

BLACK & VEATCH CORPORATION

TECHNICAL MEMORANDUM

**Fountain Sanitation District
Master Plan Enhancement Study
Task 400 – Hydraulic Model Update and Analysis;
Valley Ranch and Christian Ranch Sewer Extensions**

**B&V Project 137033
November 22, 2004**

To: Jim Heckman
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Introduction

After the completion of the June 2003 Master Plan additional areas of possible inclusion into the District's service area have been considered. These areas are southeast and southwest of the current District service area and would significantly increase the area served by the District. An analysis was performed to determine the system impact of including these areas into the District Service area. The analysis includes both a year 2033 analysis for the Valley Ranch area and a build out analysis of both areas. The analysis was completed assuming that all the flows from the development areas will be discharged to the existing WWTP location. The growth areas and the Implementation Plan from the June 2003 report are shown in Figure 2-1. The results of the analysis are discussed below.

Valley Ranch Development

The Valley Ranch Development is a development southeast of the existing service area. The District provided a copy of the information they have received showing the location and types of land uses for the proposed Valley Ranch Development. The location of the development is shown on Figure 2-1 (The northern boundary was manipulated to alleviate area redundancy with FSD's current service area). The total proposed area for development is 2,793 acres with an estimated population of 57,854 people and with 628 acres of the development being used for commercial and industrial development. Approximately 17% of the area will be fully developed by the year 2033.

Christian Ranch Development

The Christian Ranch Development is a development west southwest of the existing service area. The District provided a map highlighting the location of the proposed Christian Ranch Development. The location of the development is shown on Figure 2-1. The total proposed area for development is 2,920 acres with all the area proposed for industrial uses.

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Extension Sewers

For the Valley Ranch development, three primary interceptor sewers were laid out to service the area at build out. The sewers generally follow Jimmy Camp Creek Road, Powers Boulevard and the eastern edge of the development. Due to the features of the area, all three sewers were routed towards the south to a common point just south of Birdsall Road. This will allow for the construction of a pump station and force main to convey the flows to the existing wastewater treatment plant or allow flows to be carried further south in a single sewer to a proposed regional wastewater facility. For the Christian Ranch development four primary interceptor sewers were laid out to service the area. Due to the features of the area, all the sewers were routed towards the southeast corner of the development to a common point along the Little Fountain Creek. This will allow for the construction of a pump station and force main to pump the flows to the existing wastewater treatment plant or the proposed regional wastewater treatment facility. It may be possible to construct a gravity sewer from the Christian Ranch outlet to the proposed treatment facility.

Ground elevations for manholes in the extensions were estimated from the USGS quadrangle map. Slopes able to achieve self-cleansing velocities for the extensions were generated without unreasonable sewer depths.

Flow Development

Included in the Valley Ranch Development notes that were provided to Black & Veatch was information that had the development divided into 21 separate areas. All 21 of the areas were entered into the model for the build out conditions. Acres, population, and unit wastewater flow were taken from a table supplied in the documents and a copy of the table is attached as Appendix 2-A. It was determined that this information was more specific and detailed than the design curve from the June 2003 report, so the information supplied in the table was used for developing the build out flows. The infiltration and inflow parameters used for the flows were taken out of the June 2003 report.

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Growth for Valley Ranch by 2033 was assumed to be in the North and Northwest area of the Development. A total of 11 separate areas were assumed to have growth. These areas included a mix of neighborhood commercial, regional commercial, residential, and governmental and are roughly outlined on Figure 2-1. The total acres and infiltration for these areas were included as flow parameters, but the population equivalents were adjusted to match the ADDF of 0.848 mgd at 2033. This flow estimate was provided by the District and a copy is attached as Appendix 2-B.

The Christian Ranch Development was entered into the model as an industrial development. The acreage for the development was estimated from the approximate boundary as shown on Figure 2-1. The wastewater production (average daily dry weather, ADDF) flows, infiltration and inflow for this area for the analysis was taken out of the 2003 Master Plan flow design curve for Planned Industrial areas. A 5-year rainfall event was used for this analysis which is consistent with the 2003 Master Plan.

