4.0 ALTERNATIVES UNDER CONSIDERATION

Alternatives under consideration for this Project are defined by the alignment and construction method (alternative = alignment + construction method).

4.1 CONSTRUCTION METHODS

The three construction methods for consideration in this EIR are: (1) Cut-and-cover, (2) Micro-tunneling (or “boring”), which are proposed for optional alignments as described below, and (3) Continuous large-diameter (or “mined”) tunneling, which is described below as an alternative means of constructing the sewer. Each method provides both benefits and issues of concern for the project. For example, while open trench with micro-tunneling construction costs less, mined tunneling would eliminate the majority of traffic and parking impacts to residential areas both north and south of the channels in Venice and can facilitate mitigation of other impacts such as noise and visual aesthetics.

4.1.1 Cut-and-Cover Construction

Cut-and-cover construction is a very common method of linear pipeline construction and replacement. The contractor would not start work in all areas on a site at the same time, but rather would proceed with finishing and restoring relatively short segments at a time. Underground utilities that conflict with the construction would be temporarily relocated as necessary.

For the purpose of this EIR, it is assumed that the 54-inch pipe would be placed on a 1-foot gravel bed on top of a 1-foot concrete mud slab placed at the bottom of an approximately 8-foot wide and 12-foot deep trench. A shoring-installation crew would get a head-start driving sheet piles approximately 200 to 300 feet in front of the pipeline crew. The latter would excavate approximately 80 feet of trench every day and pour the mud slab. The next day, 80 feet of pipe would then be installed and backfilled. This approach would yield an effective production rate of about 40 feet of completed pipe installation per day (i.e., 200 feet per week). Subsequent to pipe installation, a third crew would extract shoring, restore curbs and utilities, and repave about 600 feet of roadway every 3 weeks. With this approach, major construction activities could be limited to within relatively short segments of about 1,000 feet at any given time (Figure 4.1-1, Cut-and-Cover Construction).

4.1.2 Small-Diameter Micro-Tunneling (Boring)

Boring is a trenchless construction method, which utilizes hydraulic jacks to push pipes through the ground behind a remotely operated TBM. Drive lengths are generally limited to about 1,000 feet, depending upon ground conditions and pipe size; but intermediate jacking stations can be used to extend the drive length. Unlike conventional trenching techniques that require excavation for the entire length of pipeline, excavation for tunneling is limited to the endpoints of each drive at designated launching (jacking) and receiving pits. The launching pit contains the hydraulic jacks used to push the pipes, and the receiving pit is used to recover the TBM at the end of each drive. Tunneling can proceed intermittently; although, it is often necessary to proceed continuously, particularly on long drives through sticky soils, to prevent the pipe from getting stuck short of the receiving pit. Tunnel advance rates are typically between 30 and 50 feet per 8-hour work shift, depending on soil conditions and pipe size.
The tunnel face is supported by a thick liquid (“slurry”), which is a mixture of the excavated soil (“muck”) and bentonite (a natural clay mineral). Keeping the slurry pressurized in a closed chamber behind the cutter-head of the TBM prevents groundwater and excess soil material from entering the TBM. This minimizes tunneling-induced ground settlements and associated damage to existing utilities and buildings along the tunnel alignment. A mixture of the excavated muck and slurry is pumped from the TBM to a slurry-processing plant on the surface, where soil particles are extracted from the slurry with vibrating screens and cyclones. The extracted soil is hauled away for disposal off-site, and the cleaned slurry is pumped (recycled) back to the TBM. The slurry-processing plant, remote control cabin for operating the TBM, as well as cranes and other construction equipment, are located near the jacking pit. The equipment setup is site specific, depending on available space. The jacking pipe, which is made of reinforced concrete or steel, serves as a temporary tunnel liner. Upon completion of the tunnel drive, the carrier pipe will be inserted and the space between it and the jacking pipe will be filled with grout.

