APRIL 2010

Appendix 3: Additional Details on Costs and Project Timelines for Los Angeles River Watershed Bacteria TMDL Dry Weather Implementation Plan

Prepared for:

CLEANER RIVERS THROUGH EFFECTIVE STAKEHOLDER-LED TMDLS (CREST)

Prepared by:

CREST CONSULTING TEAM

Table of Contents

List of Tables

List of Figures

A3.1 Introduction

California Water Code section 13242 requires that the Basin Plan include an Implementation Plan to describe the nature of actions to be taken to achieve water quality objectives and a time schedule for action.

This **Appendix 3** supports the Dry Weather Implementation Plan (**Section 7)** of the TMDL Technical Report. The sections herein are very similar to the corresponding cost and timeline sections in Section 7, except they provide additional detail with respect to assumptions and methodology for development of the costs and timelines for Watershed-wide Strategies. Some of the text/information herein is duplicative for Section 7, which is intentional to allow both Section 7 and Appendix 3 to be standalone documents. Additional details for the following implementation components are included herein:

- Dry Weather Implementation Costs for the Watershed-wide Strategies (**Section A3.2**)
- Timeline for the Implementation of Individual Projects (**Section A3.3**)

For reference, **Figure 1** shows the spatial extent of the LA River segments and tributaries addressed under this TMDL. The LA River segments are as follows:

- **Segment E**: Reach 6 – LA River headwaters to Balboa Boulevard
- **Segment D**: Reach 5 to middle Reach 4 – Balboa Boulevard to Tujunga Avenue
  Segment C: lower Reach 4 and Reach 3 – Tujunga Avenue to Figueroa Street
- **Segment B**: upper and middle Reach 2 – Figueroa Street to Rosecrans Avenue
- **Segment A**: lower Reach 2 and Reach 1 – Rosecrans Avenue to Willow Street

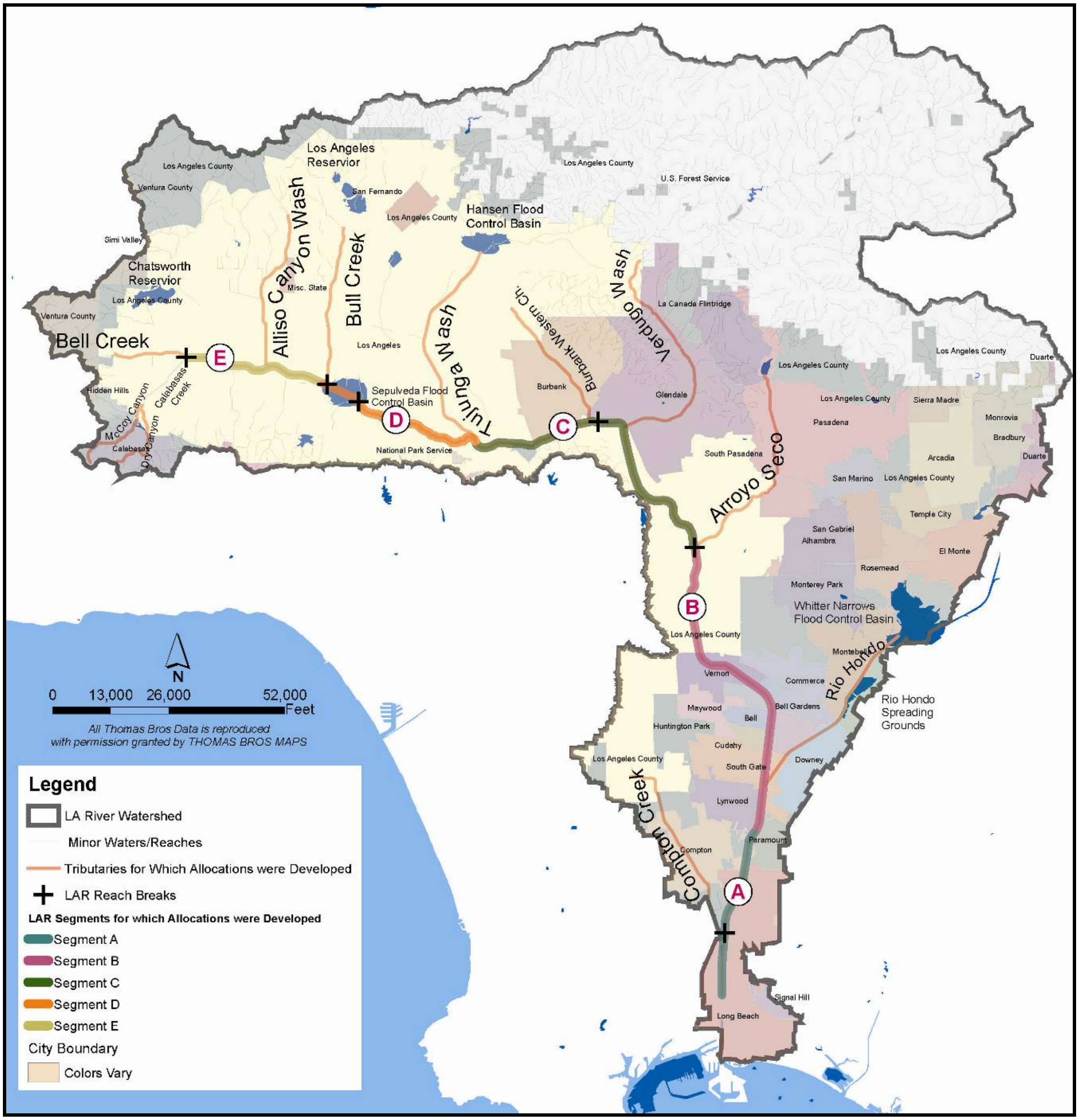

Figure 1. Segments and Tributaries for which Allocations were Developed for the Los Angeles River Watershed Dry Weather Bacteria TMDL

A3.2 Dry Weather Implementation Costs

Water Code Section 13000 requires the State and Regional Boards to regulate so as to achieve the highest water quality which is reasonable, based on consideration of economics and other public interest factors. The following section presents estimated costs for implementing the Conventional (Outfall-based only) and Alternative (combined Downstream-based and Outfall-based) Watershed-Wide Strategies.

A3.2.1 Estimated Costs for Conventional Watershed Wide Strategy

The process for developing an implementation cost estimate included the following steps for a Conventional Strategy that uses an Outfall-based LRS approach for all LA River segments and tributaries (this provides additional detail to **Section 7.8.1.1**).

1. **Estimate the number of outfalls –** available data sets include a visual count of drains along the channels within the City of Los Angeles boundary (Outlets2000) and the visual count of flowing drains identified during the BSI Study (CREST 2008) along Segment B (Reach 2) and Segment C/D (upper Reach 4). These outfall counts were also compared with a GIS analysis conducted for the entire Watershed, including the tributaries using GIS overlays of watersheds, storm drain systems and jurisdictional boundaries. To extrapolate the City of Los Angles data and develop an estimate of the number of outfalls outside of the City, an analysis of the distribution or density of drains for the known Outlets2000 layer was developed. By observation, the numbers of outfalls increased substantially in the areas of heavy industrialization near the rivers or tributaries. The total estimated number is very large if every potential discharge point is included. These range from large diameter outfalls draining major subwatersheds to numerous small pipes that may drain only a few local culverts, industrial sites and other private property. Based on an extrapolation of the information, it is estimated by the City of Los Angeles that there may be more than 1980 storm drains of all types and sizes with outfalls to the mainstem LA River and tributaries within the City of Los Angeles, and as many as 1735 outfalls to the mainstem and tributaries outside of the City.
2. **Estimate the number of outfalls that flow during dry weather –** based on a review of the information developed during the BSI Study (CREST 2008) in Segment B (Reach 2) there were 51 flowing outfalls observed out of an estimated 493 outfalls identified in the GIS analysis, or slightly greater than 10% of the outfalls were flowing during dry weather. Within a portion of Segment C and D (upper Reach 4) there were 57 flowing outfalls observed out of an estimated 256 outfalls, or slightly greater than 22% of the outfalls were flowing during dry weather. It should be noted that Segment B is predominantly industrial with a much larger number of small, private or industrial outfalls compare to Segment C/D which is predominantly residential and commercial in the vicinity of the river. Taking the average of these two percentages yields a mean value of approximately 16.4% of all outfalls having dry weather flow. If this average is extrapolated to the entire watershed, and distributed among the mainstem LA River and tributaries based on additional GIS analyses, then the estimated number of flowing outfalls would be as follows:

