

August 6, 2009  
7087B00

City of Morro Bay  
955 Shasta Avenue  
Morro Bay, California 92442

Cayucos Sanitary District  
200 Ash Avenue  
Cayucos, CA 93430

Attention: Mr. Bruce Keogh, Wastewater Division Manager  
Mr. Bill Callahan, District Manager

Subject: Morro Bay/Cayucos Sanitary District Wastewater Treatment Plant Facility Master  
Plan - Amendment No. 1

Dear Ladies and Gentlemen of the Joint Board:

The purpose of this letter is to summarize the material being covered in the August 11, 2009 meeting of the Joint Powers Agreement (JPA) Board. The topic that will be discussed is the amendment to the Facility Master Plan (FMP), which presents modifications to the final recommended project due to flood impact mitigation (Amendment No. 1). These recommendations include all the aspects of the upgrade of the Morro Bay/Cayucos Sanitary District (MBCSD) WWTP including secondary or tertiary treatment facilities, biosolids management, and new support facilities to replace existing facilities that must be demolished to accommodate the flood path. Please note that the costs remain at the 2006 costing level to facilitate comparison to the FMP.

Carollo Engineers, P.C. (Carollo) has completed the engineering review and is pleased to report that the amended cost for the oxidation ditch project is lower than the original costs presented in the FMP. This cost reduction can be attributed to the following:

- Flood mitigation costs were less than the \$4 million (project cost) initially budgeted in the FMP; and
- Biosolids treatment and handling is more limited due to the flood hazard.

The amended project cost is \$657,000 lower than presented in the draft FMP. A line item cost summary comparison is attached.

### **Background**

The final FMP project recommended by Carollo, MBCSD staff, and the JPA Board was Recommendation No. 1A - Oxidation Ditch with Filtration with partial composting. The project cost estimate was \$28 million.

As a result of the Flood Study conducted by the Wallace Group (Wallace), the existing WWTP would be inundated with approximately three to six feet of storm water in a 100-year flood event depending on existing grade. To mitigate the flood hazard, a flood path through the existing facility is recommended. To accommodate the flood path, the majority of the existing WWTP needs to be demolished. The new treatment facilities would be located in the area currently

occupied by the sludge drying beds and/or trailer storage referred to as the low impact zone in the amendment.

Recommendation No. 1A (Oxidation Ditch with Filtration) and Recommendation No. 3 (Membrane Bioreactor [MBR]) are reevaluated as part of Amendment No. 1, (referred to as Recommendation No. 1AR and Recommendation No. 3R). These were the two alternatives of most interest.

The revised total project cost for Recommendation No. 1AR and Recommendation No. 3R, based on the flood impacts, is \$27,395,000 and \$36,413,000 respectively. The oxidation ditch with filtration remains the lowest cost and most reliable alternative for the long-term operation of the WWTP.

### **Revised Demolition Approach**

As mentioned previously, the majority of the existing facilities will be demolished to create the flood path, which increases the costs. This new flow path will be paved and approximately at the existing plant grade. The facilities now scheduled for demolition are:

- Headworks
- Chlorine Contact Basin
- Trickling Filter No. 1
- Trickling Filter No. 2
- Primary Clarifier No. 1
- Primary Clarifier No. 2
- Digester No. 1
- Administration Building
- Maintenance Building
- Chlorination Building
- Digester No. 2
- Digester No. 3
- Secondary Clarifier
- Air Release Structure
- Shed
- Hazardous Waste Facility

The total project cost for demolition of these structures is \$1,866,000 versus \$420,000 originally budgeted in the FMP.

### **Changes in Biosolids Management Practices**

There are substantial cost reductions associated with the revised biosolids management practices. Sludge drying and composting are no longer viable options for the MBCSD. First, the exposure of these large areas to flooding becomes environmentally problematic. Second, the sludge beds are located in the area designated as the low impact zone where treatment facilities are best relocated. The revised MBCSD WWTP biosolids plan is to dewater biosolids for offsite processing and disposal. The costs for digestion, sludge drying beds and composting has been eliminated. The new cost for biosolids management facilities is \$2,344,000. The originally estimated project cost included in the FMP was \$5,030,000, including the cost to rehabilitate the existing digesters.

### **New Support Facilities**

The final recommended project presented in Chapter 9 of the FMP included significant rehabilitation of existing support facilities. Major support facilities include the Control Building and Headworks. Since these structures must now be demolished to accommodate the flow

path, much of the rehabilitation cost will be committed to new construction. The cost attributed to both the rehabilitation and construction of support facilities was \$5,298,000 in the FMP, excluding rehabilitation of the existing digesters. The cost to construct all new support facilities for Recommendation No. 1AR is now estimated at \$5,699,000.

### **Secondary/Tertiary Treatment Facilities**

Recommendation No. 1AR includes construction of new oxidation ditches and filtration at the WWTP. One significant change between the facilities described in the FMP and the amendment is the need to construct two secondary clarifiers. The addition of a second secondary clarifier increases the cost of the process by approximately \$1,224,000 in total project cost. The cost of the oxidation ditch and filters presented in the FMP was \$11,635,000. The updated project cost based on the addition of another clarifier and additional site work for flood impact mitigation is \$13,954,000. The increases cost of the oxidation ditch and filtration treatment facilities is attributed to flood impact mitigation site accommodations.

### **Potential Offsite Flood Mitigation Impacts**

Additional flood impact mitigation may be required outside of the WWTP site to accommodate the 100-year flood event as described in the Wallace Flood Study. These items, and their associated costs, are outside of the scope of this amendment and FMP.

### **Constructability**

An additional, significant benefit to the Revised project is constructability. The revised plan no longer includes significant rehabilitation and use of existing facilities. The new plant can be constructed on the sludge bed site without significant plant interruptions. The construction period will also be reduced because there will be limited need to complete new facilities prior to rehabilitation efforts, i.e., sequencing becomes much easier. All of this has a cost benefit. We have not included the possible cost benefit because it falls within the revised estimate contingency.

### **Operations and Maintenance Cost Impacts**

Amendment of the recommended project has also reduced the annual operating and maintenance (O&M) costs, and therefore the 20-year net present value (NPV) costs originally developed in the FMP. This cost reduction can be attributed to the simplification of the biosolids handling practices and the energy costs associated with these processes. Specifically, the energy to heat and mix the anaerobic digesters is no longer part of the annual O&M costs, and the centrifuges originally included in the recommended project have been replaced with screw presses. The screw presses use significantly less electricity than the centrifuges.

### **Summary**

Based on the flood impact mitigations identified in the Wallace Flood Study, the cost of the final recommended project has decreased from \$28,052,000 to \$27,395,000. This cost reduction is due to a decreased level of biosolids treatment and a reduction in the cost of flood impact

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mitigation. A summary of the individual components of the recommended project from the FMP and amendment are presented in Table 1.

Carollo appreciates the opportunity to assist the MBCSD Board. If you have any questions, please call.

Sincerely,

CAROLLO ENGINEERS, P.C.