4.1.3 Large-Diameter (Mined) Tunneling

In contrast to small-diameter micro-tunnels, which are constructed by remote-controlled TBMs and pipe-jacking, large-diameter tunnels (i.e., minimum excavated diameter = 10 to 12 feet) can be constructed with manned TBMs. The most important difference between these larger TBMs and the micro-tunneling machines discussed above is that the tunnel liner can be erected in segments immediately behind the TBM. This type of tunnel liner does not need to be continuously pushed (jacked) forward, and there is no length limitation due to frictional resistance building up with increasing tunnel length. For tunneling below the groundwater level without the need for dewatering, pressurized-face TBMs are used to stabilize the tunnel face and prevent the water from entering the TBM. There are two basic types of these machines: (1) Slurry TBMs and (2) Earth Pressure Balance (EPB) TBMs.

Both types of TBMs use pressurized muck to stabilize the tunnel face. The liquidized muck in Slurry TBMs is pumped in the same manner as described above for micro-tunneling. In contrast, the muck in EPB TBMs is more solid (“toothpaste-like”). Therefore, it is extracted from the face chamber of the TBM by means of a screw conveyor and then transported out of the tunnel by muck cars on rails or with a belt conveyor.

4.2 Cut-and-Cover Alignment Alternatives

The City’s objectives can be achieved by any one of several proposed construction alternatives under consideration in this section. During the course of this study and analysis, the cut-and-cover method of construction for two of the alignments proposed as alternatives to this project were “considered but determined to be not viable.” They are: The South Dockweiler Beach to Pacific Avenue cut-and-cover alternative and the Dockweiler Beach cut-and-cover alternative, as described below. For the purpose of this EIR, these alignment alternatives are described without extended detailed analysis and the reason for their rejection are described in Section 6.0 of this document (Figure 4.2-1, Alignment Alternatives Overview).
Marina Del Rey

Marquesas Way/Via Marina Way
From the existing VPP on Hurricane Street, the alignment would proceed east under the Grand Canal and along Marquesas Way, then southeasterly on Via Marina to the Marina Del Rey entrance channel to a boring shaft. From there, the alignment continues south along Pacific Avenue and Vista Del Mar to the connection near Waterview Street. This alignment is about 10,400 feet long. The new 54-inch line would be constructed by boring tunneling under the Grand Canal, cut-and-cover along Marquesas, Via Marina Way and Pacific Avenue/Vista Del Mar, and boring tunneling approximately 1,800 feet to cross the Marina Del Rey Channel and Ballona Creek. This alternative route has an estimated construction cost of $46,700,000.

Venice

Pacific Avenue Alignment
From the pumping plant on Hurricane Street, the alignment would proceed westerly to Pacific Avenue, then turn southeast and proceed along Pacific Avenue, cross under the Marina Del Rey and Ballona Creek channels, and continue southeast within Pacific Avenue and Vista Del Mar to a junction structure under Vista Del Mar near Waterview Street. This alternative would be constructed by using the cut-and-cover method in the streets and tunneling beneath the channels. The approximate cost is $46,700,000.

Dockweiler Beach to Pacific Avenue Alignment
From the pumping plant on Hurricane Street, the alignment would proceed westerly to the existing 20-foot-wide sewer easement in Venice Municipal Beach and Dockweiler State Beach, then turn southeast and cross under the Marina Del Rey and Ballona Creek channels, and continue south within the Pacific Avenue and Vista Del Mar alignments to a junction structure under Vista Del Mar near Waterview Street. The cut and cover method of construction was initially considered for this alignment, however, due to the extensive number of impacts that it would impose along the beachfront, it was deemed not viable. The micro-tunnel method of construction is still an option for this alignment. The cost to micro-tunnel from Hurricane to the channel would be approximately $45,000,000.

Dockweiler Beach Alignment
From the pumping plant on Hurricane Street, the alignment would proceed westerly to the existing 20-foot wide sewer easement in Venice Municipal Beach and Dockweiler State Beach, then turn southeast and cross under the Marina Del Rey and Ballona Creek channels, and continue south along the Dockweiler Beachfront to a point west of the junction structure in Vista Del Mar near Waterview Street. From this point, the line runs easterly to the junction structure under Vista Del Mar near Waterview Street. The cut and cover method of construction was initially considered for this alignment, however, due to the extensive number of impacts that it would impose along the beachfront, it was deemed not viable. The micro-tunnel method of construction is still an option for this alignment. The cost to micro-tunnel from Hurricane to the tie in near Waterview in Playa Del Rey would be approximately $45,000,000.
Westchester/Playa Del Rey Alignment Alternatives

The alignment alternatives located in Westchester/Playa Del Rey are identified in the narratives above as the southern portion of the alignment descriptions and are located on Pacific Avenue/Vista Del Mar and on Dockweiler Beach respectively (Figure 4.2.1).