- Mainstem LA River – approximately 280 flowing outfalls during dry weather
- Tributaries – approximately 330 flowing outfalls during dry weather

3. **Estimate the number of outfalls that may require *initial* actions/structural controls along the mainstem LA River –** using information generated during the BSI Study (CREST 2008) in combination with a Monte Carlo analysis, the number of outfalls that would require elimination of flow and/or bacteria was estimated. Based on the Monte Carlo Analysis for Segment B (see **Section A1.2** in **Appendix 1**), it was estimated that if the discharge from the five Priority Outfalls were completely eliminated, then the MS4 WLA for Segment B could be met. This would represent approximately 10% of the "flowing" outfalls found in Segment B during the BSI Study sampling events. Data from Segment C/D (upper Reach 4) was also considered. Based on the experience from BSI Study data analysis, a conservative estimate of 10% of the projected "flowing" outfalls was extrapolated across all in the LA River segments to develop an estimate for a <u>total</u> count of initial required <u>structural</u> controls (**Table 1**). Application of an LFD approach as a "surrogate" structural control that assumes 100% of the dry weather flow and bacteria loading from the Priority Outfalls is eliminated would account for all of the load reduction needed to meet the WLA. Note that LFDs are simply used for the purposes of developing costs for the TMDL. If MS4 Permittees elect to pursue other options such as an upstream infiltration projects that capture runoff from only a fraction of the watershed, and/or if LFDs are not feasible for some of the outfalls, then the number of "actions" needed to achieve the WLA could increase. However, based on the assumptions described above, a minimum of approximately 28 outfalls to the mainstem of the LA River would require initial projects (**Table 1**). A similar approach was used for Outlier Outfalls; approximately 10% of the flowing outfalls in Segment B were categorized as Outlier Outfalls, leading to an estimate of 28 Outlier Outfall investigations over the course of TMDL implementation.
4. **Estimate the number of outfalls that will require *follow-up* actions/structural controls along the mainstem LA River** – it was assumed that after completing one iteration for a given river segment and conducting follow-up monitoring, there would be a potential need to install additional structural controls. Note that this assumption of necessary additional structural controls does not necessarily reflect lack of confidence in ability of the Monte Carlo approach; the approach handles *existing* sources well. Instead, the assumption that additional projects are necessary accounts for potential *future* sources of bacteria that arise over the course of TMDL implementation. For estimating purposes, it was assumed that after the initial projects were completed in accordance with an LRS, an additional 100% more controls would be needed (i.e., an additional 10% of the "flowing" outfalls assumed based on the initial assessment would need to be addressed under a *subsequent* LRS), for an ultimate total of 20% of outfalls (1 in 5) along each LA River segment for which an Outfall-based LRS approach is assumed. Based on this approach, and for the purposes of developing TMDL costs, approximately 28 additional outfalls are assumed to require actions to fully meet the WLAs (**Table 1**).
5. **Estimate the total number of outfalls that will require structural controls along tributaries –** as discussed in **Section 7.8.1.2**, unlike the mainstem LA River, tributaries in the Watershed have little assimilative capacity. For most tributaries with the

exception of Burbank Western Channel, all of the flow in the tributaries is urban runoff. As such it is quite possible that when compared to the mainstem LA River, compliance with the TMDL will require a higher proportion of outfalls along tributaries to be addressed. However, since there is little basis for developing specific estimates for any of the tributaries, for purposes of costs (and schedule, as discussed in **Section 7.8.1.2**), the same percentages applied to the mainstem LA River were used to develop estimates for the tributaries. That is, 10% of the "flowing" outfalls along tributaries are assumed to need initial structural controls. Based on the assumptions described above, a minimum of approximately 33 outfalls to the mainstem of the LA River would require initial projects (**Table 1**). Further, just as with the mainstem LA River, it was assumed that an additional 100% of the initially "flowing" tributary outfalls, or approximately 33, will need to be addressed with follow-up projects (**Table 1**) for a total of 66 projects[1]. Similar to the mainstem LA River, this assumption of necessary additional projects along tributaries accounts for potential *future* sources of bacteria that arise over the course of TMDL implementation.

6. **Establish representative storm drain outfall flow rate** – a representative flow rate for storm drain outfalls was established to estimate LFD costs as well as treatment plant capacity costs and incremental collection systems costs and are assumed to be proportional to the flow rate, as discussed below. Storm drain outfall flow data collected during the BSI Study (CREST 2008) indicated that the observed dry weather flows ranged over several orders of magnitude. However, a "typical" value was selected by reviewing the data collected during the BSI Study (CREST 2008) and calculating an approximate median value of 0.15 cfs for each of the Priority Outfalls in the segment identified using the Monte Carlo analysis. All of the flow rates measured from storm drain outfalls were relatively small with 0.7 cfs being the highest flow rate observed. The capital cost of LFD facilities are relatively insensitive to the average flow rate assumed for this range of (low) flow flows.
7. **Establish representative water quality conditions** – Representative values for Total Suspended Solids (TSS) and Biological Oxygen Demand (BOD) in dry weather storm drain discharges were established as these are also used to estimate treatment plant capacity costs. Based on data collected from stormwater programs, dry weather concentrations for these parameters are typically quite low compared to wastewater, and values of 10 mg/L for both TSS and BOD were used. These values have a very minor impact on the overall cost estimate.
8. **Create "typical" LFD design** – a "typical" LFD facility design for was created based on prior projects planned and designed by the City of Los Angeles BOS/BOE. This includes a diversion weir in a storm drain, a diversion pipeline from the storm drain to a trash collection device and then to a wet well with a submersible pump, with and a

[1] Because the tributaries have limited assimilative capacity, one "worst case" assumption is that every outfall along the tributaries would require a structural control, rather than just 20% of the outfalls (10% for initial action, and 10% for follow-up). As noted, during dry weather there could potentially be as many as 330 flowing drains discharging to tributaries. Based on the employed assumptions herein (20% of outfalls), the resulting schedule is based on 66 structural controls on the tributaries. For comparison, if an assumption were made that structural controls were needed at 50% or, the worst case 100%, of all outfalls along the tributaries and applying similar assumptions as noted above, the number of outfalls to address with projects would increase to approximately 165 compared to the estimated 66, and at 100% the number of outfalls to address would be 330 which would add several hundred million dollars to the cost estimate. The schedule implications would also be dramatic as discussed in Section 7.7.

discharge force main to the assumed closest sanitary sewer with adequate capacity for conveying the flow to a major trunk or interceptor facility and to a wastewater treatment plant. The conceptual facilities are depicted in **Figure 2**. However, for the purposes of the cost estimate, pumping is included as discussed under item 10 below. For the purposes of this exercise the basic infrastructure was assumed to include the diversion manhole retrofit, a separate manhole for trash collection, and a third manhole/wet well with pumps, plus interconnecting piping, electrical and instrumentation.

