Evaluation of Wastewater and Recycled Water Treatment Alternatives for the Proposed Treasure Island Development

December 3, 2003
EXECUTIVE SUMMARY

Brown and Caldwell was contracted to evaluate wastewater and recycled water options for the proposed redevelopment of Treasure Island. This draft report summarizes our analysis and findings related to the identification and evaluation of wastewater and recycled water treatment opportunities and supply for the proposed redevelopment of Treasure Island. This report presents the following elements:

- Purpose and Goals
- Flow and Capacity Estimates
- Alternatives Evaluated
- Opinions of Construction Cost
- Estimates of Annual Operation and Maintenance Costs

This report is based on Brown and Caldwell’s review of Treasure Island Community Development, LLC’s (“TICD”) January 2003 Revised Land Plan, and information obtained following meetings with representatives from TICD to learn more about its proposed land plan, and in depth discussions with representatives of the San Francisco Public Utilities Commission (“SFPUC”), East Bay Municipal Utilities District (“EBMUD”) and the staff of the Treasure Island Development Authority (“TIDA”).

PURPOSE AND GOALS

TIDA has entered into an Exclusive Negotiating Agreement (“ENA”) with TICD with regard to the redevelopment of former Naval Station Treasure Island. The ENA requires that a feasibility study be prepared that discusses the two alternative methods of treating wastewater generated by the redevelopment of TI, including the further treatment of a portion of the treated water effluent for recycling on TI. The wastewater treatment capacity analyzed in this study is based on estimated flows that will be generated from the redevelopment of TI, plus the flows generated by the existing Federal facilities, including the Coast Guard and the Department of Labor Jobs Corps.

Brown and Caldwell understands that the land plan analyzed in this study is undergoing further review and consideration. Assuming the land uses, total number of housing units and total acreage of commercial, retail, and open spaces remain approximately the same, the analysis and conclusions set forth here will generally remain the same.

This study did not analyze potable water supply for the redevelopment plan. It has been assumed that potable water needs will continue to be met by the existing SFPUC supply line.
Current Conditions

The SFPUC currently treats wastewater from existing Treasure Island and Yerba Buena development on-site at the existing treatment plant located at the northeastern corner of TI and will continue to do so until the proposed TICD development and new capacity is online. The SFPUC has no off-Island treatment capability at this time, and it does not have plans to build the infrastructure necessary to support off-Island treatment. Caltrans, however, has designed a wastewater conveyance pipeline as part of the Bay Bridge Eastern Span Seismic Safety Project (ESSSP) and EBMUD has offered to propose an agreement to treat the wastewater from the TICD development at its Special District 1 Main Wastewater Treatment Plant (“MWWTP”) in Oakland, and to provide recycled water from the same facility.

FLOW AND CAPACITY ESTIMATES

Flow and capacity estimate assumptions were based on the land use matrix prepared by TICD in January 2003 for the proposed development. In addition, staff of the SFPUC provided information on existing uses and development on TI and YBI that will remain through and after the development.

A summary of the TICD land use matrix, including the existing uses to be retained, is shown on Table 1. The table presents the estimated potable water and recycled water demand for each of the land use categories. The potable water quantities are based on capacity factors for each land use type summarized on Table 1.

The following are additional assumptions used to generate the values presented:

1. Average wastewater flows are estimated at about 90 percent of potable water usage. (Based on SFPUC sewer service charge ordinance) This assumes that residential irrigation will use potable water, and that open space and commercial areas will use recycled water for irrigation.

2. Recycled water will be used for flushing toilets in the hotel(s) and other commercial buildings as required by the San Francisco ordinance for recycled water use.

