

**Location:** City of Brentwood, California  
West Sanitary Interceptor Project

**Date Performed:** December 1990

**Type of Pipe:** 36" Spirolite HDPE Pipe

**Depth of Burial:** 20 ft.

**Amount of Deflection:** up to 14.8%

**Length of Rerounding:** 764 ft.

**Attached References:**

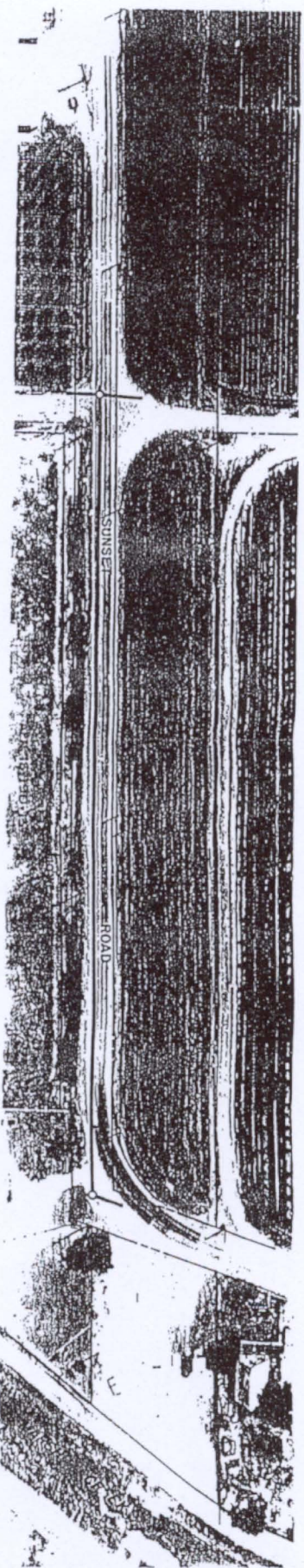
Plan sheet of project with plan note (2 sheets)

Excerpts from evaluation report from Robert Miles, consultant to City of Brentwood

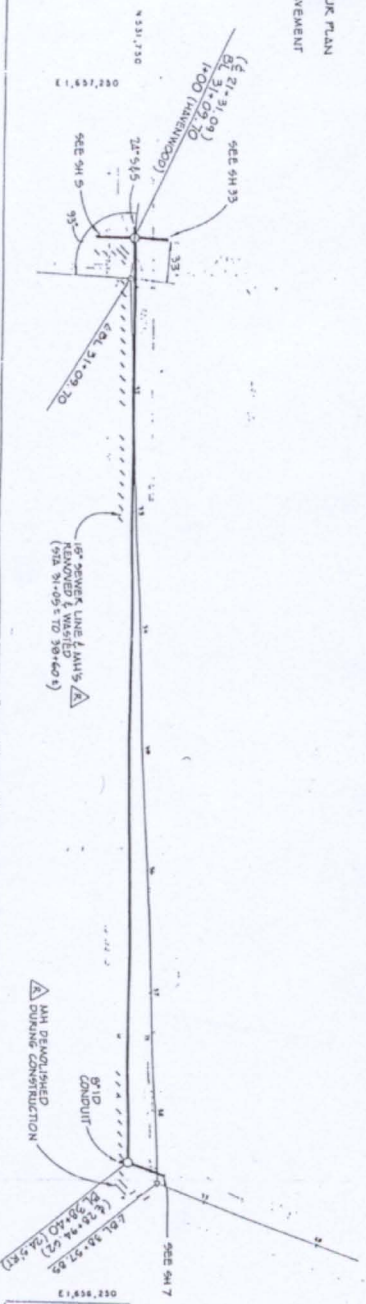
- This project was used as a demonstration of the Rerounding™ process to the City of Brentwood
- Mr. Miles's report gives the background of their deflection situation.
- Mr. Miles's report indicates that the pipe was "uniformly circular, with no noticeable deflection" after the Rerounding™ process."

In a telephone conversation with Mr. Miles in 2000, he indicated that the pipe still passed the required deflection test as recent as 1998.