Table 1. Estimated Number of Required Structural Controls (LFDs or other BMPs) for Conventional Strategy (Outfall-based Approach)

Los Angeles River Segment or Tributary	**Length (mi)**	**Estimated Number of Required Initial Structural Controls** (Rounded)	**Estimated Number of Required Follow-up Structural Controls** (Rounded)	**Estimated Total Number of Required Structural Controls** (Rounded)
LA River Segment A (lower Reach 2 and Reach 1 – Rosecrans Avenue to Willow Street)	**7.1**	**3**	**3**	**6**
Compton Creek	**8.5**	**4**	**4**	**8**
LA River Segment B (upper and middle Reach 2 – Figueroa Street to Rosecrans Avenue)	13.7	5	5	10
Arroyo Seco Reach 1	5.2	3	3	6
Arroyo Seco Reach 2	4.4	1	1	2
Rio Hondo Reach 1	4.6	2	2	4
Rio Hondo Reach 2	9.3	2	2	4
LA River Segment C (lower Reach 4 and Reach 3 – Tujunga Avenue to Figueroa Street)	12.2	8	8	16
Burbank Western Channel	14.4	4	4	8
Verdugo Wash Reach 1	2.0	1	1	2
Verdugo Wash Reach 2	7.5	5	5	10
Tujunga Wash	9.7	4	4	8
LA River Segment D (Reach 5 to middle Reach 4 – Balboa Boulevard to Tujunga Avenue)	7.8	6	6	12
Bull Creek	6.6	1	1	2
LA River Segment E (Reach 6 – LA River headwaters to Balboa Boulevard)	6.5	6	6	12
Aliso Canyon Wash	10.1	1	1	2
Bell Creek	8.9	2	2	4
Dry Canyon Creek	3.9	2	2	4
McCoy Canyon Creek	4.0	1	1	2
Totals				
Mainstem LA River Segments	47.3	28	28	**56**
Tributaries	99.1	33	33	**66**
Mainstem LA River Segments and Tributaries	146.4	61	61	**122**

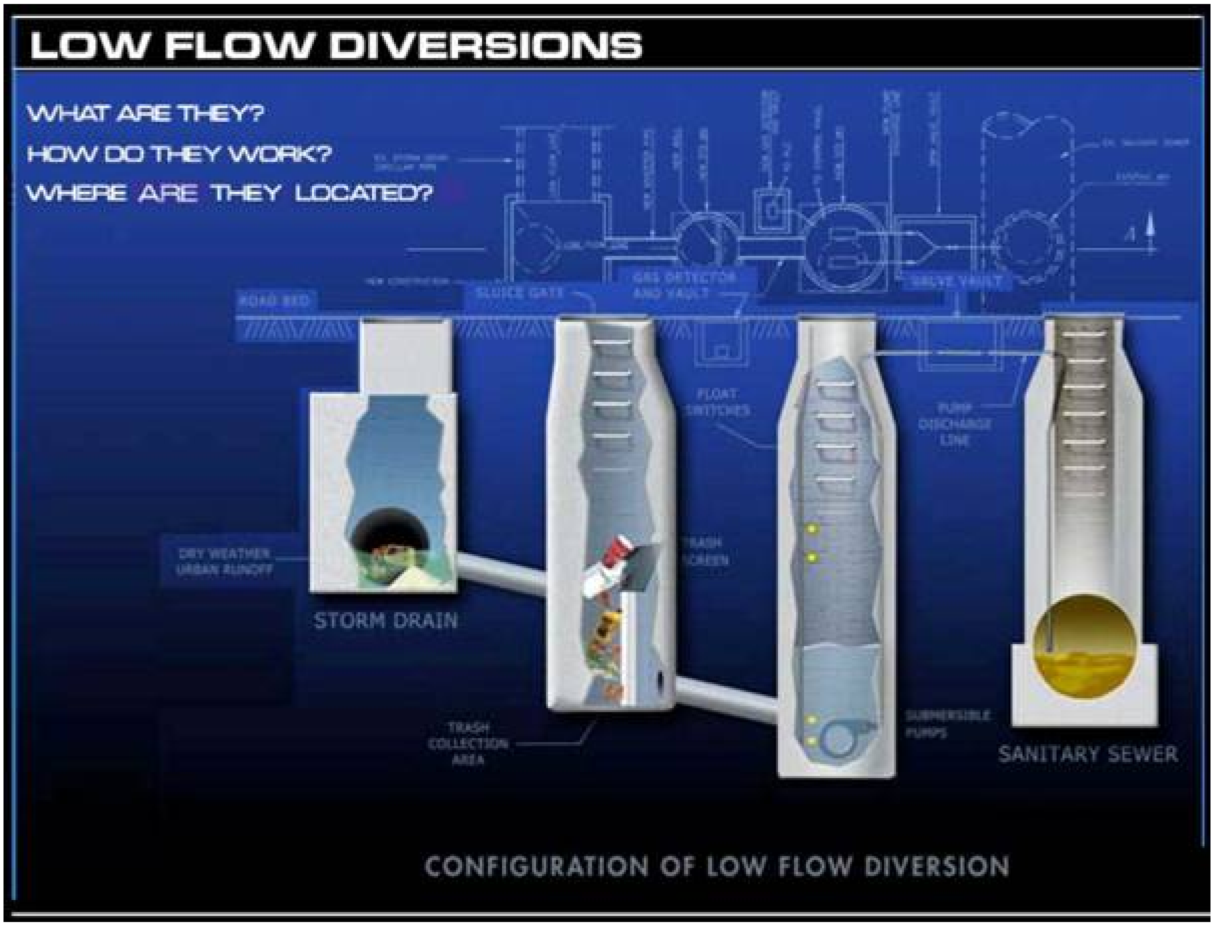

Figure 2. Typical Low Flow Diversion (courtesy of City of Los Angeles Bureau of Sanitation)

9. **Estimate distances from outfalls to wastewater infrastructure –** an average distance between major outfalls to the river and wastewater infrastructure within the vicinity of the river was estimated. For the majority of the river and tributaries, the wastewater collection system is the responsibility of the City of Los Angeles. In Reach 1 and the lower portion of Reach 2, the collection systems are the responsibility of a combination of local jurisdictions and the County Sanitation Districts of Los Angeles (LACSD). For portions of Reach 3 and 4 and certain tributaries, the collection systems are the responsibility of other jurisdictions. Reviewing GIS overlays of the collection systems in the vicinity of the river, an average distance of 300 feet was used.
10. **Develop costs for infrastructure and treatment capacity** – a cost basis was developed for acquiring incremental interceptor capacity and incremental treatment plant capacity for the dry weather flows. For the initial estimates for the upper watershed it was assumed that most of the wastewater collection systems would ultimately be tributary to the City of Los Angeles wasewater system. Thus information provided by the City of Los Angeles BOS was used to develop the cost estimates on the basis of the following factors:

a. Conveyance - $208,900/mgd-mile. The miles are measured from the Hyperion Wastewater Treatment Plant to the center of the agency in which the discharge takes place.
b. Treatment Flow - $1,706,184/mgd of capacity
c. BOD - $409.65/ ppd (pounds per day)
d. TSS - $354.13/ppd

For the lower portion of the Watershed, where sanitary sewers typically convey wastewater to LACSD facilities, treatment plant capacity and operational costs would be different and were accounted for separately. For runoff diversions directed to the Sanitation Districts' collection system, the Districts would charge the diverting agencies the standard rates that are applied to industrial discharges. These rates consist of a one-time hookup charge to pay for the additional capacity needed in the LACSD system, (a “connection fee”), and on-going charges to cover the cost of treating the water (called “surcharge fees”). As of July 2010, the Districts connection fee will be approximately $4000 per capacity unit (CU), where a capacity unit is set at the volume and strength typical of a discharge from a single family home. For a typical storm drain flow rate of 0.15 cfs (approximately 0.1 mgd), the estimate flow rate for an average diversion, 258 CUs would be required. The connection fee for one LFD project would therefore be $1,030,000.

No separate cost allowance is included in the lower watershed for collection system capacity upgrades, if needed, or the use of collection systems as there was no direct basis for establishing this. This component could add additional capital and/or operating costs.