Channel Crossing

As noted in the alignment alternatives descriptions, each alignment under consideration crosses the Marina entrance channel and Ballona Creek, requiring approximately 1,800 feet of tunneling under the two channels. The location and alignment of the channel crossing will ultimately be determined by the chosen alternatives for the north and south portions of the overall sewer alignment.

Shafts and Laydown Areas

The shafts for the boring associated with the cut-and-cover alignments (that is, locations where construction equipment will be used on the surface and visible during the construction of the particular alignment) may be located at any of the following locations numbered from 4 to 12 respectively (Figure 4.2-2):

- #4 - 62nd Avenue at Pacific Avenue;
- #5 - The beach south of the Ballona Creek Channel;
- #6 - The beach at Waterview;
- #7 - Via Maria at Pacific Avenue;
- #8 - Marquesas Way at Via Marina;
- #9 - The beach at Hurricane Street;
- #10 - Hurricane at Canal Street;
- #11 - Hurricane at the Grand Canal; and
- #12 - Via Marina at the County surface parking lot.

Timelines for Cut-and-Cover/Boring Construction

Each method of construction will have temporary impacts to the immediate and surrounding vicinity of the chosen alignment. In an effort to provide accurate information regarding the length of time associated with these impacts, Table 4.2-1 outlines the estimated duration of time it will take to install the sewer for each of the proposed alignment alternatives.

<table>
<thead>
<tr>
<th>Alignment</th>
<th>Cut-and-Cover Location</th>
<th>Boring/Tunneling Location</th>
<th>Approximate Length in Feet (Lft)</th>
<th>Duration +/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marina Del Rey</td>
<td>Grand Canal</td>
<td>Marinhas/Via Marina Way (to #1)</td>
<td>3,800</td>
<td>25 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marinhas/Via Marina Way (to #2)</td>
<td>4,300</td>
<td>29 weeks</td>
</tr>
<tr>
<td>Venice</td>
<td>Hurricane Street</td>
<td>Pacific Avenue</td>
<td>4,000</td>
<td>27 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Via Marina/Ballona Lagoon Channel</td>
<td>1,800</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Westchester/Playa Del Rey</td>
<td>Pacific Avenue</td>
<td>Vista Del Mar</td>
<td>2,400</td>
<td>16 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marinhas/Via Marina Way</td>
<td>1,700</td>
<td>12 weeks</td>
</tr>
<tr>
<td>For All cut-and-cover alignments</td>
<td>Marina entrance/Ballona Lagoon Channels</td>
<td></td>
<td>1,800</td>
<td>8 weeks</td>
</tr>
</tbody>
</table>
Cut & Cover Trench-Construction Sequence

*Includes re-paving 500 ft of road every 3 weeks
CONSTRUCTION LAYDOWN AREAS

It is important to provide adequate space for staging construction operations so that pipe installation can be completed efficiently. Construction areas for cut-and-cover trenching would “travel with” progress. An area 1,000 feet long and approximately one lane wide would be under construction at any given time for driving sheet piles, trenching, laying pipe, backfilling, and paving. Some laydown areas would “travel with” progress; others may remain in one location throughout the duration of the project and would be removed upon final completion of the project. At least 10,000 square feet would be added to shaft laydown areas for this purpose. Construction access to jacking pits would be provided for transporting tunnel muck, pipe sections, and tunneling equipment. A typical pit site utilizes enough space for the jacking pit, slurry separation tanks, a crane, the control cabin, pipe storage, and support facilities (e.g., generator, power pack, and bentonite lubrication unit). The jacking pit is placed a sufficient distance from overhead electrical lines to avoid hazards in operating the crane. A gantry system may be used instead of a crane for smaller pipe sizes. These areas will contain anywhere from 12,000 to 5,000 square feet of additional space at shaft locations.