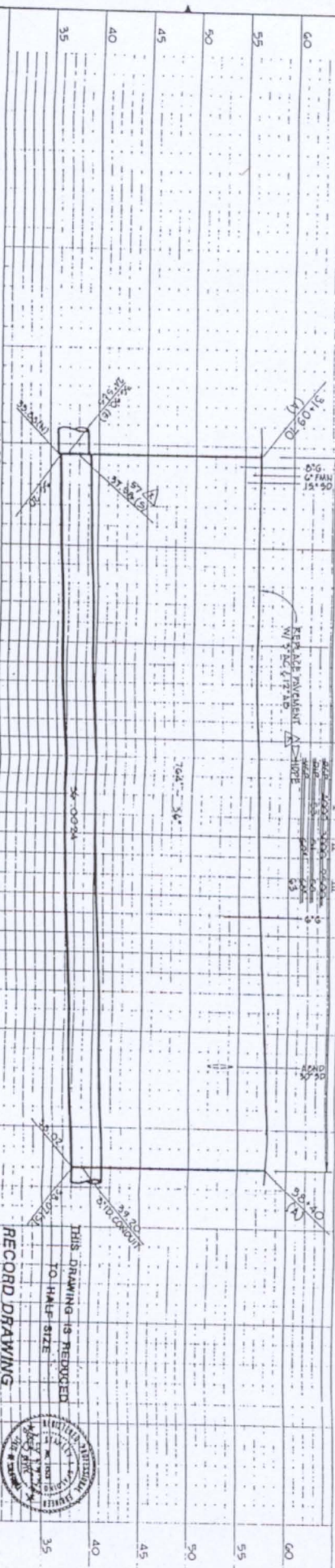


NOTES:  
 1 SEE 541 3 FOR DETOUR PLAN FOR SUNSET ROAD  
 2 PROVIDE TEMPORARY PAVEMENT ON SUNSET ROAD



NOTE:  
 1. MAN 518 31-31 & 38-38 ARE INSTALLED 30\"/>

PLAN NOTE



THIS DRAWING IS REDUCED TO HALF SIZE  
 RECORD DRAWING



|          |             |                        |                           |                |              |
|----------|-------------|------------------------|---------------------------|----------------|--------------|
| SCALE    | DATE        | DESIGNED BY            | SUBMITTED BY              | DRAWING NUMBER | SHEET NUMBER |
| 1" = 30' | AUGUST 1969 | J.S.                   | J.S.                      | 6 OF 36        | 6 OF 36      |
| FILE     | PROJECT NO. | RECOMMENDED BY         | APPROVED BY               |                |              |
| 89-33    | CHECKED 523 |                        |                           |                |              |
|          |             | DEWANTE AND STOWELL    | CITY OF BRENTWOOD         |                |              |
|          |             | CONSULTING ENGINEERS   | MARSH CREEK TRUNK         |                |              |
|          |             | SACRAMENTO, CALIFORNIA | WEST SANITARY INTERCEPTOR |                |              |
|          |             |                        | STA 31+10 TO 38+40        |                |              |

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**CITY OF BRENTWOOD**

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***WEST SANITARY INTERCEPTOR  
EVALUATION AND RESOLUTION OF  
CONSTRUCTION PROBLEMS***

April 1994

**ROBERT W. MILES**  
CONSULTING CIVIL ENGINEER

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CONSULTING CIVIL ENGINEER

RCE 20595

Mr. David W. Bryan  
Public Works Director  
City of Brentwood  
708 Third Street  
Brentwood, CA 94513

April 15, 1994

Subject: West Sanitary Interceptor  
Evaluation and Resolution of  
Construction Problems

File: 2.0100

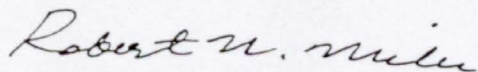
Dear Mr. Bryan:

This report contains the results of my work on evaluation and resolution of the construction problems of the West Sanitary Interceptor. The first draft was submitted on November 23, 1993. Since that time the staffs of the Public Works Department and the City Manager's office have reviewed the original and subsequent drafts of the report and have contributed many helpful suggestions.

Based upon the work, two alternative courses of action are available for implementation. Each alternative varies greatly in cost, required facilities, and implementation schedule. The following Executive Summary presents a brief summary of the report. Section 5 contains detailed descriptions of the alternatives, an evaluation of the alternatives, and recommendations.

I am very thankful to have been able to work closely with the City staff during the study. Each person has been very responsive to my many probing questions and requests for documents, observations, and other information. In particular, Messrs. Chuck Vosicka, Carrol Elkins, Lu Schrader, and yourself have been very helpful. In addition, I would like to acknowledge the contributions from the firms of Dewante and Stowell, Nolte and Associates, and Chevron Spirolite. These firms have provided photographs, documents, technical information, and personal descriptions and accounts that have been very useful.