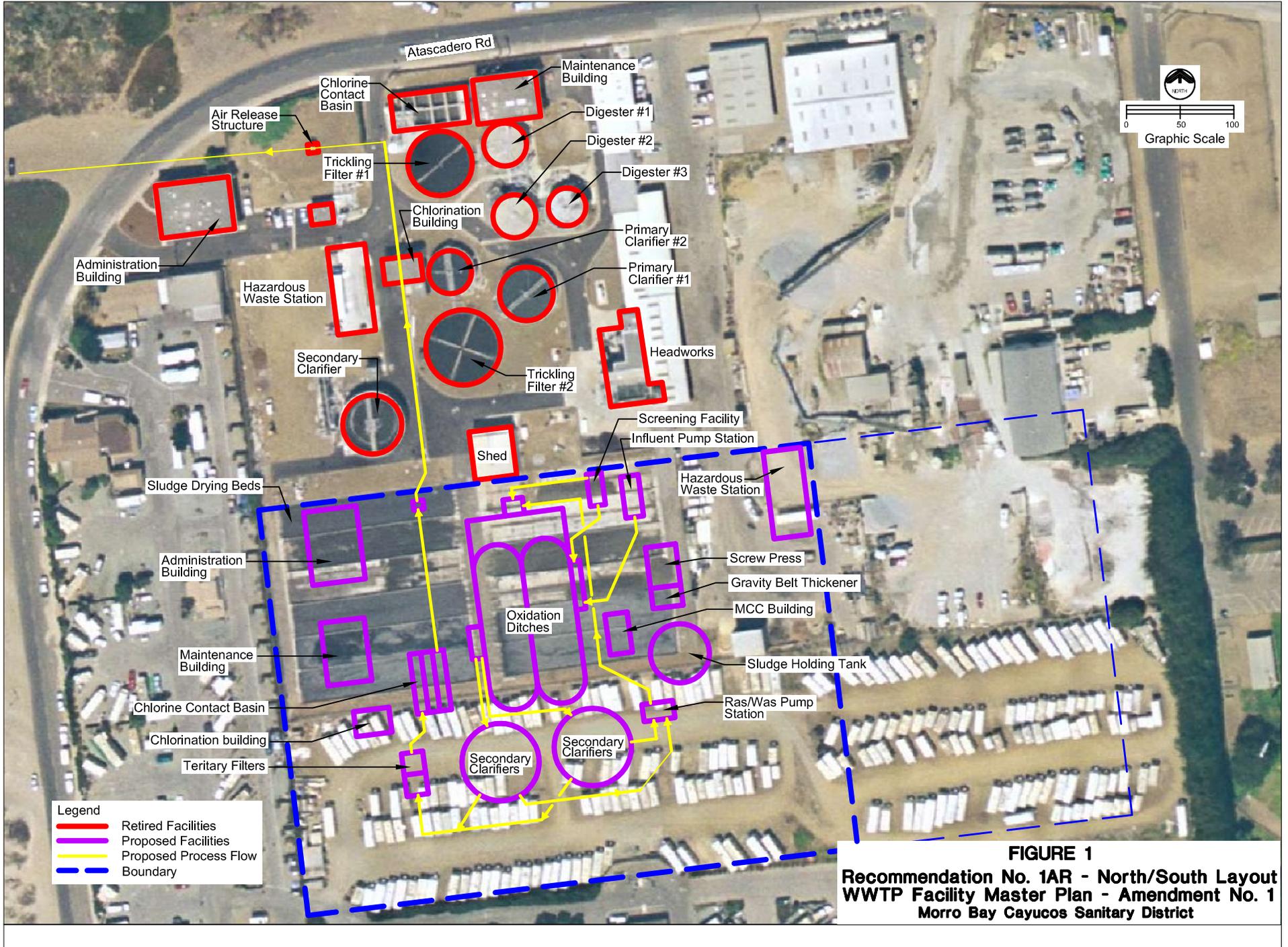


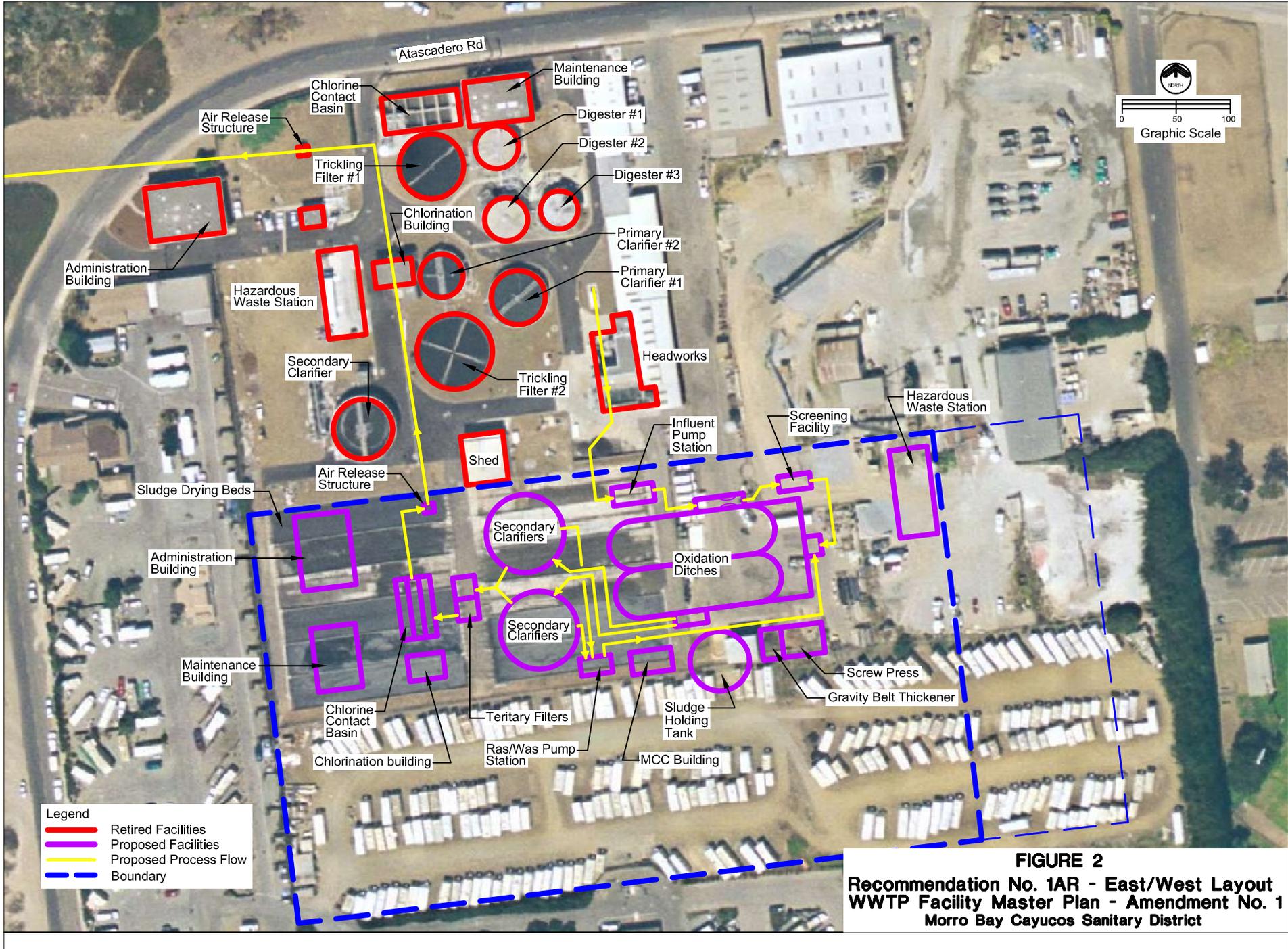
David L. Stringfield, P.E.

DLS:ETC:asw

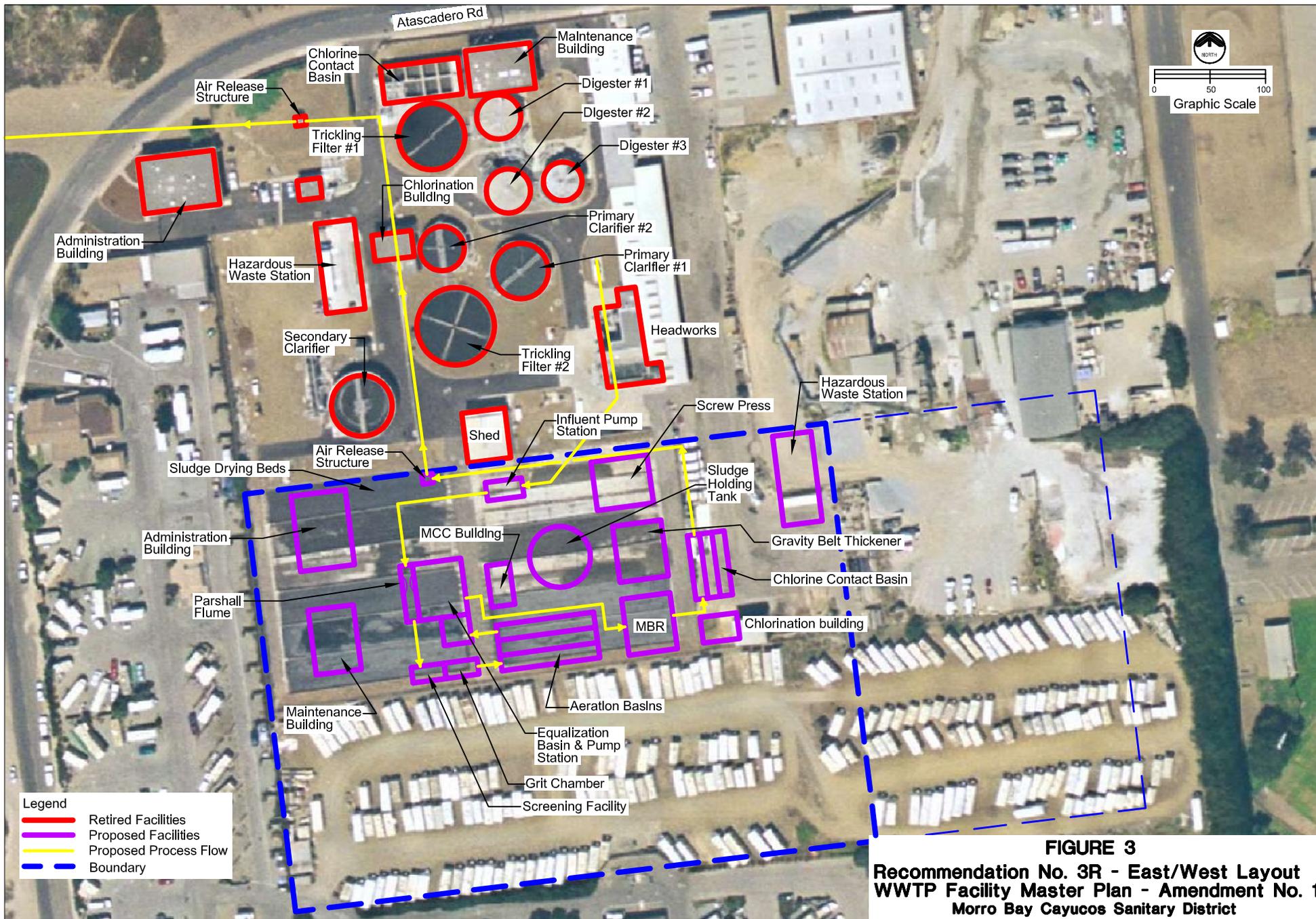
Enclosures: Table 1 - Summary of Amendment No. 1 and FMP Costs  
Figure 1 - Recommendation No. 1AR - North/South Layout  
Figure 2 - Recommendation No. 1AR - East/West Layout  
Figure 3 - Recommendation No. 3R - East/West Layout  
Amendment No. 1 to FMP

<b>Table 1      Summary of Amendment No. 1 and FMP Costs WWTP Facility Master Plan - Amendment No. 1 MBCSD</b>		
<b>Component</b>	<b>Project Cost</b>	
	<b>FMP Recommendation No. 1A</b>	<b>Revised Recommendation No. 1AR</b>
<b><u>Secondary/Filtration Treatment Facilities</u></b>	\$11,635,000	\$13,954,000
<b><u>Biosolids Management Facilities</u></b>	\$5,030,000	\$2,344,000
<b><u>Support Facilities</u></b>	\$5,298,000	\$5,699,000
<b><u>Subsoil Stabilization Contingency</u></b>	\$1,619,000	\$1,912,000
<b><u>Flood Impact Mitigation</u></b>		
Contingency	\$4,050,000	\$1,620,000
Demolition	\$420,000	\$1,866,000
<b>Total Project Cost 2006</b>	<b>\$28,052,000</b>	<b>\$27,395,000</b>





**FIGURE 2**  
**Recommendation No. 1AR - East/West Layout**  
**WWTP Facility Master Plan - Amendment No. 1**  
**Morro Bay Cayucos Sanitary District**



**FIGURE 3**  
**Recommendation No. 3R - East/West Layout**  
**WWTP Facility Master Plan - Amendment No. 1**  
**Morro Bay Cayucos Sanitary District**



**MORRO BAY CAYUCOS SANITARY DISTRICT**

**FACILITY MASTER PLAN**

**AMENDMENT NO. 1**

**DRAFT**

August 2009

**MORRO BAY CAYUCOS SANITARY DISTRICT  
FACILITY MASTER PLAN - AMENDMENT NO. 1**

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## FACILITY MASTER PLAN - AMENDMENT NO. 1

### 1.0 SUMMARY

The purpose of this amendment is to present two recommendations that have been developed for upgrade of the Morro Bay Cayucos Sanitary District (MBCSD) Wastewater Treatment Plant (WWTP). These recommendations were initially developed in Chapter 9 (Recommendations) of the Facility Master Plan (FMP). However, due to potential flood impacts discovered after preparation of the FMP, several recommendations have been redeveloped as part of this amendment (Amendment No. 1).

The recommendations revised in Amendment No. 1 include Recommendation No. 1A - Oxidation Ditch with Filtration and Recommendation No. 3 - Membrane Bioreactor (MBR) because of their potential to operate within the 7.3 acre footprint identified in the Wallace Group (Wallace) Flood Study. For this amendment, the revised recommendations are referred to as Recommendation No. 1AR (Oxidation Ditch with Filtration) and Recommendation No. 3R (Membrane Bioreactor).

#### 1.1 Recommendation No. 1AR - Oxidation Ditch with Filtration

Recommendation No. 1AR includes the construction of new oxidation ditches and filters at the WWTP with biosolids handling facilities that will produce a biosolids product that must be hauled offsite for further treatment. The large area required to dry and compost biosolids is not compatible with the Wallace Flood Study. This recommendation has a total project cost of \$27,395,000 and 20-year net present value (NPV) cost of \$49,532,000. Following the upgrade, the WWTP will have the ability to treat the full design peak seasonal dry weather flow (PSDWF) of 1.5 mgd. The total effluent flow will receive secondary treatment, filtration, and disinfection before being discharged to the ocean. Sludge will be thickened and sent to a holding tank before it is dewatered and discharged to a bin or trailer for immediate offsite disposal.