3. Recycled water will be used for irrigation of open space. Irrigation is assumed to happen over a seven-month period per year, for the open space areas that require irrigation. Much of the open space will be planted with drought tolerant species that only require irrigation for the first two years for plant establishment. The limited turf areas will require long term irrigation.
### Table 1. YBI - Treasure Island Land Use Matrix

<table>
<thead>
<tr>
<th>Use Type</th>
<th>Units</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Total</th>
<th>Projected Water Use Per Unit</th>
<th>Projected Potable Water Use</th>
<th>Projected Recycled Water Use</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>No.</td>
<td>1,104</td>
<td>881</td>
<td>816</td>
<td>2,801</td>
<td>250</td>
<td>700,250</td>
<td>---</td>
<td>Note 1</td>
</tr>
<tr>
<td>Retail</td>
<td>SF</td>
<td>138,800</td>
<td>32,000</td>
<td>50,000</td>
<td>220,800</td>
<td>--</td>
<td>15,200</td>
<td>7,620</td>
<td>Note 2</td>
</tr>
<tr>
<td>Hotel</td>
<td>SF</td>
<td>251,000</td>
<td>0</td>
<td>163,000</td>
<td>414,000</td>
<td>--</td>
<td>95,040</td>
<td>47,520</td>
<td>Note 3</td>
</tr>
<tr>
<td>Production Studio</td>
<td>SF</td>
<td>240,767</td>
<td>0</td>
<td>0</td>
<td>240,767</td>
<td>--</td>
<td>8,980</td>
<td>6,900</td>
<td>Note 4</td>
</tr>
<tr>
<td>Flex Use</td>
<td>Acres</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>7,500</td>
<td>75,000</td>
<td>10,000</td>
<td>Note 5</td>
</tr>
<tr>
<td>Cultural, Education</td>
<td>SF</td>
<td>254,799</td>
<td>250,000</td>
<td>33,000</td>
<td>537,799</td>
<td>--</td>
<td>37,000</td>
<td>12,400</td>
<td>Note 6</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>SF</td>
<td>0</td>
<td>0</td>
<td>74,000</td>
<td>74,000</td>
<td>--</td>
<td>5,100</td>
<td>1,700</td>
<td>Note 7</td>
</tr>
<tr>
<td>Open Space</td>
<td>Acres</td>
<td>117</td>
<td>17</td>
<td>127</td>
<td>261</td>
<td>250</td>
<td>26,100</td>
<td>165,000</td>
<td>Note 8, Note 9</td>
</tr>
<tr>
<td>Coast Guard</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>17,000</td>
<td>---</td>
<td>Note 10</td>
</tr>
<tr>
<td>DOL Job Corp.</td>
<td>No.</td>
<td>900</td>
<td>0</td>
<td>0</td>
<td>900</td>
<td>150</td>
<td>135,000</td>
<td>---</td>
<td>Note 11</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,114,670</td>
<td>251,140</td>
</tr>
</tbody>
</table>

**Notes:**

1. 85 gallons per capita per day (gpcd), 2.9 people per residence
2. Potable use based on 30 persons per acre at 100 gallons per capita per day (gpcd), recycled use based on 50 gpcd.
3. Potable use based on 100 persons per acre at 100 gpcd, recycled use based on 50 gpcd.
4. Potable use based on 25 persons per acre at 65 gpcd, recycled use based on 50 gpcd.
5. Potable use based on 50 persons per acre at 150 gpcd, recycled use based on 50 gpcd.
6. Potable use based on 200 persons per acre at 15 gpcd, recycled use based on 5 gpcd.
7. Potable use based on 200 persons per acre at 15 gpcd, recycled water use (toilets) at 5 gpcd.
8. Approximately 181 acres on TI, 80 acres on YBI. 31 acres will be planted in turf grass. The remainder in drought tolerant/native plants with the reduced irrigation after 2 years. 800,000 gpd for max month during first 2 years, 225,000 gpd average for first two years, 165,000 gpd long term average during 7 months of irrigation per year.
9. Potable use based on 20 persons per acre at 5 gpcd.
10. Value provided by S. Larano, SFPUC.
11. Estimation based on dormitory for 900 residents, with educational use during the day.