Very truly yours,



Robert W. Miles

925-634-9716

## EXECUTIVE SUMMARY

This executive summary provides a brief overview of the report that follows. The report is divided into sections that address each major element of the investigation and analysis work.

### DESIGN PHASE.

The work done during the design phase set the stage for several problems that became evident during and after construction. The project geotechnical report contained text that was ambiguous in places and it is unclear how some of the conclusions and recommendations were derived from the exploratory borings. Recommendations for jetting of backfill were in contrast to the practices of many municipalities and public agencies. As an example, at the time that the design work was being completed the City was in the process of changing the public works standards to prohibit jetting of pipeline trench backfill. This change was being made due to unsatisfactory results on projects within the City.

Pipe material selections were made and specified that could only be successfully implemented with special design considerations. For example, the design safety factors for vitrified clay pipe and high density polyethylene pipe were low, and both of these materials would have required special requirements and extreme care during installation.

As a result of the factors above, the design trench sections did not reflect the probable excavation conditions at many locations and the pipe subsequently chosen by the contractor had a relatively low factor of safety for deflection.

### CONSTRUCTION PHASE

The pipe selected by the contractor for installation was the high density polyethylene pipe. The construction phase was typified by difficult soil conditions, lack of adequate compaction for the pipe embedment backfill, lack of effective compaction control procedures, and difficulty in achieving the deflection criteria for the high density polyethylene pipe.

The experience since the completion of construction has been occurrence of excessive pipe deflection at many locations, settlement of the pipe trench backfill that has required an ongoing program of repair work, and discovery of a pipeline grade break at the Highway 4 crossing of the Marsh Creek Trunk.

## **ANALYSIS AND RECOMMENDATIONS**

Analysis of the deficiencies has resulted in identification of their effects upon the flow capacity, structural performance, service life, reliability, and the maintenance burden of the pipeline system.

After consideration of the probable effects of the deficiencies, a strategy for resolution of the construction problems has been formulated. The strategy consists of a pipe rerounding program, a continuation of the trench recompaction work, some excavation and rerounding of the pipelines, and repair of the grade break at Highway 4. The capital cost of the recommended strategy will be approximately \$1,000,000. The strategy is a proactive approach designed to prevent a more costly series of repairs if the deficiencies are not corrected.

It should be emphasized that before any action occurs, additional investigation and research must be done to supplement this preliminary evaluation. This additional work should include a deflection survey for the entire pipeline system and a preliminary design report.

### **Balfour Road Trunk**

The Balfour Road Trunk had sandy and caving excavation conditions at many locations along the pipeline, according to the field reports. It is not possible to determine the conditions at each location along the pipeline due to lack of such specific information in the field reports. The field reports also note a lack of compaction effort for the pipe zone backfill materials. At approximately Station 40+00 the inspector's entry reads "contractor planned to use re-rounder," to correct a section of pipe that had overdeflected due to poor compaction.

### **Sand Creek Trunk**

The Sand Creek Trunk had sandy and caving excavation conditions at several locations along the pipeline, but according to the construction manager the pipe trenches were excavated with vertical walls. The available photographs were taken at locations where the excavations had vertical sidewalls and relatively stable conditions.

### **Soil Compaction Test Records**

The project soil compaction test records have been reviewed for the test results and locations of the tests. The test results appear to be in compliance with the specifications, and where compaction tests failed, the necessary retests appeared to be the subject of follow-up action by the inspectors. One significant problem has been revealed by a plot of test locations on the pipeline profile drawings. Of the test locations plotted, only a few were as close to the top of the pipe as four feet. Most of the test locations were at least seven feet above the top of the pipe. This pattern of compaction testing resulted in no information about the degree of compaction within the pipe zone backfill material. Adequate compaction of the pipe zone material is extremely critical to the structural support of the very flexible high density polyethylene pipe. Inadequate compaction within the pipe zone is a cause of increased pipe deflection.<sup>10</sup>

### **Change Orders**

A review of the project change orders indicates that none of the change orders were likely to affect the performance of the pipe or be a source of construction problems.