4.3 MINED-TUNNEL ALTERNATIVES

The mined-tunneling method of construction of the sewer is under consideration for the following alignment areas/locations (Figure 4.3-1):

Alt. 1 - Beach Alignment (Waterview to Hurricane) (also see Figures 4.3-2, 4.3-3, and 4.3-5)
Alt. 2 - Beach Alignment (LAX to Hurricane) (also see Figures 4.3-4, 4.3-5, 4.3-6, and 4.3-7)
Alt. 3 - Beach Alignment (LAX to VPP) (also see Figures 4.3-6, 4.3-7, and 4.3-8)
Alt. 4 - Inland Alignment (LAX to VPP) (also see Figures 4.3-7 and 4.3-9)

CONSTRUCTION-RELATED IMPACTS AND MITIGATION ACTIONS ASSOCIATED WITH MINED TUNNELING

Oil Wells – There are hundreds of abandoned oil wells dotting the Venice area and Marina Del Rey Channel. Probing for possible oil wells ahead of the TBM will have to be performed during tunneling along any of the alternative alignments. This may be accomplished by magnetometer surveys performed in horizontal borings drilled from the TBM (Figure 4.3-10).

Methane Zones – Because the project area is designated as a “Methane Zone,” emergency escape shaft(s) need to be provided during tunnel construction at intervals not exceeding 5,000 feet. With the alternative tunnel alignments being no more than 10,000 feet long, one escape shaft could be sufficient. However, since the Marina Del Rey Channel is right in the center of the alignment, it may be necessary to construct one of these shafts on either side of the channel. These shafts may be relatively simple consisting of nothing more than a 3-foot-diameter vertical casing accessible through the roof or side wall of the tunnel; and construction can be accomplished with a drill rig within a few days with minimal impact on the surface.
VENICE FORCE MAIN

Mined (Large-Diameter) Tunnel

Alternative 1
Beach Alignment
Waterview St. to Hurricane St.

MINED (LARGE-DIAMETER) TUNNEL - ALIGNMENT 1

Project No.: 29870322
Project: VENICE PUMPING PLANT DUAL FORCE MAIN EIR
Figure 4.3-2
VENICE FORCE MAIN

Mined (Large-Diameter) Tunnel

Alternative 2
Beach Alignment
LAX Shaft → Hurricane St

MINED (LARGE-DIAMETER) TUNNEL - ALIGNMENT 2

Project No.: 29870322
Project: VENICE PUMPING PLANT DUAL FORCE MAIN EIR
Figure 4.3-4
VENICE FORCE MAIN

Mined (Large-Diameter) Tunnel

Alternative 3
Beach Alignment
LAX Shaft → Venice Pump Plant
MINED (LARGE-DIAMETER) TUNNEL - ALIGNMENT 4

VENICE FORCE MAIN
Mined (Large-Diameter) Tunnel
Alternative 4
Inland Alignment
LAX Shaft → Venice Pump Plant

URS
Project No.: 29870322
Project: VENICE PUMPING PLANT DUAL FORCE MAIN EIR
Figure 4.3-9
TIMELINES ASSOCIATED WITH MINED-TUNNELING CONSTRUCTION ALTERNATIVE

Rough-order-of-magnitude (ROM) estimates have been prepared for consideration in the EIR. Table 4.3-1 below summarizes estimated construction costs and durations:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Length of Tunnel [feet]</th>
<th>Cost Estimate (tunnel only) [million $]</th>
<th>Construction Duration (tunnel only) [months]</th>
<th>Length of Cut-and-Cover Construction (in addition to tunnel) [feet]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8,700</td>
<td>64.7</td>
<td>27</td>
<td>1,300</td>
</tr>
<tr>
<td>2</td>
<td>9,200</td>
<td>66.8</td>
<td>27</td>
<td>1,000</td>
</tr>
<tr>
<td>3</td>
<td>9,700</td>
<td>67.8</td>
<td>28</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>9,700</td>
<td>67.8</td>
<td>28</td>
<td>300</td>
</tr>
</tbody>
</table>

CONSTRUCTION LAYDOWN AREAS

Construction laydown areas of at least 12,000 square feet would be required for the starter shaft sites which, in addition to construction of the shaft itself, will also handle muck disposal and storage of tunnel-liner and carrier-pipe segments throughout the duration of tunneling. An area of only about 5,000 square feet would be required for constructing the TBM extraction shafts for an approximate duration of 10 weeks; plus about 1 week for TBM removal after tunnel excavation has been completed (see Figure 4.2-2).