The estimate of average wastewater flows is assumed to be 90% of the potable water use plus 100% of the recycled water used for nonirrigation purposes. Table 2 presents a summary of the estimated wastewater flows and the recycled water demands. These flow projections are used in the remainder of this evaluation.
Table 2. Projected Wastewater and Recycled Water Flows for Final TI-YBI Development

<table>
<thead>
<tr>
<th>Flow stream</th>
<th>Flow, mgd&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td>Wastewater</td>
<td>1.1</td>
</tr>
<tr>
<td>Recycled water for first two years of plant establishment&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.23</td>
</tr>
<tr>
<td>Non-irrigiation</td>
<td>0.09</td>
</tr>
<tr>
<td>Total recycled water</td>
<td>0.32</td>
</tr>
<tr>
<td>Long Term Recycled Use (after plant establishment)&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.16</td>
</tr>
<tr>
<td>Non-irrigiation</td>
<td>0.09</td>
</tr>
<tr>
<td>Total recycled water</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Notes:
1. mgd equals million gallons per day.
2. Recycled water is used throughout the year in commercial buildings and seven months per year for irrigation.
3. Peak potable water flow will be based on design fire flows and is not used in estimating peak wastewater flows.
4. Peak wastewater flow is estimated for a peak wet weather condition and assumes a new, well constructed, well maintained collection system with low inflow and infiltration (I/I). Peak wastewater flow will exceed water usage due to I/I.

TREATMENT LOCATION ALTERNATIVES

This study evaluated two separate locations for both the wastewater treatment and recycled water treatment requirements. These are an on-island and off-site location for each type of treatment. Combining these produces a matrix of four treatment alternatives. These alternatives are shown in Table 3.

Table 3. Alternative Wastewater and Recycled Water Treatment Location Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wastewater treatment Location</th>
<th>Recycled Water Treatment Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>On-island</td>
<td>On-island</td>
</tr>
<tr>
<td>2.</td>
<td>On-island</td>
<td>EBMUD&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.</td>
<td>EBMUD&lt;sup&gt;1&lt;/sup&gt;</td>
<td>On-island</td>
</tr>
<tr>
<td>4.</td>
<td>EBMUD&lt;sup&gt;1&lt;/sup&gt;</td>
<td>EBMUD&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Notes:
1. Treatment is assumed to occur at EBMUD’s MWWTP in Oakland, with transmission of raw sewage, effluent or recycled water via the new pipes designed as part of the ESSSP.

The following are brief descriptions of the elements associated with each treatment location. This information forms the basis for the projected cost for each alternative.
On-Island Wastewater Treatment

The on-island wastewater treatment alternative is defined in this study as an on-site plant sized to treat all island-generated wastewater to secondary treatment standards for disposal through the existing Treasure Island outfall. For the purpose of this study, it was assumed that this plant will be located in the vicinity of the existing plant on the northeast corner of Treasure Island. If the on-island wastewater treatment alternative is selected, the location may be modified during final design based on the final development plan. The approximate location is shown in Figure 1. The sizing and cost estimates for this facility are based on the following:

- All infrastructure to collect and convey the wastewater to this location is common to all alternatives, has been costed as part of TICD’s underlying financial analysis, and is not part of this evaluation.

- 1.2 mgd average capacity, 3.6 mgd peak wet weather capacity. This capacity is the estimated capacity for final buildout. Initial peak flows will likely be lower, when the sewers are new.

- Treatment to secondary treatment standards, 30 milligrams per liter (mg/L) five-day biochemical oxygen demand (BOD₅) and 30 mg/L total suspended solids (TSS).

- Treatment plant will include: influent screening, a combined primary/secondary treatment process (either membrane bio-reactors or sequencing batch reactors), aerobic sludge digestion, sludge dewatering and truck load-out, disinfection emergency power and odor control. Multiple process units are assumed, and the facility could be built in phases. However, for this evaluation, we assumed a single construction phase for the treatment plant.