### **Pipe Deflection Tests**

During construction, pipe deflection measurements were taken during the initial stage of construction, for the Marsh Creek Trunk, from Stations 1+06 to 28+95. Thereafter, compliance with the specified deflection limits was confirmed by using

a mandrel. The specification required that the pipe deflection measured at least 30 days after completion of backfill be no more than 5 percent.

Only deflection measurements between the manholes at Stations 2+03 to 9+11, 14+69 to 21+31, and 21+31 to 28+94 could be found in the documentation. The segment between manholes at Stations 2+03 and 9+11 had pipe sections with deflections less than 5 percent, except for two sections of pipe between Stations 5+45 and 5+85. These two sections had deflections of approximately 6 percent.<sup>21</sup> These two sections were excavated and the backfill reinstalled at a later date. During the original installation, the inspector had noted that the native material had been mixed with the crushed rock pipe zone material at this location.

The segment between manholes at Stations 21+31 and 28+94 had pipe sections with deflections of up to 14.8 percent. All but six sections of pipe had at least one measurement with a deflection greater than 5 percent.<sup>22</sup> This pipeline segment had the most adverse excavation and pipe installation conditions during construction, as noted above in the paragraph "Pipe Trench Conditions and Pipe Installation." In December of 1990 this segment was re-rounded by the contractor with a pneumatic-type pipe rerounding machine. Records from a television inspection performed as part of the rerounding operations<sup>23</sup> indicate that the pipeline had several leaks at the joints prior to the rerounding work. During the rerounding process the joint leaks apparently stopped flowing. This preliminary conclusion inferred from the records should be confirmed by a viewing of the television tapes as part of additional investigative work. If it is confirmed that the over-deflection of the joints resulted in leaks this would be important information about the potential consequences of deflection in the rest of the pipeline system.

The project documentation shows that all pipelines passed the required mandrel tests<sup>24</sup> using a 5 percent mandrel.

### Pipeline Grade Measurements

The project construction documentation contains no records of pipeline grade measurements, except for the casing under the railroad tracks for the Marsh Creek Trunk, Station 93+50. At this location, the pipeline was anticipated to be installed at an elevation 0.12 feet higher than design. The pipeline design grade was changed upstream of the casing to accommodate the elevation of the pipeline at Station 93+50.

### REVIEW OF POST-CONSTRUCTION WORK

Since the end of construction work a significant amount of effort and expense has

been required for investigative and corrective work for the West Sanitary Interceptor. This paragraph summarizes this post-construction work.

### **Pipe Television Inspection and Deflection Survey - First Phase**

As part of the project warranty inspection, the City engaged a firm to provide television inspection and deflection surveys<sup>25</sup> of the pipeline system. This work was conducted in two phases. The first phase was performed on the Marsh Creek Trunk between Stations 1+06 and 49+06 and on the Balfour Trunk between Stations 16+80 and 63+95 in May and June of 1992. The first phase consisted of television inspection only, and no deflection instrumentation was used. However, from the videotapes of the Marsh Creek Trunk it is possible to observe approximate deflection measurements from a visual deflectometer that was pulled ahead of the camera.

#### **Marsh Creek Trunk, Stations 1+06 to 49+06**

The portion between Stations 2+03 and 9+11 has several locations at pipe joints with deflections of up to approximately 8 percent. Except for these deflected locations the pipe appears to be reasonable round, probably between 0 and 5 percent deflection. The portion between Stations 9+11 and 14+69 appears to be in approximately the same status as downstream, with maximum deflections less than 8 percent, but in general, less deflection at the joints. In the portion between Stations 14+69 and 21+31 no extreme deflections were noted, but almost all of the pipe joints are deflected more than the body of the pipe. The portion between Stations 21+31 and 28+95 was re-rounded during construction, and appears to be uniformly circular, with no noticeable deflection. The portion between Stations 28+95 and 43+00 was installed within sheetpile excavations and casings, but Stations 35+67 to 40+28 were not included in the television inspection. The portion available on the videotape record appears to have minimal deflection, with no systematic deflection at the pipe joints. Two isolated locations appear to have a deflection of about 5 or 6 percent.

#### **Balfour Road Trunk, Stations 16+80 to 63+95**

The videotape record indicates that the Balfour Road Trunk is free from excessive deflection, and the deflection at the joints is not noticeably greater than the deflection of the rest of the pipeline. Since the Balfour Road Trunk was television inspected without any visual deflectometer, it is not possible to estimate the deflections encountered in the pipeline.