 1700 \times 1.1$ gpm

From DI Pipe Hand Book, ϕ16": Pipe Thickness = 0.34" OD = 17.40"

$\therefore$ ID = 17.40 - 2 x 0.34 = 16.72"

$$V_T = \frac{(1700 \times 1.1) \times (0.13368 \times \frac{1}{60})}{\frac{\pi}{4}\left(\frac{16.72}{12}\right)^2} = 2.73 \text{ ft/s}$$

$$H_1 = \frac{10.44 \times (1700 \times 1.1)^{1.85}}{120^{1.85} \times 16.72^{4.8655}} = 1.88 \times 10^{-3} \text{ ft}$$

$\therefore$ Head Loss Per 1000 ft Pipe = 1.88 ft

10% additional flow

II $Q = (1700 + 1700) \times 1.1$ gpm

$$V_T = \frac{(3,400 \times 1.1) \times (0.13368 \times \frac{1}{60})}{\frac{\pi}{4} \times \left(\frac{16.72}{12}\right)^2} = 5.47 \text{ ft/s}$$

$$H = \frac{10.44 \times (3400 \times 1.1)^{1.85}}{120^{1.85} \times 16.72^{4.8655}} = 6.77 \times 10^{-3} \text{ ft}$$

$\therefore$ Head Loss Per 1000 ft pipe = 6.77 ft

III $Q = 2000 \times 1.1$ gpm

$$V_T = \frac{(2000 \times 1.1) \cdot (0.13368 \frac{1}{60})}{\frac{\pi}{4} \times \left(\frac{16.72}{12}\right)^2} = 3.22 \text{ ft/s}$$

$$H = \frac{10.44 \times (2000 \times 1.1)^{1.85}}{120^{1.85} \times 16.72^{4.8655}} = 2.54 \times 10^{-3} \text{ ft}$$

$\therefore$ Head Loss Per 1000 ft pipe = 2.54 ft

URS Consultants, Inc.

Sheet No. 3/3
Calc No.
Rev. No. 1

Job no. _____ Job Newmark - South
Client EPA
Subject Pipe Sizing - South (Waterman) Plains 12" Sheet
By NN Date 5-29-97
Chk'd [illegible] Date 6/11/97

In ϕ - 24" (DI Pipe - Class 50)

$Q = (1700 + 1700 + 1700 + 1700) \times 1.1$ gpm ← 10% additional flow

From DI Pipe Hand Book, ϕ 24": pipe thickness = 0.38" OD = 25.80"

$\therefore ID = 25.80 - 2 \times 0.38 = 25.04"$

$$v = \frac{(6800 \times 1.1) \times (0.13368 \times \frac{1}{60})}{\frac{\pi}{4} \times \left(\frac{25.04}{12}\right)^2} = 4.87 \text{ ft/s}$$

$$H = 10.44 \times \frac{(6800 \times 1.1)^{1.85}}{120^{1.85} \times 25.04^{4.8655}} = 3.42 \times 10^{-3} \text{ ft}$$

$\therefore$ Head Loss Per 1000 ft Pipe = 3.42 ft

IN ϕ = 24"

$Q = (1700 + 1700 + 1700) \times 1.1 = 5610$

$$v = \frac{(5610) \times (0.13368 \times 1/60)}{\frac{\pi}{4} \times \left(\frac{25.04}{12}\right)^2} = 3.066 \text{ ft/sec}$$

$$H_L = \frac{10.44 \times (5610)^{1.85}}{120^{1.85} \times 25.04^{(4.8655)}} = 2.01$$

IN ϕ = 20"

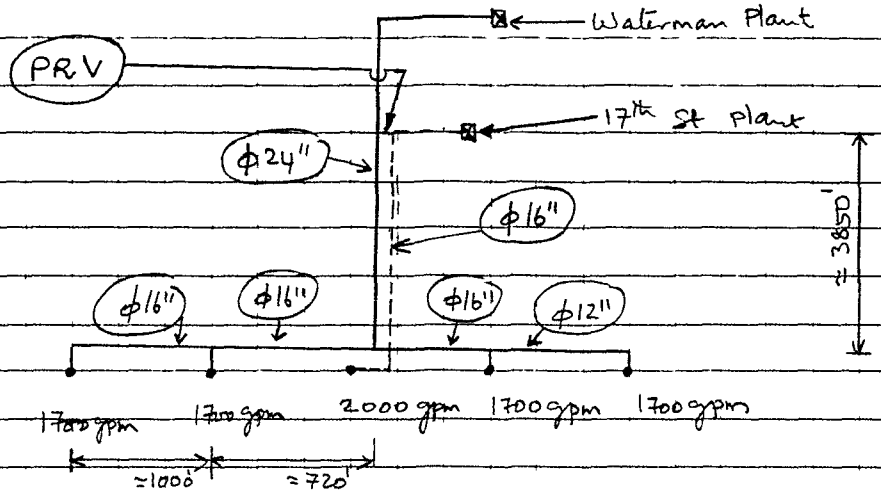
$$v = \frac{5610 \times (0.13368 \times 1/60)}{\frac{\pi}{4} \times \left(\frac{20.88}{12}\right)^2} = 5.27$$

$$H_L = \frac{10.44 \times (5610)^{1.85}}{120^{1.85} \times (20.88)^{4.8655}} = 4.861$$

URS Consultants, Inc.

Sheet No. 1 | 2
Calc No.
Rev. No. 1

Job no. _____ Job Newmark South
Client EPA
By NN Date 5-29-97
Subject Pressure Reduction Valve (PRV) - South Plant (24" to 16") Chk'd _____ Date 6/11/97



Newmark South wells & Pipeline

17th Street Plant :

Head in ϕ-16" at PRV Location = pumping head, h_p + Frictional Headloss + elevation head + Headloss at treatment Plant

$$= h_p + \left[3850 \times \frac{2.54}{1000}\right] + [1140 - 1090] + 60'$$

$$= h_p + 120' \text{ ft}$$

Waterman Plant :

Head in ϕ-24" at PRV Location = pumping head, h_p + Frictional Headloss + elevation head + Headloss at treatment plant.

$$= h_p + \left[1000 \times \frac{1.88}{1000} + 720 \times \frac{6.77}{1000} + 3850 \times \frac{3.42}{1000}\right] + [1250 - 1090] + 60'$$

URS Consultants, Inc.

Sheet No. 2/2
Calc No.
Rev. No. 1

Job no. _____ Job Newmark - South
Client EPA
By NN Date 5-29-97
Subject Pressure Reduction Valve (PRV) - South Plant (24 to 16')
Chk'd [illegible] Date 6/11/97

$\approx$ hp + 240 ft

∴ Pressure Differential Across PRV

$= (hp + 240)' - (hp + 120)$ ft

$= 120$ ft

$\approx$ 52 psi

⟹ Select CAV = 2" APCO No. 145C
3" APCO No 147C