11. **Develop overall capital costs** – the number of overall projects and the schedule for bringing projects on-line (as outlined in **Section 7.8.1**) were used to develop an overall capital cost estimate for all projects. The unit capital costs for a single LFD project in current (2009) dollars was estimated to be $1.7M not including conveyance and treatment capacity allowances (these were categorized as operation and maintenance costs). Costs for Outlier Outfall investigations were estimated as $100,000 per Outlier Outfall. Total cost estimates were developed both with and without an allowance for cost escalation over the implementation period. For the escalated cost estimate, an average cost escalation rate of 3% was assumed and a timeline for TMDL implementation was used (as discussed further in **Section 7.8.1.2**). For simplicity, costs for all projects in a given segment or tributary were assumed be incurred during the middle year of the implementation period for that segment or tributary.
12. **Develop operation and maintenance costs** – once LFDs are on line, operation and maintenance costs were assumed to begin, starting with the completion of each LFD and continue through the end of the overall TMDL implementation period (costs would continue indefinitely, but for simplicity the estimated TMDL costs were constrained to the implementation period). Assumptions for operation and maintenance costs were based on information supplied by the City of Los Angeles, as follows:
    a. Average diversion flow rate – 0.15 cfs
    b. Diversion system pumping and operation and maintenance costs – assumed $50,000/yr

c. Collection system maintenance costs – assumed $209,000/mgd-mile of distance to treatment plant
d. Treatment plant operation and maintenance charges – For the LFD's assumed to be tributary to the City of Los Angeles Wastewater System, the basis of cost was $1.7M/mgd/yr plus BOD and TSS surcharges. For the LFD's assumed to be tributary to the LACSD system, the basis of the cost was applying a surcharge fee for a discharge with 10 mg/L suspended solids and 10 mg/L COD of $715/MG, or approximately $261,000 per year for a 1 mgd discharge.

13. **Compile costs** – the combination of capital cost and operation and maintenance costs were complied on an annual basis over the entire TMDL implementation time period (see **Section 7.8.1.1**). Total capital costs, based on the 122 initial and follow-up projects shown in **Table 1**, are projected to be approximately $283,000,000 in current (2009) costs (**Table 2**), and approximately $469,000,000 allowing for a 3% cost escalation over the assumed implementation period (**Table 3**). Annual costs for operation and maintenance assumed to begin at year eight (8) when the first set of projects are all expected to be on line are estimated at approximately $856,000 per year with no allowance for escalation (**Table 2**), and approximately $1,090,000 per year if escalation is accounted for (**Table 3**). By the end of the complete TMDL implementation period with all assumed projects on line, total annual operation and maintenance costs are estimated to reach $21,700,000/yr without escalation or allowing for 3% inflation, total annual operation and maintenance costs are estimated to reach $56,400,000/yr. Combining both the capital costs and O&M costs over the TMDL implementation period, the total costs of the TMDL under the Conventional Strategy, with and without escalation, are estimated to be $585,000,000 and $1,097,000,000, respectively. Note that the O&M costs would likely continue indefinitely beyond the TMDL implementation period.

To further illustrate TMDL costs, **Figure 3** and **Figure 4** show the estimated annual capital costs for initial and follow-up projects, and annual operational and maintenance costs by year through the end of the assumed implementation period with and without an allowance for escalation, respectively. **Figure 5** and **Figure 6** present the total annual costs added together over the same period as well as cumulative costs over the TMDL implementation period with and without an allowance for escalation, respectively.

Table 2. Conventional Strategy – Estimated Total Costs (Capital and O&M, 2009 Dollars) for Treatment Facilities to Implement the Dry Weather Los Angeles River Bacteria TMDL assuming zero cost escalation

Diversion Facilities and Outlier Outfall Investigations (Capital Cost)	$217,000,000
Conveyance Facilities (Capital Cost)	$23,000,000
Treatment Capacity Cost (Capital Cost)	$42,000,000
Total Capital Costs	$283,000,000
Operation & Maintenance [a]	$302,000,000
Total TMDL Cost [a,b]	**$585,000,000**

a – The estimated total O&M cost is for the TMDL implementation period only. Efforts for O&M costs will likely continue indefinitely, with estimated annual costs exceeding $21,700,000 per year after the TMDL implementation period.
b – This total cost does not include costs for monitoring efforts or special studies, as described in Section 8.

Table 3. Conventional Strategy – Estimated Total Costs (Capital and O&M, 2009 Dollars) for Treatment Facilities to Implement the Dry Weather Los Angeles River Bacteria TMDL assuming 3% cost escalation

Diversion Facilities and Outlier Outfall Investigations (Capital Cost)	$363,000,000
Conveyance Facilities (Capital Cost)	$40,700,000
Treatment Capacity Cost (Capital Cost)	$65,300,000
Total Capital Costs	$469,000,000
Operation & Maintenance [a]	$628,000,000
Total TMDL Cost [a,b]	**$1,097,000,000**

a – The estimated total O&M cost is for the TMDL implementation period only. Efforts for O&M costs will likely continue indefinitely, with estimated escalated annual costs exceeding $56,400,000 per year after the TMDL implementation period.
b – This total cost does not include costs for monitoring efforts or special studies, as described in Section 8.

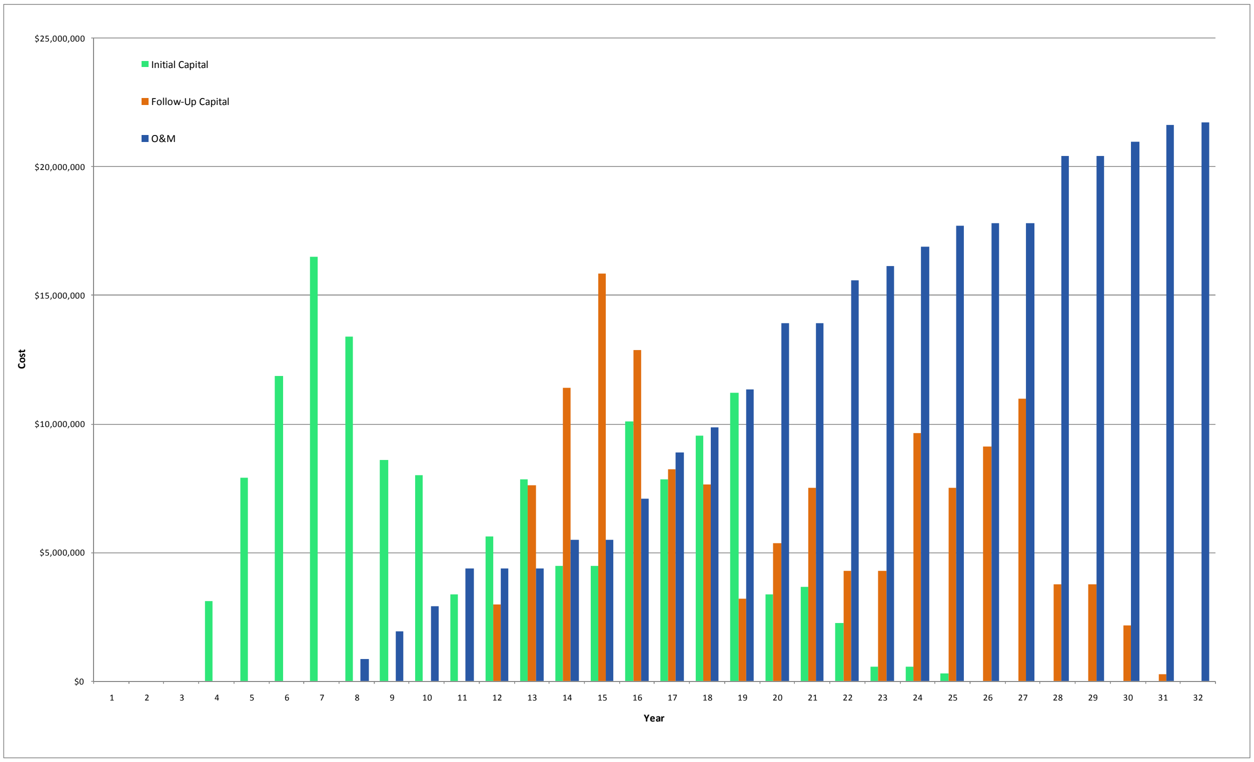

Figure 3. Outfall-Based Approach – Estimated Annual Capital Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs Without Annual Escalation Factor