#### 1.2 Recommendation No. 3R - Membrane Bioreactor (MBR)

Recommendation No. 3R includes the construction of a new MBR facility at the WWTP and, like Recommendation No. 1AR, facilities for direct hauling of biosolids. The recommendation has both the highest project and NPV costs at \$36,413,000 and \$63,993,000 respectively. Following the upgrade, the WWTP will have the ability to treat the full design PSDWF of 1.5 mgd. The total effluent flow will receive secondary treatment, membrane filtration, and disinfection before being discharged to the ocean. The effluent quality produced by the MBR has the highest quality of the two recommendations being considered.

### **1.3 Final Recommended Project**

After consideration of the economic and non-economic factors associated with the different project recommendations made in this amendment, Carollo recommends Recommendation No. 1AR (Oxidation Ditch with Filtration) with direct hauling of biosolids as the final recommended project for upgrade of the WWTP.

The final recommendation includes new influent pump station, screening facility, oxidation ditches, secondary clarifiers, cloth media filters, sludge holding tank, gravity belt thickener (GBT) and screw press housed in a thickening/dewatering building, chlorine contact basin and chlorination building, motor control center (MCC) building, standby generator, control building, maintenance building, and air release structure. The majority of the existing WWTP will be retired and demolished to create a flood flow path. This new flow path will be paved and approximately at the existing plant grade.

After upgrade of the WWTP, the MBCSD will have the ability to discharge 1.5 mgd of filtered and disinfected effluent to the ocean. Sludge produced from the secondary treatment process will be thickened, temporarily stored, and dewatered before being hauled offsite by a third party. The incompatibility of sludge drying beds or additional compost area due to flood considerations at the site has eliminated the possibility to continue composting onsite.

## **2.0 SCOPE**

The scope of Amendment No. 1 includes comparison of two viable treatment alternatives for reliable, long-term compliance with the current and anticipated future WWTP discharge requirements and 20-year flows and loadings. Four recommendations for upgrade of the MBCSD WWTP were initially evaluated in the FMP. These recommendations included:

- Recommendation No. 1 - Oxidation Ditch
- Recommendation No. 1A - Oxidation Ditch with Filtration
- Recommendation No. 2 - Trickling Filter Solids Contact
- Recommendation No. 3 - Membrane Bioreactor (MBR)

Based on the evaluation performed in Chapter 9 of the FMP, the final recommended project selected by Carollo, MBCSD staff, and the Joint Powers Agreement (JPA) Board was Recommendation No. 1A - Oxidation Ditch with Filtration with partial composting. This project would give the MBCSD the ability to discharge 1.5 mgd of filtered and disinfected effluent to the ocean.

As a result of the Flood Study conducted by Wallace, the existing WWTP would be inundated with approximately three to six feet of storm water in a 100-year flood event. The most viable option for mitigation of the flood hazard at both the WWTP and upstream

facilities, such as the Morro Bay High School, is creation of a flood path through the existing facility footprint. To accommodate the flood path, the majority of the existing WWTP would need to be demolished. The new treatment facilities would be located in the area currently occupied by the sludge drying beds and/or trailer storage area and is referred to as the low impact zone in this amendment. This new flow path will be paved and approximately at the existing plant grade.

Recommendation No. 1A and Recommendation No. 3 are being reevaluated as part of Amendment No. 1. For the purpose of this amendment, these projects will be referred to as Recommendation No. 1AR and Recommendation No. 3R. Recommendation No. 1A (Oxidation Ditch with Filtration) was reevaluated since it was rated as best and chosen as the final recommended project in Chapter 9 (Recommendations) of the FMP. Recommendation No. 3 (MBR) was reevaluated because it represents the smallest footprint and can fit within the 7.3-acre low impact zone.

The cost analysis for Recommendation No. 1AR and Recommendation No. 3R has been split into the following components:

- Flood impact mitigation demolition (Section 3.0);
- Secondary/tertiary treatment process (Sections 4.0 and 5.0);
- Biosolids management (Section 6.0); and
- Support facilities (Section 7.0).

These cost components for each recommendation are summarized and presented in Table 14 and Table 15 (Section 8.0) as the total project cost for upgrade of the MBCSD WWTP.

### **3.0 FLOOD IMPACT MITIGATION DEMOLITION**

As part of the final recommended project presented in the FMP, Carollo recommended demolition or major rehabilitation of the following structures due to their age and condition:

- Chlorine Contact Basin
- Trickling Filter No. 1
- Trickling Filter No. 2
- Primary Clarifier No. 1
- Primary Clarifier No. 2
- Digester No. 1

As mentioned previously, almost all of the facilities at the WWTP will be demolished to accommodate the flood path recommended in the Wallace Flood Study. In addition to the facilities mentioned above, the following will also be demolished as part of the final recommended project:

- Headworks
- Administration Building
- Maintenance Building
- Chlorination Building
- Digester No. 2
- Digester No. 3
- Secondary Clarifier
- Air Release Structure
- Shed
- Hazardous Waste Facility

The cost for demolition of these facilities as well as demolition of existing electrical equipment and yard piping is presented in Table 1. This new flow path will be paved and approximately at the existing plant grade.

<b>Table 1 Demolition Cost Estimate - All Recommendations WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Administration Building	\$40,000
Maintenance Building	\$28,000
Headworks	\$59,000
Chlorine Contact Basin	\$44,000
Chlorination Building	\$10,000
Trickling Filter No. 1	\$34,000
Trickling Filter No. 2	\$46,000
Digester No. 1	\$43,000
Digester No. 2	\$46,000
Digester No. 3	\$41,000

<b>Table 1 Demolition Cost Estimate - All Recommendations WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Primary Clarifier No. 1	\$41,000
Primary Clarifier No. 2	\$28,000
Secondary Clarifier	\$66,000
Air Release Structure	\$6,000
Small Shed	\$18,000
Hazardous Waste Structure	\$26,000
Existing Electrical Equipment	\$75,000
Existing Yard Piping/Site Grading	\$500,000
<b>Subtotal</b>	<b>\$1,151,000</b>
Unidentified Item Contingency (20 percent)	\$231,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$1,382,000
Engineering, Administrative, and Legal Costs (35 percent)	\$484,000
<b>Total Project Cost 2006</b>	<b>\$1,866,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

As part of the FMP, Carollo included a construction contingency of \$2,500,000 (\$4,050,000 in project cost) for each recommendation to cover the cost of flood impact mitigation measures that will need to be addressed during design of the upgrade to the WWTP. This contingency has been substantially reduced to \$1,000,000 (\$1,620,000 in project cost) for this amendment. As can be seen in Table 1, the demolition cost of \$1,866,000 and reduced contingency is far less than the previously estimated flood impact mitigation cost. As will be presented hereinafter, this will result in an overall project cost reduction for the revised alternatives.

#### **4.0 RECOMMENDATION NO. 1AR - OXIDATION DITCH WITH FILTRATION TREATMENT**

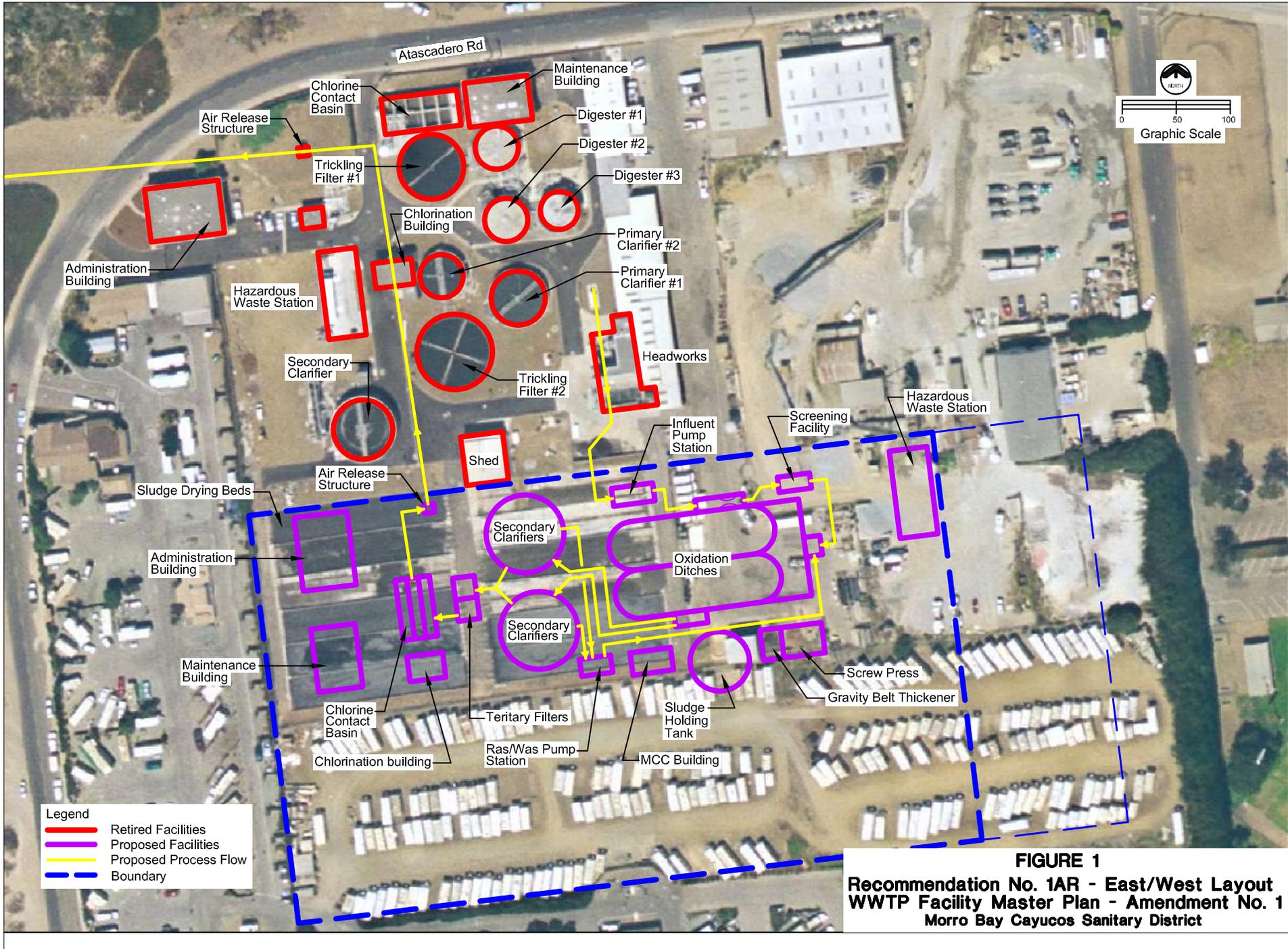
Recommendation No. 1AR includes the construction of two new parallel oxidation ditches and cloth media filters at the WWTP with direct hauling of dewatered biosolids offsite by a third-party land applier. In addition to the secondary treatment, filtration, and biosolids management facilities, the recommendation also includes support facilities such as a new chlorine contact basin, and contingencies for subsoil stabilization. The major aspects of the project are described in detail in Sections 8.4.4 and 8.5.4 in Chapter 8 (Alternatives Analysis) of the FMP.