- Flow from the plant to the outfall is assumed to be by gravity.
Off-site Wastewater Treatment

In this alternative, wastewater would be collected at a single point on Treasure Island, and conveyed to the EBMUDMWWTP for treatment with disposal through the EBMUD outfall. The sizing and cost opinion for this alternative are based on the following assumptions:

- All infrastructure to collect and convey the wastewater to the primary station location is common to all alternatives, has been costed as part of TICD’s underlying financial analysis, and is not part of this evaluation. For this evaluation, the pumping station was assumed to be located at the same location as the potential on-island WWTP.

- A pumping station would be built in the vicinity of the existing TI wastewater treatment plant. This pumping station would be designed to provide the peak flows to EBMUD with one pump unit out of service. The pumping station would have an average capacity of 1.2 mgd, and a peak wet weather flow capacity of 3.6 mgd. The cost estimate for the pumping station is based on including five pumps at 0.9 mgd each. This provides firm peak wet weather capacity with one pumping unit as a standby. The total pipeline length is about 6.5 miles. This includes about 2.5 miles on island, 2 miles on the bridge, and about 2 miles from the bridge to the EBMUD MWWTP. A full hydraulic evaluation of the pumping system (pumping station and pipeline) would be required to select the pumps and drive size. Pump horsepower is estimated to be between 200 and 300 hp each. The pumping station will include grinding, odor control, and emergency power.

- The static lift, or the vertical distance from the pumping station to the high point of the pipe on the bridge, is about 200 feet.
• A 12-inch-diameter forcemain from the pumping station to the bridge has been estimated. The approximate length of the pipe, dependent on routing, is about 2.5 miles or 13,200 feet. The size and location would be further refined during design.

• The 12-inch-diameter, double contained sewage pipeline is being included as part of the ESSSP by Caltrans. The cost of this pipeline is included in the cost estimate for the seismic retrofit of the eastern span and therefore is excluded from this evaluation. A cost recovery program may be established, payable through the user rate base. A pipeline from the eastern end of the bridge to the EBMUD MWWTP is required. The approximate length of this pipe, depended on routing, is about two miles or 10,500 feet.

Recycled Water Use and Treatment.

Recycled water is intended for irrigating open space areas, and for use in toilets in the planned hotel(s) and other non-residential buildings. For purposes of this analysis, it is assumed that recycled water is not used for irrigation on residential property. The development plan for Treasure Island includes about 181 acres of open space. There will also be about 80 acres of open space on Yerba Buena Island that would be irrigated by the recycled water system, for a total of 261 acres. The development plan calls for 31 of these acres to be planted in turf grass. The remainder will be planted with native and drought tolerant species that require significantly less or no irrigation after being irrigated for two years for plant establishment. Irrigation will take place during the dry months of April through October, with peak irrigation demands expected in July. The average recycled water demand during the irrigation months for the first two years of plant establishment is estimated to be 225,000 gallons per day (gpd). The long term average (after establishment) is 165,000 gpd. Combined with the other building uses, the reclaimed water demand is about 0.25 mgd. (Note: 0.09 mgd of the recycled water use will be year-round, the additional 0.16 mgd is seasonal.)

For treated wastewater to be used as recycled water and applied to areas subject to human contact, the water must be treated to levels established by the California Department of Health Services Title 24, for unrestricted use. Title 24 requires coagulation, filtration and disinfection of the secondary effluent for reuse. Selection of newer technology such as a membrane bioreactor (MBR) system for the secondary treatment of the wastewater would deliver the equivalent of filtered and coagulated water without the need for tertiary filtration. The level or degree of filtration and disinfection determine the suitability of the water for different types of contact. Additionally, the water must have any other impurities removed that would detract from its intended use. For example, wastewater collected on Treasure Island is high in chlorides due to intrusion of salty ground water into the sewers. The level of salt (chloride) in the water could be detrimental to plants and make it unsuitable for landscaping unless the chloride is removed.
On-island Treatment of Recycled Water