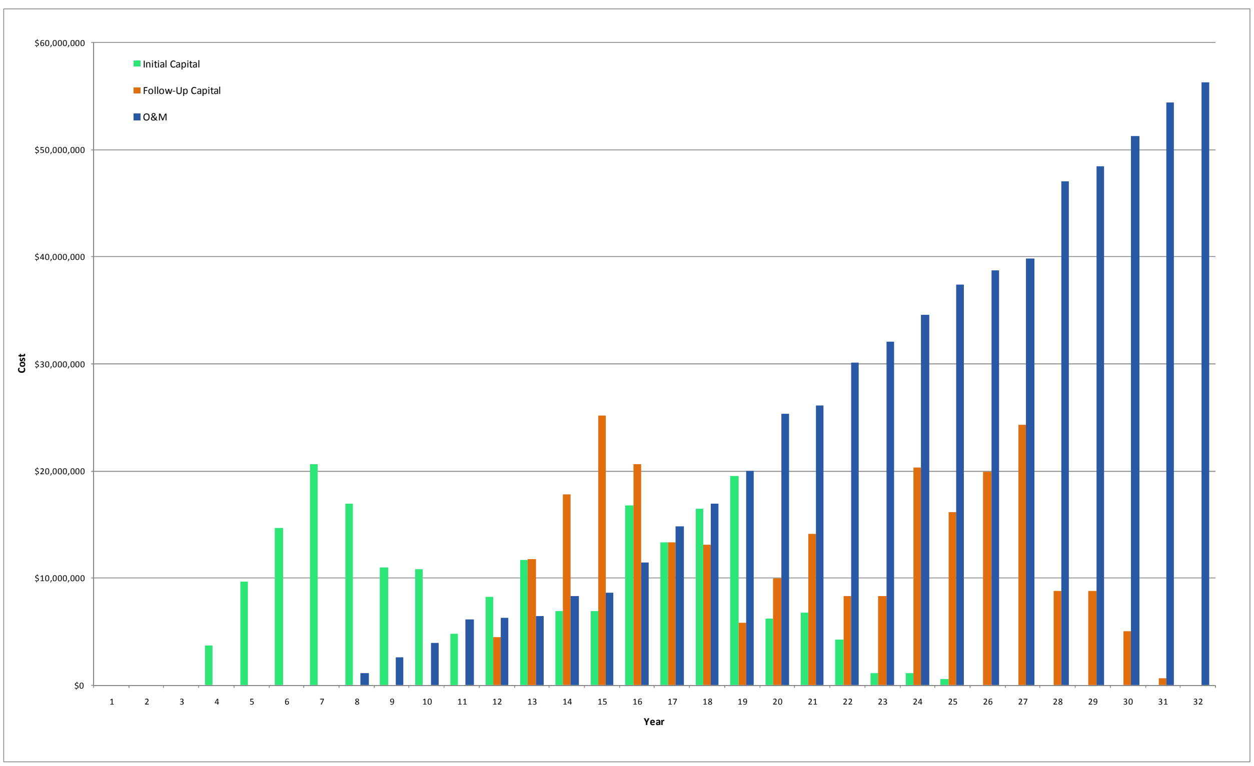

Figure 4. Outfall-Based Approach – Estimated Annual Capital Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs With Annual Escalation Factor

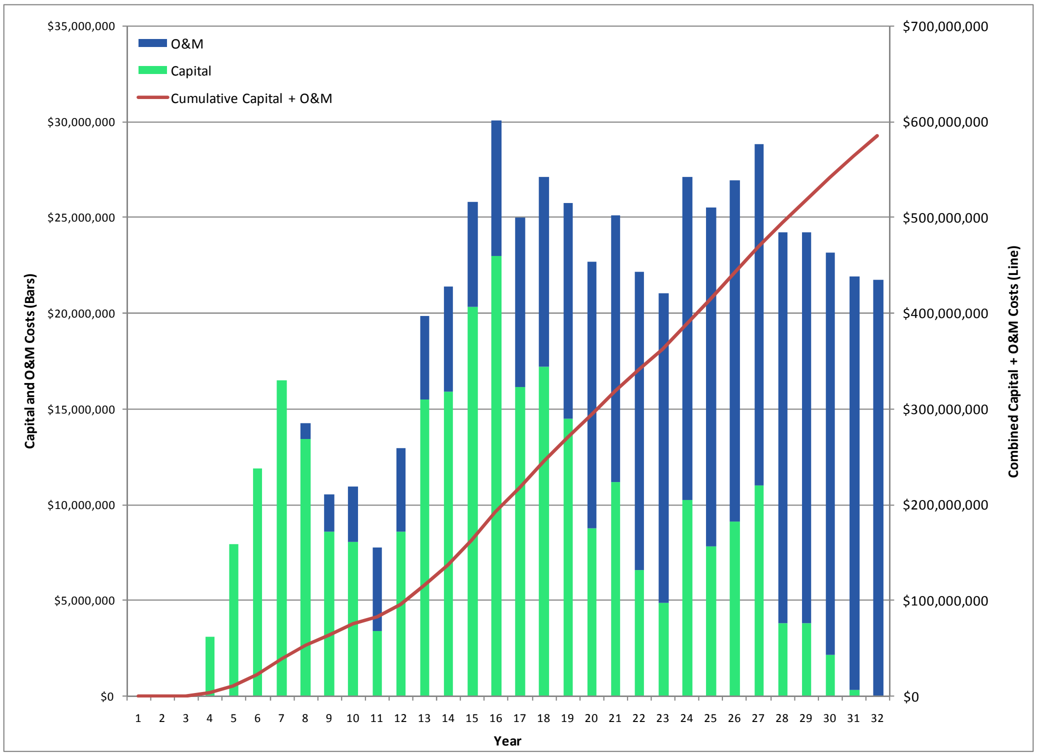

Figure 5. Outfall-Based Approach – Estimated Total Annual and Cumulative Capital Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs Without Annual Escalation Factor

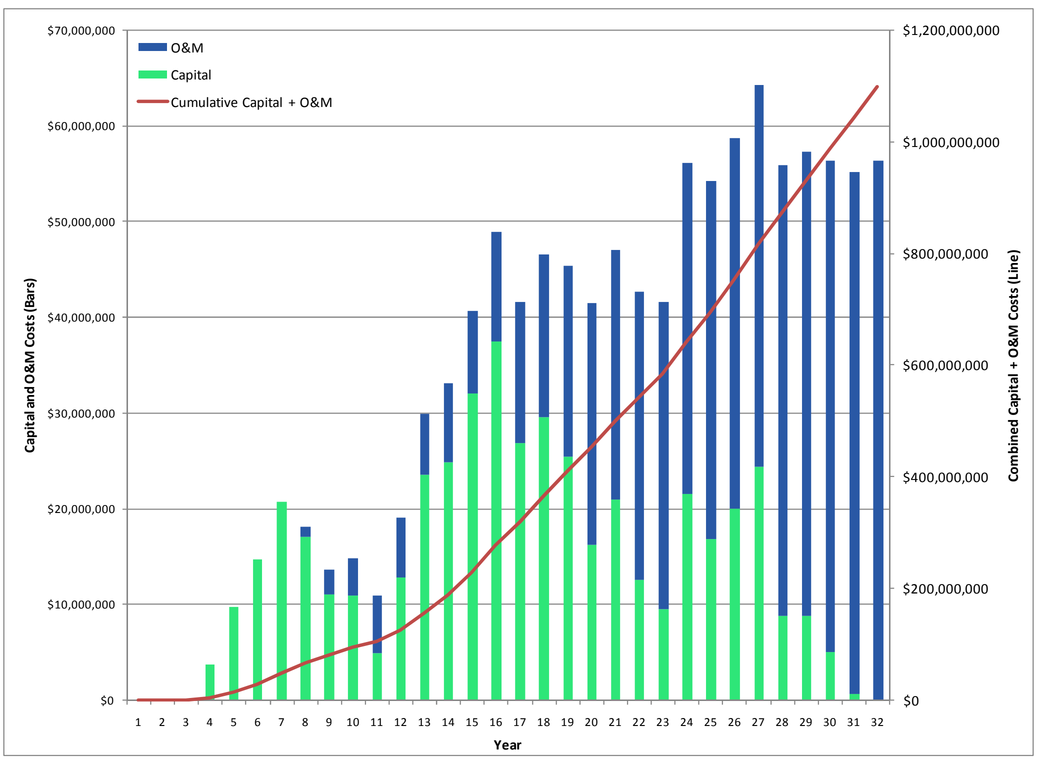

Figure 6. Outfall-Based Approach – Estimated Annual Capital and Cumulative Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs With Annual Escalation Factor