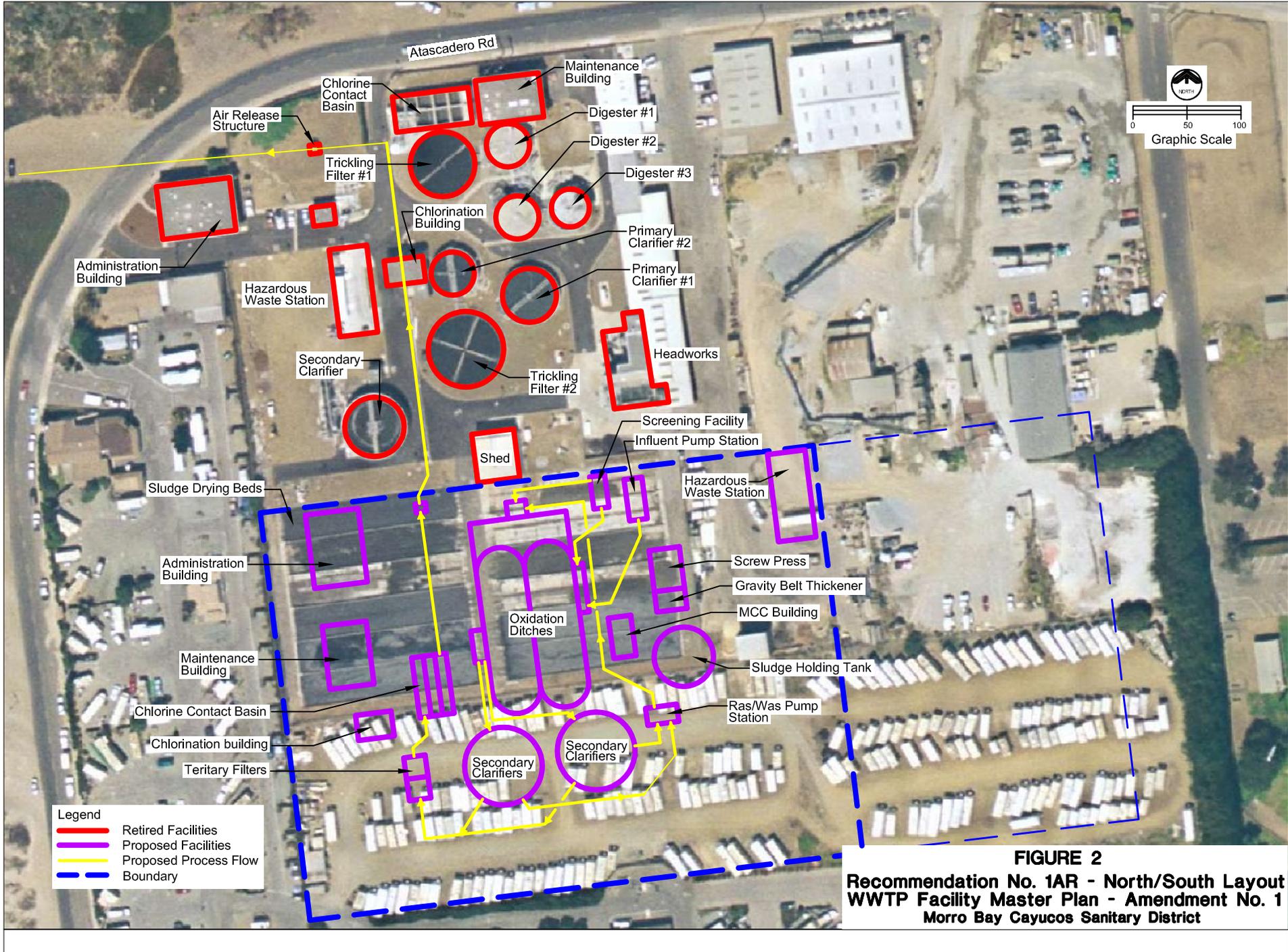
One major difference between Recommendation No. 1AR as presented in the FMP and this amendment is the addition of a secondary clarifier. During preparation of the FMP, it was assumed the existing 55-foot diameter secondary clarifier would be used in conjunction with a new 95-foot diameter clarifier. Since the existing secondary clarifier will be demolished as part of the upgrade project, Recommendation No. 1AR now includes construction of two new 80-foot diameter clarifiers. These new clarifiers will provide comparable overflow rates to the use of the existing 55-foot and new 95-foot diameter secondary clarifiers.

The total project treatment cost for Recommendation No. 1AR, without biosolids management or support facilities, has been estimated at \$13,954,000, with an associated construction cost of \$8,613,000. These figures are given in June 2006 dollars to stay consistent with the FMP. The components of the oxidation ditch with filtration treatment alternative are presented in Table 2.

<b>Table 2 Recommendation No. 1AR - Oxidation Ditch with Filtration Treatment Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Oxidation Ditches	\$2,866,000
RAS/WAS Pump Station	\$233,000
Secondary Clarifiers	\$2,462,000
Tertiary Filters	\$1,064,000
Yard Piping/Sitework	\$994,000
Electrical and Instrumentation	\$994,000
<b>Subtotal</b>	<b>\$8,613,000</b>
Unidentified Item Contingency (20 percent)	\$1,723,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$10,336,000
Engineering, Administrative, and Legal Costs (35 percent)	\$3,618,000
<b>Total Project Cost 2006</b>	<b>\$13,954,000</b>
<b>Notes:</b>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

For Recommendation No. 1AR, Carollo prepared two alternative facility layouts in the low impact area. The first conceptual layout, shown in Figure 1, has the oxidation ditch and support facilities oriented in an east/west configuration with the facilities located on the WWTP site, Maintenance Yard, and a lease site jointly owned by the City of Morro Bay (City) and Cayucos Sanitary District (CSD). The second conceptual layout, shown in Figure 2, has the oxidation ditch and support facilities oriented in a north/south configuration with the facilities located in the WWTP site and a lease site owned by the City. Based on





**FIGURE 2**  
**Recommendation No. 1AR - North/South Layout**  
**WWTP Facility Master Plan - Amendment No. 1**  
**Morro Bay Cayucos Sanitary District**

Carollo's estimating ability at this stage in the planning process, the cost to construct the facilities is the same for both configurations.