On-island treatment for recycled water is part of two alternatives. The first is on-island recycled water treatment coupled with on-island treatment of wastewater. In this case, the additional treatment would be provided by add-on treatment units at the same facility. The second alternative for on-island recycled water treatment would be a coupling with off-island wastewater treatment at EBMUD. In this case, wastewater is pumped to EBMUD for treatment and secondary effluent is pumped back to TI for further treatment, storage and reuse. The reason for considering both of these alternatives is that the level and cost of treatment required for the two alternatives differs significantly. As noted above, the wastewater collected on TI is high in salts. Chloride removal would likely be required if on-site wastewater and recycled water treatment is provided. If the secondary effluent source is the EBMUD MWWTP, chloride removal would likely not be required. (The high chloride levels in 1.2 mgd of TI wastewater would be "diluted" by about 70 mgd of low chloride wastewater at EBMUD’s returning an effluent with a lower chloride content for tertiary treatment.)

The sizing of the recycled water treatment facility is based on the following:

- Average capacity of 0.25 mgd. Depending upon the salt concentration of the wastewater, it might be possible to install a smaller reverse osmosis (RO) facility and then blend a combination of filtered secondary effluent and RO permeate, to achieve an acceptable salt level, (e.g. 1,000 mg/L), in the product water. For example, if the wastewater has a salt concentration of 2,000 mg/L, a RO facility with about 0.14-mgd capacity would be sufficient. If the wastewater has a salt concentration of 8,000 mg/L, a RO facility with about 0.25-mgd capacity would be required. The brine from the RO facility would combine with the secondary effluent not used for recycle, for discharge to the Bay. Proper facility sizing would be confirmed during detailed design. Modular construction, with 0.25 mgd capacity provided with one module out of service.

- The cost estimate for on-island treatment of on-island generated secondary effluent is based on filtration, RO (for chloride removal) and disinfection.

- The cost estimate for on-island treatment of EBMUD produced secondary effluent is based on filtration and disinfection only.

- On-site recycled water treatment alternatives include storage of about 0.2 million gallons since peak recycled water demands will likely occur at night (irrigation) while diurnal wastewater flow peaks will occur during daylight hours.

Note, the on-island recycled water facilities have been sized and estimated based on the long term demand capacities. If the facility is built to supply the full irrigation need for the first two years of plant establishment, it would be 50% larger than required for the long-term demand. After two years, that excess capacity would not be used. The alternatives to building a larger on-island recycled water treatment facility are to purchase additional
recycled water from EBMUD or additional potable water to make up the irrigation demand during the first two years of plant establishment.

**Off-site Treatment of Recycled Water**

EBMUD would provide recycled water treated for unrestricted use. The recycled water would be provided via a pipeline from the EBMUD MWWTP to Treasure Island and YBI. Caltrans will be providing the portion of the pipeline on the bridge as part of the ESSSP. The construction costs for this alternative are based on providing the pipeline segments to and from the bridge landings, about four miles of 6-inch-diameter pipe. No on-site storage is anticipated, based on the assumption that peak or variable needs can be met by EBMUD without storage.

**COSTS**

The economic evaluation of the alternatives includes: plant and conveyance pipeline construction costs, operational costs (power, water, chemicals, operations and maintenance), and estimates on contract costs for off-site services. Construction costs are presented in Table 4, annual operating and contract costs are presented in Table 5, and a present worth analysis is presented in Table 6.

**Construction Cost Estimates**

Table 4 presents the estimated cost of constructing each of the four treatment alternatives. These costs do not include associated costs such as engineering, construction management or administration which should be between 20 to 30 percent of the estimated construction costs. The cost opinions presented here are planning level estimates as defined by the American Association of Cost Engineers classification for comprehensive studies. The cost estimates have an accuracy of plus 50 percent and minus 30 percent, and are based on price levels for the San Francisco Bay Area in August 2003 (ENR CCI 7800).
Table 4. Estimated Construction Cost for Four Treatment Alternatives, $Million