A3.2.2 Estimated Costs for Alternative Watershed Wide Strategy

This section presents a cost estimate for one potential Alternative Strategy that combines outfall- and Downstream-based LRS approaches (**Section 7.8.2**). **Section 7.8.2.2** discusses a potential timeline for this approach. Any or all of the potential "Downstream Solutions" contemplated under this approach may ultimately be infeasible for regulatory, political, or technical reasons. However, for the purposes of developing the Alternative Strategy, the following assumptions were made **(**see **Figure 7** in Section 7**)**:

- Outfall-based actions would be implemented for the following segments and tributaries:
  - Segments A, Segment B, Segment C, and Segment D.
  - Compton Creek
- Downstream solutions would be implemented near the downstream end of the following tributaries just prior to the confluence with the mainstem LA River:
  - Rio Hondo
  - Arroyo Seco
  - Verdugo Wash
  - Burbank-Western Channel (potentially implement upstream of from the Burbank WRP discharge)
  - Tujunga Wash
  - Bull Creek
- A Downstream-based approach would be implemented on Segment E of the mainstem LA River just upstream of the Sepulveda Basin, and no additional projects would be required on the tributaries to Segment E.

To develop an order-of-magnitude cost estimate for a single Downstream Solution, a concept was used that assumes that some type of off-line diversion and treatment facility would be constructed in the general vicinity of the diversion location, potentially on publicly-owned land. Other options, including in-stream wetlands, are available; however, for the purpose of developing a cost estimate, the assumption of off-line diversion and treatment was utilized. The treatment facility would be based on filtering and disinfecting the runoff so that effluent could be either 1) be reused for non-potable irrigation or other purposes, such as infiltrated to the groundwater basin, or 2) discharged downstream. This is similar to the Dry Weather Urban Runoff Plant (URP) concept incorporated in the Maximum Reuse alternatives investigated under the City of Los Angeles's Integrated Resources Plan in 2005. Under those alternatives, various locations and sizes of URPs were included, some at similar locations to those being considered under this Implementation Plan. A unit cost of these projects per MGD of flow capacity was developed for the Integrated Resources Plan (IRP) for both capital and operation and maintenance costs. Under the IRP it was assumed that all dry weather flow to the mainstem or tributaries would have to be intercepted from all outfalls and conveyed through separate parallel pipelines to each downstream treatment facility. Under the current assumption, flow would be allowed to be conveyed in the mainstem or tributary and intercepted at only one location near the URP, and therefore the diversion pipeline costs were not included.

Based on these assumptions, the assumed dry weather flows rates for each of the locations listed above, the estimated capital costs of each project, and the estimated operation and maintenance costs once the project was on-line are summarized in
Table 4.

Table 4. Locations, Sizes, and Costs for Downstream Solutions

Location of Project	**Flow Rate/Capacity** (MGD)	**Estimated Capital Cost** ($M 2009)	**Estimated Annual Operation and Maintenance Costs** ($/yr 2009)
Arroyo Seco	2.50	18.0	875,000
Rio Hondo	0.16	1.2	56,000
Verdugo Wash	5.2	37.5	1,820,000
Burbank Western Channel	2.6	18.7	910,000
Tujunga Wash	1.0	7.2	350,000
Bull Creek	2.40	17.3	840,000
LAR Segment E	5.80	41.8	2,030,000

Other assumptions and costs for all other segments and the one tributary (Compton Creek) that are presumed to still require Outfall-based approaches are the same as those described in the preceding section (**A3.2.1**).

The combination of capital cost and operation and maintenance costs were complied on an annual basis over the entire implementation time period (**Section 7.8.2.2**). Total capital costs are based on the number of projects along the segments/tributaries subject to an Outfall-based approach (**Table 1**), which includes 26 initial and 14 follow-up Outfall-based projects, plus the Downstream Solutions identified in
Table 4. The schedule used to estimate operation and maintenance costs is presented in **Section 7.10**. As shown in
Table 5, total capital costs are projected to be approximately $264,000,000 in current (2009) costs, and approximately $391,000,000 allowing for a 3% cost escalation (
Table 6) over the assumed TMDL implementation period.

These estimated total capital costs for the Alternative Strategy are slightly lower than those estimated for the Conventional Strategy. With zero cost escalation, the total capital cost for Alternative Strategy is estimated to be $20,000,000 (7%) less than the Conventional Strategy. With a 3% cost escalation, the total capital cost for the Alternative Strategy is estimated to be $78,000,000 (17%) less than the Conventional Strategy. While in terms of percentages these costs savings are not dramatic, there are other reasons that the Alternative Strategy could be preferred even at equivalent or higher costs. First, the costs estimates for segments/tributaries addressed with the Outfall-based approach made assumptions that could result in an underestimation of the total number of Priority Outfalls that may ultimately need to be addressed to meet WLAs. In contrast, there is more certainty that Downstream Solutions would result in the attainment of in-stream TMDL targets thus reducing the likelihood that additional (follow-up) solutions and costs would be necessary. Second, it should be recognized that the Downstream-based approaches treat 100% of the flow that affects the downstream recreational areas, as opposed to a fraction of the flow treated with Outfall-based approaches. As such, the Downstream-based approach could be considered more "reliable" and more "protective" than the Outfall-based approach.

Annual costs for operation and maintenance are assumed to begin at year eight (8) when the first set of projects are expected to be on-line are, estimated at approximately $856,000 per year with no allowance for escalation, and approximately $1,090,000 per year if escalation is accounted for. By the end of the complete TMDL implementation period with all assumed projects on line, total annual operation and maintenance costs are estimated to reach $2,300,000/yr without escalation, while when allowing for 3% inflation, total annual operation and maintenance costs are estimated to reach $54,400,000/yr. Combining both the capital costs and O&M costs over the TMDL implementation period, the total costs of the TMDL under the Alternative Strategy, with and without escalation, are estimated to be $590,000,000 and $1,024,000,000, respectively. Note that the O&M costs would likely continue indefinitely beyond the TMDL implementation period.

To further illustrate TMDL costs, **Figure 7** and **Figure 8** show the estimated annual capital costs for initial and follow-up projects, and annual operational and maintenance costs by year through the end of the assumed implementation period with and without an allowance for escalation, respectively. **Figure 9** and **Figure 10** present the total annual costs added together over the same period as well as cumulative costs over the TMDL implementation period with and without an allowance for escalation, respectively.

Table 5. Alternative Strategy – Estimated Total Costs (Capital and O&M, 2009 Dollars) for Treatment Facilities for Implementation of the Dry Weather LA River Bacteria TMDL assuming zero cost escalation

Diversion Facilities and Outlier Outfall Investigations (Capital Cost)	$93,000,000
Downstream Facilities (Capital Cost)	$141,000,000
Conveyance Facilities (Capital Cost)	$9,000,000
Treatment Capacity Cost (Capital Cost)	$20,000,000
Total Capital Costs	$264,000,000
Operation & Maintenance [a]	$326,000,000
Total TMDL Cost [a,b]	**$590,000,000**

a – The estimated total O&M cost is for the TMDL implementation period only. Efforts for O&M costs will likely continue indefinitely, with estimated annual costs exceeding $22,800,000 per year after the TMDL implementation period.
b – This total cost does not include costs for monitoring efforts or special studies, as described in Section 8 (not yet developed).

Table 6. Alternative Strategy – Estimated Total Costs (Capital and O&M, 2009 Dollars) for Treatment Facilities for Implementation of the Dry Weather LA River Bacteria TMDL assuming 3% cost escalation

Diversion Facilities and Outlier Outfall Investigations (Capital Cost)	$139,000,000
Downstream Facilities (Capital Cost)	$208,000,000
Conveyance Facilities (Capital Cost)	$14,000,000
Treatment Capacity Cost (Capital Cost)	$30,000,000
Total Capital Costs	$391,000,000
Operation & Maintenance [a]	$633,000,000
Total TMDL Cost [a,b]	**$1,024,000,000**

a – The estimated total O&M cost is for the TMDL implementation period only. Efforts for O&M costs will likely continue indefinitely, with estimated escalated annual costs exceeding $54,400,000 per year after the TMDL implementation period.
b – This total cost does not include costs for monitoring efforts or special studies, as described in Section 8 (not yet developed).