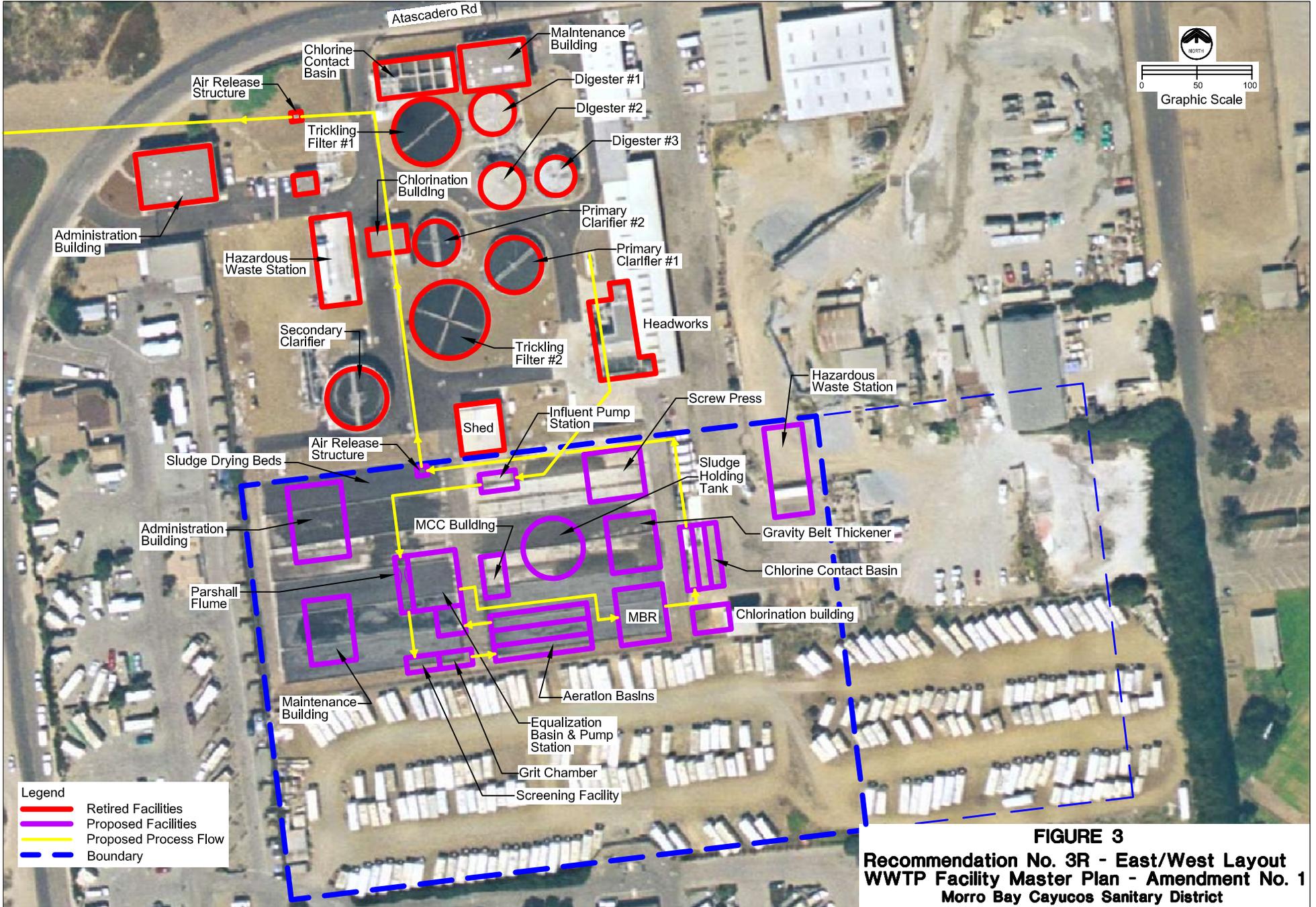
## 5.0 RECOMMENDATION NO. 3R - MEMBRANE BIOREACTOR (MBR) TREATMENT

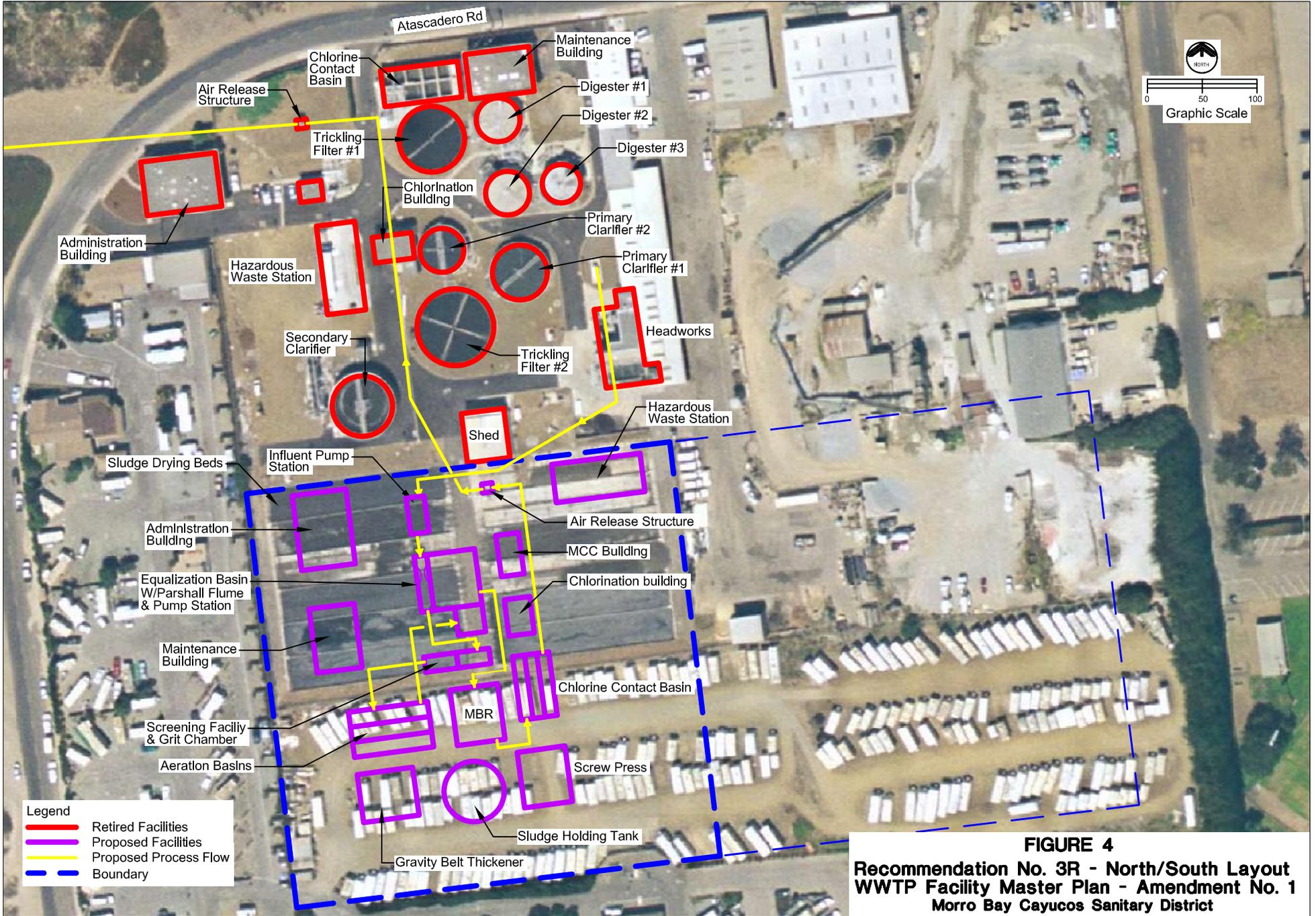
Recommendation No. 3R includes the construction of a MBR facility at the MBCSD WWTP. The biosolids generated by the MBR will be sent directly to a dewatering facility before being discharged to a container for direct hauling out of San Luis Obispo County. The total project cost for Recommendation No. 3R without the biosolids management or support facilities, in June 2006 dollars, has been estimated at \$22,267,000 with an associated construction cost of \$13,745,000.

This recommendation represents the highest level of treatment available for upgrade of the MBCSD WWTP.

For Amendment No. 1, Carollo prepared two alternative facility layouts in the low impact area. The first conceptual layout, shown in Figure 3, has the MBR and support facilities oriented in an east/west configuration with the facilities located on the WWTP site, Maintenance Yard, and a lease site jointly owned by the City and CSD. The second conceptual layout, shown in Figure 4, has the MBR and support facilities oriented in a north/south configuration with the facilities located in the WWTP site and a lease site owned by the City. Based on Carollo's estimating ability at this stage in the planning process, the cost for both configurations is the same.

<b>Table 3 Recommendation No. 3R - MBR Treatment Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Equalization Basin	\$163,000
Aeration Basins	\$1,307,000
Membrane Facilities	\$9,103,000
Yard Piping/Sitework	\$1,586,000
Electrical and Instrumentation	\$1,586,000
<b>Subtotal</b>	<b>\$13,745,000</b>
Unidentified Item Contingency (20 percent)	\$2,749,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$16,494,000
Engineering, Administrative, and Legal Costs (35 percent)	\$5,773,000
<b>Total Project Cost 2006</b>	<b>\$22,267,000</b>
<b>Notes:</b>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	





**FIGURE 4**  
**Recommendation No. 3R - North/South Layout**  
**WWTP Facility Master Plan - Amendment No. 1**  
**Morro Bay Cayucos Sanitary District**

## **6.0 BIOSOLIDS MANAGEMENT FACILITIES**

The MBCSD WWTP currently sends primary and secondary sludge to the anaerobic digesters, and on to the sludge drying beds. After the solids are dried, approximately 30 percent is composted onsite in windrows that are maintained by WWTP staff. The remaining biosolids are stored onsite until they can be hauled away by San Joaquin Composting for further treatment.

The biosolids management practices included for both Recommendation No. 1AR and Recommendation No. 3R are a major departure from the current biosolids management practices at the WWTP. Based on the Wallace Flood Study, the majority of the facilities at the MBSD WWTP will be relocated to the low impact area. The low impact area has been identified as the area south of the WWTP facilities currently occupied by the sludge drying beds and/or trailer storage area. The new low impact zone area available is relatively small and therefore high land use processes such as sludge drying beds and composting are not practical at this biosolids site. Therefore, these processes will be eliminated in favor of dewatering and hauling similar to the operating practices of City of Pismo Beach. The net cost to the project for this biosolids handling change is a reduction in cost as digestion and composting carry significant costs.

The new biosolids handling facilities recommended for upgrade of the MBCSD WWTP include biosolids thickening, storage, and dewatering. The individual components of the biosolids handling facilities are discussed below.

### **6.1 Sludge Thickening**

In order to increase the solids concentration of waste activated sludge (WAS) before biosolids dewatering, sludge wasted from either the secondary clarifiers (Recommendation No. 1AR) or membrane basins (Recommendation No. 3R) will be pumped to a gravity belt thickener (GBT). The GBT will be housed in a thickening/dewatering building along with ancillary equipment including a polymer feed system and sludge pumps. A discussion of sludge thickening is provided in Sections 7.4.2 and 7.8.1 in Chapter 7 (Biosolids Treatment and Disposal) of the FMP.

### **6.2 Sludge Holding Tank**

A new component of the biosolids management facilities not discussed in the FMP is sludge storage. For Class A (composting) and Class B (sludge drying beds) biosolids treatment options discussed in Chapter 7 at the FMP, sludge storage and stabilization is accomplished via the existing anaerobic digesters. For the sub-Class B (direct haul) option, Carollo recommended conversion of Digester No. 3 to a sludge storage tank.

Since both recommended projects for upgrade of the WWTP include direct hauling of dewatered biosolids and demolition of the existing digesters, a new dedicated sludge

storage tank is required to allow constant flow to the biosolids dewatering facility. The tank will also serve as emergency storage in the event the dewatering or thickening facilities are temporarily taken out of service. The sludge storage tank will consist of an uncovered bolted steel or concrete tank. The design criteria for the sludge storage tank are shown in Table 4.

<b>Table 4 Sludge Storage Tank Design Criteria WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>		
<b>Criteria</b>	<b>Value</b>	
	<b>Recommendation No. 1AR EAAS/Filtration</b>	<b>Recommendation No. 3R MBR</b>
Sludge Volume (gpd) <sup>(1)</sup>	23,800	29,000
Storage (days)	3	3
Required Volume (gal)	71,400	87,000
Unthickened Sludge Storage (hours) <sup>(2)</sup>	22	32
<b>Notes:</b>		
(1) Based on 5 days per week wasting schedule and thickened sludge solids concentration of 3%.		
(2) Unthickened sludge concentrations 7,000 mg/L and 10,000 mg/L for EAAS and MBR respectively.		

### 6.3 Biosolids Dewatering

Based on the recommendations made in the FMP, the preferred biosolids dewatering technology was a centrifuge. Since completion of the draft of the FMP in September 2007, a third option for reliable and effective biosolids dewatering has gained popularity. A screw press can dewater municipal sludge to a solids concentration comparable to a centrifuge or belt filter press (BFP). Facilities such as the Monterey Regional Treatment Plant and Cambria Water Quality Control Plant use a screw presses to produce a dewatered biosolids product suitable for offsite disposal.

In screw presses, a screw conveyor moves the biosolids in a reduced diameter screen. This reduction in diameter results in increased pressure along the length of the screw press, which results in dewatering of the biosolids with typical solids capture rates of 90 percent. A main advantage of the screw press is its simplicity, which allows it to be operated on a 24-hour schedule, virtually unattended. Another advantage is they use significantly less energy than a centrifuge. Design criteria used for sizing of the screw press units for this amendment is summarized in Table 5.

<b>Table 5 Screw Press Dewatering Design Criteria WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>		
<b>Criteria</b>	<b>Value</b>	
	<b>Recommendation No. 1AR EAAS/Filtration</b>	<b>Recommendation No. 3R MBR</b>
Influent Sludge Concentration (%)	3.0	3.0
Dewatered Sludge Concentration (%)	18	18
Number of Screw Presses	2	2
Size of Screw Press (gpm)	13	13
Operating Hydraulic Loading per Unit (gpm) <sup>(1)</sup>	11	13
Operating Solids Loading per Unit (lbs/hr) <sup>(1)</sup>	111	135
Operating Cycle (days/week)	4	4
Operating Cycle (hr/day)	24	24
Polymer Feed Rate (lbs/dry ton)	30	30
<b>Notes:</b>		
(3) Conditions are given with both units in service.		

Screw presses are the new recommended dewatering technology for the MBCSD WWTP based on a consensus from MBCSD staff, significantly less energy usage as compared to centrifuges, and relative ease of shutdown/start-up.

#### **6.4 Cost Summary**

Table 6 and Table 7 summarize the costs associated with biosolids management for both Recommendation No. 1AR and Recommendation No. 3R respectively. The slight difference in cost is attributed to a slightly larger sludge holding tank required for Recommendation No. 3 (MBR).