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Force-mains</th>
<th>Raw Sewage Pumping Station</th>
<th>Wastewater Treatment</th>
<th>Recycled Water Treatment</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On-island wastewater and recycled water treatment (including chloride removal)</td>
<td>0</td>
<td>0</td>
<td>7-10</td>
<td>3.5^1</td>
<td>10.5-13.5</td>
</tr>
<tr>
<td>2. On-island wastewater treatment and recycled water purchased from EBMUD</td>
<td>2^1</td>
<td>0</td>
<td>7-10</td>
<td>0</td>
<td>9-12</td>
</tr>
<tr>
<td>3. Wastewater treatment at EBMUD, on-island recycled water treatment (no chloride removal required)</td>
<td>4.1^2</td>
<td>2.8</td>
<td>0</td>
<td>2.5</td>
<td>9.4</td>
</tr>
<tr>
<td>4. Wastewater and recycled water treatment at EBMUD</td>
<td>4.1^3</td>
<td>2.8</td>
<td>0</td>
<td>0</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Notes:
^1 2.5 miles on island, 2 miles in Oakland of 6-inch recycled water pipe at $85/lf.
^2 2.5 miles on island, 2 miles in Oakland of 12-inch raw sewage pipe at $125/lf and 2.5 miles of 6-inch secondary effluent pipe at $85/lf.
^3 2.5 miles on island, 2 miles in Oakland of 12-inch raw sewage pipe at $125/lf and 2.5 miles of 6-inch recycled water pipe at $85/lf.
^4 Include recycled water storage.

Operating and Maintenance (O&M) Costs

An estimate of the O&M costs for the on-island wastewater treatment plant has been developed. The assumptions and information that form the basis for this estimate are presented below.

- Staffing of the on-site treatment facility would be by the SFPUC.
- Staffing will be similar (in terms of shift and time of day coverage by operators and sharing of maintenance with other facilities) to the current staffing at the existing TI WWTP.
- SFPUC provided a spreadsheet summarizing existing TI wastewater treatment plant staffing and costs. For this evaluation we escalated the 2002-2003 costs by 4% for
current costs, and increased the costs by 25% to reflect the increase in capacity and systems at a new on-island facility.

- Based on this information, the estimated annual labor cost to staff a 1.2 mgd on-island wastewater treatment plant is about $840,000.

- The estimated cost of electricity for the facility is about $365,000 per year.

- The estimated cost for maintenance/replacement of equipment is based on 3% of the construction value or $255,000 per year.

- Residuals and biosolids hauling and disposal is estimated at $220,000 per year. Chemical use is estimated at $250,000 per year. Laboratory and compliance monitoring costs are estimated at $220,000 per year.

Table 5 presents an outline of annual costs for each alternative. These costs will be used to compare 25-year present worth estimate for each alternative. Some of these are O&M costs for facilities that would be owned and operated by SFPUC, others are between the SFPUC and EBMUD.

### Table 5. Estimated Annual O&M Cost for Four Treatment Alternatives, $Million

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Pipelines</th>
<th>Raw Sewage Pumping Station</th>
<th>Wastewater Treatment</th>
<th>Recycled Water Treatment or supply</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On-island wastewater and recycled water treatment</td>
<td>--</td>
<td>--</td>
<td>2.2(^1)</td>
<td>.65(^1)</td>
<td>2.85</td>
</tr>
<tr>
<td>2. On-island wastewater treatment and recycled water purchased from EBMUD</td>
<td>0.04</td>
<td>--</td>
<td>2.2(^1)</td>
<td>0.4(^2)</td>
<td>2.64</td>
</tr>
<tr>
<td>3. Wastewater treatment at EBMUD, on-island recycled water treatment</td>
<td>0.1</td>
<td>0.5</td>
<td>1.5(^4)</td>
<td>0.5(^1)^0.3</td>
<td>2.6</td>
</tr>
<tr>
<td>4. Wastewater and recycled water treatment at EBMUD</td>
<td>0.1</td>
<td>0.5</td>
<td>1.5(^4)</td>
<td>0.4(^2)</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Notes:
1. SFPUC O&M costs for treatment.
2. Estimated EBMUD contract cost.
3. Include O&M for pipelines.
4. An estimate of potential contract costs with EBMUD. This value is estimated based on a prorated factor from the SFPUC Sewer Service Charge, Schedule C, applied to the total projected potable water usage. The SFPUC Sewer Service Charge recovers the cost for the collection system and treatment. In this case, EBMUD would not be providing collection system services. Based on the State Water Resources Control Board annual survey of wastewater rates, the typical EBMUD wastewater customer pays about 50% of their fee for collection system and 50% for treatment. Therefore, 50% of the SFPUC rate was applied to the flow rate to estimate the contract rate.
Table 6. Estimated 25 Year Present Worth for Four Treatment Alternatives, $Million