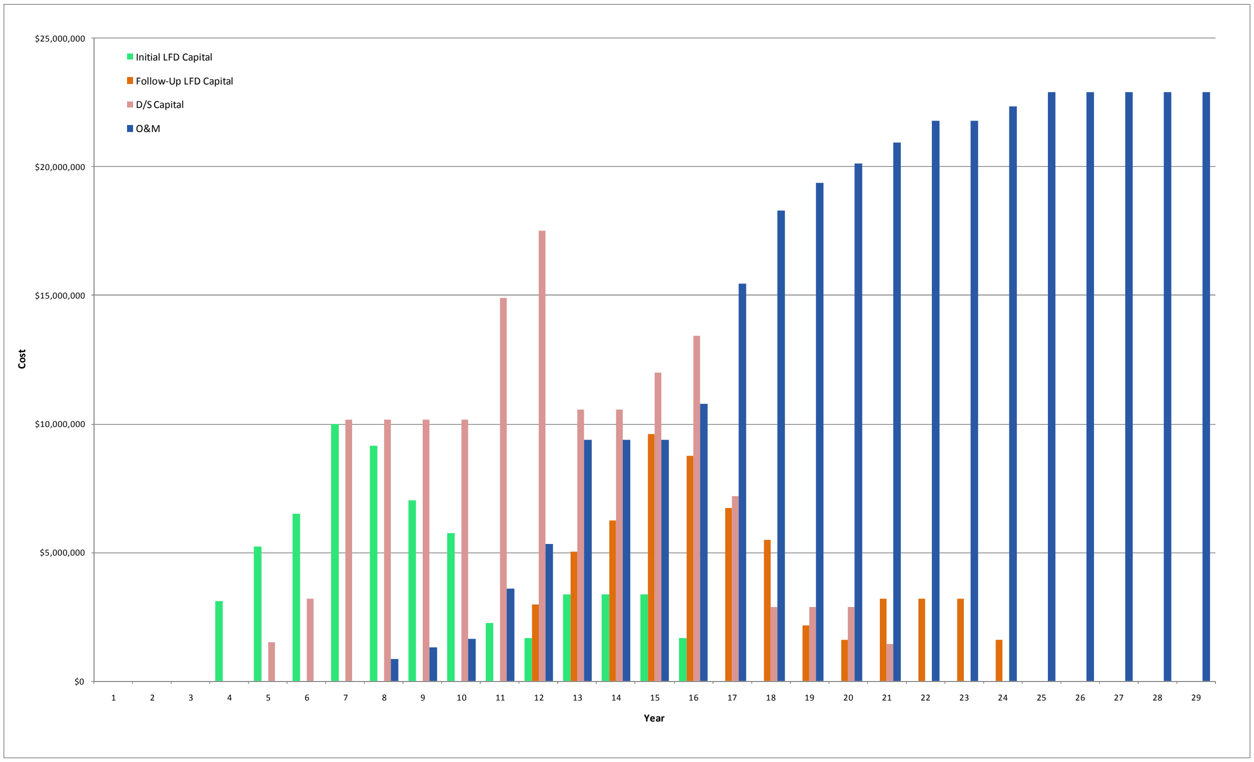

Figure 7. Alternative Strategy Approach – Estimated Annual Capital Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs Without Annual Escalation Factor

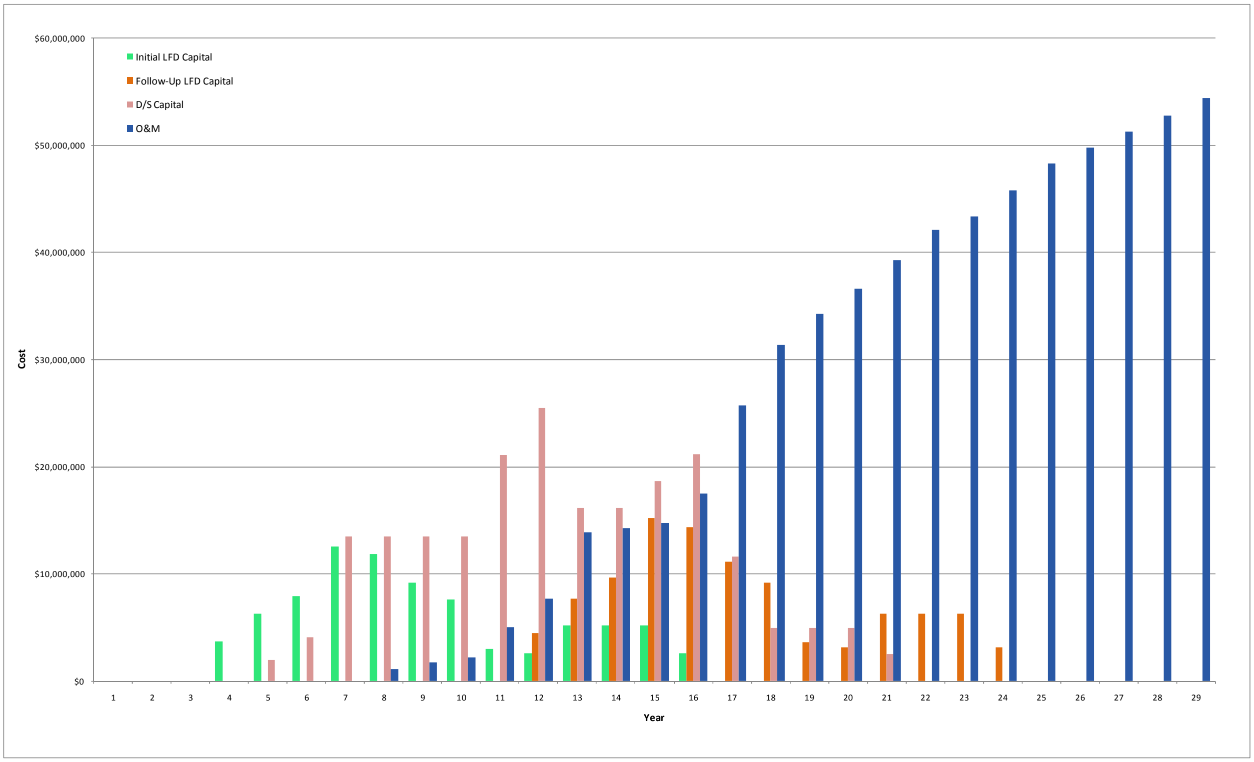

Figure 8. Alternative Strategy Approach – Estimated Annual Capital Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs With Annual Escalation Factor