<b>Table 6 Recommendation No. 1AR - Biosolids Management Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Thickening/Dewatering Facility	\$300,000
Gravity Belt Thickener	\$138,000
Screw Press	\$605,000
Sludge Holding Tank	\$69,000
Yard Piping/Sitework	\$167,000
Electrical and Instrumentation	\$167,000
<b>Subtotal</b>	<b>\$1,446,000</b>
Unidentified Item Contingency (20 percent)	\$290,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$1,736,000
Engineering, Administrative, and Legal Costs (35 percent)	\$608,000
<b>Total Project Cost 2006</b>	<b>\$2,344,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

<b>Table 7 Recommendation No. 3R - Biosolids Management Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Thickening/Dewatering Facility	\$300,000
Gravity Belt Thickener	\$138,000
Screw Press	\$605,000
Sludge Holding Tank	\$84,000
Yard Piping/Sitework	\$170,000
Electrical and Instrumentation	\$170,000
<b>Subtotal</b>	<b>\$1,467,000</b>
Unidentified Item Contingency (20 percent)	\$294,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$1,761,000
Engineering, Administrative, and Legal Costs (35 percent)	\$617,000
<b>Total Project Cost 2006</b>	<b>\$2,378,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

## **7.0 SUPPORT FACILITIES**

In addition to the improvements to the secondary treatment and biosolids management facilities discussed previously, improvements to several other areas of the MBCSD WWTP are required as part of the upgrade. In Chapter 9 of the FMP, improvements to the support facilities included rehabilitation of the existing headworks, 3-W pump station, electrical equipment, control building and laboratory, and plant drain system. Based on the results of the Wallace Flood Study, these facilities will now be retired and demolished as part of the project. Therefore, new facilities will be constructed to replace them. A summary of the new support facilities is presented below.

### **7.1 Preliminary Treatment**

As part of the FMP, Carollo recommended significant rehabilitation of the existing headworks at the MBCSD WWTP at a total project cost of \$2,138,000. Major improvements to the headworks included addition of a new influent pump, mechanical bar screen, and screenings washer/compactor. In addition, several improvements to the aerated grit basins were also recommended.

There are two major challenges to rehabilitation of the existing headworks. First, the headworks lies in the flood path identified in the Wallace Flood Study. Therefore the majority of the headworks would need to be demolished to existing grade, leaving the pump dry well as the only reusable component of the structure. In order to convert the dry well to a wet well, the existing dry-pit pumps would need to be replaced with submersible pumps, and the existing MCCs, variable frequency drives (VFDs), and control panels for the pumps relocated at a significant cost. Second, significant rehabilitation of the headworks would require a lengthy shutdown of the influent pumping and screening facilities leading to construction sequencing issues and project delays.

Due to the issues associated with rehabilitation of the headworks, Carollo recommends construction of new preliminary treatment facilities located in the low impact zone. The preliminary treatment facilities will consist of an influent pump station and screening facility for Recommendation No. 1AR. For Recommendation No. 3R, the preliminary treatment facilities also include a grit chamber. Grit removal is required upstream of the MBR to prevent permanent fouling or damage to the membranes. Grit removal is not required ahead of an oxidation ditch as demonstrated by the operation of the City of Pismo Beach WWTP. The elimination of grit facilities for the ditch option further reduces the project cost and annual operating costs for that option.

#### **7.1.1 Influent Pump Station**

The new influent pump station proposed for the WWTP will consist of a wet well with multiple submersible pumps. Isolation and check valves will be located in a valve box at grade to make access easier for WWTP staff. The pump station will be designed to handle

a peak hour flow of 5.97 mgd. Design flows and loadings were determined in Chapter 3 (Historical and Projected Flows and Loadings) of the FMP.

### **7.1.2 Screening Facility**

The new screening facility proposed for the WWTP will consist of a freestanding concrete structure that contains two channels. Each channel will be designed to pass the design PHF of 5.97 mgd. Like the existing headworks at the WWTP, the main screening channel will include a mechanical bar screen while the secondary, or bypass, channel will have a manually cleaned bar screen. The manual bar screen will allow MBCSD staff to temporarily take the mechanical bar screen out of service for maintenance without disruption of the screening process. Screenings will be removed from the influent raw wastewater flow and sent to a screenings/washer compactor before being discharged to a roll-off bin for disposal.

Numerous problems with the existing screen/grinder system at the headworks were noted in Chapter 6 (Rehabilitation) of the FMP. These issues included grinder maintenance and screenings disposal. The new screening facility will simplify the preliminary treatment process at the MBCSD WWTP and alleviate the problems identified in Chapter 6. Many of these issues, such as the safety and health concerns associated with the current screenings handling and disposal practices, may not have been fully eliminated even with rehabilitation of the existing headworks.

As discussed in Chapter 8 of the FMP, additional fine screens are required downstream of the screening facility for Recommendation No. 3R (MBR). The cost for these screens is included as part of the MBR facilities and not the preliminary treatment facilities.

### **7.1.3 Grit Chamber**

The MBCSD WWTP currently uses aerated grit basins to remove grit from the screened wastewater upstream of the primary clarifiers. Much of the exposed air piping, swing arms, and diffusers were slated for replacement in Chapter 6 of the FMP. The grit cyclones and classifiers were also determined to have reached the end of their useful life. Based on the recommendations made in Chapter 6, the existing grit chambers required significant rehabilitation as part of the recommended project.

Since the grit chambers are located in the flood path, they will now be retired and demolished as part of the recommended project. A new aerated grit chamber will be constructed in the low impact zone for Recommendation No. 3R to replace the existing grit basins. The new grit chamber will be designed with two separate trains each designed to handle a PHF of 5.97 mgd. Redundant trains will provide reliability to the grit removal process ahead of the membranes.

As noted previously, Recommendation No. 1AR does not include grit removal as part of the preliminary treatment facilities. Grit in the influent wastewater stream will be harmlessly

deposited in the bottom of the oxidation ditches. A new grit chamber is only required for Recommendation No. 3R.

#### 7.1.4 **Cost Summary**

The cost for preliminary treatment for both Recommendation No. 1AR and Recommendation No. 3R are presented in Table 8 and Table 9 respectively. The difference in cost for the two recommendations is attributed to the grit chamber required for the MBR project.

<b>Table 8 Recommendation No. 1AR - Preliminary Treatment Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Influent Pump Station	\$222,000
Screening Facility	\$343,000
Yard Piping/Sitework	\$85,000
Electrical and Instrumentation	\$85,000
<b>Subtotal</b>	<b>\$735,000</b>
Unidentified Item Contingency (20 percent)	\$147,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$882,000
Engineering, Administrative, and Legal Costs (35 percent)	\$309,000
<b>Total Project Cost 2006</b>	<b>\$1,191,000</b>
<b>Notes:</b>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

<b>Table 9 Recommendation No. 3R - Preliminary Treatment Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Influent Pump Station	\$222,000
Screening Facility	\$343,000
Grit Chambers	\$371,000
Yard Piping/Sitework	\$141,000
Electrical and Instrumentation	\$141,000
<b>Subtotal</b>	<b>\$1,218,000</b>
Unidentified Item Contingency (20 percent)	\$244,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$1,462,000

<b>Table 9 Recommendation No. 3R - Preliminary Treatment Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Engineering, Administrative, and Legal Costs (35 percent)	\$512,000
<b>Total Project Cost 2006</b>	<b>\$1,974,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

## 7.2 Chlorination/Dechlorination Facilities

As part of the recommended project outlined in Chapter 9 of the FMP, Carollo recommended construction of a new chlorine contact basin. The design criteria developed for the chlorine contact basin are summarized in Table 9.3 of the FMP.

In addition to a new chlorine contact basin, Carollo also recommended several improvements to the existing sodium hypochlorite (NaOCl) and sodium bisulfite (NaHSO<sub>3</sub>) feed systems. Based on the Wallace Flood Study, the chlorination building and chemical feed equipment are located in the flood path and will be demolished as part of the upgrade project.

As part of the recommended project, a new chlorination building will be constructed adjacent to the chlorine contact basin. The existing chlorination building is no longer used for its intended purpose, and the chemical storage and feed equipment is located outdoors near the chlorine contact basin. As part of the project, the feed equipment will be housed in an enclosed structure.

A summary of the costs for the new chlorination/dechlorination facilities is shown in Table 10.

<b>Table 10 Disinfection Facilities Cost Estimate and Recommendations WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Chlorine Contact Basin	\$181,000
Chlorination Building	\$214,000
Yard Piping/Sitework	\$60,000
Electrical and Instrumentation	\$60,000
<b>Subtotal</b>	<b>\$515,000</b>
Unidentified Item Contingency (20 percent)	\$103,000
<b>Subtotal Construction Cost 2006<sup>(2)</sup></b>	<b>\$618,000</b>

<b>Table 10 Disinfection Facilities Cost Estimate and Recommendations WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Engineering, Administrative, and Legal Costs (35 percent)	\$217,000
<b>Total Project Cost 2006</b>	<b>\$835,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

### 7.3 Control Building

Several recommended improvements to the control building were identified in Chapter 9 of the FMP. Based on the results of the Wallace Flood Study, the existing control building will be demolished to accommodate the new flood path. The majority of the improvements were upgrades to the laboratory. MBCSD staff has also expressed the need for additional office space, training area, and locker rooms at the existing building.

A new control building will be constructed at the WWTP site in the low impact zone. The current control building is approximately 3,000 square feet (ft<sup>2</sup>). However, this area includes a room for the standby generator, main switchgear, and a MCC. For the purposes of this amendment, the new control building will be roughly the same footprint as the existing building and will include a laboratory. Additional area will be available for WWTP staff since the standby generator, main switchgear, and MCC will no longer be located in the control building.

### 7.4 Maintenance Building

Only minor improvements to the maintenance building were identified in the FMP. However, since the maintenance building is located in the flood path, it must be demolished as part of the upgrade project. The existing maintenance building is approximately 2,000 ft<sup>2</sup>. The new maintenance building will be approximately the same size, and will be located in the low impact zone.

### 7.5 Electrical Equipment

The existing main switchgear and standby generator are located in the control building at the MBCSD WWTP. Since the control building is located in the flood path, and will be demolished as part of the recommended project, a new standby generator and main switchgear is required as part of the recommended project. The MBCSD WWTP also has six separate MCCs located in five different locations throughout the plant. Since the facilities where these MCCs are located will be demolished to accommodate the flow path, all of the MCCs will be replaced.

### 7.5.1 MCC Building

A new centralized MCC building will be constructed in the low impact zone as part of the recommended project to house the main switchgear, MCCs, and other ancillary electrical equipment required to operate the new facilities.

### 7.5.2 Standby Generator

The standby generator will be located outdoors on a concrete pad adjacent to the new MCC building in the low impact zone. For the purpose of this amendment, an initial generator capacity of 800 kilowatts (kW) has been assumed.

### 7.5.3 Cost Summary

A summary of the costs for the new electrical facilities is presented in Table 11.

<b>Table 11      Miscellaneous Electrical Facilities Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
MCC Building	\$395,000
Standby Generator	\$222,000
Yard Piping/Sitework	\$93,000
Electrical and Instrumentation	\$93,000
<b>Subtotal</b>	<b>\$803,000</b>
Unidentified Item Contingency (20 percent)	\$161,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$964,000
Engineering, Administrative, and Legal Costs (35 percent)	\$338,000
<b>Total Project Cost 2006</b>	<b>\$1,302,000</b>
<b>Notes:</b>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

### 7.6 Subsoil Stabilization

Based on the last expansion of the WWTP in 1982, subsoil stabilization using vibrocompaction was performed in areas where structures were constructed. The assumption has been made that a similar type of soil preparation will be necessary during this phase of expansion of the WWTP. Therefore, based on direction from Hayward-Baker, a local geotechnical contractor with experience in subsoil compaction, a \$1,000,000 contingency was added to the construction costs for each alternative to cover the cost of subsoil stabilization over a one-acre area. The details regarding vibrocompaction are discussed in detail in Chapter 4 (Subsoil Stabilization) of the FMP. Due to the addition of

several new facilities as part of this amendment, the cost for subsoil stabilization has been adjusted for both recommendations to accommodate the additional area.