A summary of the flows used for the analysis is presented in Table 2-1.

| Table 2-1 Design Flow Projection Summary | | | | | | | | |
|---|--|----------------------------|-----------------------|---------------------------|--|-------------------------------|---------------------------------|--------------------------------------|
| Develop- ment | Total Sewered Population Equivalent | Developed Acres | ADDF (mgd) | Peaking Factor | Peak Daily Flow (mgd) | Infiltration (mgd) | Inflow (1) (mgd) | Design Flow (1) (mgd) |
| Year 2033 | | | | | | | | |
| Valley Ranch | 13,016 | 875 | 0.848 | 1.33 | 1.13 | 0.18 | 2.73 | 4.04 |
| Build-out | | | | | | | | |
| Valley Ranch | 78,265 | 2,793 | 6.26 | 1.33 | 8.34 | 0.56 | 8.35 | 17.25 |
| Christian Ranch | 53,436 | 2,920 | 3.65 | 1.00 | 3.65 | 0.58 | 6.67 | 10.91 |
| Build-out Total | 131,701 | 5,713 | 9.91 | 1.21 (2) | 11.99 | 1.14 | 15.02 | 28.15 |
| (1) Inflow and Design flow are projected peak flows for a 5-year storm event. | | | | | | | | |
| (2) Calculated from totals of Peak Daily Flow and ADDF. | | | | | | | | |

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Sewer Sizing and Estimated Cost

Pipe, pump station, and force main unit costs from the June 2003 Master Plan report were used to generate cost estimates for serving the two development areas. The design criteria used in the June 2003 report was used to determine the sizes of the extension sewers and facilities. A summary of the extension sewers and facilities that would be required to serve the development areas is presented in Table 2-2. The sizes and costs for the year 2033 analysis are the minimum required to serve the area until 2033. If these are the sizes installed then near year 2033 larger facilities will need to be installed to handle the continued growth of the area. The total capital cost for the Valley Ranch Development at build out conditions is \$17.71 million and the total capital cost for the Christian Ranch Development is \$10.16 million for a total capital cost of \$27.87 million at build out conditions. A detailed listing of the extension sewers and construction costs are attached as Appendix 2-C.

| Table 2-2 | | | | |
|---|--------------------|-------------|--|---|
| Extension Sewers and Facilities Cost | | | | |
| Improvement | Length (ft) | Size | Probable Construction Cost (\$ million) | Probable Capital Cost (1) (\$ million) |
| Year 2033 | | | | |
| Valley Ranch Development | | | | |
| West extension | 17,237 | 8 – 21 in | 2.10 | 2.94 |
| North extension | 14,688 | 8 in | 1.33 | 1.87 |
| Pump station | - | 3.62 mgd | 1.29 | 1.80 |
| Force main | 26,942 | 16 in | 1.52 | 2.13 |
| Year 2033 Total | | | 6.24 | 8.74 |
| Build-Out | | | | |
| Valley Ranch Development (2) | | | | |
| East extension | 17,455 | 15 – 30 in | 2.28 | 3.19 |
| West extension | 17,237 | 12 – 24 in | 2.30 | 3.22 |
| North extension | 14,688 | 8 – 24 in | 1.88 | 2.63 |
| Pump station | - | 17.0 mgd | 3.31 | 4.64 |
| Force main | 26,942 | 30 in | 2.88 | 4.03 |
| Sub-Total | | | 12.65 | 17.71 |

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| Christian Ranch Development | | | | |
|-----------------------------|--------|------------|--------------|--------------|
| South extension | 2,938 | 12 in | 0.24 | 0.34 |
| West extension | 8,468 | 10 – 24 in | 0.82 | 1.15 |
| Northwest extension | 11,212 | 8 – 18 in | 1.02 | 1.43 |
| Northeast extension | 10,520 | 10 – 18 in | 0.95 | 1.33 |
| Pump station | - | 11.0 mgd | 2.58 | 3.61 |
| Force main | 19,408 | 24 in | 1.64 | 2.30 |
| Sub-Total | | | 7.25 | 10.16 |
| Build-Out Total | | | 18.92 | 27.87 |

(1) Capital cost includes 40% for legal, engineering and contingency costs.
(2) Valley Ranch build-out costs assume construction of Year 2033 sewers has not occurred.

Impact on Existing WWTP

The maximum flow to the existing wastewater treatment facility from the 2003 Master Plan from a 5-year rain event is projected to be 24.7 mgd. The maximum flow to the extension pump station from the build-out conditions of the Valley Ranch Development is projected to be 17.0 mgd. The maximum flow to the extension pump station from the build-out conditions of the Christian Ranch Development is projected to be 11.0 mgd. With the additional flow from the Christian Ranch Development and the Valley Ranch Development, the maximum flow at the existing wastewater treatment facility is projected to be 49.6 mgd.

Possible New WWTP

After the completion of the above analysis it was indicated that the District has committed to the addition of treatment capacity through the Lower Fountain Metropolitan Sewage Disposal District (LFMSDD). Currently, LFMSDD has property along Birdsall Road that may be used as the location of a second treatment plant. If this property is used for a second treatment plant then the costs for Valley Ranch will be reduced by approximately the cost of the pump station and force main. The cost of Christian Ranch will also be reduced since a shorter force main will be required to reach the second treatment plant.