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-island wastewater and recycled water treatment</td>
<td>76.5</td>
</tr>
<tr>
<td>On-island wastewater treatment and recycled water purchased from EBMUD</td>
<td>70.4</td>
</tr>
<tr>
<td>Wastewater treatment at EBMUD, on-island recycled water treatment</td>
<td>68.1</td>
</tr>
<tr>
<td>Wastewater and recycled water treatment at EBMUD</td>
<td>62.7</td>
</tr>
</tbody>
</table>

1. Includes engineering and administration at 25% of construction cost.
2. Assumes a 25 year period
3. Assumes an inflation rate of 3% on labor
4. Assumes an interest rate of 4% based on 4 year average. Local Agency Investment Fund

Other Evaluation Considerations

There are several non-economic issues related to the location of the treatment facilities that need to be considered in the selection of the alternative. These include potential impacts on traffic, noise, odor, and visual aesthetics. Each of these is described briefly below.

- **Traffic.** On-island wastewater treatment will require 2 to 5 truck trips per day for the delivery of chemicals and the removal of sewage screenings and biosolids and/or disinfection and/or odor control chemicals. On-island recycled water treatment would likely add one or more truck trips per week for additional chemical delivery. The alternative that requires a pumping station to convey raw sewage to EBMUD could also require chemical delivery for an odor control system. However, it is possible that a biofilter, that would not require chemicals, could be used for odor control. A biofilter requires more space than a chemical odor control unit.

- **Noise.** Operating equipment and loading and unloading of trucks will generate noise in the vicinity of the on-site treatment facility and/or pumping station. A treatment plant is expected to generate more noise than a pumping station.

- **Odor.** Any wastewater conveyance or treatment facility presents the potential for odor issues. The facilities must be designed and operated with odor prevention and odor
control elements. There will often be some odor associated with these facilities, and "acceptable" levels of odor are very subjective. Treatment of wastewater at an off-island facility reduces the potential for local odor and transfers the odor control and treatment to a facility already equipped to do so.

- **Visual Aesthetics.** An on-site treatment facility of the projected capacity will consume at least several acres of land. Typically, some form of visual screening will be desired or required. This may include architectural treatments, fencing, and landscaping. A pumping station associated with off-site treatment, which would be much smaller than a treatment plant, could also be designed to include some form of visual screening, including architectural treatments, fencing and landscaping. Architectural treatment or special landscaping has not been estimated into the facility construction cost.

**Summary**

The construction costs associated with development related wastewater and recycled water treatment and conveyance facilities have been estimated, along with annual operations and maintenance costs for each alternative. An estimate of potential contract costs with EBMUD was made based on SFPUC fees and a prorated factor based on the composition of EBMUD user fees. The 25-year present worth analysis indicates that treatment of wastewater and recycled water at the EBMUD facility is the lowest cost alternative. On-island treatment is the most expensive alternative. The absolute and relative present worth values may change when the contract numbers are received from EBMUD.

The construction and O&M costs associated with on-island treatment appear high on a per gallon basis when compared to other operating facilities in the Bay Area. This is attributed to the small size and remoteness of the on-island facilities, and the lack of economy of scale that is available at larger facilities such as the EBMUD MWWTP or SFPUC’s Southeast Wastewater Treatment Plant. Other benefits of off-island treatment that are not quantified in the life cycle costs include reduced visual impact, truck traffic and odor potential on-island.