## 7.7 Cost Summary

A summary of the costs for the support facilities for both Recommendation No. 1AR and Recommendation No. 3R are presented in Table 12 and Table 13 .

<b>Table 12 Recommendation No. 1AR - Support Facilities Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Preliminary Treatment Facilities	\$565,000
Disinfection Facilities	\$395,000
MCC Building and Standby Generator	\$617,000
Control Building	\$832,000
Maintenance Building	\$285,000
Air Release Structure	\$11,000
Yard Piping/Sitework	\$406,000
Electrical and Instrumentation	\$406,000
<b>Subtotal</b>	<b>\$3,517,000</b>
Unidentified Item Contingency (20 percent)	\$704,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$4,221,000
Engineering, Administrative, and Legal Costs (35 percent)	\$1,478,000
<b>Total Project Cost 2006</b>	<b>\$5,699,000</b>
<b>Notes:</b>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

<b>Table 13 Recommendation No. 3R - Support Facilities Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Preliminary Treatment Facilities	\$936,000
Disinfection Facilities	\$395,000
Miscellaneous Electrical Facilities	\$617,000
Control Building	\$832,000
Maintenance Building	\$285,000

<b>Table 13 Recommendation No. 3R - Support Facilities Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Air Release Structure	\$11,000
Yard Piping/Sitework	\$462,000
Electrical and Instrumentation	\$462,000
<b>Subtotal</b>	<b>\$4,000,000</b>
Unidentified Item Contingency (20 percent)	\$800,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$4,800,000
Engineering, Administrative, and Legal Costs (35 percent)	\$1,680,000
<b>Total Project Cost 2006</b>	<b>\$6,480,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

## 8.0 COMPARISON OF RECOMMENDATIONS

A cost estimate summary for Recommendation No. 1AR and Recommendation No. 3R is provided in Table 14 and Table 15 respectively. A detailed cost breakdown for each recommendation is shown in Appendix A. Annual operations and maintenance costs and 20-year NPV calculations are included in Appendix B. The project costs developed for this amendment include all the components of a complete project for upgrade of the WWTP to a secondary or tertiary capacity of 1.5 mgd. These costs include additional components such as biosolids management facilities, preliminary treatment facilities, chlorination/dechlorination facilities, control building, maintenance building, electrical facilities, and subsoil stabilization.

A summary of the costs from Chapter 9 of the FMP and the revised costs presented in Amendment No. 1 (including total present value) are also presented in Table 16.

<b>Table 14 Recommendation No. 1AR - Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Oxidation Ditch/Filtration Facilities	\$6,625,000
Biosolids Management Facilities	\$1,112,000
Support Facilities	\$2,705,000
Yard Piping/Sitework	\$1,567,000
Electrical and Instrumentation	\$1,567,000

<b>Table 14 Recommendation No. 1AR - Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
Demolition	\$1,151,000
Flood Impact Mitigation	\$1,000,000
Subsoil Stabilization	\$1,183,000
<b>Subtotal</b>	<b>\$16,910,000</b>
Unidentified Item Contingency (20 percent)	\$3,382,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$20,292,000
Engineering, Administrative, and Legal Costs (35 percent)	\$7,103,000
<b>Total Project Cost 2006</b>	<b>\$27,395,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

<b>Table 15 Recommendation No. 3R - Cost Estimate WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District</b>	
<b>Parameter</b>	<b>Value<sup>(1)</sup></b>
MBR Facilities	\$10,573,000
Biosolids Management Facilities	\$1,127,000
Support Facilities	\$3,076,000
Yard Piping/Sitework	\$2,217,000
Electrical and Instrumentation	\$2,217,000
Demolition	\$1,151,000
Flood Impact Mitigation	\$1,000,000
Subsoil Stabilization	\$115,000
<b>Subtotal</b>	<b>\$22,476,000</b>
Unidentified Item Contingency (20 percent)	\$4,496,000
Subtotal Construction Cost 2006 <sup>(2)</sup>	\$26,972,000
Engineering, Administrative, and Legal Costs (35 percent)	\$9,441,000
<b>Total Project Cost 2006</b>	<b>\$36,413,000</b>
<u>Notes:</u>	
(1) ENR (20 cities) June 2006 = 7,700.	
(2) Includes Contractor overhead and profit.	

<b>Table 16 Summary of Amendment No. 1 and FMP Costs WWTP Facility Master Plan - Amendment No. 1 Morro Bay Cayucos Sanitary District)</b>					
<b>Recommendation</b>	<b>Description</b>	<b>Estimated Cost</b>			
		<b>Construction</b>	<b>Project</b>	<b>O&amp;M Present Value (20 years)</b>	<b>Total Present Value</b>
No. 1A	EAAS/Filtration with Partial Composting	\$20,799,000	\$28,052,000	\$24,255,000	\$52,307,000
No. 1AR	EAAS/Filtration with Direct Hauling	\$20,292,000	\$27,395,000	\$22,137,000	\$49,532,000
No. 3	MBR with Partial Composting	\$25,910,000	\$34,979,000	\$28,065,000	\$63,044,000
No. 3R	MBR with Direct Hauling	\$26,972,000	\$36,413,000	\$27,580,000	\$63,993,000

## 9.0 FINAL RECOMMENDED PROJECT

Based upon the revised cost estimates prepared as part of this amendment, as well as evaluation of the non-economic factors in Chapter 9 of the FMP for Recommendation No. 1AR and Recommendation No. 3R, the final recommended alternative for upgrading the MBCSD WWTP is the oxidation ditch with filtration option. The components of the recommended project would be located in the low impact zone. As previously discussed, two alternative layouts of the new facilities have been developed as part of this amendment. There is no appreciable difference in cost between the two layouts, and MBCSD staff and the JPA Board will make the final decision regarding the layout of the oxidation ditch facilities.

Two new oxidation ditches, with a total volume of 1.83 million gallons (MG) will be constructed to treat a PSDWF of 1.5 mgd. The new oxidation ditch will be configured with both aerobic and anoxic zones to facilitate nitrification and denitrification or a reduction of total nitrogen in the wastewater stream. The MBCSD WWTP currently uses a single 55-foot diameter secondary clarifier to remove suspended solids from the treated effluent. As mentioned previously, the existing secondary clarifier is located in the flood path and will be demolished as part of the upgrade project. In order to increase clarifier capacity, improve effluent quality, and add redundancy to the treatment process, two new 80-foot diameter clarifier will be included as part of this project. A new RAS/WAS pump station would return settled mixed liquor from the clarifiers to the oxidation ditches and waste to the new biosolids management facilities.

While the new oxidation ditches will produce a significantly better quality effluent than the existing trickling filter process, MBCSD staff and the JPA Board, during preparation of the draft FMP, decided to further treat the secondary effluent being discharged to Estero Bay. With the use of cloth media disk filters, the MBCSD will remove additional suspended solids from the wastewater stream resulting in the discharge of filtered effluent to the ocean.

The biosolids management practices at the WWTP will undergo significant changes as part of the upgrade project. MBCSD staff currently devotes a significant amount of time to the production of Class A biosolids with operation of multiple anaerobic digesters, sludge drying beds, and a large-scale composting operation. While the composting program has been very successful over the last several years, the impact of the Wallace Flood Study will force demolition of the sludge drying beds and digesters.

In order to optimize the use of the new 7.3-acre WWTP site, the biosolids management practices will be streamlined. Sludge from the secondary clarifiers will be sent directly to a GBT for thickening and then stored before dewatering. Unlike the digesters that currently operate with a detention time of several weeks, the detention time in the sludge holding tank will be hours. Sludge pumped from the holding tank will be dewatered by a pair of screw presses and conveyed directly to a bin or trailer for immediate removal from the WWTP site. The GBT and screw presses will be housed jointly in a biosolids thickening/dewatering building.

Another major change in the recommended project as described in the FMP is construction of new support facilities to replace existing facilities demolished to accommodate the flood path. These facilities include a new influent pump station, screening facility, chlorine contact basin and chlorination building, control building, maintenance building, standby generator, and MCC building.

Amendment of the recommended project has also reduced the annual O&M costs, and therefore the 20-year NPV costs originally developed in the FMP. This cost reduction can be attributed to the simplification of the biosolids handling practices and the energy costs associated with these processes. Specifically, the energy to heat and mix the anaerobic digesters is no longer part of the annual O&M costs, and the centrifuges originally included in the recommended project have been replaced with screw presses. The screw presses use significantly less electricity than the centrifuges.

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**APPENDIX A – RECOMMENDED DETAILED COST ESTIMATES**

<b>Recommendation No. 1AR - EAAS/Filtration</b>		<b>Capital Costs</b>
<b>Unit Process</b>	<b>Parameter</b>	<b>Year 2006</b>
<b>Construction of New Facilities</b>		
Influent Pump Station	LS	\$222,000
Screening Facility	LS	\$343,000
Oxidation Ditch (x2)	LS	\$2,866,000
RAS/WAS Pump Station	LS	\$233,000
Secondary Clarifier (x2)	LS	\$2,462,000
Tertiary Filters (x2)	LS	\$1,064,000
Chlorine Contact Basin	LS	\$181,000
Chlorination Building	LS	\$214,000
Thickening/Dewatering Facility	LS	\$300,000
Gravity Belt Thickener	LS	\$138,000
Screw Press (x2)	LS	\$605,000
Sludge Holding Tank	LS	\$69,000
MCC Building	LS	\$395,000
Standby Generator	LS	\$222,000
Air Release Structure	LS	\$11,000
Hazardous Waste Facility*	LS	\$0
Control Building	LS	\$832,000
Maintenance Building	LS	\$285,000
	<b>SUBTOTAL</b>	<b>\$10,442,000</b>
Yard Piping/Sitework	15%	\$1,566,000
Electrical and Instrumentation	15%	\$1,566,000
	<b>SUBTOTAL</b>	<b>\$13,574,000</b>
<b>Miscellaneous Construction Activities</b>		
Demolition		
Administration Building	LS	\$40,000
Maintenance Building	LS	\$28,000
Headworks	LS	\$59,000
Chlorine Contact Basin	LS	\$44,000
Chlorination Building	LS	\$10,000
Trickling Filter No. 1	LS	\$34,000
Trickling Filter No. 2	LS	\$46,000
Digesters No. 1	LS	\$43,000
Digester No. 2	LS	\$46,000
Digester No. 3	LS	\$41,000
Primary Clarifier No. 1	LS	\$41,000
Primary Clarifier No. 2	LS	\$28,000
Secondary Clarifier	LS	\$66,000
Air Release Structure	LS	\$6,000
Small Shed	LS	\$18,000
Hazardous Waste Structure	LS	\$26,000
Existing Electrical Equipment	LS	\$75,000
Existing Yard Piping	LS	\$500,000
Flood Impact Mitigation	LS	\$1,000,000
Subsoil Stabilization	LS	\$1,183,000
	<b>SUBTOTAL</b>	<b>\$16,908,000</b>
Estimating Contingency	20%	\$3,382,000
Engineering/Admin/Legal	35%	\$7,102,000
	<b>TOTAL PROJECT COSTS</b>	<b>\$27,392,000</b>
Maintenance	1%	\$274,000
Chemical Cost		\$110,000
Annual Electrical Cost		\$277,000
Annual Labor		\$563,000
Biosolids Hauling Cost		\$164,000
	<b>Total O&amp;M Annual Cost</b>	<b>\$1,388,000</b>
<b>PRESENT VALUES</b>		
Capital Cost		\$27,392,000
Operations and Maintenance		\$22,137,000
	<b>TOTAL PRESENT WORTH</b>	<b>\$49,529,000</b>