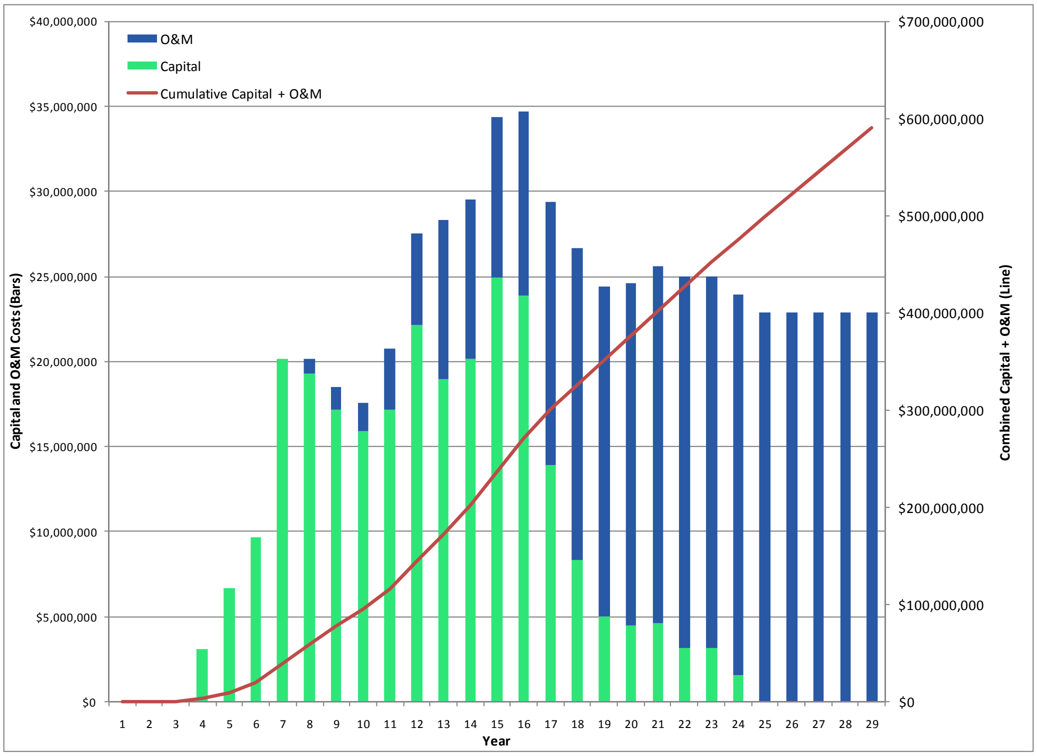

Figure 9. Alternative Strategy Approach – Estimated Total Annual Capital and Cumulative Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs Without Annual Escalation Factor

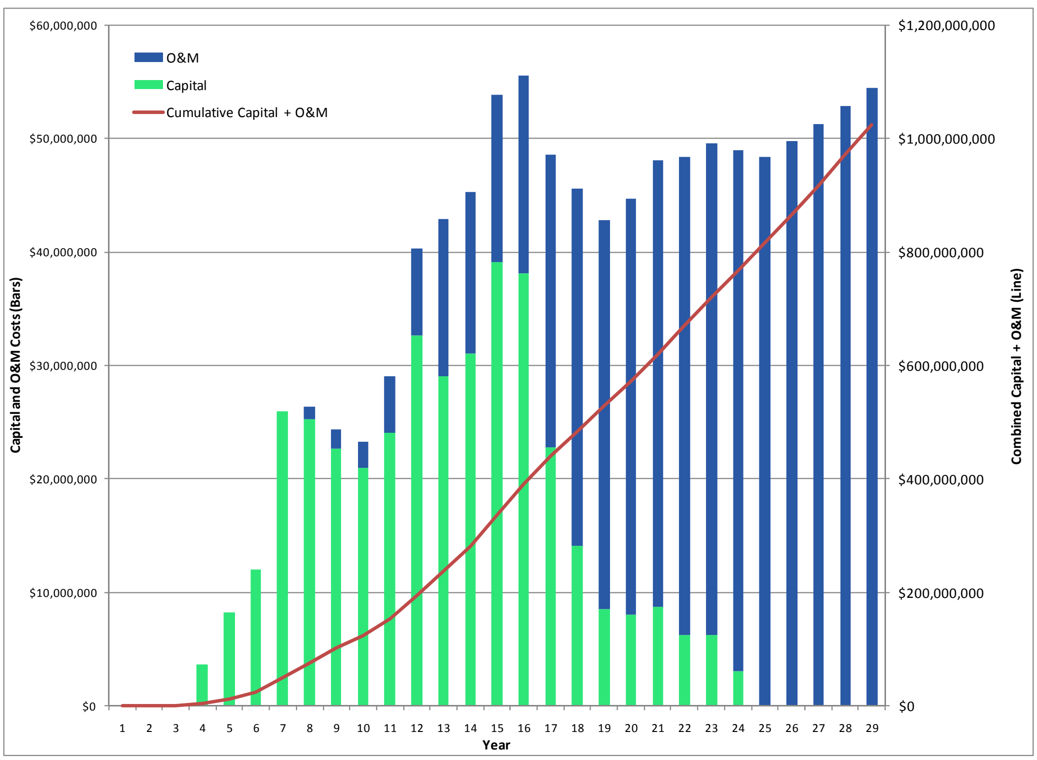

Figure 10. Alternative Strategy Approach – Estimated Annual Capital and Cumulative Costs for Initial, and Follow-up Projects and Operational and Maintenance Costs With Annual Escalation Factor

A3.3 Individual Project Timeline

The length of the overall Implementation Schedule is a function of the length of time needed to complete individual projects/actions. The estimated timeline to complete an individual project is based on LFD of a dry weather storm drain discharge (as a “surrogate” structural BMP) because reliable examples of LFD projects conducted locally by MS4 Permittees are available. Additionally, implications of choosing alternative projects/actions (i.e., infiltration) are considered.

For LFDs, information provided by the City of Los Angeles Bureau of Sanitation and Bureau of Engineering was reviewed to relate "typical" time lines for activities for similar public works projects and experience gained by the City in implementing LFD projects. The projects evaluated include LFDs along Santa Monica Bay, recent projects underway for the Los Angeles River near downtown Los Angeles, and projects developed as part of the City of Los Angeles Proposition O funding. Based on review of these projects, the following steps and timeline are considered typical once a decision has been made to pursue an LFD project in a highly urbanized setting:

- **Preliminary Engineering Design** (9-12 months) – preliminary evaluation leading to the decision to implement an LFD project would confirm that (1) there is sewer with adequate capacity within reasonable distance, and (2) that either the City of Los Angeles or LACSD has the capacity to accept the dry weather runoff into the wastewater treatment plant. There are a number of remaining steps before detailed design can be initiated. These can include any or all of the following steps depending upon the specific situation:
    - Securing agreements – this component can involve such activities as: (1) establishing specific inter-agency implementation agreements where multiple jurisdictions are involved in a project because the subwatershed drains multiple jurisdictions or where multiple agencies agree to jointly participate in the funding of projects; and (2) securing intra-agency arrangements among departments (stormwater, wastewater, planning, etc.)
    - Conducting planning/pre-design and completing CEQA requirements – this component could include preliminary design; completing CEQA compliance, ranging from a Negative Declaration through a full environmental impact report (EIR) depending upon the complexity and extent of each project; activities such as surveying, utility research, or geotechnical work; and other related tasks.
    - Obtaining permits – LFD projects may require one or more permits, including encroachment permits, sanitary sewer connection permits, etc.
- **Design** (8 months) – typical design for an LFD includes final surveying and geotechnical work, and detailed design of modifications to the existing storm drain system, the manholes and pumping structures and related infrastructure, and connections to the wastewater collection system. Also included is development of plans, specifications and contract documents.
- **Advertisement**, **bid and award** (6 months) – this step includes the standard processes that public agencies are typically required to go through to prepare design documents

for public review, advertise the project, and allow an adequate time for bidding, evaluation of bids received, and execution of a construction contract.

- **Construction** (8 months) – the timeline for this step is based on construction of a moderately complex project in relatively congested urban areas with some potential constraints on scheduling or activities such as traffic, tie-ins to existing utilities, etc.
- **Post-construction, start-up and turnover** (3 months) – the final step covers the period at the close-out of the construction contract, initial operation and "shake-down" of the facilities, and the training of and transition to the agency staff who will operate and maintain the constructed facility.

As presented above, a total project timeline to bring an identified LFD project from pre-planning to operations is estimated to be 37 months. Note that this timeline begins after it has been determined that an LFD is feasible and desirable at a given outfall. More complex projects will likely require a longer timeline (e.g., a reuse or infiltration project, in-stream BMPs and other projects with permitting challenges, etc).

In the case of infiltration actions, fewer projects were available to evaluate the timeline and steps associated with a "typical" project. Relative to LFDs, it is likely that infiltration projects would require a similar or longer timeline especially if additional land acquisition is required. All of the implementation steps noted above for LFDs would be required for an infiltration type project. In addition there may be other activities that could potentially add more time. For example, if the project were to be constructed on public land under the ownership and management of another department (e.g., Recreation and Parks) or even another outside agency (e.g., School District), the institutional and potential funding arrangements could be significantly more complex. There is also the possibility of utilizing land that is privately-owned, in which case property acquisition or long-term lease arrangements would need to be secured.