<b>Recommendation No. 3R - MBR</b>		<b>Capital Costs</b>
<b>Unit Process</b>	<b>Parameter</b>	<b>Year 2006</b>
<b>Construction of New Facilities</b>		
Influent Pump Station	LS	\$222,000
Screening Facility	LS	\$343,000
Grit Chamber (x2)	LS	\$371,000
Equalization Basin	LS	\$133,000
Equalization Basin Pump Station	LS	\$30,000
Aeration Basin (x3)	LS	\$1,307,000
MBR Facilities	LS	\$9,103,000
Chlorine Contact Basin	LS	\$181,000
Chlorination Building	LS	\$214,000
Thickening/Dewatering Facility	LS	\$300,000
Gravity Belt Thickener	LS	\$138,000
Screw Press	LS	\$605,000
Sludge Holding Tank	LS	\$84,000
MCC Building	LS	\$395,000
Standby Generator	LS	\$222,000
Air Release Structure	LS	\$11,000
Hazardous Waste Facility*	LS	\$0
Control Building	LS	\$832,000
Maintenance Building	LS	\$285,000
	<b>SUBTOTAL</b>	<b>\$14,776,000</b>
Yard Piping/Sitework	15%	\$2,216,000
Electrical and Instrumentation	15%	\$2,216,000
	<b>SUBTOTAL</b>	<b>\$19,208,000</b>
<b>Miscellaneous Construction Activities</b>		
Demolition		
Administration Building	LS	\$40,000
Maintenance Building	LS	\$28,000
Headworks	LS	\$59,000
Chlorine Contact Basin	LS	\$44,000
Chlorination Building	LS	\$10,000
Trickling Filter No. 1	LS	\$34,000
Trickling Filter No. 2	LS	\$46,000
Digesters No. 1	LS	\$43,000
Digester No. 2	LS	\$46,000
Digester No. 3	LS	\$41,000
Primary Clarifier No. 1	LS	\$41,000
Primary Clarifier No. 2	LS	\$28,000
Secondary Clarifier	LS	\$66,000
Air Release Structure	LS	\$6,000
Small Shed	LS	\$18,000
Hazardous Waste Structure	LS	\$26,000
Existing Electrical Equipment	LS	\$75,000
Existing Yard Piping	LS	\$500,000
Flood Impact Mitigation	LS	\$1,000,000
Subsoil Stabilization	LS	\$1,115,000
	<b>SUBTOTAL</b>	<b>\$22,474,000</b>
Estimating Contingency	20%	\$4,495,000
Engineering/Admin/Legal	35%	\$9,439,000
	<b>TOTAL PROJECT COSTS</b>	<b>\$36,408,000</b>
	Maintenance	1% \$364,000
	Chemical Cost	\$120,000
	Annual Electrical Cost	\$472,000
	Annual Labor	\$563,000
	Biosolids Hauling Cost	\$200,000
	<b>Total O&amp;M Annual Cost</b>	<b>\$1,719,000</b>
<b>PRESENT VALUES</b>		
Capital Cost		\$36,408,000
Operations and Maintenance		\$27,580,000
<b>TOTAL PRESENT WORTH</b>		<b>\$63,988,000</b>

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**APPENDIX B – DETAILED 20-YEAR NET PRESENT VALUE  
CALCULATIONS**



Starting Year	2007
Inflation Rate	3.00%
Discount Rate	6.00%
Electricity Cost (2007)	\$0.1390
GBT Polymer Usage	14 lb/dry ton
Screw Press Polymer Usage	30 lb/dry ton
Sludge Hauling	\$46.00 lb/ton
Polymer Cost (2007)	\$1.50
Labor Cost (2007)	\$40.19
Maintenance Cost (% of Unit Cost)	\$472,000

Recommendation 3R - MBR	Year																			
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
<b>Annual Costs for Projects</b>																				
<i>Polymer Usage (Biosolids Thickening)</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Biosolids Production, ppd	4,684	4,738	4,792	4,847	4,901	4,956	5,010	5,065	5,119	5,174	5,228	5,283	5,337	5,392	5,446	5,446	5,446	5,446	5,446	5,446
Polymer Cost, \$/lb	\$1.50	\$1.55	\$1.59	\$1.64	\$1.69	\$1.74	\$1.79	\$1.84	\$1.90	\$1.96	\$2.02	\$2.08	\$2.14	\$2.20	\$2.27	\$2.34	\$2.41	\$2.48	\$2.55	\$2.63
Annual Polymer Usage, lb/year	11,966	12,106	12,245	12,384	12,523	12,662	12,801	12,941	13,080	13,219	13,358	13,497	13,636	13,775	13,915	13,915	13,915	13,915	13,915	13,915
Annual Polymer Cost, \$/year	\$17,950	\$18,703	\$19,486	\$20,298	\$21,142	\$22,018	\$22,928	\$23,873	\$24,853	\$25,871	\$26,928	\$28,025	\$29,163	\$30,344	\$31,570	\$32,848	\$34,176	\$35,553	\$36,980	\$38,457
<i>Polymer Usage (Biosolids Dewatering)</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.9	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1	1	1	1	1	1.00
Biosolids Production, ppd	4,450	4,501	4,553	4,605	4,657	4,708	4,760	4,812	4,864	4,915	4,967	5,019	5,071	5,122	5,174	5,174	5,174	5,174	5,174	5,174
Polymer Cost, \$/lb	\$1.50	\$1.55	\$1.59	\$1.64	\$1.69	\$1.74	\$1.79	\$1.84	\$1.90	\$1.96	\$2.02	\$2.08	\$2.14	\$2.20	\$2.27	\$2.34	\$2.41	\$2.48	\$2.55	\$2.63
Annual Polymer Usage, lb/year	24,362	24,645	24,928	25,212	25,495	25,778	26,061	26,345	26,628	26,911	27,195	27,478	27,761	28,044	28,328	28,328	28,328	28,328	28,328	28,328
Annual Polymer Cost, \$/year	\$36,543	\$38,077	\$39,670	\$41,324	\$43,042	\$44,826	\$46,678	\$48,601	\$50,597	\$52,670	\$54,821	\$57,054	\$59,371	\$61,776	\$64,272	\$66,860	\$69,541	\$72,316	\$75,187	\$78,154
<i>NaOCl Usage (Disinfection)</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
NaOCl Cost, \$/mgd	\$47,674	\$49,105	\$50,578	\$52,095	\$53,658	\$55,268	\$56,926	\$58,634	\$60,393	\$62,204	\$64,070	\$65,993	\$67,972	\$70,011	\$72,112	\$74,275	\$76,503	\$78,799	\$81,163	\$83,597
Annual NaOCl, \$/year	\$41,000	\$42,721	\$44,508	\$46,365	\$48,292	\$50,294	\$52,372	\$54,529	\$56,769	\$59,094	\$61,508	\$64,013	\$66,613	\$69,311	\$72,112	\$74,275	\$76,503	\$78,799	\$81,163	\$83,597
<i>NaHSO<sub>3</sub> Usage (Dechlorination)</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
NaHSO <sub>3</sub> Cost, \$/mgd	\$27,907	\$28,744	\$29,607	\$30,495	\$31,410	\$32,352	\$33,322	\$34,322	\$35,352	\$36,412	\$37,505	\$38,630	\$39,789	\$40,982	\$42,212	\$43,478	\$44,783	\$46,126	\$47,510	\$48,935
Annual NaHSO <sub>3</sub> , \$/year	\$24,000	\$25,007	\$26,054	\$27,140	\$28,269	\$29,440	\$30,657	\$31,920	\$33,231	\$34,592	\$36,004	\$37,471	\$38,993	\$40,573	\$42,212	\$43,478	\$44,783	\$46,126	\$47,510	\$48,935
<i>Electricity Cost, \$/kWh</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Annual Usage, kWh/year	3,393,668	3,433,129	3,472,590	3,512,051	3,551,513	3,590,974	3,630,435	3,669,896	3,709,358	3,748,819	3,788,280	3,827,741	3,867,203	3,906,664	3,946,125	3,946,125	3,946,125	3,946,125	3,946,125	3,946,125
Annual Power Cost, \$/year	\$471,720	\$491,521	\$512,086	\$533,442	\$555,619	\$578,646	\$602,555	\$627,378	\$653,148	\$679,899	\$707,667	\$736,490	\$766,405	\$797,452	\$829,673	\$854,563	\$880,200	\$906,606	\$933,804	\$961,818
<i>Labor Cost, \$/hr</i>																				
Labor Hours, hrs/year	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000
Annual Labor Cost, \$/year	\$562,660	\$579,540	\$596,926	\$614,834	\$633,279	\$652,277	\$671,845	\$692,001	\$712,761	\$734,144	\$756,168	\$778,853	\$802,219	\$826,285	\$851,074	\$876,606	\$902,904	\$929,991	\$957,891	\$986,628
<b>7 Operators</b>																				
Annual Maintenance Cost, \$	\$472,000	\$486,160	\$500,745	\$515,767	\$531,240	\$547,177	\$563,593	\$580,500	\$597,915	\$615,853	\$634,329	\$653,358	\$672,959	\$693,148	\$713,942	\$735,361	\$757,421	\$780,144	\$803,548	\$827,655
<i>Sludge Hauling</i>																				
Flow (AADF), mgd	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Sludge Hauling Cost, \$/ton	\$46.00	\$47.38	\$48.80	\$50.27	\$51.77	\$53.33	\$54.93	\$56.57	\$58.27	\$60.02	\$61.82	\$63.67	\$65.59	\$67.55	\$69.58	\$71.67	\$73.82	\$76.03	\$78.31	\$80.66
Annual Sludge Production, tons/year	4,336	4,386	4,435	4,485	4,535	4,585	4,635	4,685	4,734	4,784	4,834	4,884	4,934	4,984	4,984	4,984	4,984	4,984	4,984	4,984
Annual Sludge Hauling Cost, \$/year	\$199,442	\$207,787	\$216,453	\$225,451	\$234,795	\$244,496	\$254,568	\$265,025	\$275,880	\$287,147	\$298,842	\$310,981	\$323,579	\$336,653	\$346,752	\$357,155	\$367,870	\$378,906	\$390,273	\$401,981
<b>Total Annual Costs</b>																				
<b>Present Worth of Annual Costs</b>																				
<b>TOTAL PRESENT VALUE (O&amp;M)</b>																				